

Integrated Draft EIA Report

for

“Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity”

At

Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005

Category: 5(e), Category “A”

TOR Identification No.: TO25A2301TN5808288N Dated 28.07.2025

and

“Upgradation of Existing Marine Terminal Facilities with proposed Hydrocarbon transfer pipelines, crossover bridge along Uppanar River, Sea water intake & Outfall facilities and 20 MLD Desalination Plant”

At

Chithirapettai, Semmankuppam and Thiyagavalli Villages, Cuddalore District, Tamil Nadu

Category : 7(e) Category “A”

TOR Identification No: TO24A3501TN5664131N Dated: 01.12.2024

PROJECT PROPONENT

M/s. CHEMPLAST CUDDALORE VINYL LIMITED

EIA CONSULTANTS

**Volume 1 by M/S. PERFECT ENVIRO SOLUTIONS PVT. LTD
(NABET Registered List of Accredited Consultant Organisations/ NABET/EIA/2225/RA 0284)
(Rev.01) Valid Up to 26/11/2025)**



**Volume 2 by INDOMER COASTAL HYDRAULICS (P) LTD.
(ISO 9001: 2015 CERTIFIED, NABET- QCI & NABL ACCREDITED)**



DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

For

**“Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity” by
M/s. Chemplast Cuddalore Vinyls Limited**

At

Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005

Existing Cost: INR 500 Cr.

Proposed Cost: INR 6000 Cr.

Total cost after Expansion: INR 6500 Cr.

Category : 5(e) Category “A”

TOR Identification No: TO25A2301TN5808288N Dated 28.07.2025

Baseline Seasons: February 2024 to April 2024

(Laboratory Assigned: M/s. Perfact Researchers Pvt Ltd., vide Certificate No. TC-6993, valid up to 03.04.2029)

PROJECT PROPONENT

M/s. CHEMPLAST CUDDALORE VINYLs LIMITED

9, Cathedral Road, Chennai - 600086

ENVIRONMENTAL CONSULTANT

M/S. PERFECT ENVIRO SOLUTIONS PVT. LTD

**(NABET Registered List of Accredited Consultant Organisations/ NABET/EIA/2225/RA 0284
(Rev.01) Valid Up to 26/11/2025)**

**Registered Address:- Perfact House, A 14, Shubham Enclave (Outer Ring Road),
Paschim Vihar, New Delhi 110063**

Regional Address : 4th Floor, Kochur Bliss, Thiru. V. Ka. Industrial Estate, Guindy, Chennai 600032.

UID: PE241879-E-03

October 2025

Declaration by EIA Coordinator & Experts Contributing to the EIA "Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity" at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005 by M/s. Chemplast Cuddalore Vinyls Limited.

I hereby declare that I was involved in the following EIA Report submitted to MoEFCC, as EIA Coordinator. I further certify that the data given in this report is true and correct to the best of my knowledge.

EIA Coordinator:

Name	Mr. Ramdas A Wani
	5(e) Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes).
Signature & Date	R. A. Wani 17.09.2025.
Task & Period of Involvement	I had visited the site along with the FAEs to understand the project site and the study area. Coordinated with the experts and prepared the impact assessment methodology. Identification and Prediction of the impact assessment, Formulation of the Environment Management Plan, Technical Review. Period of Involvement: Feb 2024 to Sep 2025
Office Address	Perfact Enviro Solutions Pvt. Ltd. A 14, Shubham Enclave (Outer Ring Road), Paschim Vihar, New Delhi 110063

Name of Assistants to EIA Coordinator	Mrs. Sadaf Akhtar
Signature & Date	Sadaf 05.09.2025

Task & Period of Involvement	I had understood the project site and the study area. Coordinated with the experts and prepared the impact assessment methodology. Identification and Prediction of the impact assessment, Formulation of the Environment Management Plan, Technical Review. Period of Involvement: Feb 2024 to Sep 2025.
Office Address	Perfact Enviro Solutions Pvt. Ltd. A 14, Shubham Enclave (Outer Ring Road), Paschim Vihar, New Delhi 110063

List of FAEs Involved (Cat A)

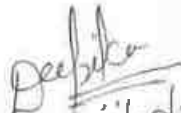
S.No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature & Date
1	AP	Mr. Ramdas A. Wani	I had visited the site to assess the site conditions in the surrounding area. After assessing the Air pollution sources. Made Sampling plan & conducted monitoring; based on the results and the site specific details along with Project Specific Details obtained, I have prepared the Impact Mitigation measures Period of Involvement: Feb 2024 to Sep 2025.	R. A. Wani 17-09-2025
2	AQ	Mr. Ramdas A. Wani	I had visited the site for the assessment of the sources and the emissions. After studying, I calculated the model input data related to the proposed emissions and micrometeorology interpretation of modeling results and development of EMP. Period of Involvement: Feb 2024 to Sep 2025.	R. A. Wani 17-09-2025

S.No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature & Date
3	WP	Mr. Muthukumaran Ganpathi Narayanan	I had visited the site to assess the water sources and its water quality in the study area. After studying the Water pollution sources have prepared Sampling plan & collected samples; based on the results from the lab and the site specific details along with Project Specific Details obtained, I have prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.	 09/09/2025
4	RH	Mr. Ramdas A. Wani	I had visited the site to assess the site conditions in the surrounding area and identified hazards. After assessing the risk and hazard, I prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.	 17-9-25
5.	SE	Dr. Rahul Deshmukh	I had visited the site to collect the baseline status of socio-economic conditions and studied Villages in study areas using Topographical maps and extracted Secondary data from Census of India. Then was involved in preparing a socio economic study report using the primary survey and secondary data which includes impact and mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.	
6.	NV	Mr. Muthukumaran Ganpathi Narayanan	I had visited the site to assess the site conditions in the surrounding area. After assessing the Noise pollution sources have prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.	 09/09/2025

S.No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature & Date
7.	SHW	Mr. Ramdas A. Wani	I had visited the site to assess the Solid waste sources and status in the study area. After studying the sources have prepared the Impact report and suggested Mitigation measures and development of EMP. Period of Involvement: Feb 2024 to Sep 2025.	R. A. Wani 17-9-2025
8.	HG	Mr. Santosh Pant	The physical observation of the study area including Ground water sources and its water quality was made. After studying the Water pollution sources, the Impact report was prepared and Mitigation measures were suggested. Period of Involvement: Feb 2024 to Sep 2025.	Santosh Pant
9.	GEO	Mr. Santosh Pant	I had visited the site to assess the geology of the study area. After studying I have prepared the Impact report and suggested mitigation measures Period of Involvement: Feb 2024 to Sep 2025.	Santosh Pant
10.	SC	Mrs. Rachna Dogra	I had visited the site to assess the site conditions in the surrounding area. After assessing the type of soil and need of Soil Conservation, Prepared the Impact Mitigation measures accordingly. Period of Involvement: Feb 2024 to Sep 2025.	Rachna 9/9/25
11.	EB	Mrs. Tulika Rawat	I had visited the site to assess the various forest areas, Ecological and Biodiversity sources in the study area. After studying the various floral and faunal species, assisted FAE in preparing the impact report and suggested Mitigation measures	Tulika 11/9/2025

S.No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature & Date
			Period of Involvement: Feb 2024 to Sep 2025.	
12.	LU	Mr. Santosh Pant	I was involved in preparing a Land Use map using Satellite Imagery, Google maps after primary survey. Period of Involvement: Feb 2024 to Sep 2025.	

List of Category-B FAEs Involved

S.No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature & Date
1	AP	Mrs. Deepika Arora	I had visited the site to assess the site conditions in the surrounding area. After assessing the Air pollution sources. Made Sampling plan & conducted monitoring; based on the results and the site specific details along with Project Specific Details obtained, I have prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.	 11/09/25
2	AQ	Mrs. Shweta Rajput	I had visited the site for the assessment of the sources and the emissions. After studying, I calculated the model input data related to the proposed emissions and micrometeorology interpretation of modeling results and development of EMP. Period of Involvement: Feb 2024 to Sep 2025.	 12/09/25
3	WP	Mrs. Shweta Rajput	I had visited the site to assess the water sources and its water quality in the study area. After studying the Water pollution sources have prepared Sampling plan & collected samples; based on the results from the lab and the site specific details along with Project Specific Details obtained, I have prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.	 12/09/25

S.No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature & Date
4	RH	Mrs. Megha Solanki	I had visited the site to assess the site conditions in the surrounding area and identified hazards. After assessing the risk and hazard, I prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.	<i>Megha Solanki</i> 15/09/25
5	HG	Mrs. Saloni Sharma	I have visited the site and assessed the hydrology of the area. After studying the hydrology and pollution sources the impact and mitigation have been identified. Period of Involvement: Feb 2024 to Sep 2025.	<i>Saloni Sharma</i> 09/09/25

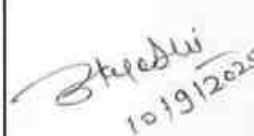
List of FAA

S. No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature
1.	WP	Ms. Sakshi Tripathi	I had visited the site to assess the water sources and its water quality in the study area. After studying the Water pollution sources have prepared Sampling plan & collected samples ; based on the results from the lab and the site specific details along with Project Specific Details obtained, I have prepared the Impact Mitigation measures. Period of Involvement: June 2025 to Sep 2025.	Sakshi 11/09/2025
2.	SE	Mr. Pramod Kumar	I had visited the site to collect the baseline status of socio-economic conditions and studied Villages in study areas using Topographical maps and extracted Secondary data from Census of India. Then was involved in preparing a socio economic study report using the primary survey and secondary data which includes impact and mitigation measures. Period of Involvement: June 2025 to Sep 2025.	Pramodkumar 11/09/2025
3.	SHW	Ms. Sakshi Tripathi	I had visited the site to assess the Solid waste sources and status in the study area. After studying the sources have prepared the Impact report and suggested Mitigation measures and development of EMP. Period of Involvement: June 2025 to Sep 2025.	Sakshi 11/09/2025

List of Team Members

S. No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature
1.	AP	Mrs. Sadaf Akhtar	I had visited the site to assess the site conditions in the surrounding area. After assessing the Air pollution sources. Made Sampling plan & conducted monitoring; based on the results and the site specific details	Sadaf 09.09.2025

S. No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature
			along with Project Specific Details obtained , I have prepared the Impact Mitigation measures Period of Involvement: June 2025 to Sep 2025.	
2.	WP	Mrs. Sadaf Akhtar	I had visited the site to assess the water sources and its water quality in the study area. After studying the various WP sources, assisted FAE in preparing the impact report and suggested mitigation measures. Period of Involvement: June 2025 to Sep 2025.	Sadaf 09.09.2025
3.	EB	Mrs. Disha Patel	I had visited the site to assess the various forest areas, Ecological and Biodiversity sources in the study area. After studying the various floral and faunal species, assisted FAE in preparing the Impact report and suggested Mitigation measures Period of Involvement: Feb 2024 to Sep 2025.	Disha 12/09/25
4.	SHW	Ms. Sreeja Sreekanth	I had visited the site to assess the Solid waste sources and status in the study area. After studying the sources have prepared the Impact report and suggested Mitigation measures and development of EMP. Period of Involvement: Feb 2024 to Sep 2025.	Sreeja 11/09/25
5.	LU	Mr. Deepak Kumar	I was involved in preparing a Land Use map using Satellite Imagery, Google maps after primary survey. Period of Involvement: June 2025 to Sep 2025.	Deepak 09.09.25

S. No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)	Signature
6.	SE	Mr. Manoj Kumar Joshi	I had visited the site to collect the baseline status of socio-economic conditions and studied Villages in study areas using Topographical maps and extracted Secondary data from Census of India. Then was involved in preparing a socio economic study report using the primary survey and secondary data which includes impact and mitigation measures. Period of Involvement: June 2025 to Sep 2025.	 10/9/2025

Plagiarism/ QMS Certificate

Title of EIA Report:	"Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity" by M/s. Chemplast Cuddalore Vinyls Limited located at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005
Name of Accredited Organization:	M/s Perfact Enviro Solutions Pvt Ltd
Unique Identification Number:	PE241879-E-04
Name of EIA Coordinator (EC):	Mr. Ramdas A Wani
Name of the Software:	Plagiarism Checker X (4 %)
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I hereby certify that this EIA Report has been evaluated using online/In-house software Duplichecker. The report produced has been analyzed by the system and based on it, I certify that the EIA report produced in accordance with good scientific practice.

R. A. Wani
17-09-2025

Date and Sign of EIA Coordinator:

Signature and Date:

Name: **Mr. Ramdas A Wani**

[Signature]
Date and Sign of Head of Accredited Organisation:
(Mrs. Rachna Bhargava)

Name of the EIA consultant organisation: M/s Perfact Enviro Solutions Pvt Ltd

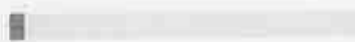
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20/10/2023 valid up to 26/11/2025



Plagiarism Checker X - Report

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Undertaking by Head of EIA Consultant

I, Rachna Bhargava, Director & CEO of M/s Perfact Enviro Solutions Pvt. Ltd., A 14, Shubham Enclave (Outer Ring Road), Paschim Vihar, New Delhi 110063 authorize Mr. Ramdas A Wani (EIA Coordinator) for the preparation and conducting the Environment Impact Assessment for project "Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity" at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005 by M/s. Chemplast Cuddalore Vinyls Limited.



Rachna Bhargava, Director & CEO

M/s Perfact Enviro Solutions Pvt. Ltd.

A 14, Shubham Enclave (Outer Ring Road),
Paschim Vihar, New Delhi 110063

Undertaking By EIA Coordinator

I, **Ramdas A Wani** EIA Coordinator from Environmental Consultant M/s Perfact Enviro Solutions Pvt. Ltd., A 14, Shubham Enclave (Outer Ring Road), Paschim Vihar, New Delhi 110063 for project "Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity" at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005 by M/s. Chemplast Cuddalore Vinyls Limited. hereby undertake that the report is prepared in accordance with a robust quality management system adopted by EIA consulting organization for the EIA process and the prescribed ToR have been complied with and that the data submitted is factually correct.

Signature and Date:

Name: **Mr. Ramdas A Wani**

R. A. Wani
17-09-2025.

EIA Coordinator

M/s Perfact Enviro Solutions Pvt. Ltd.

A 14, Shubham Enclave (Outer Ring Road),
Paschim Vihar, New Delhi 110063

Table of Content

Table of Content.....	2
1. INTRODUCTION.....	16
1.1 PURPOSE OF THE REPORT.....	16
1.2 IDENTIFICATION OF THE PROJECT AND PROJECT PROPONENT.....	17
1.2.1 IDENTIFICATION OF THE PROJECT.....	17
1.2.2 IDENTIFICATION OF THE PROPONENT.....	18
1.3 BRIEF DESCRIPTION OF THE PROJECT.....	18
1.3.1 DESCRIPTION OF ACTIVITIES AND IMPORTANCE TO THE REGION.....	18
1.3.3 EMPLOYMENT GENERATION.....	19
1.4 STATUS OF THE PROJECT SITE.....	20
1.5 THE ASSIGNMENT & SCOPE OF THE STUDY.....	21
1.6 IDENTIFIED APPLICABLE STATUTORY.....	21
1.7 SCOPE OF EIA STUDY - DETAILS OF REGULATORY SCOPING CARRIED OUT.....	24
1.7.1 SCOPING.....	24
1.7.2 TOR COMPLIANCE.....	26
2. PROJECT DESCRIPTION.....	39
2.1 TYPE OF PROJECT.....	39
2.2 NEED OF THE PROPOSED PROJECT.....	39
2.3 PROJECT LOCATION.....	40
2.3.1 SPECIFIC LOCATION.....	43
2.3.2 MAJOR INDUSTRIES IN BUFFER AREA WITH 10 KM RADIUS.....	50
2.3.3 TOPOGRAPHICAL Map for 10 km Radius of Project Site.....	51
2.3.4 ENVIRONMENT SENSITIVITY OF THE PROJECT.....	52
2.3.4. ACCESSIBILITY & CONNECTIVITY.....	54
2.3.6 SEISMICITY.....	55
2.4 SIZE OR MAGNITUDE OF OPERATION.....	57
2.4.1 PLOT AREA DISTRIBUTION.....	57
2.4.2 PRODUCTION CAPACITY.....	61
2.4.3 PROJECT COST.....	62
2.4.4 PROJECT SCHEDULE AND COMPLETION.....	62
2.4.5 MACHINERY & EQUIPMENTS.....	62
2.5 POWER.....	63
2.6 FUEL REQUIREMENTS.....	64
2.7 WATER REQUIREMENT.....	64
2.8 RAW MATERIAL REQUIREMENT.....	64
2.9 MANPOWER REQUIREMENT.....	66
2.9.1 INFRASTRUCTURE AND AMENITIES.....	67
2.10 MANUFACTURING PROCESS AND PROCESS FLOW DIAGRAM.....	67
2.11 AIR EMISSIONS.....	75
2.11.1 DETAILS OF FLUE GAS STACKS.....	75

2.11.2 DETAILS OF PROCESS GAS STACKS.....	76
2.11.3 FUGITIVE EMISSIONS & CONTROL MEASURES.....	78
2.12 WATER CONSUMPTION, WASTEWATER GENERATION & DISPOSAL DETAILS.....	78
2.13 DESALINATION PLANT DETAILS.....	84
2.13 WASTEWATER AND ITS MANAGEMENT.....	91
2.13.1 WASTEWATER GENERATION AND ITS MANAGEMENT.....	92
2.13.2 DETAILS OF EFFLUENT TREATMENT PLANT.....	92
2.14 NOISE MANAGEMENT.....	99
2.15 SOLID AND HAZARDOUS WASTE MANAGEMENT.....	99
2.15.1 WASTE MINIMIZATION, RECYCLE/REUSE/RECOVER TECHNIQUES, ENERGY CONSERVATION ENVISAGED IN THE PROJECT.....	101
2.16 PLANTATION & GREEN BELT.....	101
2.16.1 GREENBELT DEVELOPMENT.....	101
2.17 RAINWATER HARVESTING & STORMWATER MANAGEMENT.....	103
3. DESCRIPTION OF ENVIRONMENT.....	106
3.1. INTRODUCTION.....	106
3.2. BASE MAPS OF THE AREA.....	106
3.2.1. GOOGLE IMAGE OF THE PROJECT SITE.....	106
3.2.2. TOPOGRAPHICAL MAP.....	106
3.2.3. ACCESSIBILITY MAP FOR ENVIRONMENTAL MONITORING.....	107
3.2.4. DIGITAL ELEVATION MODEL (DEM) MAP.....	108
3.2.5. VILLAGES MAP.....	120
3.3. METHODOLOGY OF BASELINE DATA COLLECTION.....	121
3.4. METEOROLOGY.....	121
3.4.1 CLIMATIC CONDITIONS (AS PER INDIAN METEOROLOGY DEPARTMENT DATA, TAMIL NADU).....	121
3.4.1.1. Temperature.....	122
3.4.2 Relative Humidity.....	124
3.4.4 Rainfall.....	126
3.4.5 Wind Speed.....	127
3.4.6 Wind Direction.....	129
3.4.7 ONSITE SEASON SPECIFIC MEASURED MICRO-METEOROLOGICAL DATA.....	134
3.5. AMBIENT AIR QUALITY.....	134
3.5.1. SAMPLING STATION SELECTION.....	134
3.5.2. AMBIENT AIR SAMPLING LOCATIONS.....	135
3.5.3. SAMPLING PROCEDURE.....	138
3.5.4. ANALYTICAL METHODS FOLLOWED FOR AMBIENT AIR QUALITY MONITORING.....	139
3.5.5. AMBIENT AIR QUALITY RESULTS.....	140
3.5.5.1. SUMMER SEASON (FEBRUARY 2024 TO APRIL 2024).....	140
3.5.5.2. INVERSE DISTANCE WEIGHTED (IDW) INTERPOLATION.....	146
3.5.6. AIR QUALITY INDEX.....	159
3.5.7. DATA INTERPRETATION.....	160

3.6. NOISE LEVEL.....	160
3.6.1. METHODOLOGY.....	160
3.6.2. AMBIENT NOISE SAMPLING STATION.....	161
3.6.3. RESULTS AND DISCUSSION.....	163
3.7. HYDROLOGY & GEOLOGY.....	165
3.7.1. OBJECTIVES.....	165
3.7.2 TOPOGRAPHY.....	165
3.7.4 GEOLOGY.....	167
3.7.5 HYDROLOGY.....	169
3.7.5.1 DRAINAGE.....	169
3.7.5.2 FLOOD HISTORY.....	170
3.7.5 GEOHYDROLOGY.....	170
3.7.5.1 GROUNDWATER DEVELOPMENT.....	171
3.8 WATER QUALITY.....	171
3.8.1 SAMPLING STATION.....	171
3.8.2. CRITERIA OF SELECTION OF SAMPLING LOCATIONS.....	175
3.8.3 SAMPLING FREQUENCY AND SAMPLING TECHNIQUES.....	175
3.8.4 GROUND WATER QUALITY RESULTS.....	176
3.8.5 Ground Water Quality Result Interpretation.....	178
3.8.6 SURFACE WATER QUALITY RESULTS.....	179
3.8.7 Data Interpretation.....	180
3.9 LAND ENVIRONMENT.....	180
3.9.1 INTRODUCTION.....	180
3.9.2 METHODOLOGY.....	181
3.10 SOIL QUALITY.....	186
3.10.1 SOIL.....	186
3.10.2 SAMPLING LOCATION.....	186
3.10.3 SAMPLING PROCEDURE AND ANALYSIS.....	188
3.10.4. PHYSICAL & CHEMICAL PROPERTIES OF SOIL.....	189
3.10.5. DATA INTERPRETATION.....	190
3.11 BIOLOGICAL ENVIRONMENT.....	190
3.11.1 Objective.....	191
3.11.2 Cropping Pattern.....	192
3.11.3 Methodology.....	192
3.11.3 Flora of the study area:.....	194
3.11.4 Schedule I species:.....	200
3.12. SOCIO-ECONOMIC ENVIRONMENT.....	201
3.12.1 Study Area.....	201
3.12.2 Methodology.....	201
3.12.3 Habitation in the Study Area.....	201
3.12.4 Demographic Structure.....	203

3.12.5 Literacy Details.....	204
3.12.6 WorkForce/Employment Pattern.....	205
3.12.7 Crop Pattern.....	206
3.12.8 Diseases in Surveyed Villages:.....	206
3.12.9 Population Growth & Projected Population:.....	207
3.12.10 Infrastructure Available.....	207
3.12.11 Quality of Life Assessment.....	208
3.12.12 Key Findings and Summary of Primary Data Collection.....	209
3.12.13 Need Based Gaps:.....	211
3.13 TRAFFIC SURVEY.....	211
4. ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES.....	214
4.1. IMPACT ASSESSMENT METHODOLOGY.....	214
4.2. POTENTIAL IMPACTS DURING CONSTRUCTION PHASE.....	215
4.2.1. ACTIVITY – CONSTRUCTION OF STRUCTURE.....	215
4.2.2. ACTIVITY –INSTALLATION & UPGRADATION OF MACHINERIES AND UTILITIES.....	217
4.2.3. ACTIVITY –OPERATION OF CONSTRUCTION MACHINERY (CONCRETE MIXING MACHINERY, DG SETS, JCB, ETC.).....	218
4.2.4. ACTIVITY – TRANSPORTATION (RAW MATERIAL, LABOUR).....	220
4.2.5. ACTIVITY –WORKING & DAILY ACTIVITY OF CONSTRUCTION LABOR.....	221
4.3. POTENTIAL IMPACT DURING OPERATION PHASE.....	222
4.3.1. ACTIVITY – LOADING, UNLOADING & STORAGE OF RAW MATERIAL.....	222
4.3.2. ACTIVITY –MANUFACTURING PROCESS OF PRODUCTS ASPECTS.....	223
4.3.3. ACTIVITY – OPERATION OF MANUFACTURING PROCESS & EQUIPMENT (BOILER, DG SET, ETP, ETC).....	225
4.3.4. ACTIVITY – TRANSPORTATION OF RAW MATERIAL, FINISHED PRODUCT, WASTE, ETC.....	227
4.3.5. ACTIVITY - WORKING & DAILY ACTIVITY OF STAFF, VISITORS.....	229
4.4. SUMMARY OF IMPACT & MITIGATION.....	230
4.4.1. Air Environment.....	230
4.4.2. Water Environment.....	231
4.4.3. Land Use.....	231
4.4.4. Soil Environment.....	231
4.4.5. Socio-economic.....	232
4.4.6. Ecology & Biodiversity.....	232
4.4.7. Noise and Vibration.....	232
4.4.8. Hydrology and Geology.....	233
4.4.9. Solid and Hazardous Waste.....	233
4.4.10. Traffic density.....	234
4.5 AIR QUALITY MODELLING.....	234
4.5.1. Data Interpretation.....	242
4.6 AIR DISPERSION MODELLING USING THE CALPUFF MODEL.....	243
4.6.1 Conclusion.....	244

4.7 Stack optimization.....	244
5. ANALYSIS OF ALTERNATIVES.....	247
5.1 SITE SELECTION.....	247
5.2 SITE TECHNOLOGY.....	248
6. ENVIRONMENTAL MONITORING PROGRAM.....	249
6.1. DETAILS OF MONITORING TO JUDGE EFFECTIVENESS OF MEASURE.....	249
6.1.1. CONSTRUCTION PHASE.....	249
6.1.2. OPERATION PHASE.....	250
6.2. SUBMISSION OF SIX MONTHLY COMPLIANCES.....	252
6.3. ENVIRONMENT AUDIT.....	253
6.4 COMPLIANCE OF ENVIRONMENTAL APPROVALS.....	253
6.4.1. ENVIRONMENT CLEARANCE.....	253
6.4.2. HW AUTHORISATION/DISPOSAL.....	253
6.4.3. CGWA CLEARANCE.....	253
6.4.4. CONSERVATION PLAN.....	253
6.4.5. FOREST CLEARANCE.....	253
6.4.6. ANNUAL RETURNS.....	253
7. ADDITIONAL STUDIES.....	255
7.1 INTRODUCTION.....	255
7.2. PUBLIC CONSULTATION.....	255
7.3 PHILOSOPHY OF RISK ASSESSMENT.....	255
7.3.1 Study Objectives.....	255
7.3.2 Methodology.....	255
7.4 HAZARD IDENTIFICATION.....	256
7.5 RISK ANALYSIS.....	256
7.5.1 Definition.....	256
7.5.2 Storage and Handling of Hazardous Chemicals.....	257
7.5.2.1 Details of Storage.....	257
7.7 QUALITATIVE RISK ASSESSMENT.....	257
7.7.1 Natural Hazard.....	257
7.7.1.1 Earthquake.....	257
7.7.1.2 Flooding.....	257
7.7.2 Manmade Hazard.....	258
7.7.2.1 Fire and Explosion.....	258
7.7.2.2 Chemical Spillage/ Leakage.....	259
7.7.2.3 Thermal.....	260
7.8 QUANTITATIVE RISK ASSESSMENT.....	261
7.8.1 Risk Assessment Approach.....	261
7.8.2 Modeling Tools and Input Data.....	261
7.8.3 Scenario Descriptions and Consequence Analysis.....	262
7.8.4 Conclusions.....	269
7.8.4.1 Principal Findings.....	269

7.8.4.2 Compliance Status.....	270
7.8.4.3 Residual Risk, Uncertainties, and ALARP Demonstration.....	270
7.8.4.4 Risk-Informed Recommendations.....	271
7.9 HAZARDOUS MATERIAL ASSESSMENT.....	271
7.9.2 Hazard Identification and Risk Assessment.....	272
7.9.2.1 Risk Matrix.....	272
7.9.2.2 Risk Accessibility Criteria.....	273
7.10 DISASTER MANAGEMENT PLAN.....	275
7.10.1 Objectives of DMP.....	275
7.10.1.1 Methodology.....	276
7.10.1.2 Classification of Emergencies.....	277
7.10.2 Disaster Preparedness Onsite.....	277
7.10.2.1 Fire Alarms/Other Measures.....	277
7.10.2.2 Onsite DMP Team.....	278
7.10.2.3 Emergency Equipments.....	279
7.10.2.4 Disaster Emergency Kit.....	280
7.10.2.5 Mock Drills.....	281
7.10.3 Disaster Preparedness Offsite.....	281
7.10.4 Emergency Response in the Event of Disaster.....	281
7.10.4.1 Action in the event of Fire.....	281
7.10.4.2 Actions in case of Flood/Tsunami.....	282
7.10.4.3 Lightning strike.....	282
7.11 EVACUATION PLAN FOR THE MANUFACTURING UNIT.....	282
7.12 EMERGENCY PREPAREDNESS PLAN.....	283
7.13 GENERAL SAFETY AND OCCUPATIONAL HEALTH.....	285
7.13.1 General Working Conditions.....	285
7.13.1.1 Housekeeping.....	285
7.13.2 Ventilation.....	286
7.13.3 Electrical Safety.....	286
7.13.4 Work Permit.....	286
7.13.5 Working at Heights.....	288
7.14 OCCUPATIONAL HEALTH AND SAFETY.....	288
7.14.1 Personal Protective Equipment.....	289
7.14.2 Worker Health Checkup Plan.....	290
7.14.3 Summary & Conclusions.....	292
7.15 Flood Risk Assessment.....	292
7.16 Hydrogeological study.....	295
7.17 Decarbonization Study.....	295
7.18 Environmental Cost Benefit Analysis (ECBA).....	296
7.19 Marine Ecological Study.....	297
7.20 Eco Risk Assessment.....	298

7.20.1 Methodological Framework.....	298
7.20.2 Models, Data Sets and Assessment Endpoints.....	298
7.20.3 COPECs and Ecotoxicological Benchmarks.....	299
7.20.5 Receptor Definition and Food Webs.....	299
7.20.6 Model Outcomes.....	300
7.20.7 Risk Characterisation and Significance.....	300
7.20.8 Conclusion.....	300
8. PROJECT BENEFITS.....	301
8.1 ENVIRONMENT BENEFIT.....	301
8.2. ECONOMIC BENEFIT.....	303
8.3 SOCIAL BENEFIT.....	303
9. ENVIRONMENTAL COST BENEFIT ANALYSIS.....	304
9.1. INTRODUCTION.....	304
9.2. ENVIRONMENTAL COSTS.....	304
9.2.1. CAPITAL INVESTMENT ON ENVIRONMENTAL PROTECTION.....	304
9.2.2. RECURRING COSTS.....	304
9.2.3. ENVIRONMENTAL FOOTPRINT.....	305
9.3 ENVIRONMENTAL COST BENEFITS.....	305
9.3.1 POLLUTION CONTROL AND RESOURCE CONSERVATION.....	305
9.3.2. INDUSTRIAL SYMBIOSIS AND INFRASTRUCTURE AUGMENTATION.....	305
9.4. ECONOMIC BENEFITS.....	305
9.5 SOCIAL BENEFITS.....	306
9.6. SUMMARY OF ENVIRONMENTAL COST-BENEFIT ANALYSIS.....	306
10. ENVIRONMENT MANAGEMENT PLAN.....	307
10.1 INTRODUCTION.....	307
10.2 PROJECT DETAILS.....	307
10.3 ORGANIZATIONAL ROLE AND RESPONSIBILITY.....	310
10.3.1 ROLE OF PROJECT PROPONENT (TOP MANAGEMENT).....	311
10.3.2 ROLE OF CONTRACTOR.....	312
10.3.3 INSPECTION, MONITORING AND AUDIT.....	313
10.3.4 MONITORING, REPORTING AND DOCUMENTATION.....	313
10.4 INTERNAL MONITORING, REPORTING AND COMMUNICATION.....	313
10.4.1 DOCUMENTATION.....	314
10.5 EMP REVIEW & AMENDMENTS.....	314
10.5.1 Environment Management Plan.....	315
10.5.2 AIR EMISSION.....	315
10.5.2.1 PROCESS GAS STACK.....	315
10.5.2.2 FLUE GAS STACK.....	318
10.5.2.3 FUGITIVE EMISSION & CONTROL MEASURES.....	319
10.5.3 WATER CONSUMPTION, WASTEWATER GENERATION & DISPOSAL DETAILS.....	320
10.5.4 WASTEWATER AND WASTEWATER GENERATION:.....	326

10.5.4.1 DETAILS OF PROPOSED TRADE EFFLUENT TREATMENT PLANT.....	326
10.6 RAINWATER HARVESTING.....	333
10.6.1 HAZARDOUS, NON- HAZARDOUS, SOLID WASTE & OTHER WASTES IDENTIFICATION, QUANTIFICATION, STORAGE, AND DISPOSAL.....	336
10.6.2 NOISE POLLUTION.....	338
10.7 EMP IMPLEMENTATION BUDGET.....	339
10.9 SOCIAL WELFARE RESPONSIBILITY.....	339
10.11. ENVIRONMENTAL COST SUMMARY.....	339
10.5 CARBON FOOTPRINT.....	340
10.5.1 Life Cycle Analysis.....	340
10.5.2 Results.....	341
10.5.3 Conclusions.....	342
10.6 CPA Compliance.....	342
10.7 Compliance Statement of G.S.R 84(E) & 85(E) dated 29th Jan. 2025 and 30th January, 2025.....	353
11. SUMMARY & CONCLUSION.....	356
11.1. PROJECT DESCRIPTION.....	356
11.2. DESCRIPTION OF THE ENVIRONMENT.....	356
11.3. ANTICIPATED ENVIRONMENTAL IMPACT AND MITIGATION MEASURES.....	361
11.4. ENVIRONMENTAL MONITORING PROGRAMME.....	363
11.5. ADDITIONAL STUDIES.....	363
11.6. PROJECT BENEFITS.....	363
11.6.1 ENVIRONMENT BENEFIT.....	363
11.7. ENVIRONMENT MANAGEMENT PLAN.....	366
11.8. CONCLUSION.....	366
12. DISCLOSURE OF CONSULTANTS ENGAGED.....	367

List Of Tables

- Table 1. Identification of the Project
- Table 2. List of Directors
- Table 3. Brief Description of Site
- Table 4. Details of Employment (Construction)
- Table 5. Details of Employment (operation)
- Table 6. Identified Applicable Statutory
- Table 7. CTE/CTO Chronology
- Table 8. TOR Compliance Specific Points
- Table 9. TOR Compliance Standard Points
- Table 10. Coordinates of the Project
- Table 11. List of Major Industries in 10 km radius
- Table 12. Project Site Specific Environmental Sensitivity Details
- Table 13. Project Details
- Table 14. Area Distribution
- Table 15. Land Area Details
- Table 16. Land Ownership Details
- Table 17. Production Capacity
- Table 18. List of Plant & Machinery (Existing)
- Table 19. List of Plant & Machinery (Proposed)
- Table 20. Details of Power Requirement
- Table 21. Fuel Details
- Table 22. Details of Raw Materials Quantity
- Table 23. Details of Raw Materials (Storage, Source & Transportation Details)(SPVC)
- Table 24. Details of Raw Materials (Storage, Source & Transportation Details)(VCM)
- Table 25. Manpower Details (During Construction Phase)
- Table 26. Manpower Details (During Operation Phase)
- Table 27. Material Balance VCM
- Table 28. Material Balance PVC
- Table 29. Details of Flue Gas Stacks
- Table 30. Details of Process Gas Stacks
- Table 31. Non-Monsoon Water Requirement
- Table 32. Feed Water for Desalination Plant Analysis
- Table 33. Treated Water Quality at R.O- II Outlet-Desalination Plant Outlet –Treated Water
- Table 34. Desalination Plant Dimensions
- Table 35. Wastewater Generation Details
- Table 36. Wastewater treatment units
- Table 37. Characteristics of process wastewater stream
- Table 38. Inlet and Outlet Characteristics of Sewage Treatment Plant
- Table 39. Detail of Solid Waste Management
- Table 40. Detail of Non-Hazardous Solid Waste
- Table 41. Details of Hazardous Waste and its Management

- [Table 42. E-Waste Details](#)
- [Table 43. Battery Waste Details](#)
- [Table 44. Biomedical Waste Details](#)
- [Table 45. Details of Existing Trees](#)
- [Table 46. Annual Rooftop Rainwater Harvesting](#)
- [Table 47. Peak Rooftop Rainwater Harvesting](#)
- [Table 48. Stormwater Harvesting](#)
- [Table 49. Methodology of Baseline Data Collection](#)
- [Table 50. Temperature](#)
- [Table 51. Relative Humidity](#)
- [Table 52. Rainfall](#)
- [Table 53. Wind Speed](#)
- [Table 54. Wind Direction](#)
- [Table 55. Micro-Meteorological Data](#)
- [Table 56. Ambient Air Sampling Locations](#)
- [Table 57. Ambient Air Quality Results \(PM2.5 & PM10\)](#)
- [Table 58. Ambient air quality results for NO2 & SO2](#)
- [Table 59. Ambient air quality results for CO & VOC](#)
- [Table 60. Ambient Air Quality Results for HCl & Cl2](#)
- [Table 61. Ambient Air Quality Results for O3 & NH3](#)
- [Table 62. Ambient Air Quality Results for THC & NMHC](#)
- [Table 63. IDW Ambient Air Result](#)
- [Table 64. AQI of the Sampling Locations](#)
- [Table 65. Ambient Noise Sampling Station](#)
- [Table 66. Ambient Noise Quality \(Core Zone\)](#)
- [Table 67. Ambient Noise Quality \(Buffer Zone\)](#)
- [Table 68. Stratigraphic Succession of Area](#)
- [Table 69. Details of Cuddalore Ground Water developments](#)
- [Table 70. Groundwater Sampling Locations](#)
- [Table 71. Surface Water Sampling Locations](#)
- [Table 72. Ground Water Quality Results](#)
- [Table 73. Surface Water Quality Result](#)
- [Table 74. Surface Water Designated best Use by CPCB](#)
- [Table 75. Major land use/land cover categories of study area \(10 Km Radius Buffer zone\)](#)
- [Table 76. Onsite & Offsite Soil Sampling Location](#)
- [Table 77. Physical & Chemical Properties of Soil](#)
- [Table 78. Fertility of soil at onsite](#)
- [Table 79. Flora in Study Area](#)
- [Table 80. List of Floral Species of the Study Area other than Trees and Shrubs](#)
- [Table 81. List of the Mammals in the Study Area](#)
- [Table 82. List of the Herpetofauna in the Study Area](#)
- [Table 83. List of Avifauna Species of the Study Area](#)
- [Table 84. Schedule I Species Recorded in the Study Area](#)
- [Table 85. List of Villages within Study Area](#)

- [Table 86. List of Villages \(Primary Survey\)](#)
- [Table 87. Demographic Details](#)
- [Table 88. Demographic Structure of Surveyed Village](#)
- [Table 89. Literacy Details](#)
- [Table 90 Literacy Details](#)
- [Table 91. Working Pattern](#)
- [Table 92. Main Workforce Employment Pattern](#)
- [Table 93. Crop Pattern](#)
- [Table 94. Disease Prevalence Rate](#)
- [Table 95. Population Growth](#)
- [Table 96. Education](#)
- [Table 97. Performance Score](#)
- [Table 98. Poor performing group](#)
- [Table 99. Need Based Gaps:](#)
- [Table 100. PCU](#)
- [Table 101. Traffic](#)
- [Table 102. Traffic Details](#)
- [Table 103. LOS Value](#)
- [Table 104. Construction of New Structure](#)
- [Table 105. Installation of Machinery](#)
- [Table 106. Operation of Construction Machinery](#)
- [Table 107. Transportation Impact and Mitigation Measures](#)
- [Table 108. Working & Daily Activity of Construction Labor](#)
- [Table 109. Loading, Unloading & Storage of Raw Material](#)
- [Table 110. Manufacturing Process](#)
- [Table 111. Operation of Manufacturing machinery & Equipment](#)
- [Table 112. Transportation of Raw Material, finished product, waste, etc.](#)
- [Table 113. Working & daily activity of staff, Visitors](#)
- [Table 114. The input parameters for air quality modeling \(AERMOD\)](#)
- [Table 115. Village Wise Impacts of various scenario\(s\) for PM2.5 pollutant](#)
- [Table 116. Village Wise Impacts of various scenario\(s\) for PM10 pollutant](#)
- [Table 117. Village Wise Impacts of various scenario\(s\) for NO2 pollutant](#)
- [Table 118. Village Wise Impacts of various scenario\(s\) for SO2 pollutant](#)
- [Table 119. Village Wise Impacts of various scenario\(s\) for CO pollutant](#)
- [Table 120. Village Wise Impacts of various scenario\(s\) for HCl pollutant](#)
- [Table 121. Village Wise Impacts of various scenario\(s\) for VCM pollutant](#)
- [Table 122. Village Wise Impacts of various scenario\(s\) for HF pollutant](#)
- [Table 123. Village Wise Impacts of various scenario\(s\) for Cl2 pollutant](#)
- [Table 124. Village Wise Impacts of various scenario\(s\) for TOC pollutant](#)
- [Table 125. Environment Monitoring Plan-Construction Phase](#)
- [Table 126. Monitoring Plan-Operation Phase](#)
- [Table 127. Employment](#)
- [Table 128. Cost Benefit Analysis](#)
- [Table 129. Project Details](#)

- [Table 130. Process Gas Stack Details](#)
- [Table 131. Flue Gas Stack Details](#)
- [Table 132a. Non-Monsoon Water Requirement](#)
- [Table 132b. Wastewater Generation Details](#)
- [Table 133. Wastewater treatment units](#)
- [Table 134. Characteristics of process wastewater stream](#)
- [Table 135. Inlet and Outlet Characteristics of Sewage Treatment Plant](#)
- [Table 136. Annual Rooftop Rainwater Harvesting](#)
- [Table 137. Peak Rooftop Rainwater Harvesting](#)
- [Table 138. Stormwater Harvesting](#)
- [Table 139. Details of Hazardous Waste and its Management](#)
- [Table 140. Detail of Solid Waste Management](#)
- [Table 141. Non Hazardous Waste](#)
- [Table 142. E-Waste Details](#)
- [Table 143. Battery Waste Details](#)
- [Table 144. Biomedical Waste Details](#)
- [Table 145. Capital Cost](#)
- [Table 146. Recurring Cost](#)
- [Table 147. Cost Summary](#)
- [Table 148. Cumulative emission load- Air](#)
- [Table 149. Cumulative emission load- Transport](#)
- [Table 150. Cumulative emission load-Electricity](#)
- [Table 151. Green Area Carbon Sequestration](#)
- [Table 152. Carbon Footprint](#)
- [Table 153. Calculated Life Cycle Impact Potentials](#)
- [Table 155. Compliance Statement](#)
- [Table 156. Core Team](#)

List Of Images

- [Figure 1. Site Photographs](#)
- [Figure 2. Project Location on Google Satellite Imagery](#)
- [Figure 3. Map Showing General Location of the Site](#)
- [Figure 4. Study Area Map of 1km radius](#)
- [Figure 5. Google Image of Project Site showing Coordinates of the Site](#)
- [Figure 6. Layout Plan](#)
- [Figure 7. PLANT LAYOUT SHOWING EASTERN & WESTERN CORRIDOR LAND](#)
- [Figure 8. EXISTING LAYOUT PLAN OF PLANT \(WESTERN CORRIDOR LAND\)](#)
- [Figure 9. PROPOSED LAYOUT OF PLANT \(EASTERN CORRIDOR LAND\)](#)
- [Figure 10. Layout Plan showing contour level](#)
- [Figure 11. Topographical Map showing study area \(10 Km radius\)](#)
- [Figure 12. Project Site Specific Environmental Sensitivity Map](#)
- [Figure 13. Accessibility to Project Site](#)
- [Figure 14. Map Showing Seismicity of the Area](#)

- [Figure 15. Area Distribution Chart](#)
- [Figure 16. Process Flow Diagram \(VCM\)](#)
- [Figure 17. Vent gas absorption system](#)
- [Figure 18. Process flow diagram of PVC](#)
- [Figure 19. Existing Water Balance Diagram \(600 KTA\)](#)
- [Figure 20. Water Balance Diagram of Proposed \(600 KTA\) SPVC Plant \(Non-monsoon\)](#)
- [Figure 21. Water Balance Diagram of Proposed \(750 KTA\) VCM Plant \(Non-monsoon\)](#)
- [Figure 22. Combined Water Balance Diagram \(Non-monsoon\)](#)
- [Figure 23. ETP Flow Chart](#)
- [Figure 24. STP Flow Chart](#)
- [Figure 25. Green Belt Photographs \(Existing\)](#)
- [Figure 26. Accessibility Map 1 km](#)
- [Figure 27. Accessibility Map 2 km](#)
- [Figure 28. DEM Map](#)
- [Figure 29. Village Map of the Study Area](#)
- [Figure 30. Temperature](#)
- [Figure 31. Humidity](#)
- [Figure 32. Rainfall](#)
- [Figure 33. Wind Speed](#)
- [Figure 34. Windrose of Summer Season](#)
- [Figure 35. Windrose of Winter Season](#)
- [Figure 36. Annual Windrose](#)
- [Figure 37. Windrose Diagram](#)
- [Figure 38. Ambient Air Sampling Map](#)
- [Figure 39. Ambient Air Monitoring Photographs](#)
- [Figure 40. Ambient air quality results for PM_{2.5} & PM₁₀](#)
- [Figure 41. Ambient air quality results for NO₂ & SO₂](#)
- [Figure 42. Ambient air quality results for CO & VOC](#)
- [Figure 43. Ambient air quality results for HCl & Cl₂](#)
- [Figure 44. Ambient air quality results for O₃ & NH₃](#)
- [Figure 45. Ambient air quality results for THC & NMHC](#)
- [Figure 46. Baseline Concentration of PM_{2.5}](#)
- [Figure 47. Baseline Concentration of PM₁₀](#)
- [Figure 48. Baseline Concentration of SO₂](#)
- [Figure 49. Baseline Concentration of NO₂](#)
- [Figure 50. Baseline Concentration of THC](#)
- [Figure 51. Baseline Concentration of Cl₂](#)
- [Figure 52. Baseline Concentration of CO](#)
- [Figure 53. Baseline Concentration of HCl](#)
- [Figure 54. Baseline Concentration of NH₃](#)
- [Figure 55. Baseline Concentration of NMHC](#)
- [Figure 56. Baseline Concentration of O₃](#)
- [Figure 57. Baseline Concentration of VOC](#)
- [Figure 58. AQI Range with Category](#)

- [Figure 59. Noise Sampling Locations Map](#)
- [Figure 60. Noise Monitoring Photographs](#)
- [Figure 61. Geomorphological Map](#)
- [Figure 62. Geological Map](#)
- [Figure 63. Drainage Map](#)
- [Figure 64. Ground Water Sampling Photographs](#)
- [Figure 65. Surface Water Sampling Photographs](#)
- [Figure 66. Water Sampling Map](#)
- [Figure 67. Methodology of LULC Map](#)
- [Figure 68. FCC Map](#)
- [Figure 69. Landuse/Land Cover Map](#)
- [Figure 70. Land Use/ Land Cover Breakup Chart](#)
- [Figure 71. Soil Sampling Map](#)
- [Figure 72. Soil Sampling Photographs](#)
- [Figure 73. Output file showing scenario 1 for PM10, &...](#)
- [Figure 74. Output file showing scenario 2 for PM10, &...](#)
- [Figure 75. Environment Policy](#)
- [Figure 76. EMP Cell](#)
- [Figure 77. Existing Water Balance Diagram \(600 KTA\)](#)
- [Figure 78. Water Balance Diagram of Proposed \(600 KTA\) SPVC Plant \(Non-monsoon\)](#)
- [Figure 79. Water Balance Diagram of Proposed \(750 KTA\) VCM Plant \(Non-monsoon\)](#)
- [Figure 80. Combined Water Balance Diagram \(Non-monsoon\)](#)
- [Figure 81. ETP Flow Chart](#)
- [Figure 82. STP Flow Chart](#)
- [Figure 83. Parameters v/s Kg CO2 Eq.](#)

1. INTRODUCTION

M/s Chemplast Cuddalore Vinyls Limited is engaged in the manufacturing of Suspension Grade Poly Vinyl Chloride (SPVC) at its facility in Cuddalore, Tamil Nadu. The existing plant is located within the SIPCOT Industrial Complex, Phase II, covering a total area of 25.1862 hectares. It falls under Survey Nos. 70 (Part), 71 (Part), 72, 73, 74 (Part), 75 (Part), 76 (Part), 133 (Part), and 134. The plant has an existing production capacity of 600 KTA of PVC Resins, for which prior Environmental Clearance was granted via Letter No. SEIAA-TN/F.No.6788/5(e)EC-69/2019 dated **19.11.2019** and subsequently amended via letter No. SEIAA-TN/ F. No. 6788/ 5(e)EC. No:69/ Amendment/ 2023 dated **08.08.2023**.

Now, the company proposes an expansion of the existing SPVC facility. The proposed project involves the addition of a new Vinyl Chloride Monomer (VCM) production unit with a capacity of **750 KTA**, Following the increase in SPVC production capacity from **600 KTA to 1200 KTA**, with addition in plot area by acquiring an adjacent land parcel measuring 39.4436 ha. This expansion area is located across multiple survey numbers, including: 130/1A1A, 131/1B, 131/2, 132/1, 132/2, 132/4, 135/1B1, 129/3, 129/6, 62/1, 62/2B (Part), 67/1B, 67/2, 112/1B, 133/15 to 133/21, 133/4, 133/6, 134/1, 134/3 to 134/5, 136/1 (Part), 137/2, 137/9 to 137/14, 138/2 to 138/5, 138/9A, 138/13, 139/3, 139/5 to 139/12, 139/14B, 141/2B, 141/3B, 141/4, 141/5, 154/2, 158/5, 158/7, 160/4 to 160/7, 163/2, 163/3A & 3B, 164/2B, 165/1A (Part), 165/1B2 (Part), 175/1, 176/2 & 6, 177/3, and 178/6. These are located near Semmankuppam and Thiyagavalli villages in Cuddalore District, Tamil Nadu.

The proposed land area lies partly within **SIPCOT area** (Survey Nos. 129/3 & 129/6, 132/2 & 132/4) and the balance of the survey numbers are outside the SIPCOT area. The existing cost of the project is INR 500 Cr. The cost of proposed expansion is INR 6000 Cr. Thus, the total cost of the project after expansion will be **INR 6500 Cr**.

1.1 PURPOSE OF THE REPORT

Based on the proposal submitted vide proposal number IA/TN/IND2/542531/2025 submitted by **Chemplast Cuddalore Vinyls Limited (CCVL)**, the project was granted Specific Terms of Reference (ToR) from MoEF&CC vide TOR IdentificationNo. TO25A2301TN5808288N and **File No. IA-J-11011/132/2020-IA(II)**, dated **28.07.2025** for the proposed expansion of production capacity. The EIA study has been carried out as per the TOR granted and in compliance to the requirements of the EIA Notification, 2006 and its subsequent amendments to identify environmental impacts resulting from the proposed project and to prescribe mitigation measures.

We are now submitting the Draft EIA report to the District Environmental Engineer, TNPCB along with compliance to the Terms of Reference (ToR) conditions with a request to conduct Public Hearing for the said proposal.

Demand Supply Gap:

The India Poly Vinyl Chloride (PVC) market has reached approximately 3.1 million tonnes in the Financial Year, 2022 and is anticipated to grow to 6.1 Million tonnes by 2032. At present, there is a significant demand supply gap in the PVC industry and this gap will further widen in the ensuing years, unless capacity additions happen in the country.

Import vs Indigenous:

The demand for PVC in India is projected to grow to 6.1 Million tonnes by 2032. A significant portion of the domestic PVC demand is met through import. The Proposed expansion of SPVC Plant will result in the reduction of the import. The produced product will be used to meet the domestic demand, thereby reducing the dependency on the import. VCM is used as a raw material for SPVC production. The proposed Production of VCM will be used for existing as well as proposed expansion of SPVC Plant. Hence thereby, reducing the dependency on the import.

Export Possibility

There is a strong export potential for PVC Products, particularly PVC pipes and sheets. The Proposed expansion of SPVC Plant will result in increase in the production of PVC resin which will directly influence the production of PVC Products. Hence, increasing the Export Possibility. The VCM produced from the proposed VCM Plant will be consumed captive for PVC production. Therefore, looking at the demand for PVC and the proponent's experience in the sector, the setting up of a feedstock VCM plant in Cuddalore is essential.

1.2 IDENTIFICATION OF THE PROJECT AND PROJECT PROPONENT

1.2.1 IDENTIFICATION OF THE PROJECT

Table 1. Identification of the Project

Name of Project	Activity & Category	Remark
"Expansion of existing SPVC plant from 600 KTA to 1200 KTA with backward integration of the raw material VCM of 750 KTA capacity" by M/s. Chemplast Cuddalore Vinyls Limited (CCVL)	Activity: 5(e) & Category: A	The project falls under, Petrochemical based processing industry. The existing land is located within the SIPCOT area and proposed land lies partly within the SIPCOT area.

The project involves expansion of existing SPVC plant production capacity from 600 KTA to 1200 KTA setting up of a new VCM production unit of 750 KTA.

The proposed expansion project being involved in the manufacture of SPVC, a petrochemical based product, attracts the provisions of schedule 5(e) of EIA Notification 2006 and its subsequent amendments. The existing plant is located within the SIPCOT Industrial Complex, Phase II. Also, the proposed expansion project site is located on various survey Nos. out of which 129/3, 129/6, 132/1 & 132/4 survey numbers which are within the SIPCOT industrial area (which is a Severely

polluted area (SPA)) and the rest of the land is outside the SIPCOT area. Hence, the project is categorized as category A project as per EIA notification 2006 as amended to date with applicability of general conditions (due to proximity to the SPA).

In the proposed expansion VCM facility will be developed in an overall plot area of 3,94,436.00 m² and will have a total manufacturing capacity of 750 KTA of Vinyl Chloride Monomer & expansion of PVC resin from 600 KTA to 1200 KTA will be done in existing land area of 2,51,862.00 m².

1.2.2 IDENTIFICATION OF THE PROPONENT

Project Proponent : M/s. Chemplast Cuddalore Vinyls Limited

Registered Address : 9, Cathedral Road, Chennai-600086, Tamil Nadu.

Authorized Signatory : Mr. S. Gajendiran

Details of Directors are given in Table 2.

Table 2. List of Directors

S. No.	Name of Directors	Designation
1	Ramkumar Shankar	Managing Director
2	Amarnath Ananthanarayanan	Director
3	Lakshmi Vijaykumar	Director
4	Aditya Jain	Director

M/s Chemplast Cuddalore Vinyls Limited, is a wholly owned subsidiary of M/s Chemplast Sanmar Limited. The facility is dedicated to the manufacture of Suspension PVC resin, which is a key component for manufacturing crystal clear blow moulded bottles, rigid and clear calendered PVC films and injection moulded pipe fittings. It's also been used in rigid and flexible applications like pipes, conduits, hoses and tubes, wire and cable coating, calendared films/sheets, extruded profiles and for making cable/footwear compounds. The registered office of the company is located at 9, Cathedral Road, Chennai - 600086.

1.3 BRIEF DESCRIPTION OF THE PROJECT

1.3.1 DESCRIPTION OF ACTIVITIES AND IMPORTANCE TO THE REGION

Chemplast Cuddalore Vinyls Ltd (CCVL) plans to set up a New Vinyl Chloride Monomer (VCM) manufacturing facility at Cuddalore along with an increase in production quantity of PVC resin from 600 KTA to 1200 KTA. CCVL has been operating a Suspension PVC manufacturing facility at Cuddalore since 2009 based on imported VCM. The proposed VCM plant will be installed as a backward integration to supply raw material for the PVC plant. The proposed VCM plant will import feedstock Ethylene and Ethylene Dichloride through the existing Marine Terminal Facility.

Table 3. Brief Description of Site

S. No.	Particulars	Details
1	Location	Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers,

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

S. No.	Particulars		Details
			Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005
2	District		Cuddalore
3	State		Tamil Nadu
4	Project Coordinates		Latitude : 11°38'36.92"N Longitude : 79°44'51.62"E
5	Plot Area	Existing	2,51,862.00 Sqm
		Total After Expansion	6,46,298.00 Sqm
6	Production Capacity	Existing	EC Product: 600 KTA (SPCV)
		After Expansion	EC Product: 1950 KTA (SPCV-1200 KTA & VCM- 750 KTA) By Product: 200 KTA (HCl-30-35%)
7	Approach Road		Nochikkadu to Perumal Koil Road (Adjacent to Project Area)
			NH-45A (Chennai-Nagapathinam HWY 32)
8	Project Cost	Existing	500.0 Cr.
		After Expansion	6500.0 Cr.

1.3.3 EMPLOYMENT GENERATION

Table 4. Details of Employment (Construction)

Employment Generation during Construction Phase			
Permanent Employment [X]		Temporary / Contractual Employment [Y]	
No.s of Permanent Employment [A]	50	No.s of Temporary / Contractual Employment [A]	800
Period of Employment (No. of days) [B]	350	Period of Employment (No. of days) [B]	350
No. of Man Days [A]* [B]	17,500	No. of Man Days [A]* [B]	2,80,000
Total [X] + [Y] = 297500			

Table 5. Details of Employment (operation)

Employment Generation during Operational Phase			
Particulars	Existing	Proposed	Total After Expansion
Permanent Employment [X]			
No.s of Permanent Employment [A]	176	190	346
Period of Employment (No. of days) [B]	350	350	350
No. of Man Days [A]* [B]	61,600	66,500	1,28,100
Total [X] = 128100			
Temporary / Contractual Employment [Y]			
No.s of Temporary / Contractual Employment [A]	568	500	1,068
Period of Employment (No. of days) [B]	350	350	350
No. of Man Days [A]* [B]	1,98,800	1,75,000	3,73,800
Total [Y] = 373800			
Total [X] + [Y] = 501900			

1.4 STATUS OF THE PROJECT SITE

At present the existing plant is operational with a production capacity of 600 KTA of PVC Resins, for which prior Environmental Clearance was granted via Letter No. SEIAA-TN/F.No.6788/5(e)EC-69/2019 dated **19.11.2019** and subsequently amended via letter No. SEIAA-TN/ F. No. 6788/ 5(e)EC. No:69/ Amendment/ 2023 dated **08.08.2023**.

The existing plant is in possession of M/s Chemplast Cuddalore Vinyls Limited and is located within the SIPCOT Industrial Complex, Phase II, covering a total area of 25.1862 hectares. It falls under Survey Nos. 70 (Part), 71 (Part), 72, 73, 74 (Part), 75 (Part), 76 (Part), 133 (Part), and 134.

Now the company proposes an expansion of the existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity. For the expansion project an additional area of 39.4436 ha is included. The proposed land area lies partly within SIPCOT area (Survey Nos. 129/3 & 129/6, 132/2 & 132/4) and the balance of the survey numbers are outside the SIPCOT area. Land documents are attached as **Annexure 1**.





Figure 1. Site Photographs

1.5 THE ASSIGNMENT & SCOPE OF THE STUDY

- To Determine the status of current environmental parameters:** This study involves assessment of present environment and ecology, flora and fauna, land use/ land cover, socio-economic condition of the area, monitoring of atmospheric pollutants like air, water, soil, noise and meteorological parameters. Studies in this respect were carried out in core zone (i.e. project area) as well as in buffer zone (area covering 10 km radius from the project) as per the guidelines of MoEF&CC and TOR Granted.
- To Predict, Assess, categorize, quantify and mitigate probable significant environmental impacts (considering alternate assignments, baseline scenario and public opinion):** In order to predict the expected impact of processes and activities of the project on various environmental factors, a detailed study of interrelationship of project activities and environmental factors has been carried out in this report. Since the project is partially located in a Notified Industrial Area.
- To prepare a detailed Environmental Management Plan (EMP)** with best available management tools and techniques including monitoring, reporting along with Operation and Maintenance Budget for better implementation.
- Undertake Risk assessment for the proposed project and lay down risk mitigation measures for safe Operations.**

1.6 IDENTIFIED APPLICABLE STATUTORY

The list of statutory provisions as applicable to the project is given in **Table 12**.

Table 6. Identified Applicable Statutory

S.No.	Acts/Rules	Publishing Year	Project Relevance	Objective of Legislation
1	The Environment (Protection) Act	1986, amended 1991	All types of environmental pollutants	Protection and Improvement of the Environment

S.No.	Acts/Rules	Publishing Year	Project Relevance	Objective of Legislation
1.1	Environmental (Protection) Rules,	1986 (Amendments in 1999, 2001, 2002, 2002, 2003, 2004)	All types of Environmental Pollutants	Protection and Improvement of the Environment
1.2	Hazardous Waste (Management and Handling) Rules	1989 amended 2000 and 2003, Apr 2016	Hazardous Wastes generated from industries using hazardous chemicals	Management & Handling of hazardous wastes in line with the Basel convention
1.3	Manufacture Storage and Import of Hazardous Chemicals Rules	1989 amended 2000	Hazardous Chemicals - Toxic, Explosive, Flammable, Reactive	Regulate the manufacture, storage and import of Hazardous Chemicals
1.4	Chemical Accidents (Emergency Planning, Preparedness and Response) Rules	1996	Hazardous Chemicals - Toxic, Explosive, Flammable, Reactive	Emergency Planning Preparedness and Response to chemical accidents
2	Factories Act	1948	All the Chemicals specified in the chapter 2	Control of workplace environment, and providing for good health and safety of workers
3	The Petroleum Act	1934	Class B and C - as defined in the rules are present	Regulate the import, transport, storage, production, refining and blending of petroleum
3.1	The Petroleum Rules	2002	Class B and C - as defined in the rules are present	Regulate the import, transport, storage, production, refining and blending of petroleum
4	The Explosives Act	1884	Explosive substances as defined under the Act like Boiler, Flammable Hazardous material	To regulate the manufacture, possession, use, sale, transport, export and import of explosives with a view to prevent accidents
4.1	The Explosive Rules	1983	Explosive substances as defined under the Act	To regulate the manufacture, possession, use, sale, transport, export and import of explosives with a view to prevent accidents
4.2	The Gas Cylinder Rules	2004	Gases (Toxic, non-toxic and non-flammable, non-toxic and flammable, Dissolved Acetylene Gas, Non-toxic and flammable liquefiable gas other than LPG, LPG	Regulate the import, storage, handling and transportation of gas cylinders with a view to prevent accidents

S.No.	Acts/Rules	Publishing Year	Project Relevance	Objective of Legislation
4.3	The Static and Mobile Pressure Vessels (Unfired) Rules	1981	Gases (Toxic, non-toxic and non-flammable, non-toxic and flammable, Dissolved Acetylene Gas, Non-toxic and flammable liquefiable gas other than LPG, LPG	Regulate the import, manufacture, design, installation, transportation, handling, use and testing of mobile and static pressure vessels (unfired) with a view to prevent accidents
5	Air (Prevention and Control of Pollution) Act	1981 amended 1987	Air pollutants from chemical industries	The prevention, control and abatement of air pollution
6	EIA Notification	2006	For all the identified Developmental activities in the notification	Requirement of environmental clearance before establishment of or modernization / expansion of identified developmental projects.
7	Water (Prevention and Control of Pollution) Act	1974 amended 1988	Water Pollutants from water polluting industries	The prevention and control of water pollution and also maintaining or restoring the wholesomeness of water
8	Public Liability Insurance Act	1991 amended 1992	Hazardous Substances	To provide immediate relief to persons affected by accident involving hazardous substances
8.1	Public Liability Insurance Rules	1991 amended 1993	Hazardous Substances	To provide immediate relief to persons affected by accident involving hazardous substances and also for Establishing an Environmental Relief fund
9	The Motor Vehicle Act	1988	Hazardous and Dangerous Goods	To consolidate and amend the law relating to motor vehicles
9.1	The Central Motor Vehicle Rules	1989	Hazardous and Dangerous Goods	To consolidate and amend the law relating to motor vehicles including to regulate the transportation of dangerous goods with a view
10	Tamil Nadu Fire Service Act	1985	Flammable and Explosive Substances/ Chemical	Establishment and maintenance of a Fire Service in the State of Tamil Nadu

1.7 SCOPE OF EIA STUDY - DETAILS OF REGULATORY SCOPING CARRIED OUT

1.7.1 SCOPING

- **Terms of Reference (ToR):** Under the provision of the EIA Notification 2006 as amended till date, TOR for the purpose of preparing an environment impact assessment report for obtaining Environment Clearance has been issued vide **File No IA-J-11011/132/2020- IA(II)**, dated **28.07.2025**.
- **Existing Environmental Clearance:** The unit was initially granted Environmental Clearance (EC) vide letter No. J-11011/180/2004-IA.II(I) dated 28.11.2005. The plant has since then renewed its EC from Tamil Nadu Pollution Control Board (TNPCB). The plant has received its most recent EC vide letter No. SEIAA-TN/F.No.6788/5(e)EC-69/2019 dated 19.11.2019 for the production of Suspension Grade Poly Vinyl Chloride (SPVC). Further, an amendment to the EC was obtained due to changes in the land extent, while maintaining the same production capacity vide letter No. SEIAA-TN/F.No:69/Amendment/2023 dated 08.08.2023. Copy of the EC dated **19.11.2019** and amended EC dated **08.08.2023** is attached as **Annexure 2**.
- **Certified Compliance Report (CCR) as per EC:** Applicable, CCR applied, CCR Letter awaited.
- **Coastal Regulation Zone (CRZ):** NA
- **Wildlife Clearance:** NA
- **Other Permissions:** Existing Consents Details given in Table 7.

The consent chronology for the industry is mentioned in the table below:

Table 7. CTE/CTO Chronology

S. No.	CTO/CTE or EC	Company Name	Consent Number	Date of Issue	Validity	Products
1	EC	M/s. Chemplast Sanmar Ltd.	No.J-11011/180/2004-I. A.II(I)	28.11.2005	-	1,70,000 TPA
2	EC	M/s. Chemplast Sanmar Ltd.	F.No.J-11-11/180/2004-I A II (I)	2.06.2011	-	2,26,000 TPA
3	EC	M/s. Chemplast Sanmar Ltd.	F.No.J-11011/364/2011-I .A.II(I)	18.12.2012	-	3,00,000 TPA
4	EC	M/s. Chemplast Cuddalore Vinyls Limited	Letter No.SEIAA-TN/F.No.6788/ 5(e)EC-69/2019	19.11.2019	-	6,00,000 TPA
5	CTO - Air	M/s. Chemplast Cuddalore Vinyls Limited	Consent Order No. 17945	14.07.2009	30.09.2009	1,40,000 TPA upgradable to 1,70,000 TPA
6	CTO - water	M/s. Chemplast Cuddalore Vinyls Limited	Consent Order No. 21906	14.07.2009	30.09.2009	1,40,000 TPA upgradable to 1,70,000 TPA

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



S. No.	CTO/CTE or EC	Company Name	Consent Number	Date of Issue	Validity	Products
7	CTE	M/s. Chemplast Cuddalore Vinyls Limited	CONSENT ORDER NO. 2206239983654	23.05.2022	31.03.2026	6,00,000 TPA
8	Amendment in EC- due to change in land extent	M/s. Chemplast Cuddalore Vinyls Limited	Lr.No.SEIAA-TN/F.No:69/ Amendment/2023	08.08.2023	-	6,00,000 TPA
9	CTO - Air	M/s. Chemplast Cuddalore Vinyls Limited	Consent Order No. 2307247638383	08.02.2023	31.03.2027	3,50,000 TPA
10	CTO - water	M/s. Chemplast Cuddalore Vinyls Limited	Consent Order No. 2307147638383	08.02.2023	31.03.2027	3,50,000 TPA

1.7.2 TOR COMPLIANCE

Table 8. TOR Compliance Specific Points

S. No.	Specific ToR Points	ToR Compliance	Citation in EIA Report
1.	Carryout cumulative impact assessment for the instant proposal including the interlinked project for upgradation of MTF along with associated facilities as per OM dated 24.12.2010.	Cumulative Impact Assessment has been undertaken to evaluate the combined effects of both the projects - the MTF upgradation and the SPVC expansion with the proposed VCM unit. Cumulative EIA which has two volumes as under: Volume I: Expansion of the existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity. - in compliance with TOR granted vide TOR Identification No. TO25A2301TN5808288N, file No. IA-J-11011/132/2020-IA(II) dated 28.07.2025 (this document) Volume II: Upgradation of Existing Marine Terminal Facilities and Proposed 20 MLD Desalination Plant - in compliance with TOR granted vide TOR Identification No. TO24A3501TN5664131N, file No. 11-63/2005-IA-III dated 02.12.2024	
2.	A compounded flood study along with the rise in water level of Uppanar during tsunami and cyclone periods and final flood risk assessment report.	As per the Flood Risk Assessment Study conducted by NIOT, there is no risk of flooding in the project area.	Chapter 7, section 7.1.2.
3.	NOC from PWD/concerned department for their own approach to cross and go towards Zone 2,3,4 (Eastern Corridor) from Zone 1 (Western corridor).	NOC from PWD for the approach to cross and go towards Zone 2,3,4 (Eastern Corridor) from Zone 1 (Western corridor) has been applied.	-
4.	Action plan for additional safeguards for projects located in CPA/SPA as per MoEF&CC OM dated 31st October, 2019.	As the project is located in SPA Cuddalore, an action plan for additional safeguards is prepared and given in Chapter 10 of EIA report.	Chapter 10, section 10.6.
5.	A revised contour map for 2 m interval shall	We have conducted a survey for	Chapter 3 Section 3.2.4 of

S. No.	Specific ToR Points	ToR Compliance	Citation in EIA Report
	be submitted.	generating contour maps at an interval of 2 m. Contour map for 2 m interval is given in Chapter 3.	the EIA report
6.	The PP/consultant shall submit Certified Compliance reports for all the existing ECs as per OM IA3- 22/10/2022-IA.III [E 177258] dated 08th June, 2022.	Request for site inspection to IRO, has been made.	-
7.	EIA/EMP report shall include details such as (i) Details of advertisements for Public Hearing (ii) Copy of forwarding letter of SPCB to MoEF&CC (iii) Legible copy of public hearing proceedings duly signed by the presiding officer (iv) Attendance sheets (v) Action plan to address the issues raised during existing public consultation (vi) Copy of written grievances/submissions if any.	Noted and will be complied after PH completion.	-
8.	PP shall submit the soil profile & structure study and hydrogeological study for the complete project area.	A hydrogeological study was conducted at two Sanmar sites in Semmankuppam Panchayat, Cuddalore, to assess hydrogeology and potential piling impacts. The coastal sites feature Quaternary sediments (clay/silt) over Cuddalore Sandstone, near the Uppanar Backwaters, which keep shallow aquifers brackish. Deeper sandstone (below 20m) is used for irrigation west of the highway. No significant groundwater extraction occurs in the industrial complex, as SIPCOT supplies water. Soil strata include soft silt to 7m, followed by sandy silty clay/clayey silty sand/clayey silty sand with gravel to 13m. Piling to 11-13m will use bentonite clay and MS casing, minimizing shallow aquifer contamination. Piling is limited to 13m and won't involve groundwater extraction. Thus, piling for the proposed VCM plant in Cuddalore will not impact the area's hydrogeological characteristics	Hydrogeological study report is attached as Annexure 15 .
9.	PP shall conduct an ecological risk assessment using appropriate modelling tools.	Ecological risk assessment has been done and given in Chapter 7 of the EIA report..	Chapter 7, section 7.20 of EIA Report.

S. No.	Specific ToR Points	ToR Compliance	Citation in EIA Report
10.	PP shall carry out air dispersion modelling using the CALPUFF model for toxic air pollutants.	Air dispersion modelling is given in Chapter 4 of EIA Report	Chapter 4 Section 4.6
11.	PP shall undertake a Detailed Quantitative Risk Assessment (QRA), including hazard identification and consequence analysis.	Quantitative Risk Assessment (QRA) is given in Chapter 7.	Chapter 7 Section 7.7
12.	PP shall prepare a decarbonisation plan outlining measures for emission reduction and carbon neutrality.	The decarbonisation study is given in Chapter 7.	Chapter 7 Section 7.9
13.	PP shall carry out an Environmental Cost-Benefit Analysis (ECBA) covering social, ecological, and economic aspects.	Environmental Cost-Benefit Analysis (ECBA) is given in Chapter 7.	Chapter 7 Section 7.10
14.	PP shall conduct a drone survey along with contour mapping for the entire project area.	Drone survey was done on 04.09.2025. Ortho images are given in Chapter 3.	Chapter 3 Section 3.2.4 of the EIA report
15.	PP shall provide high-resolution land use and land cover imagery/maps of the project and surrounding area.	High-resolution Land use and land cover imagery /maps of the project and surrounding area are given in Chapter 3 of the EIA report.	Chapter 3 Section 3.2.4 of the EIA report
16.	PP shall undertake comprehensive marine ecological studies, if applicable.	Comprehensive marine ecological study is attached as Chapter 7	Chapter 7 Section 7.11
17.	PP shall carry out long-term air quality modelling studies, including sensitivity analysis, to determine the optimal stack height for flue gas and process vents, and/or propose necessary changes in layout to minimise impacts on sensitive receptors.	Long-term air quality modelling studies, including sensitivity analysis, to determine the optimal stack height for proposed process vents were carried out and given in Chapter 4.	Chapter 4 Section 4.7

Table 9. TOR Compliance Standard Points

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
1	Executive Summary		
1.1	Executive Summary	Executive Summary is given in Chapter 11 of the EIA report.	Chapter 11 of the EIA report.
2	Introduction		
2.1	Details of the EIA Consultant including NABET accreditation	EIA Consultant involved is M/s Perfect Enviro Solutions Pvt Ltd. (NABET Registered List 'A' of Accredited Consultant Organisation [NABET/EIA/2225/RA 0284 (Rev.01) valid up to 26.11.2025. Details of the EIA consultant are given in Chapter 12 of the EIA report.	Chapter 12 of the EIA report.

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
2.2	Information about the project proponent	The proposed project will be developed by M/s Chemplast Cuddalore Vinyls Limited. The details about the Project Proponent are given in Chapter 1.	Chapter 1, Section 1.2.2 of the EIA report.
3	Project Description		
3.1	Cost of project and time of completion.	Existing Project Cost: INR 500 Cr. After Expansion Project Cost: INR 6500 Cr. The project is expected to be completed and commissioned by April 2029.	Chapter 2, Section 2.4.3 and 2.4.4 of the EIA report.
3.2	Products with capacities for the proposed project. If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.	In the proposed expansion VCM facility will be developed in an overall plot area of 3,94,436.00 m ² and will have a total manufacturing capacity of 750 KTA of Vinyl Chloride Monomer & expansion of PVC resin from 600 KTA to 1200 KTA will be done in existing land area of 2,51,862.00 m ² .	Chapter 2, Section 2.4.2 of the EIA report.
3.3	List of raw materials required and their source along with mode of transportation.	The details of required raw materials, their source, and corresponding transportation methods are given in Chapter 2.	Chapter 2, Section 2.8 of the EIA report.
3.4	Other chemicals and materials required with quantities and storage capacities	Details of all the chemicals required with quantities are discussed in Chapter 2 of the EIA report. Separate storage facilities will be provided for the chemicals and raw materials. Storage of all the chemicals will be done as per MSIHC Rules 1986.	Chapter 2, Section 2.8 of the EIA report.
3.5	Details of Emission, effluents, hazardous waste generation and their management. Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract)	Emission: The details of process gas emission and flue gas emissions are given in Chapter 2 of EIA report. Hazardous waste: Hazardous waste generation will be from used or spent oil, wastes or residue containing oil, any process or distillation residue, furnace residue, Desal sludge, ETP sludge, Chemical sludge from wastewater treatment, PVC lumps, and Spent Catalyst. Details are given in Chapter 2 of EIA report Effluent generation & management: Total waste water generation after expansion will be 13.419 MLD.	Chapter 2, Section 2.11 of the EIA report. Chapter 2, Section 2.15 of the EIA report. Chapter 2, Section 2.13.1 of the EIA report.

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
		Total 104 KLD of treated sewage will be generated from Domestic which will be treated in STP of capacity 140 KLD. Remaining 13310 KLD of effluent (8840 KLD from process, 300 KLD from Plant Wash, 3309 KLD from Cooling Tower & 770 KLD from DM Regeneration & 90 KLD from Boiler Blowdown) will be treated in ETP of capacity 15800 KLD.	
3.6	Process description along with major equipments and machineries, process flow sheet (quantitative) from raw material to products to be provided.	Details of process description along with major equipments and machineries, process flow sheet (quantitative) from raw material to products are discussed in Chapter 2 of the EIA report.	Chapter 2, Section 2.10 of the EIA report.
3.7	Hazard identification and details of proposed safety systems.	Identified Hazards & proposed safety systems for the study area is given in Chapter 7. Detailed study is also attached in the RH report annexed with the EIA report.	Chapter 7, Section 7.4.4 of the EIA report.
3.8	Expansion/modernization proposals: A. Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MOEF/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment and Forests as per circular dated 08th June, 2022 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing /existing operation of the project from SPCB shall be attached with the EIA-EMP report.	The plant has an existing production capacity of 600 KTA of PVC Resins, for which prior Environmental Clearance was granted via Letter No. SEIAA-TN/F.No.6788/5(e)EC-69/2019 dated 19.11.2019 and subsequently amended via letter No. SEIAA-TN/ F. No. 6788/ 5(e)EC. No:69/ Amendment/ 2023 dated 08.08.2023.	Chapter 1 of the EIA report.
	B. In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted.	Not applicable	

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
	Further, compliance reports to the conditions of consents from the SPCB shall be submitted.		
4	Site Details		
4.1	Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.	Location of the site-Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005 Justification for selecting the site: The project is a brownfield site with a proposed expansion of the existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity. Land: The existing plant is operational under 25.1862 ha area, and for the proposed expansion there will be addition of land area of 39.4436 ha owned by M/s Chemplast Cuddalore Vinyls Limited. This total area will be adequate for the proposed expansion including locating our environmental components like greenbelt area, HW storage area, etc. Connectivity: The site is well connected with roads (Nochikkadu to Perumal Koil Road & Nochikadu-Naduthittu Road which are adjacent to project boundary) and Alapakkam Railway Station at a distance of 2.36 km, SSW. Facilities & Utilities: The existing plant has got all the facilities and utilities for the existing plant. There will be addition of machinery to cater the proposed expansion.	Chapter 2 Section 2.3 of the EIA report. Chapter 5 Section 5.1 of the EIA report.
4.2	A toposheet of the study area of radius of 10 km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)	The toposheet of the study area including the eco sensitive areas and environmentally sensitive places are given in Chapter 2 of the EIA Report.	Chapter 2 Section 2.3.3 of the EIA report.
4.3	Co-ordinates (lat-long) of all four corners	The coordinates of all the corners	Chapter 2 Section 2.3 of

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
	of the site. Google map-Earth downloaded of the project site. Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.	are given in Chapter 2 of the EIA report.	the EIA report.
4.4	Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.	Site Photographs are given in Chapter 1 of the EIA Report.	Chapter 1 Section 1.4 of the EIA report.
4.5	Land use break-up of total land of the project site (identified and acquired), government/ private - agricultural, forest, wasteland, water bodies, settlements, etc shall be included. (not required for industrial area).	The land area of the project site will increase from 25.1862 ha (62.23 acres) to 64.6298 ha (159.69 acres). Land use break up of the project site is given in Chapter 2.	Chapter 2 Section 2.4.1 of the EIA report.
4.6	A list of major industries with name and type within study area (10km radius) shall be incorporated.	The list of industries in the study area is given in chapter 2 of the EIA Report.	Chapter 2 Section 2.3.2 of the EIA report.
4.7	Details of Drainage of the project up to 5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided. (mega green field projects).	Details of drainage of the study area are given in Chapter 3 of the EIA report.	Chapter 3 Section 3.7.5.1 of the EIA report.
4.8	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.	In the proposed expansion, VCM facility will be developed in an additional land parcel measuring 39.4436 ha.	The land documents are attached as Annexure 1.
4.9	R&R details in respect of land in line with state Government policy.	There is no need for R&R activities for the proposed project.	
5	Forest and wildlife related issues (if applicable):		
5.1	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)	Not applicable. No forest land is involved.	
5.2	Land use map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland (in case of projects involving forest land more than 40 ha).	No forest land is involved. However, a Land-use map based on High resolution satellite imagery of the proposed unit is attached in Chapter 3 of EIA.	Chapter 3 Section 3.9.3 of the EIA report.
5.3	Status of Application submitted for	Not applicable	

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
	obtaining the stage I forestry clearance along with latest status shall be submitted.		
5.4	The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon	Not applicable	
5.5	Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any exists in the study area	The Wildlife Conservation Plan is under preparation.	-
5.6	Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.		
6	Environmental Status		
6.1	Determination of atmospheric inversion level at the project site and site-specific micrometeorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.	Site-specific micro meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall recorded for the study area is given in Chapter 3 of the EIA Report.	Chapter 3 Section 3.4 of the EIA report.
6.2	AAQ data (except monsoon) at 8 locations for PM10, PM2.5, SO2, NOX, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre- dominant wind direction, population zone and sensitive receptors including reserved forests.	AAQ data of Summer season (Feb 2024-April 2024) has been collected. The monitoring stations were selected based on the predominant wind direction, population zone and sensitive receptors. Details are provided in Chapter 3 of the EIA Report	Chapter 3 Section 3.5 of the EIA report.
6.3	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.	Raw data of all AAQ measurements is attached as Annexure 10.	Attached as Annexure 10.
6.4	Surface water quality of nearby River (100m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB/MoEF&CC guidelines.	Baseline study of the Surface water quality for Summer season (Feb 2024-April 2024) is given in Chapter 3 of the EIA Report.	Chapter 3 Section 3.8.6 of the EIA report.
6.5	Whether the site falls near to polluted	No, the site does not fall near to	

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
	stretch of river identified by the CPCB/MoEF&CC, if yes give details.	polluted stretch of river	
6.6	Ground water monitoring at minimum 8 locations shall be included.	The Groundwater Monitoring locations for Summer season (Feb 2024-April 2024) is given in Chapter 3 of the EIA Report.	Chapter 3 Section 3.8.7 of the EIA report
6.7	Noise levels monitoring at 8 locations within the study area.	The baseline study of the Noise level Monitoring for Summer season (Feb 2024-April 2024) is given in Chapter 3 of the EIA Report.	Chapter 3 Section 3.6 of the EIA report
6.8	Soil Characteristic as per CPCB guidelines.	The baseline study of Soil Quality for Summer season (Feb 2024-April 2024) is given in Chapter 3 of the EIA Report.	Chapter 3 Section 3.10 of the EIA report
6.9	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.	The traffic study of the study area is given in Chapter 3 of the EIA Report.	Chapter 3 Section 3.13 of the EIA report
6.10	Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule- I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.	The baseline status of the existing Flora and Fauna in the study area is given in Chapter 3 of the EIA Report. There are 13 Schedule-I species and the conservation plan is drafted for the same.	Chapter 3 Section 3.11 of the EIA report
6.11	Socio-economic status of the study area.	The baseline status of the Socio-Economic study is given in Chapter 3 of the EIA Report.	Chapter 3 Section 3.12 of the EIA report
7	Impact and Environment Management Plan		
7.1	Assessment of ground level concentration of pollutants from the stack emission based on site specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modeling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be assessed. Details of the model used and the input data used for modeling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.	Cumulative impact of all sources of emissions (including transportation) on the ambient air quality of the area has been assessed. Air dispersion modelling has been done considering all the sources of the pollution. AERMOD developed by Lakes Environmental Inc. is used to calculate incremental Ground Level concentrations (GLC) for the proposed sources of air pollution, for Particulate emissions, Gaseous emissions. The air quality contours have been plotted on a location map showing the location of project site, habitation nearby, sensitive receptors. The details are mentioned in Chapter 4 of the EIA	Chapter 4 Section 4.4. of the EIA report

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
		report. The Air Dispersion Report is attached as Annexure 11.	
7.2	Water Quality modeling - in case of discharge in water body	Not Applicable	
7.3	Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor cum- rail transport shall be examined.	Impact due to transportation of raw material with mitigation measures is given in Chapter 4.	Chapter 4 Section 4.3.1 of the EIA report
7.4	A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules.	Details of Wastewater Treatment & Management and its scheme are given in Chapter 2.	Chapter 2 Section 2.13 of the EIA report
7.5	Details of stack emission and action plan for control of emissions to meet standards.	Stack Emissions along with their characteristics Height, emission limits, and control emissions are given in Chapter 2 of the EIA Report.	Chapter 2 Section 2.11 of the EIA report
7.6	Measures for fugitive emission control	Measures for fugitive emission control are given in Chapter 4 of the EIA Report.	Chapter 4 Section 4.3 of the EIA report
7.7	Details of hazardous waste generation and their storage, utilization and management. Copies of MOU regarding utilization of solid and hazardous waste in cement plant shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.	Hazardous waste generation and their storage, utilization and management is given in Chapter 2 of the EIA Report. Hazardous waste will be managed via authorised HW recyclers, HW utilisers and CHWTSDf by M/s. Chemplast Cuddalore Vinyls Limited”_ The Agreement copy for the same is attached as Annexure 3.	Chapter 2 Section 2.15 of the EIA report
7.8	Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.	Details are given in Chapter 2 of the EIA Report.	Chapter 2 Section 2.15 of the EIA report
7.9	Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be	Greenbelt will be developed in a total area of 25.0515 ha i.e., 40.31 % of total project area. Detailed plan is given in Chapter 2 Section 2.16.	Chapter 2 Section 2.16 of the EIA report

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
	included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.		
7.10	Action plan for rainwater harvesting measures at the plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to be used for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.	Detailed plan is given in Chapter 2 Section 2.17.	Chapter 2 Section 2.17 of the EIA report
8	Occupational health		
8.1	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers.	The Plan with the budget to ensure occupational Health and safety for the workers is given in Chapter 7 of the EIA Report.	Chapter 7 Section 7.7 of the EIA report
8.2	Details of exposure specific health status evaluation of workers. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre placement and periodical examinations give the details of the same. Details regarding last month analyzed data of above mentioned parameters as per age, sex, duration of exposure and department wise.	Noted & will be complied.	
8.3	Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that the health of the workers can be preserved.	The unit has ensured to take high-class measures to limit the exposure to hazardous chemicals to workers. The Hazardous chemicals will be stored within their Permissible Exposure level. Hazardous chemical storage and the preventive measures for the same are given in Chapter 7 of the EIA Report.	Chapter 7 Section 7.6 of the EIA report
8.4	Annual report of health status of workers with special reference to Occupational Health and Safety.	Noted & will be complied.	
9	Corporate Environment Policy		
9.1	Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.	Yes, the Environment Policy by the company is given in Chapter 10 of the EIA Report.	Chapter 10 Section 10.2 of the EIA report
9.2	Does the Environment Policy prescribe for standard operating process /	Yes, the Environment Policy prescribes for standard operating	Chapter 10 Section 10.2 of the EIA report

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
	procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.	process / procedures.	
9.3	What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.	Detailed hierarchical chart given in Chapter 10 of the EIA Report.	Chapter 10 Section 10.3 of the EIA report
9.4	Does the company have a system of reporting of non compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report.	Yes, the company have a system of reporting non compliances / violations of environmental norms.	Chapter 10 Section 10.3 of the EIA report
9.5	Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during the operation phase.	Noted and complied.	-
10	Enterprise Social Commitment (ESC)		
10.1	Adequate funds (at least 2.5 % of the project cost) shall be ear marked towards the Enterprise Social Commitment based on Public Hearing issues and item-wise details along with time bound action plan shall be included. Socio- economic development activities need to be elaborated upon.	It will be updated after successful completion of public Hearing.	-
10.2	Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details there of compliance/ATR to the notice(s) and present status of the case.	There is no litigation pending against the project.	-
10.3	A tabular chart with index for point wise compliance of above TOR.	Noted.	
11	Specific Conditions		
11.1	Details on requirement of raw material, its source of supply and storage at the plant.	Details on the requirement of raw material, its source of supply and storage are given in Chapter 2 of the EIA report.	Chapter 2 Section 2.8 of the EIA report

S. No.	Standard ToR Points	ToR Compliance	Citation in EIA Report
11.2	Complete process flow diagram for all products with material balance.	Process flow diagram for all products are given in Chapter 2 of the EIA report	Chapter 2 Section 2.10 of the EIA report
11.3	Details on requirement of auxiliary chemicals, solvents, catalysts, reactors and utilities to support the unit processes.	Details are given in Chapter 2 of the EIA report	Chapter 2 Section 2.10 of the EIA report
11.4	Brief description of equipment for various processes.	Details of equipment for various processes are given in Chapter 2 of the EIA report	Chapter 2 Section 2.4.5 of the EIA report
11.5	Details of proposed source- specific pollution control schemes and equipment to meet the national standards.	Details of proposed source-specific pollution control schemes and equipment are given in Chapter 2 of the EIA report	Chapter 2 Section 2.11 of the EIA report
11.6	Details on VOC emission control system from vents, stacks, fugitive emissions and flare management, etc.	Details on VOC emission control system from vents, stacks, fugitive emissions are given in Chapter 2 of the EIA report	Chapter 2 Section 2.11 of the EIA report
11.7	Details on proposed LDAR protocol.	Noted and will be complied.	-
11.8	Ambient air quality should include total hydrocarbon , methane and non methane hydrocarbon & VOC and VCM (if applicable).	The details of the same are given in Chapter 3.	Chapter 3 Section 3.5 of the EIA report
11.9	Risk Assessment & Disaster Management Plan • Identification of hazards • Consequence Analysis • Measures for mitigation of risk.	Risk Assessment & Disaster Management Plan are given in Chapter 7.	Chapter 7 of the EIA report

2. PROJECT DESCRIPTION

This chapter presents a concise overview of the project, encompassing its activities, proximity to major infrastructure, resource demands (raw materials, power, water, etc.), potential environmental consequences arising from these activities, and proposed mitigation strategies to address those impacts.

2.1 TYPE OF PROJECT

- 1) Type:- Activity : 5(e), Category A- Petrochemical based processing
- 2) New / expansion / change in product mix:- Expansion

2.2 NEED OF THE PROPOSED PROJECT

India is witnessing robust growth in the demand for PVC-based products, particularly in sectors like agriculture (irrigation pipes), infrastructure (cables, conduits, doors, windows), water supply, sanitation, healthcare, and packaging. The country's per capita PVC consumption is still below the global average, indicating significant untapped potential.

Poly vinyl Chloride (PVC) is a highly versatile plastic with a wide range of applications, particularly in the production of pipes and fittings for agriculture and industry.

These PVC pipes offer significant advantages over traditional metal alternatives due to their lightweight nature, resistance to corrosion, flexibility, and ability to deliver higher flow rates.

India's PVC market is booming, reaching approximately 3.1 million tonnes in FY 2022 and expected to grow at a healthy Compound Annual Growth Rate (CAGR) of 7.11% by FY 2032.

- **Economic benefits:** PVC production is a significant economic driver. As a relatively inexpensive and versatile material used in construction, piping, and packaging, it can create jobs and stimulate the economy.
- **Infrastructure development:** Widely used in water distribution, sanitation, and irrigation systems, PVC pipes play a crucial role in infrastructure development. Increased PVC production can directly support improvements in a region's infrastructure.

Chemplast Cuddalore Vinyls Limited has been operating a suspension PVC plant at Cuddalore, Tamilnadu since 2009. The expansion of the SPVC plant along with VCM backward integration by M/s Chemplast Cuddalore Vinyls Limited is a strategically planned, demand-driven initiative that aligns with national priorities of industrial growth, import substitution, and sustainable manufacturing. The project is expected to deliver long-term socio-economic and environmental benefits with minimal incremental ecological footprint due to its location within an established industrial estate and adoption of modern process technologies. This will help in saving foreign exchange reserves and promote **Atmanirbhar Bharat**.

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

2.3 PROJECT LOCATION

Location: Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005

Latitude: 11°38'38.90"N

Longitude: 79°44'25.47"E

Elevation: 28 m (msl)

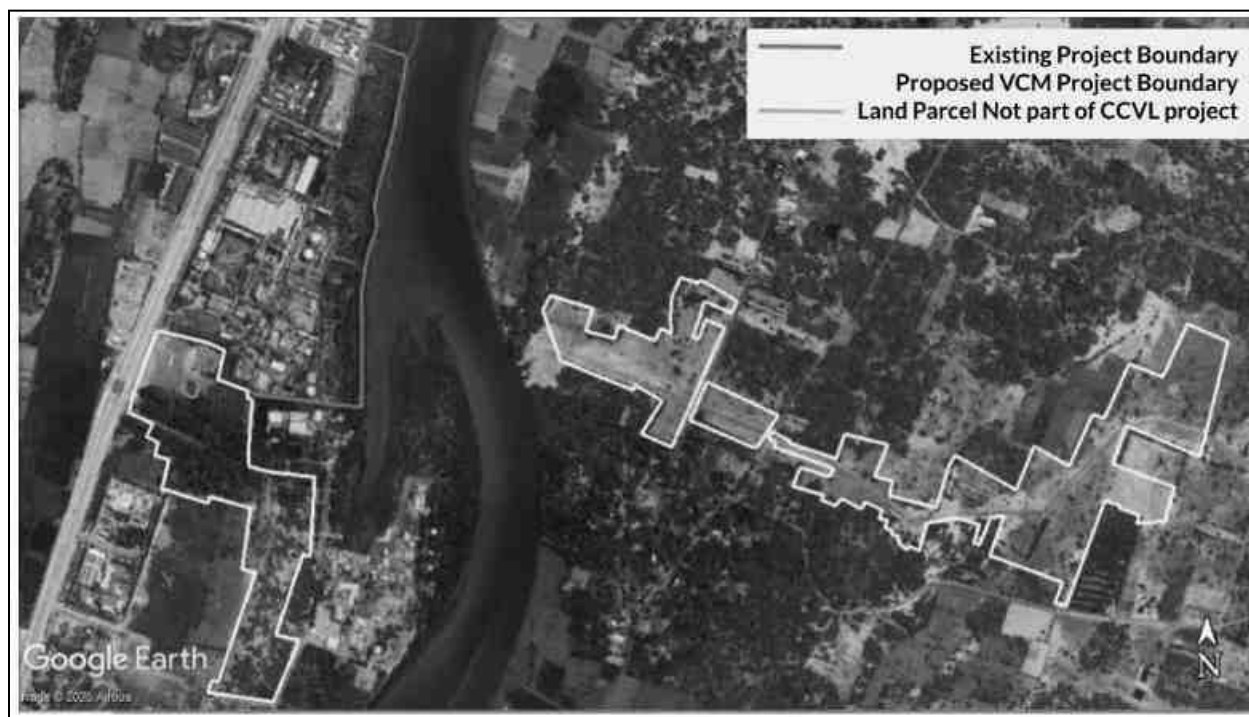


Figure 2. Project Location on Google Satellite Imagery

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

- **General Location**

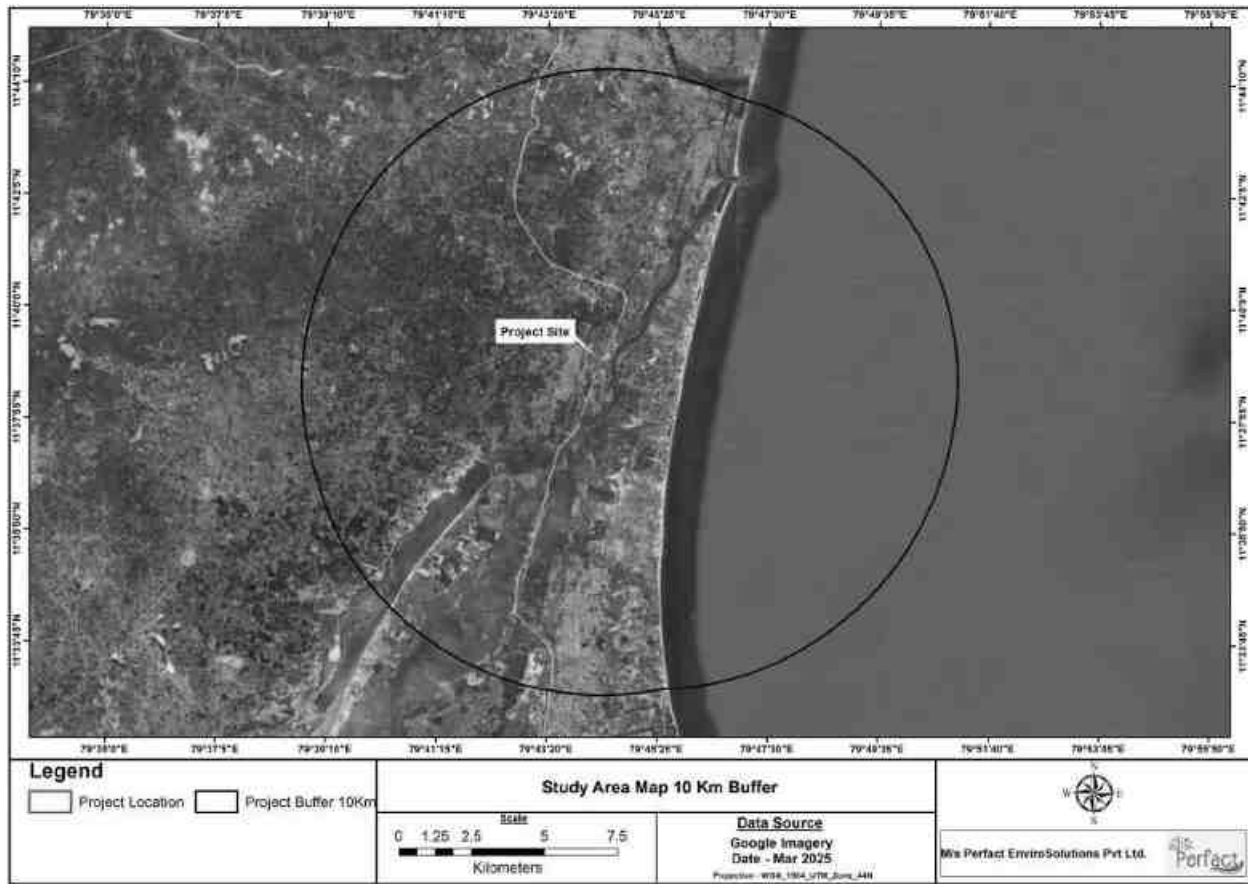


Figure 3. Map Showing General Location of the Site

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

- Map showing close view of the project site with 1 km radius:



Figure 4. Study Area Map of 1km radius

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

2.3.1 SPECIFIC LOCATION

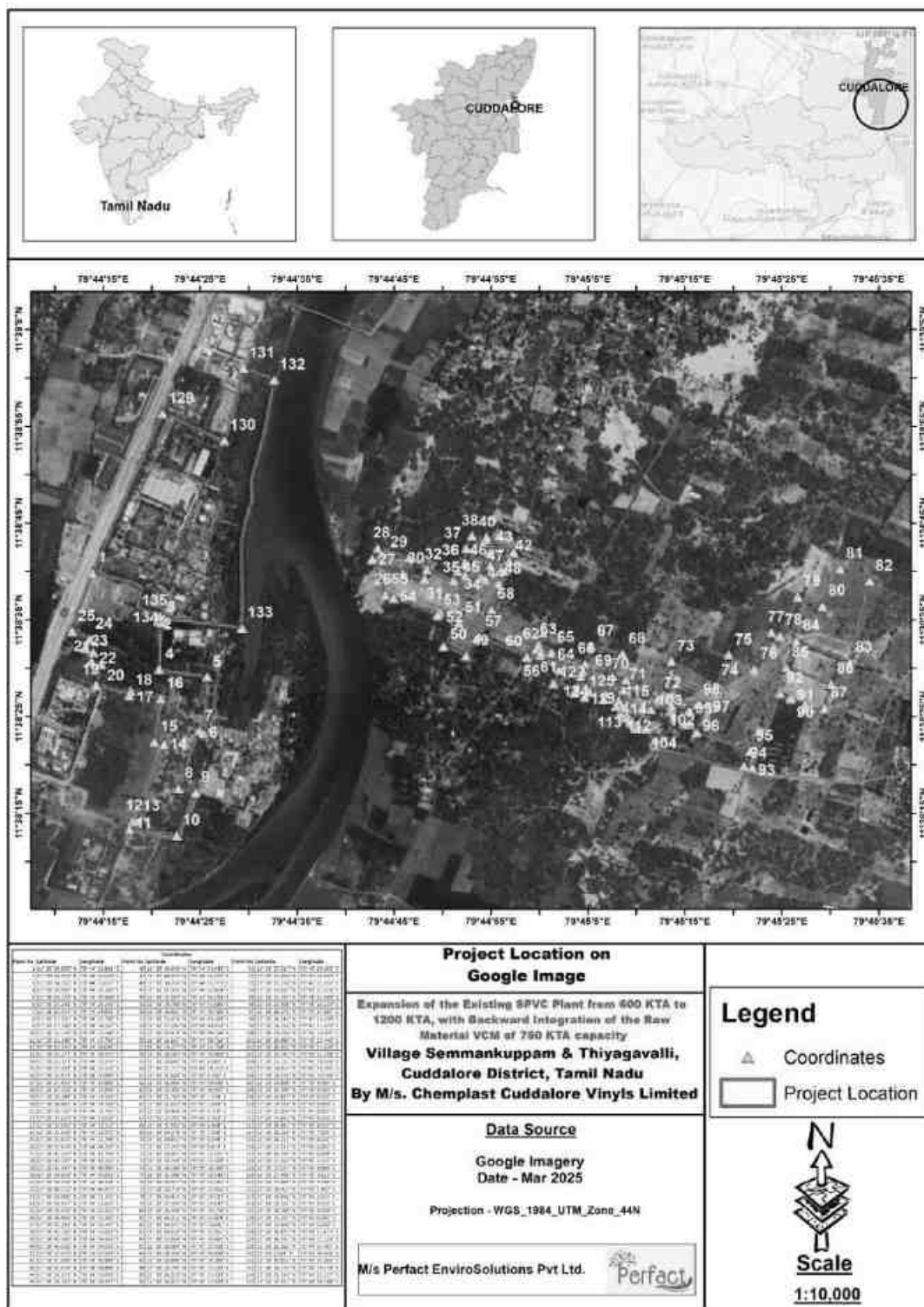


Figure 5. Google Image of Project Site showing Coordinates of the Site

Table 10. Coordinates of the Project

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



S. No.	Latitude	Longitude
1	11° 38' 39.856" N	79° 44' 13.891" E
2	11° 38' 34.932" N	79° 44' 20.624" E
3	11° 38' 34.765" N	79° 44' 21.017" E
4	11° 38' 29.909" N	79° 44' 20.783" E
5	11° 38' 29.125" N	79° 44' 25.698" E
6	11° 38' 23.291" N	79° 44' 25.340" E
7	11° 38' 23.534" N	79° 44' 24.835" E
8	11° 38' 17.585" N	79° 44' 22.780" E
9	11° 38' 17.148" N	79° 44' 24.507" E
10	11° 38' 12.718" N	79° 44' 22.588" E
11	11° 38' 13.398" N	79° 44' 17.703" E
12	11° 38' 14.243" N	79° 44' 18.045" E
13	11° 38' 14.177" N	79° 44' 18.473" E
14	11° 38' 22.171" N	79° 44' 21.270" E
15	11° 38' 22.391" N	79° 44' 20.261" E
16	11° 38' 26.871" N	79° 44' 20.886" E
17	11° 38' 27.693" N	79° 44' 17.806" E
18	11° 38' 27.222" N	79° 44' 17.690" E
19	11° 38' 28.288" N	79° 44' 14.254" E
20	11° 38' 30.403" N	79° 44' 14.785" E
21	11° 38' 30.705" N	79° 44' 13.745" E
22	11° 38' 31.659" N	79° 44' 13.958" E
23	11° 38' 32.093" N	79° 44' 13.112" E
24	11° 38' 33.026" N	79° 44' 13.575" E
25	11° 38' 33.835" N	79° 44' 11.786" E
26	11° 38' 37.614" N	79° 44' 44.103" E
27	11° 38' 41.259" N	79° 44' 42.764" E
28	11° 38' 42.397" N	79° 44' 43.316" E
29	11° 38' 41.447" N	79° 44' 46.540" E
30	11° 38' 39.816" N	79° 44' 45.952" E
31	11° 38' 39.255" N	79° 44' 48.136" E
32	11° 38' 40.212" N	79° 44' 48.421" E
33	11° 38' 39.080" N	79° 44' 51.150" E
34	11° 38' 40.017" N	79° 44' 51.601" E
35	11° 38' 39.616" N	79° 44' 52.352" E
36	11° 38' 40.869" N	79° 44' 52.305" E
37	11° 38' 42.391" N	79° 44' 52.447" E
38	11° 38' 43.706" N	79° 44' 53.061" E
39	11° 38' 43.300" N	79° 44' 54.414" E
40	11° 38' 43.539" N	79° 44' 54.553" E
41	11° 38' 42.014" N	79° 44' 57.325" E
42	11° 38' 41.099" N	79° 44' 56.884" E
43	11° 38' 41.974" N	79° 44' 54.884" E
44	11° 38' 39.373" N	79° 44' 53.993" E
45	11° 38' 39.205" N	79° 44' 54.437" E
46	11° 38' 40.640" N	79° 44' 54.945" E
47	11° 38' 40.035" N	79° 44' 56.372" E
48	11° 38' 38.726" N	79° 44' 55.775" E

S. No.	Latitude	Longitude
49	11° 38' 31.301" N	79° 44' 52.414" E
50	11° 38' 32.297" N	79° 44' 50.134" E
51	11° 38' 34.709" N	79° 44' 51.686" E
52	11° 38' 35.827" N	79° 44' 49.726" E
53	11° 38' 35.476" N	79° 44' 49.503" E
54	11° 38' 37.286" N	79° 44' 44.953" E
55	11° 38' 37.614" N	79° 44' 44.103" E
56	11° 38' 31.217" N	79° 44' 58.712" E
57	11° 38' 33.277" N	79° 44' 53.758" E
58	11° 38' 36.087" N	79° 44' 55.063" E
59	11° 38' 33.642" N	79° 45' 0.385" E
60	11° 38' 31.217" N	79° 44' 58.712" E
61	11° 38' 31.660" N	79° 45' 0.200" E
62	11° 38' 31.992" N	79° 44' 59.630" E
63	11° 38' 32.481" N	79° 44' 59.907" E
64	11° 38' 31.783" N	79° 45' 1.244" E
65	11° 38' 31.615" N	79° 45' 1.209" E
66	11° 38' 30.468" N	79° 45' 4.718" E
67	11° 38' 32.285" N	79° 45' 5.362" E
68	11° 38' 31.501" N	79° 45' 8.568" E
69	11° 38' 29.178" N	79° 45' 7.598" E
70	11° 38' 28.852" N	79° 45' 8.948" E
71	11° 38' 27.795" N	79° 45' 8.673" E
72	11° 38' 26.891" N	79° 45' 12.217" E
73	11° 38' 30.744" N	79° 45' 13.609" E
74	11° 38' 28.186" N	79° 45' 18.190" E
75	11° 38' 31.389" N	79° 45' 19.542" E
76	11° 38' 29.927" N	79° 45' 22.161" E
77	11° 38' 33.719" N	79° 45' 23.905" E
78	11° 38' 33.413" N	79° 45' 24.792" E
79	11° 38' 37.399" N	79° 45' 26.647" E
80	11° 38' 36.448" N	79° 45' 29.174" E
81	11° 38' 40.312" N	79° 45' 31.008" E
82	11° 38' 39.037" N	79° 45' 34.051" E
83	11° 38' 30.610" N	79° 45' 31.961" E
84	11° 38' 32.838" N	79° 45' 26.492" E
85	11° 38' 30.084" N	79° 45' 25.418" E
86	11° 38' 28.384" N	79° 45' 30.059" E
87	11° 38' 25.896" N	79° 45' 29.395" E
88	11° 38' 25.745" N	79° 45' 27.223" E
89	11° 38' 26.319" N	79° 45' 27.410" E
90	11° 38' 26.871" N	79° 45' 25.920" E
91	11° 38' 27.017" N	79° 45' 25.963" E
92	11° 38' 27.430" N	79° 45' 24.839" E
93	11° 38' 19.730" N	79° 45' 21.932" E
94	11° 38' 19.932" N	79° 45' 21.078" E
95	11° 38' 21.437" N	79° 45' 21.685" E
96	11° 38' 23.408" N	79° 45' 16.224" E

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



S. No.	Latitude	Longitude
97	11° 38' 26.275" N	79° 45' 17.287" E
98	11° 38' 26.243" N	79° 45' 16.298" E
99	11° 38' 24.236" N	79° 45' 15.478" E
100	11° 38' 24.330" N	79° 45' 14.997" E
101	11° 38' 25.666" N	79° 45' 15.442" E
102	11° 38' 26.162" N	79° 45' 13.630" E
103	11° 38' 25.741" N	79° 45' 11.528" E
104	11° 38' 23.725" N	79° 45' 10.926" E
105	11° 38' 24.055" N	79° 45' 10.285" E
106	11° 38' 24.076" N	79° 45' 10.168" E
107	11° 38' 23.808" N	79° 45' 9.984" E
108	11° 38' 24.399" N	79° 45' 9.383" E
109	11° 38' 24.827" N	79° 45' 9.342" E
110	11° 38' 24.918" N	79° 45' 8.869" E
111	11° 38' 25.264" N	79° 45' 8.899" E
112	11° 38' 25.432" N	79° 45' 8.356" E
113	11° 38' 25.942" N	79° 45' 8.547" E
114	11° 38' 26.126" N	79° 45' 7.915" E
115	11° 38' 26.713" N	79° 45' 8.181" E
116	11° 38' 27.316" N	79° 45' 6.893" E
117	11° 38' 26.795" N	79° 45' 6.608" E
118	11° 38' 27.562" N	79° 45' 5.121" E
119	11° 38' 27.027" N	79° 45' 4.669" E
120	11° 38' 27.469" N	79° 45' 3.613" E
121	11° 38' 27.805" N	79° 45' 3.786" E
122	11° 38' 28.457" N	79° 45' 1.482" E
123	11° 38' 29.836" N	79° 45' 2.023" E
124	11° 38' 29.153" N	79° 45' 4.255" E
125	11° 38' 29.768" N	79° 45' 4.500" E
126	11° 38' 31.323" N	79° 45' 0.082" E
127	11° 38' 31.660" N	79° 45' 0.200" E
128	11° 38' 39.871" N	79° 44' 13.871" E
129	11° 38' 56.332" N	79° 44' 21.110" E
130	11° 38' 53.562" N	79° 44' 27.467" E
131	11° 39' 1.044" N	79° 44' 29.442" E
132	11° 38' 59.822" N	79° 44' 32.602" E
133	11° 38' 34.173" N	79° 44' 29.278" E
134	11° 38' 35.126" N	79° 44' 21.277" E
135	11° 38' 35.431" N	79° 44' 20.788" E

Site layout plan is attached below:

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

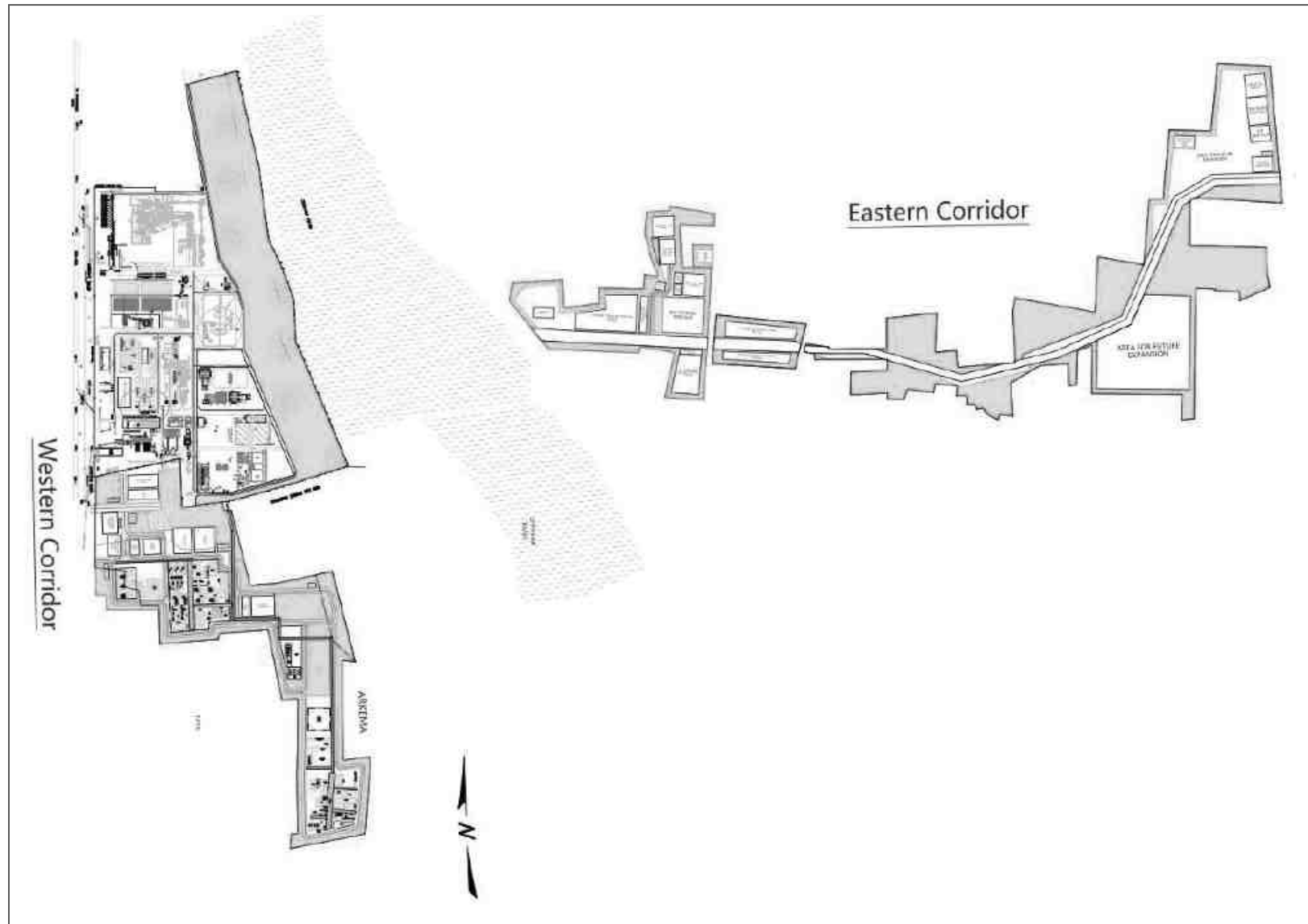


Figure 6. PLANT LAYOUT SHOWING EASTERN & WESTERN CORRIDOR LAND

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and / Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

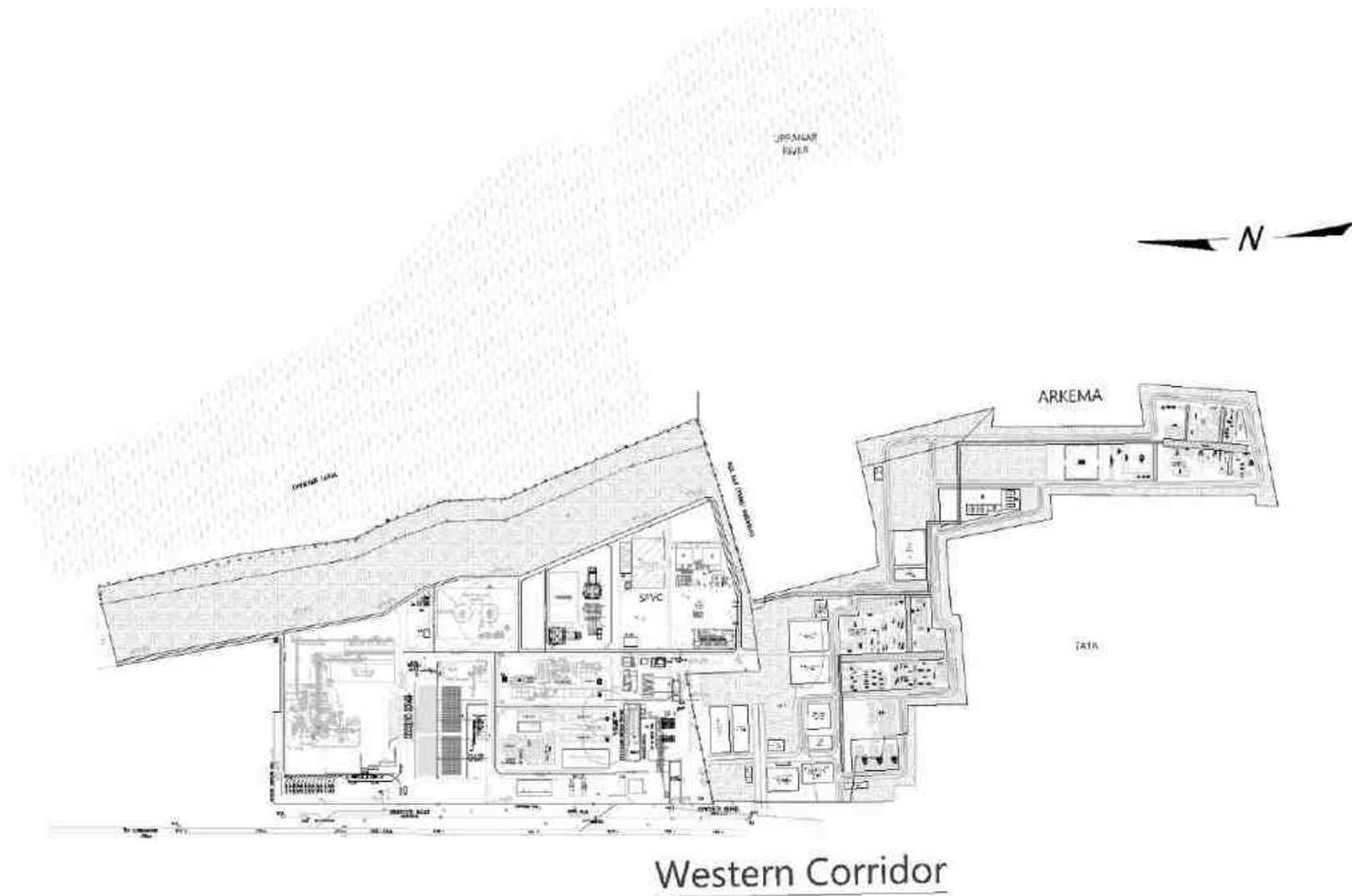


Figure 8. EXISTING LAYOUT PLAN OF PLANT (WESTERN CORRIDOR LAND)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

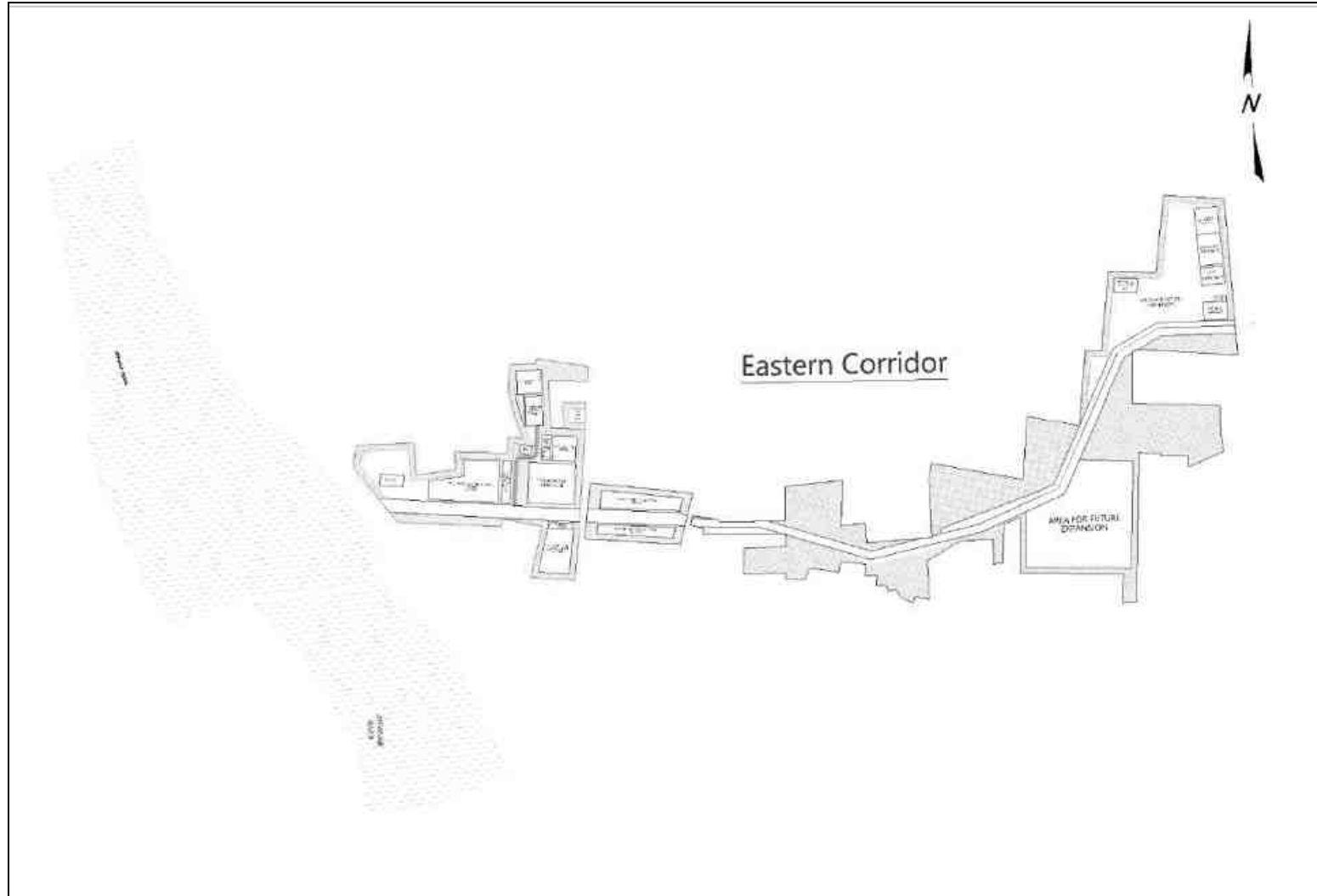


Figure 9. PROPOSED LAYOUT OF PLANT (EASTERN CORRIDOR LAND)

2.3.2 MAJOR INDUSTRIES IN BUFFER AREA WITH 10 KM RADIUS

Table 11. List of Major Industries in 10 km radius

S. No.	Industry Name	Type	Distance	Direction
1.	Arkema Peroxides India Pvt Ltd. - JPQR+M88 Sembankuppam, Tamil Nadu 607005	Chemical Manufacturer	0.10 km	East
2.	Aria chemicals Pvt Ltd - JPPP+FQR Cuddalore, Tamil Nadu 607001	Chemical plant	0.18 km	SW
3.	Tata Chemicals - JPQP+VGF Tamil Nadu 607005	Chemical plant	0.20 km	West
4.	Chemplast Cuddalore Vinyls Limited Main Gate - Sipoct Phase II Periya Karaikadu, Tamil Nadu 607005	PVC industry	0.40 km	North
5.	PJIPL-Biogas plant - MP4V+83M Sembankuppam, Tamil Nadu 607005	Cosmetics industry	1.53 km	NNE
6.	Asian Paints Limited, Penta plant, Cuddalore - Sipcot Industrial Complex, B5 - B10, Kudikadu, Tamil Nadu 607005	Paint Manufacturer	4.52 Km	NNE
7.	Morgan Industries Ltd - MQM5+75W Tamil Nadu 607005	Chemical plant	5.00 km	NNE
8.	BMM ICE PLANT - MPVX+XW5 Pachchyankuppam, Tamil Nadu 607003	Manufacturer	5.89 km	NNE
9.	Plant 3 -MQW4+7VR, SH 49 Pachchyankuppam, Tamil Nadu 607003	Manufacturer	6.22 km	NNE
10.	RANI ICE PLANT - No.2, Manjini Rajendirapuram, SH 49 opposite to Tagros Chemical Company Sipcot Chidambaram, Tamil Nadu 605007	Ice supplier	6.23 km	NNE
11.	Hemalathaa Hitech Industries - 67-73 Vallalar Nagar, SIPCOT Cuddalore, Pachchyankuppam, Tamil Nadu 607005	Manufacturer	6.62 km	NNE
12.	ARVEES INDUSTRIES - 13, Imperial Rd Cuddalore Old Town, Tamil Nadu 607003	Machining manufacturer	8.15 km	NNE
13.	BioGas Plant - HP4G+GP7, Cuddalore Chidambaram Hwy, Tamil Nadu 608501	Manufacturer	9.04 km	South

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Environmental Consultant- Perfect Enviro Solutions Pvt. Ltd

2.3.4 ENVIRONMENT SENSITIVITY OF THE PROJECT

Table 12. Project Site Specific Environmental Sensitivity Details

Particulars	Sensitive Area	Distance & Direction
Water Bodies	Uppanar River	0.01 Km East
	Perumal Lake	4.34 Km SW
	Gedilam River	7.17 Km NNE
	Copper Hills Lake	7.40 Km North
	Kedilam River	10.76 Km NNW
	Then Pennai River	12.60 Km NNE
Settlement	Pundiyanakuppam	0.81 Km, SW
Educational Institute	PUP School	0.40 Km West
	SKS Complex	0.48 Km WSW
	Government Higher Secondary School	1.27 Km SW
	Santhosh Kumar - High school	1.74 Km SW
Worship Place	Hindu temple	Within the Project site
	Ammakali temple Vairankuppam	0.30 Km West
	Sri Veeran kovil	0.62 Km SE
	Shri Muniappan Temple	0.85 Km South
Reserve Forests	None	
Railway Line	Alapakam Railway Station	2.36 Km SSW
	Capper Quarry Railway Station	3.45 Km NNE
	Kullanchavadi Railway Station	7.44 Km WSW
	Cuddalore Port Junction/ Railway Station	7.78 Km NNE
	Tirupadripuliyur Railway Station	10.87 Km NNE
	Varakalpattu Railway Station	13.21 Km NNW
Hospital	Government Hospital	3.07 Km NW
	Child Health Care Centre Kizhavan Kuppam	4.63 Km SSW
	Sivakumar Hospital and Medical	4.67 Km North
	General Hospital	4.91 Km North
	Sudharshna Healthcare	7.46 Km WSW
Eco-sensitive Area: None		
Wildlife Sanctuary: None within 15 km radius		
Critically Polluted Area	The project lies in severely polluted area	
Post Office	Sedapalayam Post office	2.37 Km NW
	Sipcot Post Office	3.81 Km NNE
	Periyakuppam Post Office	3.87 Km SE
Bank	Federal Bank Bus Stop	2.58 KmNW
	Axis Bank	4.44 KmNNW
	Canara Bank	4.73 KmNNE
	Cooperative Bank	6.13 KmNW
Road	Nochikkadu to Perumal Koil Road	Adjacent to Project Area
	Nochikadu-Naduthittu Road	Adjacent to Project Area
	NH-45A (Chennai-Nagapathinam HWY 32)	0.02 Km West
	NH-532 (Cuddalore-Vadalur Road)	2.58 Km NW
	State Highway No.-138 (Kurinjpadi-Cuddalore)	7.52 Km NW
Airport	Puducherry Airport	35.74 Km, NNE

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiayagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

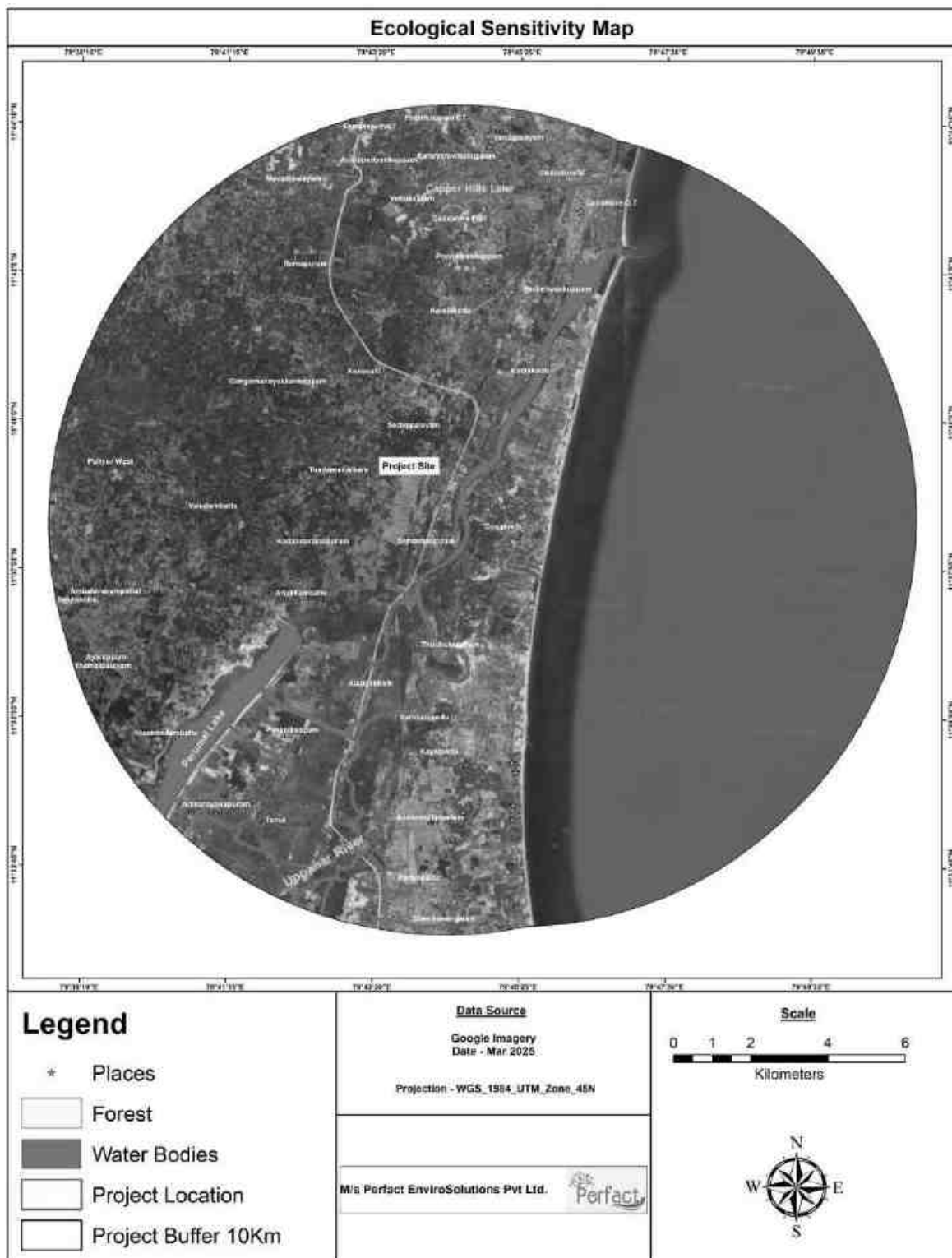


Figure 12. Project Site Specific Environmental Sensitivity Map

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



2.3.4. ACCESSIBILITY & CONNECTIVITY

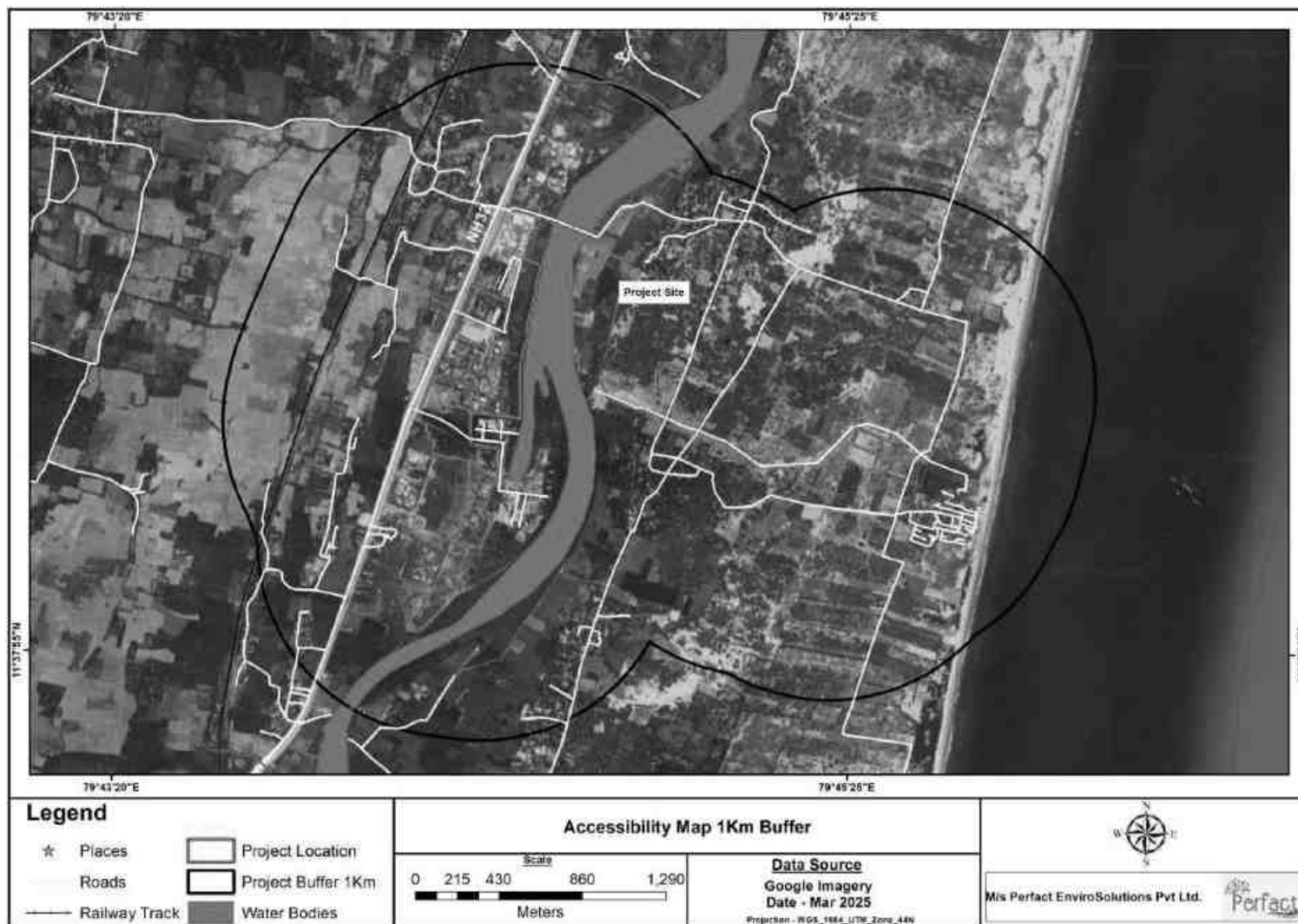


Figure 13. Accessibility to Project Site

2.3.6 SEISMICITY

India is one of the most earthquake-prone countries because of the existence of technically active young fold mountains in the Himalayas. The seismic scenario of peninsular India has been changed due to many devastating earthquakes in the past few years.

The project area falls in Seismic Zone- II. Although the seismic risk is considered minimal, the design and layout of the proposed expansion of the **existing 600 KTA SPVC plant to 1200 KTA**, along with the **new 750 KTA VCM manufacturing unit**, will adhere to the structural and safety requirements prescribed for Seismic Zone II. This includes:

- Structural design of new process units, tanks, warehouses, utility buildings, and pipelines will be carried out as per **IS 1893, IS 456**, and other applicable BIS codes.
- Critical equipment and hazardous chemical storage areas will incorporate appropriate seismic anchoring, support systems, and design redundancies.
- The disaster management plan (DMP) and emergency response systems will include provisions to handle earthquake scenarios, even if the probability is low.

The project site lies within the **SIPCOT Industrial Complex**, which is a notified industrial estate with stable ground conditions and no known history of significant seismic activity.

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

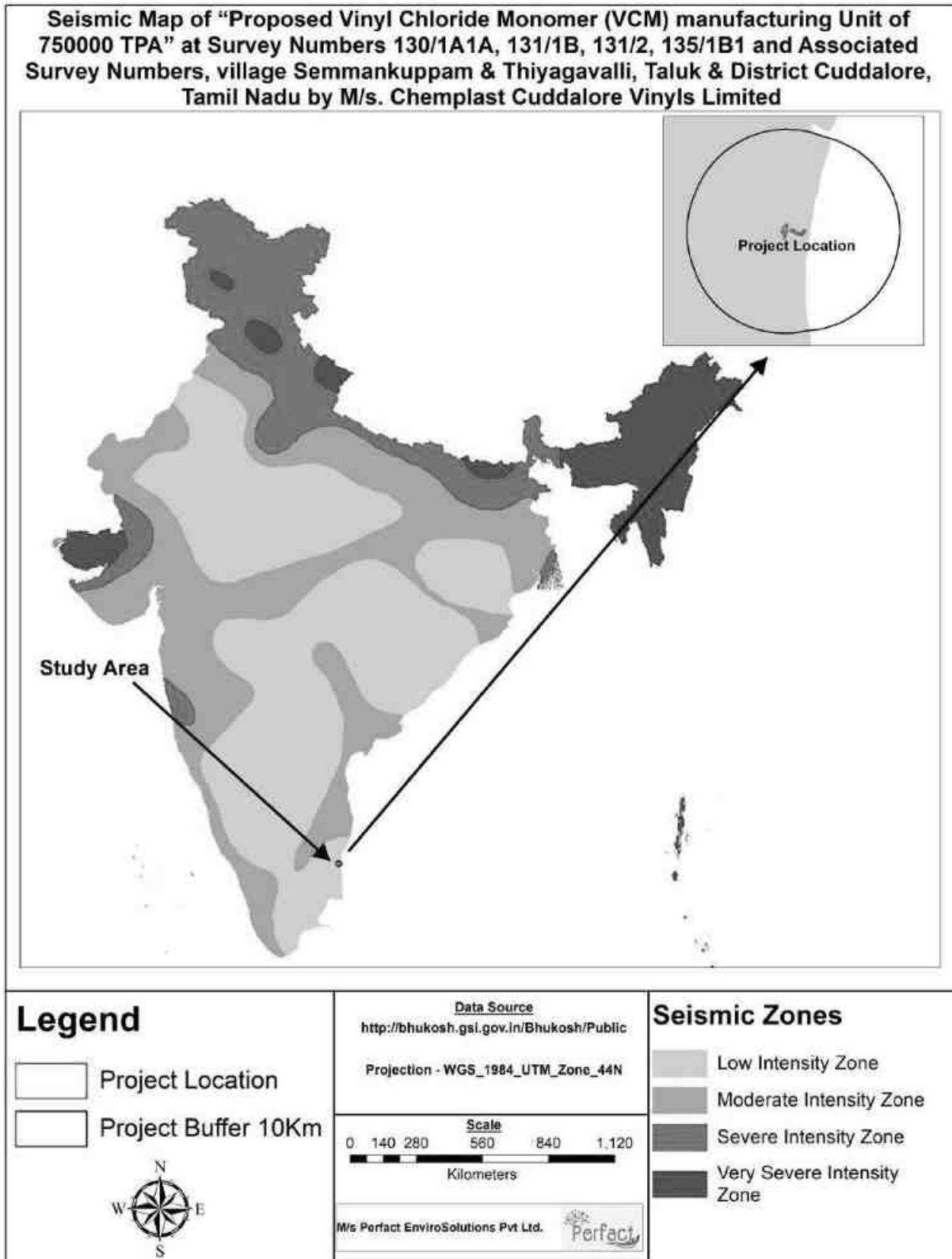


Figure 14. Map Showing Seismicity of the Area

2.4 SIZE OR MAGNITUDE OF OPERATION

Table 13. Project Details

S. No.	Particulars	Unit	Project Details			
			Existing (A)	Proposed SPVC (B)	Proposed VCM (C)	Total After Expansion (D = A+B+C)
1.	Plot area	ha	25.1862	-	39.4436	64.6298
		Acres	62.23		97.46	159.69
2.	Green Area	ha	9.7976	-	16.2539	26.0515
		%	15.16		25.15	40.31
3.	Project Cost	INR Crores	500		6000	6500
4.	EMP Capital Cost	INR Lakhs	3347.7		8762.5	12110.2
5.	EMP Recurring Cost	INR Lakhs	4922.4		8107.5	13029.9

2.4.1 PLOT AREA DISTRIBUTION

The plot area of the project site will increase from 25.1862 ha (62.23 acres) to 64.6298 ha (159.69 acres).

Table 14. Area Distribution

Description of Area	Area in Sq. m				
	Existing SPVC	%	Proposed VCM	Total After Expansion	%
Built Up Area/Ground Coverage	108242	42.98	88545	196787	30.45
Road & Storm water Drain/Pipe Line	16693	6.63	30141	46834	7.25
Green Belt Area	97976	38.90	162539	260515	40.31
New Pipe Rack	0	0	4491	4491	0.69
Existing Pipeline	0	0	22004	22004	3.40
Set Back	0	0	27460	27460	4.25
Assembly Area	0	0	300	300	0.05
Future Expansion/Open Area	28951	11.49	58956	87907	13.60
Total Area	251862	100.00	394436	646298	100.00

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

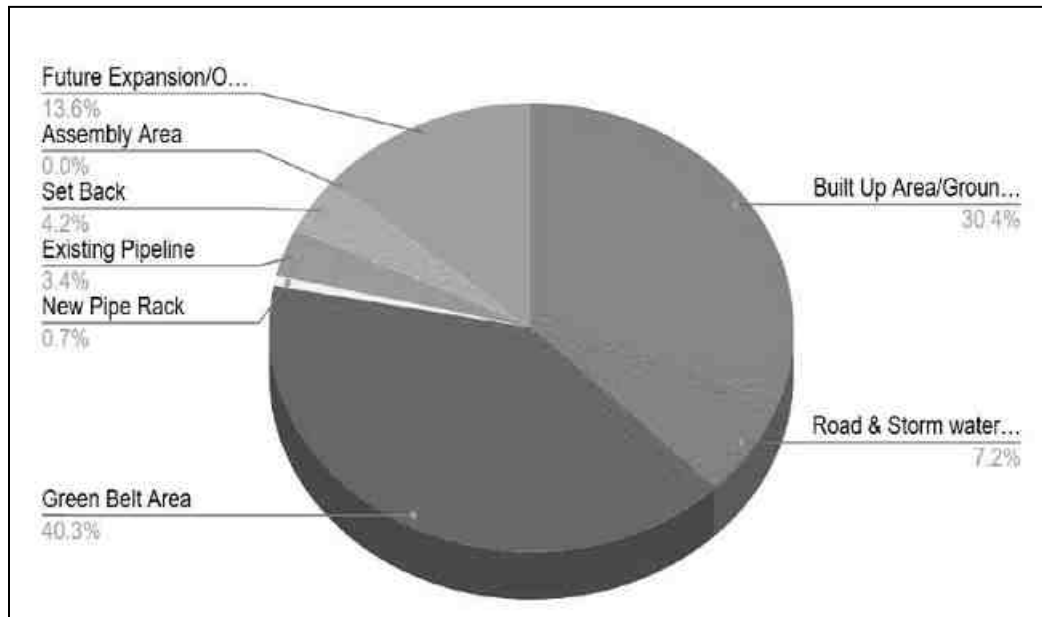


Figure 15. Area Distribution Chart

Land revenue record documents are enclosed as **Annexure 1**.

Table 15. Land Area Details

Item	Extent (ha)		
	SIPCOT land	CCVL own land	Total
Existing land	25.19	0.00	25.19
Proposed land (western corridor)	3.21	12.31	15.51
Proposed land (eastern corridor)	0.00	23.93	23.93
Total	28.39	36.23	64.63

- The existing plant is located within the SIPCOT Industrial Complex, Phase II, covering a total area of 25.1862 hectares. It falls under Survey Nos. 70 (Part), 71 (Part), 72, 73, 74 (Part), 75 (Part), 76 (Part), 133 (Part), and 134.
- Following the expansion with addition in plot area by acquiring an adjacent land parcel measuring 39.4436 ha. This expansion area is located across multiple survey numbers, including: 130/1A1A, 131/1B, 131/2, 132/1, 132/2, 132/4, 135/1B1, 129/3, 129/6, 62/1, 62/2B (Part), 67/1B, 67/2, 112/1B, 133/15 to 133/21, 133/4, 133/6, 134/1, 134/3 to 134/5, 136/1 (Part), 137/2, 137/9 to 137/14, 138/2 to 138/5, 138/9A, 138/13, 139/3, 139/5 to 139/12, 139/14B, 141/2B, 141/3B, 141/4, 141/5, 154/2, 158/5, 158/7, 160/4 to 160/7, 163/2, 163/3A & 3B, 164/2B, 165/1A (Part), 165/1B2 (Part), 175/1, 176/2 & 6, 177/3, and 178/6. These are located near Semmankuppam and Thiyagavalli villages in Cuddalore District, Tamil Nadu.
- The total plot area after expansion will be 64.6298 ha. which is allotted to M/s Chemplast Cuddalore Vinyls Limited. The lease deed is attached as **Annexure 1**.

Table 16. Land Ownership Details

Section	Survey numbers	Land type
Existing SPVC plant and proposed SPVC expansion area	70 (Part)	SIPCOT Industrial land
	71 (part)	SIPCOT Industrial land
	72	SIPCOT Industrial land
	73	SIPCOT Industrial land
	74 (part)	SIPCOT Industrial land
	75 (part)	SIPCOT Industrial land
	76 (part)	SIPCOT Industrial land
	133 (part)	SIPCOT Industrial land
	134	SIPCOT Industrial land
VCM project main land area	130/1A1A	Private land under CSL ownership
	131/1B	Private land under CSL ownership
	131/2	Private land under CSL ownership
	135/1B1	Private land under CSL ownership
	129/3	SIPCOT Industrial land
	129/6	SIPCOT Industrial land
	132/1	Private land under CCVL ownership
	132/2	SIPCOT Industrial land
	132/4	SIPCOT Industrial land
VCM project utility area	61/2	Private land under CCVL ownership
	62/1	Private land under CCVL ownership
	62/2B	Private land under CCVL ownership
	67/1B	Private land under CCVL ownership
	67/2	Private land under CCVL ownership
	112/1B	Private land under CCVL ownership
	133/15	Private land under CCVL ownership
	133/16	Private land under CCVL ownership
	133/17	Private land under CCVL ownership
	133/18B	Private land under CCVL ownership
	133/19A and 133/19B	Private land under CCVL ownership
	133/20	Private land under CCVL ownership
	133/21	Private land under CCVL ownership
	133/4	Private land under CCVL ownership
	133/6	Private land under CCVL ownership
	134/1	Private land under CCVL ownership
	134/3	Private land under CCVL ownership
	134/4	Private land under CCVL ownership
	134/5	Private land under CCVL ownership
	136/1	Private land under CCVL ownership
	137/10	Private land under CCVL ownership
	137/12	Private land under CCVL ownership
	137/13	Private land under CCVL ownership
	137/14	Private land under CCVL ownership
	137/2	Private land under CCVL ownership
	137/9	Private land under CCVL ownership
	137/9	Private land under CCVL ownership
	138/13	Private land under CCVL ownership

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Section	Survey numbers	Land type
	138/2	Private land under CCVL ownership
	138/3	Private land under CCVL ownership
	138/4	Private land under CCVL ownership
	138/4	Private land under CCVL ownership
	138/5	Private land under CCVL ownership
	138/9A	Private land under CCVL ownership
	139/10	Private land under CCVL ownership
	139/11	Private land under CCVL ownership
	139/12	Private land under CCVL ownership
	138/13	Private land under CCVL ownership
	138/2	Private land under CCVL ownership
	138/3	Private land under CCVL ownership
	138/4	Private land under CCVL ownership
	138/4	Private land under CCVL ownership
	138/5	Private land under CCVL ownership
	138/9A	Private land under CCVL ownership
	139/10	Private land under CCVL ownership
	139/11	Private land under CCVL ownership
	139/12	Private land under CCVL ownership
	138/13	Private land under CCVL ownership
	138/2	Private land under CCVL ownership
	138/3	Private land under CCVL ownership
	138/4	Private land under CCVL ownership
	138/4	Private land under CCVL ownership
	138/5	Private land under CCVL ownership
	138/9A	Private land under CCVL ownership
	139/10	Private land under CCVL ownership
	139/11	Private land under CCVL ownership
	139/12	Private land under CCVL ownership
	139/14B	Private land under CCVL ownership
		Private land under CCVL ownership
	139/3	Private land under CCVL ownership
	139/5	Private land under CCVL ownership
	139/6	Private land under CCVL ownership
	139/7	Private land under CCVL ownership
	139/8	Private land under CCVL ownership
	139/9	Private land under CCVL ownership
	141/2B	Private land under CCVL ownership
	141/3B	Private land under CCVL ownership
	141/4	Private land under CCVL ownership
	141/5	Private land under CCVL ownership
	141/5	Private land under CCVL ownership
	154/2	Private land under CCVL ownership
	158/5	Private land under CCVL ownership
	158/7	Private land under CCVL ownership
	160/4	Private land under CCVL ownership
	160/4	Private land under CCVL ownership

Section	Survey numbers	Land type
	160/5	Private land under CCVL ownership
	160/5	Private land under CCVL ownership
	160/6	Private land under CCVL ownership
	160/7	Private land under CCVL ownership
	163/2	Private land under CCVL ownership
	163/3A	Private land under CCVL ownership
	163/3B	Private land under CCVL ownership
	164/2B	Private land under CCVL ownership
	164/2B	Private land under CCVL ownership
	165/1A	Private land under CCVL ownership
	165/1B2	Private land under CCVL ownership
	166/1	Private land under CCVL ownership
	166/10	Private land under CCVL ownership
	166/10	Private land under CCVL ownership
	166/11	Private land under CCVL ownership
	166/2	Private land under CCVL ownership
	166/4	Private land under CCVL ownership
	166/4	Private land under CCVL ownership
	166/9B	Private land under CCVL ownership
	168/2	Private land under CCVL ownership
	168/3	Private land under CCVL ownership
	168/4	Private land under CCVL ownership
	168/5	Private land under CCVL ownership
	174/2A	Private land under CCVL ownership
	174/3	Private land under CCVL ownership
	174/4	Private land under CCVL ownership
	175/1	Private land under CCVL ownership
	175/1	Private land under CCVL ownership
	176/2	Private land under CCVL ownership
	176/1B1	Private land under CCVL ownership
	177/3	Private land under CCVL ownership
	178/6	Private land under CCVL ownership
VCM project utility are	135/3	Tharisu land on lease from Govt
	135/5	
	177/4	
	177/5	
	177/7	

2.4.2 PRODUCTION CAPACITY

Details of existing & proposed products are Tabulated in Table 16.

Table 17. Production Capacity

S. No.	Product/ Byproduct	CAS No.	Unit	Existing (As per EC 2019)	Proposed	Total After Expansion
1	PVC Resin	9002-86-2	KTA	600	600	1200
2	Vinyl Chloride Monomer	75-01-4		0	750	750

S. No.	ByProduct	CAS No.	Unit	Existing (As per EC 2019)	Proposed	Total After Expansion
3	HCl (30-35%)	7647-01-0	KTA	-	200	200

2.4.3 PROJECT COST

The existing cost of the project is INR 500 Cr. The cost of proposed expansion is INR 6000 Cr. Thus, the total cost of the project after expansion will be INR 6500 Cr.

2.4.4 PROJECT SCHEDULE AND COMPLETION

The project has obtained **Terms of Reference (ToR)** from the **Expert Appraisal Committee (EAC)** on **28th July 2025** for the preparation of the Environmental Impact Assessment (EIA) Report. In line with the prescribed ToR, Draft EIA will be submitted for The **Public Hearing (PH)**. Following the PH and submission of the Final EIA/EMP along with the proceedings, the proposal will be appraised for **grant of Environmental Clearance (EC)** by the Ministry of Environment, Forest and Climate Change (MoEF&CC).

Subject to receipt of all statutory clearances and approvals, the project activities are planned to commence by **April 2026**, with an estimated implementation period of **36 months**. The project is therefore expected to be completed and commissioned by **April 2029**.

2.4.5 MACHINERY & EQUIPMENTS

Table 18. List of Plant & Machinery (Existing)

PVC - Cuddalore (Existing)		
S.No	Category	Major Equipment Description
1	Process Section	Reactors
2		Additive preparations tanks
3		Blow down vessel
4		Stripper feed vessel
5		Slurry stripper
6		Slurry Tank
7	Dryer Section	Fluidized Bed Dryer
8		Pneumatic Conveyor
9		Silo
10		Bagging Machines
11	VCM Storage	VCM day tank
12		RVCM day tank
13		RVCM compressors
14	VCM Recovery	Vent gas absorption system
15		Waste water stripper
16	Utilities	Cooling tower
17		Nitrogen generator
18		Instrument air compressor
19		Coal based Boiler
20		Emergency diesel generators

PVC - Cuddalore (Existing)		
21	Desal & Water Treatment	Desalination system
22		Zero liquid Discharge system
23		Sewage treatment system

Table 19. List of Plant & Machinery (Proposed)

Proposed VCM Plant		
S. No.	Category	Major Equipment Description
1	EDC Purification Section	Light Ends Column
2		Recycle Column
3		Recovery Column & Tar Still
4		Waste Water Stripper
5	EDC Cracking & Quench Section	EDC Cracking Furnace
6		Quench Column
7	VCM Purification Section	HCl Column & Refrigeration
8		VCM Column
9		VCM Stripper
10		Vent Scrubber
11	Oxychlorination Section	Oxy-reactor
12		Ethylene Recycle compressor
13		Ethylene Stripper
14	Utilities	Boiler
15		Cooling Tower
16		DM Plant
17		Air and N2 Compressor
18		Desalination Plant
19	Offsites & Storages	Flare System
20		VCM Storage Tanks
21		EDC Storage Tanks
22		Oxygen Plant (Air separation unit)
23		Incinerator
24		ETP & ZLD & STP
25	Desal & Water Treatment	Zero liquid Discharge system
26		Sewage treatment system

2.5 POWER

Demand & Source of Power Supply: The total power requirement after the proposed expansion will be 58 MW. It is proposed to be sourced from the Grid power from Tamil Nadu Electricity Board (TNEB). The agreement copy for the same is attached as **Annexure 4**.

For standby power requirements, the existing installation comprises **7 nos. of 2000 kVA DG sets**. As part of the expansion, **4 additional DG sets of 2000 kVA each** are proposed for the **SPVC plant**, and **3 DG sets of 2000 kVA each** are proposed for the **VCM plant**.

Accordingly, the **total DG capacity after expansion will be 14 nos. x 2000 kVA**, ensuring uninterrupted power supply during grid outages.

Table 20. Details of Power Requirement

S. No.	Particular	Existing (A)	Proposed SPVC (B)	Proposed VCM (C)	Total After Expansion (D = A+B+C)
1	Source	Grid power from Tamil Nadu Electricity Board (TNEB)			
2	Requirement (MW)	14	14	30	58
3	DG Sets	7 Nos. x 2000 kVA	4 No. x 2000 kVA	3 Nos. x 2000 kVA	14 Nos. x 2000 kVA

2.6 FUEL REQUIREMENTS

Table 21. Fuel Details

S. No.	Fuel Type	Fuel used For	Unit	Source	Mode of Transport	Existing Quantity	Proposed Quantity	After Expansion Quantity
1	Diesel (HSD)	DG Sets 14 Nos. (7E+7P)	LPH each.	Local	Road	100	100	200
2	Natural Gas	EDC cracking furnace 04 Nos.	Nm3/day each	Local	Road	-	216000	216000
3	Natural Gas	Boiler (5 in No.) (50 TPH each)	Nm3/day each	Local	Road	-	70000	70000
4	Coal	Boiler	TPD	Local	Road	330	-	330

Renewable Energy: The company commits to sourcing renewable energy, where feasible, through partnerships with solar and wind power plants.

2.7 WATER REQUIREMENT

- **Source of Freshwater:** Desalination plant
- **Total Water Requirement:** Existing operation requirement - 9.799 MLD, After expansion requirement- 24.84 MLD.
- **Fresh Water Requirement:** Existing 4102 KLD, After expansion 11422 KLD sourced through inhouse Desalination plant.
- **Reuse Water Requirement:** Existing 38 KLD treated sewage and 5659 KLD treated effluent. After expansion 104 KLD treated sewage and 13315 KLD treated effluent.

2.8 RAW MATERIAL REQUIREMENT

Table 22. Details of Raw Materials Quantity

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



Product Name	Raw Material	CAS No.	Existing Quantity (TPA)	Proposed Quantity (TPA)	Total After Expansion (TPA)
PVC Resin	VCM Feedstock	75-01-4	601800	601800	1203600
	Dematerialized water	7732-18-5	1440000	1440000	2880000
	Initiators	1611162-9	600	600	1200
	Granulating Agents	NA	780000	780000	1560000
	Stabilizers	NA	360	360	720
	Build up suppressant	NA	60	60	120
	Others (includes inhibitor, antifoam, solvents)	NA	900	900	1800
	Ethylene	74-85-1	-	183750	183750
	Oxygen	-	-	101250	101250
	Ethylene Dichloride	0107-06-02	-	633750	633750

Table 23. Details of Raw Materials (Storage, Source & Transportation Details - SPVC Plant)

S. No.	Chemicals	State	No. of Vessels / bag	Capacity of Vessel / Bag	Max. Qty. Of Storage	Transportation Details
SPVC- Existing 600 KTA						
1	VCM Feedstock	Liquid	2	7500 MT	15000 MT	Ship (Pipeline)
			1	10000 MT	10000 MT	
2	Granulating Agents	Solid	~1000	20 kg	20000 Kg	Road (Trucks)
3	Granulating Agent	Liquid	~10	1000 Kg	10000 Kg	Road (Trucks)
4	Stabilizers	Liquid	~10	175 Litres	1750 Litres	Road (Trucks)
5	Build up Suppressant	Liquid	~10	175 litres	1750 litres	Road (Trucks)
6	HSD	Liquid	1	20 KL	20 KL	Road (Trucks)
			1	30 KL	30 KL	Road (Trucks)
SPVC - Proposed 600 KTA						
S. No.	Chemicals	State	No. of Vessels / bag	Capacity of Vessel / Bag	Max. Qty. Of Storage	Transportation Details
1	Granulating Agents	Solid	~1000	20 kg	20000 Kg	Road (Trucks)
2	Granulating Agent	Liquid	~10	1000 Kg	10000 Kg	Road (Trucks)
3	Stabilizers	Liquid	~10	175 Litres	1750 Litres	Road (Trucks)
4	Build up Suppressant	Liquid	~10	175 litres	1750 litres	Road (Trucks)

Table 24. Details of Raw Materials (Storage, Source & Transportation Details)(VCM)

Proposed - VCM										
S. No.	Chemical	State	Means of Storage	Capacity of Storage Means	No. of Storage means	Total Capacity	Operating Pressure	Temperature (°C)	Transportation Details	Remarks
Raw Material										
1	Ethylene	Liquid	Double walled storage tank	5000 MT	2	10000 MT	Atm.	-103	Ship (Pipeline)	Cryogenic bulk storage tank for

Proposed - VCM										
S. No.	Chemical	State	Means of Storage	Capacity of Storage Means	No. of Storage means	Total Capacity	Operating Pressure	Temperature (°C)	Transportation Details	Remarks
										Ethylene
2	Ethylene Di-Chloride	Liquid	Tank	7500 MT	3	22500 MT	Atm.	Ambient	Ship (Pipeline)	Bulk storage tank for EDC
3	Ethylene Di-Chloride	Liquid	Tank	1000 MT	2	2000 MT	Atm.	Ambient		Day storage tank for EDC
4	Propylene	Liquid	Cylindrical tank	75 m ³	1	75 m ³	20 barg	Ambient		Propylene is not a raw material. It is used for refrigeration
Products										
1	Vinyl Chloride	Liquid	Sphere	1500 MT	2	3000 MT	6 barg	40	Ship (Pipeline)	Day storage tank for product VCM
2	Vinyl Chloride	Liquid	Sphere	1500 MT	1	1500 MT	6 barg	40	Ship (Pipeline)	Day storage tank for offspec VCM

2.9 MANPOWER REQUIREMENT

Details of manpower are given in **Table 25 & 26**.

Table 25. Manpower Details (During Construction Phase)

Employment Generation during Construction Phase			
Permanent Employment [X]		Temporary / Contractual Employment [Y]	
No.s of Permanent Employment [A]	50	No.s of Temporary / Contractual Employment [A]	800
Period of Employment (No. of days) [B]	350	Period of Employment (No. of days) [B]	350
No. of Man Days [A]* [B]	17,500	No. of Man Days [A]* [B]	2,80,000
Total [X] + [Y] = 297500			

Table 26. Manpower Details (During Operation Phase)

Employment Generation during Operational Phase			
Particulars	Existing	Proposed	Total After Expansion
Permanent Employment [X]			
No.s of Permanent Employment [A]	176	190	346
Period of Employment (No. of days) [B]	350	350	350
No. of Man Days [A]* [B]	61,600	66,500	1,28,100
Total [X] = 128100			
Temporary / Contractual Employment [Y]			

Employment Generation during Operational Phase			
No.s of Temporary / Contractual Employment [A]	568	500	1068
Period of Employment (No. of days) [B]	350	350	350
No. of Man Days [A]* [B]	1,98,800	1,75,000	3,73,800
Total [Y] = 373800			
Total [X] + [Y] = 501900			

2.9.1 INFRASTRUCTURE AND AMENITIES

Amenities:

- Good drinking water facility
- Canteen Facility
- Restrooms, and waiting lounge
- Parking facility: Truck parking, car parking, parking for differently abled
- Retiring rooms for truck drivers
- First aid kits at all prominent places

Infrastructure:

- Sewerage network connected to Sewage Treatment plant, treated water will be reused for gardening.
- All trade effluent will be collected and channelized to the Effluent treatment plant and treated effluent will be used in the cooling tower.
- Rainwater Harvesting
- Stormwater management
- Assembling points for fire and safety.

2.10 MANUFACTURING PROCESS AND PROCESS FLOW DIAGRAM

1. **Vinyl Chloride Monomer- VCM** plant is proposed to be installed as VCM is the raw material for the manufacturing of PVC.

Process Description:

Production of Vinyl Chloride from Ethylene / Ethylene Di-chloride (EDC) will consist of following sections:

A. EDC Cracking

Furnace feed-EDC (Imported EDC + OxyChlorination EDC) from the EDC Purification Unit is partially cracked to vinyl chloride and hydrogen chloride as per the below equation:



The reaction takes place at approx. 500 °C and 15 bar. The hot reaction gas downstream the EDC Cracking Furnace is sent for further purification (to remove products, by-products and unreacted reactants) after heat recovery and quenching.

B. VCM Purification

Oxy-Chlorination:

Oxy-Chlorination section is critical for neutralization/consumption of HCl produced as by-product during EDC cracking. In the Oxy-Chlorination section, ethylene, anhydrous Hydrogen chloride and oxygen react in the vapor phase over copper chloride catalyst to form ethylene dichloride (EDC) and water.



The liquid mixture of EDC and water is pumped to the ethylene stripper and is then sent to the caustic wash decanter. Wet crude EDC is purified by removing water, light ends and heavy ends in two distillation columns.

C. Oxychlorination

The first step after EDC cracking is recovery of Hydrogen chloride. HCl is recovered in the first distillation column as an overhead product under refrigerated condition and sent to the Oxy-chlorination Unit for neutralization.

Recovery of vinyl chloride takes place in the VCM distillation Column. VCM is removed as an overhead product at a temperature slightly higher than atmospheric temperature. The VCM recovered from the VCM Column is sent to the VCM stripping column where traces of HCl are separated from the VCM-product through steam stripping. The purified VCM from the bottom is sent to the VCM sphere storage tanks.

The bottom product from the VCM distillation column i.e., unconverted EDC, is recycled to the EDC Column.

Wastewater treatment

A **Wastewater Stripper** is provided for the removal of **chlorinated hydrocarbons** from aqueous streams generated across the process plant.

All water-based waste streams from different sections of the plant are collected in the **Wastewater Stripper Feed Tank**, which also functions as a **phase separator** and **storage tank**. Within this tank, any separated **EDC (ethylene dichloride)** phase settles at the bottom and is pumped back into the process for **recovery and reuse**.

The **aqueous phase** from the feed tank is then pumped to the **top of the Wastewater Stripper**, where it is pre-mixed with steam. The **steam stripping process** removes volatile and semi-volatile organic compounds, primarily chlorinated hydrocarbons, from the water.

The **stripped wastewater**, after **pH adjustment**, is sent to the **Zero Liquid Discharge (ZLD)** system for further treatment and **recycling** within the plant.

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

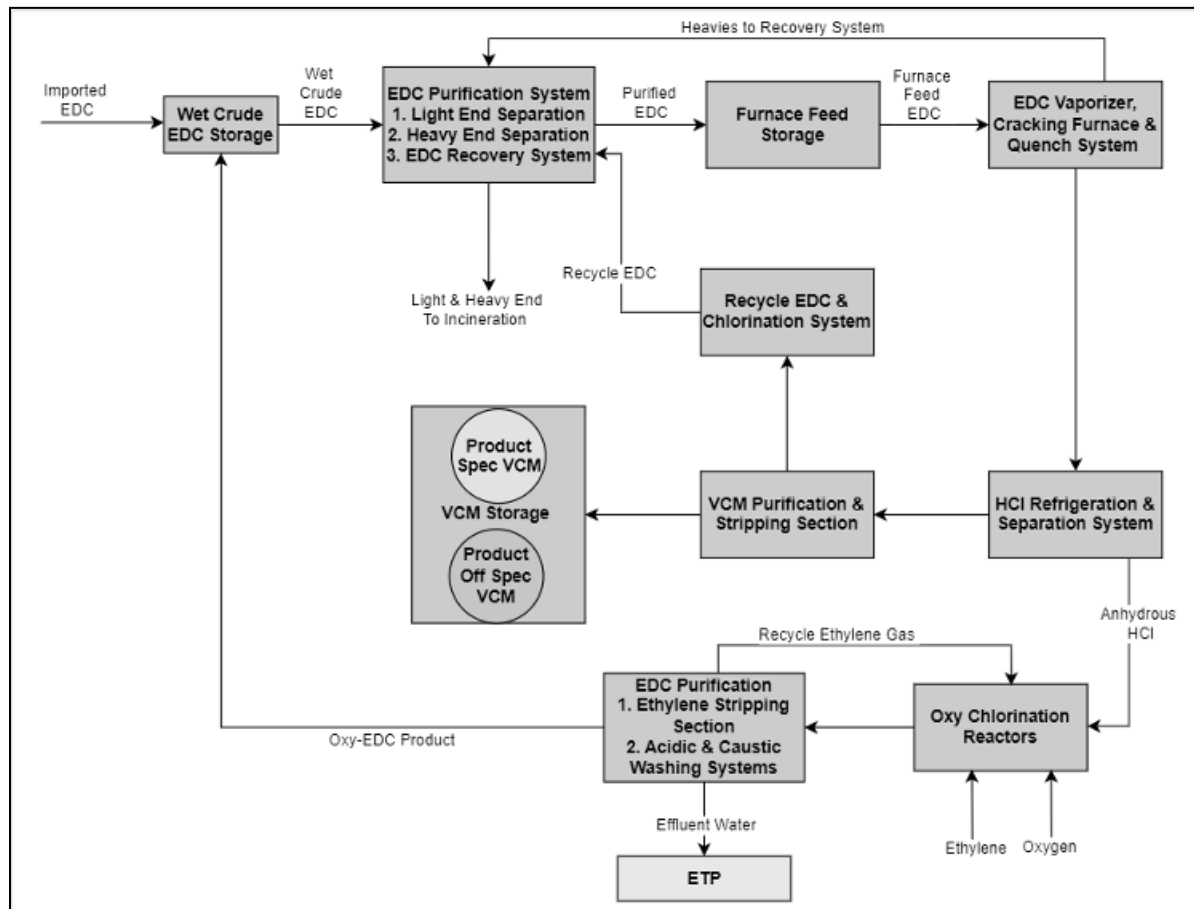


Figure 16. Process Flow Diagram (VCM)

Table 27. Material Balance VCM

Item	Quantity (MT/MT)	Output	Quantity (MT/MT) of Product	Remarks
Input				
Ethylene	0.245	VCM	1	Product
Oxygen	0.135	Liquid effluent	0.2	Recycle after treatment
Imported Ethylene Dichloride	0.845	Gas effluent	0.015	Captive incineration
		Organic residue	0.01	Captive incineration
Total	1.225	Total	1.225	

2. Poly Vinyl Chloride

Process Description

PVC is manufactured using VCM as a raw material which will be sourced through the captive VCM plant. VCM is polymerized in a batch process by dispersing it in de-mineralized (DM) water under its own pressure. The initiators required for the process are prepared outside and fed into the reactor. The reactor contents are heated to the required temperature (57°C for pipe grade) at which the initiator starts decomposing to give free radicals and the monomer starts polymerizing.

The reaction is exothermic and therefore the reactor is cooled through continuous circulation of cooling water in the jacket. PVC is insoluble in its monomer, and once formed, precipitates as sub-micron particles in the monomer.

As the reaction proceeds, these particles agglomerate. At about 70% conversion, there is no free liquid monomer left, as the remaining monomer would be contained in the polymer particles resulting in falling of the reaction pressure. At the required conversion, a stabilizer is injected to destroy free radicals and improve polymer heat stability and colour. The reactor contents at the end of reaction are slurry of PVC particles in water containing about 30-35% solids with approximately 10% VCM adsorbed in the polymer.

Polymerization

Polymerization is conducted batch wise in stainless steel clad reactors each equipped with bottom entry, variable speed agitators and reflux condensers. The reactors are provided with a double mechanical seal.

Agitation of reaction mass is essential for dispersion of VCM in DM water and determination of product grain size, as well as removal of polymerization heat through the water phase. Initially, hot water is circulated through the reactor jacket to provide the required temperature to start the reaction. Then the excess reaction heat is removed through circulation of cooling water in the reactor jacket and overhead condenser.

Distributed control system (DCS) controls the polymerization sequence in a batch. DCS checks all key parameters before and during the processing of the batch to ensure safe operation. There is a provision of an independent hardwired interlock system to prevent unsafe operation of critical valves.

Reactor Operation Parameters

Reactor Preparation

The reactor is sprayed with anti-fouling chemical and the chemical rapidly coats the reactor wall. Pre-batch checks are conducted by DCS to check the status of the reactor and its connected system. These checks also ensure the availability of adequate raw material & additives for completion of the reaction.

Charging

DM water and VCM are charged to the reactor. The granulating agent and buffer chemical are injected into the charge water line. Then the initiator, which is prepared outside the reactor, is charged. VCM is charged from a fresh VCM tank and then from the recovered VCM tank.

Heat up and Temperature Control

The batch is heated to the required set point by circulating hot water through the jacket. The reaction starts immediately after VCM is charged. Heating time is minimized by charging with hot DM water. Excess heat of reaction is removed by circulating cooling water through the jacket and condenser. The temperature set point and heat load balance between the condenser and jacket are controlled to give optimal kinetics, stable operation and required resin properties.

Reaction

As the reaction proceeds, the contents shrink since PVC is denser than VCM, and water is injected

at a recipe determined rate to control slurry viscosity. The agitator runs normally at a fixed speed during the reaction and at slower speed before and after the reaction to minimize power utilization. The speed will be different for different grades to give the required polymer properties. After 70% conversion, the free VCM is used up and subsequently the pressure falls down. As the pressure falls by a predetermined value, the rundown sequence starts.

Stabilizer Injection

The stabilizer is injected into the reactor at the end of the reaction. A rundown pump transfers the slurry to the blow down vessel. The slurry passes through the blow down slurry filter to remove lumps and coarse particles.

Reactor Rinse

After rundown, the reactor is rinsed with medium pressure water to remove the loose polymer. The reactor pressure is reduced to approximately 0.5 bar during the rinse sequence and then the reactor is ready for the new batch. The rinse is pumped to the blow down vessel.

Reactor Opening

If the reactor has to be opened, VCM is evacuated by using the monomer vacuum pump. After opening for maintenance, inspection or cleaning, the reactor is again pressurized with nitrogen and evacuated again. The reactor shall not be opened more often than once in every 500 batches.

Reactor Cycle Time

The Cycle time comprises the following:

- Pre-batch checks
- Build-up suppressant coating
- Charging of additives and VCM
- Actual reaction
- Emptying (rundown) of the reactor
- Rinsing – preparatory to next batch

The reactor cycle time is around 250 to 260 minutes. The exact cycle time however depends on the grade of PVC.

Slurry Degassing

The polymerization reaction is stopped at 85 to 90 % conversion of monomer depending on the resin being produced.

Degassing at High Pressure

The product in the form of slurry is then transferred to the blow down vessel under its own pressure or by a rundown pump. The slurry would be passed through a blow down filter, which removes any large particles and it would be periodically cleaned between rundowns. Most of the unreacted monomer would flash from the slurry and is recovered through High-pressure (HP) recovery system.

Degassing at Low Pressure

After degassing in the blow down vessel, the slurry contains 3-5% of the original VCM charge. This slurry is then pumped to a stripper feed vessel, which is controlled at lower pressure. VCM, would flash further and a Low Pressure (LP) VCM Compressor compresses it for recovery.

Stripping Column and Spiral Heat Exchanger

The remaining VCM levels of 1-2 % are reduced to low levels by stripping to minimize environmental impact, for recovery of the VCM and to give specified levels in final product resin. In the column the slurry passes over a series of trays where it is stripped with a counter current flow of steam in the column. The vapour from the top of the column passes through a condenser and VCM goes to the LP Recovery compressor for recovery. From the base of the column, the slurry is pumped through the spiral heat exchanger to preheat the feed before it goes to the slurry tank. The slurry from the stripping column is stored in the slurry tank. The stripping column is a special tray design developed to prevent build-up of PVC on column internal surfaces and subsequent degradation and product contamination, and also to allow close control of residence time by changing operating parameters for optimum stripping. There is neither a requirement of a special rinse system nor to stop the column for cleaning to ensure clean space between the trays. To clean, water will run for a short period until the slurry is washed out. This design has been well proven and is efficient with good VCM removal characteristics and low steam consumption.

PVC Drying Unit

From the slurry tanks, slurry is circulated through a main ring to the centrifuges where it is dewatered to get a wet PVC powder containing 22-28% water (wet basis), depending on grade. The wet PVC powder is then transferred to the contact fluid bed dryer having two sections: a back mix section and a plug-flow section. In the back-mix section, the moist PVC powder is fed into a fluidized bed containing heating panels and fluidized by hot air. The heating panels contain hot water typically at 90oC. Due to this heat transfer by direct contact, the dryer can be operated at low temperatures with clear benefits on resin colour and contamination. It indicates that the exit air can be operated close to its dew point i.e. close to the theoretical thermodynamic minimum heat input. The PVC overflows from this zone at approximately 2-4 % moisture to the plug flow section where the fluidized polymer would flow through a serpentine path designed to give plug flow and reduce moisture levels to less than 0.2%.

The fluid bed dryer is heated with low-pressure (5-bar) steam. Dust is removed by cyclones and wet scrubbers from the dryer exhaust to give exit concentrations of less than 50 mg/m³ (typically 10-20 mg/m³). After drying, the polymer is screened in 2 vibrating screens for removal of oversize material.

The liquor from the centrifuge is routed to the effluent treatment facility for clarifying. Further stripping is not required.

Product Handling

PVC powder is conveyed pneumatically from the vibrating screens to silos through a hopper. Three silos, each of capacity 100 Ton are provided to store the finished product. The PVC final product is packed in 25 kg bags by means of an automatic machine, then palletized and transferred to the storage area. In the case of 1000 kg and 500 kg bags, the final product is packed using a semi-automatic bagging machine with manual handling of bags. VCM Recovery The SPVC plant is equipped with an efficient two stage VCM recovery process that can recover 95 % of the unreacted monomer from the polymerization process. The process uses cooling water at the first stage and

Chilled water at the second stage condenser. The exhaust gases from this two-stage unit would predominantly contain inert gases such as N_2 , CO_2 , etc. along with trace quantities of VCM.

VCM recovery system involves vacuum pumps and compressors, which are provided with installed standby equipment. Similarly, backup power is provided from the emergency DG sets. In extreme situations when the recovery section cannot be operated, the unreacted VCM can be held in the polymerizer itself, until the recovery system can be brought back on line.

Vent Gas Absorption System

The trace VCM vapors from the outlet of the second stage of the VCM recovery system is recovered in the Vent Gas Absorption (VGA) system, which is basically an absorption-stripping system. The system absorbs the trace VCM in an inert solvent and subsequently stripped using steam to recover the absorbed VCM to reuse in the plant. This is a very efficient system that ensures 100% recovery of the trace VCM.

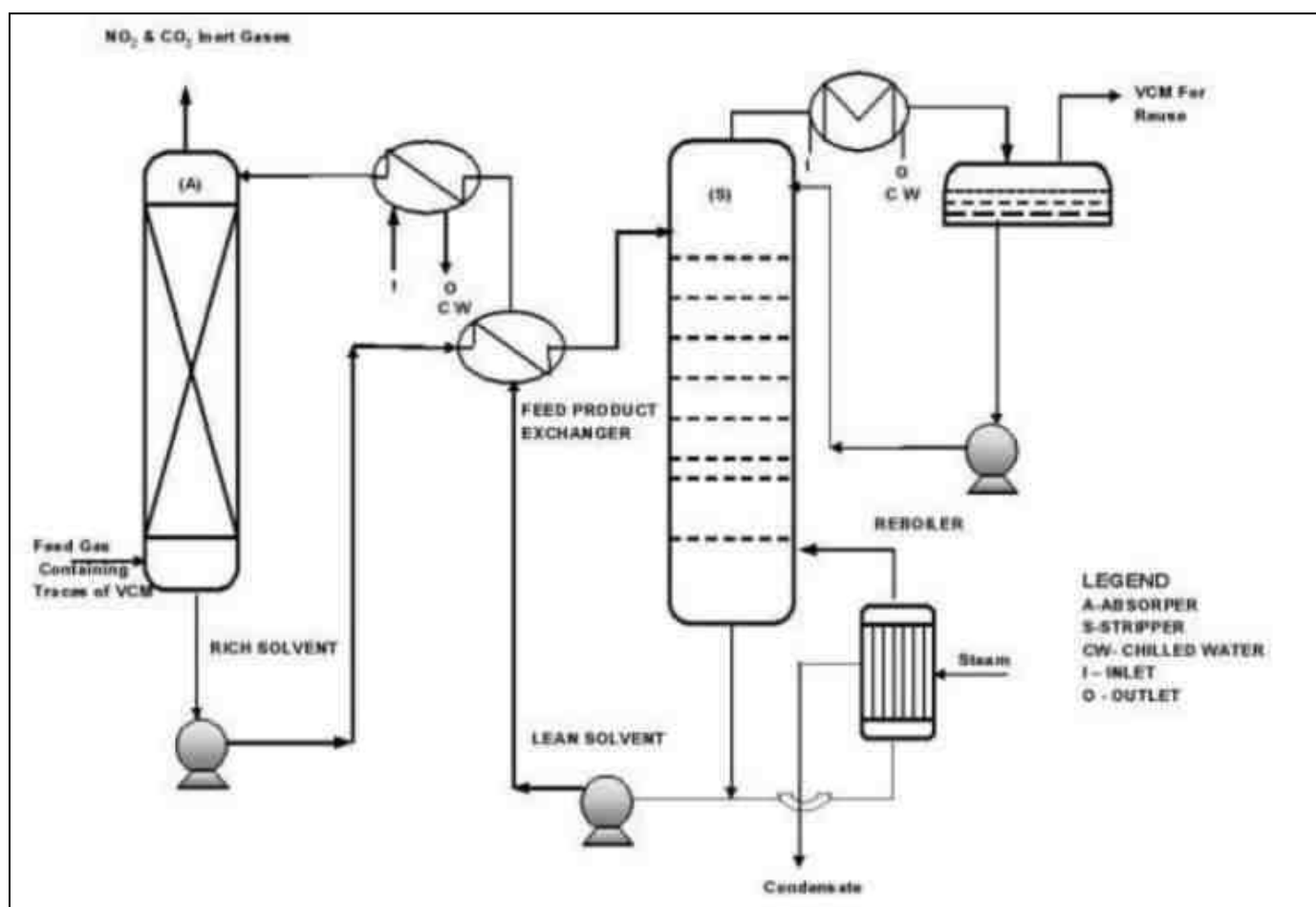


Figure 17 . Vent gas absorption system

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

Process Flow diagram of PVC

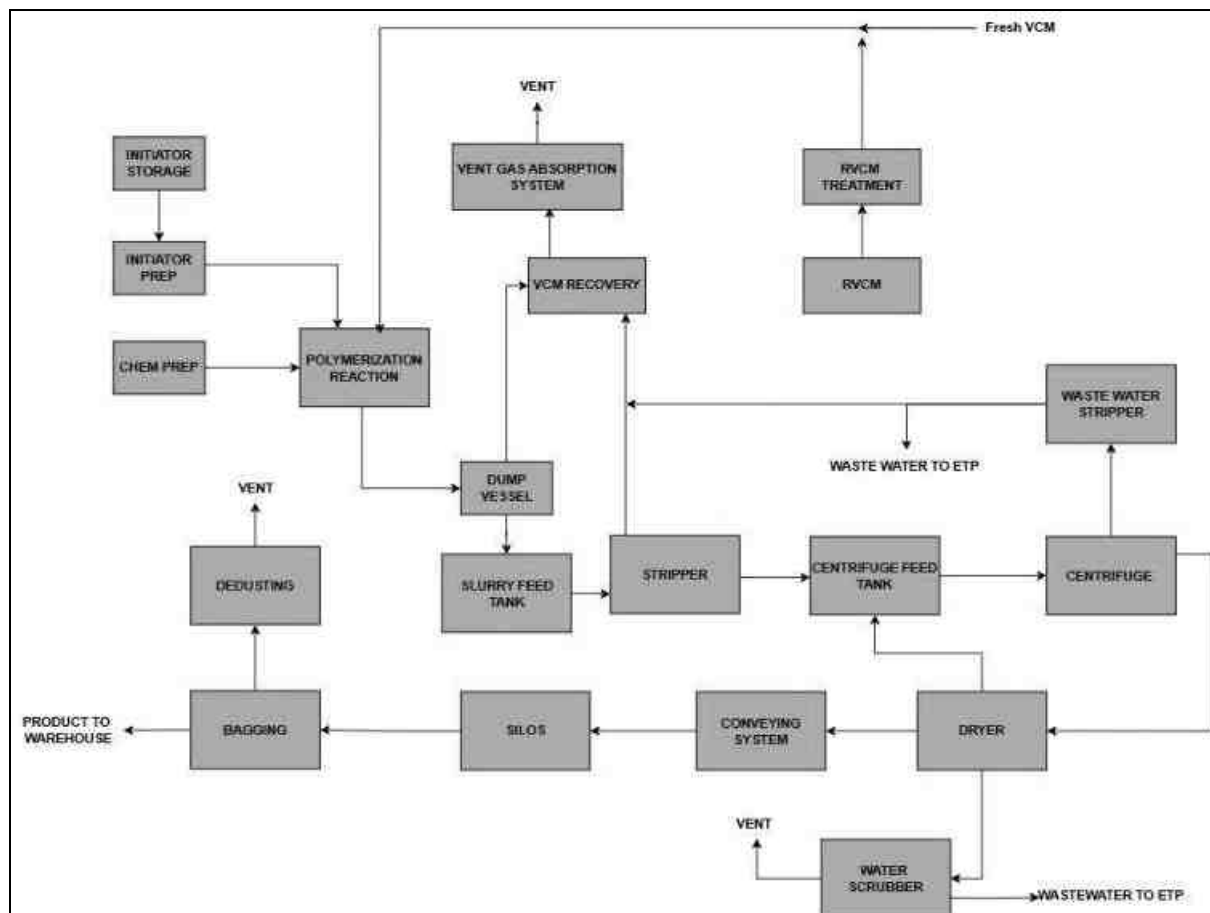


Figure 18. Process flow diagram of PVC

Table 28. Material Balance PVC

Item	Quantity (MT/MT)	Output	Quantity (MT/MT) of product	Remarks
Input				
VCM	1.003	PVC	1	Product
DM Water	1.942	Water loss in drying	0.285	To Atmosphere
Initiators, Suspending agents and other additives	0.0045	Off Spec PVC	0.0045	Authorised recyclers
-		Liquid Effluents	1.66	Recycle after treatment
Total	2.9495	Total	2.9495	-

2.11 AIR EMISSIONS

2.11.1 DETAILS OF FLUE GAS STACKS

Table 29. Details of Flue Gas Stacks

S. No.	Stack attached to	Capacity	Fuel Name and its Quantity	Stack Height m	Stack Dia (m)	Stack Velocity (m/s)	APCM Detail	Emissions	Standard Limit (mg/Nm³)	Proposed Limits as project is in CPA (mg/Nm³)
Existing Stacks for 600 KTA SPVC Plant										
1	DG Sets (7 Nos.)	2000 kVA	HSD, 100 lit/hr. each	30	0.45	14	Adequate stack height	PM, NOx, CO	As per CPCB Emission Standard for DG: PM: 75 mg/Nm³ CO: 150 mg/Nm³ NOx: 360 ppmv	PM: 55 mg/Nm3 CO: 100 mg/Nm3 NOx: 250 ppmv
2	Boiler-1	43 MT/hr	Coal, 220 TPD	54	1.2	18	ESP and Stack	PM, SOx, NOx, CO	As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm3 NOx: 250 mg/Nm3 PM: 50 mg/Nm3 CO: 100 mg/Nm	SO2: 30 mg/Nm³ NOx: 150 mg/Nm³ PM: 50 mg/Nm³ CO: 80 mg/Nm³
3	Boiler-2	52.5 MT/hr	Coal, 220 TPD	60	1.2	18	ESP and Stack	PM, SOx, NOx, CO		
Proposed Stacks for 600 KTA SPVC Plant										
1.	DG Sets (4 Nos.)	2000 kVA	HSD, 100 lit/hr. each	30	0.45	14	Adequate stack height	PM, NOx, CO	As per CPCB Emission Standard for DG: PM: 75 mg/Nm³ CO: 150 mg/Nm³ NOx: 360 ppmv	PM: 55 mg/Nm3 CO: 100 mg/Nm3 NOx: 250 ppmv
2.	Boiler-3	50 TPH	Natural gas, 70000 Nm³/day	60	1.2	18	Adequate stack height	PM, SOx, NOx, CO	As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm3 NOx: 250 mg/Nm3 PM: 50 mg/Nm3 CO: 100 mg/Nm	SO2: 30 mg/Nm³ NOx: 150 mg/Nm³ PM: 50 mg/Nm³ CO: 80 mg/Nm³
3.	Boiler-4	50 TPH	Natural gas, 70000 Nm³/day	60	1.2	18	Adequate stack height	PM, SOx, NOx, CO		
Proposed Flue Gas Stacks for 750 KTA VCM Plant										
1.	EDC Cracking Furnace-1*	-	Natural Gas 216000 Nm³/day	60	0.7	9.70	Adequate stack height	PM, SOx, NOx, CO	As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm³ NOx: 250 mg/Nm³ PM: 50 mg/Nm³ CO: 100 mg/Nm³	SO2: 30 mg/Nm³ NOx: 150 mg/Nm³ PM: 50 mg/Nm³ CO: 80 mg/Nm³
2.	EDC Cracking Furnace-2*	-	Natural Gas 216000 Nm³/day	60	0.7	9.70	Adequate stack height	PM, SOx, NOx, CO		
3.	EDC Cracking Furnace-3*	-	Natural Gas 216000 Nm³/day	60	0.7	9.70	Adequate stack height	PM, SOx, NOx, CO		
4.	EDC Cracking Furnace-4*	-	Natural Gas 216000 Nm³/day	60	0.7	9.70	Adequate stack height	PM, SOx, NOx, CO		
5.	Incinerator	-	Natural Gas 1000	45	0.11	11	HCl scrubber and	PM, SOx, CO, NOx, HCl	As per CPCB Common HW	PM: 50 mg/Nm³ SO2: 100

S. No.	Stack attached to	Capacity	Fuel Name and its Quantity	Stack Height m	Stack Dia (m)	Stack Velocity (m/s)	APCM Detail	Emissions	Standard Limit (mg/Nm ³)	Proposed Limits as project is in CPA (mg/Nm ³)
			Nm ³ /hr (only during start up)				Adequate stack height		Incinerator Guidelines: PM: 50 mg/Nm ³ SO ₂ : 200 mg/Nm ³ CO: 100 mg/Nm ³ NO _x : 400 mg/Nm ³ As per G.S.R. 820(E) dated 09.11.2012 HCl: 50 mg/Nm ³ Cl ₂ : 10 mg/Nm ³	mg/Nm ³ CO: 50 mg/Nm ³ NO _x : 200 mg/Nm ³ HCl: 30 mg/Nm ³ Cl ₂ : 5 mg/Nm ³
6.	Emergency DG Set-1	2000 kVA	HSD, 100 lit/hr	30	0.45	14	Adequate stack height	PM, NO _x , CO	As per CPCB Emission Standard for DG: PM: 75 mg/Nm ³ CO: 150 mg/Nm ³ NO _x : 360 ppmv	PM: 55 mg/Nm ³ CO: 100 mg/Nm ³ NO _x : 250 ppmv
7.	Emergency DG Set-2	2000 kVA	HSD, 100 lit/hr	30	0.45	14	Adequate stack height	PM, NO _x , CO		
8.	Emergency DG Set-3	2000 kVA	HSD, 100 lit/hr	30	0.45	14	Adequate stack height	PM, NO _x , CO		
9.	Boiler-5	50 TPH	Natural gas, 70000 Nm ³ /day	60	1.2	18	Adequate stack height	PM, SO _x , NO _x , CO	As per G.S.R. 820(E) dated 09.11.2012 SO ₂ : 50 mg/Nm ³ NO _x : 250 mg/Nm ³ PM: 50 mg/Nm ³ CO: 100 mg/Nm ³	SO ₂ : 30 mg/Nm ³ NO _x : 150 mg/Nm ³ PM: 50 mg/Nm ³ CO: 80 mg/Nm ³
10.	Boiler-6	50 TPH	Natural gas, 70000 Nm ³ /day	60	1.2	18	Adequate stack height	PM, SO _x , NO _x , CO		
11.	Boiler-7	50 TPH	Natural gas, 70000 Nm ³ /day	60	1.2	18	Adequate stack height	PM, SO _x , NO _x , CO		

***Note:** SKO and LDO will be used as backup fuels for natural gas (NG) when it is unavailable for EDC Cracking furnace.

2.11.2 DETAILS OF PROCESS GAS STACKS

Table 30. Details of Process Gas Stacks

S. No.	Source of Emission	Number of Stacks	Stack Height (m)	Stack Height (m)	Stack Dia (m)	Pollution Control Measures	Emissions	Standard Emission Limit (mg/Nm ³)	Proposed Limits as project is in CPA(mg/Nm ³)
Existing Stacks for 600 KTA SPVC Plant									
1	Vent Gas Absorption System for VCM Recovery	2	20 m each	0.60	12	-	VCM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³
2	PVC Dryer Section	2	44 m each	1.00	14	Multi-cyclone followed by wet scrubber	VCM & HCl	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³ HCl -30 mg/Nm ³	VCM- 10 mg/Nm ³ HCL -20 mg/Nm ³

S. No.	Source of Emission	Number of Stacks	Stack Height (m)	Stack Height (m)	Stack Dia (m)	Pollution Control Measures	Emissions	Standard Emission Limit (mg/Nm ³)	Proposed Limits as project is in CPA(mg/Nm ³)
						and stack			
3	Emergency Vent attached to VCM Storage Tank	1	60	0.35	20	-	-	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³
4	Coal Heading Conveyor- Transfer Point - 1	2	15.5 m each	0.40	14	Bag filter and stack	PM	As per G.S.R. 820(E) dated 09.11.2012 PM- 50 mg/Nm ³	PM- 50 mg/Nm ³
5	Coal Heading Conveyor- Transfer Point - 2	2	22.75 m each	0.40	14	Bag filter and stack	PM		
6	Coal Feed Hopper	2	-	0.50	14	Water sprinklers for dust suppression	PM		
7	PVC Bagging Section - Bagging machine - 3 Nos.	6	-	0.35	14	Reverse jet bag filter- 3 Nos.	PM		
8	Product Silo - 3 Nos.	6	-	0.30	14	Bin vent filter	PM		
Proposed Stacks for 600 KTA SPVC Plant									
9	Vent Gas Absorption System for VCM Recovery	2	20 m each	0.60	12	-	VCM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³
10	PVC Dryer Section	2	44 m each	1.00	14	Multi-cyclone followed by wet scrubber and stack	VCM & PM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³ HCL -20 mg/Nm ³ HCl -30 mg/Nm ³	VCM- 10 mg/Nm ³ HCL -20 mg/Nm ³
11	Emergency Vent attached to VCM Storage Tank	0	60	0.35	20	-	-	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³
12	Coal Heading Conveyor- Transfer Point - 1	2	15.5 m each	0.40	14	Bag filter and stack	PM	As per G.S.R. 820(E) dated 09.11.2012 PM- 50 mg/Nm ³	PM- 50 mg/Nm ³
13	Coal Heading Conveyor- Transfer Point - 2	2	22.75 m each	0.40	14	Bag filter and stack	PM		
14	Coal Feed Hopper	2	-	0.50	14	Water sprinklers for dust suppression	PM		

S. No.	Source of Emission	Number of Stacks	Stack Height (m)	Stack Height (m)	Stack Dia (m)	Pollution Control Measures	Emissions	Standard Emission Limit (mg/Nm ³)	Proposed Limits as project is in CPA(mg/Nm ³)
15	PVC Bagging Section - Bagging machine - 3 Nos.	6	-	0.35	14	Reverse jet bag filter- 3 Nos.	PM		
16	Product Silo - 3 Nos.	6	-	0.30	14	Bin vent filter	PM		
Proposed Process Stacks for 750 KTA VCM Plant									
17	Oxy scrubber vent	-	-	-	-	Captive Incineration	Air, Hydrocarbons	As per G.S.R. 820(E) dated 09.11.2012 Ethylene- 10 mg/Nm ³ VCM- 10 mg/Nm ³	
18	Emergency vent for ethylene storage tank	-	-	-	-	Adequate stack height	Ethylene		Ethylene- 10 mg/Nm ³
19	Emergency vent for EDC storage tank	-	-	0.35	20	Adequate stack height	VCM		VCM- 10 mg/Nm ³

2.11.3 FUGITIVE EMISSIONS & CONTROL MEASURES

- Pumps & Compressors will be provided with mechanical seals.
- Process: Use of closed loop systems will be practiced in the process for arresting fugitive emissions.
- Pipes: Installation of right leak proof valves. Valves and flanges preventive maintenance programs will be followed regularly. Regular monitoring of the system for leaks.
- Use of double pipe with nitrogen purging for VCM transfer from outside Plant.

2.12 WATER CONSUMPTION, WASTEWATER GENERATION & DISPOSAL DETAILS

Source of Water - Desalination plant.

Existing Water Requirement: Total Fresh Water Requirement of the industry is 4102 KLD, which is being met through Desalination Plant. Out of total fresh water, 40 KLD is used for domestic purposes, 1986 KLD is used in DM Plant, 100 KLD is used in Plant Wash, 1560 KLD will be used in Cooling tower and the balance 416 KLD will be used in Greenbelt. 4510 KLD is used for Process and 775 KLD is used for Boiler. 38 KLD of treated sewage is reused in Greenbelt development and 2000 KLD of treated effluent is used in Cooling Tower and 3659 KLD of treated effluent is used in DM Plant.

After Expansion Water Requirement:

(a) **Non-Monsoon Water Requirement:**

Total Fresh Water Requirement for the proposed expansion is 11.422 MLD, which is being met through the Desalination Plant. Out of total water requirement of 24.841 MLD, 0.11 MLD will be used for domestic purposes, 12.430 MLD will be used in DM Plant, 0.30 MLD is used in Plant Wash, 11.07 MLD will be used in Cooling tower and the balance 0.958 MLD will be used in Greenbelt. Details of water consumption and wastewater generation are provided in Table 31.

Table 31. Non-Monsoon Water Requirement

S. No.	Water Consumption Pattern	Water Consumption in KLD			
		Existing PVC (600 KTA)	Proposed PVC (600 KTA)	Proposed VCM (750 KTA)	Total
1	From sea to Desalination plant	12184	12184	-	24368
2	From Desalination Plant	4102	4102	3218	11422
A	Cooling Tower Makeup	1560(F)+ 2000(R)=3560	1560(F)+ 2000(R)=3560	1953(F)+ 1997(R)=3950	11070
B	DM water	1986(F)+ 3659(R)=5645	1986(F)+ 3659(R)=5645	1113	12403
a	Process	4510	4510	0	9020
b	Boiler feed	775	775	1013	2563
C	Plant washing	100	100	100	300
D	Greenbelt	416(F)+38(R)=454	416(F)+38(R)=454	22(F)+28(TS)=50	958
E	Domestic	40	40	30	110
	Total (A to E)	9799	9799	5243	24841

Note:
 *STP Capacity: 50 KLD
 *ETP Capacity: 6400 KLD

Figure 19. Existing Water Balance Diagram (600 KTA)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

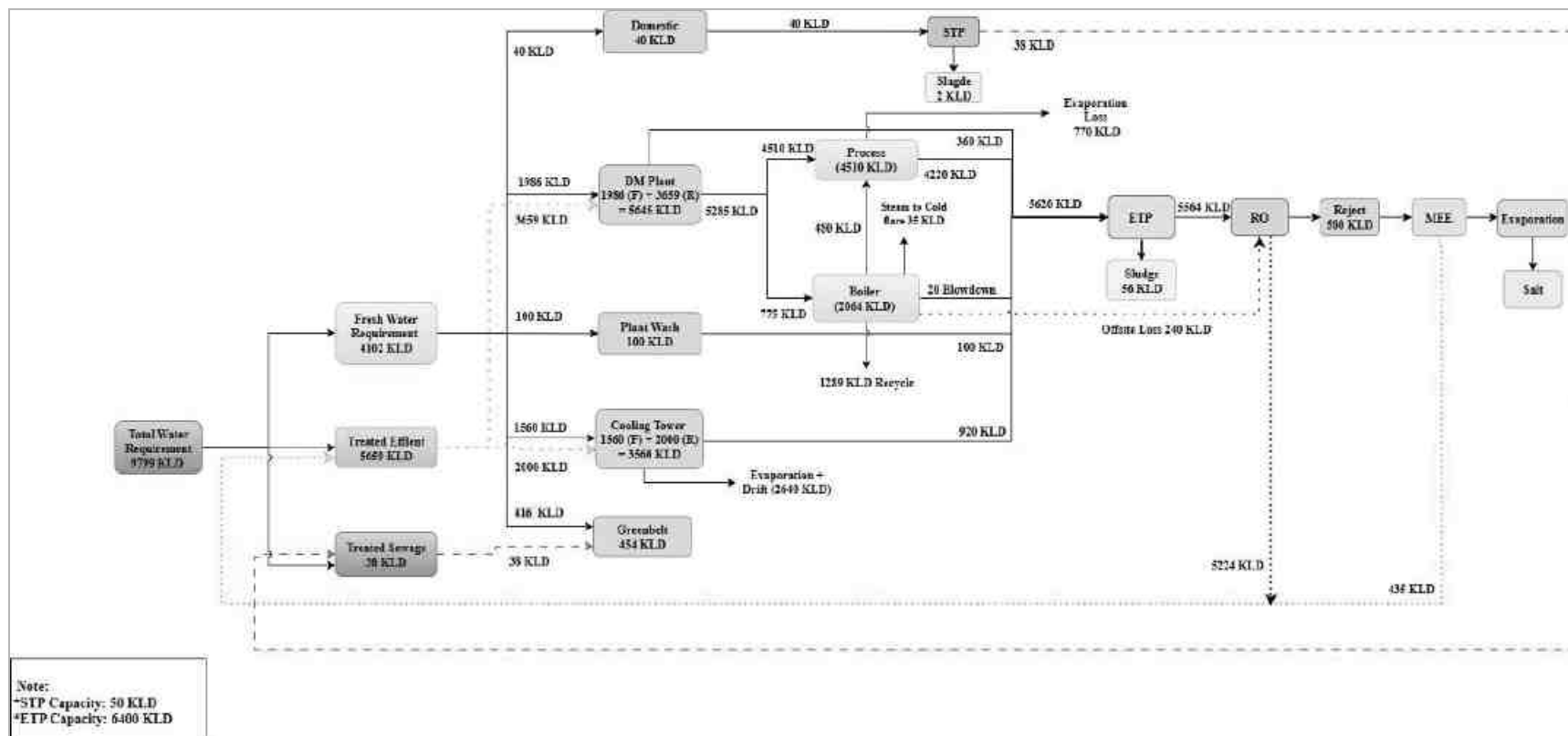


Figure 20. Water Balance Diagram of Proposed (600 KTA) SPVC Plant (Non-monsoon)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

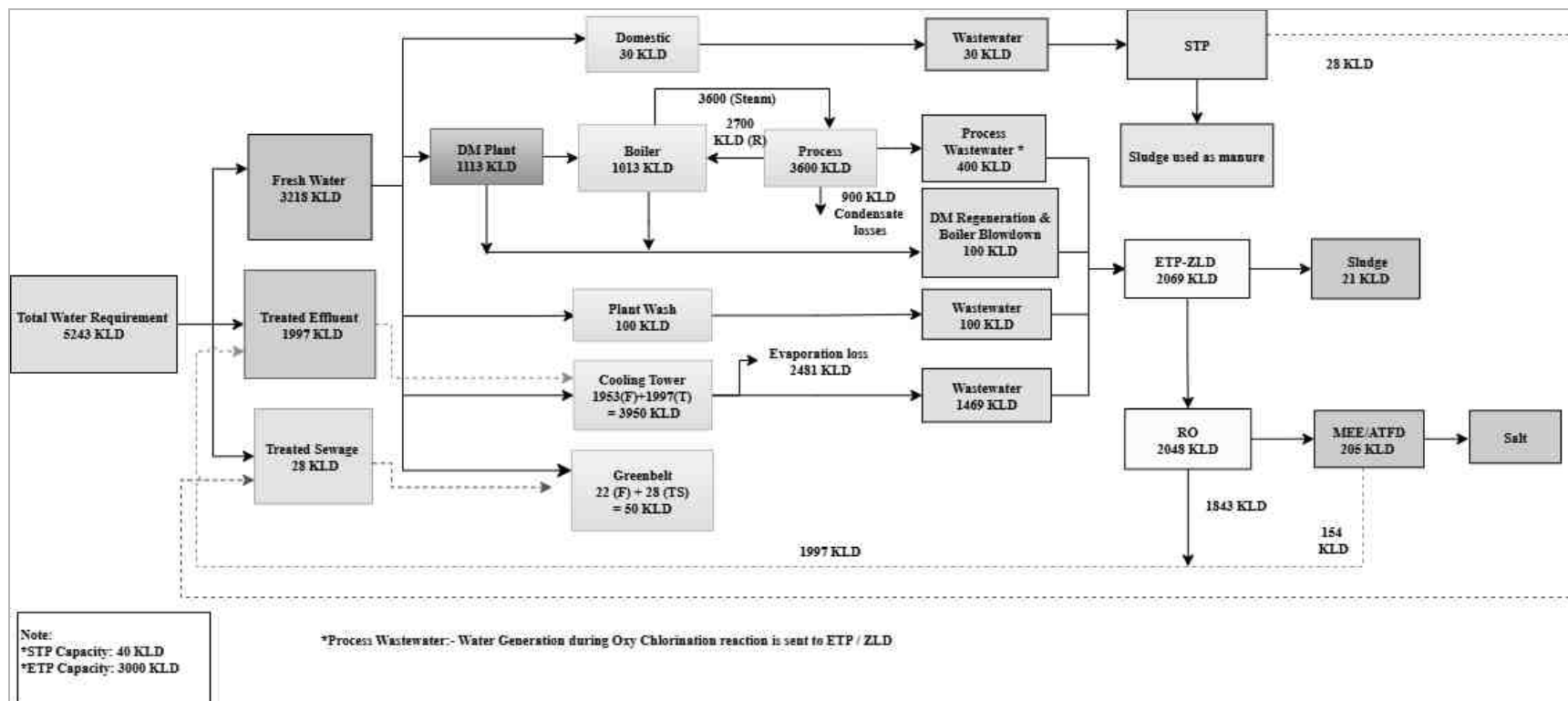


Figure 21. Water Balance Diagram of Proposed (750 KTA) VCM Plant (Non-monsoon)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and / Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

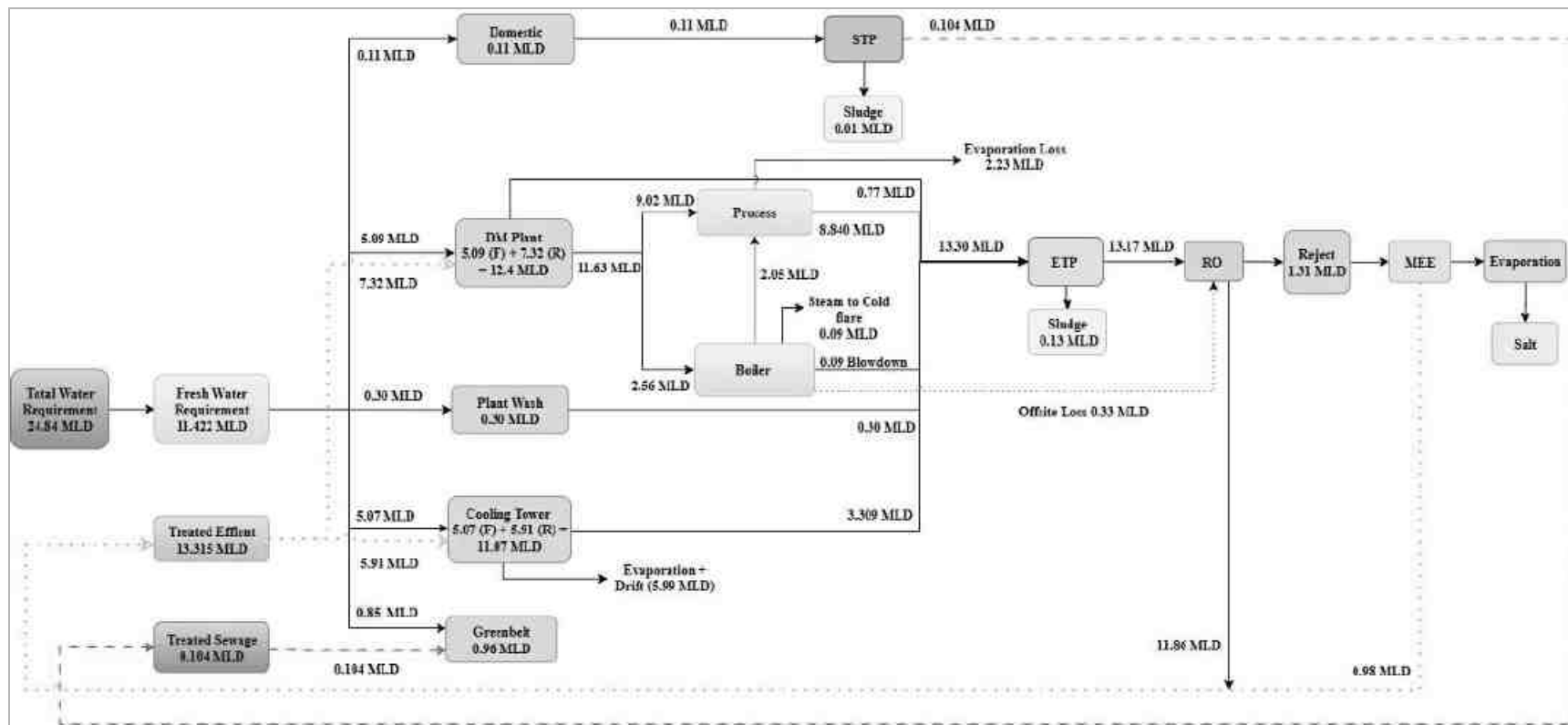


Figure 22. Combined Water Balance Diagram (Non-monsoon)

2.13 DESALINATION PLANT DETAILS

Complete RO based desalination plant is divided in three major parts:

Section- I : Pretreatment System

Section-II : RO System

Section-III : DM Plant (MB Polisher)

Section- I: Pretreatment System

Stilling Chamber

Incoming Sea water enters in the stilling chamber to still the turbulence in water and for that purpose a RCC cubical tank of 8.5 m³ capacities is provided. On the upstream of the stilling chamber one auto flow control valve is provided to control the flow to the RO desalination plant.

To disinfect the sea water, sodium hypo-chlorite is dosed upstream of the stilling chamber and for that purpose, two Sodium hypo-chlorite dosing tanks, one working and one standby, with Mild Steel (rubber lined) construction are provided. Each tank is designed to hold the solution required for 24 hours of operation. While one tank is in operation, another tank will be used to prepare a solution. Both the tanks are connected by a three-way valve to the dosing pumps provided for feeding the solution.

Coagulant (FeCl₃) Dosing System

Sea water contains turbid and suspended particles, which can be coagulated by dosing Ferric chloride (FeCl₃). The dosages rate of FeCl₃ depends/varies according to the inlet turbidity and total suspended solids in the feed water. For this purpose, two FeCl₃ dosing tanks, one working and one standby with Mild Steel (rubber lined) construction are provided. Each tank is designed to hold the solution required for 24 hours of operation. While one tank is in operation, another tank will be used to prepare a solution. Both the tanks are connected by a three-way valve to the dosing pumps provided for feeding the solution. To disperse FeCl₃ and to prepare a homogenous solution, each tank will have a motorized agitator made up of stainless steel 316 L.

Lime Dosing System

After coagulant dosing the pH of water may reduce but in order to achieve effective coagulation the pH should be raised, therefore, a lime dosing system is provided for that purpose and the dosage rate of lime depends upon the feed water. The final dosage rate of lime is decided by conducting a jar test. For this purpose, two lime dosing tanks, one working and one standby with Mild Steel (rubber lined) construction are provided. Each tank is designed to hold the solution required for 24 hours of operation. While one tank is in operation, another tank will be used to prepare a solution. Both the tanks are connected by a three-way valve to the dosing pumps

provided for feeding the solution. To disperse lime and to prepare a homogenous solution, each tank will have a motorized agitator made up of stainless steel 316 L.

Poly-Electrolyte Dosing System

For the removal of very fine colloidal particles (for flocculation purpose) a suitable grade of poly electrolyte is dosed before water enters the flocculating zone. Polyelectrolyte helps in better flocculation due to its special characteristics of absorbing micron size particles and forming a heavy floc. Normally, 0.5-1.0 ppm of poly-electrolyte is dosed for this purpose. For this purpose, two Poly-electrolyte dosing tanks, one working and one standby with Mild Steel (rubber lined) construction are provided. Each tank is designed to hold the solution required for 24 hours of operation. While one tank is in operation, another tank will be used to prepare a solution. Both the tanks are connected by a three-way valve to the dosing pumps provided for feeding the solution. To keep Poly-electrolyte in suspension, each tank will have a motorized agitator made up of stainless steel 316 L.

Flash Mixer

This is a tank of RCC construction having a holding capacity of 8.5 m³ and retention time of 1 min. pretreated dosing chemicals like FeCl₃ and lime are added in flash mixture. Chlorinated sea water is thoroughly mixed in a flash mixture for intimate mixing and effective coagulation. A high speed stirrer is provided at the center for this purpose. Flash mixture is used to obtain proper mixing of coagulant with water.

Flocculator

It is a rectangular tank, with a volume of 127.5 m³ and retention time of 15 minutes, which is made up of RCC with a slow speed paddle type agitator.

Tube Settler (inclined tube type clarifier)

This system is provided for separation of suspended solids and flocs formed due to the addition of coagulants to the raw water. It is an RCC tank, with tube settler mechanism fitted in it, and consists of a set of tubes placed at an angle. Water enters from the bottom and passes up through the tube settler banks. Laminar flow of water ensures that the solid particles get stuck to the sides of the tubes. As the solids accumulate on the surface of the tube they slide down due to gravity and are collected on the bottom hopper. The solids are drained by gravity through the sludge line. The effective settling area in sedimentation tanks has a direct effect on the performance of the system. The profile design ensures laminar flow and encourages the solids to slide down.

Sludge Handling System

Sludge generated by tube settlers is transferred to the sludge pit. The sump pit has been sized for 24 hr storage and of RCC construction. Two numbers of sludge transfer pumps, one working, and

one on standby are provided to throw the sludge out from the pit. To keep the solids in suspension, air is provided in sludge pit through the HDPE grid.

Clarified Water Storage Tank

One RCC storage tank is provided for storage of clarified water. It is designed for a retention time of 30 minutes. Two filter pumps, one working and one standby, continuously feed water to the pressure sand filter. Pressure sand filter, dual media, and micron cartridge filter are installed in series configuration.

Pressure Sand Filter Unit

The clarified water is filtered through a Pressure Sand Filter (PSF), two working and one on standby, in order to remove the suspended matters and turbidity present in the feed water. It is a mild steel (rubber lined) horizontal vessel internally fitted with an inlet distributor and a bottom collecting system.

This unit is charged with a uniform grade of filtering sand, which is supported on different grades of under bed materials. Suspended matters get entrapped when raw water is passed in downward direction through the sand bed. The unit is isolated for backwash when the pressure drop across the sand bed exceeds the specified limit.

Dual Media Filter Unit

Filtered water is then passed through Dual Media Filter unit (DMF), two working, and one standby; in order to remove very fine suspended solids, silt, organics, & residual chlorine if any.

The DMF unit is made up of mild steel (rubber lined), and fitted with top inlet distributor and header lateral type of bottom collecting system. Externally this unit is fitted with frontal pipe work and control valves. This unit is charged with anthracite and fine sand, which is supported on different grades of under bed materials. Fine suspended solids and silt will be filtered through the fine sand bed and organics and free chlorine are absorbed on the surface of anthracite. The unit is isolated for backwash, when the pressure drop across the bed increases the specified limit or quality of filtered water deteriorates, whichever occurs earlier. Filtered water from DMF is directly fed to the micron cartridge filter of RO plant.

Filter Air Blower

Two numbers of (one working and one standby), twin lobe type rotary air blowers are provided for supply of low pressure high flow air, which is required during pressure sand filter (PSF) air scouring operation.

Filter Water Storage Tank

Backwashing of PSF and DMF shall be done by filtered water and for that one RCC storage tank is

provided. One tapping from DMF outlet header is taken to filter the water storage tank. It is designed to store water required for one backwash of PSF and DMF each. Two filter backwash pumps, one working and one on standby, are installed for backwashing of filters.

Filter Backwash Tank

Effluent generated during backwashing of PSF and DMF has a high amount of suspended solids, hence it cannot be thrown back to sea. Therefore, it is collected in an RCC filter backwash tank and will be recycled back to the flash mixture by two no. of pumps. These solids will settle in tube settlers and can be removed from underflow.

Section-II: RO System

Reverse Osmosis System

For the removal of dissolved salts; a two-pass Reverse Osmosis system is provided. The system consists of the following equipment in series:

Sodium Meta Bi-Sulphite Dosing System

A Sodium Meta-Bi-Sulphite (SMBS) dosing system is provided for de-chlorination. Filtered water may contain free chlorine depending upon actual utilization of chlorine dosed. This free chlorine is injurious to the RO membrane and needs to be removed prior to feeding to the RO system. Sodium Sulphite reacts with residual chlorine to form sulphate, thus water gets de-chlorinated.

For this purpose, two SMBS dosing tanks, one working and one standby with Mild Steel (rubber lined) construction are provided. Each tank is designed to hold the solution required for 24 hours of operation. While one tank is in operation, another tank will be used to prepare a solution. Both the tanks are connected by a three-way valve. The dosing pumps provided for feeding the solution. To dissolve SMBS in water, each tank will have a motorized agitator made up of stainless steel 316 L.

Anti-Scalant Dosing System

During the reverse osmosis process, dissolved salts are concentrated on the reject side, whereas the permeate water is being drawn at specific recovery. As a result of this, concentration of dissolved salts increases on the reject side and may precipitate if saturation limit exceeds. As a resultant effect of salt concentration, scaling (deposition) occurs on the membrane surface, which results in inferior performance of RO. Anti-scalant are dosed to avoid/deter the formation of scales to improve the RO performance.

Micron Cartridge

After chemical dosing, RO feed water may get contaminated with very fine suspended matters. To supply highly filtered water to RO, micron cartridge filter units are used. MCF unit is a vertical pressure vessel made up of SS 316 internally fitted with PP wound depth type micron cartridge

filter element. Filtered water from DMF passes through cartridge element to produce highly filtered RO feed water.

High Pressure Pump (with Energy Recovery Unit)

Multi stage horizontal centrifugal high pressure pump with energy recovery device is provided for the supply of high pressure filter water to RO system. This pump increases pressure required for the RO system.

An energy recovery device is used to recover significant energy available in RO brine stream thereby reducing the pump cost. It comprises a Hydraulic Turbo Charger, which is a device to reduce energy consumption by reclaiming energy from pressure of RO reject water. The high pressure pump generates the pressure up to a certain extent and the water then passes through the turbo charger, which further boosts the pressure. The high-pressure reject enters the turbo charger which reduces the brine pressure as it extracts hydraulic energy and is used to drive the turbine of the turbo charger. This leads to saving a significant amount of power consumption.

Sea Water Reverse Osmosis System

Seawater is fed to the Reverse Osmosis System (ROS-1) for removal of salinity from sea water to get potable quality water. ROS-1 system comprises spirally wound seawater RO membranes, housed in specially constructed FRP pressure tubes.

RO pressure tubes mounted horizontally on Mild Steel structural fabricated/Epoxy painted RO skid. For each stream, a feed, product, and reject header with end ports connections are provided for easy maintenance. Permeate water from ROS-I is stored in a permeate water storage tank. The tank is of mild steel (rubber lined) and sized for 15 minute retention time.

Chemical Cleaning System

A common chemical cleaning system for all RO skids is available. This system comprises two chemical solution preparation tanks, two micron cartridge filter units and chemical cleaning pumps. Cleaning of membrane is carried out at a regular interval for removal of any deposition of organic salts, suspended matters, and micro-biological impurities on membrane surface over a continuous period of usage. The cleaning chemical is passed in the same direction as that of feed water flow in order to remove the deposition from membranes. Prescribed chemical solution of required concentration is prepared in the tank. It is re-circulated with the help of a chemical cleaning pump and micron cartridge filter through the RO system at specified flow rate and pressure for about 60 minutes after primary flushing with permeate water. After cleaning again, permeate water is used for RO system flushing and final cleaning.

Brackish Water Reverse Osmosis System (ROS-II)

This RO system is provided to produce permeate water of less than 50 ppm TDS. Each RO system

comprises spirally wound brackish water RO membranes, housed in specially constructed FRP pressure tubes. RO pressure tubes are mounted horizontally on a mild steel structural fabricated/Epoxy painted RO skid. For each system, a feed, product and reject header with U bends is provided for easy maintenance

Multi stage centrifugal type high pressure pump is provided for supply of high pressure water to RO system-II. Reject water from ROS-II is re-circulated back to the high pressure pump of ROS-I suction. Due to blending of ROS-II reject water in ROS-I feed water, TDS of ROS-I feed water reduces. This results in lower operating pressure of the overall system and better treated water quality.

Permeate from ROS-II is stored in permeate water storage tank-II. This tank is made up of mild steel (rubber lined) and is sized for 15 minutes retention time.

RO Transfer Pump

The product water from product water storage tank for RO-2 is taken through RO transfer pump to permeate tanks.

Mixed bed polisher system

Permeate water from permeate tanks and effluent recycled from ETP still contains traces of dissolved salts, which are to be removed by mixed bed polisher units. MB polisher units are provided for 24 hrs continuous operation. There are four MBs, two working and two standbys. Each MB unit is a vertical pressure vessel fitted internally with a top distributor and header-lateral type middle collecting system. Externally it is fitted with MSRL frontal pipe work and pneumatically operated CI butterfly/CIEL diaphragm valves. Each MB polisher unit is charged with strong acid cation and strong base anion resins in mixed form. Water to be polished flows in a downward direction to produce DM water. MB unit is isolated for regeneration whenever it has delivered its specified output or quality of DM water deteriorates whichever is earlier. For regeneration of cation resin an acid measuring tank and for anion resin a caustic dilution tank is provided of MSRL construction with accessories. Twin lobe type rotary air blowers are provided for mixing of cation and anion resin after regeneration.

Effluent Neutralization System

Acidic/alkaline effluent water generated during the MB unit is stored in an RCC pit with acid/alkali proof lining. An HDPE air grid pipe work with isolation valves for air agitation is provided. MB air blower is used for this purpose after completion of MB regeneration.

Horizontal centrifugal pump in SS 316 construction is provided for transfer of effluent water from neutralization pit.

Waste Water Collection Pit and Pump

One pit in RCC is provided to collect all the waste generated in RO based desalination plants. The capacity of the pit is 100 m³. The waste from this pit is disposed of to RO reject tanks. There are two numbers of tanks, one working, and one standby in SS 316 construction.

pH Boosting of Process Water (8-8.5)

Two MSRL caustic tanks (1W+1S) along with two dosing pumps (1W+1S) and a pH boosting pump are provided.

Mixed bed ion exchanger unit – Demineralized Water Plant (DM Plant)

DM Plant is required to operate satisfactorily for RO permeate and effluent recycled from ETP. As recycled effluent has higher TDS, we have designed a mixed bed ion exchanger unit considering the same.

The capacity of the UF and pre-treatment in the desalination plant is 4080 m³/day and R.O of 2040 m³/day. Where R.O is going to be augmented to the proposed total capacity of 4080 m³/ day of process water.

To achieve permeate quality of less than 50 mg/l TDS, RO block has been designed for two passes. First and second passes are designed for 40% and 85% recovery, respectively. Moreover, the second pass RO stream is designed for two stages, to achieve 85% recovery. We have designed an RO based desalination plant for following sea water analysis.

Table 32. Feed Water for Desalination Plant Analysis

S. No.	Description	Unit	Input Value
1	TSS	mg/l	280
2	Temperature	°C	25-31
3	Potassium	mg/l as K	483
4	Sodium	mg/l as Na	12525
5	Magnesium	mg/l as Mg	1280
6	Calcium	mg/l as Ca	460
7	Alkalinity	mg/l as CaCO ₃	200
8	Bicarbonate	mg/l as CaCO ₃	129
9	Nitrate	mg/l as NO ₃	60
10	Chloride	mg/l as Cl	21300
11	Sulphate	mg/l as SO ₄	2300
12	TDS	mg/l	40175
13	pH	-	7.8-8.2
14	Turbidity	NTU	50
15	COD	mg/l	40
16	BOD	mg/l	9
17	Conductivity	µmoh/cm	56900
18	Phosphate	mg/l	17

Table 33. Treated Water Quality at R.O- II Outlet-Desalination Plant Outlet –Treated Water

Parameters	Limit
Total Dissolved Solids	<50 ppm

Parameters	Limit
pH (After pH Correction)	8-8.5
Chlorides as Cl	20 ppm
Total Hardness	<40 ppm

Table 34. Desalination Plant Dimensions

S. No.	Unit Description	MOC	Nos. W+S	Capacity
1	Pressure Sand Filter	MSRL	3(2W+1S)	246.5 m ³ /hr
2	Dual Media Filter	MSRL	3(2W+1S)	246.5 m ³ /hr
3	Micron Cartridge Filters for RO	SS 316 (with Teflon coating)	2(1W + 1S)	470.3 m ³ /hr
4	Micron Cartridge Filters for chemical cleaning	SS 316 (with Teflon coating)	2(1W + 1S)	225 m ³ /hr
5	RO-I (Pass-1)	MSEP	1+1	100.1 m ³ /hr
6	RO-II (Pass-2)	MSEP	1+1	85.1 m ³ /hr
7	Mixed Bed Exchanger-MB	MSRL	4	59.1 m ³ /hr
8	Energy Recovery Turbine	Duplex	2	250.2 m ³ /hr
Vertical Cylindrical Tank				
9	NaOCl	MSRL	2 (1W + 1S)	1243 l
10	FeCl ₃ Dosing Tank	MSRL	2 (1W + 1S)	3179 l
11	Lime Dosing Tank	MSRL	2 (1W + 1S)	1243 l
12	Polyelectrolyte Dosing Tank	MSRL	2 (1W + 1S)	269 l
13	Antiscalant Dosing Tank	MSRL	2 (1W + 1S)	393 l
14	SMBS Dosing Tank	MSRL	2 (1W + 1S)	665 l
15	Suckback Tank	MSRL	1	7220 l
16	Product Water Storage Tank RO 1	MSRL	1	50300 l
17	Chemical Cleaning Tank	MSRL	2 (1W + 1S)	7220 l
18	Product water Storage Tank RO 2	MSRL	1	42800 l
19	Caustic Dosing Tank	MSRL	2 (1W + 1S)	113 l
20	Acid Dilution tank for Regeneration	MSRL	1	1356 l
21	Caustic Dilution Tank for Regeneration	MSRL	1	1470 l
22	Acid Dilution Tank for N Pit	MSRL	1	200 l
23	Caustic Dilution Tank for N Pit	MSRL	1	200 l

2.13 WASTEWATER AND ITS MANAGEMENT

Waste Water Generation & Disposal Method

Wastewater Generation: Total waste water generation after expansion will be 13.41 MLD. Total 110 KLD of sewage will be generated from Domestic which will be treated in STP of capacity 140 KLD. Remaining 13309 KLD of effluent (8840 KLD from process, 300 KLD from Plant Wash, 3309 KLD from Cooling Tower, 820 KLD from DM Plant & 90 KLD from Boiler Blowdown) will be treated in ETP of capacity 15800 KLD.

Table 35. Wastewater Generation Details

S. No.	Wastewater Generation Pattern	Wastewater Generation in KLD				Disposal mode
		Existing PVC (600 KTA)	Proposed PVC (600 KTA)	Proposed VCM (750 KTA)	Total	
1	Cooling Tower	920	920	1469	3309	Treated in Effluent Treatment (ZLD) and treated effluent will be recycled back in process.
2	DM water	360	360	50	770	
3	Process	4220	4220	400	8840	
4	Boiler	20	20	50	90	
5	Plant Washing	100	100	100	300	
6	Greenbelt	-	-	-	-	
7	Domestic	40	40	30	110	Treated in STP and used in gardening
	Total	5660	5660	2099	13419	-

2.13.1 WASTEWATER GENERATION AND ITS MANAGEMENT

Table 36. Wastewater treatment units

Particulars	Existing	Proposed	Total After Expansion
	Capacity (KLD)		
STP	50	90	140
ETP	6400	9400	15800
RO	6000	9000	15000
MEE	600	900	1500

2.13.2 DETAILS OF EFFLUENT TREATMENT PLANT

Settling Pond

Effluent from the wastewater stripper, centrifuge, and stripping column, effluent from FBD & effluent from PVC sludge dewatering system is collected in the settling pond (two compartments), from the settling tank mixed effluent is routed under gravity to the equalization tank. Settled PVC shall be disposed off at TSDF.

Equalization Tank

Overflow from the settling pond, blow down streams from cooling tower & boiler, surface drainage, seal flush, side stream filter, regeneration from MB, backwash of PSF & UF and filtrate from the centrifuge is collected in the equalization tank. HDPE air grid provides air supply through blower for complete mixing & avoiding settling of solids in the tank. The tanks are connected to two pumps by a three-way valve.

Flash Mixer

The effluent from the equalization tank is pumped to a flash mixer where effluent water containing turbid and suspended particles can be coagulated by dosing Ferric chloride. Dosage rate of ferric chloride varies depending upon inlet turbidity & total suspended solids in feed water. Each tank is

designed to hold solutions required for 24 hours of operation. While one tank is in operation, another tank is used to prepare a solution. Both tanks are connected to the pumps (1W + 1S), positive displacement type diaphragm pumps in PP construction. To disperse ferric chloride and to prepare a homogenous solution, each tank has a motorized agitator of stainless steel 316. After coagulant dosing; pH of feed water may reduce. For effective coagulation; pH of water is required to be raised, for which lime dosing system is provided. Dosage rate of lime varies depending upon feed water pH. For this purpose two Lime dosing tanks of mild steel (rubber lined) construction are provided, one working and one standby. Each tank is designed to hold the solution required for 24 hours of operation. While one tank is in operation, another tank will be used to prepare a solution.

Both tanks are connected to pumps (1W + 1S), positive displacement type diaphragm pumps in PP construction. To dissolve the solid lime and to prepare a homogenous solution, each tank has a motorized agitator of stainless steel 316L.

High Rate Solid Contact Clarifier

For removal of very fine colloidal particles (for flocculation purpose) a suitable grade of Poly electrolyte is dosed before water enters the flocculating zone. Effluent enters the slow mixing zone where Polyelectrolyte is dosed to the effluent to bring flocks into intimate contact with suspended solids to make a solid layer. The incoming solids are brought in contact with a solid layer near the bottom. The incoming solids rise and come in contact with solids in the sludge layer. This layer acts as a blanket and the incoming solids agglomerate and remain enmeshed within this blanket. The clarified water rises upward while a distinct interface retains the solids below. The Solid Contact clarifier has better hydraulic performance and has minimum retention time for effective solids removal. Clarifier mechanism is provided for continuous mechanical removal of settleable solids. The sludge removal mechanism revolves slowly and scrapes settled solids at the bottom and clear effluent overflows into the peripheral launder.

The sludge generated from HRSCC is routed under gravity to sludge sump. Overflow from the clarifier is collected into the filter feed cum chlorination sump.

Mechanical Dewatering System (Centrifuge)

The sludge generated from Solid contact Clarifier is drained into the Sludge sump.

The collected sludge is pumped to the centrifuge system for dewatering from the sludge. The polyelectrolyte is added to the centrifuge system. Dewatering is a physical (mechanical) unit operation used to reduce the moisture content of sludge. The filtrate from Centrifuge is taken back to the equalization tank under gravity.

Pressure Sand Filter

Effluent from Filter feed cum Chlorination sump is pumped to PSF through basket strainer for removing suspended solids, turbidity etc. The arrested solids/turbidity in the filter is removed by

back washing. Solids are entrapped when raw water is passed in downward direction through the sand bed. This unit is charged with a uniform grade of filtering sand, which is supported on different grades of under-bed materials. The Pressure Sand Filter is made of MSRL vertical vessels. It is fitted with a top inlet distributor and header - lateral type of bottom collecting system. Externally this unit is fitted with frontal pipe work and control valves. The unit is isolated for backwash, when the pressure drop across the bed exceeds the specified limit (0.8 Kg/cm^2) or quality of filtered water deteriorates, whichever is earlier. PSF backwash is done by using PSF filtrate collected into the filter back wash sump. Backwash generated from PSF is routed to the equalization tank.

Advanced Membrane Technology (Ultra Filtration)

Ultra Filtration is a dead end filtration, low pressure hollow fiber membrane process in which particulate colloidal and high molecular weight material is filtered from water. The UF module consists of UF membranes. The pore size of the membrane is such that it allows clear water free from suspended impurities to flow through but retain any colloidal particles and macromolecules.

The contaminated water from back wash is recycled to HRSCC. UF permeate having $\text{SDI} < 3$ and turbidity of $< 1 \text{ NTU}$ is collected in UF permeate storage tank.

Chemical enhanced backwashing of UF membrane is carried out intermittently, using UF backwash pumps. The UF backwash pumps take feed from UF permeate storage tanks and chemicals are dosed online. The operation of a complete UF system, including backwashing PLC control. Adequate instrumentation is provided for safety measures.

Reverse Osmosis

Reverse Osmosis is the third & final stage of treatment for removal of dissolved salts; two pass Reverse Osmosis system is provided. UF permeate is pumped by the cartridge filter feed pumps, to the cartridge filters. The capacity of the pump is such that they will pump the required quantity of UF permeates to RO skid. The system consists of the following equipment in series.

Sodium Meta Bi-sulphite Dosing System

A Sodium Meta-Bi-Sulphite (SMBS) Dosing System is provided for Dechlorination. Filtered water may contain free chlorine depending upon actual utilization of chlorine dosed. This free chlorine is injurious to RO Membranes and hence need to be removed prior to feeding the RO System. Sodium Sulphate reacts with residual chlorine to form Sulphate, thus water is dechlorinated.

For this purpose two SMBS dosing tanks, one working and one standby in Mild steel (rubber lined) construction is provided. Each tank is designed to hold the solution required for 24 hours of operation.

While one tank is in operation, another tank will be used to prepare a solution. Both tanks are connected to pumps (1W+1S), Positive displacement type, and Diaphragm pumps in PP

construction. To dissolve SMBS in water, each tank will have a motorized agitator of stainless steel 316.

Anti Scalant Dosing System

During the Reverse Osmosis process, dissolved salts are concentrated on the reject side as permeate water is being drawn at specific recovery. As a result of this, dissolved salts concentration increases on the reject end and may precipitate if saturation limit exceeds. As a resultant effect of salt concentration, scaling (deposition) occurs on the membrane surface, which results in inferior performance of the RO system. For this purpose two Anti scalant dosing tanks, one working and one standby in Mild steel (rubber lined) construction is provided.

Each tank is designed to hold the solution required for 24 hours of operation. While one tank is in operation, another tank will be used to prepare a solution. Both tanks are connected to both pumps (1W + 1S), positive displacement type diaphragm pumps in PP construction. To form a homogeneous solution, each tank has a motorized agitator of stainless steel 316.

Micron Cartridge System

After chemical dosing, RO feed water may get contaminated with very fine suspended matters. To supply highly filtered water to RO, micron cartridge filter units are used. MCF unit is a vertical pressure vessel built of SS 316 material. Internally it is fitted with PP wound depth type micron cartridge filter element. Filtered water from DMF passes through this cartridge element to produce highly filtered RO feed water.

Chemical Cleaning System

A common Chemical Cleaning System for all RO skids is provided. This system comprises two Chemical solution preparation tanks, two micron cartridge filter units and chemical cleaning pumps. Cleaning of membrane is carried out at a regular duration for removal of any deposition of organic salts, suspended matters, microbiological impurities on membrane surface over a continuous period of usage.

The Cleaning chemical is passed in the same direction as that of feed water flow in order to remove the deposition from membranes. Prescribed chemical solution of required concentration is prepared in the tank. It is re-circulated with the help of a chemical cleaning pump and micron cartridge filter through the RO system at specified flow rate and pressure for about 60 minutes after primary flushing with permeate water.

After cleaning again permeates, water is used for RO system flushing and final cleaning. The RO-I (A) & (B) system comprises R.O. membranes housed in FRP Pressure tubes. Necessary instrumentation is provided for monitoring and safe operation of the system. Permeates generated from RO-I (A) & (B) systems are directly fed through degasser tanks & then collected in Permeate Collection tank-I. Reject generated from RO-I (A) & (B) shall be routed to RO –I reject tank.

Reject collected from RO - I reject tank is pumped to RO-II (A) & (B) system for further TDS reduction. Permeates generated from the RO-II (A) & (B) system are directly collected in Collection tank-II. Reject generated from RO-II (A) & (B) is routed to the Final RO reject tank. Then it is treated through the Thermal Evaporator system.

Thermal Evaporation

A Multiple Effect forced circulation evaporation plant to attain zero discharge and recover water for recycling back to the plant is installed. Forced circulation evaporation route has been selected since the RO reject contains considerable amounts of silica, CaSO_4 , MgSO_4 , and other hardness, which are very detrimental to the evaporator heating surface. In the forced circulation evaporator tubes are always flooded with high velocity liquid, which suppresses evaporation. All precipitated scales along with the salt remain in suspension, which gets discharged along with mixed salt. The mixed stream containing High TDS shall be concentrated in the final effect (forced circulation) of the evaporation plant to increase concentration above saturation level to precipitate the salt from the feed liquor.

Table 37. Characteristics of process wastewater stream

Parameters	Units	ETP Inlet	ETP Outlet/ RO Inlet	RO Permeate	RO Reject/ MEE Inlet	MEE Outlet
PH	-	6-9	6.5-8.5	6-8	7-9	7-9
COD	mg/l	1000-5000	250-1000	<50	250-500	<50
BOD	mg/l	300-1500	50-500	<10	50-250	<10
TDS	mg/l	2000-10000	1000-5000	<100	1000-2500	<100
TSS	mg/l	100-500	50-200	<10	50-100	<10
Oil & Grease	mg/l	10-50	<10	<1	10-30	<1

Flow Chart for ETP

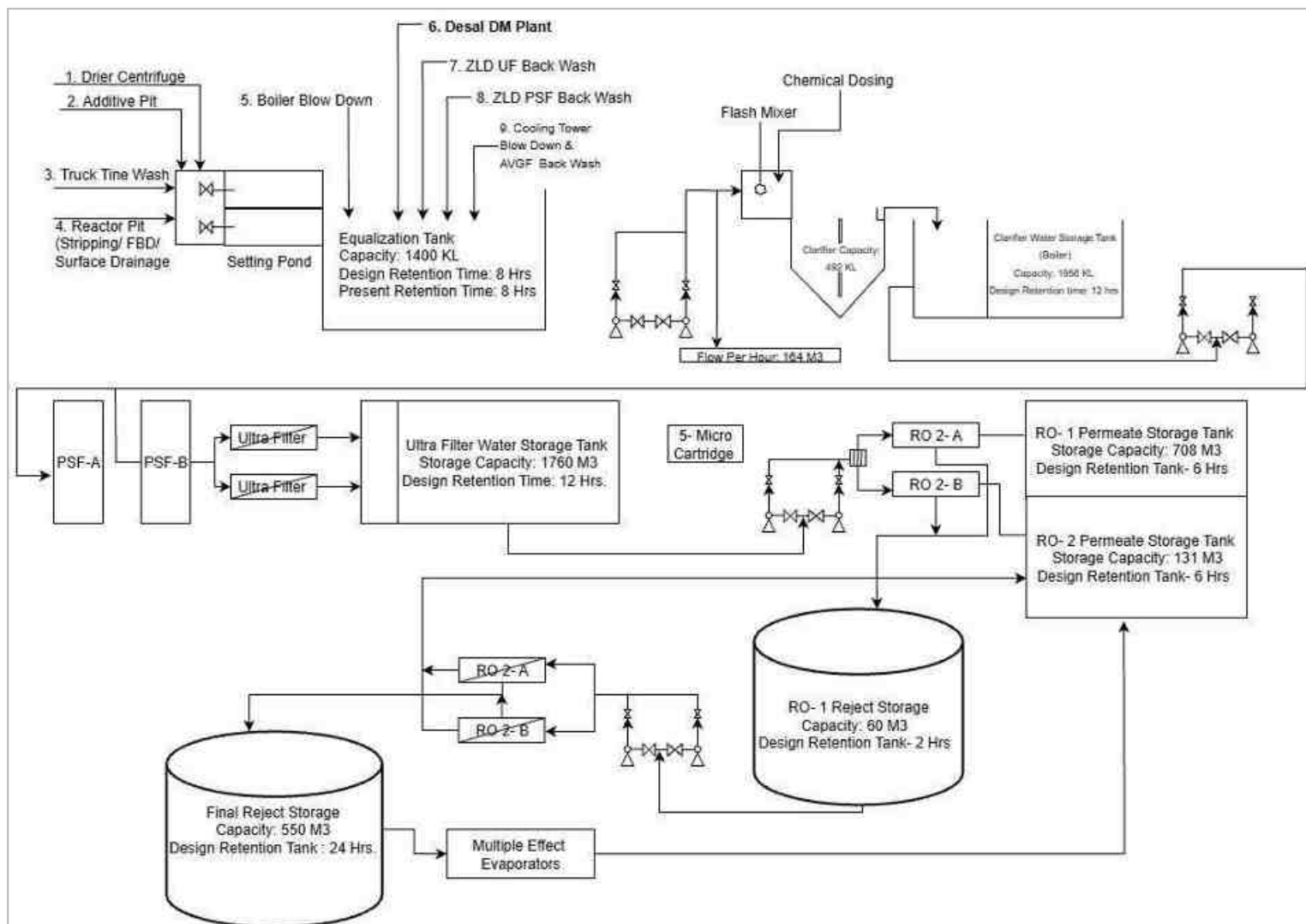


Figure 23. ETP Flow Chart

Wastewater treatment facilities for STP -

Incoming Sewage is first sent to a screen for screening and then transferred to sewage collection to still the turbulence in sewage. A RCC tank 8.0 m³ capacity is provided for this purpose. Upstream of the settling chamber has a low-level indicator for monitoring further systems.

Aeration Tank

Sewage from the collection sump is directly pumped to the inlet of the aeration tank. In aeration system, organic content in wastewater degrades in aerobic condition and organic matter is converted into CO₂ and H₂O.

Aerobic condition in the aeration system is achieved by means of the floating aerator. An oxy-radiation potential switch is provided at the upstream of the aeration tank.

Secondary Clarifier

The sewage from the aeration tank is routed under gravity to the secondary clarifier. Clarifiers are widely used for continuous mechanical removal of settleable solids from wastes.

The wastewater is carried to the centre of the tank, the wastewater enters into a circular well, designed to distribute the flow equally in all directions.

Sludge Handling System

The sludge removal mechanism revolves slowly and scrapes bio-solids settled at the bottom. The settled sludge is partly recycled into aeration to maintain TSS concentration. Excess biological sludge is routed to sludge sump. Overflow from the clarifier is routed under gravity to the treated sewage collection tank. Treated sewage water is pumped to the Cascade aerator & collected back into the treated sewage collection tank. Disinfection of the sludge is done by dosing Sodium Hypochlorite Solution. For this purpose a Sodium hypo-chlorite dosing HPPE tank has been provided.

Flow Chart for STP

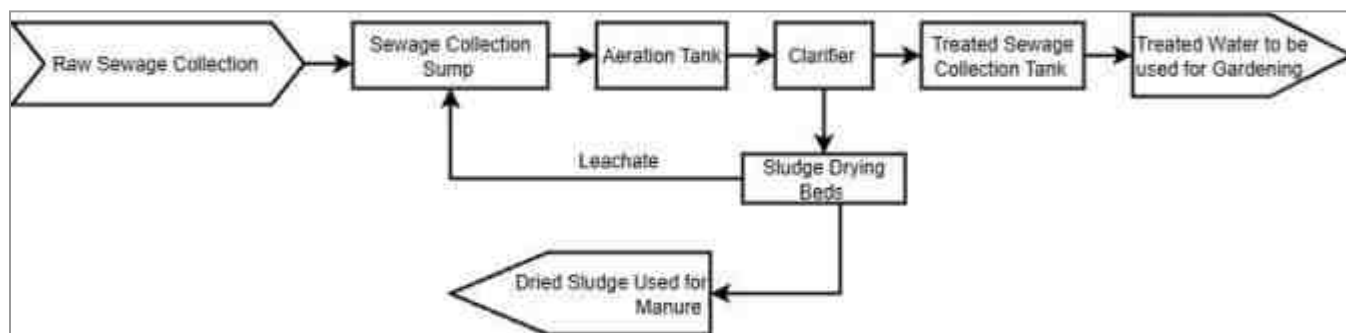


Figure 24. STP Flow Chart

Table 38. Inlet and Outlet Characteristics of Sewage Treatment Plant

S. No.	Parameters	Units	Raw Sewage	Treated Water	CPCB Standards
1	pH	-	8.5	6.5 - 8.0	5.5-9.0
2	Total Suspended Solids	mg/l	200 - 300	<10	<20
3	COD	mg/l	100 - 250	<50	<50
4	BOD	mg/l	260 - 360	<10	<10
5	Oil & Grease	mg/l	<60	BDL	<10
6	Faecal Coliform	mg/l	100	<50	<100

2.14 NOISE MANAGEMENT

- There is noise generation due to the movement of vehicles carrying products and as this is only a temporary phenomenon, it will be managed by properly regulating the movement of vehicular traffic so that the ambient noise quality is not adversely affected.
- All the machinery and equipment will be regularly maintained to reduce the noise level.
- DG sets of capacity 14 Nos. x 2000 kVA (7 Nos. x 2000 kVA existing and 7 Nos. x 2000 kVA proposed) will be installed acoustically enclosed.

2.15 SOLID AND HAZARDOUS WASTE MANAGEMENT

i) Solid Waste:-

Solid Waste: Non-Biodegradable wastes like plastic, paper and glass will be sold to authorized recyclers. Biodegradable wastes will be disposed of by inhouse OWC and will be used as manure for greenbelt development.

Table 39. Detail of Solid Waste Management

Category	Type of Waste	Existing (A)	Proposed SPVC (B)	Proposed VCM (C)	Total After Expansion (D = A+B+C)	Treatment Method
		Quantity (TPA)				
Biodegradable	Organic Waste	14.78	14.78	10.18	39.74	Treatment in inhouse organic waste convertor (OWC) and use manure for horticulture development purposes in the premises
Non-Biodegradable	Recyclable Waste (Plastic, paper, wood, glass, etc)	22.18	22.18	11.32	55.68	Given to authorized recycler
Total		36.96	36.96	21.50	95.42	-

ii) Non-Hazardous Wastes

Table 40. Detail of Non-Hazardous Solid Waste

Name of the Waste	Existing	Proposed	Total After Expansion	Mode of Disposal
	Quantity (TPA)			
Fly ash	3,360	3,360	6,720	Will be sold to Brick Manufacturers

iii) Hazardous Wastes

Hazardous wastes will be managed via authorised HW recyclers, by M/s. Chemplast Cuddalore Vinyls Limited. The agreement was made with Re Sustainability IWM Solutions Limited on 05.09.2022 and Atlas Corporation on 17.03.2023. The agreement for the same is attached as **Annexure 3**.

Table 41. Details of Hazardous Waste and its Management

S. No.	Type of Waste	HW Category*	Quantity per Year (MT)				Source	Treatment / Disposal
			Existing PVC (600 KTA)	Proposed PVC (600 KTA)	Proposed VCM (750 KTA)	Total		
1	Used / spent Oil	5.1	16.2	16.2	20	52.4	Plant equipments	Sent to authorized recyclers
2	Wastes or residues containing oil	5.2	-	-	5	5	Plant equipments	Sent to authorized recyclers (co-processing)
3	Distillation residue	20.3	-	-	22500	22500	Manufacturing process	Captive incineration
4	Furnace residue	1.1	-	-	50	50	Manufacturing process	To TSDF
5	Desal sludge	35.3	1250	1250	2500	5000	Desalination plant	To TSDF
6	ETP sludge	35.3	160	160	1500	1820	ETP	To TSDF
7	Chemical sludge (salt)	35.3	1656	1656	1000	4312	Multiple Effect Evaporator	To TSDF
8	PVC lumps	22.2	10.8	10.8	-	21.6	Manufacturing process	Disposed off at TNWML (Tamil Nadu Waste Management Limited) common disposal facility at Gummudipondi, an authorized agency
9	Spent Catalyst	1.7	-	-	40	40	Manufacturing process	Sell to Authorised recycler

*Note: (as per HWM Rules, 2016)

iv) Other Wastes

E-Waste

Table 42. E-Waste Details

Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport
		Quantity (TPA)				
E-Waste	Office electronic equipments	0.5	0.5	1.0	Sent to Authorized recyclers	By Road

Battery Waste

Table 43. Battery Waste Details

Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport
		Quantity (TPA)				
Battery Waste	Used battery	1.5	1.5	3.0	Sell/dispose to Authorized recyclers	By Road

Bio Medical Waste

Table 44. Biomedical Waste Details

Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport
		Quantity (TPA)				
Soiled Waste	Occupational Health Center	0.16	0.16	0.32	Dispose of at Biomedical waste site.	By Road
Expired or discarded medicine	Occupational Health Center	0.16	0.16	0.32		By Road
Microbiology & Biotechnology & other clinical waste	From Microbiology Lab	0.16	0.16	0.32		By Road
Waste Sharps	From Microbiology Lab	0.16	0.16	0.32		By Road
Contaminated Waste (Recyclable)	OHC Medical Check up	0.16	0.16	0.32		By Road
Glassware	OHC Medical Check up	0.16	0.16	0.32		By Road
Total		9.6	9.6	19.2		

2.15.1 WASTE MINIMIZATION, RECYCLE/REUSE/RECOVER TECHNIQUES, ENERGY CONSERVATION ENVISAGED IN THE PROJECT

- Recyclable waste will be given to authorization recyclers.
- Trade effluent treated in an inhouse ETP will be reused back in process, boiler & cooling tower. Sewage treated in STP will be used in gardening and STP sludge will be used as manure in greenbelt. The unit will be ZLD.
- Energy Conservation: Led bulbs will be used to achieve the Lux rate with reduced power consumption, VFD in motors.
- Best environmental practices to be followed by people within the premises.

2.16 PLANTATION & GREEN BELT

It is proposed to develop gardening and landscaping in an area of 26.0515 ha (64.3746 acres) by the proponent. The overall green cover in the project site will be 40.31 % of the plot area after the proposed expansion. The water for gardening will be met via the STP treated water which shall be solely dedicated for this purpose.

2.16.1 GREENBELT DEVELOPMENT

- Existing Greenbelt Area: 9.7976 ha (15.15%)
- Greenbelt Area after Expansion: 26.0515 ha (40.31%)
- No. of Existing Tree Species: 23611

Considering 2,500 trees per hectare, Total No. of Trees to be planted: 65,129. The No. of existing Tree Species is 55 So, total No. of Trees to be planted is 65,129 - 23611 = 41518.

Table 45. Details of Existing Trees

S. No.	Common Name	Botanical Name	Number of Trees available
1	Ashoka	<i>Saraca asoca</i>	5
2	Axle wood tree	<i>Anogeissus latifolia</i>	109
3	Arjun	<i>Terminalia arjuna</i>	612
4	Badam tree	<i>Prunus amygdalus</i>	101
5	Bullet wood	<i>Mimusops elengi</i>	103
6	Banyan	<i>Ficus bengalensis</i>	14
7	Cherry	<i>Prunusserotina</i>	395
8	Coconut	<i>Cocos nucifera</i>	40
9	Cannon ball	<i>Couroupita guianensis</i>	109
10	Custered	<i>Annona Squamosa</i>	44
11	Cluster fig	<i>Ficus racemosa</i>	31
12	Casuarina	<i>Casuarina equisetifolia</i>	8382
13	Drum stick	<i>Moringa oleifera</i>	8
14	Five leaf yam (Caucasian tree)	<i>Dioscorea pentaphylla</i>	123
15	Gmelina Arborea	<i>Gmelina Arborea</i>	33
16	Gulmuhar	<i>Delonix regia</i>	30
17	Indian butter	<i>Madhuca longifolia</i>	1044
18	Indian Goosbery	<i>Emblicaofficinalis</i>	16
19	Indian cork	<i>Millingtonianortensis</i>	8
20	Jack fruit	<i>Artocarpus heterophyllus</i>	24
21	Jujube	<i>Ziziphus mauritiana</i>	10
22	Jambul Tree	<i>Syzygium cumini</i>	1057
23	Lemon	<i>Backhousia citriodora</i>	7
24	Mango	<i>Mangifera indica</i>	2500
25	Margosa	<i>Meliacomsita</i>	229
26	Millingtonia	<i>Millingtonia hortensis</i>	10
27	Mahogany tree	<i>Myroxylon</i>	55
28	Neem	<i>Azadirachta Indica</i>	1716
29	Peacock tree	<i>Calathea makoyana</i>	146
30	Palm	<i>Hyophorbelagenicaulis</i>	93
31	Portia tree	<i>Thespesia populnea</i>	1975
32	Pungan	<i>Pungamia Clabra</i>	255
33	Pensil Tree	<i>Pensil Tree</i>	67
34	Red gum	<i>Eucalyptus camaldulesis</i>	182
35	Rubber	<i>Ficus elastica</i>	10
36	Sacred fig	<i>Ficus religiosa</i>	14
37	Sapota	<i>Manikara zapota</i>	15
38	Tamarind	<i>Tamarindus indica</i>	7
39	Teak	<i>Techtona grandis</i>	1613
40	Wild date palm	<i>Phoenix sylvestris</i>	2
41	Thiruvatchi maram	<i>Bauhinia tomentosa</i>	1
42	Aditank maram	<i>Pongamia pinnata</i>	12
43	Othyamaram	<i>Lannea coromandelica</i>	15

S. No.	Common Name	Botanical Name	Number of Trees available
44	Senbhaga maram	Magnolia champaca	74
45	Kadappa maram	Phyllanthus emblica	5
46	Rose wood Tree	Dalbergia sp.	204
47	Unnamed Trees		1263
Total (A)			22768
S. No.	Common Name	Botanical Name	Number of small Trees available
1	Banana	Musasapientium	32
2	Bamboo	Banbusabambos	2
3	Curryleaves	Murraya koenigii	2
4	Guava	Psidium guajava	44
5	Pomegranate	Punica granatum	15
6	Tail grape	Artabotrys hexxapatalus	29
7	Savundal maram	Leucaena leucocephala.	600
8	Hibiscus tree	Hibiscus syriacus	119
Total (B)			843
Total A + B			22768(A)+843(B)=23611

2.17 RAINWATER HARVESTING & STORMWATER MANAGEMENT

Objectives:

- To channelize excess rooftop water, rainwater falling over paved & road areas through a garland network to maximize recharging the under-groundwater aquifer.
- To ensure maximum percolation in the undeveloped areas and excess if any, to be collected and disposed/percolated as much as possible.
- In the event of high intensity rainfall, to have a designed storm water collection and disposal mechanism to prevent water logging within the plant area.

Parameters of Rainwater Harvesting Potential-

- Average annual rainfall: 1014.05 mm
- Peak intensity: 30 to 50 mm/day
- Average no. of rainy days: 200 - 210 days
- Soil type: Red Soil, Black Soil, Lateritic Soil
- Soil infiltration rate: Red soil - 0.5 - 2.5 inches per hour, Black soil - 0.2 - 0.8 inches per hour, Lateritic Soil - 0.05 - 0.5 inches per hour.

Scheme for Ground Water Recharging

A rainwater harvesting system comprises components of various stages - transporting rainwater through pipes or drains, filtration, and tanks for ground water recharge. As the proposed facility will comprise only the roof top rain water for ground water recharge. The runoff from the first spell of rain carries a relatively larger amount of pollutants from the air and catchments surface so the system will be provided with a filtration pit consists of the layers of sand, gravel and pebbles of relevant sizes to remove the removable impurities from the runoff water from the rooftop.

Benefits of Rainwater Harvesting

- Rainwater harvesting from the roof -top provides an avenue for collection & reuse with lighter filtration which in turn will reduce the consumption of fresh water

- Rainwater on the paved areas and other developed areas can be channelised.
- Structured garland Storm water drain will be avoiding the flooding of low-lying areas in the factory premises,

Estimation of Rainwater Harvested

Estimation of harvestable rainwater can be done in many methods. Use of run-off coefficient is one of the simplest methods to assess the quantity of rain water harvested within the area. The effective rainfall is such that the amount of rainfall which can build up surface runoff after satisfying the soil moisture requirement and evaporation loss. It is assumed that about 85% total rainfall is considered to be the effective rainfall.

The details of the incremental run offs on account of the proposed development and the rain water harvesting measures are detailed in the subsequent pages.

Rational formula for calculating runoff, $Q = C I A$

Q	=	Runoff in m ³ /sec
I	=	Intensity of rainfall in mm/ hr.
A	=	Drainage area in hectares.
C	=	Coefficient of runoff as below

Run-off coefficient for various types of surfaces

Rooftop	0.85
Open grounds, unpaved street	0.30
Parks, lawns, gardens	0.15
Macadam roads, pavements	0.65

Design of Rainwater Harvesting:

(a) Annual Rooftop RWH

Table 46. Annual Rooftop Rainwater Harvesting

Particular	Area	Harvesting Factor	Intensity of Annual Rainfall in mm	Annual Potential of RWH in cub. m	No. of rainy days	Max. volume of water available for harvesting in cub. m during rainy day
Roof top	137,750.90	0.85	1290	151043.86	63	2397.52

(b) Peak Rainfall RWH

Table 47. Peak Rooftop Rainwater Harvesting

Particular	Area	Harvesting Factor	Intensity of peak rainfall in mm/day	Daily Potential of RWH in cub. m/day
Roof top	137,750.90	0.85	30	3513

- Two Nos. of rainwater collection tanks with dimensions 12m x 12m x 7.3m each, having a total capacity of about 4200 cum are proposed for collection of rooftop rainwater and storage of 2 days.
- First and second rain from rooftops of admin, engineering, and stores buildings will be

collected in a proposed collection tank and sent to ETP for treatment. After the second rainfall, runoff from these areas will be collected in the same collection tank and will be reused.

Storm Water Management:

Table 48. Stormwater Harvesting

Particular	Area	Harvesting Factor	Intensity of peak rainfall in mm/day	Daily Potential of RWH in cub. m/day
Road and other Open Area	137750.90	0.65	30	2686.14
Green Belt Area	260515.00	0.3	30	2344.64
Total	99,300	-	-	5030.78

- Stormwater will be collected in a proposed rainwater collection pond with a total capacity of about 10060 cum and storage of 2 days of stormwater.

Rainfall runoff from other rooftops and surface runoff will be channelised to the proposed collection pond. 1st and 2nd rainfall will be sent to ETP. Afterward 2nd rainfall excess runoff will be channelised to the storm water drainage of the area.

3. DESCRIPTION OF ENVIRONMENT

3.1. INTRODUCTION

To cover environmental baseline studies, following aspects have been covered :-

The baseline data is generated through field study within the impact zone (Core Zone and Buffer Zone) for various components of the environment viz. Air, Noise, Soil, Water, Land, Ecology and Socioeconomic. The baseline environmental studies have been done from **February 2024 to April 2024** by M/s Perfact Researchers Pvt. Ltd. in a study area of 10 km radius from the project site. While generating the baseline status of the physical and biological environment of the study area, the concept of impact zone has been considered. The impact zone selection is based on preliminary screening and modeling studies. The data collection had been done as given below:

Field Survey and site visit:-

- Primary monitoring of key environmental parameters like Air, Noise, Soil, Water, Land, Ecology and Socio Economic survey during the post monsoon season.
- Consultation with local people, government departments such as the Forest department, Panchayats etc.
- Literature review on secondary information available for the study area.

3.2. BASE MAPS OF THE AREA

3.2.1. GOOGLE IMAGE OF THE PROJECT SITE

Map showing Study area & Close view of the study area with 1 km Buffer radius is already given at Section No. 2.3

3.2.2. TOPOGRAPHICAL MAP

Topographical Map with 10 km radius is already given at Section No. 2.3.3.

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

3.2.3. ACCESSIBILITY MAP FOR ENVIRONMENTAL MONITORING

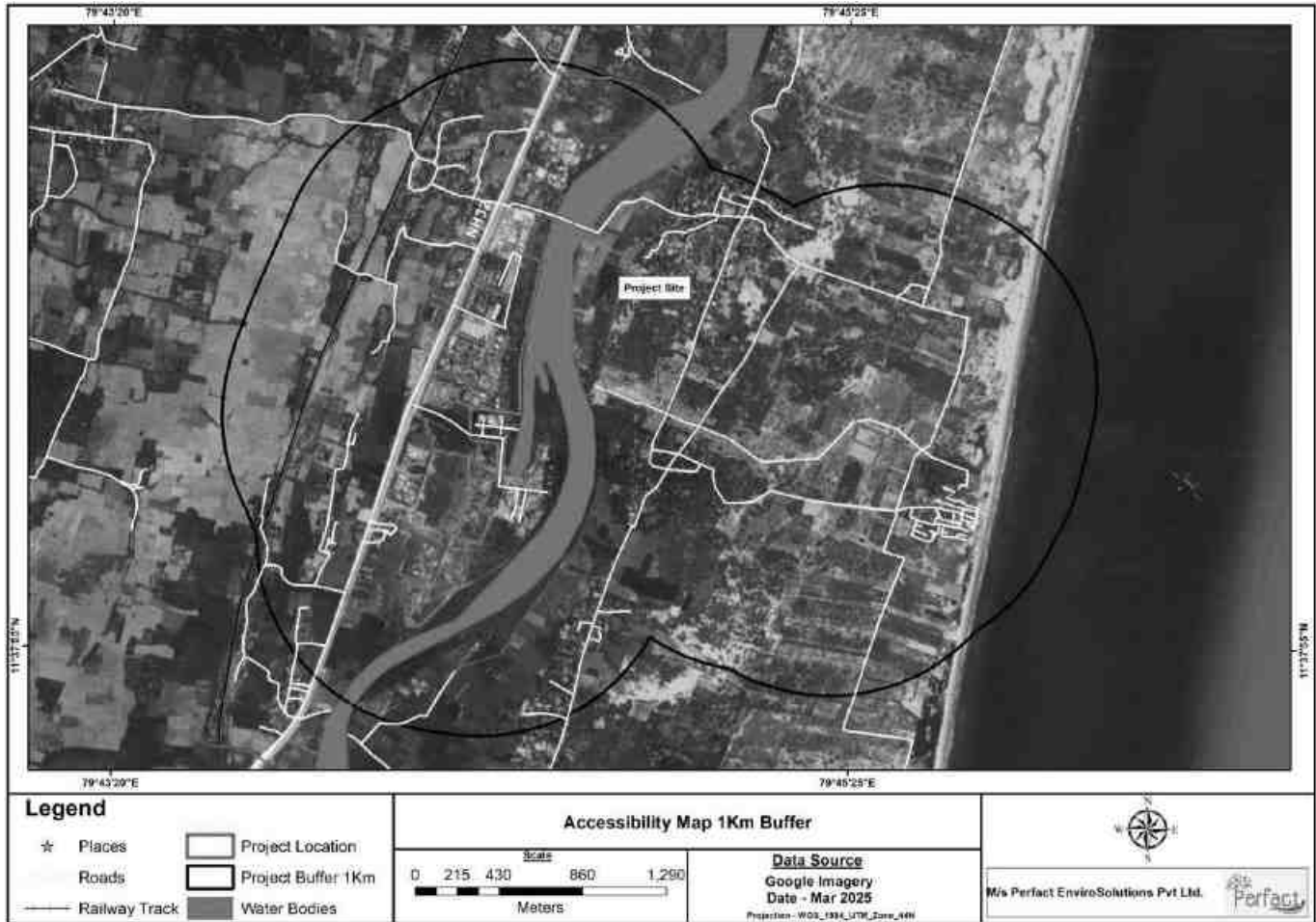


Figure 26. Accessibility Map 1 km

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

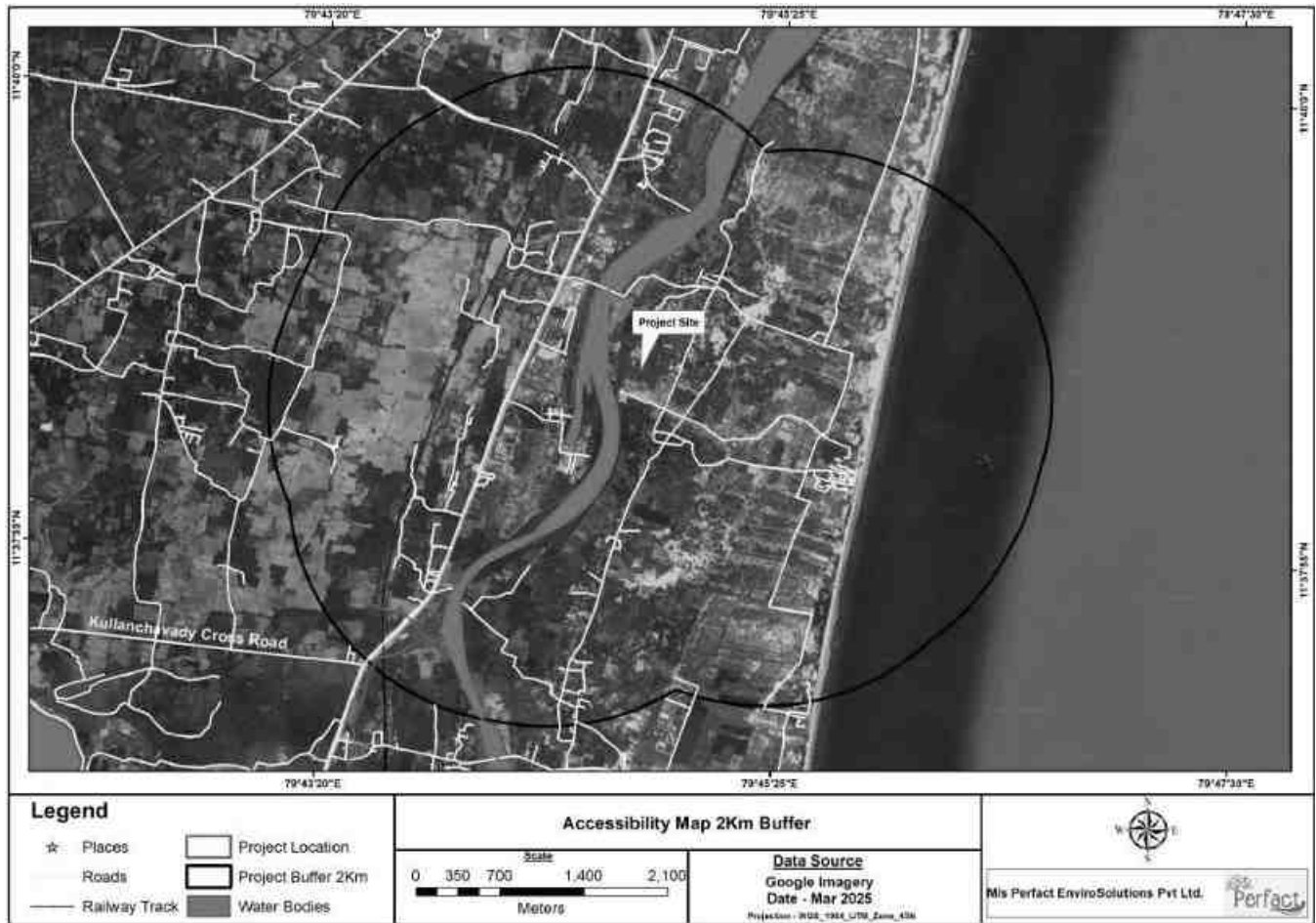


Figure 27. Accessibility Map 2 km

3.2.4. DIGITAL ELEVATION MODEL (DEM) MAP

DEM Map with 10 km radius is given below:

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

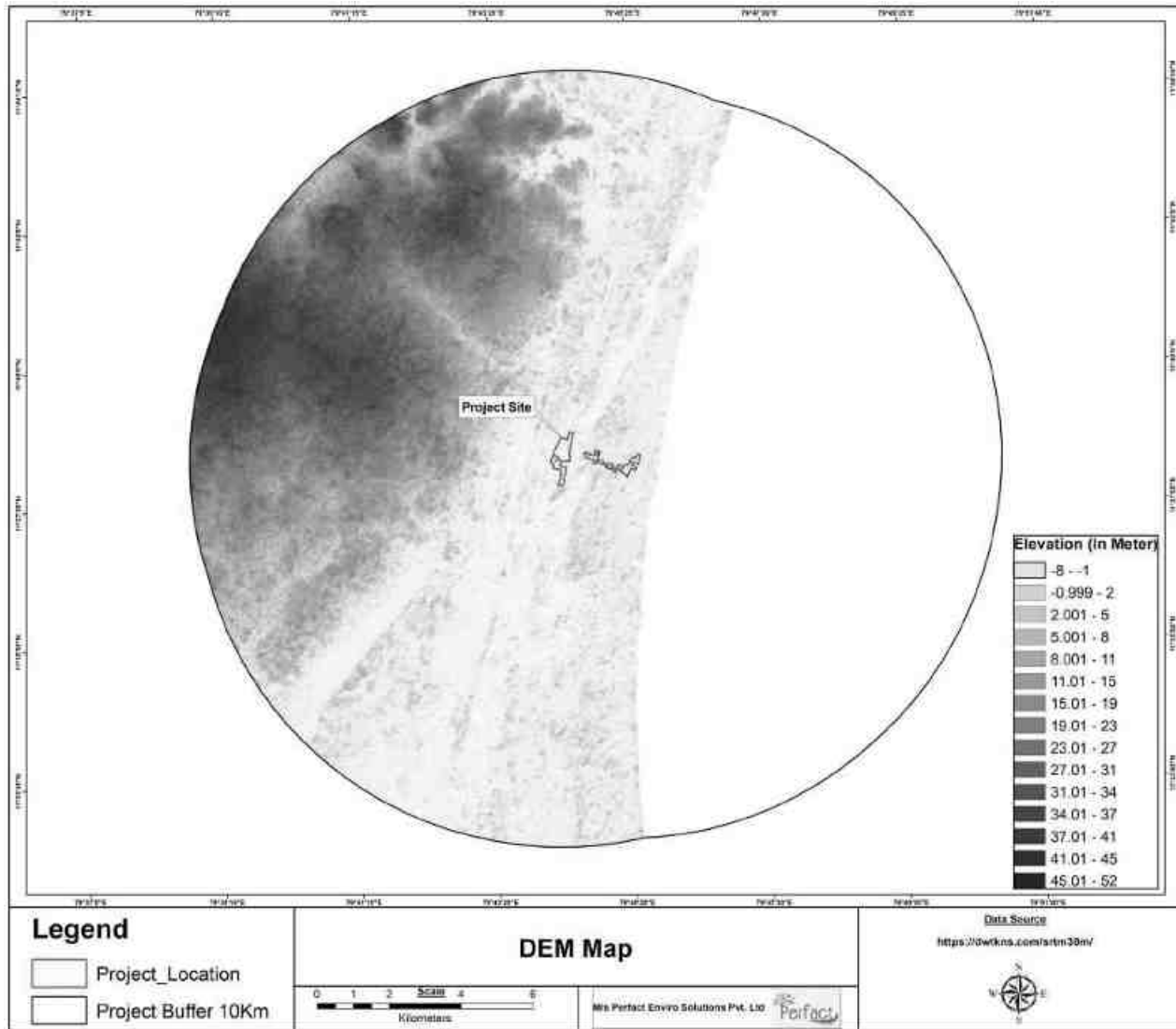


Figure 28. DEM Map

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

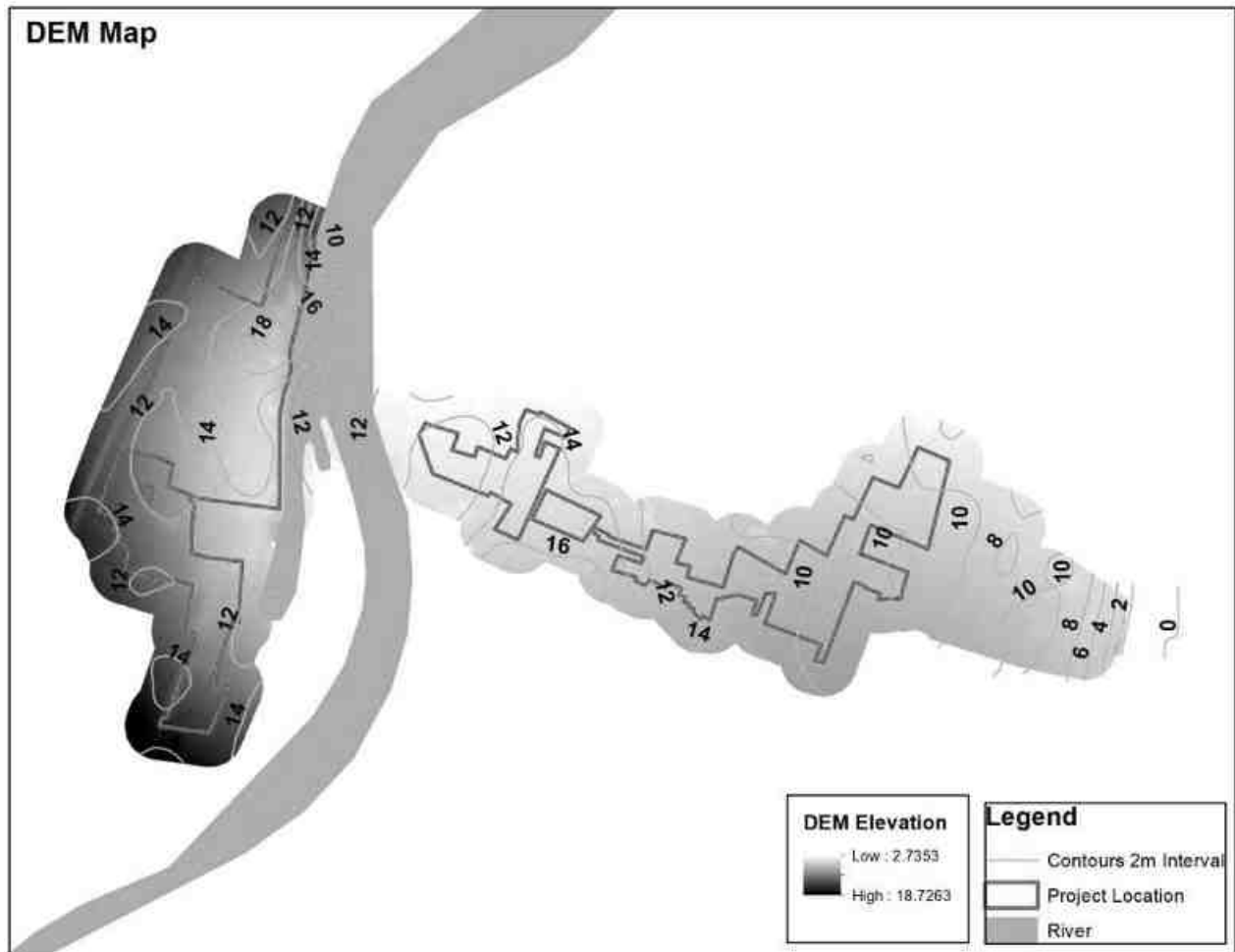


Figure 29. DEM Map with Contour

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

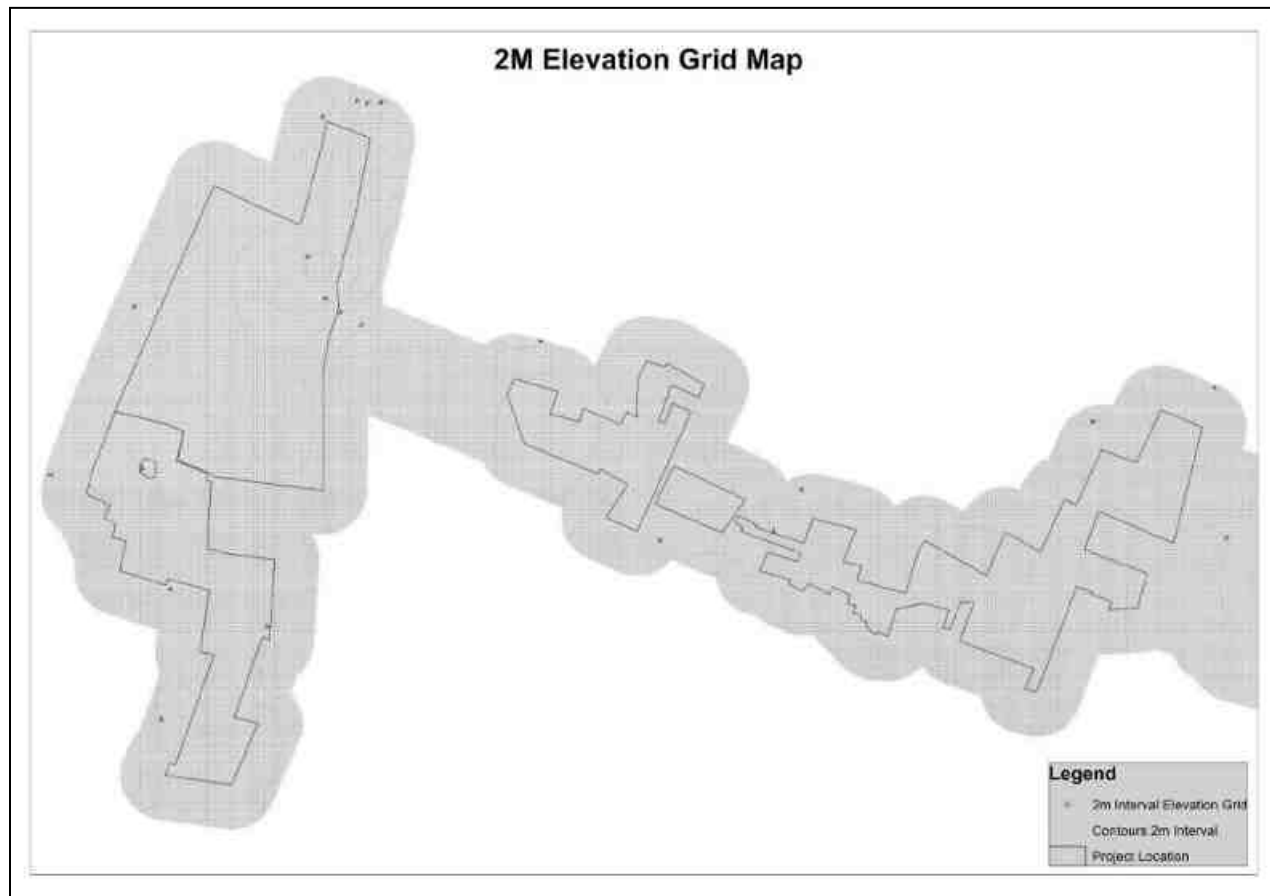


Figure 30. 2m Elevation Grid Map

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

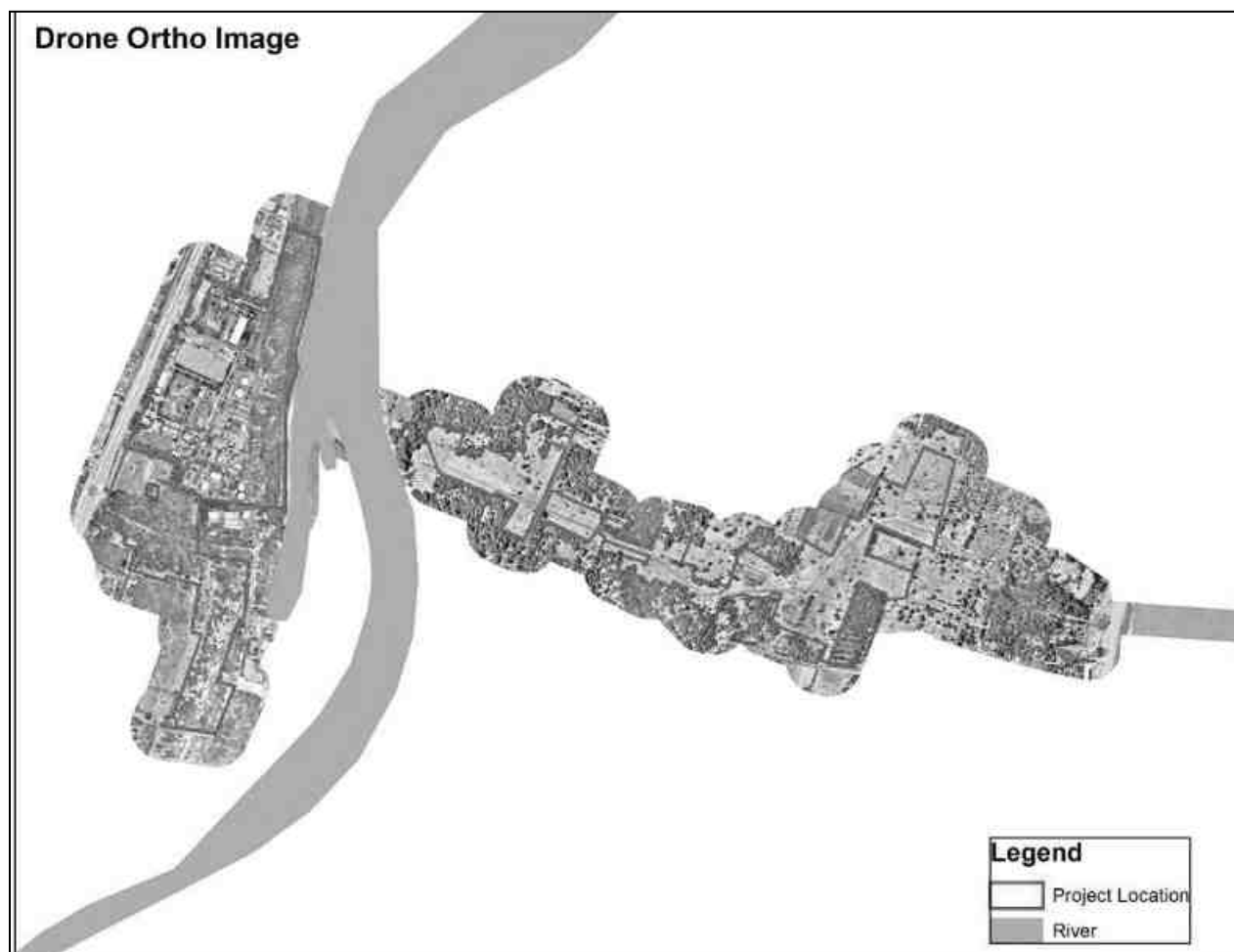


Figure 31. Ortho Image

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

Map Showing 2m Lines from Sea towards Project Area and Spot Heights

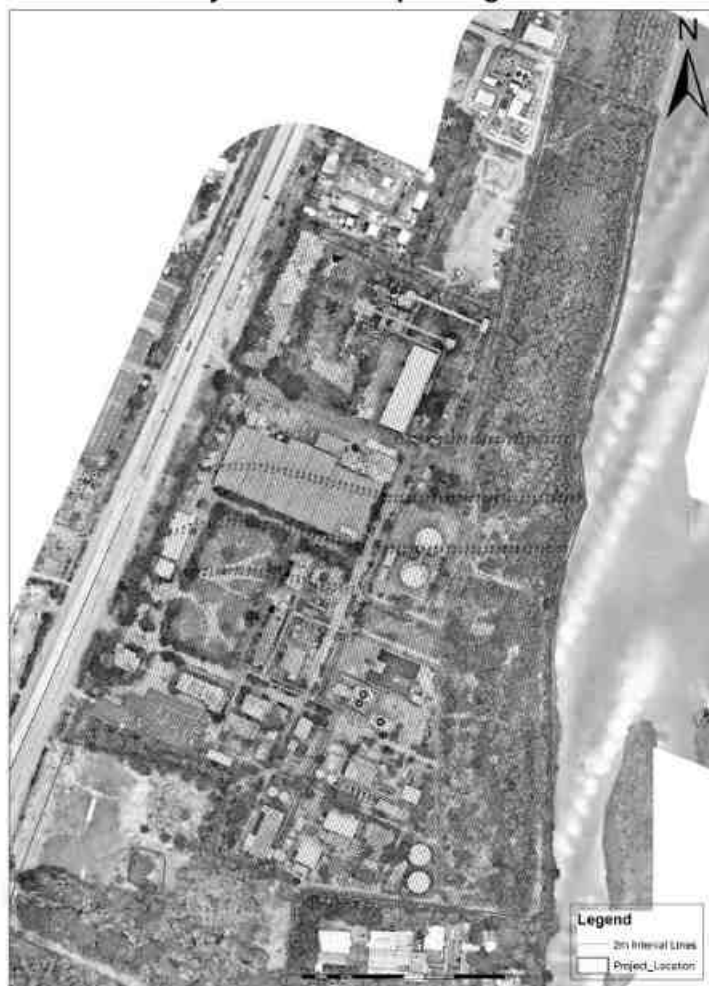


Figure 32. Map Showing 2m Lines from Sea Towards Project Area (Western Corridor)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



Figure 33. Map Showing 2m Lines from Sea Towards Project Area (Western Corridor)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

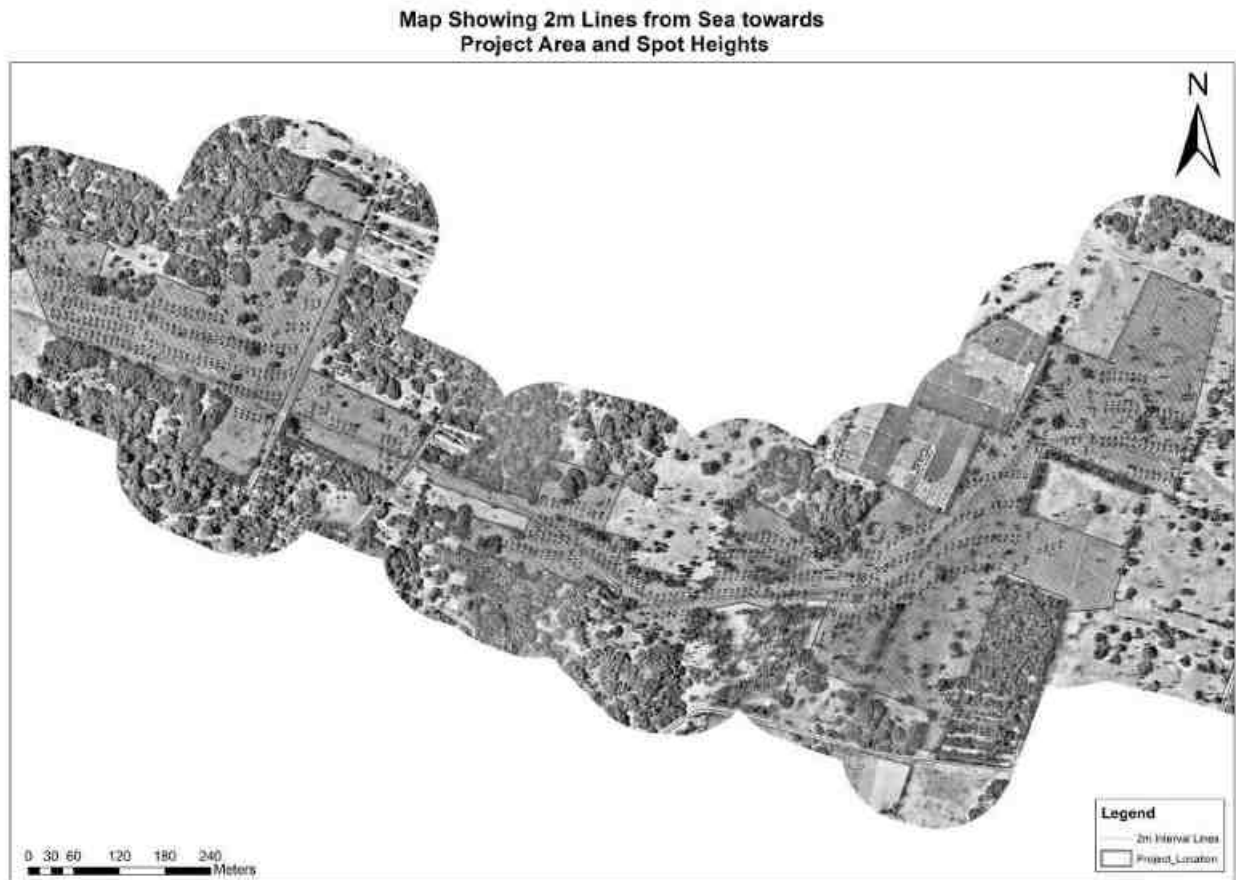


Figure 34. Map Showing 2m Lines from Sea Towards Project Area (Eastern Corridor)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

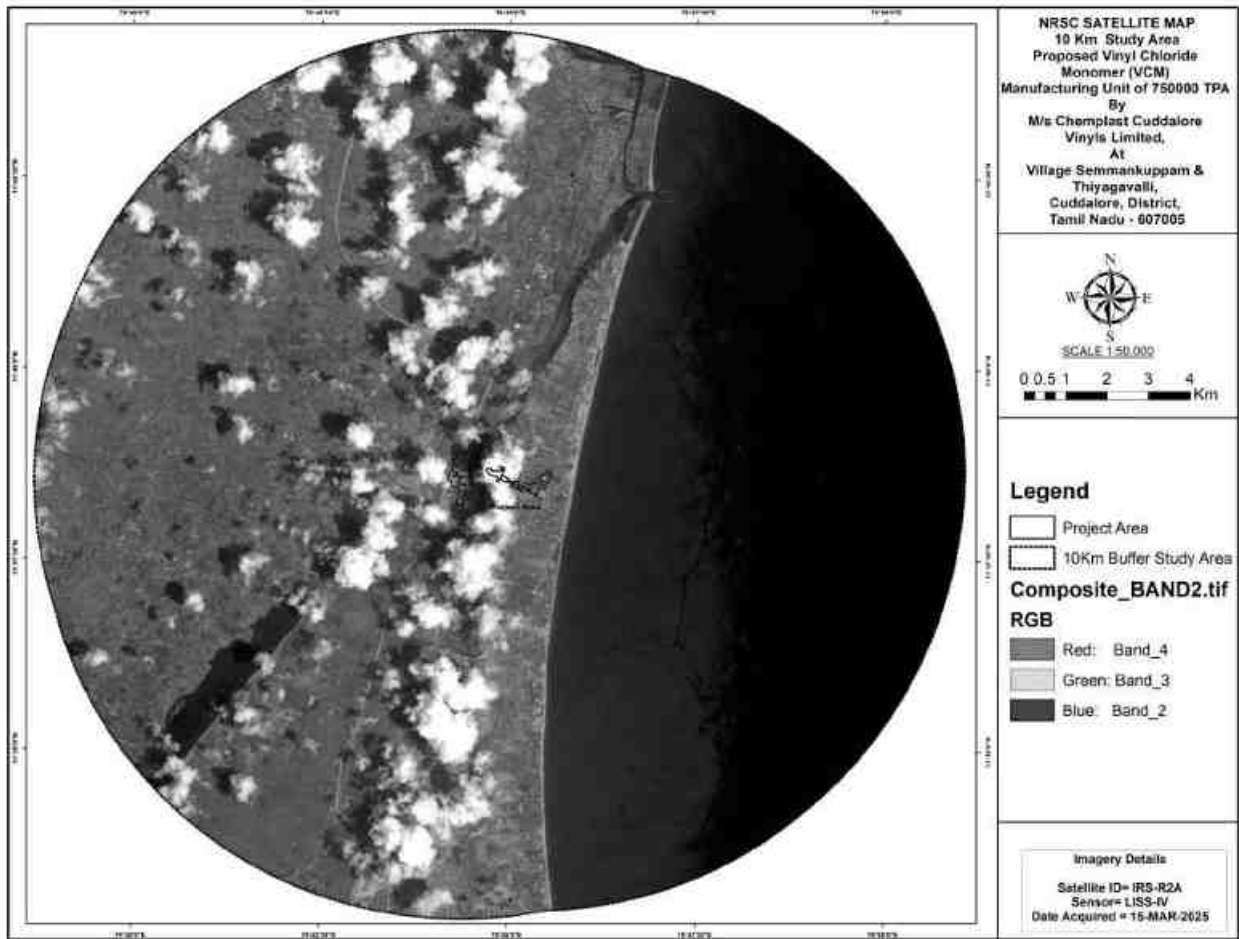


Figure 35. Figure. Showing NRSC Satellite Map (10 km Study Area)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

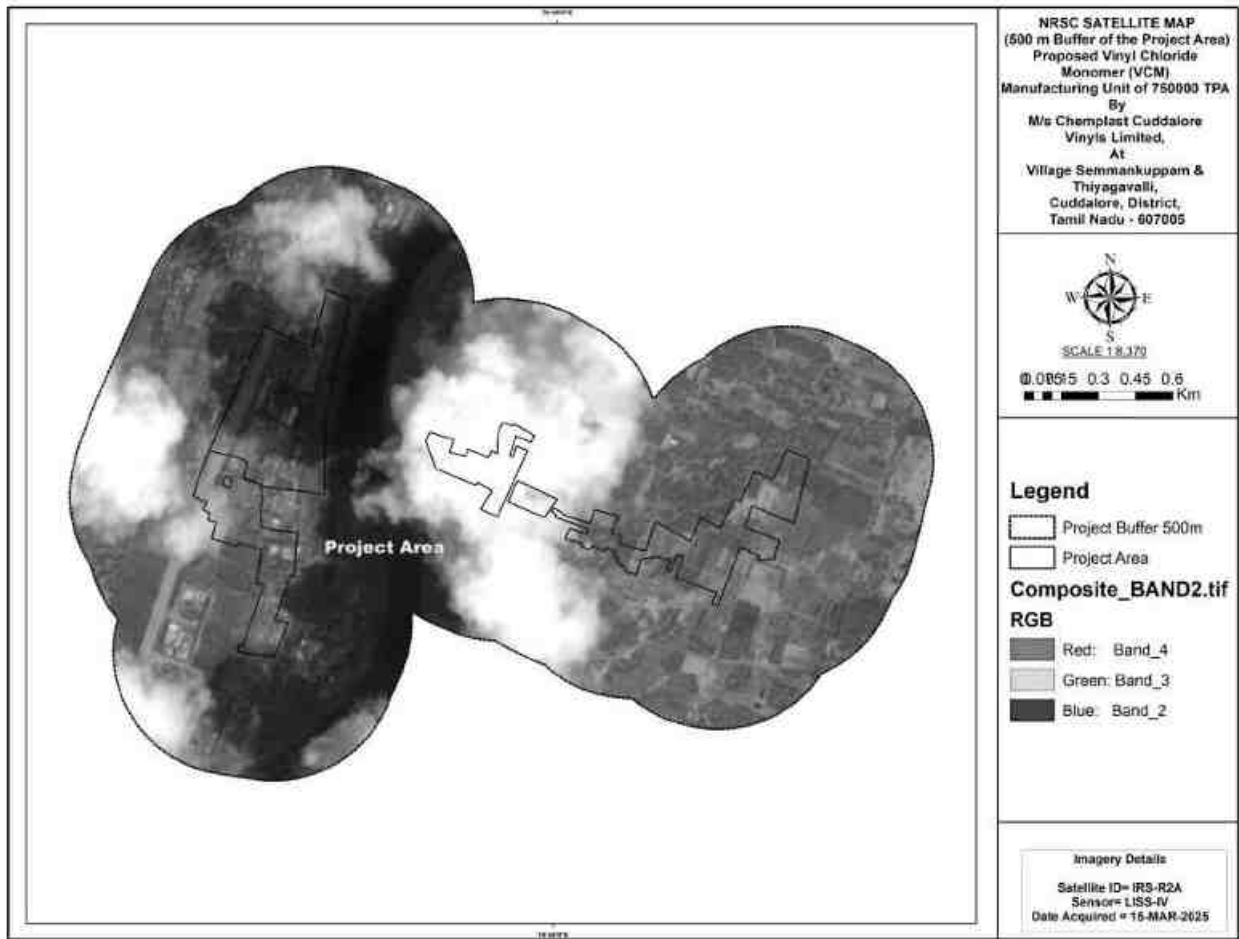


Figure 36. Figure showing NRSC Satellite Map (500 m of the Project Area)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

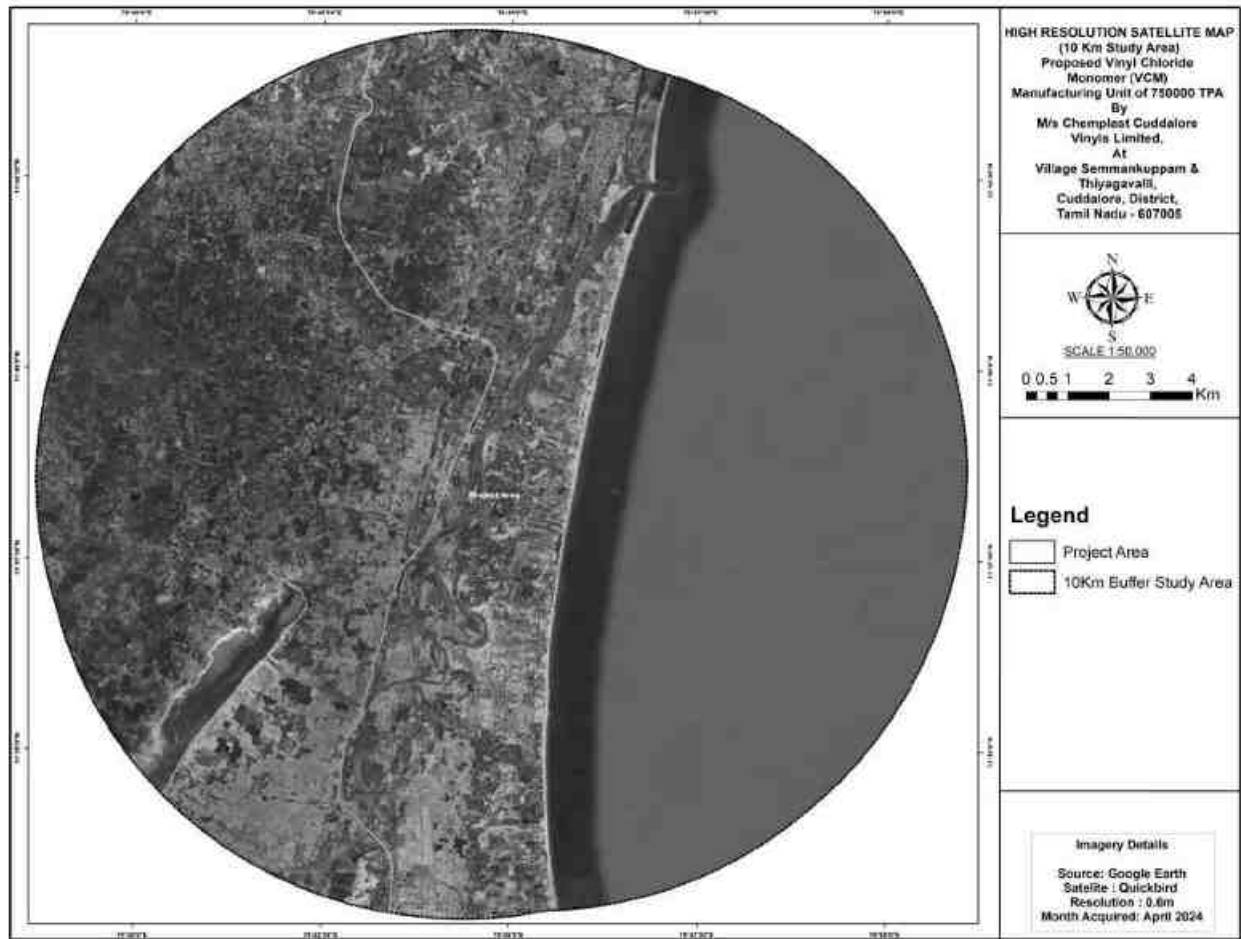


Figure 37. Figure showing High Resolution Satellite Map (10 km Study Area)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

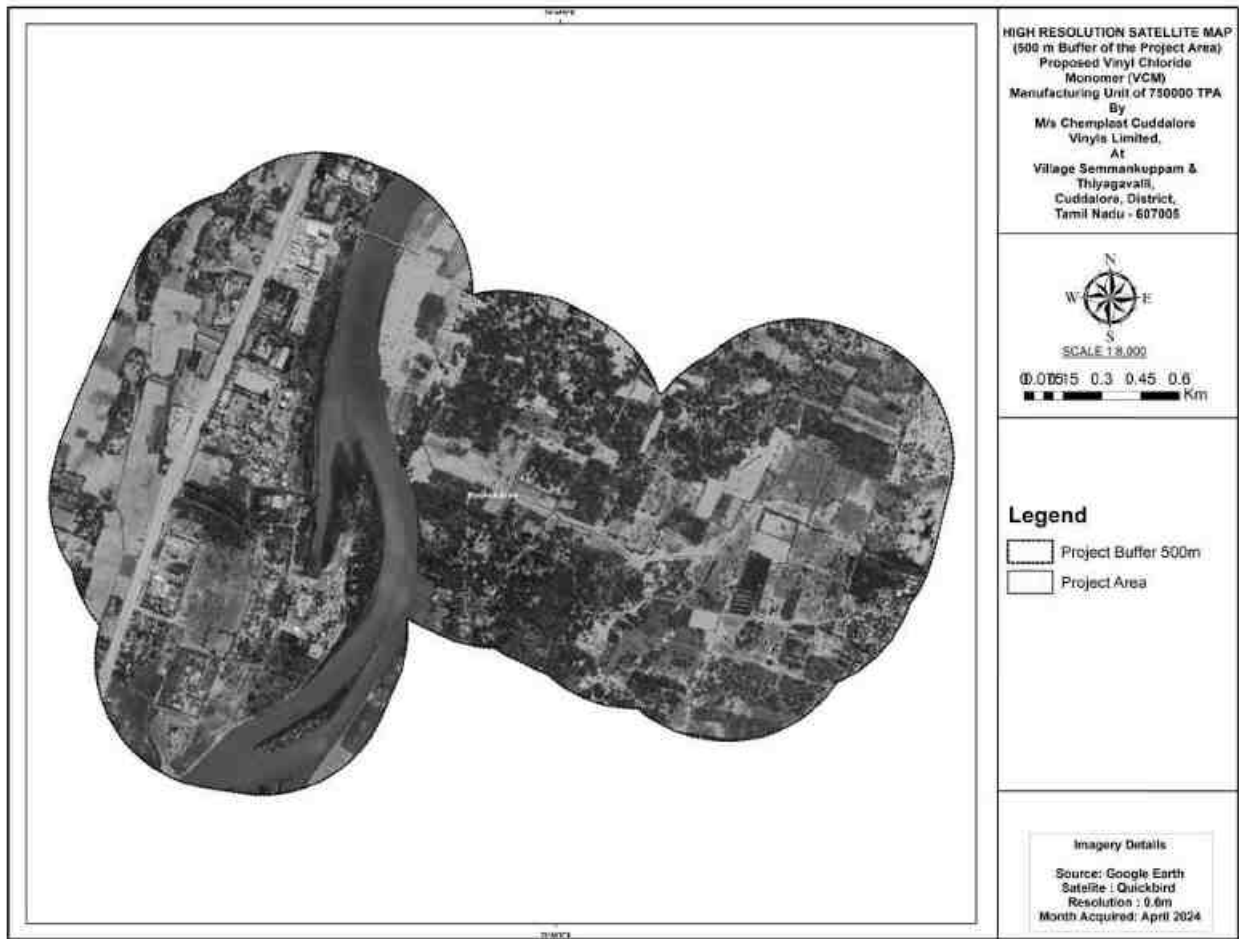


Figure 38. Figure showing High Resolution Satellite Map (500 m Buffer of the Project Area)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

3.2.5. VILLAGES MAP

Villages Map with 10 km radius is given below:

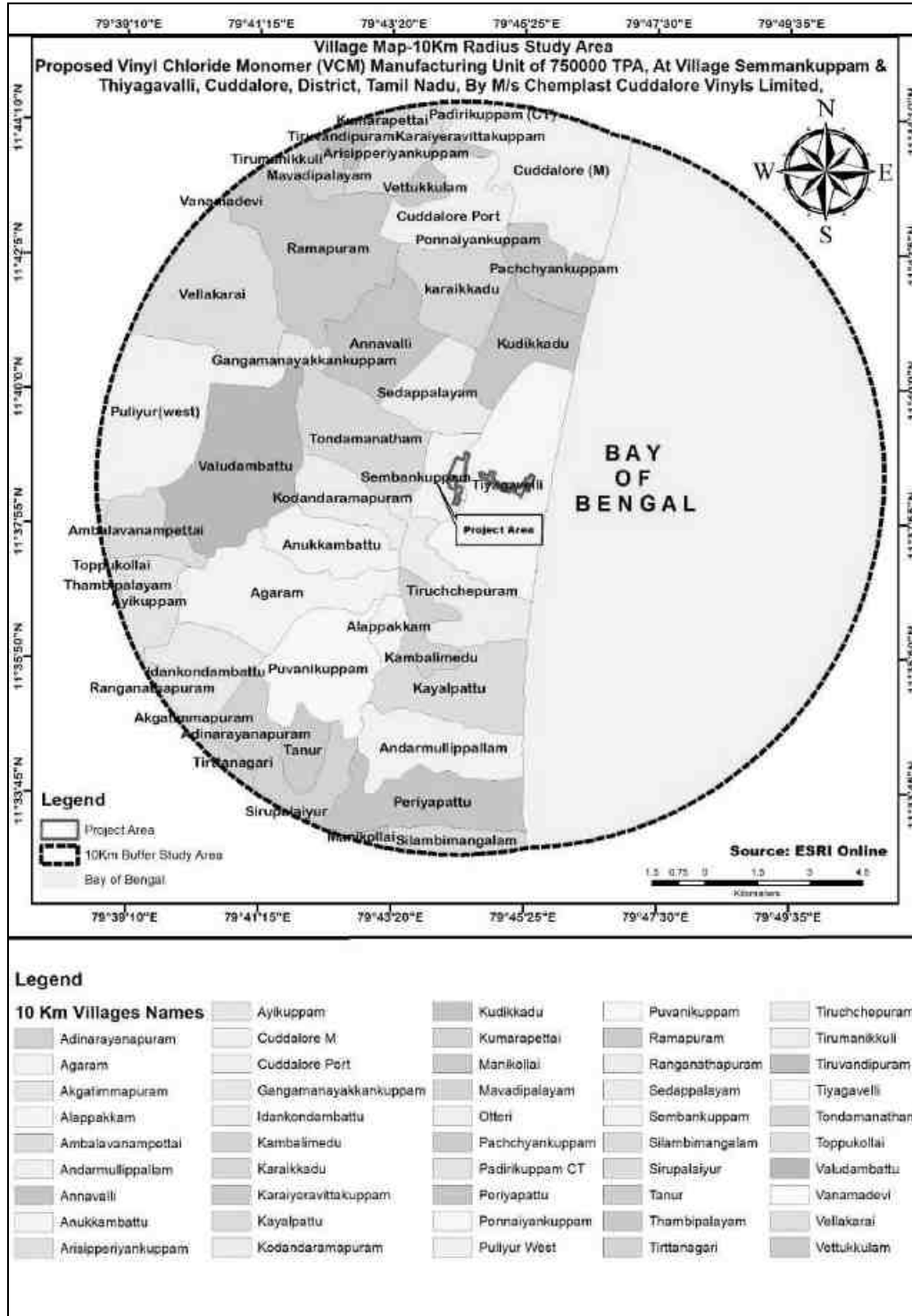


Figure 39. Village Map of the Study Area

3.3. METHODOLOGY OF BASELINE DATA COLLECTION

Table 49. Methodology of Baseline Data Collection

S. No.	Functional Area	Methodology
1.	Micro-Meteorological Data	Site specific Micro-Meteorological Data has been used for the study. The important parameters considered are temperature, humidity & wind speed.
2.	Ambient Air Quality	The ambient air quality monitoring was done to assess the ambient air quality in the winter season February 2024 to April 2024. The guidelines for selections of ambient air monitoring stations given in IS – 5182(part 14), 2000 were followed.
3.	Water Quality	To assess the water quality of the proposed area, Grab, Composite sampling done for water sample collection. Water samples were taken as per the Standard Methods (IS & APHA, 23 rd Edition 2017). Necessary precautions were taken for the preservation of samples. The physical parameters viz. pH, temperature and conductivity were measured at site using a portable water analyser.
4.	Ambient Noise Quality	At each station noise level was monitored for 24-hours. For each measurement, dB (A) readings were taken for every 15 minutes for 24 hrs once in a season to get Leq values.
5.	Soil Quality	Augur method was used for soil sampling and samples were collected at 15 cm depth after removing the upper crust.
6.	Topography, Land-form and Land Use	The land use/ land cover map has been generated on a 1:50,000 scale using Satellite imagery, topographical maps, Survey of India and ground truth information.
7.	Biological Environment	Primary and secondary data collection has been done by the Ecology and Biodiversity team for the study of flora and fauna in the core and Buffer Zone.
8.	Socio Economic Environment	For demography and socioeconomics, block wise data has been collected and used for the assessment of impacts.

3.4. METEOROLOGY

Before dwelling on the various aspects of air quality, it would be in the fitness of things to discuss the meteorological status of the area as the dispersion of fugitive emission depends largely on the meteorological conditions of the area. The selection of sampling stations is mainly guided by the predominant wind direction during the monitoring season in the area.

3.4.1 CLIMATIC CONDITIONS (AS PER INDIAN METEOROLOGY DEPARTMENT DATA, TAMIL NADU)

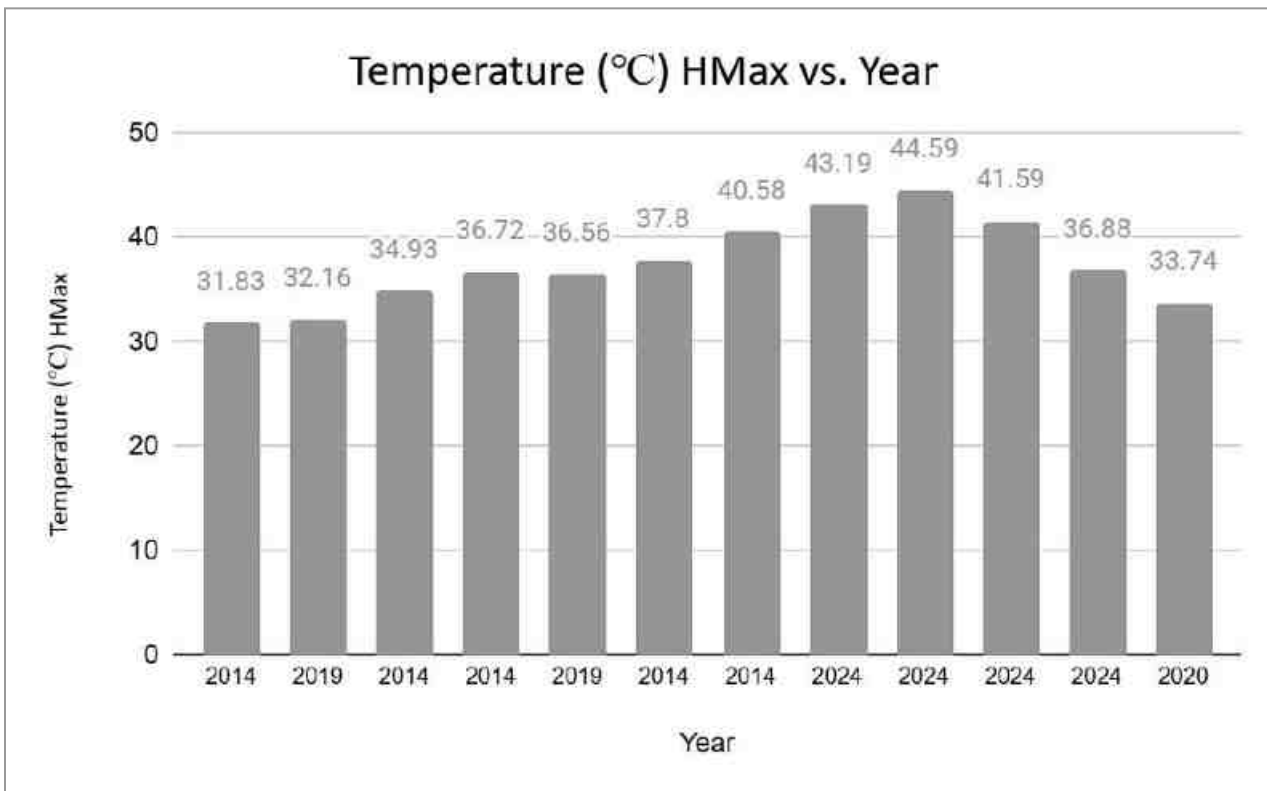
The meteorological data from Indian Meteorological Station was processed for the nearest IMD station at Cuddalore which has been utilized for the study. The important parameters considered are temperature, humidity, wind speed, wind direction and rainfall. The meteorological data of last 10 years (2014-2024) as recorded at Cuddalore are given below:

3.4.1.1. Temperature

The Maximum temperature of the area in ten years was recorded as 43.1 °C in May 2024 whereas the minimum temperature of the area was recorded 16.0 °C in February 2018. Data of the maximum and minimum temperature are given below.

Table 50. Temperature

Month	Temperature (°C)							
	HMax	Year	LMin	Year	MMax	Year	MMin	Year
January	33.74	2020	18.25	2020	31.06	2020	22.08	2022
February	36.88	2024	18.84	2020	32.33	2016	23.36	2019
March	41.59	2024	20.67	2021	35.83	2024	26.54	2022
April	44.59	2024	22.1	2020	38.63	2024	29.56	2020
May	43.19	2024	22.84	2024	36.4	2024	29.67	2022
June	40.58	2014	22.75	2024	34.69	2024	29.83	2022
July	37.8	2014	22.14	2024	32.8	2024	28.37	2024
August	36.56	2019	22.42	2023	32.72	2017	28.38	2023
September	36.72	2014	23.4	2014	32.89	2014	29.17	2024
October	34.93	2014	21.61	2024	31.95	2014	26.68	2021
November	32.16	2019	20.66	2023	29.59	2019	25.17	2023
December	31.83	2014	18.27	2024	29.58	2014	23.01	2022



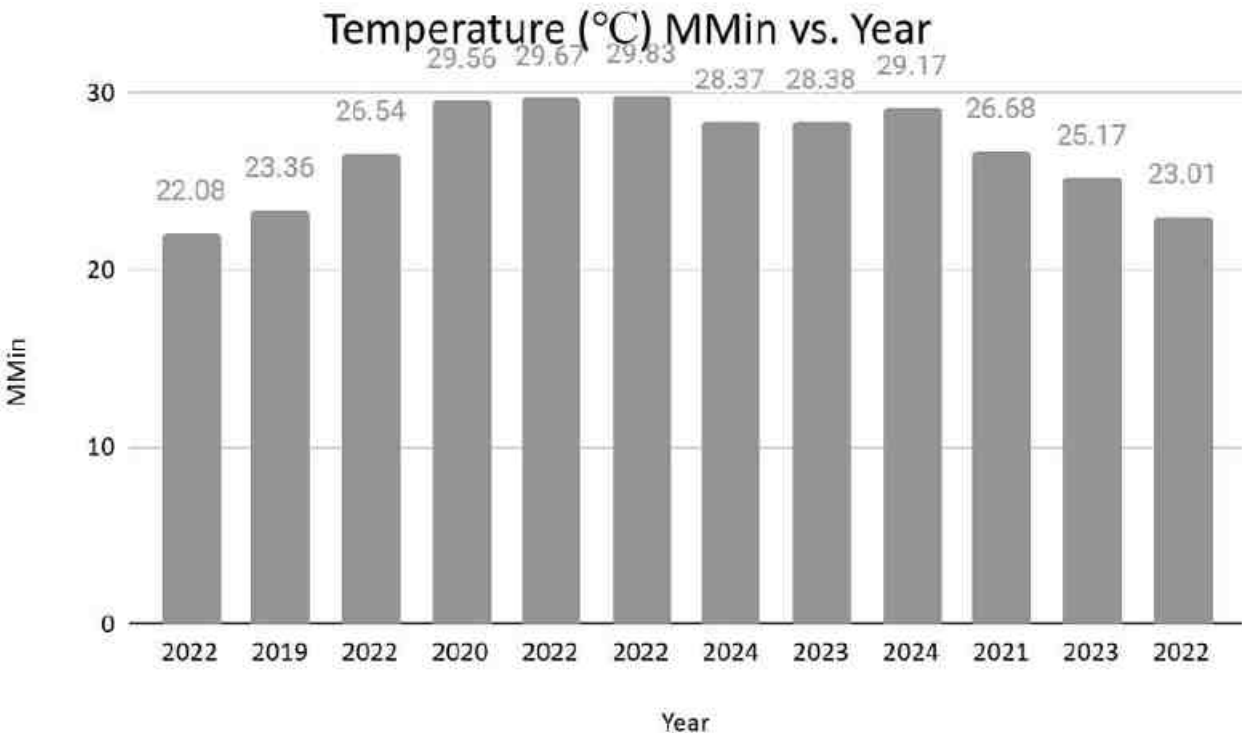
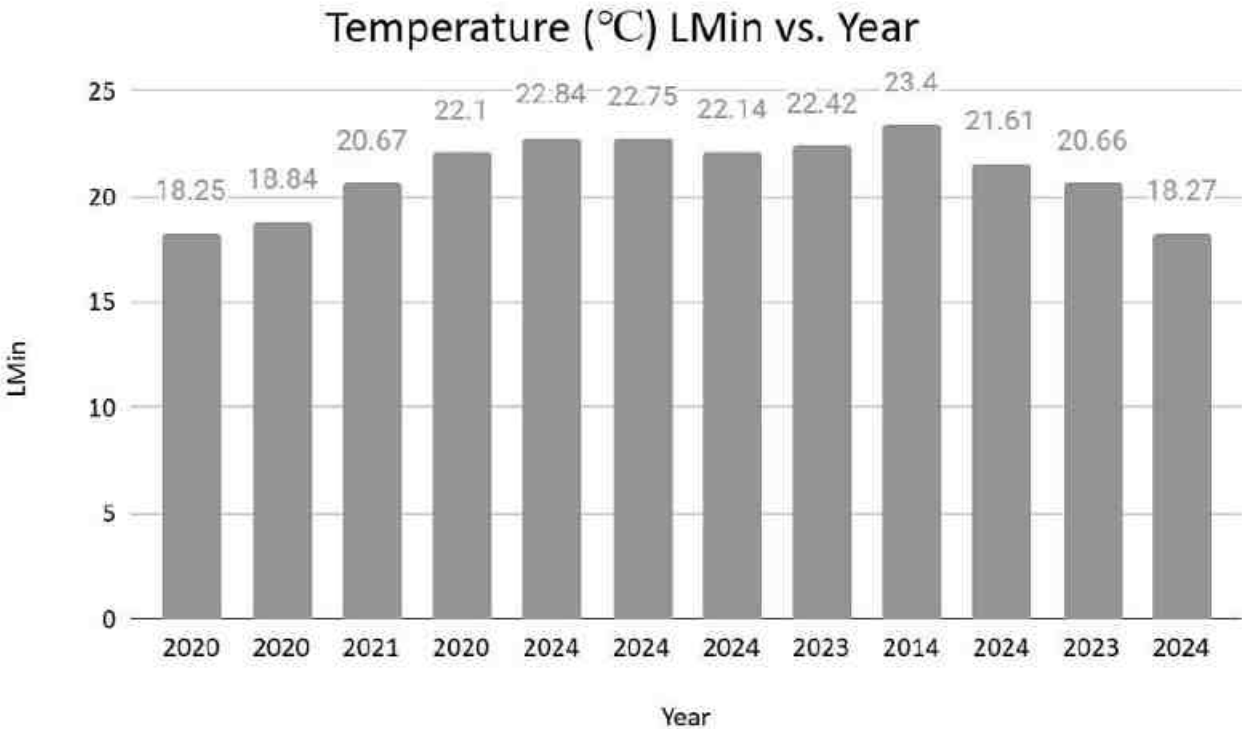


Figure 40. Temperature

3.4.2 Relative Humidity

The relative humidity was around 20.89 % to 97.4 % during the pre-monsoon period. In the monsoon period, the relative humidity ranged between 28.61% to 97.77%. During the post monsoon season, the humidity was observed between 20.66% to 98.12%. The variations in relative humidity are presented in the below table

Table 51. Relative Humidity

Month	Humidity (%)			
	Year	MMax	Year	MMin
January	2024	98.41	2020	28.37
February	2023	98.02	2023	28.91
March	2023	97.4	2014	21.05
April	2023	96.65	2022	20.89
May	2023	96.48	2024	25.1
June	2023	97.58	2024	25.96
July	2023	97.77	2014	31.79
August	2023	97.57	2024	29.54
September	2023	97.49	2014	28.61
October	2023	97.66	2021	29.89
November	2023	98.12	2018	43.14
December	2023	97.74	2014	32.25

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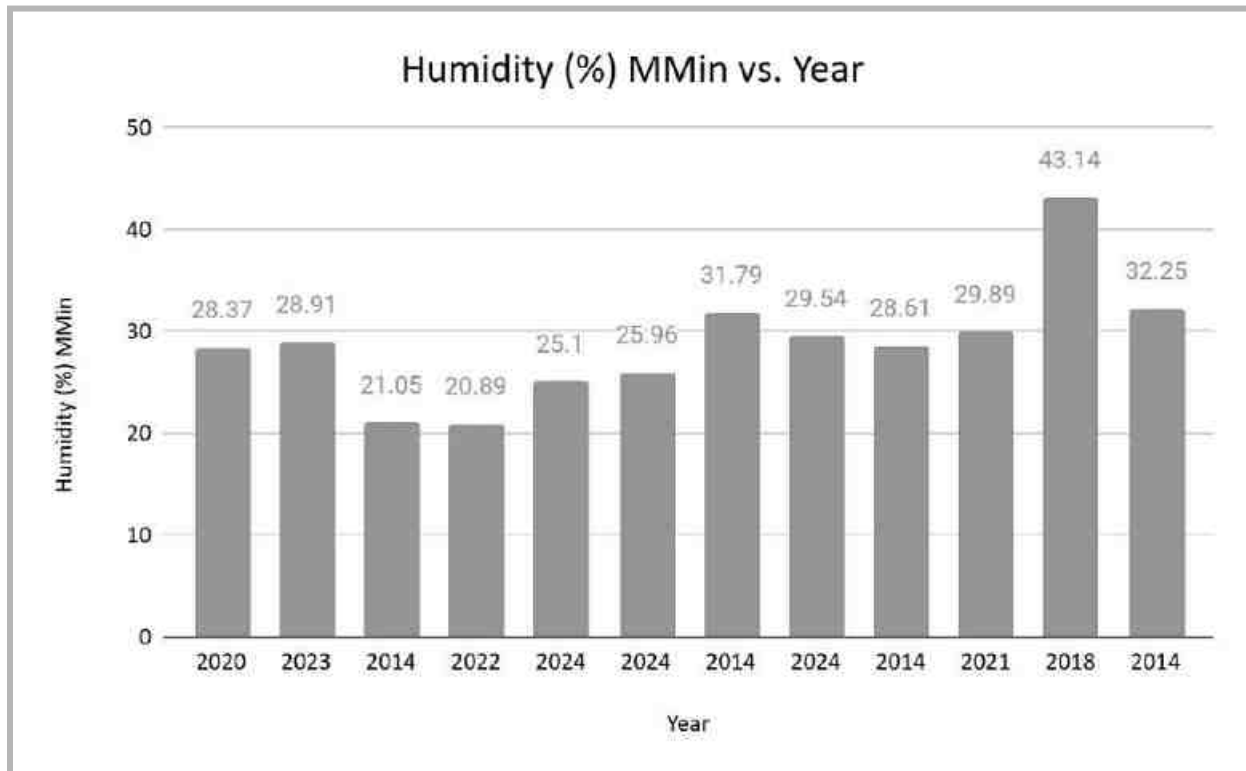
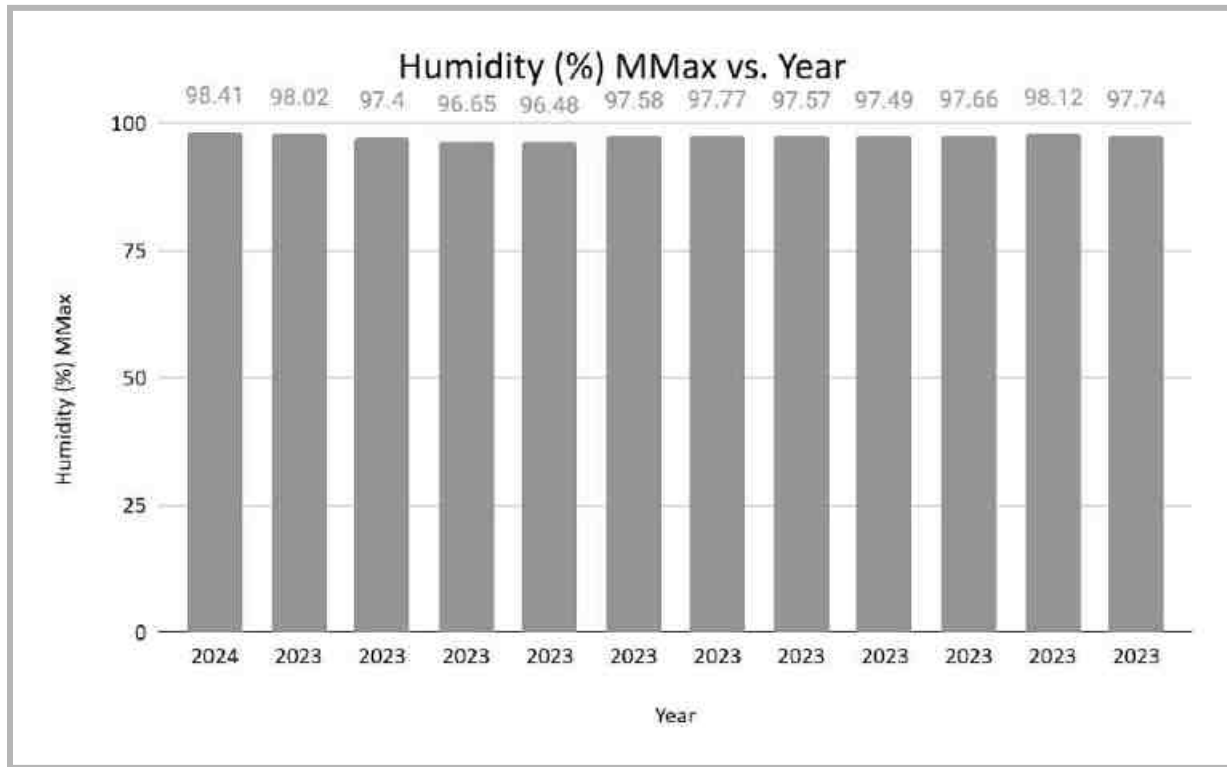


Figure 41. Humidity

3.4.4 Rainfall

The maximum rainfall was recorded in November (up to 18.23 mm) in 2014. October, November, and December are the wettest months and are considered the monsoon season. Average Annual rainfall is 3.10 m.

Table 52. Rainfall

Month	Rainfall (m)				
	Year	Max	Year	Min	Average
January	2014	1.82	2017	0	0.08
February	2017	1.34	2017	0	0.07
March	2024	1.15	2016	0	0.05
April	2023	2.51	2016	0	0.12
May	2021	2.51	2015	0	0.09
June	2017	3.03	2017	0	0.06
July	2017	2.72	2016	0	0.1
August	2023	10.73	2014	0	0.23
September	2016	10.74	2014	0	0.35
October	2024	14.54	2015	0	0.7
November	2014	18.23	2017	0	0.99
December	2021	10.42	2016	0	0.58

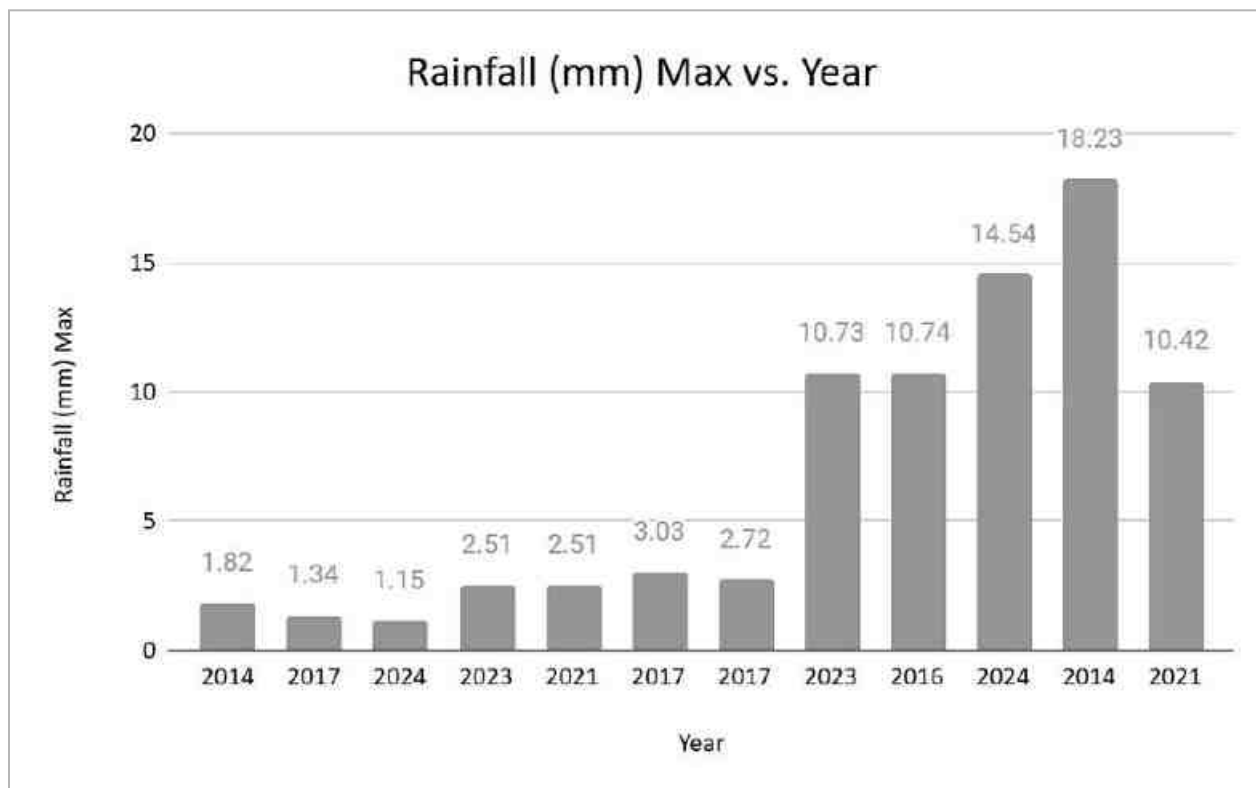


Figure 42. Rainfall

3.4.5 Wind Speed

The maximum wind speed was recorded up to 41.004 kmph in monsoon and minimum wind speed was recorded up to 0.036 kmph in winter.

Table 53. Wind Speed

Month	Wind Speed (kmph)			
	Year	Max	Year	Min
January	2014	24.34	2023	1.84
February	2017	25.02	2023	1.84
March	2015	25.13	2024	2.19
April	2016	28.51	2024	2.19
May	2016	27.29	2014	2.72
June	2016	24.52	2021	2.56
July	2015	21.06	2020	2.94
August	2020	21.06	2023	2.84
September	2014	21.06	2024	2.29
October	2021	16.2	2024	2.29
November	2016	18.23	2023	1.94
December	2022	18.49	2023	1.94

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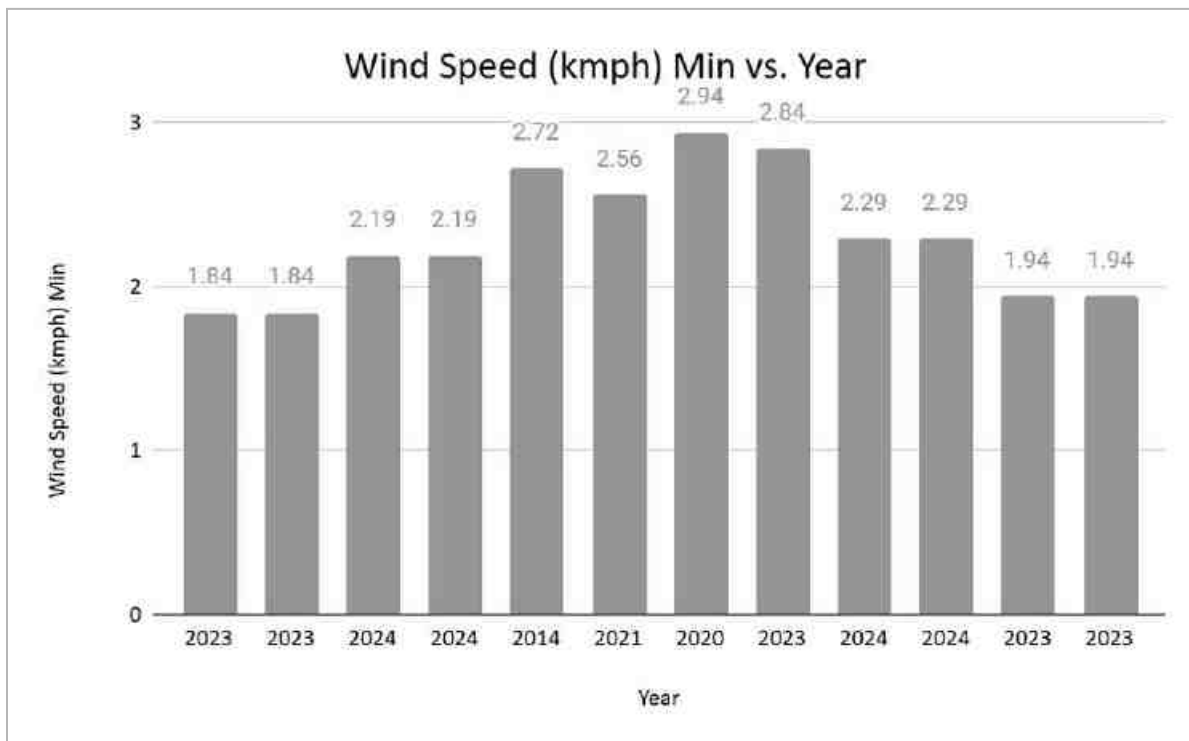
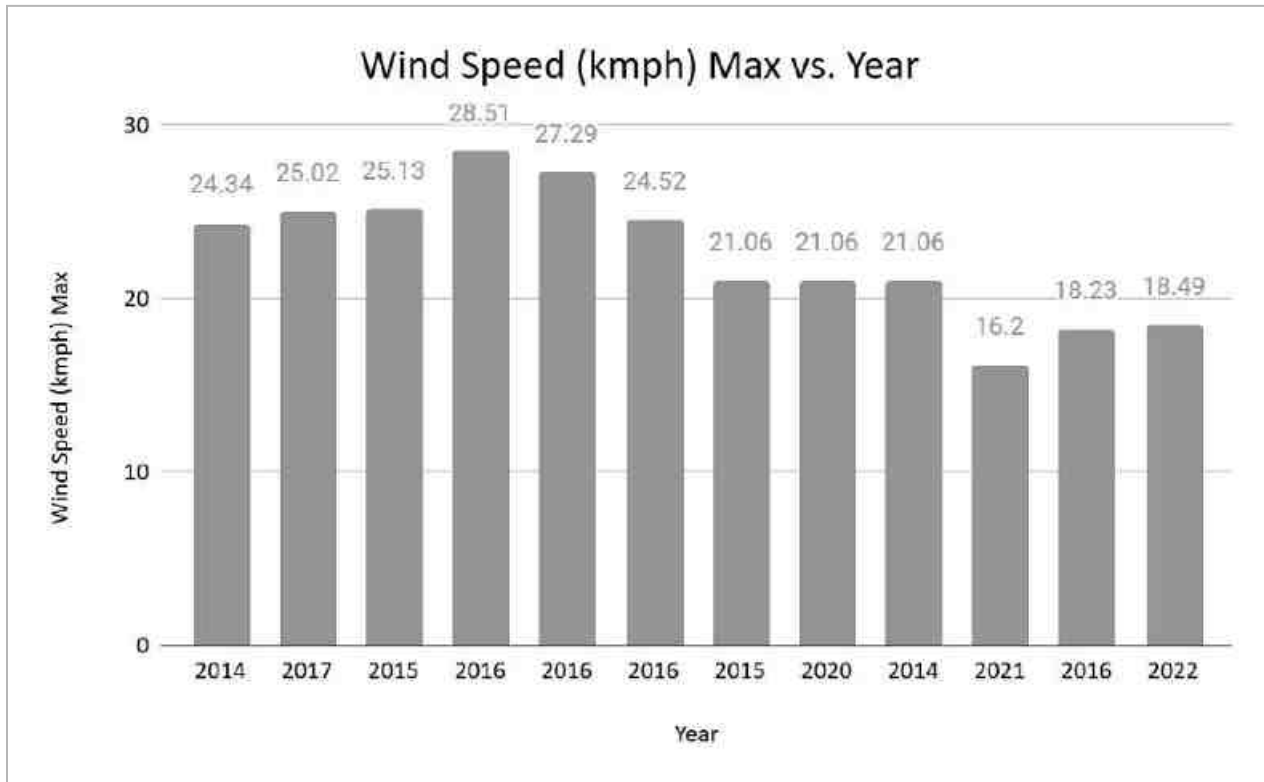


Figure 43. Wind Speed

3.4.6 Wind Direction

Table 54. Wind Direction

Month	Wind Direction	
	Direction	Calm
January	NE	0.08
February	NE	0.04
March	E	0.05
April	E	0.06
May	E	0.04
June	SE	0.04
July	SE	0.04
August	SW	0.04
September	SW	0.06
October	NE	0.06
November	NE	0.04
December	NE	0.04

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

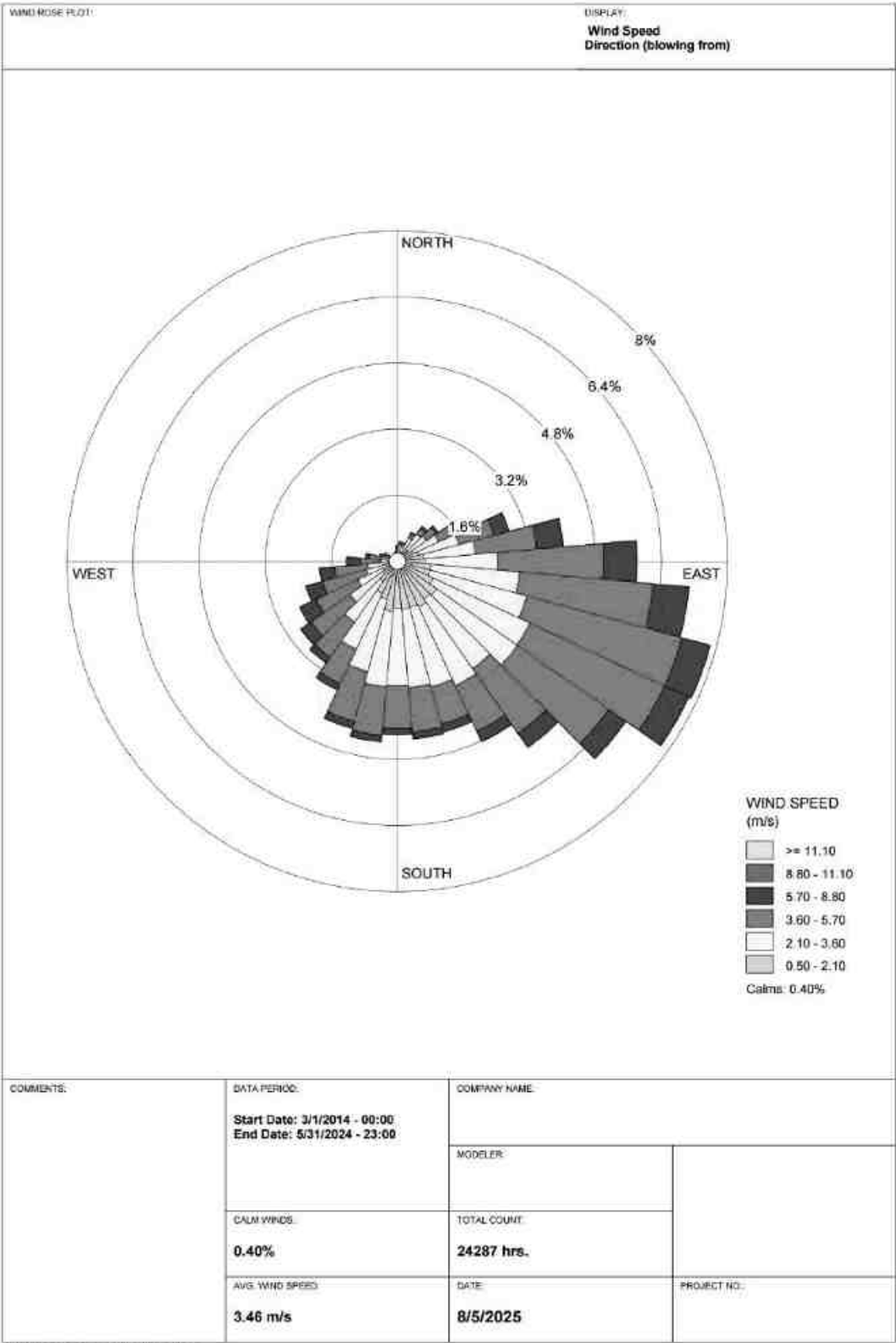


Figure 44. Windrose of Summer Season

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

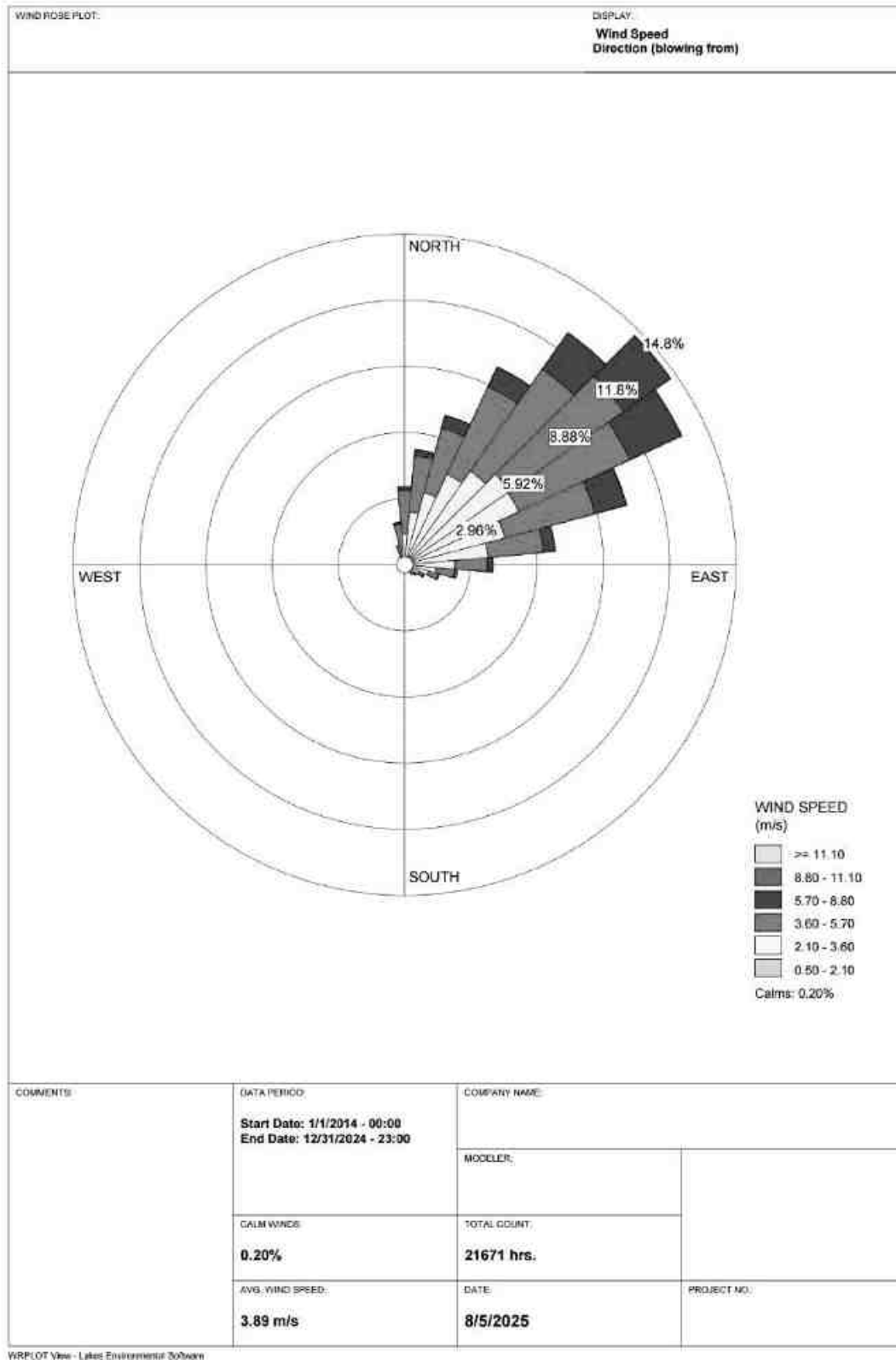


Figure 45. Windrose of Winter Season

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

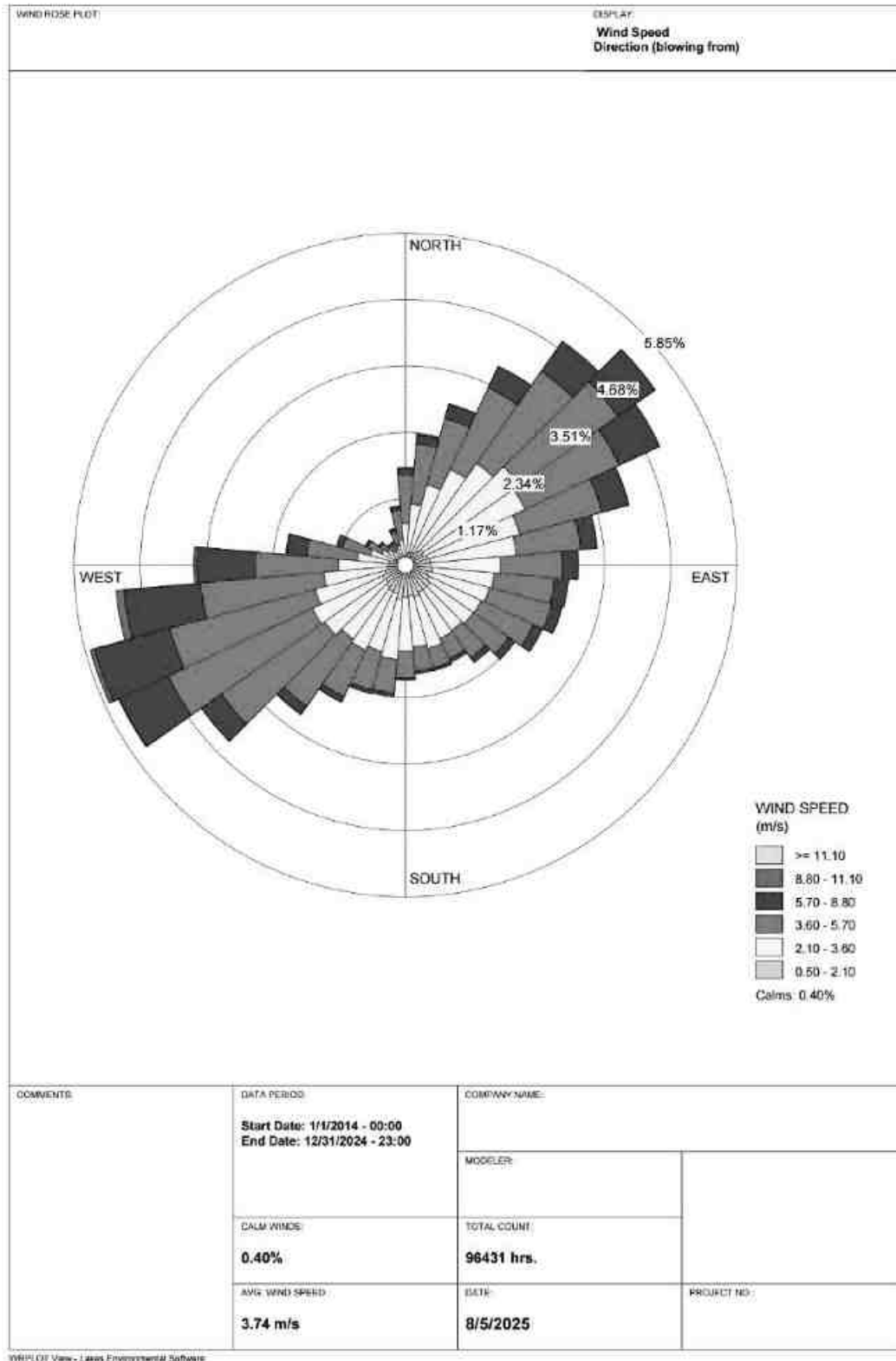


Figure 46. Annual Windrose

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

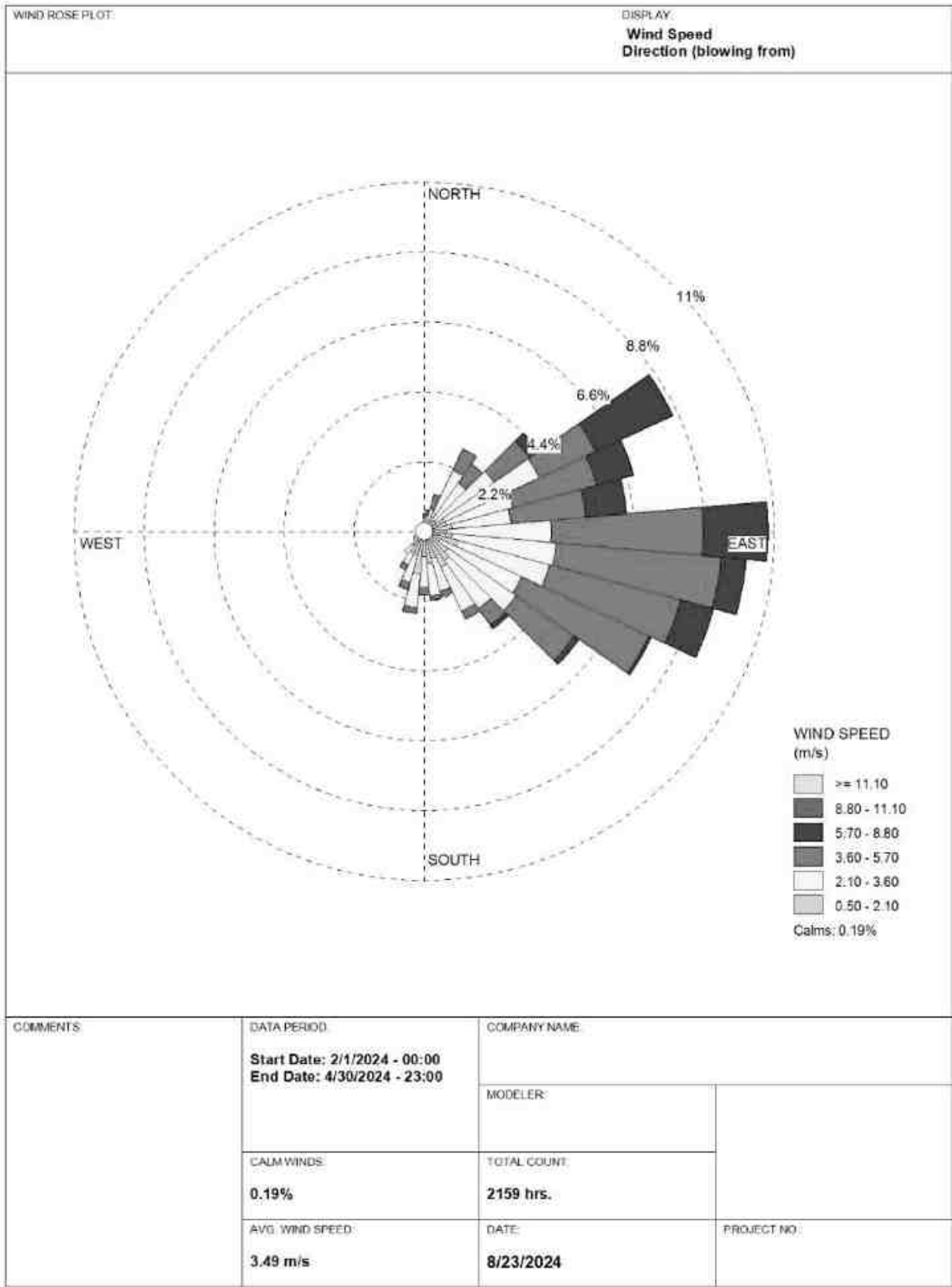


Figure 47. Windrose Diagram

3.4.7 ONSITE SEASON SPECIFIC MEASURED MICRO-METEOROLOGICAL DATA

Table 55. Micro-Meteorological Data

Month	Temperature (°C)			Relative Humidity (%)			Wind Speed (m/s)		
	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean
1 st February 2024 - 29 th February 2024	36	20	27	100	33	73	7	1	4
1 st March 2024 - 31 st March 2024	39	22	29	100	18	61	6	0	3
1 st April 2024 - 30 th April 2024	42	25	32	100	23	59	7	0	3

3.5. AMBIENT AIR QUALITY

The ambient air quality monitoring was done to assess the ambient air quality. Monitoring was carried out at Eleven stations for the month of **February 2024 to April 2024**

3.5.1. SAMPLING STATION SELECTION

Selection of Onsite Stations:

The site selection for air quality sampling is based on the objective of the study which is to assess the environmental impact due to activities carried out at the project site. The ambient air quality monitoring plan was therefore designed keeping the project site as the chief source of emission.

Two locations within the project site (A1 and A2) were thereby selected as the core zone air quality monitoring sites in upwind (SW) and downwind (NE) directions of the wind flow (as per the historical data wind rose pattern discussed in above section).

Selection of Buffer Zone Sample Locations:

The selection of the monitoring sites around the project area (termed as buffer zone monitoring sites) was based on screening the region for several important factors including meteorological conditions, environmental sensitivity, human settlement and the surrounding geographical features.

- The meteorological features considered were wind speed and direction
- The human settlement was observed considering its proximity and density
- Geographical features were looked for in the presence of any possible obstacles around the project site.

The above factors were critically analysed using wind rose graph, topographical map, and land use map to validate the spatial distribution and correct representation of the project site. Following this, the site visit was carried out to check for

- Accessibility of the selected monitoring sites.

- Micro inventories were also conducted to check for those locations where the influence of such probable air pollution sources as highways, other industries, and construction sites is minimal.

The location of the eight buffer zone monitoring sites: A3, A4, A5, A6, A7, A8, A9, A10 and A11 are shown in the topographical map of the study area.

Quality assurance and sample preservation during pre sampling and post sampling period: Prior to following Standard operating procedure, all the performance checks were followed to avoid sampling bias and measurement errors.

- The equipment was checked for any leakage, flow rate calibration, dust free filter holders, appropriate pre sampling processing of filter papers and their handling.
- The filter papers were desiccated for 24 hours both prior and post sampling to remove any moisture content. These were handled with non serrated forceps for preventing any wear and tear.
- The filter papers were kept in air- tight zipper bags and transported in the air tight box to prevent any contamination.
- Post sampling the filter papers were kept under controlled laboratory conditions, i.e. 20 - 25°C if processed immediately, else wrapped in aluminium foil and preserved in the refrigerator at 4 °C till further processing.
- The absorption solutions were also transferred accordingly, preventing any exposure to sunlight.

(<http://indiaenvironmentportal.org.in/files/NAAQSMannualVolume1-1.pdf>)

Sampling instrument placement: The standard guidelines were followed while placing the sampler at the sampling site (IS 5182 (Part 14): 2000).

- The sampler was kept at greater than 3m height to avoid impact of windblown dust.
- The samplers were maintained at >20 m distance from trees and more than twice the height of the hindrances such as buildings and other structures to ensure unrestricted airflow for sampling.
- To avoid impact from road dust, the equipment was kept at a minimum distance of 50m from paved roads and 100 m from unpaved roads.

3.5.2. AMBIENT AIR SAMPLING LOCATIONS

Table 56. Ambient Air Sampling Locations

S. No.	Sampling Location	Latitude & Longitude	Distance & Distance and direction from Center of site	Type of Area	Environmental Significance	Justification
A1	Onsite South West	11°38'27.80"N 79°44'15.76"E	SW	Industrial area	Core Zone	Base Station
A2	Onsite North East	11°38'29.63"N 79°44'23.70"E	NE	Industrial area		
A3	Thatchan Colony	11°38'31.34"N 79°44'0.63"E	0.32km West	Residential area	Buffer Zone	Crosswind
A4	Poondiyankuppam	11°37'55.67"N 79°43'51.74"E	0.93km SW	Residential area		Crosswind
A5	Nochikadu	11°39'9.81"N 79°44'59.99"E	1.71km NE	Residential area		Crosswind
A6	Thyagavalli	11°37'14.67"N 79°44'33.57"E	1.84 km South	Residential area		Upwind
A7	Tondamanathan	11°39'31.73"N 79°43'15.59"E	2.46 km NW	Residential area		Downwind
A8	Valudambattu	11°38'33.57"N 79°41'50.62"E	4.28km West	Residential area		Crosswind
A9	Anukkambattu	11°37'26.44"N 79°41'34.92"E	5.28km SW	Residential area		Crosswind
A10	Annavalli	11°41'30.57"N 79°43'21.77"E	5.73km NW	Residential area		Downwind
A11	Puvanikuppam	11°35'31.32"N 79°41'48.37"E	6.67 SW	Residential area		Crosswind

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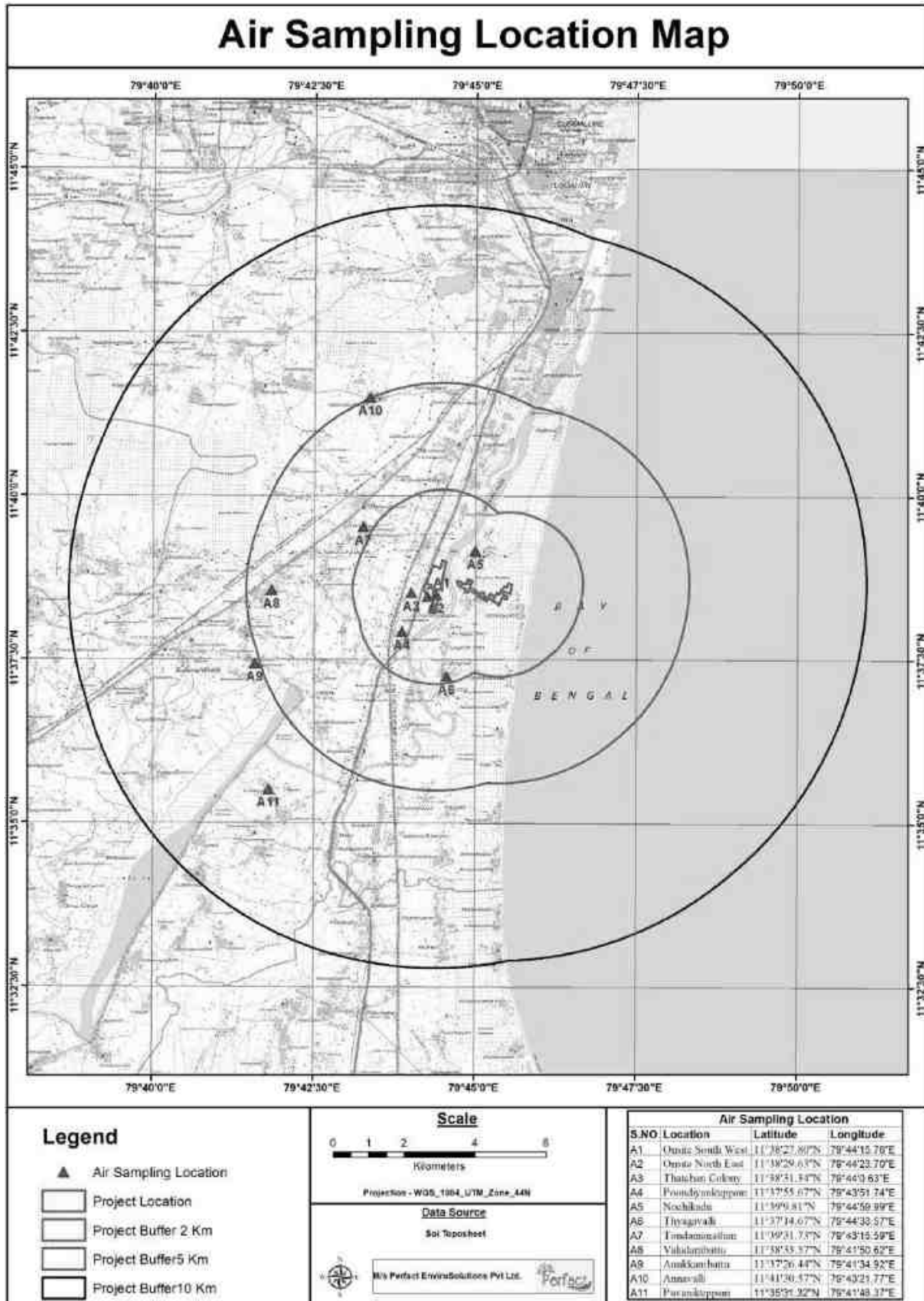


Figure 48. Ambient Air Sampling Map

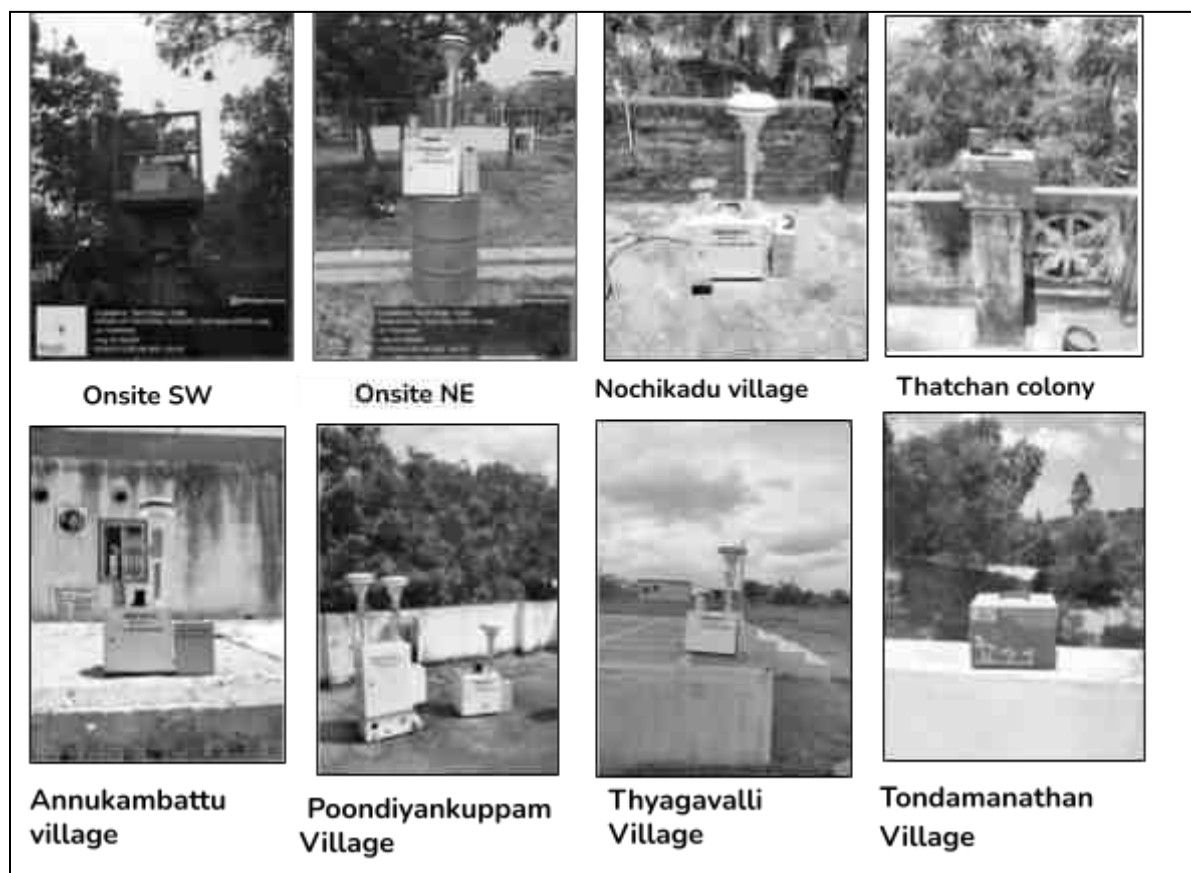


Figure 49. Ambient Air Monitoring Photographs

3.5.3. SAMPLING PROCEDURE

Respirable Dust Samplers were used to collect samples for PM_{10} and $PM_{2.5}$ in ambient air at a flow rate of $1.2 \text{ m}^3/\text{min}$. The ambient air was sucked through the cyclone and filter paper by a blower. Samples of gases were drawn at a flow rate of 0.5 litres per minute and were analysed in the laboratory.

Monitoring was conducted in respect of the following parameters:

- Particulate Matter (PM_{10})
- Particulate Matter ($PM_{2.5}$)
- Sulphur Dioxide (SO_2)
- Nitrogen Dioxide (NO_2)
- Carbon Monoxide (CO)
- Total Volatile Organic Compounds (TVOCs)
- Hydrochloric Acid (HCl)
- Chlorine (Cl_2)
- Total Hydrocarbons (THC)
- Non-Methane Hydrocarbons (NMHC)

This procedure was adopted because there are no short-term variations and low concentration of gaseous pollutants was expected.

3.5.4. ANALYTICAL METHODS FOLLOWED FOR AMBIENT AIR QUALITY MONITORING

- Particulate Matter (PM_{2.5}) (US EPA Quality Assurance HandBook (Vol.II) Part II, Quality Assurance Guideline Document, 2.12): Particulate Matter (PM_{2.5}) was analyzed by the Gravimetric Method. Particulate matter was collected on the 37 mm diameter glass microfiber Filter Paper. PM_{2.5} value is determined from the values of volume of air passed through Ambient Fine Dust Sampler.
- Particulate Matter (PM₁₀) (IS: 5182 Part 23:2006): Particulate Matter (PM₁₀) was analyzed by the Gravimetric Method. It was carried out by Respirable Dust sampler as per IS: 5182(Part 23):2006. Particulate matter was collected on the GF/A Filter Paper. Particles with aerodynamics diameter less than the cut-point of the inlet are collected by the filter. The mass of these particles is determined by the difference in filter weight prior to and after sampling.
- Sulphur dioxide (SO₂) (IS: 5182; Part – II – 2001): Sulphur dioxide is absorbed by aspirating a measured air sample through a solution of Potassium or sodium tetrachloromercurate, TCM. This procedure results in the formation of a dichloro sulphite mercurate complex. The Sulphite Ion produced during sampling is reacted with sulphamic acid, formaldehyde and pararosaniline to form an azo dye and then determined colorimetrically.
- Nitrogen Oxides (IS: 5182; Part – VI – 2006): Nitrogen dioxide is collected by bubbling air through a sodium hydroxide- sodium arsenite solution to form a stable solution of sodium Nitrite. The Nitrite Ion produced during sampling is reacted with hydrogen peroxide, Sulphanilamide and NEDA to form an azodye and then determined colorimetrically.
- Carbon monoxide (CO) (IS:5182; Part -10-1999): Samples containing Carbon monoxide in the range of 0 to 100 mg/m³ are analyzed on a non-dispersive infrared absorption gas analyser, namely, an electro-optical spectrophotometer with no spectral dispersion component. It may consist of a single or double source of infrared energy and one or more infrared detectors separated by an optical cell or cells to one or more of which the sample flows, whereby the specific spectral absorption of the component of interest is determined.
- Volatile Organic Compounds (VOCs) (USEPA 0031/ ASTM D6889): Samples were analyzed by USEPA method 0031 for collection of samples from site, i.e. properly sealed in tubes, locked and refrigerated until desorbed; these were desorbed at laboratory and further analyzed by using SPME technique and followed by injection to GC similar to that of ASTM D6889. Individually quantitated peaks were then used to calculate the TVOC Value by using calibration curve obtained for standard mass liquids i.e. CRMs. The Area thus was translated into values in µg/m³. This study however did not include aldehydes, ketones, high molecular weight hydrocarbons, etc. It included Volatile PAH(s), Alcohols, Chlorinated Benzenes, Chloromethane and Chloromethane similar to that of USEPA TO-17A and USEPA 0031.

- HCl: (Lab SOP in reference to Constant Current Coulometry): Polystyrene filter followed by KOH / triethanol-amine treated filters are generally used to collect gaseous HCl from the ambient air. Flow rates of about 1 m³ per minute are used. The collected chloride is determined using Constant Current Coulometry, which can detect Cl⁻ equivalent to about 400 µg HCl.
- Chlorine (IS 5182 Part XIX; 2019): Chlorine is absorbed from a metered volume of air by an acidified methyl orange solution in a bubbler, reacting with the methyl orange to produce a color change which is measured by colorimetry at 505 nm. Chlorine concentration depends on the colour intensity of the methyl orange solution. If the chlorine content is higher, bleaching of the methyl orange colour will be more.
- Methane (CH₄)/ Non Methane Hydro Carbons (NMHC)/ Total Hydro Carbons: (Method 18) : The component is separated by gas chromatography (GC) and quantified by appropriate detection principles. The retention time of the compound is compared with known data under identical conditions, thereby determining the approximate concentrations of the organic emission component beforehand.

3.5.5. AMBIENT AIR QUALITY RESULTS

3.5.5.1. SUMMER SEASON (FEBRUARY 2024 TO APRIL 2024)

At each station ambient air quality parameters i.e PM₁₀, PM_{2.5}, SO₂, NO_x & CO, TVOC, HCl, Cl₂, THC & NMHC were monitored twice a week on 24 hrs basis for 3 months (Feb 2024 to April 2024) 24 hourly at uniform intervals.

Table 57. Ambient Air Quality Results (PM_{2.5} & PM₁₀)

S. No.	Min	Max	Mean	98th Percentile	Min	Max	Mean	98th Percentile
	PM _{2.5} (Standard – 60 µg/m ³)				PM ₁₀ (Standard – 100 µg/m ³)			
A1	16.07	24.21	19.67	23.05	48.11	67.48	56.03	65.16
A2	15.15	23.51	18.86	22.38	46.71	65.52	53.88	62.62
A3	18.97	24.92	20.50	23.73	55.11	69.45	58.22	69.01
A4	18.97	28.66	23.96	27.74	55.11	85.53	67.30	77.82
A5	19.45	30.14	24.87	28.98	56.51	89.93	69.64	81.83
A6	20.42	33.20	26.72	31.93	59.32	99.07	74.43	90.15
A7	14.25	22.80	18.06	21.71	44.32	63.55	51.75	60.74
A8	18.01	26.33	22.21	25.82	52.31	77.05	62.70	73.38
A9	17.52	25.62	21.35	24.46	50.91	72.98	60.44	71.41
A10	19.94	31.65	25.78	30.44	57.92	94.44	72.02	85.94
A11	18.49	27.22	23.08	27.03	53.71	81.23	64.98	75.34

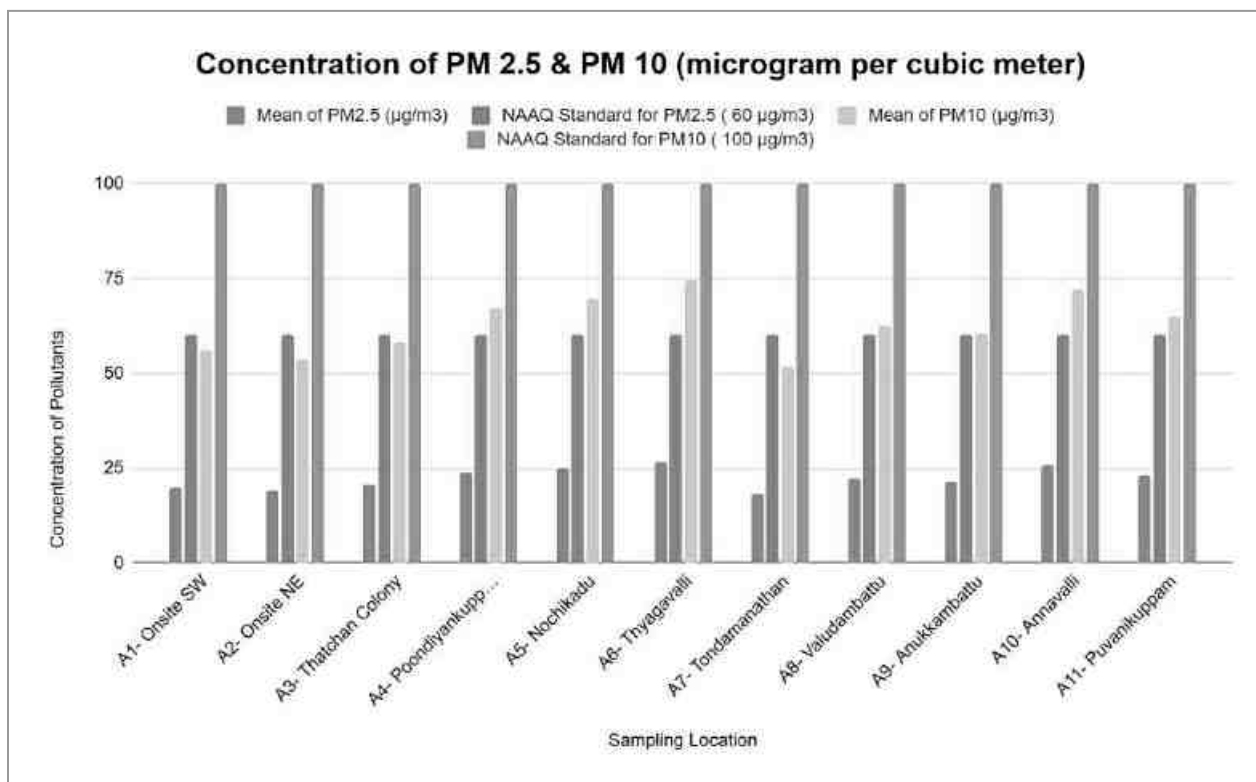


Figure 40. Ambient air quality results for PM2.5 & PM10

Table 58. Ambient air quality results for NO₂ & SO₂

S. No.	Min	Max	Mean	98th Percentile	Min	Max	Mean	98th Percentile
	NO ₂ (Standard – 80 µg/m ³)				SO ₂ (Standard – 80 µg/m ³)			
A1	10.89	19.38	14.64	16.62	6.55	10.37	8.40	9.92
A2	10.26	18.81	14.06	16.13	6.36	10.07	8.07	9.63
A3	11.53	19.94	15.24	17.10	6.74	10.68	8.74	10.21
A4	14.01	22.20	17.72	20.74	7.50	11.89	10.15	11.37
A5	14.36	22.76	18.37	21.81	7.69	12.19	10.52	11.85
A6	15.08	24.03	19.69	23.89	8.07	13.06	11.27	13.03
A7	9.65	18.25	13.48	15.65	6.00	9.77	7.74	9.35
A8	12.87	21.07	16.46	18.69	7.12	11.28	9.44	10.79
A9	12.19	20.51	15.84	17.70	6.93	10.98	9.09	10.50
A10	14.72	23.33	19.02	22.91	7.88	12.49	10.89	12.45
A11	13.57	21.63	17.09	19.70	7.31	11.58	9.79	11.08

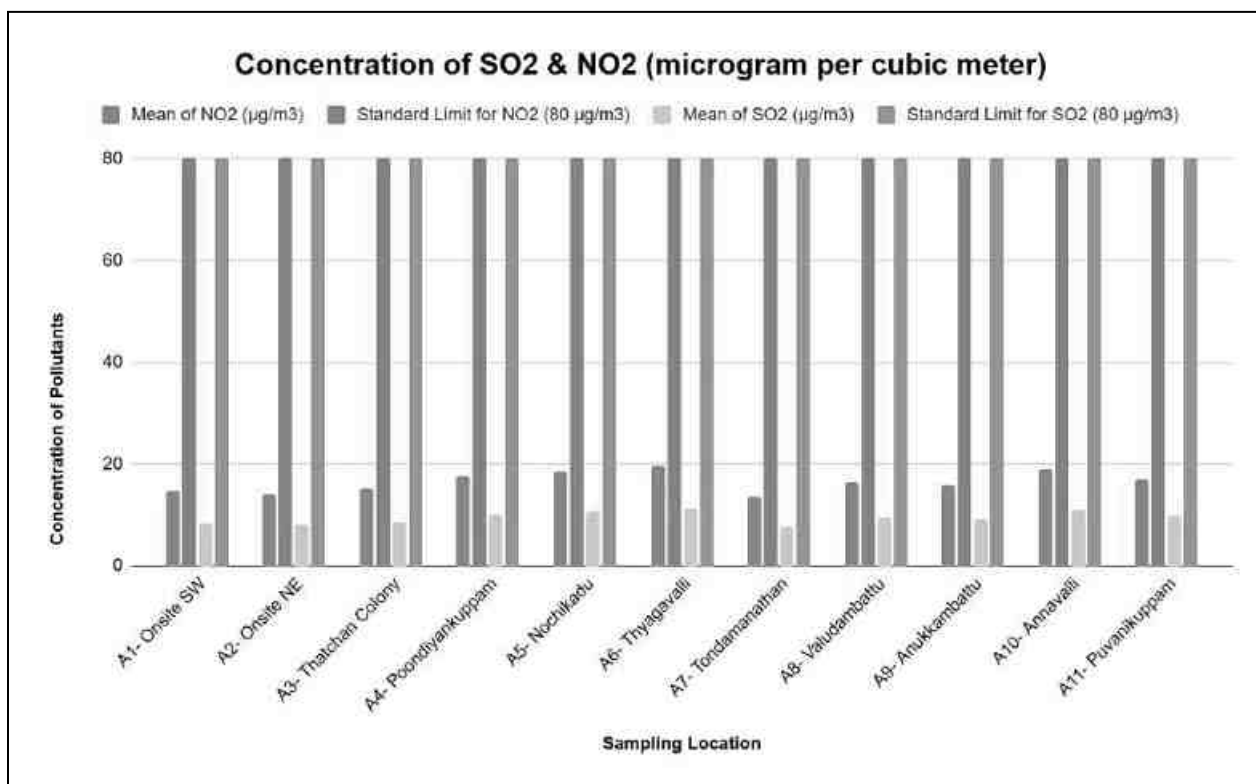


Figure 41. Ambient air quality results for NO₂ & SO₂

Table 59. Ambient air quality results for CO & VOC

S. No.	Min	Max	Mean	98th Percentile	Min	Max	Mean	98th Percentile
	CO (mg/m ³)				VOC (mg/m ³)			
A1	0.32	0.56	0.42	0.48	0.009	0.017	0.013	0.014
A2	0.30	0.55	0.41	0.47	0.009	0.016	0.012	0.014
A3	0.33	0.58	0.44	0.50	0.010	0.017	0.013	0.015
A4	0.41	0.64	0.51	0.60	0.012	0.019	0.015	0.018
A5	0.42	0.66	0.53	0.63	0.012	0.020	0.016	0.019
A6	0.44	0.70	0.57	0.69	0.013	0.021	0.017	0.021
A7	0.28	0.53	0.39	0.45	0.008	0.016	0.012	0.014
A8	0.37	0.61	0.48	0.54	0.011	0.018	0.014	0.016
A9	0.35	0.59	0.46	0.51	0.011	0.018	0.014	0.015
A10	0.43	0.68	0.55	0.66	0.013	0.020	0.017	0.020
A11	0.39	0.63	0.50	0.57	0.012	0.019	0.015	0.017

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

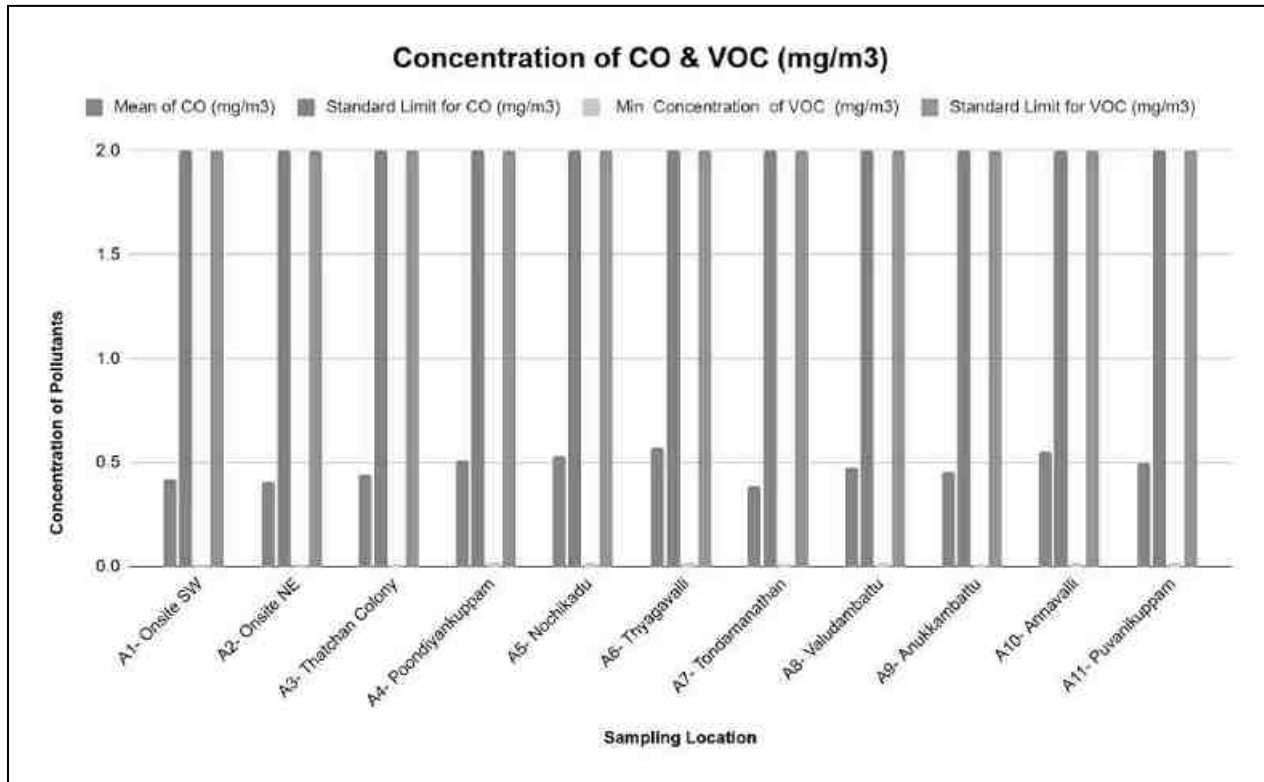


Figure 42. Ambient air quality results for CO & VOC

Table 60. Ambient Air Quality Results for HCl & Cl₂

S.No	Min	Max	Mean	98th Percentile	Min	Max	Mean	98th Percentile
	Cl ₂ (µg/m ³)				HCl (µg/m ³)			
A1	8.18	12.97	10.50	12.40	1.56	2.46	2.00	2.36
A2	7.95	12.59	10.09	12.04	1.51	2.39	1.92	2.29
A3	8.42	13.35	10.93	12.77	1.60	2.54	2.08	2.43
A4	9.38	14.86	12.69	14.21	1.78	2.82	2.41	2.70
A5	9.62	15.23	13.15	14.82	1.83	2.89	2.50	2.81
A6	10.09	16.32	14.08	16.29	1.92	3.10	2.68	3.10
A7	7.50	12.21	9.68	11.68	1.42	2.32	1.84	2.22
A8	8.90	14.10	11.80	13.49	1.69	2.68	2.24	2.56
A9	8.66	13.72	11.36	13.13	1.65	2.61	2.16	2.49
A10	9.85	15.61	13.61	15.56	1.87	2.97	2.59	2.96
A11	9.14	14.48	12.24	13.85	1.74	2.75	2.33	2.63

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

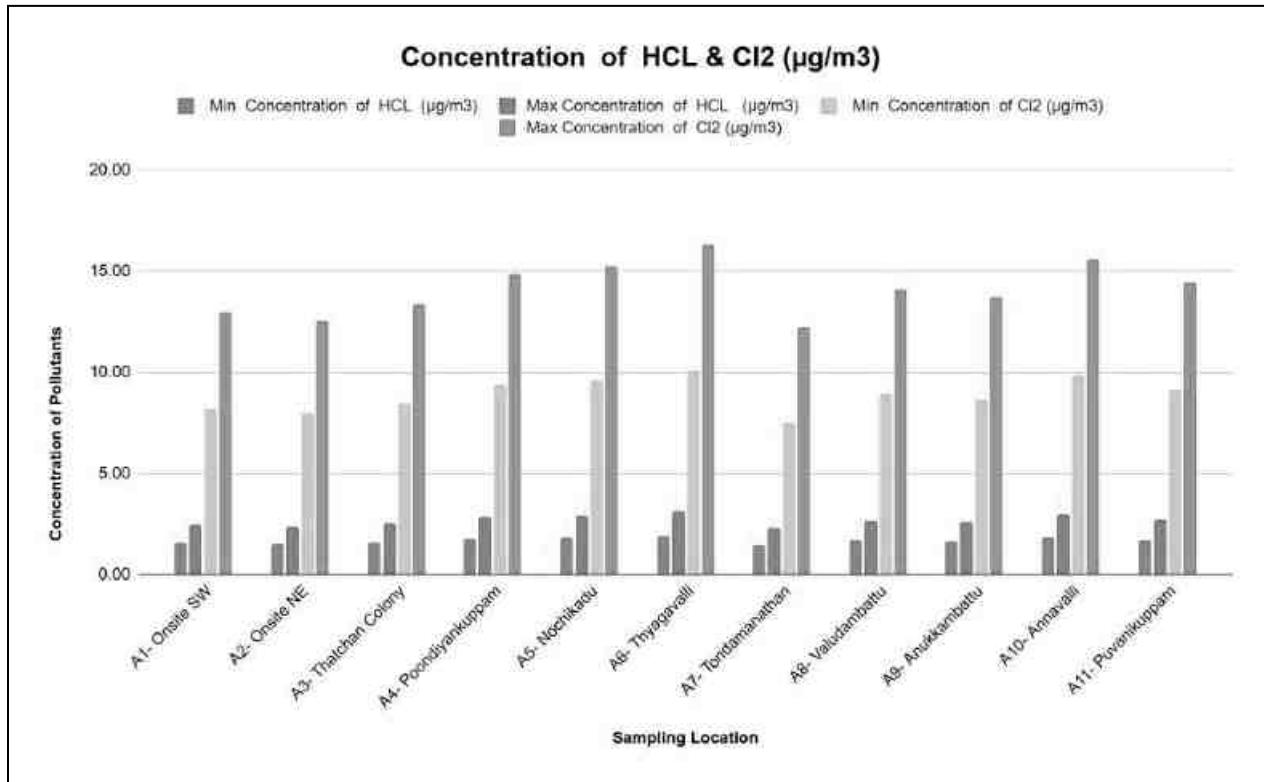


Figure 43. Ambient air quality results for HCL & Cl2

Table 61. Ambient Air Quality Results for O3 & NH3

S.No	Min	Max	Mean	98th Percentile	Min	Max	Mean	98th Percentile
	O3 (µg/m3)				NH3 (µg/m3)			
A1	2.35	4.19	3.16	3.59	3.27	5.81	4.39	4.98
A2	2.22	4.06	3.04	3.48	3.08	5.64	4.22	4.84
A3	2.49	4.31	3.29	3.69	3.46	5.98	4.57	5.13
A4	3.03	4.80	3.83	4.48	4.20	6.66	5.32	6.22
A5	3.10	4.92	3.97	4.71	4.31	6.83	5.51	6.54
A6	3.26	5.19	4.25	5.16	4.52	7.21	5.91	7.17
A7	2.09	3.94	2.91	3.38	2.90	5.47	4.04	4.69
A8	2.78	4.55	3.56	4.04	3.86	6.32	4.94	5.61
A9	2.63	4.43	3.42	3.82	3.66	6.15	4.75	5.31
A10	3.18	5.04	4.11	4.95	4.42	7.00	5.71	6.87
A11	2.93	4.67	3.69	4.26	4.07	6.49	5.13	5.91

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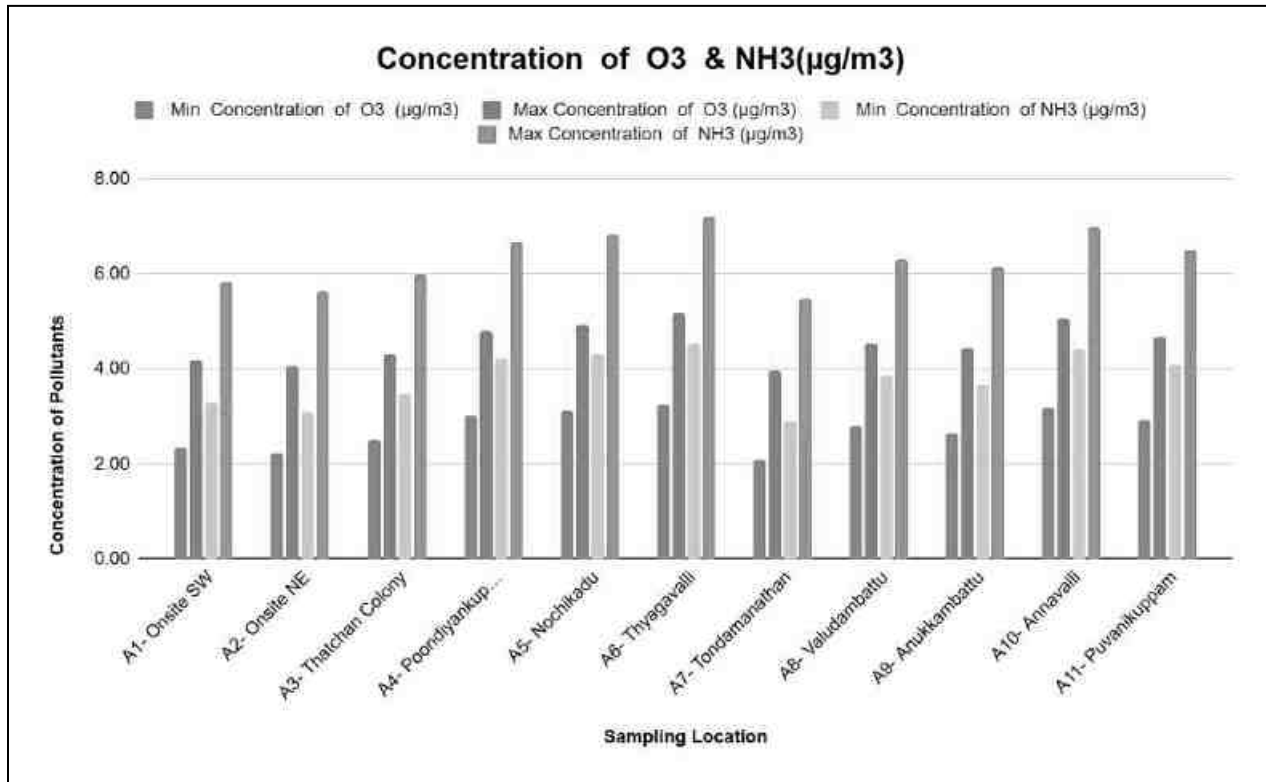


Figure 44. Ambient air quality results for O3 & NH3

Table 62. Ambient Air Quality Results for THC & NMHC

S.No	Min	Max	Mean	98th Percentile	Min	Max	Mean	98th Percentile
	THC (mg/m ³)				NMHC (mg/m ³)			
A1	0.87	1.55	1.17	1.33	0.05	0.09	0.06	0.07
A2	0.82	1.51	1.12	1.29	0.05	0.08	0.06	0.07
A3	0.92	1.60	1.22	1.37	0.05	0.09	0.07	0.08
A4	1.12	1.78	1.42	1.66	0.06	0.10	0.08	0.09
A5	1.15	1.82	1.47	1.74	0.06	0.10	0.08	0.10
A6	1.21	1.92	1.57	1.91	0.07	0.11	0.09	0.11
A7	0.77	1.46	1.08	1.25	0.04	0.08	0.06	0.07
A8	1.03	1.69	1.32	1.50	0.06	0.09	0.07	0.08
A9	0.98	1.64	1.27	1.42	0.05	0.09	0.07	0.08
A10	1.18	1.87	1.52	1.83	0.06	0.10	0.08	0.10
A11	1.09	1.73	1.37	1.58	0.06	0.10	0.08	0.09

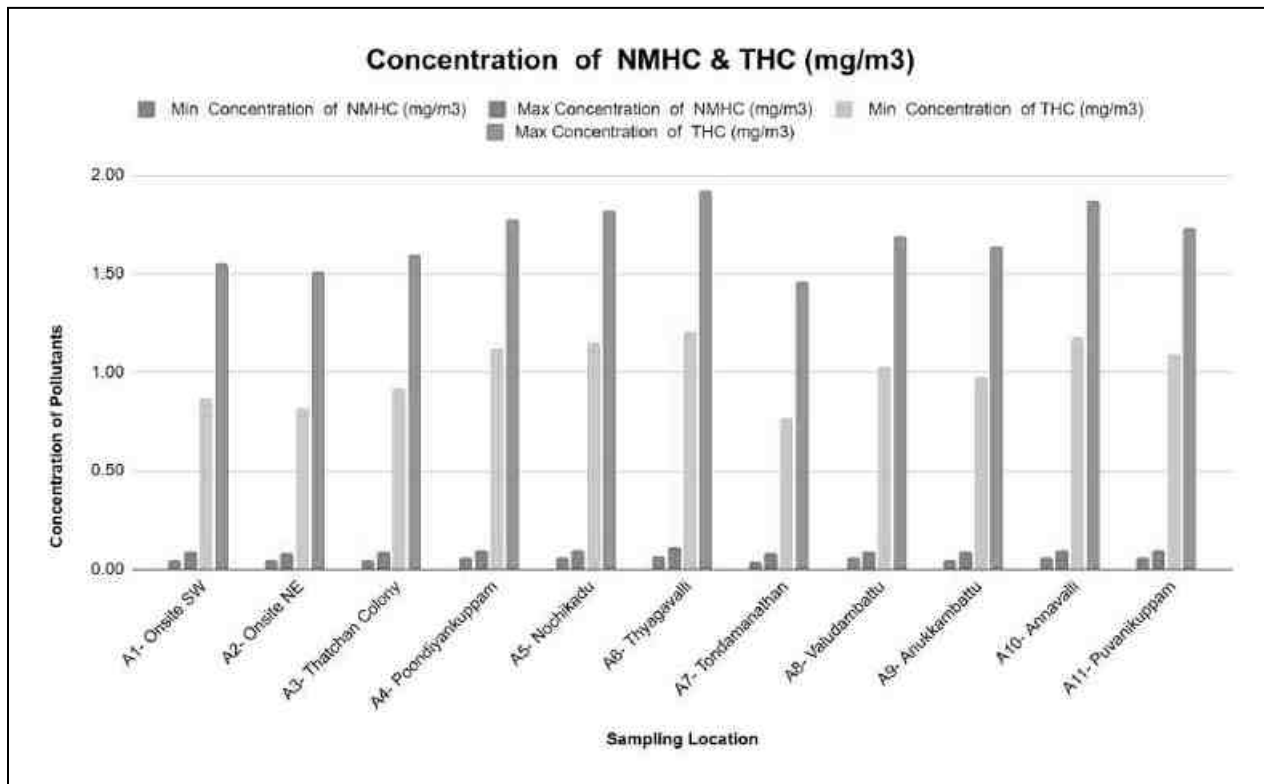


Figure 45. Ambient air quality results for THC & NMHC

3.5.5.2. INVERSE DISTANCE WEIGHTED (IDW) INTERPOLATION

The IDW technique computes an average value for unsampled locations where sampling was not possible using values from nearby weighted locations.

The IDW interpolation has been done for the buffer zone by which the concentration of the ambient air parameters are plotted with respect to the baseline known concentration. The maximum concentration range in the Buffer areas for all the parameters are given below based on IDW Maps.

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

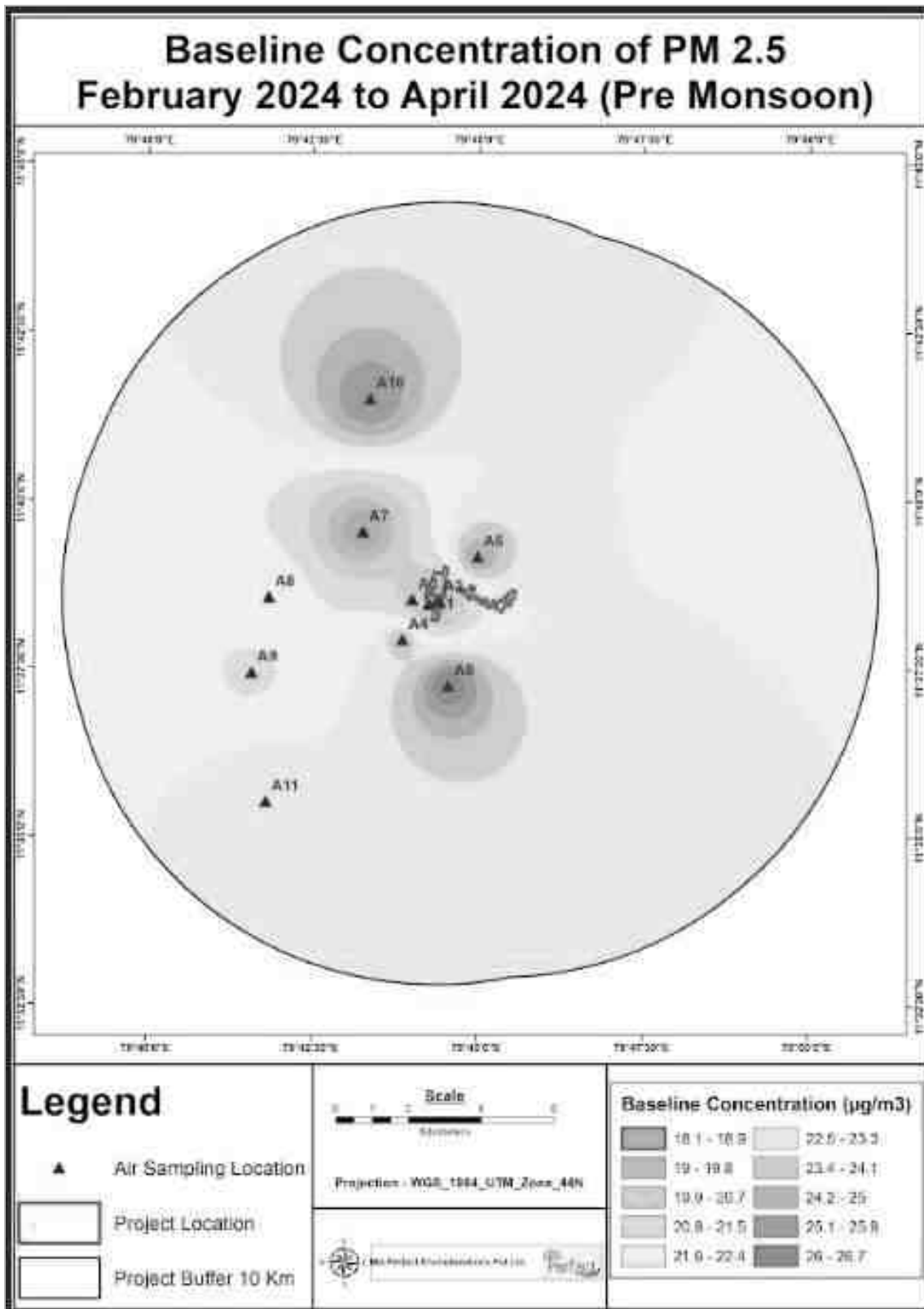


Figure 50. Baseline Concentration of PM 2.5

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

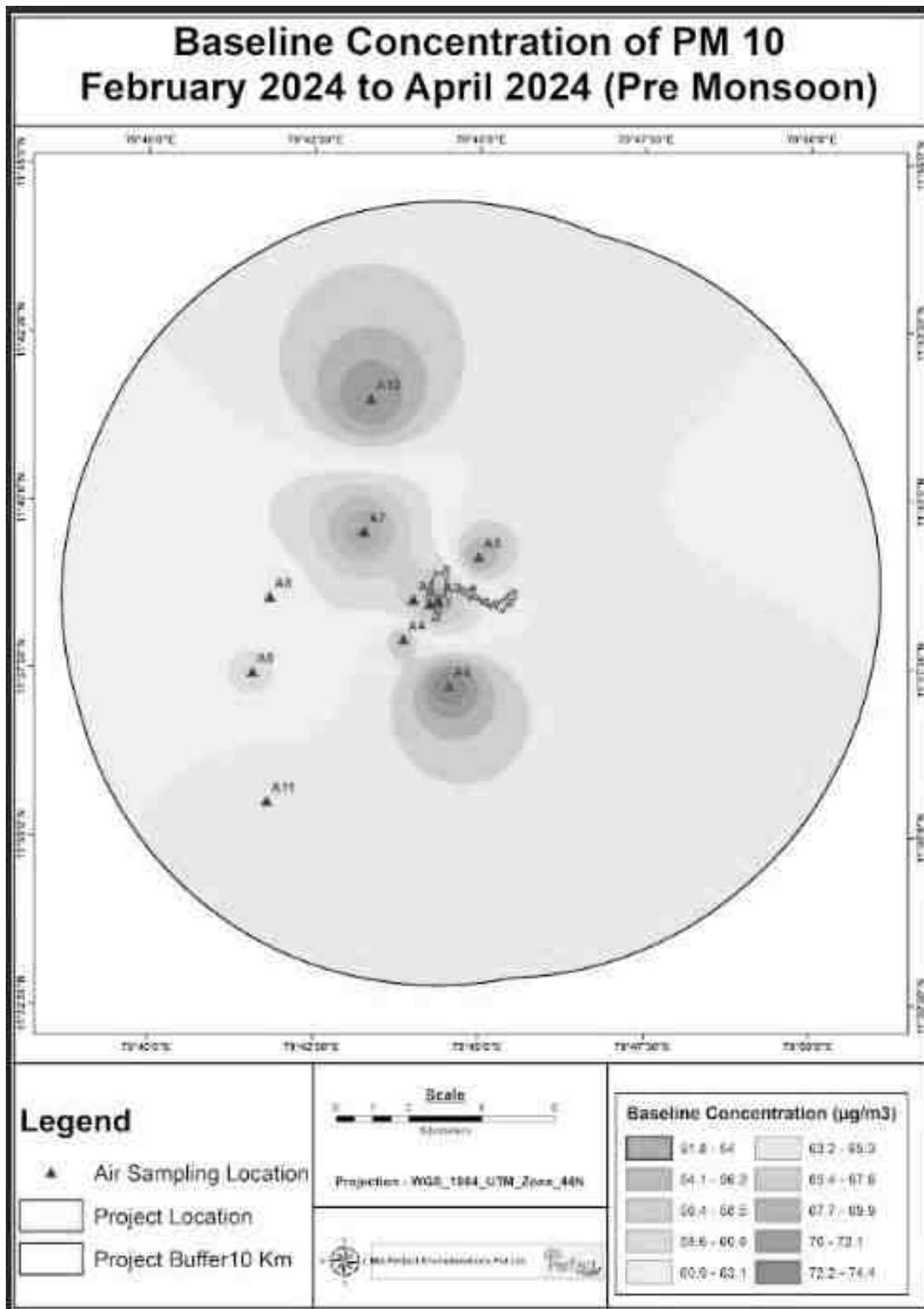


Figure 51. Baseline Concentration of PM10

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

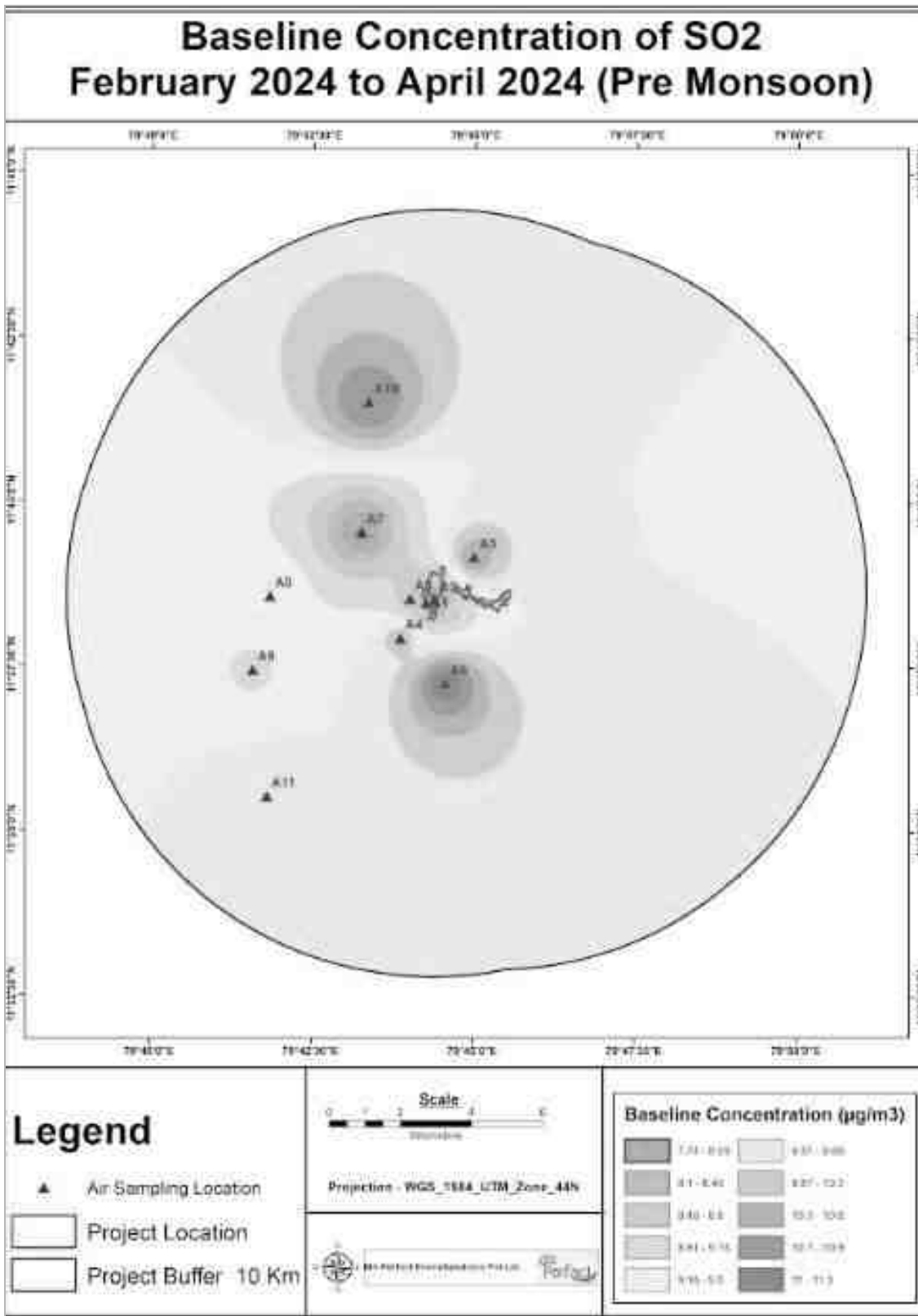


Figure 52. Baseline Concentration of SO₂

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

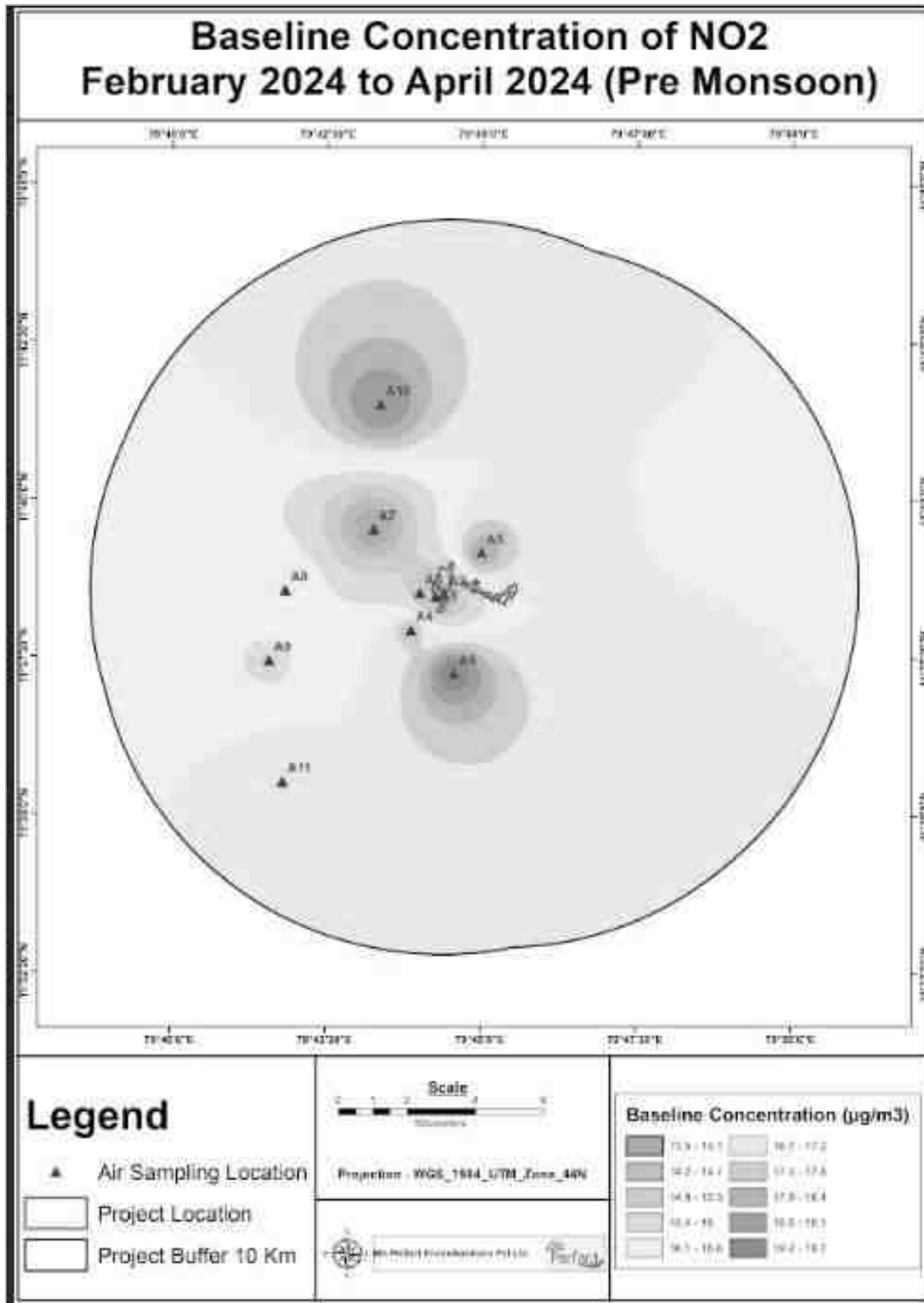


Figure 53. Baseline Concentration of NO₂

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

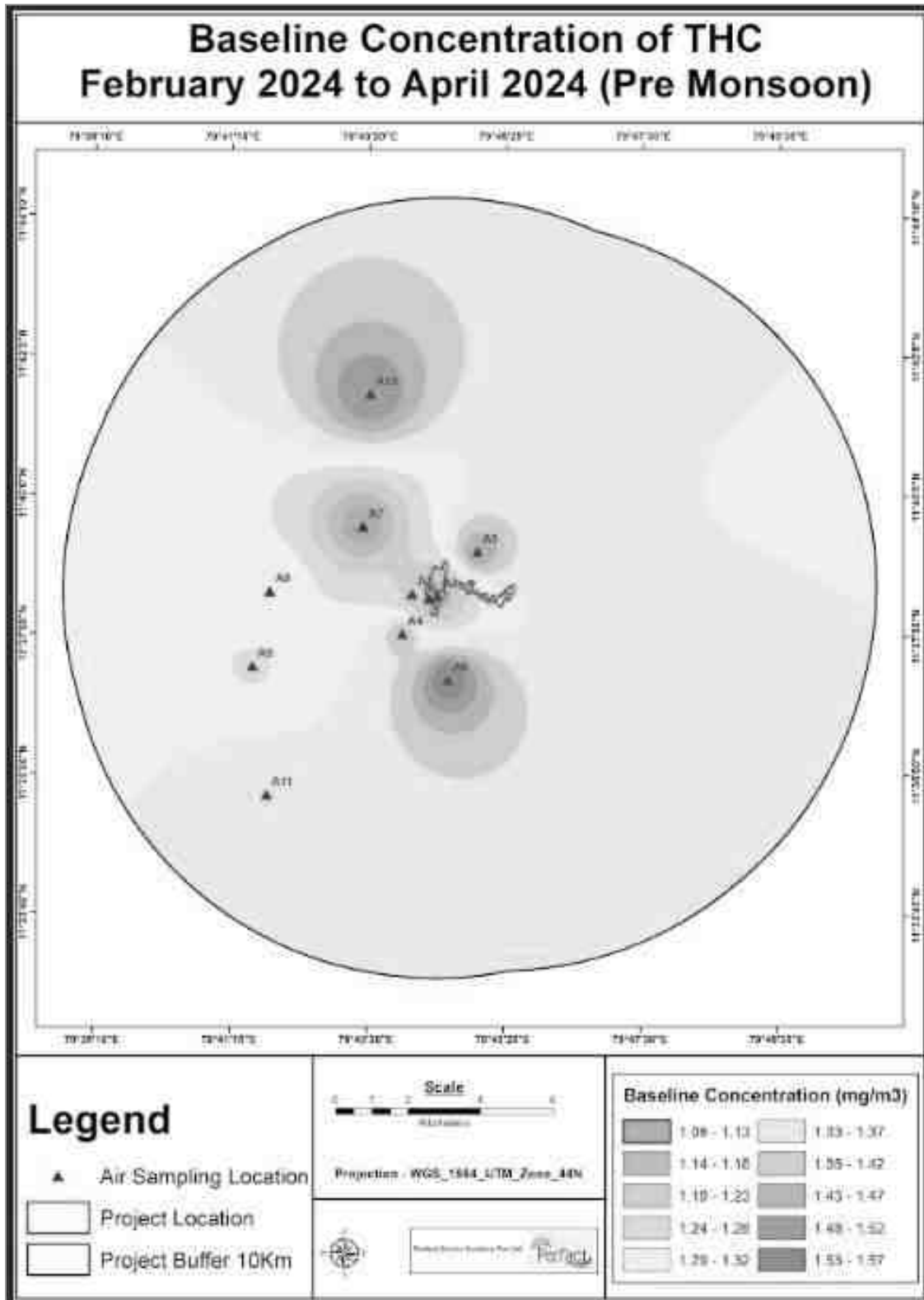


Figure 54. Baseline Concentration of THC

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

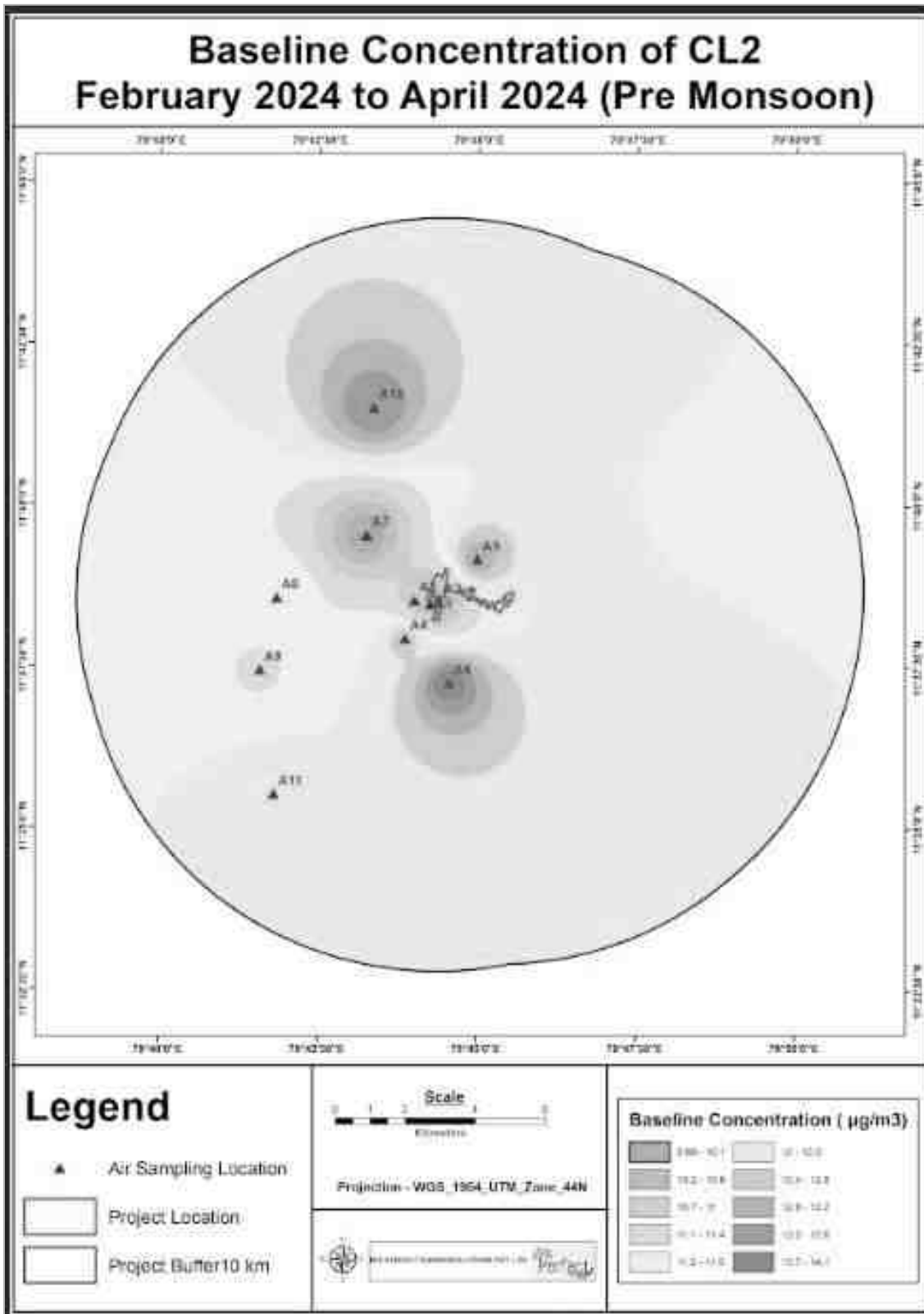


Figure 55. Baseline Concentration of CL2

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

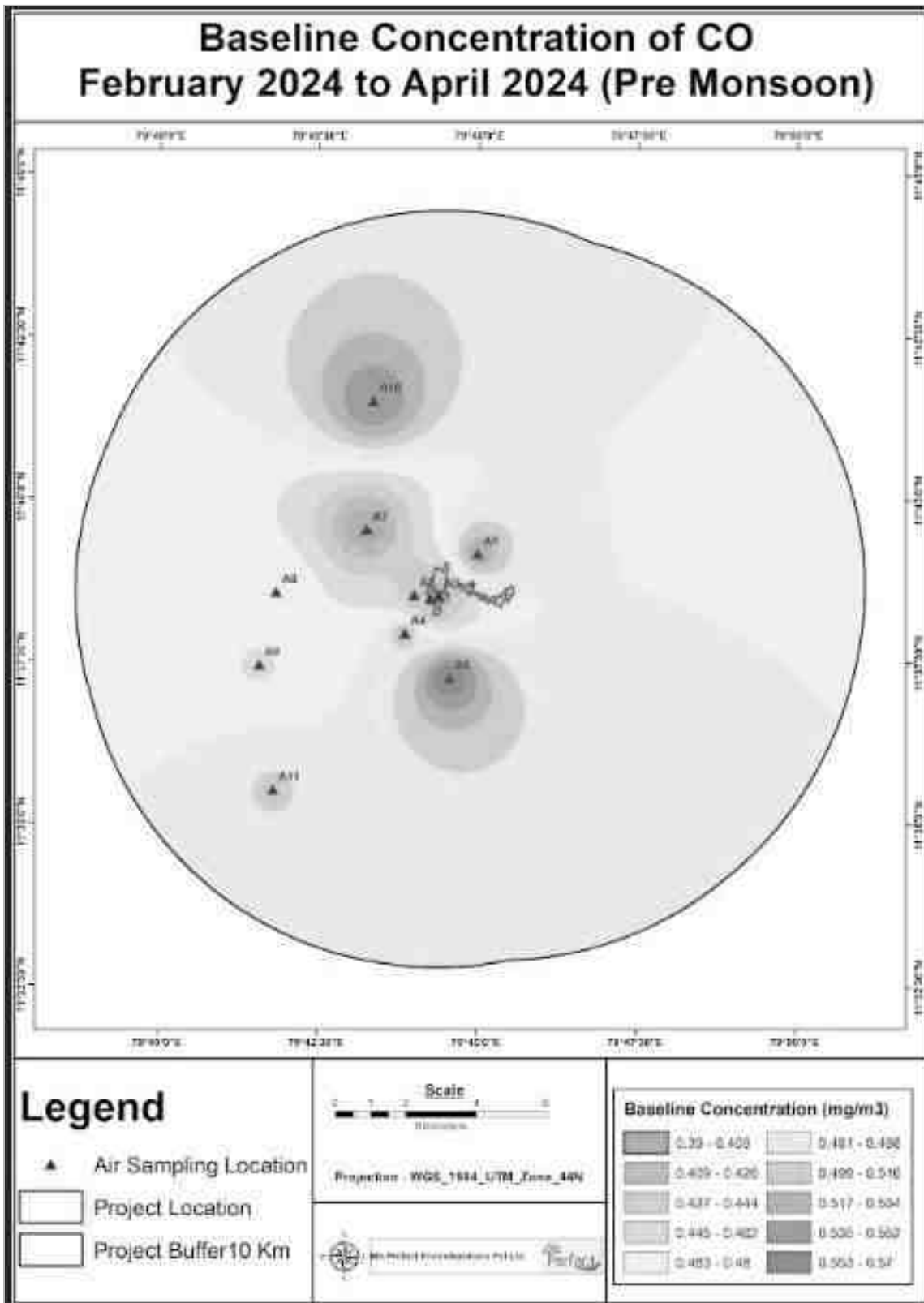


Figure 56. Baseline Concentration of CO

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

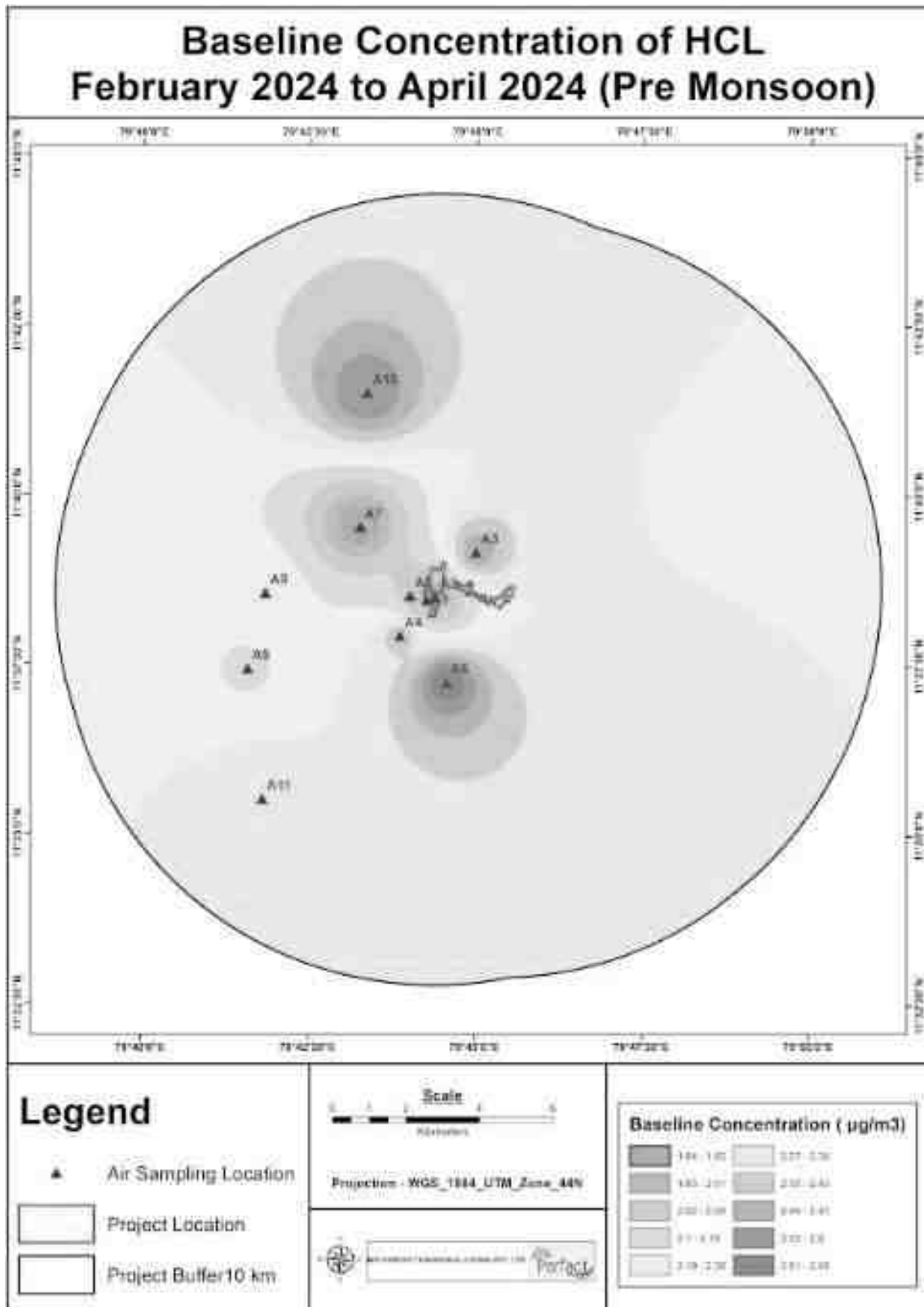


Figure 57. Baseline Concentration of HCL

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

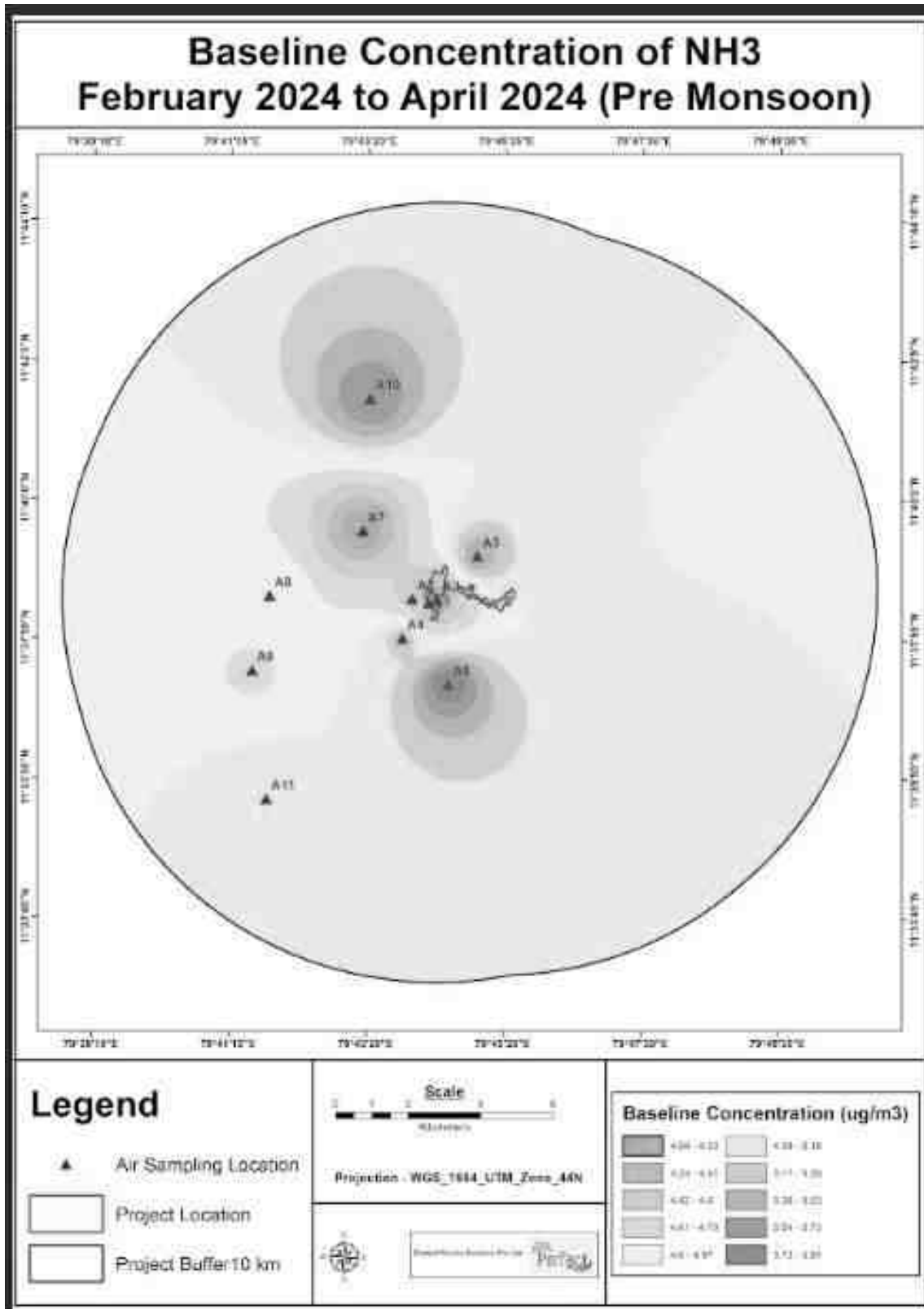


Figure 58. Baseline Concentration of NH3

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

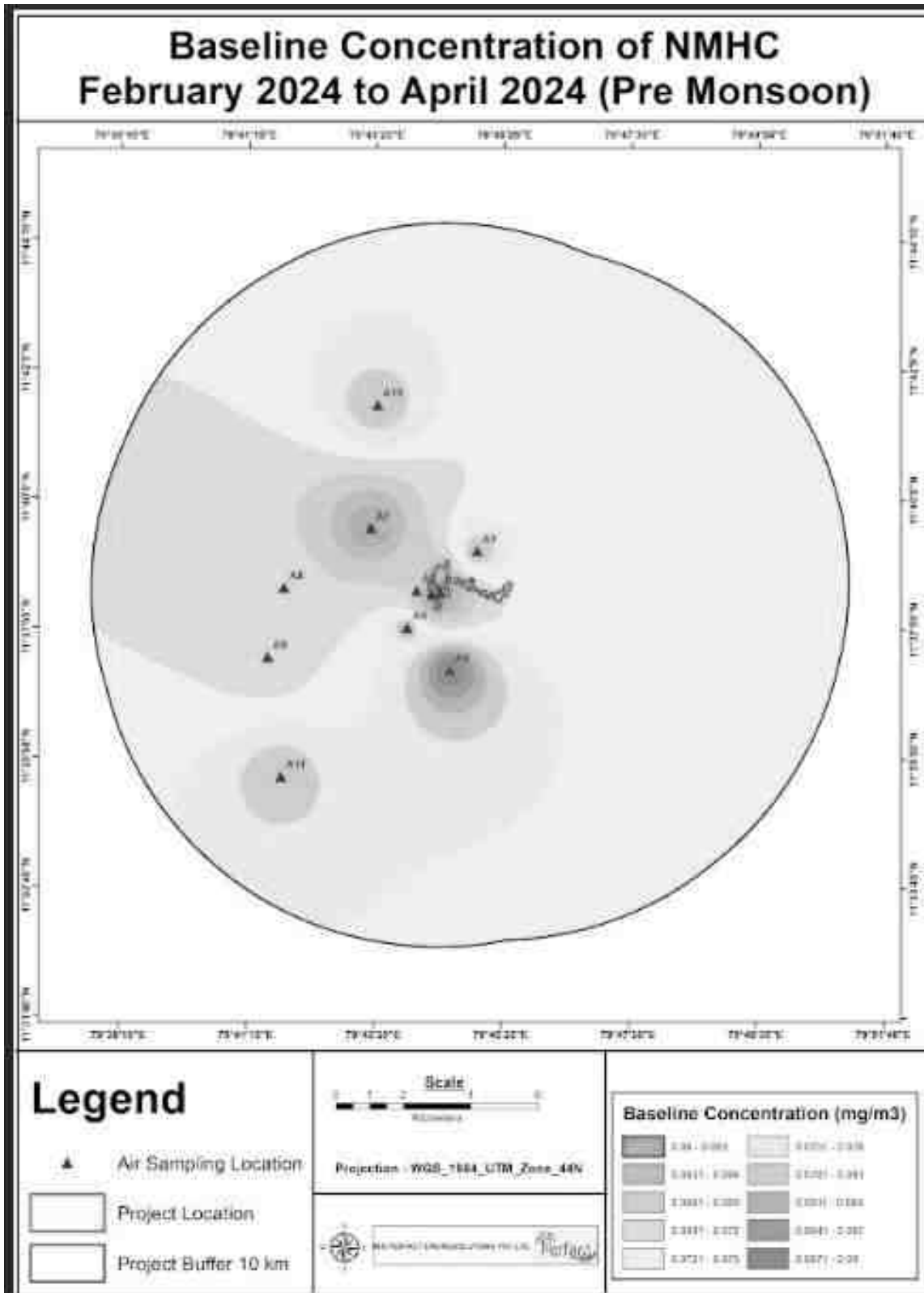
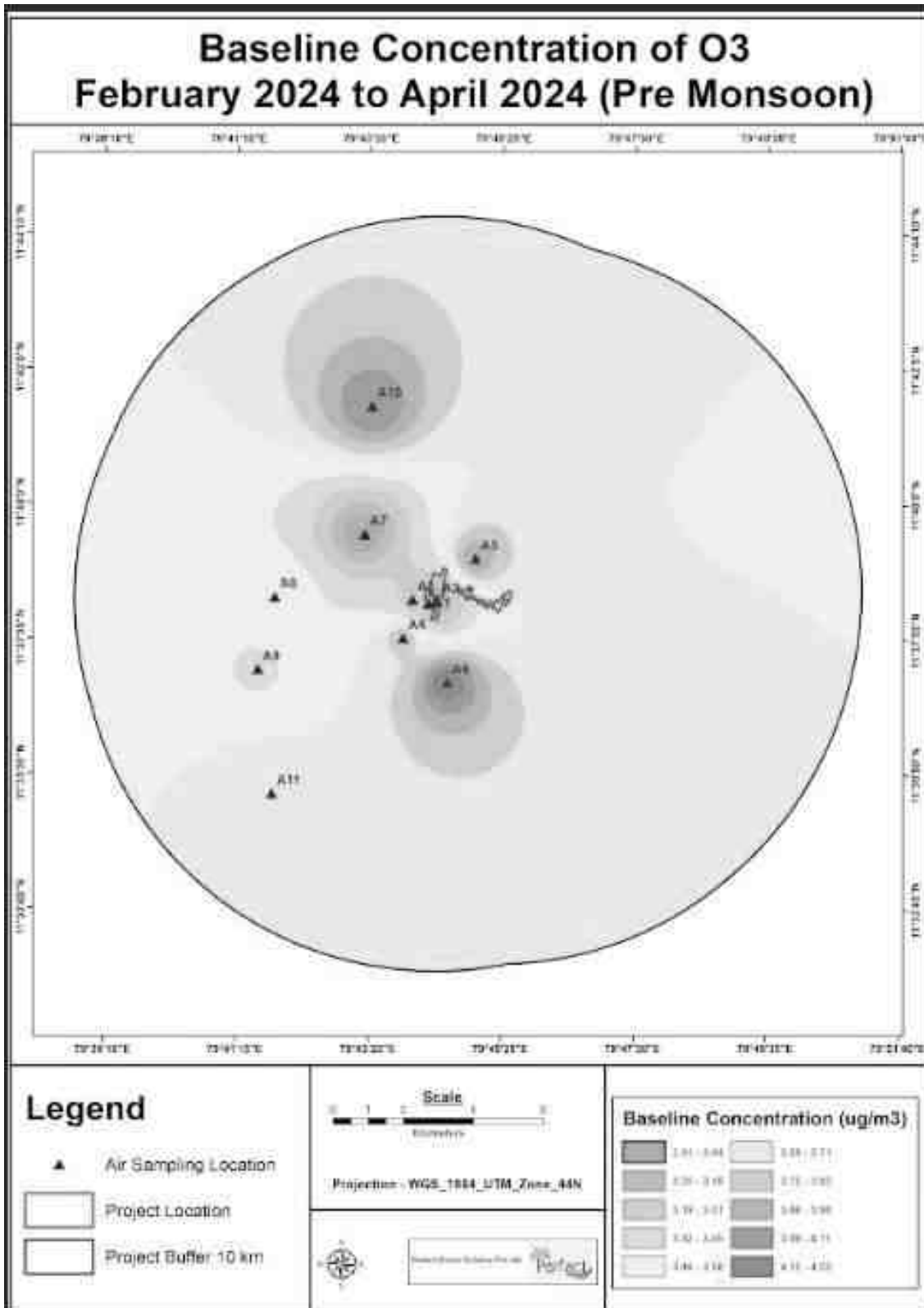


Figure 59. Baseline Concentration of NMHC

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

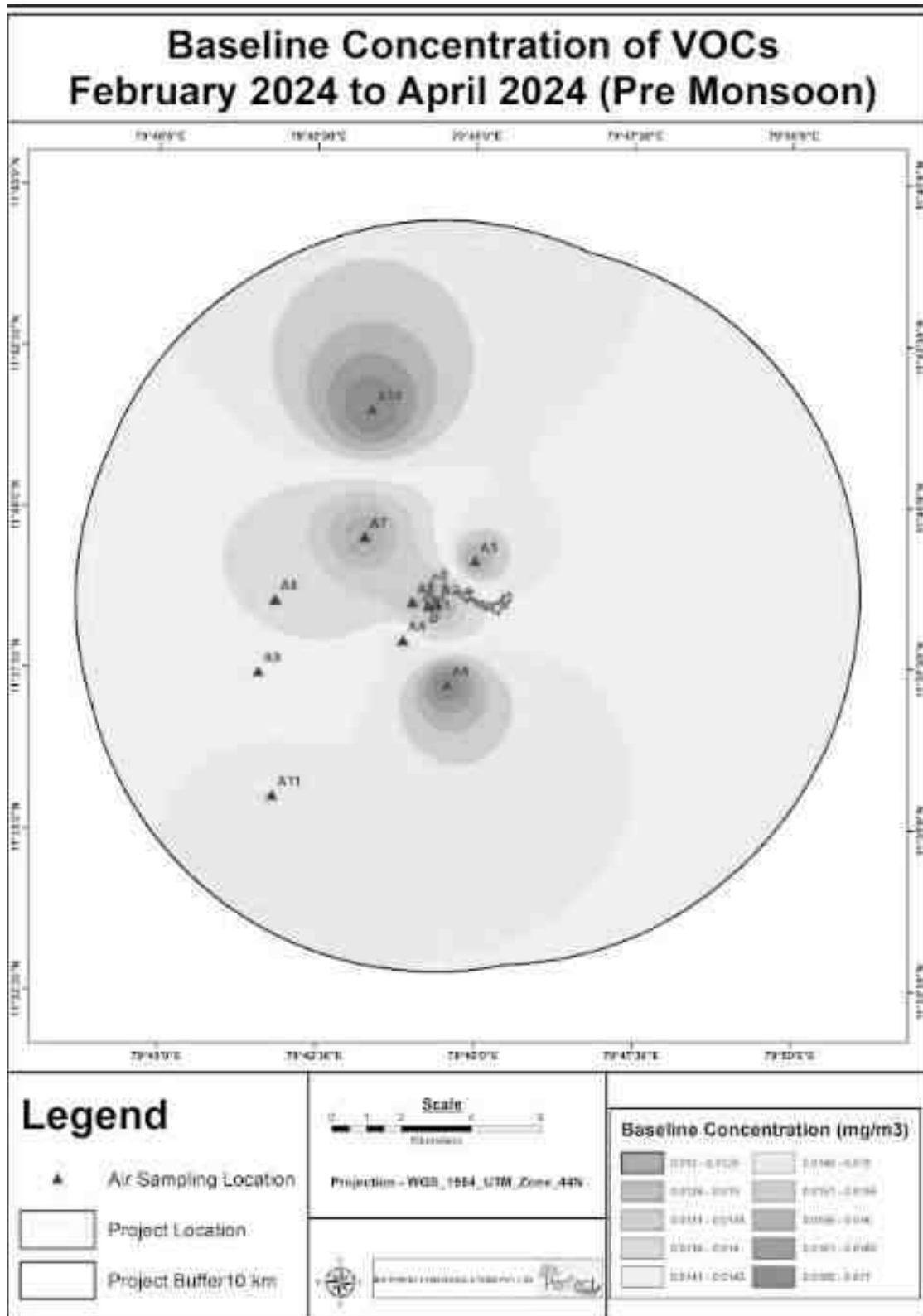


Figure 61. Baseline Concentration of VOC

Table 63. IDW Ambient Air Result

Parameters	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	VOC (mg/m ³)	HCI (µg/m ³)	Cl ₂ (µg/m ³)	O ₃ (µg/m ³)	NH ₃ (µg/m ³)	THC (mg/m ³)	NMHC (mg/m ³)
Maximum Concentration in buffer zone	74.43	26.72	11.27	19.69	0.57	0.017	2.68	14.08	4.25	5.91	1.57	0.09

3.5.6. AIR QUALITY INDEX

As per CPCB guidelines, the worst sub index in a location is the AQI of that region (Source: <https://cpcb.nic.in/National-Air-Quality-Index/>). The results show that PM₁₀ has a good sub index over all the sampling sites. Therefore, the PM₁₀ has been considered for calculating the overall AQI. The table given below shows the Air Quality Index (AQI) range & category.

AQI RANGE	AQI CATEGORY	AQI RANGE	AQI CATEGORY
Good (0-50)	Minimal Impact	Poor (201-300)	Breathing discomfort to people on prolonged exposure
Satisfactory (51-100)	Minor breathing discomfort to sensitive people	Very Poor (301-400)	Respiratory illness to the people on prolonged exposure
Moderate (101-200)	Breathing discomfort to the people with lung, heart disease, children and older adults	Severe (>401)	Respiratory effects even on healthy people

(Computed using: CPCB AQI CALCULATOR)

Figure 58. AQI Range with Category

Table 64. AQI of the Sampling Locations

Sampling Station	Sub-index Parameter	AQI Value	AQI Range
A1- Onsite SW	PM ₁₀	56.03	Satisfactory
A2- Onsite NE	PM ₁₀	53.88	Satisfactory
A3- Thatchan Colony	PM ₁₀	58.22	Satisfactory
A4- Poondiyankuppam	PM ₁₀	67.30	Satisfactory
A5- Nochikadu	PM ₁₀	69.64	Satisfactory
A6- Thyagavalli	PM ₁₀	74.43	Satisfactory
A7- Tondamanathan	PM ₁₀	51.75	Satisfactory
A8- Valudambattu	PM ₁₀	62.70	Satisfactory
A9- Anukkambattu	PM ₁₀	60.44	Satisfactory
A10- Annavalli	PM ₁₀	72.02	Satisfactory
A11- Puvanikuppam	PM ₁₀	64.98	Satisfactory

3.5.7. DATA INTERPRETATION

The ambient air quality results are summarized in the above tables:

Core zone: The mean value of PM_{10} at core zone locations ranges from (46.71 - 67.48 $\mu\text{g}/\text{m}^3$) & $PM_{2.5}$ ranges from (15.15 - 24.21 $\mu\text{g}/\text{m}^3$), SO_2 ranges from (6.36- 10.37 $\mu\text{g}/\text{m}^3$), NO_2 ranges from (10.26- 19.38 $\mu\text{g}/\text{m}^3$), CO (0.30- 0.56 mg/m^3), TVOC (0.009- 0.017 mg/m^3), HCl (1.51- 2.46 $\mu\text{g}/\text{m}^3$), Cl_2 (7.95- 12.97 $\mu\text{g}/\text{m}^3$), O₃ (2.22- 4.19 $\mu\text{g}/\text{m}^3$), NH₃ (3.27-5.81 $\mu\text{g}/\text{m}^3$), THC (0.82- 1.55 mg/m^3) & NMHC (0.05- 0.09 mg/m^3) which are within the limits of National Ambient Air Quality Standards (NAAQS).

As per the Air Quality Index by CPCB, the air quality of the **core zone** is found to be **Satisfactory** during the sampling period from **February 2024 to April 2024**.

Buffer zone: The mean value of PM_{10} at buffer zone locations ranges from (44.32 - 99.07 $\mu\text{g}/\text{m}^3$) & $PM_{2.5}$ ranges from (14.25 - 33.20 $\mu\text{g}/\text{m}^3$), SO_2 ranges from (6.00- 13.06 $\mu\text{g}/\text{m}^3$), NO_2 ranges from (9.65- 24.03 $\mu\text{g}/\text{m}^3$), CO (0.28- 0.70 mg/m^3), TVOC (0.008- 0.021 mg/m^3), HCl (1.42- 3.10 $\mu\text{g}/\text{m}^3$), Cl_2 (7.50- 16.32 $\mu\text{g}/\text{m}^3$), O₃ (2.09- 5.19 $\mu\text{g}/\text{m}^3$), NH₃ (2.90-7.21 $\mu\text{g}/\text{m}^3$), THC (0.77- 1.92 mg/m^3) & NMHC (0.04- 0.11 mg/m^3) which are within the limits of National Ambient Air Quality Standards (NAAQS).

As per the Air Quality Index by CPCB, the air quality of the **buffer zone** is found to be **satisfactory** during the sampling period from **February 2024 to April 2024**.

3.6. NOISE LEVEL

3.6.1. METHODOLOGY

At each station noise level was monitored for 24-hours simultaneously. For each measurement, dB (A) readings were taken for every 15 minutes for 24 hrs ones in a season to get Leq values. As per CPCB guidelines, the site of an area shall be selected such that it meets the land use pattern e.g. Commercial, Residential, Industrial. To assess the noise level of the proposed area, following stations were selected.

Criteria for site selection:

The baseline study of noise levels in the study area of 3 km has been carried out by selecting the noise monitoring locations based on the following criteria:

The site selection for noise quality monitoring were selected following the CPCB guidelines:

1. As per CPCB guidelines, the sites of an area for noise quality monitoring were selected such that it meets the land use pattern e.g. Commercial, Residential, Industrial, and silent zone. Silence zone is defined as an area comprising not less than 100 m around hospitals, educational institutions and courts. As per the site location, the type of location that was selected: industrial location, roads, and residential area, lies within the core and buffer area.

2. The presence of Noise sensitive receptors (environmental and ecological) in the vicinity of the project site were selected for noise quality monitoring. These included schools, hospitals, old age homes, religious places, etc.
 3. Proximity of the noise generating source to the human settlements. The major source of noise in the site surrounding the area is increased urbanization, vehicular movement at day time and ambient base noise at night. The impacts from these sources are expected to be captured in the levels of noise measured in the site-specific background noise monitoring study.
- Based on the above factors, overall 10 stations were selected.

Quality Assurance:

The noise level meter was calibrated immediately prior to and following each measurement event to check for the accuracy of measurement using an acoustic calibrator.

3.6.2. AMBIENT NOISE SAMPLING STATION

Table 65. Ambient Noise Sampling Station

S. No.	Sampling Locations	Latitude & Longitude	Distance and direction from Center of site	Type of Area	Environmental Significance
N1	Onsite South West	11°38'27.81"N 79°44'15.28"E	Onsite SW	Industrial area	Existing Ambient Noise Quality at Core Zone
N2	Onsite North East	11°38'29.77"N 79°44'23.67"E	Onsite NE	Industrial area	
N3	Thatchan Colony	11°38'31.84"N 79°44'0.30"E	0.34 km West	Residential area	Existing Ambient Noise Quality at Buffer Zone
N4	Poondiyankuppam	11°37'55.86"N 79°43'51.08"E	0.94 km SW	Residential area	
N5	Nochikadu	11°39'11.13"N 79°44'59.08"E	1.72 km NE	Residential area	
N6	Thiruchopuram	11°36'55.81"N 79°44'30.12"E	2.34 km South	Residential area	
N7	Tondamanathan	11°39'32.79"N 79°43'15.52"E	2.45 km NW	Residential area	
N8	Valudambattu	11°38'33.69"N 79°41'50.06"E	4.24 km West	Residential area	
N9	NH-32	11°38'38.38"N 79°44'12.04"E	-	Commercial Area	
N10	NH-532	11°39'27.70"N 79°42'47.52"E	-	Commercial Area	

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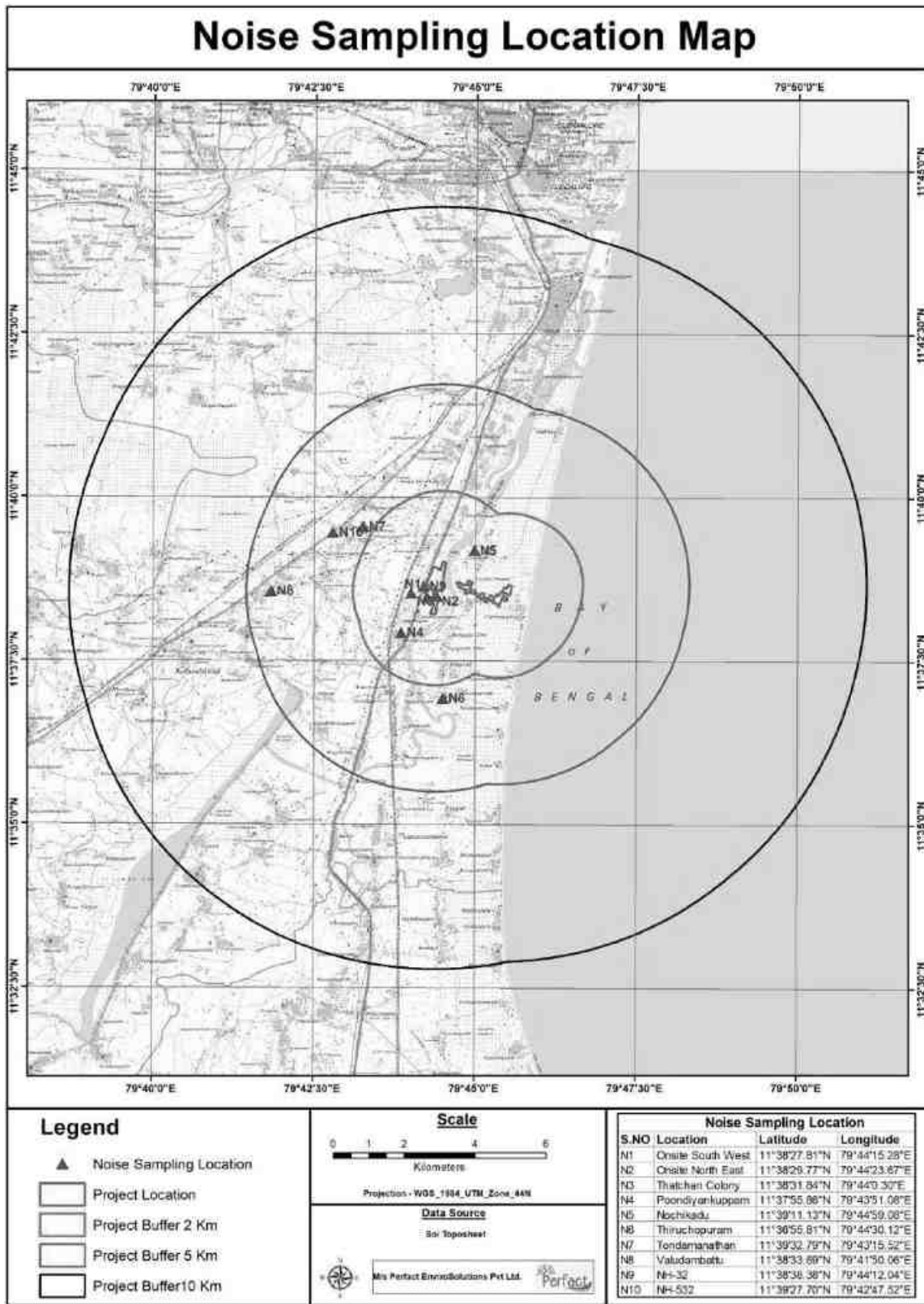


Figure 62. Noise Sampling Locations Map

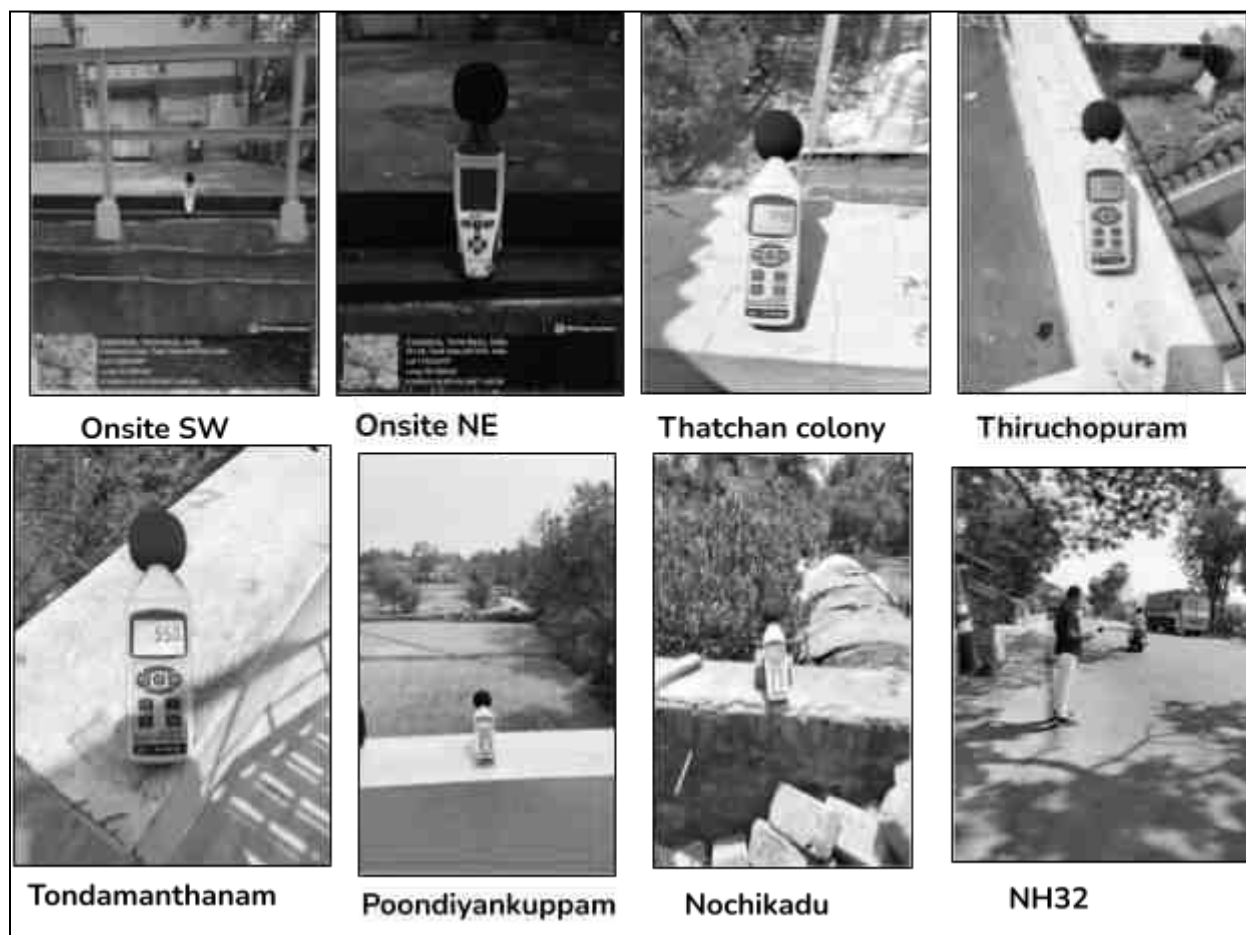


Figure 63. Noise Monitoring Photographs

3.6.3. RESULTS AND DISCUSSION

The Ambient Noise Quality results are summarized above. The results are discussed below:

Core Zone :

Table 66. Ambient Noise Quality (Core Zone)

S. No.	Locations	Zone	Leq Day Time Leq dB(A)	Leq Night Time Leq dB(A)	Day time (6.00 A.M to 10.00 P.M)	Night time (10.00 P.M to 6.00A.M)
N1	Onsite South East	Industrial area	61.9	56.9	75	70
N2	Onsite North East	Industrial area	62.2	57.4	75	70

Buffer Zone:

Table 67. Ambient Noise Quality (Buffer Zone)

S. No.	Locations	Zone	Leq Day Time Leq	Leq Night Time Leq	Day time (6.00 A.M to 10.00P.M)	Night time (10.00 P.M to 6.00A.M)
N3	Thatchan Colony	Residential area	57.2	46.1	55	45
N4	Poondiyankuppam	Residential area	57.7	46.4	55	45
N5	Nochikadu	Residential area	54.7	44.5	55	45
N6	Thiruchopuram	Residential area	55.8	45.8	55	45
N7	Tondamanathan	Residential area	56.8	46.5	55	45
N8	Valudambattu	Commercial Area	54.6	43.9	65	55
N9	NH-32	Commercial Area	61.3	58.9	65	55
N10	NH-532	Commercial Area	63.2	60.2	65	55

The Ambient Noise Quality results are summarized above. The results are discussed below:

Core Zone :

The ambient noise level during day time at the proposed project site varies from 61.9 dB (A) to 62.2 dB (A) which are within the day time standard limit of Industrial area ~75 dB (A). During night the noise level at the project site ranges from 56.9 dB (A) to 57.4 dB (A) which are within the night time standard limit of Industrial area 70.0 dB (A).

Buffer Zone:

Residential Area:

N3: The ambient noise level at Thatchan Colony is 57.2 dB (A) which is slightly higher than daytime noise standard limit of Residential area ~ 55.0 dB (A). During the night the noise level was recorded at 46.1 dB (A) which is slightly higher than the night-time noise standard limit of ~ 45 dB (A).

N4: The ambient noise level at Poondiyankuppam is 57.7 dB (A) which is slightly higher than daytime noise standard limit of Residential area ~ 55.0 dB (A). During the night the noise level was recorded at 46.4 dB (A) which is slightly higher than the night-time noise standard limit of ~ 45 dB (A).

N5: The ambient noise level at Nochikadu 54.7 dB (A) which is within the daytime noise standard limit of the Residential area of ~ 55.0 dB (A). During the night the noise level was recorded at 44.5 dB (A) which is within the night-time noise standard limit of ~ 45.0 dB (A).

N6: The ambient noise level at Thiruchopuram is 55.8 dB (A) which is slightly higher than the daytime noise standard limit of the Residential area of ~ 55.0 dB (A). During the night the noise level was recorded at 45.8 dB (A) which is slightly higher than the night-time noise standard limit of ~ 45.0 dB (A).

N7: The noise level at Tondamanathan 56.8 dB (A) which is slightly higher than the daytime noise standard limit of ~ 55 dB (A). During the night the noise level was recorded at 46.5 dB (A) which is slightly higher than the night-time noise standard limit of ~ 45 dB (A).

N8: The noise level at Valudambattu is 54.6 dB (A) which is within the daytime noise standard limit of ~ 55 dB (A). During the night the noise level was recorded at 43.9 dB (A) which is within the night-time noise standard limit of ~ 45 dB (A).

Commercial Area:

N9: The noise level at NH-32 is 61.3 dB (A) which is within the daytime noise within the standard limit of Commercial area ~ 65.0 dB (A). During the night the noise level was recorded at 58.9 dB (A) which is slightly higher than the night-time noise standard limit of ~ 55 dB (A).

N10: The noise level at NH-532 is 63.2 dB (A) which is within the daytime noise within the standard limit of Commercial area ~ 65.0 dB (A). During the night the noise level was recorded at 60.2 dB (A) which is slightly higher than the night-time noise standard limit of ~ 55 dB (A).

3.7. HYDROLOGY & GEOLOGY

This chapter illustrates the description of the existing environmental status of the study area with reference to the prominent environmental attributes. The study area covers an area equal to 10 km radius around the project site. The existing environmental setting covers baseline conditions with respect to geology and groundwater quality.

3.7.1. OBJECTIVES

The objectives of this study were to:

- To study the drainage network in the Core and Buffer zone.
- To study groundwater development status of the area.
- Identify potential impacts that the construction and operation of the Project could have on this environmental component.

3.7.2 TOPOGRAPHY

Core Zone : Topographically, the proposed site area is mildly undulating. According to the KML file, the minimum elevation of the project site is 20 m AMSL close to the center of the site, whereas the maximum elevation in the north is 36 m AMSL.

Buffer Zone : The buffer area is a combination of undulating as well as flat topography. As per the KML file, the maximum elevation towards the NNW near the periphery is 74 m AMSL, whereas the minimum elevation towards the eastern direction of the site in the Bay of Bengal is 1 m AMSL.

The geomorphic features of the area are shown in the Map given below:

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

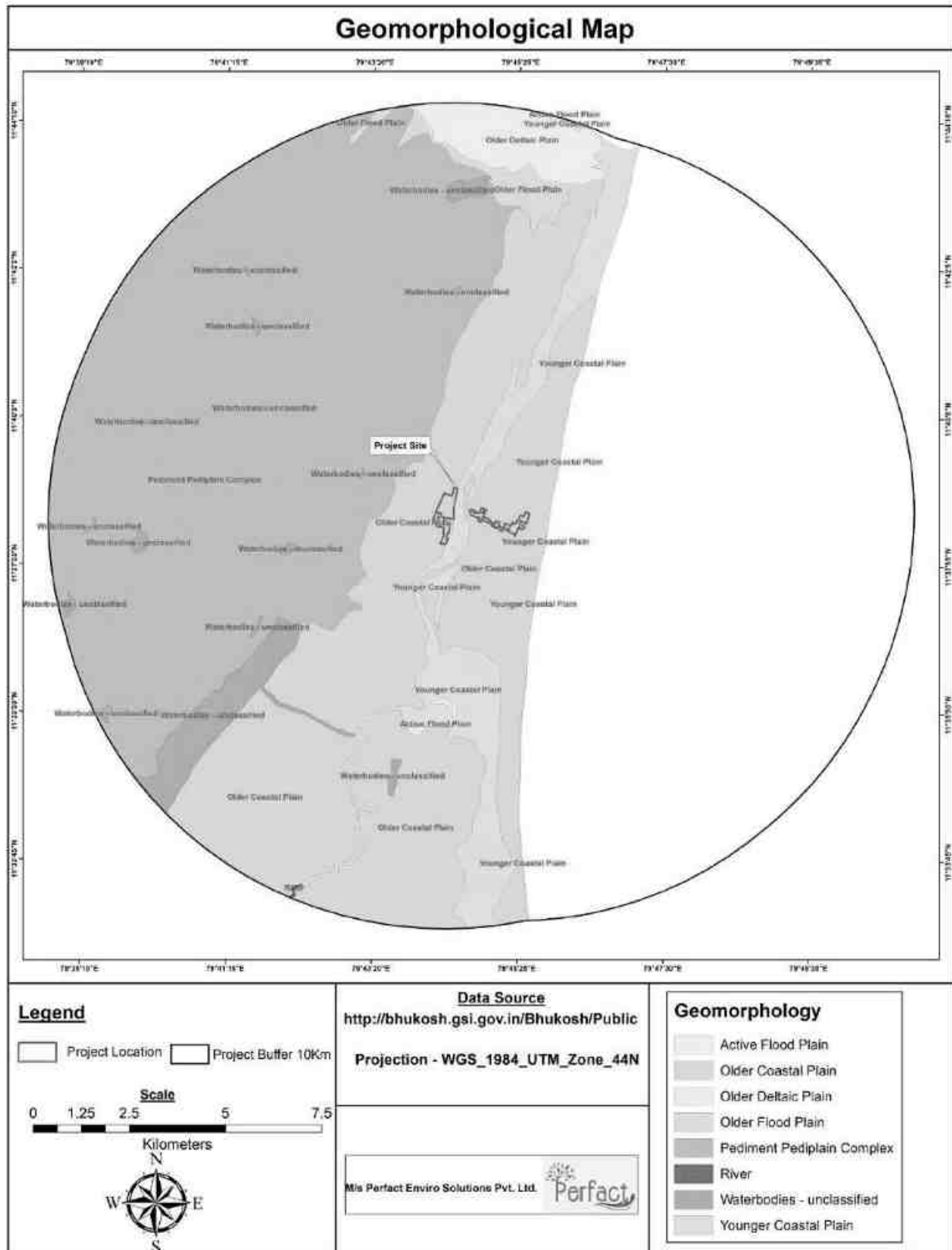


Figure 64. Geomorphological Map

3.7.4 GEOLOGY

Geologically, the entire study area can be broadly classified into hard rock and sedimentary formations:

- **Hard rock formation:** The western part of the area is covered by Granitic gneiss, Hornblende gneiss, and Charnockite with intrusions of Dolerite dykes and Pegmatites. These rocks are highly metamorphosed and subjected to severe folding, crushing, and faulting.
- **Sedimentary formation:** The Cuddalore sandstones of the Tertiaries are well-developed in this area and occur in two discontinuous patches in extensive areas. The formation consists of white clays, sands, sandy clays, and unconsolidated sandstones mottled in color with lignite seams. The Cuddalore taluk is covered with sedimentary formations, namely Cuddalore sandstones and alluvial formations. The northeast and southern parts of this taluk are covered with alluvial deposits, whereas the western part of the taluk is covered with Cuddalore sandstone. The Cuddalore sandstone formations are confined by an impervious clay bed, giving rise to several flowing artesian wells.

Source: Ground Water Report Of Cuddalore District

Table 68. Stratigraphic Succession of Area

Era	Period	Stage	Lithology
Cenozoic	Quaternary	Pleistocene to Recent	Alluvial clay & sand, laterite with reddish brown ferruginous clayey soil
	Tertiary	Cuddalore Formation - Mio Pliocene (Early Neogene)	Mottled, fine to coarse-grained yellowish to brownish grey argillaceous, brownish ferruginous sandstone, pebbly sandstone, hard compact clay stone, greenish grey clay with bands of limestones,
		Neyveli Formation - Eocene	Argillaceous sandstone, sandy clay, clay, carbonaceous clay, lignite beds, aquifer sand & clay
		Niniyur Formation - Paleocene (Palaeogene)	Limestone, calcareous shale/mud, clay and sandstone
Mesozoic	Cretaceous	Ariyalur Group	Argillaceous and micaceous sandstone with bands and lenses of limestones, clay sandy clay, and siltstone with fine-grained argillaceous sandstone
Paleozoic	Lower Permian	Lower Gondwana	Boulder bed, conglomerates, olive green to khaki-colored shale with pink sandstones
Achaean	---	Gneissic Group	Pink migmatitic granitoid gneiss

Source: District Survey Report For Sand Cuddalore District 2019

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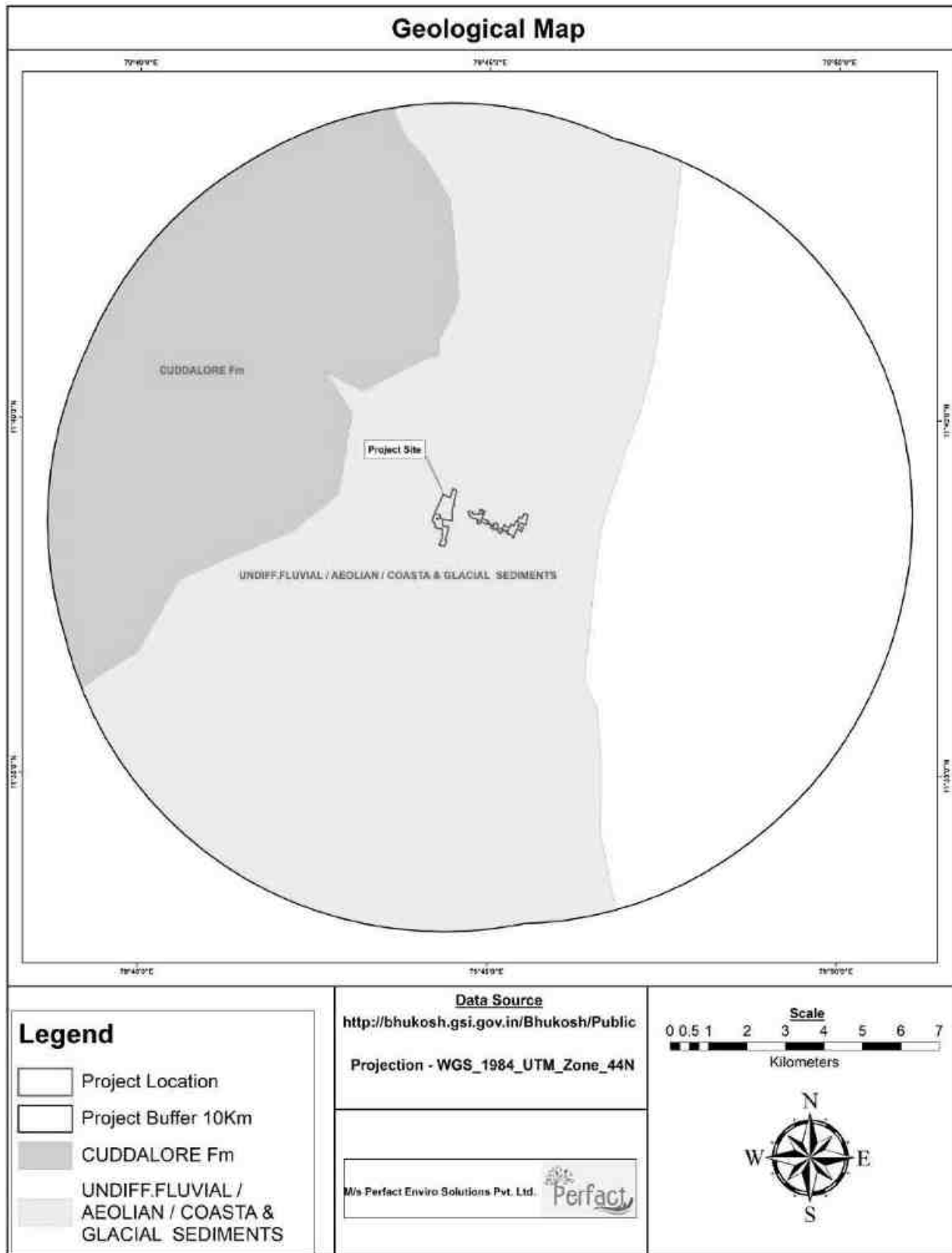


Figure 65. Geological Map

3.7.5 HYDROLOGY

3.7.5.1 DRAINAGE

- The area's major River Estuary of Uppanar flows from south-southwest to north-northeast. The Estuary of the Uppanar River separates the project site into two parts, on either side. The Estuary of Uppanar River is situated about 0.10 km west and 0.01 km east of the site.
- The Estuary of the Gadilam River flows from NNE to the south. The confluence of the Gadilam and Uppanar Rivers is about 7.13 km NNE of the site.
- The Bay of Bengal is situated about 0.59 km east of the sites. The buffer zone comprises various water bodies such as the Bay of Bengal, Rivers, ponds, etc.
- The area has sub-parallel and dendritic drainage patterns, having first to third-order streams.

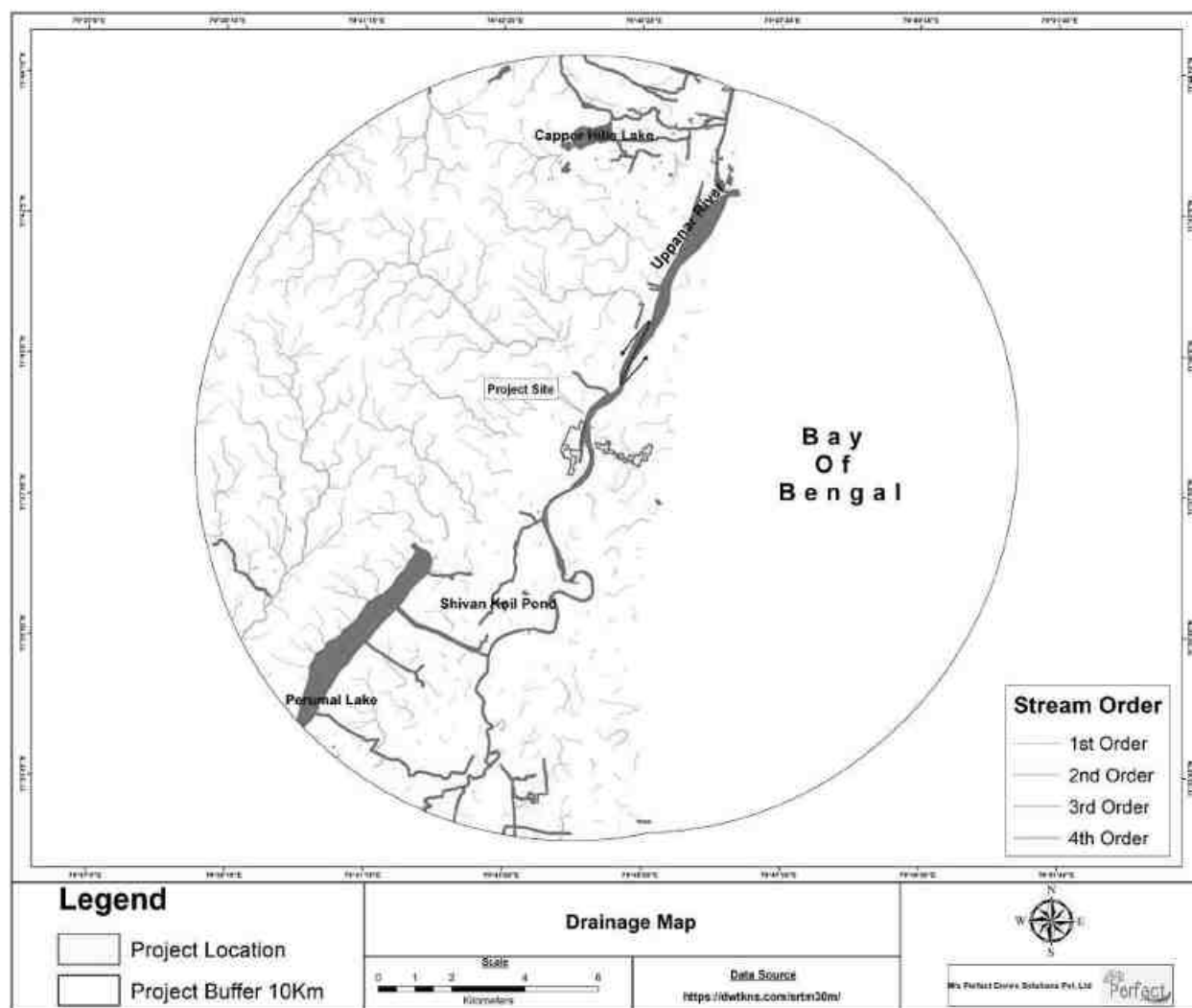


Figure 66. Drainage Map

3.7.5.2 FLOOD HISTORY

During the monitoring team's survey, local residents reported that no flood incidents have occurred in the past 10–12 years. However, considering the site's distance to the estuary of the Uppanar River, the chances of flooding are always there. Therefore, precautionary measures for flood hazards are considered required which are as follows:

- **Greenbelt/Plantation** will be done around the project site.
- **A retaining wall** will be constructed around the project site.
- **Pumping Arrangement** – Pumping Arrangement - In case of heavy rainfall or flood, pumps will be provided in low lying areas to immediately drain out the stagnant water.
- **Emergency Preparedness & Response Plan** - A detailed Flood Emergency Response Plan (FERP) will be prepared and integrated with the Disaster Management Plan of the plant.
- The construction of floodways (man-Made channels to divert floodwater), and Flood barriers.

3.7.5 GEOHYDROLOGY

- As per the CGWB Report, Groundwater occurs in all the geological formations ranging in age from Archaean to Recent, which can be broadly classified into two hydrogeological units, namely:

a) Fissured and fractured formations

b) Porous formation

a) Fissured and fractured formations

The secondary porosity in the weathered fissured and fractured zones forms the avenues for groundwater occurrence and movement, which are more than 12 m BGL at places. Groundwater in this terrain is developed using dug wells, dug cum bore wells, bore wells/tube wells, etc.

b) Porous formation

- The unconsolidated quaternary sediments consisted of laterite and the fluvial and coastal alluvium and the semi-consolidated formations comprised the Cuddalore sandstone and Gopurapuram formations of Tertiary era, Calcareous sandstone moral of Upper cretaceous. The unconsolidated quaternary alluvium and the Cuddalore sandstone form the principal and potential aquifers in the area.
- In the area underlain by cretaceous formations groundwater occurs generally at bedding places and joints of siliceous limestones or in the intergranular pore spaces of calcareous sandstone.
- The tertiary aquifer comprising Cuddalore Sandstone is the most productive and occurs in the depth range of 100 to 457 m.
- The pre-monsoon and post-monsoon water levels vary from 17.54 m BGL to 0.04m BGL.

Source: District Groundwater Brochure Cuddalore District, Tamil Nadu

- ❖ During our primary survey at the project site, the monitoring team found that the groundwater levels in the area of the project site vary about 6.09 to 7.6 metres below ground level (BGL).

3.7.5.1 GROUNDWATER DEVELOPMENT

The area falls under the Cuddalore Taluk of Thiruvandhipuram Firka of Tamil Nadu. As per the CGWB report, the area falls under the Over Exploited category with the stage of groundwater development at about 200%. The following table shows the Thiruvandhipuram Firka of Groundwater developments.

Table 69. Details of Cuddalore Ground Water developments

Assessment unit Firka	Total annual Groundwater recharge (Ham)	Annual Extractable Groundwater Resource (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Stage of Groundwater Development (in %)	Category
Thiruvandhipuram	4497.04	4047.34	4159.49	119.15	102.77	Over Exploited

3.8 WATER QUALITY

3.8.1 SAMPLING STATION

Table 70. Groundwater Sampling Locations

S. No.	Sampling Locations	Lat.& Longitude	Distance and direction from the project boundary	Environmental Significance
GW1	Nearby Site	11°38'27.17"N 79°44'19.11"E	Bore well	Core Zone
GW2	Thatchan Colony	11°38'31.34"N 79°44'0.63"E	0.32 km West	Buffer Zone
GW3	Poondiyankuppam	11°37'55.67"N 79°43'51.74"E	0.93 km SW	
GW4	Nochikadu	11°39'9.81"N 79°44'59.99"E	1.71 km NE	
GW5	Thiruchopuram	11°36'55.81"N 79°44'30.12"E	2.32 km South	
GW6	Tondamanathan	11°39'31.73"N 79°43'15.59"E	2.46 km NW	
GW7	Valudambattu	11°38'33.57"N 79°41'50.62"E	4.28 km West	
GW8	Anukkambattu	11°37'26.44"N 79°41'34.92"E	5.28 km SW	

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Figure 67. Ground Water Sampling Photographs

Table 71. Surface Water Sampling Locations

S. No.	Sampling Locations	Lat. & Longitude	Distance and Direction from the project boundary	Environmental Significance
SW1	Uppanar River Upstream	11°39'7.55"N 79°44'35.41"E	1. 3 km NNE	Buffer Zone
SW2	Uppanar River Downstream	11°38'3.57"N 79°44'17.88"E	0.72 km North	
SW3	Pond Near Kodandaramapuram	11°38'43.01"N 79°42'58.73"E	2.21 km West	
SW4	Perumal Lake	11°36'56.06"N 79°42'12.17"E	4.44 km SW	
SW5	Capper Hills Lake	11°43'10.12"N 79°44'45.57"E	8.53 km North	

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

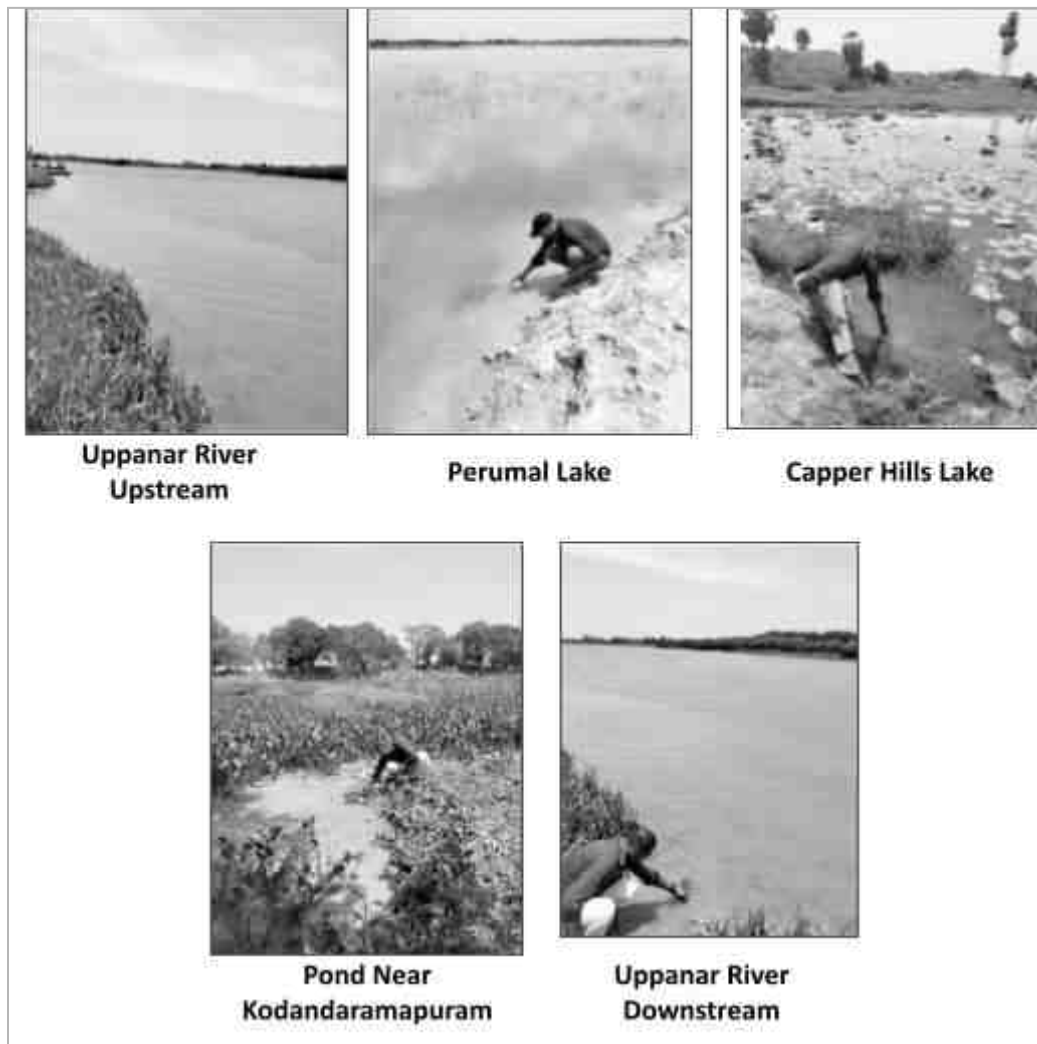


Figure 68. Surface Water Sampling Photographs

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

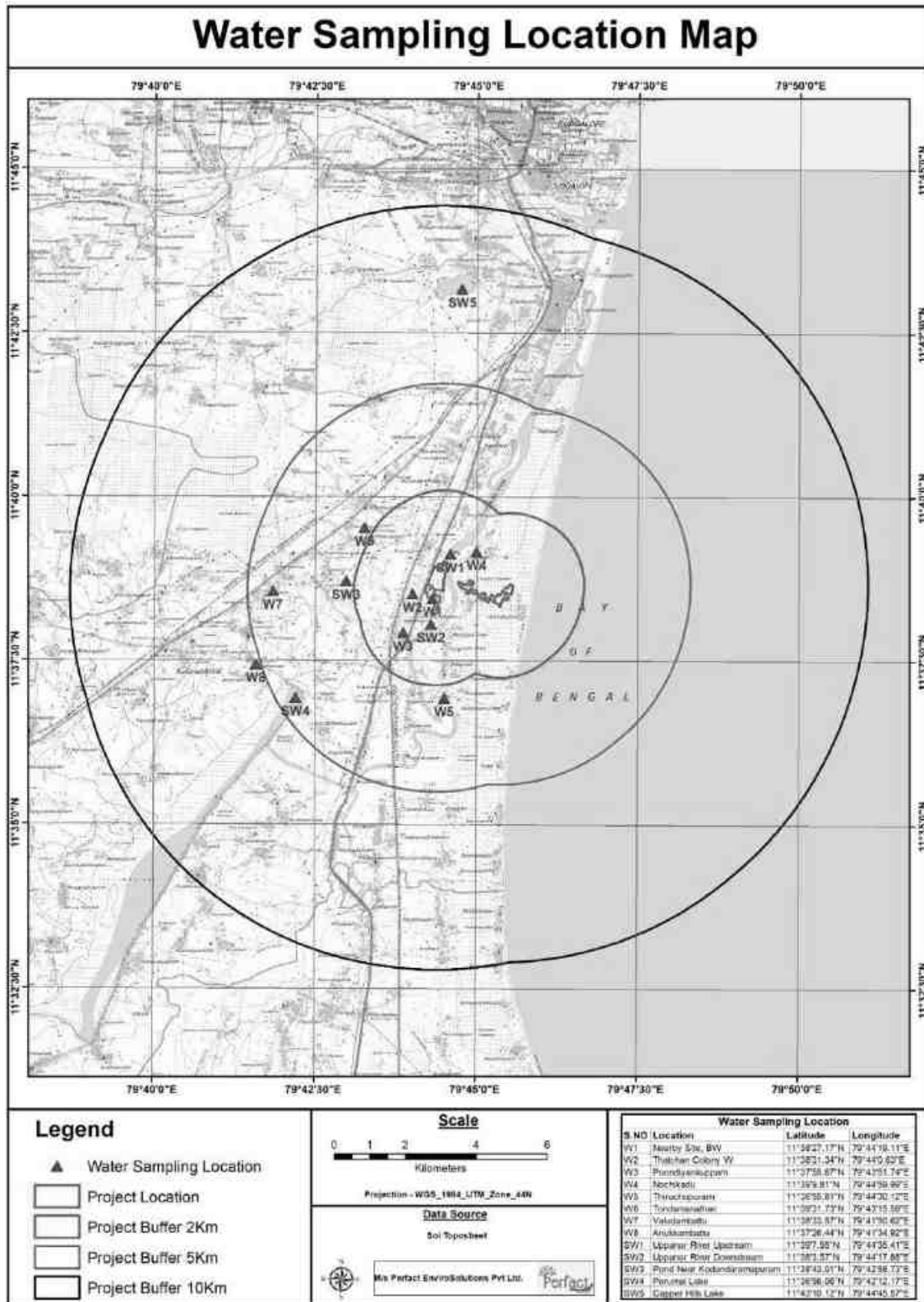


Figure 69. Water Sampling Map

3.8.2. CRITERIA OF SELECTION OF SAMPLING LOCATIONS

Quality Assurance for Sampling

- Water samples were taken as per the Standard Methods (IS & APHA, 23rd Edition 2017).
- Prior to sampling, all the materials (sampling equipment, water collection bottles, storage boxes) were thoroughly cleaned and sterilized in the laboratory.
- Precautions were taken to prevent any contamination while handling the sample bottles, i.e. neither the bottle lip nor the interior surface were touched during sampling.
- Before collecting the sample, the water bottle was rinsed three times by shaking it followed by the water being discarded downstream.
- In the monitoring site, samples were collected upstream with water flowing directly towards the sample collector to avoid any human-caused contamination.
- The samples were collected thrice from each spot and were stored in a cold box. The samples were transported between laboratory and sampling sites within these cold boxes.

3.8.3 SAMPLING FREQUENCY AND SAMPLING TECHNIQUES

As per the standard practice, grab sampling was done for 8 locations, Composite sampling was done for Surface Water locations as per the Standard Methods (IS & APHA, 23rd Edition 2017). Necessary precautions were taken for preservation of samples.

- The physical parameters viz. pH, temperature and conductivity were measured at site using a portable water analyzer.
- Quality assurance during sample analysis:
- The collected samples were transferred to the laboratory and analyzed for the selected water quality parameters.
- All samples were analyzed according to the methods described in the American Public Health Association Standard Method for Water and Wastewater Analysis
- All the chemicals used in the analysis were of analytical grade. Double deionized water (Milli-Q system, Millipore) water was used for analysis purposes throughout the study.
- Both the glassware and the sample containers used for the analysis were thoroughly cleaned and rinsed with double distilled water before analysis.

As evident from the sampling locations for water quality assessment, it represented surface and groundwater.



3.8.4 GROUND WATER QUALITY RESULTS

Table 72. Ground Water Quality Results

Parameters	Unit	IS 10500:2012 (Drinking water standard)	Onsite (Borewell 300ft)	Thatchan colony (Hand Pump 45 ft)	Poondiyankuppam village (Hand Pump 120 ft)	Nochikadu village (Ground Water 300 ft)	Thirachopuram village (Hand Pump 60 ft)	Tondamanathan village (Groundwater 170 ft)	Valudambattu village (Groundwater 230 ft)	Annukampattu village (Groundwater 200 ft)
Colour	Hazen	5.00	<1	<1	<1	<1	<1	<1	<1	<1
Odour	--	Unobjectionable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Turbidity	NTU	5.00	<1	<1	<1	<1	<1	<1	<1	<1
pH Value		6.5-8.5	7.3	7.3	7.0	7.1	7.2	6.6	6.6	7.2
Temperature	°C	—	24.6	24.8	24.6	24.8	25.1	24.5	23.8	25.2
Conductivity	Mmho /cm	—	860.0	1650.0	750.0	1123.0	1954.0	533.0	2485.0	519.0
Total Dissolved Solids	mg/l	500	504.0	1072.5	487.5	800.0	1270.1	346.5	1515.3	337.4
Chloride (as Cl)	mg/l	250	284.0	349.9	189.9	249.9	399.9	150.0	559.8	159.9
Fluoride (as F)	mg/l	1.00	<0.1	0.60	0.30	0.20	0.20	0.20	0.60	0.20
Total Hardness	mg/l	200	310.0	340.0	200.0	420.0	600.0	224.0	400.0	200.0
Calcium (as Ca)	mg/l	75	89.6	97.6	45.6	108.8	152.8	41.2	115.2	49.6
Magnesium (as Mg)	mg/l	30.0	20.9	23.3	20.9	36.0	53.0	23.3	27.2	18.5
Iron (as Fe)	mg/l	0.30	0.30	0.40	0.30	0.60	0.70	0.40	1.40	0.40
Sulphate (as SO ₄)	mg/l	200	21.6	28.3	10.2	74.9	113.6	9.8	127.1	2.0
Nitrate Nitrogen	mg/l	45.0	1.5	20.7	5.6	1.1	2.4	8.7	35.7	35.5
Nitrite Nitrogen	mg/l	—	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Alkalinity	mg/l	200	260.0	280.0	80.0	256.0	360.0	60.0	192.0	44.0
Aluminum (as Al)	mg/l	—	0.010	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron	mg/l	0.5	<0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.1
Phosphate	mg/l	—	<0.01	1.3	<0.01	<0.01	0.9	<0.01	<0.01	<0.01
Sodium (as Na)	mg/l	—	147.2	193.1	61.0	91.2	149.1	35.2	298.2	32.5
Potassium (as K)	mg/l	—	7.7	26.6	4.9	17.6	48.2	2.1	12.0	11.3
Total Chromium	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



Parameters	Unit	IS 10500:2012 (Drinking water standard)	Onsite (Borewell 300ft)	Thatchan colony (Hand Pump 45 ft)	Poondiyankuppam village (Hand Pump 120 ft)	Nochikadu village (Ground Water 300 ft)	Thirachopuram village (Hand Pump 60 ft)	Tondamanathan village (Groundwater 170 ft)	Valudambattu village (Groundwater 230 ft)	Annukampattu village (Groundwater 200 ft)
Nickel (as Ni)	mg/l	0.02	<0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese (as Mn)	mg/l	0.1	BDL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper (as Cu)	mg/l	0.05	BDL	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Mercury (as Hg)	mg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium (as Cd)	mg/l	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (as As)	mg/l	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead (as Pb)	mg/l	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Zinc (as Zn)	mg/l	5	0.26	0.02	0.15	0.38	0.05	0.10	2.45	0.40
Lithium(as Li)	mg/l	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
TSS	mg/l	-	<1	<1	<1	<1	<1	<1	<1	<1

3.8.5 Ground Water Quality Result Interpretation

Core zone: The water quality of the core zone shows that

1. The Total Dissolved Solids (TDS) of the sampling location is 504 mg/l. The TDS of sampling location is within the acceptable limit of 500 mg/l & permissible limit i.e. 2000 mg/l respectively.
2. The Total Hardness of the sampling location is 310 mg/l. The Total Hardness of sampling location is within the acceptable limit of 200 mg/l & permissible limit of 600 mg/l respectively.
3. The Alkalinity of the sampling location is 260 mg/l. The alkalinity of sampling location is within the acceptable limit of 200 mg/l & permissible limit i.e. 600 mg/l respectively.
4. The Chloride Concentration of the sampling location is 284 mg/l. The Chloride concentration of sampling location is within the acceptable limit of 250 mg/l respectively.

Buffer zone: The water quality of the buffer zone shows that

1. The Total Dissolved Solids (TDS) of the sampling locations ranges from 337.4 mg/l to 1515.3 mg/l. The TDS of sampling locations are within the acceptable limit of 500 mg/l & permissible limit i.e. 2000 mg/l respectively.
2. The Total Hardness of the sampling locations ranges from 200 mg/l to 420 mg/l. The Total Hardness of sampling locations are within the acceptable limit of 200 mg/l & permissible limit of 600 mg/l respectively.
3. The Alkalinity of the sampling locations ranges from 44 mg/l to 280 mg/l. The alkalinity of sampling locations are within the acceptable limit of 200 mg/l & permissible limit i.e. 600 mg/l respectively.
4. The Chloride Concentration of the sampling locations ranges from 159.9 mg/l to 559.8 mg/l. The Chloride concentration of sampling locations are within the acceptable limit of 250 mg/l respectively.

Conclusion

- The groundwater quality parameters (buffer zone) are within the IS 10500:2012 (Drinking water standard).

3.8.6 SURFACE WATER QUALITY RESULTS

Table 73. Surface Water Quality Result

Parameters	Unit	IS 10500:2012 (Drinking water standard)	Uppanar River Upstream (Surface water)	Uppanar River Downstream (Surface water)	Pond near kodandarampuram (Surface water)	Perumal lake (Surface water)	Copperhill lake (Surface water)
Colour	Hazen	5.00	<1	<1	<1	<1	<1
Odour	--	Unobjectionable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Turbidity	NTU	5.00	13.6	20.0	2.6	1.3	2.2
pH Value		6.5-8.5	6.4	6.8	6.7	6.5	6.9
Temperature	°C	-	24.6	24.4	24.4	24.2	24.6
Conductivity	µmho/cm	-	30900.0	57300.0	1392.0	886.0	652.0
Total Dissolved Solids	mg/l	500	20085.0	30941.0	904.8	575.9	387.0
Chloride (as Cl)	mg/l	250	11196.5	16395.5	349.9	199.9	152.9
Fluoride (as F)	mg/l	1.00	0.60	0.90	0.30	0.70	0.20
Total Hardness	mg/l	200	5200.0	6100.0	360.0	192.0	208.0
Calcium (as Ca)	mg/l	75	1080.0	1400.0	96.0	49.6	48.8
Magnesium (as Mg)	mg/l	30.0	506.8	631.8	29.2	16.5	13.1
Iron (as Fe)	mg/l	0.30	3.20	3.50	1.10	0.30	3.90
Sulphate (as SO ₄)	mg/l	200	97.2	166.8	4.5	93.6	16.1
Nitrate Nitrogen	mg/l	45.0	5.7	5.2	10.1	2.1	3.8
Nitrite Nitrogen	mg/l	-	0.7	0.1	<0.02	<0.02	<0.02
Alkalinity	mg/l	200	160.0	140.0	244.0	80.0	60.0
Aluminum (as Al)	mg/l	-	0.54	0.24	0.157	<0.003	0.34
Boron	mg/l	0.5	2.4	<0.1	0.1	0.1	0.2
Phosphate	mg/l	-	<0.01	<0.01	1.4	<0.01	<0.01
Sodium (as Na)	mg/l	-	5096.0	7977.0	149.7	112.5	51.8
Potassium (as K)	mg/l	-	202.2	288.3	10.4	1.8	4.5
Total Chromium	mg/l	0.05	BDL	BDL	BDL	BDL	BDL
Nickel (as Ni)	mg/l	0.02	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese (as Mn)	mg/l	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper (as Cu)	mg/l	0.05	<0.02	<0.02	<0.02	<0.02	<0.02
Mercury (as Hg)	mg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium (as Cd)	mg/l	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (as As)	mg/l	-	<0.02	<0.02	<0.02	<0.02	<0.02
Lead (as Pb)	mg/l	0.01	<0.25	<0.25	<0.25	<0.25	<0.25
Zinc (as Zn)	mg/l	5	0.076	0.083	0.065	0.28	0.147
Lithium (as Li)	mg/l	-	<0.015	<0.015	<0.015	<0.015	<0.015
BOD	mg/l	-	33.2	8.8	6.7	2.1	3.3
COD	mg/l	-	120.0	40.0	32.0	8.0	16.0
DO	mg/l	-	4.1	5.2	5.3	5.5	5.3
Ammonical Nitrogen	mg/l	-	0.1	<0.1	0.2	<0.1	<0.1
TSS	mg/l	-	4.2	4.8	1.6	1.6	1.8

Parameters	Unit	IS 10500:2012 (Drinking water standard)	Uppanar River Upstream (Surface water)	Uppanar River Downstream (Surface water)	Pond near kodandarampuram (Surface water)	Perumal lake (Surface water)	Copperhill lake (Surface water)
Total Coliform	MPN	-	1200.0	1220.0	970.0	920.0	970.0

Table 74. Surface Water Designated best Use by CPCB

Designated-Best-Use	Class of Water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	pH between 6.5 and 8.5 Dissolved Oxygen 6 mg/l or more Biochemical Oxygen Demand 5 days 20°C 2 mg/l or less
Outdoor bathing (Organised)	B	pH between 6.5 and 8.5 Dissolved Oxygen 5 mg/l or more Biochemical Oxygen Demand 5 days 20°C 3 mg/l or less
Drinking water source after conventional treatment and disinfection	C	pH between 6 to 9 Dissolved Oxygen 4 mg/l or more Biochemical Oxygen Demand 5 days 20°C 3 mg/l or less
Propagation of Wildlife and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4 mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25°C micro mhos/cm Max.2250 Boron Max. 2 mg/l

(Source: Surface Water quality criteria as per CPCB)

3.8.7 Data Interpretation

Surface water samples were collected from 5 locations namely Uppanar River Upstream, Uppanar River Downstream, Pond Near Kodandaramapuram, Perumal Lake and Capper Hills Lake. As per the samples collected and analyzed from locations SW1, SW2, SW3, SW4 & SW5, surface water quality is meeting the criteria defined by class C as per the CPCB criteria. It is suitable for drinking water after conventional treatment and disinfection.

3.9 LAND ENVIRONMENT

3.9.1 INTRODUCTION

The land use/ land cover map has been generated on 1:50,000 scale using digital classification of imagery. Based on the methodology developed for the present land use/ land cover, categories have been grouped under the following major land use/land cover categories. The data analysis process involves examining the data using various image processing techniques by a digital computer. Its application in the field of environmental management is of great prominence.

Objective

The objectives of Land use studies are:

- To determine the present land use pattern.

Data Used

A. Remote Sensing Data

- LANDSAT-ORI (8)
- Google Earth Image
- ISRO Classification

B. Collateral Data

The study area comprises a 10 km buffer from the periphery of the project site. In this study Topo sheets 58 M/10, & 58 M/14 with 1:50,000 Scale were acquired from Survey of India (SOI).

3.9.2 METHODOLOGY

The methodology applied comes under following steps:

Image Extraction:

Satellite images for the Area of Interest were created through Image processing software.

Geo-Rectification:

Geometric correction includes correction for geometric distortions due to sensor, earth geometry variations and conversion of the data to real world coordinates (e.g. Latitude and Longitude) on the Earth's surface. The satellite imagery was geometrically rectified with reference to the geo-referenced toposheets and vector data.

Image Enhancement:

Image enhancement is one of the important image processing functions primarily done to improve the appearance of the imagery to assist in visual interpretation and analysis. Various options of image enhancement techniques were tried out to get the best image for visual interpretation. Histogram equalized stretch enhancement techniques were applied to the imagery of the study area for better interpretation of different features in the satellite imagery.

Interpretation Of Satellite Image

Visual interpretation techniques have been used for digitization of geographical features for different land use and vegetation cover classes based on spatial patterns of geographic features. Spectral signatures represent various land use classes. Image interpretation keys are developed based on image characteristics like color, tone, size, shape, texture, pattern, shadow, association etc, which enables interpretation of satellite images for ground features. Statistics of geographic features have been developed for impact assessment due to project activity.

After the above process the final LULC map has been prepared. The Flow chart of the methodology is given below:

Flow Chart for Methodology of LULC Map Preparation

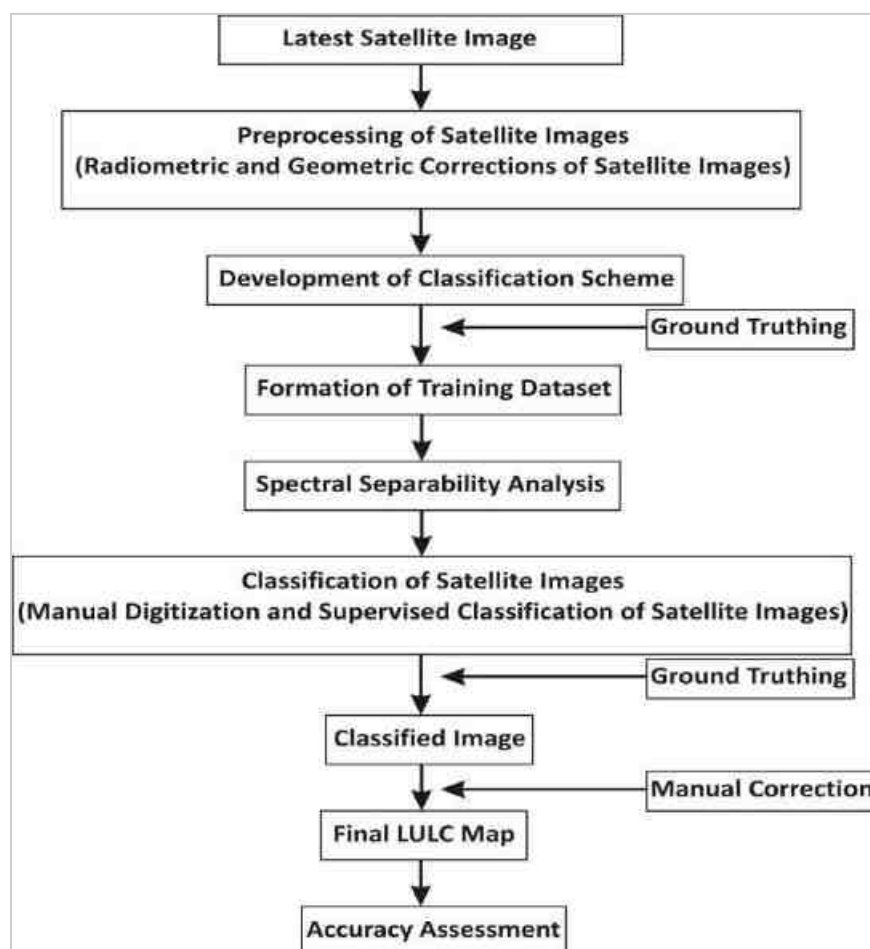


Figure 70. Methodology of LULC Map

Pre-field Interpretation of Satellite Data

False color images are a representation of a multi-spectral image produced using bands other than visible red, green and blue as the red, green and blue components of an image display. The False Colour Composite (FCC) of LANDSAT satellite imagery having 30m spatial resolution satellite data and SOI toposheet at 1:50,000 scale was used for pre-field interpretation work. Taking the help of toposheets and by using the image elements, the features were identified. Each feature was identified on image by their image elements like tone, texture, color, shape, size, pattern and association. A tentative legend in terms of land cover and land use was formulated. The sample area for field check is selected covering all the land use/land cover feature cum image characteristics.

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



Figure 71. FCC Map

RESULTS AND CONCLUSIONS:

After the above process, the final LULC map has been prepared & the land use/ land cover map has been generated on a 1:50,000 scale using digital classification of Imagery. Based on the methodology developed for the present land use/ land cover, categories have been grouped under the following major land use/land cover categories.

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

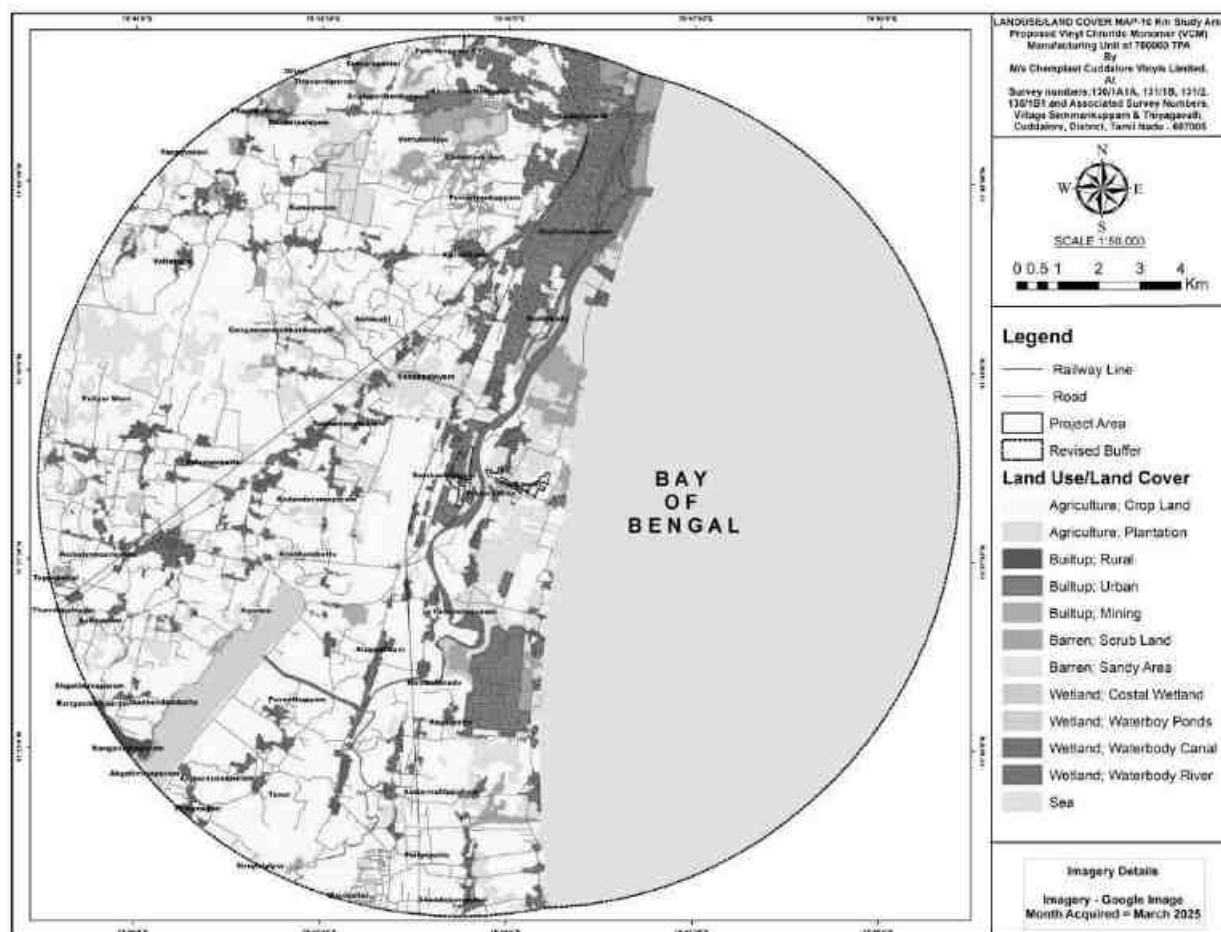


Figure 72. Landuse/Land Cover Map

Table 75. Major land use/land cover categories of study area (10 Km Radius Buffer zone)

S. No.	Category		Area in Sqm	Area In Ha	Percentage
	Label-I	Label-II			
1	Agriculture Land (45.48%)	Agriculture; Crop Land	144.3529	14435.3	37.88%
		Agriculture; Plantation	28.97466	2897.5	7.60%
2	Builtup Land (9.87%)	Builtup; Rural	18.14301	1814.3	4.76%
		Builtup; Urban	18.54001	1854.0	4.87%
		Builtup; Mining	0.924812	92.5	0.24%
3	Barren Land (3.82%)	Barren; Sandy Area	5.298452	529.8	1.39%
		Barren; Scrub Land	9.272165	927.2	2.43%
4	Wet Land (40.82%)	Wetland; Coastal Wetland	0.804088	80.4	0.21%
		Wetland; Waterbody Ponds	6.295696	629.6	1.65%
		Wetland; Waterbody Canal	0.228378	22.8	0.06%
		Wetland; Waterbody River	4.964802	496.5	1.30%
		Sea	143.2818	14328.2	37.60%
	Total		381.0808	38108.1	100.00%

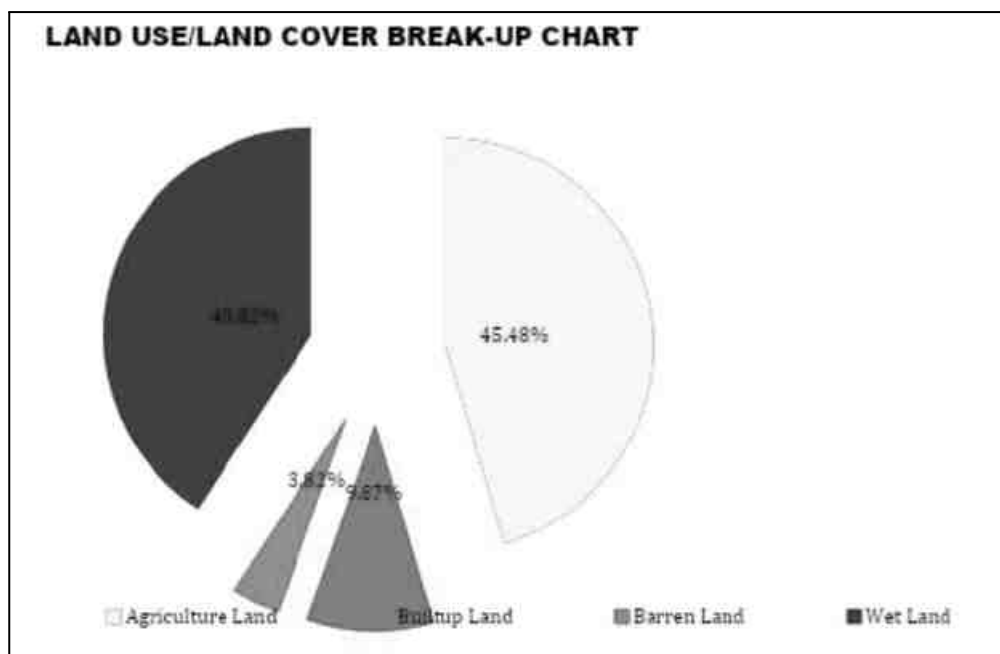


Figure 73. Land Use/ Land Cover Breakup Chart

- Agriculture Land:**

Based on analyzed imagery and ground truth, Crop land area extents have been extracted. The Agricultural Land area is about 17332.8 hectares which is 45.48 percent of the total 10 km radius study area.

- Built up Land:**

Based on analysis of imagery, using GIS and ground truth the total built up area is about 3760.8 hectares which is 9.87 percent of the total study area.

- **Waste/Barren Land:**

The Barren Land area occupies around 1457.1 ha which is 3.82 percent of the study area.

- **Wet Land-Water Bodies:**

Based on satellite data and ground truth, the total area covered by the inland wetland, river and water bodies is 15557.5 hectares which is 40.82 percent of the total study area.

3.10 SOIL QUALITY

3.10.1 SOIL

The major soil types of the Cuddalore district are sandy soil, Black soil, Red & Laterite soil.

3.10.2 SAMPLING LOCATION

Table 76. Onsite & Offsite Soil Sampling Location

S. No.	Sampling Locations	Latitude & Longitude	Distance and direction from site	Environmental Significance
S1	Onsite	11°38'27.81"N 79°44'15.28"E	Onsite	Core Zone
S2	Thatchan Colony	11°38'31.34"N 79°44'0.63"E	0.32 km West	Buffer Zone
S3	Poondiyankuppam	11°37'55.67"N 79°43'51.74"E	0.93 km SW	
S4	Nochikadu	11°39'9.81"N 79°44'59.99"E	1.71 km NE	
S5	Thiruchopuram	11°39'9.81"N 79°44'59.99"E	2.32 km South	
S6	Tondamanathan	11°39'31.73"N 79°43'15.59"E	2.46 km NW	
S7	Valudambattu	11°38'33.57"N 79°41'50.62"E	4.28km West	
S8	Anukkambattu	11°37'26.44"N 79°41'34.92"E	5.28 km SW	

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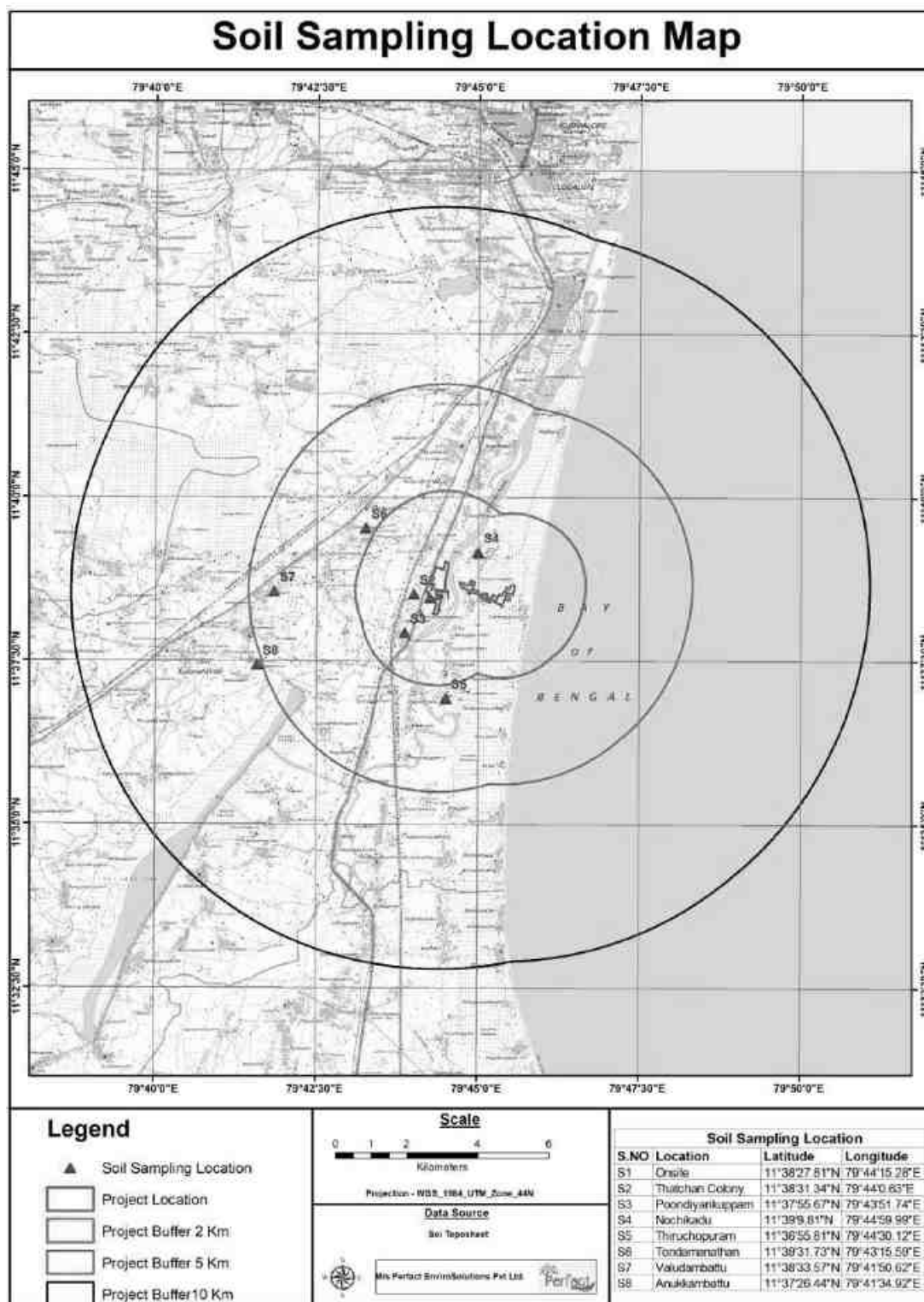


Figure 74. Soil Sampling Map

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 7 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

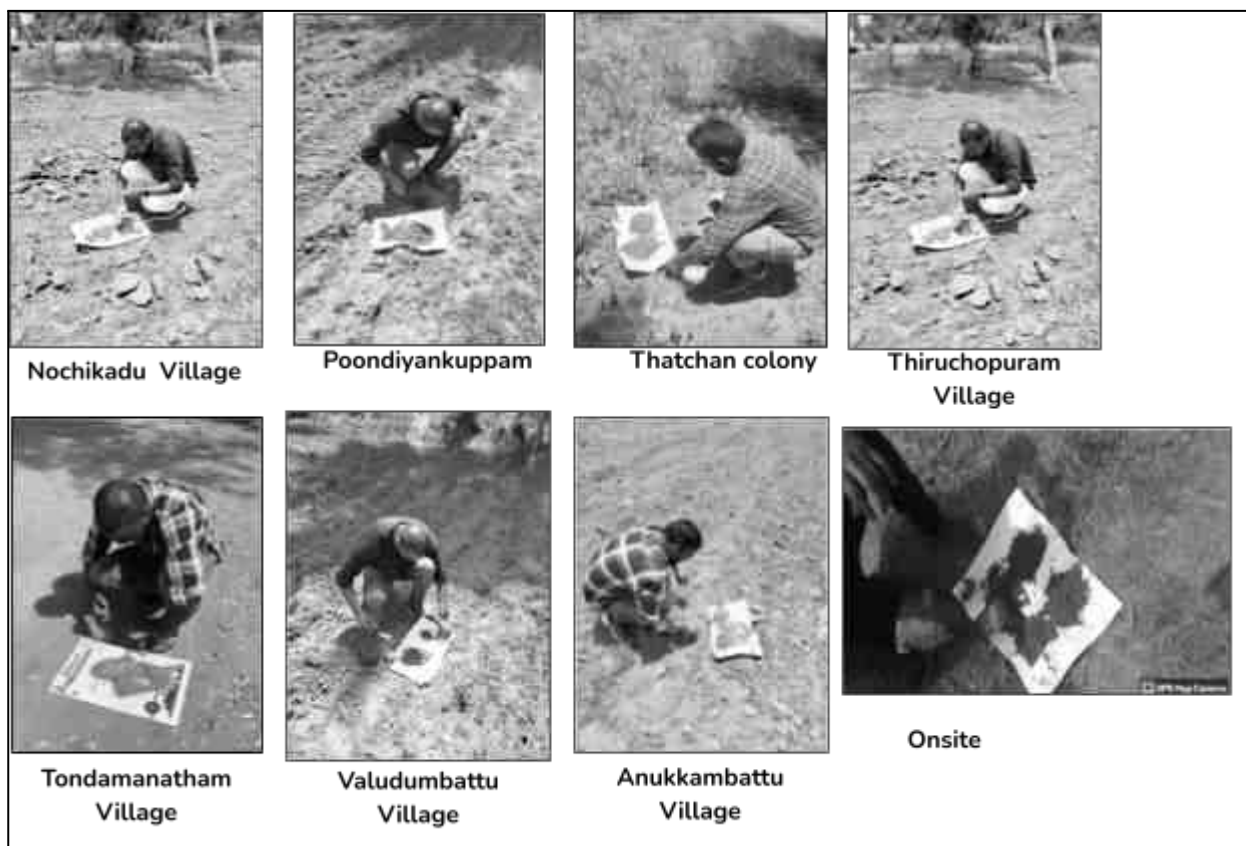


Figure 75. Soil Sampling Photographs

3.10.3 SAMPLING PROCEDURE AND ANALYSIS

Augur method was used and samples were collected at 15 cm depth after removing the upper crust. Samples from each spot were well mixed with hand on a clean polythene sheet. About 1 kg of soil was retained after the quartering process. This sample was kept for some time for air-drying at room temperature, stored in a polythene bag with a label at the top. Soil Quality Results are summarized below on the next page.



3.10.4. PHYSICAL & CHEMICAL PROPERTIES OF SOIL

Table 77. Physical & Chemical Properties of Soil

Land Type		Vacant Land	Agriculture Land	Agriculture Land	Agriculture Land	Agriculture Land	Agriculture Land	Agriculture Land	Agriculture Land
PARAMETER	UNITS	Onsite CCVL	Thatchan Colony	Pondiyankuppam Vill.	Nochikadu Village	Thiruchopuram Vill.	Tondamanutham Vill.	Valudambattu	Anukambattu Vill.
Physical Characteristics									
Color	-	5/3 Dull Reddish Brown	4/6 Reddish Brown	4/6 Reddish Brown	4/6 Brown	5/3 Dull Reddish Brown	4/6 Brown	5/2 Grayish Brown	3/4 Brown
Texture	Sand %	55.2	50.0	55.2	52.9	54.8	55.7	37.5	35.5
	Silt %	34.9	44.2	34.9	33.9	34.9	42.3	48.3	46.9
	Clay %	9.8	5.7	9.8	13.1	10.2	1.9	14.1	17.5
Texture Class	-	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Loam	Loam
Moisture content	%	2.1	0.7	2.1	0.9	0.5	0.9	1.8	1.9
Electric Conductivity	µS/cm	65.3	90.8	68.3	277.3	192.5	243.6	212.9	127.6
Bulk density	g/cc	1.43	1.65	1.60	1.51	1.49	1.43	1.39	1.35
Porosity	%	27.6	29.6	30.2	26.6	25.8	27.4	28.6	29.4
Chemical Characteristics									
pH	-	7.24	6.54	6.16	7.34	6.91	7.01	6.23	6.72
Organic Matter	%	0.39	0.74	0.56	0.53	1.05	0.74	0.21	0.95
Available Nitrogen	mg/kg	64.6	78.6	62.8	66.8	99.4	80.2	54.6	96.4
Available Calcium	mg/kg	66.2	53.9	62.2	64.9	68.2	74.6	46.7	51.8
Available Magnesium	mg/kg	48.4	51.2	48.4	57.2	46.2	47.3	46.2	41.6
Available Potassium	mg/kg	20.9	29.8	20.9	28.2	25.3	24.9	23.9	22.3
Nitrate Nitrogen	mg/kg	36.4	42.8	36.4	36.4	56.6	42.2	28.2	54.2
Available Phosphorus	mg/kg	4.6	5.4	7.2	7.2	6.8	6.4	8.8	7.2
Chloride	mg/kg	35.5	44.4	35.5	97.6	62.1	88.8	88.8	44.4
Cation Exchange Capacity	meq/100gm	14.2	13.5	14.3	15.9	15.1	12.6	15.7	16.8
Available Sulphur	mg/kg	6.04	5.62	6.04	5.03	5.33	6.46	5.25	3.60
Available Sodium	mg/kg	33.7	39.2	33.7	64.7	51.3	76.8	65.8	48.1
Bicarbonate	mg/kg	85.4	61.0	48.8	109.8	85.4	85.4	48.8	73.2
SAR	%	4.5	5.4	4.5	8.3	6.8	9.8	9.7	7.0
WHC	-	38.0	39.0	36.0	37.0	36.0	35.0	41.0	42.0

Table 78. Fertility of soil at onsite

Parameters	Low mg/kg (0-15 cm)	Medium mg/kg (0-15 cm)	High mg/kg (0-15 cm)
Nitrogen	54.6	75.4	99.4
Potassium	20.9	24.5	29.8
Phosphorus	4.6	6.7	8.8

3.10.5. DATA INTERPRETATION

Core Zone : After analyzing the samples collected from the site, it shows that the soil texture is 5/3 Dull Reddish Brown, pH is 7.24 .Amount of primary nutrients like Organic matter is 0.39 %, the available nitrogen 64.6 mg/kg is low to medium and available Potassium 20.9 mg/kg is medium to high & the available Phosphorus 4.6 mg/kg is medium to high range.

The overall fertility of this soil would be considered moderate to low. While the phosphorus levels are adequate, the low levels of organic matter, nitrogen, and potassium suggest that the soil may need amendments, particularly organic matter and fertilizers, to improve fertility.

Buffer Zone: 4/6 Reddish Brown, pH ranges from 6.16 to 7.34, Amount of primary nutrients like Organic matter 0.21 to 1.05 %, the Available Nitrogen 54.6 to 99.4 mg/kg is low to high range, the Available Phosphorus 5.4 to 8.8 mg/kg is low to high range, Available Potassium 20.9 to 29.8 mg/kg is low to high range.

The overall fertility of this soil would be considered moderate. The soil has good potential due to its clay loam texture and relatively neutral pH, but the fertility is limited by low to medium levels of organic matter, nitrogen, and potassium.

3.11 BIOLOGICAL ENVIRONMENT

The ecological systems within and around the proposed project site for the backward integration and expansion of the existing SPVC plant by M/s Chemplast Sanmar at Cuddalore, encompass a range of interconnected natural components—including vegetation, faunal populations, soil microorganisms, and abiotic factors—that together sustain local ecosystem functionality. Situated in Semmankuppam and Thiyagavalli villages, Cuddalore District, Tamil Nadu, the project area falls within a coastal agro-climatic zone characterized by high humidity, tropical temperatures, seasonal monsoon rains, and saline influences. These environmental conditions play a significant role in shaping the distribution, behavior, and resilience of local biodiversity. The expansion—from a current production capacity of 6.0 LTPA SPVC to include 7.5 LTPA of VCM, along with an increase in plot area from 25.1862 ha to 62.4674 ha through addition of abutting land parcels—necessitates a detailed ecological appraisal to evaluate the implications of increased industrial activity and land use change. The surrounding landscape includes a mix of developed industrial plots, residual natural habitats, and scattered patches of agricultural and scrub lands, interspersed with seasonal water bodies.

According to the National Bureau of Soil Survey and Land Use Planning (ICAR), the region's predominant soils are sandy loam and alluvial in nature, moderately suited for supporting both agriculture and native vegetation. However, the area's ecological integrity is vulnerable to

cumulative stressors such as industrial emissions, effluent discharge, habitat fragmentation, and anthropogenic pressures. These can disrupt ecosystem processes and diminish biodiversity if not effectively managed. Therefore, conducting a thorough assessment of the region's flora, fauna, habitat connectivity, and ecological linkages—especially within a 10 km study radius—is crucial for aligning the project with regional conservation goals and statutory environmental norms. A science-based understanding of the local ecological context will help integrate environmentally sustainable practices into project design and operations, thereby minimizing ecological impacts, conserving biodiversity, and promoting long-term environmental stewardship.

Forest Type and Dominant Flora and Fauna Species in Cuddalore district, Tamil Nadu

During the brief coastal and estuarine stretches of Cuddalore district, Tropical Dry Evergreen Forests (TDEF) persist in small, fragmented segments—often conserved in sacred groves—where a diverse array of medicinal and woody plants thrive under anthropogenic protection. In the district's prominent Pichavaram mangrove ecosystem, which lies between the Vellar and Coleroon estuaries, the vegetation is dominated by mangrove species such as *Rhizophora*, adapted to brackish, tidal environments; this ecosystem supports exceptionally rich biodiversity, including bird species, mammals, multiple amphibians, fishes, butterflies, zooplankton, and several snakes. Stretching across coastal wetlands, these mangroves play a critical bio-shield role, stabilizing shorelines and buffering against erosion and wave impacts. On the broader state level, Cuddalore leads Tamil Nadu in carbon storage per hectare in mangrove areas, highlighting the ecological importance of these forests.

3.11.1 Objective

The objective of this study is in accordance with the Terms of Reference (ToR), primarily concentrating on a detailed inventory of the species (flora and fauna) identified in the mining lease expanse and in the vicinity encompassing a 10 km radius. As such, the key objectives involve assessing the ecological health of the existing flora and fauna and their habitats, creating foundational data, and evaluating potential project induced impacts on the biological environment.

Terrestrial and Arboreal Ecology and Biodiversity

- Scrutinization the key characteristics of the vegetation, with an emphasis on the various types of natural forests, the most frequently encountered and dominant floral species, their foliage retention patterns, associated families, the occurrence of man-made plantations, Exotic plant species, and any indications of habitat deterioration in the area of interest.
- One of the objectives against the current study entails recognizing the prevailing habitat and land cover categories within the study region, such as forests, wetlands, agricultural areas, and urban development *etc.*
- Evaluation of the crop-diversity of the study area, along with an assessment allied to the native plant species with commercial and ethnomedicinal values.

- Identification of the susceptible plant and animal species in respect to their long-term survivability on the basis of IUCN Red Data List.
- Identification of the Schedule I species (as per WLPA, 1972 and the amendments thereafter).
- Studying the dietary and habitat preference of the animal species found.

Aquatic Ecology and Biodiversity

- Identification of aquatic species including macrophytes, and fish species.
- This study focuses on identifying aquatic species that are susceptible to threats, evaluating their long-term viability according to the IUCN Red Data List and the Wildlife Protection Act of 1972, including its amendments afterward.

3.11.2 Cropping Pattern

During the baseline environmental monitoring season from February 2024 to April 2024 in Cuddalore district, Tamil Nadu, agriculture reflected the district's mixed crop-livestock farming system and favourable coastal agro-climatic conditions. Groundnut was the predominant seasonal crop, typically sown in February or March and harvested by April or May, valued for its oil yield and adaptability to rainfed areas. Maize, increasingly preferred for its short growth duration, was also planted during February–March and harvested by April–May. Pulses such as black gram and green gram were frequently intercropped with cereals, enhancing soil fertility through nitrogen fixation, with harvesting carried out in April and May. Oilseeds like sesame (gingelly), though grown on a smaller scale, were sown in February and harvested by May. In areas with assured irrigation, vegetables including brinjal, tomato, and chilli were cultivated, with planting starting in February–March and harvesting completed by April–May. Millets such as cumbu and ragi formed part of the cropping mix in certain pockets, following a similar sowing and harvesting schedule. While cashew and sugarcane remained important cash crops in the district, their perennial or long-duration nature meant they were not part of the short-season Feb–Apr harvest cycle. This diverse pattern was shaped by the district's coastal climate, varied soil types, and irrigation availability, ensuring both subsistence and commercial crop production during the season.

3.11.3 Methodology

o Baseline survey Period

Feb 2024 to April 2024

o Expanse of Study Area

314.16 square kilometers ($\pi r^2 = \pi \cdot 10^2 \approx 314.16$).

o Survey Approach

The primary and secondary survey that included the core zone as well as a buffer zone that extended 10 km surrounding the core zone was used to assess the biological variety of the area. Primary and secondary surveys were the main focus of the survey methodology. The adjacent land and water regions were taken into account for the assessments associated with natural vegetation. The process used for establishing a thorough inventory of the study area's floral variety and habitat categories using original observations and secondary data. Furthermore, the local population's traditional ecological knowledge supported these findings.

Investigations toward fauna species were carried out in day time (considering both direct and Indirect survey) usually by visual encounters and tracking animal calls, footprints, excreta evidence, scents of particular animals, etc., in order to gather ground truthing. A comprehensive listing of the study area's animal species was created by gathering primary and secondary records. Understanding the existing faunal life in the study region is additionally significantly helped by the insights offered by the locals. To improve and streamline the process of identifying different species, the surveys included photographic evidence. Consequently, the following is a summary of the environmental indicators associated with biological factors for the current course of action:

- Species composition of flora and fauna.
- Flora: Species diversity, predominant floral species, economic significance, and commercial values.
- Fauna: Species diversity, their feeding habit, migratory habits of avifauna species, etc.

Primary Survey:

A conscious effort was made to clearly note the variety of plant species, including aquatic flora, during the field study, with a focus on the most common species and their habitats. Through visual observations, the existence of animal species, including birds, reptiles, and mammals, was carefully assessed. The information that locals in the study region supplied was essential for guiding current projects. Fish markets have become important informational resources for the diversity of fish and other aquatic creatures found there.

Understanding the distinctive characteristics of animals in a particular area requires a significant investment of time and effort. In addition to collecting direct observations of species, ecological studies often documented indirect evidence of their presence, such as animal odors, footprints, droppings, and vocalizations. Furthermore, the confirmation of the existence of wildlife was made easier by talking to locals, who shared insightful information and mentioned how frequently animals interacted in the survey region.

The early morning hours of 7:00 to 9:00 am and the late afternoon hours of 3:30 to 5:00 pm were set aside for the avifauna survey. During the day, surveys of animals, amphibians, reptiles, and vegetation were carried out, along with from 9:00 am to 4:00 pm, butterflies were observed. A comprehensive survey of the bird species was carefully documented at each sample location,

resulting in the creation of an extensive list. Binoculars and reputable field guides made it easier to identify different kinds of birds, guaranteeing precise species identification. Fishermen, fish markets, and other similar sources were the only sources of the primary aquatic data.

Secondary Survey:

Many secondary sources, including books, research projects, and research papers, have provided support for the data and conclusions drawn from the primary survey. Additionally, the Divisional Forest Officer's verified list of plants and animals for the present project serves as a valuable additional source of information.

Species Inventorization:

After merging primary data with information from desktop analysis, the biological diversity record of the study region for the current project was finally acquired and completed.

3.11.3 Flora of the study area:

A primary and secondary floral study was conducted to record the floral species and their composition in the study area. The table below provides details of the existing flora in the study area.

Table 79. Flora in Study Area

S. NO.	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	FOLIAGE TYPE	IUCN STATUS
HABIT: TREE						
1.	<i>Peltophorum pterocarpum</i>	Yellow Flame Tree	Caesalpiniaceae	Native	Deciduous	LC
2.	<i>Mangifera indica</i>	Mango	Anacardiaceae	Native	Evergreen	DD
3.	<i>Polyalthia longifolia</i>	Ashoka Tree	Annonaceae	Native	Evergreen	LC
4.	<i>Casuarina equisetifolia</i>	Whistling Pine	Casuarinaceae	Exotic	Evergreen	LC
5.	<i>Calophyllum inophyllum</i>	Beauty Leaf	Clusiaceae	Native	Evergreen	LC
6.	<i>Cassia fistula</i>	Golden Shower Tree	Caesalpiniaceae	Native	Deciduous	LC
7.	<i>Cassia siamea</i>	Kassod tree	Caesalpiniaceae	Exotic	Deciduous	LC
8.	<i>Delonix regia</i>	Gulmohar	Caesalpiniaceae	Exotic	Deciduous	LC
9.	<i>Lannea coromandelica</i>	Indian Ash Tree	Anacardiaceae	Native	Deciduous	LC
10.	<i>Crateva magna</i>	Sacred Garlic Pear	Capparaceae	Native	Deciduous	-
12.	<i>Terminalia catappa</i>	Sea Almond	Combretaceae	Exotic	Deciduous	LC
13.	<i>Cordia sebestena</i>	Geiger Tree	Cordiaceae	Exotic	Evergreen	LC
14.	<i>Phyllanthus emblica</i>	Amla	Euphorbiaceae	Native	Deciduous	LC
15.	<i>Dalbergia sissoo</i>	Shisham	Fabaceae	Native	Deciduous	LC
16.	<i>Pongamia pinnata</i>	Karanja	Fabaceae	Native	Evergreen	LC
17.	<i>Sesbania grandiflora</i>	Agati	Fabaceae	Native	Deciduous	DD
18.	<i>Thespesia populnea</i>	Indian Tulip Tree	Malvaceae	Native	Evergreen	LC
19.	<i>Azadirachta indica</i>	Neem Tree	Meliaceae	Native	Evergreen	LC
20.	<i>Melia azedarach</i>	Chinaberry Tree	Meliaceae	Native	Deciduous	LC

S. NO.	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	FOLIAGE TYPE	IUCN STATUS
21.	<i>Acacia auriculiformis</i>	Earleaf Acacia	Mimosaceae	Exotic	Evergreen	LC
22.	<i>Adenanthera microsperma</i>	Bead Tree	Mimosaceae	Native	Deciduous	LC
23.	<i>Albizia lebbeck</i>	Siris Tree	Mimosaceae	Native	Deciduous	LC
24.	<i>Albizia saman</i>	Rain Tree	Mimosaceae	Exotic	Evergreen	-
25.	<i>Ficus hispida</i>	Hairy Fig	Moraceae	Native	Evergreen	LC
26.	<i>Ficus religiosa</i>	Peepal Tree	Moraceae	Native	Semi-evergreen	LC
27.	<i>Moringa pterygosperma</i>	Moringa	Moringaceae	Native	Deciduous	LC
28.	<i>Eucalyptus tereticornis</i>	Mysore Gum	Myrtaceae	Exotic	Evergreen	NT
29.	<i>Syzygium cumini</i>	Jamun	Myrtaceae	Native	Evergreen	LC
30.	<i>Ziziphus mauritiana</i>	Ber	Rhamnaceae	Native	Deciduous	LC
31.	<i>Morinda ferruginea</i>	Indian Mulberry	Rubiaceae	Native	Evergreen	-
32.	<i>Aegle marmelos</i>	Bael Tree	Rutaceae	Native	Deciduous	NT
33.	<i>Tectona grandis</i>	Teak Tree	Verbenaceae	Native	Deciduous	EN
34.	<i>Dichrostachys cinerea</i>	Sickle Bush	Mimosaceae	Native	Deciduous	LC
35.	<i>Leucaena latisiliqua</i>	White Lead Tree	Mimosaceae	Exotic	Evergreen	-
36.	<i>Prosopis cineraria</i>	Khejri Tree	Mimosaceae	Native	Evergreen	-
HABIT: Shrubs						
1.	<i>Justicia adhatoda</i>	Malabar Nut	Acanthaceae	Native	Evergreen	LC
2.	<i>Tabernaemontana divaricata</i>	Pinwheel Flower	Apocynaceae	Native	Evergreen	LC
3.	<i>Parthenium hysterophorus</i>	Carrot Grass	Asteraceae	Exotic	-	-
4.	<i>Calotropis gigantea</i>	Crown Flower	Asclepiadaceae	Native	Evergreen	-
5.	<i>Tecoma stans</i>	Yellow Elder	Bignoniaceae	Exotic	Semi-evergreen	LC
6.	<i>Commiphora berryi</i>	Indian Myrrh	Burseraceae	Native	Deciduous	LC
7.	<i>Opuntia stricta</i>	Prickly Pear Cactus	Cactaceae	Exotic	Evergreen	LC
8.	<i>Cassia alata</i>	Ringworm Bush	Caesalpiniaceae	Exotic	Deciduous	LC
9.	<i>Suaeda maritima</i>	Sea-blite	Chenopodiaceae	Native	-	-
10.	<i>Ipomoea carnea</i>	Bush Morning Glory	Convolvulaceae	Exotic	Evergreen	-
11.	<i>Jatropha gossypifolia</i>	Bellyache Bush	Euphorbiaceae	Exotic	Deciduous/ Evergreen	LC
12.	<i>Phyllanthus reticulatus</i>	Black-Honey Shrub	Euphorbiaceae	Native	Deciduous	LC
13.	<i>Ricinus communis</i>	Castor Oil Plant	Euphorbiaceae	Native	Evergreen	LC
14.	<i>Gliricidia sepium</i>	Quickstick	Fabaceae	Exotic	Deciduous	LC
15.	<i>Lawsonia inermis</i>	Henna	Lythraceae	Native	Evergreen	LC
17.	<i>Pavetta indica</i>	Indian Pavetta	Rubiaceae	Native	Evergreen	LC
18.	<i>Murraya koenigii</i>	Curry Leaf Plant	Rutaceae	Native	Evergreen	LC
20.	<i>Solanum torvum</i>	Devil's Fig	Solanaceae	Native	Evergreen	-
21.	<i>Clerodendrum inerme</i>	Glory Bower	Verbenaceae	Native	Evergreen	-

Table 80. List of Floral Species of the Study Area other than Trees and Shrubs

S. NO.	BOTANICAL NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS
Category: Herbs					
1.	<i>Ruellia tuberosa</i>	Minnie Root	Acanthaceae	Exotic	-
2.	<i>Achyranthes aspera</i>	Prickly Chaff Flower	Amaranthaceae	Native	-
4.	<i>Nothosaerva brachiata</i>	Salt Marsh Plan	Amaranthaceae	Native	-
5.	<i>Crinum asiaticum</i>	Giant Crinum Lily	Amaryllidaceae	Native	-
6.	<i>Catharanthus roseus</i>	Madagascar Periwinkle	Apocynaceae	Exotic	-
7.	<i>Aponogeton natans</i>	Floating Aponogeton	Aponogetonaceae	Native	LC
8.	<i>Colocasia esculenta</i>	Taro	Araceae	Native	LC
9.	<i>Blumea bifoliata</i>	Guest tree	Asteraceae	Exotic	-
10.	<i>Blumea obliqua</i>	Makadmari	Asteraceae	Native	-
11.	<i>Emilia sonchifolia</i>	Lilac Tasselflower	Asteraceae	Native	-
12.	<i>Sphaeranthus indicus</i>	East Indian Globe Thistle	Asteraceae	Native	LC
13.	<i>Vernonia cinerea</i>	Little Ironweed	Asteraceae	Native	-
14.	<i>Trichodesma indicum</i>	Camel Bush	Boraginaceae	Native	-
15.	<i>Canna indica</i>	Canna Lily	Cannaceae	Exotic	-
16.	<i>Salicornia brachiata</i>	Glasswort	Chenopodiaceae	Native	-
19.	<i>Arivela viscosa</i>	Wild Mustard	Cleomaceae	Native	-
21.	<i>Acalypha lanceolata</i>	Copperleaf	Euphorbiaceae	Native	-
22.	<i>Phyllanthus debilis</i>	Niruri	Euphorbiaceae	Native	-
23.	<i>Phyllanthus simplex</i>	Simple Leaf Chanca Piedra	Euphorbiaceae	Native	-
27.	<i>Aeschynomene indica</i>	Indian Jointvetch	Fabaceae	Native	LC
28.	<i>Ocimum basilicum</i>	Sweet Basil	Lamiaceae	Native	-
29.	<i>Leucas aspera</i>	Common Leucas	Lamiaceae	Native	-
30.	<i>Polygonum glabrum</i>	Knotweed	Polygonaceae	Native	LC
34.	<i>Scoparia dulcis</i>	Licorice Weed	Scrophulariaceae	Exotic	-
Category: Palm					
1.	<i>Cocos nucifera</i>	Coconut Palm	Arecaceae	Exotic	-
2.	<i>Phoenix sylvestris</i>	Wild Date Palm	Arecaceae	Native	-
3.	<i>Phoenix pusilla</i>	Dwarf Date Palm	Arecaceae	Native	-
4.	<i>Borassus flabellifer</i>	Palmyra Palm	Arecaceae	Native	LC

NE: Not evaluated, DD: Data deficient, LC: Least Concern, VU: Vulnerable, NT: Near Threatened, EN: Endangered, CR: Critically Endangered.

Fauna of the Study area :

A comprehensive study of the local fauna within the study area was conducted through both primary and secondary surveys, with a focus on birds, mammals, and herpetofauna. Given that the study was limited to a single season and data was extensive, secondary sources were also utilized to enhance our ecological biodiversity assessment. This included an extensive review of existing literature, such as research papers, recent articles, dissertations, topographical maps, and textbooks, to identify critical corridors and the presence of any endangered species near the

project buffer zone.

Table 81. List of the Mammals in the Study Area

S. NO.	ZOOLOGICAL NAME	COMMON NAME	FAMILY	FOOD HABIT	SCHEDULE (WLPA, 2022)	IUCN STATUS
1	<i>Sus scrofa</i>	Wild Pig	Suidae	O	II	LC
2	<i>Funambulus pennantii</i>	Five-striped Squirrel	Sciuridae	O	-	LC
3	<i>Felis chaus</i>	Jungle Cat	Felidae	C	I	LC
4	<i>Urva edwardsii</i>	Indian Grey Mongoose	Herpestidae	O	I	LC
5	<i>Macaca mulatta</i>	Rhesus Macaque	Cercopithecidae	O	-	LC
6	<i>Canis aureus</i>	Jackal	Canidae	O	I	LC
7	<i>Hystrix indica</i>	Porcupine	Hystriidae	H	I	LC
H: Herbivore, C: Carnivore, O: Omnivore.						
NE: Not evaluated, LC: Least Concern, VU: Vulnerable, NT: Near Threatened, EN: Endangered, CR: Critically Endangered.						

Table 82. List of the Herpetofauna in the Study Area

S. NO.	ZOOLOGICAL NAME	COMMON NAME	FAMILY	FOOD HABIT	SCHEDULE (WLPA, 2022)	IUCN STATUS
Category: Amphibians						
1	<i>Duttaphrynus melanostictus</i>	Common Indian Toad	Bufoinae	C	-	LC
2	<i>Euphlyctis cyanophlyctis</i>	Skittering Frog	Dicroglossidae	C	II	LC
Category: Reptiles						
1.	<i>Hemidactylus brookii</i>	Spotted Indian House Gecko	Gekkonidae	C	-	LC
2.	<i>Hemidactylus flaviviridis</i>	Yellow Bellied House Gecko	Gekkonidae	C	-	LC
3.	<i>Calotes versicolor</i>	Indian Garden Lizard	Agamidae	C	-	LC
4.	<i>Ptyas mucosa</i>	Indian Rat Snake	Colubridae	C	I	LC
5.	<i>Fowlea piscator</i>	Checkered Keelback Water Snake	Colubridae	C	I	LC
6.	<i>Naja naja</i>	Indian Cobra	Elapidae	C	I	LC
O- Omnivorous, H- Herbivorous, C- Carnivorous Data Deficient (DD) • Least Concern (LC) • Near Threatened (NT) • Vulnerable (VU) • Endangered (EN)						

Table 83. List of Avifauna Species of the Study Area

S. NO.	COMMON NAME	SCIENTIFIC NAME	FAMILY	FOOD HABIT	IUCN STATUS	SCHEDULE (WLPA, 2022)
1.	Asian Paradise Flycatcher	<i>Terpsiphone paradisi</i>	Muscicapidae	C	LC	II

S. NO.	COMMON NAME	SCIENTIFIC NAME	FAMILY	FOOD HABIT	IUCN STATUS	SCHEDULE (WLPA, 2022)
2.	Black-headed Bunting	<i>Emberiza melanocephala</i>	Emberizidae	O	LC	II
3.	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	Ciconiidae	C	NT	II
4.	Black-tailed Godwit	<i>Limosa limosa</i>	Scolopacidae	C	NT	II
5.	Blue rock Pigeon	<i>Columba livia</i>	Columbidae	O	LC	-
6.	Blue Rock-Thrush	<i>Monticola solitarius</i>	Muscicapidae	O	LC	II
7.	Blue-cheeked Bee-eater	<i>Merops persicus</i>	Meropidae	C	LC	II
8.	Blue-tailed Bee-eater	<i>Merops philippinus</i>	Meropidae	C	LC	II
9.	Bluethroat	<i>Luscinia svecica</i>	Turdidae	C	LC	II
10.	Blyth's Pipit	<i>Anthus godlewski</i>	Motacillidae	C	LC	II
11.	Booted Warbler	<i>Hippolais caligata</i>	Acrocephalidae	C	LC	-
12.	Brown Shrike	<i>Lanius cristatus</i>	Laniidae	C	LC	II
13.	Cattle Egret	<i>Bubulcus ibis</i>	Ardeidae	C	LC	II
14.	Citrine Wagtail	<i>Motacilla citreola</i>	Motacillidae	C	LC	II
15.	Common Chiffchaff	<i>Phylloscopus collybita</i>	Phylloscopidae	C	LC	II
16.	Common Crane	<i>Grus grus</i>	Gruidae	O	LC	I
17.	Common Greenshank	<i>Tringa nebularia</i>	Scolopacidae	C	LC	I
18.	Common Hoopoe	<i>Upupa epops</i>	Upupidae	C	LC	II
19.	Common Kestrel	<i>Falco tinnunculus</i>	Falconidae	C	LC	II
20.	Common Pariah Kite	<i>Milvus migrans</i>	Accipitridae	O	LC	II
21.	Common Quail	<i>Coturnix coturnix</i>	Phasianidae	H	LC	II
22.	Common Redshank	<i>Tringa totanus</i>	Scolopacidae	C	LC	II
23.	Common Rosefinch	<i>Carpodacus erythrinus</i>	Fringillidae	O	LC	II
24.	Common Sandpiper	<i>Actitis hypoleucos</i>	Scolopacidae	C	LC	II
25.	Common Snipe	<i>Gallinago gallinago</i>	Scolopacidae	C	LC	II
26.	Common Starling	<i>Sturnus vulgaris</i>	Sturnidae	O	LC	II
27.	Common Stonechat	<i>Saxicola torquata</i>	Muscicapidae	C	LC	-
28.	Common Teal	<i>Anas crecca</i>	Anatidae	O	LC	II
29.	Dark-throated Thrush	<i>Turdus ruficollis</i>	Turdidae	O	LC	II
30.	Demoiselle Crane	<i>Grus virgo</i>	Gruidae	O	LC	I
31.	Desert Wheatear	<i>Oenanthe deserti</i>	Turdidae	C	LC	II
32.	European Roller	<i>Coracias garrulus</i>	Coraciidae	C	LC	II
33.	Ferruginous Pochard	<i>Aythya nyroca</i>	Anatidae	O	NT	II
34.	Gadwall	<i>Anas strepera</i>	Anatidae	H	LC	-
35.	Glossy Ibis	<i>Plegadis falcinellus</i>	Threskiornithidae	C	LC	II

S. NO.	COMMON NAME	SCIENTIFIC NAME	FAMILY	FOOD HABIT	IUCN STATUS	SCHEDULE (WLPA, 2022)
36.	Grass Owl	<i>Tyto capensis</i>	Tytonidae	C	LC	-
37.	Great Bittern	<i>Botaurus stellaris</i>	Ardeidae	C	LC	II
38.	Great Crested Grebe	<i>Podiceps cristatus</i>	Podicipedidae	C	LC	II
39.	Green Sandpiper	<i>Tringa ochropus</i>	Scolopacidae	O	LC	II
40.	Grey Heron	<i>Ardea cinerea</i>	Ardeidae	C	LC	II
41.	Grey Partridge	<i>Francolinus pondicerianus</i>	Phasianidae	O	LC	II
42.	Grey Quail	<i>Coturnix coturnix</i>	Phasianidae	H	LC	II
43.	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>	Stenostiridae	C	LC	II
44.	Greylag Goose	<i>Anser anser</i>	Anatidae	H	LC	II
45.	Grey-necked Bunting	<i>Emberiza buehanani</i>	Emberizidae	H	LC	II
46.	House Crow	<i>Corvus splendens</i>	Corvidae	O	LC	-
47.	Indian Peafowl	<i>Pavo cristatus</i>	Phasianidae	O	LC	I
48.	Jungle Crow	<i>Corvus macrorhynchos</i>	Corvidae	O	LC	II
49.	Kentish Plover	<i>Charadrius alexandrinus</i>	Charadriidae	C	LC	II
50.	Lesser Whitethroat	<i>Sylvia curruca</i>	Sylviidae	C	LC	-
51.	Little Crake	<i>Porzana parva</i>	Rallidae	O	LC	-
52.	Little Stint	<i>Calidris minuta</i>	Scolopacidae	C	LC	II
53.	Little Tern	<i>Sterna albifrons</i>	Laridae	C	LC	-
54.	Long-billed Pipit	<i>Anthus similis</i>	Motacillidae.	C	LC	II
55.	Marsh Sandpiper	<i>Tringa stagnatilis</i>	Scolopacidae	C	LC	II
56.	Montagu's Harrier	<i>Circus pygargus</i>	Accipitridae	C	LC	-
57.	Northern Pintail	<i>Anas acuta</i>	Anatidae	O	LC	II
58.	Northern Shoveler	<i>Anas clypeata</i>	Anatidae	O	LC	-
59.	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	Columbidae	H	LC	II
60.	Pallid Harrier	<i>Circus macrourus</i>	Accipitridae	C	NT	I
61..	Pied Bushchat	<i>Saxicola caprata</i>	Muscicapidae	C	LC	II
62.	Pied Cuckoo	<i>Clamator jacobinus</i>	Cuculidae	C	LC	II
63.	Pintail Snipe	<i>Gallinago stenura</i>	Scolopacidae	C	LC	II
64.	Red Wattled Lapwing	<i>Vanellus malabaricus</i>	Charadriidae	C	LC	II
65.	Red-crested Pochard	<i>Rhodonessa rufina</i>	Anatidae	C	-	-
66.	Red-headed Bunting	<i>Emberiza bruniceps</i>	Emberizidae	O	LC	II
67.	Red-throated Flycatcher	<i>Ficedula parva</i>	Muscicapidae	C	LC	II
68.	Richard's Pipit	<i>Anthus richardi</i>	Motacillidae	C	LC	II
69.	Roller / Blue Jay	<i>Coracias benghalensis</i>	Coraciidae	C	LC	II
70.	Rose Ringed Parrot	<i>Psittacula krameri</i>	Psittacidae	H	LC	II

S. NO.	COMMON NAME	SCIENTIFIC NAME	FAMILY	FOOD HABIT	IUCN STATUS	SCHEDULE (WLPA, 2022)
71.	Rosy Starling	<i>Sturnus roseus</i>	Sturnidae	O	LC	-
72.	Sparrow	<i>Passer domesticus</i>	Passeridae	O	LC	II
73.	Spotted Crane	<i>Porzana porzana</i>	Rallidae	O	LC	II
74.	Spotted Dove	<i>Streptopelia chinensis</i>	Columbidae	H	-	II
75.	Spotted Redshank	<i>Tringa erythropus</i>	Scolopacidae	C	LC	II
76.	Steppe Eagle	<i>Aquila nipalensis</i>	Accipitridae	C	EN	I
77.	Tawny Pipit	<i>Anthus campestris</i>	Motacillidae	C	LC	II
78.	Verditer Flycatcher	<i>Eumyias thalassina</i>	Muscicapidae	C	LC	-
79.	Whiskered Tern	<i>Chlidonias hybridus</i>	Laridae	C	LC	-
80.	White Wagtail	<i>Motacilla alba</i>	Motacillidae	C	LC	II
81.	White-tailed Lapwing	<i>Vanellus leucurus</i>	Charadriidae	O	LC	II
82.	Wood Sandpiper	<i>Tringa glareola</i>	Scolopacidae	C	LC	II
O- Omnivorous, H- Herbivorous, C- Carnivorous Data Deficient (DD) · Least Concern (LC) · Near Threatened (NT) · Vulnerable (VU) · Endangered (EN)						

3.11.4 Schedule I species:

Based on both our primary and secondary surveys, as well as the compiled table above, we have identified a total of **13** species listed under Schedule I of the Wildlife Protection Act, indicating their endangered status and necessitating conservation efforts (<https://www.iucnredlist.org>). Accordingly a detailed conservation plan for these scheduled species will be submitted separately.

Table 84. Schedule I Species Recorded in the Study Area

S. NO.	ZOOLOGICAL NAME	COMMON NAME	FAMILY	SCHEDULE (WLPA, 2022)	IUCN STATUS
CLASS: MAMMALIA					
1.	<i>Felis chaus</i>	Jungle cat	Felidae	I	LC
2.	<i>Canis aureus</i>	Jackal	Canidae	I	LC
3.	<i>Urva edwardsii</i>	Grey mongoose	Herpestidae	I	LC
4.	<i>Hystrix indica</i>	Indian crested Porcupine	Hystriidae	I	LC
CLASS: REPTILIA					
5.	<i>Ptyas mucosa</i>	Indian rat snake	Colubridae	I	LC
6.	<i>Fowlea piscator</i>	Checkered keelback	Colubridae	I	LC
7.	<i>Naja naja</i>	Indian Cobra	Elapidae	I	LC
CLASS: AVES					
8.	<i>Grus grus</i>	Common Crane	Gruidae	I	LC
9.	<i>Tringa nebularia</i>	Common Greenshank	Scolopacidae	I	LC
10.	<i>Grus virgo</i>	Demoiselle crane	Gruidae	I	LC
11.	<i>Pavo cristatus</i>	Peafowl	Phasianidae	I	LC
12.	<i>Circus macrourus</i>	Pallid Harrier	Accipitridae	I	NT
13.	<i>Aquila nipalensis</i>	Steppe eagle	Accipitridae	I	EN

3.12. SOCIO-ECONOMIC ENVIRONMENT

3.12.1 Study Area

The study area for the project has been considered a 10 km peripheral area from the project site. Depending upon their proximity, The Study area was divided into three zones viz Zone-I (0-2 Km), Zone-II (02 Km to 05Km) & Zone-III (5Km to 10Km).

The Village map with the Study area Zone is shown below in Map-1.

3.12.2 Methodology

Socio-economic survey is based on proportionate, stratified and random sampling methods. Secondary data from census records, statistical hard books, topo sheets, health records and relevant official records available with Govt. agencies. Primary data collection through questionnaire.

Collection of secondary Data

- Identifying villages in 10 Km radius from the project boundary as per PCA (Primary Census Abstract) Census 2011.
- On the basis of available census data, 2011 identifying different aspects of socio-economic conditions.
- Analysis of the secondary data.

ii) Collection of Primary Data

- 100% villages (3 out of 3 villages) up to 2 km from the project site are selected, 22% villages (2 out of 9 villages) from 2 to 5 km, and one village from 5 to 10 km distance from the project site are also selected to study the primary survey. These villages justify the overall socio-economic scenario of the study area.
- Preparation of list of villages and questionnaire for survey.
- Carrying out site visits.
- Physical survey for sanitation, drinking water facilities, availability of banks, primary health centers, roads, education facilities and source of income of the villagers.
- Focus Group Discussion (FGD).
- Collection of the relevant Photographs.

iii) Collection of Secondary & Primary Data

Developing socio economic significance and influence to the local community.

3.12.3 Habitation in the Study Area

A. District Cuddalore

The nearest major city is Cuddalore. Cuddalore City (also District Head Quarter) is located within the district and serves as the main administrative, commercial, and service center. Cuddalore District is a coastal district located in the state of Tamil Nadu on the Bay of Bengal. The district's

economy is based on agriculture, fishing, and significant industrial activity, including the operations of the Neyveli Lignite Corporation (NLC).

As per the 2011 Census, Cuddalore District had a population of 2,605,914. The district's population density was 704 persons per square kilometer, with approximately 6,35,578 families residing there. The sex ratio was 987 females per 1,000 males, and 10.74% of the population was under six years old. The effective literacy rate was 78.04%, with male literacy at 85.95% and female literacy at 70.14%.

Other details of the district are as below:

- Total Population: 2,605,914
- Population Growth (2001–2011): 14.02%
- Area: 3,703 square kilometers
- Population Density: 704 persons per square kilometer
- Number of Families (Households): Approx. 6,35,578
- Sex Ratio: 987 females per 1,000 males
- Child Population (0–6 years): 10.74%
- Effective Literacy Rate: 78.04%
- Male Literacy Rate: 85.93%
- Female Literacy Rate: 70.14%

B. Total Villages in the Study Area (10 Km radius)

The villages within the study area are further classified into three categories, depending upon their proximity to the project site as per **Table 85- Village within Study Area**:

Table 85. List of Villages within Study Area

Within 2 km (3 Village, 0 Urban)					
1	Sedappalayam	2	Tiyagavelli	3	Sembankuppam
More than 2 km and less than equal to 5 km (9 Villages, 0 Urban)					
4	Kudikkadu	7	Tondamanatham	10	Kambalimedu
5	Karaikkadu	8	Kodandaramapuram	11	Alappakkam
6	Annavalli	9	Anukkambattu	12	Tiruchchepuram
More than 5 km and less than equal to 10 km (35 Villages, 2 Urban)					
13	Tiruvandipuram	25	Ponnaiyankuppam	37	Puvanikuppam
14	Arisipperiyanakuppam	26	Pachchyankuppam	38	Idankondambattu
15	Kumarapettai	27	Gangamanayakkankuppam	39	Akgatimmapuram
16	Otteri	28	Kayalpattu	40	Ranganathapuram
17	Tirumanikkuli	29	Andarmullippallam	41	Tirttanagari
18	Vanamadevi	30	Puliyur(west)	42	Adinarayanapuram
19	Vellakarai	31	Valudambattu	43	Tanur
20	Ramapuram	32	Ambalavanampettai	44	Sirupalaiyur
21	Mavadipalayam	33	Toppukollai	45	Manikollai
22	Karaiyeravittakuppam	34	Thambipalayam	46	Periyapattu
23	Vettukkulam	35	Ayikuppam	47	Silambimangalam
24	Cuddalore Port	36	Agaram		

URBAN					
1	Padirikuppam (CT)	2	Cuddalore (M)		

Source: PCA Census 2011, District: Cuddalore State- Tamil Nadu.

C. Villages Selected for Socio Study Using Primary Survey

Depending upon their proximity to the project site, the village level information has been compiled for the villages which were selected as per Methodology. The main objective of the socio-economic study is to collect social and economic information about the area and to identify the expected impacts due to the project activities and to provide the appropriate mitigation measures.

Based on Methodology prepared and followed by team SE, few questionnaires were filled for 6 villages (as per Table 86) to identify and record the demography, Source of Income & Working Pattern, Infrastructure Facilities, Cropping Pattern, Farmer Category, Disease Prevalence and Need based gaps is prepared.

Table 86. List of Villages (Primary Survey)

S. No.	Name of Village	Direction	Study Area Zone
1	Sedappalayam	NNW	Zone-I (0-2Km)
2	Tiyagavelli	E	Zone-I (0-2Km)
3	Sembankuppam	W	Zone-I (0-2Km)
4	Anukkambattu	SW	Zone-II (2-5Km)
5	Tiruchchepuram	S	Zone-II (2-5Km)
6	Pachchyankuppam	NNE	Zone-III (2-5Km)

Source: Physical survey Team SE

3.12.4 Demographic Structure

A. Demographic Structure of Study Area

As per details extracted from, PCA Census 2011 the Demographic details such as household, total population, sex ratio, %age of SC and %age of ST population, literacy rate and employment pattern are summarized. Demographic details presented in Table 87. Demographic Details

Table 87. Demographic Details

Study area		Total Household	Population			0-6 Child Population	Sex Ratio	SC %	ST %	Others %
			Total	Male	Female					
Zone-I	Rural	3445	13629	6855	6774	1514	988	26.7	3.6	69.7
	Urban	0	0	0	0	0	0	0	0	100
	Overall	3445	13629	6855	6774	1514	988	26.7	3.6	69.7
Zone-II	Rural	9053	37773	19105	18668	4338	977	45.3	0.7	54
	Urban	0	0	0	0	0	0	0	0	100
	Overall	9053	37773	19105	18668	4338	977	45.3	0.7	54
Zone-III	Rural	30119	122564	62186	60378	13899	971	27.5	0.6	71.9
	Urban	46913	192381	95023	97358	19182	1025	12.5	0.3	87.2
	Overall	77032	314945	157209	157736	33081	1003	18.3	0.4	81.3
Overall Study Area		89530	366347	183169	183178	38933	1000	21.4	0.6	78

Source: PCA Census 2011, District: Cuddalore State- Tamil Nadu.

B. Demographic Structure of Villages Selected for Primary survey:

Demographic detail of the villages PCA Census 2011 are compared with data extracted from surveyed by primary survey team of Perfact and Tabulated below:

Table 88. Demographic Structure of Surveyed Village

Sr. No.	Particulars	As per PCA Census 2011	Primary Survey by Team Perfact
1	Total HouseHold	6943	8611
2	Total Population	28137	32973
3	Total Male	50.34%	50.13
4	Total Female	49.66%	49.87
5	Sex Ratio	987	983
6	Total SC population	21.7%	28%
7	Total ST population	2.9%	6%
8	Others	75.4%	66%

Source: PCA Census 2011 and Primary Survey by Team Perfact

INFERENCE

- As per primary survey, the population of the surveyed villages is 32973(Male 50.13%, Female-49.87%) as compared to PCA Census 2011 was 28137.
- The total number of households in the Surveyed Village are 8611 as compared to PCA Census 2011 were 6943. The average occupancy is 3.8 persons per household as compared to PCA Census 2011 was 4.5
- Sex ratio (number of females to per 1000 males) in the surveyed area is 983 as compared to PCA 2011 Census was 987.
- Total SC population in the surveyed area 28% as compared to PCA Census 2011 was 21.7%
- Total ST population in the Surveyed area is 6% as compared to PCA Census 2011 was 2.9%
- Total Others population in the Surveyed area is 66% as compared to PCA Census 2011 was 75.4%

3.12.5 Literacy Details

Data extracted from PCA Census 2011, Literacy Detail of villages in study area are compared with details of Villages surveyed by primary survey team of Perfact is prepared. Summarized details are tabulated in **Table 89 Literacy Details:**

Table 89. Literacy Details

Study Area		Population above 0-6 Years			Literate			
		Total	Male	Female	Total	Overall %	Male (%)	Female (%)
Zone-I	Rural	7972	12115	6056	6059	65.8	74.9	56.8
	Urban	0	0	0	0	0	0	0
	Overall	7972	12115	6056	6059	65.8	74.9	56.8
Zone-II	Rural	24366	33435	16849	16586	72.9	81.3	64.3
	Urban	0	0	0	0	0	0	0
	Overall	24366	33435	16849	16586	72.9	81.3	64.3
Zone-III	Rural	79389	108665	54833	53832	73.1	81.6	64.4
	Urban	152717	173199	85238	87961	88.2	92.7	83.8
	Overall	232106	281864	140071	141793	82.3	88.3	76.4
Overall Study Area		264444	327414	162976	164438	80.8	87.1	74.5

Source: PCA Census 2011, District: Cuddalore State- Tamil Nadu.

Demographic detail of the villages PCA Census 2011 are compared with data extracted from surveyed by primary survey team of Perfect and Tabulated below

Table 90 Literacy Details

Sr. No.	Particulars	As per PCA Census 2011	Primary Survey by Team Perfect
1	Overall Literacy (%)	69.6%	81%
2	Male Literacy (%)	77.9%	87%
3	Female Literacy (%)	61.3%	75%

- Overall Literacy in the surveyed villages is 81% as compared to PCA Census 2011 was 69.6%

3.12.6 WorkForce/Employment Pattern

The workforce/employment in the study area as per Census 2011 is prepared. Summarized details are tabulated in **Table 91**.

Table 91. Working Pattern

Study area		Total Population	Total Working Population	% Total Working Population	% Non-working Population	% Main-working Population	% Marginal working Population
Zone-I	Rural	13629	6213	45.6	54.4	65.6	34.4
	Urban	0	0	0	0	0	0
	Overall	13629	6213	45.6	54.4	65.6	34.4
Zone-II	Rural	37773	17706	46.9	53.1	58.9	41.1
	Urban	0	0	0	0	0	0
	Overall	37773	17706	46.9	53.1	58.9	41.1
Zone-III	Rural	122564	56993	46.5	53.5	70.9	29.1
	Urban	192381	69880	36.3	63.7	83.9	16.1
	Overall	314945	126873	40.3	59.7	78.1	21.9
Overall Study Area		366347	150792	41.2	58.8	75.3	24.7

Source: PCA Census 2011, District: Cuddalore State- Tamil Nadu.

A. Main Workforce Employment Pattern

The main workers employment pattern in the study area as per Census 2011 is prepared. Summarized details is tabulated in **Table 92 Main Workers Employment Pattern**.

Table 92. Main Workforce Employment Pattern

Study area		Total no of Main Workforce	Cultivators %	Agricultural Labour %	Household Industries %	*Others %
Zone-I	Rural	4076	10.4	44.2	1.7	43.7
	Urban	0	0	0	0	0
	Overall	4076	10.4	44.2	1.7	43.7
Zone-II	Rural	10425	16.7	45.2	2.4	35.7
	Urban	0	0	0	0	0
	Overall	10425	16.7	45.2	2.4	35.7
Zone-III	Rural	40390	16.7	47.3	2.8	33.2
	Urban	58646	1.2	3.8	2.9	92.1
	Overall	99036	7.5	21.6	2.8	68.1
Overall Study Area		113537	8.5	24.6	2.8	64.1

Source: PCA Census 2011, District: Cuddalore State- Tamil Nadu.

*Includes, Non Agricultural Labour, Govt. Job, Private service, business, etc

B. Source of Income & Workforce Pattern in Surveyed Villages:

The primary source of income in the surveyed villages is agriculture, farmers and other agricultural labourers and other occupations like government jobs, private services, business, animal husbandry etc

3.12.7 Crop Pattern

The main crop from District Census Handbook 2011 of villages in study area are compared with details of Villages surveyed by the primary survey team of Perfect as summarized below.

Table 93. Crop Pattern

S. No.	Village Name	As per District Census Handbook 2011	Primary Survey by Team Perfect
1	Sedappalayam	Coconut,Paddy,Casuarina	Sugarcane, Groundnut, Paddy, Black gram and green gram, Varagu, Maize, Banana, Vegetables
2	Tiyagavelli	Paddy,Ground Nut	
3	Sembankuppam	Paddy,Coconut,Ground Nut	
4	Pachchyankuppam	Ground Nut,Paddy	
5	Anukkambattu	Sugarcane,Casuarina	
6	Tiruchchepuram	Ground Nut,Paddy	

Source: District Census Handbook 2011

- The main crops in the surveyed area are Paddy and Groundnut, followed by Sugarcane, Varagu, Maize, Banana, Black Gram, Green Gram and Vegetables which are cultivated in most of the villages.

3.12.8 Diseases in Surveyed Villages:

Air, water and other pollutants may inflict stomach and lung related diseases. Therefore, the prevalence rate of these diseases was assessed for measurement of future impact on the human

health of the proposed project. Discussions were held with local community groups. To assess the status of stomach and lung related diseases. The outcome of these discussions is summarized in **Table 94 Disease Prevalence Rate:**

Table 94. Disease Prevalence Rate

Disease Name	Prevalence Rate
Diarrhea	1%
Typhoid	1-2%
Jaundice	1-2%
Asthma	1-3%

Source : Primary survey Perfect Team

Reported waterborne diseases in the study area include jaundice (1-2% prevalence), typhoid (1-2%), diarrhea (1%), and asthma (1-3%)

3.12.9 Population Growth & Projected Population:

To know the expected population growth rate in the study area, census data 2001 & census data 2011 was analyzed. The study area comes in Cuddalore District. The census data indicates that the study area Zone-I decadal growth is highest as 9.73%, Study area Zone-II decadal growth rate is lowest as 6.02% and Study area Zone-III is 10.51%.The Cuddalore district decadal growth is 14.02%, and The Rewari district decadal growth is Details are presented in Table 95 Population Growth.

Table 95. Population Growth

Particulars	Population in year 1991	Population in year 2001	Population in year 2011	Decadal Growth Rate %	Yearly Growth Rate %	Projected Population (As on 2025)		
						Total	Male	Female
0-2 Km Zone-I	11207	12420	13629	9.73	0.97	15450	7770	7680
2-5Km Zone-II	28992	35628	37773	6.02	0.60	40832	20652	20180
5-10 Km Zone-III	251966	284985	314945	10.51	1.05	360801	180098	180703
Study Area	292165	333033	366347	10.00		417083	208520	208563
District Cuddalore	4878433 (*)	2,285,395	2,605,914	14.02				

In 1991 Cuddalore was part of South Arcot district.

Source: Census Data 1991, 2001 & 2011

3.12.10 Infrastructure Available

A. Infrastructure Available in Study Area

The result of infrastructure resources based on the District Census Handbook 2011 is attached as summarized below.

Education: As per the 2011 record, about 47 villages (3 villages in Zone-I, 9 Villages in Zone-II, and 35 villages in Zone-III) and 2 urban areas in Zone-III of Cuddalore districts come in the study area (10 km radius area).

Table 96. Education

Education (No. of School)		Primary School		Middle School		Secondary School		Senior Secondary School	
		Govt	Private	Govt	Private	Govt	Private	Govt	Private
0-2 Km Zone-I	Rural	8	0	4	0	1	0	1	0
	Urban	0	0	0	0	0	0	0	0
2-5 Km Zone-II	Rural	29	3	12	3	3	2	3	0
	Urban	0	0	0	0	0	0	0	0
5-10 Km Zone-III	Rural	66	7	28	2	10	3	6	0
	Urban	29	29	18	13	10	13	9	10
Study Area	Rural	103	10	44	5	14	5	10	0
	Urban	29	29	18	13	10	13	9	10

3.12.11 Quality of Life Assessment

Infrastructure related and Services related 15 social demographic indicators were selected to ascertain the Quality-of-life index. Every present QOL indicator has 10 points and for the absence zero points are given. Allocation of the weightage to the Economic variables is made owing to the significance of social demographic data. Infrastructure related variables were assigned 70% weightage. Services related variables were assigned 30% weightage.

Following social demographic indicators were selected:

Infrastructure:

Anganwadi Centre, Govt. Primary School, Govt. Vocational Training Centre ITI, Govt. PHC/SC, Tap Water Untreated, River & Canal, Total Sanitation Campaign, Metal Road, Community Centre, Commercial Bank, Agricultural Credit Society.

Services:

Self Help Group; Electric Power (Domestic); Telephone/mobile; Mode of transportation.

The outcome of the study is given below:

The maximum score obtained by a village is 7.8 and the minimum score is 2.6 the average score in the study area is 5.8 Based on the results the following criteria is defined:

Table 97. Performance Score

Average Score Group	Performance Group	Freq of Villages	Percentage
2.6-3.9	Poor	4	8.5%
4.0-5.3	Fair	13	27.7%
5.4-6.7	Good	20	42.6%
6.8 & above	Excellent	10	21.3%

Thus, as per above index about 21.3% villages stand Excellent, 42.6% villages are Good and 27.7% villages in the study area comes in the Fair group. About 4 Villages (8.5%) in the study area are in the Poor performance group.

INFERENCE:

Following 4 villages have been identified in the poor performing group. There are no villages in Zone-I and Zone II.

Table 98. Poor performing group

Name of Village	Score obtained	Study Area Zone	Name of Village	Score obtained	Study Area Zone
Ponnaiyankuppam	2.6	Zone-III	Akgatimmapuram	3.5	Zone-III
Mavadipalayam	3.5	Zone-III	Otteri	3.9	Zone-III

3.12.12 Key Findings and Summary of Primary Data Collection

1. Demographics and Literacy

- The surveyed villages have varied population sizes, with the largest being Pachchyankuppam (8885 people) and the smallest being Anukkambattu (1645 people).
- Literacy rates are generally above 76%, with Tiruchchepuram 88%) and Pachchyankuppam (85%) being the most literate.
- Female literacy continues to trail behind male literacy in several villages, requiring gender-targeted educational support.

2. Infrastructure and Basic Amenities

- Road connectivity: All villages are connected by metalled roads
- Electrification: All villages are electrified with 100% individual connections, but many have non-functioning streetlights.

3. Sanitation and Toilets

- Most villages have access to both individual and public toilets. In contrast, Tiyagavelli village has yet to be provided with public toilet facilities.

4. Education & Health Facilities

- No village in the area has a college, highlighting a significant gap in local education.

5. Occupation and Livelihoods

- Agriculture is the primary livelihood in 50-60% of households across villages.

- However, lack of deep boring facilities, farming equipment, and training continues to hinder productivity.
- Very few households are engaged in self-employment, businesses, or service jobs.

6. Water Supply

- Drinking Water: all villages have piped water supply (PWS) to households, drinking water is supplied mainly through borewells, indicating problems related to the reliability or quality of the piped water supply system.

7. Social Composition and Inclusion

The distribution of Scheduled Caste (SC), Scheduled Tribe (ST), and General category populations varies significantly across the villages

- Tiruchipuram: Features a majority SC population (57%).
- Sedappalayam: Records the highest proportion of ST (11%).
- Pachchankuppam: Is predominantly inhabited by the General category (96%).

8. Health & Disease Prevalence

- Seasonal illnesses like Diarrhea, typhoid, jaundice, and asthma were reported in almost all villages.
- 1–3% prevalence of jaundice and asthma across some villages.

Critical Gaps Identified Across All Villages

1. Lack of Public Toilets and Drainage Facilities
2. Absence of Sub-Centres, PHCs, and Medical Infrastructure
3. Inadequate Educational Institutions (College)
4. No public dustbins are available in the village.
5. Fire station needed for better emergency response
6. Need for Youth Training Center
7. Installation of LED based street lights
8. Playgrounds and parks

3.12.13 Need Based Gaps:

During the survey of the villages, the following need-based gaps were assessed. The need-based gaps of surveyed villages are summarized below in Table 99:

Table 99. Need Based Gaps:

S. No.	Aspect	Issued Observed/Gaps	Villages
1	Training and skill development canter.	Training Centre	Sedappalayam, Tiyagavelli, Sembankuppam, Pachchyankuppam, Anukkambattu, Tiruchchepuram,
2	Sanitation facility	Drainage Facilities	Tiyagavelli, Sembankuppam, Pachchyankuppam, Anukkambattu, Tiruchchepuram
3	Solid waste management	Solid waste management is required in the villages.	Sedappalayam, Tiyagavelli, Sembankuppam, Pachchyankuppam, Anukkambattu, Tiruchchepuram,
4	Health facilities	Health Facilities are lacking ambulance and medicine facilities.	Sedappalayam, Tiyagavelli, Sembankuppam, Pachchyankuppam, and Anukkambattu
5	Education system available	Senior college facility in village	Semmankuppam, Tiyagavelli, Anukkambattu
6	Infrastructure/Road condition	Public toilets are required in the village	Tiyagavelli.
		Fire Station required	Sedappalayam, Tiyagavelli, Sembankuppam, Pachchyankuppam, Anukkambattu, Tiruchchepuram,
		A playground, and park is required in the village.	Sedappalayam, Tiyagavelli, Sembankuppam, Pachchyankuppam, Anukkambattu, Tiruchchepuram,
7	Electrification including Solar lights	Installation of LED based Street lights	Sedappalayam, Tiyagavelli, Sembankuppam, Pachchyankuppam, Anukkambattu, Tiruchchepuram,

3.13 TRAFFIC SURVEY

Traffic survey is a very important parameter to assess the impact due to the proposed project on local existing transportation. Baseline Study for Chemplast Cuddalore Vinyls Ltd (CCVL) located at (SIPCOT), Phase II Industrial Development Area, near Semmankuppam village which connects to Talegaon Chakan Road. This is the main access road to Project Site.

Road Identification: A traffic survey was carried out on Chennai to Nagapattinam Hwy). Road is a Two-lane two-way road 15 Mtr (Divided Road). with 1mtr space on either side.

Conversion Factor (Ref: IRC 106, 1990): PCU values are used to convert various vehicles into one standard vehicle i.e. Passenger car units (PCU). The PCU values as per IRC are as given below:

Table 100. PCU

S. No.	Vehicle Type	Pcu Value
1	Car	1
2	Two-wheeler	0.5
3	Truck/bus	2.2
4	Auto	1.2
5	LCV	2
6	Tractor and Trailer	5
7	Cycle rickshaw	0.5

Methodology:

A traffic survey was carried out on both sides (up & down) of the Chennai to Nagapattinam Hwy. Vehicles were observed and the count was recorded for 24 hours. The table below represents the total no. of vehicles over 24-hour duration.

I. Traffic Analysis: 4 Lane Road, 15 Meters with Divider NH-32 (Chennai to Nagapattinam Hwy)

Table 101. Traffic

Hours	Baseline					Incremental		Capacity of Road in PCU/Hr	LOS Baseline	LOS Incremental	% increase
	Car	Bus/ Truck	Two Wheeler	Others/ Auto	PCU/ Hr	PCU/ Hr	Incremental PCU/Hr				
06:00- 07:00	213	86	198	12	516	12	528	5143	0.100	0.103	2.327
07:00- 08:00	223	95	244	10	566	15	581	5143	0.110	0.113	2.650
08:00-09:00	245	105	247	15	618	14	632	5143	0.120	0.123	2.267
09:00-10:00	293	112	250	18	686	12	698	5143	0.133	0.136	1.749
10:00-11:00	312	126	256	20	741	13	754	5143	0.144	0.147	1.754
11:00-12:00	333	136	260	21	787	17	804	5143	0.153	0.156	2.159
12:00-13:00	308	132	271	19	757	16	773	5143	0.147	0.150	2.114
13:00-14:00	296	130	280	18	744	12	756	5143	0.145	0.147	1.614
14:00-15:00	299	143	264	17	766	14	780	5143	0.149	0.152	1.828
15:00-16:00	256	136	276	22	720	11	731	5143	0.140	0.142	1.529
16:00-17:00	288	127	259	25	727	12	739	5143	0.141	0.144	1.651
17:00-18:00	310	120	280	26	745	15	760	5143	0.145	0.148	2.013
18:00-19:00	256	132	244	19	691	13	704	5143	0.134	0.137	1.881
19:00-20:00	264	120	223	26	671	14	685	5143	0.130	0.133	2.087
20:00-21:00	312	106	200	23	673	12	685	5143	0.131	0.133	1.784
21:00-22:00	311	120	188	19	692	13	705	5143	0.135	0.137	1.878
22:00-23:00	250	103	49	18	522	14	536	5143	0.102	0.104	2.681
23:00-24:00	263	124	156	15	632	12	644	5143	0.123	0.125	1.899
24:00-01:00	236	114	123	12	563	15	578	5143	0.109	0.112	2.666
01:00-02:00	200	118	142	9	541	12	553	5143	0.105	0.108	2.216
02:00-03:00	186	110	130	10	505	15	520	5143	0.098	0.101	2.970
03:00-04:00	140	98	114	13	428	11	439	5143	0.083	0.085	2.569
04:00-05:00	128	109	110	8	432	12	444	5143	0.084	0.086	2.775
05:00-06:00	120	104	96	7	405	14	419	5143	0.079	0.082	3.455
Average	281	119	235	19	630	13	644	5143	0.12	0.13	2.19
						320					

Carrying Capacity at Chennai to Nagapattinam Hwy =2143 PCU/hr

Existing traffic density at **Chennai to Nagapattinam Hvy**= 470 PCU/hr

Existing LOS (Without Project) = 0.12 i.e. Cat "A"

Proposed traffic from Site=475 PCU/hr

LOS (With Project) = 0.22 i.e. Cat "A"

Table 102. Traffic Details

ROAD1 4 Lane Road, 15 Meters with Divider NH-32 (Chennai to Nagapattinam Hvy)	Parameter	Existing	Proposed
	WIDTH (m)	15	15
	Carrying Capacity (PCU/ Hr)	5143	5143
	Traffic (PCU/Hr)	630	644
	LOS	0.12 i.e. Cat "A"	0.12 i.e. cat "A"

Table 103. LOS Value

S.no	LOS Value (Ratio of V:C) (V/C)	Category	Inference based on IRC 106: 1990
1	0-0.2	A	Represents a condition of free flow; individual users are generally unaffected by others in the traffic and this condition is generally considered in the Excellent Category.
2	0.2-0.4	B	Represents a condition of stable flow; individual users have a level of comfort and convenience but less than that of A.
3	0.4-0.6	C	Represents a condition of zonal stable flow; individual users are starting in a bit of discomfort; users start to feel inconvenience due to the presence of other users on the road. The general level of discomfort increases and there is a noticeable decline in convenience.
4	0.6-0.8	D	Represents the level of stable flow; the level of comfort of users is poor and discomfort is significant in the flow of traffic. This category traffic streams are extremely susceptible to traffic problems.
5	0.8-1	E	Represents operating conditions close to capacity level; freedom to traffic stream is low and the speed is relatively uniform but very less. Comfort and convenience is relatively poor and discomfort is visible.
6	1 or above	F	Breakdown Flow; These streams often break down, susceptible to long delays and therefore there is huge discomfort in these streams.

Conclusion :

The carrying capacity of the **Chennai to Nagapattinam Hvy** is much higher than the traffic volume. The traffic (to & fro) from the "Chemplast Cuddalore Vinyls Ltd (CCVL)" will not create any traffic congestion.

Chennai to Nagapattinam Hvy The volume/capacity ratio is likely to change from 0.12 to 0.12 with LOS being "A" to "A".

4. ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

Prediction of impacts is the most important component in the Environmental Impact Assessment studies. Several scientific techniques and methodologies are available to predict impacts of developmental activities on physical, ecological and socio-economic environments. Such predictions are superimposed over the baseline (pre-project) status of environmental quality to derive the ultimate (post-project) scenario of environmental conditions. The prediction of impacts helps to minimize the adverse impacts on environmental quality during pre-and post-project execution.

Generally, the environmental impacts can be categorized as either primary or secondary. Primary impacts are those, which are attributed directly by the project and secondary impacts are those, which are indirectly induced and typically include the associated investment and changed patterns of social and economic activities by the proposed actions.

4.1. IMPACT ASSESSMENT METHODOLOGY

For the proposed project, the impact assessment shall be performed in following steps:

- Identification of interactions between activities and environmental receptors.
- Identification of potentially significant environmental impacts.

Based on this preliminary identification, environmental indices that are likely to be impacted due to the project are:

- **Land use/Land cover:** There will be change in land use and land cover as additional land area is being added in this project. The proposed land area is located at at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005.
- **Air quality:** Dust generation during construction work, installation of machineries, vehicle movement, loading/unloading of raw material/products, manufacturing process area, transportation and operation of Boiler, DG set, Incinerators, EDC cracking Furnace, emission from process gas stacks and APCS, etc.
- **Noise:** Vehicle movement during construction, transportation and operation of Boiler, DG set, APCS, manufacturing process area, loading/unloading of raw material/products .
- **Water:** Disposal of waste water from construction activity, manufacturing processes, boilers, cooling, domestic cum sanitary uses and stormwater runoff from the plant premises.
- **Soil:** Excavation activity and contamination due to deposition of dust, oil, grease and other chemicals bearing wastewater.
- **Storage and handling** of Chemicals, solid and hazardous waste.
- **Ecology and Biodiversity:** Construction activities and emission from operational activities may have an effect on the avifauna of the study area.

- **Socio - Economic:** There will be a minor positive impact due to increase in additional employment generation, increased revenue to neighborhood people and increased tax payment to the local administration.
- **Occupational Health, Community Health and Safety:** Occupational health risk during exposure to dust, noise, hazardous wastes and solid wastes.

4.2. POTENTIAL IMPACTS DURING CONSTRUCTION PHASE

In this proposed expansion there will be an increase in plant area from 25.1862 ha to 64.6298 ha, greenbelt area from 9.7976 ha to 26.0515 ha. Also, there will be installation of some machinery and STP capacity from 50 KLD to 140 KLD and ETP capacity from 6400 KLD to 15800 KLD will also be done.

Manpower is also increasing so there will be construction of restrooms for drivers and also other facilities will be improved.

As the land area is increasing the structures for rainwater harvesting and stormwater harvesting will also be expanded.

4.2.1. ACTIVITY – CONSTRUCTION OF STRUCTURE

Construction structures like MS structures, RCC structures, mechanical beams, etc.

Aspects:

- Dust Generation
- Generation of Construction and demolition (C&D) waste
- Generation of Broken raw material
- Generation of Scrap materials
- Noise from construction equipment & machinery
- Soil Contamination

Table 104. Construction of New Structure

Environmental Components	Anticipated Impact	Proposed Mitigation Measures
Air Environment	-Emission from DG set -Emission from Construction machinery including mixing machines and grinder -Dust generation during material handling. -Handling of C&D waste can cause the generation of dust which can cause problems in breathing to the construction workers and nearby population. Emission of VOCs from paints can cause irritation in eyes, nose and throat and can cause difficulty in breathing and nausea.	-Stack of adequate height will be provided. -Dust emission can be localized by handling limited quantities and water sprinkling. -Construction Waste will be stored properly and covered with tarpaulin cover. -Noise masks will be provided to the laborers working in dust-prone areas.

Environmental Components	Anticipated Impact	Proposed Mitigation Measures
Water Environment	-Utilization of water may impact the water demand of the vicinity. -During the construction period, Stagnation of water & Run off water may lead to breeding of mosquitoes & run off can lead to soil erosion. -Improper disposal of C&D waste if it comes in contact with the water body, may deteriorate its quality.	-In-house ETP treated water shall be used for construction/installation phase, no ground or fresh water will be used. -During the construction period, runoff from the construction site shall not be allowed to stand (water logging) or enter the roadside or nearby Canal. -The runoff due to rain water from the site shall be collected and reused. -Proper channelization of surface runoff will be done with flow towards the drainage system.
Land Use	- It is already an established factory wherein we are going in for the expansion activity, hence no adequate impact.	- The existing Greenbelt area is 9.7976 ha (15.16 %) and will be increased to 26.0515 ha (40.31 %) after proposed expansion.
Soil Environment	-Construction activity does not have any negative impact on the soil as there will be no basement activities. - Improper disposal of C&D waste.	- C&D will be either disposed off weekly to the C&D Waste site or utilized in internal road formation for the proposed expansion. - Due to construction activity, soil fertility will not deteriorate, however periodically monitoring of soil quality will be conducted.
Noise & Vibration	- Noise generation from DG set. -Vibration will be due to construction equipment like cutter and driller and will be limited as it will be operated intermittently and the vibration area is limited to 1m radius.	- DG set will be put under an acoustic enclosure. The noise generation will be limited to 1 m radius. - Machines and equipment will be properly greased, lubricated and regularly maintained and shall be provided with anti-vibration pads.
Hydrology & Geology	- No impact	-
Solid & Hazardous Waste	- Due to construction workers about 3.47 kg/day solid waste will be generated. - Packaging waste will be generated. - Construction debris & waste materials approx 1.5 tons will be generated. - Generation of used oil from existing DG sets @ 98KL/year.	- Recyclable construction waste material will be sold to authorized recyclers. - Packaging waste will be sold to authorized recyclers. -The construction debris will be used within the site for road laying.
Socio-Economic	- Positive impact by giving employment to the local people. - Increase in local economic activity. -Increased noise and dust emission might cause irritation to workers and nearby people. -Accidents during installation might lead to loss of life to workers.	- Equipment like PPEs and nose masks will be provided to workers. -Safety equipment will be provided to workers.
Ecology & Biodiversity	- Increase in PM level will result in deposition of dust on Leaves which may	-Water sprinkling will be done to reduce the dust generation.

Environmental Components	Anticipated Impact	Proposed Mitigation Measures
	cause decrease in Transpiration rate of flora. -Increased noise during construction activities may lead to displacement of existing nearby fauna.	-Dust suppression system (water spray) will be installed as per the requirement at the construction site. -Barricading will be done to avoid entry of any stray animals into the construction site. -Increasing the greenbelt parallelly in the expansion area and the density of the greenbelt will be increased in the existing plant area.

4.2.2. ACTIVITY –INSTALLATION & UPGRADATION OF MACHINERIES AND UTILITIES Aspects

- Emission of dust
- Increased PM level
- Generation of noise
- Soil contamination

Table 105. Installation of Machinery

Environmental components	Impact	Proposed Mitigation Measures
Air Environment	Dust will be generated due to the installation of the machineries and other equipment within the project site, which may cause respiratory problems to the workers and decrease the aesthetic look of the area	-Water sprinkling will be done to reduce the dust generation -Flexible dust suppression system (water spray) shall be done. Soil or mud that will be generated from the project site during the installation of machinery will be properly stacked and covered within the project site for the due course of time and if required water sprinkling will be done on the muck so that it may not blow off.
Water Environment	No major impact envisaged	None
Land Use	-Installation of different machineries will decrease the aesthetic beauty of the site.	-Greenbelt area of 26.0515 ha (40.31 %) will be done to enhance the aesthetic beauty of the project site.
Soil Environment	None	None
Socio-Economic	-Increased noise and dust emission might cause irritation to workers and nearby people. The noise level generation will be 80-85 dB (A) during installation.	- Equipment like PPEs like earmuffs/ear plugs and nose masks will be provided to workers.
Ecology & Biodiversity	-Increased PM Level will result in deposition of dust on leaves which may cause decrease in Transpiration rate of flora	-Water sprinkling will be done to reduce the dust generation. -All the construction activities will be carried out during the daytime. No activity will be done during late evenings which is the

Environmental components	Impact	Proposed Mitigation Measures
	-Increased noise will cause disturbance of existing avi-fauna; however, avifauna is not restricted to one place for a long time, thus it will not result in their displacement.	roosting time for the avian population and also during night time. -All the machinery will be provided with vibration isolators in accordance with their vibration generation.
Noise & Vibration	- Drilling and hammering for installation of different equipment/machinery may generate noise and vibration. - Drilling at high frequency may cause annoyance, problems like speech interference, headache, Auditory impact.	- Drilling machines used will be of reputed make and in good condition and drillers may be provided anti-vibration gloves and earmuffs/plugs. -Construction machinery will be properly lubricated and equipped with vibration isolator wherever possible -Provision of protective devices like earmuffs/plugs to the workers will be done.
Hydrology & Geology	None	None
Solid Waste	-Solid waste and fabrication waste generated from unpacking of machines and equipment if not properly managed result in decrease the aesthetic value of the site	-All the solid waste will be properly collected, stored and given to the recycler.

4.2.3. ACTIVITY - OPERATION OF CONSTRUCTION MACHINERY (CONCRETE MIXING MACHINERY, DG SETS, JCB, ETC.)

Aspects

- Used oil generation
- Air emission
- Dust generation
- Oil and Chemical spillage
- Noise generation

Table 106. Operation of Construction Machinery

Environmental components	Impact	Proposed Mitigation Measures
Air Environment	-Emissions from the use of construction machinery will cause respiratory problems to the workers at site and nearby population. -Pollutants emitted from the stack will increase the Ground Level Concentration of pollutants which will affect the respiratory health of people in a nearby area. -Generation of dust from the operation of construction machinery. -Spillage of HSD, used oil, chemicals may result in emission of VOCs in the air environment which may cause irritation in	-Adequate stack shall be provided in order to minimize the GLC. -Low Sulphur fuel shall be used in operation of DG sets. -Personal Protective Equipment like nose masks shall be provided to the construction workers. -Proper maintenance of construction equipment/ machineries, etc. -Dust suppression and water sprinkling system will be installed for suppression of particulates

Environmental components	Impact	Proposed Mitigation Measures
	eyes, nose and throat, difficulty breathing and nausea.	
Water Environment	-Spillage of oil & chemicals, if in any case encounters with water bodies can deteriorate the groundwater & surface water body which in turn may affect life also.	-The hazardous waste generated will be used for oil only. Used Oil will be stored in HDPE drums and kept in covered rooms under lock and key and will be sold to authorized vendors only. -Spillage of oil from the machinery or cement residue from concrete mixer plants will be properly collected and reused in construction sites
Land Use	None	None
Soil Environment	-Chemical degradation of soil may occur while refueling vehicles transporting construction materials and servicing of vehicles through breakage due to wear and tear.	-Procedures for maintenance of equipment would ensure that this risk is minimized, and clean-up response is rapid if any spill occurs. -Lubricating waste oil will be collected separately in drums and handed over to the authorized outside agency.
Socio-Economic	-Noise due to operation of DG Set and machinery. -Impact due to sudden slip/breakage of machinery can cause injury to workers.	-DG Sets will be enclosed in an acoustic enclosure & will be used during the emergency. -Provision of Ear Plugs to workers can reduce the impact of noise on Ears of Workers can reduce the impacts.
Ecology & Biodiversity	-Increase in PM level will result in deposition of dust on leaves which may cause decrease in Transpiration rate of flora. -Increased noise will cause disturbance of existing avi-fauna; however, avifauna is not restricted to one place for a long time, thus it will not result in their displacement.	-Water sprinkling will be done at the site to reduce dust emission. -All the construction activities will be carried out during the daytime. No activity will be done during late evenings which is the roosting time for the avian population and also during night time. -Acoustically enclosed DG sets will be provided along with vibration pads. -All the machinery used will be provided with vibration isolators in accordance with their vibration generation.
Noise & Vibration	-Noise and vibration generated due to the operation of machinery and equipment may cause physiological and psychological effects on laborers like annoyance, problems like speech interference, sleep disturbance, headache, Auditory impact, increase in heartbeat of elderly people. Running of machinery will cause vibration generation in the immediate surrounding area.	-Noise & vibration due to the running of concrete mixture/Pneumatic hammer m/c will be prevented by provision of protective devices like earmuff/plugs to the workers and keeping the machine in an enclosed system with a provision of vibration isolator. -Greenbelt area of 26.0515 ha (40.31 %) will be developed at the project site which will act as a barrier and help in reducing noise levels at the project site as a result of

Environmental components	Impact	Proposed Mitigation Measures
		attenuation of noise generated due to plant operations and transportation. -Less noise producing machinery will be purchased and shall be properly lubricated and regularly maintained.
Hydrology & Geology	None	None
Solid & Hazardous Waste	-Waste generated from construction machinery including waste oil, grease, and any other may cause nuisance if not maintained properly.	-All the waste generated will be properly disposed of as per solid waste management rules, 2016

4.2.4. ACTIVITY – TRANSPORTATION (RAW MATERIAL, LABOUR)

Aspects

- Vehicular emission
- HSD/petrol leakage
- Road congestion & breakage of roads
- Noise generation
- Dust Emission

Table 107. Transportation Impact and Mitigation Measures

Environmental components	Impact	Proposed Mitigation Measures
Air Environment	-Gaseous emissions from vehicles used for transportation will affect the health of construction workers and nearby population.	-Vehicles with valid PUC certificates will be used for transportation of construction material -Construction material shall be transported in closed and covered trucks. - Improved combustion efficiency, catalytic converters, and reformulated gasoline shall be used to reduce VOC emissions from vehicles. - Water sprinkling shall be carried out for dust suppression from movement of transport vehicles. - Plantation of trees around the project periphery will be carried out.
Water Environment	-Leakage of HSD/ petrol from vehicles, if in any case comes in contact with the water body then it may deteriorate the groundwater & surface water body quality. This in turn may affect aquatic life also. -Vehicular emission & dust emission if deposited over the surface of the water body may deteriorate the water quality and thereby affect aquatic life and make water unfit for consumption. -If raw material falls down near or on the water body it can deteriorate the	-PUC certified vehicles will be used, so that HSD/ petrol leakage does not occur & air emissions will be maintained within the prescribed limit & thereby restricting its deposition on the water bodies. -The vehicles carrying construction material and construction debris will be cleaned before they are permitted to ply on the road and covered vehicles will be used to reduce the dust emission & thereby restricting its deposition on the water body. -Wheel washing arrangement of construction vehicles will be provided at site.

Environmental components	Impact	Proposed Mitigation Measures
	water quality.	-Adequate drainage will be provided.
Land Use	None	None
Soil Environment	-Contamination of soil may occur due to HSD/ petrol seepage into the soil if any spillage occurs or while refueling (HSD petrol) of vehicles transporting construction materials and servicing of vehicles.	-Procedures for maintenance of vehicles would ensure that this risk is minimized, and clean-up response is rapid if any spill occurs. Lubricating waste oil shall be collected separately in drums and handed over to the authorized outside agency.
Socio-Economic	-Due to the construction of the project there will be an increase in usage of vehicles which will have a direct impact on traffic load on the existing roads in the area. Due to which there will be a traffic jam, chaos, discomfort, safety issues on the roads. - Indirect employment generation due to transportation will be there, hence, the economic condition of their families will improve. The purchasing power of people will increase. Hence, there will be overall development of the area.	-Existing road width is sufficient to handle the load of increased traffic. - Adequate parking is provided for trucks, cars within the factory premises. -There will be a positive impact due to increase in employment and other indirect requirements.
Ecology & Biodiversity	-None	-None
Noise & Vibration	-Due to transportation of construction materials and machinery for installation high levels of noise may be generated which may cause physiological & psychological effects. - There will not be much impact due to vibration on the project.	-Barriers of noise absorbing materials with adequate height will be maintained throughout the boundary of the project site. -Green belt within the project site will be done which will dampen the noise.
Hydrology & Geology	None	None
Solid & Hazardous Waste	-Due to improper handling & transportation of raw material such as RMC & waste during transportation, littering of waste will occur leading to unhygienic conditions.	-Proper care will be taken while handling & transportation of raw material such as RMC & waste during transportation to avoid littering of it on roads and sites.

4.2.5. ACTIVITY –WORKING & DAILY ACTIVITY OF CONSTRUCTION LABOR

Aspects

- Vehicular movement of construction materials
- Solid waste & E-waste generation
- Water requirement & waste water disposal

Table 108. Working & Daily Activity of Construction Labor

Environmental components	Impact	Proposed Mitigation Measures
Air Environment	-Bio-degradable waste generation may lead to odour problems if not stored properly & treated within time.	-The generated organic waste will be collected properly & will be treated in OWC.
Water Environment	-For construction laborers (Permanent 50 Nos. & Contractual 800 Nos.) 38.3 KLD of Domestic water shall be sourced from the Desalination plant and this will lead to 34 KLD of wastewater. If the wastewater is not properly disposed off, then it can deteriorate the surface water quality of nearby water bodies.	-Water required for domestic use will be sourced from the Desalination plant and the waste water generated from the plant will be sent to a STP. -Temporary toilets will be made.
Land Use	None	None
Soil Environment	-Impact on soil due to improper disposal of solid waste & liquid waste.	-Solid waste generated during the installation phase will be treated in OWC.
Socio-Economic	-Improper disposal of Solid waste & wastewater from labors may cause nuisance due to smell if not properly managed & treated.	-The generated organic waste will be collected and disposed of by an approved vendor.
Ecology & Biodiversity	None	None
Noise & Vibration	None	None
Hydrology & Geology	None	None
Solid & Hazardous Waste	-Improper storage and disposal of Biodegradable waste will enhance the risk of microbial contamination and will enhance the risk of disease occurrence and cause foul smell. It will attract the vectors.	-Solid waste from the laborers will be properly collected, stored in respective color coded containers. -The generated organic waste will be collected properly and will be sent to the Solid waste Handling Site. -Recyclable materials like aluminum, steel, wood pieces, cement bags, plastic containers, cartons, glass etc. will be given to recyclers.

4.3. POTENTIAL IMPACT DURING OPERATION PHASE

4.3.1. ACTIVITY – LOADING, UNLOADING & STORAGE OF RAW MATERIAL

Aspects

- Generation of dust particles.
- Generation of Noise
- Generation of solid waste, packaging material
- Generation of empty barrels.

Table 109. Loading, Unloading & Storage of Raw Material

Environmental Components	Impact	Mitigation Measures
Air Environment	- Point Source- Nil - Fugitive emission - Nil - Spillage/leakage of raw materials during loading or unloading may generate flue gases, VOCs which may cause irritation in the eyes of the workers and mucous membrane, acute respiratory illness, stress-related disorder and may also affect their immune system. - Very less dust will be generated during the loading or unloading activity.	- Workers are trained properly regarding handling of raw materials/chemicals, PPE like nose mask and goggles have been provided to the workers. - Transfer of liquid raw materials in reactors and storage tanks is being done through pipelines and pumps to avoid spillage/leakage. - Raw material dumping should be restricted to closed sheds. - Water sprinkling will be done for the dust suppression. - Loading or unloading activity will be mechanically supported.
Water Environment	- If dust particles are spread out in the neighborhood of the shed it may contaminate the water	- Dust particles should not spill in water and soil. The storage of raw materials will be in a pucca earmarked area with flooring where washing will be done and washed water channelized to ETP. - Water sprinkling for dust suppression.
Land Use	- No impact	-
Soil Environment	- The dust, if uncontrolled emission occurs over the neighborhood soil, will settle on the top soil.	- Periodic Sweeping of the surface - Periodic washing and washed water will be sent to ETP.
Socio-Economic	- The truck drivers and cleaners may create unwanted interaction with the neighborhood area. - Traffic density will increase.	- Restrooms for the truck drivers and other people also who are coming in the factory premises. - Adequate parking is provided within the factory premises.
Ecology & Biodiversity	- Vehicular emission like NO₂, NO etc. can inhibit the growth of plants and premature leaves senescence. - Traffic density will increase.	- Water sprinkling is done to reduce dust generation.
Noise & Vibration	- Loading and unloading of raw materials will not cause much of a significant impact on noise level of the area, it may only cause physiological effects like annoyance to the workers. - Noise due to transportation	- Limited to plant area - Regular checking of PUC.
Hydrology & Geology	None	None
Solid & Hazardous Waste	- Improper handling of raw material may cause its littering thereby generating the waste.	- Solid waste generated from the site is collected and sent to an authorized recycler.

4.3.2. ACTIVITY –MANUFACTURING PROCESS OF PRODUCTS ASPECTS

- Water requirement
- Generation of Process, scrubbing and other steam wastewater

- Generation of Heat
- Air Emissions from Boiler
- Generation of Solid & Hazardous waste
- Energy and Steam requirement
- Generation of Noise & Vibration
- Spillage/leakage from Reactor vessel
- Generation of odour
- Generation of Flue gases, VOCs
- Generation of fumes, etc.

Table 110. Manufacturing Process

Environmental Components	Impact	Mitigation Measures
Air Environment	- Emission from all production equipment. - Emission from DG sets, Boilers - Process emissions will be from the vents attached to the process reactor from which pollutants/gasses H₂S, SO₂, VOCs, & HCl will be released in the form of flue gasses which will degrade the ambient air quality of the area by increasing GLC and may cause eye irritation and acute respiratory illness to the people nearby. - Dust emission during material handling.	-Acoustic enclosures with adequate stack height is provided for DG set - Multi-cyclone followed by wet scrubber and adequate stack height will be provided for VCM & PM - Adequate stack height is provided for Boilers. - Ambient air quality will be monitored regularly. - APCS like Multi-cyclone followed by wet scrubber, Bag filters, Reverse jet bag filters. Height will be installed in accordance with CPCB norms and to avoid emissions from process pollutants, measures like continuous scrubbing off acidic gases and harmful particulates, with water for production of by-product will be done.
Water Environment	- The existing freshwater load is 4102 KLD, which will increase to 13041 KLD after expansion - Water sprinkling & Cleaning of area may lead to contamination of the groundwater and soil. - Process wastewater will be generated from Process @ 8840 KLD, and Boiler & Cooling tower and @3399 KLD. - Due to manpower 104 KLD sewage water will be generated.	Total 40 KLD of treated sewage will be generated from Domestic which will be treated in STP of capacity 50 KLD. Remaining 5620 KLD of effluent (4220 MLD from process, 100 KLD from Plant Wash, 920 KLD from Cooling Tower & 360 KLD from DM Regeneration & 20 KLD from Boiler Blowdown) will be treated in ETP of capacity 6400 KLD. -Groundwater recharging with rainwater harvesting during the rainy season.
Land Use	- Production plant area, Solid waste storage/ Disposal Area	
Soil Environment	No Impact	-
Socio-Economic	Revenue increase through increased production - Employment generation @ 346 permanent and 1068 contractual employment will be generated.	None

Environmental Components	Impact	Mitigation Measures
Ecology & Biodiversity	-No impact	-Greenbelt area of 26.0515 ha (40.31%) will be maintained to enhance the aesthetic beauty of the project site.
Noise & Vibration	-Noise: Boiler, DG set, material transportation, etc. Vibration: Due to machinery and DG set.	-Heavy equipments will have noise suppressors installed in the shed in order to localize the noise pollution -Workers will be given a PPE/Ear muffler and controlled exposure will be allowed at a time period for 20 mins. -It will be re-checked and assured that mufflers systems will be installed in engines of machineries which helps in reduction of noise. -Silencers of all the machineries and equipment will be checked and old worn out machineries replaced by new and less noisy machineries/equipment. -Sufficient oiling and lubrication will be done to all the parts of the machineries to ensure that minimal noise will be generated.
Hydrology & Geology	No impact	-
Solid & Hazardous Waste	Used or spent oil, Wastes or residues containing oil, distillation residue, Furnace residue, Diesel, ETP, Chemical sludge, PVC Lumps & Spent catalyst - HW will be impacting the workers and nearby villagers	-Proper care will be taken while handling & transportation, PPE will be used. - Biodegradable organic waste @ 39.74 TPA treated in inhouse organic waste convertor (OWC) and use manure for horticulture development purposes in the premises and non- biodegradable waste @55.68 TPA will be sold to authorized recyclers. - Hazardous waste @ 52.4 MT spent oil, Wastes or residues containing oil @ 5 MT and spent catalyst @ 40 MT will be sold to authorized recyclers. Distillation residue @ 2000 MT will be used in captive incineration. Furnace residue @ 50 MT, Desal sludge @ 5000 MT , ETP sludge @ 1820 MT & Chemical sludge @ 4312 - will send to TSDF. PVC lumps @ 21.6 MT will Disposed off at TNWML (Tamil NaduWaste Management Limited) common disposal facility at Gummudipondi, an authorized agency

4.3.3. ACTIVITY – OPERATION OF MANUFACTURING PROCESS & EQUIPMENT (BOILER, DG SET, ETP, ETC)

Aspects

- Generation of waste gases, Particulate Matter (PM₁₀), Particulate Matter (PM_{2.5}), Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Carbon Monoxide (CO), Total Volatile Organic Compounds (TVOCs), Hydrochloric Acid (HCl), Chlorine (Cl₂), Total Hydrocarbons (THC), Non-Methane Hydrocarbons (NMHC).
- Generation of Sludge, used oil.
- Water requirement and generation of wastewater
- Generation of Noise & vibration
- Generation of waste water
- Requirement of Fuel
- Generation of Ash
- Spillage/leakage
- Generation of Hazardous waste

Table 111. Operation of Manufacturing machinery & Equipment

Environmental Components	Impact	Mitigation Measures
Air Environment	-Flue gas emissions (SO ₂ , NO _x & PM _{2.5} , PM ₁₀ & VCM will be generated from a stack.	-To prevent emissions, APCS like adequate stack height, Multi-cyclone followed by wet scrubber with adequate stack height, and dust collector bag filter will be installed with appropriate stacks in accordance with CPCB norms. -Regular maintenance of valves, pipes etc will be done. PPEs are provided to the workers.
Water Environment	-Utilisation of water may impact the water demand of the vicinity and improper disposal of waste water generated may affect the quality of nearby surface water body & ground water. -The waste water If not properly disposed off, then it can deteriorate the surface water quality of nearby water bodies by increasing the no. of pathogens, BOD, COD, TSS etc and making water unfit for consumption. It will also affect aquatic life.	-Total waste water generation after expansion will be 13419 KLD. Total 104 KLD of treated sewage will be generated from Domestic which will be treated in STP of capacity 140 KLD. Remaining 13310 KLD of effluent (8840 KLD from process, 300 KLD from Plant Wash, 3309 KLD from Cooling Tower, 770 KLD from DM Regeneration & 90 KLD from Boiler Blowdown) will be treated in ETP of proposed capacity 15800 KLD followed by RO and MEE. The plant will be based on Zero Liquid discharge system and no effluent/treated water will be discharged outside factory premises. - Groundwater recharging with rainwater harvesting during the rainy season.
Land Use	None	-
Soil Environment	-	-
Socio-Economic	None	None
Ecology & Biodiversity	-NO _x , SO _x , VOC, and other gaseous emissions from the boilers, DG set inhibit the growth of plants and premature leaves senescence. -Untreated water can deteriorate the plant/tree.	-All the machinery will be installed with an appropriate air pollution control system.

Environmental Components	Impact	Mitigation Measures
Noise & Vibration	-During the operation of machinery, noise and vibration may be generated from the machinery which may cause speech interference, annoyance, hearing impairment, increase in heartbeat/ blood pressure in the workers.	-Machineries of the reputed make and less noise producing will be purchased. -Stationary machineries and equipment will be properly enclosed by enclosures and provided with dampeners for minimizing noise generated due to vibration of machineries. -Silencers of all the machineries and equipment will be checked and old worn out machineries will be replaced by new and less noisy machinery/equipment. -Sufficient oiling and lubrication will be done to all the parts of the machineries to ensure that minimal noise is generated. -Greenbelt area of 26.0515 ha (10.31%) will be developed at the project site which will act as a barrier and help in reducing noise levels at the project site as a result of attenuation of noise generated due to plant operations and transportation.
Hydrology & Geology	-	-
Solid & Hazardous Waste	STP/ETP sludge, and used oil will be generated which are hazardous, which may cause harm if come into contact. Sludge and any other may cause nuisance if not maintained properly.	-Proper care will be taken while handling & transportation, PPE will be used. - Biodegradable organic waste @ 39.74 TPA treated in inhouse organic waste convertor (OWC) and use manure for horticulture development purposes in the premises and non- biodegradable waste @55.68 TPA will be sold to authorized recyclers. - Hazardous waste @ 52.4 MT spent oil, Wastes or residues containing oil @ 5 MT and spent catalyst @ 40 MT will be sold to authorized recyclers. Distillation residue @ 2000 MT will be used in captive incineration. Furnace residue @ 50 MT, Desal sludge @ 5000 MT , ETP sludge @ 1820 MT & Chemical sludge @ 4312 - will send to TSDF. PVC lumps @ 21.6 MT will Disposed off at TNWML (Tamil Nadu Waste Management Limited) common disposal facility at Gummudipondi, an authorized agency.

4.3.4. ACTIVITY – TRANSPORTATION OF RAW MATERIAL, FINISHED PRODUCT, WASTE, ETC.

Aspects

- Vehicular Emission and Dust emission

- Littering of solid waste
- Road congestion & Breakage of roads
- Noise Generation
- Spillage/leakage of raw material

Table 112. Transportation of Raw Material, finished product, waste, etc.

Environmental Components	Impact	Mitigation Measures
Air Environment	-Gaseous emissions from vehicles used for transportation will affect the respiratory health of staff and nearby population.	-Vehicles with valid PUC certificates are being used for transportation. -Tree Plantation all around the periphery has been done. -Proper maintenance of vehicles are done periodically to ensure no leakage from the vehicles -Vehicular transportation is done shift wise in order to reduce the stress on the roads. -Proper maintenance and cleaning of vehicles and tyres are done in order to reduce dust generation. -The transportation of the raw material, & products is being done in covered trucks & tempos.
Water Environment	If dust emitted or spillage/leakage gets deposited on the water body it can deteriorate the water quality.	-Trucks used are fully covered during transportation to the project by road.
Land Use	None	None
Soil Environment	-	-
Socio-Economic	-Dust and emission from movement of vehicles are likely to cause some impacts on the working population within the immediate vicinity of the project site. -Traffic congestion in the area	-The present road conditions are reasonably good for proposed movement of traffic, the site is connected to the National Highway. -Preventive maintenance is carried out for vehicles and pollution checks on a periodic basis. -Materials transported are fully covered during transportation to the project site by road.
Ecology & Biodiversity	-Increased noise due to vehicular transportation will cause disturbance of existing avi-fauna, however, avifauna is not restricted to one place for a long time, thus it will not result in their displacement.	-Water sprinkling is being done to reduce the dust generation -Vehicular movements for transportation of raw material are carried out only in day-time and try to avoid unnecessary honking with the help of sign boards.
Noise & Vibration	-Due to transportation of construction materials and machinery for installation high levels of noise may be generated which may cause physiological & psychological effects	-Silencers are checked in the vehicles used for transportation of materials. -No honking zone is maintained. -Reverse horn in the transportation vehicles is banned. -Only PUC certified vehicles are allowed for

Environmental Components	Impact	Mitigation Measures
	on workers like annoyance, speech interference, headache, Auditory impact, increase in heartbeat of elderly people. - There will not be much impact due to vibration on the project.	transportation -Maintenance of vehicles is done on a regular basis. -Tree Plantation within the project site has been done which will dampen the noise.
Hydrology & Geology	-	-
Solid & Hazardous Waste	-	-

4.3.5. ACTIVITY - WORKING & DAILY ACTIVITY OF STAFF, VISITORS

Aspects

- Solid & e-waste generation
- Water requirement & wastewater generation

Table 113. Working & daily activity of staff, Visitors

Environmental Components	Impact	Mitigation Measures
Air Environment	-Bio-degradable waste generation may lead to odour problems if not stored properly.	Biodegradable waste is Treatment in inhouse organic waste converter (OWC) and use manure for horticulture development purposes in the premises.
Water Environment	-Waste water, if not properly disposed of, can deteriorate the surface water quality of nearby water bodies. -The abstraction of groundwater is not proposed for the project, hence there will be impact on Groundwater of the area.	-Total waste water generation after expansion will be 13419 KLD. Total 104 KLD of treated sewage will be generated from Domestic which will be treated in STP of capacity 140 KLD. Remaining 13310 KLD of effluent (8840 KLD from process, 300 KLD from Plant Wash, 3309 KLD from Cooling Tower, 770 KLD from DM Regeneration & 90 KLD from Boiler Blowdown) will be treated in ETP of proposed capacity 15800 KLD followed by RO and MEE. The plant will be based on Zero Liquid discharge system and no effluent/treated water will be discharged outside factory premises. - Groundwater recharging with rainwater harvesting during the rainy season.
Land Use	None	None
Soil Environment	-	-
Socio-Economic	-Direct & indirect employment generation	-
Ecology & Biodiversity	No significant impact	None
Noise & Vibration	No significant impact	None

Environmental Components	Impact	Mitigation Measures
Hydrology & Geology	-Infiltration of silt and sand may occur with improper stormwater harvesting. -Untreated wastewater, if infiltrated to ground water it may deteriorate water quality of ground water by increasing the no. of pathogens, BOD, COD, TSS etc in ground water and thereby affecting and making water unfit for consumption.	-The rainwater from part of rooftops is diverted using rain water pipes to the surface and via a storm water drain network. - Proper closed channelization will be done.
Solid & Hazardous Waste	-Improper storage and disposal of Biodegradable waste will enhance the risk of microbial contamination, population. -Improper storage and disposal of MSW waste, will enhance the risk of disease occurrence and cause foul smell. It will attract the vectors. -Improper hazardous chemical disposal if comes in contact with human body may cause skin irritation and could be flammable also sometimes	-Proper care will be taken while handling & transportation, PPE will be used. - Biodegradable organic waste of 39.74 TPA treated in inhouse organic waste convertor (OWC) and use manure for horticulture development purposes in the premises and non-biodegradable waste @55.68 TPA will be sold to authorized recyclers. - Hazardous waste @ 52.4 MT spent oil, Wastes or residues containing oil @ 5 MT and spent catalyst @ 40 MT will be sold to authorized recyclers. Distillation residue @ 2000 MT will be used in captive incineration. - Furnace residue @ 50 MT, Desal sludge @ 5000 MT, ETP sludge @ 1820 MT & Chemical sludge @ 4312 - will be sent to TSDF. PVC lumps @ 21.6 MT will Disposed off at TNWML (Tamil Nadu Waste Management Limited) common disposal facility at Gummudipondi, an authorized agency

4.4. SUMMARY OF IMPACT & MITIGATION

4.4.1. Air Environment

The project activities which would increase the emission of SO₂, CO₂, HCl, Chlorine, PM, CO, SO₂, NO₂ are dust generation which could lead to an increase in ground concentration level (GLC), respiratory problems, damage to flora and fauna and aesthetic properties in the environment and increase the level of toxic chemicals to other aspects of the environment indirectly.

APCS like adequate stack height, Multi-cyclone followed by wet scrubber with adequate stack height, and dust collector bag filter will be installed with appropriate stacks in accordance with CPCB norms and to avoid emissions from process pollutants, measures like continuous scrubbing off the fumes with water for production are being done, Plantation of trees, installation of water sprinkling systems and dust compression systems in the nearby areas, provision of proper nose masks to workers, Vehicles with valid PUC certificates is used for transportation & the same will be

followed after expansion. Vehicles with valid PUC certificates will be used for transportation of raw material, waste and finished products.

4.4.2. Water Environment

The activities which would probably pose an impact on the water environment would be the manufacturing process, operation of machinery & equipment, working & daily activities of staff, visitors, transportation. The aspects of the activities may be the generation of waste water, scarcity of water, depletion of water table and deterioration of water quality which could lead to deterioration of aquatic life, generation of water-borne diseases to nearby populations.

The total water requirement for the operational industry is 9799 KLD out of which fresh water requirement is 4102 KLD & treated water (ETP & STP water combined) is 5697 KLD. After expansion, Total Fresh Water Requirement for the proposed expansion is 11422 KLD, which is being met through the Desalination Plant. Out of total water requirement of 24841, 110 KLD will be used for domestic purposes, 12430 KLD will be used in DM Plant, 300 KLD is used in Plant Wash, 11070 KLD will be used in Cooling tower and the balance 958 KLD will be used in Greenbelt. ETP treated effluent will be used @ 7320 KLD in DM Plant and 5910 KLD Cooling Tower and STP treated water will be used @ 104 KLD in Gardening. ZLD will be maintained within the premises. To reduce the impact on Surface Water, a rainwater harvesting system is already in place and will continue after proposed expansion as well.

4.4.3. Land Use

No negative impact on land use is envisaged as the project site is an existing operational industry. Moreover, the additional plot will be used for the Production plant area, Solid waste storage/disposal Area.

4.4.4. Soil Environment

The major activities which would negatively impact the soil environment would be loading & unloading of raw material, manufacturing process of product, operation of machinery (DG sets, EDC cracking Furnace, APCS, etc.), handling of raw material, transportation of raw material, finished product and waste. The aspects of the activities would be soil erosion, waste generation and spillage of hazardous wastes or chemical on the soil which could lead to permanent damage to land productivity, destabilization of landscape, decrease in permeability, damage to fertility of soil, chemical degradation and indirect negative impact on other aspects of environment like Air, Water & Ecology and Biodiversity. To minimize such impacts, mitigation measures like proper treatment and disposal of waste, proper maintenance of equipment and storage for chemicals, provision and maintenance of Green areas in the project site and nearby areas. Procedures for maintenance of equipment would ensure that the risk is minimized and clean-up response is rapid if any spill occurs. The tankers, drums etc., would be ISO approved and as per the specifications of internationally

approved vendors so as to minimise any spillage, etc. therefore there would be no impact on soil after this precaution is ensured. For any spills- apart from dumps, provision of spill kits are being made available.

4.4.5. Socio-economic

Aspects of project activities which would be dust emission, waste generation and socio-economic conditions in the nearby area which could impact to the extent of annoyance, loss of life respiratory problems to nearby population further, positive impacts include an increase in employment and revenue generation among the population in the nearby area. To minimize negative impacts, mitigation measures like proper air pollution control systems will be used, effluent treatment by ETP will be provided and industrial activities will be restricted and limited only to the project area. Proper segregation of waste, good housekeeping, maximization of employment to locals, proper treatment and disposal of all wastes generated from the plant would also be adopted in the area. All the safety measures will be followed and a safety data sheet will be provided.

4.4.6. Ecology & Biodiversity

The major activities which would have an impact on the Ecology and Biodiversity in the project area and the surroundings would be site preparation, excavation, manufacturing process, operation of machinery & equipment, transportation, loading & unloading of raw material. The aspects of the activities would be dust emission, increase in GLC, increase in noise level, soil erosion, noise generation, water contamination, vehicular emission and waste generation which would directly /indirectly impact in decrease in transpiration rate of flora, loss of habitat, decrease in plant/tree cover, disturbance to avi-fauna and other species, premature senescence of floral species and hence decrease in population of local faunal species in the area and the surroundings.

To minimize such impacts, mitigation measures like provision of air pollution control equipment, scrubbing system to the vents, provision and proper maintenance of green area, installation of water sprinkling systems and dust suppression systems, provision of noise barriers, maintenance of vehicular movement near the project site and proper disposal and treatment of wastes generated from the project site. Vehicular movement for transportation of raw material will be carried out only in day-time and will try to avoid unnecessary honking with the help of sign boards. Green belt/greenery will be developed along most of the periphery of the project area as well as along roads.

4.4.7. Noise and Vibration

The major activities which would have an impact on the environment would be operation of machinery and transportation. The aspects of the activities would be an increase in noise level which could lead to physiological and psychological problems to workers and nearby population, increased vibration in the nearby areas and an indirect decrease in the biological diversity in the

nearby area. To minimize such impacts, mitigation measures like restriction of activities in the limited project area, proper maintenance of equipment and machinery, maintenance of noise barriers, provision of protective devices like earmuffs, compactors, silencers etc., installation of green area in the nearby area, provision of No-Honking Zone in the area, maintenance of vehicular and traffic movement etc. would be adapted in the project site.

4.4.8. Hydrology and Geology

The major activities which would have an impact on the Hydrology and Geology in the project area and the surroundings would be the occurrence of infiltration of silt and sand if improper stormwater harvesting practises, untreated wastewater, if infiltrated to ground water it may deteriorate water quality of ground water by increasing the no. of pathogens, BOD, COD, TSS etc in ground water and thereby affecting and making water unfit for consumption. To minimize such impacts, mitigation measures like diversion of the rainwater from part of rooftops using rain water pipes to the surface and via a storm water drain network, Proper closed channelization will be done.

4.4.9. Solid and Hazardous Waste

The solid wastes generated from the expansion units will be utilized for beneficial purposes. The Company has assured that it will not dump the solid wastes inside the plant premises or on any land outside the plant premises.

The Hazardous Wastes that will be generated from the expansion units will be disposed of in a scientifically acceptable manner, after obtaining authorization from CPCB as per Rules. The wastes will be collected in drums and stored at an earmarked place in a covered shed. The storage will be done for a maximum 90 days and thereafter given to TSDF or sold to authorized re- processors. The details of hazardous wastes after expansion are given below:

Item 5.1: Used or spent oil: 52.4 TPA (Generated from equipment, collected, stored, transported and disposed to authorized recyclers).

Item 5.2: Wastes or residues containing oil: 5 TPA (Generated from equipment, collected, stored, transported and disposed to authorized recyclers).

Item 20.3: Distillation residues: 2000 TPA (Generated from the process, collected, transported and incinerated through Captive incinerator).

Item 1.1: Furnace residues: 50 TPA (Generated from the process, collected, transported and given to TSDF).

Item 35.3: Desalination Sludge : 5000 TPA (Generated from the Desalination Plant, collected, stored and given to TSDF).

Item 35.3: ETPSludge : 1820 TPA (Generated from the ETP, collected, stored and given to TSDF).

Item 35.3: Chemical Sludge (salt) : 4312 TPA (Generated from the Multiple Effect Evaporator, collected, stored and given to TSDF).

Item 22.2: PVC lumps : 21.6 TPA (Generated from the Manufacturing process, collected, stored and disposed off at TNWML (Tamil Nadu Waste Management Limited) common disposal facility at Gummudipondi).

Item 1.7: Spent Catalyst : 40 TPA (Generated from the Manufacturing process, collected, stored, transported and disposed to authorized recyclers).

4.4.10. Traffic density

The activities which would probably be responsible for traffic congestion would be transportation of raw materials and products for which trucks and tempo will be used. Traffic to the different sites during construction/installation will be intensive and heavier than at present in normal operating conditions. The aspect of the activities would be generation of dust from movement of vehicles are likely to cause some impacts on the working population within the immediate vicinity of the project site. In turn, it will subject existing roads to more stress. To control the impact, dust suppression systems (water spray) will be used as per requirement at the construction site.

Construction materials will be fully covered during transportation to the project site by road. Vehicle flow during shift changes will be regulated by allowing exits in a phased manner. The present road conditions are reasonably good for proposed movement of traffic. Preventive maintenance will be carried out for vehicles and pollution checks on a periodic basis will be mandatory. All the activities will be done for a limited period of time. The traffic survey for the proposed unit was conducted and detail is given in Chapter 3 Section 3.13.

4.5 AIR QUALITY MODELLING

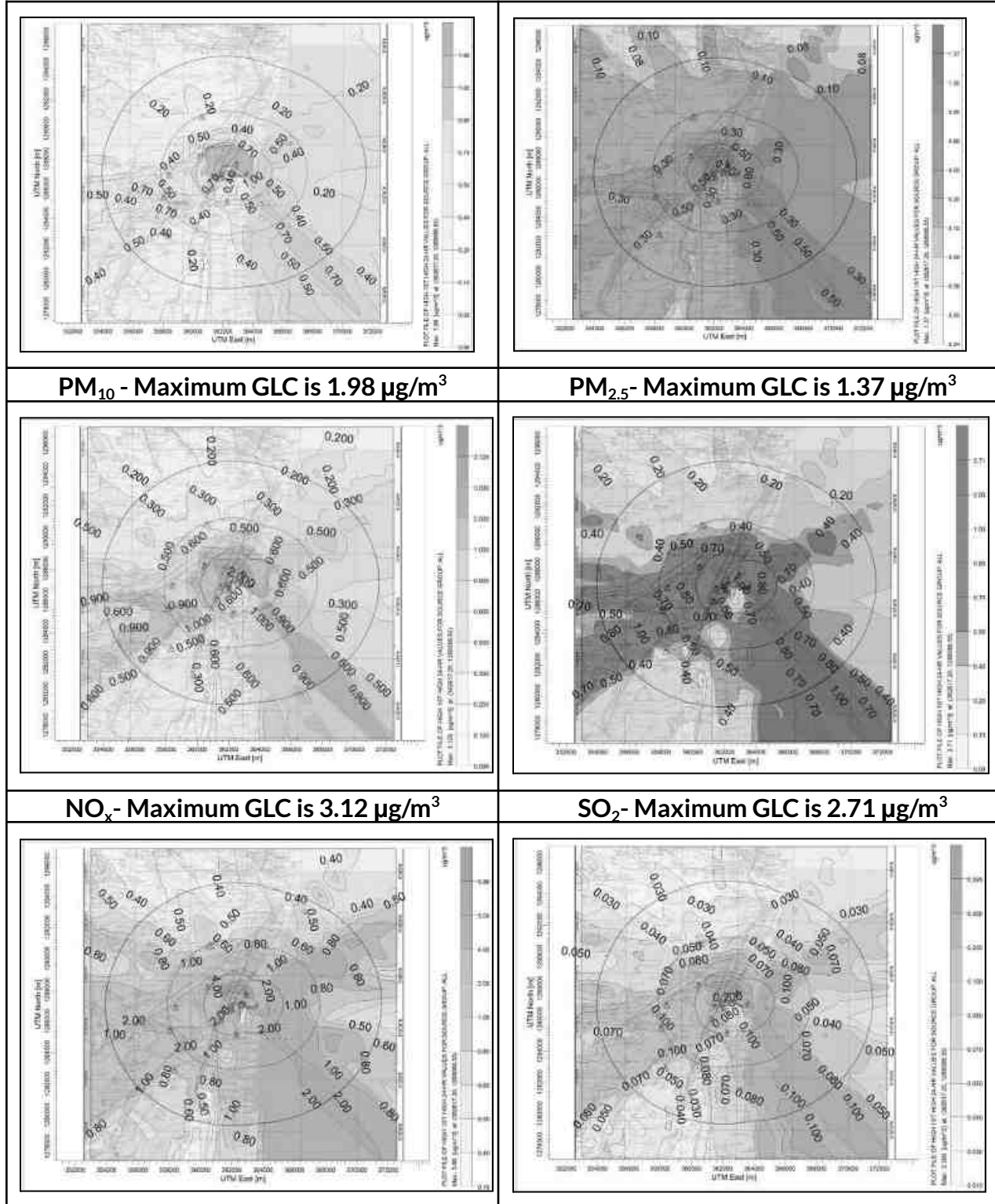
The input parameters for air quality modeling (AERMOD) are given below:

Table 114. The input parameters for air quality modeling (AERMOD)

Input		Description
Modelling Software Used		AERMOD View-Version 11.2.0
Control Pathway		
Terrain		Elevated
Dispersion Coefficient		Rural
Meteorology Pathway		
1	Met Input Data	AERMET Meteorological data for the year 2023
2	Latitude:	Plant Location as shown earlier
3	Longitude:	
4	Datum	WGS 84
5	Base Elevation:	28 mSL
Receptor		Uniform Cartesian Grid 2 with 5-10 m receptor spacing

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

Scenario I - All Utilities



Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

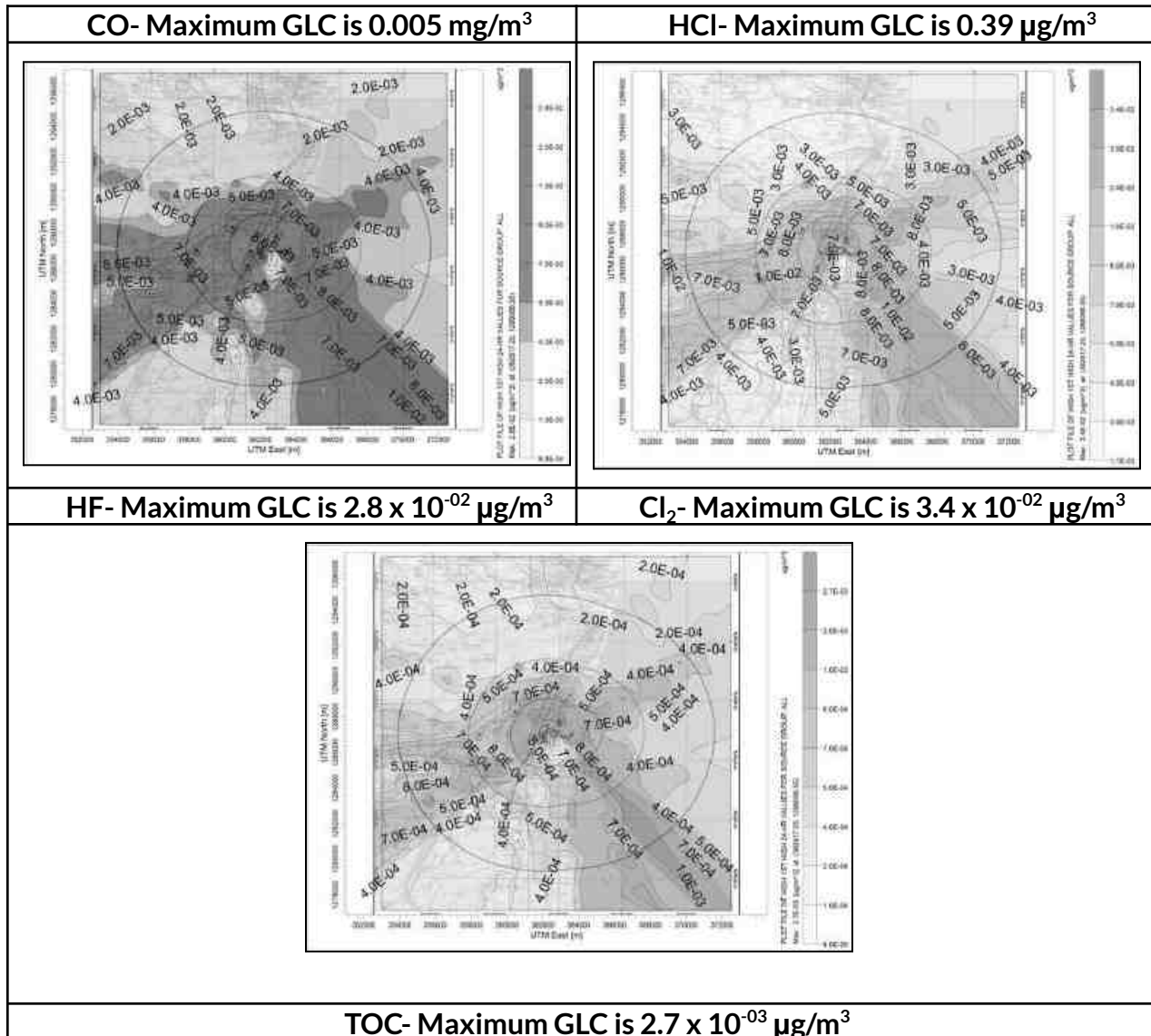


Figure 77. Output file showing scenario 1 for PM10, & PM2.5

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

Scenario II - Process Emission

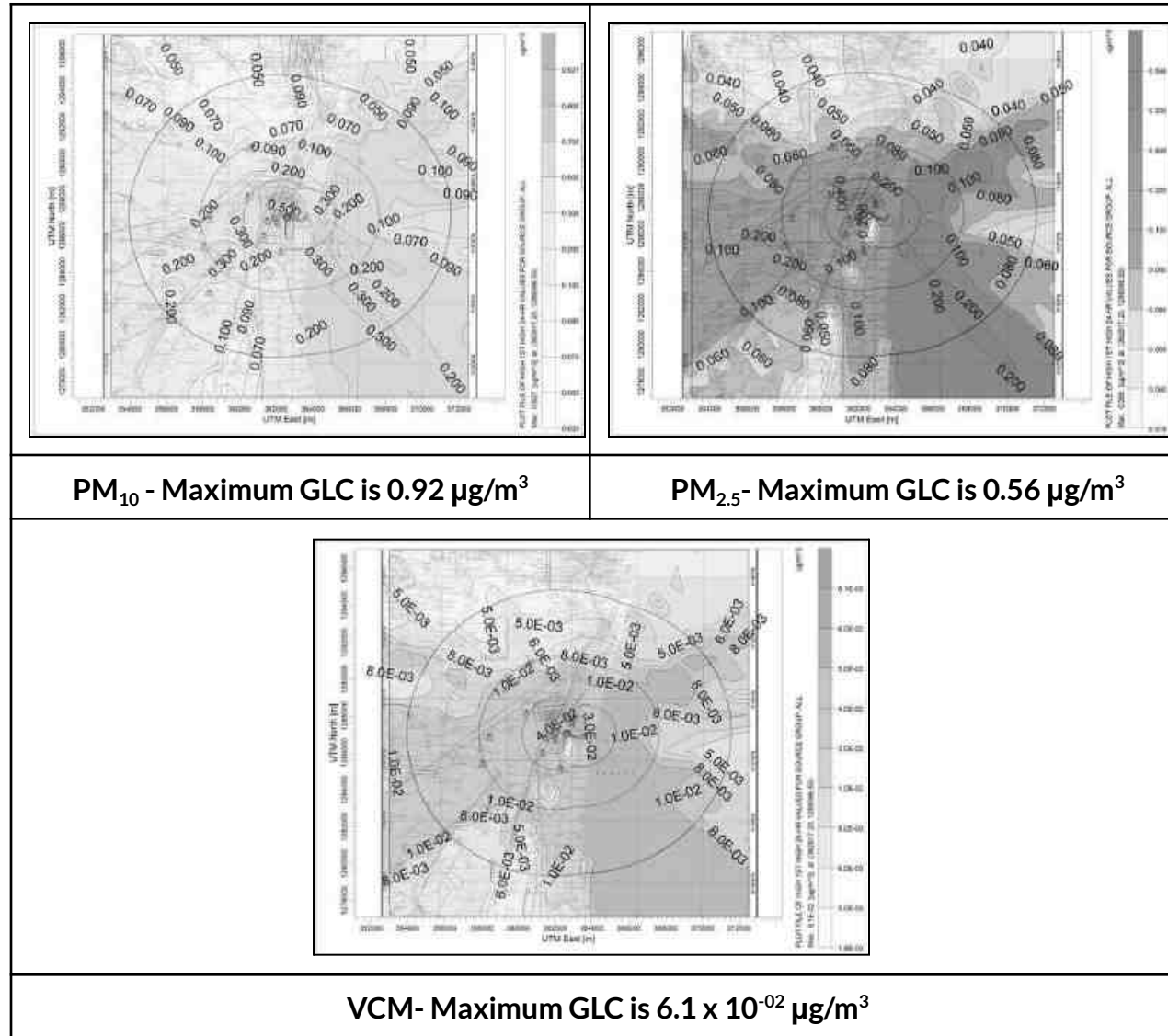


Figure 77. Output file showing scenario 2 for PM10, & PM2.5

PREDICTED AMBIENT AIR QUALITY AND EMISSIONS FROM UTILITY & PROCESS (PM_{2.5}, PM₁₀, NO₂, CO, SO₂, HCl, Cl₂, HF & VCM)

Table 115. Village Wise Impacts of various scenario(s) for PM_{2.5} pollutant

PM _{2.5} -60 µg/m ³			A. All Utilities		B. Process Emission	
			Scenario 1		Scenario 2	
Location	Distance & Direction	Background Concentration PM _{2.5} (µg/m ³)	Predicted Incremental Concentration PM _{2.5} (µg/m ³)	Post Project Air Quality PM _{2.5} (µg/m ³)	Predicted Incremental Concentration PM _{2.5} (µg/m ³)	Post Project Air Quality PM _{2.5} (µg/m ³)
A1 Onsite	South West	19.67	1.37	21.04	0.56	20.23

PM _{2.5} -60 µg/m ³			A. All Utilities		B. Process Emission	
			Scenario 1		Scenario 2	
Location	Distance & Direction	Background Concentration PM _{2.5} (µg/m ³)	Predicted Incremental Concentration PM _{2.5} (µg/m ³)	Post Project Air Quality PM _{2.5} (µg/m ³)	Predicted Incremental Concentration PM _{2.5} (µg/m ³)	Post Project Air Quality PM _{2.5} (µg/m ³)
A2 Onsite	North East	18.86	1.37	20.23	0.56	19.42
A3 Thatchan Colony	0.32km W	20.50	1.00	21.5	0.50	21.00
A4 Poondiyankuppam	0.93km SW	23.96	1.00	24.96	0.50	24.46
A5 Nochikadu	1.71km NE	24.87	1.12	25.99	0.52	25.39
A6 Thyagavalli	1.84 km S	26.72	0.89	27.61	0.40	27.12
A7 Tondamanathan	2.46km NW	18.06	0.90	18.96	0.42	18.48
A8 Valudambattu	4.28km W	22.21	0.40	22.61	0.26	22.47
A9 Anukkambattu	5.28km SW	21.35	0.40	21.75	0.25	21.60
A10 Annavalli	5.73km NW	25.78	0.40	26.18	0.25	26.03
A11 Puvanikuppam	6.67 km SW	23.08	0.35	23.43	0.20	23.28

Table 116. Village Wise Impacts of various scenario(s) for PM₁₀ pollutant

PM ₁₀ -100 µg/m ³			A. All Utilities		B. Process Emission	
			Scenario 1		Scenario 2	
Location	Distance & Direction	Background Concentration PM ₁₀ (µg/m ³)	Predicted Incremental Concentration PM ₁₀ (µg/m ³)	Post Project Air Quality PM ₁₀ (µg/m ³)	Predicted Incremental Concentration PM ₁₀ (µg/m ³)	Post Project Air Quality PM ₁₀ (µg/m ³)
A1 Onsite	South West	56.03	1.98	58.01	0.92	56.95
A2 Onsite	North East	53.88	1.98	55.86	0.92	54.80
A3 Thatchan Colony	0.32km W	58.22	1.48	59.7	0.87	59.09
A4 Poondiyankuppam	0.93km SW	67.30	1.48	68.78	0.87	68.17
A5 Nochikadu	1.71km NE	69.64	1.50	71.14	0.90	70.54
A6 Thyagavalli	1.84 km S	74.43	1.21	75.64	0.60	75.03
A7 Tondamanathan	2.46km NW	51.75	1.00	52.75	0.58	52.33
A8 Valudambattu	4.28km W	62.70	0.88	63.58	0.40	63.10
A9 Anukkambattu	5.28km SW	60.44	0.75	61.19	0.37	60.81
A10 Annavalli	5.73km NW	72.02	0.60	72.62	0.30	72.32
A11 Puvanikuppam	6.67 km SW	64.98	0.60	65.58	0.30	65.28

Table 117. Village Wise Impacts of various scenario(s) for NO₂ pollutant

NO ₂ - 80 µg/m ³			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration NO ₂ (µg/m ³)	Predicted Incremental Concentration NO ₂ (µg/m ³)	Post Project Air Quality NO ₂ (µg/m ³)
A1 Onsite	South West	14.64	3.12	17.76
A2 Onsite	North East	14.06	3.12	17.18
A3 Thatchan Colony	0.32km W	15.24	2.20	17.44
A4 Poondiyankuppam	0.93km SW	17.72	2.20	19.92
A5 Nochikadu	1.71km NE	18.37	2.25	20.62
A6 Thyagavalli	1.84 km S	19.69	2.00	21.69
A7 Tondamanathan	2.46km NW	13.48	1.80	15.28
A8 Valudambattu	4.28km W	16.46	1.70	18.16
A9 Anukkambattu	5.28km SW	15.84	1.61	17.45
A10 Annavalli	5.73km NW	19.02	1.60	20.62
A11 Puvanikuppam	6.67 km SW	17.09	1.50	18.59

Table 118. Village Wise Impacts of various scenario(s) for SO₂ pollutant

SO ₂ -80 µg/m ³			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration SO ₂ (µg/m ³)	Predicted Incremental Concentration SO ₂ (µg/m ³)	Post Project Air Quality SO ₂ (µg/m ³)
A1 Onsite	South West	8.40	2.71	11.11
A2 Onsite	North East	8.07	2.71	10.78
A3 Thatchan Colony	0.32km W	8.74	1.20	9.94
A4 Poondiyankuppam	0.93km SW	10.15	1.20	11.35
A5 Nochikadu	1.71km NE	10.52	1.25	11.77
A6 Thyagavalli	1.84 km S	11.27	1.00	12.27
A7 Tondamanathan	2.46km NW	7.74	0.80	8.54
A8 Valudambattu	4.28km W	9.44	0.70	10.14
A9 Anukkambattu	5.28km SW	9.09	0.61	9.70
A10 Annavalli	5.73km NW	10.89	0.60	11.49
A11 Puvanikuppam	6.67 km SW	9.79	0.50	10.29

Table 119. Village Wise Impacts of various scenario(s) for CO pollutant

CO- 2 mg/m ³			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration CO (mg/m ³)	Predicted Incremental Concentration CO (mg/m ³)	Post Project Air Quality CO (mg/m ³)
A1 Onsite	South West	0.42	0.005	0.425
A2 Onsite	North East	0.41	0.005	0.415
A3 Thatchan Colony	0.32km W	0.44	0.003	0.443
A4 Poondiyankuppam	0.93km SW	0.51	0.003	0.513

CO- 2 mg/m ³			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration CO (mg/m ³)	Predicted Incremental Concentration CO (mg/m ³)	Post Project Air Quality CO (mg/m ³)
A5 Nochikadu	1.71km NE	0.53	0.004	0.534
A6 Thyagavalli	1.84 km S	0.57	0.002	0.572
A7 Tondamanathan	2.46km NW	0.39	0.002	0.392
A8 Valudambattu	4.28km W	0.48	0.001	0.481
A9 Anukkambattu	5.28km SW	0.46	0.001	0.461
A10 Annavalli	5.73km NW	0.55	0.001	0.551
A11 Puvanikuppam	6.67 km SW	0.50	0.001	0.501

Table 120. Village Wise Impacts of various scenario(s) for HCl pollutant

HCl			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration HCl (µg/m ³)	Predicted Incremental Concentration HCl (µg/m ³)	Post Project Air Quality HCl (µg/m ³)
A1 Onsite	South West	2.00	0.39	2.39
A2 Onsite	North East	1.92	0.39	2.31
A3 Thatchan Colony	0.32km W	2.08	0.20	2.28
A4 Poondiyankuppam	0.93km SW	2.41	0.20	2.61
A5 Nochikadu	1.71km NE	2.50	0.25	2.75
A6 Thyagavalli	1.84 km S	2.68	0.18	2.86
A7 Tondamanathan	2.46km NW	1.84	0.18	2.02
A8 Valudambattu	4.28km W	2.24	0.10	2.34
A9 Anukkambattu	5.28km SW	2.16	0.10	2.26
A10 Annavalli	5.73km NW	2.59	0.10	2.69
A11 Puvanikuppam	6.67 km SW	2.33	0.10	2.43

Table 121. Village Wise Impacts of various scenario(s) for VCM pollutant

VCM			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration VCM (µg/m ³)	Predicted Incremental Concentration VCM (µg/m ³)	Post Project Air Quality VCM (µg/m ³)
A1 Onsite	South West	BDL	6.1 x 10 ⁻⁰²	6.1 x 10 ⁻⁰²
A2 Onsite	North East	BDL	6.1 x 10 ⁻⁰²	6.1 x 10 ⁻⁰²
A3 Thatchan Colony	0.32km W	BDL	5.0 x 10 ⁻⁰²	5.0 x 10 ⁻⁰²
A4 Poondiyankuppam	0.93km SW	BDL	5.0 x 10 ⁻⁰²	5.0 x 10 ⁻⁰²
A5 Nochikadu	1.71km NE	BDL	5.5 x 10 ⁻⁰²	5.5 x 10 ⁻⁰²
A6 Thyagavalli	1.84 km S	BDL	3.0 x 10 ⁻⁰²	3.0 x 10 ⁻⁰²
A7 Tondamanathan	2.46km NW	BDL	3.0 x 10 ⁻⁰²	3.0 x 10 ⁻⁰²
A8 Valudambattu	4.28km W	BDL	2.0 x 10 ⁻⁰²	2.0 x 10 ⁻⁰²

VCM			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration VCM ($\mu\text{g}/\text{m}^3$)	Predicted Incremental Concentration VCM($\mu\text{g}/\text{m}^3$)	Post Project Air Quality VCM ($\mu\text{g}/\text{m}^3$)
A9 Anukkambattu	5.28km SW	BDL	2.0×10^{-02}	2.0×10^{-02}
A10 Annavalli	5.73km NW	BDL	2.0×10^{-02}	2.0×10^{-02}
A11 Puvanikuppam	6.67 km SW	BDL	2.0×10^{-02}	2.0×10^{-02}

Table 122. Village Wise Impacts of various scenario(s) for HF pollutant

HF			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration HF ($\mu\text{g}/\text{m}^3$)	Predicted Incremental Concentration HF ($\mu\text{g}/\text{m}^3$)	Post Project Air Quality HF ($\mu\text{g}/\text{m}^3$)
A1 Onsite	South West	BDL	2.8×10^{-02}	2.8×10^{-02}
A2 Onsite	North East	BDL	2.8×10^{-02}	2.8×10^{-02}
A3 Thatchan Colony	0.32km W	BDL	1.8×10^{-02}	1.8×10^{-02}
A4 Poondiyankuppam	0.93km SW	BDL	1.8×10^{-02}	1.8×10^{-02}
A5 Nochikadu	1.71km NE	BDL	2.0×10^{-02}	2.0×10^{-02}
A6 Thyagavalli	1.84 km S	BDL	1.3×10^{-02}	1.3×10^{-02}
A7 Tondamanathan	2.46km NW	BDL	1.2×10^{-02}	1.2×10^{-02}
A8 Valudambattu	4.28km W	BDL	1.1×10^{-02}	1.1×10^{-02}
A9 Anukkambattu	5.28km SW	BDL	1.0×10^{-02}	1.0×10^{-02}
A10 Annavalli	5.73km NW	BDL	1.0×10^{-02}	1.0×10^{-02}
A11 Puvanikuppam	6.67 km SW	BDL	1.0×10^{-02}	1.0×10^{-02}

Table 123. Village Wise Impacts of various scenario(s) for Cl_2 pollutant

Cl_2			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration Cl_2 ($\mu\text{g}/\text{m}^3$)	Predicted Incremental Concentration Cl_2 ($\mu\text{g}/\text{m}^3$)	Post Project Air Quality Cl_2 ($\mu\text{g}/\text{m}^3$)
A1 Onsite	South West	10.50	3.4×10^{-02}	10.53
A2 Onsite	North East	10.09	3.4×10^{-02}	10.12
A3 Thatchan Colony	0.32km W	10.93	2.1×10^{-02}	10.95
A4 Poondiyankuppam	0.93km SW	12.69	2.1×10^{-02}	12.71
A5 Nochikadu	1.71km NE	13.15	2.6×10^{-02}	13.17
A6 Thyagavalli	1.84 km S	14.08	1.8×10^{-02}	14.09
A7 Tondamanathan	2.46km NW	9.68	1.8×10^{-02}	9.69
A8 Valudambattu	4.28km W	11.80	1.4×10^{-02}	11.81
A9 Anukkambattu	5.28km SW	11.36	1.2×10^{-02}	11.37
A10 Annavalli	5.73km NW	13.61	1.2×10^{-02}	13.62

Cl ₂			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration Cl ₂ (µg/m ³)	Predicted Incremental Concentration Cl ₂ (µg/m ³)	Post Project Air Quality Cl ₂ (µg/m ³)
A11 Puvanikuppam	6.67 km SW	12.24	1.2 x 10 ⁻⁰²	12.25

Table 124. Village Wise Impacts of various scenario(s) for TOC pollutant

TOC			A. All Utilities	
			Scenario 1	
Location	Distance & Direction	Background Concentration TOC (µg/m ³)	Predicted Incremental Concentration TOC (µg/m ³)	Post Project Air Quality TOC (µg/m ³)
A1 Onsite	South West	0.013	2.7 x 10 ⁻⁰³	0.013
A2 Onsite	North East	0.012	2.7 x 10 ⁻⁰³	0.012
A3 Thatchan Colony	0.32km W	0.013	2.1 x 10 ⁻⁰³	0.013
A4 Poondiyankuppam	0.93km SW	0.015	2.1 x 10 ⁻⁰³	0.015
A5 Nochikadu	1.71km NE	0.016	2.3 x 10 ⁻⁰³	0.016
A6 Thyagavalli	1.84 km S	0.017	1.7 x 10 ⁻⁰³	0.017
A7 Tondamanathan	2.46km NW	0.012	1.7 x 10 ⁻⁰³	0.012
A8 Valudambattu	4.28km W	0.014	1.3 x 10 ⁻⁰³	0.014
A9 Anukkambattu	5.28km SW	0.014	1.3 x 10 ⁻⁰³	0.014
A10 Annavalli	5.73km NW	0.017	1.3 x 10 ⁻⁰³	0.017
A11 Puvanikuppam	6.67 km SW	0.015	1.3 x 10 ⁻⁰³	0.015

4.5.1. Data Interpretation

AERMOD (Version 11.2.0) model was applied for impact assessment from the different point sources. Modeling facilitates an in-depth investigation for evaluating assimilative capacity of the air environment so as to devise appropriate air pollution control policy for the study area. However, for the present study, air pollution inventory was only developed for sources to establish the contribution of the project site.

Annually, most of the time, the wind blows from the SW/E which means that dispersion takes place in the downwind direction i.e. in the NE/W direction. The maximum GLC is observed at the core zone of the plant and doesn't really impact the sensitive receptors near the site. The air quality at project site is within the NAAQS standards. The ambient air quality standards and one hourly GLC values to run AERMOD for different hours of the day have been used for calculating average 24 hourly GLC of the day. From the results generated by AERMOD in the form of Isopleth and results of the same in table above shows that the post-project air quality for all the pollutants is within the limits for the core zone and buffer zone as per the Ambient Air Quality standard NAAQS. The maximum GLC does not have a significant impact on environment/ ambient air quality on sensitive

receptors of the project. Appropriate Measures will be identified and proper installation of air control devices will be done to control the source and impact of air pollution.

4.6 AIR DISPERSION MODELLING USING THE CALPUFF MODEL

The CALPUFF modeling system generates a number of output files, each serving different purposes (e.g. concentrations, deposition, puff tracking). The outputs can be post-processed by CALPOST to derive statistics, maps, time series, etc. Among these outputs, two types are especially relevant when dealing with 3D modeling and terrain effects:

- 3D pollutant concentration / dispersion fields,
- Terrain (elevation / topographic) files

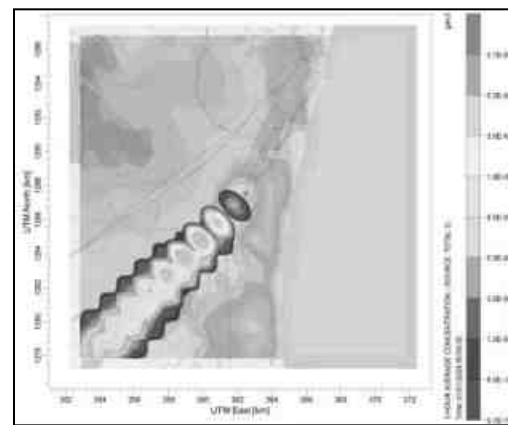
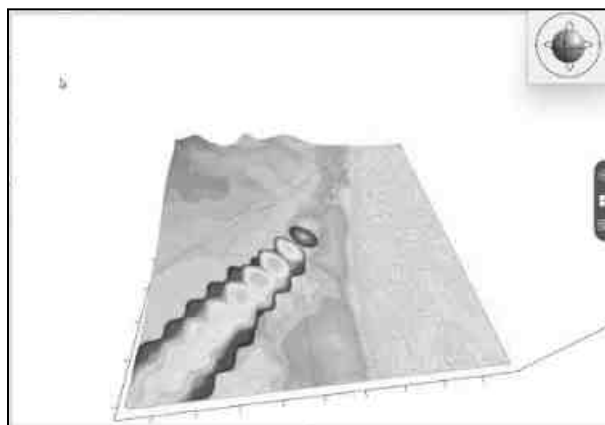
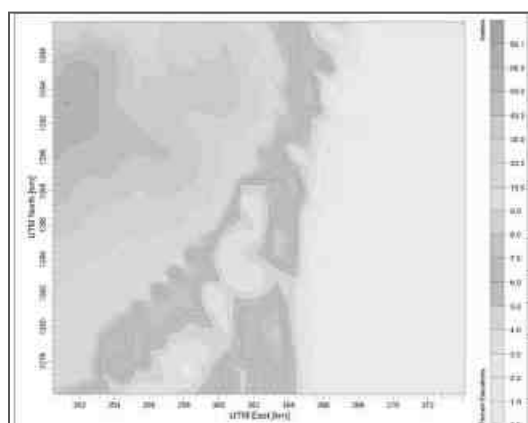
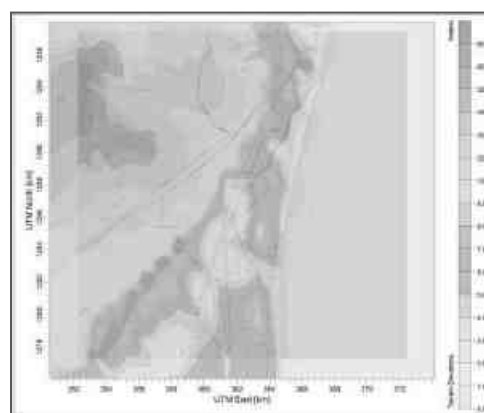


Figure. 3D pollutant dispersion



Terrain Map



Terrain Map - 2 m with OSM

Figure. Terrain Map

4.6.1 Conclusion

The CALPUFF modeling results indicate that the projected post-project air quality will remain well within the NAAQS limits for all assessed pollutants. Furthermore, the consistency between CALPUFF and AERMOD predictions supports the validity of the modeling approach, confirming that the project complies with air quality standards.

4.7 Stack optimization

The ambient air quality Ground Level Concentration (GLC) of the area near any project is impacted due to air pollution sources in the project. The air pollution sources are of two types:

- Point Sources – Chimneys/ Stacks/ ducts/ Vents
- Non-Point Sources – Vehicles, machinery, blasting, drilling etc.

The emissions from these sources spread or disperse in the air and cause an increase in the pollution level in ambient air. This causes an increase in Ground Level Concentration (GLC). This increase in GLC can be predicted for proposed projects using Air Dispersion Modelling. In this study, AERMOD developed by Lakes Environmental Inc. is used to calculate incremental Ground Level concentrations (GLC) for the proposed sources of air pollution in the current expansion, for Particulate emissions, Gaseous emissions (NO₂ & SO₂).

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

Table 125. Stack Height optimization

Parameter		GLC ($\mu\text{g}/\text{m}^3$)							
		30m stack height	40m stack height	50m stack height	60m stack height	65m stack height	70m stack height	75m stack height	80m stack height
PM2.5	Max	0.921	0.866	0.811	0.758	0.741	0.690	0.667	0.664
	Min	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
PM10	Max	1.080	1.010	0.949	0.874	0.855	0.837	0.817	0.798
	Min	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
SO ₂	Max	1.390	1.310	1.230	1.15	1.12	1.10	1.07	1.05
	Min	0.020	0.020	0.020	0.02	0.02	0.02	0.02	0.02
NO ₂	Max	2.330	2.190	2.050	1.92	1.88	1.84	1.80	1.76
	Min	0.030	0.030	0.030	0.03	0.03	0.03	0.03	0.03

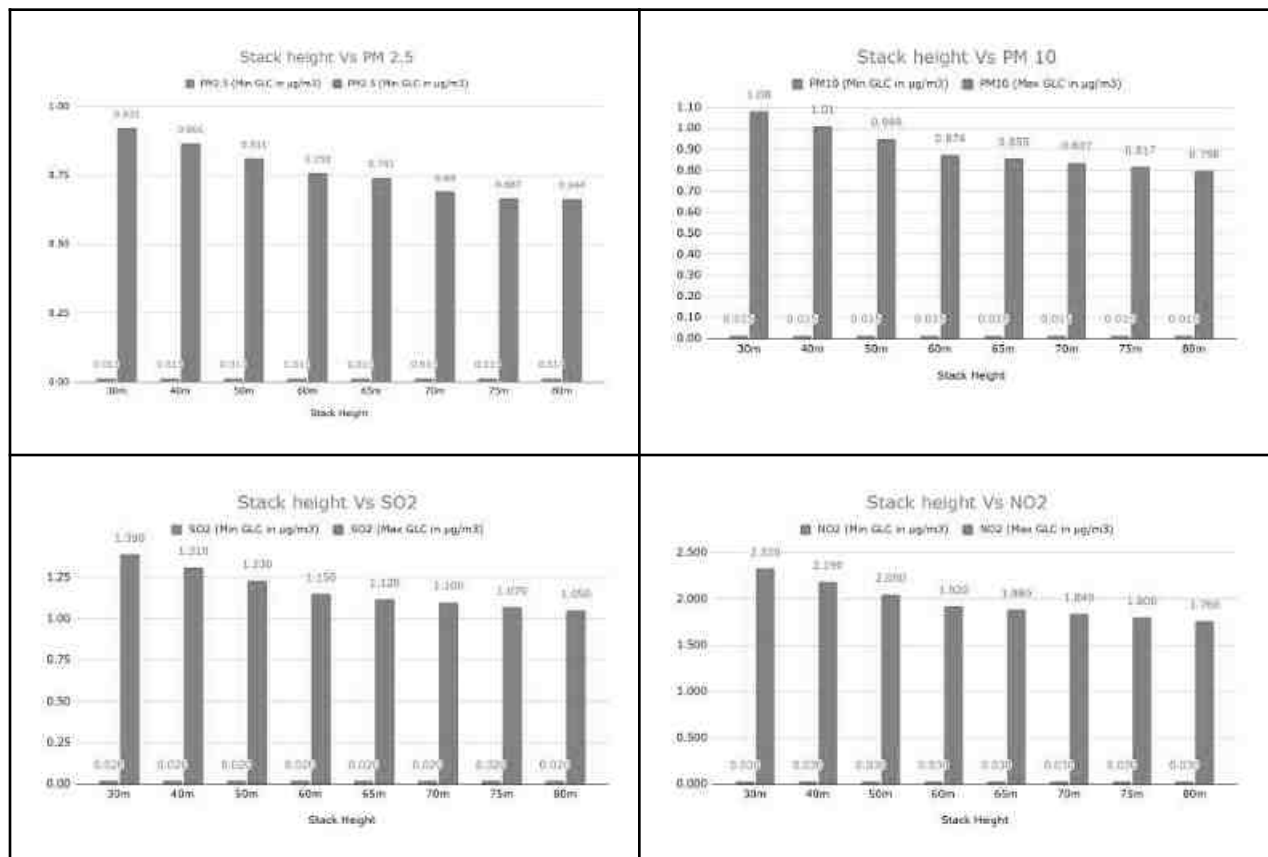


Figure 80. Stack height Vs Pollutant GLC Conc.

DATA INTERPRETATION

Air dispersion modeling was conducted using AERMOD to evaluate incremental ground-level concentrations (GLC) of key pollutants (PM₁₀, PM_{2.5}, SO₂, and NO₂) for different stack height scenarios ranging from **30 m to 80 m**. The results indicate that while there is a marginal decrease in predicted incremental concentrations with increasing stack height, the variation across scenarios is not significant.

For instance, the incremental GLC values at a 30 m stack height were found to be only slightly higher than those predicted for 40 m, 50 m, or even 80 m stack heights. The comparison of maximum GLC with respect to stack height is mentioned in the below table.

Table 126. Maximum GLCs w.r.t stack heights (30m, 40m, 50m, 60 m, 65 m, 70 m, 75 m & 80 m)

Stack height	PM2.5 (µg/m ³)	PM10 (µg/m ³)	SO2 (µg/m ³)	NO2 (µg/m ³)
	mGLC	mGLC	mGLC	mGLC
30m	0.921	1.08	1.39	2.33
40m	0.866	1.01	1.31	2.19
50m	0.811	0.949	1.23	2.05
60m	0.758	0.874	1.150	1.920
65m	0.741	0.855	1.120	1.880
70m	0.690	0.837	1.100	1.840
75m	0.667	0.817	1.070	1.800
80m	0.664	0.798	1.050	1.760

The reduction in incremental concentration with higher stacks follows the expected dispersion pattern but the differences remain negligible, with post-project pollutant levels consistently remaining well within the prescribed CPCB Ambient Air Quality Standards.

This outcome demonstrates that increasing the stack height beyond 60 m does not lead to a proportionate improvement in ambient air quality. The diminishing returns with respect to pollutant dispersion highlight that a 60 m stack height is technically sufficient and environmentally acceptable for effective dispersion of emissions from the proposed utility sources.

Accordingly, the optimized stack height for the project is recommended as 60 m, since higher stack designs would not yield any substantial air quality benefits while potentially increasing structural and operational costs. This optimization ensures both regulatory compliance and engineering efficiency.

A detailed report on Air Dispersion Modelling Using The Calpuff Model and Stack optimization is attached as **Annexure 13**.

5. ANALYSIS OF ALTERNATIVES

5.1 SITE SELECTION

The project is a brownfield site with a proposed expansion of the existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity. The assessment for the site is presented below:

- **Land:** The existing plant is operational under 25.1862 ha area, and for the proposed expansion there will be addition of land area of 39.4436 ha owned by M/s Chemplast Cuddalore Vinyls Limited. This total area will be adequate for the proposed expansion including locating our environmental components like greenbelt area, HW storage area, etc.
- **Connectivity:** The site is well connected with roads (Nochikkadu to Perumal Koil Road & Nochikadu-Naduthittu Road which are adjacent to project boundary) and Alapakkam Railway Station at a distance of 2.36 km, SSW.
- **Facilities & Utilities:** The existing plant has got all the facilities and utilities for the existing plant. There will be addition of machinery to cater the proposed expansion.
- **Power Supply:** There will be an addition of 44 MW of power supply from Grid power from Tamil Nadu Electricity Board (TNEB). Also for back-up source for power DG set of 7 Nos. x 2000 kVA are existing, DG set of 4 No. x 2000 kVA are proposed in SPVC plant and DG sets of 3 Nos. x 2000 kVA are proposed in the VCM plant. The total capacity of DG set after expansion will be 14 Nos. x 2000 kVA.
- **Water & Wastewater Management:** The fresh water requirement due to the proposed expansion will increase from 4102 KLD to 11422 KLD.
The total effluent generation after expansion will be 13419KLD, which will be sent to ETP of 15800 KLD capacity followed by RO of 15000 KLD & MEE of 1500 KLD. Treated effluent of 13315 KLD will be reused in the Process, Boiler & Cooling tower. Total sewage generation after expansion will be 110 KLD which will be treated in STP of 140 KLD capacity. The treated sewage will be reused within the plant premises for greenbelt development.
- **Employment:** Due to the proposed expansion, the plant will generate additional employment 190 Nos. of permanent and 500 Nos. of temporary.
- **Greenbelt Development:** The green belt area is increasing from 9.7976 ha (24.2104 acres) to 26.0515 ha (64.3746 acres) (40.31% of total land area) after the proposed expansion, to maintain good air quality.
- **No Rehabilitation and resettlement is required.**

Considering the above mentioned advantages of the project location the existing site has been considered for the proposed expansion. This would also give benefits in utilizing the existing utilities and infrastructure within the project site to have minimal environmental and social footprints.

5.2 SITE TECHNOLOGY

Company is fully committed to the improvement of technology to achieve conservation, safety, and environmental sustainability.

Analysis of Alternative Technology

The important factors with respect to technology which influence the project are process technology, Industrial Wastewater Treatment Technology, Domestic Wastewater Treatment Technology which is discussed below in detail.

- The unit will adopt the best technology available so far in the market for the manufacturing of proposed products to achieve maximum yield with minimum pollution generation and emission.
- Industry is very concerned and conscious about the product quality and equally about the environmental protection and resource conservation; and hence, Industry will put continuous efforts for replacing/ upgrading plant and machinery from time to time with the best available technology.
- The wastewater generated during the process will be treated in ETP and used.
- Sewage generated will be treated in STP and treated water will be used in gardening and sewage will be used as manure in green belt development.

6. ENVIRONMENTAL MONITORING PROGRAM

6.1. DETAILS OF MONITORING TO JUDGE EFFECTIVENESS OF MEASURE

To check the efficiency of the system with proposed modifications a regular monitoring programme has been drawn. The program has been outlined for the construction and operation phase. In order to facilitate this, the regular site inspections and their noting will be documented by the PP/Contractor. The organizational structure (Environment Management Cell or EMC) of the M/s Chemplast Cuddalore Vinyls Limited is discussed in Chapter 10.

6.1.1. CONSTRUCTION PHASE

Periodic monitoring of the below mentioned parameters will be done once the industry resumes construction.

Table 125. Environment Monitoring Plan-Construction Phase

S. No	Type of Monitoring	Frequency of Monitoring	Parameter	Location	Number Per Year	Responsibility
1	Ambient Air Quality	Monthly	Particulate Matter (PM _{2.5}) Particulate Matter (PM ₁₀) Sulphur Dioxide (SO ₂) Nitrogen Oxides (NO _x) Volatile Organic Compound (VOCs) Carbon monoxide (CO)	2 in Core Zone and 4 in buffer zone	72	-EMC (Air Incharge) & Contractor
2	Stack emission for point sources	Six Monthly	PM10, PM2.5, SO2, NOX, CO2, CO, VOCs	1 No. - DG Stack	2	Test Report
3	Water Quality for drinking water	Six Monthly	All parameters mentioned in IS:10500	One drinking water sample	2	-EMC (Water Incharge) & Contractor
4	Water Quality for Construction purpose	Yearly	All parameters mentioned in IS:456	One construction water sample	1	-EMC (Water Incharge) & Contractor
5	Ambient Noise Level	Monthly	Day and Night noise level	2 Locations (project site)+ 4 locations (Outside)	72	-EMC (Noise Incharge) & Contractor
6	DG Set Room Noise Level	Yearly	Day and Night noise level	1 Location	2	-

S. No	Type of Monitoring	Frequency of Monitoring	Parameter	Location	Number Per Year	Responsibility
7	Soil Quality	Yearly	All parameters to check soil Fertility	One Location in core zone and 4 locations in buffer zone	6	-EMC (Soil Incharge) & Contractor

6.1.2. OPERATION PHASE

The industry is operational and monitoring is being done for the existing unit internally. So, there will be addition of buffer zone monitoring after the proposed expansion. The periodic monitoring schedule is mentioned below in the table.

Table 126. Monitoring Plan-Operation Phase

Monitoring	Frequency of Monitoring	Parameters	Location	Numbers Per Year	Responsibility	Records to be maintained
Air & Stack						
Ambient Air Quality	Monthly	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , VOCs, HCl, Cl ₂	2 Onsite Location in different direction and 4 Buffer location	72	-EMC (Air Incharge) -External Laboratory analyst & incharge	NABL Accredited Lab Result
Process Stack	Monthly	PM, SO ₂ , NO _x , VOCs	4 in Vent Gas Absorption System, 4 in PVC Dryer Section 1 in Emergency Vent attached to VCM Storage Tank, 4 in Coal Heading Conveyor-Transfer Point - 1, 4 in Coal Heading Conveyor-Transfer Point - 2, 4 in Coal Feed Hopper 12 in PVC Bagging Section - Bagging machine, 6 in Product Silo,	48	-EMC (Air Incharge) -External Laboratory analyst & incharge	NABL 4 Buffer location Accredited Lab Result
Utility Stack	Monthly	PM, SO ₂ , NO _x , VOCs	2 no of stacks for DG sets, 7 stacks for Boiler (1, 2, 3, 4, 5, 6, 7), 4 stacks for EDC Cracking Furnace(1, 2, 3, 4), 1 in incinerator, 3 for Emergency DG Set(1, 2, 3),	84	-EMC (Air Incharge) -External Laboratory analyst & incharge	NABL Accredited Lab Result
Water & Wastewater						
Water Quality	Yearly	Monitoring for relevant parameters as per Drinking	surface water	1	-EMC (Water Incharge) -External	NABL Accredited Lab Result

Monitoring	Frequency of Monitoring	Parameters	Location	Numbers Per Year	Responsibility	Records to be maintained
		water standard IS - 10500			Laboratory analyst & incharge	
Waste Water Quality (Treated & Untreated)	Daily	Daily-BOD, COD, TSS, TDS, pH, Oil & Grease	ETP inlet & outlet, RO inlet & Outlet, MEE inlet & Outlet, STP inlet & outlet	2,920	-EMC (Water Incharge)	NABL Accredited Lab Result & Logbooks
	Monthly	CPCB discharge Parameters as given in the Standards for Standards for Organic Chemical Manufacturing Industry (GSR 608 (E) dated 21st July 2010		96	-Internal Laboratory analyst & incharge for daily parameters -External Laboratory analyst & incharge for monthly parameters	
Surface water	Monthly	Monitoring for relevant parameters as per Drinking water standard IS - 10500 and as CPCB Surface water quality criteria	Surface water: 1 onsite location	12	-External Laboratory analyst & incharge	NABL Accredited Lab Result
Noise						
Day & Night level Noise Monitoring	Monthly	Leq (night), Leq (day), Leq (24 hourly)	2 onsite location	24	-EMC (Noise Incharge) -External Environmental consultant	NABL Accredited Lab Result
Soil						
Qualitative and Quantitative Parameters	Yearly	All Parameters to check soil fertility Pesticide testing in the soil	7 Buffer location	7	-EMC (Soil Incharge) -External Environmental consultant	NABL Accredited Lab Result
Waste Generation Monitoring / Record Keeping						
Records of generation, handling, storage, transportation and disposal	Daily	Hazardous, Non Hazardous, E-waste, Organic waste, recyclable waste, manure generated	-	5		Logbooks
Sludge Characteristics and Quantity	Characteristics -Monthly Quantity-	TCLP test and Quantity	ETP Sludge, STP sludge	24	-External Laboratory analyst & incharge	NABL Accredited Lab Result

Monitoring	Frequency of Monitoring	Parameters	Location	Numbers Per Year	Responsibility	Records to be maintained
	daily					
Ecology and Biodiversity Monitoring						
Green belt & plantation monitoring	Yearly	Survival rate of the planted Trees, Greenbelt development status & Green area	-	1	EMC (gardener) -External	Logbooks
Social Monitoring						
Checking effectiveness of the Corporate Social Responsibility/ Corporate Environmental Responsibility	Annual	Cost spent and where it is carried out	-	1	CSR Team	Audit Reports
Power and Energy monitoring						
Energy savings	Annual	Energy consumption in terms of 1. Quantity of fossil fuels 2. Power drawn		1	Utility Team	Energy meter
		Renewable energy 1. Solar harvesting 2. use of Alternate source of energy				
Work Zone Monitoring						
Work Zone	Annual	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO ₂ , CO & VOCs	Process Area, DG Set Area, Raw material and finished Good Storage Area	1	-External Laboratory analyst & incharge	NABL Accredited Lab Result

6.2. SUBMISSION OF SIX MONTHLY COMPLIANCES

As per the standard environment clearance conditions, six monthly compliances of the conditions mentioned in the EC letter will be submitted to various concerned officials of MOEF, SPCB and Regional office of CPCB. These compliances will be submitted in the months of June and December for the periods April to September and October to March respectively every year for construction phase until the construction is completed and operation phase for the life of the project.

6.3. ENVIRONMENT AUDIT

Annual Environment Audits with Form V statements will be regularly conducted to check the compliance of environmental conditions for the operational industry to MoEF&CC R.O.

6.4 COMPLIANCE OF ENVIRONMENTAL APPROVALS

6.4.1. ENVIRONMENT CLEARANCE

Environmental Clearance was granted via Letter No. SEIAA-TN/F.No.6788/5(e)EC-69/2019 dated **19.11.2019** and subsequently amended via letter No. SEIAA-TN/ F. No. 6788/ 5(e)EC. No:69/ Amendment/ 2023 dated **08.08.2023**. The same is attached as **Annexure 2**.

The existing plant is operational with latest Consent to Operate (CTO) issued vide Consent Order No. 2307247638383 (Air), 2307147638383 (Water) dated 08.02.2023, valid until 31.03.2027. The same is attached as **Annexure 5**.

The project is going for a fresh Environment Clearance for the proposed expansion.

6.4.2. HW AUTHORISATION/DISPOSAL

Hazardous wastes will be managed via authorised HW recyclers, HW utilisers and CHWTSDF by M/s Chemplast Cuddalore Vinyls Limited. The agreement was made with Re Sustainability IWM Solutions Limited on 05.09.2022 and Atlas Corporation on 17.03.2023.. The agreement for the same is attached as **Annexure 3**.

6.4.3. CGWA CLEARANCE

Not Applicable

6.4.4. CONSERVATION PLAN

Based on both our primary and secondary surveys, as well as the compiled table above, we have identified a total of **13** species listed under Schedule I of the Wildlife Protection Act, indicating their endangered status and necessitating conservation efforts (<https://www.iucnredlist.org>). Accordingly a detailed conservation plan for these scheduled species will be submitted separately

6.4.5. FOREST CLEARANCE

No forest land involved. Hence, Not Applicable.

6.4.6. ANNUAL RETURNS

The Proponent with the help of 3rd party Environmental consultants will annually submit the Environment Audit with the **Form V statement, FORM 13** of Hazardous waste, CTO Compliance.

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

Similarly, six monthly EC compliance will be submitted to MoEF&CC R.O. and Regional State Pollution Control Board (Tamil Nadu) after the grant of the Environmental clearances.

The industry will have the well-defined **Environmental Management Cell (EMC)** for the communication with internal and external Stakeholders. The detailed existing reporting mechanism with the role and responsibilities is given in Chapter 10 Section 10.2.1

7. ADDITIONAL STUDIES

7.1 INTRODUCTION

As per Terms of Reference issued vide letter No **IA-J-11011/132/2020-IA(II)** dated **28.07.2025** by Ministry of Environment, Forest, and Climate Change (MoEFCC), New Delhi following Additional Studies required to be carried out for the proposed expansion project.

7.2. PUBLIC CONSULTATION

Details will be incorporated after Public consultation.

7.3 PHILOSOPHY OF RISK ASSESSMENT

Chemical hazards exist in many industries due to the use of flammable or toxic materials. These dangers are amplified when these chemicals form hazardous clouds under unfavorable weather conditions. Leaks or spills during transportation, storage, or everyday operations can create toxic pools and vapors. To prevent such incidents, industries must prioritize robust plant integrity through meticulous design, strong management practices, and rigorous operational controls. This report focuses on the risk assessment study results for the proponent M/s Chemplast Cuddalore Vinyls Limited is a major manufacturer of Suspension PVC resin.

7.3.1 Study Objectives

The overall objective of this study involves identification, prediction, and evaluation of major risks and hazards that can be possible due to the proposed expansion and post expansion of the project. Risk assessment involves the following:

- Hazard Identification
- Risk Analysis
- Quantitative Risk Assessment

7.3.2 Methodology

This report aims to identify and evaluate the hazards and risks associated with the proposed expansion, focusing on the safe handling, storage, and use of PVC Resin, Vinyl Chloride Monomer and Hydrochloric Acid. It will outline the necessary risk mitigation measures and safety protocols to ensure a secure and efficient operation. Through comprehensive analysis and strategic planning, the report seeks to safeguard health, safety, and environmental integrity in the face of this significant industrial transformation.

The Risk Assessment Methodology is primarily based on the likelihood of occurrence of the risk identified and their possible hazard consequences based on the professional/expert judgement & hypothetical scenarios. With respect to the proposed project, major risks associated like leaks, rupture of storage tanks have been assessed qualitatively and evaluated through a risk matrix generated to combine the risk severity and likelihood factor.

Hazard identification exercise is conducted taking into consideration materials, material handling methods, and safety measures to be taken in the proposed plant. Containment failure scenarios related to storage areas are considered for hazard Analysis and consequences of such containment failures are considered in detail.

7.4 HAZARD IDENTIFICATION

Hazard identification for the proposed expansion was performed using:

- HAZID/HAZOP Techniques: Review of process flows, operating conditions, inventory, and failure modes. Reference to recent QRA methodology (see "QRA METHODOLOGY Chemical Process.pdf") ensures systematic coverage .
- Past Incident Analysis: Review of industry databases for VCM, EDC, and ethylene-related incidents (Bhopal, Texas City, etc.).
- Checklists and Regulatory Schedules: Cross-referenced against MSIHC Schedules 1 & 2, OSHA PSM, and Seveso III substance lists.

Table 127. Principal Hazards Identified

Area / Equipment	Hazard Type	Representative Failure Mode	Key Consequence
VCM Storage (Bullets/Spheres)	Fire/Explosion/Toxic	Catastrophic rupture; large leak	BLEVE, VCE, flash fire, toxic dispersion
EDC Storage	Fire/Toxic	Tank leak; bund overflow	Pool fire, toxic vapor cloud
Ethylene Storage	Fire/Explosion	Bullet rupture; pipe break	Fireball, flash fire, VCE
Process Units (Reactors, Columns)	Fire/Explosion/Toxic	Overpressure; gasket failure	Jet fire, vapor cloud, overpressure
Pipelines (VCM, EDC, Ethylene)	Fire/Explosion/Toxic	Line rupture, flange leak	Jet fire, toxic cloud, flash fire
HCl Storage/Handling	Toxic/Corrosive	Pump seal leak; tank rupture	Acid mist release, environmental damage
Utilities (Diesel, ETP)	Fire/Spill	Overfill; valve failure	Pool fire, soil/water contamination

7.5 RISK ANALYSIS

7.5.1 Definition

Risk is a combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s).

Risk assessment is a process of evaluating the risk(s) arises from a hazard(s), taking into account the adequacy of any existing controls, and deciding whether or not the risk(s) is acceptable.

7.5.2 Storage and Handling of Hazardous Chemicals

7.5.2.1 Details of Storage

Table 128. Details of Chemical Storage

Chemical	State	Max. Storage Inventory (tonnes)	Storage Mode	Location
VCM	Liquefied gas	2 nos. x 7500 MT= 15000 MT 1 no. x 10000 MT 10000 MT	Bullet/Sphere, pipeline	VCM Storage Area
EDC	Liquid	3 nos x 7500= 22500 2 nos. X 1000= 2000	Atmospheric/low-pressure tank	EDC Tank Farm
Ethylene	Refrigerated/Press. Gas	2 nos. X 5000= 10000	Bullet/ISO tank, pipeline	Ethylene Storage Area

7.7 QUALITATIVE RISK ASSESSMENT

The risk is the likelihood of harmful effects big or small due to hazard, together with severity of harm suffered. Risk also depends on the number of people exposed to hazard. Risk analysis provides severity of harm from particular types of hazards.

There are two types of Hazards: 1. Natural 2. Manmade

7.7.1 Natural Hazard

7.7.1.1 Earthquake

The area under study falls in Zone-II, according to the Indian Standard Seismic Zoning Map. Suitable seismic coefficients in horizontal and vertical directions respectively, will be adopted while designing the structure. There has been no earthquake in the last 365 days.

Preventive Measures:

The project is situated in the Seismic zone-II area. Special attention has been given to the structural design of foundation, elements of masonry, timber, plain concrete, reinforced concrete, pre-stressed concrete, and structural steel.

All applicable guidelines have been followed in this regard to ensure safety of the building.

7.7.1.2 Flooding

Mettur Taluk is predominantly a hilly region, with significant elevations contributing to its geographical and climatic characteristics. The presence of the Mettur Dam at a distance of 3.81 km in this hilly setting underscores the importance of effective water management to mitigate flood risks and support local agriculture.

Historical Flood Events:

2005 Floods: In October 2005, heavy rains caused significant flooding in Mettur and surrounding areas. The release of water from the Mettur Dam exacerbated the situation, leading to widespread inundation and damage.

2015 Floods: Another notable flood event occurred in December 2015, when the northeast monsoon brought excessive rainfall. This led to the dam releasing large volumes of water, resulting in flooding in low-lying areas.

Recent Floods: In 2019 and 2021, there were instances of heavy rainfall causing the Mettur Dam to reach near full capacity, necessitating controlled water releases to prevent dam overflow, which still resulted in localized flooding.

Preventive Measures:

- Proper designing of drainage systems for domestic as well as storm water has been done.
- To control the flood following practices will be done such as planting vegetation to retain extra water, the construction of flood ways (man-made channels to divert flood water), Flood barriers, installation of Pumps for removing rainwater during flood emergency situations.
- Measures such as improved reservoir management, early warning systems, and better coordination with downstream districts to manage water releases have been implemented.
- Regular monitoring of water levels in the Mettur Dam to ensure timely release of water before the reservoir reaches critical levels.
- Improving spillway capacity to safely discharge excess water during peak inflow periods.
- Utilizing advanced meteorological systems to predict heavy rainfall and potential flood events.
- Setting up automated systems to alert communities and authorities about impending floods through sirens, SMS alerts, and other communication channels.
- Developing and using hydrological models to simulate flood scenarios and plan mitigation strategies accordingly.

7.7.2 Manmade Hazard

7.7.2.1 Fire and Explosion

Since it is a Expansion of SPVC Plant from 600 KTPA to 1200 KTPA and addition of VCM of 750 KTA, fire can occur due to exposure of chemicals used in the processes to electrical spark or vapor from chemical storage tanks, problems in EDC cracking furnace operation, etc. The Facility is located in Cuddalore surrounded by various small and large Industries manufacturing or processing different types of Hazardous Chemicals and Flammable solvents. Therefore, the probability of fire and explosion is high.

Preventive Measures:

Safety Precautions

1. Smoking is prohibited.
2. Vehicle access is strictly controlled.

3. Ventilation is sufficient to cope with the maximum expected vapour levels in the building.
4. Storage tank vents to the atmosphere are sized for fire-heated emergency vapour release.
5. Electrical equipment is explosion-proof to meet national electrical code requirements.
6. Dry chemical extinguishers are accessible for small fires. An adequate supply of handheld and wheeled types is available.
7. Hydrants are strategically placed with adequate hoses.
8. Small spills are being remediated with sand, earth, or other non-combustible absorbent material, and the area then flushed with water. Larger spills are being diluted with water and diked for later disposal.
9. Lighting is grounded. Tall vessels and structures are fitted with lightning conductors that are securely grounded.
10. The chances of explosion in the fuel burning area will be low when solid fuel (agricultural waste) is used. However, to avoid explosion in the steam side in the EDC cracking furnace safety valves and pressure control with alarm and trip is provided.

Precaution in Case of Fire

- In the existing industry, all practicable measures have been taken to prevent outbreak of fire and its spread, both internally and externally. To provide and maintain safe means of escape for all persons in the event of a fire, the necessary equipment and facilities for extinguishing fire are provided.
- Effective measures have been taken to ensure that all the workers are familiar with the means of escape in case of fire and have been adequately trained in the routine to be followed in such cases. Also, people have been trained in firefighting operations and in operation of fire extinguishers.

Fire Fighting System

- Adequate fire fighting systems will be provided for the proposed project.
- Sufficient numbers of Fire extinguishers will be installed in all process plants, Hazardous chemical storage area, Electrical area, Utility, and Admin building.

Table 129. Details of Fire Fighting System

S. No.	Type	Capacity
1	CO ₂	2 kg – 6.5 kg
2	Dry Chemical Powder	5 kg -10 kg
3	Mechanical foam	50 Litre
4	Fire Buckets with sand	--

7.7.2.2 Chemical Spillage/ Leakage

All the chemicals used in the processes which are Hazardous in nature are given in Table 121. Chemicals have a risk of leakage during handling, storage, transferring and processing.

Handling of Chemicals:

- Instructions are given to not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
- Operator training as well as written operating instructions, safety rules and checklists should be provided.
- All the toxic chemicals are pumped in a closed loop to the reactors to avoid fugitive emission.
- All the storage / reactor vents are connected with scrubbers.
- Local Exhaust ventilation facilities are available at strategic locations of all plants where chemicals are being handled / packing done to remove traces of chemical vapors / dust.
- Required Personal Protective Equipment like respirator / dust masks, Gloves, Goggles, shoes, aprons, etc. should be used by employees when handling chemicals.
- Eye washer / Safety showers should be available at strategic locations where chemicals are handled.
- All employees are advised to take a bath before leaving the work spot at the end of the shift and being followed.

Measures to be taken:

1. In case chemicals come in contact with the skin, remove contaminated clothing. Wash with soap and water for 15 minutes. Seek medical attention if irritation occurs.
2. In case of chemical contact with the eyes, flush immediately with gently running water for a minimum of 15 minutes, ensuring all surfaces and crevices are flushed by lifting lower and upper lids. Obtain medical attention.
3. In case of inhalation of a chemical's vapors, remove the individual to fresh air, but only if it is safe to do so. Asphyxiation from vapors may require artificial respiration. Due to the possibility of delayed onset of more serious illness, it is important to obtain medical attention.
4. Ingestion of chemicals is life threatening. Onset of symptoms may be delayed for 18 to 24 hours after ingestion. Do not induce vomiting. Transport to medical attention. The individual should remain under close medical care and observation for several days.

7.7.2.3 Thermal

Thermal heat can be generated from the process machinery, D.G sets, and the vehicles in the area. Thermal hazards are objects or substances that transfer energy as heat.

Preventive Measures:

- The open flame areas like the canteen are restricted for entry.
- EDC cracking furnace sections are properly insulated and safe distance & guard are provided.
- Steam lines are insulated and any leak in the steam line is attended immediately.
- D.G set room area should be restricted for entry.
- Operators in the thermal hazard area are being provided with protective gears like insulated gloves, goggles etc.

- An emergency first aid room is provided and well maintained for treatment of burns.

7.8 QUANTITATIVE RISK ASSESSMENT

A systematic Quantitative Risk Assessment (QRA) was conducted by M/s. Perfact Enviro Solutions Pvt. Ltd. to identify, quantify, and evaluate the hazards associated with accidental releases of hazardous chemicals at the proposed CCVL VCM plant expansion. The methodology adopted aligns with IS 15656:2006 (Indian Standard for Risk Analysis), OISD-STD-150 (Oil Industry Safety Directorate), and leading international best practices (CCPS, API, OSHA PSM, Seveso III Directive). All modeling and scenario analysis utilized current process design, chemical inventories, and site meteorological/topographical data.

Consequence analyses of all major credible and worst-case accidental release scenarios identified for the proposed VCM plant expansion are given in below Table. Each scenario was selected based on process risk analysis, regulatory requirements, and industry experience with similar facilities. For each, the physical basis, likely initiating events, escalation pathways, and consequence modeling results are provided. Outputs are based on Fluidyn PANACHE v 5.0.6 simulations and established QRA consequence criteria.

7.8.1 Risk Assessment Approach

The QRA approach comprised the following sequential steps:

1. Hazard Identification (HAZID):
Comprehensive HAZID was performed using process and instrumentation diagrams, equipment lists, and MSDS review. HAZOP results and past incident analyses informed scenario selection.
2. Scenario Selection:
All credible and worst-case release scenarios were identified for each major hazardous material and process unit, with escalation (domino) effects explicitly considered.
3. Consequence Analysis:
Advanced modeling (Fluidyn PANACHE v5.0.6) was used to quantify physical impacts (thermal, overpressure, toxic dispersion) for each scenario.
4. Risk Estimation:
Where data allows, frequencies were assigned to each scenario; individual and societal risk contours were developed and compared to risk acceptability criteria.
5. Evaluation and Mitigation:
Results were interpreted for risk significance, informing the hierarchy of controls and the design of the site emergency response plan.

7.8.2 Modeling Tools and Input Data

Software:

- Fluidyn PANACHE v5.0.6: Used for three-dimensional computational fluid dynamics (CFD) modeling of toxic and flammable gas/vapor dispersion, including dense gas effects, building wake, and terrain considerations .
- Fluidyn PANFIRE: Used for fire and thermal radiation modeling (jet/pool fire, BLEVE fireball).
- TNT/Equivalent Methods: Used for overpressure and blast effect estimation in vapor cloud explosion (VCE) scenarios.
- All models validated per CCPS and IS 15656 recommendations; cross-checked using empirical equations for sanity checks .

Input Data:

- Process Data: Maximum inventories, chemical properties (from MSDS), tank/pipe design pressure/temperature, transfer rates .
- Meteorology: Wind rose data, predominant stability classes (D, F), typical and worst-case wind speeds (1.5–5 m/s), temperature and humidity (coastal, tropical) .
- Site Topography: Plant layout, building footprints, relative position to river/sea, presence of barriers or open terrain.
- Population Data: Onsite manning levels, offsite residential/industrial receptors, sensitive areas (Uppanar River, Bay of Bengal).

7.8.3 Scenario Descriptions and Consequence Analysis



Table 130. Master List of Scenarios Considered

Scenario Code	Substance	Scenario	Location	Release Type	Toxic/Flammable Endpoint	LOC (level of concern), distance from leak point
EDC-A1	EDC	Ship unloading + VCM Leak to be considered	Marine Terminal Facility	Transfer point leak (25mm)	ERPG-1 (10 ppm)	Acceptable, 10m
EDC-A2	EDC	MTF Onshore via Trestle to Zone 4	Pipeline route MTF to Zone 4	Pipeline leak (25mm)	ERPG-1 (10 ppm)	Acceptable, 15m
EDC-A3	EDC	Zone 2 to Zone 1 via Uppanar	Pipeline route crossing Uppanar	Pipeline leak (25mm)	ERPG-1 (10 ppm)	Unacceptable, 50m (impact on river)
EDC-A4	EDC	Storage at Zone 0	Tank farm Zone 0	50mm tank leak	ERPG-1 (10 ppm)	100m, 20m out of site (approx, to be tweaked on model)
EDC-A5	EDC	Storage at Zone 2	Tank farm Zone 2	25mm tank leak	ERPG-1 (10 ppm)	Acceptable, 50m (impact on site)
EDC-A6	EDC	Storage at Zone 1	Tank farm Zone 1	25mm tank leak	ERPG-1 (10 ppm)	Acceptable, 50m (impact on site)
EDC-A7	EDC	Catastrophic failure of one bulk EDC tank (full inventory outfall)	EDC storage area (Zone 2)	50 mm rupture, instantaneous outfall	ERPG-1 = 10 ppm (toxic endpoint)	Unacceptable, 300m (impact outside, towards river also)
VCM-B1	VCM	Storage at Zone 0	Double walled cylindrical existing tank at atmospheric pressure -13 C, Zone 0	50mm tank leak	AEGL-1 (250 ppm)	Unacceptable, 200m (impact outside towards river)
VCM-B2	VCM	Storage at Zone 1	Spherical, Zone 1	Flange or Valve leak	AEGL-1 (250 ppm)	Acceptable, LOC within 10m of leak
VCM-B3	VCM	Catastrophic failure of one VCM sphere (full inventory outfall)	VCM intermediate storage (Zone 1)	Complete loss of one 1500 MT sphere at 6 barg, 40°C	LEL 3.8% v/v (flammable endpoint)	Unacceptable, 560m (all over the area (on habitation and other plant))
HCL-C1	HCl	Storage at Zone 0	Tonnors or pressurised tanks	25mm tank leak	ERPG-1 (3 ppm)	Acceptable, 30m within the site
HCL-C2	HCl	Storage at Zone 1	Tonnors or pressurised tanks - Pipeline	25mm tank leak	ERPG-1 (3 ppm)	Acceptable, 30m within the site

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



Scenario Code	Substance	Scenario	Location	Release Type	Toxic/Flammable Endpoint	LOC (level of concern), distance from leak point
ETH-D1	Ethylene	Liquid transfer pipeline leak during ship unloading	Marine Terminal Facility approach trestle (Zones III-IV)	25 mm flange - Evaporating Pool Fire	LEL 2.7% v/v (flammable endpoint)	Acceptable, LOC within 20m of leak
ETH-D2	Ethylene	Vapour transfer pipeline leak from tank farm to VCM plant	Pipeline corridor (Uppanar bridge and landfall to Zone 1)	25 mm flange/valve leak on 16" ethylene vapour line - Toxic Release	LEL 2.7% v/v (flammable endpoint)	Acceptable, LOC within 20m of leak
ETH-D3	Ethylene	Small leak from inner tank (double-walled)	Ethylene storage area (Zone 2/3)	25 mm nozzle/valve leak from inner tank to annular space; controlled venting	LEL 2.7% v/v (flammable endpoint)	Acceptable, 20m within the site
ETH-D4	Ethylene	Catastrophic tank failure (full inventory outfall) – worst credible scenario	Ethylene storage area (Zone 2/3)	Complete tank loss of containment of one 5000 MT tank	LEL 2.7% v/v (flammable endpoint); fireball/TNT-equivalent envelope (to be modelled)	Acceptable, 30m within the site
CUM-Z1	Mixed (EDC + VCM + Ethylene)	Cumulative combined release overlays under unfavorable meteorology	Storage areas & pipeline corridors (trestle, Uppanar bridge, Zone 1)	Composite of credible worst cases (25 mm pipeline leaks and single-unit catastrophic cases)	ERPG-1 (EDC 10 ppm) and LEL (VCM 3.8%, Ethylene 2.7%)	Unacceptable, 450m (all over the area (on habitation and other plant) - Impacts on 3 different areas)

Table 131. Summary - Consequence Modeling Results

Scenario	Endpoint(s) reported	Outer contour (m) - approx	Receptor intersection	Concern
EDC-A1	ERPG-1/2/3; 12.5/37.5 (fire)	10	Within the MTF	Low-Moderate
VCM-B2	AEGL-1; LEL; 12.5/37.5; 0.1/0.3	15	Within the Storage Dyke	Moderate-High
ETH-D1	LEL; 12.5/37.5	20	Within the MTF	Moderate
ETH-D2	LEL; 12.5/37.5; 0.1/0.3	20	Within the Uppanar River	Moderate-High

I. EDC-A1 (Credible Scenario One) – Ship Loading/Unloading Leak

Description & basis

Release from valve or flange in Marine terminal facility; dyke-bounded pool for 25 mm leaks. PANACHE computes ERPG-1/2/3 plumes

Initiating events

Local corrosion/thinning; nozzle/gasket failure; overfill; minor impact.

Immediate consequences

Dense, near-field toxic plume driven by pool evaporation; pool fire if ignited (thermal radiation to adjacent tanks/racks).

Escalation

Radiation to neighbouring tanks; potential drainage migration if dyke freeboard/valving are inadequate.

Model results to report

- ERPG-1 (10 ppm) downwind distance: 10m

Level of concern

None (onsite) under $F/2 \text{ m}\cdot\text{s}^{-1}$; Low-None under $D/5 \text{ m}\cdot\text{s}^{-1}$.

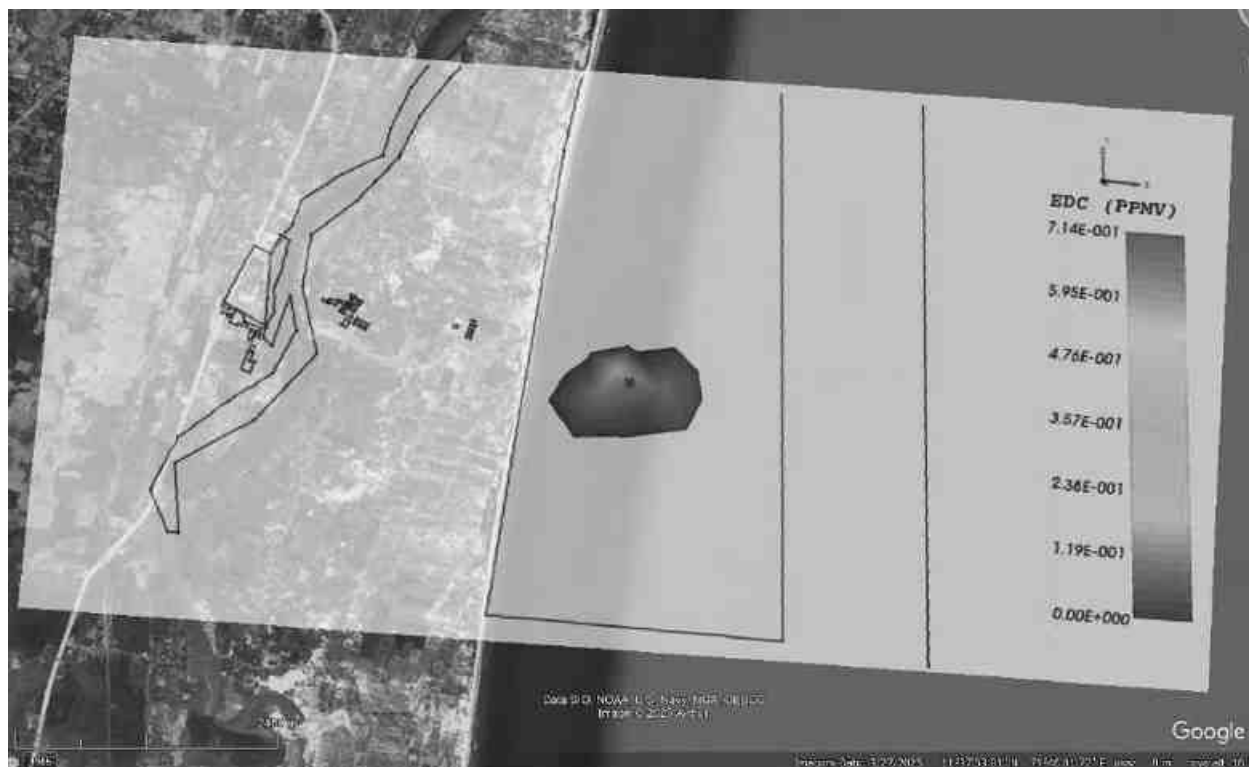


Figure 80. Scenario 1 - Release 1200 Seconds

II. VCM-B2 (Credible Scenario Two) – Zone-1 Storage Leak (25 mm)

Description & basis

Pressurised VCM at Zone-1 (sphere/bullet per design). Flashing release; PANACHE for AEGL-1 = 250 ppm and LEL plumes; PANFIRE for jet/pool-fire; VCE screening (0.1/0.3 bar) where congestion exists.

Initiating events

Nozzle/valve/seal failure; small line fracture; thermal shock; PSV maloperation.

Immediate consequences

Near-field flammable/toxic cloud with potential jet/pool-fire on immediate ignition; delayed ignition in congested bays may yield overpressure.

Escalation

Thermal/overpressure to adjacent bullets, pipe alleys, and cable tunnels; impairment of egress.

Model results to report

- AEGL-1 (250 ppm) downwind distance: 10m
- 0.1/0.3 bar screens: (with CONGEST-Z1 obstacle set)

Level of concern

Moderate-High (onsite) in Zone-1 due to congestion; Low (offsite) in the frames reviewed.



Figure 81. Scenario 2 - Release 60 Seconds

III. ETH-D1 (Credible Scenario Three) – Liquid Unloading at Trestle (25 mm)

Description & basis

Ethylene liquid line (approx. -103°C , atmospheric storage). Two-phase flashing jet at trestle deck; PANACHE outputs provided as C_2H_4 ($\mu\text{g}\cdot\text{m}^{-3}$) frames (e.g., S1, S3, 1200 s). These will be converted to %v/v and compared to LEL = 2.7 % for flash-fire reporting; PANFIRE generates jet-fire radiation.

Initiating events

Flange/gasket failure; valve stem ejection; impact/vibration; thermal shock.

Immediate consequences

Cold dense plume hugging deck/structure; flash-fire if an ignition source is encountered; jet-fire if immediate ignition.

Escalation

Thermal damage to adjacent lines/cable trays; marine/interface complications.

Model results to report

- LEL envelope (converted from $\mu\text{g}\cdot\text{m}^{-3}$): 15 m
- Jet-fire 12.5/37.5 $\text{kW}\cdot\text{m}^{-2}$: 20 m

Level of concern

Moderate (onsite) given ignition sources on trestle; low offsite in frames seen.



Figure 82. Scenario 3 - Release 1200 Seconds

IV. ETH-D2 (Credible Scenario Four) – Vapour Transfer (Uppanar→Zone-1, 25 mm)

Description & basis

Ethylene vapour line across Uppanar and into Zone-1. Elevated release; PANACHE LEL/UFL mapping; PANFIRE jet-fire; VCE screening near battery-limit congestion. Shared PNGs (e.g., S2, S4) indicate compact near-field plumes.

Initiating events

Flange/gasket leak; small-bore line failure; valve malfunction; fatigue.

Immediate consequences

Elevated flammable cloud aligned to wind; jet-fire if immediate ignition; VCE possible with delayed ignition in congested modules.

Escalation

Overpressure/thermal impacts to modules, sub-stations, evacuation corridors.

Model results to report

- LEL envelope: 10m
- Jet-fire 12.5/37.5 kW·m⁻²: 20m

Level of concern

Moderate-High (onsite) near Zone-1 BL; Low offsite in frames seen.



Figure 83. Scenario 4 - Release 1200 Seconds

7.8.4 Conclusions

7.8.4.1 Principal Findings

1. Risk significance and boundaries

- For the credible set, toxic and flammable envelopes are contained predominantly within the site under typical meteorology (D/5 m·s⁻¹). Under conservative night-time conditions (F/2 m·s⁻¹), EDC ERPG-1 and VCM AEGL-1 contours extend farther downwind but remain manageable with current siting and dyke hydraulics.
- Ethylene releases (liquid at trestle, vapour on the land corridor) produce compact near-field flammable clouds; flash/jet-fire hazards are the governing outcomes. VCE

remains a screened possibility only near congested modules at Zone-1 battery limits; preliminary 0.1/0.3 bar contours do not threaten off-site receptors.

2. Protection layers are effective and targeted
 - Double-walled, atmospheric ethylene storage at $\approx -103^\circ\text{C}$ eliminates BLEVE potential; inner-tank leaks are annulus-contained and vent-managed.
 - EDC dyke capacity and hydraulics limit pool spread and define boil-off, directly reducing toxic source strength; this is the decisive control for EDC scenarios.
 - VCM isolation and depressurisation, combined with congestion management and gas detection, constrain both toxic and flammable outcomes in Zone-1.
 - The site's ZLD and drainage isolation strategy is fit-for-purpose to prevent contaminated runoff to the Uppanar River/Bay of Bengal in firefighting situations.
3. Off-site individual risk
 - With the engineered safeguards credited per standard practice and emergency response provisions, public individual risk at the plant boundary is within broadly acceptable criteria ($\leq 10^{-6}$ per-year), with onsite risk managed to ALARP through procedural and engineered controls.
4. Environmental sensitivity
 - Short-term aquatic toxicity from an extreme, unmitigated EDC spill reaching surface water is a credible environmental concern; however, bunding, cut-off valves, retention ponds, and ZLD provide robust barriers.
 - Air-to-water transfer for HCl/acid gases is possible in rare toxic events; post-incident monitoring and neutralisation protocols are specified in the DMP.

7.8.4.2 Compliance Status

The assessment demonstrates alignment with MSIHC Rules, Chemical Accidents (EPPR) Rules, Factories Act/State Rules, PESO requirements for pressure vessels, and EIA 2006 expectations for MAH installations. The study approach and consequence criteria are consistent with IS 15656, OISD-150, CCPS, and comparable international benchmarks (OSHA-PSM/Seveso).

7.8.4.3 Residual Risk, Uncertainties, and ALARP Demonstration

- Residual risks reside primarily in near-field toxic/flammable zones around storages and transfer corridors under $F/2\text{ m}\cdot\text{s}^{-1}$ conditions.
- Uncertainties relate to final dyke dimensions/freeboard, annulus venting details for ethylene tanks, as-built congestion in Zone-1, and isolation times along trestle/Uppanar corridors. These are captured in the Assumptions Register and slated for update as vendor/IFC data are released.
- Sensitivity checks (meteorology, hole size, isolation) show that proposed controls (fast-closure ESDs, congestion management, dyke margin, gas detection density) reduce distances by $\geq 15\text{--}30\%$, supporting an ALARP conclusion when balanced against practicality and cost.

7.8.4.4 Risk-Informed Recommendations

- Confirm and lock: dyke geometry (volume, freeboard), drainage isolation valve logic, annulus vent and BOG handling for ethylene, and Zone-1 congestion mapping for VCE screening.
- Strengthen prevention/mitigation: high-integrity ESD at corridor block valves; additional open-path gas detectors along trestle and Uppanar bridge; foam resources and mobile monitors in EDC tank farm; rapid-depressurisation logic for VCM.
- Emergency readiness: integrate CFD contours into muster/egress plans, pre-plan river boom deployment, and conduct multi-agency drills with District Crisis Group.
- Monitoring and assurance: continuous boundary VCM/EDC monitoring, post-incident water quality protocols, and periodic third-party safety audits.

The expanded facility meets the intent of Indian regulatory criteria and demonstrates that risks to workers, the public, and the marine/river environment are reduced to ALARP. The combination of inherent design (double walls, atmospheric cryogenic storage), engineered safeguards (dykes, ESD/depressurisation, gas detection), and emergency provisions (ZLD, drainage isolation, firefighting capability) provides robust, multi-layered protection commensurate with a top-tier installation.

7.9 HAZARDOUS MATERIAL ASSESSMENT

Vinyl Chloride Monomer (VCM):

- Physical Hazards: Flammable, liquefied gas (boiling point -13.4°C); wide explosive limits (3.6–33% in air)
- Health Hazards: Confirmed human carcinogen (IARC Group 1); chronic exposure affects liver, CNS; acute effects include dizziness, drowsiness, asphyxiation
- Fire/Explosion: Forms explosive mixtures with air; extremely flammable; vapor can travel to source of ignition
- Exposure Limits: OSHA PEL 1 ppm; IDLH 500 ppm
- Storage Incompatibility: Strong oxidizers, alkalis; avoid heat, sparks, open flames

Ethylene Dichloride (EDC):

- Physical Hazards: Volatile, flammable liquid (flash point 13°C); denser than water; vapor heavier than air
- Health Hazards: Acute toxicity by inhalation; possible carcinogen (GHS Cat 1B); CNS depressant, liver/kidney damage
- Fire/Explosion: Forms toxic HCl and phosgene on combustion; explosive vapor-air mixtures possible
- Exposure Limits: OSHA PEL 10 ppm; IDLH 50 ppm
- Storage Incompatibility: Strong oxidizers, alkalis; corrosive to metals when wet

Ethylene:

- Physical Hazards: Flammable gas (flammability 2.7–36% in air); asphyxiant at high concentrations
- Health Hazards: Not acutely toxic; acts as a simple asphyxiant
- Fire/Explosion: Extremely flammable; can ignite with static discharge
- Exposure Limits: OSHA PEL 1,000 ppm (asphyxiant)
- Storage Incompatibility: Strong oxidizers; keep away from ignition sources

Hydrogen Chloride (HCl):

- Physical Hazards: Non-flammable gas (forms white mist); highly corrosive
- Health Hazards: Acute inhalation hazard; can cause severe burns, pulmonary edema
- Fire/Explosion: Non-flammable but reacts with metals, forming flammable hydrogen gas
- Exposure Limits: OSHA PEL 5 ppm (ceiling); IDLH 50 ppm

7.9.2 Hazard Identification and Risk Assessment

A Hazard Identification and Risk Assessment (HIRA) is a systematic risk assessment tool that can be used to assess the risks of various hazards. In Risk Assessment, risk has been analyzed using a methodology called HIRA-Hazards Identification & Risk Assessment. In HIRA, major manual activities are carried out and evaluation is carried out based on Risk Matrix and Risk Acceptability Criteria as provided below in the Table below.

7.9.2.1 Risk Matrix

Table 132. Risk Matrix

LIKE HOOD/ PROBABILITY		SEVERITY				
		Catastrophic (Death/ System Loss)	Major/ Critical (Serious injury/ Illness)	Moderate (Less Serious Injury/ Illness)	Minor/ Marginal (Minor Injury/ Illness)	Insignificant/ Negligible (No injury /illness)
		5	4	3	2	1
Almost Certain		H	H	H	M	M
Likely		H	H	M	M	L
Possible		H	M	M	M	L
Unlikely		M	M	M	L	L
Impossible		M	M	L	L	L

7.9.2.2 Risk Accessibility Criteria

Table 133. Risk Accessibility Criteria

Riskage	Risk Acceptability Criteria	Remarks
H	Unacceptable/ High	Management's Decision/Action Plan Required. Potential off-site Impact.
M	Medium	Generally Minor Impact. Acceptable with Management's Review. Specific monitoring or SOP to be followed.
L	Low	Acceptable without Review. Manage through Routine Procedure.

Table 134. Hazard Identification and Risk Analysis

Associated Hazards	Associated Risk	Initial Risk			Safety Measures	Residual Risk		
		Severity	Likelihood	Risk		Severity	Likelihood	Risk
Stages & Steps/ activities : Construction & Erection- Plant machinery								
-Fall in pit during excavation -Fall of objects due to breaking of pulley or chains of cranes, -Fall from height during lifting of equipment.	Risk of injury to workers / labours	4	3	12	-Examine ropes, hooks for defects before putting them into service. -Use chains or cables to suspend tackle over tonners. -Display of carrying capacity/load of Hoist and Pulley -Use of PPEs like Helmet etc	2	2	4
Stages & Steps/ activities : Construction & Erection - Heavy fabrication work								
-Heat radiation due to flame from the use of LPG / Acetylene gas	Eye or body injury	2	3	6	-Provision of PPEs' such as Welders goggles, heat resistant goggles, face shield	2	2	4
Stages & Steps/ activities :Unloading and handling of Flammable Chemicals								
Spillage/ Leakage/ Fire & Explosion	Fire/ Explosions may cause injury and inhalation of VOCs/fumes may affect the health of workers.	4	3	12	-Hazard area classification is carried out as per zone 0,1 & 2. -Flameproof electrical fittings/ Earthing is installed in the storage area of Toluene. -Use of spark-proof tools during maintenance in the area. -Provision of dyke wall and ensuring it dry all time following spill control SOP -Quickly and gently blot or brush away excess or spilled toluene or soak with inert material -Provision of smoke/leak detectors and sensors in the storage area. -Safety sign board indicating heat radiation hazard in 10 m	2	2	4

Associated Hazards	Associated Risk	Initial Risk			Safety Measures	Residual Risk		
		Severity	Likelihood	Risk		Severity	Likelihood	Risk
					radius of area -Self-breathing air apparatus is available to avoid CO ₂ & CO generation During Fire. -Use of CO ₂ , dry chemical or alcohol resistant foam for extinguishing fire.			
Stages & Steps/ activities :Storage and Handling of Solid Chemicals								
-Chemical Dust Exposure	Causes Skin/Eye irritation, respiratory tract irritation	3	3	9	-Loading & Unloading activity will be carried out in a well-ventilated area under proper supervision. -Immediate collection of spilled chemicals. -Rubber or neoprene Gloves and additional protection including impervious boot, apron will be used. -PPEs like chemical safety goggles, aprons and full-face shields. -Safety Showers nearby storage area	2	2	4
Stages & Steps/ activities : Production and Utility Operation - Process and reactors								
-Runaway reaction causing Fire /Explosion and release of Toxic gas	-Burn injury -Damage to property -Causes Skin/Eye irritation,Respiratory tract irritation	4	3	12	-DCS controlled operations -High temperature, high pressure and auto cutoff input reaction chemicals -During runaway reaction, downstream of safety vent in the reactor will have a catch/dump tank to collect releasing material (liquid, gas and/or vapor) -Exothermic reaction will be controlled by adequate dosing of reaction chemicals in a fixed time, having adequate cooling water/chemical circulation in the jacket of reaction vessels thereby absorbing any energy generated due to exothermicity and controlling pressurization. -Provision of adequate pressure relief valve -Equipment's, vessels properly earthed/grounded -Closed loop system with high alarm	2	2	4

Associated Hazards	Associated Risk	Initial Risk			Safety Measures	Residual Risk		
		Severity	Likelihood	Risk		Severity	Likelihood	Risk
					-Following Good Housekeeping practice -Provision of Smoke detectors, fire alarm and sprinkling /fire hydrant system & Fire extinguishers -To ensure proper use of PPEs by workers like gloves, apron, mask, gumboot & helmet -Periodical occupational health checks of the workers			
Stages & Steps/ activities : Production and Utility Operation - Operation of EDC cracking furnace								
-Fire / Explosion -Heat stress/ Thermal -Radiation -Noise	-Risk of injury to workers -Fatality -Hearing Loss -Property damage	5	3	15	-Competent & trained person should be employed for EDC cracking furnace Operation. -Regular inspection and maintenance shall be done. -Ensure the working of Safety valves, Water-level control and low-water fuel cut-off, -Water-gauge glass by periodical maintenance. -Area shall be well ventilated and adequately illuminated for safe working. -Use of PPEs like ear plugs, ear muffs, lightweight cotton clothing	2	2	4

7.10 DISASTER MANAGEMENT PLAN

7.10.1 Objectives of DMP

The main objective of preparing a Disaster Management Plan is to enumerate and estimate the potential hazards and Risks the combined resources of the Manufacturing unit would encounter due to the act of Nature and those Hazards and Risks the proposed activity would create/ would encounter as the case be and to be planned and prepared for controlling the situation at the time of any occurrence of Hazard/ Hazards :

- To assess & quantify the Hazards on Men and Material, in case if any disaster occurred
- To plan and place the rescue and medical team to deploy on the first report of any incident
- To plan & rollout effective treatment of casualties, if any , to the appropriate treatment Facilities

- To plan adequate Safeguards to prevent and contain the effects of disaster from spreading out to other people outside the project boundary
- To plan & execute immediate and safe evacuation of people
- To alert & Inform all authorities in one shot and to create a platform for all agencies to collaborate
- To preserve relevant records and equipment for root cause analysis / satisfactory action taken Report for further improvement
- To investigate and take steps to prevent recurrence of similar incidents

7.10.1.1 Methodology

The management of a disaster can be viewed as a series of phases including Prevention, Mitigation, Preparedness, Response, Relief, and Recovery (Rehabilitation and Reconstruction)

- i) **Prevention:** Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters. Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters.
- ii) **Mitigation:** Any action taken to minimize the extent of a disaster or potential disaster. Mitigation can take place before, during or after a disaster, but the term is most often used to refer to actions against potential disasters. Mitigation measures are both physical and structural, such as flood defenses or strengthening buildings as well as non-structural, such as training in disaster management, regulating land-use and public education, among others.
- iii) **Preparedness:** Activities and measures taken before a hazard event to ensure effective response to the impact of hazards. It involves measures that enable governments, communities and individuals to respond rapidly to disaster situations and cope with them effectively. Preparedness includes:
 - making of viable emergency plans
 - development of warning systems
 - maintenance of inventories
 - training of personnel
 - search and rescue measures
 - Evacuation plans for areas that may be '*at risk*' for a recurring disaster.
- iv) **Response/Relief:** The provision of assistance or intervention during or immediately after a disaster to meet the basic subsistence needs of the people affected. It can be of an immediate, short-term, or protracted duration.

- v) **Rehabilitation:** The operations and decisions taken after a disaster with a view to restore an affected community to its former living conditions, while encouraging and facilitating the necessary adjustments to the changes caused by the disaster.
- vi) **Reconstruction:** The action taken to re-establish a community following rehabilitation after a disaster. These actions would include construction of permanent housing, complete restoration of all services and physical infrastructure to the pre-disaster state etc
- vii) **Recovery:** The term refers to decisions and actions related to rehabilitation and reconstruction taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the affected community, while encouraging and facilitating necessary adjustments to reduce disaster risk

7.10.1.2 Classification of Emergencies

The Level of Emergency can be classified in three Categories, which is given in the below Table 15.

Table 135. Level of Emergency

Classification	Description	Causes
		Onsite
Level – 1	The leakage or emergency, which is confined within the plant/area.	Small pipe/valve rupture or similar leakages that do not affect outside premises.
		Release of toxic chemicals for a short duration.
		Small fire in the plant.
Level – 2	The emergency, which is confinable within the factory premises.	Leakage of toxic chemicals for a long duration.
		Medium scale fire and/or explosion confined to the factory premises.
Offsite		
Level – 3	The emergency, which is not confinable within the factory premises and general public in the vicinity are likely to be affected.	Heavy / Profuse leakage of toxic / flammable gases for a long duration. Explosion of high magnitude affecting the adjacent area. Major fire inside the factory premises

7.10.2 Disaster Preparedness Onsite

The plan will include alarm equipment and other measures and the budget for capital and running cost of the plan. Onsite preparedness for all the disasters would include a disaster preparedness plan which includes an On-site team of DMP that will be responsible for majority of action taken during a disaster. The plans also consist of emergency equipment and disaster emergency kits. It also includes an emergency communication plan for each household, an awareness program for each occupant and drills frequency and formats.

7.10.2.1 Fire Alarms/Other Measures

It is important to have a proper fire management system. Fire could take place from various accidents; one of them being faulty electrical materials. Hence all electrical wiring of the proposed building would be made as per Government standards. Also maintenance of the wiring should be

carried out at regular intervals through a professional electrician.

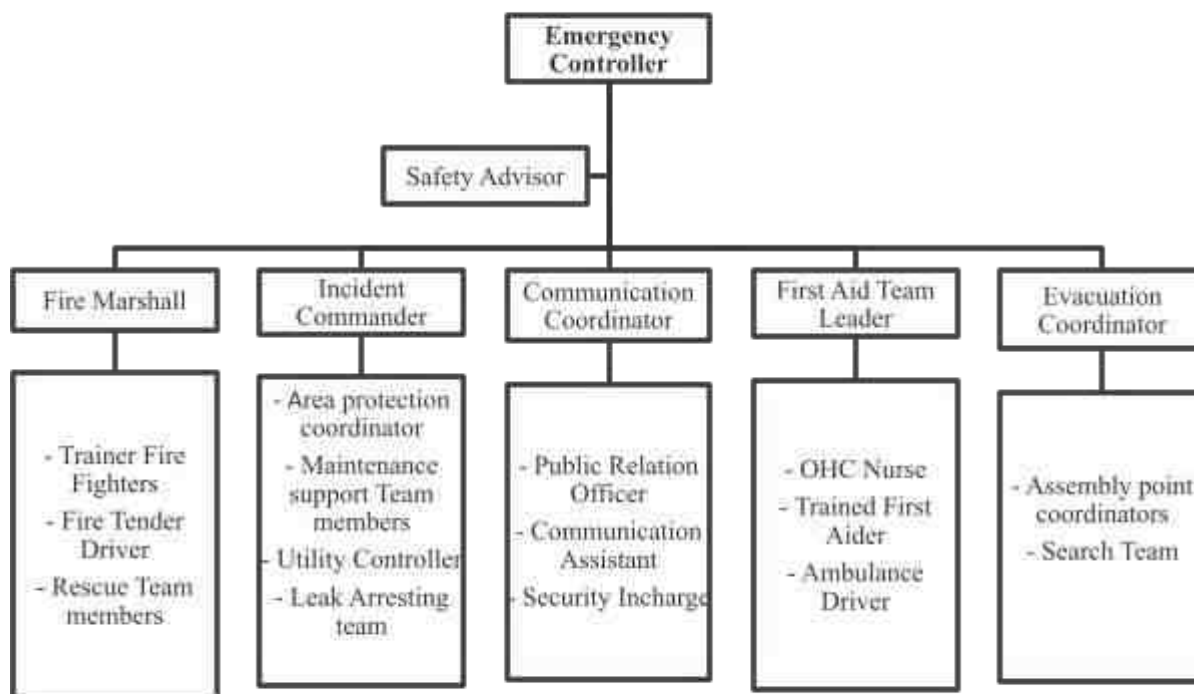
A fire and smoke alarm must be installed in every room. An alarm system will be developed so that visitors are informed and all the staff will be informed and trained with regard to the actions taken and operations necessary to efficiently use the system. Appropriate measures would be taken for their proper functioning.

To meet the requirements, the following measures will be taken:

- Posters indicating evacuation routes will be displayed in all rooms/Buildings /process areas etc. of the Manufacturing unit clearly indicating the position of the poster with 'You are here' mark. Route of evacuation should be indicated by way of arrows, leading to the assembly point.
- Fire and smoke alarms will be installed in all covered places such as rooms, lobbies, halls, offices, etc. The functioning of these fire alarms will be checked every week by the Manufacturing unit security staff.
- The courtyard will be paved suitably to bear the load of fire engines.
- The electric meter room will be sealed with non-combustible materials.
- The lighting in all fire escape routes will be based on independent circuits backed by DG sets.
- Underground and overhead water storage tanks having appropriate capacity will be provided for fire fighting.
- Automatic water sprinklers will be installed in all internal covered spaces.
- Fire Hydrants, Fire Hoses and Fire Extinguishers will be installed throughout the Manufacturing unit as mandated by the Fire Department.
- Portable fire extinguishers of dry chemical powder will be provided in the electric meter rooms and basements.
- Lightning conductors and other equipment mandatory as per existing Government Rules will be installed.

7.10.2.2 Onsite DMP Team

The structure of the team is given below. During the operational phase of the Manufacturing Unit, the name of the authority and their contact details will be included in the following chart given in Figure 2. This will be part of the DMP kit which should be prominently placed and accessible to all.



7.10.2.3 Emergency Equipments

The site security officer will maintain a list of emergency handling equipment including details of fire extinguishers, their validity and potency, protective clothing, and personal protective equipment for emergency handlers etc. Details of fire management services available at Salem District and details of nearby hospitals will be available with site security officers in his operating checklist. The major hospitals, clinics, emergency services shall be kept in the knowledge of all concerned. Fire fighting related water tanks with adequate water quantity and systems with fire hoses will be kept readily available. All the location of the fire extinguisher will be displayed by a notice board.

7.10.2.4 Disaster Emergency Kit

An emergency kit will be prepared which will have following items:

Table 136. Emergency Kit and Items and Numbers

S. No.	Emergency Kit	Items
1.	PPE Kit	Chemical gloves, HAZMAT suits, Respirators, SCBA, Safety Belts, Face shields
2.	Fire Safety kit	Fire suits, Gas Detectors, Firefighting foam & from making nozzle
3.	Document kit	MSDS of all chemicals, Hydrant layout, OSEP plan etc.

The emergency kit will be augmented frequently after its check regularly. The project proponent will provide a disaster emergency kit which would consist of:

1. Battery operated torch
2. Extra batteries
3. Battery operated radio
4. First aid kit and manual
5. Candles and matches in a waterproof container
6. Knife
7. Chlorine tablets or powdered water purifiers.
8. Can opener
9. Essential medicines
10. Thick ropes and cords
11. Gumboots and safety shoes
12. Breathing air supply
13. Communication equipments that can work in AC and DC
14. Medical and Related Resources

The medical management for the possible emergency situation essentially consists of a First Aid facility. The Security manager must maintain the staff including sweepers, security persons, etc. so that during medico emergency equal weightage would be given to all the members of the unit. Also the Security manager should keep the numbers of emergencies. Hospitals, so that doctors could be connected at the earliest at the time of medical emergency. These numbers must be prominently

displayed on the notice board and can be accessed by the members in absence of a Security manager.

7.10.2.5 Mock Drills

Mock drills activating the Disaster Preparedness Plan will be conducted periodically for ensuring its efficiency during emergency as well as refinement and update. These drills based on the plan will help achieve its objectives. Head, Security shall be the main coordinator for making people aware of the situation and emergency condition response.

Fire extinguishers would be placed in all floors of all blocks and in common areas. Every member of the facility Management staff would be given training on how to use these fire extinguishers. The working of these fire extinguishers would be evaluated every year by a qualified and trained person. If any faulty equipment is observed or any further improvement is needed then it would be repaired. A proper evacuation plan would be chalked out for the Manufacturing Unit. The map for the evacuation plan for each block and Dwelling Unit would be displayed in the respective places. A mock demonstration for evacuation of guests/visitors would be carried out at intervals of every six months. These mock drills would be performed in presence of qualified professionals. Information would be given to all the members of staff and residents on how to react in case of disaster.

7.10.3 Disaster Preparedness Offsite

The Disaster Management Plan of the Manufacturing unit will be integrated with a plan prepared for the region by Chengalpattu Revenue authorities.

7.10.4 Emergency Response in the Event of Disaster

In case of emergency due to any type of disaster a quick and immediate response is essential. This response depends on the actions taken by individuals to avoid or mitigate the adverse effects of a disaster and to undertake search and rescue operations. Following are the actions which will be taken in various emergent situations.

7.10.4.1 Action in the event of Fire

Extinguishing fires: A small fire at the point of leakage will be extinguished by enveloping it with a

water spray or a suitable smothering agent such as CO₂ or DCP (Dry Chemical Power). Trained staff will be engaged in combating fire. Fire fighting personnel working close to un-ignited vapour clouds or close to fire, will be protected continuously by water sprays.

Response Sequence during Event of Fire

Any person noticing the fire will attempt to isolate and extinguish the fire with readily available equipment and inform or arrange to inform the Security Head in-charge regarding the:

- Location of fire
- Type of material burning
- Extent of fire

Security Personnel will:

- Sound the siren as per the Siren Code.
- Will cordon off the area and call the local fire fighting Department.
- Will direct all occupiers/guests to evacuate and assemble in designated fire shelter spaces

7.10.4.2 Actions in case of Flood/Tsunami

As stated earlier, such eventualities are not expected considering the past weather records of the entire Mettur dam encompassing the project site. However, the Manufacturing unit management shall take all necessary precautions in consultation with the State weather and disaster management authorities.

7.10.4.3 Lightning strike

Apply immediate heart massage and mouth-to-mouth resuscitation to lightning victims until medical help arrives.

7.11 EVACUATION PLAN FOR THE MANUFACTURING UNIT

A standard response plan that is to be followed by any personnel that comes across an emergency situation such as fire needs to follow RACE.

RACE method of Evacuation Plan:

R Relocate All Persons In Danger!

A Always Pull The Alarm and Call the Emergency Services.

C Contain The Fire By Closing the Windows and Doors.

E Extinguish the Fire Only if You Are Trained and Confident.

Followed by this primary response, the evacuation of the public vulnerable to fire hazard is the most important step during any emergency fire. Proper coordination, prior basic knowledge on how to act in a situation is also essential. The guidelines given below are for the local evacuators and evacuees as well as planners and designers of the emergency response.

- Guidelines for Evacuation In-charge
- Evacuation and Exit Routes for each Dwelling unit
- Planning Guide For Assembly (Temporary Shelter) Place
- Evacuation Preparedness and Assessment Checklist

An assigned on-duty employee will be evacuated in-charge who will command and coordinate the situation.

7.12 EMERGENCY PREPAREDNESS PLAN

Even after all the preventive measures for any emergency following infrastructure has been provided.

- The Administrative office has also been made an Emergency Control Room.
- Assembly area has been demarked for offices/shops
- A communication system has been installed in the complex which includes an intercom and public addressing system.
- A fire alarm has been installed at a vulnerable place.
- The evacuation plan of each building has been displayed at each floor of the respective building.
- The safe zones (at the time of emergency) on map have been displayed at different locations.
- A First Aid facility has been made available at the Control room.

In case of emergency following action shall be taken.

- The emergency shall be declared in case of following:
- Fire alarm buzzing (Fire hazard)
- Vibration/Earthquake feeling (Earthquake)
- Water logging in the complex above 30 cm (Flood)
- Any unusual smell of gas or suffocating feeling (Chemical leakage)
- Security alarm from main gate. (Security risk/Terrorism)
- On declaration of emergency communication shall be made to residents for any type emergency
- All the resident of the affected area shall be moved to safe zone
- The control measures shall be done as per the emergency action plan for each type of hazard.
- All the members of the disaster management cell shall take charge of their respective duties.
- Outside help like fire tender, police ambulance etc. shall be called by site controller or Incident controller.

Recovery Procedure

The recovery procedure will depend on the type of emergency. Recovery procedure shall be followed by the engineering section to restore the essential services like electricity, water, telephone, food items.

Security Plan

ISO 27001 and 27002, which are the international best practice information security management standards, defining and guiding Information Security Management System (ISMS) development shall be adopted. These will provide the necessary benchmarking for individual users to know the type of cover and the responsibilities that are defined and provided by that institution for its guests. Most importantly, training for staff needs to be regularly imparted in dealing with such situations.

1. **Manual Checks:** At all gates the visitors and guest shall be manually checked and asked for ID's.
2. **CCTV:** At all important locations with a remote viewing facility and record back up. With highest resolution and picture quality. DVR being the backbone, its recording and replaying capabilities must be considered.

3. **Checks at Entrances:** All car entering will be checked thoroughly inclusive of Bonnets, Luggage Hold with hand held, metal detectors, mirrors and other checking stuff.
 - Central Control Room: This will control the security system from inside.
 - Communication Systems: Proper communication system to security staff shall help them to coordinate better during emergencies.

7.13 GENERAL SAFETY AND OCCUPATIONAL HEALTH

It is of utmost importance to take into account the safety of the plant personnel irrespective of the plant size. Proper safety measures should be followed in this regard.

- These include the use of Personal Protective Equipment (hand gloves, dust masks, face shield, goggles, apron, etc.) during working.
- Avoid contact with the raw materials without the use of Personal protective equipment.
- A schedule should be prepared for regular maintenance of each unit and the same should be followed regularly.
- All the valves, which are prone to open and spill inflammable/ toxic material due to accident impact, must be placed with a suitable guard.
- The unit's management should ensure that all rotating machines and moving parts are provided with appropriate guards and the guards are put back in the position after check-up and maintenance.
- All the control systems are being periodically checked for their reliability and accuracy.
- Proper ventilation to be provided in areas where there are chances of a build-up of hazardous gases, chemicals and causing fire hazards.

7.13.1 General Working Conditions

7.13.1.1 Housekeeping

- All the passages, floors, and stairways should be maintained in good condition. The system should be available to deal with any spillage of dry or liquid chemicals at the plant.
- Sufficient disposable bins should be clearly marked, and these should be suitably located in the plant.
- Chemical storage area specifically designed as per chemical properties
- Walkways should be clearly marked and free from obstructions.

- In the plant, precaution, and instructions should be displayed at strategic locations.
- All pits, sumps should be properly covered or securely fenced.
- Roads/walkways within the plant should be maintained neat and clean.

7.13.2 Ventilation

- Adequate ventilation should be provided in the work floor environment.
- The work environment should be assessed and monitored regularly.
- Local ventilation is most effective method for controlling dust and gaseous emissions at work floor

7.13.3 Electrical Safety

- A licensed electrician has deployed to complete all temporary wiring and electrical installations required for construction activities.
- Approved Rubber mat will be provided below the MCC panels and near the electrical junction.
- Electric proof hand gloves will be available to avoid electrical shock.
- Fuses and circuit breakers (ELCB) are used to protect motherboards, conductors and equipment to avoid short circuiting and electric shock. MCB's and fuses are also to be used to protect the electrical equipment from over current and over voltage.
- Extension cords for equipment or as part of a temporary wiring system shall not be damaged or compromised in any way and insulation must be of the highest grade.
- The joints of electrical wires avoided or an extension cord can be used if needed
- Anytime electrical equipment will be deactivated for repair, or circuits will be shut off, the equipment will be locked out and tagged at the point where it can be energized.
- Proper earthing is ensured for all equipment and electrical panels.
- Temporary lights are not suspended by their cords.
- The employer will provide the necessary safety equipment, supplies and monitoring equipment to their personnel.
- To follow the Lock Out Tag Out (LOTO) system.

7.13.4 Work Permit

- ❖ **Safety Permit will be taken for job in case of:**

- Work on line opening involving hazardous chemicals
- Work involving entry into tanks, vessels or work on pipelines.
- Work involving hot jobs like gas cutting, welding, burning, lighting etc. required to be done in the battery limit / hazardous area of the plant.
- When it is required to carry out hot work on or adjacent (within 7 mt. Radius) to tank / vessel containing inflammable liquid / gas / solid, rubber lines equipment and piping.
- Work involving electric shock or hazards from starting up of equipment.
- When work is to be done in the plant at Hydrogen seal water piping.
- When the work is to be done on the roof of buildings.
- Working at a height above 2 mt. Where working arrangements like ladders, stairs, platforms, railing etc. are not available.
- Work involving excavation and digging jobs in plant / factory premises.

❖ **Cold Work Permit will be taken for job in case of:**

- Work below 2 m height.
- Work where no inflammable material available within 7 m Radius.
- Work on pipeline – where hazardous material or height work is not to be carried out.
- Hot work carried out for Chlorine tonners in case it is sent for scrap at final stage, and job carried out outside battery limit.
- Excavation and digging job inside plant / factory premises.
- Any maintenance job which does not follow Safety permit criteria.

❖ **Jobs will be extended beyond office hours or non-working days:**

- Permit must be revalidated by and permitted with the consent of DGM / HOD.
- The responsible person of the concerned department should present till the validity of extension of permit.
- Shift in-charge (permit issuer) will personally take care of the situation and take necessary safety precautions like using PPE, Isolation, Decontamination, Draining, Venting, depressurization etc.

- In case of an emergency breakdown job - outside working hours (apart from 'G' shift timings) - Shift In charge (issuer) and Permittee will take care of the whole job by due concern with the Safety Department by following all the SOPs and Safety Guidelines.

7.13.5 Working at Heights

- Examine ropes, hooks for defects before putting them into service. Use chains or cables to suspend tackle over tonners.
- Each man handling the falls should know how to tie the rope knots properly and safely.
- Make sure that supports to which hoists are attached are strong enough to withstand the loads to which they will be subject.
- Do not tie knots to retain cables run through chains and hooks.
- Use cable clamps or wedge sockets, manila rope is not to be used for slings on material contaminated with acid.
- Care should be exercised in selecting equipment to snug taglines. Be sure it is strong enough to withstand the load.
- Hoisting equipment operators should keep their eyes on the man giving signals. Do not allow cables to stack up on the side of the drum. In giving signals to the Crane Operator, keep attention on the load.
- As a matter of safety, all this equipment should be inspected every year and each year a different colour code is to be used to show and exhibit that the equipment has been checked.
- Hoist ropes must not be used if more than three outside adjacent wires are broken within a length of one lay or if outer wires are worn 2/3 of their original diameter, or if marked corrosion appears.
- Truck cranes must be properly blocked and be on firm footing before lifting a heavy load with a low room.
- Employees must stand clear off the swing of the crane and keep out from under suspended loads.

7.14 OCCUPATIONAL HEALTH AND SAFETY

Action plan for the implementation of OHS standards as per OHSAS/NIOSH/ACGIH will be followed as given below:

- Occupational health surveillance programmes will be done six monthly & and their records will be maintained.
- A medical dispensary including a qualified doctor, male nurse, and Pharmacist in general shift will be available at the plant and the hospital facility is available nearby at Bankura district, West Bengal.
- Health check-up camps will be organized on a regular basis at company's dispensary/nearby locations for nearby people.
- Proper medical facility arrangements will be provided in case of any accident.
- Label Precautions and First Aid facilities will be provided.
- An emergency plan will be prepared, and mock drills of the on-site emergency will be conducted.
- Employers and employees will be made aware of the hazardous properties of materials in their workplaces, and the degree of hazard each poses.
- Inspection of the industrial activity will be done at least once in a year and an annual status report on the compliance with the Rules will be submitted.
- An Environment, Health and Safety (EHS) Manager will be available, which handles all the safety issues related to man, machine & materials.
- Exterior refuge or safe areas including parking lots, open fields or streets which will be located away from the site of the emergency, and which provide sufficient space to accommodate the employees.
- Coal storage mitigation – Proper ventilation will be provided around the coal storage shed.
- Specific written instructions will be obtained before any welding, burning, grinding or other flame heat producing work commences in coal processing areas.

7.14.1 Personal Protective Equipment

The level of risk of exposure to dust will dictate the right personal protective equipment (PPE) required such as side dust mask and appropriate gloves, footwear, respiratory protection, fire-resistant clothing, helmet.

- **Respirators:** An effective respiratory protection program will be established and maintained. A dust mask will be provided to workers.

- **Clothing:** Workers wear appropriate protective clothing to prevent skin exposure.
- **Skin Protection:** Workers wear gloves and clothing to protect skin.
- **Eye Protection:** Workers wear goggles when required.
- **Eyewash facility:** Common workplaces will be equipped with an Eyewash facility.
- **Head protection:** Helmet will be mandatory in plant premises.

7.14.2 Worker Health Checkup Plan

M/s Chemplast Sanmar Limited is committed to take care of the health of its employees. The company will be conducting pre-employment and post-employment medical tests for its employees besides various educational and awareness programs on health and safety. A full-time medical assistance centre will always be available to its employees to carry out any first aid.

Pre-Employment Tests: Any employee who joins the Plant goes under company prescribed pre-employment medical examination tests from a MBBS qualified doctor. The medical fitness report will be required to be submitted on or before joining the organization. If some new employee reports for his/her joining without a Medical Examination and fitness report; he/she will not be allowed to join until the Medical Examination and fitness report is produced to the HR department. Such incidents will also be reported to the HR Head.

Annual / Bi-annual Medical Tests: Annual/Bi-annual medical tests will be conducted in the months of January and July, respectively. All those employees who will be exposed to hazardous raw materials/processes, will be examined twice a year. Following departments will be involved in hazardous process and covered for medical examination:

- Production
- EHS
- Quality Control
- Mechanical
- Electrical
- Instrumentation
- Packing

Apart from the employees of above-mentioned departments, employees of other departments will also be covered for medical examination if they will also be exposed to hazardous processes due to any reason. The cost of pre-employment and during employment medical examinations will be borne by the company.

Exposure of workers to Raw Materials and safety Measures:

All our concerned employees will be given shop floor and classroom awareness training on raw materials that will be used. The detailed data of raw materials will be shared with them for their knowledge and awareness. This detailed data will also be made available to medical centers for everybody's information.

LIST OF MEDICAL TESTS DURING PRE AND POST EMPLOYMENT

Table 137. Medical test of workers during pre & post-employment

Pre-Employment Medical Tests	Post-Employment Medical Tests	
	Annual Medical Tests (January- February every year)	Bi-Annual Medical Tests (July-August)
Physical Examination: 1. Chest Examination 2. Weight 3. Height 4. Pulse 5. B.P.	Physical Examination: 1. Chest Examination 2. Weight 3. Height 4. Pulse 5. B.P.	Physical Examination 1. Chest Examination 2. Weight 3. Height 4. Pulse 5. B.P.
-Urine Routine Examination -Physical Examination -Macroscopic Examination	-Urine Routine Examination -Physical Examination -Macroscopic Examination	N.A.
Haematology -Haemoglobin -TLC -DLC -Polymorphs -Lymphocytes -Eosinophils -Monocytes -ESR (Win Trobe) -S. Creatinine -S. Cholesterol	Haematology -Haemoglobin -TLC -DLC -Polymorphs -Lymphocytes -Eosinophils -Monocytes -ESR (Win Trobe) -S. Creatinine -S. Cholesterol	N. A
Liver Function Tests (LFT) (For those workers only directly exposed to chemicals)	Liver Function Tests (LFT) (For those workers only directly exposed to chemicals)	N.A.
Chest X-ray P.A. View	Chest X-ray P.A. View	N. A
Vision test for near & far, colour vision	Vision test for near & far, colour vision	Vision test for near & far, colour vision
Random Blood Sugar	Random Blood Sugar	N.A.

Pre-Employment Medical Tests	Post-Employment Medical Tests	
	Annual Medical Tests (January- February every year)	Bi-Annual Medical Tests (July-August)
ECG	ECG	N.A.
Blood Group	Blood Group	N.A.
Ultrasound (Abdomen)	N. A	N.A.
Spirometry Test	Spirometry Test	N.A.
Colour Blindness Test	Colour Blindness Test	Colour Blindness Test
Audiometry Test	Audiometry Test	Audiometry Test
Sputum test	Sputum test	Sputum test

Table 138. Plan and Budget for Occupational Health and Safety

S. No.	Description	Amount (INR Lakhs)
1	Workers will be subjected to primary health check-up before they are employed to ascertain their health conditions. Thereafter, Regular Medical check-up & First Aid facility will be organized for workers to evaluate the adverse impact if any on these persons due to the proposed activity. Occupational health surveillance programmes shall be done yearly. A Medical Officer and full-fledged medical staff are recruited.	
2	Infrastructure facilities such as sanitation, fuel, restroom, canteen etc. shall be provided to the labour force during construction as well as to the casual workers including truck drivers during the operation phase.	
	Total	

7.14.3 Summary & Conclusions

"Risk" is the product of hazard and exposure. Thus, risk can be reduced by controlling or eliminating the hazard or by reducing workers' exposure to hazards. An assessment of qualitative risk helps to understand hazards in the context of the workplace and prioritize hazards for permanent control.

This study will be further substantiated by consequence studies utilizing simulation models to assess potential outcomes of identified hazards.

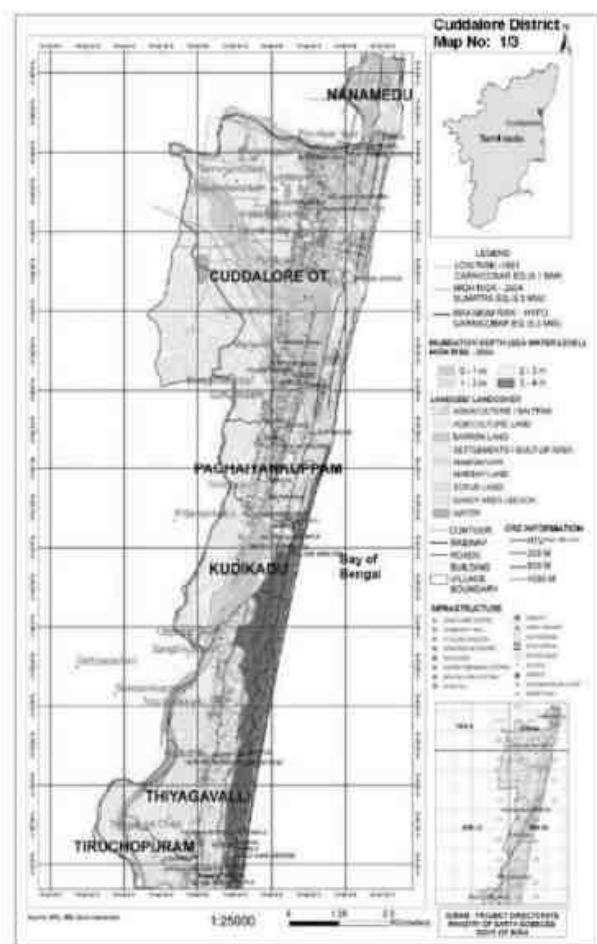
7.15 Flood Risk Assessment

The Sanmar Group manages over 30 businesses that are grouped under various industry segments viz., Chemicals, Engineering, Shipping and Metals. Chemplast Sanmar Limited is a prominent chemical manufacturing company headquartered in Chennai, Tamil Nadu, and is a flagship entity of the Sanmar Group. M/s. Chemplast Cuddalore Vinyls Limited, intends to set up a new greenfield Vinyl Chloride Monomer (VCM) manufacturing unit at Cuddalore. In this regard, M/s. Chemplast Cuddalore Vinyls Limited has approached National Institute of Ocean Technology (NIOT), Chennai

to carry out Flood Risk Assessment for the project location. This report presents the preliminary findings based on field data collection and the initial outputs from hydrodynamic and hydrological modeling analyses. Flood Risk Assessment report is attached as **Annexure 14**.

The scope of the work includes

- **Watershed Delineation:** Delineation of the watershed boundaries and sub- basins contributing to the study area using satellite data.
- **Rainfall-Runoff Modelling:** Using hydrological models to simulate rainfall-runoff processes and generate hydrographs for different return periods
- **Flood Impact Assessment:** Prediction of inundation at the site due to riverine flooding, coastal inundation and urban flooding for the defined hydrographs of the various return periods using hydrological models.
- **Generation of flood inundation maps** showing water surface elevations, flood extents, depths, and velocities.
- Identify and classify flood risk zones based on depth and velocity thresholds. Assess the impact of flooding and recommend the minimum elevation that has to be maintained by the plant in design.
- Recommendation of Flood mitigation measures.



Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

Figure 84. Tsunami vulnerability map for Cuddalore (b) Tsunami inundation extent at Cuddalore (source: MoES)

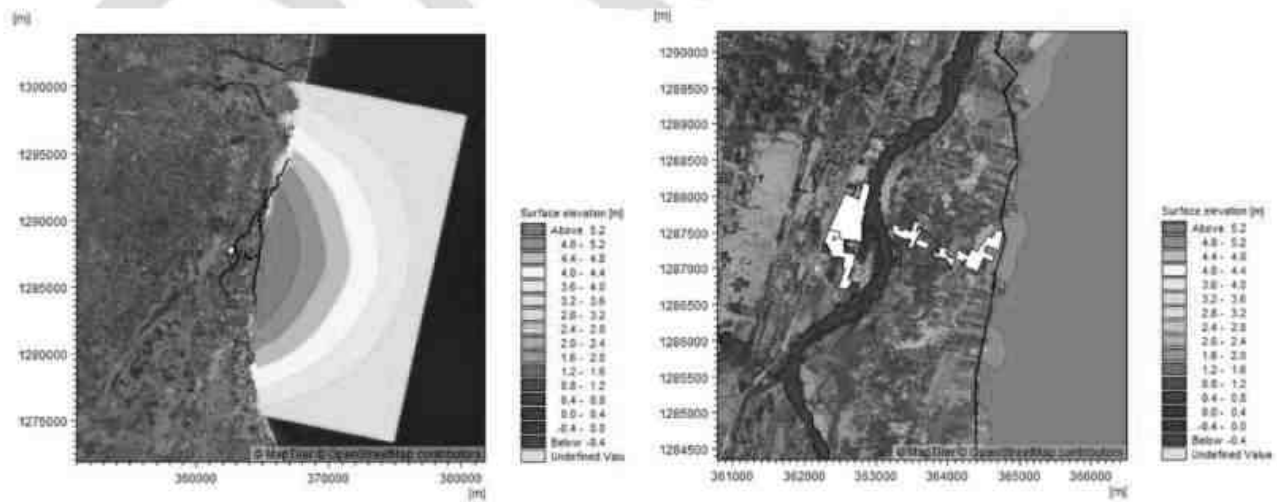


Figure 85. Tsunami inundation simulated using MIKE 21 FM

Observations

- Tidal range inside the Uppanar river was observed to be 0.79m during spring tide and 0.2m during neap tide. The tidal influence was very significant inside the river, extending up to 13 kilometers upstream from the river mouth.
- The current speed inside the river ranges from 0.35m/s during spring tide to 0.2m/s during neap tide.
- Analysis of Historical rainfall data in Cuddalore from 1990-2024 indicates that 282.2mm is the maximum daily rainfall occurred in 2020 in the month of November. Similarly, 1147.5mm is the maximum monthly rainfall occurred during 2021 in the month of November. Based on 35 years of rainfall data, the estimated 100-year return period rainfall is 321 mm.
- The catchment area of Uppanar river is divided into 8 sub-basins using HEC-HMS. Pre-processing steps include preparing fill sinks, flow direction, flow accumulation, stream definition, stream segmentation, catchment processing, and catchment grid delineation. The total area of the watershed is 373 sq km.
- Hydraulic modeling performed using HEC-RAS software indicates that for past maximum rainfall events of 282mm, the flood inundation indicates that the low lying areas in the south gets inundated.
- The compound flood scenario, integrates the effects of the 100-year return period rainfall, astronomical tide, and storm surge generated by a Thane cyclone. Flooding amplifies due to the combined contribution of intense surface runoff from extreme rainfall, astronomical tide, and additional sea level rise induced by storm surge resulting in increased spatial extent and depth of inundation.
- In both the scenarios with past maximum rainfall event and compound flood scenario, the study area remains unaffected.

- A separate scenario was formulated to evaluate the potential extent of tsunami-induced inundation in the study area. The observed water level during the 2004 Indian Ocean Tsunami at Cuddalore was applied as the boundary condition to simulate the propagation of tsunami waves within the domain. The simulation results show that the tsunami wave energy dissipates considerably before reaching the site, due to its distance from the shore.
- The study area was also superimposed on the tsunami inundation map prepared by the Ministry of Earth Sciences, which confirms that the site is located outside the tsunami hazard line. Based on the outcomes of all flooding scenarios, a safe grade elevation of 3 m is recommended for the site.

7.16 Hydrogeological study

A hydrogeological study was conducted at two Sanmar sites in Semmankuppam Panchayat, Cuddalore, to assess hydrogeology and potential piling impacts. The coastal sites feature Quaternary sediments (clay/silt) over Cuddalore Sandstone, near the Uppanar Backwaters, which keep shallow aquifers brackish. Deeper sandstone (below 20m) is used for irrigation west of the highway. No significant groundwater extraction occurs in the industrial complex, as SIPCOT supplies water. Soil strata include soft silt to 7m, followed by sandy silty clay/clayey silty sand/clayey silty sand with gravel to 13m.

Piling to 11-13m will use bentonite clay and MS casing, minimizing shallow aquifer contamination. Piling is limited to 13m and won't involve groundwater extraction. Thus, piling for the proposed VCM plant in Cuddalore will not impact the area's hydrogeological characteristics. Hydrogeological study prepared by M/s.Perfact Enviro Solutions Pvt. Ltd. is attached as **Annexure 15**.

7.17 Decarbonization Study

The decarbonization assessment of the CCVL plant demonstrates a clear opportunity for phased and targeted GHG reductions without compromising operational integrity. With gross annual emissions of approximately 426,856.9 tCO₂-eq in the base year (2025), the plant's emission profile is largely driven by indirect electricity consumption, followed by process-related and transport emissions.

Through a combination of in-plant mitigation measures (such as process optimization and utility efficiency) and offsetting strategies (like afforestation and renewable integration), the plant can achieve a total cumulative reduction of ~72,016.2 tCO₂-eq by 2045 – amounting to nearly 70-80% reduction from the base year. While the pathway does not pursue absolute net zero, it reflects a realistic, cost-effective, and technologically relevant decarbonization model for a mid-scale specialty chemical operation.

The report also highlights the inapplicability of CCUS for this plant, reaffirming that electrification, optimization, and nature-based solutions remain the most feasible strategies.

To ensure the success of this roadmap, the following actions are recommended:

1. Establish an Integrated Carbon Governance System

- Form a dedicated Carbon Steering Committee to track decarbonization KPIs.
- Digitize monitoring via Energy Management Systems (EMS) and GHG dashboards.

2. Scale Insetting & Offset Mechanisms

- Expand the greenbelt area with annual survivability audits and GIS tracking.
- Prioritize RE integration through open access PPAs and rooftop solar feasibility studies.

3. Prioritize Energy Efficiency First

- Conduct a detailed energy audit by 2026 to map efficiency hotspots.
- Prioritize low-CAPEX interventions such as motor upgrades, lighting retrofits, and heat insulation.

4. Optimize Scope 3 Logistics

- Collaborate with transport vendors for low-emission routing and reverse logistics consolidation.
- Consider pilot programs for EV or biofuel-based transport options.

5. Annual Review & Adaptive Planning

- Re-evaluate reduction trajectories every 3–4 years based on updated technology readiness and policy landscape.
- Prepare for industry-aligned reporting (e.g., BRSR, CDP, ESG ratings) with auditable data sets.

6. Leverage Policy & Partnerships

- Monitor state/national policy support (e.g., carbon credits, RE subsidies).
- Engage with industry associations for shared decarbonization initiatives and co-learning.

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

7.18 Environmental Cost Benefit Analysis (ECBA)

Environmental Cost Benefit Analysis (ECBA) is the application of Cost Benefit Analysis (CBA) to projects or activities or policies that have careful aim of environmental improvement or action that somehow affect the natural environment as an indirect consequence. CBA is a tool which now financial analysts adopt before considering a commercial activity involving a huge investment

having substantial impact on the environment. Environment to be clean & safe is the prime concern and need of society. CBA is a set of practical procedures for guiding “No Go” or “Go” decisions. There can be the most efficient resource distribution with maximum net benefit. Project benefits include Use and Non-Use values to man and environment, bequest values, option values. Environmental components broadly include living organisms, air, water & soil. Environmental costs include pollution prevention cost, pollution damage cost, welfare damage cost and cost for environmental mitigation measures and environmental management plans. It is a decision-making process that guides the decision maker to compare all possible and foreseeable direct and indirect beneficial and adverse impacts of the proposed project.

The company's impressive Benefit-Cost Ratio (BCR) of 9.359 underscores the robust economic viability of its ongoing industry project. This exceptional BCR value signifies that the anticipated benefits of the project significantly surpass its costs, illustrating a compelling value proposition. For every unit of currency (₹ 1) invested, the company stands to gain Rs. 9.359 in returns, underscoring the project's potential for generating substantial profitability and economic prosperity. This favorable BCR reflects the company's strategic foresight and prudent investment decisions, as it indicates a judicious allocation of resources towards endeavors that promise high returns. With the benefits of the project, including revenue from product sales, tax efficiencies, and optimized operational expenses, far outweighing its associated costs, the company is poised for sustainable growth and success in the competitive industry landscape.

A detailed Environmental Cost-Benefit Analysis (ECBA) report prepared by Perfact Enviro Solutions Pvt Ltd. is given in **Annexure 9**.

7.19 Marine Ecological Study

The marine and coastal environment supports rich biodiversity and provides critical ecosystem services. The Cuddalore coastal area, where the proposed project is located, includes estuaries, beaches, lagoons, mangroves, and sand dunes that sustain diverse marine flora and fauna.

Plankton

Primary productivity: 270–420 mgC/m³/day (avg. 356 mgC/m³/day); higher productivity observed at stations with better water clarity and temperature.

Phytoplankton:

56 species recorded – dominated by diatoms (Bacillariophyceae, ~81%), followed by dinoflagellates (~14%).

Population density: 9,000–25,800 cells/L (highest at station SS10).

Shannon–Wiener diversity: 4.76–5.20 (indicating good environmental conditions).

Zooplankton:

54 species recorded – dominated by copepods (Paracalanus parvus most abundant).

Density: 30,525–1,20,450 nos./100 m³; highest at SS10.

Diversity index: 4.81–5.43 (also indicating healthy conditions).

Benthic Communities

Subtidal benthos:

Density: 480–1,360 nos./m²; dominated by polychaete worms.

Diversity index: 3.55–4.56 – suggests moderate ecological status.

Intertidal benthos:

Density: 345–420 nos./m²; arthropods and molluscs most common.

Diversity index: 3.56–3.72 – moderate ecological status.

Benthic communities indicate stable, moderately productive sediment habitats.

Microbiology

Bacterial load: Seawater: $0.01\text{--}5.64 \times 10^3$ CFU/mL.

Sediment: $0.02\text{--}5.73 \times 10^4$ CFU/g.

Faecal coliforms and other indicators of contamination present but at generally low levels. Higher bacterial counts in sediments than water.

5. Coastal Vegetation

The region hosts well-developed sand dunes (0.5–5 m high) with vegetation such as Ipomoea pes-caprae, Spinifex littoreus, Prosopis juliflora, Casuarina equisetifolia, and coconut and palm plantations. Dunes act as natural barriers against erosion and support nesting of birds and turtles. Existing dunes near the project site (110 m north and 560 m southwest of proposed facilities) will remain unaffected.

Comprehensive marine ecological study prepared by Indomer Coastal Hydraulics (P) Ltd. is attached as **Annexure 17**.

7.20 Eco Risk Assessment

7.20.1 Methodological Framework

A complete ecological risk assessment (ERA) has been undertaken for the Uppanar River estuary and adjacent nearshore marine waters potentially influenced by the proposed facilities. The ERA follows the structure of internationally recognised frameworks—problem formulation, analysis (effects and exposure), risk estimation, and risk characterisation—with quantitative model outputs used to support endpoint conclusions.

7.20.2 Models, Data Sets and Assessment Endpoints

Exposure and risk calculations integrate multi-pathway ecological modelling with site meteorology and hydrodynamics:

- EcoRisk View (v2.8x): multi-pathway model used to compute exposure point concentrations (EPCs) and ecological quotients for multiple COPCs simultaneously across aquatic, sediment and dietary pathways using estuarine food webs and receptor guilds [4–6].
- CALPUFF: one-hour average concentration and deposition fields (coastal grid) applied as over-water drivers for air-to-water transfer and shoreline deposition pathways.

- Receiving water classification: CPCB designated best-use criteria for coastal and river waters used as context for aquatic life protection and compliance checks..

Assessment endpoints are the protection of aquatic biota (fish, invertebrates, plankton), benthic invertebrates, and higher trophic receptors (shorebirds and small mammals) resident in estuarine habitats.

7.20.3 COPECs and Ecotoxicological Benchmarks

Chemicals of potential ecological concern (COPECs) include Vinyl Chloride Monomer (VCM), 1,2-dichloroethane (EDC), Ethylene, and Hydrogen Chloride (HCl). Benchmarks are drawn from authoritative dossiers:

- VCM: ECHA dossier indicates low acute aquatic toxicity; aquatic PNECs are in the sub-mg/L range; VCM is not PBT/vPvB.
- EDC: ECHA reports acute LC50 values typically in the 10–100 mg/L range; aquatic classification for ecotoxicity is not warranted based on available data .
- Ethylene: gaseous hydrocarbon; QSAR-based NOECs in mg/L range; low bioaccumulation potential.
- HCl: environmental hazard mediated by hydronium-driven pH effects; chloride is not the driver within typical aquatic toxicity ranges.

7.20.4 Exposure Analysis (Media and Pathways)

Pathways include (i) air-to-water transfer and deposition of vapours and aerosols over the estuary (VCM/EDC/HCl), (ii) direct liquid release to containment with potential migration to stormwater and the estuary (EDC), (iii) sediment interaction for deposited/settled fractions, and (iv) dietary uptake across an estuarine food web. EcoRisk View food webs for brackish marsh/estuary guilds (fish, birds, small mammals) were used with site-relevant ingestion rates.

7.20.5 Receptor Definition and Food Webs

Representative receptors comprise pelagic fish (omnivore/carnivore guilds), benthic invertebrate consumers, shorebirds (e.g., sandpipers, gulls), and small riparian mammals. Dietary components (algae, aquatic plants, benthic invertebrates, fish, birds) and ingestion rates are parameterised consistent with EcoRisk View's brackish-estuary library.

7.20.6 Model Outcomes

Modelled ecological quotients (EQ = EPC/benchmark) and hazard quotients across media and diets indicate the following for credible operating and upset scenarios:

- VCM: Over-water exposure from dispersion/deposition is limited by high volatility; modelled water-column and dietary EQs remain well below 1 at and beyond the near-field mixing zone. No exceedances of aquatic-life benchmarks or CPCB class-based expectations were identified.
- EDC: For contained spills and transfer operations, near-field water-column EQs are below 1; transient, localised elevations are possible immediately at the point of entry during large upsets, with rapid decline under estuarine mixing. Sediment and dietary pathways remain below concern thresholds across the receptor guilds evaluated.
- Ethylene: Dissolved-phase exposure is negligible; EQs are orders of magnitude below 1 across aquatic and dietary pathways.
- HCl: Short-duration pH depression is confined to the immediate plume footprint under calm, stable conditions; mixing and buffering restore pH within acceptable ranges for aquatic life. No persistent off-site effects are predicted.

Across all receptors, the complete ERA indicates no chronic population-level risk under design and emergency response conditions; event-scale near-field effects are controllable through containment, isolation, and incident response.

7.20.7 Risk Characterisation and Significance

For each COPEC, the spatial extent of any potential exceedance is limited to the immediate release vicinity and short time scales. The integrated multi-pathway outputs show EQ < 1 for off-site waters and sediments and for estuarine food-web receptors. No cumulative risk interactions were identified that would elevate risk categories beyond “low”.

7.20.8 Conclusion

The complete ERA concludes that, with engineered containment and emergency isolation in place, ecological risk to the Uppanar estuary and adjacent nearshore marine zone is low during both normal operations and credible upsets. Model outcomes do not show exceedances of aquatic-life protection benchmarks beyond the near-field of a large release, and no sustained or population-level impacts are anticipated.

8. PROJECT BENEFITS

The proposed expansion of the Suspension Grade Poly Vinyl Chloride (SPVC) manufacturing capacity from 600 KTA to 1200 KTA and establishment of a backward-integrated 750 KTA Vinyl Chloride Monomer (VCM) production facility by M/s Chemplast Cuddalore Vinyls Limited (CCVL) is expected to bring multiple environmental benefits, both directly and indirectly. The project has been designed with due consideration for environmental sustainability and aims to adopt cleaner technologies, resource conservation measures, and sound waste management practices. The key environmental benefits are outlined below:

8.1 ENVIRONMENT BENEFIT

A. Backward Integration to Reduce Environmental Footprint of Supply Chain

Currently, the feedstock (VCM) for SPVC manufacturing is imported and transported through marine terminals and cross-country pipelines. With the proposed in-house VCM production:

- Transportation-related emissions and risks will be significantly reduced.
- Dependence on long-distance shipping and associated marine environmental risks will be minimized.
- Onsite integration will reduce handling losses and fugitive emissions.

This backward integration contributes to lower carbon emissions and improves supply chain efficiency, supporting India's goals under Atmanirbhar Bharat and reducing the environmental footprint of imports.

B. Cleaner Fuel Use and Air Pollution Control

The proposed project is designed to use natural gas as the primary fuel for boilers and cracking furnaces, which offers a cleaner combustion profile compared to conventional fossil fuels like coal or furnace oil. The environmental advantages include:

- Reduced emissions of SO_x, NO_x, PM, and CO₂.
- Improved local air quality within and around the plant premises

Additionally, all flue gas and process gas stacks will be provided with **adequate height and air pollution control systems**, ensuring compliance with CPCB/TNPCB norms.

C. Zero Liquid Discharge (ZLD) and Water Reuse

The facility will operate on a **Zero Liquid Discharge (ZLD)** principle, ensuring:

- No untreated effluent discharge into land or water bodies.
- Maximum reuse of treated effluent for cooling and process requirements.

- Protection of nearby water bodies such as *Uppanar River* and *Bay of Bengal* from industrial effluent impact.

Moreover, all domestic sewage will be treated in a 140 KLD STP, and the treated water will be used for greenbelt irrigation, reducing freshwater dependency.

D. Use of Desalinated Water and Freshwater Conservation

To reduce the stress on local freshwater resources, the total fresh water requirement of 11422 KLD will be met entirely through seawater desalination. A new 20,000 KLD **desalination plant** will be installed, eliminating dependence on groundwater or surface water. This initiative ensures:

- Sustainable water sourcing.
- No adverse impact on local community water supplies or agriculture.
- Resilience against seasonal water scarcity and climate-induced variability.

E. Waste Minimization and Resource Recovery

The project emphasizes solid and hazardous waste minimization through:

- Organic Waste Converter for biodegradable waste.
- Sale of recyclable waste to authorized vendors (e.g., HDPE drums, plastics).
- Safe disposal of hazardous waste at **Common Hazardous Waste Treatment, Storage and Disposal Facilities (CHWTSDF)**.
- Maximum recovery of by-products like **Hydrochloric Acid (HCl)** (200 KTA) from the VCM manufacturing process, contributing to circular economy principles.

F. Greenbelt Development for Carbon Sequestration

A total of **26.0515 hectares**, accounting for **over 40%** of the total project area, is earmarked for greenbelt development. This extensive plantation will:

- Act as a carbon sink and improve ambient air quality.
- Mitigate noise and dust dispersion within and outside the plant boundary.
- Enhance the site's ecological value by supporting native plant species and providing habitat for local fauna.

G. Efficient Energy Use and Emission Reduction

- Efficient process technologies with energy-saving designs are being adopted.
- Combined use of multiple boilers and furnaces running on natural gas will enable flexible operation with optimal energy use.

- Reduction in specific energy consumption per ton of PVC produced due to in-house VCM supply and co-located utilities.

8.2. ECONOMIC BENEFIT

The project will reduce dependency on imported feedstock by establishing in-house VCM production, conserving foreign exchange and supporting the Atmanirbhar Bharat initiative. Local and regional economies will benefit from increased demand for goods, services, and logistics support. The project will generate revenue for the government through taxes, duties, and utility charges. It will ensure consistent supply of PVC resins to downstream industries such as construction, agriculture, and packaging, supporting industrial growth. Additional capacity may open opportunities for export, enhancing India's competitiveness in the global petrochemical market.

8.3 SOCIAL BENEFIT

The project will generate 426 permanent and 1,068 contractual job opportunities, enhancing livelihoods and reducing local unemployment. The influx of skilled professionals will lead to knowledge sharing and capacity building in the region. Corporate Environmental Responsibility (CER) initiatives will focus on improving healthcare, education, sanitation, and drinking water facilities in nearby villages. Development of internal roads, utilities, and environmental infrastructure will benefit both the SIPCOT Industrial Area and surrounding communities, improving overall quality of life.

Conclusion

The proposed expansion project by CCVL is not only economically beneficial but also demonstrates a strong commitment to environmental sustainability. By integrating clean technologies, resource efficiency, and responsible waste management, the project is expected to significantly minimize its environmental impact and serve as a model for sustainable petrochemical industry expansion in India.

9. ENVIRONMENTAL COST BENEFIT ANALYSIS

9.1. INTRODUCTION

This chapter presents a qualitative and quantitative assessment of environmental costs and benefits associated with the proposed expansion of the Suspension Grade Poly Vinyl Chloride (SPVC) plant from 600 KTA to 1200 KTA, along with the establishment of a 750 KTA Vinyl Chloride Monomer (VCM) unit by M/s Chemplast Cuddalore Vinyls Limited (CCVL) at Cuddalore, Tamil Nadu.

The analysis evaluates the costs involved in environmental management measures and juxtaposes them with socio-economic and ecological benefits likely to accrue during the life cycle of the project. This forms the basis for assessing the project's overall environmental viability.

9.2. ENVIRONMENTAL COSTS

9.2.1. CAPITAL INVESTMENT ON ENVIRONMENTAL PROTECTION

The project has earmarked INR 8762.5 Lakhs as additional capital cost for environmental protection in the proposed expansion, in addition to the existing commitment of INR 3347.7 Lakhs. Key components include:

- Air Pollution Control Systems
- Wastewater Management and ZLD system
- Solid and Hazardous Waste Management
- Occupational Health & Safety Infrastructure
- Landscaping and Greenbelt Development

Total capital expenditure on environmental management (post-expansion): INR 12110.2 Lakhs

9.2.2. RECURRING COSTS

Annual recurring cost for environmental protection will be INR: 8107.5 Lakhs in the expansion phase, in addition to INR: 4922.4 Lakhs for the existing operations, covering:

- Maintenance of air and water pollution control systems
- Environmental monitoring and audit
- Greenbelt and landscape upkeep
- Hazardous waste disposal through authorized TSDF
- Safety and occupational health programs

Total annual recurring environmental cost (post-expansion): INR 13029.9 Lakhs

9.2.3. ENVIRONMENTAL FOOTPRINT

The following unavoidable impacts are acknowledged:

- Incremental emissions from boilers and EDC cracking furnaces (mitigated through natural gas use and stack height design)
- Enhanced freshwater intake from desalination (offset by water reuse and ZLD)
- Hazardous waste generation (addressed via scientific collection and disposal)

9.3 ENVIRONMENTAL COST BENEFITS

9.3.1 POLLUTION CONTROL AND RESOURCE CONSERVATION

- Zero Liquid Discharge system to ensure no untreated wastewater discharge.
- Reuse of treated effluent in cooling towers reduces freshwater demand.
- Desalination plant to avoid stress on local freshwater bodies.
- Greenbelt development over **26.0515 ha (~40.31%)** improves microclimate and acts as a pollution sink.

9.3.2. INDUSTRIAL SYMBIOSIS AND INFRASTRUCTURE AUGMENTATION

- Backward integration of feedstock (VCM) eliminates marine import dependency, reducing spill risks.
- Shared utilities like pipelines, storage, and desalination optimize resource use and minimize duplication.
- Road and utility upgrades benefit both CCVL and surrounding SIPCOT industrial units.

9.4. ECONOMIC BENEFITS

- Total investment: ₹6,000 Crores for expansion, enhancing the regional industrial economy.
- Foreign exchange savings by producing VCM domestically instead of importing.
- Improved supply security for the growing domestic PVC demand, which is expanding at 7.11% Compound Annual Growth Rate (CAGR) of the PVC market in India

Employment Generation

Table 139. Employment

Type of Employment	Existing	Proposed	Total After Expansion
Permanent	176	250	426
Temporary	568	750	1318

- Significant indirect employment for logistics, support services, and maintenance contractors.

- Skill development and local workforce engagement through training programs.

9.5 SOCIAL BENEFITS

- **Corporate Environmental Responsibility (CER)** interventions to support local health, sanitation, and education.
- Community access to improved roads and utilities developed as part of the project.
- Local CSR investment to uplift villages near Semmankuppam and Thiyagavalli.

9.6. SUMMARY OF ENVIRONMENTAL COST-BENEFIT ANALYSIS

Table 140. Cost Benefit Analysis

Category	Cost (₹ Lakhs)	Benefit
Environmental Capital Cost	12110.2	Advanced control of air, water, and solid waste
Environmental Recurring Cost	13029.9 / annum	Sustained environmental and safety performance
Socio-economic Investment (CER)	Included	Health, education, and sanitation improvement in nearby communities
Employment and Local Economy Boost	-	Over 1400 direct jobs, plus indirect economic stimulation
Infrastructure Upgrade	Included	Improved access, utility reliability, and industrial resilience
Natural Resource Use Optimization	-	Reduced freshwater draw; reuse of treated water; lower environmental risk

Conclusion

The environmental and social benefits accruing from the proposed expansion significantly outweigh the associated environmental costs. The project promotes industrial sustainability through backward integration, supports circular economy principles via ZLD and desalination, and contributes to national goals like Atmanirbhar Bharat. With robust mitigation measures and committed capital and recurring expenditure, the project is environmentally and economically viable.

10. ENVIRONMENT MANAGEMENT PLAN

10.1 INTRODUCTION

The Environmental Management Plan (EMP) is a comprehensive, site-specific framework designed to ensure that the project is executed in an environmentally responsible and sustainable manner. It serves as a practical tool for integrating environmental considerations into all phases of the project lifecycle—from planning and design through construction, operation, and eventual decommissioning.

The EMP clearly defines the roles and responsibilities of all key stakeholders, including the project proponent, contractors, subcontractors, and consultants, in identifying, mitigating, and managing potential environmental impacts associated with the proposed development. It ensures that appropriate mitigation measures are embedded in project implementation to minimize ecological degradation, uphold compliance with applicable environmental regulations and international best practices, and promote long-term sustainability.

Environmental safeguards outlined in the EMP will be actively implemented and monitored. The plan is dynamic in nature and will be periodically reviewed and updated to reflect evolving regulatory requirements, new environmental risks, technological advancements, or modifications in project design. Continuous environmental performance evaluation, through a structured post-project monitoring program, will ensure transparency, accountability, and adaptive management throughout the project's lifecycle.

10.2 PROJECT DETAILS

Table 141. Project Details

S. No.	Particulars	Unit	Project Details			
			Existing (A)	Proposed SPVC (B)	Proposed VCM (C)	Total After Expansion (D = A+B+C)
1.	Location	-	Survey Number: 70 Part, 71 Part, 72,73,74 Part,75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu			
2.	Total Area	m ²	251862	-	394436	646298
		ha	25.1862	-	39.4436	64.6298
3.	Green Area	ha	9.7976	-	16.2539	26.0515
		%				
4a.	Cost of the Project	Cr. (INR)	500		6000	6500
4b.	CER Budget	Cr. (INR)	-		20	20
5.	Plant Capacity					
5a.	EC Products					
5a.i	PVC Resin	KTA	600	600	-	1200

S. No.	Particulars	Unit	Project Details			
			Existing (A)	Proposed SPVC (B)	Proposed VCM (C)	Total After Expansion (D = A+B+C)
5a.ii	Vinyl Chloride Monomer (VCM)	KTA	-	-	750	750
5b.	By Product					
5b.i	HCl (30-35%)	TPA	-	-	200	200
6.	Manpower Details					
6a.	Construction Phase	Nos.	Permanent: 50, Contractual: 800			
6b.	Operation Phase	Nos.	568	500	250	1318
7.	Power Requirement and Source					
7a.	Source		Grid power from Tamil Nadu Electricity Board (TNEB)			
7b.	Requirement	MW	14	14	30	58
8.	Air Emission Management					
Utility Emissions						
8a.	D.G. Sets (Backup)	Capacity	kVA	2000 each	2000 each	2000 each
		No.	-	7	4	3
		Fuel	LPH	HSD-100	HSD-100	HSD-200
		APCM	-	Adequate Stack Height		
8b.	Boiler	Capacity	TPH	43, & 52.5	50	50
		No.		1 each	2	3
		Fuel type with Quantity	TPD or Nm ³ /day	Coal-330 TPD	Natural Gas-70000 Nm ³ /day each	Coal-330 TPD & Natural Gas-70000 Nm ³ /day each
		APCM	-	ESP and Adequate Stack Height		
8c.	EDC Cracking Furnace	Capacity	-	-	-	-
		No.	-	-	4	4
		Fuel type with Quantity	Nm ³ /h		Natural Gas 216000 Nm ³ /day each	Natural Gas 216000 Nm ³ /day each
8d.	Incinerator	Capacity	-	-	-	-
		No.	-	-	1	1
		Fuel type with Quantity	Nm ³ /h	-	Natural Gas 1000 Nm ³ /hr (only during start up)	Natural Gas 1000 Nm ³ /hr (only during start up)
9.	Process Emissions					
9a.	Vent Gas Absorption System for VCM Recovery	Stack	Nos.	2	2	-
		Stack Height	m	20 m each	20 m each	-
		Pollutants	-	VCM	VCM	-
		APCM	-	-	-	-
9b.	PVC Dryer Section	Stack	Nos.	4	4	-
		Stack Height	m	44 m each	44 m each	-
		Pollutants	-	VCM & PM	VCM & PM	-

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyaavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



S. No.	Particulars		Unit	Project Details			
				Existing (A)	Proposed SPVC (B)	Proposed VCM (C)	Total After Expansion (D = A+B+C)
		APCM	-	Multi-cyclone followed by wet scrubber and stack	Multi-cyclone followed by wet scrubber and stack	-	Multi-cyclone followed by wet scrubber and stack
9c.	Emergency Vent attached to VCM Storage Tank	Stack	Nos.	1	0	-	1
		Stack Height	m	60	60	-	60
		Pollutants	-	-	-	-	-
		APCM	-	-	-	-	-
9d.	Coal Heading Conveyor-Transfer Point - 1	Stack	Nos.	2	2	-	4
		Stack Height	m	15.5 m each	15.5 m each	-	15.5 m each
		Pollutants	-	PM	PM	-	PM
		APCM	-	Bag filter and stack	Bag filter and stack	-	Bag filter and stack
9e.	Coal Heading Conveyor-Transfer Point - 2	Stack	Nos.	2	2	-	4
		Stack Height	m	22.75 m each	22.75 m each	-	22.75 m each
		Pollutants	-	PM	PM	-	PM
		APCM	-	Bag filter and stack	Bag filter and stack	-	Bag filter and stack
9f.	Coal Feed Hopper	Stack	Nos.	2	2	-	4
		Stack Height	m	-	-	-	-
		Pollutants	-	PM	PM	-	PM
		APCM	-	Water sprinklers for dust suppression	Water sprinklers for dust suppression	-	Water sprinklers for dust suppression
9g.	PVC Bagging Section - Bagging machine - 3 Nos.	Stack	Nos.	6	6	-	12
		Stack Height	m	-	-	-	-
		Pollutants	-	PM	PM	-	PM
		APCM	-	Reverse jet bag filter- 3 Nos.	Reverse jet bag filter- 3 Nos.	-	Reverse jet bag filter- 3 Nos.
9h.	Product Silo - 3 Nos.	Stack	Nos.	6	6	-	12
		Stack Height	m	-	-	-	-
		Pollutants	-	PM	PM	-	PM
		APCM	-	Bin vent filter	Bin vent filter	-	Bin vent filter
9i.	Oxy scrubber vent	Stack	Nos.	-	-	-	-
		Stack Height	m	-	-	-	-
		Pollutants	-	-	-	Air, Hydrocarbons	Air, Hydrocarbons
		APCM	-	-	-	Captive Incineration	Captive Incineration

S. No.	Particulars		Unit	Project Details			
				Existing (A)	Proposed SPVC (B)	Proposed VCM (C)	Total After Expansion (D = A+B+C)
9j.	Emergency vent for ethylene storage tank	Stack	Nos.	-	-	-	-
		Stack Height	m	-	-	-	-
		Pollutants	-	-	-	Ethylene	Ethylene
		APCM	-	-	-	Adequate stack height	Adequate stack height
9k.	Emergency vent for EDC storage tank	Stack	Nos.	-	-		
		Stack Height	m	-	-		
		Pollutants	-	-	-	VCM	VCM
		APCM	-	-	-	Adequate stack height	Adequate stack height
10a.	Hazardous Waste	TPA	9551				
10b.	Solid waste	TPA	Biodegradable (Domestic Waste)- 39.74				
			Non-Biodegradable (Plastic, paper, wood, glass, etc.)-55.68				
11.	Water Requirement						
11a.	Source of Fresh water supply		Desalination Plant				
11b.	Total Requirement		KLD	9799	9799	5243	24841
11c.	Fresh Water		KLD	4102	4102	3218	11422
11d.	Total Treated Effluent for reuse		KLD	5659	5659	1997	13315
11e.	Total Treated Sewage for reuse		KLD	38	38	28	104
	Wastewater Generation & Treatment						
11e.	Total Wastewater Generation		KLD	5660	5660	2097	13417
11e - (i)	Industrial Wastewater Generation		KLD	5620	5620	2069	13309
11e -(ii)	Sewage Generation		KLD	40	40	30	110
111f	ETP		KLD	6400	6400	3000	15800
11f - (i)	STP		KLD	50	50	40	140
11f - (ii)	RO		KLD	6000	6000	3000	15000
11f - (iii)	MEE		KLD	600	600	300	1500

10.3 ORGANIZATIONAL ROLE AND RESPONSIBILITY

M/s Chemplast Cuddalore Vinyl Limited understand the responsibility to operate the industries properly with respect to the Environment and the health and safety of its employees and the other people who are associated with the project and may get affected by the activities and to conduct the operations of the industries with proper protection and safety to the environment.

Management Policy

The company has a written policy for safety, Health and Environment Management. Through this policy, the company management commits itself to the following objectives.

- Meet all the relevant laws, regulations and international agreements
- Conduct its activities safely, protecting the health of all employees and the products users
- Reduce the adverse environmental impacts to a practicable minimum at an acceptable cost to the company and society
- Encourage continuous improvement in safety, health and environment performance.

Environment Management

- Periodic review of environmental status;
- Implementation and maintenance of green buffer areas will be done;
- Review of ETP, MEE, RO, STP, Boilers, DG operations and maintenance of APCS will be done;
- Monitoring of collection and treatment of waste will be done;
- Compliance to conditions stipulated in Environmental Clearances (EC) and consents will be done;
- Implementation of EMP;
- Undertake awareness activities for industries and residential areas.
- Industry will operate the ETP properly to achieve the effluent standards as per the CPCB guidelines as mentioned in the consent.
- Biodegradable waste generated shall be converted to manure through OWC and used as manure in greenbelt development.

Social Management

- Undertake continuous engagement with local community;
- Address grievances of the complex, local community and residents.

10.3.1 ROLE OF PROJECT PROPONENT (TOP MANAGEMENT)

M/s Chemplast Cuddalore Vinyls Limited will retain overall accountability for the effective implementation of the Environmental Management Plan (EMP). This responsibility encompasses the oversight of environmental performance, ensuring contractor compliance with environmental safeguards, and the development of responsive mechanisms to address unforeseen environmental issues throughout the project lifecycle.

The project proponent will ensure that all environmental obligations are explicitly integrated into contractual agreements with contractors and subcontractors. These obligations will cover not only regulatory compliance but also adherence to good environmental practice and continuous improvement.

To support this, regular environmental audits and site inspections will be carried out by the proponent and/or designated representatives. Findings from such inspections will be systematically documented, and corrective actions will be enforced as necessary to maintain compliance with the EMP.

The organizational framework for EMP implementation, including roles, responsibilities, and reporting structures, is presented below.

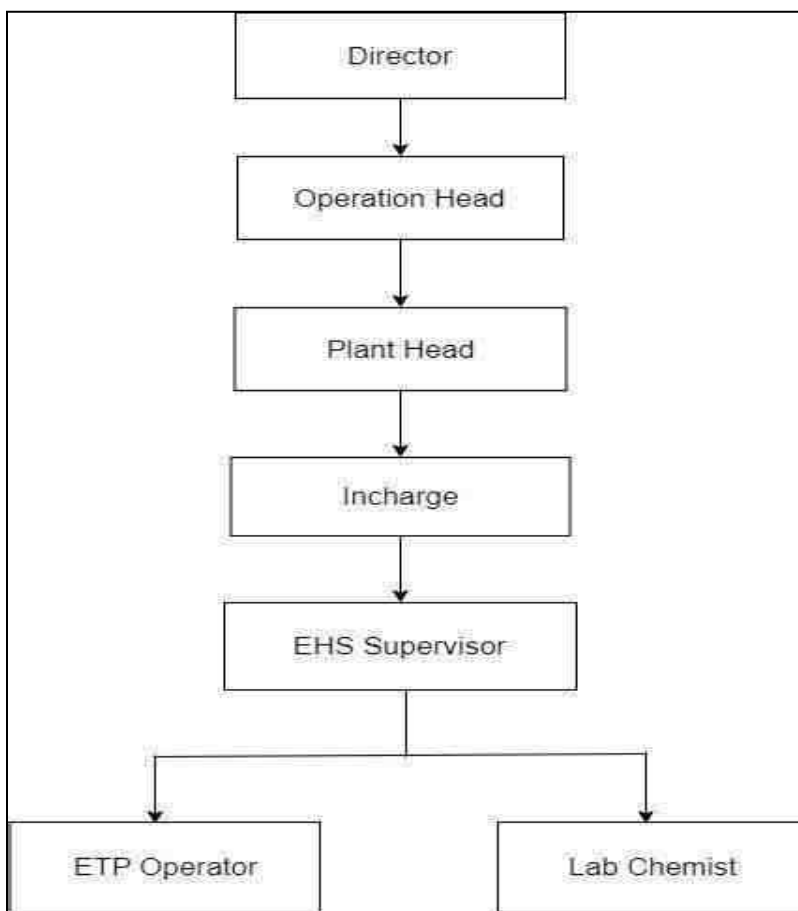


Figure 86. Environment Management Cell

10.3.2 ROLE OF CONTRACTOR

Contractors will also be expected to demonstrate commitment to the environmental monitoring programs at all levels in the contractor's management structure. It will be ensured the following:

- The Contractors involved in the project will be responsible for implementation of and adherence to, all the mitigation measures outlined in the EIA;
- Appropriate experienced and qualified personnel are employed as the Contractor's Environmental Manager

- All the environmental incidents to be reported to the M/s Chemplast Cuddalore Vinyl Limited at the earliest;
- To maintain records of all the inspections conducted;
- A program of regular self-inspection and audit will be developed and implemented and results reporting will be done to the M/s Chemplast Cuddalore Vinyl Limited. EHS team on a regular basis.

10.3.3 INSPECTION, MONITORING AND AUDIT

This will increase the effectiveness of the EMP. Through this process M/s Chemplast Cuddalore Vinyl Limited will ensure the conditions stipulated in the Environmental Clearance (EC), Consent to Establish (CTE), Consent to Operate (CTO) etc are complied with. The Audit will be conducted by the team for the implementation of the management system. The entire process of inspection and audit will be documented and findings of the above will be implemented by M/s Chemplast Cuddalore Vinyl Limited.

10.3.4 MONITORING, REPORTING AND DOCUMENTATION

- Reporting of environmental, health, safety and social performance reports or check list, incident record register etc. will be developed and implemented through a program of reporting and reviewing throughout the project.
- Reports from inspection, audits and other improvement programs will be regularly communicated;
- All complaints and enquiries will be addressed with records maintained in an assigned register by the safety officer of each contractor;
- Internal and external reporting mechanisms will be developed, internal reporting will comprise the concerned officials from the Environment management team, the representatives of the contractors and the top management of M/s Chemplast Cuddalore Vinyl Limited.
- The internal reporting will be undertaken on quarterly basis while the external reporting will be undertaken half yearly.
- Annual environmental report known as 'Environment statement' as per FORM V of the EPA Rules, 1986, six monthly compliance reports as per EC of MoEFCC, compliance reports as per CTE/CTO etc. will be submitted to the regulatory authorities.

10.4 INTERNAL MONITORING, REPORTING AND COMMUNICATION

The EHS head will be responsible for the internal monitoring. Inspection and audit findings along with the improvement program will be reported to the senior management regularly. Records should be maintained for regulatory, monitoring and operational issues.

10.4.1 DOCUMENTATION

It is the most important step in the implementation of the Environment Management plan. M/s Chemplast Cuddalore Vinyl Limited has a well established record keeping and management system as per the requirement. Responsibilities will be assigned to the relevant personnel ensuring that the EMP documentation and records are maintained. Typical record keeping requirements for the proposed project is summarized below.

- Master Environment Management System document
- Register for Statutory Compliance
- Standard Operating Procedures
- Work Instructions log book
- Incident reports
- SOP for Emergency preparedness and response procedure
- Training records
- Monitoring reports
- Audit reports
- Compliance Report
- Safety Committee meeting record.
- Complaints/Suggestions register and issue attended/closed
- Solid Waste and Hazardous waste generation, Handling and Disposal
- Quantity of wastewater and Treated water generated and its quality
- Survival rate/ratio of the Trees planted.
- Environmental Permits / Consents from MOEF
- Employee environmental, health and safety records
- Equipment inspection and calibration record where applicable
- Vehicle maintenance and inspection record

10.5 EMP REVIEW & AMENDMENTS

The Environmental Management Plan (EMP) will be subject to periodic review and revision to ensure it remains aligned with evolving organizational structures, operational processes, and applicable regulatory frameworks. This dynamic approach enables the EMP to remain relevant, effective, and responsive to change.

The Environment, Health and Safety (EHS) Head will hold the primary mandate for coordinating the implementation of all environmental mitigation and management actions. This includes monitoring progress, ensuring timely execution of control measures, and overseeing the performance of various management and action plans associated with the project's environmental responsibilities.

10.5.1 Environment Management Plan

An Environment Plan has been developed following the identification of impacts and mitigation measures. The mitigation measures suggested will be as according to the monitoring schedule.

The EMP includes the following:

- Mitigations suggested for adverse environmental and social impacts and associated risks;
- Personnel responsible for implementing the mitigation measures at various stages of the project;
- The mitigation measures suggested in Chapter 4 would be implemented. This will reduce the impact on the environment due to the proposed project. To facilitate easy implementation, the recommendations suggested are grouped in different phases.

All the above reports will be documented in the documentation system as per the requirement of MoEFCC and other relevant regulatory authorities.

10.5.2 AIR EMISSION

10.5.2.1 PROCESS GAS STACK

Table 142. Process Gas Stack Details

S. No.	Source of Emission	Number of Stacks	Stack Height (m)	Stack Height (m)	Stack Dia (m)	Pollution Control Measures	Emissions	Standard Emission Limit (mg/Nm ³)	Proposed Limits as project is in CPA(mg/Nm ³)
Existing Stacks for 600 KTA SPVC Plant									
1	Vent Gas Absorption System for VCM Recovery	2	20 m each	0.60	12	-	VCM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³
2	PVC Dryer Section	2	44 m each	1.00	14	Multi-cyclone followed by wet scrubber and stack	VCM & HCl	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³ HCl -30 mg/Nm ³	VCM- 10 mg/Nm ³ HCL -20 mg/Nm ³
3	Emergency Vent attached to VCM Storage Tank	1	60	0.35	20	-	-	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³
4	Coal Heading Conveyor- Transfer Point - 1	2	15.5 m each	0.40	14	Bag filter and stack	PM	As per G.S.R. 820(E) dated 09.11.2012 PM- 50 mg/Nm ³	PM- 50 mg/Nm ³
5	Coal Heading Conveyor- Transfer Point - 2	2	22.75 m each	0.40	14	Bag filter and stack	PM		
6	Coal Feed Hopper	2	-	0.50	14	Water sprinklers for dust suppression	PM		

S. No.	Source of Emission	Number of Stacks	Stack Height (m)	Stack Height (m)	Stack Dia (m)	Pollution Control Measures	Emissions	Standard Emission Limit (mg/Nm ³)	Proposed Limits as project is in CPA(mg/Nm ³)
7	PVC Bagging Section - Bagging machine - 3 Nos.	6	-	0.35	14	Reverse jet bag filter- 3 Nos.	PM		
8	Product Silo - 3 Nos.	6	-	0.30	14	Bin vent filter	PM		
Proposed Stacks for 600 KTA SPVC Plant									
9	Vent Gas Absorption System for VCM Recovery	2	20 m each	0.60	12	-	VCM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³
10	PVC Dryer Section	2	44 m each	1.00	14	Multi-cyclone followed by wet scrubber and stack	VCM & PM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³ HCl -30 mg/Nm ³	VCM- 10 mg/Nm ³ HCL -20 mg/Nm ³
11	Emergency Vent attached to VCM Storage Tank	0	60	0.35	20	-	-	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³
12	Coal Heading Conveyor- Transfer Point - 1	2	15.5 m each	0.40	14	Bag filter and stack	PM	As per G.S.R. 820(E) dated 09.11.2012 PM- 50 mg/Nm ³	PM- 50 mg/Nm ³
13	Coal Heading Conveyor- Transfer Point - 2	2	22.75 m each	0.40	14	Bag filter and stack	PM		
14	Coal Feed Hopper	2	-	0.50	14	Water sprinklers for dust suppression	PM		
15	PVC Bagging Section - Bagging machine - 3 Nos.	6	-	0.35	14	Reverse jet bag filter- 3 Nos.	PM		
16	Product Silo - 3 Nos.	6	-	0.30	14	Bin vent filter	PM		
Proposed Process Stacks for 750 KTA VCM Plant									
17	Oxy scrubber vent	-	-	-	-	Captive Incineration	Air, Hydrocarbons		
18	Emergency vent for ethylene storage tank	-	-	-	-	Adequate stack height	Ethylene	As per G.S.R. 820(E) dated 09.11.2012 Ethylene- 10 mg/Nm ³	Ethylene- 10 mg/Nm ³
19	Emergency vent for EDC storage tank	-	-	0.35	20	Adequate stack height	VCM	As per G.S.R. 820(E) dated 09.11.2012	VCM- 10 mg/Nm ³

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



S. No.	Source of Emission	Number of Stacks	Stack Height (m)	Stack Height (m)	Stack Dia (m)	Pollution Control Measures	Emissions	Standard Emission Limit (mg/Nm ³)	Proposed Limits as project is in CPA(mg/Nm ³)
								VCM- 10 mg/Nm ³	

10.5.2.2 FLUE GAS STACK

Table 143. Flue Gas Stack Details

S. No.	Stack attached to	Capacity	Fuel Name and its Quantity	Stack Height m	Stack Dia (m)	Stack Velocity (m/s)	APCM Detail	Emissions	Standard Limit (mg/Nm³)	Proposed Limits as project is in CPA (mg/Nm³)	
Existing Stacks for 600 KTA SPVC Plant											
1	DG Sets (7 Nos.)	2000 kVA	HSD, 100 lit/ hr. each	30	0.45	14	Adequate stack height	PM, NOx, CO	As per CPCB Emission Standard for DG: PM: 75 mg/Nm³ CO: 150 mg/Nm³ NOx: 360 ppmv	PM: 55 mg/Nm3 CO: 100 mg/Nm3 NOx: 250 ppmv	
2	Boiler-1	43 MT/hr	Coal, 220 TPD	54	1.2	18	ESP and Stack	PM, SOx, NOx, CO		As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm3 NOx: 250 mg/Nm3 PM: 50 mg/Nm3 CO: 100 mg/Nm	SO2: 30 mg/Nm³ NOx: 150 mg/Nm³ PM: 50 mg/Nm³ CO: 80 mg/Nm³
3	Boiler-2	52.5 MT/hr	Coal, 220 TPD	60	1.2	18	ESP and Stack	PM, SOx, NOx, CO			
Proposed Stacks for 600 KTA SPVC Plant											
1.	DG Sets (4 Nos.)	2000 kVA	HSD, 100 lit/ hr. each	30	0.45	14	Adequate stack height	PM, NOx, CO	As per CPCB Emission Standard for DG: PM: 75 mg/Nm³ CO: 150 mg/Nm³ NOx: 360 ppmv	PM: 55 mg/Nm3 CO: 100 mg/Nm3 NOx: 250 ppmv	
2.	Boiler-3	50 TPH	Natural gas, 70000 Nm³/day	60	1.2	18	Adequate stack height	PM, SOx, NOx, CO		As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm3 NOx: 250 mg/Nm3 PM: 50 mg/Nm3 CO: 100 mg/Nm	SO2: 30 mg/Nm³ NOx: 150 mg/Nm³ PM: 50 mg/Nm³ CO: 80 mg/Nm³
3.	Boiler-4	50 TPH	Natural gas, 70000 Nm³/day	60	1.2	18	Adequate stack height	PM, SOx, NOx, CO			
Proposed Flue Gas Stacks for 750 KTA VCM Plant											
1.	EDC Cracking Furnace-1*	-	Natural Gas 216000 Nm³/day	60	0.7	9.70	Adequate stack height	PM, SOx, NOx, CO	As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm³ NOx: 250 mg/Nm³ PM: 50 mg/Nm³ CO: 100 mg/Nm³	SO2: 30 mg/Nm³ NOx: 150 mg/Nm³ PM: 50 mg/Nm³ CO: 80 mg/Nm³	
2.	EDC Cracking Furnace-2*	-	Natural Gas 216000 Nm³/day	60	0.7	9.70	Adequate stack height	PM, SOx, NOx, CO			
3.	EDC Cracking Furnace-3*	-	Natural Gas 216000	60	0.7	9.70	Adequate stack height	PM, SOx, NOx, CO			

S. No.	Stack attached to	Capacity	Fuel Name and its Quantity	Stack Height m	Stack Dia (m)	Stack Velocity (m/s)	APCM Detail	Emissions	Standard Limit (mg/Nm ³)	Proposed Limits as project is in CPA (mg/Nm ³)
			Nm ³ /day							
4.	EDC Cracking Furnace-4*	-	Natural Gas 216000 Nm ³ /day	60	0.7	9.70	Adequate stack height	PM, SO _x , NO _x , CO		
5.	Incinerator	-	Natural Gas 1000 Nm ³ /hr (only during start up)	45	0.11	11	HCl scrubber and Adequate stack height	PM, SO _x , CO, NO _x , HCl	As per CPCB Common HW Incinerator Guidelines: PM: 50 mg/Nm ³ SO ₂ : 200 mg/Nm ³ CO: 100 mg/Nm ³ NO _x : 400 mg/Nm ³ As per G.S.R. 820(E) dated 09.11.2012 HCl: 50 mg/Nm ³ Cl ₂ : 10 mg/Nm ³	PM: 50 mg/Nm ³ SO ₂ : 100 mg/Nm ³ CO: 50 mg/Nm ³ NO _x : 200 mg/Nm ³ HCl: 30 mg/Nm ³ Cl ₂ : 5 mg/Nm ³
6.	Emergency DG Set-1	2000 kVA	HSD, 100 lit/hr	30	0.45	14	Adequate stack height	PM, NO _x , CO	As per CPCB Emission Standard for DG: PM: 75 mg/Nm ³ CO: 150 mg/Nm ³ NO _x : 360 ppmv	PM: 55 mg/Nm ³ CO: 100 mg/Nm ³ NO _x : 250 ppmv
7.	Emergency DG Set-2	2000 kVA	HSD, 100 lit/hr	30	0.45	14	Adequate stack height	PM, NO _x , CO		
8.	Emergency DG Set-3	2000 kVA	HSD, 100 lit/hr	30	0.45	14	Adequate stack height	PM, NO _x , CO		
9.	Boiler-5	50 TPH	Natural gas, 70000 Nm ³ /day	60	1.2	18	Adequate stack height	PM, SO _x , NO _x , CO	As per G.S.R. 820(E) dated 09.11.2012 SO ₂ : 50 mg/Nm ³ NO _x : 250 mg/Nm ³ PM: 50 mg/Nm ³ CO: 100 mg/Nm ³	SO ₂ : 30 mg/Nm ³ NO _x : 150 mg/Nm ³ PM: 50 mg/Nm ³ CO: 80 mg/Nm ³
10.	Boiler-6	50 TPH	Natural gas, 70000 Nm ³ /day	60	1.2	18	Adequate stack height	PM, SO _x , NO _x , CO		
11.	Boiler-7	50 TPH	Natural gas, 70000 Nm ³ /day	60	1.2	18	Adequate stack height	PM, SO _x , NO _x , CO		

***Note:** SKO and LDO will be used as backup fuels for natural gas (NG) when it is unavailable for EDC Cracking furnace

10.5.2.3 FUGITIVE EMISSION & CONTROL MEASURES

Fugitive emissions, primarily from equipment leaks and material transfers, will be minimized through a combination of design controls, operational practices, and preventive maintenance. The following measures will be adopted:

- **Pumps and Compressors:** All pumps and compressors handling volatile substances will be equipped with mechanical seals to prevent leaks during operation.
- **Process Systems:** A closed-loop process design will be employed to contain emissions at the source, particularly during reaction and transfer stages.
- **Piping Network:** Leak-proof valves, flanges, and fittings will be installed throughout the pipeline network. A preventive maintenance program will be instituted to inspect and replace worn components proactively. Routine Leak Detection and Repair (LDAR) activities will be conducted using appropriate instrumentation.
- **Transfer Systems:** For handling Vinyl Chloride Monomer (VCM), a double-pipe system with nitrogen purging will be used to ensure inertization and containment, effectively eliminating atmospheric releases during transfer operations.

These measures will collectively ensure compliance with best available techniques (BAT) for fugitive emission control and align with international environmental performance standards.

10.5.3 WATER CONSUMPTION, WASTEWATER GENERATION & DISPOSAL DETAILS

Source of Water - Desalination plant.

Existing Water Requirement: Total Fresh Water Requirement of the industry is 4102 KLD, which is being met through Desalination Plant. Out of total fresh water, 40 KLD is used for domestic purposes, 1986 KLD is used in DM Plant (5285 KLD for Process and 775 KLD for Boiler), 100 KLD is used in Plant Wash, 1560 KLD will be used in Cooling tower and the balance 416 KLD will be used in Greenbelt. 38 KLD of treated sewage is reused in Greenbelt development and 2000 KLD of treated effluent is used in Cooling Tower.

After Expansion Water Requirement:

(b) **Non-Monsoon Water Requirement:**

Total Fresh Water Requirement for the proposed expansion is 11422 KLD, which is being met through the Desalination Plant. Out of total water requirement of 24841, 110 KLD will be used for domestic purposes, 12430 KLD will be used in DM Plant, 300 KLD is used in Plant Wash, 11070 KLD will be used in Cooling tower and the balance 958 KLD will be used in Greenbelt. Details of water consumption and wastewater generation are provided in Table 29.

Table 144a. Non-Monsoon Water Requirement

S. No.	Water Consumption Pattern	Water Consumption in KLD			
		Existing PVC (600 KTA)	Proposed PVC (600 KTA)	Proposed VCM (750 KTA)	Total
1	From sea to Desalination plant	12184	12184	-	24368

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



S. No.	Water Consumption From Desalination Plant	Water Consumption in KLD			
		4102	4102	3218	11422
A	Cooling Tower Makeup	1560(F)+ 2000(R)=3560	1560(F)+ 2000(R)=3560	1953(F)+ 1997(R)=3950	11070
B	DM water	1986(F)+ 3659(R)=5645	1986(F)+ 3659(R)=5645	1113	12431
a	Process	4510	4510	0	9020
b	Boiler feed	775	775	1013	2563
C	Plant washing	100	100	100	300
D	Greenbelt	416(F)+38(R)=454	416(F)+38(R)=454	22(F)+28(TS)=50	958
E	Domestic	40	40	30	110
	Total (A to E)	9799	9799	5243	24841

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



Existing Water balance (600 KTA SPVC)

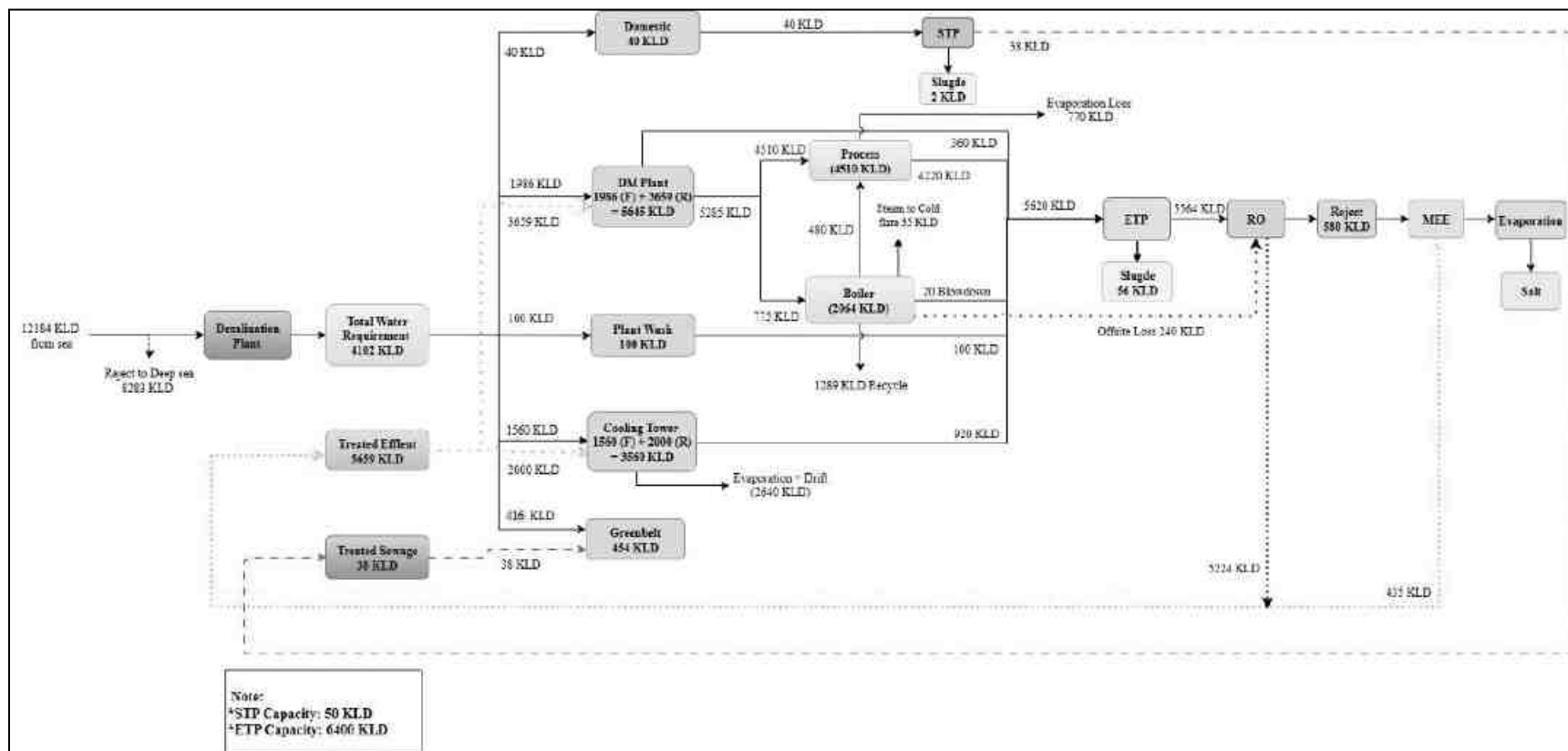


Figure 77. Existing Water Balance Diagram (600 KTA)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Survey Numbers, Village Semmankuppam & Thiyyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

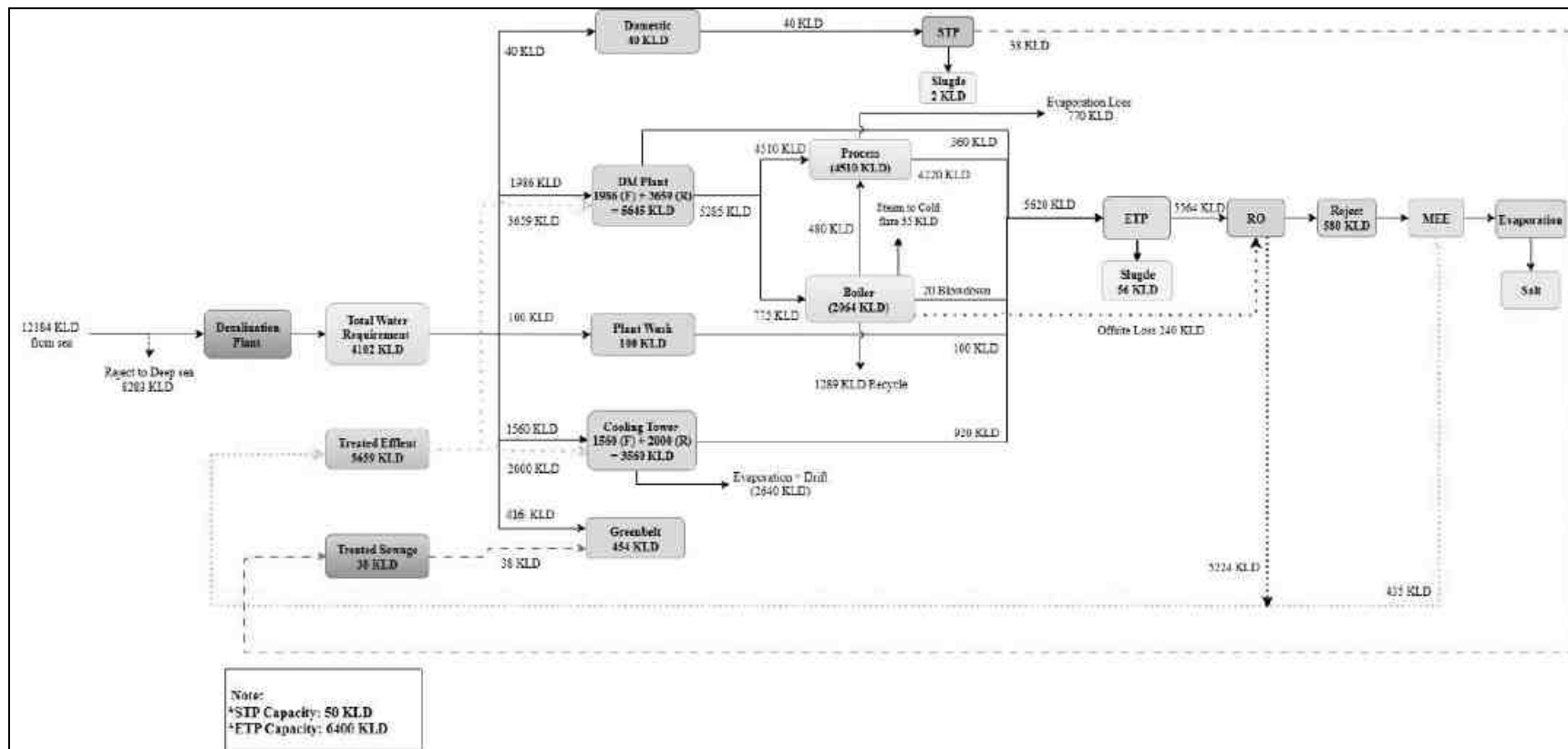


Figure 87. Water Balance Diagram of Proposed (600 KTA) SPVC Plant (Non-monsoon)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and / Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

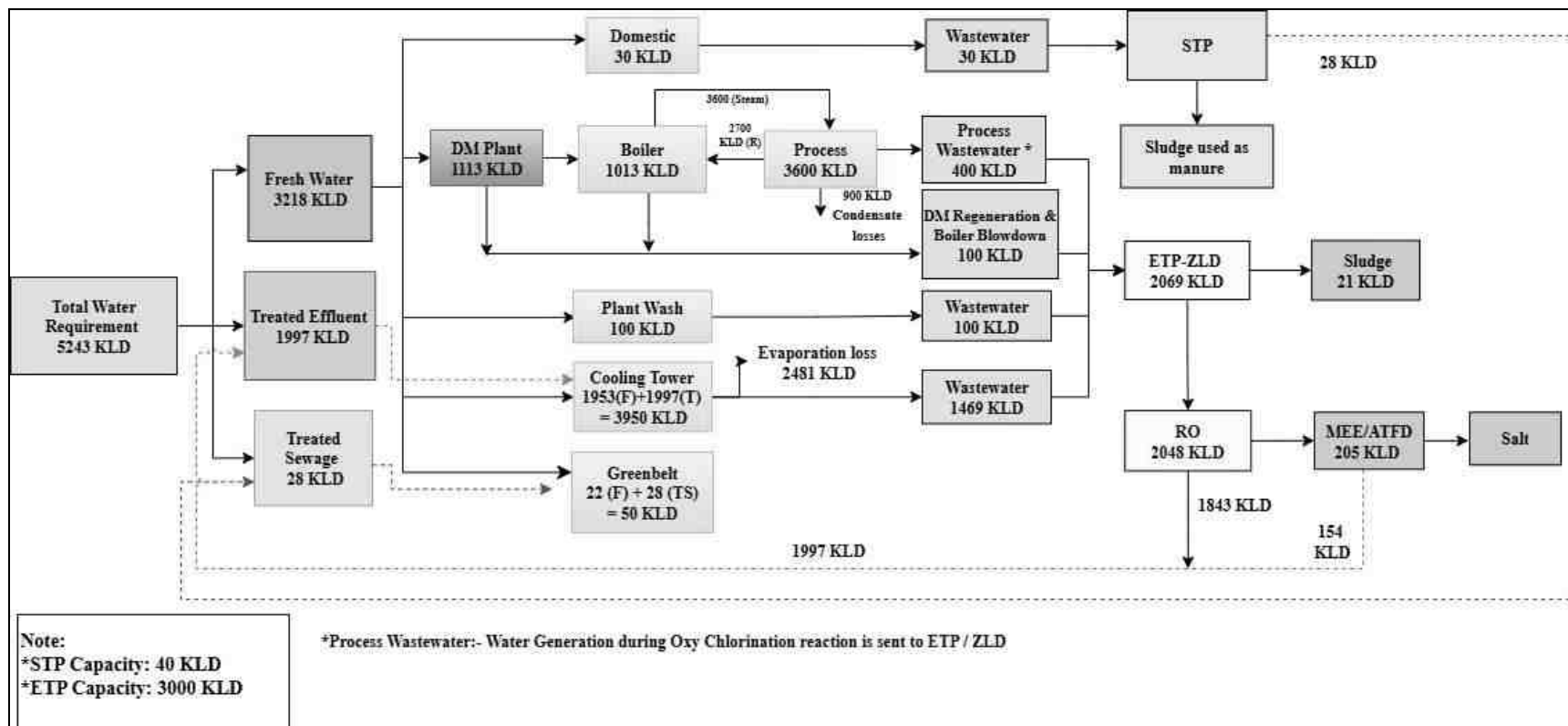


Figure 88. Water Balance Diagram of Proposed (750 KTA) VCM Plant (Non-monsoon)

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and / Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

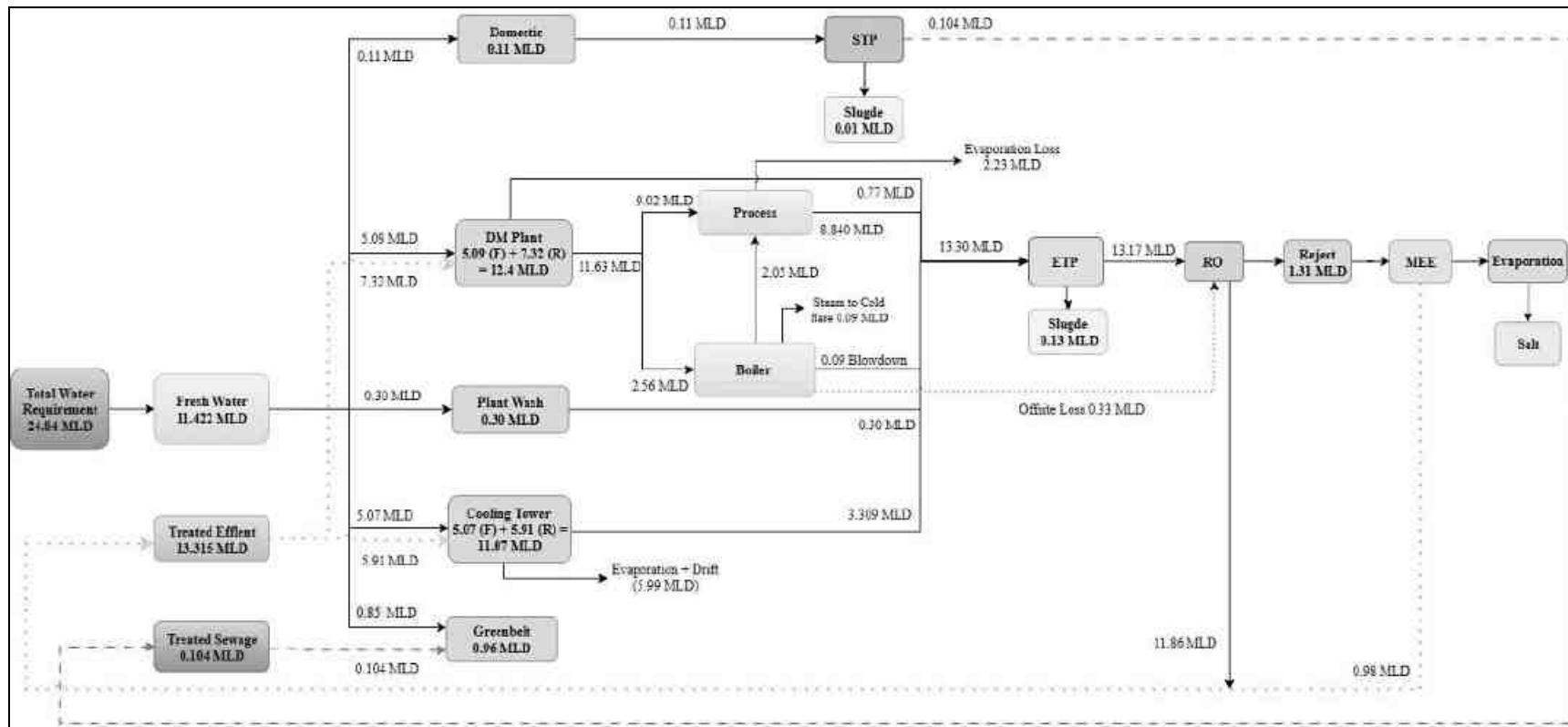


Figure 89. Combined Water Balance Diagram (Non-monsoon)

10.5.4 WASTEWATER AND WASTEWATER GENERATION:

Wastewater Generation: Total waste water generation after expansion will be 13419 KLD. Total 110 KLD of sewage will be generated from Domestic which will be treated in STP of capacity 140 KLD. Remaining 13310 KLD of effluent (8840 KLD from process, 300 KLD from Plant Wash, 3309 KLD from Cooling Tower, 770 KLD from DM Regeneration & 90 KLD from Boiler Blowdown) will be treated in ETP of capacity 15800 KLD.

Table 144b. Wastewater Generation Details

S. No.	Wastewater Generation Pattern	Wastewater Generation in KLD				Disposal mode
		Existing PVC (600 KTA)	Proposed PVC (600 KTA)	Proposed VCM (750 KTA)	Total	
1	Cooling Tower	920	920	1469	3309	Treated in Effluent Treatment (ZLD) and treated effluent will be recycled back in process.
2	DM water	360	360	50	770	
3	Process	4220	4220	400	8840	
4	Boiler	20	20	50	90	
5	Plant Washing	100	100	100	300	
6	Greenbelt	-	-	-	-	
7	Domestic	40	40	30	110	Treated in STP and used in gardening
	Total	5660	5660	2099	13419	-

Wastewater Generation and its Management

Table 145. Wastewater treatment units

Particulars	Existing	Proposed	Total After Expansion
	Capacity (KLD)		
STP	50	90	140
ETP	6400	9400	15800

10.5.4.1 DETAILS OF PROPOSED TRADE EFFLUENT TREATMENT PLANT

Settling Pond

Effluent from the wastewater stripper, centrifuge, and stripping column, effluent from FBD & effluent from PVC sludge dewatering system is collected in the settling pond (two compartments), from the settling tank mixed effluent is routed under gravity to the equalization tank. Settled PVC shall be disposed off at TSDF.

Equalization Tank

Overflow from the settling pond, blow down streams from cooling tower & boiler, surface drainage, seal flush, side stream filter, regeneration from MB, backwash of PSF & UF and filtrate from the centrifuge is collected in the equalization tank. HDPE air grid provides air supply through the blower for complete mixing & avoiding settling of solids in the tank. The tanks are connected to two pumps by a three-way valve.

Flash Mixer

The effluent from the equalization tank is pumped to a flash mixer where effluent water containing turbid and suspended particles can be coagulated by dosing Ferric chloride. Dosage rate of ferric chloride varies depending upon inlet turbidity & total suspended solids in feed water. Each tank is designed to hold solutions required for 24 hours of operation. While one tank is in operation, another tank is used to prepare a solution. Both tanks are connected to the pumps (1W + 1S), positive displacement type diaphragm pumps in PP construction. To disperse ferric chloride and to prepare a homogenous solution, each tank has a motorized agitator of stainless steel 316. After coagulant dosing; pH of feed water may reduce. For effective coagulation; pH of water is required to be raised, for which lime dosing system is provided. Dosage rate of lime varies depending upon feed water pH. For this purpose two Lime dosing tanks of mild steel (rubber lined) construction are provided, one working and one standby. Each tank is designed to hold the solution required for 24 hours of operation. While one tank is in operation, another tank will be used to prepare a solution.

Both tanks are connected to pumps (1W + 1S), positive displacement type diaphragm pumps in PP construction. To dissolve the solid lime and to prepare a homogenous solution, each tank has a motorized agitator of stainless steel 316L.

High Rate Solid Contact Clarifier

For removal of very fine colloidal particles (for flocculation purpose) a suitable grade of Poly electrolyte is dosed before water enters the flocculating zone. Effluent enters the slow mixing zone where Polyelectrolyte is dosed to the effluent to bring flocks into intimate contact with suspended solids to make a solid layer. The incoming solids are brought in contact with a solid layer near the bottom. The incoming solids rise and come in contact with solids in the sludge layer. This layer acts as a blanket and the incoming solids agglomerate and remain enmeshed within this blanket. The clarified water rises upward while a distinct interface retains the solids below. The Solid Contact clarifier has better hydraulic performance and has minimum retention time for effective solids removal. Clarifier mechanism is provided for continuous mechanical removal of settleable solids. The sludge removal mechanism revolves slowly and scrapes settled solids at the bottom and clear effluent overflows into the peripheral launder.

The sludge generated from HRSCC is routed under gravity to sludge sump. Overflow from the clarifier is collected into the filter feed cum chlorination sump.

Mechanical Dewatering System (Centrifuge)

The sludge generated from Solid contact Clarifier is drained into the Sludge sump.

The collected sludge is pumped to the centrifuge system for dewatering from the sludge. The polyelectrolyte is added to the centrifuge system. Dewatering is a physical (mechanical) unit operation used to reduce the moisture content of sludge. The filtrate from Centrifuge is taken back to the equalization tank under gravity.

Pressure Sand Filter

Effluent from Filter feed cum Chlorination sump is pumped to PSF through basket strainer for removing suspended solids, turbidity etc. The arrested solids/turbidity in the filter is removed by back washing. Solids are entrapped when raw water is passed in downward direction through the sand bed. This unit is charged with a uniform grade of filtering sand, which is supported on different grades of under-bed materials. The Pressure Sand Filter is made of MSRL vertical vessels. It is fitted with a top inlet distributor and header - lateral type of bottom collecting system. Externally this unit is fitted with frontal pipe work and control valves. The unit is isolated for backwash, when the pressure drop across the bed exceeds the specified limit (0.8 Kg/cm²) or quality of filtered water deteriorates, whichever is earlier. PSF backwash is done by using PSF filtrate collected into the filter back wash sump. Backwash generated from PSF is routed to the equalization tank.

Advanced Membrane Technology (Ultra Filtration)

Ultra Filtration is a dead end filtration, low pressure hollow fiber membrane process in which particulate colloidal and high molecular weight material is filtered from water. The UF module consists of UF membranes. The pore size of the membrane is such that it allows clear water free from suspended impurities to flow through but retain any colloidal particles and macromolecules.

The contaminated water from back wash is recycled to HRSCC. UF permeate having SDI<3 and turbidity of <1 NTU is collected in UF permeate storage tank.

Chemical enhanced backwashing of UF membrane is carried out intermittently, using UF backwash pumps. The UF backwash pumps take feed from UF permeate storage tanks and chemicals are dosed online. The operation of a complete UF system, including backwashing PLC control. Adequate instrumentation is provided for safety measures.

Reverse Osmosis

Reverse Osmosis is the third & final stage of treatment for removal of dissolved salts; two pass Reverse Osmosis system is provided. UF permeate is pumped by the cartridge filter feed pumps, to the cartridge filters. The capacity of the pump is such that they will pump the required quantity of UF permeates to RO skid. The system consists of the following equipment in series.

Sodium Meta Bi-sulphite Dosing System

A Sodium Meta-Bi-Sulphite (SMBS) Dosing System is provided for Dechlorination. Filtered water may contain free chlorine depending upon actual utilization of chlorine dosed. This free chlorine is injurious to RO Membranes and hence need to be removed prior to feeding the RO System. Sodium Sulphate reacts with residual chlorine to form Sulphate, thus water is dechlorinated.

For this purpose two SMBS dosing tanks, one working and one standby in Mild steel (rubber lined) construction is provided. Each tank is designed to hold the solution required for 24 hours of

operation.

While one tank is in operation, another tank will be used to prepare a solution. Both tanks are connected to pumps (1W+1S), Positive displacement type, and Diaphragm pumps in PP construction. To dissolve SMBS in water, each tank will have a motorized agitator of stainless steel 316.

Anti Scalant Dosing System

During the Reverse Osmosis process, dissolved salts are concentrated on the reject side as permeate water is being drawn at specific recovery. As a result of this, dissolved salts concentration increases on the reject end and may precipitate if saturation limit exceeds. As a resultant effect of salt concentration, scaling (deposition) occurs on the membrane surface, which results in inferior performance of the RO system. For this purpose two Anti scalant dosing tanks, one working and one standby in Mild steel (rubber lined) construction is provided.

Each tank is designed to hold the solution required for 24 hours of operation. While one tank is in operation, another tank will be used to prepare a solution. Both tanks are connected to both pumps (1W + 1S), positive displacement type diaphragm pumps in PP construction. To form a homogeneous solution, each tank has a motorized agitator of stainless steel 316.

Micron Cartridge System

After chemical dosing, RO feed water may get contaminated with very fine suspended matters. To supply highly filtered water to RO, micron cartridge filter units are used. MCF unit is a vertical pressure vessel built of SS 316 material. Internally it is fitted with PP wound depth type micron cartridge filter element. Filtered water from DMF passes through this cartridge element to produce highly filtered RO feed water.

Chemical Cleaning System

A common Chemical Cleaning System for all RO skids is provided. This system comprises two Chemical solution preparation tanks, two micron cartridge filter units and chemical cleaning pumps. Cleaning of membrane is carried out at a regular duration for removal of any deposition of organic salts, suspended matters, microbiological impurities on membrane surface over a continuous period of usage.

The Cleaning chemical is passed in the same direction as that of feed water flow in order to remove the deposition from membranes. Prescribed chemical solution of required concentration is prepared in the tank. It is re-circulated with the help of a chemical cleaning pump and micron cartridge filter through the RO system at specified flow rate and pressure for about 60 minutes after primary flushing with permeate water.

After cleaning again permeates, water is used for RO system flushing and final cleaning. The RO-I (A) & (B) system comprises R.O. membranes housed in FRP Pressure tubes. Necessary

instrumentation is provided for monitoring and safe operation of the system. Permeates generated from RO-I (A) & (B) systems are directly fed through degasser tanks & then collected in Permeate Collection tank-I. Reject generated from RO-I (A) & (B) shall be routed to RO –I reject tank.

Reject collected from RO – I reject tank is pumped to RO-II (A) & (B) system for further TDS reduction. Permeates generated from the RO-II (A) & (B) system are directly collected in Collection tank-II. Reject generated from RO-II (A) & (B) is routed to the Final RO reject tank. Then it is treated through the Thermal Evaporator system.

Thermal Evaporation

A Multiple Effect forced circulation evaporation plant to attain zero discharge and recover water for recycling back to the plant is installed. Forced circulation evaporation route has been selected since the RO reject contains considerable amounts of silica, CaSO_4 , MgSO_4 , and other hardness, which are very detrimental to the evaporator heating surface. In the forced circulation evaporator tubes are always flooded with high velocity liquid, which suppresses evaporation. All precipitated scales along with the salt remain in suspension, which gets discharged along with mixed salt. The mixed stream containing High TDS shall be concentrated in the final effect (forced circulation) of the evaporation plant to increase concentration above saturation level to precipitate the salt from the feed liquor.

Table 146. Characteristics of process wastewater stream

Parameters	Units	ETP Inlet	ETP Outlet/ RO Inlet	RO Permeate	RO Reject/ MEE Inlet	MEE Outlet
PH	-	6-9	6.5-8.5	6-8	7-9	7-9
COD	mg/l	1000-5000	250-1000	<50	250-500	<50
BOD	mg/l	300-1500	50-500	<10	50-250	<10
TDS	mg/l	2000-10000	1000-5000	<100	1000-2500	<100
TSS	mg/l	100-500	50-200	<10	50-100	<10
Oil & Grease	mg/l	10-50	<10	<1	10-30	<1

Flow Chart for ETP

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiayagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

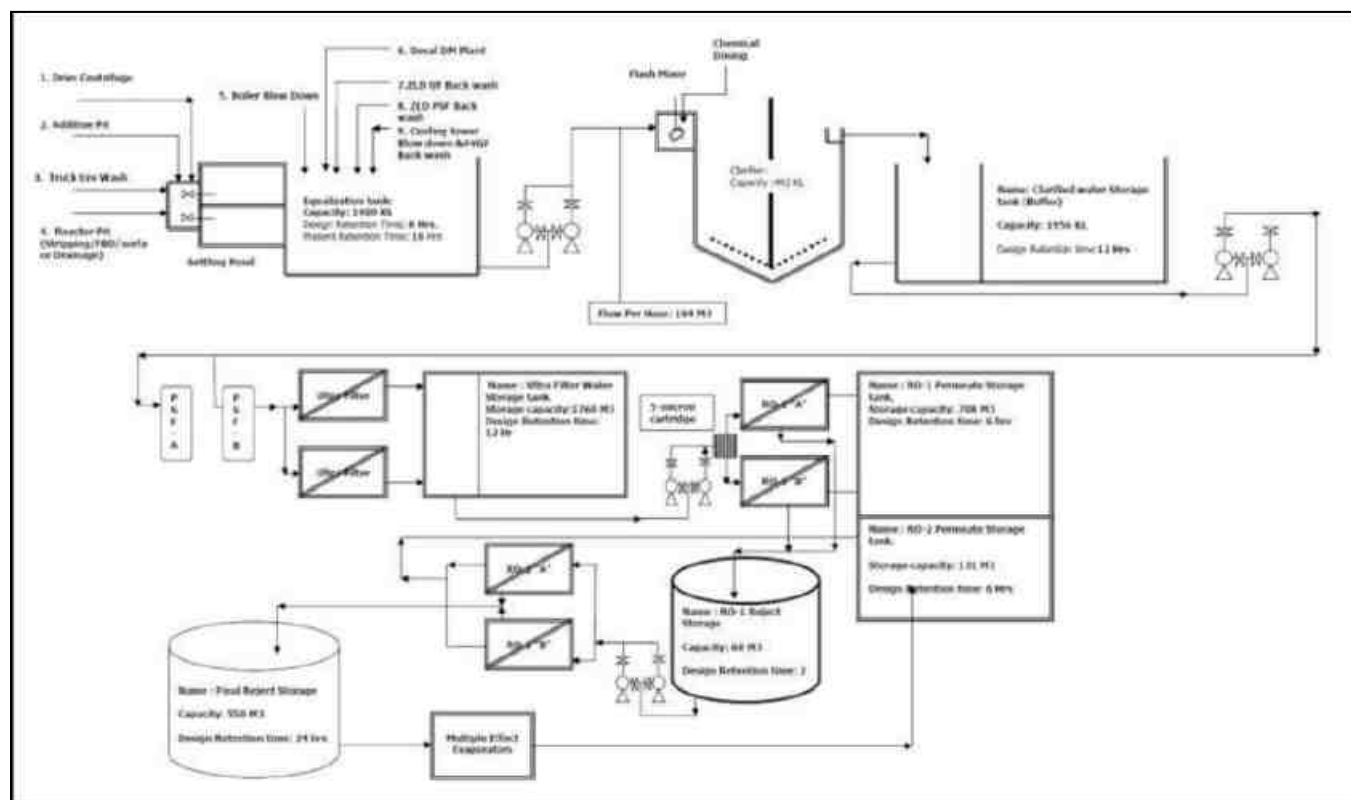


Figure 90. ETP Flow Chart

Wastewater treatment facilities for STP -

Incoming Sewage is first sent to a screen for screening and then transferred to sewage collection to still the turbulence in sewage. A RCC tank 8.0 m³ capacity is provided for this purpose. Upstream of the settling chamber has a low-level indicator for monitoring further systems.

Aeration Tank

Sewage from the collection sump is directly pumped to the inlet of the aeration tank. In aeration system, organic content in wastewater degrades in aerobic condition and organic matter is converted into CO₂ and H₂O.

Aerobic condition in the aeration system is achieved by means of the floating aerator. An oxy-radiation potential switch is provided at the upstream of the aeration tank.

Secondary Clarifier

The sewage from the aeration tank is routed under gravity to the secondary clarifier. Clarifiers are widely used for continuous mechanical removal of settleable solids from wastes.

The wastewater is carried to the centre of the tank, the wastewater enters into a circular well, designed to distribute the flow equally in all directions.

Sludge Handling System

The sludge removal mechanism revolves slowly and scrapes bio-solids settled at the bottom. The settled sludge is partly recycled into aeration to maintain TSS concentration. Excess biological sludge is routed to sludge sump. Overflow from the clarifier is routed under gravity to the treated sewage collection tank. Treated sewage water is pumped to the Cascade aerator & collected back into the treated sewage collection tank. Disinfection of the sludge is done by dosing Sodium Hypochlorite Solution. For this purpose a Sodium hypo-chlorite dosing HPPE tank has been provided.

Flow Chart for STP

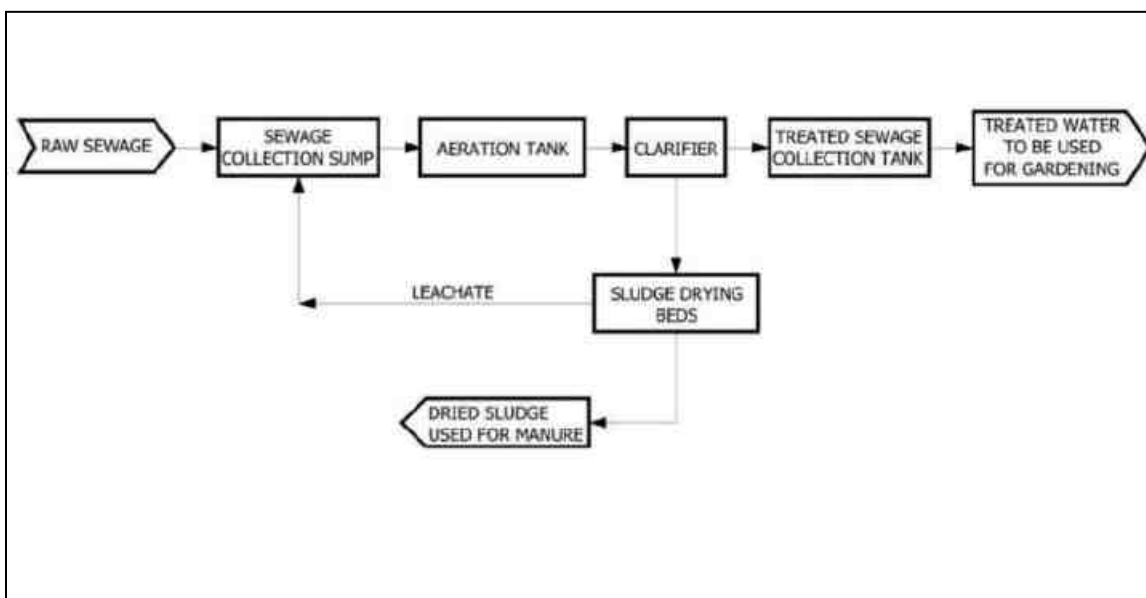


Figure 91. STP Flow Chart

Table 147. Inlet and Outlet Characteristics of Sewage Treatment Plant

S. No.	Parameters	Units	Raw Sewage	Treated Water	CPCB Standards
1	pH	-	8.5	6.5 - 8.0	5.5-9.0
2	Total Suspended Solids	mg/l	200 - 300	<10	<20
3	COD	mg/l	100 - 250	<50	<50
4	BOD	mg/l	260 - 360	<10	<10
5	Oil & Grease	mg/l	<60	BDL	<10
6	Faecal Coliform	mg/l	100	<50	<100

10.6 RAINWATER HARVESTING

Objectives:

- To maximize the roof water collection into large sumps and to reuse within the facility to the maximum extent, thereby reducing the freshwater withdrawal from underground sources.
- To channelize excess rooftop water, rainwater falling over paved & road areas through a garland network to maximize recharging the under-groundwater aquifer.
- To ensure maximum percolation in the undeveloped areas and excess if any, to be collected and disposed/percolated as much as possible.
- In the event of high intensity rainfall, to have a designed storm water collection and disposal mechanism to prevent water logging within the plant area.

Parameters of Rainwater Harvesting Potential-

6. Average annual rainfall: 1014.05 mm
7. Peak intensity: 30 to 50 mm/day
8. Average no. of rainy days: 200 - 210 days
9. Soil type: Red Soil, Black Soil, Lateritic Soil
10. Soil infiltration rate: Red soil - 0.5 - 2.5 inches per hour, Black soil - 0.2 - 0.8 inches per hour, Lateritic Soil - 0.05 - 0.5 inches per hour.

Scheme for Ground Water Recharging

A rainwater harvesting system comprises components of various stages - transporting rainwater through pipes or drains, filtration, and tanks for ground water recharge. As the proposed facility will comprise only the roof top rain water for ground water recharge. The runoff from the first spell of rain carries a relatively larger amount of pollutants from the air and catchments surface so the system will be provided with a filtration pit consists of the layers of sand, gravel and pebbles of relevant sizes to remove the removable impurities from the runoff water from the rooftop.

Benefits of Rainwater Harvesting

- Rainwater harvesting from the roof -top provides an avenue for collection & reuse with lighter filtration which in turn will reduce the consumption of fresh water
- Rainwater on the paved areas and other developed areas can be channelised.
- Structured garland Storm water drain will be avoiding the flooding of low-lying areas in the factory premises,

The Mettur Dam is located nearby. Recharging of rain water is not required.

- **Meteorological Data-** Rainfall Statistics indicate that the district receives rainfall under the influence of the South-west monsoon period extending from June to September and North-East monsoon period monsoon extending from October to December. The Southwest Monsoon rainfall is relatively moderate but the North-east monsoon provides a significant quantity of rain. On average, the normal rainfall for the district is 900 mm/annum. For most of the years the rainfall is in the range of 90-95% of the normal annual rainfall.

Estimation of Rainwater Harvested

Estimation of harvestable rainwater can be done in many methods. Use of run-off coefficient is one of the simplest methods to assess the quantity of rain water harvested within the area. The effective rainfall is such that the amount of rainfall which can build up surface runoff after satisfying the soil moisture requirement and evaporation loss. It is assumed that about 85% total rainfall is considered to be the effective rainfall.

The details of the incremental run offs on account of the proposed development and the rain water harvesting measures are detailed in the subsequent pages.

Rational formula for calculating runoff, $Q = C I A$

Q	=	Runoff in m ³ /sec
I	=	Intensity of rainfall in mm/ hr.
A	=	Drainage area in hectares.
C	=	Coefficient of runoff as below

Run-off coefficient for various types of surfaces

Rooftop	0.85
Open grounds, unpaved street	0.30
Parks, lawns, gardens	0.15
Macadam roads, pavements	0.65

Design of Rainwater Harvesting:

(b) Annual Rooftop RWH

Table 148. Annual Rooftop Rainwater Harvesting

Particular	Area	Harvesting Factor	Intensity of Annual Rainfall in mm	Annual Potential of RWH in cub. m	No. of rainy days	Max. volume of water available for harvesting in cub. m during rainy day
Roof top	137,750.90	0.85	1290	151043.86	63	2397.52

(b) Peak Rainfall RWH

Table 149. Peak Rooftop Rainwater Harvesting

Particular	Area	Harvesting Factor	Intensity of peak rainfall in mm/day	Daily Potential of RWH in cub. m/day
Roof top	80,960	0.85	30	3513

- Two Nos. of rainwater collection tanks with dimensions 12m x 12m x 7.3m each, having a total capacity of about 4200 cum are proposed for collection of rooftop rainwater and storage of 2 days.
- First and second rain from rooftops of admin, engineering, and stores buildings will be collected in a proposed collection tank and sent to ETP for treatment. After the second rainfall, runoff from these areas will be collected in the same collection tank and will be reused.

Storm Water Management:

Table 150. Stormwater Harvesting

Particular	Area	Harvesting Factor	Intensity of peak rainfall in mm/day	Daily Potential of RWH in cub. m/day
Road and other Open Area	137750.90	0.65	30	2686.14

Green Belt Area	260515.00	0.3	30	2344.64
Total	99,300	-	-	5030.78

- Stormwater will be collected in a proposed rainwater collection pond with a total capacity of about 10060 cum and storage of 2 days of stormwater.

Rainfall runoff from other rooftops and surface runoff will be channelised to the proposed collection pond. 1st and 2nd rainfall will be sent to ETP. Afterward 2nd rainfall excess runoff will be channelised to the storm water drainage of the area.

10.6.1 HAZARDOUS, NON- HAZARDOUS, SOLID WASTE & OTHER WASTES IDENTIFICATION, QUANTIFICATION, STORAGE, AND DISPOSAL

i) Hazardous Wastes

Hazardous wastes will be managed as per **Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016**. The agreement was made with Re Sustainability IWM Solutions Limited on 05.09.2022 and Atlas Corporation on 17.03.2023. The agreement for the same is attached as **Annexure 3**.

Table 151. Details of Hazardous Waste and its Management

S. No.	Type of Waste	HW Category*	Quantity per Year (MT)				Source	Treatment / Disposal
			Existing PVC (600 KTA)	Proposed PVC (600 KTA)	Proposed VCM (750 KTA)	Total		
1	Used / spent Oil	5.1	16.2	16.2	20	52.4	Plant equipments	Sent to authorized recyclers
2	Wastes or residues containing oil	5.2	-	-	5	5	Plant equipments	Sent to authorized recyclers (co-processing)
3	Distillation residue	20.3	-	-	22500	22500	Manufacturing process	Captive incineration
4	Furnace residue	1.1	-	-	50	50	Manufacturing process	To TSDF
5	Desal sludge	35.3	1250	1250	2500	5000	Desalination plant	To TSDF
6	ETP sludge	35.3	160	160	1500	1820	ETP	To TSDF
7	Chemical sludge (salt)	35.3	1656	1656	1000	4312	Multiple Effect Evaporator	To TSDF

S. No.	Type of Waste	HW Category*	Quantity per Year (MT)				Source	Treatment / Disposal
			Existing PVC (600 KTA)	Proposed PVC (600 KTA)	Proposed VCM (750 KTA)	Total		
8	PVC lumps	22.2	10.8	10.8	-	21.6	Manufacturing process	Disposed off at TNWML (Tamil Nadu Waste Management Limited) common disposal facility at Gummudipondi, an authorized agency
9	Spent Catalyst	1.7	-	-	40	40	Manufacturing process	Sell to Authorised recycler

*Note: (as per HWM Rules, 2016)

ii) Municipal Solid Waste:-

Solid Waste: Non-Biodegradable wastes like plastic, paper and glass will be sold to authorized recyclers. Biodegradable wastes will be disposed of by inhouse OWC and will be used as manure for greenbelt development.

Table 152. Detail of Solid Waste Management

Category	Type of Waste	Existing (A)	Proposed SPVC (B)	Proposed VCM (C)	Total After Expansion (D = A+B+C)	Treatment Method
		Quantity (TPA)				
Biodegradable	Organic Waste	14.78	14.78	10.18	39.74	Treatment in inhouse organic waste convertor (OWC) and use manure for horticulture development purposes in the premises
Non-Biodegradable	Recyclable Waste (Plastic, paper, wood, glass, etc)	22.18	22.18	11.32	55.68	Given to authorized recycler
Total		36.96	36.96	21.50	95.42	-

iii) Non Hazardous Waste

Table 153. Non Hazardous Waste

Name of the Waste	Existing	Proposed	Total After Expansion	Mode of Disposal	Mode of transport
	Quantity (TPA)				
Fly ash	3360	3360	6720	Will be sold to authorized recycler	By Road

iv) E-Waste Details

Table 154. E-Waste Details

Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport
		Quantity (TPA)				
E-Waste	Office electronic equipments	0.5	0.5	1.0	Sent to Authorized recyclers	By Road

v) Battery Waste

Table 155. Battery Waste Details

Table 155: Battery Waste Details						
Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport
		Quantity (TPA)				
Battery Waste	Used battery	1.5	1.5	3.0	Sell/dispose to Authorized recyclrs	By Road

vi) Bio Medical Waste

Table 144. Biomedical Waste Details

Table 17.1: Biomedical Waste Details						
Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport
		Quantity (TPA)				
Soiled Waste	Occupational Health Center	0.16	0.16	0.21	Dispose of a Biomedical waste site.	By Road
Expired or discarded medicine	Occupational Health Center	0.16	0.16	0.21		By Road
Microbiology & Biotechnology & other clinical waste	From Microbiology Lab	0.16	0.16	0.21		By Road
Waste Sharps	From Microbiology Lab	0.16	0.16	0.21		By Road
Contaminated Waste (Recyclable)	OHC Medical Check up	0.16	0.16	0.21		By Road
Glassware	OHC Medical Check up	0.16	0.16	0.21		By Road
Total		1.0	1.0	1.26		

10.6.2 NOISE POLLUTION

- There is noise generation due to the movement of vehicles carrying products and as this is only a temporary phenomenon, it will be managed by properly regulating the movement of vehicular traffic so that the ambient noise quality is not adversely affected.
- All the machinery and equipment will be regularly maintained to reduce the noise level.
- DG sets of capacity 14 Nos. x 2000 kVA (7 Nos. x 2000 kVA existing and 7 Nos. x 2000 kVA proposed) will be installed acoustically enclosed.

10.7 EMP IMPLEMENTATION BUDGET

During Operation Phase:

i) Capital Cost

Table 156. Capital Cost

S. No.	Particulars	Existing (INR Lakhs)	Proposed Cost (INR Lakhs)	After Expansion (INR Lakhs)
1	Air Management	1250.0	4400.0	5650.0
2	Solid / Hazardous Waste Management	50.0	150.0	200.0
3	Wastewater Management	2000.0	4000.0	6000.0
4	Green Belt	32.7	162.5	195.2
5	Occupational Health & Safety	15.0	50.0	65.0
Total		3347.7	8762.5	12110.2

ii) Recurring Cost

Table 157. Recurring Cost

S. No.	Particulars	Existing	Proposed Cost	After Expansion
		(INR Lakhs/Annum)		
1	Air Management	100.0	15.0	115.0
2	Solid / Hazardous Waste Management	154.0	921.3	1075.3
3	Wastewater Management	4639.1	7083.1	11722.3
4	Green Belt	1.2	8.1	9.4
5	Environment Monitoring & Management	25.0	50.0	75.0
6	Occupational Health & Safety	3.0	30.0	33.0
Total		4922.4	8107.5	13029.9

10.9 SOCIAL WELFARE RESPONSIBILITY

As per office memorandum dated 30.09.2020, it is no longer mandatory to prescribe a fixed amount of funds for Social Welfare. However, CCVL will make efforts to carry out social & environmental development work around the site as given below.

CCVL's PRO team has been carrying out several interactions & consultation with the local community around their location over the last many years and assessed their needs. Based on their consultations & assessment of the needs, they have carried out several social welfare programs over the years.

10.11. ENVIRONMENTAL COST SUMMARY

Table 158. Cost Summary

S. No.	Cost Summary	Cost (in Lakhs)	% of the project Cost
1	Project Cost	650000	100
2	Capital cost for Environment Management Plan	12110.2	1.86
3	Recurring cost for Environment Management Plan	13029.9	2.005

10.5 CARBON FOOTPRINT

10.5.1 Life Cycle Analysis

Table 159. Cumulative emission load- Air

Emission Load Cumulative			
Source	PM (kg/year)	SO ₂ (kg/year)	NO ₂ (kg/year)
Utility	1814.4	18446.4	91627.2
Process	29937.6	0	0

Table 160. Cumulative emission load- Transport

Transport Load Cumulative		
	Type of Transport	Total km per year
Waste to TSDF	Truck/local transport	99757.5

Note: The primary mode of transporting raw materials and products in this project is through pipelines. Since these pipelines operate predominantly on power load, their associated emissions are accounted for under power load.

Table 161. Cumulative emission load-Electricity

Electricity Load Cumulative per Year		
	Source	Total kWh per year
Electricity from grid	Tamil Nadu Electrical Board (TNEB) Grid Supply	487200000

Table 162. Green Area Carbon Sequestration

Carbon Sequestered through Plantation				
S. No	Species	Common name	No. of Trees	CO ₂ sequestered in Tonnes
1	<i>Albizia Lebbeck</i>	Vagai	2,874	639.01
2	<i>Azadirachta Indica</i>	Vembu	15,000	3,067.10
3	<i>Bauhinia Purpurea</i>	Ma ndarai	1,346	299.27
4	<i>Samanea saman</i>	Seemai Vagai	1,528	312.44
5	<i>Butea monosperma</i>	Flame of the Forest	3,170	648.18
6	<i>Ficus Carica</i>	Athi maram	837	171.14
7	<i>Tectona grandis</i>	Thekku maram	1,970	438.02
8	<i>Cassia Fistula</i>	Kondrai	1,070	218.79
9	<i>Delonix Regia</i>	Gulmohar	1,366	279.31
10	<i>Ficus Religiosa</i>	Arasu	6,091	1,354.29
11	<i>Ficus Benghalensis</i>	Alamaram	6,248	1,277.55
12	<i>Mangifera Indica</i>	Maamaram	2,504	556.75
13	<i>Peltophorum SP</i>	Iyal vagai	2,852	583.16
14	<i>Pithecellobium dulce</i>	Kodukkapuli	2,370	484.60
15	<i>Pongamia Glabra</i>	Pungai	5,956	1,324.27
16	<i>Tamarindus Indica</i>	Puli	954	195.07
17	<i>Thespesia Populnea</i>	Poovarasu	738	150.90
18	<i>Chloroxylon Swietenia</i>	Porusu	570	126.74
19	<i>Leucaena leucocephala</i>	Subabul	2,448	500.55
20	<i>Albizia Amara</i>	Unjai	252	44.85
21	<i>Strychnos nux-vomica</i>	Etti Maram	1796	133.17

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited

Carbon Sequestered through Plantation				
S. No	Species	Common name	No. of Trees	CO2 sequestered in Tonnes
22	<i>Dalbergia sissoo</i>	Sisoo	1585	360.06
23	<i>Syzygium cumini</i>	Naval maram	1604	189.96
	Total		65,129	13,355.17

10.5.2 Results

The results of the analysis done are given below:

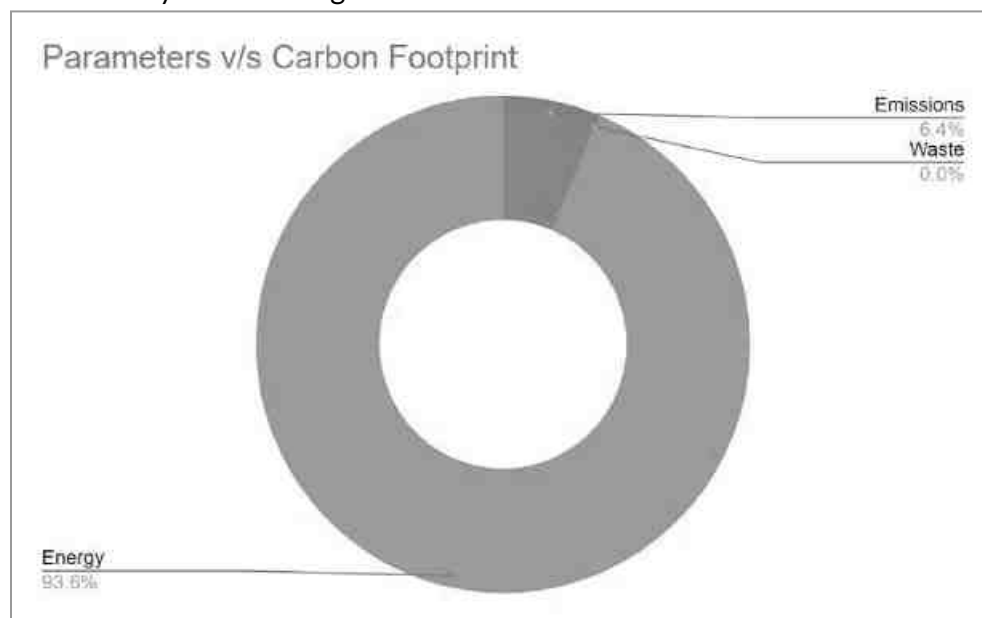


Figure 92. Parameters v/s Kg CO2 Eq.

Table 163. Carbon Footprint

Carbon Footprint	
Parameters	Tonnes CO2-eq.
Emissions	27,313.02
Waste	39.90
Energy	399,504.00
Carbon Sequestered through Plantation	13,355.17
Total w/o Offset	426856.9
Total Residual Emissions	413,501.75

Table 164. Calculated Life Cycle Impact Potentials

Life Cycle Impact Potential		
Acidification Potential	71,572.90	kg SO2-eq
Eutrophication Potential	10,209.89	kg PO4-eq.
Climate Change Potential	413,501,754.59	kg CO2-eq.
Photochemical Smog Potential	94,348.80	kg C2H4-eq.
Human Toxicity	121,564.80	kg 1,4 C6H4CL2-eq

10.5.3 Conclusions

In summary, it's clear that the project's Climate Change Potential is significant and warrants reduction efforts. The projected annual CO₂ emissions during peak operations are substantial, at 426856.9 metric tonnes, translating to 0.065 tonnes of CO₂ equivalent per tonne of production. However, the establishment of a green belt covering an area of 26.05 ha of the total land, which will be 40.31% of total land area with a total 65,129 number of trees shall be planted as per CPCB norms (considering 2500 trees per hectare). The company aims to offset 13,355.17 metric tonnes of CO₂ equivalent annually, which is 3.13 % of the total emissions, by cultivating this green space within the plant's premises each year of operation. Consequently, the net residual CO₂ emissions at full capacity are expected to be 413,501.75 tonnes of CO₂ equivalent per annum, or approximately 0.063 tonnes of CO₂ equivalent per tonne of production.

Further, the acidification potential is estimated at approximately 71.5 tonnes of SO₂-equivalent per year, indicating the release of emissions that can lead to acid rain and soil degradation. The Eutrophication Potential stands at around 10.2 tonnes of PO₄-equivalent annually, reflecting nutrient enrichment in water bodies that can cause harmful algal blooms and aquatic ecosystem imbalance. The Climate Change Potential is the most significant, with approximately 413,501.7 tonnes of CO₂-equivalent emissions per year, representing the system's contribution to global warming through greenhouse gas emissions. The Photochemical Smog Potential is about 94.3 tonnes of C₂H₄-equivalent per year, highlighting the formation of ground-level ozone and urban smog from reactive emissions. Lastly, the Human Toxicity Potential amounts to roughly 121.5 tonnes of 1,4-dichlorobenzene-equivalent per year, indicating the potential human health risks due to toxic chemical exposure throughout the product's life cycle. Together, these indicators provide a comprehensive picture of the environmental and human health burdens associated with the system or process under study.

The pie chart analysis indicates that the primary contributor to the project's carbon footprint is electricity consumption. To mitigate this, it is recommended to investigate alternative energy sources such as solar power. Adopting energy-saving practices, including the deployment of LED lighting, automated electricity shut-offs, and more efficient pump systems, should be considered. The installation of a heat recovery system could capitalize on the hot water produced in processing and utility areas. Additionally, shifting load times to off-peak periods and implementing a demand controller to manage peak demand can lead to significant power cost savings and further energy conservation over time.

The report is attached as **Annexure 7**.

10.6 CPA Compliance

Since the project is located in CPA, mitigation measures are provided as per **MoEF&CC OM: F.No. 22-23/2018-IA.III (Pt) dated: 31st October, 2019 dated 31.10.2019**.

Table 165. CPA Compliance

S. No.	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance						
Air Act								
1.	Stipulation of conditions such as: i. Stack emission levels should be stringent than the existing standards in terms of the identified critical pollutants.	Details of Utility Stacks:						
		S. No.	Stack attached to	Fuel Name and its Quantity	APCM	Standard Limit (mg/Nm ³)	Proposed Limits as project is in CPA (mg/Nm ³)	Frequency of Monitoring
		Existing Stacks for 600 KTA SPVC Plant						
		1	DG Sets (7 Nos.)	HSD, 100 lit/ hr. each	Adequate stack height	As per CBCB Emission Standard for DG: PM: 75 mg/Nm ³ CO: 150 mg/Nm ³ NOx: 360 ppmv	PM: 55 mg/Nm ³ CO: 100 mg/Nm ³ NOx: 250 ppmv	CEMS shall be installed on Boiler stack and Monthly manual sampling, through NABL Accredited Laboratory
		2	Boiler-1	Coal, 220 TPD	ESP and Stack	As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm ³ NOx: 250 mg/Nm ³ PM: 50 mg/Nm ³ CO: 100 mg/Nm ³	SO2: 30 mg/Nm ³ NOx: 150 mg/Nm ³ PM: 50 mg/Nm ³ CO: 80 mg/Nm ³	
		3	Boiler-2	Coal, 220 TPD	ESP and Stack			
		Proposed Stacks for 600 KTA SPVC Plant						
		1.	DG Sets (4 Nos.)	HSD, 100 lit/ hr. each	Adequate stack height	As per CBCB Emission Standard for DG: PM: 75 mg/Nm ³ CO: 150 mg/Nm ³ NOx: 360 ppmv	PM: 55 mg/Nm ³ CO: 100 mg/Nm ³ NOx: 250 ppmv	CEMS shall be installed on Boiler stack and Monthly manual sampling, through NABL Accredited Laboratory
		2.	Boiler-1	Natural gas, 70000 Nm ³ /day	Adequate stack height	As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm ³	SO2: 30 mg/Nm ³ NOx: 150 mg/Nm ³ PM: 50 mg/Nm ³	
		3.	Boiler-2	Natural gas, 70000 Nm ³ /day	Adequate stack height			

S. No .	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance						
						NOx: 250 mg/Nm3 PM: 50 mg/Nm3 CO: 100 mg/Nm	CO: 80 mg/Nm3	
		Proposed Flue Gas Stacks for 750 KTA VCM Plant						
		1	EDC Cracking Furnace-1	Natural Gas 216000 Nm³/day	Adequate stack height	As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm³ NOx: 250 mg/Nm³ PM: 50 mg/Nm³ CO: 100 mg/Nm³	SO2: 30 mg/Nm³ NOx: 150 mg/Nm³ PM: 50 mg/Nm³ CO: 80 mg/Nm³	CEMS shall be installed on Boiler stack and Monthly manual sampling, through NABL Accredited Laboratory
		2	EDC Cracking Furnace-2	Natural Gas 216000 Nm³/day	Adequate stack height			
		3	EDC Cracking Furnace-3	Natural Gas 216000 Nm³/day	Adequate stack height			
		4	EDC Cracking Furnace-4	Natural Gas 216000 Nm³/day	Adequate stack height			
		5	Incinerator	Natural Gas 1000 Nm³/hr (only during start up)	HCl scrubber and Adequate stack height	As per CBCB Common HW Incinerator Guidelines: PM: 50 mg/Nm³ SO2: 200 mg/Nm³ CO: 100 mg/Nm³ NOx: 400 mg/Nm³ As per G.S.R. 820(E) dated 09.11.2012 HCl: 50 mg/Nm³ Cl2: 10 mg/Nm³	PM: 50 mg/Nm³ SO2: 100 mg/Nm³ CO: 50 mg/Nm³ NOx: 200 mg/Nm³ HCl: 30 mg/Nm³ Cl2: 5 mg/Nm³	
		6	Emergency DG Set-1	HSD, 100 lit/hr	Adequate stack height	As per CBCB Emission Standard for DG: PM: 75 mg/Nm³ CO: 150 mg/Nm³ NOx: 360 ppmv	PM: 55 mg/Nm3 CO: 100 mg/Nm3 NOx: 250 ppmv	
		7	Emergency DG Set-2	HSD, 100 lit/hr	Adequate stack height			
		8	Emergency DG Set-3	HSD, 100 lit/hr	Adequate stack height			

S. No.	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance						
		9	Boiler-1	Natural gas, 70000 Nm ³ /day	Adequate stack height	As per G.S.R. 820(E) dated 09.11.2012 SO2: 50 mg/Nm3 NOx: 250 mg/Nm3 PM: 50 mg/Nm3 CO: 100 mg/Nm	SO2: 30 mg/Nm ³ NOx: 150 mg/Nm ³ PM: 50 mg/Nm ³ CO: 80 mg/Nm ³	
		10	Boiler-2	Natural gas, 70000 Nm ³ /day	Adequate stack height			
		11	Boiler-3	Natural gas, 70000 Nm ³ /day	Adequate stack height			
Details of Process Stacks:								
S. No.	Source of Emission	No. of Stacks	Stack Height (m)	APCM	Parameter	Standard Emission Limit (mg/Nm ³)	Proposed Limits as project is in CPA (mg/Nm ³)	Frequency of Monitoring
Existing Stacks for 600 KTA SPVC Plant								
1	Vent Gas Absorption System for VCM Recovery	2	20 m each	-	VCM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³	
2	PVC Dryer Section	2	44 m each	Multi-cyclone followed by wet scrubber and stack	VCM & PM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³ HCl -30 mg/Nm ³	VCM- 10 mg/Nm ³ HCL -20 mg/Nm ³	
3	Emergency Vent attached to VCM Storage Tank	1	60	-	VCM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³	
4	Coal Heading Conveyor-Transfer Point - 1	2	15.5 m each	Bag filter and stack	PM	As per G.S.R. 820(E) dated 09.11.2012 PM- 50 mg/Nm ³	PM- 50 mg/Nm ³	
5	Coal Heading Conveyor-Transfer Point - 2	2	22.75 m each	Bag filter and stack	PM			
6	Coal Feed Hopper	2	-	Water sprinklers for dust suppression	PM			

S. No.	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance									
		7	PVC Bagging Section - Bagging machine - 3 Nos.	6	-	Reverse jet bag filter- 3 Nos.	PM				
		8	Product Silo - 3 Nos.	6	-	Bin vent filter	PM				
		Proposed Stacks for 600 KTA SPVC Plant									
		9	Vent Gas Absorption System for VCM Recovery	2	20 m each	-	VCM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³	Monthly manual sampling through NABL Accredited Laboratory	
		10	PVC Dryer Section	2	44 m each	Multi-cyclone followed by wet scrubber and stack	VCM & PM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³ HCl -30 mg/Nm ³	VCM- 10 mg/Nm ³ HCL -20 mg/Nm ³		
		11	Emergency Vent attached to VCM Storage Tank	0	60	-	VCM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³		
		12	Coal Heading Conveyor- Transfer Point - 1	2	15.5 m each	Bag filter and stack	PM	As per G.S.R. 820(E) dated 09.11.2012 PM- 50 mg/Nm ³	PM- 50 mg/Nm ³		
		13	Coal Heading Conveyor- Transfer Point - 2	2	22.75 m each	Bag filter and stack	PM				
		14	Coal Feed Hopper	2	-	Water sprinklers for dust suppression	PM				
		15	PVC Bagging Section - Bagging machine - 3 Nos.	6	-	Reverse jet bag filter- 3 Nos.	PM				
		16	Product Silo - 3 Nos.	6	-	Bin vent filter	PM				
		Proposed Process Stacks for 750 KTA VCM Plant									
		17	Oxy scrubber vent	-	-	Captive Incineration	Air, Hydrocarbons			Monthly manual sampling through NABL Accredited Laboratory	
		18	Emergency vent for ethylene storage tank	-	-	Adequate stack height	Ethylene	As per G.S.R. 820(E) dated 09.11.2012 Ethylene- 10	Ethylene- 10 mg/Nm ³		

S. No .	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance																															
							mg/Nm ³																										
		19	Emergency vent for EDC storage tank	-	-	Adequate stack height	VCM	As per G.S.R. 820(E) dated 09.11.2012 VCM- 10 mg/Nm ³	VCM- 10 mg/Nm ³																								
	ii. CEMS may be installed in all large/ medium red category industries (air polluting) and connected to SPCB and CPCB servers.	Existing: - The stacks have been fitted with CEMS to ensure monitoring of emissions and the same is connected to the SPCB & CPCB server. After Expansion: - The proposed stacks will be fitted with CEMS to ensure monitoring of emissions and the same will be connected to the SPCB & CPCB server.																															
	iii. Effective fugitive emission control measures should be imposed in the process of transportation, packing etc	Measures are taken in the existing as well as for proposed expansion are as under: Equipment and Storage Measures <table><tr><th>Aspects</th><th>Details</th></tr><tr><td>Reactors</td><td>Provided with mechanical seals</td></tr><tr><td>Condensers</td><td>Chilled water condenser to minimize evaporation losses.</td></tr></table> Process Controls and Emission Monitoring <table><tr><th>Aspects</th><th>Details</th></tr><tr><td>Scrubbers</td><td>Wet scrubbers to remove harmful gases and odors from industrial emissions</td></tr><tr><td>Instrumentation</td><td>Leakage detection and alarm system for critical equipment.</td></tr><tr><td>Charging</td><td>Liquid & solid raw materials will be done under vacuum wherever necessary, pumps with mechanical seals to avoid leakages.</td></tr><tr><td>Closed Loop Systems</td><td>Used to arrest fugitive emissions.</td></tr><tr><td>Pipes</td><td>Installation of right leak proof valves. Valves and flanges preventive maintenance program will be followed regularly. Regular monitor of system for leaks</td></tr></table> Dust and Fugitive Emission Control <table><tr><th>Aspects</th><th>Details</th></tr><tr><td>Fugitive Emission Monitoring</td><td>- Monitoring in the work zone environment. - Strong ventilation and local exhaust systems.</td></tr><tr><td>Equipments</td><td>Regular inspection and maintenance.</td></tr></table> The same will be followed after expansion as well.								Aspects	Details	Reactors	Provided with mechanical seals	Condensers	Chilled water condenser to minimize evaporation losses.	Aspects	Details	Scrubbers	Wet scrubbers to remove harmful gases and odors from industrial emissions	Instrumentation	Leakage detection and alarm system for critical equipment.	Charging	Liquid & solid raw materials will be done under vacuum wherever necessary, pumps with mechanical seals to avoid leakages.	Closed Loop Systems	Used to arrest fugitive emissions.	Pipes	Installation of right leak proof valves. Valves and flanges preventive maintenance program will be followed regularly. Regular monitor of system for leaks	Aspects	Details	Fugitive Emission Monitoring	- Monitoring in the work zone environment. - Strong ventilation and local exhaust systems.	Equipments	Regular inspection and maintenance.
Aspects	Details																																
Reactors	Provided with mechanical seals																																
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Aspects	Details																																
Fugitive Emission Monitoring	- Monitoring in the work zone environment. - Strong ventilation and local exhaust systems.																																
Equipments	Regular inspection and maintenance.																																

S. No.	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance
	iv. Transportation of materials by rail/ conveyor belt, wherever feasible.	Transportation of materials is being done via PUC compliant vehicles adhering to the safety norms. The same will be followed after expansion as well.
	v. Encourage use of cleaner fuels (pet coke/ furnace oil/ LSHS may be avoided).	- Current fuel being used in Boiler is Coal & HSD is used for Emergency DG sets - As part of the proposed expansion, fuel to be used in Boiler, EDC Cracking Furnace and Incinerator is Natural Gas. Emergency DG sets fuel will use HSD, which are, in compliance with the CPA Norms.
	vi. Best Available Technology may be used. For example, usage of EAF/SAF/IF in place of Cupola furnace: Usage of Supercritical technology in place of sub-critical technology.	- The unit is already in compliance with the latest norms in the manufacturing industry. The R&D team of the unit works to reduce use of toxic chemicals and for low pollution load processes. - The same will be followed after expansion as well.
	vii. Increase of green belt cover by 40% of the total land area beyond the permissible requirement of 33%, wherever feasible.	An existing green area of 9.7976 ha. has been developed within the site which is 15.15 % of the existing plant area with 23611 No. of trees. - In the proposed expansion, the green belt will increase from 9.7976 ha to 26.0525 ha (40.31 %), with a total of 65129 No. of trees with different native species.
	viii. Stipulation of greenbelt outside the project premises such as avenue plantation, plantation in vacant areas, social forestry, etc.	- PP commits for Plantation of about 10,000 no. of trees in the nearby villages & common areas as part of Social Welfare for which a budget of INR 7.5 Lakhs.
	ix. Assessment of carrying capacity of transportation load on roads inside the industrial premises. If the roads required to be widened, shall be prescribed as a condition.	The existing roads inside the industrial area are of sufficient carrying capacity for the proposed project and also the carrying capacity of approach road will not be exceeded due to the proposed expansion and therefore widening of roads is not proposed. The vehicle movement area is on paved surface to avoid dusting. The carrying capacity of the Chennai to Nagapattinam Hvy is much higher than the traffic volume. The traffic (to & fro) from the "Chemplast Cuddalore Vinyls Ltd (CCVL)" will not create any traffic congestion. The volume/capacity ratio will remain the same after proposed expansion with LOS being "A".

S. No.	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance
2	Water	
	Stipulation of conditions such as: i. Reuse/recycle of treated wastewater, wherever feasible.	- Existing effluent of 5620 KLD is generated from DM plant, Boiler, Process, Plant wash & cooling Tower, is being treated in ETP (6400 KLD Capacity) followed by RO (6000 KLD Capacity) and MEE (600 KLD Capacity) & 5659 KLD treated effluent is reused in Cooling Tower makeup & DM plant. - After proposed expansion, The total wastewater generation after expansion will be 13.41 MLD. Out of which 0.11 MLD will be sent to STP of 0.14 MLD capacity and Rest 13.30 MLD effluent generation will be sent to ETP of 15.8 MLD capacity followed by RO of 15 MLD capacity and MEE of 1.5 MLD capacity. The treated sewage of 0.104 MLD will be reused within plant premises for gardening and/or greenbelt development. Treated effluent of 12.84 MLD will be reused in the cooling tower makeup & DM Plant.
	ii. Continuous monitoring of effluent quality/ quantity in large and medium Red Category Industries (water polluting).	- Our unit operates under a Zero Liquid Discharge (ZLD) system, wherein the entire quantity of treated effluent is recycled and reused within the plant premises and there is no final discharge to the environment. - We continue to maintain records of our treatment performance, flow data, and water quality, which are readily available for review by regulatory authorities. - Our unit remains fully aligned with the objectives of the CEPI Action Plan and is committed to maintaining environmental compliance. - Further we assure to install necessary systems for continuous monitoring of effluent quality / quantity and shall be connected to the TNPCB server.
	iii. A detailed water harvesting plan may be submitted by the project proponent	- Two Nos. of rainwater collection tanks with dimensions 12m x 12m x 7.3m each, having a total capacity of about 4200 cum are proposed for collection of rooftop rainwater and storage of 2 days. - First and second rain from rooftops of admin, engineering, and stores buildings will be collected in a proposed collection tank and sent to ETP for treatment. After the second rainfall, runoff from these areas will be collected in the same collection tank and will be reused.
	iv. Zero liquid discharge wherever techno- economically feasible.	The unit is maintaining Zero liquid discharge and in the existing unit 5620 KLD of effluent is sent to ETP & treated effluent 5659 KLD is reused in Cooling Tower makeup. After the proposed expansion, 13.30 MLD of effluent will be sent to ETP of 15.8 MLD, followed by RO of 15 MLD capacity and MEE of 1.5 MLD capacity. Treated effluent of 12.84 MLD will be reused in Cooling Tower makeup & DM Plant, thus maintaining ZLD.
	v. In case, domestic waste water generation is more than 10 KLD, the industry may install STP.	- In the existing unit, domestic waste water generation projected is 40 KLD and is treated in the existing STP of capacity 50 KLD and 38 KLD treated sewage is reused in greenbelt development. - After Expansion, sewage of 110 KLD will be generated from the plant and will be treated in the existing STP of 140 KLD & 104 KLD treated sewage will be reused in greenbelt development.
	Land	

S. No.	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance
3.	Stipulation of conditions such as: i. Increase of green belt cover by 40% of the total land area beyond the permissible requirement of 33%, wherever feasible for new projects.	An existing green area of 9.7976 ha. has been developed within the site which is 15.15 % of the existing plant area with 23611 No. of trees. - In the proposed expansion, the green belt will increase from 9.7976 ha to 26.0525 ha (40.31 %), with a total of 65129 No. of trees with different native species.
	ii. Stipulation of greenbelt outside the project premises such as avenue plantation, plantation in vacant areas, social forestry, etc.	- PP commits for Plantation of about 10,000 no. of trees in the nearby villages & common areas as part of Social Welfare for which a budget of INR 7.5 Lakhs.

iii. Dumping of waste (fly ash, slag, red mud, etc.) may be permitted only at designated locations approved by SPCBs/ PCCs.

Type of waste, source of generation, category, schedule and mode of disposal as under:

(a) Hazardous Waste:

*As per HWM Rule 2016

S. No.	Type of Waste	HW Category*	Quantity per Year (MT)				Source	Treatment / Disposal
			Existing PVC (600 KTA)	Proposed PVC (600 KTA)	Proposed VCM (750 KTA)	Total		
1	Used / spent Oil	5.1	16.2	16.2	20	52.4	Plant equipments	Sent to authorized recyclers
2	Wastes or residues containing oil	5.2	-	-	5	5	Plant equipments	Sent to authorized recyclers (co-processing)
3	Distillation residue	20.3	-	-	2000	2000	Manufacturing process	Captive incineration
4	Furnace residue	1.1	-	-	50	50	Manufacturing process	To TSDF
5	Desal sludge	35.3	1250	1250	2500	5000	Desalination plant	To TSDF
6	ETP sludge	35.3	160	160	1500	1820	ETP	To TSDF
7	Chemical sludge (salt)	35.3	1656	1656	1000	4312	Multiple Effect Evaporator	To TSDF
8	PVC lumps	22.2	10.8	10.8	-	21.6	Manufacturing process	Disposed off at TNWML (Tamil Nadu Waste Management Limited) common disposal facility at Gummudipondi, an authorized agency
9	Spent Catalyst	1.7	-	-	40	40	Manufacturing process	Sell to Authorised recycler

(b) Solid Waste:

Biodegradable Waste:

Category	Type of Waste	Existing (A)	Proposed SPVC (B)	Proposed VCM (C)	Total After Expansion (D = A+B+C)	Treatment Method
		Quantity (TPA)				
Biodegradable	Organic Waste	14.78	14.78	10.18	39.74	Treatment in inhouse organic waste convertor (OWC) and use manure for horticulture development purposes in the premises

S. No .	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance																																																											
		<table><tr><td>Non-Biodegradable</td><td>Recyclable Waste (Plastic, paper, wood, glass, etc)</td><td>22.18</td><td>22.18</td><td>11.32</td><td>55.68</td><td>Given to authorized recycler</td></tr><tr><td colspan="2">Total</td><td>36.96</td><td>36.96</td><td>21.50</td><td>95.42</td><td>-</td></tr></table>						Non-Biodegradable	Recyclable Waste (Plastic, paper, wood, glass, etc)	22.18	22.18	11.32	55.68	Given to authorized recycler	Total		36.96	36.96	21.50	95.42	-																																								
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Total		36.96	36.96	21.50	95.42	-																																																							
		c) Biomedical Waste:																																																											
		<table><tr><th rowspan="2">Name of the Waste</th><th rowspan="2">Source</th><th>Existing</th><th>Proposed</th><th>Total After Expansion</th><th rowspan="2">Mode of disposal</th><th rowspan="2">Mode of transport</th></tr><tr><th colspan="3">Quantity (TPA)</th></tr><tr><td>Soiled Waste</td><td>Occupational Health Center</td><td>0.16</td><td>0.16</td><td>0.21</td><td rowspan="6">Dispose of at Biomedical waste site.</td><td>By Road</td></tr><tr><td>Expired or discarded medicine</td><td>Occupational Health Center</td><td>0.16</td><td>0.16</td><td>0.21</td><td>By Road</td></tr><tr><td>Microbiology & Biotechnology & other clinical waste</td><td>From Microbiology Lab</td><td>0.16</td><td>0.16</td><td>0.21</td><td>By Road</td></tr><tr><td>Waste Sharps</td><td>From Microbiology Lab</td><td>0.16</td><td>0.16</td><td>0.21</td><td>By Road</td></tr><tr><td>Contaminated Waste (Recyclable)</td><td>OHC Medical Check up</td><td>0.16</td><td>0.16</td><td>0.21</td><td>By Road</td></tr><tr><td>Glassware</td><td>OHC Medical Check up</td><td>0.16</td><td>0.16</td><td>0.21</td><td>By Road</td></tr><tr><td colspan="2">Total</td><td>1.0</td><td>1.0</td><td>1.26</td><td></td><td></td></tr></table>						Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport	Quantity (TPA)			Soiled Waste	Occupational Health Center	0.16	0.16	0.21	Dispose of at Biomedical waste site.	By Road	Expired or discarded medicine	Occupational Health Center	0.16	0.16	0.21	By Road	Microbiology & Biotechnology & other clinical waste	From Microbiology Lab	0.16	0.16	0.21	By Road	Waste Sharps	From Microbiology Lab	0.16	0.16	0.21	By Road	Contaminated Waste (Recyclable)	OHC Medical Check up	0.16	0.16	0.21	By Road	Glassware	OHC Medical Check up	0.16	0.16	0.21	By Road	Total		1.0	1.0	1.26		
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Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport																																																							
		Quantity (TPA)																																																											
E-Waste	Office electronic equipments	0.5	0.5	1.0	Sent to Authorized recyclers	By Road																																																							
		• Battery Waste																																																											
		<table><tr><th rowspan="2">Name of the Waste</th><th rowspan="2">Source</th><th>Existing</th><th>Proposed</th><th>Total After Expansion</th><th rowspan="2">Mode of disposal</th><th rowspan="2">Mode of transport</th></tr><tr><th colspan="3">Quantity (TPA)</th></tr><tr><td>Battery Waste</td><td>Used battery</td><td>1.5</td><td>1.5</td><td>3.0</td><td>Sell/dispose to Authorized recyclers</td><td>By Road</td></tr></table>						Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport	Quantity (TPA)			Battery Waste	Used battery	1.5	1.5	3.0	Sell/dispose to Authorized recyclers	By Road																																					
Name of the Waste	Source	Existing	Proposed	Total After Expansion	Mode of disposal	Mode of transport																																																							
		Quantity (TPA)																																																											
Battery Waste	Used battery	1.5	1.5	3.0	Sell/dispose to Authorized recyclers	By Road																																																							

S. No.	Mitigation Measures as per MoEF&CC OM dated 31.10.2019	Compliance
	iv. More stringent norms for management of hazardous waste. The waste generated should be preferably utilized in co-processing.	Wastes or residues containing oil (5 TPA) shall be disposed off to authorized recyclers. (Co-processing)
4.	Other Condition (Additional):	
	i. Monitoring of compliance of EC conditions may be submitted with a third party audit every year.	The unit will hire a third party to monitor the compliance of the condition and will submit EC Compliance every year.
	ii. The % of the CER may be at least 1.5 times the slabs given in the OM dated 01.05.2018 for SPA and 2 times for CPA in case of Environmental Clearance.	Will be updated after Public Hearing.

10.7 Compliance Statement of G.S.R 84(E) & 85(E) dated 29th Jan. 2025 and 30th January, 2025

Compliance statement in line with the criteria specified under 'Clause-9, Chapter 3 - Criteria for Establishment of Industrial Plant' of the G.S.R 84(E) & 85(E) dated 29th Jan. 2025 and 30th January, 2025 respectively, is given below:

Table 166. Compliance Statement

S. No.	Clause-9, Chapter 3 (G.S.R 84(E) & 85(E))		Compliance
1.	Restrictions on establishing an industrial plant based on technological and scientific developments to protect sensitive areas like national parks, sanctuaries, wetlands, and archaeological monuments.		Complied There are no National Parks, Sanctuaries, wetlands and archeological monuments within 10 km. radius of the plant site.
2.	Industrial plants must comply with criteria set by the Central Government, State Government, or Union Territory Administration.		Noted for compliance
3.	While establishing an industrial plant, the following minimum distance shall be maintained:		
3(a)	From the nearest boundary of surface water body (flood plain/HFL/Red line) as per revenue records in case of industrial plant of:		
	5(e) (ii): Red category, A. with effluent generation, beyond five hundred meters; B. without effluent generation, beyond five hundred meters;		The nearest distance of the Uppanar River is 0.01 km, East. Proposed Environment Safeguards to mitigate potential impacts: • A robust storm water management system and impermeable boundary wall will be constructed along the river-facing boundary. • Zero Liquid Discharge (ZLD) system will be adopted; treated effluent will not be discharged into the river. • Online effluent monitoring will be installed and connected to SPCB/CPCB servers. • River water quality will be monitored at upstream and downstream points periodically.
3(b)	From settlements, educational institutes, worship places, archaeological monuments, national parks, reserve forests, heritage sites, in case of industrial plant of:		
	3(b) (ii): Redcategory, beyond five hundred meters;	Settlement	Nearest Village settlement of Pundiyanakuppam Village is at 0.81 km, SW.
		Educational Institutes	Nearest School is PUP School School-0.40 km W.
		Worship Places	Hindu temple - Within the Project Site. Nearest place of Worship is Ammakali Temple, 0.30 km, W
		Archaeological monuments	None within 200 m

Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity by M/s Chemplast Cuddalore Vinyls Limited, at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu by M/s Chemplast Cuddalore Vinyls Limited



S. No.	Clause-9, Chapter 3 (G.S.R 84(E) & 85(E))	Compliance
	National Parks	None within 200 m
	Reserve Forests	None within 200 m
	Heritage Sites	None within 200 m
3(c)	The State Board shall ensure compliance with all applicable laws, rules, regulations, and notifications	-
3(d)	Natural or storm drains passing through the industrial plant location shall not be disturbed.	There are no Natural or storm drains passing through the proposed plant location.

11. SUMMARY & CONCLUSION

11.1. PROJECT DESCRIPTION

M/s. Chemplast Cuddalore Vinyls Limited is proposing an expansion of existing SPVC Plant in addition of new VCM Production at Survey Nos. 70 (Part), 71 (Part), 72, 73, 74 (Part), 75 (Part), 76 (Part), 133 (Part), and 134 and Associated Survey Numbers, near Semmankuppam and Thiyagavalli villages in Cuddalore District, Tamil Nadu with a plot area of 64.6298 ha. Current Production involves **EC Products** - PVC Resins 600 KTA.

The proposed expansion requires prior Environmental Clearance as per EIA Notification 2006 and its subsequent amendments. The project falls within the scope of Schedule Activity 5(e) of the EIA Notification due to its association with organic chemical products, under Category "A" since the project is located outside the notified industrial area, and hence requires Public Hearing in the process of obtaining Environmental Clearance.

After the proposed expansion, the total production capacity for **EC products** will be PVC Resins 1200 KTA, Vinyl Chloride Monomer (VCM) 750 KTA. **By Product**- HCl(30-35 %) 200 KTA. The cost of the project after expansion will be INR 6500 Cr.

11.2. DESCRIPTION OF THE ENVIRONMENT

Study Period:

Monitoring was carried out in the Summer season (**February 2024 to April 2024**)

Ambient Air Quality:

Core zone: The mean value of PM_{10} at core zone locations ranges from (46.71 - 67.48 $\mu\text{g}/\text{m}^3$) & $PM_{2.5}$ ranges from (15.15 - 24.21 $\mu\text{g}/\text{m}^3$), SO_2 ranges from (6.36- 10.37 $\mu\text{g}/\text{m}^3$), NO_2 ranges from (10.26- 19.38 $\mu\text{g}/\text{m}^3$), CO (0.30- 0.56 mg/m^3), TVOC (0.009- 0.017 mg/m^3), HCl (1.51- 2.46 $\mu\text{g}/\text{m}^3$), Cl_2 (7.95- 12.97 $\mu\text{g}/\text{m}^3$), O₃ (2.22- 4.19 $\mu\text{g}/\text{m}^3$), NH₃ (3.27-5.81 $\mu\text{g}/\text{m}^3$), THC (0.82- 1.55 mg/m^3) & NMHC (0.05- 0.09 mg/m^3) which are within the limits of National Ambient Air Quality Standards (NAAQS).

As per the Air Quality Index by CPCB, the air quality of the **core zone is found to be Satisfactory** during the sampling period from **February 2024 to April 2024**.

Buffer zone: The mean value of PM_{10} at buffer zone locations ranges from (44.32 - 99.07 $\mu\text{g}/\text{m}^3$) & $PM_{2.5}$ ranges from (14.25 - 33.20 $\mu\text{g}/\text{m}^3$), SO_2 ranges from (6.00- 13.06 $\mu\text{g}/\text{m}^3$), NO_2 ranges from (9.65- 24.03 $\mu\text{g}/\text{m}^3$), CO (0.28- 0.70 mg/m^3), TVOC (0.008- 0.021 mg/m^3), HCl (1.42- 3.10 $\mu\text{g}/\text{m}^3$), Cl_2 (7.50- 16.32 $\mu\text{g}/\text{m}^3$), O₃ (2.09- 5.19 $\mu\text{g}/\text{m}^3$), NH₃ (2.90-7.21 $\mu\text{g}/\text{m}^3$), THC (0.77- 1.92 mg/m^3) & NMHC (0.04- 0.11 mg/m^3) which are within the limits of National Ambient Air Quality Standards (NAAQS).

As per the Air Quality Index by CPCB, the air quality of the **buffer zone** is found to be **satisfactory** during the sampling period from **February 2024 to April 2024**.

Ambient Noise Quality:

Core zone: The ambient noise level during day time at the proposed project site varies from 61.9 dB (A) to 62.2 dB (A) which are within the day time standard limit of Industrial area ~75 dB (A). During night the noise level at the project site ranges from 56.9 dB (A) to 57.4 dB (A) which are within the night time standard limit of Industrial area 70.0 dB (A).

Buffer Zone:

Residential Area:

N3: The ambient noise level at Thatchan Colony is 57.2 dB (A) which is slightly higher than daytime noise standard limit of Residential area ~ 55.0 dB (A). During the night the noise level was recorded at 46.1 dB (A) which is slightly higher than the night-time noise standard limit of ~ 45 dB (A).

N4: The ambient noise level at Poondiyankuppam is 57.7 dB (A) which is slightly higher than daytime noise standard limit of Residential area ~ 55.0 dB (A). During the night the noise level was recorded at 46.4 dB (A) which is slightly higher than the night-time noise standard limit of ~ 45 dB (A).

N5: The ambient noise level at Nochikadu 54.7 dB (A) which is within the daytime noise standard limit of the Residential area of ~ 55.0 dB (A). During the night the noise level was recorded at 44.5 dB (A) which is within the night-time noise standard limit of ~ 45.0 dB (A).

N6: The ambient noise level at Thiruchopuram is 55.8 dB (A) which is slightly higher than the daytime noise standard limit of the Residential area of ~ 55.0 dB (A). During the night the noise level was recorded at 45.8 dB (A) which is slightly higher than the night-time noise standard limit of ~ 45.0 dB (A).

N7: The noise level at Tondamanathan 56.8 dB (A) which is slightly higher than the daytime noise standard limit of ~ 55 dB (A). During the night the noise level was recorded at 46.5 dB (A) which is slightly higher than the night-time noise standard limit of ~ 45 dB (A).

N8: The noise level at Valudambattu is 54.6 dB (A) which is within the daytime noise standard limit of ~ 55 dB (A). During the night the noise level was recorded at 43.9 dB (A) which is within the night-time noise standard limit of ~ 45 dB (A).

Commercial Area:

N9: The noise level at NH-32 is 61.3 dB (A) which is within the daytime noise within the standard limit of Commercial area ~ 65.0 dB (A). During the night the noise level was recorded at 58.9 dB (A) which is slightly higher than the night-time noise standard limit of ~ 55 dB (A).

N10: The noise level at NH-532 is 63.2 dB (A) which is within the daytime noise within the standard limit of Commercial area ~ 65.0 dB (A). During the night the noise level was recorded at 60.2 dB (A) which is slightly higher than the night-time noise standard limit of ~ 55 dB (A).

Groundwater Quality:

Core Zone: The water quality of the core zone shows that

1. The Total Dissolved Solids (TDS) of the sampling location is 504 mg/l. The TDS of sampling location is within the acceptable limit of 500 mg/l & permissible limit i.e. 2000 mg/l respectively.
2. The Total Hardness of the sampling location is 310 mg/l. The Total Hardness of sampling location is within the acceptable limit of 200 mg/l & permissible limit of 600 mg/l respectively.
3. The Alkalinity of the sampling location is 260 mg/l. The alkalinity of sampling location is within the acceptable limit of 200 mg/l & permissible limit i.e. 600 mg/l respectively.
4. The Chloride Concentration of the sampling location is 284 mg/l. The Chloride concentration of sampling location is within the acceptable limit of 250 mg/l respectively.

Buffer zone: The water quality of the buffer zone shows that

1. The Total Dissolved Solids (TDS) of the sampling locations ranges from 337.4 mg/l to 1515.3 mg/l. The TDS of sampling locations are within the acceptable limit of 500 mg/l & permissible limit i.e. 2000 mg/l respectively.
2. The Total Hardness of the sampling locations ranges from 200 mg/l to 420 mg/l. The Total Hardness of sampling locations are within the acceptable limit of 200 mg/l & permissible limit of 600 mg/l respectively.
3. The Alkalinity of the sampling locations ranges from 44 mg/l to 280 mg/l. The alkalinity of sampling locations are within the acceptable limit of 200 mg/l & permissible limit i.e. 600 mg/l respectively.
4. The Chloride Concentration of the sampling locations ranges from 159.9 mg/l to 559.8 mg/l. The Chloride concentration of sampling locations are within the acceptable limit of 250 mg/l respectively.

Surface water Quality:

Surface water samples were collected from 5 locations namely Uppanar River Upstream, Uppanar River Downstream, Pond Near Kodandaramapuram, Perumal Lake and Capper Hills Lake. As per the samples collected and analyzed from locations SW1, SW2, SW3, SW4 & SW5, surface water quality is meeting the criteria defined by class C as per the CPCB criteria. It is suitable for drinking water after conventional treatment and disinfection.

Soil Quality:

Core Zone : After analyzing the samples collected from the site, it shows that the soil texture is 5/3 Dull Reddish Brown, pH is 7.24 .Amount of primary nutrients like Organic matter is 0.39 %, the available nitrogen 64.6 mg/kg is low to medium and available Potassium 20.9 mg/kg is medium to high & the available Phosphorus 4.6 mg/kg is medium to high range.

The overall fertility of this soil would be considered moderate to low. While the phosphorus levels are adequate, the low levels of organic matter, nitrogen, and potassium suggest that the soil may need amendments, particularly organic matter and fertilizers, to improve fertility.

Buffer Zone: 4/6 Reddish Brown, pH ranges from 6.16 to 7.34, Amount of primary nutrients like Organic matter 0.21 to 1.05, the Available Nitrogen 54.6 to 99.4 mg/kg is low to high range, the Available Phosphorus 5.4 to 8.8 mg/kg is low to high range, Available Potassium 20.9 to 29.8 mg/kg is low to high range.

The overall fertility of this soil would be considered moderate. The soil has good potential due to its clay loam texture and relatively neutral pH, but the fertility is limited by low to medium levels of organic matter, nitrogen, and potassium.

Biological Environment:

Flora and fauna of Core Zone:

Flora(Core zone): In the core zone following a variety of tree species were observed, Proposed project site is dominated by few grass species and few scattered patches of *Prosopis juliflora*, *Calotropis procera*, *Zizyphus mauritiana*, etc.

Fauna (Core zone): *Calotes versicolor* (Indian Garden Lizard) and *Hemidactylus flaviviridis* (Yellow Bellied House Gecko), Green bee-eater, Spotted dove, Asian koel, Asian paradise-flycatcher, White-browed wagtail, Indian Robin, *Funambulus pennanti* (Indian Five-Striped Squirrel) have been sighted at core zone.

Flora of the Buffer Zone: *Peltophorum pterocarpum*, *Cocos nucifera*, *Phoenix sylvestris*, *Annona squamosa*, *Mangifera indica*, *Lannea coromandelica*, *Tectona grandis*, *Acacia auriculiformis*, *Adenanthera microsperma*, *Albizia lebbek*, *Albizia saman*, *Ficus hispida*, *Ficus religiosa*, *Moringa pterygosperma*, *Eucalyptus tereticornis*, *Syzygium cumini*, *Zizyphus mauritiana*, *Phyllanthus debilis*, *Phyllanthus simplex*, *Aeschynomene indica*, *Ocimum basilicum*, *Leucas aspera*, *Polygonum glabrum*, *Scoparia dulcis*, *Tylophora indica*, *Ipomoea pes-tigridis*, etc.

Fauna (Buffer zone): *Ptyas mucosa*, *Xenochrophis piscator*, *Naja naja*, *Motacilla citreola*, *Phylloscopus collybita*, *Grus grus*, *Tringa nebularia*, *Upupa epops*, *Falco tinnunculus*, *Milvus migrans*, *Anas clypeata*, *Streptopelia orientalis*, *Circus macrourus*, *Saxicola caprata*, *Clamator jacobinus*, *Gallinago stenura*, *Vanellus malabaricus*, *Rhodonessa rufina*, *Emberiza bruniceps*, *Ficedula parva*, *Anthus richard*, *Coracias benghalensis*, *Sus scrofa*, *Funambulus pennantii*, *Felis chaus*, *Herpestes edwardsii*, *Rhesus macaque* *Canis aureus*, *Hystrix indica*, etc.

Endangered Species: There are 13 numbers of scheduled species. These are *Felis chaus*, *Canis aureus*, *Urva edwardsii*, *Hystrix indica*, *Ptyas mucosa*, *Fowlea piscator*, *Naja naja*, *Grus grus*, *Tringa nebularia*, *Grus virgo*, *Pavo cristatus*, *Circus macrourus*, *Aquila nipalensis*.

Socio-economic Environment:

1. Demographics and Literacy: The surveyed villages have varied population sizes, with the largest being Pachchyankuppam (8885 people) and the smallest being Anukkambattu (1645 people).

- Literacy rates are generally above 76%, with Tiruchchepuram (88%) and Pachchyankuppam (85%) being the most literate.
- Female literacy continues to trail behind male literacy in several villages, requiring gender-targeted educational support.

2. Infrastructure and Basic Amenities

- Road connectivity: All villages are connected by metalled roads
- Electrification: All villages are electrified with 100% individual connections, but many have non-functioning streetlights.

3. Sanitation and Toilets

- Most villages have access to both individual and public toilets. In contrast, Thiyagavalli village has yet to be provided with public toilet facilities.

4. Education & Health Facilities

- No village in the area has a college, highlighting a significant gap in local education.

5. Occupation and Livelihoods

- Agriculture is the primary livelihood in 50-60% of households across villages.
- However, lack of deep boring facilities, farming equipment, and training continues to hinder productivity.
- Very few households are engaged in self-employment, businesses, or service jobs.

6. Water Supply

- Drinking Water: all villages have piped water supply (PWS) to households, drinking water is supplied mainly through borewells, indicating problems related to the reliability or quality of the piped water supply system.

7. Social Composition and Inclusion

The distribution of Scheduled Caste (SC), Scheduled Tribe (ST), and General category populations varies significantly across the villages

- Tiruchipuram: Features a majority SC population (57%).
- Sedappalayam: Records the highest proportion of ST (11%).
- Pachchankuppam: Is predominantly inhabited by the General category (96%).

8. Health & Disease Prevalence

- Seasonal illnesses like Diarrhea, typhoid, jaundice, and asthma were reported in almost all villages.
- 1–3% prevalence of jaundice and asthma across some villages.

11.3. ANTICIPATED ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

Air environment

During the construction/ installation phase impacts on ambient air would be mainly due to dust emissions and movement of vehicles. However, these impacts would be short term in nature and limited only to the construction period. Dust suppression systems (water spray) will be used. Construction materials will be fully covered during transportation to the project site by road.

During the operational phase, impacts will be mainly due to emissions from the operation of DG sets. Adequate stack height and other APCMs shall be installed to mitigate negative impacts on the environment.

Water Environment

Source of Fresh water: Desalination Plant

Operational phase: Total Water Requirement for the proposed expansion is 24840 KLD, which is being met through the Desalination Plant. Out of total water, 110 KLD will be used for domestic purposes, 12430 KLD will be used in DM Plant, 2563 KLD will be used in Boiler, 300 KLD is used in Plant Wash, 11070 KLD will be used in Cooling tower and the balance 958 KLD will be used in Greenbelt.

Land Use : There will be change in land use and land cover as additional land area is being added in this project. The proposed land area is located at Survey numbers: 70 Part, 71 Part, 72, 73, 74 Part, 75 Part, 76 Part, 133 Part & 134 and Associated Survey Numbers, Village Semmankuppam & Thiyagavalli, Cuddalore District, Tamil Nadu - 607005.

Soil Quality: Chemical degradation of soil may occur while refueling vehicles transporting construction materials and servicing. Procedures for maintenance of equipment would ensure that this risk is minimized, and clean-up response is rapid if any spill occurs. Lubricating waste oil will be collected separately in drums and handed over to the authorized outside agency of vehicles through breakage due to wear and tear.

Noise Levels : Noise and vibration generated due to the operation of machinery and equipment may cause physiological and psychological effects on laborers like annoyance, problems like speech interference, sleep disturbance, headache, Auditory impact, increase in heartbeat of elderly people. Running of machinery will cause vibration generation in the immediate surrounding area.

Hydrology and Geology : The major activities which would have an impact on the Ecology and Biodiversity in the project area and the surroundings would be site preparation, excavation, manufacturing process, operation of machinery & equipment, transportation, loading & unloading of raw material. The aspects of the activities would be dust emission, increase in GLC, increase in noise level, soil erosion, noise generation, water contamination, vehicular emission and waste generation which would directly /indirectly impact transpiration rate of flora, loss of habitat, decrease in plant/tree cover, disturbance to avi-fauna and other species, premature senescence of floral species and hence decrease in population of local faunal species in the area and the surroundings. To minimize such impacts, mitigation measures like provision of air pollution control equipment, scrubbing system to the vents, provision and proper maintenance of plantation area, installation of water sprinkling systems and dust suppression systems, provision of noise barriers, maintenance of vehicular movement near the project site and proper disposal and treatment of wastes generated from the project site. Vehicular movement for transportation of raw material will be carried out only in day-time and will try to avoid unnecessary honking with the help of sign boards.

Solid and Hazardous Waste: Waste generated from construction machinery including waste oil, grease, and any other may cause nuisance if not maintained properly. All the waste generated will be properly disposed of as per solid waste management rules, 2016

Ecology & Biodiversity : The major activities which would have an impact on the Ecology and Biodiversity in the project area and the surroundings would be site preparation, excavation, manufacturing process, operation of machinery & equipment, transportation, loading & unloading of raw material. The aspects of the activities would be dust emission, increase in GLC, increase in noise level, soil erosion, noise generation, water contamination, vehicular emission and waste generation which would directly /indirectly impact in decrease in transpiration rate of flora, loss of habitat, decrease in plant/tree cover, disturbance to avi-fauna and other species, premature senescence of floral species and hence decrease in population of local faunal species in the area and the surroundings. To minimize such impacts, mitigation measures like provision of air pollution

control equipment, scrubbing system to the vents, provision and proper maintenance of green area, installation of water sprinkling systems and dust suppression systems, provision of noise barriers, maintenance of vehicular movement near the project site and proper disposal and treatment of wastes generated from the project site. Vehicular movement for transportation of raw material will be carried out only in day-time and will try to avoid unnecessary honking with the help of sign boards. Green belt/greenery will be developed along most of the periphery of the project area as well as along roads.

Socio-Economic Environment: There will be a minor positive impact due to increase in additional employment generation, increased revenue to neighborhood people and increased tax payment to the local administration.

11.4. ENVIRONMENTAL MONITORING PROGRAMME

M/s Chemplast Cuddalore Vinyls Limited will ensure that the environmental performances of all the activities are monitored throughout the execution of the various project activities. Monitoring will include all the aspects and parameters related to the process emissions from the manufacturing process, storage area, work zone area, quantities of waste generated, effluent generation and its characteristics, Environmental quality of components like Air, water, Soil, Noise are being verified that they meet the prescribed standards. All the reports will be periodically submitted to the concerned regulatory authorities as compliance, audit reports.

11.5. ADDITIONAL STUDIES

As per the Standard Terms of Reference issued vide letter No. **File No IA-J-11011/132/2020-IA(II)**, dated **28.07.2025** by Ministry of Environment, Forest, and Climate Change (MoEFCC), New Delhi following Additional Studies required to be carried out for the proposed expansion project.

1. Hazard Identification and Risk Management

Type of Hazards: The project faces both natural and man-made hazards. Natural hazards include earthquakes and floods. Man-made hazards stem from potential fires, explosions, electrical accidents, chemical spills, and toxic chemical releases. These hazards can be caused by factors such as faulty equipment, human error, and extreme weather conditions.

11.6. PROJECT BENEFITS

11.6.1 ENVIRONMENT BENEFIT

A. Backward Integration to Reduce Environmental Footprint of Supply Chain

Currently, the feedstock (VCM) for SPVC manufacturing is imported and transported through marine terminals and cross-country pipelines. With the proposed in-house VCM production:

- Transportation-related emissions and risks will be significantly reduced.

- Dependence on long-distance shipping and associated marine environmental risks will be minimized.
- Onsite integration will reduce handling losses and fugitive emissions.

This backward integration contributes to lower carbon emissions and improves supply chain efficiency, supporting India's goals under Atmanirbhar Bharat and reducing the environmental footprint of imports.

B. Cleaner Fuel Use and Air Pollution Control

The proposed project is designed to use natural gas as the primary fuel for boilers and cracking furnaces, which offers a cleaner combustion profile compared to conventional fossil fuels like coal or furnace oil. The environmental advantages include:

- Reduced emissions of SO_x, NO_x, PM, and CO₂.
- Improved local air quality within and around the plant premises

Additionally, all flue gas and process gas stacks will be provided with **adequate height and air pollution control systems**, ensuring compliance with CPCB/TNPCB norms.

C. Zero Liquid Discharge (ZLD) and Water Reuse

The facility will operate on a **Zero Liquid Discharge (ZLD)** principle, ensuring:

- No untreated effluent discharge into land or water bodies.
- Maximum reuse of treated effluent for cooling and process requirements.
- Protection of nearby water bodies such as *Uppanar River* and *Bay of Bengal* from industrial effluent impact.

Moreover, all domestic sewage will be treated in a **140 KLD STP**, and the treated water will be used for greenbelt irrigation, reducing freshwater dependency.

D. Use of Desalinated Water and Freshwater Conservation

To reduce the stress on local freshwater resources, the total fresh water requirement (after expansion) of 11422 KLD will be met entirely through seawater desalination. A new **desalination plant** will be installed, eliminating dependence on groundwater or surface water. This initiative ensures:

- Sustainable water sourcing.
- No adverse impact on local community water supplies or agriculture.
- Resilience against seasonal water scarcity and climate-induced variability.

E. Waste Minimization and Resource Recovery

The project emphasizes solid and hazardous waste minimization through:

- Organic Waste Converter for biodegradable waste.
- Sale of recyclable waste to authorized vendors (e.g., HDPE drums, plastics).
- Safe disposal of hazardous waste at **Common Hazardous Waste Treatment, Storage and Disposal Facilities (CHWTSDF)**.
- Maximum recovery of by-products like **Hydrochloric Acid (HCl)** (200 KTA) from the VCM manufacturing process, contributing to circular economy principles.

F. Greenbelt Development for Carbon Sequestration

A total of **26.0515 hectares**, accounting for **over 40%** of the total project area, is earmarked for greenbelt development. This extensive plantation will:

- Act as a carbon sink and improve ambient air quality.
- Mitigate noise and dust dispersion within and outside the plant boundary.
- Enhance the site's ecological value by supporting native plant species and providing habitat for local fauna.

G. Efficient Energy Use and Emission Reduction

- Efficient process technologies with energy-saving designs are being adopted.
- Combined use of multiple boilers and furnaces running on natural gas will enable flexible operation with optimal energy use.
- Reduction in specific energy consumption per ton of PVC produced due to in-house VCM supply and co-located utilities.

SOCIAL BENEFIT

Due to the proposed expansion 426 Nos. of permanent employment and 1318 Nos. of contractual employment will be given.

OTHER TANGIBLE BENEFIT

The global refrigerants market is projected to grow significantly, with the market size expected to reach USD 40.31 billion by 2030, growing at a CAGR of 7.10%. In Asia Pacific, which is the largest refrigerants market, the demand for inorganic refrigerants is expected to rise due to the phase-out of HCFCs and HFCs, with China being the largest market in terms of volume. The demand for refrigerants is driven by factors like the increasing consumption of refrigeration and air conditioning equipment in commercial buildings and supermarkets, rapid urbanization, and the growing infrastructure industry in countries like India and China.

- The project will contribute to the Government treasury by way of direct and indirect taxes, like GST, Custom Duty and Income Tax. Chemplast Cuddalore Vinyls Limited will contribute funds for undertaking infrastructure development in surrounding villages, including

roads, community centers, training centers, traditional activity, health, education under the Corporate Social Responsibility, as prescribed under the Companies Act.

11.7. ENVIRONMENT MANAGEMENT PLAN

An effective Environment Management System (EMS) is essential to ensure that environmental safeguards are implemented and maintained throughout the lifecycle of the project. Continuous monitoring and adaptive management are key to minimizing adverse environmental impacts and ensuring regulatory compliance.

Based on the nature of the project and its activities, **M/s Chemplast Cuddalore Vinyls Limited** has formulated a detailed Environment Management Plan (EMP) addressing all critical environmental components. The EMP outlines mitigation measures, monitoring strategies, and institutional responsibilities for managing air, water, noise, and solid/hazardous waste impacts.

To ensure effective implementation of the EMP, the company has committed a **capital cost of ₹12,110.2 lakhs** and a **recurring annual cost of ₹13,029.9 lakhs** for post-expansion environmental management measures.

Work zone monitoring shall be carried out for gaseous pollutants and dust. Records will be kept in standard Form as per Factories Rules. Location for sampling shall be identified. Quarterly and half yearly monitoring will be carried out during the operation phase. Capital Investment for the proposed Expansion: **INR 6500 Cr.**

12. DISCLOSURE OF CONSULTANTS ENGAGED

About Environmental Consultant

Perfact Enviro Solutions Pvt. Ltd, established by experienced environmental and related experts, provides specialised services in the field of Environment and Pollution Control for all types of Industrial, Construction, Nuclear Sciences, Biodiversity Mining, Aerial Ropeway and other related fields. Our transparent and professional approach, commitment to excellent quality and service, and timely deliveries have contributed to create a name in the field of environment. We have a core group of highly qualified experts from various fields like Environment, Forestry, Chemistry, Civil Engineering, Geology, Social Sciences, Electronics and Telecommunication with rich and diversified experience in the field of environment and pollution control. Perfact Enviro Solutions Pvt. Ltd management, experience, excellence, professionalism and ultimate satisfaction has helped in achieving the heights of success in their specialised field of environment.

ACCREDITATIONS OBTAINED

- ISO-9001:2015 Certification
- ISO-14001:2015 Certification
- QCI – NABET Scheme for Accreditation of EIA Consultant Organizations

Table 167. List of FAEs Involved (Category A)

S.No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
1	AP	Mr. Ramdas A. Wani	I had visited the site to assess the site conditions in the surrounding area. After assessing the Air pollution sources. Made Sampling plan & conducted monitoring; based on the results and the site specific details along with Project Specific Details obtained , I have prepared the Impact Mitigation measures Period of Involvement: Feb 2024 to Sep 2025.
2	AQ	Mr. Ramdas A. Wani	I had visited the site for the assessment of the sources and the emissions. After studying, I calculated the model input data related to the proposed emissions and micrometeorology interpretation of modeling results and development of EMP. Period of Involvement: Feb 2024 to Sep 2025.

S.No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
3	WP	Mr. Muthukumaran Ganpathi Narayanan	I had visited the site to assess the water sources and its water quality in the study area. After studying the Water pollution sources have prepared Sampling plan & collected samples; based on the results from the lab and the site specific details along with Project Specific Details obtained, I have prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.
4	RH	Mr. Ramdas A. Wani	I had visited the site to assess the site conditions in the surrounding area and identified hazards. After assessing the risk and hazard, I prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.
5.	SE	Dr. Rahul Deshmukh	I had visited the site to collect the baseline status of socio-economic conditions and studied Villages in study areas using Topographical maps and extracted Secondary data from Census of India. Then was involved in preparing a socio economic study report using the primary survey and secondary data which includes impact and mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.
6.	NV	Mr. Muthukumaran Ganpathi Narayanan	I had visited the site to assess the site conditions in the surrounding area. After assessing the Noise pollution sources have prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.
7.	SHW	Mr. Ramdas A. Wani	I had visited the site to assess the Solid waste sources and status in the study area. After studying the sources have prepared the Impact report and suggested Mitigation measures and development of EMP. Period of Involvement: Feb 2024 to Sep 2025.
8.	HG	Mr. Santosh Pant	The physical observation of the study area including Ground water sources and its water quality was made. After studying the Water pollution sources, the Impact report was prepared and Mitigation measures were suggested. Period of Involvement: Feb 2024 to Sep 2025.

S.No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
9.	GEO	Mr. Santosh Pant	I had visited the site to assess the geology of the study area. After studying I have prepared the Impact report and suggested mitigation measures Period of Involvement: Feb 2024 to Sep 2025.
10.	SC	Mrs. Rachna Dogra	I had visited the site to assess the site conditions in the surrounding area. After assessing the type of soil and need of Soil Conservation, Prepared the Impact Mitigation measures accordingly. Period of Involvement: Feb 2024 to Sep 2025.
11.	EB	Mrs. Tulika Rawat	I had visited the site to assess the various forest areas, Ecological and Biodiversity sources in the study area. After studying the various floral and faunal species, assisted FAE in preparing the Impact report and suggested Mitigation measures Period of Involvement: Feb 2024 to Sep 2025.
12.	LU	Mr. Santosh Pant	I was involved in preparing a Land Use map using Satellite Imagery, Google maps after primary survey. Period of Involvement: Feb 2024 to Sep 2025.

Table 168. List of Category-B FAEs Involved

S. No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
1	AP	Mrs. Deepika Arora	I had visited the site to assess the site conditions in the surrounding area. After assessing the Air pollution sources. Made Sampling plan & conducted monitoring; based on the results and the site specific details along with Project Specific Details obtained, I have prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.
2	AQ	Mrs. Shweta Rajput	I had visited the site for the assessment of the sources and the emissions. After studying, I calculated the model input data related to the proposed emissions and micrometeorology interpretation of modeling results and development of EMP. Period of Involvement: Feb 2024 to Sep 2025.

S. No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
3	WP	Mrs. Shweta Rajput	I had visited the site to assess the water sources and its water quality in the study area. After studying the Water pollution sources have prepared Sampling plan & collected samples; based on the results from the lab and the site specific details along with Project Specific Details obtained, I have prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.
4	RH	Mrs. Megha Solanki	I had visited the site to assess the site conditions in the surrounding area and identified hazards. After assessing the risk and hazard, I prepared the Impact Mitigation measures. Period of Involvement: Feb 2024 to Sep 2025.
5	HG	Mrs. Saloni Sharma	I have visited the site and assessed the hydrology of the area. After studying the hydrology and pollution sources the impact and mitigation have been identified. Period of Involvement: Feb 2024 to Sep 2025.

Table 169. List of FAA

S. No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
1.	WP	Ms. Sakshi Tripathi	I had visited the site to assess the water sources and its water quality in the study area. After studying the Water pollution sources have prepared Sampling plan & collected samples ; based on the results from the lab and the site specific details along with Project Specific Details obtained, I have prepared the Impact Mitigation measures. Period of Involvement: June 2025 to Sep 2025.
2.	SE	Mr. Pramod Kumar	I had visited the site to collect the baseline status of socio-economic conditions and studied Villages in study areas using Topographical maps and extracted Secondary data from Census of India. Then was involved in preparing a socio economic study report using the primary survey and secondary data which includes impact and mitigation measures. Period of Involvement: June 2025 to Sep 2025.
3.	SHW	Ms. Sakshi Tripathi	I had visited the site to assess the Solid waste sources and status in the study area. After studying the sources have prepared the Impact report and suggested Mitigation measures and development of EMP. Period of Involvement: June 2025 to Sep 2025.

Table 170. List of Team Members

S. No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
1.	AP	Mrs. Sadaf Akhtar	I had visited the site to assess the site conditions in the surrounding area. After assessing the Air pollution sources. Made Sampling plan & conducted monitoring; based on the results and the site specific details along with Project Specific Details obtained , I have prepared the Impact Mitigation measures Period of Involvement: June 2025 to Sep 2025.
2.	WP	Mrs. Sadaf Akhtar	I had visited the site to assess the water sources and its water quality in the study area. After studying the various WP sources, assisted FAE in preparing the impact report and suggested mitigation measures. Period of Involvement: June 2025 to Sep 2025.

S. No.	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
3.	EB	Mrs. Disha Patel	I had visited the site to assess the various forest areas, Ecological and Biodiversity sources in the study area. After studying the various floral and faunal species, assisted FAE in preparing the Impact report and suggested Mitigation measures Period of Involvement: Feb 2024 to Sep 2025.
4.	SHW	Ms. Sreeja Sreekanth	I had visited the site to assess the Solid waste sources and status in the study area. After studying the sources have prepared the Impact report and suggested Mitigation measures and development of EMP. Period of Involvement: Feb 2024 to Sep 2025.
5.	LU	Mr. Deepak Kumar	I was involved in preparing a Land Use map using Satellite Imagery, Google maps after primary survey. Period of Involvement: June 2025 to Sep 2025.
6.	SE	Mr. Manoj Kumar Joshi	I had visited the site to collect the baseline status of socio-economic conditions and studied Villages in study areas using Topographical maps and extracted Secondary data from Census of India. Then was involved in preparing a socio economic study report using the primary survey and secondary data which includes impact and mitigation measures. Period of Involvement: June 2025 to Sep 2025.

**EIA & EMP STUDY TO OBTAIN EC AND CRZ CLEARANCE FOR
UPGRADATION OF EXISTING MARINE TERMINAL FACILITIES
AND PROPOSED 20 MLD DESALINATION PLANT AT
CHITHIRAPETTAI, SEMMANKUPPAM AND THIYAGAVALLI
VILLAGES, CUDDALORE DISTRICT, TAMIL NADU**

PROJECT CODE: 867122324



For
Chemplast Cuddalore Vinyls Limited (CCVL)



JULY 2025



INDOMER COASTAL HYDRAULICS (P) LTD.

(ISO 9001: 2015 CERTIFIED, NABET- QCI & NABL ACCREDITED)

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	INDOMER COASTAL HYDRAULICS (P) LTD. (ISO 9001: 2015 CERTIFIED, QCI - NABET & NABL ACCREDITED) 63, Gandhi Road, Alwarthirunagar, Chennai 600 087. Tel: + 91 44 2486 2482 to 84; M: (+91) 96000 56652 / 99629 37397 Web site: www.indomer.com, E-mail: ocean@indomer.com				
Client	Chemplast Cuddalore Vinyls Limited (CCVL)				
Project Title	EIA & EMP study to obtain EC and CRZ clearance for upgradation of existing Marine Terminal Facilities and proposed 20 MLD desalination plant at Chithirapettai, Semmankuppam and Thiayagavalli villages, Cuddalore district, Tamil Nadu.				
Project Code	867122324				
Abstract	Chemplast Cuddalore Vinyls Limited (CCVL) is operating a Marine Terminal Facility in Cuddalore from 2009, it is being used for the import of feedstock for its PVC manufacturing facility. As part of its backward integration plans, CCVL aims to establish a Vinyl Chloride Monomer (VCM) production facility. To meet the increased import needs for this expansion, CCVL plans to undertake the construction of an approach trestle to connect the existing offshore jetty from the shore, laying new pipelines for ethylene and ethylene di chloride (EDC) in addition to VCM. These upgrades are essential for supporting the VCM project and improving the facility's operational efficiency. Environmental & CRZ Clearance of existing Chemplast Cuddalore Marine Terminal of M/s Chemplast Cuddalore Vinyls Limited was granted by MoEFCC on 19th December 2005 and CRZ clearance on 19th December 2005. In February 2023, CCVL approached to MOEFCC for the extension of validity vide Consent Order No. 2307147638958 dt. 28.02.2023 and the MOEFCC extended the validity of EC & CRZ clearance for CCVL up to 31st March 2027. As per EIA Notification 2006, the proposed development falls under Schedule 7(e) - Ports and Harbours - Ports, harbours, jetties, marine terminals, breakwaters and dredging, Category A and requires Environmental Clearance and CRZ clearance from TNCZMA and MoEFCC. Accordingly, Chemplast Cuddalore Vinyls Limited (CCVL) has obtained the ToR from MoEFCC, New Delhi vide proposal No. IA/TN/INFRA1/498995/2024 dt. 28.10.2024, for the preparation of the Environmental Impact Assessment report and Environmental Management Plan (EMP). EIA & EMP study have been taken up by Indomer Coastal Hydraulics (P) Ltd., Chennai, which is an ISO 9001:2015 organization and QCI - NABET accredited organization vide NABET/EIA/23-26/RA 0315 dt. 13.09.26 for the Sector 27: Oil & Gas Transportation pipeline (crude and refinery/ petrochemical products), passing through national parks/ sanctuaries/ coral reefs/ ecologically sensitive areas including LNG Terminal and Sector 33: Ports, harbours, jetties, marine terminals, breakwaters and dredging. It also has NABL accredited organization for laboratory testing.				
Foreword	The materials presented in the report carry the copyright of CCVL and Indomer. These data should not be altered or distorted or copied or presented in different manner by any other organizations without the written consent from CCVL and Indomer				
Document type	Controlled				
Date	Report Type	Originator	Checked by	Approved by	Approver's sign
08.02.2025	Draft - V 2	M. Parthiban	Mr. J. Guru prasad	Dr. P. Chandramohan	
1	Project Code	867122324		Text pages	358
2	File Location	F: / Projects/ 2024/ CCVL/867122324		Tables	61
				Figures	63

Declaration by Experts contributing to the EIA

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator

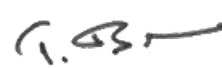
Name : Dr. P. Chandramohan

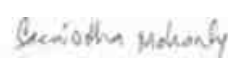
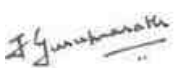
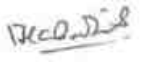
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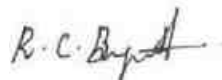
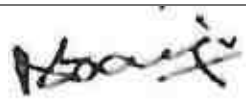
Period of involvement : February 2024 - Till date

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Functional Area Associates:

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2	EB	Dr. S. Sundaramoorthy	Field investigation, Ecology and Biodiversity assessment, Impact and Mitigation Measures (Feb - July 2024)	
3	EB	Dr. P. Venkadeswaran	Study on Ecology & Biodiversity, involved in the study on Mangroves and preparation of EIA report. (Feb - July 2024)	

Sl. No.	Functional Areas	Name of the Expert/s	Involvement (Task & period)	Signature & Date
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5	HG	Dr. P. Chandramohan	Hydrological pattern analysis of the project region (Feb - July 2024)	
6	GEO, LU	Dr. Terry Machado	Field investigations, geological classification of the project site (Feb - July 2024)	
7	NV, RH (Marine)	Mr. J. Guru Prasath	Selection of sampling location, Impact Assessment and Mitigation Measures, identification of potential risk and hazards (Feb - July 2024)	
8	WP, RH	Mr. V. Kesava Das	Field investigations, identification of sampling locations, sample analysis & report preparation (Feb - July 2024)	
9	AP	Mr. Santosh Gupta	Field investigations, assessment of air quality, fixing air quality sampling locations, Impact Assessment and Mitigation Measures (Feb - July 2024)	
10	SC	Dr. B. K. Patel	Field investigation, identification of soil sampling locations, soil analysis and report preparation	

Sl. No.	Functional Areas	Name of the Expert/s	Involvement (Task & period)	Signature & Date
			(Feb - July 2024)	
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12	NV	Mr. Vivek P. Navare	Field investigations, assessment of noise quality, fixing noise sampling locations and Impact Assessment & Mitigation Measures (Feb - July 2024)	
13	RH, HW	Mr. Anil L. Choumal	Field investigation, suggestion of hazardous waste management, its Impact & Mitigation Measures (Feb - July 2024)	
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Sl. No.	Functional Areas	Name of the Expert/s	Involvement (Task & period)
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Declaration by the Head of the Accredited Consultant Organization/authorized person

I, Mr. Dr. P. Chandramohan, hereby, confirm that the above-mentioned experts were involved in the preparation of this EIA report entitled “EIA & EMP study to obtain EC and CRZ clearance for upgradation of existing Marine Terminal Facilities and proposed 20 MLD desalination plant at Chithirapettai, Semmankuppam and Thiyagavalli villages, Cuddalore district, Tamil Nadu”. I also confirm that the consultant organization shall be fully accountable for any misleading information mentioned in this statement.

It is certified that no ethical plagiarism have been carried out and external data/ text has not been used without proper acknowledgement, while preparing this EIA report.

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Table of Contents

1. INTRODUCTION.....	14
1.1 PURPOSE OF THE REPORT.....	15
1.2 IDENTIFICATION OF THE PROJECT AND PROJECT PROPONENT.....	15
1.2.1 Identification of the Project.....	15
1.2.2 Identification of the Proponent.....	16
1.3 BRIEF DESCRIPTION OF THE PROJECT.....	16
1.3.1 Existing Facilities.....	16
1.3.1 Proposed Facilities.....	17
1.4 STATUS OF THE PROJECT SITE.....	18
1.4.1 Description of existing facilities.....	18
1.4.2 Description of proposed facilities.....	21
1.5 THE ASSIGNMENT & SCOPE OF THE STUDY.....	27
1.6 SCOPE OF EIA STUDY - DETAILS OF REGULATORY SCOPING CARRIED OUT...27	
1.6.1 Scoping.....	27
1.6.2 TOR Compliance.....	27
2. PROJECT DESCRIPTION.....	36
2.1 TYPE OF PROJECT.....	36
2.2 NEED OF THE PROPOSED PROJECT.....	36
2.3 PROJECT LOCATION.....	37
2.3.1 Major Infrastructure Near the Project.....	40
2.4 SIZE OR MAGNITUDE OF OPERATION.....	41
2.4.1 Plot Area Distribution.....	41
2.4.2 Project Cost.....	42
2.5 POWER.....	42
2.6 MANPOWER.....	42
2.7 NOISE MANAGEMENT.....	43
2.8 PLANTATION & GREEN BELT.....	44
2.9 RAINWATER HARVESTING.....	47
3. DESCRIPTION OF ENVIRONMENT.....	48
3.1. INTRODUCTION.....	48
3.2. BASE MAPS OF THE AREA.....	49
3.2.1 Google Image of the Project Site.....	49
3.2.2 Topographical Map.....	49
3.3 METHODOLOGY OF BASELINE DATA COLLECTION.....	50



3.4 METEOROLOGY.....	50
3.4.1 Temperature.....	50
3.4.2 Relative Humidity.....	51
3.4.3 Rainfall.....	52
3.4.4 Average pressure:.....	53
3.4.5 Cloud cover.....	54
3.5 AMBIENT AIR QUALITY.....	54
3.5.1 Sampling Station Selection.....	54
3.5.2 Ambient Air Sampling Locations.....	56
3.5.3 Sampling Procedure.....	57
3.5.4 Analytical methods followed for Ambient Air Quality Monitoring.....	59
3.5.5 Ambient Air Quality Results.....	59
3.5.5.1 Feb 2024 to May 2024:.....	59
3.5.5.2 Data Interpretation.....	61
3.6 NOISE LEVEL.....	63
3.6.1 Methodology.....	63
3.6.2 Ambient Noise Sampling Station.....	63
3.6.2.1 Results and Discussion.....	65
3.8 WATER QUALITY.....	67
3.8.1 Sampling Station.....	67
3.8.1.2 Ground Water Quality Results.....	71
3.8.1.3 Ground Water Quality Result Interpretation.....	72
3.8.1.4. Surface Water Quality Results.....	72
3.8.1.5. Data Interpretation.....	73
3.9 LAND ENVIRONMENT.....	74
3.9.1 Land Use/Land Cover.....	74
3.9.1.1 Relief.....	78
3.9.1.2 Slope.....	79
3.9.1.3 Drainages.....	79
3.10 SOIL QUALITY.....	82
3.10.1 Soil.....	82
3.10.2 Sampling Location.....	83
3.10.3. Soil Result.....	84
3.11 Biological Environment.....	85
3.11.1 Flora.....	87
3.11.2 Fauna.....	94



3.11.3 Inference.....	96
3.11.4 Marine environment.....	97
3.11.2.1 Physical parameters.....	98
3.11.2.2 Seawater Quality.....	111
3.11.2.3 Seabed Sediment Quality.....	120
3.11.2.4 Environmental status - comparison with secondary data.....	122
3.11.2.5 Marine Ecology and Biodiversity.....	125
3.11.2.5.1 Plankton.....	126
3.11.2.5.2 Zooplankton.....	134
3.11.2.5.3 Benthos.....	140
3.11.2.5.4 Microbiology.....	146
3.11.2.5.5 Coastal vegetation.....	147
3.11.2.5.6 Seagrasses and Seaweeds.....	153
3.11.2.5.7 Mangroves.....	153
3.11.2.5.8 Marine Mammals.....	156
3.11.2.5.9 Marine Protected Areas.....	157
3.11.2.5.10 Turtle.....	158
3.11.2.5.11 Fisheries.....	161
3.11.2.5.12 Ecologically Sensitive Area.....	172
3.12 SOCIO-ECONOMIC ENVIRONMENT.....	173
3.12.1 District profile study area.....	173
3.12.2 Study Area.....	174
3.12.3 Administrative details.....	175
3.12.4 Demographic Structure.....	175
3.12.5 Social categories.....	176
3.12.6 Literacy profile.....	176
3.12.7 Economic Activity & Livelihood Pattern.....	177
4. ANTICIPATED IMPACTS AND MITIGATION MEASURES.....	188
4.1 IDENTIFICATION OF IMPACTS.....	188
4.2 DEVELOPMENT OF THE MARINE TERMINAL FACILITIES.....	192
4.2.1 Legislative Compliance.....	192
4.2.2 Adoption of environment friendly methods.....	193
4.2.3 Continuous environment monitoring through EMP.....	194
4.3 IMPACTS AND MITIGATION MEASURES FOR TERRESTRIAL ENVIRONMENT.....	195
4.3.1 Air environment.....	195
4.3.2 Noise environment.....	198
4.3.3 Water Environment.....	199



4.3.4 Land and soil environment.....	201
4.3.5 Impact on Socio Economic Environment.....	201
4.4 MARINE ENVIRONMENT IMPACT MITIGATION.....	203
4.4.1 Impact due to construction of approach trestle.....	203
4.4.2 Impact due to construction of crossover bridge in Uppanar river creek.....	208
4.4.3 Impact due to construction of mooring dolphins and associated facilities.....	208
4.4.4 Impact due to expansion of existing facilities.....	209
4.4.5 Impact due to laying of intake and outfall pipelines in sea and land.....	210
4.4.6 Impact due to discharge of brine reject.....	212
4.4.7 Impact due to Vinyl Chloride Monomer, Ethylene & Ethylene dichloride pipelines.....	215
4.4.8 Impact due to dredging and disposal of dredged material.....	216
4.4.9 Impact on shoreline.....	218
4.4.10 Impact on Ecologically Sensitive Areas.....	219
4.4.11 Summary of Impacts and Mitigation.....	222
5. ANALYSIS OF ALTERNATIVES.....	223
6. ENVIRONMENTAL MONITORING PROGRAM.....	224
6.1. DETAILS OF MONITORING.....	227
6.2 Review and Reporting.....	228
7. ADDITIONAL STUDIES.....	229
7.1 INTRODUCTION.....	229
7.2 HYDRODYNAMIC MODELLING.....	229
7.2.1 Model setup.....	229
7.2.2 Nested grid system.....	230
7.2.3 Depth schematization.....	230
7.2.4 Model description.....	231
7.2.5 Boundary conditions.....	232
7.2.6 Calibration and Validation.....	233
7.2.7 Simulations.....	233
7.2.8 Results.....	233
7.3 SEDIMENT TRANSPORT MODEL - MIKE 21 ST.....	236
7.3.1 Model description.....	237
7.3.2 Model input.....	238
7.3.3 Model simulations.....	239
7.3.4 Results.....	239
7.4 LITTORAL DRIFT.....	240
7.4.1 Model description.....	240
7.4.2 Model input.....	241



7.4.3 Results.....	241
7.5 SHORELINE CHANGE STUDY.....	242
7.5.1 Introduction.....	242
7.5.2 Methodology.....	243
7.5.3 Data collection.....	243
7.5.4 Data processing.....	244
7.5.6 Shoreline delineation.....	244
7.5.7 DSAS processing.....	244
7.5.8 Results and discussion.....	245
7.5.9 Shoreline prediction (2034 and 2044).....	247
7.5.10 Inference.....	247
7.6 STORM SURGE.....	247
7.6.1 Estimation of storm surge.....	248
7.6.2 Storm surge due to Thane cyclone.....	249
8. PROJECT BENEFITS.....	273
8.1 ENVIRONMENT BENEFIT.....	273
8.2 Employment opportunities.....	273
8.3 Corporate Social Responsibility (CSR).....	274
8.3.1 Existing CSR Activities.....	274
9. ENVIRONMENTAL COST BENEFIT ANALYSIS.....	276
10. ENVIRONMENT MANAGEMENT PLAN.....	277
10.1 INTRODUCTION.....	277
10.2 PROJECT DETAILS.....	278
Details of project are given below:-.....	278
10.3 ORGANIZATIONAL ROLE AND RESPONSIBILITY.....	278
10.3.1 Occupational health and safety.....	278
10.3.2 International Ship and Port Facility Security Code (ISPS Code).....	280
10.3.3 Green Port Guidelines.....	280
10.3.4 Corporate Environmental Policy.....	283
10.3.5 Environment Management Cell.....	283
10.3.6 Implementation of EMP.....	284
10.3.7 Training, communication, and reporting.....	286
10.4 ENVIRONMENT MANAGEMENT PLAN.....	286
10.4.1 Air Emission.....	286
10.4.1.1 Fugitive dust emissions.....	286
10.4.1.2 Vehicular emission and Construction machinery.....	286
10.4.1.3 Diesel generator.....	287



10.4.2 Water & Wastewater management plan- Construction Phase.....	287
10.4.2.1 Water Demand.....	287
10.4.2.2 Storm Water Drainage System.....	287
10.4.2.3 Sewage management.....	288
10.4.2.4 Rainwater Harvesting.....	288
10.4.3 Wastes management plan.....	288
10.4.4 Noise quality management plan.....	289
10.4.5 Dredge spoil management plan.....	290
10.4.6 Environment Management Plan during Operation Phase.....	290
10.4.7 EMP IMPLEMENTATION BUDGET.....	292
11. SUMMARY & CONCLUSION.....	293
11.1 PROJECT DESCRIPTION.....	294
11.2 DESCRIPTION OF THE ENVIRONMENT.....	296
11.3 ANTICIPATED ENVIRONMENTAL IMPACT AND MITIGATION MEASURES..	301
11.4 ENVIRONMENTAL MONITORING PROGRAMME.....	302
11.5 ADDITIONAL STUDIES.....	302
11.6 PROJECT BENEFITS.....	303
11.7 ENVIRONMENT MANAGEMENT PLAN.....	303
11.8 CONCLUSION.....	304
12. DISCLOSURE OF CONSULTANTS ENGAGED.....	304

List Of Tables

- [Table 1. Identification of the Project](#)
- [Table 2. Details of Directors](#)
- [Table 3. Details of Existing facilities](#)
- [Table 4. Details of Proposed facilities](#)
- [Table 5. Details of Dredging](#)
- [Table 6. Dredging Requirement](#)
- [Table 7. CTE/CTO Chronology](#)
- [Table 8. TOR Compliance](#)
- [Table 9. TOR Compliance](#)
- [Table 10. Project Site Specific Connectivity Details](#)
- [Table 11. Project Details](#)
- [Table 12. Details of cargo handling \(existing and after expansion\)](#)
- [Table 13. Land Details](#)
- [Table 14. Project Cost](#)



- Table 15. Details of Power Requirement
- Table 16. Manpower Details (During Construction)
- Table 17. Recommended plants
- Table 18. Sampling Locations
- Table 19. Temperature
- Table 20. Relative Humidity
- Table 21. Rainfall
- Table 22. Average Pressure
- Table 23. Ambient Air Sampling Locations
- Table 24. National Ambient Air Quality Standards (NAAQS)
- Table 25. Ambient Air Quality Results (PM10 , PM2.5 & SO2)
- Table 26. Ambient Air Quality Results (NO2, O3 & Ammonia)
- Table 27. Ambient Air Quality Results (CO, Lead, Arsenic, Nickel & Benzene)
- Table 28. Locations of noise level monitoring
- Table 29. Ambient Noise Quality Standards
- Table 30. Noise quality
- Table 31. Location of ground water sampling stations
- Table 32. Location of surface water sampling stations
- Table 33. Results of Groundwater
- Table 34. Results of surface water
- Table 35. Land areal spread of LU/LC
- Table 36. Soil Sampling Location
- Table 37. Soil quality - Soil Texture
- Table 38. Soil quality results
- Table 39. List of flora presented in the study area
- Table 40. List of Terrestrial birds observed during the study
- Table 41. Monthwise predominant wind characteristics
- Table 42. Monthwise predominant wave characteristics
- Table 43. Design tide level
- Table 44. Monthly and annual longshore transport
- Table 45. Monthly and annual longshore transport
- Table 46. Number of cyclones crossed within 100 km radius (1924 – 2023)
- Table 47. Classification based on magnitude of earthquake
- Table 48. History of Tsunamis along the coastal regions bordering the Indian Ocean
- Table 49. Location of seawater and biological sampling stations
- Table 50. Seawater quality



- [Table 51. Seawater quality - Part I \(Nutrients\)](#)
- [Table 52. Seawater quality - Part II \(Trace Metals\)](#)
- [Table 53. Seabed sediment quality Texture](#)
- [Table 54. Seabed sediment quality - Part I](#)
- [Table 55. Seabed sediment quality - Part II - Heavy Metals](#)
- [Table 56. Water quality - comparison with secondary data](#)
- [Table 57. Sediment quality - comparison with secondary data](#)
- [Table 58. Primary productivity](#)
- [Table 59. Phytoplankton species-wise composition*](#)
- [Table 60. Numerical abundance of Phytoplankton* \(cells/l\)](#)
- [Table 61. Diversity indices of phytoplankton](#)
- [Table 62. Similarity Index of Phytoplankton](#)
- [Table 63. Numerical abundance of Zooplankton \(Nos./100m3\)](#)
- [Table 64. Diversity indices of Zooplankton](#)
- [Table 65. Similarity Index of Zooplankton](#)
- [Table 66. Sub-tidal and Intertidal benthic population \(Nos./m2\)](#)
- [Table 67. Diversity indices ruciateushic organisms](#)
- [Table 68. Similarity Index of macrobenthic organisms in subtidal and intertidal areas](#)
- [Table 69. Shannon -Weiner diversity index](#)
- [Table 70. Bacterial population \(x103 CFU/ml\) in seawater](#)
- [Table 71. Bacterial population \(x104 CFU/g\) in seabed sediment](#)
- [Table 72. List of sand dune and associated flora](#)
- [Table 73. List of mangroves and mangrove associates study area](#)
- [Table 74. Marine mammals of India and CITES status](#)
- [Table 75. Protected areas in Tamil Nadu coast](#)
- [Table 76. Village-wise profile Of fisheries in 5 km radius of project location](#)
- [Table 77. Details of experimental bottom trawl survey](#)
- [Table 78. Classification of experimental bottom trawl fishes](#)
- [Table 79. Demographic details of Cuddalore District](#)
- [Table 80. villages from proposed project](#)
- [Table 81. Demographic profile in the study area](#)
- [Table 82. SC and ST population](#)
- [Table 83. Literacy profile](#)
- [Table 84. Occupational profile of revenue village in the study area](#)
- [Table 85. Fisheries Family](#)
- [Table 86. Fishermen fishing Activities](#)



- Table 87. Medical facilities
- Table 88. Education facilities
- Table 89. Infrastructure facilities
- Table 90. Impacts of marine terminal facilities
- Table 91. Potential Terrestrial Impact & Measures During Construction Phase
- Table 92. Environmental impact matrix for construction and operational phases
- Table 93. Potential Marine Impact & Measures During Construction Phase
- Table 94. Potential Terrestrial Impact & Measures During Operation Phase
- Table 95. Potential Marine Impact & Measures During Operation Phase
- Table 96. Environmental impact matrix
- Table 97. Environmental monitoring matrix
- Table 98. Monthly and annual longshore transport
- Table 99. Data Used
- Table 100. Shoreline classification schemes used in the analysis
- Table 101. Shoreline Change (1972 -2023) – Statistics
- Table 102. Shoreline change statistics – 4 sectors (2000 - 2024)
- Table 103. Details of likely employment opportunities
- Table 104. Details of the Project
- Table 105. Appropriate time to implement EMP
- Table 106. Details of Hazardous waste
- Table 107. Environment Management Plan During Operational Phase
- Table 108. Capital Expenditure
- Table 109. Recurring Expenditure
- Table 110. List of Functional Area Experts
- Table 111. List of Functional Area Associate
- Table 112. List of Team Members

List Of Images

- Figure 1. Existing Port Facilities
- Figure 2. Details of existing facilities
- Figure 3. Details of proposed facilities
- Figure 4. Master plan (Existing and Proposed facilities)
- Figure 5. Layout of dredging area and dredge disposal point
- Figure 6. Location map of project region
- Figure 7. Location map of CCVL MTF



- Figure 8. CRZ Map
- Figure 9. Outline of Baseline data
- Figure 10. Survey of India Toposheet (1:50,000 scale)
- Figure 11. Meteorological parameters
- Figure 12. Temperature
- Figure 13. Relative Humidity
- Figure 14. Rainfall
- Figure 15. Average Pressure
- Figure 16. Sampling Air Location
- Figure 17. Locations of air quality monitoring
- Figure 18. Air Sampling Stations
- Figure 19. Sampling Procedure
- Figure 20. Ambient Air Quality Results PM10, PM2.5...
- Figure 21. Ambient Air Quality Results NO2, Ozone & Ammonia
- Figure 22. Locations of noise level monitoring
- Figure 23. Locations of Noise
- Figure 24. Results of Noise Locations
- Figure 25. Locations of ground water sampling
- Figure 26. Ground water Locations
- Figure 27. Locations of surface water sampling
- Figure 28. Surface water sampling Locations
- Figure 29. Methodology for the preparation of LULC map
- Figure 30. Survey of India Toposheet (1:50,000 scale)
- Figure 31. Land use land cover map
- Figure 32. Spatial distribution of LU/LC at 10 km radius from the proposed Project location
- Figure 33. Nearby Area Photographs
- Figure 34. Relief map
- Figure 35. Slope map
- Figure 36. Drainage Network
- Figure 37. Water bodies map
- Figure 38. Location of soil sampling
- Figure 39. Soil Sampling Location
- Figure 40. Green Photographs
- Figure 41. Common flora observed in study area
- Figure 42. Century years old Banyan tree
- Figure 43. Common birds observed in study area



- Figure 44. Variation of measured tide
- Figure 45. Variation of measured current speed and current direction
- Figure 46. Tracks of Cyclones and Depressions, 19-4 - 2023 (100 km project radius)
- Figure 47. Movement of tectonic plates
- Figure 48. Bathymetry map of open sea
- Figure 49. Bathymetry map of Uppanar river creek
- Figure 50. Seawater sample collection
- Figure 51. Locations of seawater, seabed sediments sampling collection
- Figure 52. Seabed sediment sample collection
- Figure 53. Plankton sample collection
- Figure 54. Dominance plot of phytoplankton
- Figure 55. Common phytoplankton
- Figure 56. Dominance plot of Zooplankton
- Figure 57. Common zooplankton species
- Figure 58. Subtidal and Intertidal benthos sample collection
- Figure 59. Dominance plot of macrobenthic organisms
- Figure 60. Common benthic organisms
- Figure 61. Plantation by forest department for sand dune stabilization
- Figure 62. Northern side sand dunes from proposed facilities
- Figure 63. Distance of sand dunes from proposed project location
- Figure 64. Sand Dune Flora
- Figure 65. Distance of mangroves from proposed facilities as per CRZ and latest google earth image
- Figure 66. Common mangrove plants in the study area
- Figure 67. Major species / groups with their contribution (lakh tonnes) in 2021 & 2022
- Figure 68. Marine fish landing in state Tamil Nadu (CMFRI, 2023)
- Figure 69. Locations of fishing villages near project area
- Figure 70. Group-wise marine fish production in Cuddalore district
- Figure 71. Fish Trawling Operations
- Figure 72. Species composition of total caught fish.
- Figure 73. Economically important finfishes and shellfishes caught during experimental trawl
- Figure 74. Ecological sensitive area map
- Figure 75. Location of fishing villages
- Figure 76. Socio Economic Study



- [Figure 77. Coarser Domain](#)
- [Figure 78. Finer Domain without Dredging Channel](#)
- [Figure 79. Comparison of Predicted and Simulated Tides](#)
- [Figure 80. Flow Field- Fair Weather- Spring Tide-...](#)
- [Figure 81. Flow Field- Fair Weather- Neap Tide-...](#)
- [Figure 82. Flow Field- SW Monsoon- Spring Tide-...](#)
- [Figure 83. Flow Field- SW Monsoon- Neap Tide-...](#)
- [Figure 84. Flow Field- NE Monsoon- Spring Tide-...](#)
- [Figure 85. Flow Field- NE Monsoon- Neap Tide-...](#)
- [Figure 86. Variation of Simulated Tides & Currents- 1km offshore...](#)
- [Figure 87. Variation of Simulated Tides & Currents- 1km offshore...](#)
- [Figure 88. Flow Field- Fair Weather- Spring Tide-...](#)
- [Figure 89. Flow Field- Fair Weather- Neap Tide-...](#)
- [Figure 90. Flow Field- SW Monsoon- Spring Tide-...](#)
- [Figure 91. Flow Field- SW Monsoon- Neap Tide-...](#)
- [Figure 92. Flow Field- NE Monsoon- Spring Tide-...](#)
- [Figure 93. Flow Field- NE Monsoon- Neap Tide-...](#)
- [Figure 94. Variation of Simulated Tides and Currents - 1 km...](#)
- [Figure 95. Variation of Simulated Tides and Currents - 1 km...](#)
- [Figure 96. Variation of Simulated Tides and Currents - 1 km...](#)
- [Figure 97. Bed level changes in one month -Fair Weather...](#)
- [Figure 98. Bed level changes in one month -SW Monsoon...](#)
- [Figure 99. Bed level changes in one month -NE Monsoon...](#)
- [Figure 100. Bed level changes in one month -Fair Weather...](#)
- [Figure 101. Bed level changes in one month - SW Monsoon...](#)
- [Figure 102. Bed level changes in one month - NE Monsoon...](#)
- [Figure 103. Methodology](#)
- [Figure 104. Shoreline Change \(1972 - 2023\)](#)
- [Figure 105. Box Plot Diagram for Shoreline Change \(2000-...](#)
- [Figure. 106. Predicted Shoreline for 2034 and 2044](#)
- [Figure. 107. Bathymetry - Storm Surge Model - Path of...](#)
- [Figure 108. Wind Field during Thane 2011 Cyclone](#)
- [Figure. 109. Maximum Storm surge Contours during Thane 2011 Cyclone](#)
- [Figure 110. EMP Implementation flow diagram](#)





1. INTRODUCTION

Chemplast Cuddalore Vinyls Limited (CCVL) is a major player in India's chemical industry, specializing in the production of polyvinyl chloride (PVC) resins located in Cuddalore district, Tamil Nadu. CCVL is a subsidiary of Chemplast Sanmar Limited, which is a part of Sanmar Group, a prominent business conglomerate in India with interests in chemicals, engineering and shipping. Established to cater to the growing demand for PVC; CCVL produces high-quality suspension-grade PVC resins, which are widely used in various sectors like construction, agriculture, and consumer goods. The company's PVC products are essential for making pipes, profiles, wires, cables, and other materials due to their durability and versatility which places a strong emphasis on sustainable manufacturing practices, including effective wastewater management, pollution control, and compliance with environmental standards. Over the years, CCVL has maintained a solid reputation for quality, consistency, and commitment to safety, making it a preferred supplier for PVC resins in the domestic market.

CCVL had set up Marine Terminal Facilities (MTF) to support the PVC manufacturing facility near Cuddalore in the SIPCOT Industrial Estate, Phase II complex. In September 2009, CCVL started to operate a PVC plant at Cuddalore. The MTF are located at Latitude 11° 38' 20" N and Longitude 79° 45' 49" E and near the southern limit of Cuddalore Minor Port within the limits of Cuddalore Minor Port, approved by Tamil Nadu Maritime Board.

At present CCVL is operating a MTF at Chithirapettai village, Cuddalore for importing Vinyl Chloride Monomer (VCM) which is the feed stock for the above-mentioned PVC manufacturing unit. MTF is constructed 1.0 km offshore within the port limits of Cuddalore minor port.

The Ministry granted the Environmental & CRZ Clearance to the CCVL for setting up Marine Terminal Thiyagavalli village, Cuddalore Taluk, Cuddalore District vide Letter No. CUD/ENV/400/004 dt. 19. 12. 2005.

CCLV has obtained Consent to Operate vide Consent Order No. 2307147638958 dt. 28.02.2023, and the ministry extended the validity of Environmental & CRZ clearance for CCVL up to 31st March 2027.

Chronology of the various clearances obtained is shown below.

EC and CRZ clearance were granted for construction of MTF on 19th December 2005 by MoEFCC.

Transfer of EC from Chemplast Sanmar Limited to Chemplast Cuddalore Vinyls Limited Vide Order No. F. No. 11-63/2005-IA-III dt. 09.08.2024.

As per EIA Notification 2006, the proposed development falls under Schedule 7 (e) - Ports and Harbours - Ports, harbours, jetties, marine terminals, breakwaters and dredging, Category A and requires CRZ clearance and Environmental Clearance from TNCZMA and MoEFCC.



Baseline data collection has been done during the period February 2024 to May 2024. This report presents the EIA and EMP studies carried out for the upgradation of Marine Terminal Facilities.

1.1 PURPOSE OF THE REPORT

As per Environment Impact Assessment Notification dated 14th September 2006, new projects or activities, or the expansion or modernization of existing projects proposed in any part of India shall obtain prior environmental clearance from the Ministry of Environment Forests and Climate Change (MoEF&CC).

As per CRZ Notification, 2011, setting up of any industry, operations or processes and manufacture or handling within CRZ limit requires prior CRZ clearance from Tamil Nadu Coastal Zone Management Authority (TNCZMA).

Further on the proposed port expansion falls under Schedule 7(e) – Ports and Harbours - Category A, it needs both EC and CRZ clearance from MoEFCC INFRA - I committee and Tamil Nadu Coastal Zone Management Authority (TNCZMA).

Accordingly, CCVL has obtained the ToR from MoEF & CC, through the 377th meeting held on 16th and 17th October 2024 after detailed deliberation of the proposed project by the project proponent with MoEF & CC meeting. The EAC has issued the ToR vide proposal No. **IA/TN/INFRA1/498995/2024** with file No. **1-63/2005-IA-III (Pt.)** dt: 26.10.2024 for the preparation of the EIA report and EMP. The details on compliance ToR are given in Chapter 1 - Section 1.6. The ToR letter is attached in Annexure I.

This EIA report has been prepared covering all aspects as required under the provisions of EIA Notification, 2006.

This report also includes the information from other parallel studies.

DPR for “Upgradation of Marine Terminal Facilities for Chemplast Cuddalore Vinyls Ltd. at Cuddalore” by IITM. - Annexure II

“Preparation of CRZ Map for upgradation of existing Marine Terminal Facility with proposed hydrocarbon transfer pipelines, crossover bridge along Uppanar river, sea water intake & outfall facilities and 20 MLD desalination plant at Chithirapettai, Semmankuppam villages, Cuddalore district by Superimposing on Approved CZMP as per CRZ Notification 2011” by IRS of Anna University Chennai - Annexure III

1.2 IDENTIFICATION OF THE PROJECT AND PROJECT PROPONENT

1.2.1 Identification of the Project



Table 1. Identification of the Project

Particulars	Details	Relevance to EIA Notification 2006
Project Name	EIA & EMP study to obtain EC and CRZ clearance for Upgradation Of Existing Marine Terminal Facilities And Proposed 20 Mld Desalination Plant	Expansion Project
Industry	The project falls under Ports and Harbours	Activity: 7(e) & Category: A

CCVL had set up Marine Terminal Facilities to support PVC manufacturing facilities. The Island jetty is located at 1 km from the shore and the approach to the jetty at present is only by boat from Cuddalore minor port. Hence, to improve safety in case of emergency and approach to the Jetty for normal operation and to satisfy the water requirement of the CCVL, it intends to upgrade the existing facilities.

Now, CCVL is planning to construct additional facilities to increase the capacity. The details of proposed facilities are given in chapter 2.

1.2.2 Identification of the Proponent

Project Proponent : M/s. Chemplast Cuddalore Vinyls Limited (CCVL)

Details of Directors are given in Table 2.

Table 2. Details of Directors

S. No.	Name of Directors	Designation
1	Dr. P. Chandramohan	Managing Director

1.3 BRIEF DESCRIPTION OF THE PROJECT

1.3.1 Existing Facilities



Table 3. Details of Existing facilities

Existing Facilities		
In sea	On land	In Uppanar River
- Island jetty capable of berthing ships upto 20000 DWT. 2 nos. breasting Dolphins (14 m x 14 m) 4 nos. mooring dolphins (10 m x 10 m) - Unloading platform (20 m x 10 m) with marine loading arm for VCM - Substation cum control building (20 m x 9 m) - Walkway Bridge connecting mooring and breasting dolphins (200 m x 1.2 m) 2 nos. subsea VCM pipelines passing 1060 m in sea and 2430 m in land. - Seawater intake system with pipeline having 400 m in sub-sea and 2430 m in land. - Brine rejects the outfall system with the pipeline having 800 m in sub-sea and 2430 m in land.	2 nos. x VCM pipelines along with intake and brine reject pipelines in RCC trench having 2430 m from LFP to plant.	2 nos. x VCM pipelines running beneath the Uppanar riverbed, along with desalination intake and brine reject pipelines, approximately 384 m across the river.

Status of activities from existing clearance

Chronology of the various clearances obtained is shown below.

- EC and CRZ clearance were granted for construction of MTF on 19th December 2005 by MoEFCC.
- Consent to Operate renewal from TNPCB obtained on 28.02.2023 and valid till 31st March 2027.
- Transfer of EC from Chemplast Sanmar Limited to Chemplast Cuddalore Vinyls Limited Vide Order No. F. No. 11-63/2005-IA-III dt. 09.08.2024.

1.3.1 Proposed Facilities



Table 4. Details of Proposed facilities

Proposed Facilities		
In sea	On land	In Uppanar River
• New approach trestle from jetty to land fall point (1060 m x 12 m) • Upgradation of existing breasting dolphins (22 m x 18 m) - 2 nos. • Upgradation of existing mooring dolphins - 4 nos. • Additional mooring dolphins (10 m x 10 m) - 2 nos. • Two additional loading arms • Proposed walkway bridge • New firewater pump house cum substation (65 m x 21 m) • New tug berth (27 m x 5 m) • Capital dredging - $2.6 \times 10^6 \text{ m}^3$ • Pipelines for transporting chemicals, fire water and desalinated water from MTF to existing and proposed plant (1060 m in sea over approach trestle and 3430 m on land) EDC Pipeline (20" dia.) VCM Pipeline (16" dia.) VCM coolant (4" dia.) Ethylene (16" dia.) Ethylene Coolant pipeline (6" dia.) Fire water pipeline (24" dia.) Desalinated water pipeline (4" dia.) • Seawater intake pipeline (1200 m in land and 800 m in sea laid over the approach trestle) • Brine rejects outfall pipeline diffuser (1200 m) in land 800 m in sea laid over the approach trestle. • Construction of temporary material load out the jetty for a length of 400 m from LFP.	• Desalination plant of 20 MLD capacity • Pipelines for transporting feedstock from MTF to proposed VCM plant extending ~3430 m (LFP to plant) • Seawater intake and brine reject pipeline from LFP to desalination plant. • 2 nos. x 12" pipeline for supplying desalinated water extending 1900 m (Desalination plant to Main plant)	• Crossover bridge across Uppanar river carrying Pipelines for transporting chemicals and 2 nos. x 12" pipeline for supplying desalinated water (Desalination plant to Main plant) - 384 m • Power, communication cables, overhead transmission lines etc.

1.4 STATUS OF THE PROJECT SITE

1.4.1 Description of existing facilities

Island Jetty

The existing MTF is located at approximately 1060 m from landfall point. The existing jetty berthing line was approximately orientated along the south-east direction. The existing seawater intake and the outfall is located approximately 400 m and 800 m from the shoreline respectively. A substation cum control room is located behind the jetty with boat landing steps and the link between jetty and



the substation building is provided through a steel walkway. At present the approach to the jetty is by boat only from Cuddalore port.

Breasting Dolphins

The existing 2 nos. of breasting dolphins are 14 m x 14 m and supported on 16 number of bored cast-in-situ RC piles of 1300 mm diameter. The top elevation of the breasting dolphin deck is EL (+) 6.50 m. An elevated access deck at elevation (+) 9.0 m provided to support the walkway bridge and to provide access. The capacity of mooring hooks, 2 x 75 tonnes, is provided for mooring vessels.

Mooring Dolphins

The existing 4 nos. of mooring dolphins are 10 m x 10 m and supported on 9 number of bored cast-in-situ RC piles of 1300 mm diameter. The top elevation of the mooring dolphin deck is EL (+) 6.50 m. An elevated access deck at elevation (+) 9.0 m provided to support the walkway bridge and to provide access. The capacity of mooring hooks, 2 x 75 tonnes, is provided for mooring vessels.

Unloading Platform

The size of the existing unloading platform is 20 m x 10 m supported on 12 nos. of bored cast-in-situ RC piles of diameter 1300 mm. The unloading platform consists of RCC beams and slabs. The deck level of the platform is EL (+) 9.00 m. The unloading platform supports the following equipment /facilities.

- 10" Two marine loading arm foundation (One Present and One future)
- 18" Header pipe (Pipe in Pipe)
- 10" Pig launcher
- 10" Control valves (2 Nos.)
- 18" Riser (Pipe in Pipe)
- 3.85 m x 2.35 m Operator Room (elevated by 1.5 m above deck level)
- Sump Tank (5 m³ capacity) below the deck

Substation cum control building

The platform size is 20 m x 9 m supported on 16 numbers of bored cast-in-situ RC piles of diameter 1200 mm. The substation building was located about 50 m away from the unloading platform. The pump platform consists of concrete decks on a piled structure. The deck level of the platform is at EL (+) 9.0 m to support the facilities. The building is a two-storey structure accommodating a sub-station, toilet on the first floor and the viewing room on the second floor.



Walkway Bridge.

The service platform, breasting and mooring dolphins are connected by a 200 m length and 1.2 m wide walkway made of tubular members. Sliding and pinned supports were provided at the end of each walkway bridge to accommodate the lateral deflection of various structures.

Submarine VMC pipelines and cable

The power supply to the MTF is provided through submarine cable from an onshore substation. The fire water is routed through a HDPE pipeline. The diameter of the HDPE pipeline is 315 mm and the VCM transporting from jetty to plant through a pipeline. The diameter of the VCM pipeline is 406 mm and the diameter of the corresponding precooling line is 200 mm. It is also connected to plants from the jetty.

Seawater intake and outfall system

The offshore seawater intake well is in the sea about 800 m from the high-water line. The seawater requirement for the desalination system is taken from the intake well. Two seawater pumps of capacity 400 Cum/h. with a head of 30 m are installed at the intake well. The material for construction of the pump is Duplex steel. The seawater from the intake well is pumped to the PVC plant via the onshore pipeline of 355 mm OD HDPE PE10 PN100 and the rejected water from the desalination plant is pumped back to the sea through a pipeline of 280 mm OD HDPE PE8 PN 100.

The diameter of the existing sea water intake pipeline is 500 mm, and the diameter of the sea water reject pipeline is 280 mm. The existing sea water intake pipeline is of diameter 500 mm from intake location to the landfall point and the sea water reject pipeline is of the diameter 280 mm laid from landfall point to the existing outfall point.



Figure 1. Existing Port Facilities

1.4.2 Description of proposed facilities

The details of proposed facilities are shown in Fig. 2. The master (plan existing and proposed facilities) is given in Fig. 3.

Proposed Approach trestle to the Jetty

The approach trestle is designed to provide access roadway and to support pipelines for various cargo and fire water from unloading platform to landfall. The firewater pipelines are also laid over the approach trestle from the proposed pumphouse to the jetty. The dimensions of the proposed Approach trestle are 1060 m in length and 12 m wide. The piles are spaced at 6.0 m in transverse direction and 15 m in longitudinal direction. The diameter of Approach trestle is bored cast in-situ piles 1200 mm. The deck slab of 400 mm is provided at approach trestle which is partly precast and in-situ. The deck level is kept at +9.00 m in CD. The roadway of 5 m is provided along the approach trestle from the land to the jetty and in Zone IV at the location of the pumphouse cum substation a road width of 11.9 m is provided for parking and vehicle crossing. The road is designed for the movement of light vehicles for jetty inspection and movement of light cranes to jetty for repairs works.

Pipeline Arrangement on the Proposed Trestle

- A 5 m wide access road to the jetty and is designed for 10 T tyre mounted mobile cranes for operational purposes such as maintenance and repair to the jetty facilities and pipelines.
- Supports for 32-inch diameter seawater intake and brine reject pipelines from land to the pumphouse.
- Supports 20-inch diameter EDC, 16-inch diameter VCM, 4-inch diameter VCM coolant, 16-inch diameter ethylene, and 6-inch diameter coolant pipelines.
- Supports 24-inch diameter fire water pipelines and 4-inch diameter potable water pipelines.
- Cable trays of 500 mm width and its supports.
- Light poles at every 30 m c/c.

Upgradation of Existing Breasting Dolphins

Two numbers of existing berthing dolphins have been verified to accommodate the 38506 DWT vessel. The existing breasting dolphins will be modified to 22 m x 18 m each. The berthing energy for 38506 DWT is calculated and the two numbers of SCN 2000H Trelleborg fender has been proposed for berthing dolphins. The existing berthing dolphins shall be designed to withstand a reaction force of 3133 kN for absorbing energy due to berthing of design maximum ship size. Each dolphin is fitted with Quick Release Mooring Hooks (QRMH) of 2x75 Tonne capacity. The additional piles shall be provided in the back and 2 sides of existing breasting dolphin to withstand the berthing energy of 38506 DWT vessel Proposed dredge depth at the berth pocket is (-) 16.5 m CD. The manoeuvring



basin will be maintained at (-) 15.0 m CD. Onshore development of the required facilities such as storage yards etc. will be developed in the existing available/ reclaimed land.

Additional Mooring Dolphins

Two numbers of mooring dolphins of 10 m x 10 m each have been proposed at the jetty to accommodate the 38506 DWT EDC / Ethylene vessel. Each dolphin deck consisting of 10 m x 10 m is supported on 9 Nos. of 1200 mm diameter vertical RC piles. Each dolphin shall be fitted with Quick Release Mooring Hooks (QRMH) of 3 x 60 Tonne capacity.

Additional Loading Arms

Two additional loading arms [Extension of Breasting Dolphin] i.e., one over the existing foundation to handle Ethylene and another over new foundation for EDC at the proposed jetty as feedstock for VCM.

Proposed walkway bridge

Two additional walkways are proposed to the connection between the existing mooring dolphins with 1.2 m wide. Sliding and pinned supports were provided at the end of each walkway to accommodate the lateral deflection of various structures. The walkway bridge levels are fixed as EL (+) 9.0 m.

Firewater Pump house cum substation

The pump house cum substation is located 150m from the jetty. The pump house cum substation is a framed structure of size 65 m x 21 m supported on bored cast- in- situ RC piles of 1200 mm diameter. The deck elevation of the pump house cum substation is (+) 9.00 m. The ground floor at EL (+) 9 m has the following facility.

- 22kV/6.6kV/415V Substation
- 20 MLD water intake pumps for desalination system
- Firewater pumps for the jetty

The first floor on top of the substation building is used for the control room, storeroom, accommodation rooms and toilets. The control room building provides a clear view to the jetty. The pump house also houses the following ancillary facilities.

- Instrument Air compressor.
- DTRO for potable water
- Sewage Treatment Package

Tug berth

A tug berth is proposed to be constructed on the side of the approach trestle at the west side of the pumphouse cum substation building to facilitate berthing of the tugboat. The tug berth will have two levels of landing for berthing of the tugboats during low and high tides. The fenders and bollards shall



be provided to cater for the berthing and mooring of the tugboats. The tug berth shall be located on the western side of the proposed pumphouse cum substation building.

The tug berth shall have two levels of landing one at +5.00 m with a dimension of 12 m in length and 5 m wide and another landing at +2.50 m with a dimension of 27 m length and 5 m wide. The piles are spaced 3.4 m in transverse direction and 5m in longitudinal direction. The berth is supported on 1000 mm diameter bored cast in-situ piles. The deck slab of 300 mm is provided at the tug berth which is partly precast and in-situ.

Dredging

The existing jetty is designed for the water depth of 10.7 m with respect to chart datum. The maximum draft of the vessel expected to be handled at the jetty at present condition is 11.72 m. The existing seabed level at the jetty location is in the range of (-)10 m to (-)11 m. Hence the proposed dredging depth is (-)14 m CD.

The capital dredging is estimated around 2.6×10^6 m³. Capital dredging will be conducted in the navigational channel area to maintain the required navigational depth.

Table 5. Details of Dredging

Description	Dimensions
Dredging Quantity	2.6×10^6 m ³
Dredging Depth	(-) 14 m CD

The dredged materials will be disposed of at 13.25 km offshore.

Table 6. Dredging Requirement

Description	Depth (m)
Fully loaded Draft	11.72
Under Keel Clearance (10% of draft)	1.20
Allowance for vessel movement	0.40
Low Water (below MSL)	0.27
Total	13.59

Dredge Depth requirements

The existing jetty is designed for the water depth of 10.7 m with respect to chart datum. The maximum draft of the vessel expected to be handled at the jetty at present condition is 11.72 m. The water depth required for the proposed 38,506 DWT is summarised in the above table and the dredging layout for the berth pocket, tuning circle and approach channel region is shown below.

The existing seabed level at the jetty location is in the range of (-)10.00 to (-)11.00 m. Hence the dredge depth shall be proposed at the level of (-)14.0 m CD. The approach channel shall also be dredged to the level of (-)14.00m CD from the jetty to the nearest natural water depth of a length of 3



km approx. The overall capital dredging quantity is estimated to be 2.6×10^6 m³. The dredging area and dredge disposal point is shown in Fig. 5.

Proposed crossover bridge in Uppanar river creek

The crossover bridge along the Uppanar river is located 50 m away from the existing VCM underground pipeline. The dimensions of the proposed bridge are 384 m in length and 11 m wide. The piles are spaced 6.0 m in transverse direction and 12 m in longitudinal direction. The bridge is supported on 1000 mm diameter bored cast in-situ piles. The deck slab of 500 mm is provided at the bridge which is partly precast and in-situ. Ramp shall be provided with a slope of 1:20 on either ends of the bridge for smooth transition to the existing ground level. Abutments shall be provided with wing walls on either side of the bridge to protect the shore from sliding and erosion.

Pipeline arrangement on crossover bridge

The proposed bridge shall consist of the following facilities.

- A 5 m wide access road across the bridge and is designed for 10T mounted mobile cranes for operational purposes such as maintenance and repair to the pipelines.
- Supports for a 12-inch desalination permeate pipeline to the DM plant and a 12-inch desalination permeate pipeline to the VCM plant.
- Supports 20-inch EDC, 16-inch VCM, 4-inch VCM coolant, 16-inch ethylene, and 6-inch coolant pipelines.
- Cable trays of 500 mm width and its supports.
- Light poles at every 24 m c/c

Desalination plant

To cater for the needs to expand the PVC plant, CCVL intends to develop desalination plants of 20 MLD for additional requirements of DM water and industrial water uses, near the existing control building at the landfall point. The outfall pipeline will be diverted from the offshore pumphouse towards north by 300 m. The desalinated water will be pumped to the PVC plant through 2 x 12" pipelines across the Uppanar river creek on the proposed crossover bridge.





Figure 2. Details of existing facilities

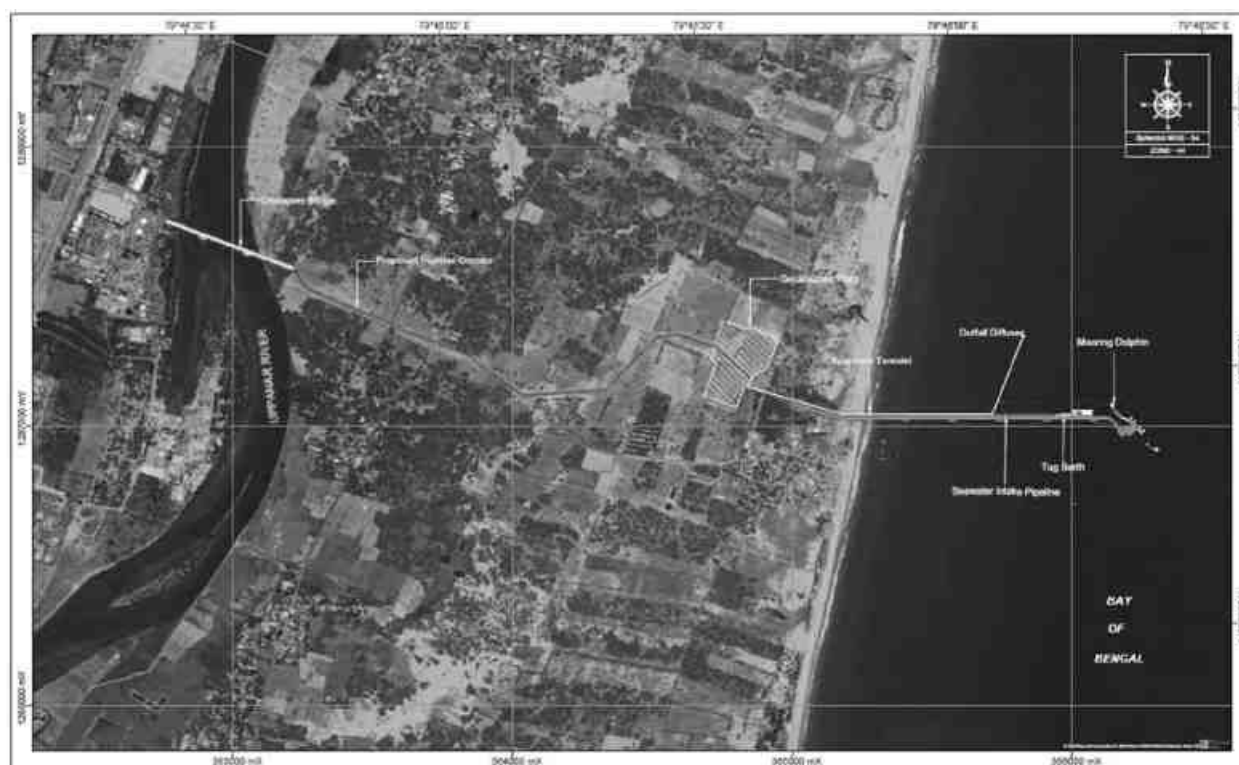


Figure 3. Details of proposed facilities

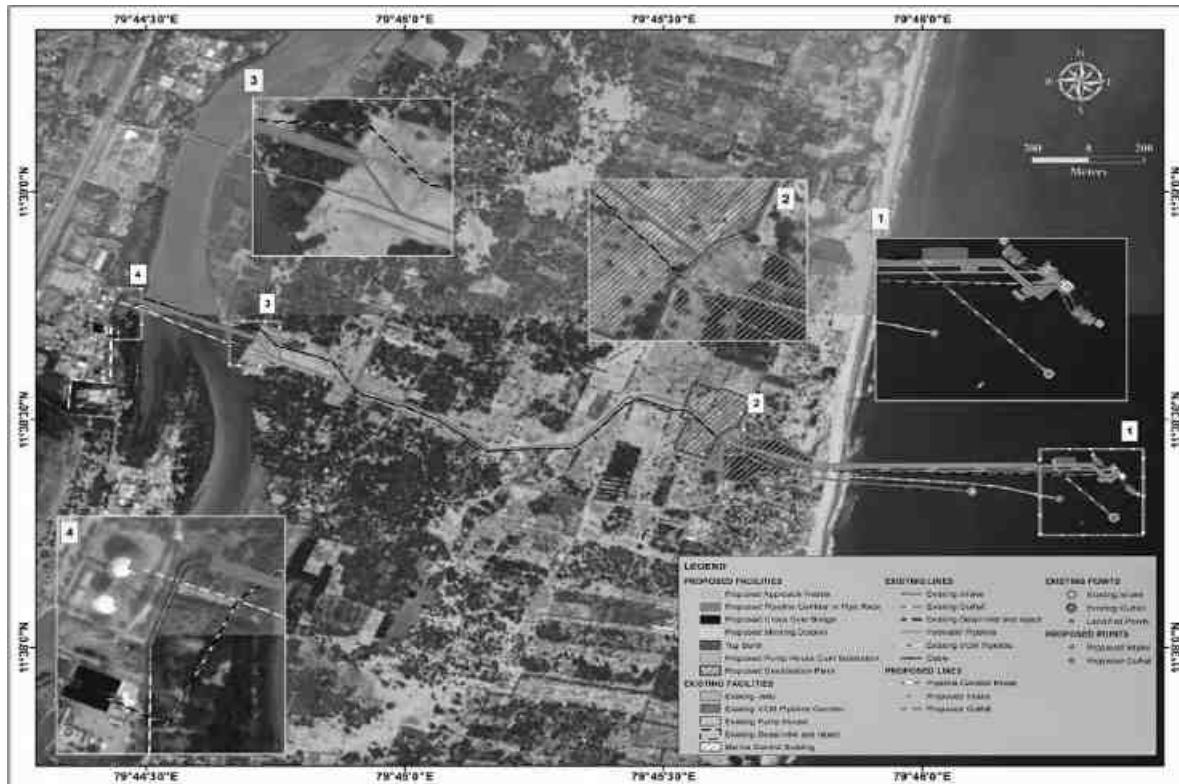


Figure 4. Master plan (Existing and Proposed facilities)

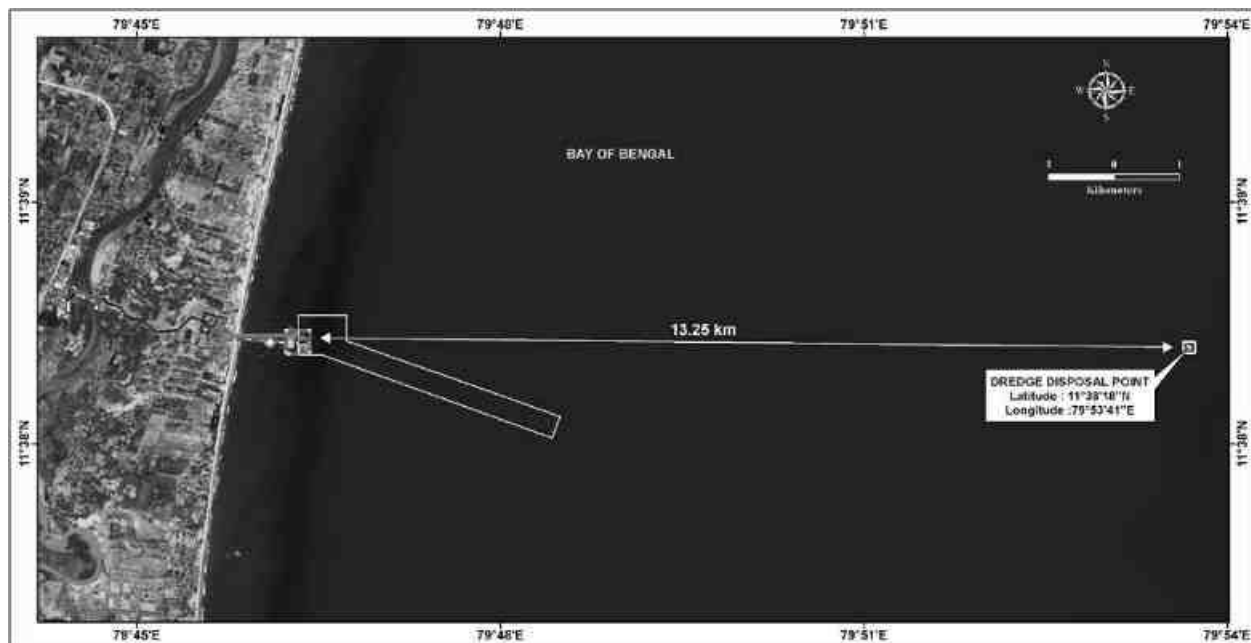


Figure 5. Layout of dredging area and dredge disposal point



1.5 THE ASSIGNMENT & SCOPE OF THE STUDY

1.6 SCOPE OF EIA STUDY - DETAILS OF REGULATORY SCOPING CARRIED OUT

1.6.1 Scoping

As per EIA Notification 2006, the proposed development falls under Schedule 7 (e) - Ports and Harbours - Ports, harbours, jetties, marine terminals, breakwaters and dredging, Category A and requires CRZ clearance and Environmental Clearance from TNCZMA and MoEFCC.

Accordingly, CCVL has obtained the ToR from MoEF & CC, through the 377th meeting held on 16th and 17th October 2024 after detailed deliberation of the proposed project by the project proponent with MoEF & CC meeting. The EAC has issued the ToR vide proposal No. **IA/TN/INFRA1/498995/2024** with file No. **1-63/2005-IA-III (Pt.)** dt: 26.10.2024 for the preparation of the EIA report and EMP.

Table 7. CTE/CTO Chronology

S. No.	CTE/CTO/EC	Granted On	Proceeding No./ Consent No.
1	EC & CRZ Clearance	19.12.2005	Letter No. CUD/ENV/400/004
2	Consent to Operate (CTO)	28.02.2023	Consent Order No. 2307147638958
3	Transfer of EC	09.08.2024	Order No. F. No. 11-63/2005-IA-III
4	ToR for EIA & EMP	26.10.2024	Proposal No. IA/TN/INFRA1/498995/2024, File No. 1-63/2005-IA-III (Pt.)
5	Extension of EC & CRZ Clearance validity	Valid till 31.03.2027*	Ministry Order (validity extended)

*In February 2023, CCVL approached to MOEFCC for the extension of validity vide Consent Order No. 2307147638958 dt. 28.02.2023 and the MOEFCC extended the validity of EC & CRZ clearance for CCVL up to 31st March 2027.

1.6.2 TOR Compliance

The proposed upgradation of Marine Terminal Facilities falls under polluted area as per CPCB norms therefore the project falls under 'Category A' as per Schedule of EIA notification 2006. All 'Category -A' projects require Terms of Reference (ToR) at scoping stage from EAC to address all relevant environmental concerns related to the preparation of EIA Report for the project for which prior environmental clearance is sought.

Accordingly, CCVL presented the details of project to the EAC of MoEF & CC, New Delhi for the grant of ToR in its 377th meeting held on 16th and 17th October 2024. The EAC has issued the ToR vide Proposal No. **IA/TN/INFRA1/498995/2024** with file No. **11-63/2005-IA-III (Pt.)** dt:



26.10.2024 for the preparation of the Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP).

(a) Standard ToR

Table 8. TOR Compliance

ToR No.	Standard ToR	Status of Compliance
1	Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection.	Since the proposed project is expansion within the existing Marine Terminal premises, there is no requirement for alternative site study. It is further indicated in Chapter 5 of the EIA report.
2	The examination should justify site suitability in terms of environmental angle, resources sustainability associated with selected sites as compared to rejected sites.	The proposed project is upgradation of existing MTF within the CCVL premises. So, there is no alternative rejected site.
3	The analysis should include parameters considered along with weightage criteria for short-listing selected sites.	The proposed project is an upgrade of existing MTF. So, there is no site selection.
4	Submit the status of shoreline change at the project site	Evaluation of shoreline changes is given in Section 7.4 of Chapter 7.
5	A detailed draft EIA/EMP report should be prepared in accordance with the above additional TOR and should be submitted to the Ministry in accordance with the Notification.	A detailed draft EIA/EMP report prepared in accordance with the above additional TOR and will be submitted to the Ministry in accordance with the 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	Total project capital expenditure is assessed based on the current market situation of the construction industry. Total capital cost estimate for the proposed expansion works out to ₹450 Crore. Capital Cost Estimation for expansion is given in chapter 2.
7	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponents can refer to the model ToR available on Ministry.	Anticipated impact and mitigating measures for the proposed and upgradation of marine terminal facilities are given in Chapter 4.
8	Details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site.	The project does not involve any change in the land use as all the constructions of proposed facilities take place within the existing marine terminal. The land use break-up for the proposed project is given in Section 2.7 of Chapter 2. The details of the Land use break-up map covering 10 km project radius is given in Section 3.1.4 of Chapter 3 and Fig. 3.6.
9	Submit details regarding R&R involved in the project	No R&R is involved in the project. The project does not require any additional acquisition of land and no relocation of the green habitation of the people. The expansion project will be carried out within the existing area.



ToR No.	Standard ToR	Status of Compliance
10	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 wildlife (Protection) Act, 1972/critically polluted areas as identified by the CPCB from time to time/notified eco-sensitive areas/interstate boundaries and international boundaries.	The details of land use around 10 km radius of the project site are given in section 3.1.4. of chapter 3 and Fig. 3.6.
11	Erosion and accretion study at the mouth of the creek which is adjacent to the proposed site be carried out and submitted	The mouth of the Uppanar river creek is located 8 km north from the proposed project area. The proposed approach trestle will be constructed with arrangements of piles designed by IITM. Erosion and accretion (shoreline changes) study given in section 7.4 of Chapter 7.
12	Detailed modelling studies to understand whether the selected site can withstand severe cyclones and develop design in accordance with due safety measures	Detailed modelling studies are given in Chapter 7.
13	Submit superimposing of latest CZMP as per CRZ Notification (2011) on the CRZ map. And submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scales.	The latest CZMP as per CRZ Notification (2011) on the CRZ map and a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scales is given in Annexure III
14	Submit a complete set of documents required as per para 4.2 (i) of CRZ Notification, 2011.	Will be prepared and submitted.[JR--MC1]
15	Hydrodynamics study on impact of dredging on flow characteristics shall be carried out.	Hydrodynamics study is given in section 7.1 of Chapter 7.
16	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 proximity of the site should be conducted and a required mitigation plan be submitted.	The 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 conducted and required mitigation plan given in section 4.4.10 of chapter 4.
17	A management plan for the area under which mangroves are or is likely to be removed and compensatory mangrove plantation plan be submitted.	The proposed crossover bridge along the Uppanar river creek crosses the river basin and the existing mangroves. [JR--MC2] It will not affect the existing mangroves in Uppanar river creek. Mangroves are located 70 m south of the elevated pipeline and 300 m from the CCVL plant. Also due to the proposed upgradation of MTF the existing mangroves will not be affected. It is located 3.8 km away from LFP according to CRZ map 2011. Given in detail in section 3.2.4.2 of Chapter 3.
18	Analysis should be made based on the latest satellite imagery for land use with raw images.	Yes, analysis was made based on the latest satellite imagery for land use with raw images. The land use map is given in Fig. 3.6.
19	Submit the present land use and permission required for any conversion such as forest, agriculture etc.	There is no forest and agriculture land involved in this project.
20	Land acquisition status, rehabilitation of communities / villages and present status of acquiring Forest and Agricultural activities.	Nil. The proposed upgradation of MTF within the existing project boundary.



ToR No.	Standard ToR	Status of Compliance
21	Submit details of the trees to be cut including their species and whether it also involves any protected or endangered species.	Nil. The development of the project within the existing project boundary. So, there is no tree cutting involved.
22	Measures taken to reduce the number of trees to be removed should be explained in detail.	There is no tree cutting.
23	Submit the details of compensatory plantation.	There is no tree cutting so there is no compensatory plantation. The greenbelt will be developed in the development work.
24	Explore the possibilities of relocating the existing trees.	Nil[JR--MC3]
25	Examine the details of afforestation measures indicating land and financial outlay.	Nil
26	Landscape plans, green belts and open spaces may be described. A thick green belt should be planned all around the nearest settlement to mitigate noise and vibrations.	As per the existing EC granted on 19th December 2005, the total land area is 7.542 Ha. In that 2 Ha has been allotted for green belt development as per existing clearance. The project includes an expansion of the green belt, with the area increasing by 0.5 hectares, bringing the total to 2.5 hectares. The width of the green belt will double from 5 meters to 10 meters. Given in section 2.6 of Chapter 2.
27	The identification of species/ plants should be made based on botanical studies.	The species proposed for plantation include Millingtonia ortensis, Casuarina equisetifolia, and Delonix regia, in addition to the existing species such as Ashoka and Cannan ball.
28	Examine the details of water requirements, impact on competitive users, treatment details, use of treated waste water. Prepare a water balance chart.	Water requirement during the operational phase will be supplied by the proposed desalination plant. i) Domestic demand for employees and users ii) Gardening and greenbelt Existing - Septic tank (for port control building) Proposed - STP will be established
29	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.	In the study area,, Lake/Reservoir/Tank/Canal are identified by its shape with an area of about 502 ha. River/Stream constitute another category of water bodies distinguishable by their linear or curvilinear form. Uppanar river is the prominent river that flows nearly parallel to the coastline. This river displays a meandering pattern across an aerial expanse of 454 ha. Given in section 3.1.4.1 of chapter 3.
30	Submit the details of fishing activity and likely impacts on the fishing activity due to the project.	The detailed fishing activity is given in section 3.1.6 of chapter 3 and Table 3.22 and Table 3.23. Due to construction of approach trestle and associated facilities, fishes are mobile, they tend to move away from underwater disturbances. Thus, no significant impact on fishes are anticipated. The fishes will usually return to the original area once the construction activity is stopped.



ToR No.	Standard ToR	Status of Compliance
31	Specific study on effects of construction activity and pile driving on marine life.	During construction of approach trestle piling will be required. Concrete mixing and construction debris in the marine environment are envisaged during the construction activity. The bottom living communities like intertidal and sub-tidal benthos present in the berth region will get temporarily disturbed due to increased turbidity in the water quality and in turn affect the fishes during the construction period. Once the construction is over, the system will slowly return to its normal status. The detailed impact and mitigation study on effect of construction activity and pile driving on marine life is given in section 4.4.1. of chapter 4.
32	Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area.	The project location appears to be situated on gently sloping terrain. The slope map is shown in Fig.35. And the drainage network is shown in Fig 36. in chapter 3.
33	Examine details of Solid waste generation treatment and its disposal.	CCVL does not have any solid waste generation treatment. After expansion, in solid waste generation treatment the STP sludge will be used for gardening in the main plant.
34	Details of oil spill contingency plan.	Given in Annexure VII
35	Details of the layout plan including details of channel, breakwaters, dredging, disposal and reclamation.	The details of the layout plan, dredging area and dredge disposal point is shown in Fig. 2.4. in chapter 2.
36	Submit the details of terrain, level with respect to MSL, filling required, source of filling materials and transportation details etc.	The study area does not display any drastic change in elevation along the northern and western parts where it ranges up to 47 m above msl. However, the eastern side from the proposed project location is noticed with higher elevation. The relief map is given in Section 3.1.4.2 and Fig.3.7 of Chapter 3
37	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.	The layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scale is given Fig. 1.3. and section 1.7 of Chapter 1.
38	Details of bathymetry study	Details of bathymetry study is given in Fig. 3.17 & Fig. 3.18 in Section 3.2.1 of Chapter 3.
39	Details of ship tranquility study	Ship tranquility study is given in Annexure IX
40	The ecologically fragile area including CRZ 1A area etc. shall be demarcated and superimposed on the layout plan and submitted	Ecologically fragile areas including CRZ 1A area etc. demarcated and superimposed on the layout plan is given Fig. 1.3. in section 1.5 of Chapter 1.
41	Examine road/rail connectivity to the project site and impact on the existing traffic network due to the proposed project/activities	Road/rail connectivity to the project site is given in section 2.4.1 of Chapter 2. Impact on the existing traffic network due to the proposed project/activities are given in section 4.3.1 of Chapter 4.
42	A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.	Vessel traffic study is given in Annexure - X



ToR No.	Standard ToR	Status of Compliance
43	Details of handling of each cargo, storage, transport along with spillage control, dust preventive measures.	Details of cargo handling capacity of MTF is given in section 1.3 of Chapter 1. The impact and mitigation measures for liquid cargo handling is given in section 4.4.7 of Chapter 4.
44	In case of coal, mineral cargo, details of storage and closed conveyance, dust suppression and prevention filters.	CCVL handles only liquid cargo. CCVL will transport their liquid cargo through a pipeline on the approach trestle and will be stored in CCVL's existing plant.
45	An assessment of the cumulative impact of all development and increased inhabitation being carried out or proposed to be carried out by the project or other agencies in the core area, shall be made for traffic densities and parking capabilities in a 05 kms radius from the site. Detailed traffic management and traffic decongestion plan drawn up through an organization of repute and specializing in Transport Planning shall be submitted with the EIA.	There is no traffic due to the existing and proposed MTF.
46	Details of rainwater harvesting and utilization of rainwater.	Details of rainwater harvesting is given in section 10.2.3. of Chapter 10
47	Examine baseline environmental quality along with projected incremental load due to the proposed project/activities.	Baseline environmental quality along with increment in impacts are given in Chapters 3 and 4.
48	The air quality monitoring should be carried out according to the notification issued on 16th November 2009.	Yes, the air quality monitoring study carried out according to the Notification and presented in Chapter 3 - Section 3.1.1.
49	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.	The Environmental Management Plan is given in Chapter 10. Post Project Monitoring is given in Chapter 6.
50	Submit details of a comprehensive Risk Assessment and Disaster Management Plan including emergency.Evacuation during natural and man-made disasters.	CCVL to be included as Annexure VIII
51	Details of the plant desalination and the study for outfall and intake.	Details of the desalination plant are given in section 2.2.2 of Chapter 2. Impact and mitigation study for intake and outfall is given in section 4.4.5 of Chapter 4.
52	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	Nil
53	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	Yes. The Public Hearing will be conducted based on the ToR letter issued by the Ministry.



ToR No.	Standard ToR	Status of Compliance
	ministry as part of the EIA Report. The EMP shall be implemented in the project cost or any other funding source available with the project proponent.	

(b) Additional ToR

Table 9. TOR Compliance

S. No.	Specific Conditions	Status of Compliance
1	Considering the integrated and inter-linked projects EIA/EMP report shall prepare as per the guidelines issued by the Ministry's OM no. J-11013/41/2006-IA II(I) dated 24th December 2010.	Yes, EIA and EMP reports were prepared as per the guidelines issued by the Ministry's OM no. J-11013/41/2006-IA II(I) dated 24th December 2010.
2	The project area is also located within the critically polluted area, thus PP shall draw the specific mitigation measures as per the guidelines mentioned/issued by the Ministry as per the Ministry's OM no. 22-23/2018-IA.III(E-115231) dated 5th July 2022.	The project area is not a critically polluted area. The Impact and mitigation as per the guidelines mentioned/issued by the Ministry as per the Ministry's OM no. 22-23/2018-IA.III(E-115231) dated 5th July 2022 is given in section 4.3.1 of Chapter 4
3	As the proposed intake and outfall structures fall under the same contour, detailed contour studies shall be carried out and the details of the same shall be incorporated in the detailed EIA/ EMP Report.	Detailed bathymetry studies carried out in the detailed EIA/ EMP Report in section 3.2.1 of chapter 3 and Fig. 3.17 and Fig. 3.18.
4	The EAC suggested the PP explore the possibilities to utilize dredged material and the details of the same shall be incorporated in the detailed EIA/ EMP Report.	The dredged materials will be disposed of in offshore sea 13.25 km away from the navigational channel. The details of dredged material is given in section 2.2.2 of Chapter 2.
5	PP shall keep the structures/pears bare minimum inside river/backwater to prevent obstruction of the flow and provide a wider span in the middle of the proposed bridge over Uppanar River.	Yes, PP keeps the structures/pears bare minimum inside river/backwater to prevent obstruction of the flow and provide a wider span in the middle of the proposed bridge over Uppanar River. The cross section of the cross over bridge is given in section 4.4 in "Upgradation of marine terminal Facility at Cuddalore" prepared by IITM.
6	PP shall plan to provide adequate layover, turning radius for moving vehicles in the proposed captive bridge for all pipelines, cables with consideration to prevent fire incidents from the safety point of view.	Yes, PP will plan to provide adequate layover, turning radius for moving vehicles in the proposed captive bridge for all pipelines, cables with consideration to prevent fire incidents from the safety point of view.
7	The ecologically fragile area including CRZ 1A area etc. shall be demarcated and superimposed on the layout plan and submitted.	Ecologically fragile areas including CRZ 1A area etc. demarcated and superimposed on the layout plan is given Fig. 1.3. and section 1.5 of Chapter 1.
8	Risk analysis and its management plan for handling different types of liquid cargos (if handling) shall be conducted and submitted with the EIA/EMP report.	CCVL to be included as Annexure VIII.
9	Detailed modelling studies to understand whether the selected site can withstand severe cyclones	Detailed modelling studies given in Chapter 7.



S. No.	Specific Conditions	Status of Compliance
	and develop design in accordance with due safety measures including sea-level rise.	
10	Erosion and accretion study at the mouth of the creek and adjoining areas of port site be carried out and submitted.	The mouth of the Uppanar river creek is located 8 km north from the proposed project area. Proposed approach trestle will be constructed with arrangements of piles designed by IITM Erosion and accretion (shoreline changes) study given in section 7.4 of Chapter 7.
11	Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scales.	The layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scales is given in Fig. 1.3.
12	Recommendation of the Tamil Nadu CZMA shall be obtained and submitted	Yes, recommendations of the Tamil Nadu CZMA will be obtained and submitted.
13	Submit superimposing of latest CZMP as per CRZ Notification (2011) on the CRZ map.	Superimposing of the latest CZMP as per CRZ Notification (2011) on the CRZ map is given in Fig. 1.3.
14	Submit a complete set of documents required as per para 4.2 (i) of CRZ Notification, 2011.	Will be prepared and submitted.[JR--MC2]
15	Hydrodynamics study on impact of dredging on flow characteristics shall be carried out.	Hydrodynamics study on impact of dredging on flow characteristics were carried out and given in Chapter 7.
16	Bathymetric survey of the existing dumping site used for dredged material shall be conducted and availability of dumping area for the proposed dredging activity shall be evaluated and submitted. Sediment budget for the area adjoining areas to be conducted and mitigation measures for shoreline management to be drawn.	Bathymetry map is given in Fig. 3.17 and Fig. 3.18. Dredge disposal location is given in Fig. 2.4.
17	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 proximity of the site should be conducted including mitigation plan through nationally recognized institution or university	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 are given in section 4.4.10. of Chapter 4.
18	A management plan for the area under which mangroves are or likely to be removed and compensatory mangrove plantation plan be submitted.	The mangroves will not be removed due to the proposed project. The proposed crossover bridge along the Uppanar river crosses the river basin and the existing mangroves. It will not affect the existing mangroves in Uppanar river creek.[JR--MC3]
19	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).	Requirement of water is given in
20	A certificate from the local body supplying water, specifying the total annual water availability with the local authority, the quantity of water already committed the quantity of water allotted to the project under consideration and the balanced water available. This should be specified separately for	Source of water : CCVL desalination plant Source of Power : TNEB



S. No.	Specific Conditions	Status of Compliance
	ground water and surface water sources, ensuring that there is no impact on other users.	
21	A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project	Source of Power : TNEB
22	A certificate from the competent authority handling municipal solid waste, indicating the existing civic capacities of handling and their adequacy to cater to the M.S.W. generated from the project.	Existing - None After expansion: STP sludge will be used for gardening in main plant
23	An assessment of the cumulative impact of all development and increased inhabitation being carried out or proposed to be carried out by the project or other agencies in the core area, shall be made for traffic densities and parking capabilities in a 5 kms radius from the site. A detailed traffic management and a traffic decongestion plan drawn up through an organization of repute and specializing in Transport Planning shall be submitted with the EIA.	There is no traffic due to the existing and proposed MTF.
24	Disaster Management Plan for the project shall be prepared and submitted	Given in Annexure VIII.
25	Details and status of court cases pending against the project, if any.	Nil
26	Occupational Safety health plan shall be submitted for the workers/employs along with the EIA/EMP report	Occupational Safety health plan will be submitted for the workers/employs along with the EIA/EMP report
27	Public hearing to be conducted and issues raised and commitments made by the project proponent the same should be included in EIA/EMP Report in the form of tabular chart with financial budget for complying with the commitments made.	Public hearing to be conducted and issues raised, and commitments made by the project proponent on the same will be included in EIA/EMP Report in the form of tabular chart with financial budget for complying with the commitments made.
28	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.	Tabular chart with index for point-wise compliance of above ToR is given in Chapter 1 - Section 1.4 of EIA report.
29	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, 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 implemented at the project cost or any other funding source available with the project proponent.	Yes. The Public Hearing will be conducted based on the ToR letter issued by the Ministry.



2. PROJECT DESCRIPTION

2.1 TYPE OF PROJECT

- 1) Type:- **Activity : 7(e), Category A- Ports and Harbours**
- 2) New / expansion / change in product mix:- **Expansion**

2.2 NEED OF THE PROPOSED PROJECT

CCVL has been operating a suspension PVC plant at Cuddalore, Tamil Nadu since 2009 based on imported feedstock Vinyl Chloride Monomer (VCM). As a part of backward integration, CCVL proposes to manufacture feedstock VCM at Cuddalore and supply to existing suspension PVC plant.

Vinyl Chloride Monomer (VCM) is the main feedstock for manufacture of Poly Vinyl Chloride (PVC). PVC (Suspension grade) plays a major role in our day-to-day life. Suspension PVC is a versatile polymer, finding varied applications, the most important one being the manufacture of Pipes & Fittings for irrigation purposes.

The existing MTF is located at 1 km from shore and the approach to the MTF at present is only by boat from Cuddalore minor port. In case of emergency evacuation, it poses a serious threat in case boats are not able to reach the MTF due to inclement weather. Hence, to improve the safety in case of emergency and approach to the jetty for maintenance works, CCVL has intent to build an approach bridge from the landfall point to the jetty. The approach trestle is also used for supporting the pipelines above water from landfall point to the MTF. This will also reduce the risk of damage to pipelines during cyclones. The bridge will have space for supporting the pipelines cables.

Ethylene and Ethylene Dichloride are feedstock for manufacture of VCM. Ethylene and Ethylene Dichloride are available locally and hence need to be imported through ships. CCVL currently imports VCM through its captive Marine Terminal Facilities at Cuddalore. For the new imports, CCVL proposes to expand the existing jetty for berthing of higher capacity ships and construct trestle for movement of manpower/laying of new pipelines. This expansion will help in considerable forex savings as well as reduce dependence on feedstock import thus resulting in expansion of downstream PVC industry.

2.3 PROJECT LOCATION

Location of project: The proposed project is located in the Chithirapettai, Semmankuppam and Thiyagavalli villages, Cuddalore district, 32 km south of Pondicherry and 80 km north of Karaikal. The location of the project region and CCVL MTF is shown in Fig.1.1 and Fig.1.2.

Latitude: 11° 38' 20" N



Longitude: 79° 45' 49"E.

Nature of project: The nature of the project is upgradation of existing MTF to expand the operating capacity of the CCVL as well as to access the island jetty during rough weather through proposed trestle. The project does not involve relocation of the green habitation of the people.

Coastal Regulation Zone

Based on CRZ Notification 2011, the CRZ map is being prepared by Institute of Remote Sensing (IRS) of Anna University Chennai, which is one of the approved agencies for demarcation of HTL / LTL. The CRZ report on 'Preparation of upgradation of existing Marine Terminal Facility with proposed hydrocarbon transfer pipelines, crossover bridge along Uppanar river, sea water intake & outfall facilities and 20 MLD desalination plant at Chithirapettai, Semmankuppam villages, Cuddalore district by Superimposing on Approved CZMP as per CRZ Notification 2011 - Annexure III.

The CRZ map is shown in Figure 8.

layout

Figure 6. Location map of project region



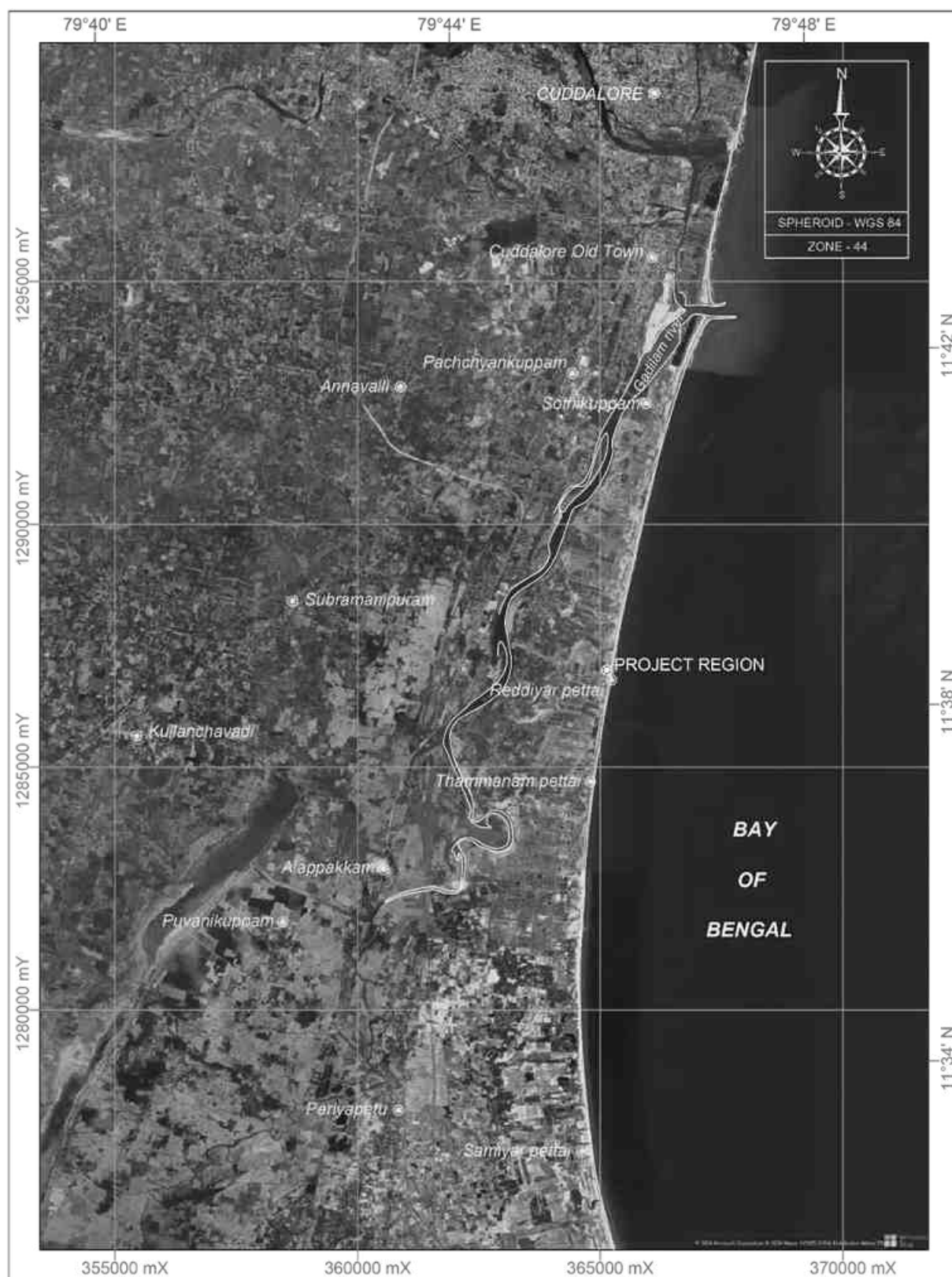


Figure 7. Location map of CCVL MTF



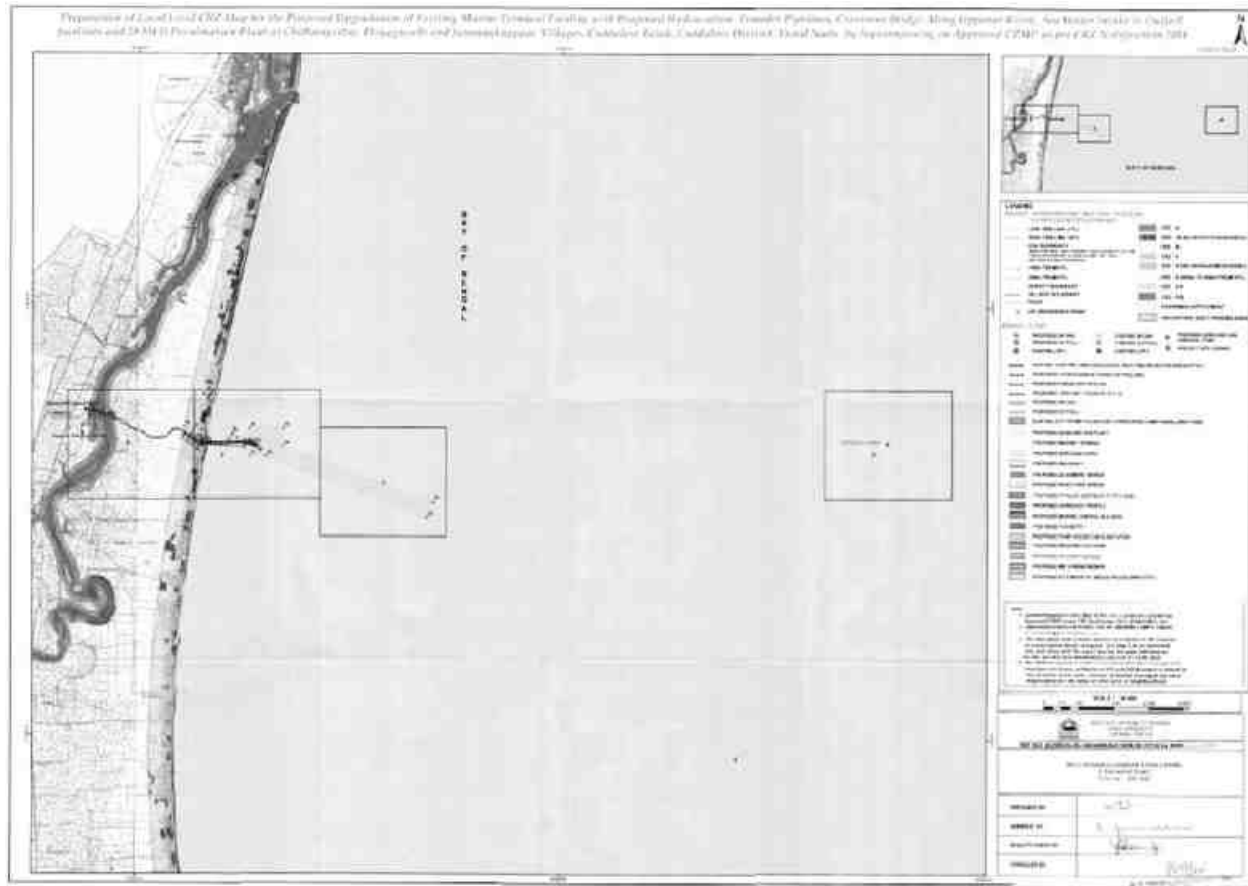


Figure 8. CRZ Map

2.3.1 Major Infrastructure Near the Project

Table 10. Project Site Specific Connectivity Details

Particulars	Distance	Direction
River		
Gadilam River	~ 8 km	N
Uppanar river	~ 2 km	W
Road		
NH-32	~3 km	NW
NH-532	~6.5 km	NW
Railway Station		
Alapakam Railway Station	~4.5 km	SW
Cuddalore Railway Station	~13 km	N
Airport		
Tiruchirappalli International Airport	~150 km	SW
Chennai International Airport	~155 km	N
Port		
Cuddalore Port	~7.5 km	N
Chennai Major Port	~170 km	N
Village		



Particulars	Distance	Direction
Chithiraipettai & Reddiyar Pettai	Within 2 km radius	
Industry		
Arkema Peroxides India Ltd	~ 2.51 km	W
Chemplast Cuddalore Vinyl Ltd	~ 2.82 km	NW
Ecologically Sensitive Areas		
Sand dunes	~ 500 m	N
Mangroves	~ 3.8 km	SW
Seismic Zone		
II		

2.4 SIZE OR MAGNITUDE OF OPERATION

Size of project: Size of the proposed facilities and cargo handling is given below:

Table 11. Project Details

Facilities	Existing	After Expansion
Berthing capacity	20000 DWT	38500 DWT
Breasting Dolphin	2 nos.	2 nos.
Mooring dolphin	4 nos.	6 nos.
Approach trestle	-	1060 m x 12 m
Crossover bridge	-	384 m x 11 m
Desalination plant	-	20 MLD

Table 12. Details of cargo handling (existing and after expansion)

Feedstock import requirement (Million TPA)		
Feedstock	Existing	After Expansion
VCM	0.366	0.6
Ethylene	0	0.2
Ethylene Dichloride	0	0.7
Total	0.366	1.5

2.4.1 Plot Area Distribution

Details of area requirement for port infrastructure is assessed based on various factors and they are given below

Table 13. Land Details

Description	Area Existing (Ha)	Additional Area Proposed (Ha)	Total Area required after Expansion (Ha)
Non-Forest Area	6.374	7.745	14.119
Forest Area	0	0	0
Total Development Area	6.374	7.745	14.119



2.4.2 Project Cost

The total project capital expenditure is assessed based on the current market situation of the construction industry. The total capital cost estimate for the proposed expansion works out to **₹500 Crore**. Capital Cost Estimation for expansion is given below.

Table 14. Project Cost

Cost estimate for Jetty expansion project at Cuddalore	
Activity	Cost (Rs. In Crore)
Approach trestle	150
Jetty expansion	150
Uppanar River bridge (Crossover)	50
Desalination plant, Intake and Outfall systems	150
Total	500

2.5 POWER

The project involves expanding the current power capacity from 500 KVA to 2500 KVA, necessitating upgrades to the electrical infrastructure. Emergency DG sets will be installed to ensure backup power during outages. The existing stack for the current DG set is compliant with emission standards, and new stacks will be designed for the proposed DG sets to meet environmental regulations, ensuring safe exhaust dispersal. This setup will ensure reliable power supply and maintain compliance with safety, environmental, and regulatory requirements. Existing and proposed emergency power source details are given in the below table.

Table 15. Details of Power Requirement

Existing			
Stack No.	Description of Power Source	Control measures	Stack height (m)
1	Emergency DG Set 250 KVA	Stack	4.6
2	Emergency DG Set 62.5 KVA	Stack	3
Proposed			
1	Emergency DG Set 1000 KVA	Stack	30 m

2.6 MANPOWER

At present they are employed directly during the operational phase.. Manpower Requirement for the proposed expansion is given below.

Table 16. Manpower Details (During Construction)

S. No.	Present Employment Details		Construction Phase Employment Details		Operational Phase Employment details	
	Permanent Employee	Contractual Employee	Permanent Employee	Contractual Employee	Permanent Employee	Contractual Employee
1	15	50	10	150	10	50



2.7 NOISE MANAGEMENT

The following noise management measures and controls will be implemented at the Project where it is reasonable and feasible to do so:

Sound Barriers

- Acoustic fencing along the processing area.
- Temporary site buildings used as barriers.
- Acoustic screens for works near dwellings.
- Screens must block line of sight, mass $\geq 16 \text{ kg/m}^2$, length $\geq 5 \times$ height.
- Well-placed barriers can reduce noise by **10–15 dB**.

Operational Practices

- Switch off / throttle down idle machines.
- Handle materials carefully, avoid dropping.
- Schedule deliveries in off-peak hours.
- Implement traffic management.
- Communicate disruptive activities to stakeholders.

Maintenance

- Reduce resonance in machine panels with stiffening/damping.
- Regular maintenance by trained personnel.

Plant Specification

- Provide acoustic enclosures/screening for generators & equipment.
- Use anti-vibration mountings where practicable.

DG Set Noise Control



- One **160 kVA DG set** for jetty (emergency only).
- DG sets must comply with **75 dB(A) at 1 m** (as per CPCB rules).
- DG sets to be supplied with **integral acoustic enclosures**.

Noise Monitoring

- Program to cover **operation area, occupational exposure & ambient noise**.

Constructional Activities:

- Temporary cessation of work within an area, or from a particularly noisy piece of equipment, will be considered when adverse conditions are present.
- All plant and machinery used on-site will be maintained regularly to minimise noise generation.
- All plant and machinery used on-site will be operated in a proper and efficient manner (e.g., at correct speed) to minimise noise generation.
- Lesser noise generating construction activities (e.g., welding, and electrical works) will be conducted during the evening/night-time period.
- Regular communication and updates will be provided to local residents on the status and nature of site construction activities

2.8 PLANTATION & GREEN BELT

The project includes an expansion of the green belt, with the area increasing by 0.5 hectares, bringing the total to 2.5 hectares. The width of the green belt will double from 5 meters to 10 meters. The percentage of the total area covered by the green belt will rise from 6.51% to 12.96%. The species proposed for plantation include Millingtonia ortensis, Casuarina equisetifolia, and Delonix regia, in addition to the existing species such as Ashoka and Cannan ball. A total of 550 additional saplings will be planted, adding to the current 2,200. The funds allocated for the plantation will increase by ₹8.20 lakhs, totaling ₹41.02 lakhs after the expansion.

Green vegetation has the inborn capacity to absorb pollution, retention of soil moisture, conservation of biodiversity and reduce sediment transport. Rising green belts with the right type of species can act as a buffer to contain pollution resulting from operation of the Port. Already the CCVL area is covered by a proper Green Belt.

General considerations for selecting plant species for green belt development are:

- Fast growing and tall trees.
- Perennial and evergreen trees.
- Should have a thick canopy cover.



- Appropriate to prevent lateral pollution dispersion.
- Should maintain regional ecological balance and conform to soil and hydrological conditions. Indigenous species should be preferred.

Area Proposed

Taking into account the area availability within the existing layout and potential future expansion, it may not be possible to ensure compliance with this green belt area requirement. Hence, CCVL will be required to acquire additional land parcel/s of suitable size at appropriate locations and carry out compensatory afforestation basis guidance from the Forest Dept.

Guidelines for green belt development

- Proponents shall follow CPCB guidelines for development & maintenance of greenbelt area.
- Expected growth rate of trees shall be more than 90%.
- Trees growing to a height of 5 m or more shall be planted.
- Plantation of trees shall be undertaken in and around the project area in alternating rows to prevent horizontal pollution dispersion.
- Since trees take many years to grow to their full height, fast growing trees with thick perennial foliage shall be considered.

General considerations for selecting plant species for green belt development are:

- Fast growing and tall trees.
- Perennial and evergreen trees.
- Should have a thick canopy cover.
- Appropriate to prevent lateral pollution dispersion.
- Should maintain regional ecological balance and conform to soil and hydrological conditions. Indigenous species should be preferred.

a) Density and pit size

The choice of plants for the green belt shall include shrubs and trees. Green belt shall be planted at a density of 2500 nos./ha in a pit size of 1 m x 1 m x 1 m for large trees and 0.45 m x 0.45 m x 0.45 for shrubs. Soil used for filling the pit should be mixed with red earth, well decomposed farmyard manure or sewage sludge. The filling of soil must be completed within 5 to 10 days before actual plantation. Healthy sapling of identified species should be planted in each pit with the commencement of monsoon. Planted species shall be cared for with adequate water and nutrient supply at least for a period of two years.

Recommendation made in Biodiversity report by MS University Baroda

1. Conservation of *Hyphane dichotoma*.



This plant could be propagated by the seeds. A number of plants can be planted across the project area, especially as wind breaks from the seacoast side.

2. Conservation of aquatic/saline pockets as they harbour important species like *Tamarix*, *Aeluropus*, *Suaeda*, *Typha*, *Ipomoea* etc., stabilising the soil and attracting a number of insects, butterflies, dragon flies etc.
3. Aquatic pockets which are sites of migratory birds should be retained.
4. The essential role that mangroves could play in defending coastal zones, their role in carbon sequestration, and the increased risks posed by the predicted rise in sea level and the rising cost of maintaining sea defense structures have prompted a commitment to the conservation, restoration, and protection of mangrove forests to guard low-lying coastal lands by forming a protective barrier. Their intricate root systems provide protection and serve as a food source for estuarine and coastal fishery food chains. Many fish, shellfish, birds, and other wildlife species utilize mangrove areas as breeding, feeding, and nursery grounds. It has been estimated that nearly 90% of all marine animals spend some part of their life cycle within mangrove ecosystems (Benfield, 2002). Mangroves exhibit a wide variety of adaptations in terms of morphology, anatomy, physiology, seed and seedling development, physiognomy, and succession mechanisms. Prop roots, knee roots, plank buttresses, pneumatophores, sclerophyllous leaves with sunken stomata, and vivipary are some common adaptations. Mangroves are notably different from other halophytic and mesophytic plant species, as they survive in a hostile environment characterized by fluctuations in salinity, storms, tidal surges, and recent human-induced biotic pressures such as pollution. The roots possess pneumatophores or lenticels for gaseous exchange. Control of tissue water potential through specialized leaves and stems, exclusion of salt through rhizo-filtration, excretion of salts through salt glands, and the ability to deposit salt in older leaves, barks, and pneumatophores help the plants acquire a high level of salt tolerance (Tomlinson, 2016). Effective governance, adaptation and mitigation options, better planning for rehabilitation of degraded mangroves and creation of awareness to local communities are the need of the hour to conserve, protect and restore the valuable mangrove wetland ecosystem.
5. Planting *Tamarix dioica* within a project area environment can offer multiple benefits. Its salt tolerance makes it suitable for coastal regions, where it can help stabilize soil and prevent erosion along waterfronts. Additionally, its dense foliage provides habitat for wildlife, contributing to biodiversity within the CCVL area. Integrating *Tamarix dioica* into CCVL landscapes can enhance environmental resilience and ecosystem services while requiring ongoing monitoring and management to mitigate potential ecological impacts.
6. Plant species for the green belt development are mentioned below.



Table 17. Recommended plants

Category	Species
Trees	<i>Acacia catechu</i> , <i>Acacia nilotica</i> , <i>Acacia dichrostachys</i> , <i>Acacia farnesiana</i> , <i>Albizia lebbek</i> , <i>Azadirachta indica</i> , <i>Casuarina equisetifolia</i> , <i>Coccolobauvifera</i> , <i>Dalbergia sissoo</i> , <i>Ficus cordifolia</i> , <i>Ficus religiosa</i> , <i>Ficus amplissima</i> , <i>Ficus glomerata</i> , <i>Morus alba</i> , <i>Prosopis cineraria</i> , <i>Thespesia populnea</i> , <i>Terminalia arjuna</i> , <i>Terminalia bellirica</i> , <i>Oroxylum indicum</i> , <i>Hyphane dicotoma</i> , <i>Pongamia pinnata</i> , <i>Salvadora persica</i> , <i>Salvadoraoleoides</i> , <i>Wrightia tinctoria</i> , <i>Putranjiva rouxburghii</i>
Shrubs and bushes	<i>Tamarix dioica</i> , <i>Lycium europaeum</i> , <i>Vogelia indica</i> , <i>Adhatoda vasica</i> , <i>Calotropis procera</i> , <i>Carissa carandas</i> , <i>Jasminum sambac</i> , <i>Nerium oleander</i> , <i>Pluchea rouxburghii</i>
Ground Covers and Grasses	<i>Cynodon dactylon</i> , <i>Desmostachya bipinnata</i> , <i>Vetiveria zizanioides</i> , <i>Panicum maximum</i> , <i>Pennisetum purpureum</i> , <i>Saccharum spontaneum</i> , <i>Setaria sphacelata</i> , <i>Vetiveria zizanioides</i> , <i>Zoysia matrella</i>
Fruit-Bearing Trees and Shrubs Medicinal and Aromatic Plants	<i>Aegle marmelos</i> , <i>Citrus limon</i> , <i>Carissa carandas</i> , <i>Morus alba</i> , <i>Moringa oleifera</i> , <i>Syzygium cumini</i> , <i>Ziziphus mauritiana</i> , <i>Psidium guajava</i> , <i>Aloe vera</i> , <i>Asparagus dumosus</i> , <i>Lycium europaeum</i> , <i>Coleus aromaticus</i> , <i>Vogelia indica</i> , <i>Plumbago zeylanica</i> , <i>Cymbopogon citratus</i> , <i>Cymbopogon martini</i> , <i>Ocimum basilicum</i> , <i>Salvia santolinifolia</i> , <i>Fagonia cretica</i> , <i>Withania somnifera</i> , <i>Tribullus terrestris</i> , <i>Pedaliium murex</i>

2.9 RAINWATER HARVESTING

Rainwater harvesting systems will be installed in all the proposed area, canteen buildings. Installing a rainwater harvesting system in residential buildings can be a sustainable way to conserve water and reduce reliance on traditional water sources.

The natural source of rainwater will be collected, stored and the filtration process was carried out by charcoal bed filter and Chlorination. After the treatment, the treated water was stored and pumped to various locations in the CCVL area through underground pipes. No filtration system water was used for the dust suppression system.



3. DESCRIPTION OF ENVIRONMENT

3.1. INTRODUCTION

This chapter covers the description of the baseline status of the study area for both terrestrial and marine components with respect to the prevailing environment attributes. The baseline data were collected during February to May 2024. The radial distance of 10 km from the project site is selected as study area for baseline data collection and monitoring. The primary data collected under this project and also compared with secondary data.

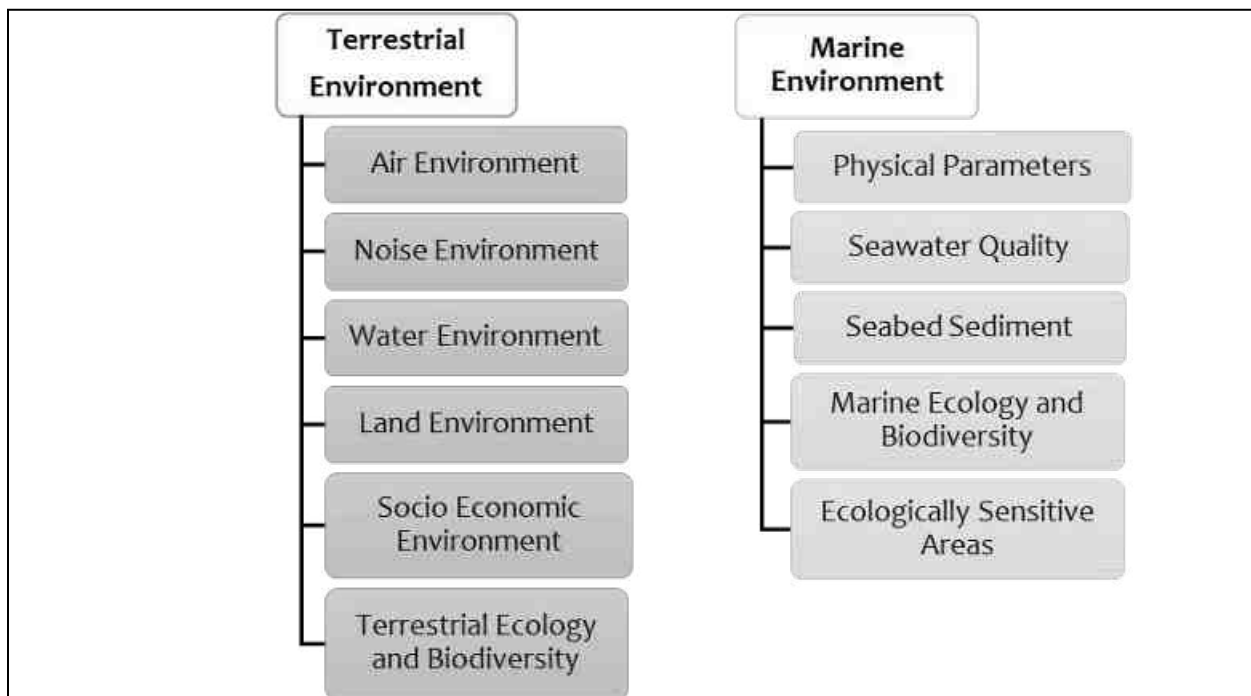


Figure 9. Outline of Baseline data

All samples were analysed at Indomer's in-house laboratory which is accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL). NABL certificate is given in **Chapter 12**. Methods of collection and analysis protocols are given in **Annexure IV**.

Study area: A radial distance of 10 km from the project boundary is selected to undertake baseline monitoring. Initial assessment of the study area through satellite imagery and field visit has been conducted to work out basic planning of environmental monitoring of various parameters. Details of the study area around the project region are given below. Terrestrial monitoring stations were established in the selected villages based on monitoring guidelines prescribed for each environmental attribute.



Table 18. Sampling Locations

S. No.	Study area	Distance (km) from project area	Direction
1	Chithirai pettai	1.6	W
2	Semmankuppam	3.5	NW
3	Karaikadu	6.8	NW
4	Thontamanattam	5.1	NW
5	Thiyagavalli	2.3	SW
6	Anukkambattu	7.0	SW

3.2. BASE MAPS OF THE AREA

3.2.1 Google Image of the Project Site

Map showing Study area & Close view of the study area is given at section 2.3.

3.2.2 Topographical Map

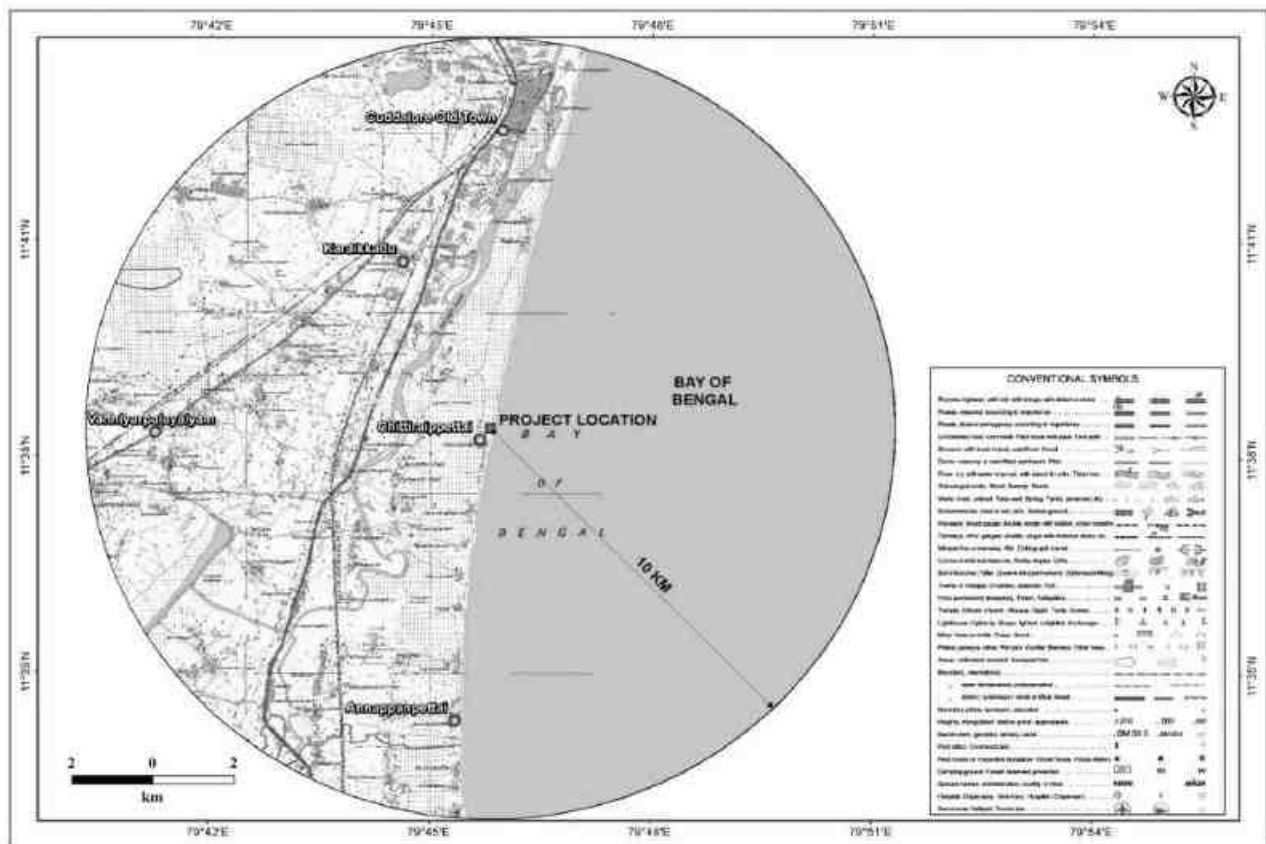


Figure 10. Survey of India Toposheet (1:50,000 scale)

3.3 METHODOLOGY OF BASELINE DATA COLLECTION

3.4 METEOROLOGY

The meteorological parameters were collected for different parameters as follows.



Figure 11. Meteorological parameters

3.4.1 Temperature

The monthly mean maximum air temperature for Cuddalore district varies from 28°C to 35°C. The maximum temperature of 35°C is found in June. Minimum temperature of 22°C is found in January and February. As per IMD classification, the Cuddalore region experiences four seasons.

Table 19. Temperature

Month	Max (°C)	Min (°C)	Avg (°C)	Season
Jan	28	22	25	Northeast monsoon
Feb	29	22	26	Fair weather
Mar	31	24	27	
Apr	33	29	29	
May	34	28	30	Southwest monsoon
Jun	35	28	31	
Jul	33	27	30	
Aug	33	27	29	
Sep	32	26	28	Northeast monsoon
Oct	30	26	28	

Source: World Weather Online



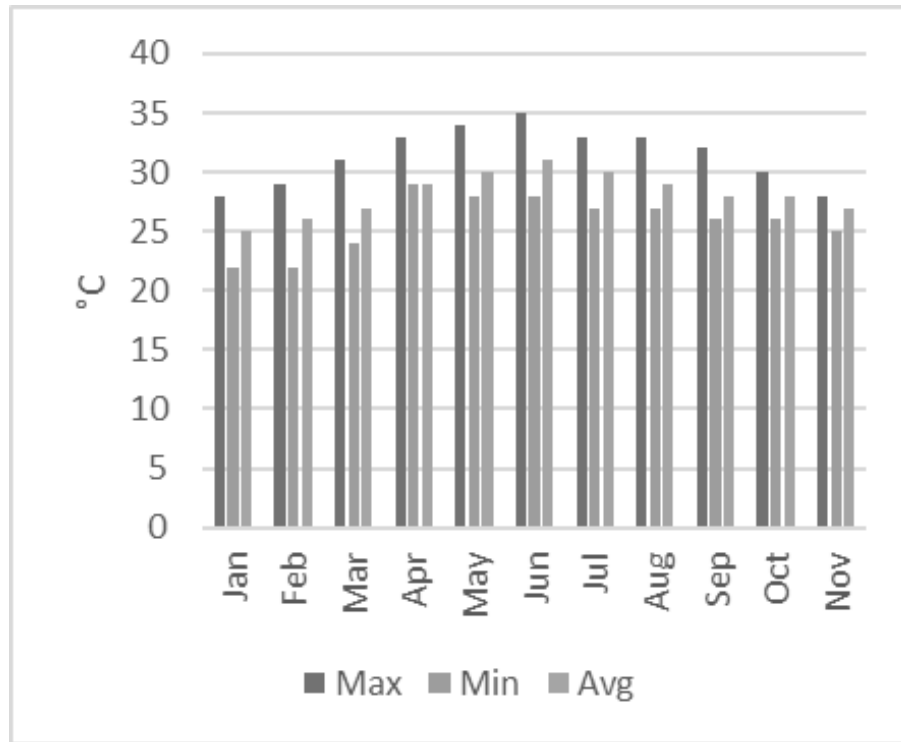


Figure 12. Temperature

3.4.2 Relative Humidity

The water content in the form of water vapour present in the atmosphere is referred to as humidity. The humidity varied between 65 % and 81 % in the year 2023.

Table 20. Relative Humidity

Month	Humidity %	Cloud cover %
Jan	71	33
Feb	71	15
Mar	75	23
Apr	74	20
May	71	27
Jun	67	44
Jul	65	48
Aug	69	43
Sep	73	54
Oct	75	38
Nov	81	65
Dec	78	65

Source: World Weather Online



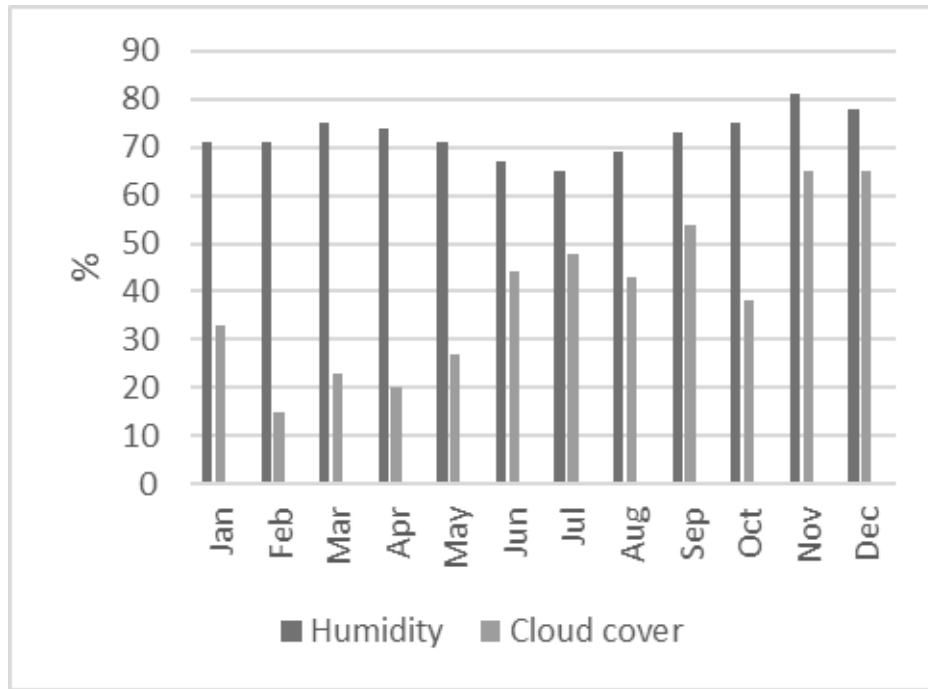


Figure 13. Relative Humidity

3.4.3 Rainfall

The available monthly average rainfall data for Cuddalore district from world weather online for the year 2023 is given below. The year 2023 has received the annual rainfall of 1299.6 mm. The maximum rainfall of 331.6 mm is received in the month of November 2023, whereas minimum rainfall of 8.8 mm in February 2023.

Table 21. Rainfall

Month	Monthly rainfall in 2023 (mm)
Jan	37.6
Feb	8.8
Mar	21.2
Apr	20.4
May	46.4
Jun	62.8
Jul	75.8
Aug	134.2
Sep	103.9
Oct	208.1
Nov	331.6
Dec	178.8
Annual rainfall	1299.6

Source: World Weather Online



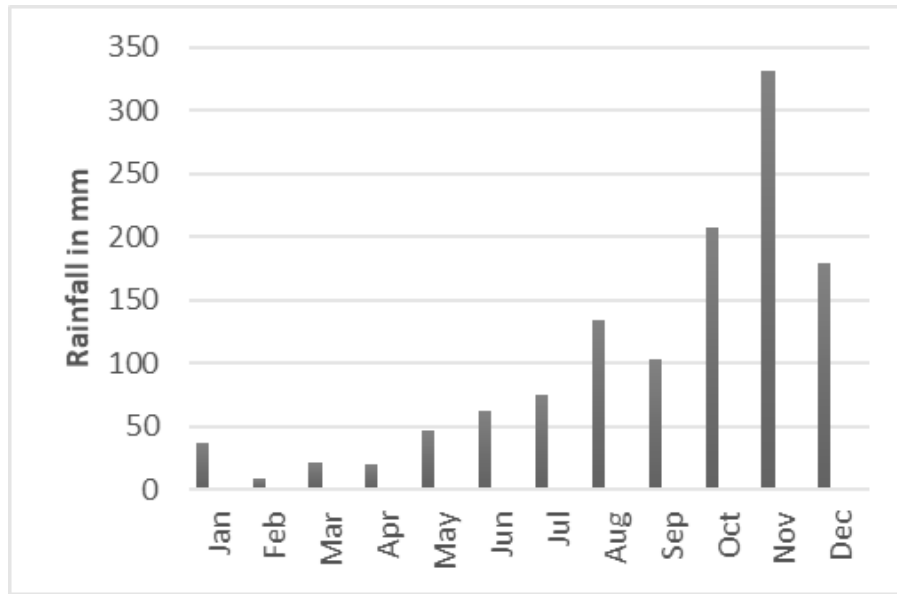


Figure 14. Rainfall

3.4.4 Average pressure:

The cloudiness, wind and precipitation are caused by the fall in atmospheric pressure. The atmospheric pressure varies between 1001 mbar in March to 1013 mbar in January 2023.

Table 22. Average Pressure

Month	Average Pressure (mbar)
Jan	1013
Feb	1012.7
Mar	1001
Apr	1008.6
May	1007.1
Jun	1005.7
Jul	1006.7
Aug	1007.4
Sep	1006.9
Oct	1010.5
Nov	1011.2
Dec	1011.9

Source: World Weather Online



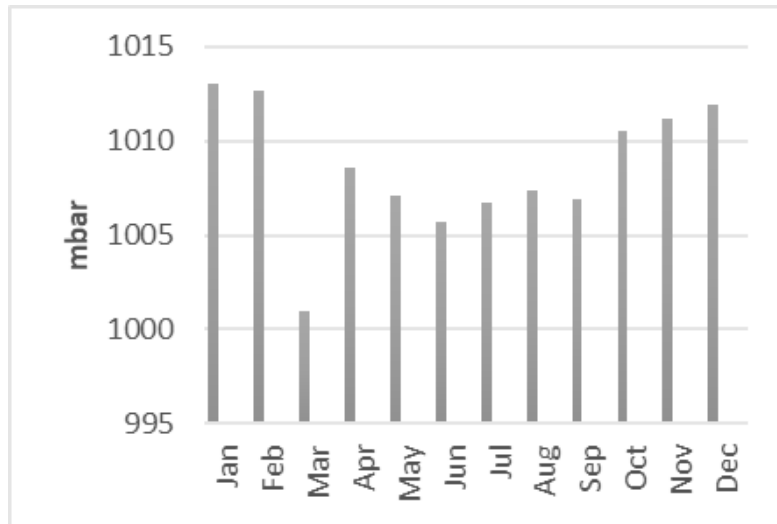


Figure 15. Average Pressure

3.4.5 Cloud cover

The cloud cover during the daytime helps to filter the direct effect of sun rays over the earth's surface thus reducing the heat. While the cloud cover in the night-time traps the heat emitted from the earth and thus feels warmer. From the data, it is observed that the cloud cover is very low during the winter and high during the pre-monsoon, monsoon and post-monsoon seasons experiencing earth's heat.

3.5 AMBIENT AIR QUALITY

3.5.1 Sampling Station Selection

The baseline status of the ambient air quality has been assessed through a scientifically designed monitoring network based on the following considerations on:



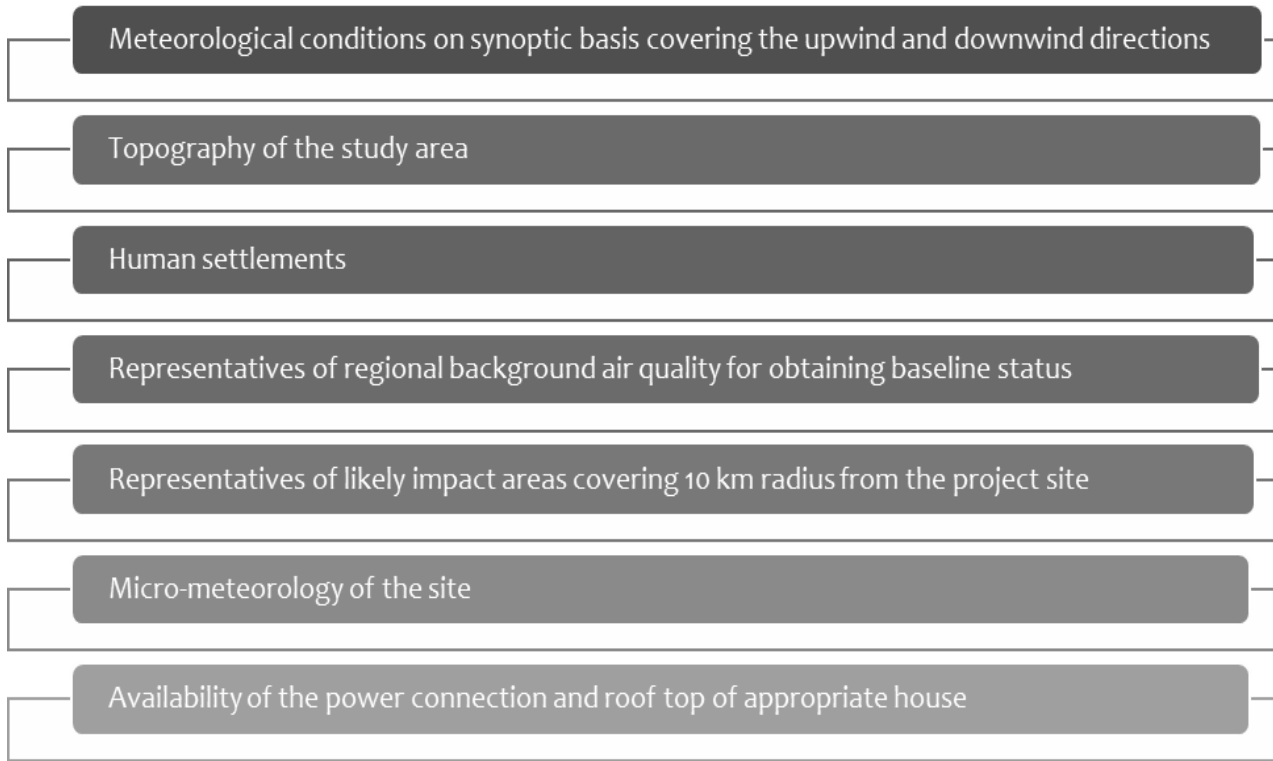


Figure 16. Sampling Air Location

Accordingly, Ambient Air Quality Monitoring (AQ) stations were set up at four locations with due consideration to the above-mentioned points. The monitoring stations were selected in consultation with FAEs and as per the guidelines of CPCB considering micro-meteorology of the site. The monitoring locations were selected within a 10 km radius of the proposed project location. The sampling points are well distributed around the project location and appropriate parameters were monitored. The locations of Ambient Air quality monitoring are given in Table 21. and is shown in Fig. 3.1.

- AQ1 - Near Project area
- AQ2 - Upwind direction
- AQ3 - Down wind direction
- AQ4 - Upwind direction
- AQ5 - Upwind direction
- AQ6 - Down wind direction



3.5.2 Ambient Air Sampling Locations

Table 23. Ambient Air Sampling Locations

Station	Locations	Project Area/Study Area	Environmental setting /Area Classification	WGS 84		Distance & Direction from project area (km)
				Latitude, N	Longitude E	
AQ1	MTF Port control office	Near Project area	-	11°38'22.4"	79°45'44.7"	0.15 -W
AQ2	CCVL Plant	Study area	Industrial	11°38'17.6"	79°45'43.8"	2.8- W
AQ3	Poondiyankuppam	Study area	Residential	11°37'57.0"	79°43'53.1"	3.5-Sw
AQ4	Sangolikuppam	Study area	Residential	11°39'43.6"	79°44'47.2"	3.1 - NW
AQ5	Annavalli	Study area	Residential	11°41'29.1"	79°43'26.9"	7.2 - NW
AQ6	Tazhanchavadi	Study area	Residential	11°35'11.0"	79°43'48.5"	6.8 - SW

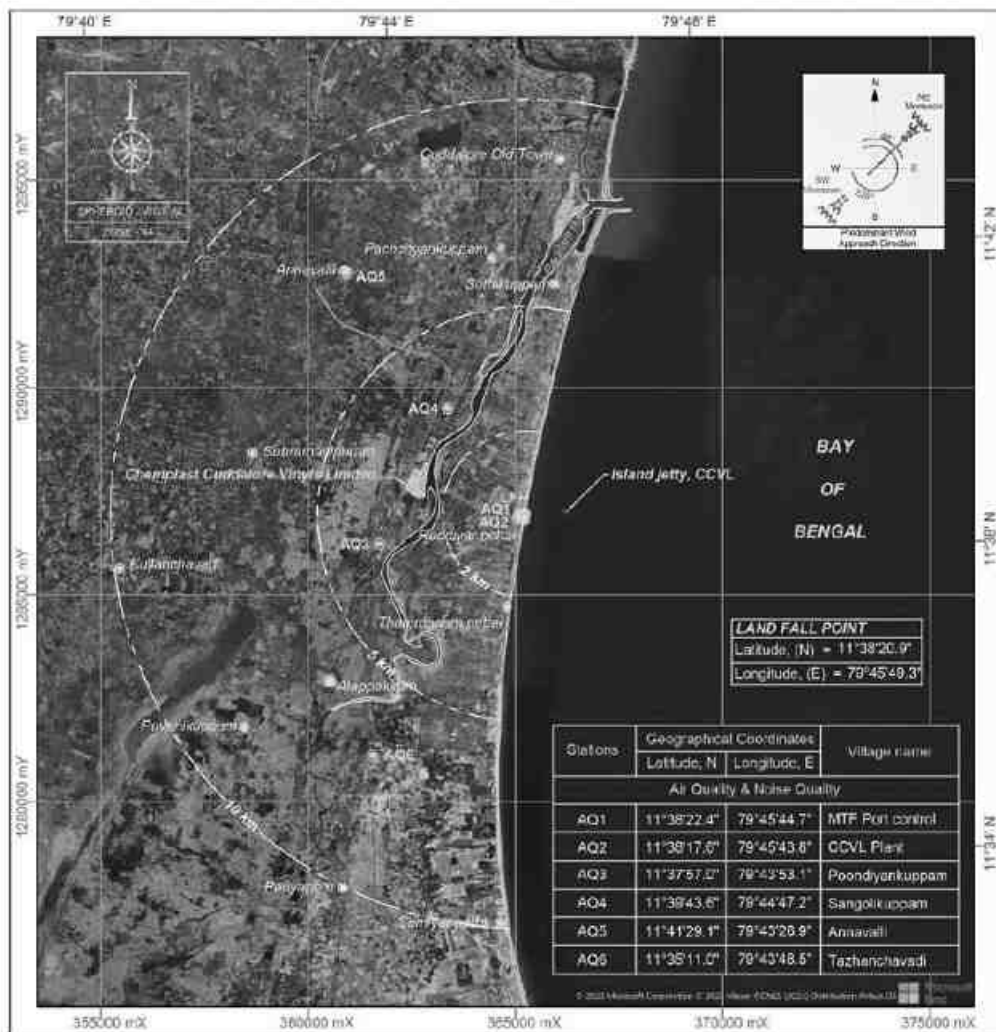


Figure 17. Locations of air quality monitoring



AQ1 – Badaputti



AQ3 – Poondiyankuppam



AQ4 – Sangolikuppam



AQ5 – Annavelli



AQ6 – Thazhanchavadi

Figure 18. Air Sampling Stations

3.5.3 Sampling Procedure

The particulate matters and gaseous air samples were collected using Respirable dust sampler PM₁₀ and PM_{2.5} samplers. The monitoring was carried out with a frequency of 24 hours twice in week at each location for one season. The National Ambient Air Quality Standard is given in Table 22. In compliance with the National Ambient Air Quality Standards (NAAQS), 2009 issued by MoEFCC vide G.S.R. No. 826 I dated 18th November 2009; the parameters monitored are as follows:

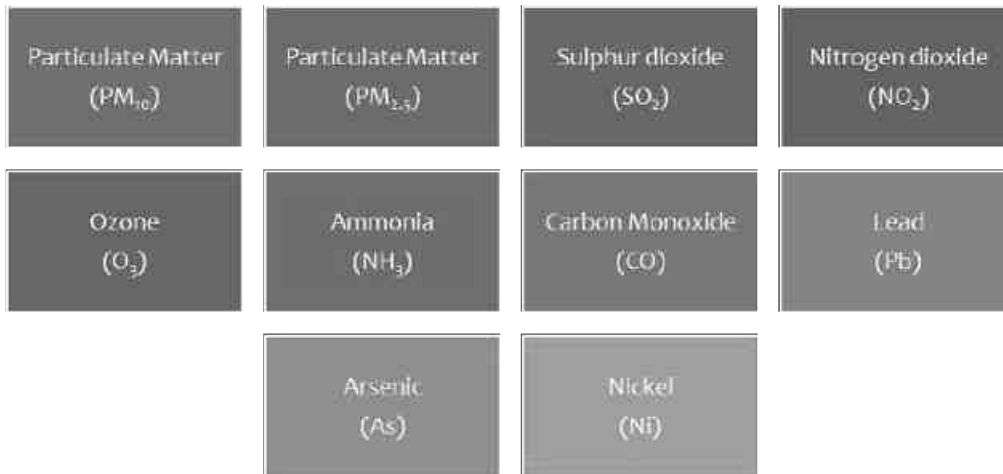


Figure 19. Sampling Procedure

Table 24. National Ambient Air Quality Standards (NAAQS)

Pollutant	Time	Industrial, Residential, Rural & other areas	Ecologically sensitive area (Notified by Central Govt.)
Particulate Matter (Size less than 10 µm) PM ₁₀ µg/m ³	Annual Avg.	60	60
	24 hours	100	100
Particulate Matter (Size less than 2.5 µm) PM _{2.5} µg/m ³	Annual Avg.	40	40
	24 hours	60	60
Sulphur Dioxide (µg/m ³)	Annual Avg.*	50	20
	24 hours**	80	80
Oxides of Nitrogen (µg/m ³)	Annual Avg.	40	30
	24 hours	80	80
Carbon monoxide (mg/m ³)	8 hours	2	2
	1 hour	4	4
Ozone (µg/m ³)	8 hours	100	100
	1 hour	180	180
Ammonia (µg/m ³)	Annual	100	100
	24 Hours	400	400
Lead (µg/m ³)	Annual	0.5	0.5
	24 Hours	1.0	1.0
Arsenic (ng/m ³)	Annual	06	06
Nickel (ng/m ³)	Annual	20	20

Source: Gazette of India Notification, dated 18th November 2009

* Annual Arithmetic Mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals

** 24 hourly or 8 hourly or 01 hourly monitored values, as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed the limits but not on two consecutive days of monitoring.



3.5.4 Analytical methods followed for Ambient Air Quality Monitoring

3.5.5 Ambient Air Quality Results

3.5.5.1 Feb 2024 to May 2024:

Table 25. Ambient Air Quality Results (PM10, PM2.5 & SO2)

Station	PM10 ($\mu\text{g}/\text{m}^3$)				PM2.5 ($\mu\text{g}/\text{m}^3$)				SO2 ($\mu\text{g}/\text{m}^3$)			
	Min	Max	Mean	98 th percentile	Min	Max	Mean	98 th percentile	Min	Max	Mean	98 th percentile
AQ1	42.5	57.2	49.4	56.0	18.2	29.8	23.1	29.0	5.9	9.2	7.4	9.0
AQ2	45.9	82.2	65.9	81.6	29.7	43.1	33.8	42.1	9.4	18.6	13.4	18.0
AQ3	37.9	58.6	46.3	57.6	17.6	31.5	23.4	30.5	6.1	10.7	8.1	10.1
AQ4	40.6	55.6	47.3	54.4	17.3	27.9	20.9	26.5	6.5	9.9	7.8	9.5
AQ5	39.7	52.4	45.4	51.6	19.4	25.3	21.6	24.6	5.9	8.4	6.9	8.3
AQ6	33.6	49.9	42.4	49.1	16.7	28.8	21.5	28.2	6.2	10.8	8.2	10.2

Table 26. Ambient Air Quality Results (NO2, O3 & Ammonia)

Station	NO2 ($\mu\text{g}/\text{m}^3$)				Ozone ($\mu\text{g}/\text{m}^3$)				Ammonia ($\mu\text{g}/\text{m}^3$)			
	Min	Max	Mean	98 th percentile	Min	Max	Mean	98 th percentile	Min	Max	Mean	98 th percentile
AQ1	7.1	12.9	10.0	12.4	5.4	8	6.2	7.9	5.1	9.1	6.0	8.7
AQ2	13.6	26.8	19.7	25.7	6.2	11.3	8.5	11	5.2	7.6	5.9	7.4
AQ3	10.7	20.4	14.6	19.7	5.2	6.1	5.4	6.0	5.1	5.9	5.2	5.8
AQ4	8.5	19.6	13.2	19	BDL	BDL	BDL	BDL	5.5	9.8	7.0	9.6
AQ5	7.7	17.4	11.7	16.6	BDL	BDL	BDL	BDL	5.8	9.6	6.7	9.4
AQ6	6.9	15.5	10.4	14.7	BDL	BDL	BDL	BDL	5.9	12.1	7.7	11.7



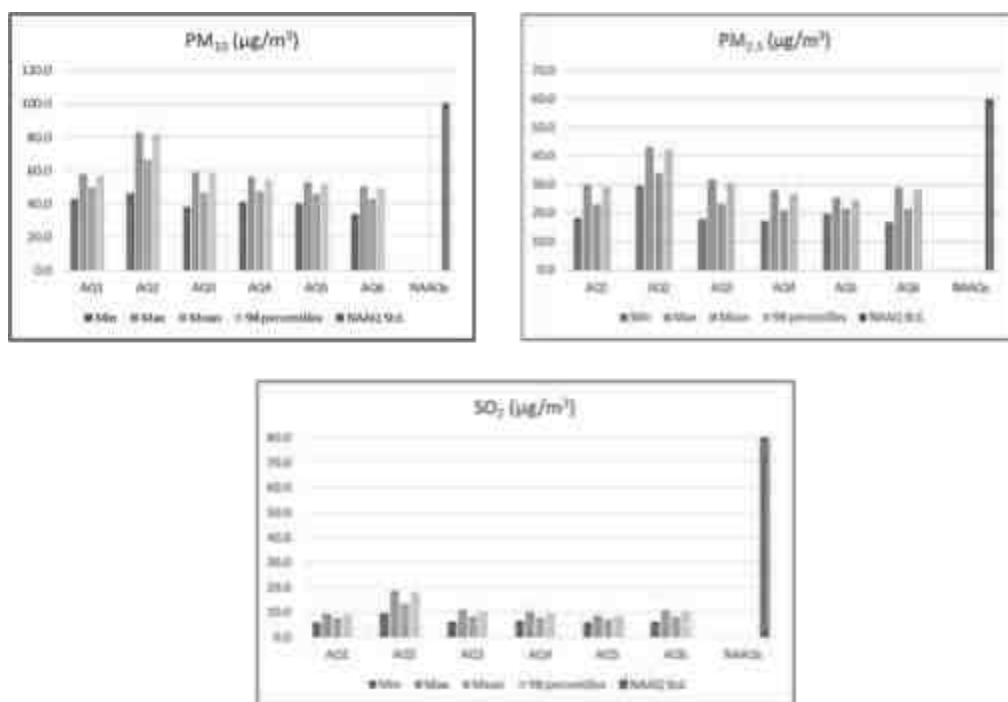


Figure 20. Ambient Air Quality Results PM10, PM2.5 & SO2

Table 27. Ambient Air Quality Results (CO, Lead, Arsenic, Nickel & Benzene)

Station	Carbon monoxide (mg/m ³)				Lead (µg/m ³)	Arsenic (ng/m ³)	Nickel (ng/m ³)	Benzene (µg/m ³)
	Min	Max	Mean	98 percentiles				
AQ1	BDL (DL:0.115)				BDL (DL:0.02)	BDL (DL:1.0)	BDL (DL:3.0)	12.2
AQ2	0.12	0.87	0.43	0.85	BDL (DL:0.02)	BDL (DL:1.0)	BDL (DL:3.0)	16.74
AQ3	BDL (DL:0.115)				BDL (DL:0.02)	BDL (DL:1.0)	BDL (DL:3.0)	14.63
AQ4	BDL (DL:0.115)				BDL (DL:0.02)	BDL (DL:1.0)	BDL (DL:3.0)	24.5
AQ5	BDL (DL:0.115)				BDL (DL:0.02)	BDL (DL:1.0)	BDL (DL:3.0)	5.88
AQ6	BDL (DL:0.115)				BDL (DL:0.02)	BDL (DL:1.0)	BDL (DL:3.0)	6.03



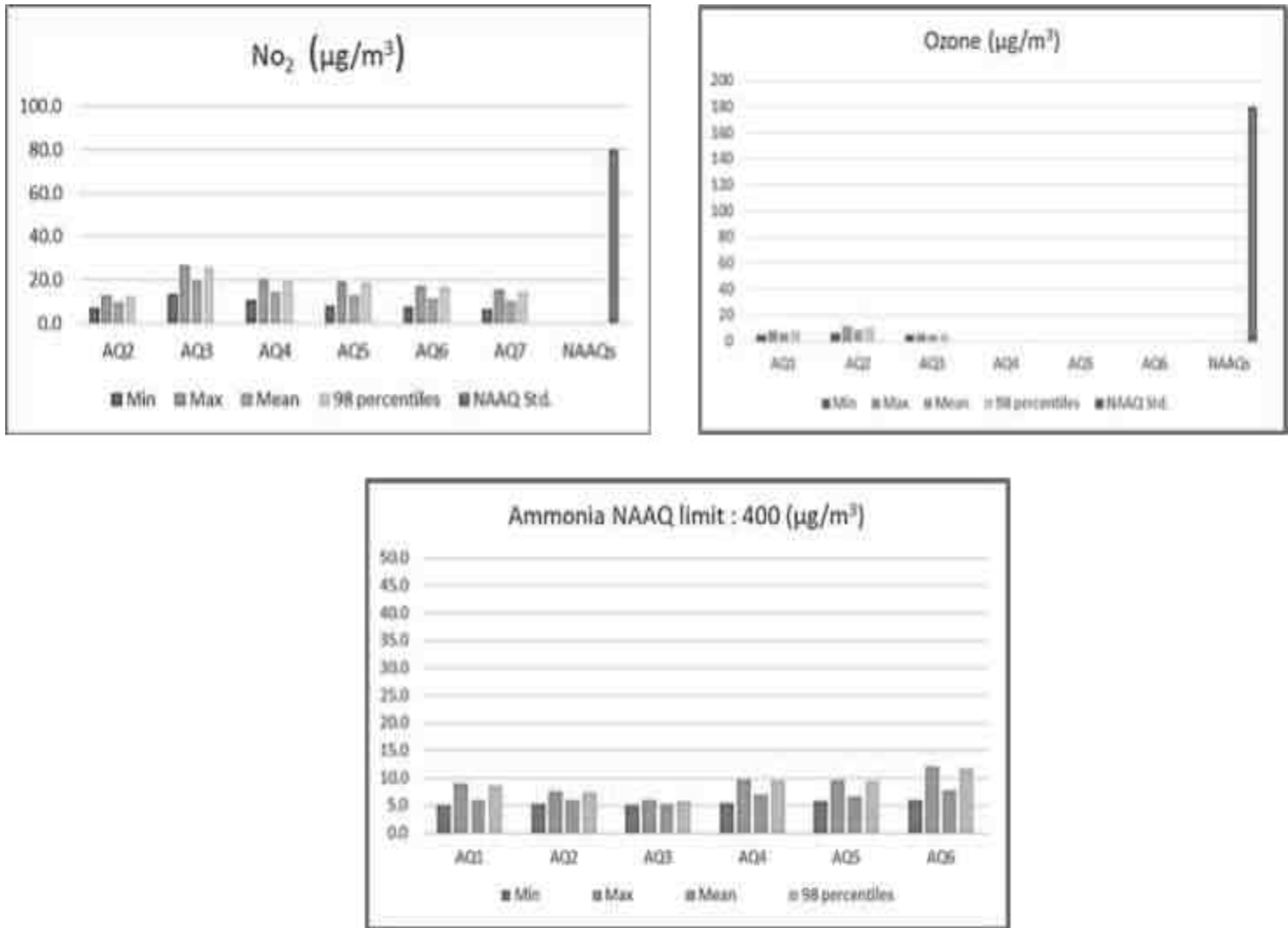


Figure 21. Ambient Air Quality Results NO₂, Ozone & Ammonia

3.5.5.2 Data Interpretation

The ambient air quality results are summarized in the above tables.

Particulate Matter (PM₁₀)

Airborne particulate matter is a complex mixture of fine particles and aerosols that varies greatly in size, shape, and chemical content depending on its sources. As a result, they include organic chemicals, carbon, metal compounds, inorganic salts, etc. The respiratory system exposed to PM₁₀ having a diameter of 10 microns or less will have detrimental health effects.

The Particulate Matter (PM₁₀) concentration varied between 33.6 µg/m³ and 82.2 µg/m³. The maximum level (82.2 µg/m³) was observed at CCVL Plant (stn. AQ2) and the minimum level (33.6



$\mu\text{g}/\text{m}^3$) were observed at Thazhan chavadi (stn. AQ6). The observed levels are within the NAAQS, 2009 standard's permissible limit of $100\mu\text{g}/\text{m}^3$.

Particulate Matter (PM_{2.5})

Particulate matter that falls in this category will have particles that are 2.5 micrometers or smaller and are fine enough to penetrate the respiratory tract and enter the lungs. On partial exposure, shortness of breath, coughing, sneezing, runny nose and discomfort in eyes, nose, throat & lung can occur. Chronic bronchitis decreased lung function; lung cancer and heart disease mortality have been linked to long term exposure of PM_{2.5}.

The concentration of PM_{2.5} varied between $16.7\mu\text{g}/\text{m}^3$ and $43.1\mu\text{g}/\text{m}^3$. The maximum ($43.1\mu\text{g}/\text{m}^3$) occurred at AQ2-CCVL Plant (stns. AQ2) and the minimum ($16.7\mu\text{g}/\text{m}^3$) at Thazhan chavadi (stns. AQ6) during the study period. The measured readings are within the NAAQ, 2009 standard's permissible limit ($60\mu\text{g}/\text{m}^3$).

Gaseous Pollutants

SO₂: The respiratory tract becomes irritated and is more likely to contract which results in infection when SO₂ is inhaled. Asthma and chronic bronchitis are aggravated and causes cough and mucus production. The concentration of SO₂ varied between $5.9\mu\text{g}/\text{m}^3$ and $18.6\mu\text{g}/\text{m}^3$. The values are within the prescribed limit ($80\mu\text{g}/\text{m}^3$) of NAAQ, 2009 standard.

NO₂: Elevated levels of NO₂ can cause damage to the human respiratory tract and increase vulnerability and severity of respiratory infections and asthma. Long-term exposure to high levels can cause chronic lung disease. The concentration of NO₂ varied between $6.9\mu\text{g}/\text{m}^3$ and $26.8\mu\text{g}/\text{m}^3$. The values are within the prescribed limit ($80\mu\text{g}/\text{m}^3$) of NAAQ, 2009 standard.

Ozone: Ozone exposure commonly causes health problems such as headaches, coughing, dry throat, shortness of breath and heavy feeling in the chest. The concentration of ozone AQ1, AQ2 and AQ3 varied from $5.2\mu\text{g}/\text{m}^3$ to $11.3\mu\text{g}/\text{m}^3$ and AQ3, AQ4 and AQ5 values are below detectable limit. The values are within the prescribed limit ($180\mu\text{g}/\text{m}^3$) of NAAQ, 2009 standard.

Ammonia: Low concentrations of ammonia in the body can cause cough, sore throats and nose & throat irritation. Whereas high concentrations of ammonia in the air can cause blindness, lung damage or even death due to burning of the eyes, nose, throat and respiratory system. The concentration of ammonia varied from $5.1\mu\text{g}/\text{m}^3$ to $12.1\mu\text{g}/\text{m}^3$. The values are within the prescribed limit ($400\mu\text{g}/\text{m}^3$) of NAAQ, 2009 standard.

Carbon monoxide: The concentration of CO Values varied between $0.12\text{ mg}/\text{m}^3$ and $0.87\text{ mg}/\text{m}^3$ in AQ2- CCVL plant and all other stations were found to be below the detection limit of $<0.115\text{ mg}/\text{m}^3$ i.e stn.AQ1, stn.AQ3 to stn.AQ6. The value is within the prescribed limit ($4\text{ mg}/\text{m}^3$) of NAAQ, 2009 standard.



Lead, Arsenic and Nickel: Their levels were below the detectable limits (Detection ranges for Pb, As, Ni were 0.02 µg/m³, 1.0 ng/m³ and 3.0 ng/m³, respectively).

3.6 NOISE LEVEL

Impact of noise sources on the environment depends upon the sources which are generating the noise and their respective characteristics. The environmental impact of the noise level can have several effects varying from annoyance to hearing loss depending on loudness of noise levels.

3.6.1 Methodology

3.6.2 Ambient Noise Sampling Station

Environmental noise is usually measured outdoors where noise exposure may be an issue. To analyse the current ambient noise level status considerations like noise source, significant activity occurring at the areas, temporal pattern, shift length, etc., are taken.

The daytime noise levels were measured from 6 am to 10 pm and the nighttime levels were measured from 10 pm to 6 am. Following the field survey's identification of the noise source, four monitoring stations (stns. NQ1 to stn. NQ6) were chosen to be within a 10 km radius from the proposed project location. Using a digital sound level meter, the noise levels were tracked for 24 hours on an hourly basis (i.e., an average reading was taken every 15 minutes). Locations of Noise level monitoring are given in Table 28.

Table 28. Locations of noise level monitoring

Station	Locations	Environmental setting /Area Classification	WGS 84	
			Latitude, N	Longitude E
NQ1	MTF Port control office	Residential	11°38'2".0"	79°45'4".0"
NQ2	CCVL Plant	Industrial	11°38'5".3"	79°44'2".1"
NQ3	Poondiyankuppam	Residential	11°37'4".6"	79°43'5".3"
NQ4	Sangolikuppam	Residential	11°39'4".0"	79°44'5".0"
NQ5	Annavalli	Residential	11°39'2".0"	79°43'1".0"
NQ6	Tazhanchavadi	Residential	11°35'".0"	79°43'3".0"

Table 29. Ambient Noise Quality Standards

Type of Area	Limits in dB(A) L_{eq}^*	
	Day Time	Night Time
Industrial	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

*-dB (A) L_{eq} denotes the time weighted average of the sound level in decibels on scale A which is relatable to human hearing Source: Pollution Control Acts, Rule and Notifications issued there under, by Pollution Control Law Series:



CLS/02/2006(Fifth Edition) of Central Pollution Control Board, January 2006, pp 926 Day and Night time shall mean from 6:00 a.m. to 10:00 p.m. and 10:00 p.m. to 6:00 a.m. respectively.

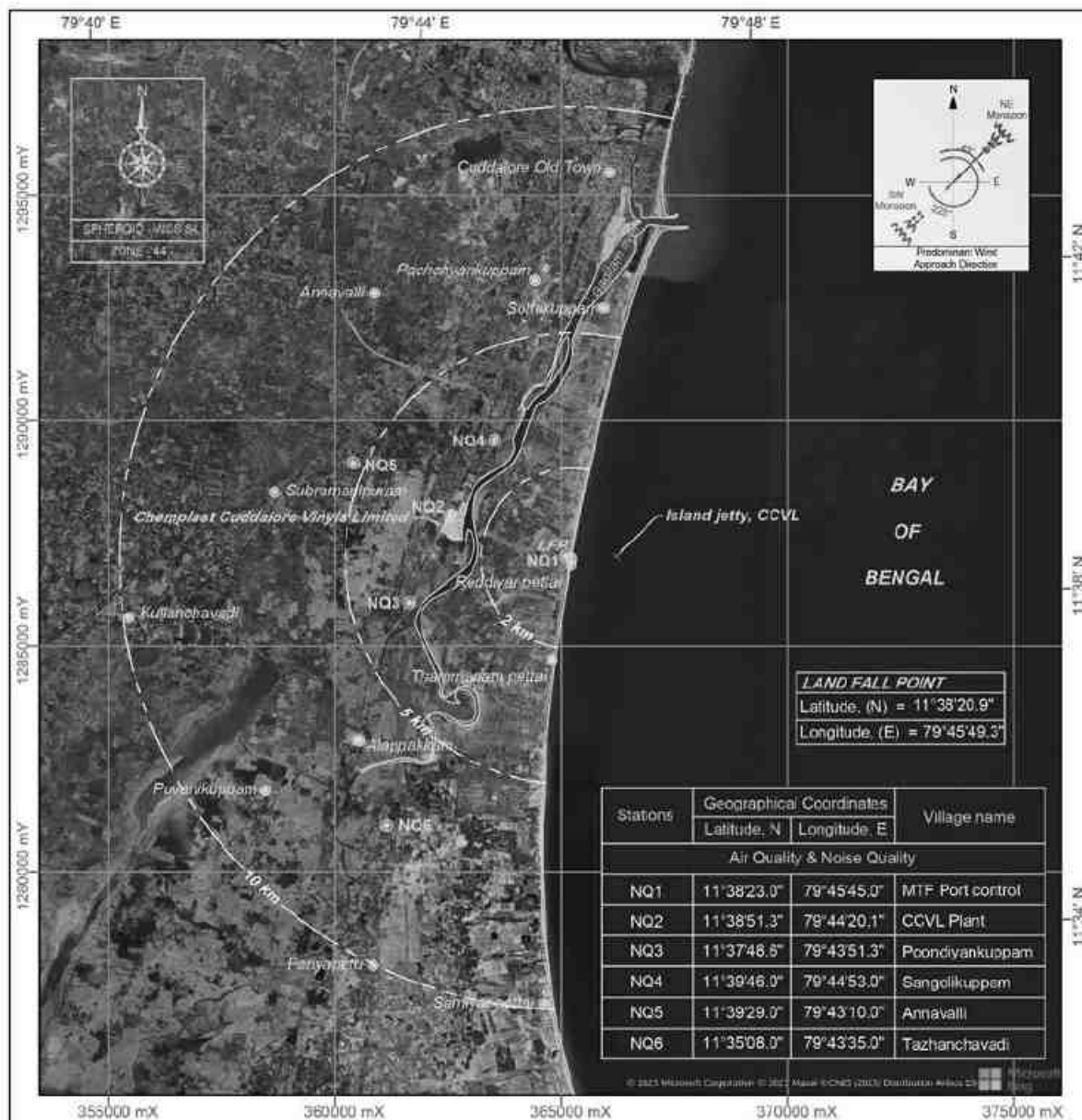


Figure 22. Locations of noise level monitoring



NQ1-MTF Port control office



NQ3 – Poondiyan kuppam



NQ1-MTF Port control office



NQ3 – Poondiyan kuppam



N-6 - Thazanchavadi

Figure 23. Locations of Noise

3.6.2.1 Results and Discussion

The Ambient Noise Quality results are summarized above. The results are discussed below:

Table 30. Noise quality

Station	Equivalent Noise Level in dB(A)					
	Day Time			Nighttime		
	L Min	L Max	L equivalent	L Min	L Max	L equivalent
NQ1	41.1	51.9	47.5	40.2	42.6	41.6
NQ2	49.7	64.0	59.9	48.3	55.6	52.8
NQ3	37.4	49.8	46.3	34.8	43.9	40.1
NQ4	38.7	49.8	44.5	37.9	41.2	39.6
NQ5	40.0	53.7	48.6	37.4	42.4	40.5
NQ6	34.7	49.4	43.6	33.8	42.7	40.2

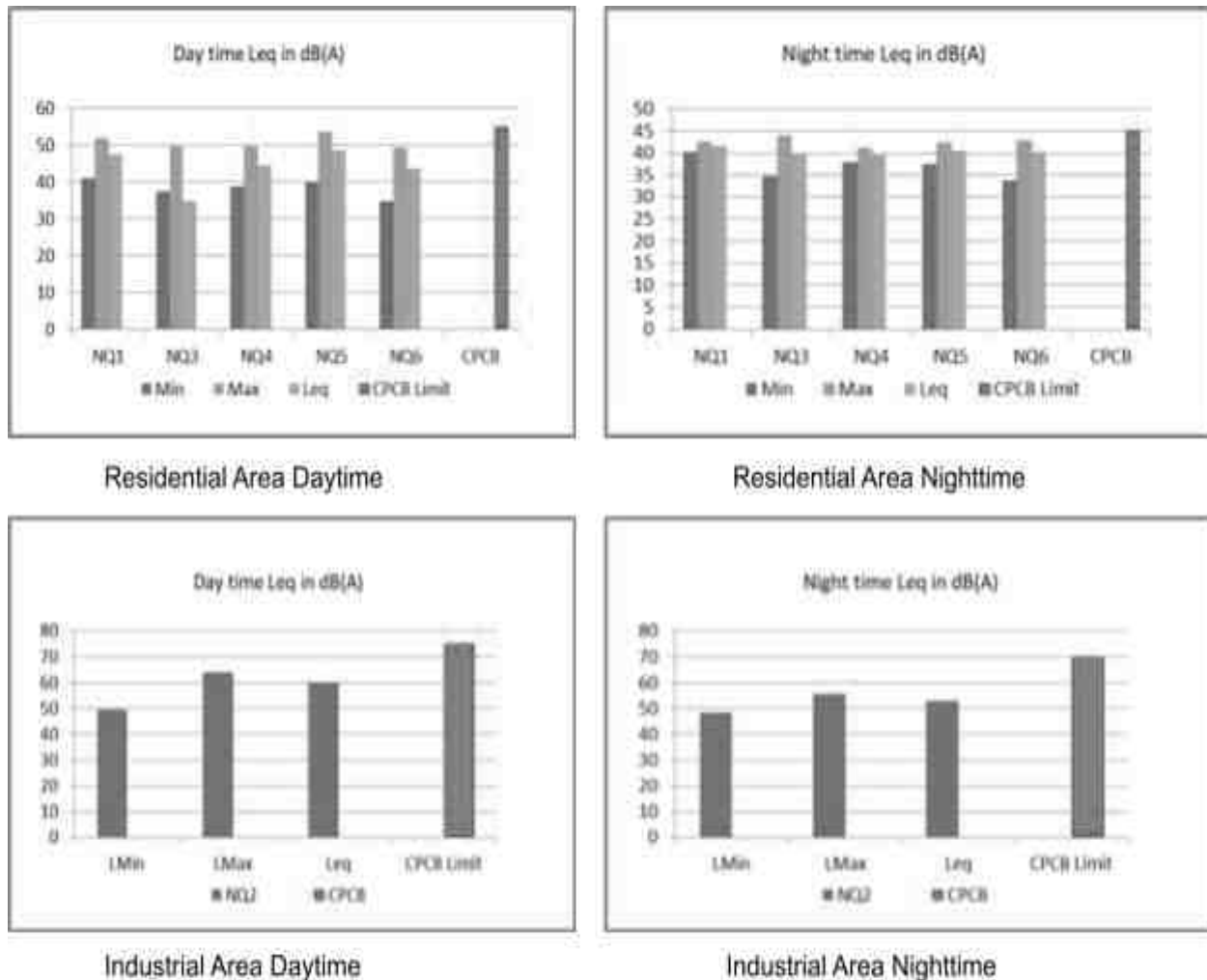


Figure 24. Results of Noise Locations

The Ambient Noise Quality results are summarized above. The results are discussed below:

Residential area: During the day, the equivalent noise levels in this area ranged from (NQ1, NQ3, NQ4, NQ5 and NQ6) 34.7 dB (A) to 53.7 dB (A), whereas at night they were in the range of 33.8 to 43.9 dB (A). The Stn. NQ6- Thazhanchavadi is the lowest daytime noise equivalent 34.7dB (A) level and the Stn. NQ5- Annavalli had the highest 53.7dB (A). The NQ6-Thazhanchavadi site area had the lowest nighttime noise equivalent 33.8 dB (A) and the NQ3- Poondiyankuppam site area the highest 43.9 dB (A).

Industrial area: NQ2 – CCVL plant Day time range is 49.7 dB (A) to 64.0 and the night time is 48.3dB (A) to 55.6dB (A).



The monitored noise level of (Stns NQ1 to NQ6) both residential and Industrial areas at day and night time were within the CPCB's limit.

3.8 WATER QUALITY

3.8.1 Sampling Station

Water samples were collected from six stations for surface water (stns. SW1 to SW6) and ground water (stns. GW1 to GW6).

Locations of ground water sampling are given in Table 29 and in Figs. 12.

One of the most vital supplies for the agricultural, industrial and human economies is groundwater. The bore-wells in the study areas villages are in use since most of their population use the water for drinking and domestic purposes. As a result, samples of bore well water have been taken into consideration.

Table 31. Location of ground water sampling stations

Station	Location	WGS 84		Environmental setting /Area Classification	Distance & Direction from project area
		Latitude, N	Longitude, E		
Ground water					
GW1	Chithirai pettai	11°38'33.8"	79°44'54.5"	Bore well	1.6 - W
GW2	Semmankuppam	11°39'16.7"	79°44'12.3"	Bore well	3.5 - NW
GW3	Karaikadu	11°41'50.6"	79°45'9.8"	Bore well	6.8 - NW
GW4	Thontamanattam	11°39'37.03"	79°43'16.5"	Bore well	5.1 -NW
GW5	Thiyagavalli	11°37'42.9"	79°44'37.1"	Bore well	2.3 - SW
GW6	Anukkambattu	11°37'29.4"	79°42'2.1"	Bore well	7.0 - SW



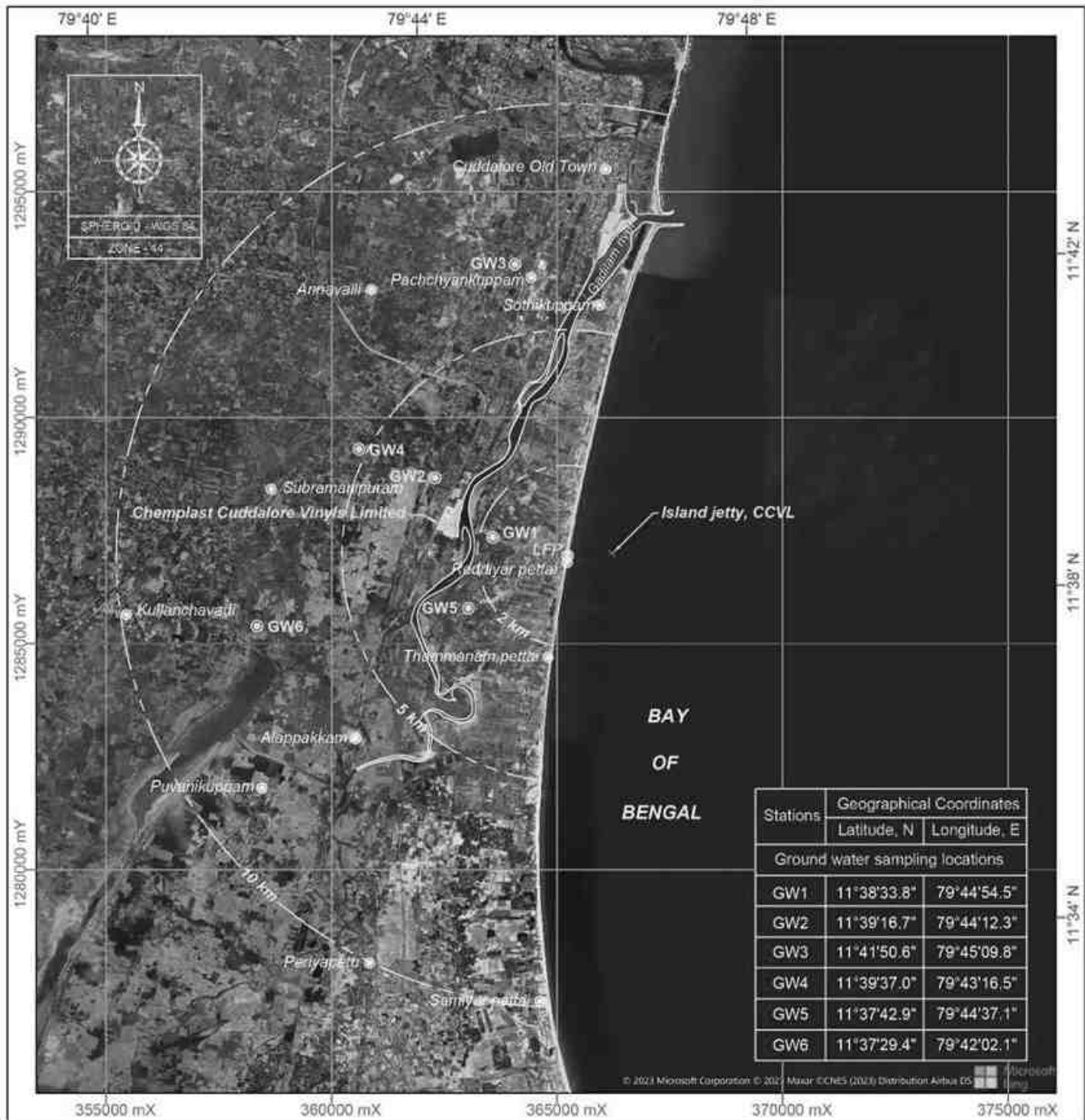


Figure 25. Locations of ground water sampling





Figure 26. Ground water Locations

Locations of surface water sampling are given in Table 30 and shown in Figs. 13.

The analysis of surface water quality is important because they help to protect and restore the quality of the surface waters, consistent with the requirements of the Water (Prevention and Control of Pollution) Act, 1974. Consequently, the water study may identify the changes of water quality or quantity, and a reduction or loss of the important function of this natural, i.e, streams and other water bodies can result in unfavourable impacts such as erosion, sedimentation, loss of aquatic and other wildlife habitats, changes to down or upstream ecosystems. In this regard, surface water samples were collected around the 10 km radius of the proposed project site.

Table 32. Location of surface water sampling stations

Station	Location	WGS 84		Environmental setting /Area Classification	Distance & Direction from project area
		Latitude, N	Longitude, E		
Surface Water					
SW1	Nochikadu	11°39'2.9"	79°45'10.9"	Pond	2.0 - NW



Station	Location	WGS 84		Environmental setting /Area Classification	Distance & Direction from project area
		Latitude, N	Longitude, E		
Surface Water					
SW2	Kodandaramapuram	11°38'46.7"	79°42'58.4"	Pond	5.0 - W
SW3	Cuddalore OT	11°42'38.5"	79°45'49.9"	Pond	9.0 - NW
SW4	Poochimedu	11°35'7.2"	79°44'6.2"	Pond	6.5 - S
SW5	S. Subramaniyapuram	11°40'8.0"	79°41'47.9"	Pond	8.0 - NW
SW6	Perumal Lake	11°37'8.2"	79°42'0.5"	Lake	7.0 SW

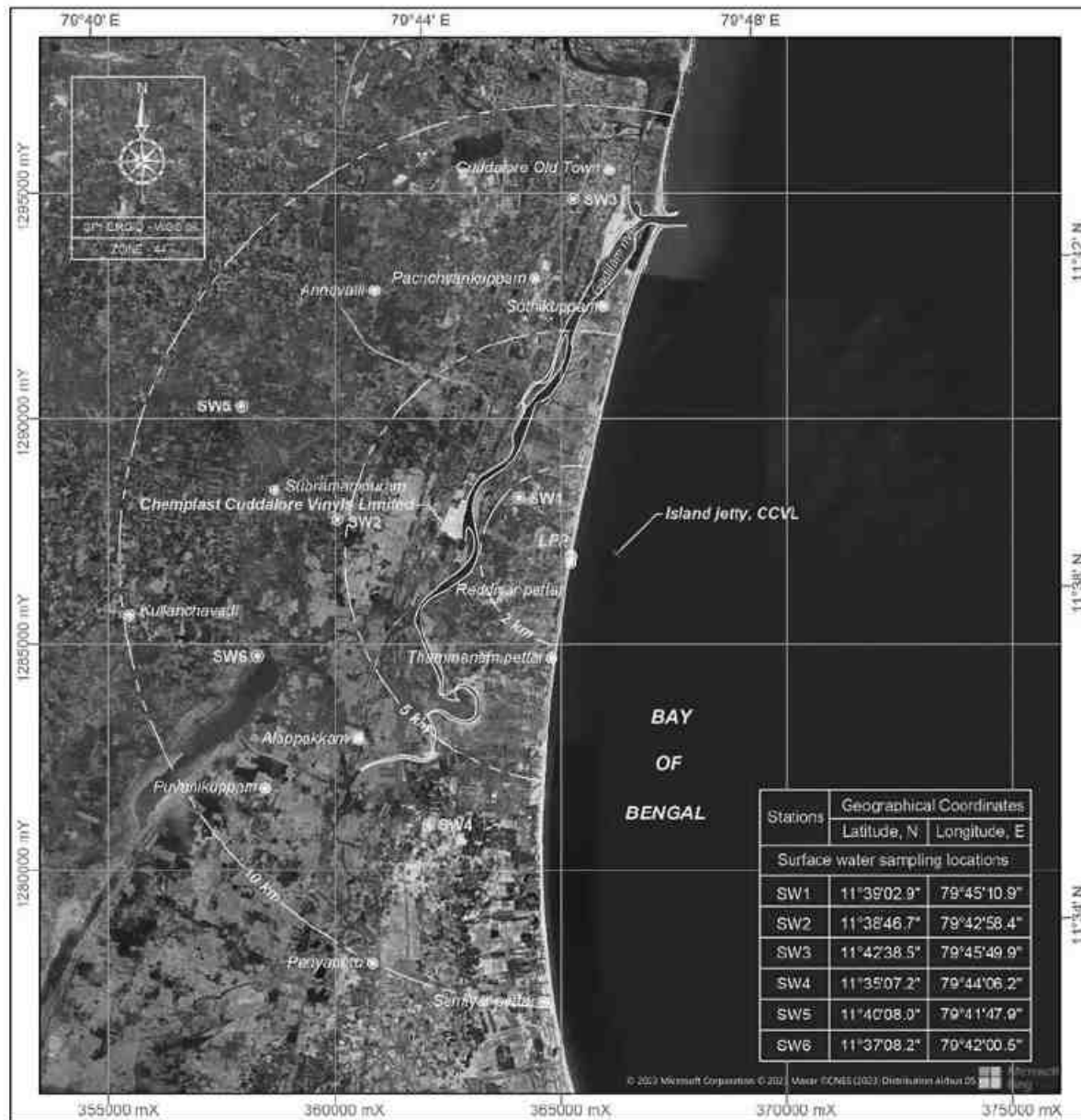


Figure 27. Locations of surface water sampling





Figure 28. Surface water sampling Locations

3.8.1.2 Ground Water Quality Results

Table 33. Results of Groundwater

S. No.	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	IS 10500:2012 Standards
1	Colour	Hazen	5	5	5	5	5	5	5 - 15
2	pH	-	7.92	8.06	8.11	7.35	8.01	7.34	6.5 - 8.5
3	Turbidity	NTU	0.43	0.23	0.79	0.99	0.13	1.16	1 - 5
4	Total Suspended Solid	mg/l	1	0.5	1.5	2	0.5	2.5	-
5	TDS	mg/l	280	440	720	440	1480	280	500 - 2000
6	Total Alkalinity	mg/l	117.9	143.5	110.7	16.4	188.6	61.5	200 - 600
7	Total Hardness	mg/l	90.0	95.0	100.0	90.0	360.0	140.0	200 - 600
8	Calcium as Ca	mg/l	32.1	36.1	26.1	28.1	106.2	46.1	75 - 200
9	Magnesium as Mg	mg/l	2.4	1.2	8.5	4.9	23.1	6.1	30 - 100
10	Ammonia	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5
11	Nitrate Nitrogen	mg/l	<0.1	1.01	7.17	9.77	0.61	7.15	45



S. No.	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	IS 10500:2012 Standards
12	Chloride	mg/l	20	69	30	60	357	69	250 - 1000
13	Sulphate	mg/l	11.7	29.9	22.9	31.8	16.2	25.4	200 - 400
14	Phosphate	mg/l	0.45	0.09	0.18	0.17	0.37	0.19	-
15	Sulphide	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05
16	Residual Chlorine	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2 - 1.0
17	Fluoride	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.0 - 1.5
18	Sodium	mg/l	38.8	88.7	52.3	33.4	168	32.3	-
19	Potassium	mg/l	0.5	7.0	2.5	0.4	1.4	1.3	-
20	Oil & Grease	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
21	DO	mg/l	3.4	3.7	3.2	4.0	3.6	2.7	-
22	BOD	mg/l	0.8	1.0	0.7	0.6	0.9	1.0	-
23	Chemical Oxygen Demand	mg/l	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	-
24	E-coli	MPN/100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent
25	Total Coliform	MPN/100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Ground water quality shows that it complies with IS 105-0 - 2012 for drinking water. It suggests that the region's ground water good in nature and it may be used for drinking purposes after conventional treatment

3.8.1.3 Ground Water Quality Result Interpretation

3.8.1.4. Surface Water Quality Results

Table 34. Results of surface water

S. No.	Parameter	Unit	SW1	SW2	SW3	SW4	SW5	SW6	CPCB (Water Quality Criteria) Class A to E
1	Colour	Hazen	5.0	5.0	5.0	5.0	5.0	5.0	*
2	pH	-	7.59	7.53	7.59	7.32	7.16	7.11	6.5 - 9.0
3	Turbidity	NTU	34.5	10.5	45.9	9.47	118	100	*
4	Total Suspended Solids	mg/l	65.4	21.8	93.9	20.7	239.0	199.6	*
5	TDS	mg/l	280	200	1000	200	120	480	*
6	Dissolved Oxygen	mg/l	3.5	3.2	3.8	3.4	3.5	3.7	4.0 - 6.0
7	Biochemical Oxygen Demand	mg/l	1.0	0.8	1.1	0.9	0.7	0.4	2.0 - 3.0
8	Chemical Oxygen Demand	mg/l	<4.0	39.5	39.5	39.5	39.5	<4.0	*
9	Ammonia	mg/l	0.72	0.56	0.52	0.66	0.67	0.58	<1.2
10	Nitrate	mg/l	6.13	1.3	5.9	5.6	5.9	1.8	*
11	Total Alkalinity	mg/l	82.0	41.0	360.8	98.4	8.2	69.7	*
12	Total Hardness	mg/l	80.0	55.0	340.0	105.0	80	190.0	*
13	Calcium	mg/l	22.0	20.0	92.2	36.1	6.0	48.1	*
14	Magnesium	mg/l	6.1	1.2	26.8	3.6	15.8	17.0	*



S. No.	Parameter	Unit	SW1	SW2	SW3	SW4	SW5	SW6	CPCB (Water Quality Criteria) Class A to E
15	Chloride	mg/l	9.9	39.7	268.0	29.8	19.9	49.6	*
16	Sulphate	mg/l	12.5	18.4	56.8	29.3	12.0	124.0	*
17	Phosphate	mg/l	0.51	0.2	0.36	0.47	0.26	0.24	*
18	Sulphide	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	*
19	Residual Chlorine	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*
20	Fluoride	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*
21	Oil & Grease	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*
22	Sodium	mg/l	55.0	37.3	305.5	63.4	37.2	91.7	*
23	Potassium	mg/l	2.9	8.1	30.7	36.1	9.4	2.0	*
24	Total Coliform	MPN/100 ml	Absent	Absent	Absent	Absent	Absent	Absent	50 - 5000
25	E-coli	MPN/100 ml	Absent	Absent	Absent	Absent	Absent	Absent	--

Note: *Not Specified; Class A – Drinking water source without conventional treatment but after disinfection limit; Class B – Outdoor Bathing limit; Class C – Drinking water source with conventional treatment followed by disinfection limit; Class D – Fish culture and wild life propagation limit; Class E – Irrigation, Industrial cooling or controlled waste disposal limit

Surface water quality suggests that it satisfies various designated uses as per CPCB standard such as outdoor bathing, fish culture and wildlife propagation, drinking water source with conventional treatment, irrigation and industrial cooling purpose.

3.8.1.5. Data Interpretation

Groundwater quality at the monitoring station was analyzed and compared with the permissible limits prescribed under IS 10500:2012 (Drinking Water Standards). The results are presented below:

- **pH** of the groundwater was observed as **7.92**, which lies well within the acceptable range of **6.5 – 8.5**.
- **Chloride concentration (as Cl⁻)** was measured at **20.0 mg/L**, significantly lower than the permissible range of **250 – 1000 mg/L**, indicating negligible chloride contamination.
- **Total Hardness** was found to be **90.0 mg/L**, well below the acceptable range of **200 – 600 mg/L**, suggesting the water is soft in nature.
- **Total Dissolved Solids (TDS)** were recorded as **280 mg/L**, also within the desirable limit of **500 – 2000 mg/L**, reflecting good water quality with low mineral content.

Conclusion:

The groundwater quality at the monitored location meets the IS 10500:2012 standards for all analyzed parameters, with values significantly below the permissible limits. The water can be classified as fresh, soft, and suitable for potable use without significant treatment.



Surface water samples were collected from **Station SW1** and analyzed with reference to the CPCB classification criteria for water quality (Classes A to E). The observed results are summarized below:

- **pH** was measured at **7.59**, which falls within the acceptable range of **6.5 – 8.5**, indicating neutral to slightly alkaline water suitable for aquatic life.
- **Total Dissolved Solids (TDS)** were found to be **280 mg/L**, which is well below the permissible range of **500 – 2100 mg/L**, reflecting good water quality with low dissolved salts.
- **Total Coliforms** were **absent** in the analyzed sample, whereas CPCB standards allow **50 – 5000 MPN/100 ml** depending on class, showing no bacteriological contamination.
- **E. coli** was also **absent**, meeting the most stringent requirement (Class A waters), where E. coli should not be present.

Conclusion:

The surface water quality at SW1 conforms to the CPCB standards. The absence of bacteriological contamination along with low TDS levels suggests that the water quality is good and falls under the **higher water quality classes (A/B)** suitable for uses such as drinking water source with conventional treatment, outdoor bathing, and propagation of fisheries.

3.9 LAND ENVIRONMENT

3.9.1 Land Use/Land Cover

Though the land area coverage of the Earth is just 30% of its surface area, the holistic development potential of the entire mankind depends. Therefore, a spatio-temporally precise and time-line specific methodology to study LU/LC is needed for any development project. In this context, analysis of remotely sensed satellite imagery data is so valuable. Therefore, the satellite imagery-based LU/LC information of this coastal zone environment for the present study is analyzed using the GIS technology. Geographically, This coastal zone covers a 10 km buffer from the project location of fallen Cuddalore district of Tamil Nadu state.

The selected region covers the aerial spread of ocean water (Bay of Bengal) nearly 15014 ha and the land side it covers 16386 ha. On land LULC features were interpreted using high resolution satellite imagery and SOI toposheet on 1: 50,000 scale namely 58 M/10 & 58 M/14 is shown in Fig. 3.5.

The Level-II classification system of the National Remote Sensing Centre (NRSC), Hyderabad was followed while preparation of the LULC map. The flowchart shows the adopted methodology for preparation of land use and the land cover map is given below.



The LULC map and class detailed table indicate the presence of following LULC features: Built-up Land, Agricultural Land, Wastelands, Water Bodies and others. On completion of preliminary interpretation and ground truth verification, necessary corrections were incorporated to the draft map as shown in Figure. Land aerial spread of LU/LC at 10 km radius from the proposed Project location and the pie chart of spatial distribution of LU/LC is given below.

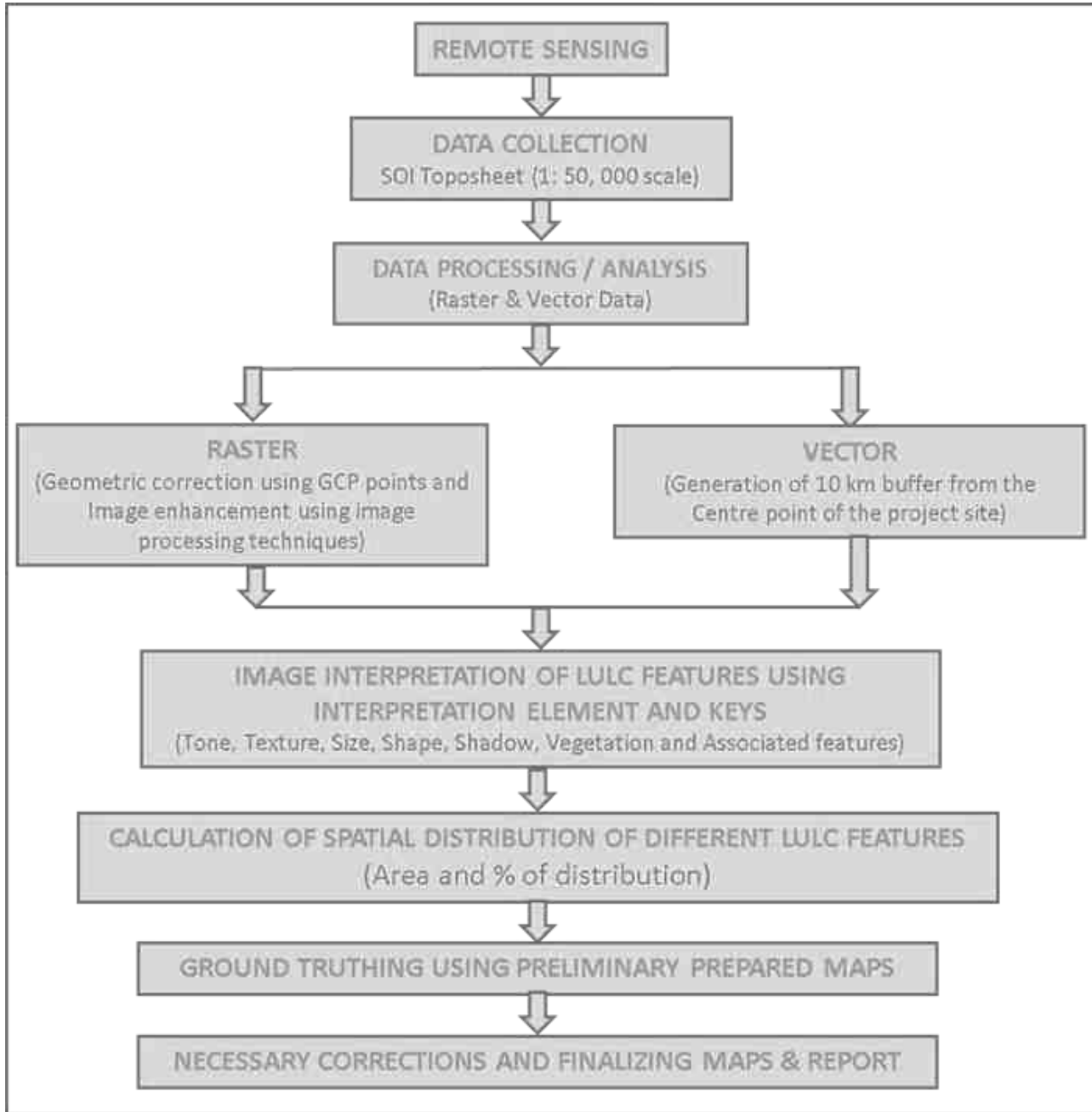


Figure 29. Methodology for the preparation of LULC map



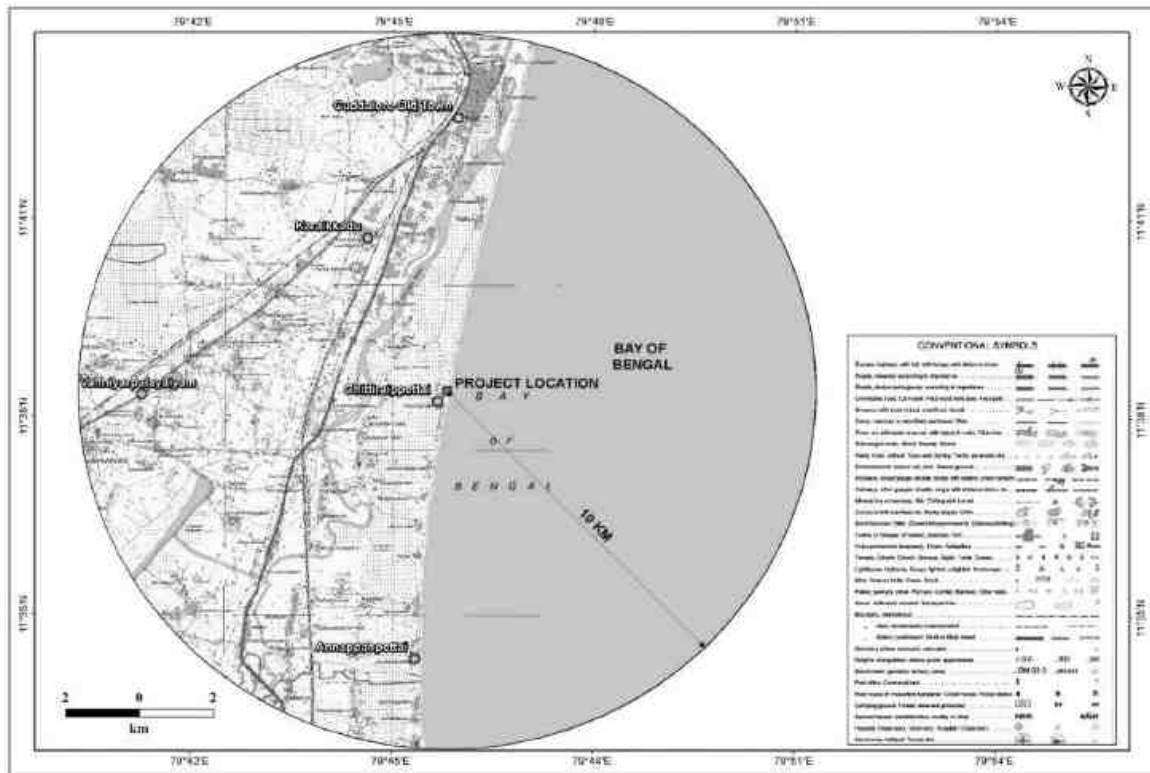


Figure 30. Survey of India Toposheet (1:50,000 scale)

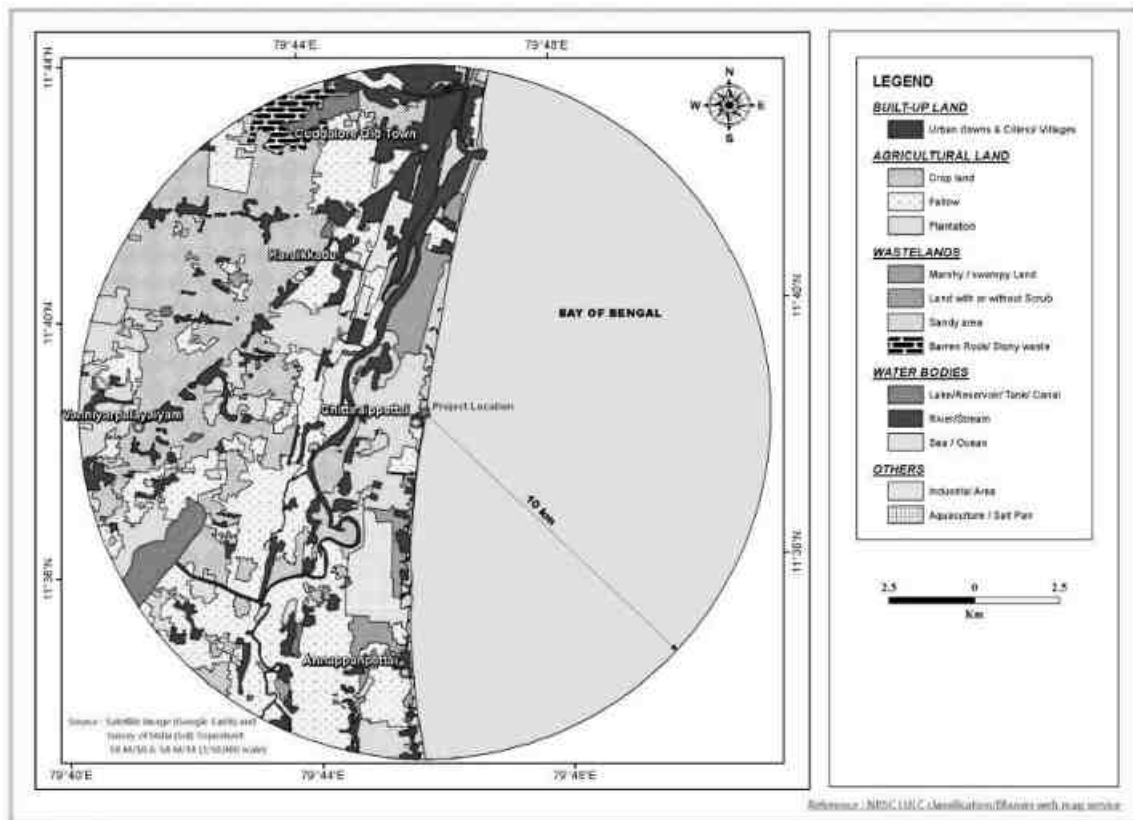


Figure 31. Land use land cover map
Table 35. Land areal spread of LU/LC

S. No.	Landuse/Landcover	Area (ha)	%
1	Urban (towns & Cities)/ Villages	2146	13.1
2	Crop land	4380	26.7
3	Fallow	4629	28.2
4	Plantation	2228	13.6
5	Marshy / Swampy Land	26	0.2
6	Land with or without scrub	631	3.9
7	Sandy Area	422	2.6
8	Barren Rock/ Stony waste	249	1.5
9	Lake/Reservoir/Tank/Canal	454	2.8
10	River/Stream	502	3.1
11	Aquaculture / Saltpans	17	0.1
12	Industrial Area	702	4.3
Total		16386	100

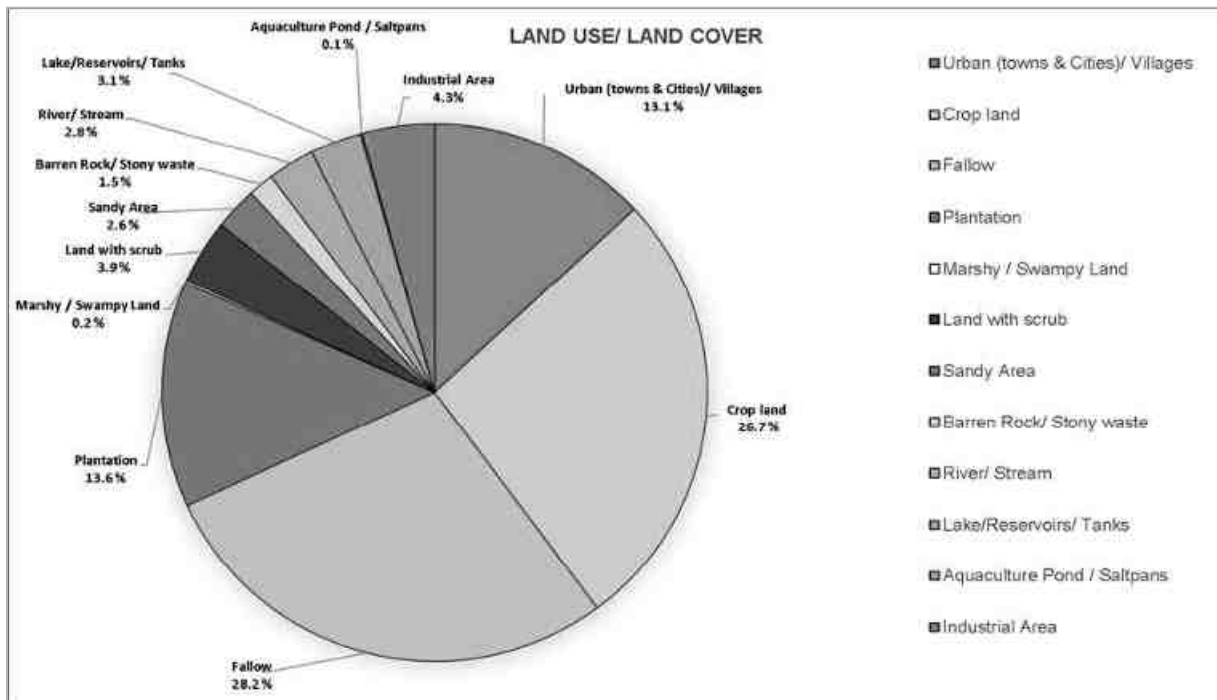


Figure 32. Spatial distribution of LU/LC at 10 km radius from the proposed Project location

Built-up land

It is defined as an area of human occupation developed due to the nonexistence of agricultural lands which covers construction of habitations, industries, transportation network, buildings, roads, parking lots, and other forms of built infrastructure etc., The visual interpretation of Urban (Town & Cities/ Villages) boundaries covered with an area of 2146 ha.



Agricultural land

It is defined as primarily the land used for farming & related agricultural activities, production of food, fiber, commercial and horticultural crops. As per the NRSC level II classification followed in the study area, agricultural land is divided into the following three categories: crop land, fallow land and plantation. The prepared LULC map shows that 68.6% of the study area is covered with agricultural land. The prepared map shows that, the majority of the area covered by fallow land with 4629 ha, crop land is observed with 4380 ha and plantations are about 2228 ha.

Wastelands

The wasteland refers to various types of terrain, including marshy & swampy land, land with scrub sandy areas. The visual interpretation of satellite imagery brings into notice that the aerial spread of land with scrub area is 631 ha, sandy area is 422 ha and marshy & swampy land is 26 ha. The industrial areas are covered about 702 ha, which is noticed towards the northern side of the project region.

Water bodies

In satellite imagery, water bodies are interpreted using its blue tone. Additionally, survey of india (SOI) toposheets are very useful to define the exact boundary of water bodies. The intensity of blue colour in the satellite imagery is based on the turbidity nature of the water bodies. In the study area, Lake/Reservoir/Tank/Canal are identified by its shape with an area of about 502 ha. River/Stream constitute another category of water bodies distinguishable by their linear or curvilinear form. Uppanar river is the prominent river that flows nearly parallel to the coastline. This river displays a meandering pattern across an aerial expanse of 454 ha.



Figure 33. Nearby Area Photographs

3.9.1.1 Relief



Relief is the difference between the highest and lowest elevations in an area. The study area does not display any drastic change in elevation along the northern and western parts where it ranges up to 47 m above msl. However, the eastern side from the proposed project location is noticed with higher elevation. The relief map is shown in **Fig. 34**.

3.9.1.2 Slope

Slope is a measure of change in elevation and happens to be a crucial parameter in a number of studies like environmental management, soil erosion prediction, runoff estimation etc. Slope can be expressed in two ways: it can be expressed either as degree or as percentage. Currently, several algorithms are developed in GIS that facilitate preparing slope maps easily and accurately. One of the commonly used methods for slope map preparation in GIS is the neighborhood method. The neighborhood method calculates the slope at one grid point by comparing the elevations of the grid points that surround it. In the present study, slope map was prepared using the 30m resolution of Shuttle Radar Topographic Mission (SRTM) data which was processed in the ArcGIS software by utilizing the neighborhood method. The prepared map exhibits a diverse topography, ranging from depressions to strongly sloping areas. The project location appears to be situated on gently sloping terrain. The map highlights within 10 km from the project location different categories of slope and the slope categories very gently sloping (0-5 - 2), gently sloping (2-5), moderately sloping (5-9), Strongly Sloping (9-0 - 15.0) and Steeply Sloping (15-0 - 30.0). The slope map is shown in Fig. 3.8

3.9.1.3 Drainages

The study area, being confined mostly within a semiarid region, does not possess a dense network of drainages. However, small ephemeral streams flow in the study area, amongst these the Uppanar river is the notable one. All the streams in the study area generally flow towards east and confluence at the bay of Bengal. The drainage network is shown in **Fig 20**. Further, analysis of different satellite images of the study area from different periods (December - 2023, February - 2024, May - 2024 and September - 2024) have brought into notice seasonal variations of the water bodies in the study area which is shown in **Fig.34**.



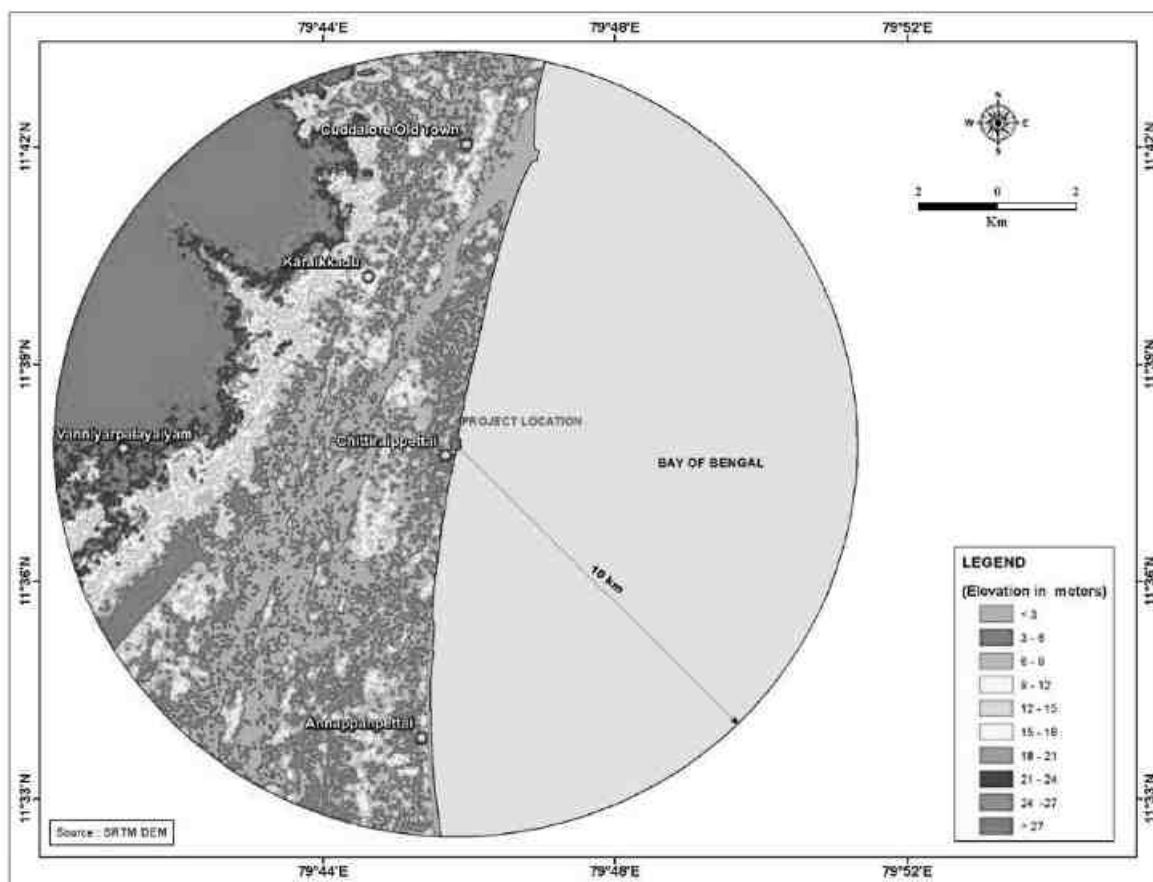


Figure 34. Relief map

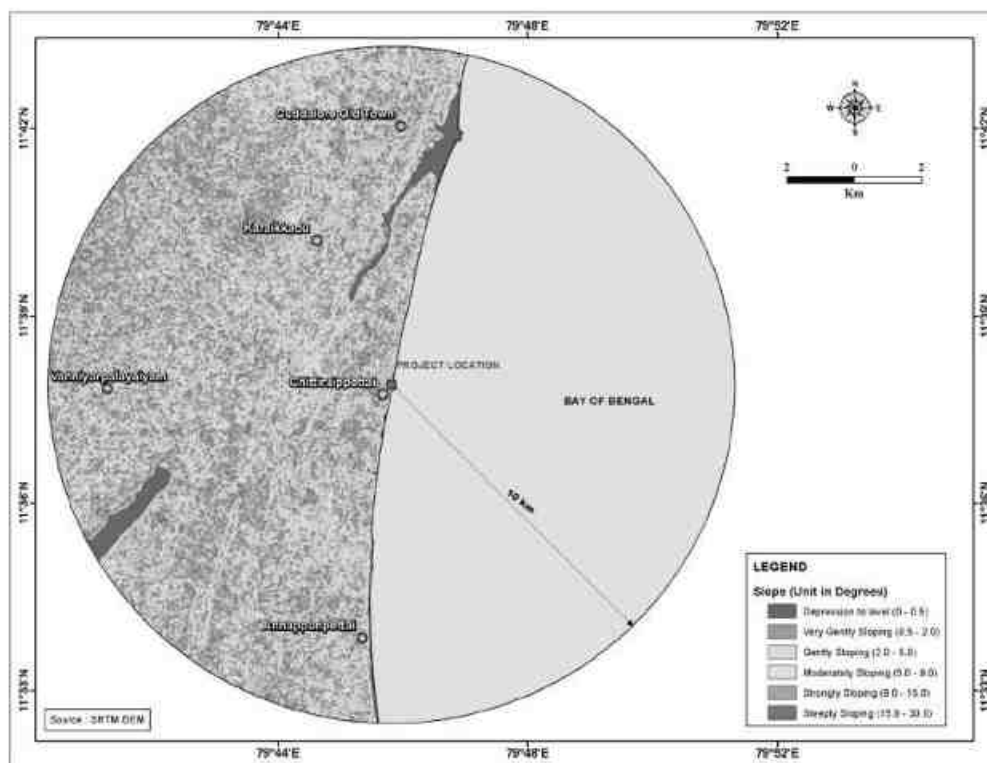


Figure 35. Slope map

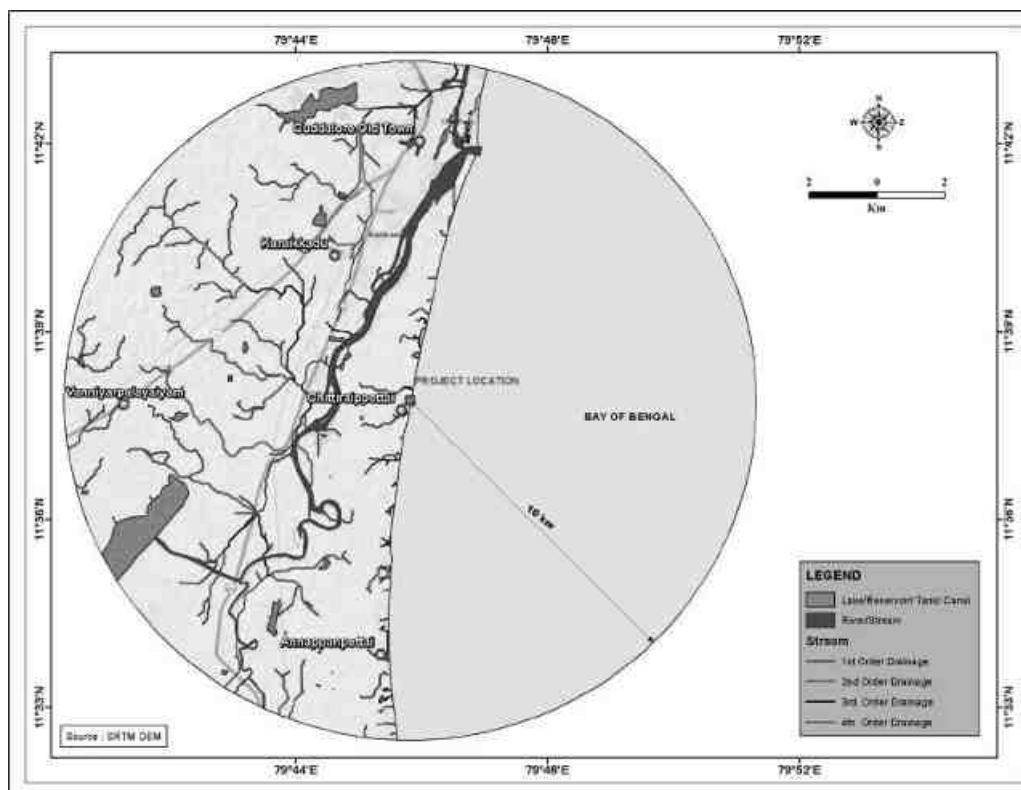


Figure 36. Drainage Network



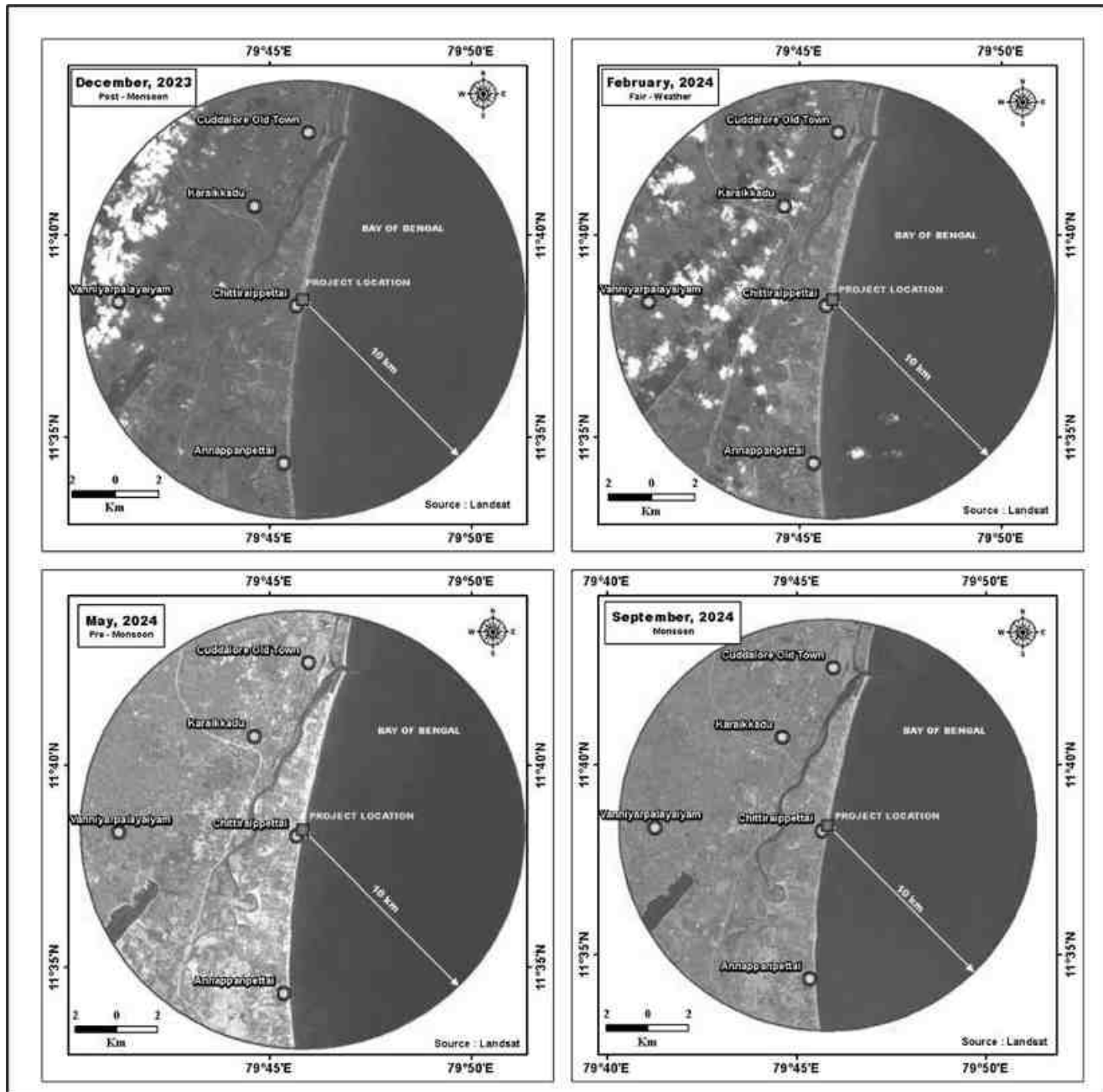


Figure 37. Water bodies map

3.10 SOIL QUALITY

3.10.1 Soil

The soil environment of the study area has been studied which will be useful for assessing the conformity to standards of the soil quality in and around the area of proposed project location. It is essential to determine the potential of soil in the area and identify the impacts of industrialization



on soil quality and to predict the impacts, which may arise due to the project activities. The sampling locations have been identified with the following objectives:

- To determine the soil characteristics of the study area
- To determine the impact of industrialization on soil characteristics
- To determine the impact on soils more importantly from agricultural productivity and green belt development point of view

3.10.2 Sampling Location

Soil samples were collected at six locations (stns. SQ1 to SQ6). These samples were taken from 0-22.5 cm depth by using auger and were analysed for physicochemical parameters. The locations of soil sample collection are given in Table 34 and shown in Fig. 38.

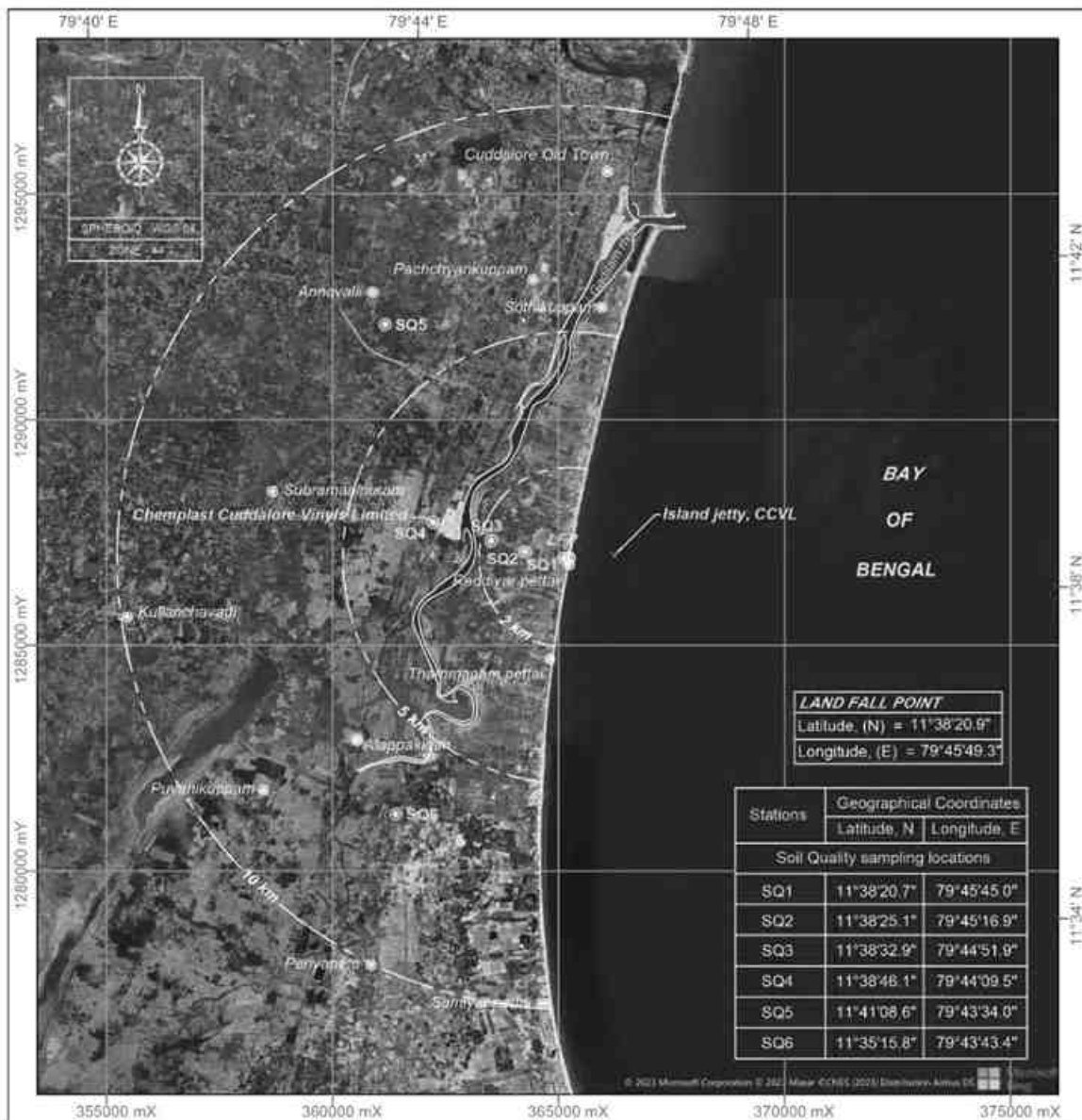


Figure 38. Location of soil sampling



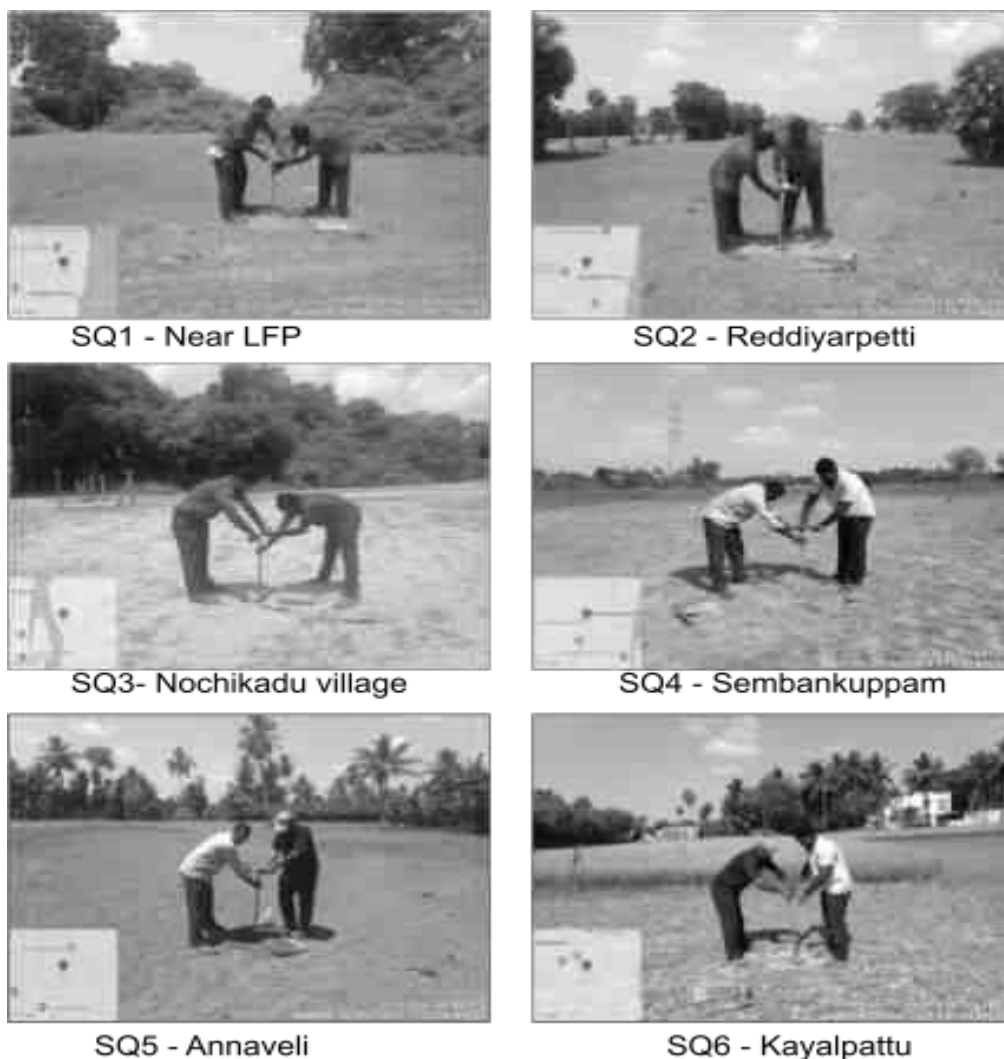


Figure 39. Soil Sampling Location

Table 36. Soil Sampling Location

Station	Locations	Environmental setting /Area Classification	WGS 84		Distance & Direction from project area
			Latitude, N	Longitude E	
SQ1	Near LFP area	Barren land	11°38'20.7"	79°45'45.0"	0.5 - NW
SQ2	Rediyar pettai	Barren land	11°38'25.1"	79°45'16.9"	1.0 -W
SQ3	Nochikadu	Barren land	11°38'32.9"	79°44'51.9"	2.0 - W
SQ4	Sembankuppam	Agriculture	11°38'46.1"	79°44'09.5"	3.0 - NW
SQ5	Annaveli	Agriculture	11°41'08.6"	79°43'34.0"	6.5 - NW
SQ6	Kayalpattu	Agriculture	11°35'15.8"	79°43'43.4"	6.0 - SW

3.10.3. Soil Result

The soil quality analysis shows that the land side of the soil in the study area is predominantly composed of fine sand nature.



Table 37. Soil quality - Soil Texture

Location	Soil Classification	D ₅₀ (mm)	Sand			Silt & Clay %
			S. No.	Parameter	Unit	
SQ1	Fine sand	0.22	0.0	0.0	98.9	1.1
SQ2	Fine sand	0.22	0.0	0.0	98.8	1.2
SQ3	Fine sand	0.21	0.0	0.0	99.4	0.6
SQ4	Fine sand	0.22	0.0	0.0	98.8	1.2
SQ5	Fine sand	0.24	0.0	19.6	77.5	2.9
SQ6	Fine sand	0.26	0.0	0.0	99.0	1.0

Table 38. Soil quality results

S. No.	Parameter	Unit	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6
1	Porosity	%	25	28	28	29	36	30
2	Bulk Density	gm/cm ³	1.54	1.53	1.51	1.53	1.47	1.51
3	pH	-	5.7	5.0	4.62	4.92	4.88	4.0
4	Moisture content	%	0.13	0.88	0.17	0.22	5.85	4.03
5	Organic Carbon	%	0.51	0.27	0.24	0.35	0.91	0.59
6	Available Phosphorous	mg/kg	27.7	19.8	29.4	13.0	174.1	90.4
7	Total Nitrogen	mg/kg	756	454	605	605	1210	756
8	Water Holding Capacity	%	90.4	98.2	98.9	97.9	99.1	.6
9	Cation Exchange Capacity	meq/100g	5.43	4.75	5.95	3.58	6.01	3.53
10	Soluble Sodium	meq/100g	0.94	0.95	0.94	0.80	2.44	1.03
11	Soluble Potassium	meq/100g	0.15	0.16	0.15	0.13	0.14	0.17
12	Soluble Calcium	meq /100g	0.03	0.04	0.01	0.02	0.23	0.09
13	Soluble Magnesium	meq/100g	0.03	0.04	0.04	0.08	0.10	0.08
14	Sodium Absorption Ratio	-	12.85	11.19	12.76	11.65	13.99	11.17

3.11 Biological Environment

Ecological survey is one of the main elements of an EIA to establish the overall ecological status of the project site before setting-up a project. This allows a complete and objective identification and evaluation of the potential ecological impacts of the proposed industry and subsequent operations and also to suggest mitigation measures for the negative impacts identified, if the site is acceptable for proposed development from the point of view of ecology.

Objectives of Study

The following are the major objectives of the ecology and biodiversity study:

- To generate baseline information on the inventory of flora and fauna in and around the 10 km radius of the project region.



- To identify and measure the prevailing biodiversity and establish the biodiversity richness of the area.
- To identify protected animals and plants as per the Wildlife (Protection) Amendment Act, 2022 to enable strategies for their protection as well as other faunal categories necessary to be protected from the impact.
- To prepare and submit conservation and management action plans for Schedule I species if any in the study area.

Methodology

The methodology for the present work involved a combination of field surveys and secondary data evaluation. The secondary data available on the project site were compiled based on literature, maps, satellite imageries, etc., to have proper understanding of the project site and its surroundings.

Extensive field surveys were conducted during August 2024 by adopting standard methods to document the floral and faunal elements occurring in the study area. For enumerating the overall species within the 10 km radial distance from the proposed project site, all major habitats such as water bodies, human habitation and agricultural lands were covered, after a rapid site visit for general understanding of the ecology of the area and also to fix the boundaries of the study area.

Study area: The project site is proposed near the village of Chithirai Pettai from Parangipettai Taluk. The site area, around 10 km radius, has different landscapes namely, coastal, terrestrial, agriculture, freshwater wetlands and mangroves. Uppanar river creek is crossing west of north-south direction from proposed project LFP. Perumal Lake is a major freshwater lake and is located in Alapakkam village. Pichavaram is a major mangrove site, which is approximately 25 km away from the proposed LFP.

Villages such as Nochikadu, Alapakkam, Thiyagavalli, Reddiyarpettai, Thammanampettai, and Thiruchepuram, Nangalinagampettai along with other field locations were studied extensively for the occurrence of flora.



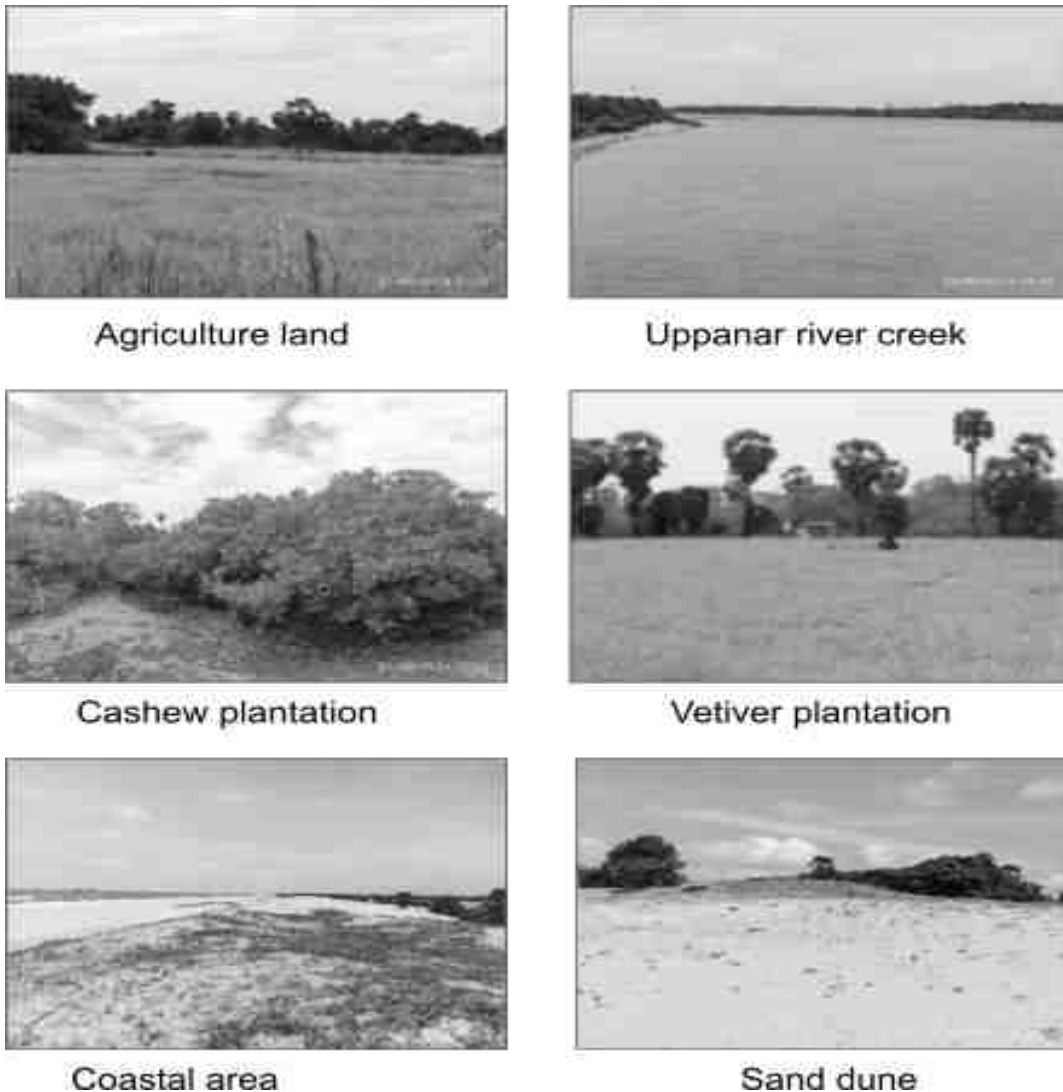


Figure 40. Green Photographs

3.11.1 Flora

Floral Composition: Diversity of vegetation is governed by several factors such as climatic, edaphic, topographic and biotic. The presence of a large number of trees and shrubs and herbaceous vegetation in the study area signifies the tropical plant's structure. Grasses were found to be significant in the area. This indicates fertile and wet soil in the upper layer of soil profile. The climatic and biotic variations and composition of species, which are adapted to these variations, have resulted in different vegetation covers.

The tree species, shrubs, herbs, climbers, creepers and grasses were documented during the study period. The most dominant trees found in the study are *Prosopis juliflora* (Vaelikaruvai), *Azadirachta indica* (Vembu), *Albizia lebbeck* (Vaagai) which are found in co-association with *Acacia nilotica* (Karuvelamaram). On wasteland the vegetation cover consists of *Pongamia pinnata* (Pongam), *Ficus*



benghalensis (Alamaram), *Jatropha gossypifolia* (Aatalai) and *Leucaena leucocephala* (Subabul). The shrubs consist of *Ziziphus mauritiana* (Ilanthai), *Ricinus communis* (Amanakku), *Xanthium stumarium* (Marulumathai), *Tephrosia hamiltonii* (Kozhunji), *Lantana camara* (Unnichedi), *Calotropis gigantea* (Erukkaikai) etc. Species of bamboo and grasses like *Dendrocalamus strictus* (Kal moongil), *Cynodon dactylon* (Arugampul) and *Cymbopogon martini* (Kavathampillu) were also observed during the field survey.

Tree species: A total of 33 tree species belonging to 17 families were observed in the study area. The dominant tree species in the study area are *Anacardium occidentale* (Mundri), *Cocus nucifera* (Thennai), *Calophyllum inophyllum* (Punnai), *Albizia lebbbeck* (Vaagai), *Delonix regia* (Neruppu Kondrai), *Ziziphus mauritiana* (Ilanthai), *Casuarina equisetifolia* (Savukku) and *Musa paradisiaca* (Vazhai).

Shrubs: During the survey a total of 24 shrub species belonging to 13 families from the study area were observed. The dominant shrubs in the study area were *Calotropis gigantea* (Erukkaikai), *Tecoma stans* (Nagasambagam), *Jatropha curcas* (Kattamanakku), *Solanum torvum* (Sundaikkai) and *Ricinus communis* (Amanakku).

Herbs and Grasses: The Herbaceous and Grasses are dried up due to the summer season, except in the river and pond sites of the study area. A total of 63 herbs and 13 grass species belonging to 25 families were recorded. The important herbs and grasses are *Ruellia tuberosa* (Vedikkaikai chedi), *Nymphaea* sp., *Aerva lanata* (Sirukan pelai), *Typha angustifolia* (Sambu pul), *Dendrocalamus strictus* (Kal Moongil), *Cynodon dactylon* (Arugampul), and *Cymbopogon martin* (Kavathampillu). *Ananas comosus* (Annachi pazham) was observed only in one location.

Climbers: The climbers were observed from the river side, coastal region and wetland parts of the study area. 10 climber species belonging to six families and five creeper species belonging to 3 families were noted from the study area. Common climbers observed are *Clitoria ternatea* (Sangu poo), *Ipomoea digitata* (Nilapoosani), *Ipomoea pes-caprae* (Atappan-koti), *Luffa acutangula* (Peercku) and *Solanum trilobatum* (Thuthuvalai). The checklist of flora observed during the study is given in Table 37.

Table 39. List of flora presented in the study area

S. No.	Family	Botanical Name	Habit	IUCN Status
1	Acanthaceae	<i>Asystasia gangetica</i>	Herb	NE
2	Acanthaceae	<i>Barleria prionitis</i>	Herb	NE
3	Acanthaceae	<i>Justicia glauca</i>	Herb	NE
4	Acanthaceae	<i>Ruellia prostrata</i>	Herb	NE
5	Amaranthaceae	<i>Achyranthes aspera</i>	Herb	NE
6	Amaranthaceae	<i>Alternanthera pungens</i>	Herb	NE
7	Amaranthaceae	<i>Alternanthera sessilis</i>	Herb	LC
8	Amaranthaceae	<i>Amaranthus spinosus</i>	Herb	NE
9	Amaranthaceae	<i>Amaranthus viridis</i>	Herb	NE
10	Amaranthaceae	<i>Gomphrena celosioides</i>	Herb	NE



S. No.	Family	Botanical Name	Habit	IUCN Status
11	Amaranthaceae	<i>Salicornia indica</i>	Herb	NE
12	Aizoaceae	<i>Paramollugo nudicaulis</i>	Herb	NE
13	Aizoaceae	<i>Sesuvium portulacastrum</i>	Herb	LC
14	Anacardiaceae	<i>Anacardium occidentale</i>	Tree	LC
15	Apocynaceae	<i>Catharanthus roseus</i>	Herb	NE
16	Apocynaceae	<i>Rauvolfia tetraphylla</i>	Shrub	LC
17	Araceae	<i>Pistia stratiotes</i>	Herb	LC
18	Arecaceae	<i>Borassus flabellifer</i>	Tree	LC
19	Arecaceae	<i>Cocos nucifera</i>	Tree	NE
20	Arecaceae	<i>Phoenix sylvestris</i>	Tree	NE
21	Aristolochiaceae	<i>Aristolochia indica</i>	Creeper	NE
22	Asclepiadaceae	<i>Calotropis gigantea</i>	Shrub	NE
23	Asclepiadaceae	<i>Pergularia daemia</i>	Climber	LC
24	Asteraceae	<i>Ageratum conyzoides</i>	Herb	NE
25	Asteraceae	<i>Ageratina adenophora</i>	Shrub	NE
26	Asteraceae	<i>Chromolaena odorata</i>	Shrub	NE
27	Asteraceae	<i>Eclipta prostrata</i>	Herb	LC
28	Asteraceae	<i>Launaea nudicaulis</i>	Herb	NE
29	Asteraceae	<i>Launaea sarmentosa</i>	Herb	NE
30	Asteraceae	<i>Parthenium hysterophorus</i>	Shrub	NE
31	Asteraceae	<i>Sphaeranthus indicus</i>	Herb	LC
32	Asteraceae	<i>Tridax procumbens</i>	Herb	NE
33	Asteraceae	<i>Xanthium strumarium</i>	Herb	NE
34	Bignoniaceae	<i>Tecoma stans</i>	Tree	LC
35	Boraginaceae	<i>Heliotropium curassavicum</i>	Herb	LC
36	Boraginaceae	<i>Trichodesma indicum</i>	Herb	NE
37	Bromeliaceae	<i>Ananas comosus</i>	Herb	NE
38	Cactaceae	<i>Cereus hexagonus</i>	Shrub	LC
39	Cactaceae	<i>Opuntia stricta</i>	Shrub	LC
40	Calophyllaceae	<i>Calophyllum inophyllum</i>	Tree	LC
41	Casuarinaceae	<i>Casuarina equisetifolia</i>	Tree	LC
42	Cleomaceae	<i>Cleome viscosa</i>	Herb	NE
43	Combretaceae	<i>Terminalia arjuna</i>	Tree	NE
44	Combretaceae	<i>Terminalia catappa</i>	Tree	LC
45	Commelinaceae	<i>Commelina benghalensis</i>	Herb	LC
46	Commelinaceae	<i>Commelina diffusa</i>	Herb	LC
47	Convolvulaceae	<i>Evolvulus alsinoides</i>	Herb	NE
48	Convolvulaceae	<i>Ipomoea carnea</i>	Shrub	NE
49	Convolvulaceae	<i>Ipomoea digitata</i>	Climber	NE
50	Convolvulaceae	<i>Ipomoea pes-caprae</i>	Creeper	LC
51	Convolvulaceae	<i>Xenostegia tridentata</i>	Creeper	NE
52	Cucurbitaceae	<i>Citrullus colocynthis</i>	Creeper	NE
53	Cucurbitaceae	<i>Coccinia grandis</i>	Climber	NE
54	Cucurbitaceae	<i>Luffa acutangula</i>	Climber	NE
55	Cyperaceae	<i>Cyperus arenarius</i>	Grass	LC
56	Cyperaceae	<i>Cyperus compressus</i>	Grass	LC
57	Cyperaceae	<i>Cyperus rotundus</i>	Grass	LC
58	Euphorbiaceae	<i>Acalypha indica</i>	Herb	NE



S. No.	Family	Botanical Name	Habit	IUCN Status
59	Euphorbiaceae	<i>Chrozophora rottleri</i>	Herb	NE
60	Euphorbiaceae	<i>Croton bonplandianus</i>	Herb	NE
61	Euphorbiaceae	<i>Euphorbia antiquorum</i>	Tree	LC
62	Euphorbiaceae	<i>Euphorbia tirucalli</i>	Tree	LC
63	Euphorbiaceae	<i>Flueggea leucopyrus</i>	Shrub	LC
64	Euphorbiaceae	<i>Jatropha curcas</i>	Tree	LC
65	Euphorbiaceae	<i>Jatropha gossypifolia</i>	Shrub	LC
66	Euphorbiaceae	<i>Phyllanthus amarus</i>	Herb	NE
67	Euphorbiaceae	<i>Ricinus communis</i>	Shrub	NE
68	Euphorbiaceae	<i>Tragia involucrata</i>	Herb	NE
69	Fabaceae	<i>Acacia auriculiformis</i>	Tree	LC
70	Fabaceae	<i>Vachellia nilotica</i>	Tree	LC
71	Fabaceae	<i>Abrus precatorius</i>	Climber	NE
72	Fabaceae	<i>Aeschynomene indica</i>	Herb	LC
73	Fabaceae	<i>Albizia lebbeck</i>	Tree	LC
74	Fabaceae	<i>Alysicarpus vaginalis</i>	Herb	NE
75	Fabaceae	<i>Bauhinia racemosa</i>	Tree	LC
76	Fabaceae	<i>Canavalia rosea</i>	Creeper	LC
77	Fabaceae	<i>Clitoria ternatea</i>	Climber	NE
78	Fabaceae	<i>Crotalaria retusa</i>	Herb	NE
79	Fabaceae	<i>Dichrostachys cinerea</i>	Tree	LC
80	Fabaceae	<i>Leucaena leucocephala</i>	Tree	NE
81	Fabaceae	<i>Mimosa pudica</i>	Herb	LC
82	Fabaceae	<i>Pithecellobium dulce</i>	Tree	LC
83	Fabaceae	<i>Prosopis juliflora</i>	Tree	LC
84	Fabaceae	<i>Rhynchosia minima</i>	Herb	LC
85	Fabaceae	<i>Sesbania sesban</i>	Shrub	LC
86	Fabaceae	<i>Senna auriculata</i>	Shrub	LC
87	Fabaceae	<i>Senna occidentalis</i>	Shrub	LC
88	Fabaceae	<i>Senna tora</i>	Shrub	NE
89	Fabaceae	<i>Tamarindus indica</i>	Tree	LC
90	Fabaceae	<i>Tephrosia purpurea</i>	Herb	NE
91	Fabaceae	<i>Vigna trilobata</i>	Herb	NE
92	Lamiaceae	<i>Leucas aspera</i>	Herb	NE
93	Lamiaceae	<i>Ocimum tenuiflorum</i>	Herb	NE
94	Lecythidaceae	<i>Barringtonia acutangula</i>	Tree	LC
95	Loganiaceae	<i>Strychnos nux-vomica</i>	Tree	LC
96	Malvaceae	<i>Abutilon indicum</i>	Shrub	NE
97	Malvaceae	<i>Bombax ceiba</i>	Tree	LC
98	Malvaceae	<i>Corchorus tridens</i>	Herb	NE
99	Malvaceae	<i>Hibiscus vitifolius</i>	Herb	NE
100	Malvaceae	<i>Malvastrum coromandelianum</i>	Herb	NE
101	Malvaceae	<i>Pavonia zeylanica</i>	Herb	NE
102	Malvaceae	<i>Sida acuta</i>	Herb	NE
103	Malvaceae	<i>Sida cordifolia</i>	Herb	NE
104	Malvaceae	<i>Thespesia populnea</i>	Herb	LC
105	Meliaceae	<i>Azadirachta indica</i>	Tree	LC
106	Moraceae	<i>Ficus benghalensis</i>	Tree	NE



S. No.	Family	Botanical Name	Habit	IUCN Status
107	Moraceae	<i>Ficus hispida</i>	Tree	LC
108	Moraceae	<i>Ficus religiosa</i>	Tree	LC
109	Molluginaceae	<i>Glinus oppositifolius</i>	Herb	LC
110	Myrtaceae	<i>Syzygium cumini</i>	Tree	LC
111	Nyctaginaceae	<i>Boerhavia diffusa</i>	Herb	NE
112	Nymphaeaceae	<i>Nymphaea nouchali</i>	Herb	LC
113	Passifloraceae	<i>Passiflora foetida</i>	Climber	NE
114	Pedaliaceae	<i>Pedaliium murex</i>	Herb	NE
115	Phyllanthaceae	<i>Phyllanthus emblica</i>	Tree	LC
116	Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>	Herb	LC
117	Plantaginaceae	<i>Scoparia dulcis</i>	Herb	NE
118	Plumbaginaceae	<i>Plumbago zeylanica</i>	Shrub	NE
119	Poaceae	<i>Apluda mutica</i>	Grass	NE
120	Poaceae	<i>Aristida setacea</i>	Grass	NE
121	Poaceae	<i>Brachiaria reptans</i>	Grass	LC
122	Poaceae	<i>Chloris barbata</i>	Grass	NE
123	Poaceae	<i>Cynodon dactylon</i>	Grass	NE
124	Poaceae	<i>Dactyloctenium aegyptium</i>	Grass	NE
125	Poaceae	<i>Echinochloa colona</i>	Grass	LC
126	Poaceae	<i>Eragrostis ciliaris</i>	Grass	NE
127	Poaceae	<i>Imperata cylindrica</i>	Grass	NE
128	Poaceae	<i>Saccharum spontaneum</i>	Grass	LC
129	Portulacaceae	<i>Portulaca oleracea</i>	Herb	LC
130	Rhamnaceae	<i>Ziziphus mauritiana</i>	Tree	LC
131	Rhamnaceae	<i>Ziziphus oenopia</i>	Tree	NE
132	Rubiaceae	<i>Canthium coromandelicum</i>	Shrub	NE
133	Rubiaceae	<i>Morinda pubescens</i>	Tree	NE
134	Rubiaceae	<i>Oldenlandia diffusa</i>	Herb	LC
135	Rutaceae	<i>Zanthoxylum asiaticum</i>	Shrub	NE
136	Sapindaceae	<i>Cardiospermum helicacabum</i>	Climber	NE
137	Simaroubaceae	<i>Ailanthus excelsa</i>	Tree	DD
138	Solanaceae	<i>Datura stramonium</i>	Shrub	NE
139	Solanaceae	<i>Solanum trilobatum</i>	Climber	NE
140	Solanaceae	<i>Solanum torvum</i>	Shrub	NE
141	Typhaceae	<i>Typha angustifolia</i>	Herb	LC
142	Verbenaceae	<i>Volkameria inermis</i>	Shrub	NE
143	Verbenaceae	<i>Lantana camara</i>	Shrub	NE
144	Verbenaceae	<i>Phyla nodiflora</i>	Herb	LC
145	Verbenaceae	<i>Vitex negundo</i>	Shrub	LC
146	Violaceae	<i>Pigea enneasperma</i>	Herb	NE
147	Vitaceae	<i>Cissus quadrangularis</i>	Climber	NE
148	Zygophyllaceae	<i>Tribulus terrestris</i>	Herb	LC

IUCN Stat-s - DD (Data Deficient), NE (Not Evaluated), LC (Least Concern), NT (Near Threatened) and VU (Vulnerable).





Ficus bengalensis – Moraceae



Anacardium occidentale - Anacardiaceae



Callophyllum inophyllum – Callophyllaceae



Ipomoea pes-caprae – Convolvulaceae



Clitoria ternatea - Fabaceae



Luffa cylindrica – Cucurbitaceae





Solanum torvum - Solanaceae



Nymphaea sp. – Nymphaeaceae



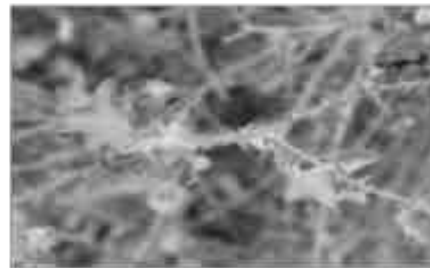
Ruellia tuberosa - Acanthaceae



Typha angustifolia – Typhaceae



Ipomoea sp. - Convolvulaceae



Solanum trilobatum – Solanaceae

Figure 41. Common flora observed in study area

Uppanar river creek ecosystem biodiversity: It is a backwater ecosystem running parallel to the coastline from 25 km upstream and opens into Bay of Bengal where also the Gadilam River meets the sea, forming as the Uppanar river creek. It supports three species of mangrove, 14 mangrove associates, including facultative halophytes, 11 species of seaweed and varieties of strand and aquatic vegetation along the sandy areas and water. Nearly 15 species of fish, 32 species of bird, 5 species of crab, 3 species of prawn and 12 species of molluscs are said to be found around this ecosystem.

Heritage tree

India is home to banyan trees (*Ficus benghalensis*) of worldwide significance. *F. benghalensis* (In Tamil Aala maram) spreads horizontally through aerial root propagation from branches, resulting in branching and crown extension. According to the current study, a sacred tree (banyan tree) that is about a century old still stands on the bank of the Uppanar River Creek even though it has witnessed

numerous natural disasters, such as cyclones and thunderstorms. Therefore, in collaboration with the Forest Department, the project proponent must take additional care to protect the century-old banyan tree.



Figure 42. Century years old Banyan tree

Agriculture ecosystem: The agriculture food production is increasingly diversified in the areas visited. The fruit crop yield comprising mango, guava, etc., is the highest when compared to the other crops. The main plantation crop is cashew nut. Other crops are paddy, groundnut, vetiver, sugarcane, cholan, kambu, redgram, cotton, gingelly, tapioca, greengram, blackgram, coriander, banana, maize, varagu, cotton, coconut are mostly found cultivated throughout the study area.

3.11.2 Fauna

Butterflies: According to a previous study report, there were 60 species, and 44 genera classified into five families in the Cuddalore district. A total of 17 species of butterflies have been documented from this region. The common butterflies reported and recorded in the study area are *Pachliopta aristolochiae* (Common Rose), *Cepora nerissa* (Common Gull), *Euploea core* (Common Crow), *Pareronia valeria* (Common Wanderer), *Eurema hecabe* (Common Grass Yellow), *Delias eucharis* (Common Jezebel) and *Ariadne merione* (Common Castor).

Amphibians: About 11 species of amphibians were reported from this region. The common amphibians sited in the study area include common toad (*Duttaphrynus melanostictus*), the wrinkled frog (*Rana curtipes*), skipping frog (*Euphlyctis cyanophlyctis*) and green frog (*Hyla arborea*).

Reptiles: About 22 species of reptiles were reported from this region. Among reptiles, Monitor lizard (*Varanus bengalensis*), House lizard (*Hemidactylus domesticus*), Common skink (*Mabuya carinata*), Garden lizard (*Hemidactylus flaviviridis*), Rat snake (*Ptyas mucosu*) and Bark gecko (*Hemidactylus leschenaulti*) are prominent. None of the reptile species is present in the IUCN Red List of threatened animals.



Birds: List of terrestrial and aquatic birds (Perumal Lake and adjacent areas and rice fields) sited and reported earlier during the present study visit. The number of species reported from Cuddalore earlier is 345 and the number of globally threatened species reported in the study area is 12. A total of 37 species were recorded. Local people mainly use Perumal Lake for fishing, cattle grazing and domestic purposes. The dominant bird species found in the Perumal Lake is Open-billed stork, little cormorant, little grebe, Cattle egret, and Common sandpiper. Terrestrial birds observed during the study are given in **Table 38**.



Indian Roller



Asian Green Bee-eater



Spotted owllet



Asian openbill stork

Figure 43. Common birds observed in study area

Table 40. List of Terrestrial birds observed during the study

S.No.	Family Name	Scientific Name	Common Name	IUCN/IWPA, 2022
1	Ardeidae	<i>Egretta garzetta</i>	Little Egret	LC / Sch II
2	Ardeidae	<i>Bubulcus ibis</i>	Cattle Egret	LC / Sch II
3	Ardeidae	<i>Ardeola grayii</i>	Indian Pond-Heron	LC / Sch II
4	Artamidae	<i>Artamus fuscus</i>	Ashy Woodswallow	LC / Sch II
5	Accipitridae	<i>Accipiter badius</i>	Shikra	LC / Sch II
6	Accipitridae	<i>Milvus migrans</i>	Black Kite	LC / SCH II
7	Alcedinidae	<i>Halcyon smyrnensis</i>	White-throated Kingfisher	LC / SCH II
8	Alaudidae	<i>Alauda gulgula</i>	Oriental Skylark	LC / SCH II
9	Apodidae	<i>Cypsiurus balasiensis</i>	Asian Palm-Swift	LC / SCH II
10	Charadriidae	<i>Vanellus indicus</i>	Red-wattled Lapwing	LC / SCH II
11	Ciconiidae	<i>Anastomus oscitans</i>	Asian openbill stork	LC / SCH II
12	Columbidae	<i>Columba livia</i>	Rock Pigeon	LC / SCH II
13	Columbidae	<i>Spilopelia senegalensis</i>	Laughing Dove	LC / SCH II
14	Columbidae	<i>Streptopelia chinensis</i>	Spotted Dove	LC / SCH II
15	Coraciidae	<i>Coracias benghalensis</i>	Indian Roller	LC / SCH II
16	Corvidae	<i>Corvus macrorhynchos</i>	Large-billed Crow	LC / SCH II
17	Corvidae	<i>Corvus splendens</i>	House Crow	LC / SCH II



S.No.	Family Name	Scientific Name	Common Name	IUCN/IWPA, 2022
18	Corvidae	<i>Dendrocitta vagabunda</i>	Rufous Treepie	LC / SCH II
19	Cuculidae	<i>Centropus sinensis</i>	Greater Coucal	LC / SCH II
20	Cuculidae	<i>Cuculus micropterus</i>	Indian Cuckoo	LC / SCH II
21	Dicruridae	<i>Dicrurus macrocerus</i>	Black Drongo	LC / SCH II
22	Leiothrichidae	<i>Argya affinis</i>	Yellow-billed Babbler	LC / SCH II
23	Megalaimidae	<i>Megalaima haemacephala</i>	Coppersmith barbet	LC / SCH II
24	Meropidae	<i>Merops orientalis</i>	Green Bee-eater	LC / SCH II
25	Motacillidae	<i>Anthus rufulus</i>	Paddyfield Pipit	LC / SCH II
26	Muscicapidae	<i>Saxicoloides fulcata</i>	Indian robin	LC / SCH II
27	Nectariniidae	<i>Cinnyris asiaticus</i>	Purple Sunbird	LC / SCH II
28	Passeridae	<i>Passer domesticus</i>	House Sparrow	LC / SCH II
29	Phasianidae	<i>Coturnix coturnix</i>	Common Quail	LC / SCH II
30	Phasianidae	<i>Francolinus pondicerianus</i>	Grey francolin	LC / SCH II
31	Picidae	<i>Dinopium benghalense</i>	Black-rumped Flameback	LC / SCH II
32	Ploceidae	<i>Ploceus philippinus</i>	Baya Weaver	LC / SCH II
33	Pycnonotidae	<i>Pycnonotus cafer</i>	Red-vented Bulbul	LC / SCH II
34	Strigidae	<i>Athene brama</i>	Spotted owlet	LC / SCH II
35	Sturnidae	<i>Acridotheres tristis</i>	Common Myna	LC / SCH II
36	Sturnidae	<i>Sturnia pagodarum</i>	Brahminy Starling	LC / SCH II
37	Upupidae	<i>Upupa epops</i>	Eurasian Hoopoe	LC / SCH II

IUCN Stat-s - DD (Data Deficient), NE (Not Evaluated), LC (Least Concern), NT (Near Threatened) and VU (Vulnerable).WPA, 20-2 - Wildlife (Protection) Amendment Act, 2022.

Mammals: The common species of mammals reported from the study area were Common Mongoose (*Herpestes edwardsii*), and Bonnet macaque (*Macaca radiata*). None of the species fall under the endangered category as per IUCN status.

Domesticated animals sited: Several pastoral groups observed in the study area migrate and criss-cross the district/state with their herds of sheep and other livestock including ducks. The sited livestock were cattle, buffalo, dogs, country poultry, ducks, cats, pigs and sheep.

3.11.3 Inference

Flora

As per the IUCN status of overall floral diversity observed out of 63 plants comes under Least Concern (LC) category, following the species are habit wise listed; 26 trees *Anacardium occidentale*, *Borassus flabellifer*, *Tecoma stans*, *Calophyllum inophyllum*, *Casuarina equisetifolia*, *Terminalia catappa*, *Euphorbia antiquorum*, *Euphorbia tirucalli*, *Jatropha curcas*, *Acacia auriculiformis*, *Vachellia nilotica*, *Albizia lebbeck*, *Bauhinia racemosa*, *Dichrostachys cinerea*, *Pithecellobium dulce*, *Prosopis juliflora*, *Tamarindus indica*, *Barringtonia acutangula*, *Strychnos nux-vomica*, *Bombax ceiba*, *Azadirachta indica*, *Ficus hispida*, *Ficus religiosa*, *Syzygium cumini*, *Ziziphus mauritiana* and *Phyllanthus emblica*.



19 herbs; *Alternanthera sessilis*, *Sesuvium portulacastrum*, *Pistia stratiotes*, *Eclipta prostrata*, *Sphaeranthus indicus*, *Heliotropium curassavicum*, *Commelina benghalensis*, *Commelina diffusa*, *Aeschynomene indica*, *Mimosa pudica*, *Rhynchosia minima*, *Thespesia populnea*, *Nymphaea nouchali*, *Phyllanthus maderaspatensis*, *Portulaca oleracea*, *Oldenlandia diffusa*, *Typha angustifolia*, *Phyla nodiflora* and *Tribulus terrestris*.

09 shrubs; *Rauvolfia tetraphylla*, *Cereus hexagonus*, *Opuntia stricta*, *Flueggea leucopyrus*, *Jatropha gossypifolia*, *Sesbania sesban*, *Senna auriculata*, *Senna occidentalis* and *Pigea enneasperma*.

6 grasses; *Cyperus arenarius*, *Cyperus compressus*, *Cyperus rotundus*, *Brachiaria reptans*, *Echinochloa colona* and *Saccharum spontaneum*. 2 creepers; *Ipomoea pes-caprae* and *Canavalia rosea* and 1 climber for *Pergularia daemia*. *Ailanthus excelsa* tree is the Data Deficient (DD), and 84 plants are listed as Not Evaluated.

Protected Flora and Fauna

The biodiversity of the study area reveals that the fauna and flora studied are ubiquitous in nature. Also the occurrence of fauna and flora protected under the schedule list of Wild Life Protection Amendment Act, 2022; Biodiversity Act, 2002 as well as categories of animals and plants under International Union for Conservation of Natural Resources (IUCN) and animals and protected under Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are circumspetctly studied and found that the impacts on these biodiversity are of very minimal in nature with in the 10 km radius of project region. The construction impacts on the terrestrial fauna and flora are found to be convincingly minimal.

Fauna

About 37 species of birds were recorded in terrestrial environments. None of these birds' species are listed under Schedule I of the Indian Wildlife (Protection) Amendment Act, 2022. Under the IUCN Red list all species are listed in the "Least Concerned" category. Among the mammals observed both Mongoose (*Herpestes edwardsii*), and Bonnet macaque (*Macaca radiata*) come under the Schedule I list of Wild Life Protection Amendment Act, 2022.

3.11.4 Marine environment

The baseline data on marine environment were collected around 10 km radius from project location. The seawater samples, seabed sediment samples and biological samples were collected. The water samples were collected at three depths across the vertical i.e., surface, mid depth and bottom.

The seawater quality parameters were analysed at Indomer in-house laboratory accredited by National Accreditation Board for Laboratory (NABL). The method of collection and analysis protocols are given in **Annexure IV**. The following parameters were studied:

Physical parameters: Tides, Currents, Waves, Cyclones, Tsunami, Bathymetry, Topography and seabed geology.



Water quality parameters: Temperature, Salinity, Turbidity, Total suspended solids, Chlorides, pH, Cadmium, Chromium, Lead, Mercury, Nitrite, Nitrate, Ammonia, Total Nitrogen, Dissolved Phosphate, Total Phosphorus, Dissolved oxygen, Bio-Chemical Oxygen Demand, Phenols, and Petroleum Hydrocarbons.

Sediment quality parameters: Sediment classification and size distribution, Total organic carbon, Total Nitrogen, Total Phosphorous, Calcium Carbonate, Cadmium, Chromium, Lead, Zinc and Mercury.

Marine ecology and biodiversity: Plankton, Benthos, Microbial population, Coastal vegetation, Seaweeds, Seagrass, Mangroves, sand dune vegetation and Fisheries.

3.11.2.1 Physical parameters

Wind: Monthwise predominant wind characteristics are given in **Table 3.29**. Based on the analysis of statistical distribution, the monthly predominant wind speed with corresponding wind directions are given below.

January: Wind speed predominantly varied 4 – 8 m/s and the wind predominantly arrived from 22.5° – 67.5°.

February: Wind speed predominantly varied 2 – 8 m/s and the wind predominantly arrived from 22.5° – 112.5°.

March: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 7.5° – 135°.

April: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 112.5° – 202.5°.

May: Wind speed predominantly varied 4 – 8 m/s and the wind predominantly arrived from 180° – 225.0°.

June: Wind speed predominantly varied 4 – 10 m/s and the wind predominantly arrived from 180° – 247.5°.

July: Wind speed predominantly varied 4 – 8 m/s and the wind predominantly arrived from 180° – 270.0°.

August: Wind speed predominantly varied 2 – 8 m/s and the wind predominantly arrived from 180° – 270.0°.

September: Wind speed predominantly varied 2 – 8 m/s and the wind predominantly arrived from 180.0° – 247.5°.



October: Wind speed predominantly varied 2 – 8 m/s and the wind predominantly arrived from 180.0° – 247.5°.

November: Wind speed predominantly varied 2 – 8 m/s and the wind predominantly arrived from 0° – 67.5°.

December: Wind speed predominantly varied 2 – 8 m/s and the wind predominantly arrived from 0° – 67.5°.

From the compilation of wind parameters, it is observed that wind speed is high during the months of January, May, June and December. Wind speeds are found to be low during the month of April. During the rest of the months, i.e., February, March and July to November, the wind speed is moderate.

Table 41. Monthwise predominant wind characteristics

Month	Wind Speed, W_s (m/s)	Wind Direction, θ_p (deg. N)
January	4 – 8	22.5° – 67.5°
February	2 – 8	22.5° – 112.5°
March	2 – 6	7.5° – 135.0°
April	2 – 6	112.5° – 202.5°
May	4 – 8	180° – 225.0°
June	4 – 10	180° – 247.5°
July	4 – 8	180° – 270.0°
August	2 – 8	180° – 270.0°
September	2 – 8	180° – 247.5°
October	2 – 8	180° – 247.5°
November	2 – 8	0° – 67.5°
December	2 – 8	0° – 67.5°

Wave: The Monthwise predominant wave characteristics are given in **Table 3.30**.

January: The significant wave height is of the order of 0.5 to 1.5 m and predominant wave direction varies between 67.5° to 90°. The peak wave period (T_p) varies between 5 and 8 seconds.

February: The significant wave height is of the order of 0.5 to 1.5 m and predominant wave direction varies between 90.0° to 112.5°. The peak wave period (T_p) varies between 5 and 7 seconds.

March: The significant wave height is of the order of 0.5 to 1.5 m and predominant wave direction varies between 112.5° to 135°. The peak wave period (T_p) varies between 6 to 7 s and 9 to 10 seconds.

April: The significant wave height is of the order of 0.5 to 1.5 m and predominant wave direction varies between 135.0° to 157.5°. The peak wave period (T_p) varies between 8 and 10 seconds.

May: The significant wave height is of the order of 0.5 to 1.5 m and predominant wave direction varies between 135° to 180.0°. The peak wave period (T_p) varies between 9 and 11 seconds.



June: The significant wave height is of the order of 0.5 to 1.5 m and predominant wave direction varies between 157.5° to 180.0°. The peak wave period (T_p) varies between 9 and 11 seconds.

July: The significant wave height is of the order of 0.5 to 1.5 m and predominant wave direction varies between 135° to 180°. The peak wave period (T_p) varies between 9 and 11 seconds.

August: The significant wave height is of the order of 0.5 to 1.5 m and predominant wave direction varies between 135° to 180°. The peak wave period (T_p) varies between 9 and 11 seconds.

September: The significant wave height is of the order of 0.5 to 1.5 m and predominant wave direction varies between 135° to 180°. The peak wave period (T_p) varies between 9 and 11 seconds.

October: The significant wave height is of the order of 0.5 to 2.0 m and predominant wave direction varies between 112.5° to 180°. The peak wave period (T_p) varies between 8 and 10 seconds.

November: The significant wave height is of the order of 0.5 to 2.5 m and predominant wave direction varies between 45.0° to 90.0°. The peak wave period (T_p) varies between 7 and 10 seconds.

December: The significant wave height is of the order of 0.5 to 2.5 m and predominant wave direction varies between 45° to 67.5°. The peak wave period (T_p) varies between 5 and 8 seconds.

During the fair weather period, the predominant wave direction remained between the sectors east to south (90° N to 180° N). During the southwest monsoon, predominant wave direction remained between southeast to south (135° N to 180° N). And in the northeast monsoon, predominant wave direction is between the sector northeast to east (45° N to 90° N) and east southeast to south southeast (112.5° N to 157.5° N) respectively.

It is observed that the significant wave height remains less than 2.0 m for 98% times. The peak wave period remains between 4 and 11 s for 89% times. The predominant wave direction remains between 45° and 180° for 94% times. The wave activity is considerably more during the northeast monsoon period between October and January.

Table 42. Monthwise predominant wave characteristics

Month	Significant Wave Height, H_s (m)	Peak Wave Period, T_p (s)	Wave Direction (deg. N)
January	0.5 - 1.5	5 - 8	67.5 - 90.0
February	0.5 - 1.5	5 - 7	90.0 - 112.5
March	0.5 - 1.5	6 - 7 & 9 - 10	112.5 - 135.0
April	0.5 - 1.5	8 - 10	135.0 - 157.5
May	0.5 - 1.5	9 - 11	135.0 - 180.0
June	0.5 - 1.5	9 - 11	157.5 - 180.0
July	0.5 - 1.5	9 - 11	135.0 - 180.0



Month	Significant Wave Height, H_s (m)	Peak Wave Period, T_p (s)	Wave Direction (deg. N)
August	0.5 - 1.5	9 - 11	135.0 - 180.0
September	0.5 - 1.5	9 - 11	135.0 - 180.0
October	0.5 - 2.0	8 - 10	112.5 - 157.5
November	0.5 - 2.5	7 - 10	45.0 - 90.0
December	0.5 - 2.5	5 - 8	45.0 - 67.5

Tide: The tides in the project region are predominantly semi-diurnal. The various design tide levels with respect to chart datum for Cuddalore region as presented in Naval Hydrographic Chart NHC No. 357.

Design tide level

Table 43. Design tide level

Level	Tide (m)
Mean High Water Spring (MHWS)	(+) 1 m
Mean High Water Neap (MHWN)	(+) 0.8 m
Mean Sea Level (MSL)	(+) 0.7 m
Mean Low Water Neap (MLWN)	(+) 0.6 m
Mean Low Water Spring (MLWS)	(+) 0.4 m

Based on the available in-house tide measurements, the variation of measured tides which is applicable to the project location is compiled and is shown. The measurements show that the tides are semi-diurnal in nature. During the measurement period, it is observed that the spring tidal range reaches up to 1.0 m and the neap tidal range reaches up to 0.4 m.



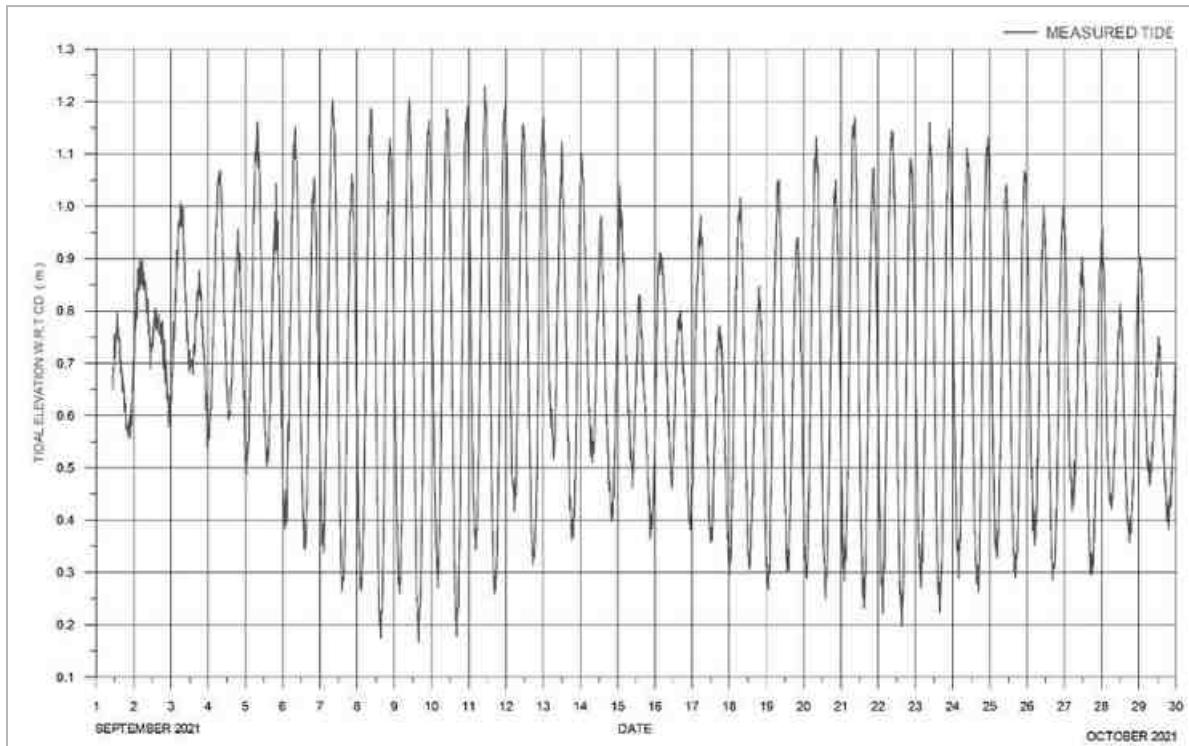


Figure 44. Variation of measured tide

Currents: Based on the available in-house current measurements, the variation of measured current speed and current direction which is applicable to the proposed project location is compiled and is shown in **Fig. 44**. The measurement shows that the current speed reaches a maximum of 0.51 m/s and average current speed during the measurement period existed around 0.21 m/s. During the measurement period, the predominant current direction remained towards north.

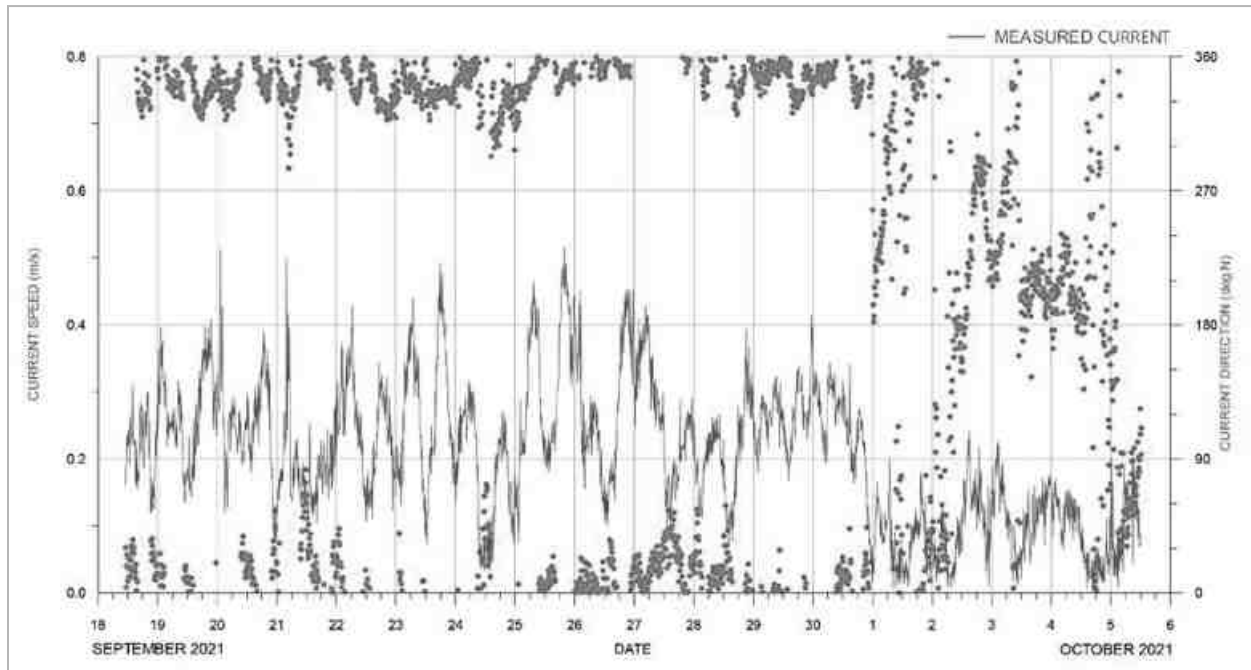


Figure 45. Variation of measured current speed and current direction

Littoral Drift

Based on the available wave data compiled for the project location, the longshore sediment transport rate was estimated using the simplified CERC empirical equation (Shore Protection Manual, CERC, US Army, 1975).

Where,

- Volume of transport rate in m^3/year
- Breaking wave height in m
- Breaking wave angle w.r.t. shoreline

The shoreline near the project location is oriented nearly in N11°E direction. The monthly volume of littoral drift is presented below.

Table 44. Monthly and annual longshore transport

Month	Quantity (m^3/month)	
	Northerly	Southerly
January	-13869	46566
February	-8508	9470
March	-17395	4195
April	-15147	4051
May	-29649	2405
June	-14614	3260



Month	Quantity (m ³ /month)	
	Northerly	Southerly
July	-54964	41
August	-42311	60
September	-53831	16
October	-28579	14412
November	-12309	64674
December	-19514	65441
ANNUAL	-0.31 x 10 ⁶	0.21 x 10 ⁶
ANNUAL GROSS	0.52 x 10 ⁶ m ³ /year	
ANNUAL NET	-0.10 x 10 ⁶ m ³ /year (Northerly)	

Note: The net transport is towards north

The annual northerly transport was estimated as -0.31 x 10⁶ m³/year and southerly transport was estimated as 0.21 x 10⁶ m³/year. The total annual gross transport was found to be 0.52 x 10⁶ m³/year and the annual net transport was estimated to be -0.10 x 10⁶ m³/year towards north.

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October	-28579	14412
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December	-19514	65441
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ANNUAL GROSS	0.52 x 10 ⁶ m ³ /year	
ANNUAL NET	-0.10 x 10 ⁶ m ³ /year (Northerly)	

Note: The net transport is towards north

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Cyclones: Based on tracks of cyclones passed in Indian coastal region, the tracks of cyclones which have crossed the coast near Cuddalore (within 100 km on either side) during 1924 to 2023 as documented by the Indian Meteorological Department (IMD) are presented and the track of cyclones is shown below. It indicates that totally 44 storms had occurred in the vicinity of the project region in the last 100 years. The occurrence of storms in this region are more frequent in November (23) followed by December (07), October (06), May (04), April (02), February (01) and March (01).

Table 46. Number of cyclones crossed within 100 km radius (1924 - 2023)

Month	Cyclones crossed within 100 km project radius
January	-
February	01
March	01
April	02
May	04
June	-
July	-
August	-
September	-
October	06
November	23
December	07
Total	44

Source: cyclone e-atlas published by IMD - 2023



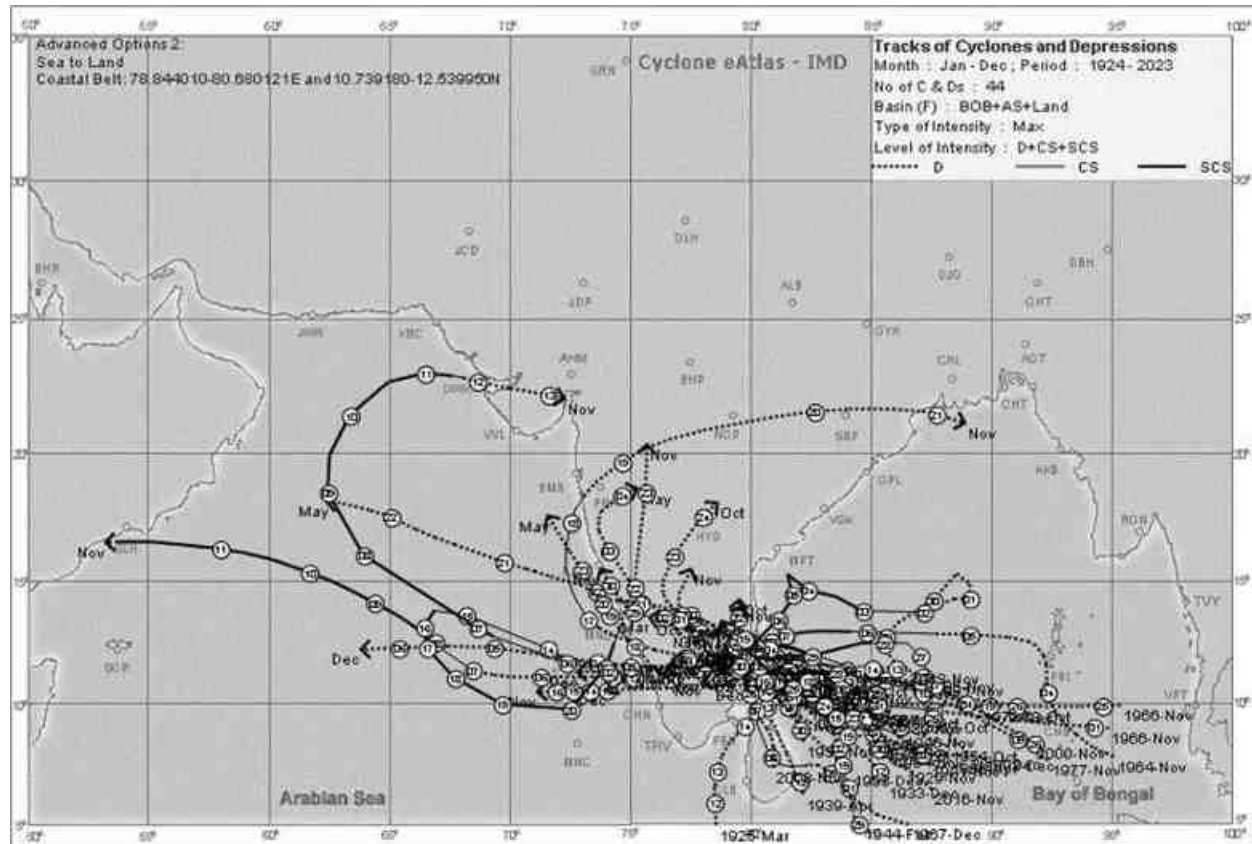


Figure 46. Tracks of Cyclones and Depressions, 19-4 - 2023 (100 km project radius)

Tsunami: The occurrence of a Tsunami along the Indian coast is a rare event with a very low frequency of once in 500 years or more. No reliable historical records of occurrence of Tsunami events and their impact along the Indian coast are available because of its exceedingly rare nature. History shows that at an average two Tsunamis occur every year in the globe causing huge damage to the people and properties along the coast. Among them the most destructive Tsunamis occur once in 15 years causing colossal damage to the coasts. While most of the Tsunamis keep frequently occurring in the Pacific Ocean, their occurrence in the Indian Ocean is found to be less. The statistical estimate indicates that an average of eight Tsunamis occur every year in the Pacific Ocean, whereas one Tsunami occurs every 3 years in the Indian Ocean (Loughlin and Lander, 2003).

Generation of Tsunami waves

Tsunami is a series of wave trains generated in the ocean by a hydraulic impulsive force that vertically displaces the water column. Earthquakes, landslides, volcanic eruptions, explosions and even the impact of cosmic bodies taking place in the ocean can generate Tsunami waves with long periods (≈ 30 min), long wavelength (≈ 100 km) with a high velocity of propagation (≈ 700 km/hr).



Tsunamis are shallow water waves which propagate with phase velocity equal to the square root of the product of the acceleration due to gravity and the water depth. For example, in the Indian Ocean, close to Andaman Sea where the typical water depth is about 4000 m, the Tsunami wave travels at about 700 km/hr. Because the rate at which the wave loses its energy is inversely related to its wavelength, Tsunami not only propagates at high speed, but it can also travel great transoceanic distances with limited energy losses and reach different continents in a shorter time.

Among the various factors causing the occurrence of Tsunami, the large vertical movements of the earth's crust are more predominant, and it can occur at **tectonic plate boundaries**. The plates that interact along these boundaries are called **faults**. Around the margins of the faults, the denser oceanic plates slip under the continental plates in a process known as **subduction**. In other words, when the oceanic lithosphere (crust) of the tectonic plate converges with the less dense lithosphere of a second plate, the heavier plate dives beneath the second plate and sinks into the mantle. Such subduction earthquakes are particularly very effective in generating the devastating Tsunamis. In the present case (2004 Indian Ocean Tsunami), the Andaman plate and Indonesian Plate move against each other and cause subduction of the interface.

The energy flux due to Tsunami is proportional to its velocity of propagation and height and it remains constant till reaching the nearby coast. Consequently, the velocity of propagation gets retarded when it enters shallower water, and its height gets amplified. Because of this shoaling effect, the Tsunami that is imperceptible at deep ocean close to centimeter height may rise to several meters near the coast called **run up**. This is because the magnitude on the Richter scale (M_L) is a constant value for an earthquake, but the intensity gets reduced gradually when moving away from the epicenter. Thus, the offshore waves generated with negligible height travels at a greater speed and then the trend of celerity gets reduced when reaching the coast causing a sudden shoaling effect and the waves get rise to several meters high. The critical magnitude of earthquake for generating Tsunami is greater than 5 M_L on the Richter scale. Based on the magnitude, the earthquake can be classified into several groups depicting the nature of earthquake as described by USGS is given in **Table 47**.

Table 47. Classification based on magnitude of earthquake

Magnitude on Richter Scale (M_L)	Category / Group
< 3	Very Minor
3.0 – 3.9	Minor
4.0 – 4.9	Light
5.0 – 5.9	Moderate
6.0 – 6.9	Strong
7.0 – 7.9	Major
8 & higher	Great

Source: <http://usgs.gov>

Tsunami waves generated with underwater earthquake of magnitude greater than 5 M_L , when they finally reach the coast, the crest of the wave appears as rapidly risen water mass gushing into



the coastline as a bore with a crashing velocity of 3-0 - 400 km/hr for about -0 - 30 min. The trough of the wave will appear as the withdrawal of water mass with same speed back into the ocean swallowing everything on the land and dragging back into the ocean.

Major Tsunami occurred in the past two hundred years along the coastal regions bordering the Indian Ocean of various countries bordering the Indian Ocean are given in **Table 45** below.

Table 48. History of Tsunamis along the coastal regions bordering the Indian Ocean

Year	Epicerter of Earthquake	Magnitude	Coastline affected
1797	Western Sumatra	8.4	Padang
1833	Western Sumatra	8.7	Southern part of Sumatra
1861	Western Sumatra	8.5	Coastal regions of Sumatra
1881	Andaman Island	7.9	East coast of India
1883	Krakatau volcano	-	2 m Tsunami at Chennai
1941	Andaman Islands	7.7	Anecdotal accounts exist
1945	South of Karachi	8.5	12 m Tsunami at Kandla
2004	Northern coast of Sumatra (26 Dec' Indian Ocean Tsunami)	9.2	Coastal regions of SE Asian countries
2005	East of Andaman Islands	8.7	Andaman Islands

Source: Chandramohan, P., et al. (2017)

2004 Tsunami - Andaman Sea

The earliest Tsunami first recorded along the Indian coast was on 31 December 1881 due to an earthquake measuring $M_L = 7.9$ near Car Nicobar Island (Murthy and Bapat, 1999). The latest Tsunami which made visually experienced by the present generation had occurred on 26 December 2004, Sunday at 00:58:53 GMT (7:58:53 IST) at the epicenter with Latitude: 3.316°N and Longitude: 95.854°E with $M_L = 9.2$ (Murty et al., 2007) and at a depth of about 30 km. Loualalen et al. (2007) described it as the third largest undersea megathrust earthquakes (occur at convergent plate boundaries, where one tectonic plate is forced underneath another) ever recorded.

The 2004 Andaman Sea Tsunami generated by the submarine earthquake in Andaman Sea triggered the worst destruction, widespread inundation and extensive damage in terms of life and property along the coasts of India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka, Seychelles, Thailand and Somalia.

The Andaman-Sumatra is currently one of the most seismically active regions in the world. The earthquake of 26th December 2004 had occurred at the interface between the Indian and Burma Plates. It is due to the static seafloor uplift caused by abrupt dip slip faults at the India/Burma Plate interface. The Burma plate is characterized by significant strain partitioning due to oblique convergence of the India and Australia plates to the west; and the Sunda and Eurasian plates to the east (**Fig. 3.16**). It is a typical oceanic-oceanic convergent plate boundary where the Indian plate moving relative to the Burma plate came together, collided and sank under the Burma plate. This subsidence of the large plate led to a giant earthquake with a magnitude of 9.2 Richter scale which ruptured the greatest fault length of other recorded earthquakes. The Tsunami was then



generated by a sudden vertical displacement of seawater near the subduction zone of Andam-n - Sumatra trench. While the Tsunami wave approaches from deepwater to the shallow water, the velocity of propagation would reduce, say from 700 kmph at 4000 m depth to 25 kmph at 5 m depth. Also, the wave induced water particle velocity would increase rapidly from 0.02 m/s at 4000 m depth to 3.5 m/s at 5 m depth. The Tsunami wave height will increase, manifold and finally surge on the coast with devastating power.

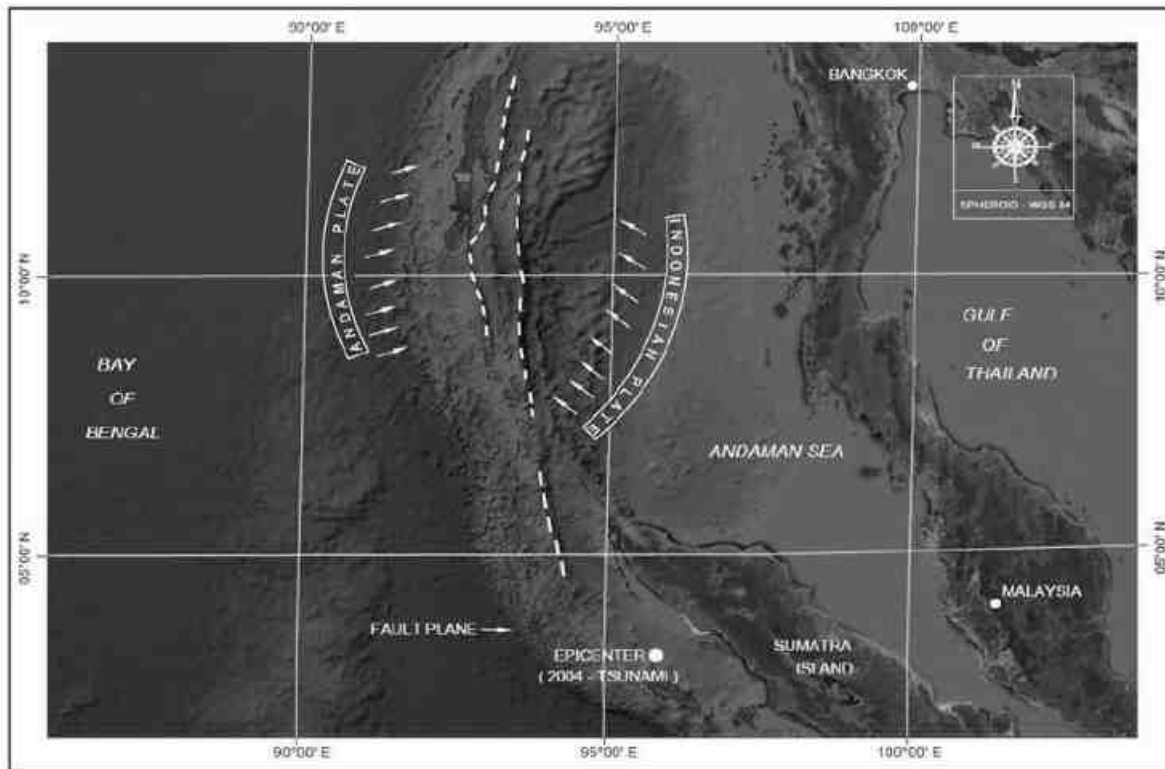


Figure 47. Movement of tectonic plates

From its epicenter, located 80 km west of the coast of northern Sumatra, the earthquake proceeded approximately northward, rupturing 1200 – 1300 km of the Andaman-Sunda trench in about 8 – 10 min (Ammon et al., 2005; Lay et al., 2005). Liberating enormous energy, corresponding to a M_L 9.2 moment magnitude, the earthquake triggered a tsunami that was one of the most devastating natural disasters ever witnessed in modern history. The largest tsunami runups, over 30 m, occurred south of Banda Aceh, Sumatra, whose shore is closest to the epicenter, only about 10 minutes away in terms of tsunami propagation time.

Inference on Tsunami

The occurrence of Tsunami along the Indian coast is an extremely rare event with a periodicity of 50 to 500 years. No reliable historical records of occurrence of Tsunami events and their impact along the Indian coast are available because of its exceedingly rare nature. One worst tsunami event was witnessed on 26th December 2004 along the east coast of India, and the water level rise (run up) on the shore at Tamil Nadu was around 2.5 m. The east coast carries the threat due to the



fault plane intersected by the Andaman plate and the Indonesian plate. On the other hand, the African plate keeps moving against the Eurasian plate in the Arabian sea. The collision of these two tectonic plates in Arabian Sea can trigger Tsunami along the west coast of India but with less frequency compared to those occurring in Bay of Bengal.

Considering the historical records on Tsunami occurrences, Tsunami up to 2 m can be expected along the project coast of Cuddalore.

Bathymetry

Open sea: The bathymetry map shows that the depth increases gradually from nearshore to offshore. Bathymetry contours upto 3 m depth are comparatively closer to the coastline falling with a gradient of 1:40 slope. The seabed between 4 m and 8 m water depths are relatively steep with a slope of 1:50. Beyond 9 m and upto 13 m water depths, the seafloor is relatively flatter with a slope of 1:680. Few undulations are noticed beyond 12 m water depth at a distance of about 2100 m. The shape of contours shows parallel to the coastline. The maximum depth of 13.3 m is noticed at the end of the survey region at 2950 m offshore.

The bathymetry map of the open sea is given in Fig. 3.17.

Uppanar river creek: The river bathymetry map prepared in 1:1000 scale is presented in Fig. 6.4 (A0 size). The depths w.r.t. chart datum are presented in a 5 m x 5 m grid. The depth contours are varied from 0.1 m to 3 m. The southern part of the study area is steeper compared to the northern part. Generally, the majority of the survey area is exposed during low tide hours. An eastern part of the survey area noticed a maximum depth of (-) 3.5 w.r.t MSL.

The bathymetry map of Uppanar river creek is given in Fig. 32.

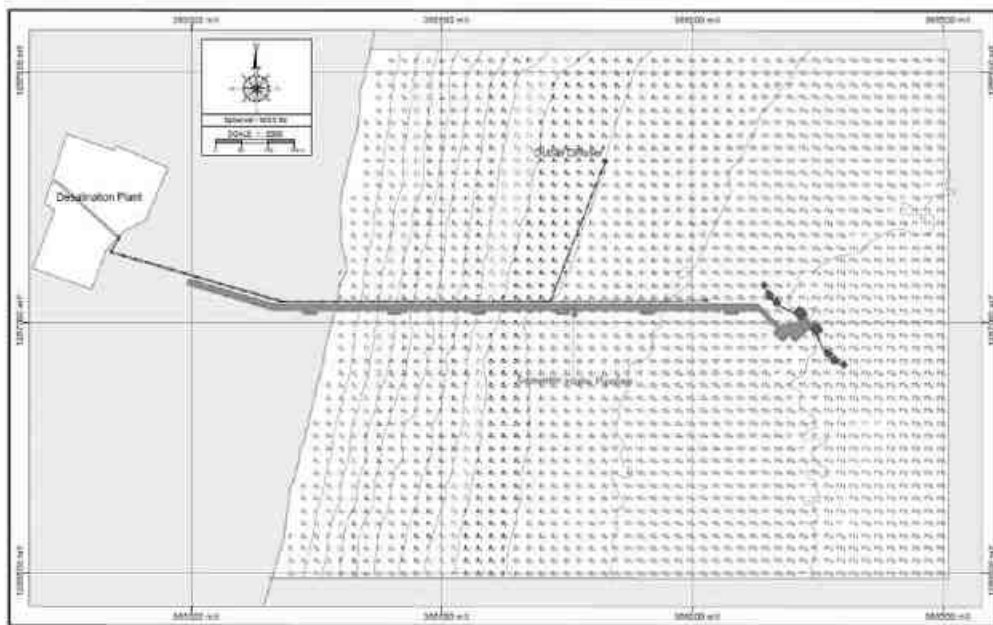


Figure 48. Bathymetry map of open sea



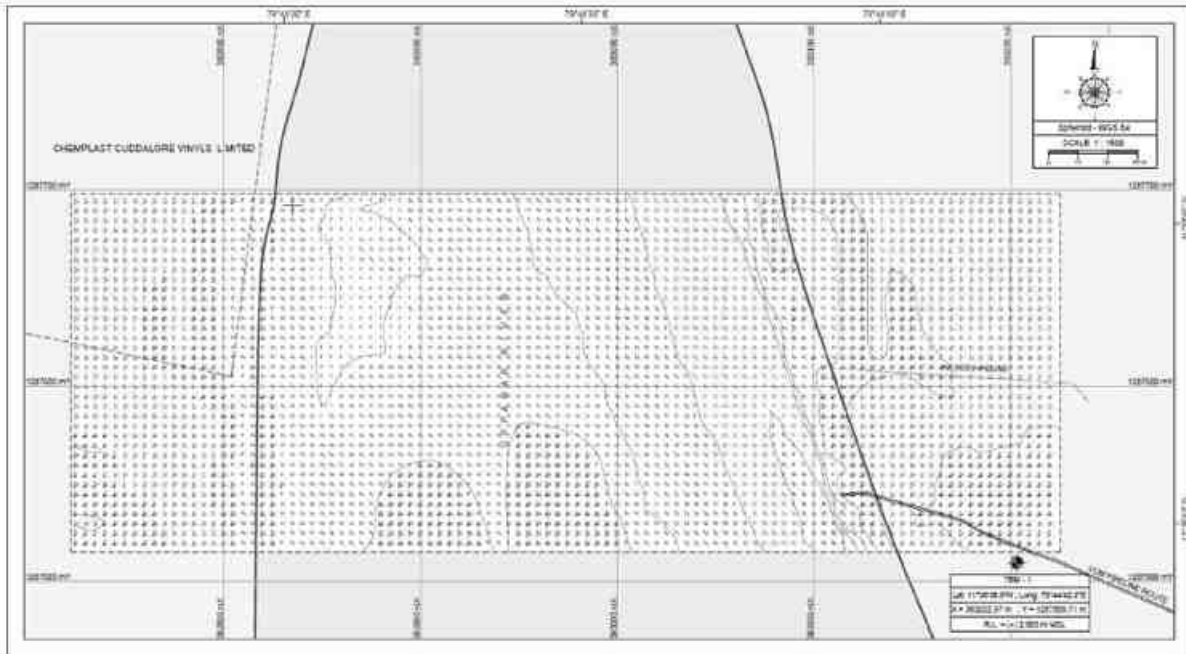


Figure 49. Bathymetry map of Uppanar river creek

The geographical coordinates of the 13 sampling locations for seawater, seabed sediments, and the 3 biological sampling locations are provided in Table 3.36.

3.11.2.2 Seawater Quality

- Temperature
- Salinity
- Turbidity
- TSS
- Chlorides
- pH
- Cadmium
- Chromium
- Lead
- Mercury
- Nitrate
- Nitrite
- Ammonia
- Total Nitrogen
- Dissolved Phosphate
- Total Phosphorus
- DO
- BOD
- Phenol



- **PHC**

The seawater, seabed sediment and biological samples were collected at 10 locations (stns. SS1 to stn. SS10) at open sea and 3 locations at Uppanar river creek (stns. SS11 to stns. SS13) covering a 10 km radius. Samples were collected at three depth surface, mid-depth, and bottom levels. The location of seawater, seabed sediment and biological samples is given in Fig.3.19.

seawater quality results are presented in Table 3.37, with Part I (Nutrients) in Table 3.38 and Part II (Trace Elements) in Table 3.39. Below are some photographs from the sample collection process.



Figure 50. Seawater sample collection

Table 49. Location of seawater and biological sampling stations

Station*	Geographical coordinates (WGS 84)	
	Latitude, N	Longitude, E
Open sea		
SS1 & SB1	11°38'2".5"	79°46'0".9"
SS2 & SB2	11°38'2".1"	79°46'1".8"
SS3 & SB3	11°38'1".8"	79°46'5".2"
SS4 & SB4	11°38'1".7"	79°47'2".2"
SS5 & SB5	11°37'2".4"	79°46'2".6"
SS6 & SB6	11°39'0".7"	79°46'3".1"
SS7 & SB7	11°36'0".3"	79°47'2".9"
SS8 & SB8	11°38'1".8"	79°48'3".7"
SS9 & SB9	11°40'1".9"	79°47'4".1"
SS10 & SB10	11°38'1".0"	79°51'1".2"
Uppanar river creek		
SS11 & SB11	11°39'0".6"	79°44'3".4"
SS12 & SB12	11°38'4".6"	79°44'3".9"
SS13 & SB13	11°38'2".9"	79°44'4".4"
Intertidal benthos		
IB1	11°39'2".0"	79°46'0".5"
IB2	11°38'2".9"	79°45'4".4"
IB3	11°37'1".9"	79°45'3".3"



*SS - Seawater sample; SB - Seabed sample; IB - Intertidal benthos

Table 50. Seawater quality

Station		Temp. (°C)	pH	Salinity (PSU)	Turbidity (NTU)	TSS (mg/l)	Chloride (mg/l)	DO (mg/l)	BOD (mg/l)	Phenol (mg/l)
Open Sea										
SS1	S	31	8.03	33.9	8.1	16.7	18462	4.1	1.1	<0.01
	M	30	8.14	33.7	9.8	19.3	18363	4.3	1.7	<0.01
	B	30	8.22	33.9	10.6	21.3	18462	5.4	1.7	<0.01
SS2	S	30	8.13	33.7	8.9	18.0	18363	5.0	1.9	<0.01
	M	30	8.17	33.5	10.2	20.7	18264	5.0	2.5	<0.01
	B	31	7.95	33.7	20.0	40.7	18363	4.6	2.4	<0.01
SS3	S	31	8.23	33.9	6.6	13.3	18462	4.5	1.9	<0.01
	M	30	8.27	34.3	8.5	17.3	18661	4.8	2.2	<0.01
	B	29	8.23	34.3	9.1	18.7	18661	5.0	2.1	<0.01
SS4	S	30	8.29	34.1	2.8	6.0	18562	4.2	1.7	<0.01
	M	30	8.31	34.1	3.5	6.7	18562	4.4	1.5	<0.01
	B	30	8.28	34.3	4.8	10.0	18661	5.4	2.6	<0.01
SS5	S	30	8.27	33.9	6.0	12.0	18462	3.9	1.4	<0.01
	M	29	8.28	34.1	6.7	13.3	18562	5.7	2.8	<0.01
	B	30	8.22	34.3	15.8	32.0	18661	4.5	1.7	<0.01
SS6	S	29	8.24	33.9	7.3	14.7	18462	4.8	2.4	<0.01
	M	28	8.2	34.1	8.7	17.3	18562	4.3	1.5	<0.01
	B	29	8.23	34.1	22.0	44.0	18562	6.0	2.4	<0.01
SS7	S	29	8.22	34.1	3.0	6.0	18562	5.6	2.2	<0.01
	M	30	8.28	34.3	4.9	10.0	18661	6.0	2.8	<0.01
	B	31	8.33	34.3	5.4	10.7	18661	6.1	2.7	<0.01
SS8	S	30	8.3	33.9	1.7	3.3	18462	5.0	2.4	<0.01
	M	29	8.28	34.1	1.8	4.0	18562	4.2	1.5	<0.01
	B	28	8.3	34.1	3.8	8.0	18562	5.3	2.6	<0.01
SS9	S	30	8.24	33.9	2.5	5.3	18462	3.5	1.5	<0.01
	M	29	8.27	34.1	3.4	6.7	18562	3.6	1.7	<0.01
	B	29	8.27	34.3	10.6	21.3	18661	3.7	1.8	<0.01
SS10	S	31	8.26	33.9	3.2	6.7	18462	3.5	1.5	<0.01
	M	30	8.31	34.1	3.7	7.3	18562	3.4	1.6	<0.01
	B	30	8.36	34.3	7.1	14.0	18661	3.6	1.9	<0.01
Uppanar river creek										
SS11	S	28	7.84	10.6	10.9	22.0	5757	4.2	1.2	<0.01
SS12	S	28	7.81	4.2	33.2	66.7	2283	4.4	1.0	<0.01
SS13	S	28	7.87	8.6	12.8	25.3	4665	4.1	1.6	<0.01



Table 51. Seawater quality - Part I (Nutrients)

Station		Nitrite ($\mu\text{mol/l}$)	Nitrate ($\mu\text{mol/l}$)	Ammonia ($\mu\text{mol/l}$)	Dissolved Phosphate ($\mu\text{mol/l}$)	Total Phosphorus ($\mu\text{mol/l}$)	Total Nitrogen ($\mu\text{mol/l}$)
Open Sea							
SS1	S	0.28	11.5	2.1	1.13	2.00	15.5
	M	0.15	11.4	1.3	0.84	1.61	14.0
	B	0.13	11.3	1.2	0.81	1.78	15.2
SS2	S	0.13	11.6	3.3	1.23	2.34	14.1
	M	0.15	11.5	1.4	1.48	2.58	13.0
	B	0.24	11.5	0.4	2.87	3.31	15.7
SS3	S	0.07	11.0	4.4	1.23	2.21	16.2
	M	0.11	10.9	3.9	1.24	2.28	15.5
	B	0.13	10.7	4.0	1.11	2.43	15.9
SS4	S	0.07	5.0	2.4	1.03	2.30	8.2
	M	0.09	4.9	2.2	0.96	2.26	7.3
	B	0.04	4.7	1.3	1.39	1.93	7.3
SS5	S	0.11	9.2	3.7	1.14	1.90	13.6
	M	0.11	9.2	2.9	1.24	2.13	14.0
	B	0.07	8.9	2.8	1.52	2.23	12.7
SS6	S	0.09	6.1	1.2	1.06	1.76	8.4
	M	0.13	6.0	1.2	1.13	2.30	8.6
	B	0.09	5.9	0.5	1.01	2.31	7.9
SS7	S	0.17	12.0	1.0	1.21	2.32	14.2
	M	0.13	11.9	0.8	1.52	2.33	13.3
	B	0.09	11.3	0.6	1.13	2.32	12.7
SS8	S	0.11	3.0	3.2	1.13	2.40	6.3
	M	0.15	3.1	2.4	1.22	2.41	7.2
	B	0.04	2.9	0.8	1.16	2.40	4.2
SS9	S	0.09	3.5	3.3	1.14	1.42	5.2
	M	0.09	3.4	1.9	1.13	1.42	7.6
	B	0.04	3.4	0.6	1.21	1.46	6.6
SS10	S	0.30	2.8	1.1	1.25	2.92	5.5
	M	0.09	2.8	0.3	1.23	2.33	4.7
	B	0.02	2.7	0.4	1.58	2.37	4.2
Uppanar river creek							
SS11	S	0.07	20.5	0.9	2.43	4.06	22.3
SS12	S	0.02	17.5	1.4	2.77	4.96	20.6
SS13	S	0.02	22.9	0.8	3.11	4.14	25.5

Table 52. Seawater quality - Part II (Trace Metals)

Location	Arsenic ($\mu\text{g/l}$)	Chromium ($\mu\text{g/l}$)	Copper ($\mu\text{g/l}$)	Manganese ($\mu\text{g/l}$)	Cadmium ($\mu\text{g/l}$)	Lead ($\mu\text{g/l}$)	Boron (mg/l)	Zinc ($\mu\text{g/l}$)	Barium ($\mu\text{g/l}$)	Mercury ($\mu\text{g/l}$)	PHC (mg/l)
Open Sea											
SS1	2.7	16.6	2.0	11.0	1.0	<0.01	3.9	<0.01	4.0	<0.01	<0.1
SS2	4.5	15.2	<0.01	7.0	1.0	<0.01	2.8	<0.01	<0.01	<0.01	<0.1
SS3	3.8	10.1	1.0	7.0	2.0	<0.01	3.2	<0.01	<0.01	<0.01	<0.1
SS4	4.0	8.0	0.0	7.0	1.0	<0.01	2.9	<0.01	<0.01	<0.01	<0.1
SS5	3.1	9.8	1.0	7.0	2.0	<0.01	3.8	<0.01	3.0	<0.01	<0.1



EIA & EMP STUDY TO OBTAIN EC AND CRZ CLEARANCE FOR UPGRADATION OF EXISTING MARINE
TERMINAL FACILITIES AND PROPOSED 20 MLD DESALINATION PLANT by M/s. Chemplast Cuddalore Vinyls
Limited (CCVL)



Location	Arsenic (µg/l)	Chromium (µg/l)	Copper (µg/l)	Manganese (µg/l)	Cadmium (µg/l)	Lead (µg/l)	Boron (mg/l)	Zinc (µg/l)	Barium (µg/l)	Mercury (µg/l)	PHC (mg/l)
Open Sea											
SS6	1.6	16.1	2.0	8.0	1.0	<0.01	3.1	<0.01	<0.01	<0.01	<0.1
SS7	3	14.3	1.0	8.0	1.0	<0.01	3.4	<0.01	<0.01	<0.01	<0.1
SS8	1.5	15.7	0.0	6.0	1.0	<0.01	3.1	<0.01	<0.01	<0.01	<0.1
SS9	1.1	13.0	0.0	3.0	1.0	<0.01	2.4	<0.01	<0.01	<0.01	<0.1
SS10	2.4	14.7	1.0	6.0	2.0	<0.01	2.9	<0.01	<0.01	<0.01	<0.1
Uppanar river creek											
SS11	2.0	12.4	3.0	6.0	2.0	1.0	1.0	<0.01	34.0	<0.01	<0.1
SS12	<0.01	17.1	19.0	10.0	1.0	<0.01	0.6	<0.01	51.0	<0.01	<0.1
SS13	0.7	23.5	9.0	14.0	1.0	<0.01	1.5	<0.01	41.0	<0.01	<0.1

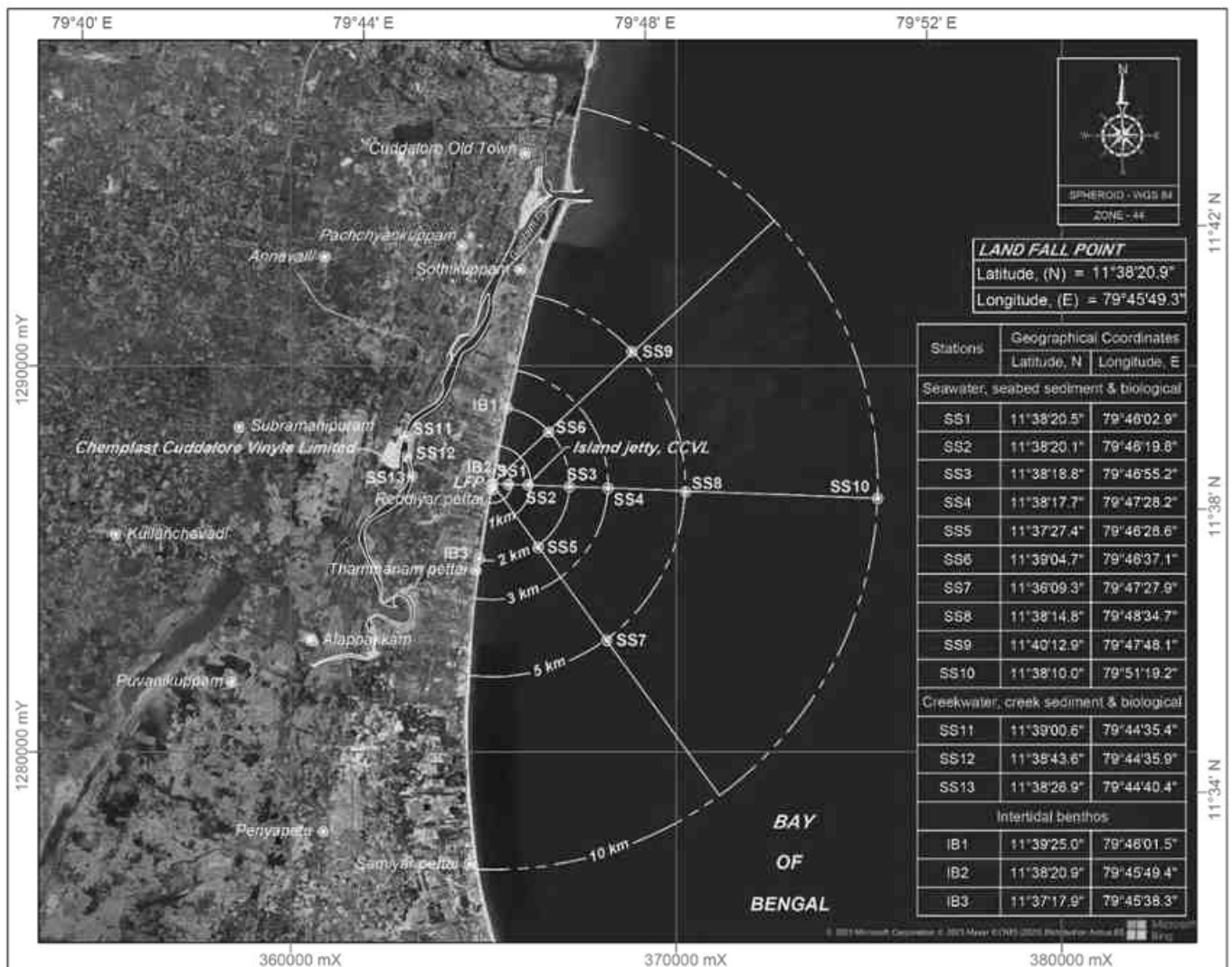


Figure 51. Locations of seawater, seabed sediments sampling collection

Physical Parameters



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Temperature: The temperature variation is one of the factors in the coastal system, which may influence the physicochemical characteristics and influence the distribution and abundance of flora and fauna.

The seawater temperature values varied from 28 °C to 31.0°C with an average of 29.7°C, while the temperature in Creek water was 28 °C during the study. The temperature profile for all stations was generally stable.

Salinity: Salinity is a crucial factor that controls how marine creatures are distributed in space. Salinity is a measure of how much seawater has seeped into inland bodies of water like estuaries and creeks. Although seawater's natural salinity is 35.5 PSU, freshwater input, evaporation, and precipitation can change the salinity of estuarine and coastal waters. The biota is often adapted to a range of salinities where they can flourish. However, a sudden salinity shock could cause the local creatures to perish.

During the study period, salinity measurements were recorded from sea water stns. SS1 to SS10 shows salinity variations from 33.5 to 34.3 PSU, with an average of 34.0 PSU. In Creek water stns. SS11 to SS13 salinity varied from 4.2 to 10.6 with an Average of 7.8.

Turbidity: Turbidity reflects the amount of light penetration in a water column and is dependent on the amount of suspended particulate matter which controls the photosynthesis in the water column. Turbidity is a measure of water clarity, which is the number of suspended materials, decreases the passage of light through the water.

Sea water turbidity ranged from 1.7 to 22.0 NTU with an average of 7.3 NTU. Creek Water: Turbidity varied from 10.9 to 33.2 NTU during this study.

Inorganic-non-metallic constituents

pH: Identifying pH for acidic or alkaline disturbances may help to locate zones of pollution and other quality conditions of seawater.

Sea Water pH ranged from 7.95 to 8.36 with an average of 7.95, while the pH in creek water varied from 7.81 to 7.84 during the period of study.

Chlorides: Natural water typically contains chlorides. The suspension of salt deposits emitted from chemical factories, sewage from oil well operations, irrigation drainage, and seawater intrusion in coastal locations can all be blamed for the presence of chloride in natural water.

The concentration of chloride in sea water ranged from 18264 to 18661mg/l, with an average of 18532 mg/l. Chloride in creek water ranged from 2283 to 5757 mg/l during the study period.

Quantification



The pH and chloride levels of the inorganic elements were determined to be within the typical range of marine water.

Solids

Total Suspended Solids (TSS): Total Suspended Solids in seawater originate either from autochthonous (biological life) or allochthonous (derived from terrestrial matter) sources.

TSS values varied between 3.3 and 44.0mg/l with a mean value of 14.8 mg/l at all stations SS1 to SS10. In Creek water the TSS has been varied from 22.0 to 66.7 mg/l at stns. SS11 to SS13 during the study period.

Organic Constituents

Dissolved oxygen (DO): Dissolved oxygen concentration varies according to many factors; the main factors are due to photosynthesis and respiration by plants and animals in water.

In the studied region, the average concentration of dissolved oxygen (DO) in sea water was 4.6 mg/l. Dissolved oxygen (DO) in sea water ranged from 3.4 to 6.1mg/l, while the dissolved oxygen (DO) in creek water ranged from 4.1 to 4.4 mg/l during the current investigation.

Biochemical Oxygen Demand (BOD): The rate of aerobic oxygen consumption is a useful indicator of the severity of degradation in an aquatic medium. When oxygen is used to oxidise organic materials, the result is a deteriorating environment or, if too many extra nutrients are released, eutrophication. The low BOD readings show that oxidizable organic matter introduced to coastal waters is efficiently absorbed. BOD levels in sea water during the current investigation varied from 1.1 to 2.8 mg/l, with an average of 1.6 mg/l. In creek water BOD values varied from 1.0 to 1.6 mg/l.

Phenol: The concentration of phenolic compounds in the study area was found to be < 0.01 mg/l at all sampling stations.

Nutrients

The potential fertility of an ecosystem is determined by nutrients, which promote the growth of primary producers. Understanding their distribution and behaviour across various geographies and seasons is crucial. The availability of primary and secondary producers affects an area's ability to support fisheries. Eutrophication could occur if these nutrients are enriched in the coastal waters due to human activity.

Nitrite: Nitrite is an intermediate product in the microbial reduction of nitrate and in the oxidation of ammonia. In addition, nitrite is excreted by phytoplankton especially during plankton bloom. Nitrite varied from 0.02 to 0.30 µmol/l with an average of 0.12 µmol/l at all stns. SS1 to SS10. In



creek water nitrite values varied from 0.02 to 0.07 $\mu\text{mol/l}$ at stns. SS11 to SS13 during the study period.

Nitrate: Nitrate is the final oxidation product of nitrogen compounds in seawater, and it is the only thermodynamically stable oxidation level of nitrogen in seawater. The mean concentration of Nitrate was 7.5 $\mu\text{mol/l}$, which ranged from 2.7 to 12.0 $\mu\text{mol/l}$ during this study. In creek water nitrate values varied from 17.5 to 22.9 $\mu\text{mol/l}$ at stns. SS11 to SS13 during the study period.

Ammonia: Similar to nitrite, ammonia is unstable in the naturally oxidized waters and is oxidized to nitrate via nitrite.

The ammonia concentration ranged from 0.3 and 4.4 $\mu\text{mol/l}$. with 2.0 $\mu\text{mol/l}$ serving as the mean value, while the ammonia concentration in creek water varied from 0.8 to 1.4 $\mu\text{mol/l}$ during the period of study.

Dissolved Phosphate: Like the nitrogen molecule, phosphate is a crucial component for primary production in the sea. River runoff and human activity have an impact on the phosphate concentration, particularly in coastal seas.

The mean concentration of phosphate was 1.24 $\mu\text{mol/l}$, which ranged between 0.81 and 2.87 $\mu\text{mol/l}$. In creek water phosphate values varied from 2.43 to 3.11 $\mu\text{mol/l}$ at stns. SS11 to SS13 during the study period.

Total Phosphorous: Total phosphorus varied from 1.42 to 3.31 $\mu\text{mol/l}$ with an average of 2.19 $\mu\text{mol/l}$ at all stations (SS1 to SS10). In creek water total phosphorus values varied from 4.06 to 4.96 $\mu\text{mol/l}$ at stns. SS11 to SS13 during the study period.

Total Nitrogen: Total nitrogen varied from 4.23 to 16.17 $\mu\text{mol/l}$, with an average of 10.48 $\mu\text{mol/l}$. In creek water total nitrogen values varied from 20.64 to 25.47 $\mu\text{mol/l}$ at stns. SS11 to SS13 during the study period.

Heavy Metal Concentration

Understanding the amount of trace metals present in seawater is crucial because of the potential harm they may do to marine life. The particulate debris absorbs many of the trace metals, which are then eventually deposited at the bottom. It is a complex link that depends largely on the speciation of the metal and the health of the organism between the gross concentration of a heavy metal in solution and its capacity to have harmful effects on an organism. The "bioavailability" of a trace metal in the medium determines whether it can interact with the biota. The cumulative toxicity of each element can be decreased or increased by the presence of other toxins or metals. Temperature, pH, salinity, turbidity, dissolved oxygen concentration, and other variables also have a big impact on how metal-organism interactions work. It has been discovered that the nominal



concentrations of trace metals found in saltwater are required to foster the growth of marine creatures.

Cadmium (Cd): The bioavailability and toxicity of trace metals such as Cd, Cu, and Zn are related to the activity of the free metal ion rather than the total metal concentration. For Cd it is the CdCl_2 complex that predominates in seawater. Therefore, salinity is the overriding factor which can alter free Cd ion activity $\{\text{Cd}^{2+}\}$, and hence, bioavailability and toxicity in marine systems

Open sea & Creek: Cadmium concentration was found to be 1.0 to 2.0 $\mu\text{g/l}$ at Sns. SS1 to SS13 during this study both in open sea and creek water.

Chromium (Cr): In natural waters trivalent chromium is most abundant. Chromium is a dietary requirement for several organisms. After a particular limit the higher concentration of chromium also becomes toxic to living organisms in the aquatic environment. Discharging chromium laden untreated wastewater in rivers has caused environmental disasters in the past. Chromium is largely bound to floating particles in water

Open Sea : During the study period, chromium concentration was found between 8.0 $\mu\text{g/l}$ to 16.6 $\mu\text{g/l}$ at stns. SS1 to SS10. **Creek:** The concentration of chromium varied between 12.4 to 23.5 $\mu\text{g/l}$ at stns. SS11 to SS13 during this study period.

Lead (Pb): Lead has been used by man for centuries and is amongst the most widely dispersed environmental contaminants. Available literature suggests that alkylation of lead is purely a chemical process which may occur in organic-rich anoxic sediment. The lead present in the gets accumulated in marine organisms especially with benthic animals like shellfish.

Open sea: Lead concentration was found to be below detectable limit i.e. $<0.01 \mu\text{g/l}$ at all sampling stns. SS1 to SS10 in the open sea.

Creek: The concentration of lead in creek water is 1.0 $\mu\text{g/l}$ at stn SS11 and other stations (stn SS12 and SS13) were found to be below the detection limit i.e. $<0.01 \mu\text{g/l}$ during this study.

Mercury (Hg): Mercury is regarded as a harmful and non-essential element for living things. Mercury has drawn attention due to its vast use, toxicity, widespread distribution, and bio magnification, among other heavy metals. It has been shown that the bio-concentrate of mercury in aquatic creatures like oysters and mussels is significantly higher than that found in the environment in which they reside.

Open sea & Creek: The mercury concentration was found to be below detectable limit ($<0.01 \mu\text{g/l}$) at all sampling stns. SS1 to SS13 during this study.

Petroleum Hydrocarbons: The coastal waters are susceptible to oil pollution due to various maritime activities like fishing operation, spillage from oil tankers, port activities etc. Hence, the



petroleum hydrocarbons analysis conducted, and that concentration was found to be below the detection limit <0.1 mg/l at all sampling stns. SS1 to SS13 during this study.

3.11.2.3 Seabed Sediment Quality

- Sediment Classification & Size distribution
- Total Organic Carbon
- Total Nitrogen
- Total Phosphorus
- Calcium Carbonate
- Cadmium
- Chromium
- Lead
- Zinc
- Mercury

Sediment Size Distribution: Sediment samples were collected at 13 station stns. (SB1 to SB13) among them three stations (SB11 to SB13) were collected at Uppanar river creek. seabed sediment quality given in Table 50. and heavy metals given in Table 51.



Figure 52. Seabed sediment sample collection

Table 53. Seabed sediment quality Texture

Station	Classification of Soil	D50(mm)	Sand (%)			Silt & Clay
			Coarse	Medium	Fine	%
Open Sea						
SB1	Fine sand	0.10	0.0	0.0	95.8	4.2
SB2	Medium sand	0.50	1.66	55.3	41.1	1.9
SB3	Medium sand	0.53	4.20	55.3	39.3	1.3
SB4	Medium sand	0.70	8.78	78.8	12.3	0.1
SB5	Medium sand	0.55	6.43	54.9	36.8	1.9
SB6	Fine sand	0.09	0.0	0.0	93.7	6.3
SB7	Medium sand	0.39	12.8	57.9	28.6	0.8



Station	Classification of Soil	D50(mm)	Sand (%)			Silt & Clay
			Coarse	Medium	Fine	%
SB8	Medium sand	0.39	0.0	48.8	50.7	0.5
SB9	Fine sand	0.12	1.0	19.5	76.0	3.5
SB10	Fine sand	0.34	2.0	55.1	42.8	0.1
Uppana river creek						
SB11	Fine sand	0.23	0.0	0.0	87.9	12.2
SB12	Fine sand	0.09	0.0	0.0	72.7	27.3
SB13	Fine sand	0.10	0.0	0.0	78.1	21.9

Total Organic Carbon: Organic carbon varied between 0.08 % and 0.59 % at stations SB1 to SB10. In creek station the Organic carbon varied from 0.19% to 1.67% at stns. SB11 to SB13 during this study.

Calcium Carbonate: The values of calcium carbonate varied between 4.4 and 33.1 % at stations SB1 to SB10. In creek stations the calcium carbonate varied from 1.5% to 4.8% at stns. SB11 to SB13 during this study.

Total Nitrogen: Total nitrogen level varied between 302 µg/g to 1663 µg/g at stations SB1 to SB10. In the creek station the total nitrogen varied from 756 µg/g to 1361 µg/g at stns. SB11 to SB13 during this study.

Total Phosphorus: Total phosphorus concentration was varied between 6.0 and 44.0 µg/g at stations SB1 to SB10 during this study. In creek station the total nitrogen varied from 14.2 to 61.0 µg/g at stns. SB11 to SB13 during this study.

Table 54. Seabed sediment quality - Part I

Stations	Total Organic carbon (%)	Total Phosphorous (µg/g)	Calcium Carbonate (%)	Total Nitrogen (µg/g)	PHC (mg/kg)
Open Sea					
SB1	0.16	44.0	6.9	302	<0.5
SB2	0.59	42.6	24.3	1663	<0.5
SB3	0.20	17.8	22.6	1058	<0.5
SB4	0.08	6.1	16.7	907	<0.5
SB5	0.39	38.7	33.1	601	<0.5
SB6	0.32	26.9	4.4	756	<0.5
SB7	0.11	17.4	19.8	605	<0.5
SB8	0.20	16.5	18.3	750	<0.5
SB9	0.42	34.8	21.2	749	<0.5
SB10	0.23	6.0	9.7	751	<0.5
Uppanar river creek					
SB11	1.67	61.0	4.8	1361	<0.5
SB12	0.19	14.2	1.5	756	<0.5
SB13	1.22	45.7	3.3	1210	<0.5



Note: Analysis on dry weight basis

Heavy Metals

Cadmium (Cd): The concentration of cadmium in the project region was found to be <0.1 µg/g at stn. SB1 to SB13.

Chromium (Cr): The concentration of total chromium was found ranged from 0.38 to 0.75 µg/g at all stn. SB1 to SB10. In creek station the total chromium varied from 0.48 to 1.16 µg/g at stns. SB11 to SB13 during this study.

Lead (Pb): The lead concentration of the project region was found <0.1 µg/g at stn. SB1 to SB13.

Mercury (Hg): The concentration of mercury was found <0.1 µg/g at all stations during this study.

Zinc (Zn): The concentration of Zinc was found to be <0.1 µg/g at all stations during this study.

Table 55. Seabed sediment quality - Part II - Heavy Metals

Location	Cadmium (µg/g)	Chromium (µg/g)	Lead (µg/g)	Mercury (µg/g)	Zinc (µg/g)
Open Sea					
SB1	BDL (<0.1)	0.65	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB2	BDL (<0.1)	0.65	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB3	BDL (<0.1)	0.51	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB4	BDL (<0.1)	0.50	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB5	BDL (<0.1)	0.71	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB6	BDL (<0.1)	0.60	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB7	BDL (<0.1)	0.38	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB8	BDL (<0.1)	0.48	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB9	BDL (<0.1)	0.55	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB10	BDL (<0.1)	0.75	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
Uppanar river creek					
SB11	BDL (<0.1)	1.16	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB12	BDL (<0.1)	0.48	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
SB13	BDL (<0.1)	1.10	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)

3.11.2.4 Environmental status - comparison with secondary data

The present data corresponding to Chemplast in Feb 2024 of the seawater quality, seabed sediment quality and were compared with pre-project data of 2010, 2018 and 2024. The comparison is given below.

Water Quality



There is no significant change in the seawater temperature between secondary data period (July 2018) and monitoring period (Feb 2024). The pH of the seawater did not show much variation during both the sampling periods, and it was within the normal range. The TSS level is slightly varied between earlier study period (July 2018) and current period (Feb 2024) probably due to algal materials decomposition.

The Salinity level is also varied between July 2018 and monitoring period Feb 2024 probably due to seasonal changes. The dissolved oxygen content has no significant variation between the present study and previous study period. Changes in the concentrations of nitrate, ammonia, phosphate, and total nitrogen were observed in the present study, when compared with the earlier study due to seasonal variation and it is very low, and it shows nil contamination.

The marine water quality was found to be in normal range within the stipulated values indicated for coastal waters. The values recorded during present study indicate natural variability and do not show any impact on marine water quality.

Table 56. Water quality - comparison with secondary data

Parameter	Chemplast 2024	Secondary data 2018 *	Secondary data 2010 *	Faculty of Marine Sciences CAS in Marine Biology, Annamalai University 2023-24 *	Remarks
Open sea					
Temp (°C)	28 - 31	29 - 31	28 - 30	27.2 - 31	No Significant change
pH	7.95 - 8.36	8.2 - 8.3	8.1 - 8.3	7.6 - 8.15	No Significant change
DO (mg/l)	3.4 - 6.1	4.64 - 6.08	4.3 - 6.04	4.14 - 5.86	No Significant change
Salinity (ppt)	33.5 - 34.3	30 - 35.4	34.3 - 34.96	27.6 - 33.5	No Significant change
Ammonia	0.3 - 4.4 (μmol/l)	<0.1 - 0.84 (mg/l)	0.23 - 1.11 (μmol/l)	0.333 - 0.741 (μmol/l)	Minimum than secondary data
No ₂	0.02 - 0.3 (μmol/l)	<0.01 (mg/l)	0.16 - 0.95 (μmol/l)	0.319 - 0.765 (μmol/l)	Minimum than secondary data
No ₃	2.7 - 12.0 (μmol/l)	<0.5 (mg/l)	0.78 - 2.60 (μmol/l)	0.599 - 4.15 (μmol/l)	Minimum than secondary data
Turbidity (NTU)	1.7 - 22.0	<1.0 - 2.0	0.6 - 16.4	1.2 - 2.3	Seasonal Variation
TSS (mg/l)	3.3 - 44.0	2.0 - 8.0	11 - 27	91 - 147	Seasonal Variation
Uppanar river creek					
Temp (°C)	28	29.5 - 30	-	-	No Significant change
pH	7.81 - 7.87	7.9 - 8.0	-	-	No Significant change



Parameter	Chemplast 2024	Secondary data 2018 *	Secondary data 2010 *	Faculty of Marine Sciences CAS in Marine Biology, Annamalai University 2023-24 *	Remarks
Open sea					
DO (mg/l)	4.1 - 4.4	5.44-5.92	-	-	No Significant change
Salinity (ppt)	4.2 -10.6	26.5 - 31.8	-	-	Seasonal variation
Ammonia	0.8 - 1.4(μmol/l)	<0.1 - 0.51 (mg/l)	-	-	Minimum than secondary data
No2	0.02 - 0.07 (μmol/l)	0.03 - 0.05 (mg/l)	-	-	Minimum than secondary data
No3	17.5 -22.9 (μmol/l)	0.62 - 1.1 (mg/l)	-	-	Minimum than secondary data
Turbidity (NTU)	10.9 -33.2	<1.0 -3.0	-	-	Seasonal variation
TSS (mg/l)	22 - 66.7	3.0 - 12.0	-	-	Seasonal variation

* Note: secondary data

Sediment quality

Sediment texture was found to be fine sand in nature during present study (Feb 2024), there is no significant variation from previous study period (July 2018). The seabed sediment properties didn't show much change, all values are within the range of coastal sediments.

Table 57. Sediment quality - comparison with secondary data

Parameter	Chemplast 2024	DHI Cuddalore (2018) *	SRM Energy (2010) *	Faculty of Marine Sciences CAS in Marine Biology, Annamalai University (2023-24) *	Remarks
Open sea					
Total Organic carbon (%)	0.14 -0.89	0.08 - 0.59	0.18 – 1.56	-	No significant change
Total Phosphorous (μg/g)	1.6 - 3.7 (μg/g)	6.0 – 44 (μg/g)	0.02 – 0.10 (mg/g)	0.25 – 0.45 (μg/g)	Seasonal variation
Calcium Carbonate (%)	11.1 -18.5	4.4 - 33.1	0.9 – 14.72	-	No significant change
Total Nitrogen (μg/g)	100 – 593	302 - 1663	0.53 – 2.83 (mg/g)	3.37 – 5.81 (mg/g)	No significant change
Total Organic carbon (%)	0.16-0.99	0.19 - 1.67	-	-	No significant change
Uppanar river creek					



Parameter	Chemplast 2024	DHI Cuddalore (2018) *	SRM Energy (2010) *	Faculty of Marine Sciences CAS in Marine Biology, Annamalai University (2023-24) *	Remarks
Total Phosphorous (µg/g)	1.4 - 2.5	14.2 - 61	-	-	Seasonal variation
Calcium Carbonate (%)	10.3 - 13.1	1.5 - 4.8	-	-	Seasonal variation
Total Nitrogen (µg/g)	77.6 - 295	756 - 1361	-	-	Seasonal variation

* Note: secondary data

3.11.2.5 Marine Ecology and Biodiversity

The coastal / marine environment of India plays a critical role in the economy of the nation by virtue of its resources and ecosystems such as estuaries, coral reefs, marshes, mangrove forests, lagoons, sandy and rocky beaches, seaweeds, seagrass beds, etc. These habitats are all known for their high biological productivity and provide a wide range of habitats for many aquatic flora and fauna. The coast is divided into three zones namely subtidal zone (mostly covered with tidal water), intertidal zone (under daily influence of tidal inundation) and high tidal zone (where tidal waters inundate generally during the spring and neap tide) based on this tidal inundation.

Coastal flora can be grouped into two distinct types namely, dry and wet coastal plant communities. The dry coastal communities are of 2 types - sandy strand vegetation and rocky strand vegetation, whereas wet coastal communities consist of seaweed, seagrasses, mangroves and salt marsh vegetation.

Marine fauna are highly diverse and range in size from microscopic zooplankton to the blue whale, comprising crustaceans, fishes, sharks, whales, sea snakes, dolphins, dugongs, etc., and live their entire / partial life in the ocean. Marine fauna are also animals that either enter or leave the ocean for feeding, breeding or resting purposes, such as crabs, turtles, penguins, sea otters, seals, etc. Seabirds can also be considered as marine fauna. While animals such as sponges and corals that are attached to the seabed are also marine fauna, they are typically considered under the benthic communities and habitats.





Figure 53. Plankton sample collection

3.11.2.5.1 Plankton

Primary productivity: Marine primary production plays an important role in food web dynamics, in biogeochemical cycles and in marine fisheries. The estimation of primary productivity is based on the relationship between oxygen evolution and carbon fixation. Primarily, phytoplankton depend on carbon dioxide, sunlight and nutrients for growth, but some other factors such as water depth, water temperature, wind and grazers also play a significant role. Primary productivity varies from freshwater to river mouth and from the river mouth to the marine water body. Its major components are gross and net primary production. The primary production is estimated by the light and dark bottle technique.

The primary productivity values are given in **Table 3.45**. Primary productivity values varied between 270 and 420 mgC/m³/day from all stations, with an average value of 356 mgC/m³/day. The higher value recorded at stations SS8 & SS10 may be related to temperature while the lower value recorded at stations SS12 & SS13 may be due to low transparency.

Table 58. Primary productivity

Station	Gross Photosynthetic activity	Net Photosynthetic activity	Primary production mgC/m ³ /day
1	1.1	0.2	330
2	1.1	0.4	330
3	1.2	0.4	360
4	1.3	0.5	390
5	1.3	0.4	390
6	1.3	0.6	390
7	1.3	0.6	390
8	1.4	0.7	420
9	1.3	0.6	390
10	1.4	0.8	420
11	1.0	0.3	300
12	0.9	0.3	270
13	0.9	0.3	270
Average			356



Phytoplankton: Phytoplankton are the most important primary producers of the sea; their productivity depends mostly on adequate supply of light and nutrients. Phytoplankton are non-evenly distributed both in space and time. The spatial and temporal abundance and composition are affected by biological, hydrographical and ecological processes. The major types of phytoplankton are diatoms, dinoflagellates, green algae, cyanobacteria and coccolithophores. Phytoplankton contribute to more than 90% of total marine primary production.

Distribution of phytoplankton was investigated quantitatively and qualitatively. The phytoplankton composition in the study area was constituted mainly by

Bacillariophyceae, Dinophyceae, Trebouxiophyceae and Cyanophyceae during the sampling period.

Species composition: The phytoplankton species composition is given in **Table 3.46**. The total number of phytoplankton species present varied considerably. Totally 56 species of phytoplankton were observed, comprising four groups viz., 41 species of diatoms (Bacillariophyta), 12 species of dinoflagellates (Pyrrophyta), 1 species of green algae (Chlorophyta) and 2 species of blue-green algae (Cyanophyta).

Table 59. Phytoplankton species-wise composition*

S. No.	Species / Genus	Station												
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13
Phylum: Heterokontophyta														
Class: Bacillariophyceae (Diatoms)														
Order: Centrales														
1	<i>Bellerochea horologicalis</i>	+	-	+	+	+	-	-	+	+	+	+	+	-
2	<i>Bellerochea malleus</i>	-	+	+	-	-	+	+	-	+	+	-	-	+
3	<i>Chaetoceros affinis</i>	+	-	-	+	+	-	+	+	-	+	+	+	-
4	<i>Chaetoceros curvisetus</i>	-	+	+	-	-	+	-	+	+	+	-	-	+
5	<i>Chaetoceros coarctatus</i>	+	+	-	+	-	-	+	+	+	-	-	+	-
6	<i>Chaetoceros decipiens</i>	+	-	+	+	+	-	-	+	+	+	+	+	-
7	<i>Chaetoceros diversus</i>	-	+	+	-	-	+	+	-	+	+	-	-	+
8	<i>Chaetoceros peruvianus</i>	+	-	-	+	+	-	+	+	-	+	+	+	-
9	<i>Chaetoceros</i> sp.	-	+	+	-	-	+	-	+	+	+	-	-	+
10	<i>Coscinodiscus centralis</i>	+	-	+	+	+	+	-	-	+	+	+	+	-
11	<i>Coscinodiscus concinnus</i>	+	+	-	+	-	-	+	+	+	-	+	-	-
12	<i>Coscinodiscus gigas</i>	-	+	-	+	+	+	+	-	-	+	-	-	+
13	<i>Coscinodiscus</i> sp.	+	-	-	+	+	+	-	+	+	+	+	+	-
14	<i>Corethron</i> sp.	-	+	+	-	-	-	+	+	+	-	-	-	+
15	<i>Cyclotella</i> sp.	+	-	+	+	+	+	+	-	-	+	+	+	-
16	<i>Guinardia</i> sp.	-	+	-	-	+	-	+	+	+	+	-	-	+



S. No.	Species / Genus	Station												
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13
17	<i>Hemidiscus</i> sp.	+	-	+	+	-	+	-	-	+	-	+	+	-
18	<i>Lauderia annulata</i>	-	+	-	+	+	+	+	-	-	+	-	-	+
19	<i>Leptocylindrus danicus</i>	-	+	+	-	-	+	-	+	+	+	-	-	+
20	<i>Leptocylindrus</i> sp.	+	-	+	-	+	-	-	+	+	-	+	+	-
21	<i>Odontella mobiliensis</i>	-	+	-	+	-	+	+	+	+	+	-	-	+
22	<i>Odontella sinensis</i>	+	-	+	+	+	+	-	-	+	-	+	+	-
23	<i>Odontella</i> sp.	+	+	-	-	-	-	+	+	-	+	+	+	-
24	<i>Pseudosolenia calcar</i>	-	+	+	-	+	-	+	+	+	+	-	-	+
25	<i>Rhizosolenia alata</i>	+	-	-	+	+	+	+	-	-	-	-	+	-
26	<i>Rhizosolenia robusta</i>	+	-	+	-	-	+	-	+	+	-	+	-	-
27	<i>Rhizosolenia setigera</i>	-	+	-	+	+	-	+	+	-	+	-	-	+
28	<i>Rhizosolenia styliiformis</i>	+	-	+	+	+	-	-	+	+	+	+	+	-
29	<i>Skeletonema costatum</i>	-	+	+	-	-	+	+	-	+	+	-	-	+
30	<i>Thalassiosira subtilis</i>	+	-	-	+	+	-	+	+	-	+	+	+	-
31	<i>Thalassiosira</i> sp.	-	+	+	-	-	+	-	+	+	+	-	-	+
Order: Pennales														
32	<i>Navicula</i> sp.	+	+	-	+	+	+	-	-	-	+	+	+	-
33	<i>Nitzschia longissima</i>	-	+	+	-	-	-	+	+	+	-	-	-	+
34	<i>Nitzschia seriata</i>	+	-	+	+	+	+	-	-	-	+	+	+	-
35	<i>Plagiotropis lepidoptera</i>	-	+	-	+	+	-	+	+	-	-	-	-	+
36	<i>Pleurosigma cuspidatum</i>	+	-	+	-	-	+	-	+	+	+	+	-	-
37	<i>Pleurosigma elongatum</i>	+	-	+	+	+	-	+	+	-	+	-	+	-
38	<i>Thalassionema frauenfeldii</i>	-	+	-	+	+	+	+	-	-	-	-	-	+
39	<i>Thalassionema nitzschioides</i>	-	+	+	-	-	+	-	+	+	+	-	-	-
40	<i>Thalassiosira oestrupii</i>	+	-	+	+	+	-	+	+	+	-	+	+	-
41	<i>Thalassiothrix longissima</i>	-	+	-	+	+	+	-	+	-	+	-	-	+
Subtotal		22	23	24	25	24	23	23	28	26	29	19	19	18
Class: Dinophyceae (Dinoflagellates)														
42	<i>Ceratium furca</i>	+	-	+	+	-	+	+	-	+	-	+	+	-
43	<i>Ceratium macroceros</i>	-	+	+	-	+	+	-	+	-	+	-	-	+
44	<i>Ceratium tripos</i>	+	-	+	+	+	-	+	-	-	+	+	+	-
45	<i>Ceratium</i> sp.	-	+	-	-	-	+	-	+	+	+	-	-	-
46	<i>Dinophysis caudata</i>	-	+	-	-	+	-	+	+	+	-	-	-	+
47	<i>Dinophysis</i> sp.	+	-	+	+	-	+	+	-	+	+	+	+	-
48	<i>Prorocentrum balticum</i>	+	-	+	+	+	-	-	+	-	+	-	-	+
49	<i>Prorocentrum lima</i>	-	+	+	-	+	+	+	-	+	+	+	-	+



S. No.	Species / Genus	Station												
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13
50	<i>Protoperidinium divergens</i>	+	-	+	+	-	-	+	+	-	-	+	+	-
51	<i>Prorocentrum</i> sp.	-	-	-	-	+	+	-	+	+	+	-	-	+
52	<i>Pyrophacus horologium</i>	+	-	+	+	-	-	+	-	-	+	+	+	-
53	<i>Pyrophacus steinii</i>	-	+	-	-	+	+	-	+	+	-	-	-	+
Subtotal		6	5	8	6	7	7	7	7	7	8	6	5	6
Class: Trebouxiophyceae														
54	<i>Chlorella marina</i>	+	+	+	+	-	+	+	-	+	+	+	-	-
Subtotal		1	1	1	1	0	1	1	0	1	1	1	0	0
Class: Cyanophyceae														
55	<i>Oscillatoria</i> sp.	+	-	+	+	+	+	+	-	+	+	-	-	+
56	<i>Trichodesmium</i> sp.	-	+	+	-	+	-	-	+	-	+	+	-	-
Subtotal		1	1	2	1	2	1	1	1	1	2	1	0	1
Grand total		30	30	35	33	33	32	32	36	35	40	27	24	25

(*) Bottle sample; (-) species absent, (+) species present

Population density: Phytoplankton population density varied from 9,000 to 25,800 cells/l. Minimum was recorded at stn. SS12, while maximum abundance was observed at stn. SS10. The phytoplankton population mostly consisted of Bacillariophyceae (80.94), Dinophyceae (13.71%) Trebouxiophyceae (2.58%) and Cyanophyceae (2.76%). *Chaetoceros coarctatus* was the most dominant species followed by *Pleurosigma cuspidatum*, *Coscinodiscus gigas*, *Thalassiosira* sp., *Odontella mobiliensis*, *Plagiotropis lepidoptera*, *Belleriochea malleus*, *Chaetoceros decipiens* and *Coscinodiscus centralis* (Table 3.47).

Table 60. Numerical abundance of Phytoplankton* (cells/l)

S. No.	Species / Genus	Station													Total	%
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13		
Phylum: Heterokontophyta																
Class: Bacillariophyceae (Diatoms)																
Order: Centrales																
1	<i>Bellerocha malleus</i>	0	400	800	1000	400	0	400	1000	1000	1200	200	200	0	6600	2.94
2	<i>Chaetoceros affinis</i>	400	600	200	600	0	600	0	800	400	800	0	200	200	4800	2.14
3	<i>Chaetoceros coarctatus</i>	800	1000	800	1200	800	1000	1200	1200	1400	1600	200	0	400	11600	5.16
4	<i>Chaetoceros decipiens</i>	1000	0	400	600	800	600	800	600	800	800	0	0	200	6600	2.94
5	<i>Chaetoceros diversus</i>	600	200	600	0	800	800	800	600	0	200	200	200	0	5000	2.23



EIA & EMP STUDY TO OBTAIN EC AND CRZ CLEARANCE FOR UPGRADATION OF EXISTING MARINE
TERMINAL FACILITIES AND PROPOSED 20 MLD DESALINATION PLANT by M/s. Chemplast Cuddalore Vinyls
Limited (CCVL)



S. No.	Species / Genus	Station													Total	%
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13		
6	<i>Chaetoceros peruvianus</i>	400	400	0	400	0	200	600	1200	600	800	400	0	400	5400	2.40
7	<i>Coscinodiscus</i> sp.	0	400	200	0	200	0	0	600	800	800	0	400	200	3600	1.60
8	<i>Coscinodiscus centralis</i>	0	600	800	400	400	600	800	800	1000	1000	200	0	0	6600	2.94
9	<i>Coscinodiscus gigas</i>	800	400	0	200	1000	1000	1400	1200	1400	1200	0	200	0	8800	3.92
10	<i>Cyclotella</i> sp.	400	400	600	800	0	400	0	200	200	200	0	400	400	4000	1.78
11	<i>Guinardia</i> sp.	800	0	800	400	0	800	600	600	1000	800	200	200	0	6200	2.76
12	<i>Hemidiscus</i> sp.	200	200	400	200	600	600	0	0	400	200	0	400	200	3400	1.51
13	<i>Lauderia annulata</i>	0	400	0	400	600	600	400	200	800	600	200	0	0	4200	1.87
14	<i>Leptocylindrus danicus</i>	200	800	0	600	600	600	400	400	0	200	0	200	200	4200	1.87
15	<i>Leptocylindrus</i> sp.	0	200	0	400	400	0	0	600	400	600	200	0	200	3000	1.34
16	<i>Odontella mobiliensis</i>	600	400	400	0	800	800	800	800	1000	1000	400	200	400	7600	3.38
17	<i>Odontella sinensis</i>	0	800	200	600	400	200	0	0	400	0	600	0	0	3200	1.42
18	<i>Odontella</i> sp.	600	0	400	400	200	0	400	400	0	600	0	400	200	3600	1.60
19	<i>Pseudosolenia calcar</i>	200	400	400	400	400	400	800	800	600	600	400	200	0	5600	2.49
20	<i>Rhizosolenia alata</i>	600	400	600	0	600	400	600	400	400	400	200	200	600	5400	2.40
21	<i>Rhizosolenia robusta</i>	400	0	400	600	0	200	400	400	0	0	0	200	200	2800	1.25
22	<i>Rhizosolenia setigera</i>	400	400	0	400	600	600	1000	800	600	200	200	0	400	5600	2.49
23	<i>Skeletonema costatum</i>	0	600	400	600	0	400	0	1000	600	1000	600	0	200	5400	2.40
24	<i>Thalassiosira subtilis</i>	400	600	0	600	0	800	200	600	400	200	0	400	0	4200	1.87
25	<i>Thalassiosira</i> sp.	400	600	0	600	800	800	800	400	1000	1000	400	400	800	8000	3.56
Order: Pennales																
26	<i>Navicula</i> sp.	0	400	200	600	400	0	800	200	400	400	200	0	0	3600	1.60
27	<i>Nitzschia longissima</i>	200	0	400	400	200	0	200	200	0	200	0	600	200	2600	1.16
28	<i>Nitzschia seriata</i>	200	600	400	0	400	200	600	600	800	600	400	0	200	5000	2.23
29	<i>Plagiotropis lepidoptera</i>	400	400	600	800	0	800	800	1000	600	800	200	0	600	7000	3.12
30	<i>Pleurosigma cuspidatum</i>	1200	400	600	1000	1000	1000	800	1200	1000	1000	0	200	200	9600	4.27



S. No.	Species / Genus	Station													Total	%
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13		
31	<i>Pleurosigma elongatum</i>	0	0	400	400	400	600	400	200	600	200	0	200	0	3400	1.51
32	<i>Thalassionema frauenfeldii</i>	400	0	200	0	0	400	200	200	0	200	0	400	400	2400	1.07
33	<i>Thalassionema nitzschioides</i>	0	200	400	200	600	600	400	200	200	400	200	0	0	3400	1.51
34	<i>Thalassiosira oestrupii</i>	0	400	600	400	800	200	400	0	0	600	400	400	0	4200	1.87
35	<i>Thalassiothrix longissima</i>	200	0	400	200	0	400	800	800	800	1000	200	200	200	5200	2.32
Class of Bacillariophyceae																80.94
Class: Dinophyceae (Dinoflagellates)																
36	<i>Ceratium furca</i>	200	0	400	200	400	200	0	0	400	200	0	200	0	2200	0.98
37	<i>Ceratium macroceros</i>	400	200	600	0	0	400	200	400	400	600	0	400	400	4000	1.78
38	<i>Ceratium tripos</i>	400	400	0	400	0	400	0	200	200	0	200	0	400	2600	1.16
39	<i>Ceratium sp.</i>	400	200	400	600	400	0	200	400	400	400	400	400	400	4600	2.05
40	<i>Dinophysis caudata</i>	0	400	200	400	400	200	0	200	200	0	0	0	0	2000	0.89
41	<i>Dinophysis sp.</i>	400	400	200	200	400	0	200	400	0	200	400	400	200	3400	1.51
42	<i>Prorocentrum balticum</i>	0	0	0	0	0	0	0	0	0	600	200	200	200	1200	0.53
43	<i>Prorocentrum lima</i>	0	200	400	400	200	0	200	400	0	400	400	0	0	2600	1.16
44	<i>Protoperidinium divergens</i>	400	0	0	400	600	0	0	400	200	0	200	400	200	2800	1.25
45	<i>Pyrophacus horologium</i>	0	400	400	0	400	200	400	0	200	200	0	0	0	2200	0.98
46	<i>Pyrophacus steinii</i>	0	400	0	400	400	200	200	200	0	1000	400	0	0	3200	1.42
Class of Dinophyceae																13.71
Class: Trebouxiophyceae																
54	<i>Chlorella marina</i>	400	600	600	600	600	400	600	400	400	200	400	200	400	5800	2.58
Class of Trebouxiophyceae																2.58
Class: Cyanophyceae																
55	<i>Oscillatoria sp.</i>	400	400	0	200	400	400	400	200	0	400	400	400	200	3800	1.69
56	<i>Trichodesmium sp.</i>	0	400	200	400	400	200	0	200	200	200	200	0	0	2400	1.07
Class of Cyanophyceae																2.76
Papulation (cells/l)		14800	16600	16000	19600	18800	19200	20200	23600	22200	25800	9400	9000	9400	224600	100
No. of species		32	38	36	40	36	38	36	43	37	44	31	30	30	-	-

(*) Bottle sample



Shannon-Wie'er's diversity: The Shann-n - Wie'er's diversity index'(H') ranged from 4.76 to 5.20 bits/ind. The lowest species diversity was at stn. SS13 and the highest species diversity was observed at stn. SS10. Simpson richness ranged from 0.959 to 0.970. Pie'ou's Evenness index'(J') ranged from 0.952 to 0.980.

Table 61. Diversity indices of phytoplankton

Range	S	N	'	J'	H'(log)	1-Lam'da'
Minimum	30	9000	3.17	0.952	4.76	0.959
Maximum	44	25800	4.23	0.980	5.20	0.970

S= Total species; N= total individuals; d= species richness' J'=evenness

Similarity Index of Phytoplankton: The similarity index of phytoplankton showed that the percentage of similarity ranged from 45.99 to 83.60%; with average similarity of 64.87%.

Table 62. Similarity Index of Phytoplankton

Station	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13
SS1													
SS2	59.07												
SS3	62.02	63.27											
SS4	64.23	75.08	66.78										
SS5	58.22	73.32	66.94	70.15									
SS6	72.68	72.74	68.33	70.78	68.20								
SS7	68.79	67.81	69.36	67.73	73.69	73.99							
SS8	73.08	72.53	70.13	76.85	68.14	74.47	79.89						
SS9	62.65	71.61	68.07	71.16	67.99	76.32	68.41	78.98					
SS10	65.59	72.09	71.63	72.05	70.71	73.04	78.77	83.60	79.70				
SS11	49.36	70.50	54.08	62.52	60.51	53.16	57.16	61.46	56.61	60.23			
SS12	69.92	50.23	58.46	54.18	51.36	52.67	52.32	56.21	45.99	57.31	46.42		
SS13	75.62	57.73	56.01	56.06	48.74	57.78	53.91	61.95	55.05	57.63	54.22	63.45	



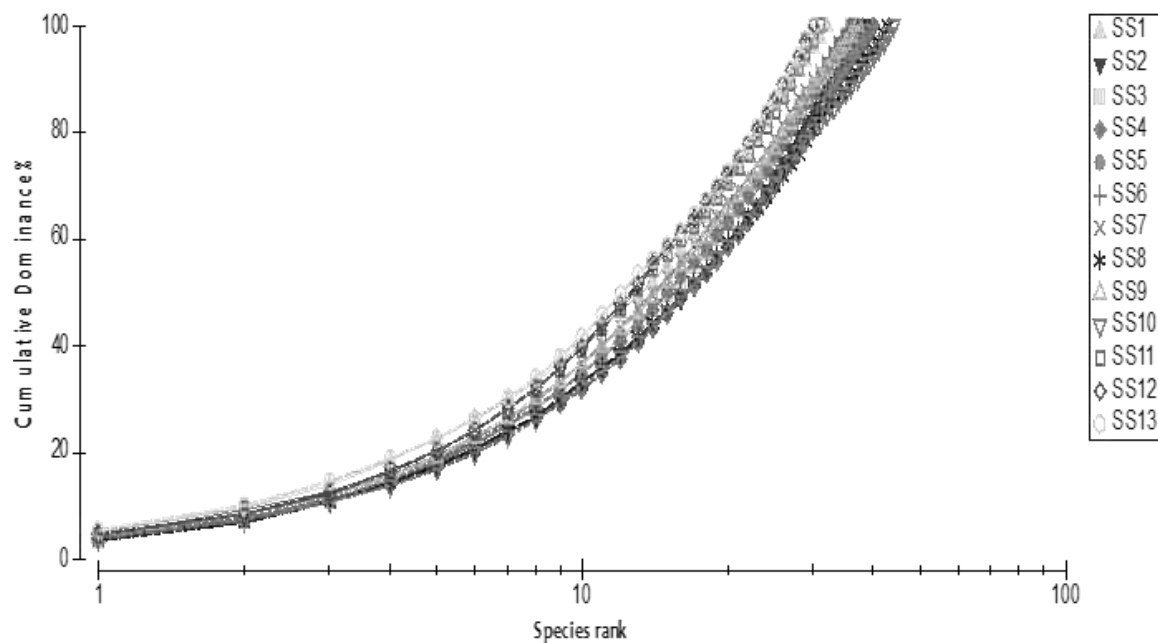


Figure 54. Dominance plot of phytoplankton

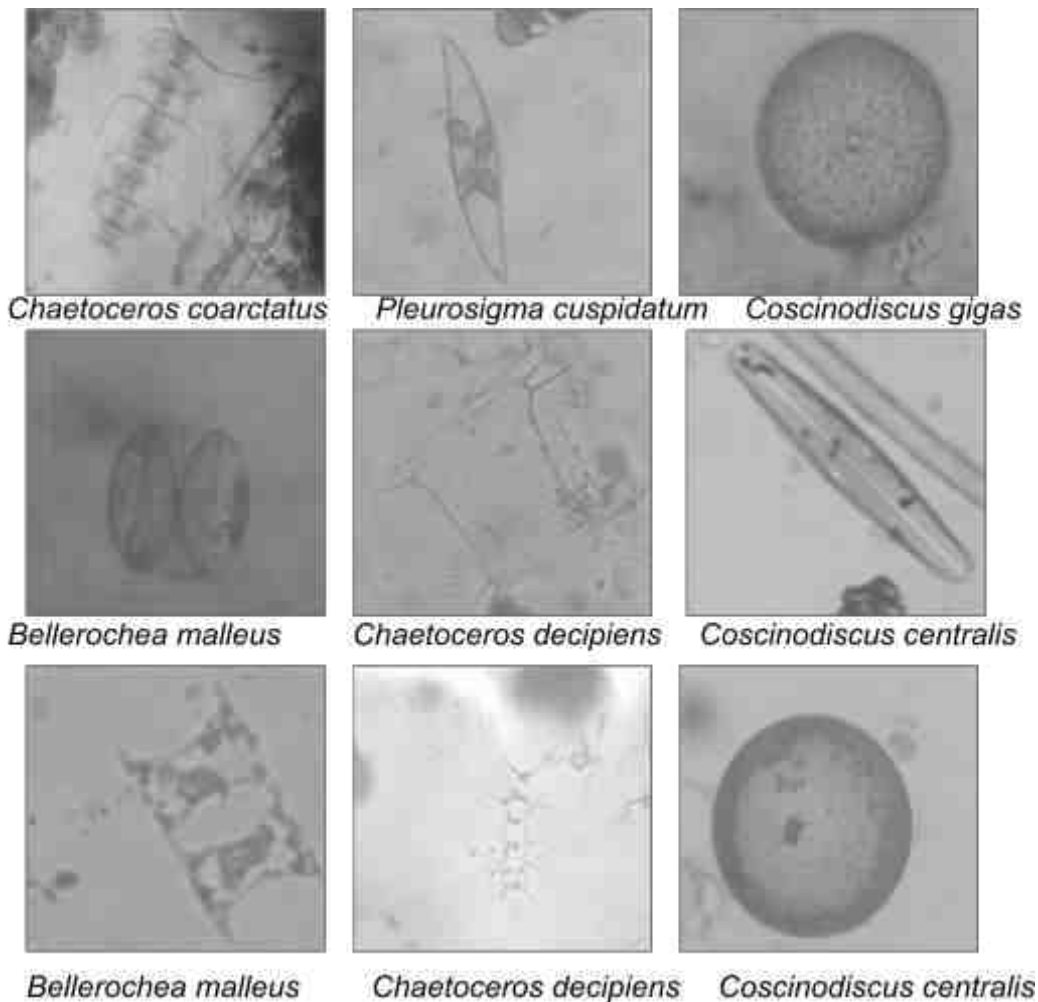


Figure 55 . Common phytoplankton

3.11.2.5.2 Zooplankton

Zooplankton play a key role in marine food web dynamics and biogeochemical cycling. Spatial distribution of zooplankton is an important factor in influencing the fish stock. Hence, any decline in zooplankton population may affect ecosystem functioning. Zooplankton dynamics is largely controlled by different environmental factors. Hence, any change in ambient water quality will significantly affect zooplankton population, which in turn can affect larval survival and hence fishery. Seasonal plankton succession is a process mainly regulated by temperature and salinity conditions.

Species composition: Totally, 54 species of zooplankton were identified in the samples from the study area. Copepods were the most diverse group containing the highest number of species, followed by Decapods, Mollusca, Ciliates, Euphausiacea, Brachiopoda,

Annelida, Cladocera, Cnidaria, Chaetognatha, Urochordata and Chordata. Copepods not only remained as the most dominant group but also appeared in large numbers during the sampling periods.

Population density: The zooplankton density ranged from 30,525 to 1,20,450 Nos./100 m³ (Table 3. 48). Lowest was recorded at stn. SS13, while the highest abundance was recorded at stn. SS10. The percentage occurrence of various groups fluctuated from station to station. The zooplankton biomass at different stations varied from 39.4 to 57.4 ml/100m³. Most dominant species recorded in the present study were *Paracalanus parvus*, *Corycaeus andrewsi*, *Corycaeus typicus*, *Temoruciateata*, *Eucalanus elongatus*, Copepod nauplii, *Calanopia minor*, *Pleuromamma gracilis*, *Centropages furcatus*, *Centropages typicus* and *Centropages elongatus*.

Table 63. Numerical abundance of Zooplankton (Nos./100m³)

S. No.	Species/ Genus	Station													Total	%
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13		
Phylum: Protozoa																
Order: Tintinnids (Ciliate groups)																
1	<i>Eutintinnus tenuis</i>	670	0	1410	1391	2080	2759	1387	2075	2789	2801	0	726	727	18815	1.88
2	<i>Favella</i> sp.	0	699	0	1391	693	2069	0	692	2092	2101	723	0	0	10460	1.04
3	<i>Tintinnopsis</i> sp.	2011	2797	1410	0	0	0	2080	1383	1395	2101	723	0	727	14627	1.46
Phylum: Cnidaria																
4	<i>Diphyes</i> sp.	670	1399	1410	2086	1387	0	693	0	697	1401	0	726	0	10469	1.04
Phylum: Annelida																
5	<i>Polychaete</i> larvae	0	2098	2116	1391	0	690	0	1383	697	0	1445	0	727	10547	1.05
Phylum: Arthropoda																
Suborder: Cladocera																
6	<i>Evadne</i> sp.	670	1399	0	1391	2080	2759	2774	3458	3487	3501	0	1451	727	23697	2.36
7	<i>Penilia avirostris</i>	2011	0	1410	0	2080	1379	2080	2075	2092	2801	1445	2177	0	19550	1.95
Class: Copepoda																
Order: Calanoida																
8	<i>Acrocalanus gracilis</i>	2011	2797	0	2086	2080	2069	2774	2766	2092	2801	0	1451	0	22927	2.29
9	<i>Acrocalanus gibber</i>	2011	2098	0	1391	0	2069	693	2766	2092	2101	0	726	1453	17400	1.74
10	<i>Calocalanus pavo</i>	2011	0	2116	2782	0	1379	2080	0	2092	0	723	726	0	13909	1.39
11	<i>Calocalanus styliremis</i>	0	0	2116	2782	1387	690	693	1383	0	2801	1445	0	727	14024	1.40
12	<i>Candacia</i> sp.	1340	0	2116	2086	2080	2069	3467	2766	3487	2101	723	0	1453	23688	2.36
13	<i>Calanopia elliptica</i>	0	2797	0	1391	1387	1379	1387	2075	1395	0	0	726	0	12537	1.25



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TERMINAL FACILITIES AND PROPOSED 20 MLD DESALINATION PLANT by M/s. Chemplast Cuddalore Vinyls
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S. No.	Species/ Genus	Station													Total	%
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13		
14	Calanopia minor	2681	2098	2821	0	2774	2069	2774	2075	2092	3501	0	1451	1453	25789	2.57
15	Clausocalanus furcatus	2011	2098	0	2086	2774	2759	1387	2766	1395	3501	1445	1451	0	23673	2.36
16	Centropages furcatus	2011	2098	1410	2782	3467	2069	0	2766	2789	3501	1445	726	0	25064	2.50
17	Centropages elongatus	4021	0	1410	2086	2774	2759	2080	2766	1395	2801	1445	0	727	24264	2.42
18	Centropages typicus	2681	2797	2116	0	2774	2069	1387	2075	2789	2101	2168	0	1453	24410	2.44
19	Eucalanus elongatus	4021	3497	2116	2782	3467	2759	2774	3458	1395	2101	0	726	0	29096	2.90
20	Labidocera acuta	670	0	1410	2782	0	1379	2080	692	1395	2101	1445	726	0	14680	1.46
21	Labidocera fluviatilis	1340	0	2116	2086	0	0	1387	0	1395	1401	723	0	727	11175	1.12
22	Labidocera sp.	670	0	2116	1391	693	0	2774	3458	3487	3501	1445	0	1453	20988	2.09
23	Paracalanus parvus	2011	2797	2821	2086	2774	3448	3467	4149	4184	4902	0	726	0	33365	3.33
24	Paracalanus sp.	0	1399	1410	2086	0	1379	2080	2075	1395	2801	723	726	0	16074	1.60
25	Pleuromamma gracilis	0	2797	2116	2782	2774	1379	2080	2766	3487	3501	723	0	727	25132	2.51
26	Pseudodiaptomus serricaudatus	2011	0	0	2086	1387	690	0	692	697	700	723	0	727	9713	0.97
27	Temora discaudata	0	2098	2116	2086	1387	0	1387	1383	0	2101	0	726	0	13284	1.33
28	Temora turbinata	1340	2797	2116	2782	3467	3448	2080	4149	3487	4202	723	0	727	31318	3.12
29	Temora stylifera	0	2098	2821	2086	3467	0	2774	4149	2092	2801	0	0	727	23015	2.30
30	Copepod nauplii	2681	0	2116	2782	0	2069	3467	3458	3487	4202	1445	0	2907	28614	2.86
Sub-order: Cyclopoida																
31	Apocyclops sp.	2011	0	1410	0	1387	690	1387	0	0	1401	723	1451	0	10460	1.04
32	Copilia vitrea	0	699	0	2086	1387	1379	2080	2766	0	2801	0	1451	727	15376	1.53
33	Corycaeus andrewsi	2681	3497	2821	2086	3467	0	3467	4841	3487	5602	723	0	727	33399	3.33
34	Corycaeus robustus	2011	1399	2821	1391	2080	2069	0	3458	3487	2801	723	1451	0	23691	2.36
35	Corycaeus typicus	2681	2098	2116	2782	3467	3448	4161	4149	2092	4902	0	0	727	32623	3.26



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S. No.	Species/ Genus	Station													Total	%
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13		
36	Farranula gracilis	2011	2098	1410	0	2080	0	1387	0	1395	1401	1445	0	727	13954	1.39
37	Farranula gibbula	0	1399	2116	2782	2080	2069	0	2766	2092	2801	723	0	1453	20281	2.02
38	Farranula concinna	0	2098	2116	2086	1387	0	1387	1383	0	2101	0	726	0	13284	1.33
39	Farranula carinata	2011	0	0	2086	1387	690	0	692	697	700	1445	0	727	10435	1.04
40	Oithona simplex	0	2797	2116	0	1387	690	2080	1383	1395	0	0	726	0	12574	1.25
41	Oithona similis	2011	2098	0	2086	0	1379	2774	4149	2789	3501	0	1451	727	22965	2.29
42	Oithona plumifera	670	1399	2116	2782	2080	2069	1387	2766	3487	4202	723	0	0	23681	2.36
43	Oncaea venusta	0	1399	705	2086	1387	1379	2080	2766	0	1401	0	726	727	14656	1.46
Sub-order: Harpacticoida																
44	ruciateussp sp.	2011	3497	0	2782	2080	2759	2080	0	2092	1401	0	1451	0	20153	2.01
45	Microsetella sp.	2011	2797	0	2086	693	1379	0	2075	1395	1401	723	0	1453	16013	1.60
Order: Decapoda																
46	Brachyuran zoeae	0	1399	705	1391	2080	2069	693	2075	2092	2101	723	0	1453	16781	1.67
47	Crustacean nauplii	2011	2797	1410	0	1387	2759	2080	2075	2092	1401	0	1451	0	19463	1.94
48	Euphausiid larvae	2011	0	0	2086	1387	690	693	692	697	700	723	0	727	10406	1.04
49	Shrimp larvae	0	2797	2116	0	1387	690	2080	1383	1395	0	1445	726	0	14019	1.40
50	Squilla larvae	670	1399	705	2782	2080	2069	0	1383	1395	1401	0	1451	0	15335	1.53
Phylum: Chaetognatha																
51	Sagitta enflata	2011	0	0	2086	1387	690	1387	692	697	700	2168	726	727	13271	1.32
52	Sagitta sp.	0	2797	2116	0	1387	690	2080	1383	1395	0	723	0	727	13298	1.33
Phylum: Urochordata																
53	Oikopleura sp.	670	0	1410	2782	0	1379	2080	692	1395	2101	0	1451	0	13960	1.39
Phylum: Chordata																
54	Fish eggs	0	699	1410	2086	693	690	693	0	697	1401	0	726	727	9822	0.98
Population (Nos./100m ³)		6903 6	81821	74754	95273	8737 0	79313	9014 2	1092 68	9763 1	1204 50	3469 0	3193 1	3052 5	10022 04	100. 00
Biomass (ml/100m ³)		52.1	49.0	49.9	51.0	52.5	52.1	54.4	54.5	54.6	57.4	40.1	39.5	39.4	-	-
No. of Species		37	38	40	44	44	45	45	47	48	48	32	30	31		



Shannon- Wie'er's diversity: Shann-n - Wie'er's diversity index'(H') values ranged from 4.81 to 5.43 bits/ind. The lowest species diversity was observed at stn. SS12 and the highest at stn. SS10. Simpson richness ranged from 0.960 to 0.976. Pie'ou's Evenness index(J') ranged from 0.969 to 0.993.

Table 64. Diversity indices of Zooplankton

Range	S	N	'	J'	H'(log)	1-Lam'da'
Minimum	30	30525	2.80	0.969	4.81	0.960
Maximum	48	120450	4.09	0.993	5.43	0.976

S= Total species; N= total individuals; d= species richness' J'=evenness

Similarity Index of Zooplankton: The similarity index of zooplankton showed that the percentage of similarity ranged from 26.51 to 84.69; the average similarity was 63.85%.

Table 65. Similarity Index of Zooplankton

Station	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13
SS1													
SS2	56.30												
SS3	59.84	66.65											
SS4	65.62	65.93	65.52										
SS5	66.57	74.50	70.58	72.38									
SS6	68.52	68.11	64.75	74.76	77.73								
SS7	67.83	68.68	76.65	70.95	74.52	72.13							
SS8	64.21	73.56	70.38	75.73	80.39	80.85	77.58						
SS9	73.41	72.31	73.69	74.50	76.24	82.64	78.92	84.00					
SS10	70.16	68.13	72.54	79.47	78.75	77.14	78.60	84.69	82.77				
SS11	56.49	40.42	58.37	51.50	53.35	56.11	50.13	53.67	58.74	51.61			
SS12	52.98	53.23	47.19	49.78	53.73	61.13	58.34	50.06	52.24	51.59	29.21		
SS13	51.23	44.99	50.17	53.01	50.73	54.88	52.67	55.23	56.79	54.45	60.30	26.51	



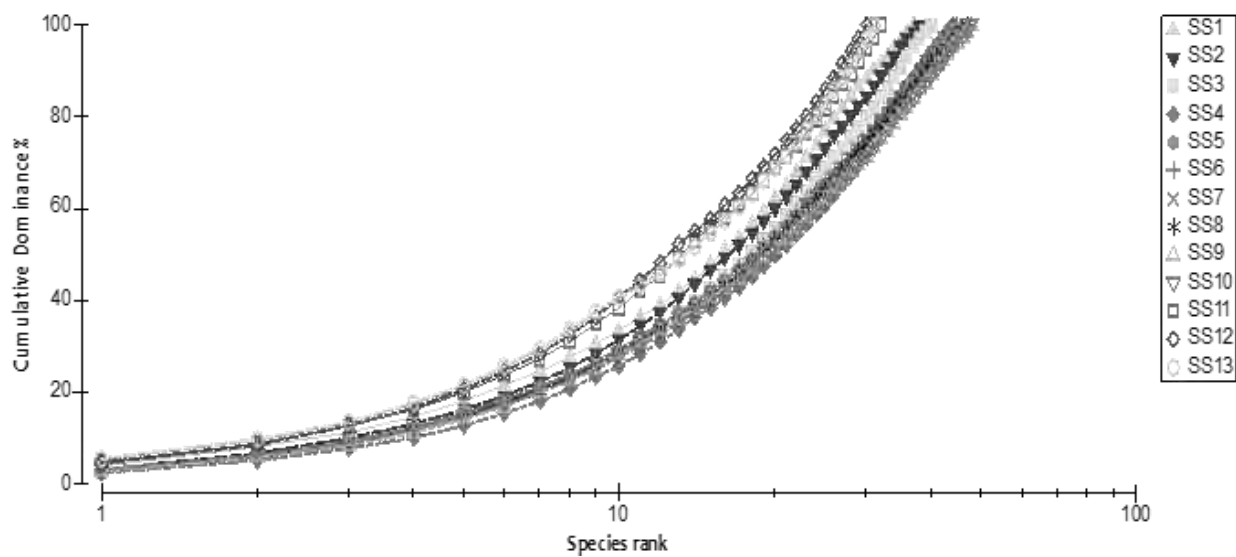


Figure 56. Dominance plot of Zooplankton

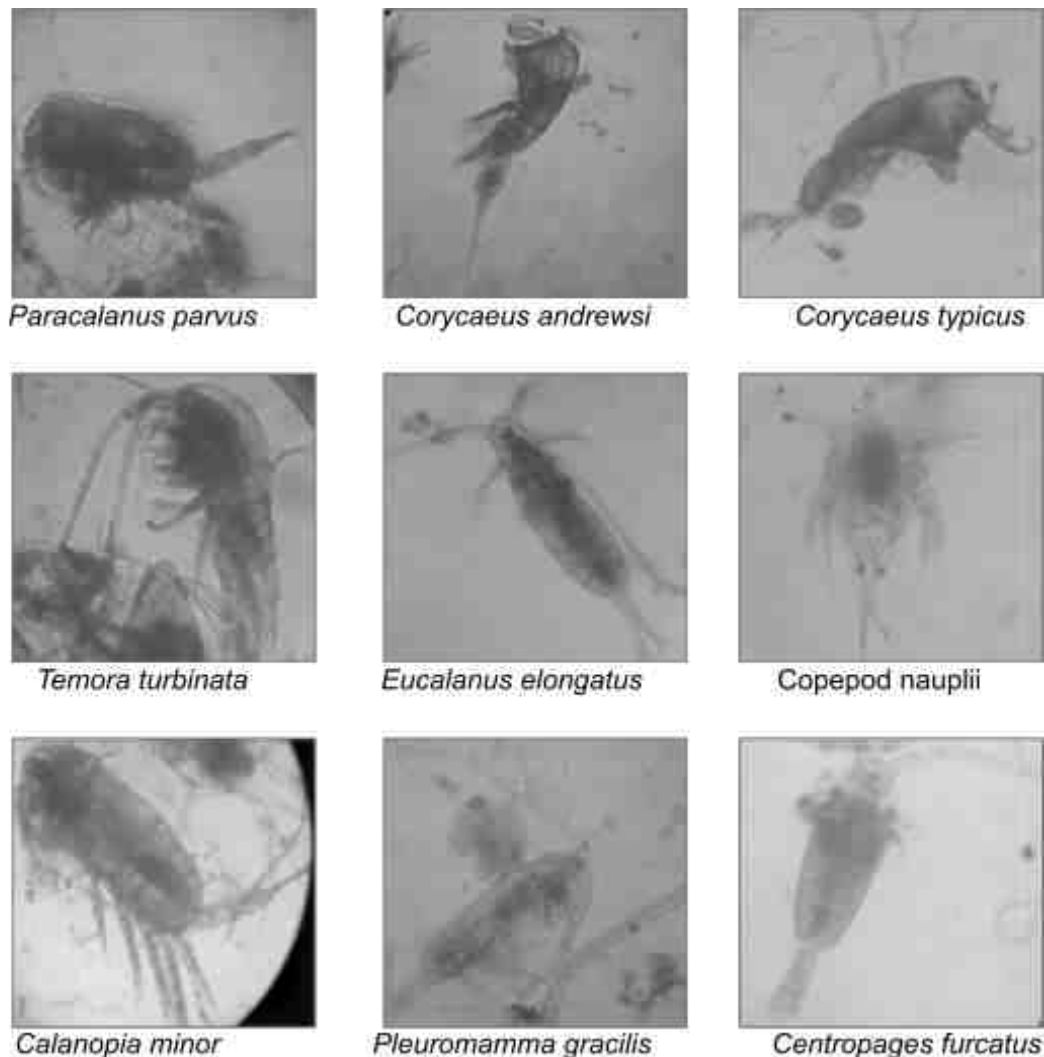


Figure 57. Common zooplankton species

3.11.2.5.3 Benthos

Benthic macrofauna play several ecological roles in the energy pathway, nutrient cycling and constitute an important link in the aquatic food chain as food resource for fishes and other animals. They are represented by many animal phyla; however dominant groups are represented by polychaetes, crustaceans, molluscs and echinoderms. Among these, polychaetes form an important component of the benthic community in terms of abundance, species richness and diversity, as also observed in most parts of the world Ocean. The dominant crustaceans include isopods, mysids, amphipods, ostracods and a few decapods. Molluscs are mainly represented by burrowing bivalves and a few gastropods that live in or on the surface. Echinoderms include brittle stars, sand dollars, sea cucumbers, starfish and heart urchins. Macrobenthos in marine sediments play an important role in ecosystem processes such as mineralization and mixing of sediments, the flux of oxygen into sediments, nutrients cycling, dispersion and burial and



secondary production. These organisms provide key linkage between primary producers and higher trophic levels. Subtidal and intertidal benthic populations are presented in **Table 3.49**.



Figure 58. Subtidal and Intertidal benthos sample collection

Numerical abundance and species diversity of subtidal benthic organisms: The density of subtidal benthic organisms varied from 480 to 1360 Nos./m² at all stations of SB1 to SB13. Minimum benthic organisms were present at stn. SB13, while maximum benthic organisms were present at stn. SB2. Polychaetes dominated at all stations over Mollusca and Arthropoda. All the stations differed in the contributions of these groups.

Numerical abundance and species diversity of intertidal benthic organisms: The intertidal region is the most dynamic region governed by a large number of physicochemical factors led by tide as a principal factor. Though intertidal regions are highly productive regions, the primary production available for benthos consumption is limited in the intertidal region. The organisms depend mostly on the deposition of materials from above, washed out from the land, sinking of phytoplankton and zooplankton from upper layers of the water column and its subsequent decomposition.

The density of intertidal benthic organisms varied between 345 and 420 Nos./m². Arthropoda and Mollusca dominated at all the stations than Polychaeta.

Table 66. Sub-tidal and Intertidal benthic population (Nos./m²)

S. No.	Genus / Species	Subtidal benthic organisms (Nos./m ²)													Intertidal benthic organisms (Nos./m ²)		
		SB1	SB2	SB3	SB4	SB5	SB6	SB7	SB8	SB9	SB10	SB11	SB12	SB13	IB1	IB2	IB3
Phylum: Annelida																	
Class: Polychaeta																	
1	<i>Arenicola</i> sp.	80	40	0	0	40	0	80	40	0	0	0	0	40	45	30	15
2	<i>Capitella capitata</i>	0	40	40	40	0	40	0	0	80	0	40	40	0	45	30	30
3	<i>Chaetopterus</i> sp.	40	80	0	0	40	0	0	40	0	40	0	0	0	30	0	0
4	<i>Dialychone collaris</i>	40	0	40	0	0	40	0	0	0	0	40	0	0	0	15	0
5	<i>Cirratulus cirratulus</i>	0	80	0	80	40	0	40	40	40	40	0	40	0	0	15	15



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 Limited (CCVL)



S. No.	Genus / Species	Subtidal benthic organisms (Nos./m ²)													Intertidal benthic organisms (Nos./m ²)		
		SB1	SB2	SB3	SB4	SB5	SB6	SB7	SB8	SB9	SB10	SB11	SB12	SB13	IB1	IB2	IB3
6	<i>Cirriformia tentaculata</i>	80	0	80	0	40	0	40	0	0	0	40	0	0	0	0	15
7	<i>Eurythoe</i> sp.	40	80	0	40	0	0	0	40	40	40	0	0	40	0	30	0
8	<i>Glycera benguellana</i>	80	0	80	40	40	0	80	0	0	0	40	0	0	0	0	0
9	<i>Glycinde</i> sp.	0	80	0	40	0	40	0	0	0	0	0	0	0	0	0	0
10	<i>Heteromastus similis</i>	40	40	0	40	80	120	0	40	40	40	0	0	0	0	0	0
11	<i>Heteromastus</i> sp.	0	40	40	80	80	0	40	0	40	0	0	40	0	0	0	0
12	<i>Lumbrinerides aberrans</i>	80	80	0	40	80	0	0	40	80	40	0	0	0	0	0	0
13	<i>Maldane sarsi</i>	0	40	80	0	0	40	0	40	0	80	0	0	0	0	0	0
14	<i>Mediomastus fragilis</i>	80	0	40	0	80	0	40	0	0	0	40	0	0	0	0	0
15	<i>Nephtys dibranchis</i>	40	0	40	0	0	40	40	40	0	40	0	40	40	0	0	0
16	<i>Nephtys polybranchia</i>	0	40	0	40	0	40	0	40	0	0	40	0	0	0	0	0
17	<i>Nephtys</i> sp.	40	0	40	40	0	0	40	0	0	0	0	0	40	0	0	0
18	<i>Notocirrus</i> sp.	0	40	40	0	40	40	0	0	40	40	0	40	0	0	0	0
19	<i>Notomastus</i> sp.	0	40	0	0	0	40	0	40	0	0	0	0	40	0	0	0
20	<i>Onuphis</i> sp.	40	0	0	40	0	80	0	40	0	0	0	40	0	0	0	0
21	<i>Ophelia agulhana</i>	0	80	40	40	0	40	0	0	40	0	0	0	0	0	0	0
22	<i>Parheteromastus tenuis</i>	0	40	0	40	40	0	40	80	0	40	0	40	0	0	0	0
23	<i>Perinereis</i> sp.	0	40	40	80	40	0	40	0	80	0	0	0	0	0	45	45
24	<i>Perinereis vancaurica</i>	40	40	0	40	80	120	0	40	40	40	0	0	40	15	0	0
25	<i>Pisone indica</i>	80	0	0	40	80	0	0	40	0	0	40	0	0	15	30	0
26	<i>Pisone</i> sp.	0	80	40	40	0	40	0	0	40	0	0	0	0	0	0	0
27	<i>Platynereis</i> sp.	40	0	40	0	0	40	40	40	0	40	0	0	40	45	0	30
28	<i>Prionospio pinnata</i>	0	40	80	0	0	40	0	40	40	0	0	0	0	0	30	45
29	<i>Sabella</i> sp.	40	0	0	40	0	0	80	0	40	0	40	0	40	0	0	0
30	<i>Sphaerosyllis capensis</i>	0	40	40	40	0	40	0	0	40	0	0	0	0	0	0	15
31	<i>Sternaspis scutata</i>	40	0	40	0	40	0	0	0	0	0	40	0	0	30	0	0
32	<i>Syllis gracilis</i>	40	0	0	0	40	0	40	0	0	80	0	0	40	30	30	0
33	<i>Thelepus</i> sp.	0	0	40	0	0	40	0	0	0	0	40	40	0	0	15	0
Phylum: Arthropoda																	



S. No.	Genus / Species	Subtidal benthic organisms (Nos./m ²)													Intertidal benthic organisms (Nos./m ²)		
		SB1	SB2	SB3	SB4	SB5	SB6	SB7	SB8	SB9	SB10	SB11	SB12	SB13	IB1	IB2	IB3
Class: Malacostraca																	
34	Amphipods	40	0	40	0	40	40	40	40	40	40	0	40	40	0	0	30
35	Crabs	0	40	0	0	0	0	0	40	0	0	0	80	0	0	15	0
36	Isopods	0	80	40	40	0	40	0	0	40	0	0	0	0	0	0	15
Phylum: Mollusca																	
Class: Gastropoda																	
37	<i>Babylonia spirata</i>	40	0	40	0	40	0	0	0	0	0	40	0	0	30	0	0
38	<i>Cypraea</i> sp.	40	0	0	0	40	0	0	40	0	80	0	0	40	30	30	0
39	<i>Conus</i> sp.	0	0	40	0	0	40	0	0	40	0	40	40	0	0	30	0
40	<i>Fusinus</i> sp.	0	40	0	0	0	0	40	0	0	40	0	0	0	30	0	30
Class: Bivalvia																	
41	<i>Donax</i> sp.	0	80	0	0	0	40	40	0	0	80	0	0	40	0	45	0
42	<i>Paphia malabarica</i>	80	40	0	80	0	0	0	80	0	0	40	40	0	45	0	45
43	<i>Volachlamys</i> sp.	40	0	0	40	0	40	0	0	0	80	0	0	0	30	0	15
Population (Nos./m ²)		1200	1360	1040	1040	1000	1080	760	880	800	880	520	520	480	420	390	345

Diversity indices of subtidal and intertidal benthic organisms

Subtidal benthic organisms: The Shannon-Wiener index' H' ranged between 3.55 and 4.56 bits/individual at stn. SB1 to SB13 during the study period. Dominance index (d) was within the range between 1.76 and 3.33. Simpson richness ranged from 0.913 to 0.956. Pie'ou's Evenness index(J') fluctuated from 0.971 to 1.000.

Intertidal benthic organisms: The Shannon-Wiener index' H' ranged from 3.56 to 3.72 bits/individual at stn. IB1 to IB3. Dominance index (d) was within the range between 1.99 and 2.18. Simpson richness ranged from 0.910 to 0.923. Pie'ou's Evenness index(J') fluctuated from 0.961 to 0.980.

Table 67. Diversity indices of benthic organisms

Range	S	N	d	J'	H'(log)	1-Lam'da'
Subtidal benthic organisms						
Minimum	12	480	1.76	0.971	3.55	0.913
Maximum	25	1360	3.33	1.000	4.56	0.956
Intertidal benthic organisms						
Minimum	13	345	1.99	0.961	3.56	0.910
Maximum	14	420	2.18	0.980	3.72	0.923

S= Total species; N= total individuals; d= species richness' J'=evenness



Similarity index ruciateushic organisms: The similarity index of benthic organisms in seabed sediments and intertidal benthos showed that the percentage of similarity ranged from 0.00 to 64.34% with average similarity of 35.61%.

Table 68. Similarity Index of macrobenthic organisms in subtidal and intertidal areas

Station	SB1	SB2	SB3	SB4	SB5	SB6	SB7	SB8	SB9	SB10	SB11	SB12	SB13	IB1	IB2	IB3
SB1																
SB2	27.14															
SB3	43.70	38.18														
SB4	46.07	62.67	38.04													
SB5	64.34	41.48	39.87	41.71												
SB6	32.14	53.23	58.90	46.28	21.29											
SB7	50.20	30.45	46.04	34.23	51.64	19.45										
SB8	57.41	56.50	22.48	46.82	47.27	44.74	31.52									
SB9	29.06	61.38	52.51	64.03	42.36	52.23	28.18	35.83								
SB10	48.92	47.76	25.34	32.77	49.31	41.91	44.06	60.15	37.52							
SB11	46.27	14.38	49.10	32.74	34.80	27.12	26.45	17.74	19.20	0.00						
SB12	20.88	34.03	38.81	33.27	29.50	38.58	33.72	42.11	39.14	31.76	31.48					
SB13	52.77	24.55	22.44	22.44	29.86	33.45	54.71	48.74	26.45	51.49	8.00	16.38				
IB1	50.99	26.55	21.21	23.60	39.71	19.65	26.36	37.19	11.24	38.84	35.42	16.71	36.93			
IB2	26.43	33.56	27.44	24.30	30.78	27.27	30.23	34.37	34.55	27.94	31.21	29.85	37.99	35.40		
IB3	25.57	36.78	38.24	32.00	23.29	31.79	39.44	32.22	39.42	26.01	21.26	29.42	21.01	44.70	36.82	

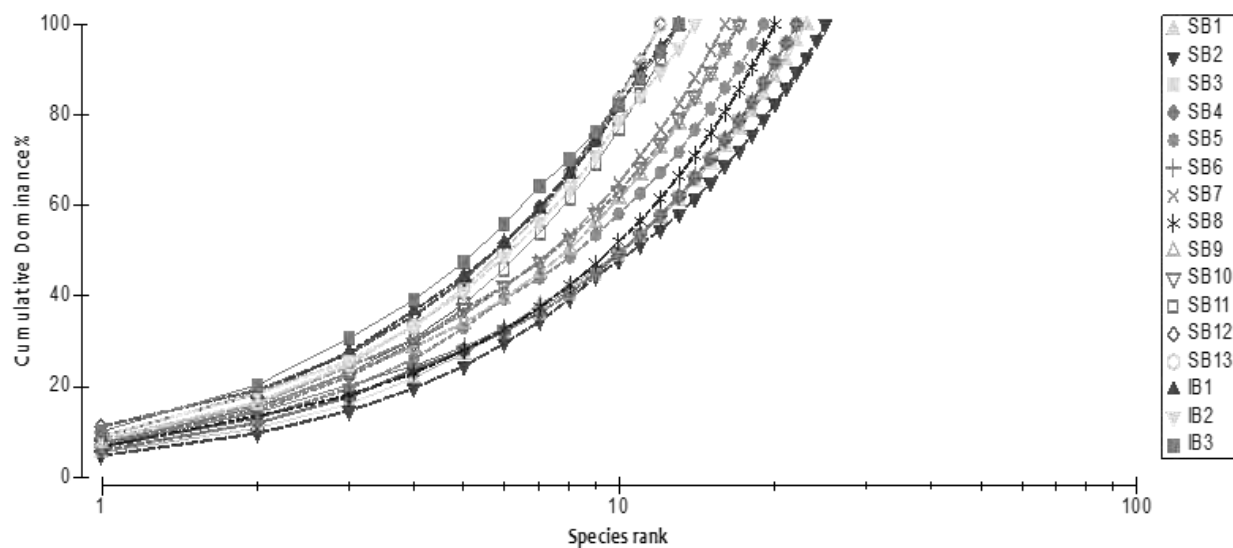


Figure 59. Dominance plot of macrobenthic organisms



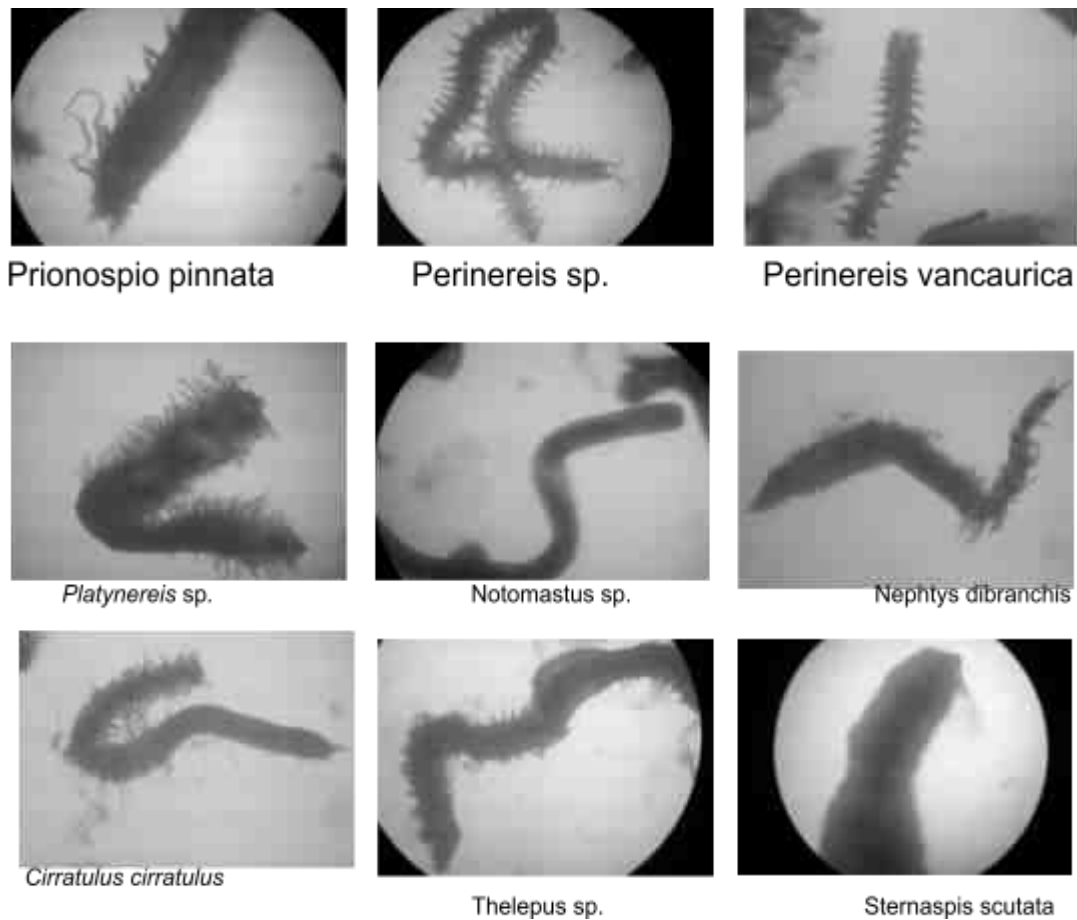


Figure 60. Common benthic organisms

Quantification of Ecological Status

It is always advantageous to assess the "Ecological Status" of a region before any major project is initiated, so that the baseline information that was recorded can be used as a reference for future assessments. There are several statistical methods and indices to explain these changes and based on the values, people classify the ecological status. One such general method is the classification of Shannon -Weiner diversity index.

Table 69. Shannon -Weiner diversity index

Productivity Status	Species Diversity (Shann-n' H')	Explanation
Very Low	0.0-1.5	Very highly polluted
Low	1.6-3.0	Highly polluted
Moderate	3.1-4.0	Moderately polluted
High	4.1-4.9	Transitional zone



Very High	5.0 and above	Normal/Pristine

In general, the pelagic environment presents a much larger uniformity than the benthic environment and species that inhabit it have much larger distribution areas.

Phytoplankton: Species diversity of the phytoplankton community of coastal water is dominated by diatoms, dinoflagellates and cyanobacteria. The most dominant phytoplankton species was *Chaetoceros coarctatus* than the other phytoplankton species during the study period.

Zooplankton: Zooplankton biodiversity in this coastal water is mostly composed of crustaceans. Copepods were the most diverse group containing the highest number of species, followed by Decapods, Ciliates, Mollusca, Chaetognatha, Cladocera, Annelida, Cnidaria, Urochordata and Chordata. The most dominant species were *Paracalanus parvus* during the study period. Among **macrobenthos**, polychaetes were the most diverse groups in the subtidal whereas in intertidal region Mollusca (Bivalvia) were dominant groups. Overall, the following are concluded:

The diversity indices of phytoplankton were within the range of 4.76 to 5.20 indicating good environmental conditions (Normal zone). Zooplankton diversity indices were within the range of 4.81 to 5.43 indicating good environmental conditions (Normal zone). The diversity indices of subtidal and intertidal benthic faunal populations ranged from 3.55 to 4.56, indicating moderate environmental conditions.

3.11.2.5.4 Microbiology

Microorganism distribution in the marine and brackish environment plays an important role in the decomposition of organic matter and its mineralization. Pathogenic bacteria which cause damage to the host invade into marine environments through human and animal excreta, river runoff, land runoff, sewage, agricultural waste and industrial waste. Hence, data on spatial and temporal distribution of the total faecal coliforms as well as other pathogenic bacteria in water and sediment is essential to assess the sanitary conditions of water bodies.

Microbial count in surface water and sediment: Bacterial population in seawater and seabed sediment are given in **Tables 3.50** and **3.51**. In the water samples, bacterial counts varied from 0.01 to 5.64 Nos. $\times 10^3$ CFU/ml among stns. SS1 to SS13. Bacterial counts in sediment samples varied from 0.02 to 5.73 Nos. $\times 10^4$ CFU/g at all stations SB1 to SB13.

Bacterial population was slightly higher in sediment samples compared to water samples. The pathogenic organisms such as Total viable count, Total coliforms, faecal coliforms, *Escherichia coli* like organisms, *Salmonella* like organisms, *Vibrio* like organisms and *Pseudomonas aeruginosa* like organisms have been recorded in the study area.

Table 70. Bacterial population ($\times 10^3$ CFU/ml) in seawater



Media	Type of Bacteria	Station												
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13
Nut Agar	TVC	5.53	5.54	5.64	5.6	5.24	5.44	5.18	5.25	5.24	5.32	5.41	5.15	5.21
Mac Agar	TC	0.53	0.54	0.56	0.52	0.55	0.48	0.47	0.44	0.45	0.52	0.49	0.44	0.39
Mac Agar	FC	0.28	0.29	0.31	0.28	0.26	0.24	0.27	0.25	0.24	0.25	0.22	0.24	0.23
Mac Agar	ECLO	0.21	0.18	0.17	0.19	0.22	0.17	0.16	0.14	0.16	0.16	0.15	0.14	0.14
XLD Agar	SLO	0.24	0.21	0.23	0.27	0.19	0.16	0.18	0.21	0.22	0.24	0.19	0.18	0.18
TCBS Agar	VLO	0.18	0.16	0.17	0.21	0.22	0.29	0.27	0.31	0.18	0.18	0.22	0.22	0.23
CET Agar	PALO	0.02	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.02	0.02

Table 71. Bacterial population (x104 CFU/g) in seabed sediment

Media	Type of Bacteria	Station												
		SB1	SB2	SB3	SB4	SB5	SB6	SB7	SB8	SB9	SB10	SB11	SB12	SB13
Nut Agar	TVC	5.73	5.59	5.7	5.68	5.43	5.71	5.64	5.4	5.44	5.33	5.44	5.19	5.23
Mac Agar	TC	0.56	0.61	0.61	0.55	0.57	0.51	0.52	0.46	0.53	0.55	0.49	0.46	0.42
Mac Agar	FC	0.29	0.31	0.32	0.31	0.27	0.25	0.29	0.29	0.27	0.28	0.23	0.28	0.24
Mac Agar	ECLO	0.25	0.21	0.23	0.22	0.24	0.18	0.19	0.23	0.24	0.25	0.16	0.16	0.15
XLD Agar	SLO	0.27	0.23	0.24	0.28	0.21	0.23	0.24	0.27	0.25	0.29	0.2	0.19	0.19
TCBS Agar	VLO	0.19	0.18	0.19	0.26	0.24	0.32	0.29	0.34	0.22	0.19	0.24	0.23	0.23
CET Agar	PALO	0.03	0.03	0.03	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03

T-C - Total viable count; -C - Total Coliforms; -C - *Faecal coliforms*; EC-O - *Escherichia coli* like organisms; S-O - *Salmonella* like organisms; V-O - *Vibrio* like organisms; PA-O - *Pseudomonas aeruginosa* like organisms.

3.11.2.5.5 Coastal vegetation

Sand dunes in Cuddalore

Cuddalore coastline close to project location is facing significant challenges due to natural calamities such as cyclonic depressions, heavy rainfall leading to floods, and the devastation caused by the 2004 tsunami (Muthusankar et al., 2018). Despite these challenges, the region is home to unique and rich sand dune formations. These dunes provide critical habitats for specialized flora and fauna that thrive in harsh, sandy environments. Notably, the sand dune areas are nearby plantations of *Casuarina equisetifolia*, *Borassus flabellifer* and *Anacardium occidentale*. These species not only contribute to ecological balance but also have economic significance and play a crucial role in protecting shorelines by stabilizing sand and reducing the impact of erosion.

Project location

The present study reveals that, sand dunes are present within 10 km radius and height ranges from 0.5 to 5 m with moderate vegetation including *Anacardium occidentale* (Munthiri), *Casuarina equisetifolia* (Savukku) and *Cocos nucifera* (Thennai) plantation. As per the CRZ map the sand dune is 110 m north and 560 m southwest of the LFP. Presence of sand dunes major vegetation like *Ipomea pes-caprae* (Adapankodi), *Spinifex littoreus* (Ravanan meesai), *Crotalaria pallidae* (Kilukiluppai), *Pedaliium murex* (Yanai nerunji), *Catharanthus roseus* (Nithyakalyani) and *Borassus flabellifer* (Panai). In order to conserve and stabilize the sand dunes along the coast, the Cuddalore



forest department started planting palm trees. Existing sand dunes will not be affected by the proposed project for elevated pipeline facilities. Distribution of plant species in coastal environments depends upon their capacity of enduring salt tolerance and this characteristic is often manifested by the mineral composition of vegetative organs. Coastal vegetation was studied qualitatively in field surveys. The coastal vegetation can be classified into four groups:

- i. marine algae or seaweeds
- ii. seagrasses
- iii. mangroves
- iv. sand dune vegetation

Each of these types of vegetation grows under a specific environmental gradient which subsequently leads to a distinct vegetation zonation in coastal or estuarine areas. During the site visit, *Spinifex littoreus* and *Ipomea pes-caprae* were observed as the common coastal plant species in the project area. Other vegetation such as *Borassus flabellifer*, *Cocos nucifera*, *Calotropis gigantea*, *Casuarina equisetifolia*, *Thespesia populnea* and *Opuntia* sp., were also observed in the nearshore areas.

Sand dunes

A coastal sand dune is a ridge, mound or mount of sand behind a tide-influenced beach that is mostly the result of deposition of littoral drift and mount in aeolian activity. In addition to providing crucial ecological habitat, after natural protection in the shoreline from storm surge and high waves, it helps to reduce coastal flooding as well as damage. They are created over years when beach vegetation arrests windblown sand. Dune grasses roots serve as temporary anchors for the dunes, while their leaves collect sand and promote dune development. In the absence of vegetation, dunes are frequently altered in shape and position by wind. Coastal bird species, especially migratory birds and sea turtles, use the sand dunes as nesting habitat and supporting a variety of organisms.

Sand dunes in Tamil Nadu

Coastal sand dunes along Tamil Nadu are found along almost all the coastal districts like Thiruvallur, Chennai, Kancheepuram, Viluppuram, Ramanathapuram, Thoothukudi, Tirunelveli and Kanyakumari. The well-developed Sand dunes are observed along the Chennai-Pondicherry belt, Pondicherry-Portonovo belt, Tharangampadi- Vedaranyam Palk Bay region, Rameswaram - Tuticorin belt Manapad to Kanyakumari belt.

Near the south Poigainnallur area in the Nagapattinam district of Tamil Nadu are some of the state's oldest and most well-established dunes. The beaches at Nagapattinam (594 m) had the longest dunes, which were 30–40 feet high, and Marakkanam (42 m) had the shortest. The height



of the dune varies between 3 – 10 m. *Ipomoea pes-caprae*, *Spinifex littoreus*, and *Casuarina equisetifolia* are common coastal plants. The background is dominated by palm and coconut trees. *Prosopis juliflora* is also widely distributed near the shore, present alongside the background trees and ground inland vegetation. These dunes are quite old and well-stabilized. Certain regions also feature mixed vegetation that supports species like *Prosopis*, *Eucalyptus*, and other shrub species, even though the majority of the dunes here are covered with *casuarina* or coconut plantations



Figure 61. Plantation by forest department for sand dune stabilization



Figure 62. Northern side sand dunes from proposed facilities

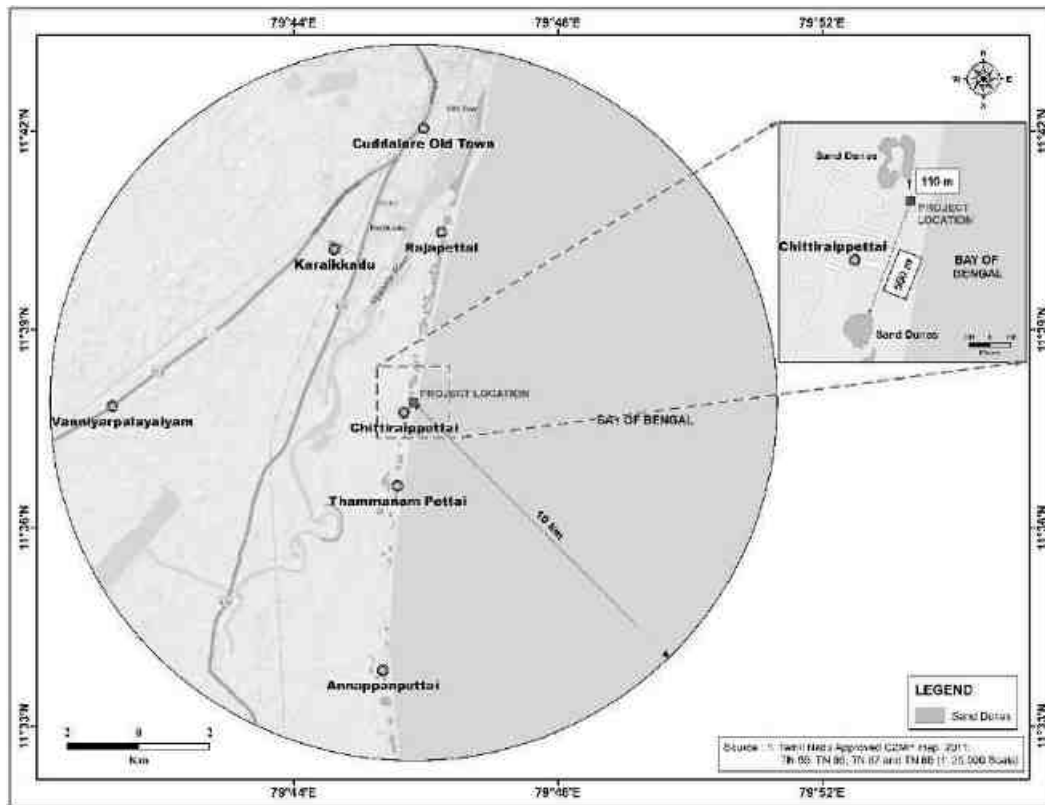


Figure 63. Distance of sand dunes from proposed project location

Dune vegetation in project region

According to a recent report by Anbarashan et al., 2022, 105 vascular plants from 39 families and 85 species were identified as part of the Cuddalore sand dunes vegetation. According to the current study, 38 floral species were identified among the sand dunes. Among the observed flora, *Prosopis juliflora*, *Ipomoea pes-caprae* and *Spinifex littoreus* are the most common flora found in the project location and its surrounding.

Table 72. List of sand dune and associated flora

S. No.	Botanical Name	Family	IUCN Status
1	<i>Aeschynomene indica</i>	Fabaceae	LC
2	<i>Alysicarpus monilifer</i>	Fabaceae	NE
3	<i>Barleria prionitis</i>	Acanthaceae	NE
4	<i>Boerhavia diffusa</i>	Nyctaginaceae	NE
5	<i>Borassus flabellifer</i>	Arecaceae	NE
6	<i>Brachiaria reptans</i>	Poaceae	LC
7	<i>Calotropis gigantea</i>	Asclepiadaceae	NE
8	<i>Casuarina equisetifolia</i>	Casuarinaceae	LC
9	<i>Catharanthus roseus</i>	Apocyanaceae	NE



S. No.	Botanical Name	Family	IUCN Status
10	<i>Chloris barbata</i>	Poaceae	NE
11	<i>Citrullus colocynthes</i>	Cucurbitaceae	NE
12	<i>Cocos nucifera</i>	Arecaceae	NE
13	<i>Crotalaria pallida</i>	Fabaceae	NE
14	<i>Croton bonplandianus</i>	Euphorbiaceae	NE
15	<i>Cyperus rotundus</i>	Cyperaceae	NE
16	<i>Dactyloctenium aegyptium</i>	Poaceae	NE
17	<i>Eragrostis amabilis</i>	Poaceae	NE
18	<i>Glinus oppositifolius</i>	Molluginaceae	LC
19	<i>Ipomoea pes-caprae</i>	Convolvulaceae	NE
20	<i>Launaea sarmentosa</i>	Asteraceae	NE
21	<i>Heliotropium curassavicum</i>	Boraginaceae	LC
22	<i>Ocimum tenuiflorum</i>	Lamiaceae	NE
23	<i>Oldenlandia umbellata</i>	Rubiaceae	NE
24	<i>Opuntia stricta</i>	Cactaceae	LC
25	<i>Passiflora foetida</i>	Passifloraceae	NE
26	<i>Pedaliium murex</i>	Pedaliaceae	NE
27	<i>Phoenix pusilla</i>	Arecaceae	NE
28	<i>Prosopis juliflora</i>	Fabaceae	NE
29	<i>Sesuvium portulacastrum</i>	Aizoaceae	LC
30	<i>Senna auriculata</i>	Caesalpinaceae	NE
31	<i>Senna occidentalis</i>	Caesalpinaceae	LC
32	<i>Senna tora</i>	Caesalpinaceae	NE
33	<i>Spinifex littoreus</i>	Poaceae	NE
34	<i>Tephrosia purpurea</i>	Fabaceae	NE
35	<i>Trichodesma indicum</i>	Boraginaceae	NE
36	<i>Tribulus terrestris</i>	Zygophyllaceae	NE
37	<i>Xenostegia tridentata</i>	Convolvulaceae	NE
38	<i>Xanthium strumarium</i>	Asteraceae	NE

IUCN Status - NE (Not Evaluated) and LC (Least Concern)



Ipomoea pes-caprae – Convolvulaceae



Spinifex littoreus – Poaceae



Pedalium murex – *Padaliaceae*



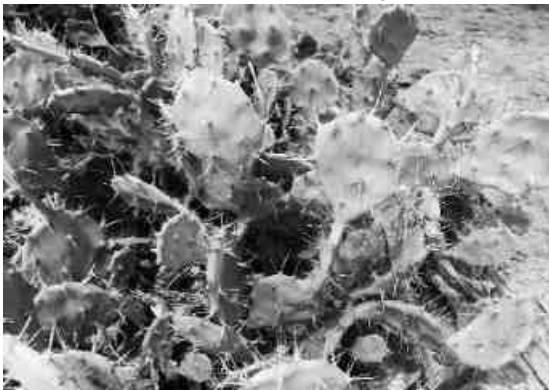
Launaea sarmentosa – *Asteraceae*



Boerhavia diffusa – *Nyctaginaceae*



Calotropis gigantea – *Asclepiadaceae*



Opuntia stricta – *Cactaceae*



Borassus flabellifera – *Arecaceae*

Figure 64. Sand dune Flora

Conclusion

The proposed project activity will not have any direct impact over the sand dune environment. Thus, the nature of the sand dunes will be preserved even during the proposed development. The project proponent will also regularly monitor the area and engage in conservation activities with the forest department and the local villagers. These activities balance the sand dune vegetation and biodiversity of the ecosystem.

3.11.2.5.6 Seagrasses and Seaweeds

Seagrasses are the marine flowering plants. They are the only angiosperms that successfully grow in intertidal and subtidal marine environments. Mangrove and coral reef ecosystems are also closely associated with the seagrass ecosystem.

Seagrass species were absent within the project region.

3.11.2.5.7 Mangroves

Mangroves are a diverse group of plants growing in the inter-tidal zone and are often referred to as mangrove forest or tidal forest. Only a limited number of plants alone have evolved to adapt to such intertidal conditions. Pneumatophores, supporting stilt roots and buttresses, salt excreting glands in the leaves and viviparous propagules are some of the several highly specialized adaptations of this group. Shallow, gently shelving shores allow mangrove seedlings to anchor, particularly in estuaries, rivers and bays. Mangrove wetlands are a multiple use ecosystem that provide protective, productive, and economic benefits to coastal communities. Mangroves contribute to the stabilization of the shoreline and prevention of shore erosion. Generally, mangroves are divided into two categories, as true mangrove species (i.e., plants which are found only in intertidal habitats) and mangrove associates (i.e., plants which are not exclusive to these habitats).

Importance of Mangroves

Mangroves are highly productive and ecologically important ecosystems. Mangrove forests provide many ecosystem services, such as support for local livelihoods through provision of fuel, food and construction materials. Mangroves host several different animal species including endangered mammals, invertebrates, fishes, amphibians, reptiles, birds, etc. Mangroves offer nutrients to the marine food web and provide spawning and nursery grounds to a variety of fish and shellfish.

Mangroves in Tamil Nadu

According to ISFR (India State of Forest Report), 2021, mangrove cover of Tamil Nadu is 44.94 sq. km and is spread over 8 districts. When compared to the ISFR report, 2019, an extent of 0.11 sq. km. of mangrove cover has increased. The reason for the increase in mangrove cover in Tamil Nadu is mainly due to the natural regeneration, plantation activities in suitable places like banks of the rivers near the estuary and on intertidal mudflats. State Forest Department takes serious concern to conserve ecology and biodiversity of mangroves by protection, restoration, regeneration, training and maintenance.

Mangroves in Pichavaram

The Pichavaram world's second largest mangrove forest. It covers an area of about 1100 ha, of which 50% is covered by forest, 40% by water - ways and the remaining filled by sand - flats and mud - flats (Krishnamurthy and Prince Jayaseelan, 1983). The Pichavaram Mangrove Forest in Tamil Nadu is renowned for its rich mangrove diversity, encompassing a total of 13 species. Among these, the *Avicennia* and *Rhizophora* species dominate, forming the core of the forest's mangrove



ecosystem. Additionally, six associated species have been identified, including *Suaeda maritima*, *Suaeda monoica*, *Ipomoea pes-caprae*, and *Sesuvium portulacastrum*. Notably, *Xylocarpus mekongensis*, an endangered species, was recorded in limited numbers, highlighting its rare presence in the forest. (Kumaravel S. and Ranganathan, R. 2018). The proposed LFP to Pichavaram mangrove forest is approximately 25 km away.

Uppanar river creek: It is a backwater ecosystem running parallel to the coastline and opens into Bay of Bengal where the Gadilam River meets the sea, forming the Uppanar estuarine system. It supports three species of mangroves.

Project region: During the study period, true mangrove species of *Avicennia marina*, *Rhizophora mucronata* and *Excoecaria agallocha* mangrove associate species (salt marsh) such as *Arthrocnemum indicum*, *Suaeda maritima* and *Sesuvium portulacastrum* were observed in the project area. According to CRZ, mangroves only present 1530 m south and 2080 m north of the proposed elevated trestle pipeline. However, based on field observation along the Uppanar river creek some of the planted mangroves were observed in the southern part of the area which occurs 100 m south of the elevated pipeline trestle and 300 m from the Chemplast plant. List of mangroves and mangrove associates is given in **Table 73**. The Distance of mangroves from proposed facilities as per CRZ and latest google earth image shown in below figure.

Table 73. List of mangroves and mangrove associates study area

S. No.	Botanical Name	Family Name
Mangrove species		
1	<i>Acanthus ilicifolius</i>	Acanthaceae
2	<i>Avicennia marina</i>	Acanthaceae
3	<i>Excoecaria agallocha</i>	Euphorbiaceae
4	<i>Rhizophora mucronata</i>	Rhizophoraceae
Mangrove associates		
1	<i>Arthrocnemum indicum</i>	Amaranthaceae
2	<i>Sesuvium portulacastrum</i>	Aizoaceae
3	<i>Suaeda maritima</i>	Amaranthaceae



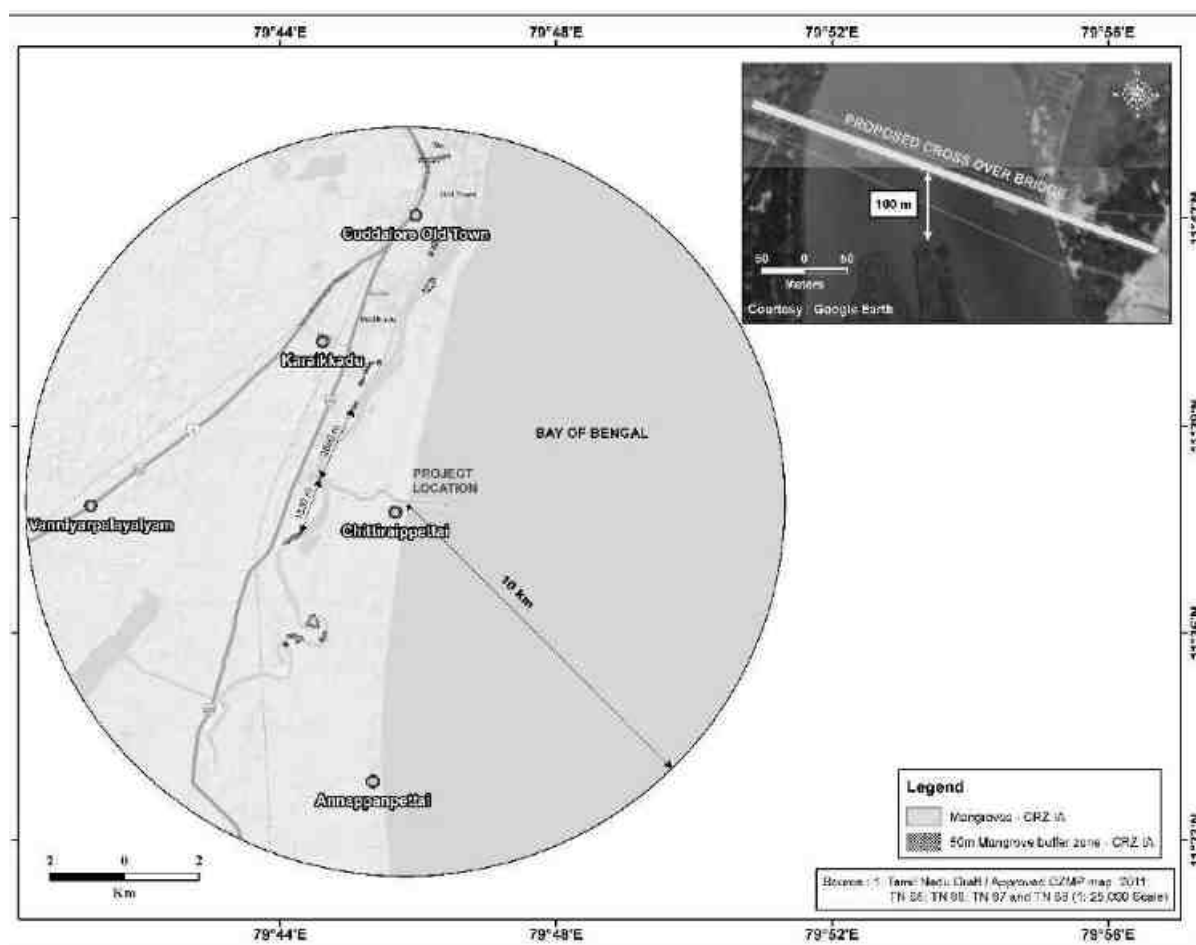


Figure 65. Distance of mangroves from proposed facilities as per CRZ and latest google earth image



Rhizophora mucronata - Rhizophoraceae



Acanthus ilicifolius - Acanthaceae



Sesuvium portulacastrum - Aizoaceae

Salicornia brachiata - Amaranthaceae

Figure 66. Common mangrove plants in the study area

Conclusion

The construction of an elevated pipeline trestle will not damage or uproot the existing mangroves. According to the present study, existing mangroves are located 100 m from the proposed elevated trestle pipeline. As a result, the proposed building will not harm the mangroves in the Uppanar River creek.

Coral reefs are one of the most diverse and dynamic ecosystems. The coral reefs not only provide a sanctuary to a myriad of marine life but also play a key role in protecting the coastline from erosion.

Coral species were absent within the project region.

3.11.2.5.8 Marine Mammals

Marine mammals are important components and occupy elevated trophic levels in the oceanic environment. About 26 cetaceans (Whales, Dolphins and Porpoises) and one Sirenian, the Dugong, are found in the waters of the Indian subcontinent. Marine mammals are adapted to thrive in wide variations of temperatures, depths, pressure, darkness, etc. All the species are protected under Schedule I of the Wildlife Protection (Amendment) Act, 2022; ten species are included in Appendix I and fifteen species are included under Appendix II of CITES are given in **Table 77**.

Table 74. Marine mammals of India and CITES status

S. No.	Common Name	Species Name	CITES status	India status *
1	Blue whale	<i>Balaenoptera musculus</i>	Appendix - I	Endangered
2	Fin whale	<i>Balaenoptera physalus</i>	Appendix - I	Endangered
3	Bryde's whale	<i>Balaenoptera edeni</i>	Appendix - I	Data Deficient
4	Common-Minke whale	<i>Balaenoptera acutorostrata</i>	Appendix - I	Data Deficient
5	Humpback whale	<i>Megaptera novaeangliae</i>	Appendix - I	Data Deficient
6	Sperm whale	<i>Physeter macrocephalus</i>	Appendix - I	Vulnerable
7	Pygmy sperm whale	<i>Kogia breviceps</i>	Appendix - II	Data Deficient
8	Dwarf-sperm whale	<i>Kogia sima</i>	Appendix - II	Data Deficient
9	Cuvier's beaked whale	<i>Ziphius cavirostris</i>	Appendix - II	Data Deficient
10	Indo-Pacific beaked whale	<i>Indopacetus pacificus</i>	Appendix - II	Data Deficient
11	Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	Appendix - II	Data Deficient
12	Killer whale	<i>Orcinus orca</i>	Appendix - II	Data Deficient



S. No.	Common Name	Species Name	CITES status	India status *
13	Fals- killer whale	<i>Pseudorca crassidens</i>	Appendix - II	Data Deficient
14	Melon-headed whale	<i>Peponocephala electra</i>	Appendix - II	Data Deficient
15	Irra-ady dolphin	<i>Orcaella brevirostris</i>	Appendix -I	Vulnerable
16	Indo-Pacific humpbacked dolphin	<i>Sousa plumbea</i>	Appendix -I	Least Concern
17	Rough-toothed dolphin	<i>Steno bredanensis</i>	Appendix - II	Data Deficient
18	Riss-'s dolphin	<i>Grampus griseus</i>	Appendix - II	Least Concern
10	Bottl-nose dolphin	<i>Tursiops aduncus</i>	Appendix - II	Least Concern
20	Spinner dolphin	<i>Stenella longirostris</i>	Appendix - II	Least Concern
21	Strip-d dolphin	<i>Stenella coeruleoalba</i>	Appendix - II	Data Deficient
22	Long-beaked common dolphin	<i>Delphinus capensis</i>	Appendix - II	Least Concern
23	Finle-s porpoise	<i>Neophocaena phocaenoides</i>	Appendix - II	Near Threatened
24	Sou-h Asian River dolphin	<i>Platanista gangetica</i>	Appendix -I	Endangered
25	Sea cow	<i>Dugong dugon</i>	Appendix -I	Endangered

(* Status assigned based on sighting surveys conducted by CMFRI during the years 2003 - 2012, under the project "Studies on marine mammals of Indian EEZ and the contiguous seas" funded by CMLRE, Ministry of Earth Sciences, Government of India)

3.11.2.5.9 Marine Protected Areas

Coastal and marine environments are among the planet's most productive and diversified ecosystems. These marine and coastal habitats include wetlands, salt marshes, seaweeds, seagrass beds, coral reefs, mangroves, lagoons, etc. These highly productive ecosystems help to recycle nutrients and organic matter and thus serve as important nursery grounds for the larvae and juveniles. They also serve as feeding, resting and breeding grounds for a variety of fauna and deserve protection from natural phenomena and human activities. Thus because of the biologically active resources MPAs are declared. All the MPAs in the country are notified under the Wildlife (Protection) Act, 1972 and fall in category I and II of IUCN categories of Protected Areas (PAs). (MNP report, 2019).

Table 75. Protected areas in Tamil Nadu coast

S. No.	Name of MPA	Category	Area (sq. km.)	Year of establishment
1	Gulf of Mannar (Marine National Park)	National Park	6.23	1980
2	Point Calimere (Sanctuary)	Sanctuary	172.6	1967
3	Pulicat Lake (Sanctuary)	Sanctuary	153.67	1980

(Source: ENVIS Centre on Wildlife and Protected Areas)

Endangered species

Marine species were thought to be abundant and unlikely to become extinct. Exploitation of marine resources over the years has caused the decline in many marine species populations and recovery is found to be much slower than previously understood. Studies have shown that many species have restricted distribution, which makes it vulnerable to exploitation and extinction.

Biodiversity loss is continuing at an unprecedented rate, with many species declining to critical levels and significant numbers going extinct. The IUCN Red List is the most comprehensive information source on the status of wild species and their links to livelihoods.



Many of the species of seabirds, marine mammals, and turtles, have had their status evaluated and are deemed globally threatened. Sharks, groupers, seahorses, manta rays, coelacanth, swordfish, sawfish, and all tuna species except yellowfin and skipjack are among the threatened marine fishes that were added to the Red List. Six species of giant clam are among the very few marine invertebrates that are listed on the IUCN Red List.

Molluscs

Marine molluscs comprise an important group of fauna that occur in diverse habitats such as sandy areas, rocky shores, seagrass beds, mangrove and coral reef ecosystems, etc., and even at abyssal depths of the sea. In general, rocky shores and coral reef ecosystems support wide diversity of molluscs in India. The majority of molluscs inhabit marine biotopes, and they occur from the backwater zone, mangroves, intertidal, shelf and coastal waters.

Molluscs comprise of some major classes such as Bivalvia, Caudofoveata, Cephalopoda, Gastropoda, Monoplacophora, Polyplacophora, Rostroconchia, Scaphopoda and Solenogastres.

In India, a total of about 3270 mollusc species, belonging to 220 families and 591 genera, were reported. Molluscs include gastropods (1900), bivalves (1100), cephalopods (210), polyplacophores (41) and scaphopods (20) (Rao, 1991).

3.11.2.5.10 Turtle

Sea turtles

Sea turtles are reptiles remarkably suited to life in the sea, their hydrodynamic shape, large size, and powerful front flippers allow them to dive to great depths and swim long distances, in spite of their long migration routes in tropical and subtropical seas and dependence on the beach land for reproduction (laying their eggs).

Seven species of sea turtles are known in the world oceans; of which five species viz., Olive Ridley (*Lepidochelys olivacea*), Green (*Chelonia mydas*), Leatherback (*Dermochelys coriacea*), Hawksbill (*Eretmochelys imbricata*), and Loggerhead (*Caretta caretta*) are common mainly in tropical and subtropical seas. Other two species Kemp's ridley (*Lepidochelys kempii*) and Flatback turtle (*Natator depressus*) have restricted distribution. Kemp's ridley is found mainly in the Gulf of Mexico and the flatback turtle around northern Australia and southern Papua New Guinea.

Importance of sea turtles

Sea turtles are a "keystone species," which implies they play a vital role in their ecosystem and impact other marine species. When a keystone species is removed from its ecosystem, the natural order can be disturbed, affecting other flora and fauna in various ways. Sea turtles are part of two important ecosystems: beaches and marine systems. If sea turtles became extinct, the marine and coastal ecosystems would suffer. And, because humans depend on the ocean for food and make use of beaches for a variety of activities, any weaknesses in these ecosystems would have a negative impact on humans.

Threats to sea turtles



Sea turtles perform long journeys and swim thousands of ocean miles during their long lifetimes. They wait decades until they can reproduce, returning to the same beaches where they were born to lay their eggs. Females can lay hundreds of eggs in one nesting season, yet few will yield hatchlings that survive their first year of life. Beyond these significant natural challenges, sea turtles face multiple threats caused by humans, such as bycatch in commercial fishing gear, entanglement in abandoned fishing nets, climate change, etc.

Worldwide sea turtles are threatened by a variety of natural and anthropogenic factors. The major threats to sea turtles are incidental catches during fishing operations, climatic factors, pollution, exposure to pathogens and degradation of their habitat.

Migration of sea turtles

Sea turtles often migrate thousands of kilometers across international waters. Current knowledge of sea turtle life history suggests that individual turtles occupy a series of different habitats during the course of their life cycles. Various modern techniques are now being used to track sea turtles to study their long-range migrations.

Tagging provides information about migration only as far as the sites of tagging and tag recovery, hence allowing inferences about the beginning and perhaps, the end points of the migration. For details of the migratory route, and behaviour during migration, one has to turn to a more advanced technique, namely telemetry. Radio telemetry is a widely used technique in wildlife studies and has been used with limited results to study turtles within the breeding area. This involves placing a transmitter on the turtle and tracking it with a receiver. However, once a sea turtle begins its (often) long journey to its foraging area, it is impossible to track and follow these turtles.

Satellite telemetry solves this problem as the transmitter signal is received by a satellite, and the animals can be tracked wherever they travel. This data can be used to trace the precise migratory route of the turtle and collect associated information such as swimming speed and travel rate. Transmitters can be fitted with equipment to provide information on water temperature and activity of the turtle.

Tamil Nadu Scenario

Tamil Nadu has a coastline of 1076 km, which is largely east-facing with a small stretch of west-facing coast (80 km). Five species of marine turtles Olive Ridley, Green, Leatherback, Hawksbill and Loggerhead turtles have been reported to occur along the Tamil Nadu coast (Kar and Bhaskar 1982). Out of these, the most prominent visitors are Olive-Ridley turtles, commonly nesting along the Coromandal coast and are known to forage in south Tamil Nadu waters, whereas nesting by other species of turtles is rare at present. Large numbers of green turtles once used the Gulf of Mannar for foraging, but these numbers have declined due to exploitation for meat (Agastheesapillai and Thiagarajan 1979). Hawksbill turtles are also found in the Gulf of Mannar, and few adults and juveniles are occasionally seen along the rest of the coast. Similarly, leatherbacks are occasionally seen along this coast. Loggerhead turtles are rare and there are few confirmed reports, but they are known to come from Sri Lankan waters and may be found in the



Gulf of Mannar. This coast forms a part of the migratory corridor for Olive Ridleys en route to the mass nesting beaches in Odisha.

Cuddalore district

Cuddalore coast is a sporadic nesting ground for Olive Ridley which is similar to the East coast districts, except mass nesting ground like Gahirmatha, Rushikulya and Devi in Odisha. Turtle nesting and sighting areas in the Cuddalore district are found along the beach from Suba Uppalavadi to Samiyarpettai. In 2016, Tamil Nadu Gazette notification listed the following locations as potential nesting sites along the Cuddalore coast: Pillumedu - Chinna vaikkal, Chinna vaikkal - Mudasalodai, Chinoor - Saamiyar pettai, Saamiyar pettai - Aiyampettai, Aiyampettai to Thamanampettai, Thamanampettai to Sothikuppam, Gori to Devanampattinam Beach, and Devanampattinam Village - Suba Uppalavaadi. Currently, the proposed facilities are coming between Aiyampettai and Thamanampettai region.

A sporadic number of turtle nesting were reported in Rasappettai village recently. Record number of turtles released last year by TNFD was recorded in Cuddalore, Nagapattinam and Chennai with highest release in Cuddalore - 89648, Nagapattinam - 60438 and Chennai - 38230 respectively.

Project location

The coastline in this region runs almost straight in a North-South direction. The pipeline's Landfall Point (LFP) starts at Reddiyar Pettai, crossing the Uppanar River towards the Chemplast Plant. Coastal vegetation in this area mainly comprises *Casuarina*, coconut, and cashew plantations, which appear in patches along the coastal stretch. The coastal region predominantly consists of sandy beaches. The width of the beach is 40 to 80 m from LTL. In 2016, Tamil Nadu Gazette notification listed the following corridors as potential nesting sites found within 10 km radius. The proposed LFP comes under Thammanampettai to Sothikuppam 8.0 km stretch, on the southern side Thammanampettai to Ayyampettai 3 km stretch and Ayyampettai to Samiyar pettai 3 km stretch and northern side Rasapettai 4.8 km stretch nesting area.

According to data provided by the Forest Department since 2016, indicates that Olive redley turtles only lay their eggs near the Cuddalore coast. The proposed project location is approximately 14 km north of Devanampatnam, where the Forest Department Cuddalore has been developing turtle nesting hatcheries from 2021 to 2023.

Conclusion

The Forest department identified sporadic turtle nesting sites along the Cuddalore coastal region, including 10 km radius of the project site (LFP). The total length of the proposed pipeline trestle from LFP to Island jetty is 1060 m in length and space between piles is 15 m. The proposed construction of the elevated pipeline does not impact the ground area of the LFP. The elevated trestle pipeline piles are minimal disturbance to turtle nesting areas, during the construction phase. These impacts are temporary and limited to the construction period. During construction, any turtle nesting activity or turtle sighting must be reported immediately to the Forest department. Additionally, no construction activities should occur in the sand dunes and nesting. However, the proposed trestle pipeline will not modify the nature of the coast at LFP point because of very few piles over the area. Even though the project proponent has come up with an extensive conservation plan is provided in **Annexure V**.



3.11.2.5.11 Fisheries

Marine fishery resources are renewable and limited; therefore, management of the harvest of marine fishery resources is necessary for sustained production from the sea. Towards this, it is very much essential to have reliable and updated knowledgebase on status of marine fishery resources, fishing effort expended, number of fishing villages, number of landing centres, fisherfolk population, their educational status, occupational status, infrastructure facilities existing in fishing villages, fishing crafts, fishing gears, etc.

Indian marine fisheries

The estimated marine fish landings of India during 2022 was 34.9 lakh tonnes, showing an increase of 14.53% compared to 2021. Among the states, Tamil Nadu got first place in fish landings with 7.22 lakh tonnes (20.69% of the total in the country), followed by Karnataka (6.95 lakh tonnes) and Kerala (6.87 lakh tonnes). The Tamil Nadu state occupying the top two slots in previous years, appropriated the fourth position in fish landings, recording a nearly 13% decrease compared to the 2021 landings due to lower fishing efforts and trade related issues. Indian mackerel contributed the most landings from the marine fishery resources in 2021 & 2022. (3.28 lakh tonnes - 9.39% of the total for the national), followed by oil sardines (2.51 lakh tonnes - 7.20%), ribbon fishes (2.27 lakh tonnes - 6.49%), cephalopods (2.06 lakh tonnes - 5.89%), threadfin breams (1.99 lakh tonnes - 5.69%), lesser sardines (1.69 lakh tonnes - 4.85%), scads (1.63 lakh tonnes - 4.68%), penaeid prawns (1.63 lakh tonnes - 4.68%), anchovies (1.57 lakh tonnes - 4.50%) and non-penaeid prawns (1.47 lakh tonnes - 4.21%). Oil sardine (*Sardinella longiceps*), which is one of the most preferred marine fishes in India, contributed second highest landing in 2022 (2.51 lakh tonnes), an increase of 188.15%, compared to 2021 (0.87 lakh tonnes).

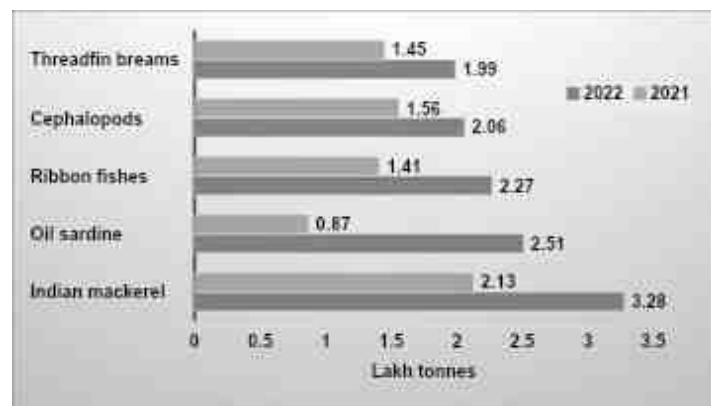


Figure 67. Major species / groups with their contribution (lakh tonnes) in 2021 & 2022

(Source: Marine fish landing in India 2022)

Tamil Nadu marine fisheries

Environmental Consultant M/S Indomer Coastal Hydraulics (P) Ltd



Tamil Nadu has a coastal length of 1076 km (13% of the country's coastline), 1.9 lakh km² of EEZ (9.4% of India's EEZ) and a continental shelf of about 41,412 km² and is one of the leading states in marine fish production. The number of marine fishing villages in Tamil Nadu is 608. There are 301 fish landing centres. The registered fishing crafts included motorised (38575), traditional crafts (42337) and mechanised boats (5893) (Department of Fisheries, Tamil Nadu).

In the year 2023, Tamil Nadu occupied 4th position in fish landings and contributed 16% of all landings in India. Total marine fish landings in Tamil Nadu in 2023 were 5.65 lakh tonnes, a 21.8% decline from the year 2022 when they were 7.22 lakh tonnes. The highest landing of species as lesser sardines (*Sardinella* sp.) in 2023 showed the same position as it declined by 20% compared to 2022. *Odonus niger* was the second highest landed in 2023. Indian mackerel and crabs landings increased as 28.8 and 28.4 thousand tonnes respectively, except cephalopods that decreased in 2023. (Source: Marine fish landings in India 2023).

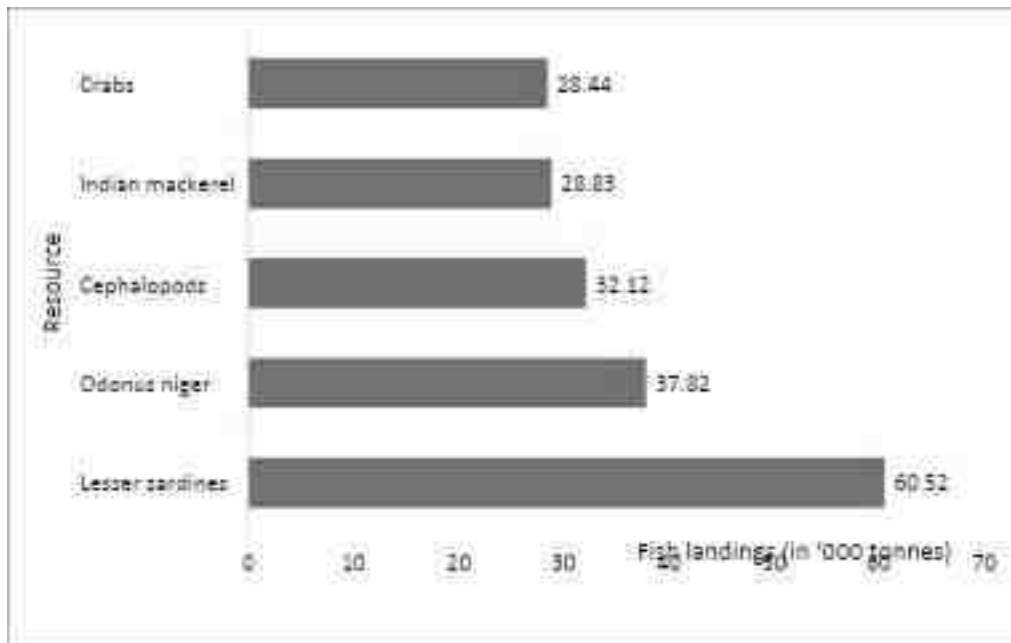


Figure 68. Marine fish landing in state Tamil Nadu (CMFRI, 2023)

Cuddalore district marine fisheries

The project location is situated in Cuddalore taluk and district. The estimated marine fish production of Cuddalore district was 5,47,615 lakh tonnes in 2020-21. There are 43 fishing villages comprising 12,988 fishing families and 12,577 traditional fishermen families. Among the total fishing families 46,090 fisherfolk population are engaged in fishing (Marine Fisheries Census 2016, Tamil Nadu).

There are 8 fishing villages located at 5 km radius of the project location viz., Reddiyarpettai, Chitiraipettai, Rajapettai, Thammanampettai, Nayakkarpettai, Nanjalingampettai, Periyakuppam and Pettodai Their fisheries details are given in table below.



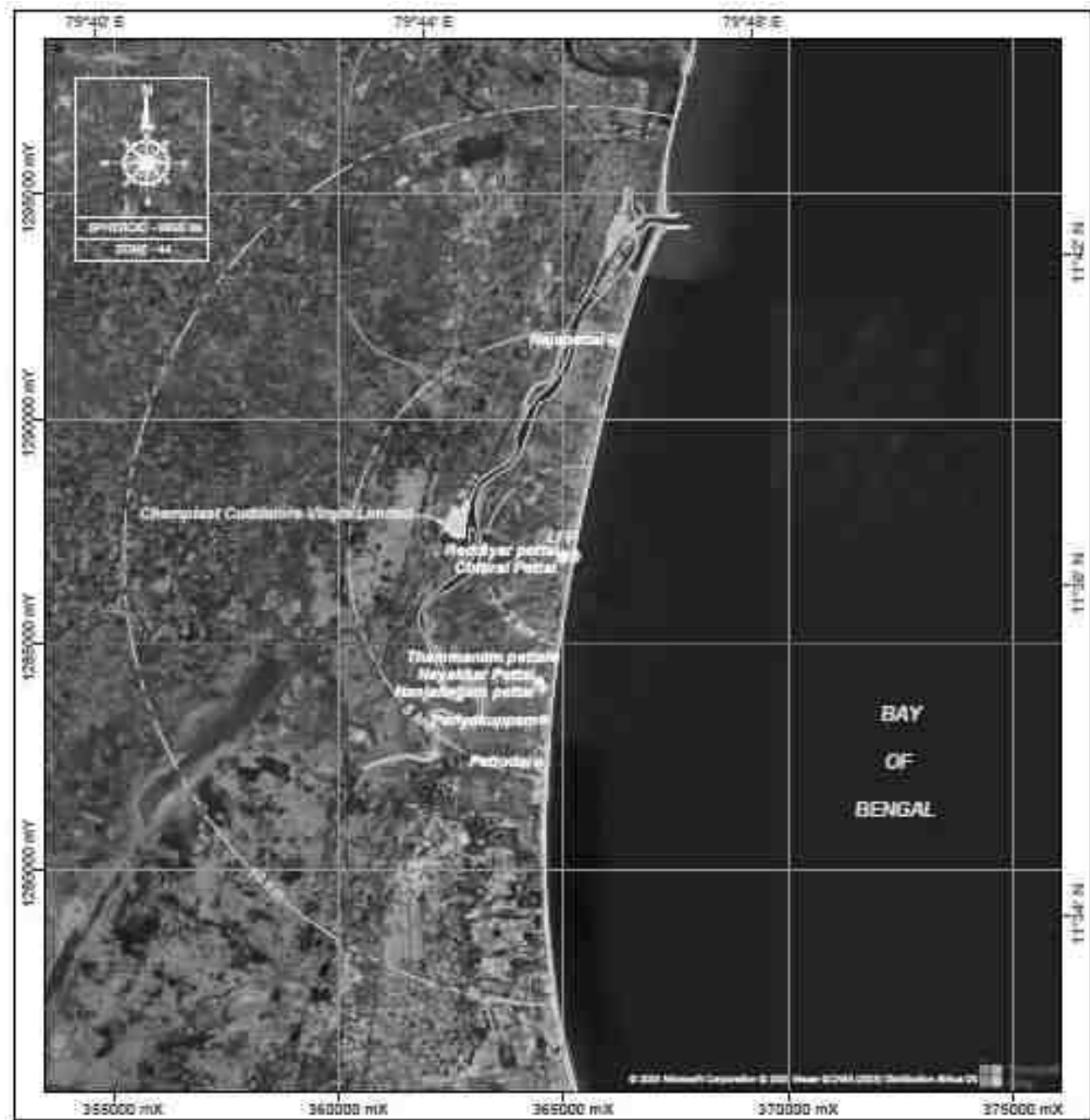


Figure 69. Locations of fishing villages near project area

Group-wise marine fish production: Group-wise marine fish production in Cuddalore district during the period 2020-21 is given below. There are 235 species recorded in fish landings. Among them, most of the fishes belonged to order Perciformes followed by Clupeiformes, Tetradontiformes, Pleuronectiformes, Anguilliformes, Siluriformes, Beryciformes, Mugiliformes, Scorpaeniformes, Aulopiformes, Gadiformes, Elopiformes, Beloniformes, Gonorhynchiformes, Syngnathiformes and Lophiiformes (M.P. Arulmoorthy *et al.*, 2022).

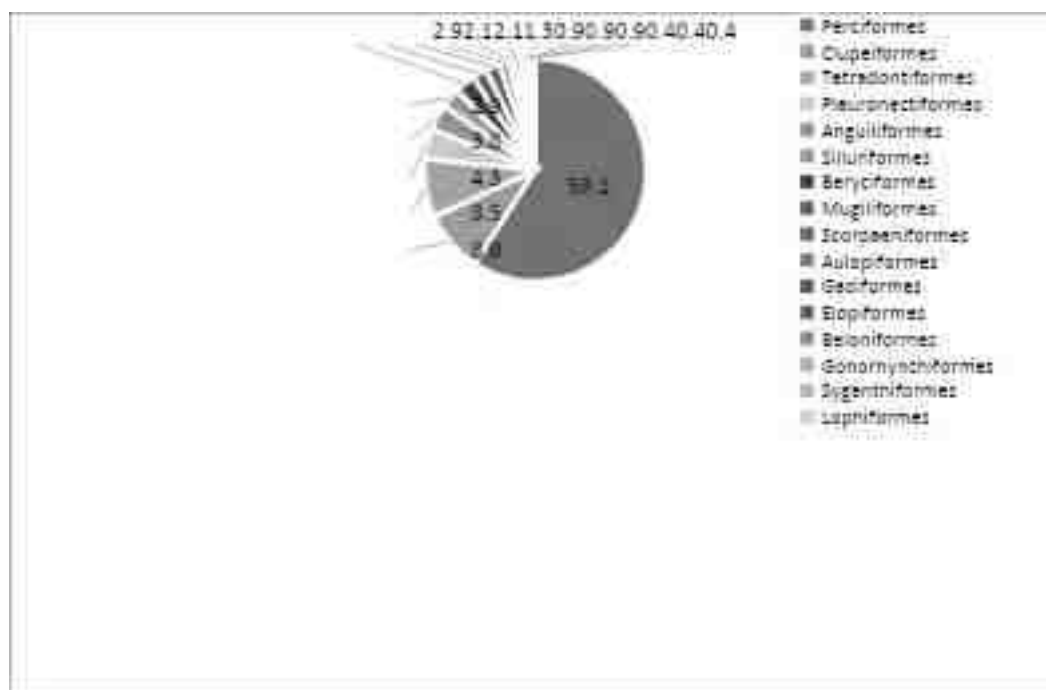


Figure 70. Group-wise marine fish production in Cuddalore district

Table 76. Village-wise profile Of fisheries in 5 km radius of project location

S. No.	Near Fishing Villages	Fishermen families	Active fishermen	Fisherfolk population	Mechanized	Motorized	Non-motorized
1	Reddiyarpettai	175	217	639	0	3	34
2	Chitiraipettai	269	291	1044	2	51	26
3	Rajapettai	462	498	1689	0	86	29
4	Thammanampettai	169	174	589	0	0	67
5	Nayakkarpettai	63	61	219	0	1	19
6	Nanjalingampettai	110	119	424	0	1	45
7	Periyakuppam	475	472	1803	0	18	83
8	Pettodai	230	231	788	0	17	20

Source: Marine fisheries census 2016, Tamil Nadu

Experimental trawl surveys: In order to assess the fishery potential of the region, exploratory and experimental fishing has to be done. Accordingly, experimental trawl fishing was conducted using a commercial mechanized stern trawler of 56 ft. in length. The area covered is adjacent to the project site and all the trawls were done at 12 to 15 m depth. Two types of bottom trawls, shrimp trawl with 10 m head-rope and cod end mesh size of 10 mm and fish trawl with 30 m head-rope with a cod end mesh size of 20 mm are available.



Figure 71. Fish Trawling Operations

Totally two hauls (fish trawl nets) were carried out on 20th February 2024 during daytime. The duration of each haul was approximately 60 minutes and the towing speed varied between 3.5 and 4.5 knots. The catch of each haul was sorted out into various groups/ species and weighed. Using the experimental trawl survey data, both biomass and density of fish stocks, were calculated following swept area method (Sparre *et.al.* 1989). This method assumes that the mean catch in weight per unit area is an index of stock abundance. The area swept by the trawl is: $\text{Area} = DW$ (km^2) where D is the distance covered by the trawl during one haul and W is the width of the path swept by the trawl. The Biomass (B) for the given area was estimated following the formula: $B = S$ (mean CPUE/Q) where S is the stratum area, CPUE is the catch per unit effort, and Q is the catch ability coefficient, which is normally taken as 0.5. Then the density of fish stock is calculated: Biomass/Area.

The location of hauls and other details are given in **Table 3.55**. The catch rate ranged from 24.4 kg/hr to 27.0 kg/hr (**Table 3.56**). Based on the experimental trawl survey from the water body, the average biomass was calculated to be 25.7 kg/h with a total estimated population density of 51.4 kg/km^2 .

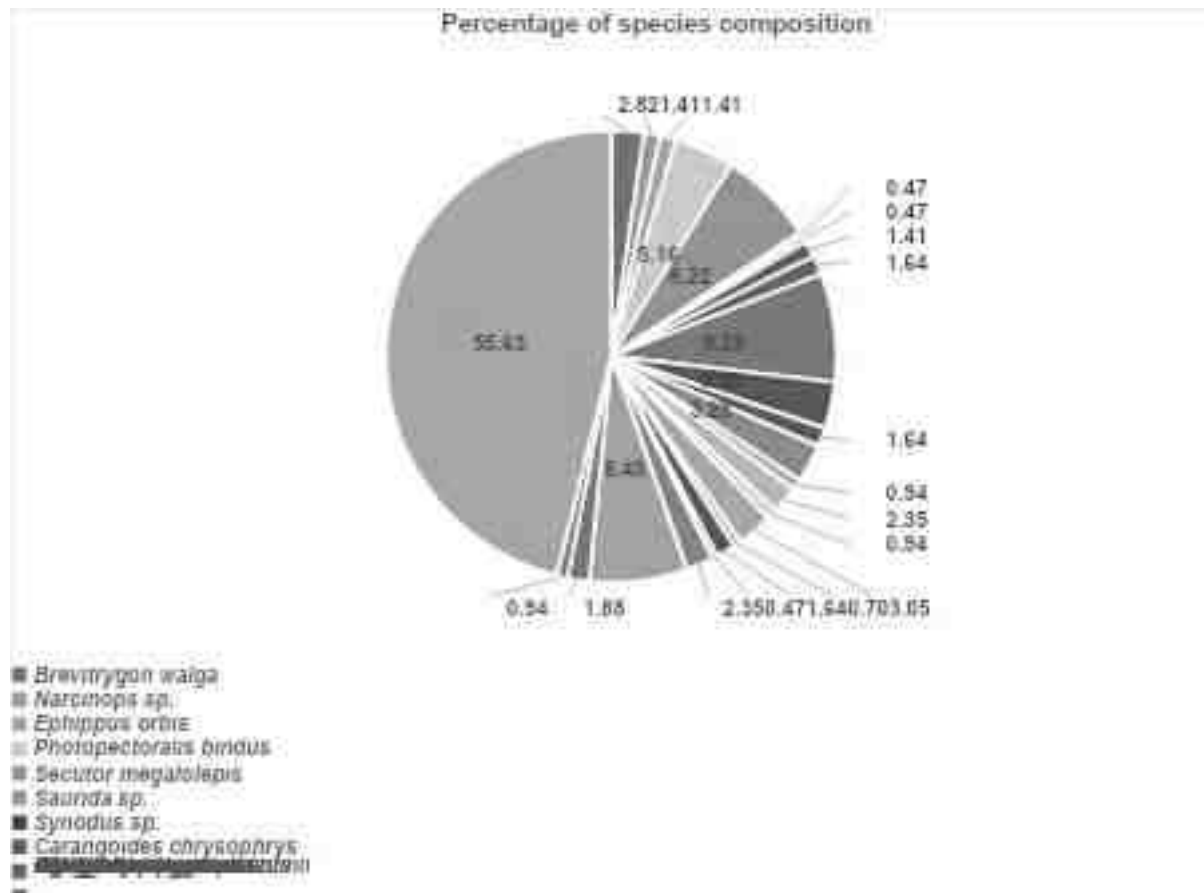


Figure 72. Species composition of total coughed fish.

During the survey, in the experimental fish trawl catches, the following species were identified. The most dominant in the two hauls was observed to be of miscellaneous groups constituting (55.63%) like dead shells of gastropods and molluscs and also some other animals. In the case of live organisms, most dominant in both hauls were *Stolephorus commersonnii* (9.39%) is common name in Tamil Nethili meen, *Squilla mantis* (8.45%) and *Secutor magalolepis* (8.22%), followed by *Photopectoralis bindus* (5.16%), *Sardinella longiceps* (3.99%), *Nemipterus japonicus*, *Lepturacanthus savala* (3.05), *Brevitrygon walga* (2.82%), *Sillago sihama* (2.35%) of the total catch. Rest of the catch was dominated by other commercially important species like *Terapon jarbua* (1.64%), *Atrubucca nibe* (1.64%), *Narcinops sp.*, (1.41%), *Ephippus orbis* (1.41%) and *Carangoides chrysophrys* (1.41%), comprising the next group of fishes contributing less than 2%. In addition, crustaceans such as *Portunus sanguinolentus*, *Charybdis cruciata* and *Penaeus merguensis* contributed 2.35%, 0.47% and 1.64%, respectively. *Loligo duvaucelii* and *Octopus sp.* of the Cephalopoda group constituted 2.82%. A set of photographs on trawling operations and groups of fishes collected are given in the following pages.

The project area was estimated based on experimental trawl survey from the water body, there are 24 fish species recorded belonging to 20 families and 23 genera with total estimated



population density in tow haul 51.4 kg /km, it has shown normal fish catching during the study of the season in the project area.

Table 77. Details of experimental bottom trawl survey

S. No.	Location of Hauls		Trawl-1	Trawl-2
1	Date		20.02.2024	20.02.2023
2	Gear		Trawl net	Trawl net
3	Starting time		8.45 am	10.30 am
4	Closing time		9.45 am	11.30 am
5	Duration of haul		1.0 hr	1.0 hr
6	Started	Latitude	11° 36'09.3"	11° 38'14.8"
		Longitude	79° 47'27.9"	79° 48'34.7"
7	Finished	Latitude	11° 38'14.8"	11° 36'09.3"
		Longitude	79° 48'34.7"	79° 47'27.9"
8	Distance (m)		4500	4500
9	Depth (m)		13	15
10	Water Temp. (°C)		27.0	27.0
11	Salinity (ppt)		34.0	34.0
12	Total catch (kg)		24.4	27



Table 78. Classification of experimental bottom trawl fishes

Phylum	Sub-Phylum	Class	Order	Family	Species	Trawl-I (kg/H)	Trawl-II (kg/H)
Chordata	Chondrichthyes	Elasmobranchii	Myliobatiformes	Dasyatidae	<i>Brevitrygon walga</i>	0.5	0.7
			Torpediniformes	Narcinidae	<i>Narcinops</i> sp.	0.3	0.3
	Osteichthyes	Teleostei	Acanthuriformes	Ephippidae	<i>Ephippus orbis</i>	0.3	0.3
				Leiognathidae	<i>Photopectoralis bindus</i>	1.0	1.2
					<i>Secutor megalolepis</i>	1.5	2.0
			Aulopiformes	Synodontidae	<i>Saurida</i> sp.	0.2	0
					<i>Synodus</i> sp.	0.1	0.1
			Carangiformes	Carangidae	<i>Carangoides chrysophrys</i>	0.5	0.1
			Centrarchiformes	Terapontidae	<i>Terapon jarbua</i>	0.5	0.2
			Clupeiformes	Engraulidae	<i>Stolephorus commersonnii</i>	2.0	2.0
				Dorosomatidae	<i>Sardinella longiceps</i>	0.5	1.2
			Eupercaria incertae sedis	Sciaenidae	<i>Atrobucca nibe</i>	0.5	0.2
				Nemipteridae	<i>Nemipterus japonicus</i>	0.5	0.9
					<i>Nemipterus virgatus</i>	0.2	0.2
			Sillaginidae	<i>Sillago sihama</i>	0.5	0.5	
Pleuronectiformes	Cynoglossidae	<i>Cynoglossus</i> sp.	0.4	0			
Scombriformes	Trichiuridae	<i>Lepturacanthus savala</i>	0.5	0.8			
Arthropoda	Crustacea	Malacostraca	Decapoda	Epialtidae	<i>Libinia</i> sp.	0.1	0.2
				Penaeidae	<i>Penaeus merguensis</i>	0.2	0.5
				Portunidae	<i>Charybdis cruciata</i>	0.2	0
					<i>Portunus sanguinolentus</i>	0.5	0.5
			Stomatopoda	Squillidae	<i>Squilla mantis</i>	1.5	2.1
Mollusca		Cephalopoda	Myopsida	Loliginidae	<i>Loligo duvaucelii</i>	0.5	0.3
			Octopoda	Octopodidae	<i>Octopus</i> sp.	0.2	0.2
Others					Miscellaneous	11.2	12.5
Total catch						24.4	27.0





Fishing activities during trawling



Highest catches
 (*Stolephorus commersonii*)



Saurida sp.



Carangoides Chrysophrys



Nemipterus japonicus



Narcinops sp.



Ephippus orbis



Terapon jarbua



Sardinella longiceps



Lepturacanthus savala



Secutor megalolepis



Leiognathus bindus



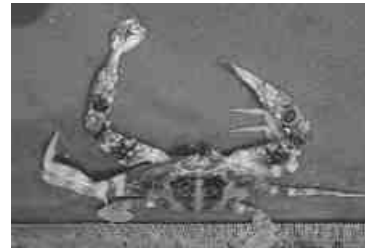
Sillago sihama



Brevitrygon walga



Octopus sp.



Charybdis cruciata

Figure 73. Economically important finfishes and shellfishes caught during experimental trawl

EIA & EMP STUDY TO OBTAIN EC AND CRZ CLEARANCE FOR UPGRADATION OF EXISTING MARINE TERMINAL FACILITIES AND PROPOSED 20
MLD DESALINATION PLANT by M/s. Chemplast Cuddalore Vinyls Limited (CCVL)



3.11.2.5.12 Ecologically Sensitive Area

Coastal zones have always been under great pressure due to high density of population, urban and industrial development along this region. In order to safeguard and manage resources along the coastal environment, the Ministry of Environment and Forests (MoEF) & Climate Change have defined the Environmental (Protection) Act 1986. According to it, observing ecologically sensitive areas within 10 km from the proposed project location is essential. Hence, in the present study demarcation of ecologically sensitive areas was made using Tamil Nadu Coastal Zone Management Plan (CZMP) (TN 85, TN 86, TN 87 & TN 88), which was prepared by National Centre for Sustainable Coastal Management (NCSCM), approved by Ministry of Environment, Forest & Climate Change and Survey of India (SOI) toposheet, Government of India.

The prepared ecological sensitive map of the study area is given in **Fig. 3.21**. The prepared map shows that within a 10 km buffer from the project location, mangroves and sand dunes are present.

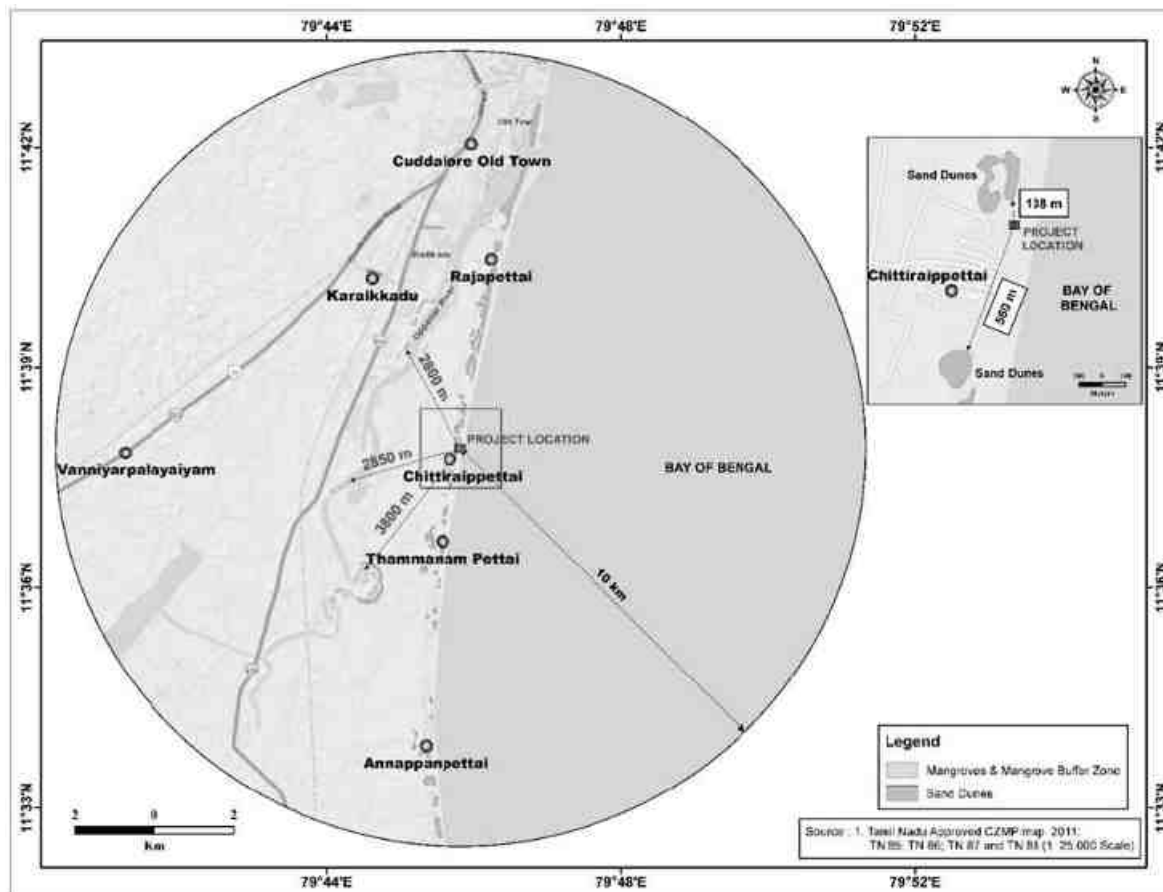


Figure 74. Ecological sensitive area map



The Sand dunes of various forms and sizes are spread along the coastal region and extend from both sides of the project area at 108 m northside and 560 m southside while patches of mangroves are distributed along the Uppanar River. The nearest mangroves are small patches of mangroves located approximately at 2.8 km northwest, 2.85 km west and 3.8 km southwest from the project site.

3.12 SOCIO-ECONOMIC ENVIRONMENT

Socio-economic had taken up around project location on the demographic structure, availability of basic amenities such as housing, education, health and medical services, occupation, water supply, sanitation, communication and power supply, prevailing diseases in the region as well as features such as places of tourist attraction and monuments of archaeological importance. The study of these parameters helps in identifying and evaluating the likely impacts due to project activity in the surrounding region. Any development activity can have direct and indirect effects, both positive and negative, on the socio-economic environment of the region.

This socioeconomic profile was conducted with a specific focus on the upgrade of the existing MTF in the SIPCOT Industrial Estate, Phase II complex. The existing MTF has been in operation for 15 years, beginning in 2009. The SIPCOT industrial park and existing CCVL business have already improved people's living conditions in the project region. Now, adding these facilities again will raise the status of the people there.

Methodology

The present study was carried out with the help of both primary and secondary sources. Primary sources involved collecting socio-economic data from a sample of individuals residing in the project site, using a questionnaire, observation methods, and small focus group discussions. The objective of these discussions was to understand the current socio-economic status of the villages and identify socio-economic issues requiring attention in the area.

The secondary sources of information about demography and occupation profile are collected from the village panchayat office, Mission Antodaya 2020, Marine Census 2016, and Census of India 2011; whereas infrastructure facilities like education, health care, public amenities are collected from Mission Antodaya 2020.

3.12.1 District profile study area

As per the 2011 census of India, Cuddalore district has a total population of approximately 26,05,914 individuals residing in about 6,33,148 households. Among them, there are 13,11,697 males and 12,94,217 females. The district spans an area of 3703 sq. km with a population density of 704 persons per sq. km. The sex ratio (females per 1000 males) stands at 987. Scheduled caste and scheduled tribe populations constitute 29.32% and 0.60% of the district, respectively. The overall literacy rate is 78.04%, with males at 85.93% and females at 70.14%. The details of the demographic for Cuddalore district is given in Table 69.



Table 79. Demographic details of Cuddalore District

Description	State (Tamil Nadu)	District (Cuddalore)
Area (in sq. km.)	130060	3703
Density of population	555	704
No. household	1,84,62,231	6,33,148
Population	7,21,47,030	26,05,914
Male	3,61,37,975	13,11,697
Female	3,60,09,055	12,94,217
Sex ratio	996	987
Literate	5,18,37,507 (80.09%)	18,15,281 (78.04%)
Male	86.77%	85.93%
Female	73.44%	70.14%
SC	20.01%	29.32%
Male	19.94%	29.27%
Female	20.09%	29.36%
ST	1.1%	0.60%
Male	1.11%	0.61%
Female	1.09%	0.60%

(Sources: District census handbook 2011)

3.12.2 Study Area

The socio-economic study will focus on villages located within a 10 km radius from the proposed project's location. In this area, there are a total of 18 revenue villages within the 10 km radius of the proposed project. Among these, 10 villages fall under Kurinjipadi and 8 villages fall under Cuddalore Tehsil in Cuddalore district, Tamil Nadu. The distance and direction of the villages from the proposed project are provided below.

Table 80. villages from proposed project

S. No.	Taluk/Block	Villages	Distance and Direction from project location
1	Kurinjiipadi	Tondamanatham	5.2 km NW
2		Tiyagavelli	3.2 km SW
3		Tiruchchepuram	4 km S
4		Kayalpattu	5.1 km N
5		Kambalimedu	4.3 km SW
6		Alappakkam	6.4 km SW
7		Andarmullippallam	7.6 km SW
8		Valudambattu	7.7 km W
9		Anukkambattu	8 km SW
10		Puvanikuppam	8.9 km SW
11	Cuddalore	Ponnaiyankuppam	6.8 km NW
12		Cuddalore Port	8 km NW
13		Annavalli	7.1 km NW
14		karaikkadu	4.4 km NW
15		Kudikkadu	3.1 km NW
16		Pachchyankuppam	6.2 km NW
17		Sedappalayam	4.4 km NW



18		Sembankuppam	2.8 km W

3.12.3 Administrative details

3.12.4 Demographic Structure

According to Mission Antyodaya 2020, the study area has a total population of 95,346, with 48,798 males (50.88%) and 46,548 females (49.17%), resulting in a sex ratio of 954 females per 1,000 males. There are 26,364 households, with an average household size of 3.6. In comparison, Census 2011 reported a population of 87,388, with 44,159 males and 43,229 females, resulting in a sex ratio of 978 females per 1,000 males. At that time, there were 21,343 households, with an average household size of approximately 4 people per household. Between Census 2011 and Mission Antyodaya 2020, significant demographic changes were observed. The total population grew by 9.1%, while the number of households increased by 23.5%, indicating a trend toward smaller family sizes or improved housing conditions. The gender ratio remained relatively balanced, suggesting minimal change in gender distribution. Table 3.18 provides the demographic profiles of the villages in the study area.

Table 81. Demographic profile in the study area

Village	Households		Total Population		Males		Females	
	2011	2020	2011	2020	2011	2020	2011	2020
Tondamanatham	1598	1678	6626	6695	3379	3400	3247	3295
Tiyagavelli	1358	1491	5250	5636	2663	2905	2587	2731
Tiruchchepuram	1039	1624	4315	4325	2175	2375	2140	1950
Kayalpattu	1010	1080	3961	3567	2016	1786	1945	1781
Kambalimedu	768	605	3110	2646	1569	1290	1541	1356
Alappakkam	395	665	1591	1972	805	1074	786	898
Andarmullippallam	835	867	3278	3300	1662	1800	1616	1500
Valudambattu	2157	2180	8900	8800	4553	4453	4347	4347
Anukkambattu	566	565	2336	2336	1168	1168	1168	1168
Puvanikuppam	1261	1057	4992	4432	2518	2219	2474	2213
Ponnaiyankuppam	480	487	1985	2001	1013	1015	972	986
Cuddalore Port	1907	1953	7911	7996	3943	3199	3968	4797
Annawali	1,39	1992	5,781	9256	2,902	4596	2,879	4660
karaikkadu	1,481	1693	6,277	6280	3,130	3132	3,147	3148
Kudikkadu	1,119	1121	4,839	4850	2,505	2515	2,334	2335
Pachchankuppam	1,893	2840	7,857	11800	3,966	7200	3,891	4600
Sedappalayam	1,333	3576	5,337	6412	2,647	3126	2,690	3286
Sembankuppam	754	890	3,042	3042	1,545	1545	1,497	1497
Total	21343	26364	87388	95346	44159	48798	43229	46548

(Source: Mission Antyodaya 2020 and Census of India, 2011)



3.12.5 Social categories

According to Census 2011, the total percentage of Scheduled caste population in the study area is 32.23%, of which 50.32% are males and 49.67% are females. The total percentage of Scheduled Tribe population in the study area is 2.28%, of which 50.71% are males and 49.28% are females.

Table 82. SC and ST population

Villages	Schedule Caste Population	Schedule Caste Male	Schedule Caste Female	Schedule Tribe Population	Schedule Tribe Male	Schedule Tribe Female
Tondamanatham	3,130	1,578	1,552	17	9	8
Tiyagavelli	1,839	954	885	1	0	1
Tiruchchepuram	1,494	745	749	0	0	0
Kayalpattu	1,199	604	595	0	0	0
Kambalimedu	3045	1538	1507	0	0	0
Alappakkam	1,234	633	601	0	0	0
Andarmullippallam	1,272	635	637	6	2	4
Valudambattu	1772	905	867	160	89	71
Anukkambattu	954	471	483	217	108	109
Puvanikuppam	3,686	1,877	1,809	27	13	14
Ponnaiyankuppam	2,373	1,168	1,205	13	8	5
Cuddalore Port	2,232	1,110	1,122	0	0	0
Annavalli	2,437	1,182	1,255	28	16	12
karaikkadu	1,081	546	535	0	0	0
Kudikkadu	13	7	6	7	4	3
Pachchyankuppam	20	11	9	99	53	46
Sedappalayam	623	318	305	467	228	239
Sembankuppam	1,180	613	567	20	9	11
Total	29584	14895	14689	1062	539	523

Sources: District handbook census 2011

3.12.6 Literacy profile

According to Census 2011, the literacy rate in the study area is 63.94%. The male literacy rate is 71.36%, and the female literacy rate is 56.34%, resulting in a gender gap of 15.02%.

Table 83. Literacy profile

Village	Total Literate	Male Literate	Female Literate
Tondamanatham	4,003	2,318	1,685
Tiyagavelli	3,056	1,753	1,303
Tiruchchepuram	2,936	1,605	1,331
Kayalpattu	2,631	1,450	1,181
Kambalimedu	2,018	1,118	900
Alappakkam	1,136	627	509
Andarmullippallam	2,148	1,206	942
Valudambattu	5978	3491	2487
Anukkambattu	1294	738	556
Puvanikuppam	3,104	1,783	1,321



Village	Total Literate	Male Literate	Female Literate
Ponnaiyankuppam	1,173	691	482
Cuddalore Port	5,194	2,856	2,338
Annavalli	3,467	2,006	1,461
Karaikkadu	4,288	2,351	1,937
Kudikkadu	3,310	1,871	1,439
Pachchyankuppam	5,162	2,838	2,324
Sedappalayam	3,109	1,751	1,358
Sembankuppam	1,807	1,029	778
Total	55814	31482	24332

Sources: District handbook census 2011

3.12.7 Economic Activity & Livelihood Pattern

The working populations in the study area are 48.16% of the total population while male workers are 64.50% and female workers are 35.50%. The work participation of the study area is given in **Table 84**.

The total working population is categorized into two types:

- Main Working Population: Individuals who work for more than six months annually.
- Marginal Working Population: Individuals who work for less than six months annually.

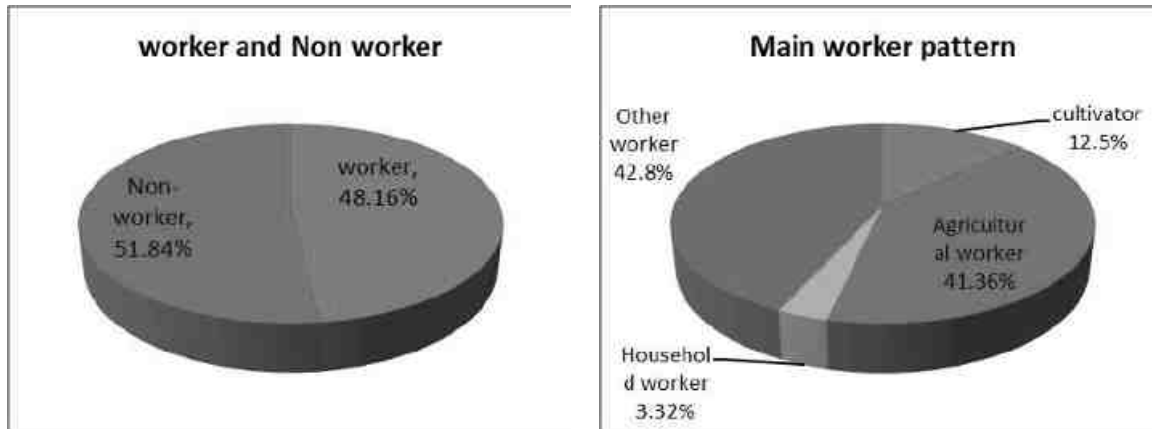
Among the workers, 63.74% are main workers, of which 73.53% are males and 26.47% are females, while 36.26% are marginal workers, of which 48.64% are males and 51.36% are females.

The main workers are further classified into four groups:

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

Among the main workers in the study area, 12.54% are cultivators, with 74.68% being males and 25.32% females. Agricultural laborers make up 41.36% of the workforce, with 61.95% males and 38.05% females. Household industrial workers account for 3.32%, comprising 58.51% males and 41.49% females. Other workers form 42.87% of the total workforce, with 85.49% males and 14.51% females. The primary occupation of most people in the study area is agriculture. About 12.54% are cultivators, while 41.36% are agricultural laborers, making up a combined total of 53.09% of the population. The distribution of the working population in the study area is shown in **Table 74**.





Worker and non worker

Main worker pattern

Table 84. Occupational profile of revenue village in the study area

Name	Total worker	Main worker	Marginal worker	Cultivator	Agriculture	Household worker	Other worker	Non worker
Tondamanatham	3,210	1,093	2,117	275	531	23	264	3416
Tiyagavelli	2467	1877	590	208	953	28	688	2783
Tiruchchepuram	1784	969	815	35	299	10	625	2531
Kayalpattu	1,732	1,158	574	169	329	11	649	2229
Kambalimedu	1,535	985	550	19	722	9	235	1575
Alappakkam	935	562	373	135	281	17	129	656
Andarmullippallam	1524	880	644	230	376	12	262	1754
Valudambattu	4143	2697	1446	472	1085	225	915	4757
Anukkambattu	1397	1286	111	526	723	7	30	939
Puvanikuppam	2580	2,077	503	36	1,692	25	324	2412
Ponnaiyankuppam	859	274	585	24	31	12	207	1,126
Cuddalore Port	2,868	2,104	764	73	462	60	1,509	5,043
Annavalli	2,913	2,056	857	546	1,088	60	362	2,868
karaikkadu	2,829	1,525	1,304	147	549	99	730	3,448
Kudikkadu	1,855	1,499	356	20	246	18	1,215	2,984
Pachchyankuppam	3,258	2,024	1,234	38	236	161	1,589	4,599
Sedappalayam	2,375	1251	1124	99	441	31	680	2962
Sembankuppam	1,371	948	423	116	406	9	417	1671
Total	39635	25265	14370	3168	10450	817	10830	47753

Sources: District handbook census 2011

Agriculture



Agriculture provides a major source of income to the population of the study area. The district primarily focuses on agriculture, with a total cultivable area of 296,787 hectares. Major crops include Paddy, Groundnut, Gingelly, Sugarcane, and Blackgram. According to the 2011 Census, 12.54 percent of workers are cultivators, and 41.36 percent are agricultural labourers, making the total percentage of people involved in agricultural activities 53.09 percent. Paddy is the most commonly cultivated crop, with Kuruvai, Samba, and Navarai being the popular seasons. The majority of people in the area are engaged in agricultural activities.

Livestock

The animal husbandry sector is important for rural welfare. Many farmers use it to add to their farm income. Livestock provides food like milk, meat, and eggs, and materials like wool, hides, and manure. Animals are valuable assets that can be sold in need. Livestock and livelihoods are closely connected in rural households. With over 50% of the population living in villages, the livestock sector plays a key role in creating rural jobs and increasing the income of small farmers and landless workers.

Fisheries

Fishing is an important occupation in this coastal area, where the villages are primarily inhabited by fishing communities. Details about the fishing villages and hamlets in the study area are provided in the table below. According to the Tamil Nadu Marine Fisheries (2016), there are twelve registered fishing villages within a 10 km radius, home to 4,842 fishing families and a total population of 16,100, with a sex ratio of 925 which is notably lower than the sex ratio of the non-fishing population in the area (1,031). 4796 are identified as Below Poverty Line (BPL) families, making up 99.04% of the total and highlighting the significant economic challenges faced by these fishing communities.

Among fishing families, 89% of marine fishermen live in pukka houses. About 25% do not have toilet facilities within the same roof, and all families have electricity. Most marine fishermen families (63%) rely on tap water as their source of drinking water. The remaining families use wells, hand pumps, bore wells, and other sources.

Table 85. Fisheries Family

Fishing village	Fishermen families	Traditional fishermen families	BPL families	Fisherfolk population
Reddiyar Pettai	175	175	175	581
Thammanam Pettai	169	169	169	584
Nanjalingam Pettai	110	110	110	391
Nayakkar Pettai	63	63	63	193
Periyakuppam	475	475	475	1684
Pettodai	230	229	215	716
Chitirai pettai	269	269	269	1044
Rajapettai	462	445	462	1689



Fishing village	Fishermen families	Traditional fishermen families	BPL families	Fisherfolk population
Akkairaikori	765	765	764	2330
Annappanpettai	230	230	230	705
Singarathoppu	1069	1,069	1,039	3499
Sonankuppam	825	825	825	2684
Total	4842	4824	4796	16100

(Source: Tamil Nadu Marine Fisheries 2016)

Among 5345 active fisher folk, the full time and part time actual fishermen are 5086 and 259 respectively and the rest are engaged in fish seed collection. There are 1857 fishermen engaged in various fishing allied activities such as marketing of fish (48.51%), repairing/making nets (10.14%), curing/ processing (4.95%), peeling (0.17%), labourer (17.08%) and other fishing related activities (19.12%). Among the total fisher folk engaged in fishing allied activities, 73.53% are females. Women dominate in almost all areas of fishing allied activities such as marketing of fish, curing/processing and other related work. Etc. The details of Fishermen fishing Activities are given in the table below.

Table 86. Fishermen fishing Activities

Fishing village	Marketing of fish		Making/ Repairing Net		Curing/ Processing		Peeling		Labourer		Others	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Reddiyar Pettai	0	67	0	0	0	0	0	0	0	0	3	1
Thammanam Pettai	0	0	0	0	0	0	0	0	0	0	0	0
Nanjalingam Pettai	0	0	9	0	0	0	0	0	0	0	0	2
Nayakkar Pettai	2	43	0	0	0	0	0	0	0	0	0	
Periyakuppam	5	296	0	7	0	62	5	0	79	53	11	2
Pettodai	0	40	9	0	0	13	1	0	70	1	1	0
Chitirai pettai	2	51	23	1	0	1	0	0	55	0	0	0
Rajapettai	2	55	0	0	0	0	0	0	35	0	0	0
Akkairaikori	0	44	0	0	0	0	0	0	0	0	0	274
Annappanpettai	1	92	51	1	0	9	0	0	0	0	0	0
Singarathoppu	0	0	11	0	0	0	0	0	0	0	0	10
Sonankuppam	0	132	86	0	0	0	0	0	0	0	0	24
Total	12	820	189	9	0	85	6	0	239	54	15	313



(Source: Tamil Nadu Marine Fisheries 2016)

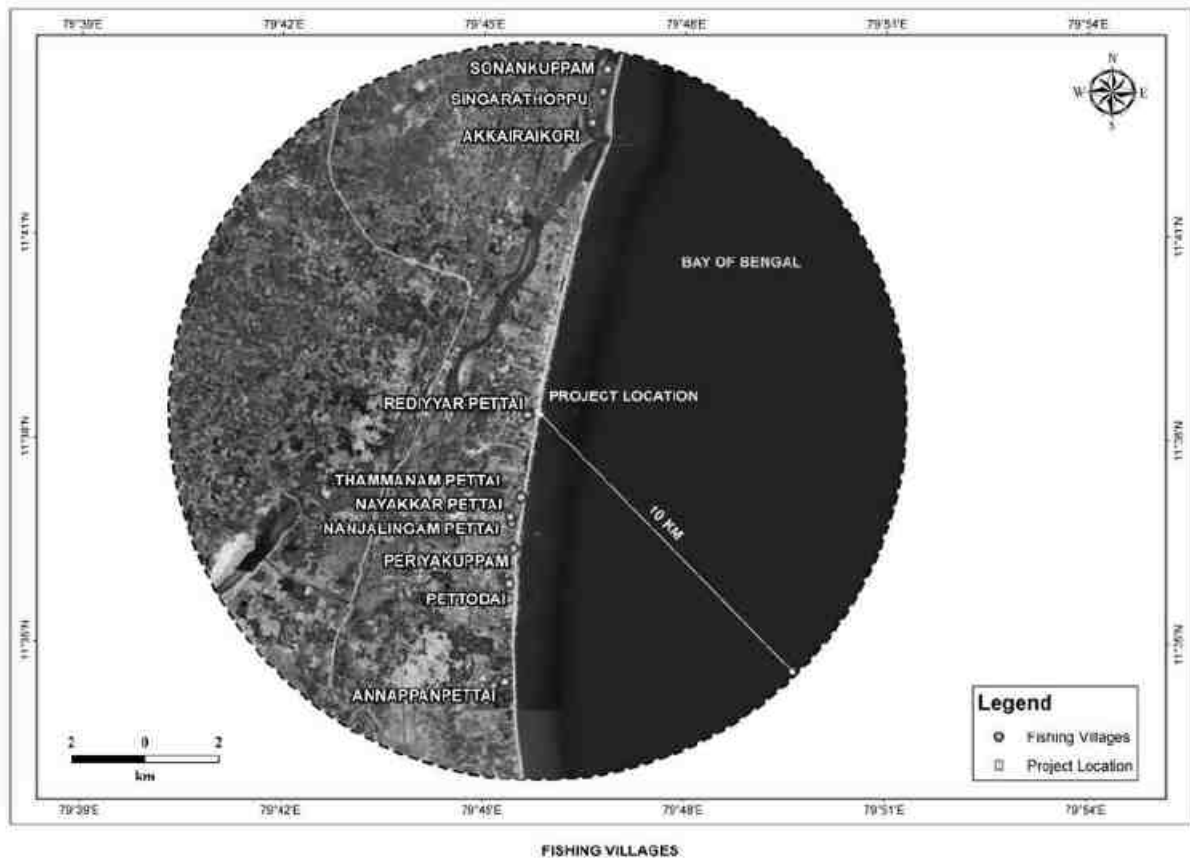


Figure 75. Location of fishing villages

Industries

The study area hosts several key industries that significantly boost the local economy. Major chemical plants include Arkema Peroxides India Pvt. Ltd., Covestro (India) Pvt. Ltd., Tata Chemicals, and Clariant Chemicals Ltd. Additionally, Chemplast Cuddalore Vinyls Limited contributes to the PVC sector. Manufacturing is supported by TANFAC Industries Ltd. and Amcor Flexibles India Pvt. Ltd., while Thangamman Textile Pvt. Ltd. and MRC Mills Private Limited represent the textile industry. These industries create employment opportunities, enhance skill development, and attract further investment, fostering sustainable economic growth in the region.

Cuddalore also hosts heavy chemical, pharmaceutical, and energy industries within SIPCOT, an industrial estate established by the state government. The National Thermal Power Corporation (NTPC) and Tamil Nadu Electricity Board (TNEB) plan to commence power plants around the town, further contributing to the region's industrial landscape.

Basic Amenities & Infrastructure



The availability of basic facilities in the villages of the study area is collected based on the Mission Antyodaya 2020 report. These facilities, like education, healthcare, water, electricity, roads, and financial services, are important for understanding rural development and quality of life. The details village wise facilities given in below

Health/Medical Facilities:

According to Mission Antyodaya 2020, there is one village, Annavalli, with a Community Health Center (CHC) available. Other villages in the study area access medical services within a range of 5 to 10 km. Additionally, there are four villages with Primary Health Centers (PHCs): Kayalpattu, Annavalli, Karaikkadu, and Sembankuppam. Only three villages—Tiyagavelli, Alappakkam, and Pachchyankuppam—have Primary Health Sub-Centers (PHSCs). For government dispensaries, villagers must travel 5 to 10 kilometers. In case of emergency medical care, residents depend on Cuddalore town and district hospitals, all of which are more than 10 km away from the villages. Veterinary hospitals are not available within the villages, and access varies, with most located within 5 to 10 kilometers.

Table 87. Medical facilities

Village	Community Health Centre	Primary Health Center	Primary Health Sub Center	Dispensary	Veterinary hospital
Tondamanatham	No	No	No	No	No
Tiyagavelli	No	No	Yes	No	No
Tiruchchepuram	No	No	No	No	No
Kayalpattu	No	Yes	No	No	No
Alappakkam	No	No	Yes	Yes	No
Andarmullippallam	No	No	No	No	No
Valudambattu	No	No	No	Yes	No
Anukkambattu	No	No	No	Yes	No
Puvanikuppam	No	No	No	No	No
Cuddalore Port	No	No	No	Yes	No
Annavalli	Yes	Yes	No	Yes	No
karaikkadu	No	Yes	No	No	No
Kudikkadu	No	No	No	Yes	No
Pachchyankuppam	No	No	Yes	No	No
Sedappalayam	No	No	No	No	No
Sembankuppam	No	Yes	No	Yes	No

(Source: Mission Antyodaya 2020)

Educational Facilities:

As shown in Table 3.25, all the villages in the 10 km radius in the study area have Anganwadi centers and primary schools. Middle schools are present in 13 villages, while high schools are available in 10 villages. Higher secondary schools are found in four villages: Andarmullippallam, Valudambattu, Annavalli, and Karaikkadu. Degree colleges are available only in Alappakkam



within the study area. Additionally, vocational or ITI institutes are present in four villages: Kayalpattu, Kambalimedu, Alappakkam, and Karaikkadu.

Table 88. Education facilities

Village	Anganwadi centre	Primary school	Middle school	High school	Higher secondary school	Degree collage	Vocational education centre (ITI)
Tondamanatham	Yes	Yes	Yes	Yes	No	No	No
Tiyagavelli	Yes	No	Yes	No	No	No	No
Tiruchchepuram	Yes	No	No	No	No	No	No
Kayalpattu	Yes	Yes	Yes	Yes	No	No	Yes
Alappakkam	Yes	Yes (2)	Yes (2)	Yes	No	Yes	Yes
Andarmullippallam	Yes	Yes	Yes	Yes	Yes	No	No
Valudambattu	Yes	Yes	Yes	Yes	Yes	No	No
Anukkambattu	Yes	Yes	No	No	No	No	No
Puvanikuppam	Yes	Yes	Yes	No	No	No	No
Cuddalore Port	Yes	Yes	Yes	No	No	No	No
Annavalli	Yes	No	No	Yes	Yes	No	No
karaikkadu	Yes	Yes	Yes	Yes	Yes	No	Yes
Kudikkadu	Yes	Yes	No	Yes	No	No	No
Pachchyankuppam	Yes	Yes (2)	Yes	Yes	No	No	No
Sedappalayam	Yes	Yes	No	Yes	No	No	No
Sembankuppam	Yes	Yes	Yes	No	No	No	No

(Source: Mission Antyodaya 2020)

Electricity

All the villages in the study area have electricity facilities for domestic uses, and villages like Kayalpattu, Annavalli, karaikkadu, Pachchyankuppam, and Sembankuppam have electricity facilities for commercial use. Most villages have electricity supply for more than 12 hours a day.

Drinking water facilities

Referring to **Table 2.26** All villages in the study area have access to drinking water facilities through tap water, except Sembankuppam where only 50% of habitations have tap water connections. While tap water is the primary source of drinking water in the study area, hand pumps and tube wells/boreholes are also utilized in most villages.

Transport and communication

All villages have roads usable in any weather, with most also served by bus routes, while Cuddalore city boasts four railway stations, connects to major cities via National Highway 32, and offers local bus and mini-bus services, with the nearest airport in Pondicherry and international airport in Chennai,



The town has several post offices providing essential postal services, as well as public call offices and internet cafes for additional connectivity. This infrastructure supports both personal and professional communication needs, contributing to the region's development. alongside reliable mobile and internet connectivity.

Banking service

The provided data indicates that only six villages have a bank within their boundaries. For the remaining villages, the nearest banking facilities are located within a distance range of 2.5 kilometres to 5-10 kilometres. This limited access to banking services can pose challenges for financial inclusion and economic development in these rural areas.

Tourism and Important place

- **Fort St. David:** Fort St. David, now in ruins, was a British fort near Cuddalore, located 11 km from the project site.
- **Silver Beach:** Silver Beach, located 2 km from Cuddalore town, is the second-longest beach on the Coromandel Coast and one of the longest in Asia, stretching 57 km.
- **Samiyarpettai Beach:** Located near Samiyarpettai village on the Coromandel Coast, this beach is home to the famous Shri Pinnai Vazhi Amman Temple. The beach has become a popular holiday spot, attracting growing crowds.

Table 89. Infrastructure facilities

Village	Bank	All weather road	Public transport	Railway station	CSC	Electricity	Electricity Supply MSME Units	Market	Piped tap water	Post office
Tondamanatham	No	Yes	Not available	No	No	>12 hrs	No	No	100% habitations covered	Yes
Tiyagavelli	No	No	Bus	No	No	>12 hrs	No	No	100% habitations covered	Yes
Tiruchchepuram	No	No	No	No	Yes	>12 hrs	No	No	Not covered	No
Kayalpattu	No	Yes	Bus	No	Yes	>12 hrs	Yes	No	100% habitations covered	Yes
Alappakkam	Yes	Yes	Bus	Yes	No	>12 hrs	No	No	100% habitations covered	Yes
Andarmullippallam	No	Yes	Bus	No	No	>12 hrs	No	No	100% habitations covered	Yes
Valudambattu	Yes	Yes	Bus	No	Yes	>12 hrs	No	Weekly haat	100% habitations covered	Yes



Village	Bank	All weather road	Public transport	Railway station	CSC	Electricity	Electricity Supply MSME Units	Market	Piped tap water	Post office
Anukkambattu	No	Yes	Auto	No	Yes	>12 hrs	No	No	100% habitations covered	No
Puvanikuppam	No	Yes	Bus	No	No	>12 hrs	No	No	100% habitations covered	Yes
Cuddalore Port	No	Yes	Auto	No	Yes	>12 hrs	No	No	100% habitations covered	No
Annavalli	No	Yes	Bus	No	Yes	>12 hrs	Yes	No	100% habitations covered	Yes
karaikkadu	Yes	Yes	Bus	Yes	Yes	>12 hrs	Yes	No	100% habitations covered	No
Kudikkadu	No	Yes	Bus	No	Yes	>12 hrs	No	No	100% habitations covered	Yes
Pachchyankuppam	Yes	Yes	Bus	No	Yes	>12 hrs	Yes	No	100% habitations covered	Yes
Sedappalayam	No	Yes	Bus	No	Yes	>12 hrs	Yes	No	100% habitations covered	Yes
Sembankuppam	No	Yes	Bus	No	Yes	>12 hrs	Yes	No	50% habitations covered	Yes

(Source: Mission Antyodaya 2020)

Major key finding & outcome

The total population showed a growth of 9.1% over nine years. The number of households grew by 23.5%, which is higher than the population growth, indicating a trend toward smaller families or better housing access. The male population grew by 10.5%, while the female population grew by 7.7%, maintaining a relatively balanced gender ratio. The average household size decreased from 4.1 persons in 2011 to 3.6 persons in 2020, reflecting a shift to smaller families due to societal or economic changes. These changes were driven by the presence of the SIPCOT (State Industries Promotion Corporation of Tamil Nadu) industrial area, which attracts workers and their families due to employment opportunities, leading to migration from surrounding rural and urban areas.

The overall literacy rate of 63.94%, with a notable gap between male and female literacy rates, highlights the need for targeted educational resources, especially for women. Educational facilities are available but limited in higher secondary and vocational training, suggesting a potential area for further development.



Agriculture remains the primary occupation, accounting for over half of the total working population. Employment opportunities in agriculture and local industries are crucial for sustaining livelihoods. With most households dependent on agriculture, the sector is central to the local economy. Paddy, groundnut, gingelly, and sugarcane are key crops, while livestock serves as an important income supplement for small and marginal farmers, further supporting rural employment and income stability. The presence of chemical, textile, and energy industries in the region adds economic diversity and generates local employment.

Coastal villages are largely dependent on fishing, with 99.04% of fishing families falling below the poverty line. Though fishing remains a primary livelihood, infrastructure for fishing communities such as better housing and sanitation could improve living conditions.

Most have basic amenities like electricity, all-weather roads, and piped water, but significant gaps remain in services such as banking, higher education, and vocational training. While primary education is widely accessible, access to higher secondary schools and beyond is limited in many areas. Enhancing financial services, transportation, and access to higher education is crucial for improving the quality of life and promoting socio-economic development in these rural communities.

Conclusion

The demographic details, including literacy rate, and working population, are based on the 2011 Census of India, which is updated every ten years. Current figures are expected to exceed those of 2011. The proposed project will not involve any land acquisition in the study area. It is expected to generate employment opportunities during construction, operation, and maintenance phases, benefiting local residents and boosting the economy of nearby communities. Existing industrial and commercial activities have already improved living standards in the region, and the proposed upgrade aims to further enhance socio-economic conditions.

Socio economic impacts

Positive impacts

The existing industrial and commercial activities have already improved living conditions in the region, and the proposed upgrade is expected to further enhance socio-economic status.

The upgraded MTF could create direct and indirect employment opportunities for local residents.

The project may necessitate improvements in local infrastructure, such as roads and utilities, benefiting the surrounding communities.

Negative impacts

Construction activities may temporarily disrupt local communities and fishermen.





Figure 76. Socio Economic Study

4. ANTICIPATED IMPACTS AND MITIGATION MEASURES

CCVL had set up Marine Terminal Facilities (MTF) to support the PVC manufacturing facility. In September 2009, CCVL started to operate PVC plant at cuddalore. The proposed project is only upgradation of existing facilities to improve safety in case of emergency and approach to the Jetty for normal operation, it intends to upgrade the existing MTF for berthing larger Ethylene or EDC vessels up to 38500 DWT from 20000 DWT and to satisfy the water requirement CCVL proposed 20 MLD desalination plant. Details of existing and proposed facilities are given in Chapter 2.

The expansion and operation of the proposed MTF comprises of various activities each of which will have minimal impact on the terrestrial and marine environment. The anticipated impacts and mitigation measure due to the project activities during construction and operation phases are discussed here.

The expansion activities planned includes construction of trestle, expansion of Marine Terminal Facilities, crossover bridge over Uppanarri river creek, construction of 20 MLD desalination plant, and construction of intake and outfall pipeline for desalination plant.

Similarly, the major activities on the terrestrial environment will include movement of men and material needed for all construction related activities. Post completion of all construction works, the operational phase impacts are anticipated due to vessel movement and cargo handling and transportation of VCM.

Besides its own impact, MTF development is often accompanied by other activities such as dredging, construction of additional facilities and laying of pipelines. These activities can add to the influence on environment impacts.

Hence it is important to factor in these impacts and develop a holistic mitigation plan for this expansion of MTF.

4.1 IDENTIFICATION OF IMPACTS

Impacts are identified for both the construction phase and operation phase.

Having identified the various impacts, it is important to mitigate the impacts by suitable measures. Sustainable Development of MTF is the key when preparing the mitigation plan.



Sustainable development is a development that meets the need of the present without compromising the ability of future generations to meet their own need."

World Commission on Environment and Development, 1987, p. 8

The sustainable development of MTF projects is the integration of three key elements:

- Economic,
- Environmental and
- Social aspects.

Table 90. Impacts of marine terminal facilities

Environmental Aspect	Type of Impact	Construction Phase	Operation Phase
Water Quality	Increased turbidity Increase in BOD/COD Change in pH, Salinity, TDS Increase in micro plastics load Increase in salinity and heavy metal concentration Increase in Hydrocarbons, Oil and grease loads Contamination with e-coli and health impacting microbes Not meeting drinking water standards	Dredging activities Dredge spoil disposal Surface runoff during earth works Pile driving activities Garbage and Sewage contamination Clearing of local vegetation for development works. Wind / Dust movement	Rainfall runoff from open storage yards Maintenance dredging activities Waste and effluent disposal from Marine spread using the port Bilge and ballast water from ships Anti-fouling paints from ships bottom Improper handling of sewage and garbage from ships VCM transfer operations Hazardous Cargo operations
Air Quality	Deterioration in ambient air quality due to increased concentration of NO _x , SO _x , PM ₁₀ , PM _{2.5} etc. directly affecting the health of Living organisms	Emission from transport equipment moving men and material to site Emission from various construction activities at construction location Use of Generators, Earth Moving Machinery, Tipper	Emissions from ships and marine spread during unloading operations Emissions from trucks and other cargo handling equipment related to cargo handling and movement.

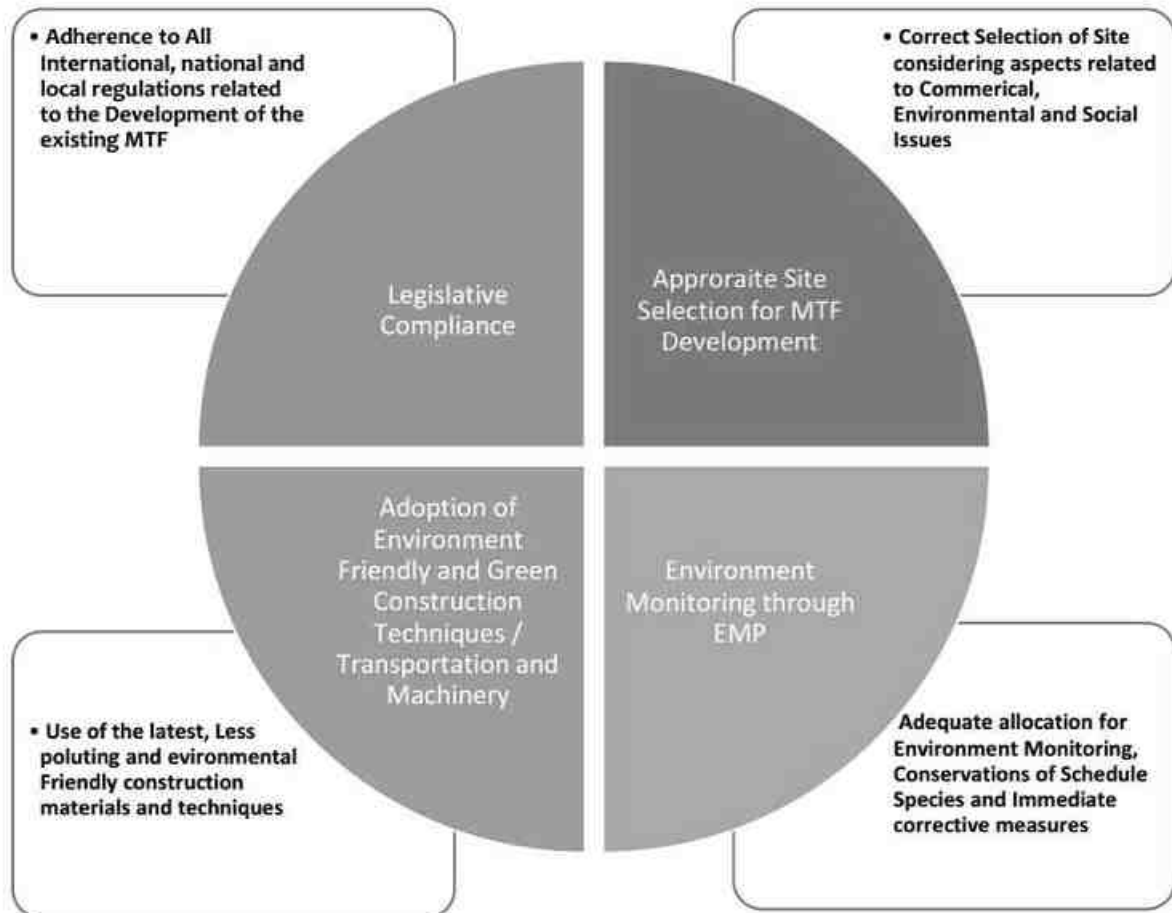


Environmental Aspect	Type of Impact	Construction Phase	Operation Phase
		Lorries, Cranes, JCBs etc. for various construction and earth moving activities. Odours related to use of fuel - during storage and use.	Volatile organic compounds associated with handling, storage and transfer of Hydrocarbons.
Noise Pollution and Vibration	Increased noise and vibration (continuous or variable) above a certain threshold value can impact the marine and terrestrial Fauna by affecting their ability to communicate, breed and find sources of food.	Vehicular traffic movement Alarms, Sirens, Power generating equipment Pile driving activities Dredging and reclamation activities	Marine traffic movement of ships Operation of Cranes, dumpers for cargo handling and other heavy equipment Maintenance dredging activities Vehicular traffic for cargo movement
Soil Pollution	Deterioration in soil quality due to contamination and loss of productive fertile soil. Change in basic soil characteristics leading to land use change.	Dredging activities Land Reclamation from dredge spoils. Surface runoff during earthworks Garbage and Sewage contamination Plastic contamination Clearing of trees and vegetation if any Wind / Dust movement Leaks and improper disposal of oil fuel and hydrocarbons	Rainfall runoff from open storage yards Maintenance dredging activities Improper storage / handling of waste and effluents Leaks and spills from tank farms and pipelines Leeching of wastes and hazardous substances stored in MTF premises
Light Pollution	Introduction of artificial lighting has effects on terrestrial and marine Fauna that depend only on natural light for biological movement.	Setting up of temporary lighting at nighttime for construction related activities	Establishment of permanent lighting for berths, jetties, marine facilities, conveyors, road and railway lines



Environmental Aspect	Type of Impact	Construction Phase	Operation Phase
			Increased lighting from offshore ship and marine vessel movement
Coastal Processes and Hydrological Impacts	Change in sedimentation and siltation patterns Impact on tidal exchange and flow Chocking of inland drainage during rainy seasons leading to flooding and hydrological impacts Barrier to movement of species that use the natural habitats to switch between marine and terrestrial water environments for breeding and feeding	Construction of Marine Structures Improper dumping of construction waste materials Improper dredge disposal locations Incorrect land levelling and reclamation techniques Building of guide bund	Improper dredge disposal locations during maintenance dredging Development of new infrastructure that affects the natural creeks and estuarine openings on the coast
Ecosystem impacts and introduction of external invasive species that will overpower the local species	Direct impact on exiting terrestrial and marine fauna leading to fatality New species can become predatory in nature and wipe out local species	Dredging Trestle construction Change in land use	Marine bio fouling from ship bottoms Underwater hull cleaning activities Ballast water with new invasive species
Fisheries	Impact on fish catch Disturbance to seasonal catch due to altered marine environmental conditions	Turbidity induced by dredging, reclamation and construction of berths Vibration and Noise from Pile driving and stone dumping during marine construction	

4.2 DEVELOPMENT OF THE MARINE TERMINAL FACILITIES



Mitigation Plan for expansion of MTF will rest on the above four important factors as represented in the figure above. The entire development of the CCVL infrastructure at every stage has to be guided by the principles encapsulated in the above points.

This will ensure that the impacts identified earlier are suitably mitigated. If any of the aspects above are not followed correctly then the possibility and risk of increasing the negative impacts to environment and personnel will be high.

4.2.1 Legislative Compliance

The various clearances required for the proposed project such as EC and CRZ Clearance are mentioned in the Chapter 1.



In addition to the clearance obtained from MoEFCC and TNCZMA. The project proponent must follow all the rules and regulations as prescribed by various statutory bodies and acts and laws passed for the protection of the environment from time to time by both the state and central government.

In addition to these various other legislative impacts will arise from time to time due to the varied nature of the cargo being handled and the fact that shipping is by default a global industry which comes with its own set of international regulations that will be applicable to both the ships and ports accommodating them.

Some of the other legislations that will be applicable to the development and operation of the jetty are mentioned here for a guidance.

International Regulations (India having given acceptance or through tacit acceptance)

- ❖ Marpol Regulations (Marine Pollution Prevention Regulations)
- ❖ Pollution from Oil, Chemical, Dangerous Goods, Sewage, Garbage, Emissions from Ships, Ballast water of Ships, Anti Fouling Coating on ships, Green Passport for Ship recycling etc.
- ❖ Solas regulations (Safety of Life at Sea)
- ❖ Aspects on Construction, Fire Safety, Safety of Crew, Emergency requirements, Collision Prevention requirements, Communication Requirements etc.
- ❖ UNCLOS (UN Convention on the law of Seas)

National Regulations

- ❖ The Offshore Areas Minerals (Development and Regulation) Act, 2002.
- ❖ Merchant Shipping, Act 1958 – amended from time to time.
- ❖ The Manufacture, Storage and Import of Hazardous Chemicals Rules, Act 1989.

4.2.2 Adoption of environment friendly methods

The major impacts in the upgradation of MTF will have significant Impact on the Environment are identified as follows:

- ❖ Dredging and disposal of dredge materials
- ❖ Expansion of existing MTF
- ❖ Construction of crossover bridge
- ❖ Construction of approach trestle from LFP to jetty
- ❖ Laying of pipelines



- ❖ Vehicular traffic Associated with the movement of Construction Material needed for expansion of the Marine Terminal

These aspects are addressed in detail in this chapter.

CCVL Terminals already have an Environment Monitoring Cell as a requirement of the EIA Notification, 2006. Responsible officer will be tasked with the role of planning the execution of the work with the contractor and ensure that he/she will implement the most environment friendly construction techniques as feasible for the proposed expansion.

4.2.3 Continuous environment monitoring through EMP

The EMP details are provided in the Chapter 10. The Project Proponent already have a separate Environment Cell with adequately staffs to manage the environmental problems same will be enhanced and funded for the proposed expansion. The Project Proponent will continue the monitoring of changes in the Terrestrial and Marine Environment during the Construction and Operation of the MTF.

The baseline data provided and established in the EIA report must be used as reference to detect any changes in the quality of the Environmental parameters and prompt remedial actions must be initiated to avoid any environmental deterioration.



4.3 IMPACTS AND MITIGATION MEASURES FOR TERRESTRIAL ENVIRONMENT



4.3.1 Air environment

Construction phase: Potential impact to air quality during construction phase is associated with dust generation and gaseous emission from activities such as site clearing, earthwork, foundation work, material transport and onsite vehicle operation. Gaseous emission from construction equipment's, DG set, dredger and material transport vehicles are anticipated.

Dust fall resulting from construction activity may be locally problematic to the workers during the worst conditions but is unlikely to affect any offsite receptors. Exhaust emissions will disperse quickly and seldom in range of any human receptors. Dust and gaseous emission resulting from construction is unlikely to travel to nearest habitation and hence offsite receptors are safe. However, dust fall on ecologically sensitive areas like



mangroves near to project site are area of concern and should be protected with suggested mitigation measures.

Hence, impact on human receptors due to construction activities will not be significant. However, the airborne dust particles shall be managed through suggested mitigation measures to prevent impacts on nearby marine habitat especially mangroves.

Operation phase: Dust generation due to port operations are expected from handling and transportation of cargoes and gaseous emissions from emergency DG sets operations, vehicle movement and vessel traffic.

Mitigation Measures

Construction Phase:

Pollution from vehicular transport

- Improving the existing traffic management Plan to cater to continuous movement of Vehicular traffic to the Marine terminal
- Vehicles entering the port area shall be checked for valid PUC and shall have capability to carry raw materials in a covered form.
- Engines and exhaust systems of all vehicles and equipment shall be maintained to keep the exhaust emission under statutory limits.
- The trucks carrying the construction materials in powder form must be covered with Tarpaulin covers.
- Material transport must be planned during non-peak hours.
- Adequate traffic arrangements and infrastructure to be developed for the routes to ensure that they can transport heavy loads.
- Sufficient Parking Facilities to be developed to ensure that they do not disturb the existing road routes within the project area.

Pollution from construction related activities

- Construction activities should be kept on hold during high wind period say while > 25 mph.
- DG set used during construction phase shall conform to the noise and air emission norms prescribed by CPCB.
- The raw materials used in construction must be covered with Tarpaulin/PP sheets to reduce dust emission.
- No waste materials should be burnt.



- Greenbelt plantations should be done prior to the commencement of construction.
- Operation phase: The Desalination plant may generate emissions from power usage, contributing to greenhouse gases and local air pollution. As well as transfer of VCM can also leads to emission of VOC's due to incomplete sealing.
- Existing dust suppression system has to be provided for the proposed expansions.
- Water sprinkler system covering the stack yard and wharf shall be provided. Water sprinkling after the event of commodities loading/unloading shall be ensured.
- Continuous monitoring of air quality should be done and displayed.
- The use of renewable energy sources, such as solar panels, is likely to reduce carbon emissions.
- Development of green belt surrounding the port area shall be ensured.
- Compliance with Tamil Nadu Pollution Control Board guidelines on handling, storage and transport of commodities shall be ensured.
- Periodic water sprinkling in high dust areas inside the port to be carried out.
- Vehicle with valid PUC certificate shall only be allowed inside the site for operations.
- Detailed vehicle/ Truck management plan shall be developed, and its recommendations shall be strictly adhered to minimize impact due to material transport.
- Use of closed transfer systems, venting systems, or vapor recovery units can reduce the emissions of harmful pollutants during the handling of vinyl monomers.
- Fugitive work emission in the work area (MTF, desalination plants, trestle, bridge, etc.) shall be monitored. Emission shall confirm to the standards prescribed by authorities such as Directorate of Industrial Health and Safety.
- Adequate stack height for DG set as per CPCB norms shall be provided.

From the Risk Point of View and from the Environment Mitigation Aspect the following Precautions to be followed for commodities in the MTF:

- Never allow different grades of commodities to be stacked together.
- The piling of commodities height to be limited at 5 m.
- Inert Gas system should be provided in Storage yard for safety as per engineering feasibility.
- Water mist system must be activated when ambient temp exceeds 43°C (this will minimise spontaneous ignition) This option or other relevant safety measures as per engineering Feasibility to be implemented.
- As a rule, First Come First go system should be followed for coal storage.



- For delay in dispatch beyond 7 days, coal layer needs to be turned over to dissipate accumulated gases and dissipation of self-generated heat.
- Fire Hydrant system must be checked and kept operationally ready.

CCVL Terminals is currently implementing optimal mitigation strategies to manage the air pollution impact. Following the existing mitigation measures will for the proposed expansion will help to reduce the impact due to the proposed expansion.

4.3.2 Noise environment

Construction phase: The anticipated impacts on ambient noise quality due to construction phase are expected from use of construction equipment, vehicle movement, running machinery etc. The impacts can be minimized by selecting proper equipment, proper maintenance of vehicles and lubrication of equipment and machineries. The construction activities such as transportation of raw materials for civil works, construction machinery, DG sets are likely to cause increase in the ambient noise levels.

Noise generated will be localized, short term and reversible in nature. However, PPEs shall be provided to workers (for noise > 85 dB) and good construction practice shall be followed to minimize disturbance to marine and terrestrial habitat.

The equipment likely to be used during the construction phase and their typical noise range is given below.

Equipment/vehicle*	Range (dB)
Earth moving	
Front End Loader	85-91
Back Hoe	79-89
Bull Dozer	89-103
Roller	79-93
Scraper	84-102
Truck	89-103
Material handling	
Concrete mixer	<85
Concrete pump	<85
Crane	97-102
Power units	
DG set	<85
Impact	
Pile driver	82-115



Operation phase: During the operation phase the major source expected to increase the noise level at loading & unloading operations, vehicular movement and operation of DG set. However, this increase in noise level will be lower compared to the construction phase.

Mitigation measures

Construction & Operation phase:

- Equipment with prime mover having suitable noise proof enclosures have to be used as stipulated values by Central Pollution Control Board (CPCB).
- Persons working in noise and vibration prone areas shall be provided with Personnel Protective Equipment (PPE) like earmuff with level III protection.
- Workers must take adequate breaks from the noise and vibration prone environment to avoid continuous exposure to high decibel noise and vibrations.
- Proper lubrication, muffling and modernization of equipment shall be done to reduce the noise level.
- D.G. set with acoustic enclosure shall be provided.
- Noise control through development of green belt shall be ensured.
- Warning Signs / Barricading shall be ensured at high noise work area.
- Proper work activity scheduling and placing of tools and equipment's to be initiated.
- Major transportation activity during night hours, shall be avoided to prevent impacts of vehicular noise on surrounding villages falling in the route of transportation.
- High Noise prone activities like Pile driving to be planned during nighttime so that disturbance to the surrounding environment will be minimal.

4.3.3 Water Environment

Construction phase: Anticipated impacts during construction activity on water quality are increased water demand, wastewater generation and its impact on ground water and surface water.

Water requirement: Water for construction phase will be extracted from existing desalination plant. Groundwater will not be drawn for the expansion of MTF. The expansion of this project will not have any impact on either quality or quantity of water, for its competitive users like agriculture and other industries. Treated wastewater will also be used in green belt development. Rainwater harvesting is in practice which has



enhanced the groundwater potential in the region. Further, the jetty has been in operation for the years without any adverse impacts on the quality and quantity of water.

Wastewater: Wastewater generation is expected from site run off and sewage. Proper sanitation facilities like toilets and bathrooms will be provided for workers. Sewage generated will be treated through STP.

No impact on existing water resource during construction phase is predicted as no ground water is required.

Operation phase: Same as during the construction phase, anticipated impacts on water environment due to operation phase are expected from increased water consumption and wastewater generation.

Water requirement: Water requirement during the operational phase will be supplied by the proposed desalination plant. Water is demanded for the following purpose during operational stage.

- iii) Domestic demand for employees and users
- iv) Gardening and greenbelt
- v) 20 MLD for desalination plant

Wastewater

- ✓ No transfer of water from ground and surface will be undertaken. Also, no land activities causing change in drainage pattern/runoff of project site and surrounding area is proposed under this proposed expansion.
- ✓ Since no discharge of wastewater, abstraction, diversion of ground and surface water will be undertaken no major threat to ground and surface water is anticipated.

Mitigation measures

- Water meter shall be installed, and records of monthly water consumption shall be maintained regularly.
- Wastewater/sewage from STP (Sewage Treatment Plant) system will be used for green belt purpose.
- No discharge of wastewater/sewage into CRZ areas.
- Project proponent must ensure that the water bodies are desilted and are used for recharging of the ground water in the surrounding areas.
- Surface runoff from wharf area shall be managed through dry sweeping. No washing and disposal into CRZ/river area shall be adopted.



4.3.4 Land and soil environment

The land proposed to set-up the desalination plant will meet the CRZ regulatory requirements. The land use pattern of the project site will change to built-up area from barren coastal land. Evidently, the threat to soil quality of the study area is not envisaged due to the construction and operation of the desalination plant.

Mitigation measures

All temporary constructions including the labour colony will be dismantled and discarded. Materials, construction wastes, machinery etc. will be removed from the site and proper landscaping will be undertaken. Beach will be cleaned and beach slope restored soon after completion of the construction activities.

Significance of impact

Apart from the change in land use of the core project area, the soil of the study region including the intertidal segment will be largely unaffected once the construction is completed and disturbed zones are restored. Hence, vulnerability to change, magnitude and extent of impact on land use and soil is predicted to be low.

The anticipated impacts on land / soil quality due to construction is anticipated from change in land use pattern, dredging and other site preparatory activities and solid & hazardous waste generation, spillages etc.

Project include activities such as levelling, reclamation and dredging and does not involve any clearance of vegetation. Terrain, coastal, soil and inland topography of project site may get disturbed due to above activities.

Waste management

Waste generation during construction and operation phase can be categorized into municipal solid waste, Plastic waste, E- Waste, Batteries waste, Bio medical waste, hazardous and construction waste/debris.

4.3.5 Impact on Socio Economic Environment

Possible impacts

Construction Phase: The manpower will be required during the construction phase. The required manpower would be engaged locally to the extent possible. In addition to the opportunity of getting employment and as construction labour, the local population would also have opportunities in related service activities like small contracts and supply of



construction materials. There will be positive impact for the local people during construction phase of the project.

Operation Phase: The positive impacts of the proposed plant would begin to be felt with the startup of the operational activities. The proposed project will generate huge number employment both directly and indirectly. From other areas also labour migration is possible. Employment opportunity will improve quality of life of the villagers as well as it will improve economical condition of the study area.

- There will be more employment generation as a result in proposed project.
- The migration for employment is likely to reduce due to better economic opportunities.
- There will be significant socio economic development.

Mitigation Measures:

- Employment to the local population based on the skill.
- Try to minimize the pollution.
- Awareness program in communities about the activities.
- Coordination with fisherman communities and regular discussion with the different communities.
- Benefits from CSR activities

Table 92. Environmental impact matrix for construction and operational phases

Environmental Parameters	Activity							
	Construction phase				Operation phase			
	Construction of approach trestle	Construction of mooring dolphin & associated facilities	Expansion of existing MTF	Laying of pipeline (Intake & outfall, Vinyl Chloride Monomer, Ethylene & Ethylene dichloride)	Operation of approach trestle	Operation of mooring dolphin & associated facilities	Operation of existing MTF	Operation of Vinyl Chloride Monomer, Ethylene & Ethylene dichloride pipeline
Seawater quality	✓	✓	✓	✓	x	✓	✓	✓
Seabed sediment quality	✓	✓	✓	✓	x	x	✓	✓
Plankton	✓	✓	✓	✓	x	✓	✓	✓
Benthos	✓	✓	✓	✓	x	✓	✓	✓
Mangroves	x	x	x	x	x	✓	x	x



Seagrass and seaweeds	x	x	x	x	x	✓	x	x
Coastal vegetation	x	x	x	x	x	x	x	x
Turtles	x	x	x	x	x	x	x	x
Sand dune	x	x	x	✓	x	x	x	x
Fish and Fisheries	✓	✓	✓	✓	x	✓	x	x
Marine Protected Areas	x	x	x	x	x	x	x	x

<i>Significance of Impact</i>	<i>High</i>		<i>Low</i>	
	<i>Medium</i>		<i>No Impact</i>	

4.4 MARINE ENVIRONMENT IMPACT MITIGATION

- Impact due to construction of approach trestle
- Impact due to construction of mooring dolphins and associated facilities
- Impact due to expansion of existing facilities
- Impact due to laying of intake and Outfall pipelines in sea and land
- Impact due to discharge of brine reject
- Impact due to laying of Vinyl Chloride Monomer, Ethylene & Ethylene dichloride pipelines in sea and land
- Impact due to handling of Vinyl Chloride Monomer, Ethylene & Ethylene dichloride
- Impact due to dredging and disposal of dredged material
- Impact on shoreline
- Impact on Ecologically Sensitive Areas

4.4.1 Impact due to construction of approach trestle

Approach trestle is often used to improve safety in case of emergency and approach to the island jetty for maintenance works, also used for supporting the pipelines. This will also reduce the risk of damage to pipelines during cyclone. The bridge will have a 5 m driveway and 2.5 m wide pipe supporting space for to accommodate the VCM and other pipelines and cables. Due to construction of approach trestle can have various impacts on the environment. Here are some potential impacts during construction and operation phase.

Construction phase



During construction phase piling will be required for the construction of approach trestle. The piles will be initially erected into the sea floor upto depth where hard stratum is available. The soil inside the pile will be dredged off and the same portion will be refilled with R.C.C concrete. Concrete mixing and construction debris in the marine environment are envisaged during the construction activity. The bottom living communities like intertidal and sub-tidal benthos present in berth region will get temporarily disturbed due to increased turbidity in the water quality and in turn affect the fishes during the construction period. Once the construction is over, the system will slowly return to its normal status. Due to construction of offshore structures impact on following environmental parameters are anticipated:

- Marine/ Coastal ecology
- Noise and vibration
- Seawater quality
- Seabed sediments
- Plankton
- Benthos
- Fishes

Impacts on marine/coastal ecology: Disturbance from construction activities may cause displacement of fishery resources and other mobile bottom biota. Piling removes bottom biota and material covers bottom habitat, both of which may reduce fishery resources. Settlement of re- suspended sediments on fragile marine fauna and flora damages the ecosystem particularly coral reefs, which are formed by the extracellular product of symbiotic plants. The organisms attached to submerged structures need dissolved oxygen for respiration and the plants need sunlight for photosynthesis. Piles, concrete surfaces, rubble mounds and other similar structures in water could form new habitats, which may introduce undesirable species.

Impacts due to Noise and vibration: One of the major impacts of pile driving on the marine organisms especially on fishes is the underwater sound pressure waves generated during hammering of the piles. Studies conducted elsewhere (even though limited) clearly indicate that pile driving causes a condition known as “barotraumas” (pathologies associated with exposure to drastic changes in pressure) in fish and mammals in the sea. These include hemorrhage and rupture of internal organs, including the swim bladder and kidneys in fish. Death can be instantaneous, occur within minutes after exposure or occur several days later. Bubble expansion in blood vessels can cause hemorrhage. Fish can also die when exposed to lower sound pressure levels if exposed for longer periods of time (eg. 50-56% for gouramis (*Trichogaster* sp.) when exposed to continuous sounds at 192 dB (re:



1 μ Pa) at 400 Hz and 198 dB at 150 Hz. These sounds can also result in acoustic “stunning” a potentially lethal effect resulting in a physiological shutdown of body functions. Loud sounds (300–4000 Hz at 142 dB) can have detrimental effects on fish by causing stress, increasing risk of mortality by reducing predator avoidance capability, and interfering with communication necessary for navigation and reproduction.

Pile driving may result in “agitation” of fish indicated by a change in swimming behaviour. They may exhibit “startle response” to the first few strokes of the pile. The startle response is a quick burst of swimming that may be involved in avoidance of predators. A fish that exhibits a startle response is not in any way injured, but it is exhibiting behaviour that suggests it perceives a stimulus indicating potential danger in its immediate environment. Fish do not exhibit a startle response every time they experience a strong hydro-acoustic stimulus. The startle response is likely to extinguish after a few piles strikes. For some species, such as Salmon, the pile driving operations may result in a disruption of normal migratory behaviour.

Impacts on Seawater and Seabed sediments: Resuspension of sediments in water leads to an increase in the level of suspended solids and concentration of organic matter, possibly to toxic or harmful levels. This will cause temporary impact to seawater quality near proposed offshore structures’ location. Contaminated bottom sediments (contained with heavy metal concentration) may lead to significant impact to seawater quality during dredging, piling etc. However, baseline data suggests that there is no heavy metal concentration build up in the seabed sediments.

Impacts on benthos: Piling and other water side construction will cause loss/displacement to bottom habitat and its associated animal and plant life. Footprint on bottom habitat and associated life will be limited to area of piling. The turbidity induced during driving of piles will also have impact on the community structure and distribution of other marine life. However, the bottom will readily be recolonized by replacement of benthic organisms within few seasons.

Impacts on Fishes: One of the major impacts of pile driving operations on the marine organisms especially on fishes is the underwater sound pressure waves generated during hammering of the piles. Pile driving may result in ‘agitation’ of fish indicate’ by a change in swimming behaviour. For some species, the pile driving operations may result in a disruption in their migratory pattern.

The various factors which are known to influence the impact on fish are: (i) Size and force of hammer strike; (ii) Distance from the pile; (iii) Depth of the water around the pile; (iv)



Depth of the fish in the water column; (v) Amount of air in the water; (vi) The texture of the surface of the water (size and number of waves on the water surface); (vii) Bottom substrate composition and texture; (viii) Size of the fish; (ix) Species of the fish; (x) Presence of swim bladder; (xi) Physical condition of the fish and (xii) Effectiveness of sound/pressure attenuation technology used to minimize the impacts.

Impacts on Plankton: The proposed project activity like piling may not have any direct bearing on plankton. It is expected that the plankton will drift away from the disturbed area leading to minimal loss to plankton. Further, compared to the abundance of the plankton in the site, the loss will be moderate and temporary.

Impacts on water quality: Pile driving, deposition of rubble, dredging, sand compaction and other construction work in water cause re-suspension of sediments and turbid water. Re-suspension of sediments in water leads to an increase in the level of suspended solids and in the concentration of organic matter, possibly to toxic or harmful levels. It also reduces sunlight penetration. Work vessels are a possible cause of oil spills, garbage discharge, and leakage of other substances into water. Diffusion from concrete work in water and overflows from landfills may be possible sources of water pollution.

Impacts on bottom contamination: Construction work disturb bottom sediments and induce re-suspension, dispersal and settlement of such sediments.

Mitigation measures

- Proper lubrication of pile driving machinery will ensure less noise.
- Trucks transporting the materials will be covered to avoid susceptible for fugitive suspension.
- If there are any accidental spillages of hazardous substances which may pose risk of contaminating run off, such areas will be immediately remedied.
- Vehicles having Pollution Under Control (PUC) certificates will be used. All vehicles used for transportation shall comply with CPCB emission norms.
- All workers, technicians and supervisors should make use of all safety equipment such as masks, goggles, helmets, safety belts, earmuffs safety shoes, lifesaving jackets, etc., as required, during the construction phase. Proper security arrangements will be made during nights to avoid any accidents due to unauthorized entry of workers, or civilians.
- The hazardous materials anticipated to be stored at the site during construction include gas for welding, fuel for operating construction equipment, paint, etc. All



these and other materials of a dangerous or hazardous nature will be stored as per the norms of industrial safety.

- Providing comprehensive safety training for construction workers.
- Regular safety inspections and audits throughout the construction process.
- Clean and efficient construction techniques should be adopted.
- Piling should not be carried out during fish breeding season.
- Screening must be provided during piling activity.
- Implementing buffer zones to protect sensitive habitats near the project region.
- The construction schedule should be strictly followed, and no over runs should be ensured.
- Reducing the construction time with efficient techniques will rescue the period of impact.
- The scrap and waste construction materials should not be disposed into the seawater.
- Proper lubrication of pile driving machinery will ensure less noise.
- Coordination with maritime authorities to establish temporary navigation restrictions.
- Continuous monitoring of vessel traffic and adjustment of construction activities accordingly.
- Structural assessments of adjacent berths and infrastructure before construction.
- Implementation of vibration monitoring during construction.
- Implementing measures to prevent damage to nearby structures.

Operation phase

Prediction of Impact

The operation of an approach trestle involves ongoing activities related to the loading, unloading, and handling of liquid cargo (Vinyl chloride monomer, Ethylene & Ethylene dichloride) which can have various impacts on the environment, safety, and surrounding communities. Here are some potential impacts and corresponding mitigation measures for the operation of approach trestle:

- Spills and Leaks: Accidental spills or leaks during liquid cargo (Vinyl chloride monomer, Ethylene & Ethylene dichloride) transfer can lead to environmental contamination.
- Fire and Explosion: Handling flammable liquids poses a risk of fire and explosion.
- Downtime and Delays: Unplanned maintenance or equipment failures can lead to operational downtime.



Mitigation measures

- Compliance with international and local regulations related to ballast water management.
- Implementation of strict safety protocols and training for personnel.
- Installation of fire detection and suppression systems.
- Regular safety drills and emergency response training.
- Regular inspection and maintenance of equipment to prevent leaks.
- Implementation of spill response plans and the availability of spill containment and recovery equipment.
- Installation of leak detection systems and automatic shutdown mechanisms.
- Vessels coming near the jetty premises should not discharge anything into the sea.
- Waste in the jetty premises should be handled as per TPCB norms.

4.4.2 Impact due to construction of crossover bridge in Uppanar river creek

A crossover bridge across the Uppanar river is proposed to easy transportation of pipelines and cables across the river. This will also create a short access to the jetty from the CCVL plant. Which can have minimal impacts on the Uppanar river creek environment.

Anticipated impact and mitigation measures will be same as given above in section 4.4.1.

4.4.3 Impact due to construction of mooring dolphins and associated facilities

Construction phase

In addition to the MTF like Construction of mooring dolphins, tug berth and fire water pumphouse cum substation. Construction of these MTF will have minor impacts on the surrounding environment, with suitable mitigation measures it can be reduced.

During construction of mooring dolphins, installation of piles will disturb the bottom beneath the proposed structure, destroying some of the bottom habitat and temporarily displacing the mobile bottom animals and local fisheries. Here are some potential impacts during construction and operation phase and respective mitigation measures:

Mitigation Measures

- Appropriate selection of pile driving equipment.
- Clean and efficient construction technique.



- Proper lubrication of pile driving machinery will ensure less noise.
- The construction schedule should be strictly followed and no over runs should be ensured. Reducing the construction time with efficient techniques will reduce the period of impact.
- The scrap and waste construction materials should not be disposed into the seawater and intertidal area.
- Brief the workers and contractors on the importance of coastal environment to restrict the unwanted damage.

Operation phase

- During the operation period the mooring dolphins act as a safe location for ships to tie up, preventing damage to the ships or the dock infrastructure.
- The operation of mooring dolphins can disturb local marine ecosystem. They may interfere with natural habitats, particularly for species such as fish, shellfish and seabirds.
- The accumulation of pollutants, such as oil, chemicals, or ballast water from vessel moored at dolphins can contribute to water pollution.
- Spillage during loading/unloading operations or from ships can have long lasting effects on water quality.
- Ship/vessel operation, including the process of docking and undocking generate noise and vibration that can disturb marine life.

Mitigation measures

To minimize these impacts, best practise include:

- Regular monitoring and maintenance of mooring structure.
- Implementing sustainable practices to reduce pollution and prevent the introduction of invasive species.
- Designing of dolphins to blend into the local marine environment and to minimize disturbance to ecosystems.
- Using technology that reduce noise and vibration as well as mitigating spill risks through secondary containment and proper waste management systems.

4.4.4 Impact due to expansion of existing facilities

CCVL had set up MTF to support the PVC manufacturing plant. CCVL would like to upgrade the existing facilities to enhance the handling capacity and accessibility. There are no major impacts on the environment due to the expansion of existing facilities.



4.4.5 Impact due to laying of intake and outfall pipelines in sea and land

CCVL had an existing intake and outfall pipeline on the seafloor. Now CCVL plans to lay the intake and outfall pipeline on the proposed approach trestle to improve safety in case of emergency and approach to the island jetty for maintenance works and to reduce the risk of damage to pipelines during cyclone.

Construction phase

The intake and outfall pipeline installation corridor are identified based on the pre-lay survey including bathymetry and dispersion of brine reject on release. From these detailed investigations, it is assessed that the pipeline corridor is clear and safe for installation with the absence of obstacles on the seabed and pipeline can be laid with minimum seabed intervention.

Laying of intake and outfall pipelines during the construction phase will cause disturbance to the backshore, fore shore, intertidal region and the seabed but it will be limited to the corridor area. The major impact will be on the benthic habitats which may be destroyed or subjected to considerable stress during the installation process.

In general, individual pipeline sections are usually fabricated by the supplier and transported to the site where they are subsequently butt-welded together into long strings. This will require a sufficiently large and relatively flat onshore area where the pipes can be stockpiled and prepared. The project site area itself can be used for this purpose and the impacts on marine environment due to construction of pipelines are considerably minimized as this activity will be done at a fair distance inland from the high tide line.

Brief description of laying pipelines is as follows: Depending on the oceanographic conditions of site, concrete weight anchors are placed around the pipe to provide stability on the seabed. The pipe sections are dragged down the shore by dozer and capped at either end before being floated out to the sea by means of a tug. The air is released from the pipe, and as it fills with water it sinks to the bottom.

The pipeline is laid in the seafloor and mostly the seabed consists of sand. The pipeline laying activity may be spread over one or two months during which the disturbance to the seabed within the corridor is expected.

Possible impacts



Macrofauna and coastal birds: Although the activities on the intertidal beach will be localized and confined to a narrow region of around one hundred meters from the construction site, the beach sediments limited to the corridor will be excavated in the process and the associated macrofauna will be eliminated. Any shorebirds feeding and/or roosting in the area will also be disturbed and displaced for the duration of construction activities. However, this is considered to be a reversible impact and macrofauna would re-establish over a period of time after the constructions are completed.

Plankton, benthos and algae: The laying of pipeline process will result in increased suspended sediments in the water column, potentially affecting light penetration and thus phytoplankton productivity and algal growth. The impact of the sediment plume, however, is expected to be relatively localized within 100 m distance and of short duration. Settlement of the suspended material on adjacent areas of seabed may result in smothering of the resident biota. However, some mobile benthic animals are capable of migrating vertically through more than 30 cm of deposited sediment. The biota that inhabited the excavated sediments will most likely perish. Once the pipeline has been laid, the affected seabed will be recolonized by the benthic macrofauna.

Fishes: The main impact on fishes during construction will be the avoidance reaction of areas where sediment is re-suspended. The impact is reversible, local and short-term. The impacts will not reach herring spawning sites and are not likely to have a significant effect on pelagic sprat

Organic matter and nutrients: The release of organic rich sediments during pipeline laying can result in the localized removal of oxygen from the surrounding water. This may lead to the suffocation of marine animals and plants within the localized area. However, the removal of oxygen from water is only temporary, as tidal exchange would quickly replenish the oxygen supply. Therefore, laying of pipeline in open coastal water, the removal of oxygen has little effect on marine life. Moreover, the seabed sediment of the study area is low in organic carbon ruling out such a possibility.

Mitigation measures

Mitigation measures will include rehabilitation of the disturbed area soon following the completion of construction, by removing all temporary structures on beach / intertidal zone, clearing the area of discarded and surplus items such as pipes, ropes, concrete blocks etc. and reshaping the beach to its original contours. Other steps taken to minimize the impact are as follows:



- Laying operation and barricading of water across surf zone will be done in the shortest duration, say within 2 months.
- The technique adopted will not unduly stir up the bed material in the water body while laying of pipelines.
- During pipeline construction, full survey capacity will be available to perform any adhoc surveys, e.g., monitoring the pipeline touchdown point.
- Laying will be carried out in a controlled manner and confined to the agreed pipeline corridor which will be properly demarcated. Fallout of activities beyond the corridor will be avoided.
- Monitoring of turbidity, pH and DO; the easily measurable parameters using in-situ probes, in the water column will be conducted if necessary, in order to assess the rise in concentration due to pipeline laying and the activity will be spaced accordingly.

Significance of impact

The impacts of construction on the seabed/seawater/ecology will be low in terms of magnitude and extent due to the limited area required for the pipeline laying. The duration of the impact will be short, reversible as the most significant impacts will be restricted to the pipeline corridor. The magnitude of change is assessed as low.

4.4.6 Impact due to discharge of brine reject

Possible impacts

Brine waste of 30 MLD will be discharged into the sea at the proposed outfall location. Discharge of brine reject can have marine environmental impacts on coastal water quality, seabed quality and biological impacts due to its elevated salinity level. Brine reject will have a salinity of 59 PSU which is 24 PSU more than the ambient salinity of 35 PSU. The effect of discharge on different biotic communities living in the discharge area will vary depending on the nature of concentrate and dispersion pattern. Some organisms are tolerant to salinity increase of 10 PSU whereas some are sensitive to elevation by 3 to 4 PSU.

The effect of brine reject discharge is as follows:

Water quality: The brine discharge into the sea would initially raise the salinity of the sea water in the mixing zone. Effect of salinity changes present in a complex manner depending upon the corresponding changes in the dissolved oxygen content. The return water would affect the marine life living in the mixing zone. The intensity of impact would



depend on how soon the high saline water and residual chlorine concentration get diluted after release. The brine reject Can have synergistic effects on the flora and fauna of the receiving water.

Seabed sediment quality: Potential impact on quality of seabed sediments depends on how the outfall discharge gets mixed with the seawater. Since brine is denser than seawater, due to negative buoyancy brine may settle on the seabed causing increased salinity. Thus, it may affect the chemical characteristics of the seabed sediments below the mixing zone.

Benthic communities: As the benthic community is sedentary in nature, they will be affected by environmental changes more than the other communities. Like other animal population, they are also sensitive to the drastic changes in saline conditions, which may affect their body physiology.

Primary producer: Change in seawater quality may affect the growth and survival of primary producer. Therefore, it is advisable that the outfall may be discharged at a location where maximum dilution takes place within a short time of discharge so that the detrimental effect can be kept to a minimum.

Intertidal fauna: In genera l, intertidal fauna are resistant to environmental changes to limited extents, but large variations may affect their metabolism. They are sensitive to any change in water quality.

Fish: In general, the impact of the brine discharge on the fishes is seen disturbing the breeding habitats. However, in the present scenario, the quality of the brine is confined to the norms of TPCB, and also it attains ample dilution in shorter distance and hence the impact will be minimum.

Mitigation measures

Oceanography and geomorphology of the receiving seawater environment affect the fate of the plume and also determine the nature of the biological communities potentially affected by the discharge. Hence, prime task in mitigating the effects of brine discharge is identification of suitable discharge location through bathymetry, physical parameters and mathematical modelling study as well as the dispersion pattern after release.

These tasks are studied in detail as explained in Chapter 7.2 to identify the discharge location.



Discharge strategies to have acceptable dispersion of the combined outfall discharge are the following:

Multiport diffusers of 6 nos. x 250 mm will be provided to ensure highest dilution.

- Selection of discharge sites with high ambient mixing and advection will be considered through Cormix model.
- Discharge site without seabed undulation will be selected as suggested in the report by avoiding bathymetric depressions or barriers along the pipeline corridor and the diffuser location.
- Sufficient distance will be ensured between the seawater intake and brine outfall sites to avoid recirculation of brine in the intake.
- The discharge site will be located at 800 m distance from the shore to ensure the outfall does not reach the shore and cause contamination. Minimum mixing zone/near field shall be verified at selected location using dispersion modelling.
- Marine discharge of brine reject will comply with the TPCB standards.
- Regular monitoring of the discharge may be carried out by water sampling.

The criteria for selection of outfall location for appropriate brine dispersion after release to the sea are listed.

Multiport diffuser

Diffusers with upwardly inclined jets will be used to discharge the brine. The diffuser will have multiple ports of 6 nos. x 250 mm for 30 MLD, the mix jet plume will extend up to ... m from the diffuser port location. Within this zone, it undergoes initial dilution of the order of ... times.

Dispersion modelling

MIKE 21 HD-AD modelling study is conducted to verify the effectiveness of the outfall location in diluting and dispersing the 30 MLD brine discharge to a satisfactory level.

Significance of impact

Marine vulnerability for change due to the brine discharge is predicted as moderate considering the mitigation measures proposed. Magnitude of impact on marine environment due to brine environment is also assessed as moderate.



4.4.7 Impact due to Vinyl Chloride Monomer, Ethylene & Ethylene dichloride pipelines

The impacts of vinyl chloride monomer (VCM), ethylene, and ethylene dichloride (EDC) on the environment and human health are significant and need careful consideration in Environmental Impact Assessment (EIA) studies. Here's a breakdown of the impacts:

Environmental Impacts due to Vinyl Chloride Monomer (VCM)

- VCM is a volatile organic compound and a sign to photochemical smog formation. It contributes to ground-level ozone and poor air quality.
- Because of its modest water solubility, accidental spills or leaks may damage soil and groundwater.
- Although VCM does not bioaccumulate excessively, its breakdown products can occasionally endanger aquatic habitats.

Health Impacts:

- VCM is categorized as a Group 1 carcinogen by IARC and has been associated to an elevated risk of liver angiosarcoma as well as other malignancies.
- Inhalation can result in dizziness, nausea, and respiratory discomfort.
- Prolonged exposure can cause liver damage, neurological system consequences, and immune system dysfunction.

Environmental Impacts due to Ethylene:

- Ethylene is a plant hormone that, in high concentrations, can cause damage to vegetation such as rapid fruit ripening and leaf senescence.
- Although ethylene has a limited atmospheric lifetime, it contributes to climate change as a small greenhouse gas.

Health Impacts:

- Ethylene, a highly flammable gas, can cause explosions in tight areas.
- Direct inhalation at high quantities might cause dizziness, asphyxiation, or unconsciousness due to oxygen displacement.

Environmental Impacts due to Ethylene Dichloride (EDC)

- EDC is toxic to aquatic life and can persist in water systems, potentially disrupting ecosystems.



- Volatilization from industrial processes can contribute to air quality degradation.
- EDC's moderate water solubility allows it to penetrate soil and reach groundwater systems, posing contamination risks.

Health Impacts:

- Prolonged exposure can increase the risk of certain malignancies.
- Inhalation or ingestion may cause nausea, vomiting, liver, and kidney damage.
- Prolonged exposure to low levels can cause depression, liver damage, and reproductive harm.

Mitigation Measures

- Emission controls include the use of scrubbers, condensers, and carbon filters in industrial settings.
- Leak Detection and Repair (LDAR) refers to the regular monitoring of pipelines and storage systems.
- Spill containment includes secondary containment systems and emergency response techniques.
- Look into less hazardous alternatives or methods where possible.
- Worker safety requires proper PPE, ventilation, and exposure limits in occupational situations.
- Transparent sharing of dangers and emergency plans to neighboring communities.

4.4.8 Impact due to dredging and disposal of dredged material

Construction phase

The upgradation of island jetty consists of dredging of berthing area and approach channel. The capital dredging is estimated around $2.6 \times 10^6 \text{ m}^3$. Capital dredging will be conducted in the navigational channel area to maintain the required navigational depth.

The dredging effects include: (i) removal of benthic organisms, (ii) increased turbidity at the dredging site, (iii) organic matter enrichment, (iv) impact on fishes.

Removal of benthic organisms: During dredging operations, the extraction of bottom sediments will directly remove benthic organism living on the seabed. Some deep burrowing animals or mobile surface animals may survive a dredging operation through avoidance.



The recovery of disturbed habitats following the dredging activity ultimately depends upon the nature of the new sediments reaching the dredged site, sources and types of recolonizing animals and the extent of disturbance. In soft sediment environment, the recovery of animal communities generally occurs relatively quick. From the rates of recovery of the benthic fauna following dredging in various habitats in coastal areas, it is reported that recolonization of benthic fauna was observed within 4 weeks to 18 months in mud substratum, while it took 1 to >2 years in sandy/gravel substratum (*Newell et al, 1998). Also, due to development of turbidity close to dredging location, removal/disturbance to plankton is also anticipated.

Increased turbidity at the dredging site: Increase in turbidity results in decrease of light penetration in water column which may eventually affect the mass of phytoplankton.

In most cases, sediment re-suspension is likely to cause problem only if it is carried away from dredging location by currents. In general, the effects of suspended sediments and turbidity are confined to short term for less than a week on completion of dredging and limited to a region of about a kilometre from the dredging location.

Organic matter enrichment: Release of organic rich sediments during dredging can result in localized removal of oxygen from water. Depending on the location and timing of the dredging, this may lead to the suffocation of marine animals and plants within the localized area or may deter migratory fish or mammals from passing through. However, it is important to stress that the removal of oxygen from water is only temporary, as tidal exchange would quickly replenish the oxygen supply. Therefore, in most cases where dredging is taking place, this localized removal of oxygen has minimal effect on marine life.

Impact on Fishes: Introduction of turbidity will cause disturbance to fish due to dredging and disposal. The impact is temporary and reversible in nature.

Mitigation measures

- Appropriate dredger, dredging technology shall be selected to minimize the impact.
- Net enclosures with booms shall be placed around the dredging area in order to control the spread of the turbid plume.
- Schedule dredging activities during daytime hours.
- To minimize the impacts of dredging, proper timings must be selected i.e. (i) selection of most favourable points in the tidal cycle to limit the extent of effects (ii) avoiding sensitive periods /breeding season for fishes and marine animals.



- Schedule for dredging shall be prepared and list of DO(s) and DO NOT(s) shall be circulated among the people involved in construction activities.
- Post dredging monitoring program shall be carried out to assess effect of dredging on marine ecology.
- Establish protected areas or buffer zones to limit dredging in ecologically sensitive regions.
- Avoid disposal in ecologically sensitive areas or areas prone to erosion.

Selection of dredge disposal location:

- The selection of dumping ground should be such that the dredged material disposed at the dumping ground should not come back into the navigational channel.
- The material shall be disposed off evenly spread at the dumping ground to see that the depths should not get reduced unevenly.
- Mathematical modelling study shall be carried out to find out dredge disposal location and change in bed level due to dumping.
- Dredge spoil disposal sites should be selected on the basis of no interference with navigation.
- Dredged material shall be tested for heavy metals, Petroleum hydrocarbons etc., for contamination.

4.4.9 Impact on shoreline

The shoreline change study are given in Chapter 7. The construction of a shore-connected structure often leads to changes in the shoreline. This warrants a study on the shoreline due to presence of the shore-connected structures. Such a study is very much essential in planning stage; so as to assess the impact of shore connected structures on the adjacent shoreline. Shoreline stabilization method is very essential in order to protect the coastline on the basis of close monitoring of the process.

Apart from this, the operating berths are erosion protected with under deck pitching, so no shoreline change corresponding to the waterfront is likely to happen. Therefore, the existing shoreline along the CCVL is quite stable without any significant change in the shoreline along its coast.

Mitigation measures

Shoreline stabilization has to be planned. Taking into account, that there should not be any excess deposition to project site. Monitoring study has to be carried out on project area



twice in a year according to changes if any noticed. Appropriate shore protection measures have to be taken up in consultation with CWPRS.

Therefore, it is expected there will not be any changes in the coastal. It will remain stable. Shoreline changes at project site is given as Chapter 7.

4.4.10 Impact on Ecologically Sensitive Areas

The coastline at project site is with wide sandy beach with formation of scattered coastal dunes and coastal vegetation. Besides these mangroves, seagrasses & seaweeds and coral reefs are absent in the project area.

Impact on turtle

Construction phase

- Dredging activity may cause disturbance
- Due to movements of workers and heavy machinery in the project location may interrupt turtles during the construction phase.
- Solid and liquid waste, if any, generated during the construction phase can create direct and indirect impacts on turtle habitats.
- Artificial illuminance used during the construction phase may affect the turtles.
- Exposed turtle nests if any during construction phase may be hunted by predators.

Operational phase

Impacts during operational phase of Elevated pipeline and jetty include:

- Leakage of chemical and accidental spill that may happen during / due to jetty area.
- Lighting from the jetty may have an impact on turtle nesting.
- Boat activity may impact the movement of turtles.

Mitigation measures

- Restrict construction activities during turtle breeding periods.
- Marking of boundaries along the area to avoid disturbance to turtles due to movement of workers and construction activities.
- Brief the workers and contractors on the importance of turtles to restrict the unwanted damage.
- Cleaning up the work field as soon as the construction is over.
- Avoiding heavy beam lights during construction to avoid disturbance to turtles.



- Taking rescued turtles if any to wildlife rehabilitation centres to be cleaned and cared for.
- Monitoring nesting beaches to safeguard incubating nests.
- Providing EMP and Monitoring program for turtle conservation.

Impact on mangroves

During the study period, some mangrove species were observed in 10 km radius of the project area. Uppanar River is crossing west of north-south direction from proposed project LFP and Some of the planted mangroves were observed in the southern part of project area. True mangroves were observed 3.8 km from the project area.

Due to the proposed upgradation of MTF the existing mangroves will not be affected.

The proposed construction of crossover bridge will not affect directly the existing mangroves. However, during the construction using machinery emissions from engines, oil spills are likely to result in atmospheric and aquatic pollution.

Such pollution will have impacts on marine life, including mangroves, since mangroves act as nursery grounds for fin fishes and shellfishes. Hence, the project proponent proposed conserving mangroves in the project area in association with the TN Forest Department.

Impact on sand dunes

The proposed project activity will not have any direct or indirect impact over the sand dune environment.

Thus, the nature of the sand dunes will be preserved even during the proposed development. At the same time, regular monitoring and conservation activity is conducted with the forest department and local village people. These activities balance the sand dune vegetation and biodiversity of ecosystem.

Laying of pipelines across sand dunes can have very minimal environmental impacts. Can vary depending on the location, method used for installation, and the characteristics of the sand dunes.

- Pipeline installation may involve removing or damaging vegetation.
- Dune vegetation plays a critical role in stabilizing the sand and preventing erosion.
- Excavating for laying of pipeline can lead to further loss of dune structure.

Mitigation measures



- Careful planning and construction techniques are essential.
- Once the pipeline has been laid, in certain period the affected dune area will be recolonized by the nature.

Sand dune conservation plan is given in Chapter 3.

Impact on Sea weeds or Sea Grass

Project site and surroundings are devoid of seagrass and seaweeds. Hence, no impact.

Impact on Coastal Vegetation

Coastal vegetation of project and within 10 km radius supports minimum halophytes. No impact to coastal vegetation is anticipated since construction and upgradation of MTF will limit to intertidal area where not much coastal vegetation is seen.

The proposed project activity will not have any direct or indirect impact over the sand dune environment. Thus, the nature of the sand dunes will be preserved even during the proposed development. At the same time, regular monitoring and conservation activity is conducted with the forest department and local village people. These activities balance the sand dune vegetation and biodiversity of ecosystem.

Impact on corals

Project site and surroundings are devoid of corals. Hence, no impact.

Impact on mud flats

There are no mudflat presents in the proposed project area and the surroundings of CCVL area. Hence there is no impact on mudflat.

Impact on fishes

Due to construction approach trestle and associated facilities, impact on fishes is also anticipated. However, since fishes are mobile, they tend to move away from under water disturbances. Thus, no significant impact on fishes is anticipated. The fishes will usually return to the original area once the construction activity is stopped.

Impact on protected areas

Project site and surroundings are devoid of protected area. Hence, no impact.



4.4.11 Summary of Impacts and Mitigation

- Construction activities should be kept on hold during high wind period say while > 25 mph.
- DG set used during the construction phase shall conform to the noise and air emission norms prescribed by CPCB.
- Water sprinkler system covering the wharf shall be provided. Water sprinkling after the event of commodities loading/unloading shall be ensured.
- Greenbelt plantations should be done prior to the commencement of construction.
- Persons working in noise and vibration prone areas shall be provided with Personnel Protective Equipment (PPE) like ear muff with level III protection.
- They have to take adequate breaks from the noise and vibration prone environment to avoid continuous exposure to high decibel noise and vibrations.
- Wastewater/sewage management through STP system shall be ensured.
- No discharge of wastewater/sewage into uppanar river environment/CRZ areas.
- Surface runoff from terminal and storage area shall be directed to drainage channel.
- Drainage channel shall be designed in accordance with existing drainage pattern of project site.
- The construction materials should be placed one above another by using proper hoisting machineries and should not be dropped on the seafloor. Once the breakwater is built, the voids in it would serve as a suitable substratum for marine flora and fauna.
- The construction schedule should be strictly followed, and no over runs should be ensured. Reducing the construction time with efficient techniques will rescue the period of impact.
- The scrap and waste construction materials should not be disposed into the seawater.
- Appropriate dredger, dredging technology shall be selected to minimize the impact.
- Net enclosures with booms shall be placed around the dredging area in order to control the spread of the turbid plume.
- To minimize the impacts of dredging, proper timings must be selected i.e. (i) selection of most favourable points in the tidal cycle to limit the extent of effects (ii) avoiding sensitive periods /breeding season for fishes and marine animals.
- Schedule for dredging shall be prepared and list of DO(s) and DO NOT(s) shall be circulated among the people involved in construction activities.
- Post dredging monitoring program shall be carried out to assess effect of dredging on marine ecology.
- Appropriate technology & reclamation method shall be selected to minimize the impact.
- All emissions shall be kept within National Ambient Air Quality Standards (NAAQS).
- Water sprinklers will be used every day at definite time interval whenever there is unloading operation. Shoreline stabilization has to be planned.
- Monitoring study has to be carried out on either side of the shoreline twice in a year according to changes if any noticed. Appropriate shore protection measures have to be taken up in consultation with expert organization.

All the existing mitigation measures with CCVL should be enhanced and same to be followed for the proposed expansion.



5. ANALYSIS OF ALTERNATIVES

The eminence of a decision depends on the quality of alternatives selected from which to select. The first step in the EIA process is “alternatives development” which means the creation, identification, and selection of alternatives that will be considered for detailed analyses in EIA. Even though alternatives are considered as the “heart” of environmental impact assessment (EIA) through Council on Environmental Quality (CEQ), 1987, alternatives development suffers from a lack of exercise.

Alternatives are options, choices, or courses of action in which they are meant to accomplish conclusions. From the perspective of EIA, these conclusions include not just a particular organization's goals, but it also considers wider social goals such as the protection and promotion of environmental quality.

Since the CCVL's Marine Terminal Facilities are already established and operating, no alternative site selection criteria have been considered for the expansion and modernization of the MTF.

Marine Terminal Facilities are existing already; Proposed activity is only expansion and modernization. Therefore, there is no alternative option.



6. ENVIRONMENTAL MONITORING PROGRAM

The primary objective of the post project monitoring program is to develop site specific monitoring programs for environmental parameters likely to be affected due to operation of the port. Post project monitoring will be undertaken to determine the environmental effects of operational activities and secondarily to increase understanding of cause-effect relationships between activity and environmental change.

In order to verify the efficacy of the implemented mitigation measures and therefore to modify them, if necessary, the post project monitoring becomes inevitable. The post project monitoring program is an equally important aspect in the Environmental Management Plan. A continuous review of the post project monitoring program shall be conducted by the Environment Management Cell (EMC) to identify the effectiveness of mitigation measures suggested.

Environmental Impact Matrix

Identification of post project monitoring locations, frequency and parameters to be analysed is done based on the anticipated impacts on the terrestrial and marine environment during the operation phase of the project. The environmental management matrix used to identify frequency, location and parameters is given below.

Table 94. Environmental impact matrix

Attribute	Anticipated impact	Proposed mitigation measures	Monitoring program
Terrestrial Environment			
Ambient air quality/stack monitoring	- Dust generation during construction phase and unloading. - Emission of VOC's while handling VCM and from DG sets.	- Water sprinkling system and development of the green belt. - DG stack monitoring.	Monitoring of air quality inside premises of Marine Terminal and nearby village areas.



Attribute	Anticipated impact	Proposed mitigation measures	Monitoring program
Noise level	Increase in noise level due to ship/vessel movement, loading & unloading operations, vehicular movement and operation of DG set.	Use of silencers and noise enclosures.	Monitoring of noise level inside premises of Marine Terminal and nearby village areas.
Ground water quality	No specific impact to ground water quality is envisaged. However, post project monitoring shall be conducted to ensure no impact due to sewage disposal.	- No abstraction of ground water. - Predicted quantity shall be met from local authorities during construction phase and during operational phase water Desalinated water will be used	Monitoring of ground water quality inside premises of Marine Terminal and nearby village areas.
Frequency of monitoring: Since proposed mitigation measures will ensure adequate control over air, noise and ground water pollution, a half yearly monitoring program is suggested.			
Marine Environment			
Barge/Ship Movement	- Degradation of seawater and seabed sediment quality. - Impact to plankton, benthos and other marine communities.	- Collection and disposal facilities at port. - Operation of ships having Indian Ballast Water Management Certificate.	Monitoring of seawater and seabed quality close to the jetty area. Monitoring biomass and species diversity of plankton, benthos and other marine communities.
Construction of Dolphins and trestle with pipelines	- Degradation of marine Species, especially benthic organisms. - Degradation of seawater and seabed sediment quality.	Use environmentally friendly construction materials to avoid introducing contaminants.	Monitoring biomass and species diversity of plankton, benthos and other marine communities along with seawater and seabed quality close to Jetty area.
Discharge of Brine water	Increases salinity levels locally, affecting marine ecosystems and species sensitive to salinity changes.	Ensure that the brine outfall is in areas with strong natural currents to disperse the brine efficiently, preventing localized salinity spikes.	Monitoring biomass and species diversity of plankton, benthos and other marine community along with seawater and seabed quality on the outfall point
Frequency of monitoring: Since proposed mitigation measures will ensure adequate control over the ship generated waste, a half yearly monitoring program of marine environment is suggested for Barge/Ship discharge.			



Attribute	Anticipated impact	Proposed mitigation measures	Monitoring program
Accident Oil spill/ Spill during handling operations	Degradation of seawater and seabed sediment quality. Impact to plankton, benthos and other marine community	Emergency oil spill contingency plan. Development of reporting and alerting mechanisms. Specialized oil spill response equipment.	Monitoring of seawater and seabed quality near the jetty area whenever there is a spillage. Monitoring biomass and species diversity of plankton, benthos, birds and other marine communities.
Frequency of monitoring: In case of oil spill immediate attending of spill must be taken up. Continuous monitoring of Oil and Grease content in seawater shall be analysed till complete recovery of spilled oil. Oil content in the seawater shall also be analysed during half yearly monitoring of marine environment.			
Drainage	Degradation of seawater and seabed sediment quality.	Construction of catch basin/sedimentation unit to deal with runoff from storage yard/wharf area.	Monitoring of seawater and seabed quality near the jetty area.
Frequency of monitoring: Monitoring locations will be covered under a monitoring programme for ship and vessel discharge.			
Maintenance dredging and disposal	Degradation of seawater and seabed sediment quality. Impact to plankton, benthos and other marine communities.	Provisions for net enclosures with booms. Selection of most favourable points in the tidal cycle to limit the extent of effects. Disposal at designated location verified using mathematical modelling study.	Monitoring of seawater and seabed quality near the jetty area. Monitoring biomass and species diversity of plankton, benthos and other marine communities.
Frequency of monitoring: Post dredging monitoring shall be carried out at half yearly intervals on seawater quality and seabed sediment quality.			
Shoreline changes	Erosion/accretion	Shoreline stabilization.	Yearly monitoring of the shoreline for 5 km on either side of the project area.

Based on the environment impact matrix, a post project monitoring program is suggested.

6.1. DETAILS OF MONITORING

A monitoring program is suggested to identify changes in the terrestrial and marine environment due to operation of approach trestle and MTF. The monitoring program shall be done during the operational phase of the project, and it shall be repeated at six monthly intervals as suggested by MoEFCC. The monitoring must be organized with a qualified and experienced environmental team. Standard procedure shall be followed in sample collection and analysis. Half yearly



monitoring of air, noise, ground water, seawater quality, seabed sediment and marine ecology is recommended at project area, nearby villages, waterfront area, approach channel and identified locations in Uppanar River.

Post project monitoring program has been planned based on the prediction of impacts and mitigation measures suggested. Summary matrix of environmental monitoring covering locations of monitoring stations, frequency of sampling, standard methods for sampling & analysis etc. are presented below.

Table 95. Environmental monitoring matrix

Environmental attributes	Parameters to be monitored	Sampling locations	Methods for sampling & analysis	Frequency of monitoring
Terrestrial Environment				
Ambient air quality and stack monitoring	PM ₁₀ , PM _{2.5} , NO _x , SO ₂ .	4 locations	Details on methods for sampling & analysis is given in Annexure IV	Half yearly
Noise quality	Leq Day and Leq Night.	4 locations		Half yearly
Ground water	pH, BOD, COD, Nutrients and Heavy metal.	4 locations		Half yearly
Marine Environment				
Seawater quality	Turbidity, BOD, DO, COD, pH, Nutrients and Heavy metals.	4 locations	Details on methods for sampling & analysis is given in Annexure IV	Half yearly
Seabed sediments	Heavy metals	4 locations		Half yearly
Marine ecology	Phytoplankton (Primary production, Species composition, Numerical abundance, biomass) Zooplankton (Numerical abundance, biomass). Benthos (Numerical abundance, biomass). Microbiology (Numerical abundance).	4 locations		Half yearly
Shoreline changes	-	10 km of coastal stretch on both sides of the project area.	-	Yearly



6.2 Review and Reporting

The results of monitoring shall be reported to the statutory authorities: i) TNPCB and ii) Regional Office of MoEFCC. Half yearly report should include the condition of Environmental clearance and status of compliance. It shall also cover different statutory returns/ compliance reports to be submitted such as:

- Submission of half yearly compliance report in respect of the stipulated prior environmental clearance terms and conditions in soft copy to TNPCB and Regional Office of MoEFCC on 1st June and 1st December of each calendar year.
- Submission of environmental statement for the financial year ending 31st March to the TNPCB on or before 30th September every year.
- Records of hazardous waste if any in Form 4 as per Hazardous Waste Rules 2016.

Onsite Mock Drill

Onsite mock drills shall be encouraged by the proponent to make aware of the existing disaster management plan and how to respond to emergency cases such as fire accident, oil, spill, Natural calamities etc. Conducting mock drill will enhance the preparedness and practicality of designed responses. Mock drills shall be done in presence of municipal authorities, hospitals, fire departments etc. Documentation of mock drills should be done to revise the shortcomings of existing plans.



7. ADDITIONAL STUDIES

7.1 INTRODUCTION

As per Terms of Reference issued vide Proposal No. IA/TN/INFRA1/498995/2024 with file No. 11-63/2005-IA-III dated 26.10.2024 by Ministry of Environment, Forest, and Climate Change (MoEFCC), New Delhi, Additional Studies required to be carried out for the proposed project are given in Volume II - Draft Environmental Impact Assessment Report For “Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity” by M/s. Chemplast Cuddalore Vinyls Limited.

7.2 HYDRODYNAMIC MODELLING

7.2.1 Model setup

Units: Units of all parameters and variables in the model study are according to international SI conventions. Coordinate system: The coordinate system used for model grid generation and other horizontal positioning was UTM based on WGS 84 spheroid. Vertical reference level: The depth information used in the tidal flow models is relative to Mean Sea Level (MSL); depths below MSL are defined as negative.

Directions: Current – Ocean current directions refer to the direction **towards** which the flow is taking place. Directions of the flow are always given clockwise with respect to the North. The unit is degrees, where 360 degrees cover the circle. Wind - Wind directions refer to the direction **from** which the wind is approaching the observer. Directions of the wind are always given clockwise with respect to the North. The unit is degrees, where 360 degrees cover the circle. Wave - Wave directions refer to the direction **from** which the wave (orthogonal) is approaching. Directions of the wave are always given clockwise with respect to the North. The unit is degrees, where 360 degrees cover the circle.

7.2.2 Nested grid system

To ensure a good representation of the tidal and wind-driven currents at the project region, nested hydrodynamical models were used. Rectilinear grids were used in the grid system. Two nested grids were used for the simulation, namely i) ‘Coarse resolution grid’ - larger grid spacing to cover a wide area and ii) ‘Fine resolution grid’ - smaller grid spacing over a region closer to the project location. The primary objective of the nested grid system is to generate accurate hydrodynamic boundary conditions, i.e., water levels at the boundaries for the finer grid model based on the results obtained from the coarser grids.



The Coarser resolution grid covers an area of approximately 34 km x 64 km. The grid spacing is 135 m in both X and Y directions. The grid system comprised approximately 1,18,750 computational points.

Existing scenario: The finer resolution grid covers an area of approximately 18 km (north-south) x 18 km (east-west). The grid spacing is 45 m in both x and y directions. The grid system comprised approximately 1,60,000 computational points. The flow field to be simulated over the project region will have three open boundaries.

Post-dredging scenario: The finer grid model domain with the incorporation of proposed navigational channel deepened to a dredging depth of -14 m

Data requirements:

The data for the MIKE 21 HD module is described below:

- i) Bathymetry
- ii) Initial Conditions:
Water surface levels and
Flux densities in x and y directions
- iii) Boundary Conditions:
Water levels
- iv) Other Driving Forces:
Wind speed and direction

7.2.3 Depth schematization

For the schematization of depths in the flow model, the water depths were extracted from: i) DHI - MIKE 21 - *C Map* data base, ii) Indian Naval Hydrographic Charts corresponding to this region, and iii) available measured bathymetry data.

Depth schematization or estimation of water depths at model grid points has always been one of the most important and yet crucial parts of any coastal modelling problem. The availability of MIKE C-MAP worldwide electronic chart database has significantly reduced the time and effort required for this task. This database and the program to extract the bathymetric data over the selected area with as much detail as possible have been developed jointly by DHI and C-MAP, Norway. The C-MAP database is extracted from large and small scale Admiralty Sea charts, where a larger scale chart covers large areas with limited detail and small scale maps cover smaller areas in greater detail. The larger scale maps offer complete coverage, and the small scale maps are available only



in regions where ships and boats navigate, which require detailed maps for safe navigation. From this database it is also possible to get information on tidal elevation at important tidal stations.

7.2.4 Model description

MIKE 21 Flow Model is a modelling system based on a rectilinear grid approach. The modelling has been developed for applications within oceanographic, coastal and estuarine environments. The MIKE 21 Flow module is a modelling system for two dimensional free-surface flows. It calculates non-steady flow and transport phenomena that result from tidal and meteorological forcing on a spherical, or rectilinear or curvilinear boundary fitted grid. This module is applicable for the simulation of flow fields in natural water bodies, such as lakes, estuaries, bays, coastal areas and seas, wherever stratification can be neglected.

The HD module forms a basic module of MIKE 21 Model suite and it provides the hydrodynamic basis for the computations performed in the Environmental Hydraulics modules. The output of the HD module is also used as input for many of the other MIKE 21 modules, viz., Transport module, Sediment Transport module (ST), Particle tracking (PT) Spill Analysis (SA) and the Environmental module (ECO).

The MIKE 21 Flow module is a multi-dimensional 2D or 3D hydrodynamic flow simulation model (in the present case a 2D model), which solves shallow-water equations for given boundary conditions to compute non-steady flow fields in response to a variety of environmental forcing and processes in natural water bodies. The environmental forcing and processes include: *bottom shear stress, wind shear stress, barometric pressure gradients, Coriolis force, momentum dispersion, sources and sinks, evaporation, flooding and drying and wave radiation stresses*. The basic shallow-water equations in the Cartesian co-ordinate system used in the HD flow module are:

Continuity equation:

$$\frac{\partial \zeta}{\partial t} + \frac{\partial p}{\partial x} + \frac{\partial q}{\partial y} = \frac{\partial d}{\partial t}$$

Momentum equations in x- and y- directions:



$$\frac{\partial p}{\partial t} + \frac{\partial}{\partial x} \left[\frac{p^2}{h} \right] + \frac{\partial}{\partial y} \left[\frac{p \cdot q}{h} \right] + gh \frac{\partial \zeta}{\partial x} + \frac{gp\sqrt{p^2 + q^2}}{C^2 h^2} - \frac{1}{\rho_w} \left[\frac{\partial}{\partial x} (h\tau_{xx}) + \frac{\partial}{\partial y} (h\tau_{xy}) \right] - \Omega_q - fVV_x + \frac{h}{\rho_w} \cdot \frac{\partial}{\partial x} (p_a) = 0$$

$$\frac{\partial q}{\partial t} + \frac{\partial}{\partial y} \left[\frac{q^2}{h} \right] + \frac{\partial}{\partial x} \left[\frac{p \cdot q}{h} \right] + gh \frac{\partial \zeta}{\partial y} + \frac{gq\sqrt{p^2 + q^2}}{C^2 h^2} - \frac{1}{\rho_w} \left[\frac{\partial}{\partial y} (h\tau_{yy}) + \frac{\partial}{\partial x} (h\tau_{xy}) \right] + \Omega_p - fVV_y + \frac{h}{\rho_w} \cdot \frac{\partial}{\partial y} (p_a) = 0$$

Symbol List:

$h(x, y, t)$	-	water depth (m)
$d(x, y, t)$	-	time varying water depth (m)
$\zeta(x, y, t)$	-	surface elevation (m)
$p(x, y, t)$	-	flux density in the x-direction ($m^3/s/m$)
$q(x, y, t)$	-	flux density in the y-direction ($m^3/s/m$)
$(u_h, v_h); (u, v)$	-	depth averaged velocity in x and y direction
$C(x, y)$	-	Chezy resistance ($m^{1/2}/s$)
g	-	gravitational acceleration (m/s^2)
$f(V)$	-	wind friction factor
$V, V_x, V_y(x, y, t)$	-	wind speed and components in x and y directions (m/s)
$\Omega(x, y)$	-	Coriolis parameter (latitude dependent) (s^{-1})
$p_a(x, y, t)$	-	atmospheric pressure ($Kg/m/s^2$)
ρ_w	-	density of water (kg/m^3)
x, y	-	space coordinates (m)
t	-	time (s)
T_{xx}, T_{xy}, T_{yy}	-	components of effective shear stress

Source: MIKE Hydrodynamic Manual

7.2.5 Boundary conditions

The coarse resolution model is forced by the tidal water level variations along the open sea boundaries. For the generation of these boundary conditions, the global tide database is used. These boundary conditions for the coarse resolution model are prescribed as a time series of tidal water level variations along the open boundaries of the model. If the tidal constituents along the boundaries of the coarse resolution model are available, then the boundary conditions are represented by:



$$h_t = A_0 + \sum_{i=1}^n f_i A_i \cos(\omega_i t + (v_0 + u)_i - g_i)$$

With:

h_t	=	water level at time = t
A_0	=	mean value of the signal
A_i	=	amplitude of component i
f_i	=	nodal amplitude factor of component i
ω_i	=	angular frequency of component i
$(v_0 + u)_i$	=	astronomic argument of component i
g_i	=	phase lag of component i

7.2.6 Calibration and Validation

The model is calibrated using the predicted tides and simulated tides for the period from 02.03.24 to 29.03.24. A good agreement has been observed between the predicted tide and simulated tide.

7.2.7 Simulations

The tide induced flow fields were simulated for the following different scenarios:

- One lunar month i.e., for 28 days
- Three seasons, i.e., Fair weather, Southwest monsoon and Northeast monsoon.
- Existing scenario
- Post - dredging scenario

The simulated currents are presented for the following typical scenarios.

- Fair Weather (March) - Flood and ebb phases of spring tide and neap tide*
- Southwest Monsoon (July) - Flood and ebb phases of spring tide and neap tide*
- Northeast Monsoon (November)- Flood and ebb phases of spring tide and neap tide*

7.2.8 Results

In order to assess the influence of proposed dredging in the nearshore region, the flow field has been simulated over the project region for the existing scenario and the post-dredging scenario.



The wind and tide induced flow field has been simulated over the project region for three seasons (Fair Weather season, Southwest monsoon and Northeast monsoon).

Flow field – Existing scenario

Fair Weather

Spring tide: The tide induced flow fields on a *spring tidal day*, when the wind effect is absent in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards northwest at the project region. The magnitude of current speed is observed as 0.13 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.10 m/s and the current direction is towards the southeast.

Neap tide: The tide induced flow fields on a *neap tidal day*, when the wind effect is absent in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards the north at the project region. The magnitude of current speed is observed as 0.08 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.06 m/s, and the current direction is towards south.

Southwest Monsoon

Spring tide: The tide induced flow fields on a *spring tidal day*, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards the north of the project region. The magnitude of current speed is observed as 0.30 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.29 m/s, and the current direction is towards northeast.

Neap tide: The tide induced flow fields on a *neap tidal day*, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards the north of the project region. The magnitude of current speed is observed as 0.29 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.28 m/s and the current direction is towards northeast.

Northeast Monsoon

Spring tide: The tide induced flow fields on a *spring tidal day*, when the wind effect is maximum during Northeast monsoon in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards the southwest of the project region. The magnitude of current speed is observed as 0.38 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.36 m/s and the current direction is towards south.

Neap tide: The tide induced flow fields on a *neap tidal day*, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards the southwest of the project region. The magnitude of current speed is observed as 0.34



m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.32 m/s and the current direction is towards south.

The time series variation of simulated tide, current speed and current direction during fair weather, SW monsoon and NE monsoon extracted at 1 km offshore from the mooring dolphin.

Flow field – post-dredging scenario

Fair Weather

Spring tide: The tide induced flow fields on a *spring tidal day*, when the wind effect is absent in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards northwest at the project region. The magnitude of current speed is observed as 0.13 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.10 m/s and the current direction is towards the southeast.

Neap tide: The tide induced flow fields on a *neap tidal day*, when the wind effect is absent in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards north at the project region. The magnitude of current speed is observed as 0.08 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.06 m/s, and the current direction is towards south.

Southwest Monsoon

Spring tide: The tide induced flow fields on a *spring tidal day*, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards the north of the project region. The magnitude of current speed is observed as 0.30 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.29 m/s, and the current direction is towards northeast.

Neap tide: The tide induced flow fields on a *neap tidal day*, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards the north of the project region. The magnitude of current speed is observed as 0.29 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.28 m/s and the current direction is towards northeast.

Northeast Monsoon

Spring tide: The tide induced flow fields on a *spring tidal day*, when the wind effect is maximum during Northeast monsoon in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards the southwest of the project region. The magnitude of current speed is observed as 0.38 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.36 m/s and the current direction is towards south.



Neap tide: The tide induced flow fields on a *neap tidal day*, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides. During the flood tide, the direction of flow is towards the southwest of the project region. The magnitude of current speed is observed as 0.34 m/s. Similarly, it is observed that during ebb tide, the magnitude of current speed is observed as 0.32 m/s and the current direction is towards south.

The time series variation of simulated tide, current speed and current direction during fair weather, SW monsoon and NE monsoon extracted at 1 km offshore from the mooring dolphin.

Discussion: *The hydrodynamic model indicates that the current speed remains less than 0.41 m/s under various conditions, including fair weather, southwest monsoon and northeast monsoon. The direction of flow varies with tidal conditions and monsoon influences, but overall, there is no significant change in the flow field after the development of proposed marine facilities.*

7.3 SEDIMENT TRANSPORT MODEL – MIKE 21 ST

The sediment transport model is normally taken up to study the quantity and direction of movement of sediments in the coastal region which are influenced by the propagation of waves, flow of currents and the geology of the seabed.

The movement of either the cohesive or the non-cohesive sediment in ocean takes place due to the propagation of waves, wind/tide induced currents and current induced turbulence. The motion is initiated above a certain threshold intensity of forces acting on the sediment particle and the subsequent drift takes place in suspended and bed load form. The movement of the sediments across the channel or within the basin would cause deposition in the dredged area. The estimation of the rate at which the siltation is taking place is very important to quantify the maintenance dredging required.

To meet the purpose, the MIKE 21 ST - Sediment Transport module in combination with MIKE 21 HD -model is used as a part of MIKE 21 application suite. The details of the Mike 21 HD model are presented in Section 7.1. It enables us to calculate *combined -current and wave induced* non-cohesive sediment transport - in the marine environment nearshore beyond the wave breaking zone. The MIKE 21 ST model integrated on the output of MIKE 21 Flow model can simulate sand transport rate in a wide array of morphological settings like tidal inlets, estuaries, coastlines and near manmade constructions like breakwaters, harbors and piers. It calculates the sand transport rate based on advection currents and wave induced currents. In addition to sand transport rates, the model also gives the bed level changes with potential areas of erosion or deposition.



7.3.1 Model description

The MIKE 21 ST model uses the Bijker's equation for estimating the suspended and bed load sediment transport. According to Bijker, the total sediment transport, q_t , is the sum of bed load transport, q_b , and suspended load transport, q_s . That is,

$$q_t = q_b + q_s = q_b(1 + 1.83Q)$$

Q is a dimensionless factor defined as,

$$Q = \left[I_1 \ln \left(\frac{33h}{r} \right) + I_2 \right]$$

where h is the water depth, r is the bed roughness and I_1 and I_2 are Einstein's integrals, which must be evaluated numerically on the basis of the dimensionless reference level $A = r/h$ and z^* , defined as:

$$z^* = \frac{w}{kU_{f,wc}}$$

W = the settling velocity of the suspended sediment,

K = von Karman's constant

U_f, W_c = the shear velocity under combined waves and current.

The influence of the waves on the suspended load transport is therefore considered through the shear velocity, U_f, W_c . The roughness, r , is related to the Chezy number (C), through

$$C = 18 \log \left(\frac{12h}{r} \right)$$

Following Bijker, the shear velocity in combined waves and current $U_{f,wc}$ is found as:

$$U_{f,wc} = U_{f,c} \sqrt{1 + \frac{1}{2} \left(\zeta \frac{\hat{u}_b}{V} \right)} = \frac{\sqrt{gV}}{C} \sqrt{1 + \frac{1}{2} \left(\zeta \frac{\hat{u}_b}{V} \right)^2}$$



Where, U_{fc} is the current-related shear velocity, V is the depth-averaged current velocity, $\hat{u}b$ is the amplitude of the wave-induced oscillatory velocity at the bottom, and ξ is a dimensionless factor that can be expressed in terms of the wave friction factor f_w and Chezy's number C .

$$\xi = C \sqrt{\frac{f_w}{2g}}$$

The wave friction factor f_w is calculated according to Swart as:

f_w = wave friction factor

a_b = the amplitude of the wave motion at the bottom

The bed load transport, q_b , and suspended load transport, q_s , are calculated according to,

$$q_b = B d_{50} U_{f,c} \exp\left(-\frac{0.27 \Delta d_{50} g}{\mu U_{f,wc}^2}\right)^2$$

B is a dimensionless bed load transport coefficient, Δ is the relative density of sediments and μ is the so-called "ripple factor".

The suspended sediment transport is calculated as the product of the instantaneous flow velocities and the instantaneous sediment concentration:

$$q_s = \frac{1}{T} \int_0^T \int_{2d}^D (uc) dz dt$$

The time integration of the diffusion equation for suspended sediment is repeated until a periodic solution is obtained.

7.3.2 Model input

- i) Flow obtained from MIKE 21 Flow model
- ii) Wave fields at various grids
- iii) Bathymetry
- iv) Sediment grain size at nearshore

Based on the secondary data available at the project site, the nature of seabed sediment characteristics is predominantly sand. This sand moves with the bottom currents in the nearshore region both in suspended load form and bed load form.



7.3.3 Model simulations

The simulations for the sediment transport were carried out for the following scenarios:

- Bed level changes with existing scenario
- Bed level changes with post-dredging scenario

7.3.4 Results

Based on the hydrodynamic output as discussed in Section 7.1, the wave and current induced sediment transport as bed load and suspended load for a period of four months covering Fair weather, Southwest monsoon and Northeast monsoon for the existing and post-dredging scenarios were simulated and discussed in detail below.

Bed level changes – Existing scenario

Fair Weather: During the fair weather period, the wave activity will be low with less influence of wind and currents. This fair-weather season prevails for a period of four months from February to May. The model reveals that the nearshore regions remain stable with moderate deposition of 0.10 m over a period of four months and slight erosion is observed in the northern part of the project area with the order of 0.05 m.

Southwest monsoon: During southwest monsoon, the project location is influenced with strong winds prevailing from southwest direction with relatively high wave activity. The associated sediment transport will be higher during southwest monsoon. The model reveals that the nearshore regions show comparatively high deposition and erosion, of which the major part happens in the northern region. The order of sediment deposition near the project area over a period of four months is 0.15 m and the order of erosion near the project area over a period of four months is 0.20 m.

Northeast monsoon season: During northeast monsoon, the project location is influenced by moderate winds prevailing from northeast direction with moderate wave activity. The model reveals that the nearshore region remains almost stable with a slight range of deposition and erosion in the order of 0.05 and 0.10 respectively.

Bed level changes – post-dredging scenario

Fair Weather: During the fair weather period, the wave activity will be low with less influence of wind and currents. This fair-weather season prevails over the period of four months from February to May. The model reveals that there is no significant bed level change in the dredging channel and the nearshore regions remain stable with moderate deposition of 0.12 m over a period of four months. Also, a slight erosion is observed in the southern part of the project area with an order of 0.08 m.

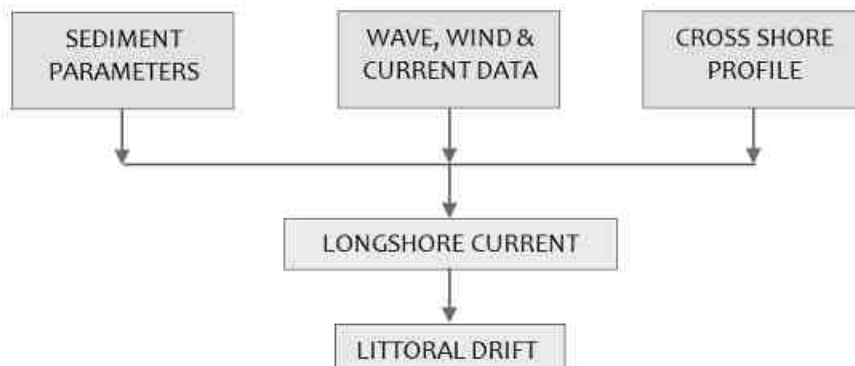


Southwest monsoon: During southwest monsoon, the project location is influenced with strong winds prevailing from southwest direction with relatively high wave activity. The associated sediment transport will be higher during southwest monsoon. The model reveals that the nearshore regions show comparatively high deposition and erosion, of which the major part happens in the northern region. The section of dredging channel at the southern part shows accretion while the section at the northern part shows erosion. The order of sediment deposition near the project area over a period of four months is 0.20 m and the order of erosion near the project area over a period of four months is 0.25 m.

Northeast monsoon season: During northeast monsoon, the project location is influenced by moderate winds prevailing from northeast direction with moderate wave activity.. The model reveals that the nearshore region remains almost stable with a slight range of deposition and erosion in the order of 0.15 and 0.12 respectively and deposition prevails in the northern section of the dredging channel.

7.4 LITTORAL DRIFT

The DHI-LITPACK model suite is a convenient tool for studying the coastal processes related to sediment transport in the wave breaking zone. The different modules in DHI- LITPACK model suite are LITSTP, LITDRIFT, LITLINE, LITTREN, LITPROF, which are used respectively to estimate the non-cohesive sediment transport, longshore current, littoral drift, shoreline evolution, sedimentation in trenches and cross-shore profile evolution. In the present study, the littoral sediment transport along the coast has been evaluated using the LITDRIFT model.



7.4.1 Model description

LITDRIFT is a deterministic numerical model which consists of two major parts, viz. i) a hydrodynamic model and ii) a sediment transport model. The hydrodynamic model includes propagation, shoaling and breaking of waves, calculation of the driving forces due to radiation stress gradients, momentum balance for the cross-shore and longshore direction giving the wave setup and the longshore current velocities. The model can be applied on complex coastal profiles with longshore bars. In the case of a longshore bar the broken waves can reform in the trough onshore of the bar.



Having computed the longshore current by the hydrodynamic module, points are selected across the coast, which are representative for the littoral drift estimation. The sediment transport calculations carried out by the STP module are made to reflect the local conditions with respect to the energy dissipation, the percentage of non-breaking waves and the rms values of wave heights.

The total sediment transport is dominated by transport contributions from areas where wave breaking occurs. In case of a bar-profile, the sediment calculation points will have to be located on the bars where waves are breaking. This gives the distribution of sediment transport across the profile, which is integrated to obtain the total longshore sediment transport rate. By considering the variation in the hydrodynamic climate (e.g., the yearly wind, wave, tide, storm surge and profile conditions) it is possible to determine the net gross littoral climate at a specific location.

The annual drift is evaluated by the contribution of transport from each of the incident waves occurring over the year. When calculating the annual drift, the wave climate in LITDRIFT is described at specified intervals in a time series file where each data set describes the characteristics of incident waves. The duration of the wave incident is given as a fraction of a year. Then the total annual drift Q_{annual} is calculated as the sum of the contributions from all incident waves,

$$Q_{\text{annual}} = \sum_{i=1}^{\text{NSETS}} Q_s(i) \cdot \text{Duration}(i)$$

Where NSETS is the total number of incident waves. The 1 hourly wave data is used as input.

7.4.2 Model input

The input data for the LITDRIFT module is described below,

- i) Orientation of the coast
- ii) Bathymetry of the cross-shore profile
- iii) Time series of wave climate
- iv) Sediment parameters

7.4.3 Results

Based on the available wave data compiled for the project location, the longshore sediment transport rate was estimated using the simplified CERC empirical equation (Shore Protection Manual, CERC, US Army, 1975).

Where,

- Volume of transport rate in m^3/year



- Breaking wave height in m
- Breaking wave angle w.r.t. shoreline

The shoreline near the project location is oriented nearly in N11°E direction. The monthly volume of littoral drift is presented below in **Table 86**.

Table 96. Monthly and annual longshore transport

Month	Quantity (m ³ /month)	
	Northerly	Southerly
January	-13869	46566
February	-8508	9470
March	-17395	4195
April	-15147	4051
May	-29649	2405
June	-14614	3260
July	-54964	41
August	-42311	60
September	-53831	16
October	-28579	14412
November	-12309	64674
December	-19514	65441
ANNUAL	-310690	214591
ANNUAL GROSS	0.52 x 10 ⁶	
ANNUAL NET	-0.10 x 10 ⁶ (Northerly)	

The annual northerly transport was estimated as -0.31×10^6 m³/year and southerly transport was estimated as 0.21×10^6 m³/year. The total annual gross transport was found to be 0.52×10^6 m³/year, and the annual net transport was estimated to be -0.10×10^6 m³/year towards south.

7.5 SHORELINE CHANGE STUDY

7.5.1 Introduction

The coast has been modified tremendously due to its dynamic nature. Along the coastal zone, modifications of the shorelines are considered as one of the most dynamic processes. In order to study shoreline positions in past and present remote sensing is one of the appropriate ways to provide a bird's eye view of the topography. In addition, it also showed the trends and rates of shoreline movement along the coastal zone.



7.5.2 Methodology

The focus of this study was to assess the shorelines by comparing the extracted shorelines from 2000 to 2024. An attempt of this suitable methodology was adopted after going through the relevant studies of the earlier researchers using remote sensing techniques. It was decided to utilize satellite images from different periods to study the shoreline positions and its changes. To attempt this task, geospatial software is essential, and Arc GIS software is an ideal package. Indomer Coastal Hydraulics Pvt. Ltd. has a licensed version of ArcGIS 10.8 and is able to do different image processing using satellite images and access high resolution satellite data. Specifically, the Digital Shoreline Analysis System (DSAS) tool was used to determine the rate of shoreline change. This tool works within the Environmental Systems Research Institute (ESRI) Geographic Information System (Arc GIS) software. In the present study an attempt has been made to understand the rate of shoreline change for a period of 25 years (2000 to 2024) using LRR (Linear Regression Model). In addition, in this study prediction for future shoreline positions (2034 and 2044) was also made with reference to calculated shoreline change. The below flow chart describes the following methodology for attempting shoreline change studies using satellite images.

ARCGIS (Geographic Information System): It is the software developed by ESRI network for mapping the Geospatial representation of the real world. ARCGIS has a wide range of applications in various fields. Particularly, In this study this software is widely used to process satellite data, extract shorelines from temporal data and prepare layouts for documentation.

DSAS (Digital shoreline analysis System): It is an add-in to ESRI ArcGIS desktop (10.4-10.7+) that enables a user to calculate rate-of-change statistics from multiple historical shoreline positions. It detects and measures shoreline change through statistics. This model also includes a beta model of shoreline forecasting with the option to generate 10 and/or 20-year shoreline horizons and uncertainty bands.

LRR (Linear Regression Rate): A linear regression rate-of-change statistic can be determined by fitting Least-Square regression lines to all shoreline points for a particular transect.

7.5.3 Data collection

The different temporal data were used to map shoreline changes over a 25 – year time period (2000 – 2024). In addition, it also infers the dynamic nature of this coast. Multi resolution satellite data such as Landsat TM-5, Landsat-7, Landsat-8 and Landsat-9 are used in this study. The details of the satellite imagery, acquisition details and resolutions are listed below (**Table 87**).

Table 97. Data Used

	Spatial Resolution	Date of data acquisition
Landsat 7	30 m	10-11-2000
Landsat 5	60 m	02-09-2005
Landsat 5	60 m	16-10-2010
Landsat 8	30 m	23-05-2015



	Spatial Resolution	Date of data acquisition
Landsat 8	30 m	07-07-2020
Landsat 8	30 m	26-05-2022
Landsat 9	30 m	12-09-2024

Landsat series of satellite images: The Landsat satellite program is a series of Earth-observing satellites jointly managed by the United States Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA). The first Landsat satellite was launched in 1972, and the program has since provided a continuous record of Earth's land surface for over four decades. Landsat satellites capture images of the Earth in visible, near infrared, and thermal infrared wavelengths, allowing scientists and researchers to monitor and study various aspects of our planet's land and resources. Landsat series of satellite images (Landsat 5 to 9) for the period from 2000, 2005, 2010, 2015, 2020, 2022 and 2024 with spatial resolution 30 m.

7.5.4 Data processing

The multi temporal images of 2000–2024 are used in this analysis for calculating the long-term erosional and accretion changes along the study area. The areas of erosion and accretion were categorized based on land loss and land gain along the project location. In the present study, seven satellite data from the years 2000, 2005, 2010, 2015, 2020, 2022 and 2024 have been taken into consideration. All the data sets are projected in UTM projection with zone no 44 and WGS 84 datum.

7.5.6 Shoreline delineation

In the present study, applying Automatic shoreline delineation was quite complex, due to the presence of water saturated zones at the land-water boundary. In order to delineate the actual shoreline position, a semi – automated method (automatic and manual digitization) was carried out to extract the shoreline. It can reduce the misinterpretation error which is more common in automatic methods. Band ratio between the NIR and the Green band was used to identify the water-land boundary and the pixels signifying the shoreline have been converted into vector layers by digitizing using Arc GIS 10.8 to get the real shoreline position of different periods of time.

7.5.7 DSAS processing

DSAS v5.0 software is an add-in to ESRI ArcGIS desktop 10.4 and above versions that enables a user to calculate the rate-of-change statistics from multiple historical shoreline positions. DSAS is an extension developed by USGS for ArcGIS which is an automated tool that gives the change statistics for the given shorelines. The digitized shoreline for the years 2000, 2005, 2010, 2015, 2020, 2022 and 2024 in the vector format were used as the input to the DSAS the rate of shoreline change was calculated. While using this tool, care was given to the parameters such as the format of the vector file, date of each vector layer and transect distance. DSAS creates transects that bisect the shorelines from a base line from which the change statistics were calculated. The rate of shoreline change was calculated for an area covered 10 km from the project location. The selected



study area transects are generated in 100 meters distance and using these transects lines to shoreline change was calculated using statistical values. In this study, 2000, 2005, 2010, 2015, 2020, 2022 and 2024 shorelines were and shoreline changes for 2000 – 2024 was calculated.

Transect lines: For attempting to study the shoreline change DSAS tool has generated the transect lines which crosses all the extracted shoreline from satellite images. In this study, transect lines were generated along the coastal stretch at every 100 meters. Accordingly, 200 transects were generated along the coastal stretch. Further for discussion in detail this 200 transects were further divided into four sectors as North (5 km to 10 km) - transect no 1 to 50, North (0 km to 5 km) - transect no 51 to 100, South (0 km to 5 km) - transect no 101 to 150 and South (5 km to 10 km) - transect no 151 to 200. The analysis using these transect lines would help to understand the dynamics of the coast.

7.5.8 Results and discussion

The shoreline modifications along the project location were calculated based on shoreline boundaries extracted from different satellite images. The rate of shoreline change was calculated using the transects lines (200 nos.), which are crossing the different shorelines. Particularly, for this analysis 2000 shoreline was considered as a baseline. The prepared table displays the shoreline changes along the transect lines for the period 2000 – 2024. The results obtained from the analysis of shorelines are in the form of numbers i.e., $\pm m/yr$, where + is for accretion, and - is for erosion. However, mapping requires classifications of accretion/erosion rates in sub-classes considering the magnitude of changes. The classification of shoreline changes is further a subjective aspect. We have classified the shoreline change rates into seven classes (**Table 88**) (Kankara et al., 2014)

Table 98. Shoreline classification schemes used in the analysis

Classification	Rate (m/year)	Colour Schemes
High Erosion	< - 5.0	
Moderate Erosion	-5.0 to - 3	
Low Erosion	-3.0 to -0.5	
Stable Coast	-0.5 to 0.5	
Low Accretion	0.5 to 3.0	
Moderate Accretion	3.0 to 5.0	
High Accretion	>5.0	

Source: National Assessment of Shoreline Changes along Indian Coast (NCCR)



Table 99. Shoreline Change (1972 -2023) – Statistics

Period (years)	Shoreline Change (in m)								
	Total number of Transect	Number of Transect Erosion	Erosion %	Maximum Erosion (m)	Average Erosion (m)	Number of Transect Accretion	Accretion %	Maximum Accretion (m)	Average Accretion (m)
North (5 km to 10 km) – Transect no 1 to 50	50	2	4	(-) 0.14	(-) 0.15	48	96	5.01	2.13
North (0 km to 5 km) Transect no 51 to 100	50	5	10	(-) 0.01	(-) 0.21	45	90	1.51	0.78
South (0 km to 5 km) Transect no 101 to 150	50	8	16	(-) 0.01	(-) 0.27	42	84	4.21	1.02
South (5 km to 10 km) Transect no 151 to 200.	50	-	-	-	-	50	100	4.34	2.56
2000 – 2024 (Overall)	200	15	7.5	(-) 0.01	(-) 0.23	185	92.5	5.01	1.66

Note. Negative values indicate erosion, while positive ones indicate accretion in meters.

Shoreline changes studies for the period of 2000 - 2024

The shoreline studies for the period of 2000 – 2024 have shown that nearly 93 % of areas showed accretion and 7 % of area only noticed with erosion. Out of 200 transect lines, 15 were noticed with erosion and remaining 185 transect lines were noticed with accretion. The maximum accretion is observed near to the river mouth with a value of 5 m. The maximum erosion is observed in the southern region from the proposed project region with a value of 0.8 m (Table 90).

Table 100. Shoreline change statistics – 4 sectors (2000 - 2024)

1972 - 1979					
S. No	Descriptives	North (5 km to 10 km)	North (0 km to 5 km)	South (0 km to 5 km)	South (5 km to 10 km)
1	Mean	2.05	0.68	0.81	2.60
2	Minimum	(-) 0.15	(-) 0.35	(-) 0.87	1.61
3	Maximum	5.01	1.51	4.21	4.34
4	Median	1.86	0.73	0.58	2.45
5	First Quartile	0.81	0.30	0.21	2.13
6	Third Quartile	3.24	0.92	1.0	2.81



7	Interquartile Range	2.44	0.61	0.79	0.69
8	Range	5.16	1.86	5.08	2.73
9	Standard Deviation	1.41	0.48	1.05	0.63

Note. Negative values indicate erosion, while positive ones indicate accretion in meters.

7.5.9 Shoreline prediction (2034 and 2044)

In this study, future shorelines (2034 and 2044) were predicted using the shoreline prediction algorithms coupled with extracted shorelines from different periods of satellite imagery. The predicted shorelines have shown significant accretion along the coast. Only in the southern section has erosion been seen.

The prediction of this shoreline is based on chronological observation of different satellite images only. Furthermore, in this study natural disastrous impacts like tsunami, storms or anthropogenic activities have not been taken into consideration.

7.5.10 Inference

To understand the dynamic nature of this coastal zone, the present study was carried out to assess the different periods of shoreline using remote sensing techniques. The salient findings of the present study are summarized below.

1. To understand the dynamic nature of the coast study area, a DSAS tool was used. Accordingly, using this tool, 200 transects were generated along the coastal zone. Further, this 200 transects were divided into four sectors as North (5 km to 10 km) - transect no 1 to 50, North (0 km to 5 km) - transect no 51 to 100, South (0 km to 5 km) - transect no 101 to 150 and South (5 km to 10 km) - transect no 151 to 200.
2. The calculated shoreline changes using different temporal data (2000, 2005, 2010, 2015, 2020, 2022 and 2024) and statistical values for the 2000 -2024 have shown that this coast is accreting naturally. The analysis of shoreline changes along these 200 transect lines have shown that 185 transect lines are accreting and remaining 15 transect lines are erosion in nature. It demonstrates 92.5% of area is noticed with accretion and 7.5% of area is noticed with erosion.
3. The maximum accretion is observed near to the river mouth with a value of 5 m. The maximum erosion is observed in the southern region from the proposed project region with a value of 0.8 m.

7.6 STORM SURGE

The storm/cyclone induced water level variations (storm surges) along the east coast of India near the project site are simulated using the MIKE21-HD module. In order to estimate the surge height, the distribution of the wind and pressure fields induced by the cyclone have to be specified over the Bay of Bengal near the study area. As the wind and pressure fields induced by a moving cyclone are



nearly circular, they are described in terms of a smaller number of storm parameters in the MIKE21 module. The parameters used to describe the wind field associated with a cyclone are:

- Radius to maximum wind, R_m ,
- Maximum wind speed, W_{max} ,
- Cyclone track, forward speed V_f and direction,
- Central pressure, P_c and
- The ambient pressure, P_a .

At a distance R from the center of the cyclone, the rotational wind speed W_r is given by,

$$W_r = W_{max} (R/R_m)^7 \exp[7(1 - R/R_m)] \quad \text{for } R < R_m$$

$$W_r = W_{max} \exp[(0.0025R_m + 0.005)(1 - R/R_m)] \quad \text{for } R \geq R_m$$

where R and R_m are in km. Cyclone induced wind rotates anti-clockwise in the northern hemisphere and clockwise in the Southern hemisphere. The direction of the wind at a distance R from the centre of the cyclone is deflected towards its centre by friction at the air-sea interface. The deflection angle θ with respect to the tangent to the circle at a particular location R from the centre of the cyclone is given by,

$$\theta = 10^\circ \text{ for } 0 < R \leq R_m$$

$$= 10^\circ + (R - R_m)/(0.2R_m) 15^\circ \text{ for } R_m < R \leq 1.2R_m$$

$$= 25^\circ \text{ for } 1.2R_m < R$$

Finally, the pressure, P , at a particular location is given by,

$$P = P_c + (P_a - P_c) \exp(-R_m/R)$$

7.6.1 Estimation of storm surge

The MIKE 21 model has been used to simulate the storm surge for cyclonic conditions. Very Severe Cyclonic Storm Thane which has crossed very close to the project location is considered for the estimation of storm surge during cyclonic events. Based on the track positions and other parameters of Very Severe Cyclonic Storm THANE over the Bay of Bengal during 25-31 December



2011 published by IMD, different input parameters pertaining to wind speed were considered for model simulation.

7.6.2 Storm surge due to Thane cyclone

The bathymetry used for the storm surge simulation model is shown in Fig. 107. The storm surge simulation has been carried out for cyclonic wind speeds of 39 m/s (2011 Thane cyclone). The wind fields of 2011 Thane cyclone with cyclone track is shown in Fig. 108. The maximum storm surge of 2011 Thane cyclone is shown in Fig. 109.

The estimated maximum storm surge close to the project location is approximately 1.4 m above astronomical tide.



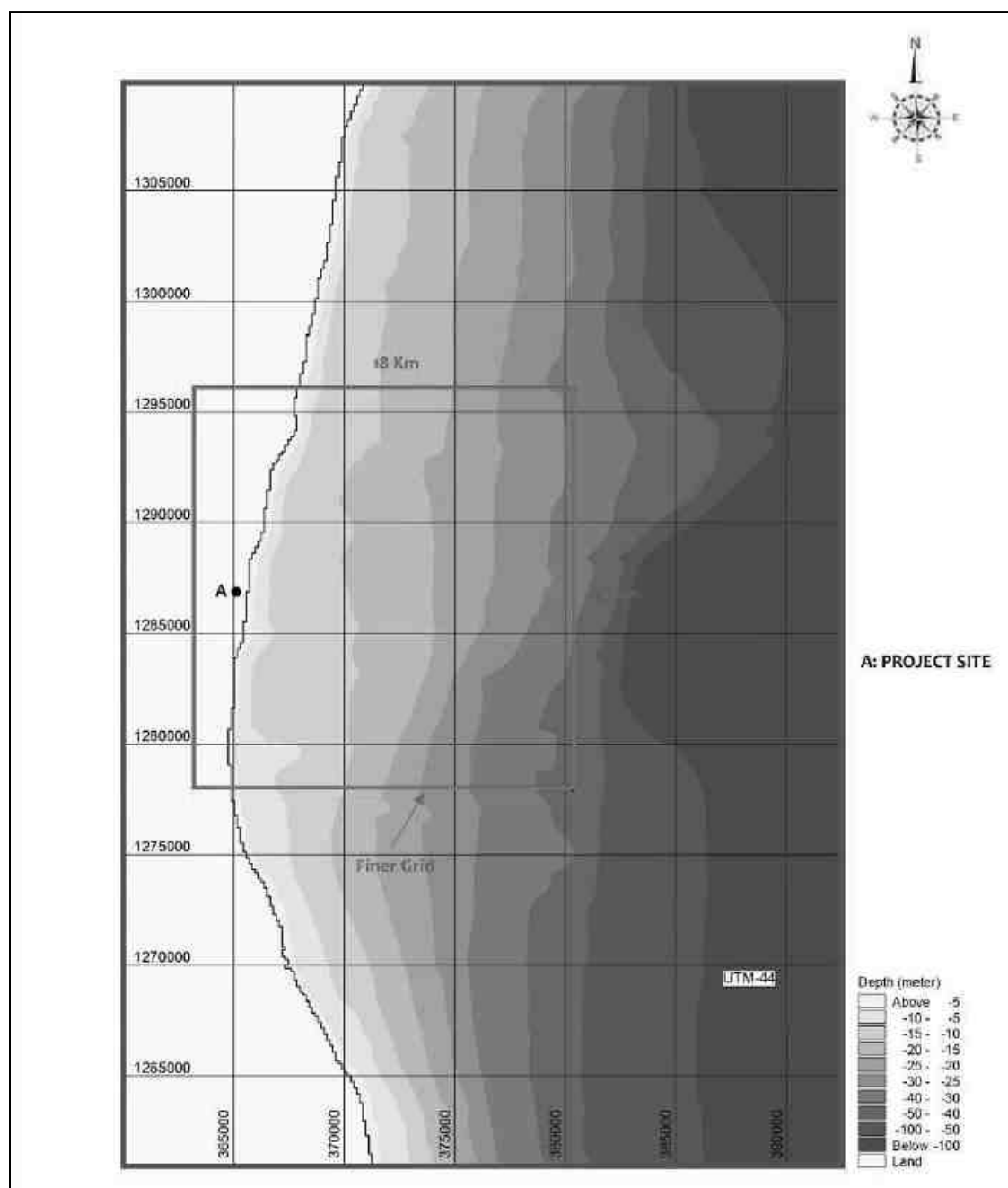


Figure 77. Coarser Domain

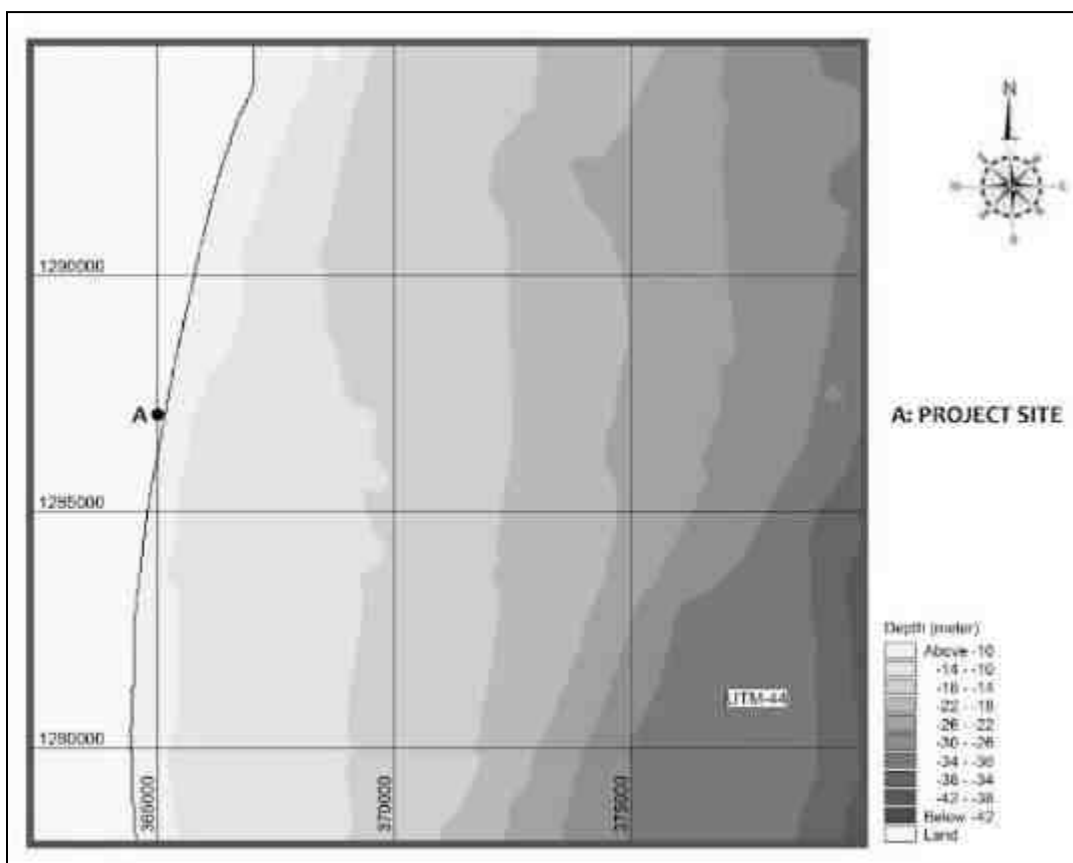


Figure 78. Finer Domain without Dredging Channel



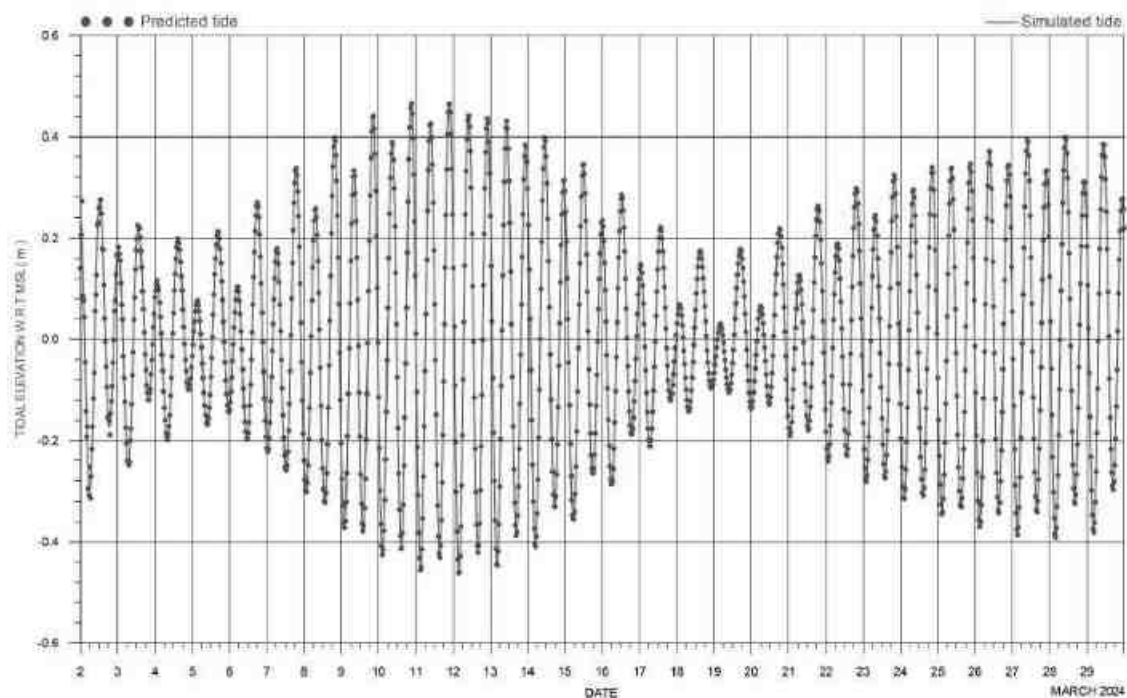


Figure 79. Comparison of Predicted and Simulated Tides

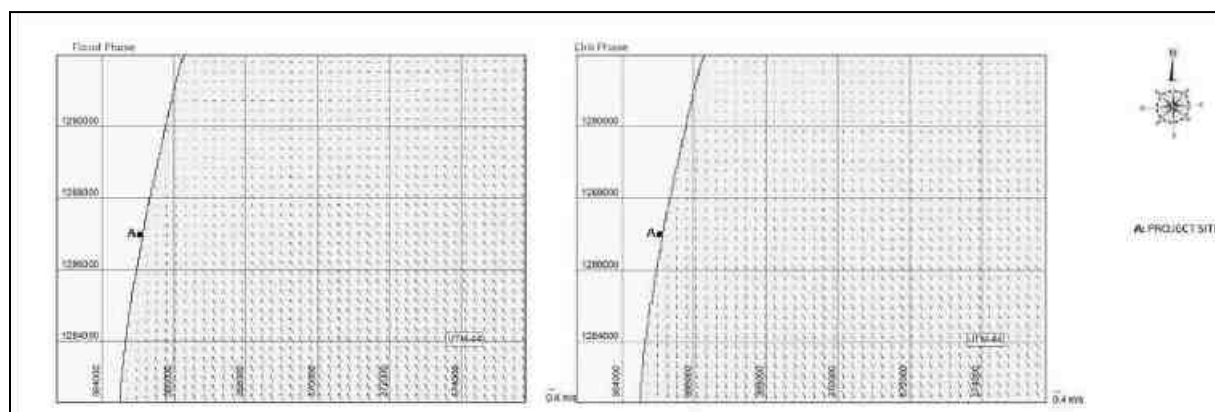


Figure 80. Flow Field- Fair Weather- Spring Tide- Without Dredging Channel

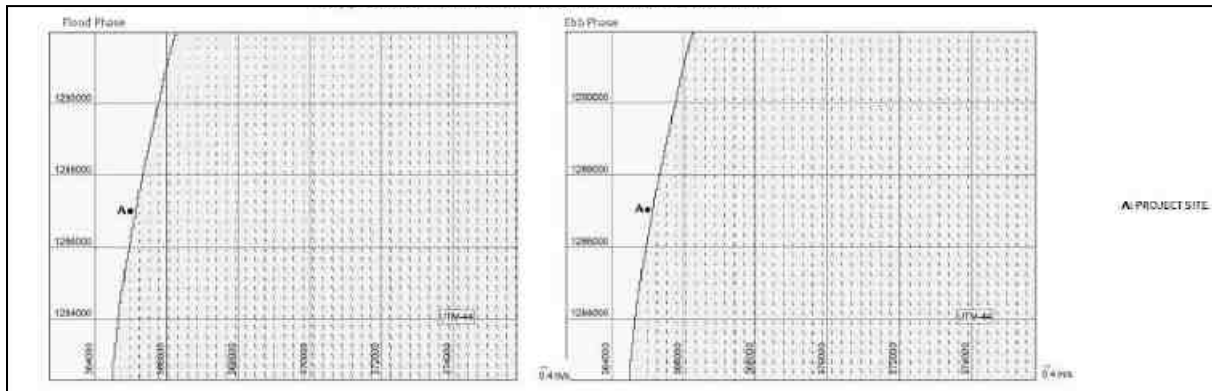


Figure 81. Flow Field- Fair Weather- Neap Tide- Without Dredging Channel

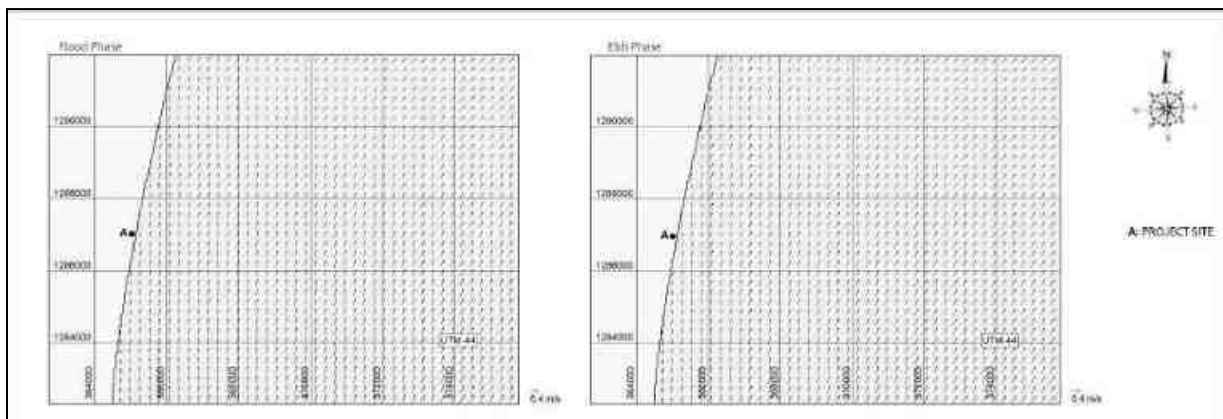


Figure 82. Flow Field- SW Monsoon- Spring Tide- Without Dredging Channel

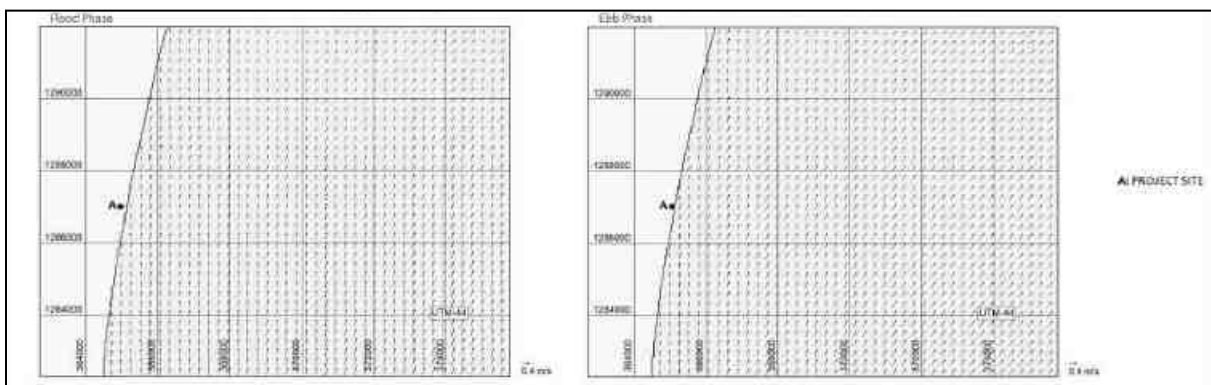


Figure 83. Flow Field- SW Monsoon- Neap Tide- Without Dredging Channel

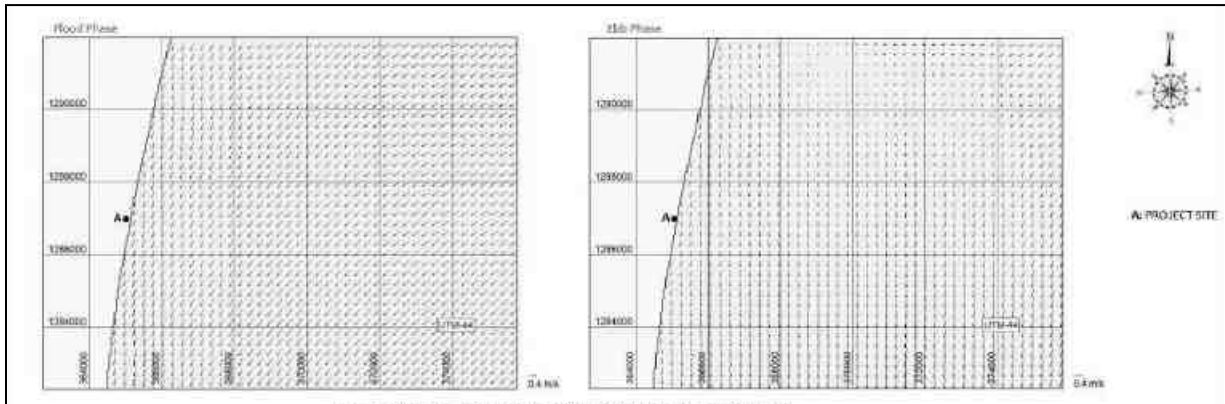


Figure 84. Flow Field- NE Monsoon- Spring Tide- Without Dredging Channel

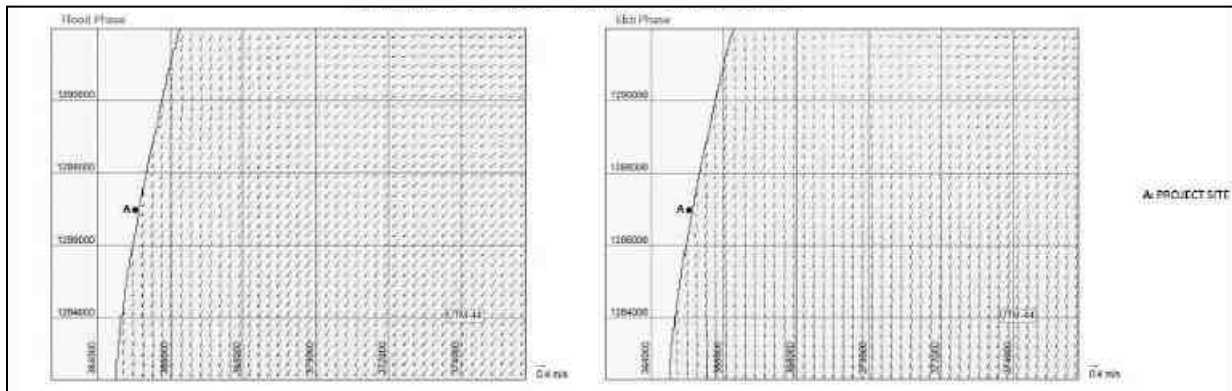


Figure 85. Flow Field- NE Monsoon- Neap Tide- Without Dredging Channel

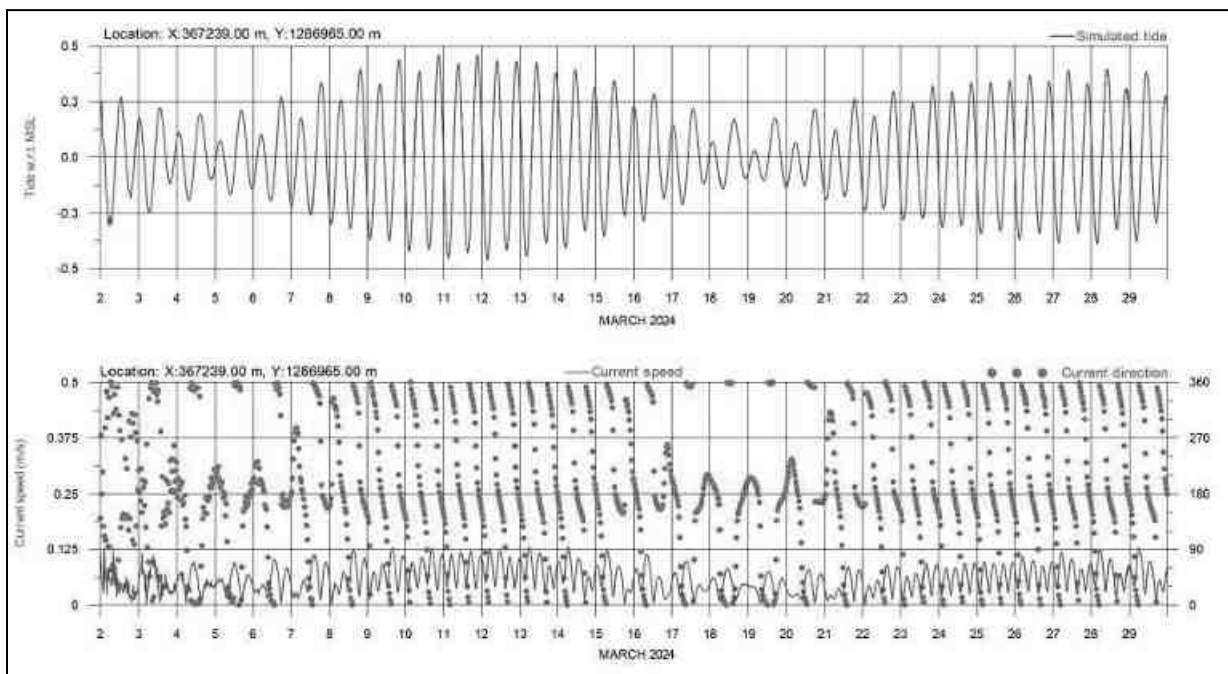


Figure 86. Variation of Simulated Tides & Currents- 1km offshore from Mooring Dolphin- Fair Weather

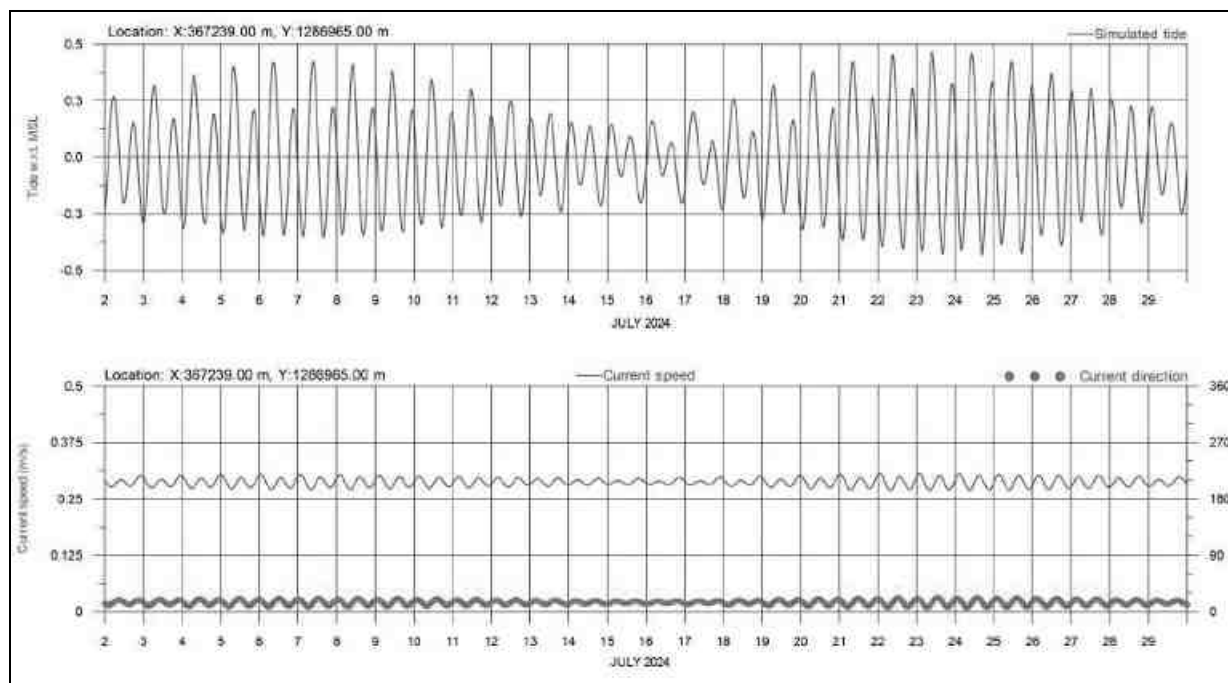


Figure 87. Variation of Simulated Tides & Currents- 1km offshore from Mooring Dolphin- SW Monsoon

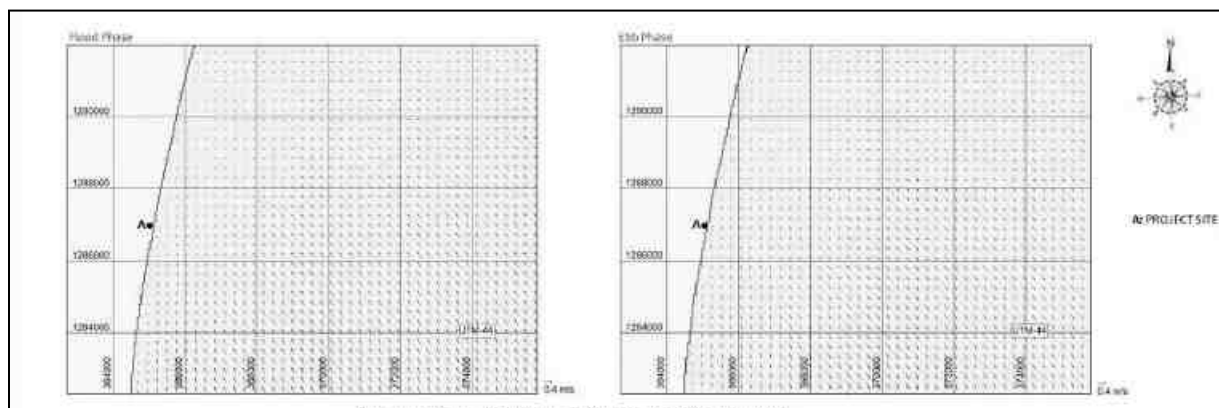


Figure 88. Flow Field- Fair Weather- Spring Tide- Without Dredging Channel

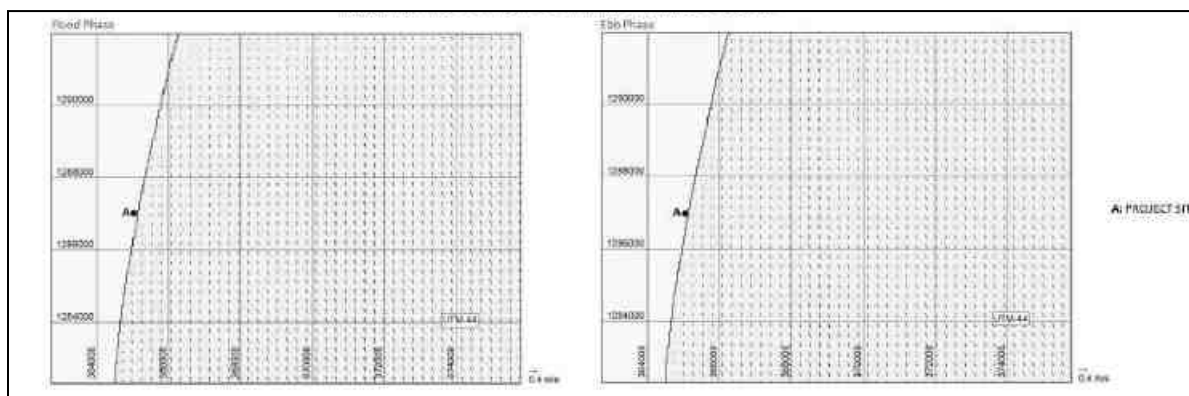


Figure 89. Flow Field- Fair Weather- Neap Tide- Without Dredging Channel

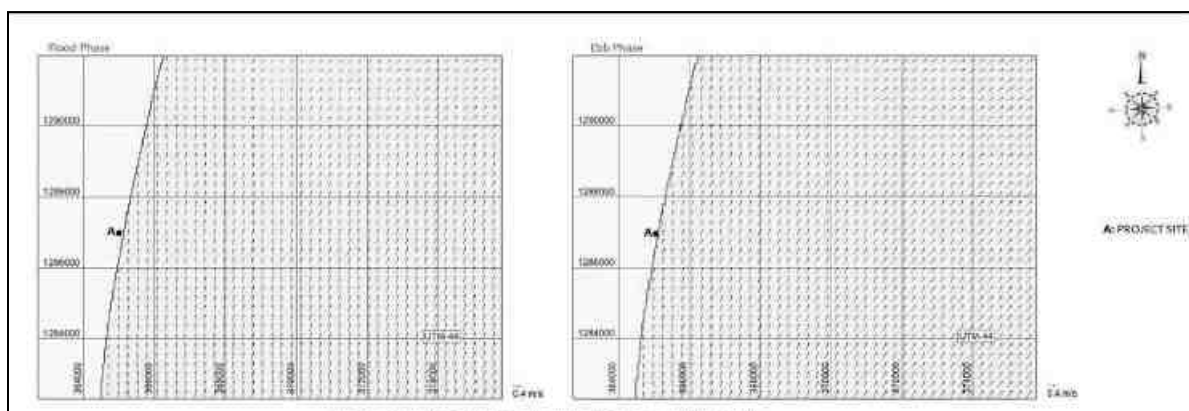


Figure 90. Flow Field- SW Monsoon- Spring Tide- Without Dredging Channel

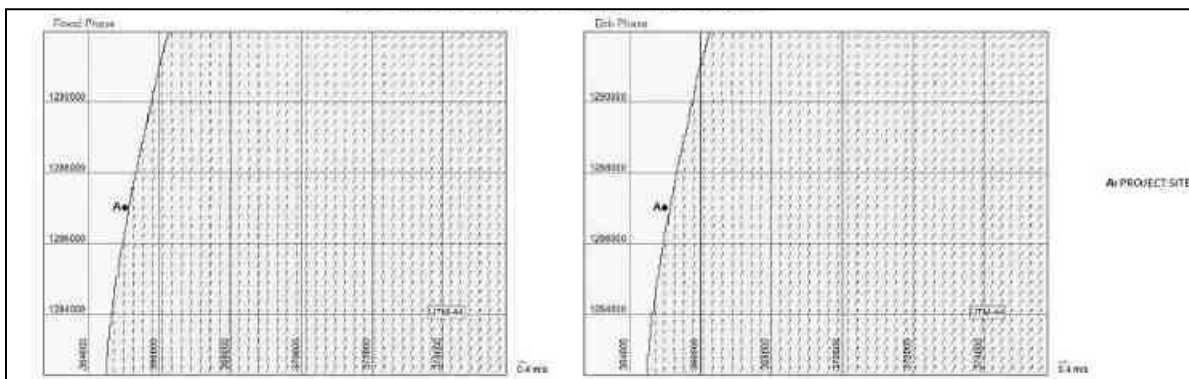


Figure 91. Flow Field- SW Monsoon- Neap Tide- Without Dredging Channel



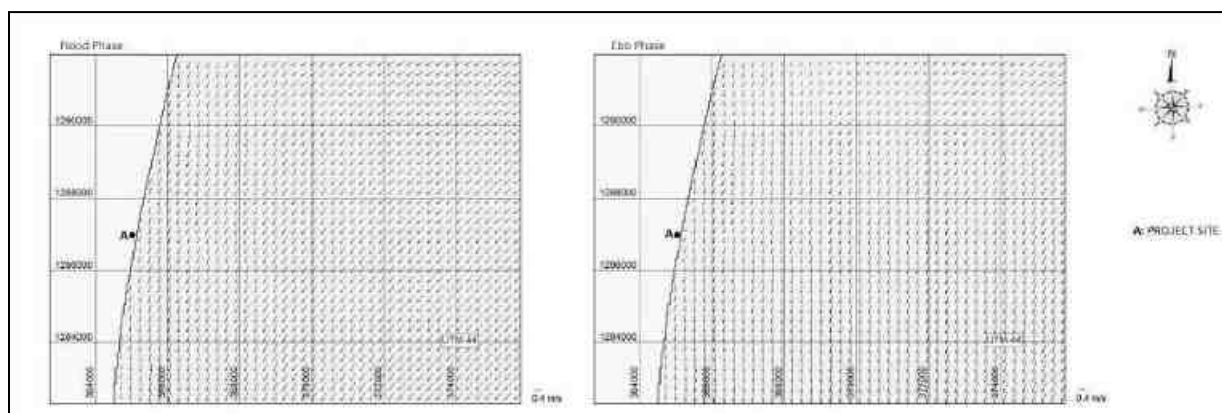


Figure 92. Flow Field- NE Monsoon- Spring Tide- Without Dredging Channel

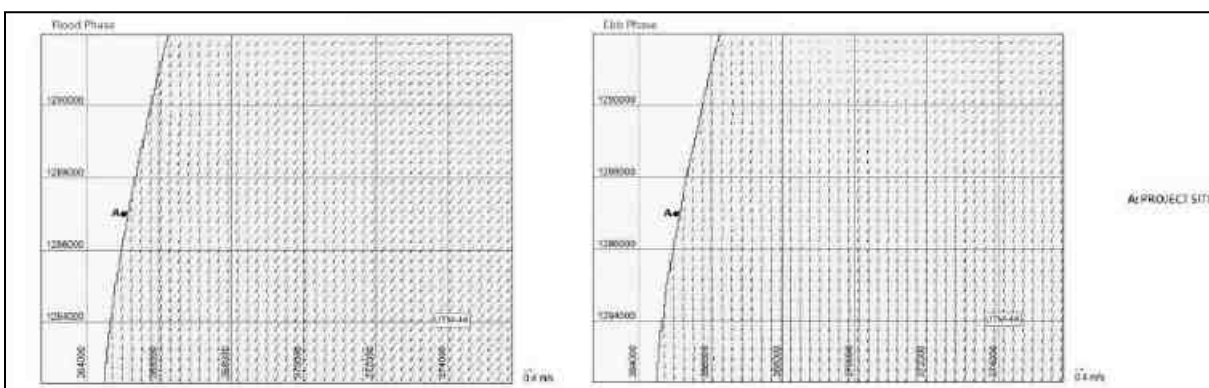


Figure 93. Flow Field- NE Monsoon- Neap Tide- Without Dredging Channel

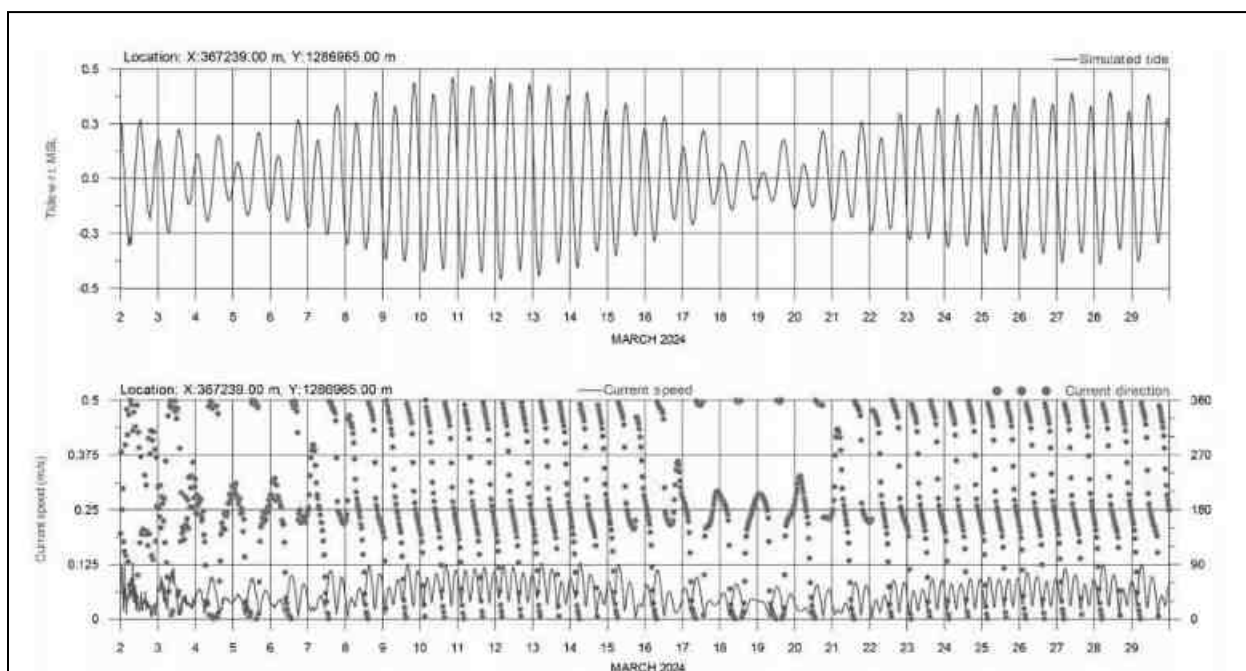


Figure 94. Variation of Simulated Tides and Currents - 1 km Offshore from Mooring Dolphin - Fair Weather

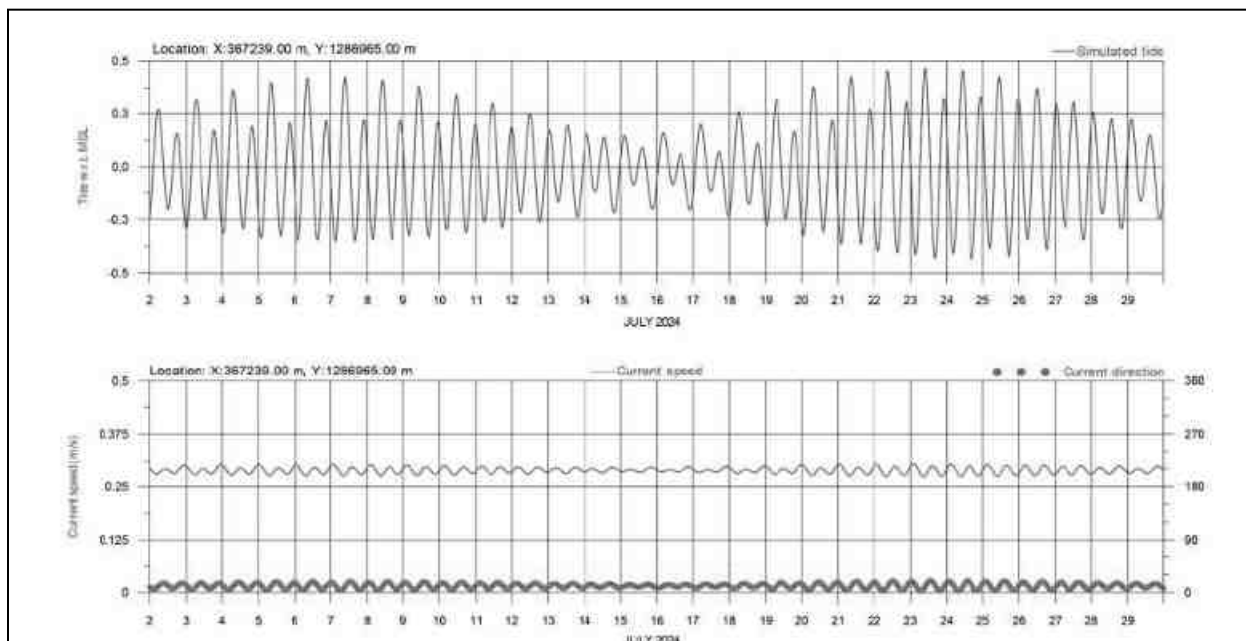


Figure 95. Variation of Simulated Tides and Currents - 1 km Offshore from Mooring Dolphin - SW Monsoon

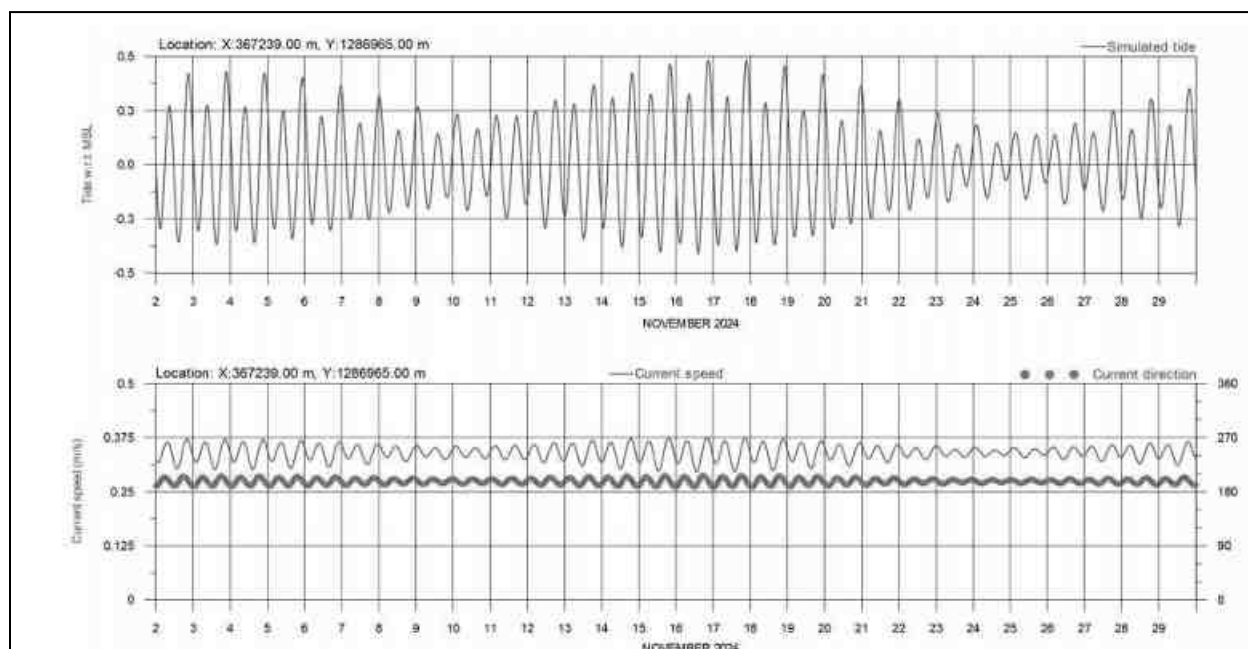


Figure 96. Variation of Simulated Tides and Currents - 1 km Offshore from Mooring Dolphin - NE Monsoon

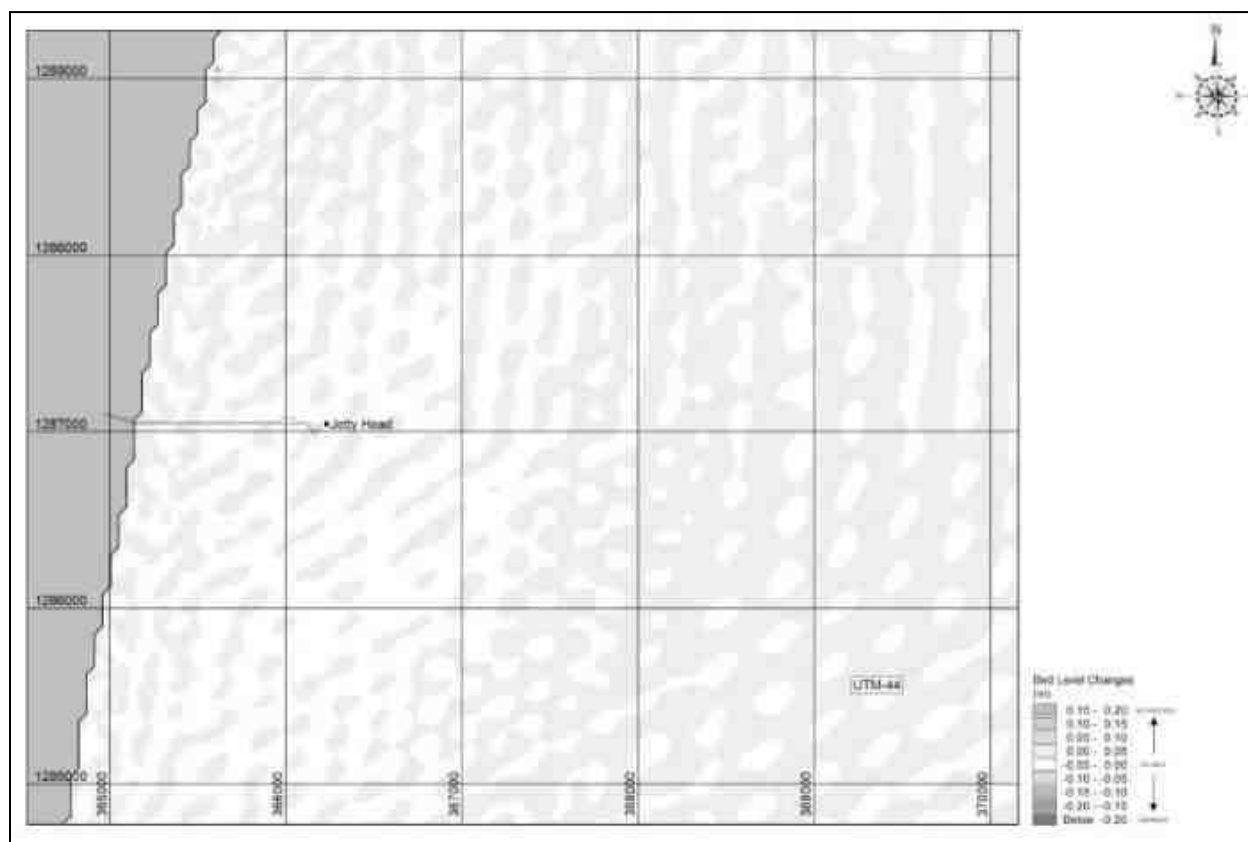


Figure 97. Bed level changes in one month -Fair Weather - Existing scenario

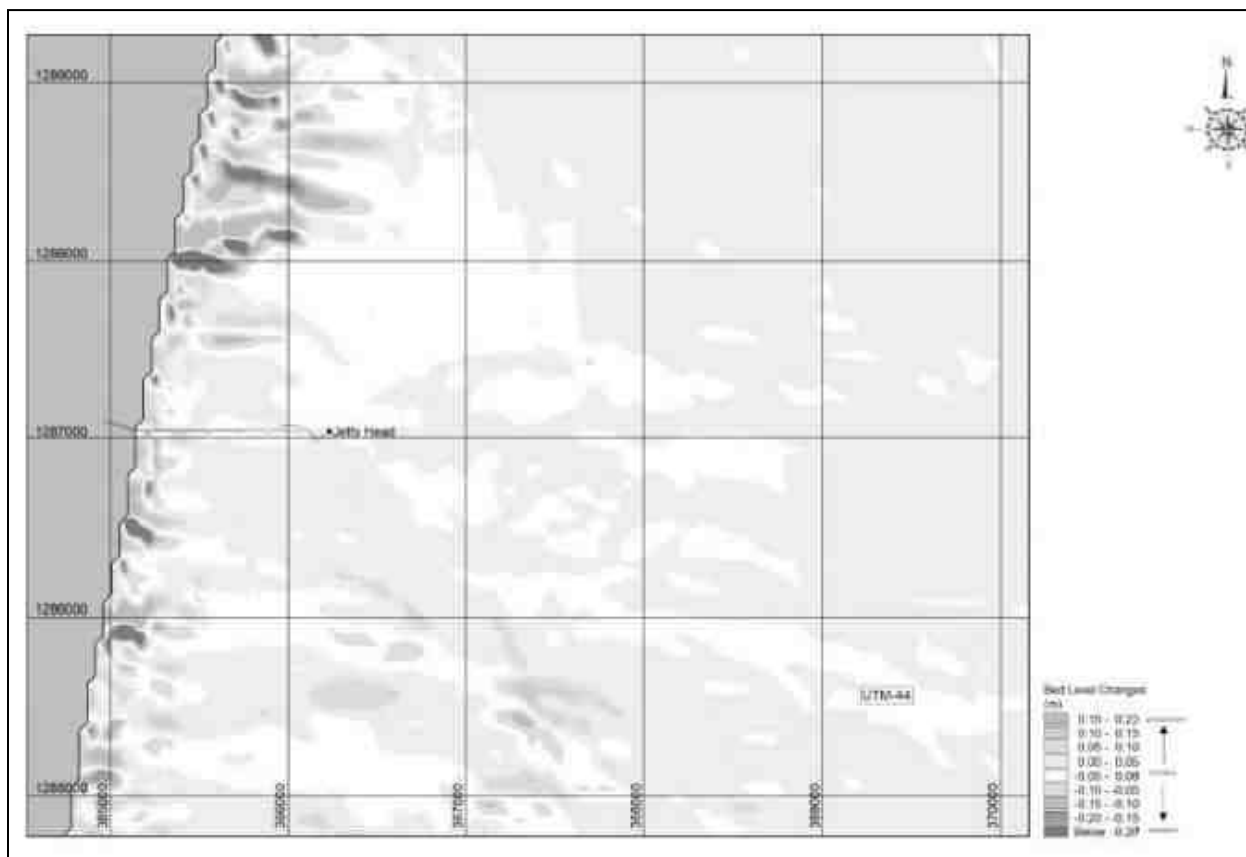


Figure 98. Bed level changes in one month -SW Monsoon - Existing scenario

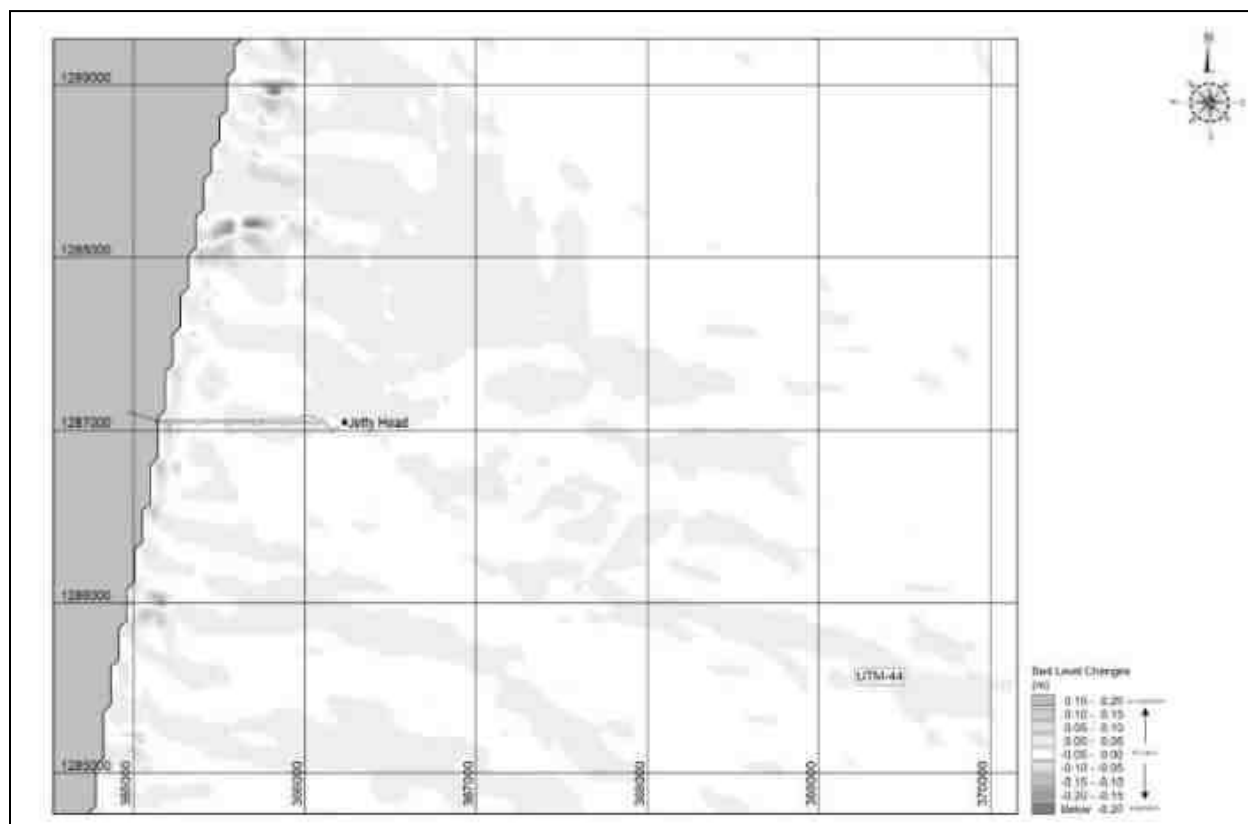


Figure 99. Bed level changes in one month -NE Monsoon - Existing scenario

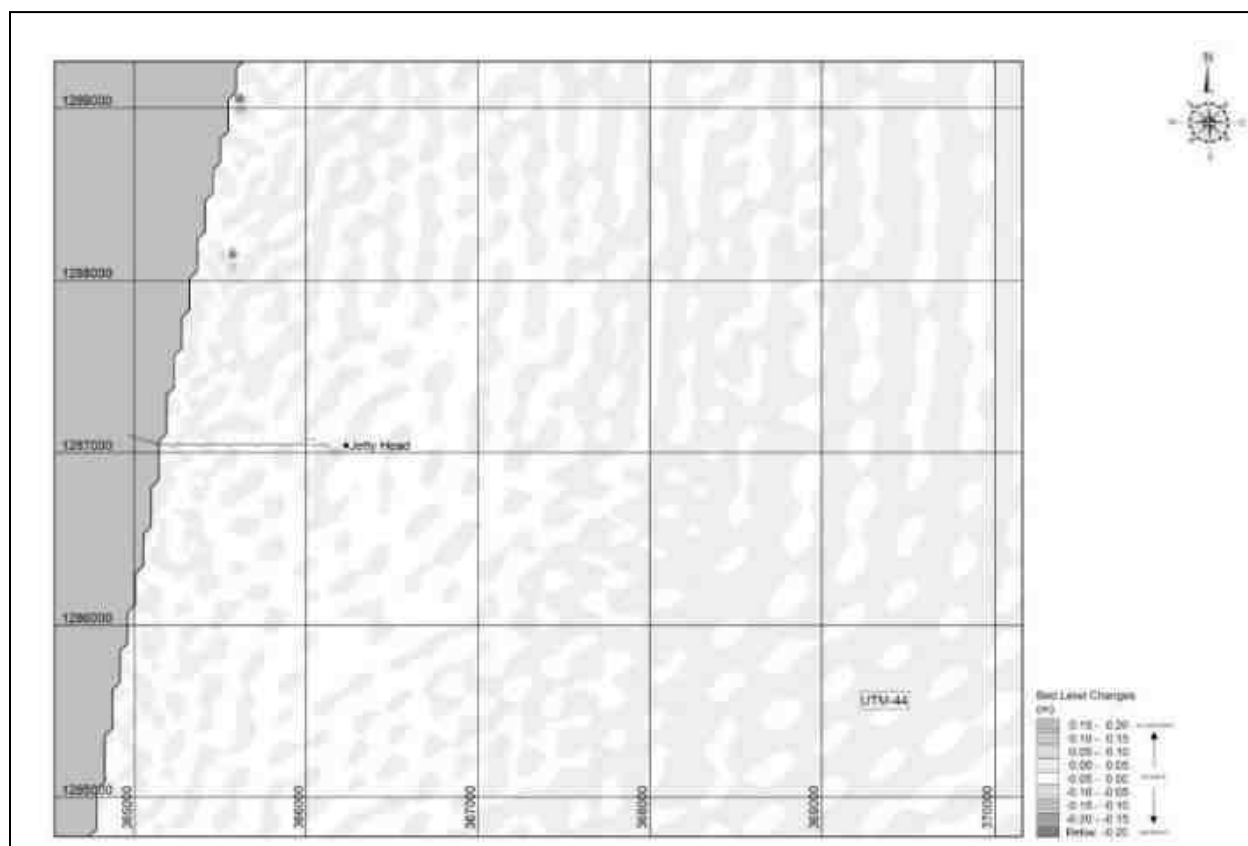


Figure 100. Bed level changes in one month -Fair Weather - post dredging scenario

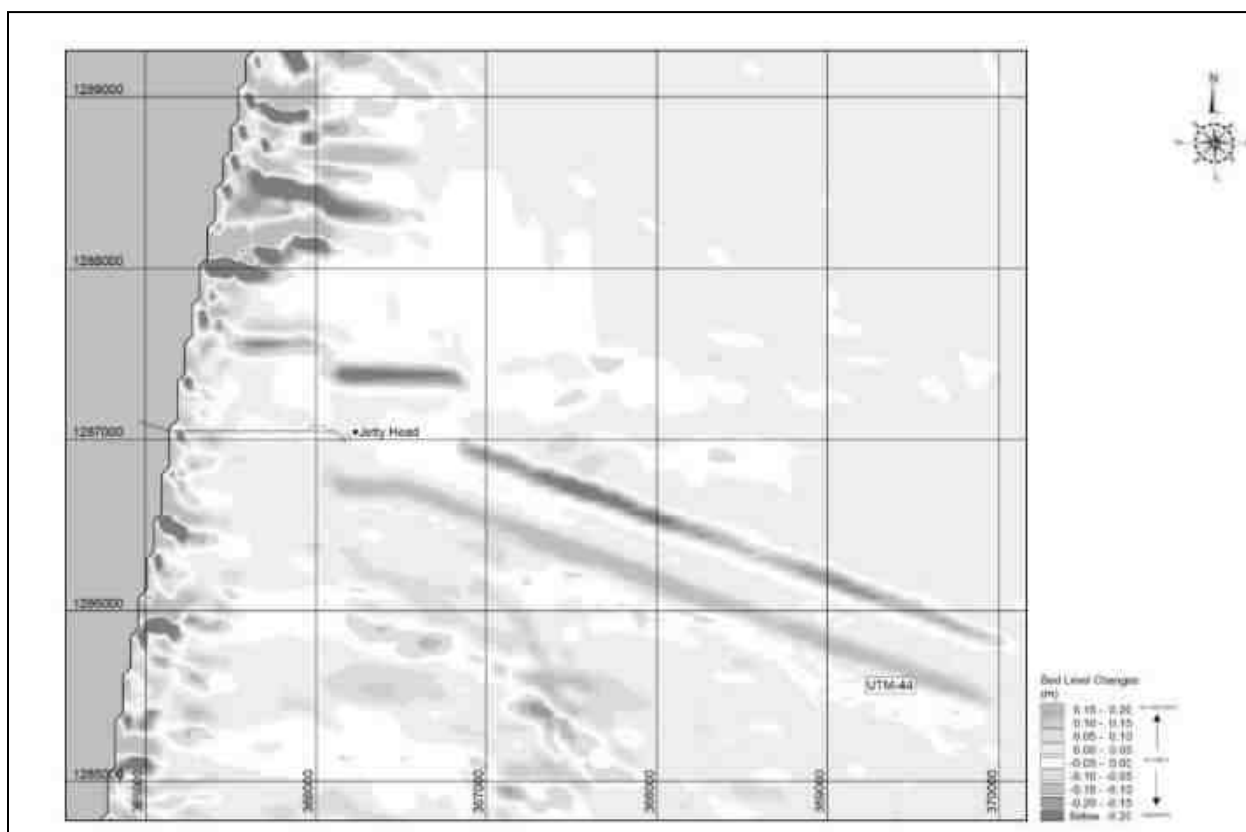


Figure 101. Bed level changes in one month - SW Monsoon - post dredging scenario

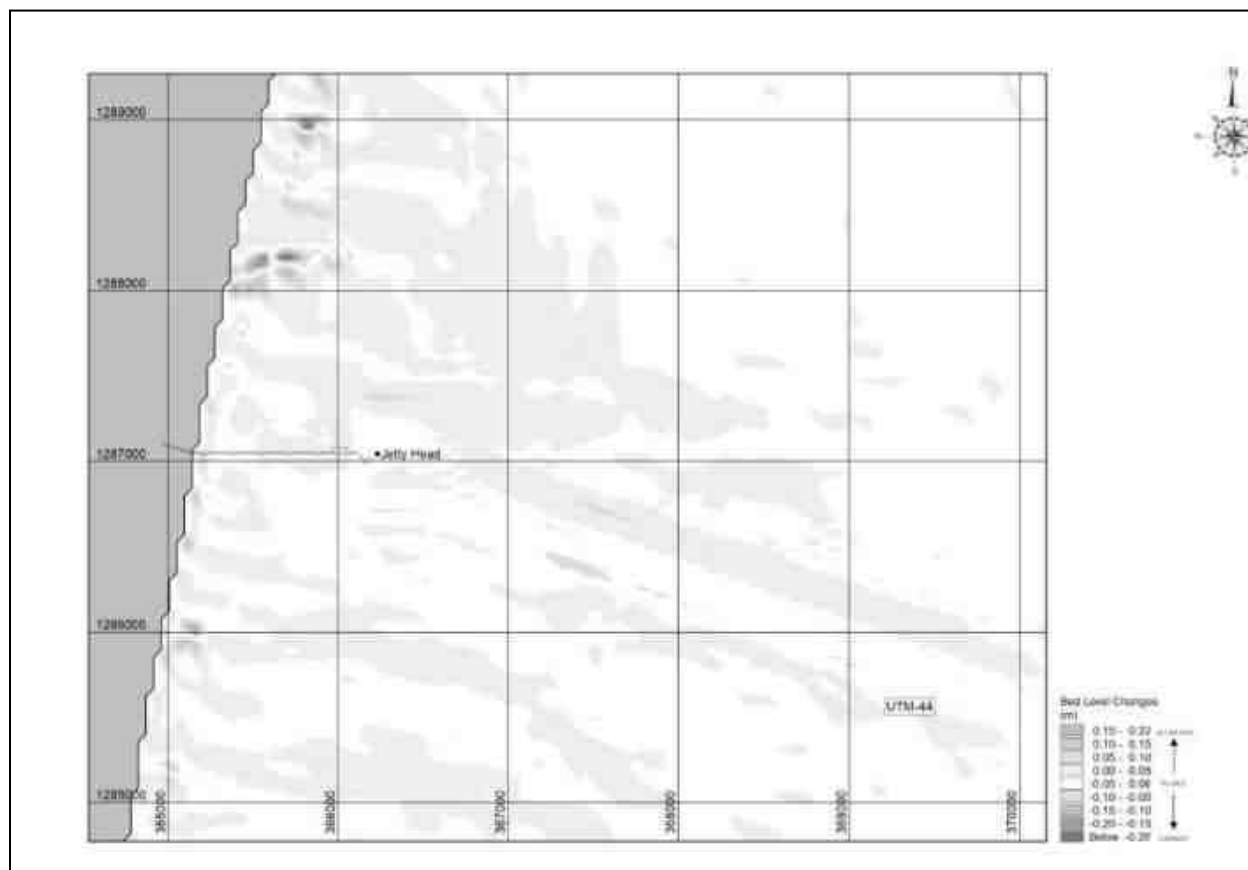


Figure 102. Bed level changes in one month - NE Monsoon - post dredging scenario

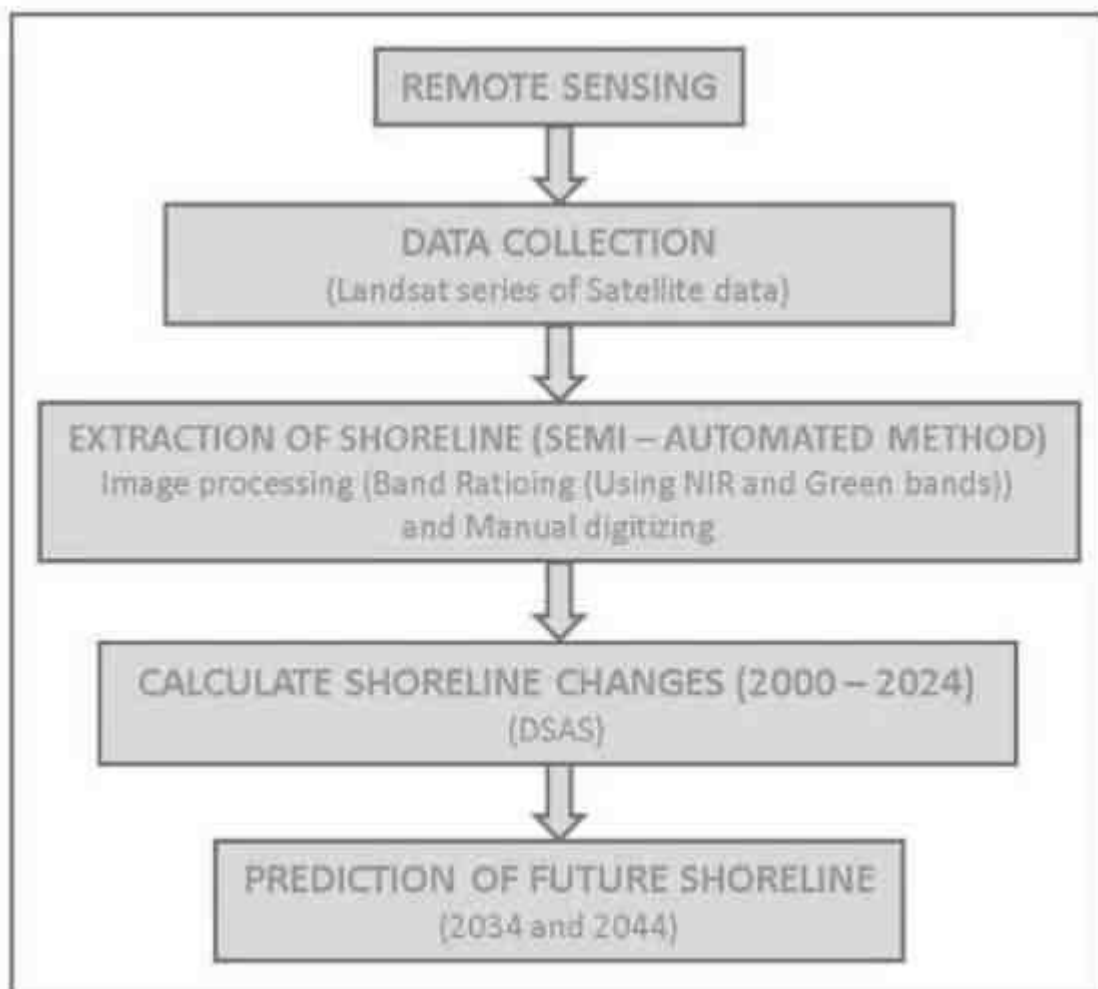


Figure 103. Methodology

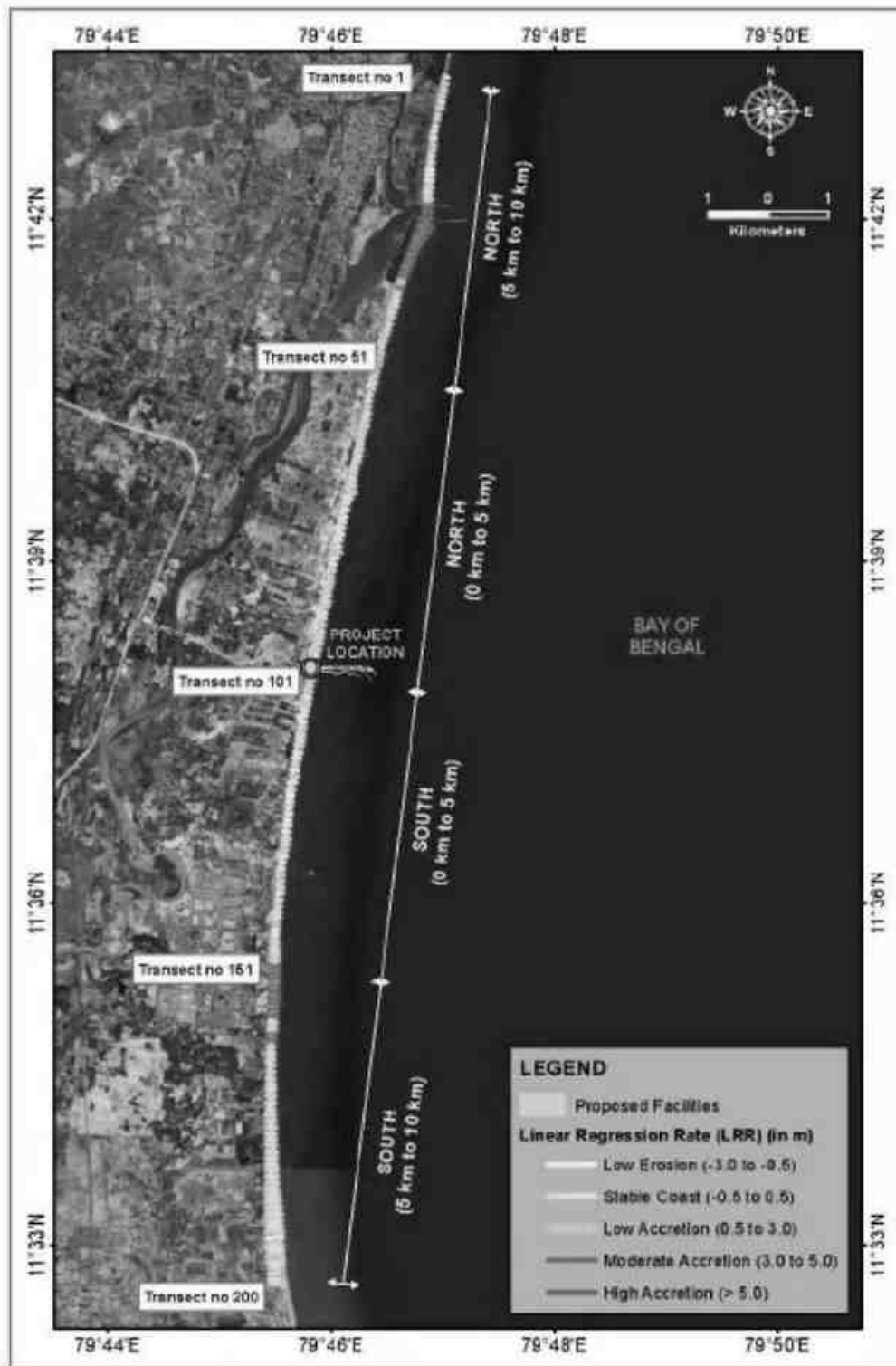


Figure 104. Shoreline Change (1972 - 2023)



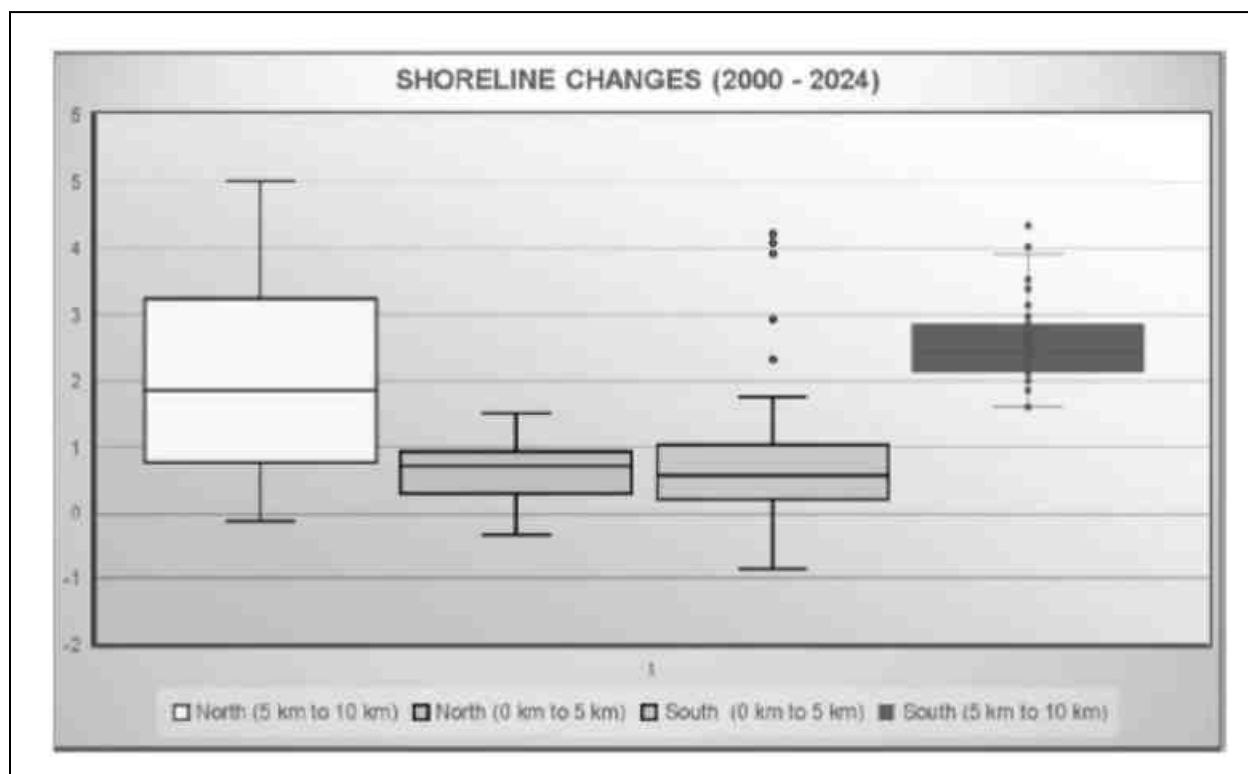


Figure 105. Box Plot Diagram for Shoreline Change (2000-2024)

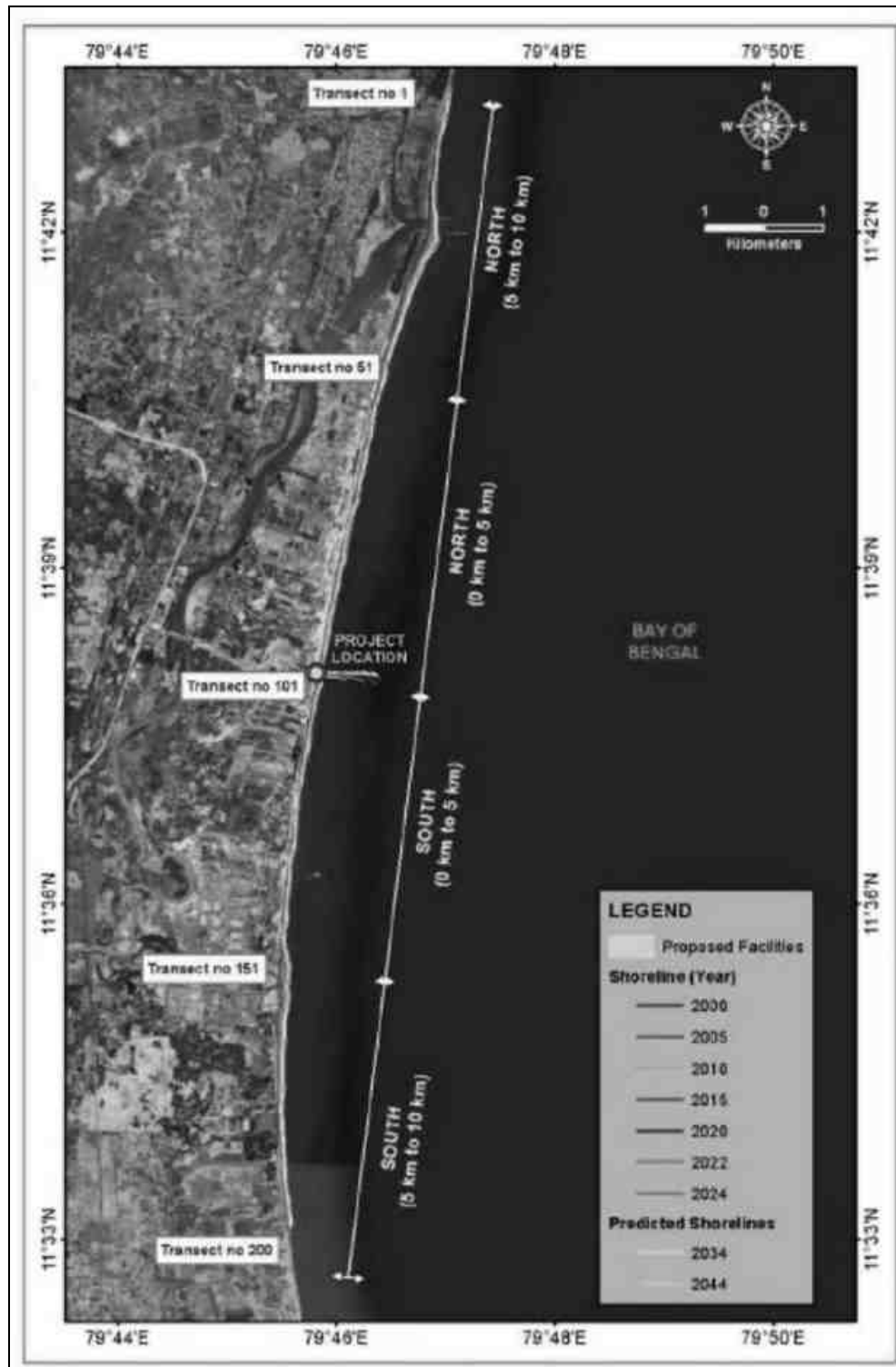


Figure. 106. Predicted Shoreline for 2034 and 2044



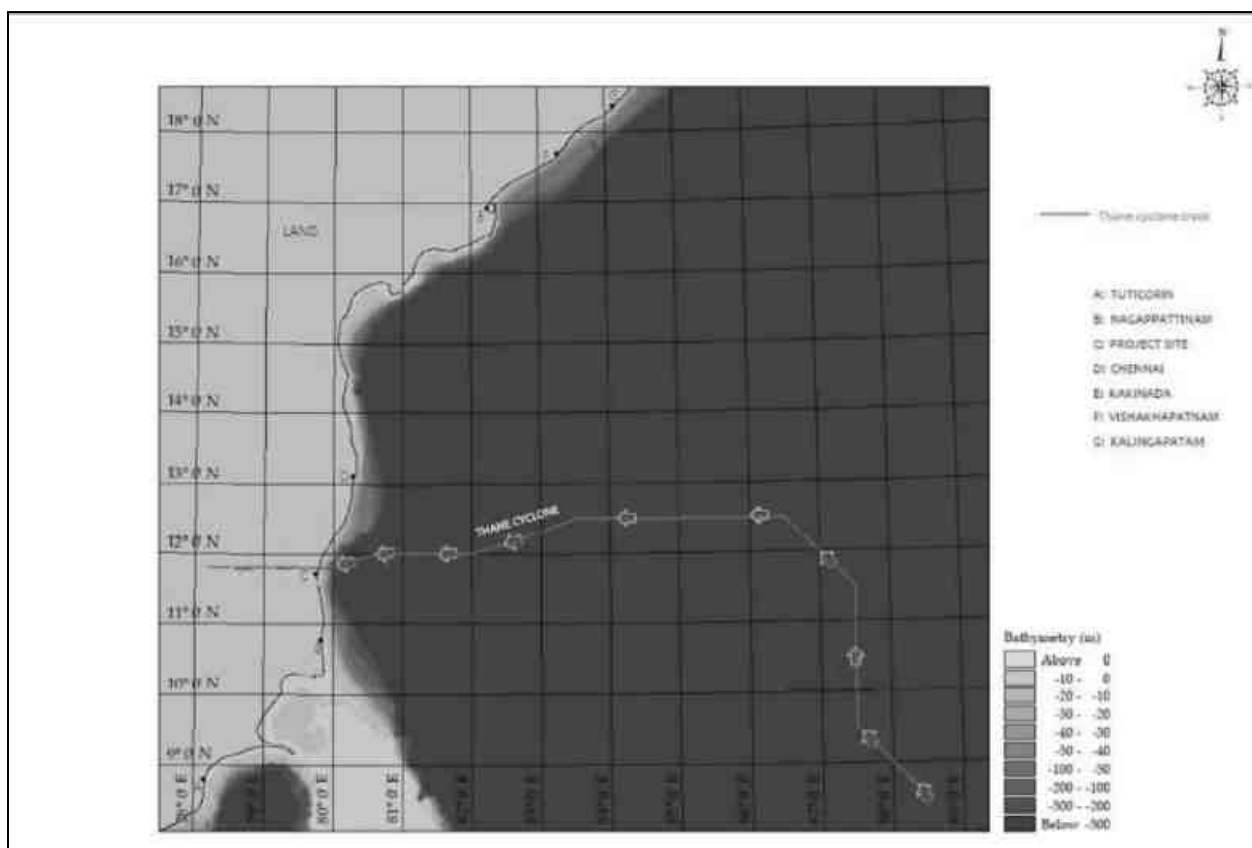


Figure. 107. Bathymetry - Storm Surge Model - Path of Thane 2011 Cyclone



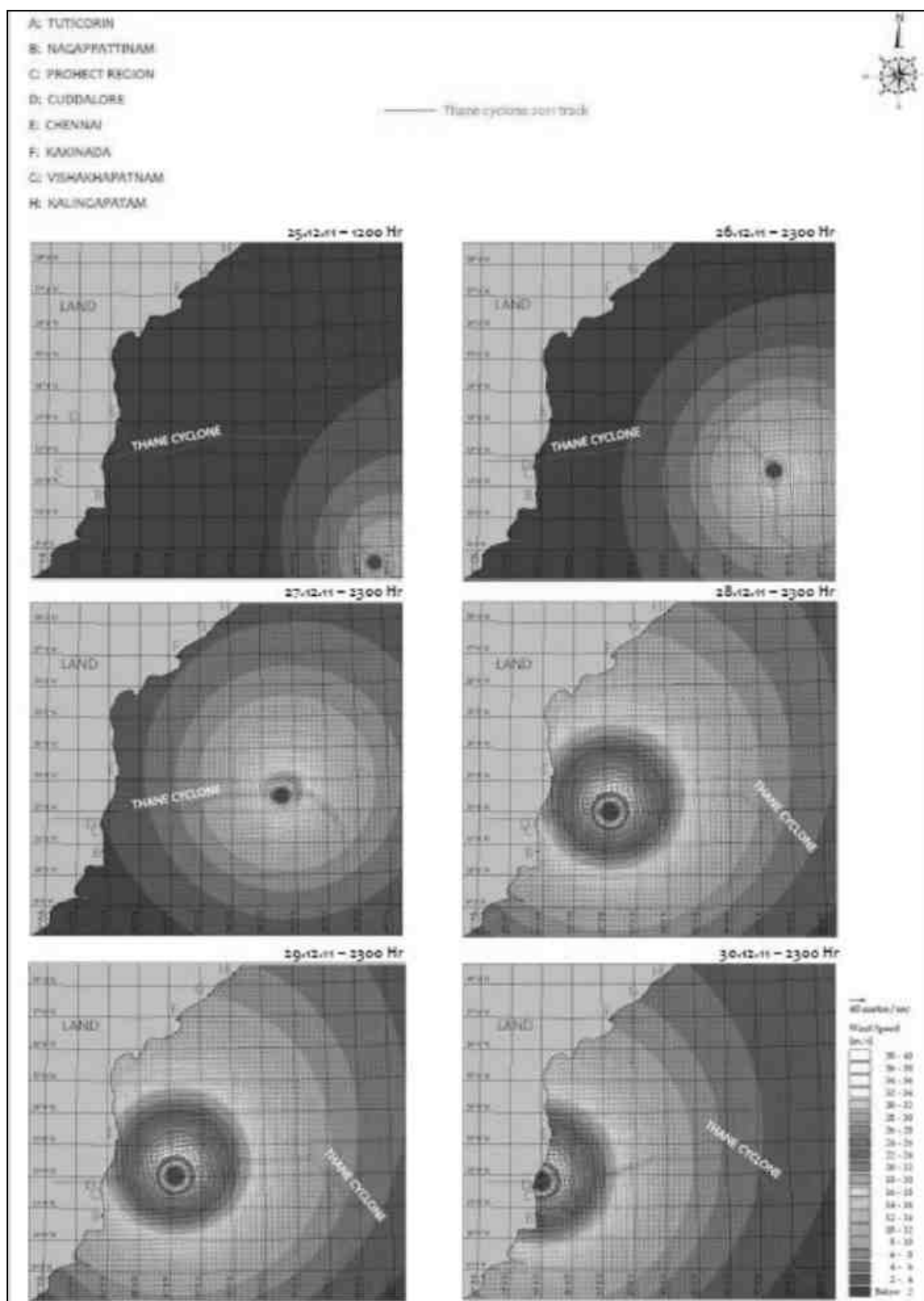


Figure 108. Wind Field during Thane 2011 Cyclone



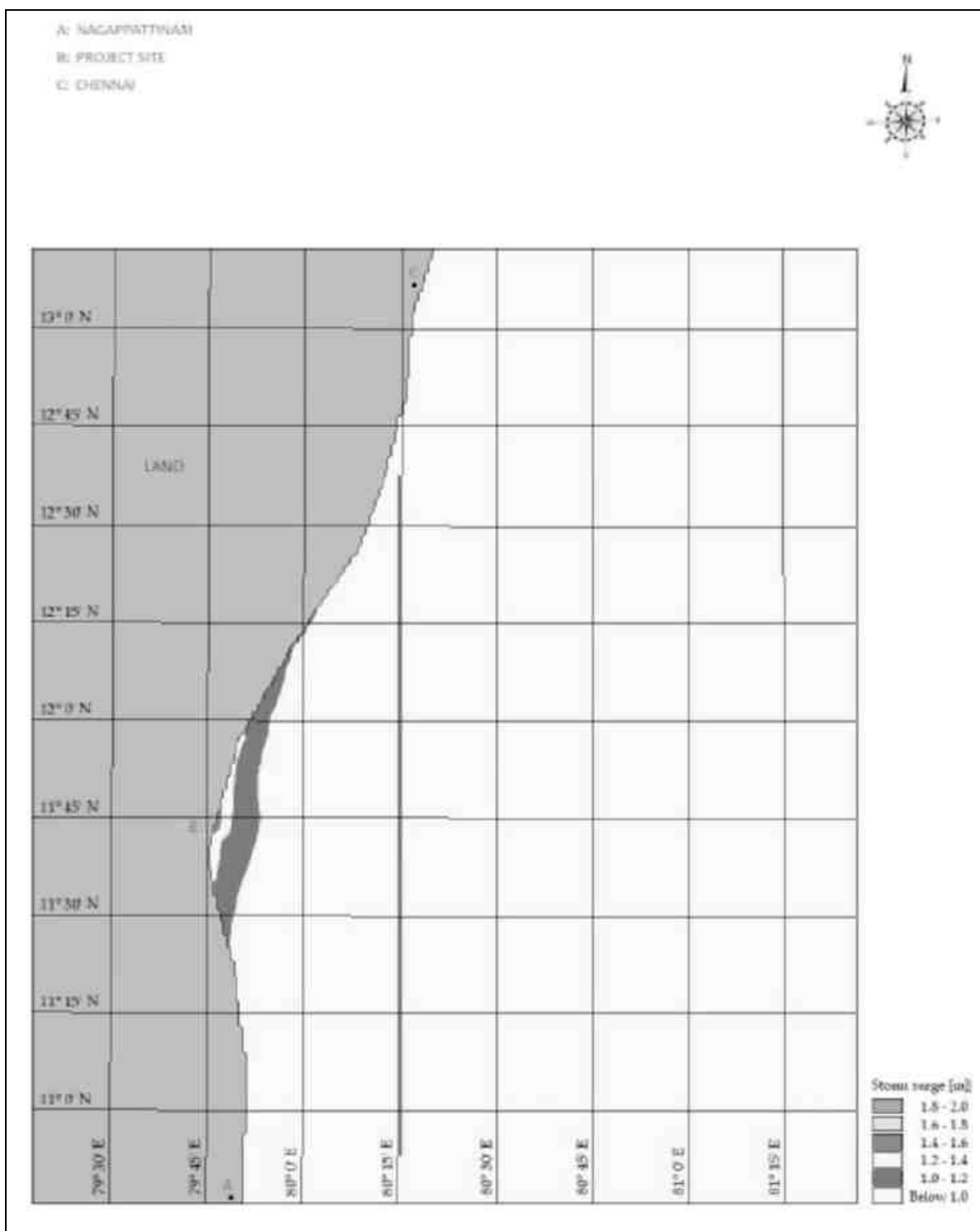


Figure. 109. Maximum Storm surge Contours during Thane 2011 Cyclone



8. PROJECT BENEFITS

8.1 ENVIRONMENT BENEFIT

The construction of the infrastructures will have both direct and indirect impacts on the economic development of the country. The project is expected to stimulate the participation of private businesses in industrial and transport sector development. There will be many ancillary industries coming up. Private investments will create employment opportunities which will ultimately create income opportunities and alleviate poverty and consequently improve the standard of living of the people.

Based on project particulars and the existing environmental conditions, potential positive impacts likely to result from the proposed MTF development are identified below.

- Better Sea transport facilities/State of the art MTF.
- Revenue Generation
- Employment Opportunities – skilled, semi-skilled and unskilled labour during construction and operation phases of the project with specific attention to employment potential of local population
- Improvement in Physical Infrastructure like project infrastructure and ancillary facilities
- Improvement in social infrastructure like roads, railways, townships, housing, water supply, electrical power, drainage, educational institutions, hospitals, improved environmental conditions etc.
- Reduction of material costs due to reduction of transport cost.

8.2 Employment opportunities

The Project essentially involves the expansion and modernisation of MTF like Construction of approach trestle, mooring dolphins, upgradation of breasting dolphins, tug berth, laying of intake and outfall pipeline and construction of desalination plant.

Economic Benefit: The expansion and modernisation Project would enable creation of state-of-the-art infrastructure facilities and necessary capacity for handling various commodities to drive & support the state & national EXIM and Coastal Trade in line with the envisaged demand growth. The Project facilities would also enable reduction in logistics cost and thereby positively impact export competitiveness for local, regional, and national trade. The Project would benefit CCVL by ensuring increased handling and operational capacity, reduced congestion, and increased revenue generation by handling more volume of liquid cargo. The Government would also directly benefit by way of more Revenue generation through taxes and other regulatory charges etc.

Social Benefit: The proposed and expansion of MTF has considerable societal benefit. It will have a major impact on social and economic upliftment of the region by overall improvement in living standard by creation of more jobs, increase in volume of general trade, general improvement in MTF facility, spurring indirect economic activity and societal and help spur economic activity in the surroundings.



The proposed project will offer both direct and indirect employment opportunities. Details of likely employment opportunities during construction and operation phase are given below.

Table 101. Details of likely employment opportunities

S. No.	Present Employment Details		Construction Phase Employment Details		Operational Phase Employment details	
	Permanent Employee	Contractual Employee	Permanent Employee	Contractual Employee	Permanent Employee	Contractual Employee
1	50	15	10	150	10	50

8.3 Corporate Social Responsibility (CSR)

Corporate Social Responsibility (CSR) has been recognized and governed by Clause 135 of the Companies Act, 2013. Clause 135 contains 5 sub-clauses in which sub clause (5) mentions that every company shall ensure that the company spends, in every financial year, at least two percent (2%) of the average net profits of the company made during three immediately preceding financial years, in pursuance of its Corporate Social Responsibility Policy. Activities which may be included by companies in their Corporate Social Responsibility Policies are as follows.

- Eradicating extreme hunger and poverty.
- Promotion of education.
- Promoting gender equality and empowering women.
- Reducing child mortality and improving maternal health.
- Combating human immunodeficiency virus, acquired immune deficiency syndrome, malaria and other diseases.
- Ensuring environmental sustainability.
- Employment enhancing vocational skills.
- Social business projects.
- Contribution to the Prime Minister's National Relief Fund or any other fund set up by the Central Government or the State Governments for socio-economic development and relief and funds for the welfare of the Scheduled Castes, the Scheduled Tribes, other backward classes, minorities and women.

8.3.1 Existing CSR Activities

CCVL has been implementing CSR activities since 2009 in sync with the Sustainable Development Goals (SDGs). Each project is carefully designed based on the need assessment surveys. The following table shows the different types of interventions taken under the CSR program:

Detailed CSR estimate for next 15 years is given below. Additional cost will be allocated to the existing CSR activities. Accordingly, the approximate break up per year on different aspects are given in the table below

Theme	Major interventions



Sustainable Agricultural Practices	• Tree plantations • Irrigation & soil conservation • Water resources management • Awareness and capacity building on sustainable agricultural practices
Water for all	• Water AMTs to provide access to drinking water for all
Sanitation & Health	• Eye care check-ups & contract surgeries • Monthly medical check-ups • Distribution of equipment to differently-abled • Construction of toilet units • Mental health awareness counselling • OPD through medical centre
Education	• Schools infrastructure & computer labs upgradation • Distribution of developmental aids • Awareness Programs on importance of education for children and capacity building government school teachers
Women Empowerment	• Supported in formation of Self-Help Groups • Distribution of smokeless chulha to women using wood -based fuel • Adult literacy • Skill development and placement
Skill Development	• Placement-linked skill development program
Disaster & Relief Management	• Distribution of masks, sanitizers, thermal scanners, oxygen concentrators & oxygen cylinders during COVID • Distribution of ration kits to families • Awareness of preventive measures for COVID in villages
Sustainable Livelihood & Livestock Management	• Rescue and treatment of injured livestock • Awareness on sustainable and emphatic livestock management practices • Awareness of sustainable fishing practices • Breed improvement through AI • Provisioning of mangers
Rural Infrastructure	• Construction of biogas units • Construction of panchayat buildings • Construction of check dams • Construction of protection bunds • Installation of solar streetlights

9. ENVIRONMENTAL COST BENEFIT ANALYSIS

Being the upgradation of MTF, no recommendation of environmental cost benefit analysis has been given during the scoping stage. Therefore, it is not applicable



10. ENVIRONMENT MANAGEMENT PLAN

10.1 INTRODUCTION

Development of any infrastructure in the coastal environment includes both social and environmental impacts. To address the anticipated impacts and to implement the mitigation measures, the Environment Management Plan (EMP) needs to be formulated. EMP identifies the approach, procedures and methods that will be used to control and minimize the environmental and social impacts of construction and operational activities associated with project development. It is intended to reduce the negative impact and to enhance the positive benefits from the project.

The main objectives of Environmental Management are to:

- Identify key environmental issues anticipated to be encountered during construction and operation phases of the project
- Provide guidelines for appropriate mitigation measures
- Ensure the mitigation measures are implemented
- Establish systems and procedures for implementing mitigation measures
- Monitor the effectiveness of mitigation measures
- Take necessary prompt action when unforeseen impacts occur

The proposed project involves construction of approach trestle, mooring dolphins, tug berth, laying of intake and outfall pipeline and construction of desalination plant. The impacts due to construction and operation of MTF were described in **Chapter 4**. This chapter details a management plan formulated to manage environmental impacts likely to arise during construction and operational phase.

As part of the project, proponent shall commit to excel in environmental and social performance by ensuring the following:

- Comply with all environmental and social conditions associated with project approvals.
- Promote environmental awareness and understanding among employees and contractors through training, identification of roles and responsibilities towards environmental and social management.
- Monitor environmental performance throughout the project and implement an adaptive approach for continuous improvement.



10.2 PROJECT DETAILS

Details of project are given below:-

Table 102. Details of the Project

S. No.	Particulars	Unit	Project Details		
			Existing	Proposed	After expansion
1	Location	-	Chithirapettai, Semmankuppam and Thiyagavalli Villages, Cuddalore District, Tamil Nadu		
2	Total Plot area	ha	6.374	7.745	14.119
3	Green area	ha	2	0.5	2.5
Manpower Details					
i	Construction Phase	Nos.	Permanent: 10, Contractual:150		
ii	Operation Phase	Nos.	65	60	125
4	Power				
i	Power Requirement	kVA	500	2000	2500

10.3 ORGANIZATIONAL ROLE AND RESPONSIBILITY

10.3.1 Occupational health and safety

A well developed Health, Safety and Environment policy has been developed covering the handling and transfer of cargo in the jetty. Some of the measures taken by the jetty are outlined in the following sections.

- The organization structure has been well defined to ensure proper and safe handling of cargo.
- Weather prediction updates from IMD are acquired daily during the operation periods.
- The CCVL limits are clearly marked and the movement of other traffic is appropriately controlled during the operations.
- Safe Operation Plans (SOP) have been prepared for every operation. According to the SOP, a checklist has been prepared. These checklists will be completed prior to any transfer operation. All operating crews are required to be familiar with such procedures. No procedure will be passed –passed to expedite unloading of the ship.
- If barges are used, they will be double-hulled barges as per MARPOL requirements, suitably designed for each chemical and approved by the competent authority.
- Pigging operations, flushing, washing, conditioning of pipelines etc., are performed under the supervision of a qualified safety professional.
- Adequate security for the area has been provided to avoid risks due to vandalism, theft, riots etc. The jetty area has been declared as a “Prohibited Area”.
- Smoking in the operating areas viz., jetty, tank farm, barge and ship is strictly prohibited.
- All employees must wear cotton clothes. Synthetic clothes are not permitted. Shoes should not have nails or metallic components.



- All vehicles entering into the operating area should be fitted with automobile spark arrestors.
- No tools would be permitted at the location during the loading and unloading operations. Spark proof type tools have been reported to be ineffective.
- All personnel are experienced. Annual training and refresher training lessons/ courses are conducted to re-emphasized the need for safety procedures and handling of emergency releases.
- HAZOP analysis is conducted on a regular basis.
- Adequate lighting is provided to conform to dock safety regulations.
- Adequate caution boards are prominently placed to highlight the hazards of the Chemicals. Notices such as „No Smoking“, „No naked lights“, „No entry to unauthorized Persons“ are placed at different locations of the premises.
- The flexible hoses are appropriately colour coded for easy identification of products to be handled. All hoses, pipelines and fittings are inspected and monitored during operation.
- During slack periods, the pipelines, hoses and pipe corridors are inspected closely for evidence of leakage.
- Wireless communications between operating personnel are provided.
- First aid kits are provided at prominent locations. For emergencies, protective clothing such as neoprene gloves or boots, safety goggles, self breathing apparatus, fire fighting suits, safety shower and eye wash fountain, combination units, canister gas masks for the different organic vapors are readily available at the location.
- Unauthorized persons are not permitted in the premises under any circumstances.
- No person with matches or lighters is permitted in the area of operation.
- No hot work, hammering, chipping etc. are permitted without a safety work permit issued by a responsible officer.
- No fibrous materials such cotton waste, canvass, bedding or similar absorbent material are permitted during operations or left near the operating area.
- Buoys marked with warning symbols are placed along the jetty area Restricted areas are clearly marked.

Safety Requirements for Jetty Area

- Emergency Shutdown Valves (ESDV) are provided along pipelines which are actuated under very low pressure (PSLL) downstream of ESDV"s.
- Manually Actuated Valves (MAV / SDV) are provided for isolating each hose in the event of emergency.
- Fire water hydrants and monitors are provided in the jetty area. One elevated fire water line with a monitor is provided to take care of fire in the barge.
- Suitably designed fenders are provided to prevent structural damage to the barge/ship due to high approach velocity.
- The jetty is equipped with appropriate public alarm systems, hooters, sirens etc.



- The jetty is provided with surface drains and required slope to drain the Oil spills. This is led into the collection pit on the jetty and pumped to the slop pit at the tank farm using a slop line.
- Every operation takes place only with hundred percent standby shore personnel including shore operating officers, staff members, fire crew and security personnel.
- Gas tests are conducted using an Explosimeter periodically to ascertain any leak.
- After every loading / unloading operation, equipment is checked and stored as per standard procedures.

Fire –Fighting Requirements

- The fire water system at the jetty end is designed in accordance with OISD Guidelines -156 “Fire Protection Facilities for jetty Oil Terminals”. This is to meet the fire water flow requirements of a single largest risk at a time.
- The fire fighting system is designed by a professional fire-fighting consultant and has to be frequently inspected.
- The organization structure for the fire fighting crew consists of manager (Fire and Safety), fire officer, safety officer, safety inspectors, pump-house Operators, fire men and driver.
- The MTF also has an arrangement with local fire fighting service for mutual emergencies. A direct line of contact for emergencies, with the local fire fighting services is maintained.

10.3.2 International Ship and Port Facility Security Code (ISPS Code)

In order to mitigate terrorist attacks on Maritime Industry, the ISPS Code was adopted by a Conference of Contracting Governments to the International Convention for Safety of Life at Sea. (SOLAS) 1974, convened in London during December 2002.

The purpose of the code is to provide a standardised, consistent framework for evaluating risk, enabling governments to offset changes in threat with changes in vulnerability for ships and port facilities.

10.3.3 Green Port Guidelines

Principles of Green Port Guidelines

- Ensuring Sustainability (Environmental, Economical and Social) in jetty Development by adopting environmentally compatible designs in constructing resilient infrastructure meeting local energy dynamics
- Ensuring sustainability in jetty operation by adopting best practices and employing best available carbon neutral and environment friendly technologies.
- Employing an ecosystem dynamic in jetty development, operation and maintenance aligning to ‘Working with Nature’ concept and ‘Panchamrit Commitments’, minimizing impact on biotic components of harbor ecosystem.



- Maximizing use of Clean / Green energy in jetty operation. Developing jetty capabilities for storage, handling and bunkering Greener Fuels viz. Green Hydrogen, Green Ammonia, Green Methanol / Ethanol etc.
- Minimizing Carbon and other harmful emissions following the Eliminate, Reduce, and Control (ERC) approach to protect local community, ecology and environment in and around jetty areas. Reduction in Carbon intensity by 30 percent per ton of Cargo handled, from the current levels (Baseline FY 2022-23), by the year 2030 and 70 percent by year 2047.
- Minimizing waste through Refuse, Reduce, Reuse, Repurpose and Recycle (5R concept) to attain zero waste discharge from jetty operations.
- Conduct appropriate environmental impact assessments for both jetty projects and jetty development plans.
- Stimulate continuous improvement in the jetty environment and its environmental management.
- Promote monitoring, based on Environmental Performance Indicators, in order to measure objectively identifiable progress in environmental jetty practices.
- Promote environmental reporting as a means of communicating environmentally good behavior to stakeholders.
- Intensify the communication about environmental improvements achieved by CCVL.

Focus Areas for Implementation

Focus areas, which have potential to contribute towards improving the sustainability component of the project area ecosystem and in achieving the “Green Port” benchmarks, have been summarized below. CCVL shall make efforts to implement best practices through induction of environment friendly technologies and adopting resilient designs to achieve the global benchmarks for development of sustainable Green Port.

Green Cover:

CCVL shall increase the green area cover to capture the fugitive emissions and attenuate the noise generated in the project area surroundings by carrying out effective plantation, developing landscapes etc. The green belt area shall be increased by more than 20 percent by 2030 and 33 percent by 2047 of the jetty area. Green belt will help in

- Supporting the biological diversity
- Retaining soil moisture.
- Erosion control and coastal protection.
- Recharging ground water and act as Carbon Sink

Electrification of MTF Equipment (including Vehicles)



- CCVL shall make efforts to achieve the target for Electrification of Vehicles/MTF equipments as envisaged in MIV 2030 / Blue Economy 2047 and accordingly, should target more than 50 percent electrification by the Year 2030 which is to be further increased to more than 90 percent by the year 2047.
- CCVL should target retro-fitment / conversion of Diesel powered equipment / cranes / forklift / pay loader / vehicles etc. to electrically powered in a phased manner by making suitable plans.
- All future procurements of vehicles and cargo handling & other equipment shall preferably be electrically driven / electrically powered or should be compatible with low carbon greener fuels viz., CNG, Methanol, Ethanol, Ammonia, Hydrogen Fuel Cell etc.

Renewable Energy

All shall make efforts to achieve the target of Renewable Energy as envisaged in MIV 2030 / Blue Economy 2047 documents. The share of renewable energy at CCVL should exceed 60 percent by the Year 2030 and 90 percent by 2047.

CCVL shall establish at least one LNG bunkering station by the Year 2030 and adequate number of EV charging stations in CCVL campus or nearby area by the year 2025.

Use of Energy Efficient equipments

- CCVL shall use energy efficient equipment / material viz. LED smart lighting system, highest energy rating equipment such as AC, Fans, Electronic devices etc. to reduce the energy consumption demand.
- No vehicles to be permitted inside the jetty area without PUC certificate.
- The CCVL shall use the digital infrastructure i.e. Sagar Setu-NLP-Marine, EBS, RFID etc. to increase the efficiency of jetty operation and in turn reduce the carbon footprint.
- All new buildings shall be built by adopting “Green Building” concept.
- All CCVL shall achieve a more than 20 percent reduction in energy consumption / ton of cargo by year 2030 (Baseline – Year 2023).

Effluent Discharge

- (Effluent discharge from the ships calling at jetty, shall be monitored closely as per the IMO (MARPOL Annex-IV) /DG Shipping Rules.
- Ships equipped with Exhaust Gas Cleaning Systems, to meet IMO emission standards, should switch to the closed-loop mode of operation if fitted with hybrid type of scrubbers, whereas, the vessels fitted with open-loop scrubbers, would need to switch over to compliant fuel.



- Discharge of any wastewater/ bilge water/ oily bilge/ wastewater generated from ships shall be prohibited in the waters.
- Ships calling to the CCVL shall compulsorily declare type (as per MARPOL) and approximate quantity of waste on board and seek CCVL's assistance in disposing the same

10.3.4 Corporate Environmental Policy

CEP includes procedures for reporting performance of the Environmental Management System and its improvement. CEP of CCVL includes the following:

- Conduct the operation in compliance with applicable environmental legislation, regulation and standards.
- Efficient utilization of raw materials, fuels, water and other natural resources.
- Minimizing the impact on various environmental components of the environment particularly on Air, Water, Land by adopting State of Art Technology.
- Continual improvement of environmental performance through the use of most appropriate practices and procedures which reduce waste and energy to conserve natural resources.
- Creating awareness among its personnel and encouraging sound environmental practices in their day-to-day activities
- Periodic review of operating procedure and environmental performance at the Board level along with noncompliance (if any) and ensure proper communication and implementation of Board decisions.

10.3.5 Environment Management Cell

The existing Environment Management Cell (EMC) of the CCVL will be continued, which will be responsible for monitoring the environment during construction and operation phase of the project. EMC shall also organize the implementation of the aforesaid Environment Management Plan (EMP) / Post Project Monitoring (PPM). The role and responsibilities of EMC is listed below.

EMC will be headed by the person who has qualifications and reported to the MoEFCC committee.

- Ensure effective communication and explanation of the content and requirements of the EMP to contractors and subcontractors.
- Provide appropriate and adequate resources allocated for the effective implementation and maintenance of the EMP.



- Review of EMP performance and implementation of corrective actions, or stop work procedures, in the event of breaches of EMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the project.
- Report any major environmental incidents that may have a significant impact on the surrounding environment.
- Preparation and implementation of Environmental Supervision Plan during construction.
- Ensuring adequate training and education to all staff involved in environmental supervision.
- Evaluating the efficacy of the EIA, mitigation measures as stipulated in the EMP.
- Coordination with MoEFCC/SEIAA and other central/state pollution control boards for prevention and control of environmental pollution.
- Carryout half yearly monitoring program and preparation of compliance report.
- To implement Environmental Clearance conditions stipulated by MOEFCC.
- Maintain environmental monitoring records.

10.3.6 Implementation of EMP

Overall implementation of EMP will be the responsibility of EMC. Various implementation items, description, and appropriate time to implement EMP are listed below.

Table 103. Appropriate time to implement EMP

Implementation item	Description	When to implement
Formation of an Environment Management Cell (EMC)	An Environmental Management Cell shall be formed to implement the proposed EMP.	Two months before the construction site for the main work. Continuous throughout the operation phase at the environmental string committee meeting is established at the jetty and headed by COO.
Contractor	The Construction Contractor should ensure that the intent of EMP is spread among construction workers. Make sure that all environmental safeguards and precautions are in place. Ensure that all equipment used is properly serviced and all precautions are in place to prevent the likelihood of an environmental impact.	Before commencing construction work.



	The contractor shall be responsible for construction and worker management plans and safety of workers.	
Workers	Should be aware of the contents of EMP, and the reason for implementing its elements. Report all environmental incidents to the contractor /manager as soon as practicable, but within 24 hours of them occurring.	Construction and operational period

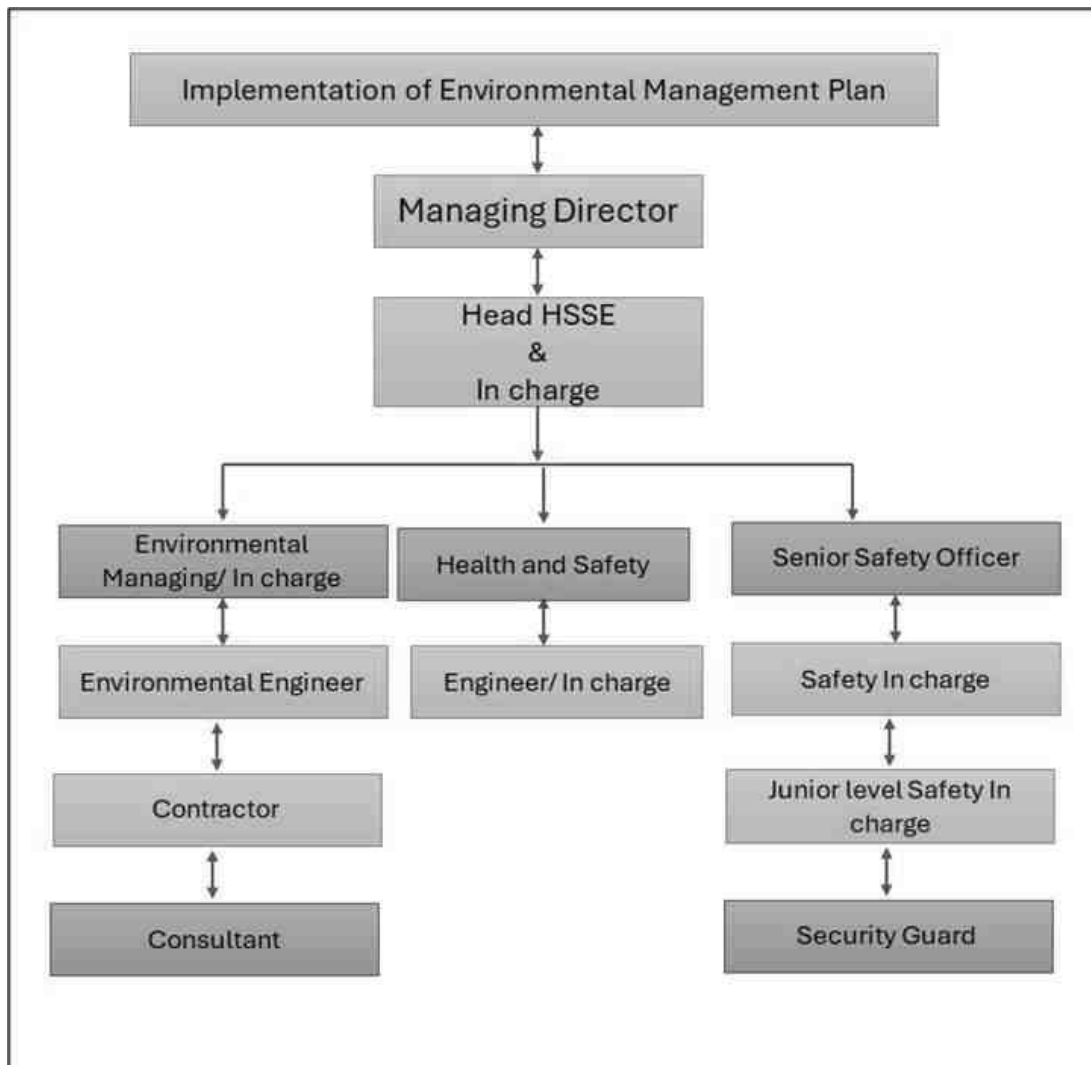


Figure 110. EMP Implementation flow diagram



10.3.7 Training, communication, and reporting

Training: Employees shall be trained for identification of various hazards, methods to combat and responsiveness to emergency preparedness etc.

Communication: Information with respect to any untoward incidences during the construction and operation of the project shall be communicated to local Gram Panchayat, local village workers, employees, and other project-related individuals. Environmental issues should be communicated to the concerned Govt. agencies such as regional office, MoEFCC, State Pollution Control Board (SPCB), Forest and Environment Department, District Collector etc.

Reporting: The EMC will be responsible for conducting environment monitoring, compilation, and review of monitoring data, filling up the statutory forms/returns, maintenance of records regarding hazardous waste, environment awareness activities, submission of compliances six months EC compliance to State Pollution Control Board and MoEFCC regional office.

10.4 ENVIRONMENT MANAGEMENT PLAN

10.4.1 Air Emission

Emissions from construction equipment, work vessels, trucks and other vehicles used in construction work are major sources of air pollution. Dust from construction activities is also a possible source of air pollution. Ships are a possible source of airborne emissions such as gasses, smoke, soot and fumes. SO₂, NO_x are typical pollutants generated by ships while maneuvering and berthing and may affect air pollution in the coastal areas.

Good maintenance practices, efficient machineries, better housekeeping, planning of material transport routes, covered storage areas for construction materials etc. will help in managing and mitigating the impacts on air environment expected during the construction phase. To reduce the impact from windblown dust, vehicular and DG set emissions following practices should be adopted.

10.4.1.1 Fugitive dust emissions

- Covered storage for construction material wherever loose material is placed in bulk.
- Sprinkling of water in dust prone areas.
- Covered transportation of loose construction material.
- All open construction activities shall be barricaded.
- Provision of PPE like dust mask to the workers in dust prone areas.

10.4.1.2 Vehicular emission and Construction machinery

- All vehicles used shall have a valid PUC.



- Regular servicing and maintenance of machineries like cranes, excavators, rollers etc., as well as vehicles to control unwanted air pollutant emission.
- Speed restrictions for all vehicles entering the jetty premises to be practiced, idle running of machines, equipment, and vehicles to be avoided.
- All the onshore vehicles as well as offshore vessels (tugs, boats, barges, etc.) operated by CCVL would be maintained properly at scheduled intervals to minimize the local air pollution impacts.

10.4.1.3 Diesel generator

- Low sulphur content fuel shall be used.
- Monitoring of DG set emission shall be carried out regularly as specified in the EMP.
- Stack emissions should be within norms prescribed by CPCB.
- It must be serviced regularly and must be used only during power cut.
- Adequate stack height should be provided.

Management of construction waste as per 2016.

10.4.2 Water & Wastewater management plan- Construction Phase

10.4.2.1 Water Demand

Existing: Drinking water is sourced locally

After expansion: Drinking water RO will be established

Fire water demand to combat firefighting at Jetty is 43,434 LPM (2246 m³/hr). Following recommendations are made with regard to fire fighting for jetty by operation of following fire water pumps as follows:

- Diesel Driven pumps 2 nos.
- Electrical Driven pumps 1 no.
- Discharge capacity 1440 m³/hr at 145 m head

CCVL has proposed a desalination plant so that the water required will be drawn from the desalination plant Hence, no ground water and additional surface water withdrawal is required.

10.4.2.2 Storm Water Drainage System

The proposed approach trestle and MTF are to be developed with a surface water drainage network connected to existing MTF. A new surface water drainage system within the new area is proposed with discharge into sea before oil separator. Surface water from the operation building, workshop, service bay etc. will be carried by the rectangular channel and container terminal will be through pipes.



10.4.2.3 Sewage management

A Packaged STP plant of 5 m³ per day capacity has been proposed as a part of the pumphouse cum substation to cater for the sewage treatment from toilets.

The skid mounted packaged sewage treatment plant (STP) is proposed, which allows the effluent to be recycled for non-potable use such as gardening use etc. The proposed location of STP is near the operation building.

Existing facilities

The sewage generated from domestic and sanitary utilization shall be treated by separate Sewage treatment plants (MBBR and MBR Technology) and the treated water is to be utilized for plantation within the CCVL premises. The proper drainage system was maintained in the jetty area.

On site sanitation facilities (Latrines and Urinals): Enough accommodation of Latrines and Urinals separately marked as "For Men only" and "For Women only" must be displayed in the local language. The sewage will be collected in collection sump and the same must be treated through STP system.

10.4.2.4 Rainwater Harvesting

Rainwater harvesting systems will be installed in all the proposed area, canteen buildings. Installing a rainwater harvesting system in residential buildings can be a sustainable way to conserve water and reduce reliance on traditional water sources.

The natural source of rainwater will be collected, stored and the filtration process was carried out by charcoal bed filter and Chlorination. After the treatment, the treated water was stored and pumped to various locations in the CCVL area through underground pipes. No filtration system water was used for the dust suppression system.

10.4.3 Wastes management plan

Wastes from construction activities may include spoils generated by dredging. Disposal of dredged material may cause impacts on vegetation, leakage of contaminated materials and salt, odour, and other nuisances to the local community.

Construction work and dredging disturb bottom sediments and induce resuspension, dispersal, and settlement of such sediments. Dumping of dredged material directly alters bottom configuration and biota and may disperse toxic or harmful chemicals around the disposal site.

Following solid and hazardous waste management practice shall be followed during the construction phase.



Table 104. Details of Hazardous waste

Type of waste	Quantity in TPA	Applicable Rule	Management method at site	Mode of disposal to be followed
Municipal Solid waste	200	Solid Waste Management Rules, 2016	Source segregation of waste and storage at site using waste bins	Through authorized vendors
Hazardous waste	45	Hazardous Waste Management Rules, 2016	Shall be stored in HDPE drums in isolated place	Through authorized vendors
Plastic Waste	10	Plastic Waste Management Rules, 2016	Shall be kept at isolated place under covered shed	Through authorized vendors
E - Waste	16	E Waste Management Rules, 2016	Shall be kept at isolated place under covered shed	Through authorized vendors
Construction and demolition waste	50	Construction and Demolition Waste Management Rules, 2016	Follow Reduce, Reuse, Recycle method	Reuse in low lying area filling

Waste minimisation followed in existing MTF

- Dedicated & specifically designed WASTE MANAGEMENT CELL for storage of all types of wastes.
- Segregation of all types of wastes, environmentally sound management of solid & hazardous wastes. 'Quantification of wastes' & 'segregation at source' drive is on, which has resulted in a 20% reduction in quantity of waste that goes for final disposal.
- Resource recovery; maximum recovery of solid & hazardous wastes reduces waste that goes to landfill site, reducing burden on the environment.
- Adopted practice of REUSE, REDUCE, RECOVER & RECYCLE of waste.
- Awareness programmes for source segregation and handling procedures for Port residents & Port employees.

10.4.4 Noise quality management plan

The effective noise control measures shall be implemented during the construction phase to address the high noise generation from operation of construction equipment and machinery, vehicular transport, operation of pumps, compressors, and diesel generators.

Periodic maintenance of construction machinery and transportation vehicles shall be undertaken to reduce the noise impact. Silencers on engines and better greasing of rolling parts can reduce the noise level. Regular servicing of construction equipment, machineries, and vehicles. Ensure use of



PPE like ear plugs/muff in high noise generating areas. Acoustic enclosure shall be provided for DG sets. Noise barriers should be adopted if required.

Controls on Construction Activities

- The following noise management measures and controls will be implemented for construction activities at the Project where it is reasonable and feasible to do so.
- Temporary cessation of work within an area, or from a particularly noisy piece of equipment, will be considered when adverse conditions are present.
- All plant and machinery used on-site will be maintained regularly to minimise noise generation.
- All plant and machinery used on-site will be operated in a proper and efficient manner (e.g., at correct speed) to minimise noise generation.
- Lesser noise generating construction activities (e.g., welding, and electrical works) will be conducted during the evening/night-time period.
- Regular communication and updates will be provided to local residents on the status and nature of site construction activities.

10.4.5 Dredge spoil management plan

The total volume of capital dredging is $2.6 \times 10^6 \text{ m}^3$ for development of the approach channel. Suitable capital dredged material will be disposed of at identified offshore disposal areas selected through mathematical model studies.

During the operational phase, part of the material dredged out as part of maintenance dredging shall be utilised for nourishment of the beach.

Recommendations to manage dredge spoil

- Dredging schedule shall be appropriately planned, (i) selection of most favorable points in the tidal cycle to limit the extent of effects (ii) avoid sensitive periods /breeding season for fishes.
- List of DO(s) and DO NOT(s) shall be circulated among the workers involved in dredging.
- The net enclosures with booms shall be placed around the dredging area in order to control the spread of the turbid plume.
- Post dredging monitoring program shall be carried out to assess effect of dredging and disposal on marine ecology with the help of repudiated institutes.

10.4.6 Environment Management Plan during Operation Phase

Table 105. Environment Management Plan During Operational Phase



Environmental Components	Impact	Mitigation Measures
Air Environment	- Dust (PM10 & PM2.5) from bulk cargo handling, storage, construction, and traffic (with heavy metals like Pb). - Gaseous emissions (SO₂, NO_x, CO, HC) from ships, vehicles, and cargo handling equipment. - Vapour/fumes release during liquid cargo tank cleaning and breather systems. - Accidental leakage causing toxic fumes, odours, explosions.	- Preventive maintenance of valves & equipment. - Closed systems to reduce HC exposure. - Continuous ambient/workplace air monitoring (SPM, RPM, SO₂, NO_x, methane, NMHC). - Monitor meteorological parameters. - Plantation around emission sources to attenuate fugitive emissions.
Noise Quality	- Noise from construction equipment, ship machinery, traffic, DG sets. - Vibration impact on nearby receptors.	- Follow BS 5228 for noise control. - Install acoustic fencing, temporary barriers, acoustic enclosures. - Shut down/ throttle idle machinery. - Handle materials carefully, plan off-peak deliveries. - Use anti-vibration mountings. - Regular maintenance of machinery. - DG sets with acoustic enclosures, meeting 75 dB(A) limits.
Water Management	- Water demand for jetty operation. - Marine water pollution due to wastewater, oil waste, spills, sewage discharge. - Stormwater runoff carrying pollutants.	- Use desalination plant – no groundwater withdrawal. - Zero Liquid Discharge (ZLD). - Treat wastewater before discharge. - Oil-water separators for oily wastewater. - Provide reception facilities for oily ship waste. - Clean drains/outfalls before monsoon. - Construct retention ponds for runoff. - Install STP for sewage; recycle for gardening. - Rainwater harvesting in reservoirs.
Solid & Hazardous Waste	Generation of municipal, plastic, e-waste, batteries, biomedical, hazardous, C&D waste.	- Dedicated Waste Management Cell. - Segregation at source & resource recovery. - Composting of organic waste. - Authorized recyclers for plastic, e-waste, batteries, hazardous waste. - Biomedical waste handled via authorized facilities. - C&D waste reused in low-lying areas.
Green Belt Development	Potential air pollution, soil erosion, biodiversity loss.	- Develop dense green belt (2500 plants/ha). - Prefer fast-growing, tall, evergreen, indigenous species. - Conserve mangroves, aquatic pockets & salt-tolerant species. - Follow CPCB green belt guidelines. - Budget allocation for planting & maintenance.
Energy Conservation & Renewable Energy	High energy demand from cargo handling, vehicles, lighting → GHG emissions.	- Energy policy & audits. - Real-time energy monitoring. - Switch off idle machinery/vehicles. - Energy-efficient appliances & LED lighting.



Environmental Components	Impact	Mitigation Measures
		• Maintenance for fuel efficiency. • Rationalize truck entry. • Install solar panels within premises.
Eco-friendly Materials	• Conventional construction materials cause environmental degradation.	• Use eco-friendly materials like fly ash, ready-mix concrete. • Use fly ash for road construction.
Leak & Accidental Spill Management	• Pipeline leakages causing explosions, pollution, accidents.	• Use appropriate thickness pipelines. • Regular pigging & intelligent pigging. • Restricted access to cargo corridor. • Oil spill contingency plan. • Prohibit discharge of oily waste & sewage from ships (MARPOL compliance). • Regular inspection & SOPs for operations.
Odour Management	• Odour from liquid cargo handling & waste storage.	• Store waste only in designated areas. • Minimize waste storage time (<5 days). • Maintain clean premises.
Cargo Management	• Stormwater runoff carrying contaminants. • Odour from liquid cargo. • Oil spill risk.	• Compact & impervious stack yard. • Direct runoff to drainage channels with sedimentation tanks. • Inspect storage after rainfall. • Maintain updated material inventory. • Regular inspection of pipelines & storage. • Suspend operations in adverse weather.

10.4.7 EMP IMPLEMENTATION BUDGET

During Operation Phase:

i) Capital Cost

Table 106. Capital Expenditure

S. No.	Particulars	Quantification	Cost in Lakhs (₹)
1	Fund allotted for concerns raised during Public Hearing (including greenbelt & open area development)	-	50
2	Environment monitoring		
	Construction Phase: Air, Seawater and Seabed sediment quality	5 locations each	5
	Operational Phase: Air, Surface & Ground water, Soil and Seabed sediment quality	5 locations each	5
3	Occupational health and safety, Training, firefighting facilities and Oil spill management facilities		
	Safety helmet, shoes, goggles, ear plugs and gloves for the MTF workers	-	5
	Health check-up facilities	yearly once	4
4	Waste management facilities		
	Collection and storage of generated waste in colour coded bins	10 locations	1
	Disposal of waste through municipality / ship chandlers / other authorised vendors	-	1
5	Green belt development	-	20
Total			71



ii) Recurring cost

The environmental cost consists of expenses towards maintaining environmental norms within the specified limits during construction/ operation phase, e.g., testing of water/ soil and air as well as mitigation measures. Most of the items are covered under respective civil/ mechanical works.

Table 107. Recurring Expenditure

S. No.	Particulars	Quantification	Cost in lakhs (₹)
1	Environmental Parameters Monitoring in and around jetty area	4 locations	10
2.	Operation of STP	-	5
5	Ecological monitoring	3 seasons	15
6	Shoreline monitoring	yearly	2
7	Environmental cell Recurring Cost	-	20
8	Greenbelt and open area development	-	5
9	Solid Waste Management	-	1
10	Celebration and awareness program on environment		1
11	Maintenance of pollution control systems		5
12	Implementation and audit for IMS		1
	Total		65



11. SUMMARY & CONCLUSION

Chemplast Cuddalore Vinyls Limited (CCVL) is operating a Marine Terminal Facility in Cuddalore from 2009, it is being used for the import of feedstock for its PVC manufacturing facility. As part of its backward integration plans, CCVL aims to establish a Vinyl Chloride Monomer (VCM) production facility. To meet the increased import needs for this expansion, CCVL plans to undertake the construction of an approach trestle to connect the existing offshore jetty from the shore, laying new pipelines for ethylene and ethylene di chloride (EDC) in addition to VCM. These upgrades are essential for supporting the VCM project and improving the facility's operational efficiency.

Environmental & CRZ clearance of existing Chemplast Cuddalore Marine Terminal of M/s Chemplast Cuddalore Vinyls Limited was granted by MoEFCC on 19th December 2005 and CRZ clearance on 19th December 2005. In February 2023, CCVL approached to MOEFCC for the extension of validity vide Consent Order No. 2307147638958 dt. 28.02.2023 and the MOEFCC extended the validity of EC & CRZ clearance for CCVL up to 31st March 2027.

As per EIA Notification 2006, the proposed development falls under Schedule 7(e) - Ports and Harbours - Ports, harbours, jetties, marine terminals, breakwaters and dredging, Category A and requires Environmental Clearance and CRZ clearance from TNCZMA and MoEFCC. Accordingly, Chemplast Cuddalore Vinyls Limited (CCVL) has obtained the ToR from MoEFCC, New Delhi vide proposal No. IA/TN/INFRA1/498995/2024 dt. 28.10.2024, for the preparation of the Environmental Impact Assessment report and Environmental Management Plan (EMP).

EIA & EMP study have been taken up by Indomer Coastal Hydraulics (P) Ltd., Chennai, which is an ISO 9001:2015 organization and QCI - NABET accredited organization vide NABET/EIA/23-26/RA 0315 dt. 13.09.26 for the Sector 27: Oil & Gas Transportation pipeline (crude and refinery/ petrochemical products), passing through national parks/ sanctuaries/ coral reefs/ ecologically sensitive areas including LNG Terminal and Sector 33: Ports, harbours, jetties, marine terminals, breakwaters and dredging. It also has a NABL accredited organization for laboratory testing.

11.1 PROJECT DESCRIPTION

i) Existing Facilities

Chemplast Cuddalore Vinyls Limited (CCVL) currently operates a Marine Terminal Facility (MTF) that is spread across the sea, land, and the Uppanar River.

In the Sea:

The existing marine infrastructure consists of an island jetty capable of berthing ships up to 20,000 DWT. The jetty is supported by two breasting dolphins (14 m × 14 m) and four mooring



dolphins (10 m × 10 m). An unloading platform measuring 20 m × 10 m is equipped with a marine loading arm dedicated for VCM handling. A walkway bridge, 200 m long and 1.2 m wide, connects the mooring and breeding dolphins. Additionally, the MTF houses two subsea VCM pipelines extending 1060 m in the sea and 2430 m on land, along with a seawater intake system (400 m subsea and 2430 m on land) and a brine reject outfall system (800 m subsea and 2430 m on land).

On Land:

Onshore infrastructure includes a substation-cum-control building (20 m × 9 m). The two VCM pipelines run along with the intake and brine reject pipelines within a 2430 m long RCC trench from the landfall point (LFP) to the main plant.

Across the Uppanar River:

The two VCM pipelines also run beneath the Uppanar riverbed for approximately 384 m, along with desalination intake and brine reject pipelines.

Regulatory Clearances:

The facility was originally granted Environmental Clearance (EC) and CRZ clearance for construction of the MTF on 19th December 2005 by the Ministry of Environment, Forest and Climate Change (MoEFCC). Consent to Operate renewal from Tamil Nadu Pollution Control Board (TNPCB) was obtained on 28.02.2023, valid up to 31st March 2027. Further, the EC was transferred from Chemplast Sanmar Limited to Chemplast Cuddalore Vinyls Limited via MoEFCC order no. F. No. 11-63/2005-IA-III dated 09.08.2024.

ii) Proposed Facilities

To meet the requirements of expansion and modernization, CCVL proposes significant upgradation of the existing MTF infrastructure, covering facilities in the sea, on land, and across the Uppanar River.

In the Sea:

A new approach trestle of 1060 m length and 12 m width is planned from the jetty to the landfall point. The existing breasting dolphins (22 m × 18 m) will be upgraded, as will the four mooring dolphins, with an additional two mooring dolphins (10 m × 10 m) to be constructed. Two new loading arms will be installed along with a proposed walkway bridge. New facilities will include a firewater pump house-cum-substation (65 m × 21 m), a tug berth (27 m × 5 m), and capital dredging of approximately $2.6 \times 10^6 \text{ m}^3$.

On Land:

Onshore pipelines will be expanded significantly to transport chemicals, firewater, and desalinated water from the MTF to both existing and proposed plants. The pipeline network will include:



- EDC pipeline (20" dia)
- VCM pipeline (16" dia)
- VCM coolant pipeline (4" dia)
- Ethylene pipeline (16" dia)
- Ethylene coolant pipeline (6" dia)
- Firewater pipeline (24" dia)
- Desalinated water pipeline (4" dia)

The seawater intake pipeline (1200 m on land and 800 m in sea) and the brine reject outfall pipeline diffuser (1200 m on land and 800 m in sea) will be laid over the new approach trestle. Additionally, a temporary material load-out jetty of 400 m length from the LFP will be constructed.

Onshore Support Facilities:

A desalination plant of 20 MLD capacity is proposed, supported by seawater intake and brine reject pipelines extending from the LFP to the desalination plant. Further, two pipelines of 12" dia, extending 1900 m, will supply desalinated water from the desalination plant to the main plant.

Across the Uppanar River:

A crossover bridge of 384 m is planned across the Uppanar River to carry the chemical pipelines along with two 12" pipelines for desalinated water supply from the desalination plant to the main plant.

Other Utilities:

The expansion also includes provision for power supply, communication cables, and overhead transmission lines to support smooth functioning of the proposed facilities.

11.2 DESCRIPTION OF THE ENVIRONMENT

Study Period:

Monitoring was carried out in the **Summer Season from Feb 2024 - May 2024.**

The baseline data on the terrestrial and marine environment were collected and the extract is given below.

Terrestrial Environment



Baseline data were collected for assessing the ambient air quality, noise levels, surface water quality, ground water quality, soil quality, socio-economic status and ecology & biodiversity of the terrestrial environment following the EIA notification 2006.

Meteorology: The meteorological parameters such as temperature, average pressure, cloud cover, humidity and rainfall were studied for the project location.

The maximum air temperature for the region is about 35°C in June and a minimum of around 22°C is found in January and February. The approximate annual rainfall received in the region is about 1299.6 mm. The humidity varied between 65 % and 81 % during the year.

Ambient air quality: Monitoring for gaseous and particulate parameters specified in NAAQS, 2009 was performed at 6 locations using high and low volume air samplers. The results obtained are for some of the important parameters are as below:

The Particulate Matter (PM₁₀) concentration varied between 33.6 µg/m³ and 82.2 µg/m³. The maximum level (82.2) µg/m³ was observed at CCVL Plant (stn. AQ2) and the minimum level (33.6 µg/m³) were observed at Thazhan chavadi (stn. AQ6). The observed levels are within the NAAQS, 2009 standard's permissible limit of 100µg/m³, the concentration of PM_{2.5} varied between 16.7 µg/m³ and 43.1 µg/m³. The maximum (43.1µg/m³) occurred at AQ2-CCVL Plant (stns. AQ2) and the minimum (16.7 µg/m³) at Thazhan chavadi (stns. AQ6) during the study period. The measured readings are within the NAAQ, 2009 stand'rd's permissible limit (60 µg/m³), the concentration of SO₂ varied between 5.9 µg/m³ and 18.6 µg/m³. The values are within the prescribed limit (80 µg/m³) of NAAQ, 2009 standard, the concentration of NO₂ varied between 6.9 µg/m³ and 26.8 µg/m³. The values are within the prescribed limit (80 µg/m³) of NAAQ, 2009 standard, the concentration of ozone AQ1, AQ2 and AQ3 varied from 5.2 µg/m³ to 11.3 µg/m³ and AQ3, AQ4 and AQ5 values are below detectable limit. The values are within the prescribed limit (180 µg/m³) of NAAQ, 2009 standard, the concentration of ammonia varied from 5.1 µg/m³ to 12.1 µg/m³. The values are within the prescribed limit (400 µg/m³) of NAAQ, 2009 standard, The concentration of CO Values varied between 0.12 mg/m³ and 0.87 mg/m³ in AQ2- CCVL plant and all other stations were found to be below the detection limit of <0.115 mg/m³ i.e stn.AQ1, stn.AQ3 to stn.AQ6. The value is within the prescribed limit (4 mg/m³) of NAAQ, 2009 standard and concentration of Lead, Arsenic and Nickel were below the detectable limits (Detection ranges for Pb, As, Ni were 0.02 µg/m³, 1.0 ng/m³ and 3.0 ng/m³, respectively).

Ambient air quality of 10 km project radius satisfies National Ambient Air Quality Standard limit.

Noise Environment:

Residential area: During the day, the equivalent noise levels in this area ranged from (NQ1, NQ3, NQ4, NQ5 and NQ6) 34.7 dB (A) to 53.7 dB (A), whereas at night they were in the range of 33.8 to 43.9 dB (A). The Stn. NQ6- Thazhanchavadi is the lowest daytime noise equivalent 34.7dB (A) level and the Stn. NQ5- Annavalli had the highest 53.7dB (A). The NQ6-Thazhanchavadi site area had



the lowest nighttime noise equivalent 33.8 dB (A) and the NQ3- Poondiyankuppam site area the highest 43.9 dB (A).

Industrial area: NQ2 – CCVL plant Day time range is 49.7 dB (A) to 64.0 and the night time is 48.3dB (A) to 55.6dB (A).

The monitored noise level of (Stns NQ1 to NQ6) both residential and Industrial area at day and night time were within the CPCB's limit.

Ground Water quality: Ground water samples were collected from different locations to assess the existing ground water quality of the study area. The physio chemical characteristics are confirmed to IS 10500:2012 standards. **pH** of the groundwater was observed as **7.92**, which lies well within the acceptable range of **6.5 – 8.5**, **Chloride concentration (as Cl⁻)** was measured at **20.0 mg/L**, significantly lower than the permissible range of **250 – 1000 mg/L**, indicating negligible chloride contamination, **Total Hardness** was found to be **90.0 mg/L**, well below the acceptable range of **200 – 600 mg/L**, suggesting the water is soft in nature and **Total Dissolved Solids (TDS)** were recorded as **280 mg/L**, also within the desirable limit of **500 – 2000 mg/L**, reflecting good water quality with low mineral content.

The water can be classified as fresh, soft, and suitable for potable use without significant treatment.

Surface Water Quality: Surface water samples were collected at different locations to assess the surface water quality in the study area. The samples were compared with CPCB surface water classification and found suitable for various designated classes such as outdoor bathing, drinking water source, irrigation, industrial purposes, etc.

pH was measured at **7.59**, which falls within the acceptable range of **6.5 – 8.5**, indicating neutral to slightly alkaline water suitable for aquatic life, **Total Dissolved Solids (TDS)** were found to be **280 mg/L**, which is well below the permissible range of **500 – 2100 mg/L**, reflecting good water quality with low dissolved salts, **Total Coliforms** were **absent** in the analyzed sample, whereas CPCB standards allow **50 – 5000 MPN/100 ml** depending on class, showing no bacteriological contamination and **E. coli** was also **absent**, meeting the most stringent requirement (Class A waters), where E. coli should not be present.

The surface water quality at SW1 conforms to the CPCB standards. The absence of bacteriological contamination along with low TDS levels suggests that the water quality is good and falls under the **higher water quality classes (A/B)** suitable for uses such as drinking water source with conventional treatment, outdoor bathing, and propagation of fisheries.

Soil Quality: Soil quality assessment was conducted at different locations to understand the existing soil characteristics. The soil quality analysis shows that the land side of the soil in the study area is predominantly composed of fine sand nature.



Soil samples were collected from **Station SQ1** and analyzed for physico-chemical characteristics. The results are as follows:

Porosity of the soil was observed as **25%**, indicating moderate pore space which supports air and water movement within the soil profile, **Bulk Density** was measured at **1.54 g/cm³**, suggesting a fairly compact soil structure with adequate root penetration capacity, **Soil pH** was recorded at **5.7**, showing the soil is slightly **acidic** in nature, **Moisture Content** was found to be very low at **0.13%**, which indicates dry soil conditions at the time of sampling and **Organic Carbon** content was **0.51%**, reflecting **moderate fertility status** of the soil.

The soil at SQ1 is slightly acidic with moderate porosity and bulk density. The organic carbon content indicates moderate fertility, though the low moisture content suggests dry conditions prevailing in the sampling location.

Socio economics: Socio-economic had taken up around project location on the demographic structure, availability of basic amenities such as housing, education, health and medical services, occupation, water supply, sanitation, communication and power supply, prevailing diseases in the region as well as features such as places of tourist attraction and monuments of archaeological importance. The study of these parameters helps in identifying and evaluating the likely impacts due to project activity in the surrounding region. Any development activity can have direct and indirect effects, both positive and negative on the socio-economic environment of the region.

This socioeconomic profile was conducted with a specific focus on the upgrade of the existing MTF in the SIPCOT Industrial Estate, Phase II complex. The existing MTF has been in operation for 15 years, beginning in 2009. The SIPCOT industrial park and existing CCVL business have already improved people's living conditions in the project region. Now, adding these facilities again will raise the status of the people there. Existing industrial and commercial activities have already improved living standards in the region, and the proposed upgrade aims to further enhance socio-economic conditions.

Ecology and Biodiversity: To understand the existing status of flora and fauna within study area, ecological assessment has been carried out.

Flora:

Tree species: A total of 33 tree species belonging to 17 families were observed in the study area.

Shrubs: During the survey a total of 24 shrub species belonging to 13 families from the study area were observed.

Herbs and Grasses: The Herbaceous and Grasses are dried up due to the summer season, except in the river and pond sites of the study area. A total of 63 herbs and 13 grass species belonging to 25 families were recorded



Climbers: The climbers were observed from the river side, coastal region and wetland parts of the study area. 10 climber species belonging to six families and five creeper species belonging to 3 families were noted from the study area.

Fauna:

Butterflies: According to a previous study report, there were 60 species, and 44 genera classified into five families in the Cuddalore district. A total of 17 species of butterflies have been documented from this region.

Amphibians: About 11 species of amphibians were reported from this region.

Reptiles: About 22 species of reptiles were reported from this region.

Birds: List of terrestrial and aquatic birds (Perumal Lake and adjacent areas and rice fields) sited and reported earlier during the present study visit. The number of species reported from Cuddalore earlier is 345 and the number of globally threatened species reported in the study area is 12. A total of 37 species were recorded. Local people mainly use Perumal Lake for fishing, cattle grazing and domestic purposes.

Marine Environment

The baseline data on marine environment were collected around 10 km radius from project location. The seawater samples, seabed sediment samples and biological samples were collected at 10 locations. The water samples were collected at three depths across the vertical i.e., surface, mid depth and bottom.

Seawater Quality: During the study period, the water quality results for the study area were found to be within the typical range for coastal waters in terms of physicochemical parameters, heavy metals, and nutrient values. Therefore, this study area is not considered to be contaminated in the open sea.

Seabed Sediment: seabed sediments are composed of Fine sand and medium sand. Concentrations of organic matter, total nitrogen, and phosphorus showed normal and within the typical range for coastal sediments.

Marine ecology and biodiversity

Phytoplankton: Primary productivity, Species composition and Numerical abundance has been studied. Totally 56 species of phytoplankton were observed, comprising four groups viz., 41 species of diatoms (Bacillariophyta), 12 species of dinoflagellates (Pyrrophyta), 1 species of green algae (Chlorophyta) and 2 species of blue-green algae (Cyanophyta).

Zooplankton: Totally, 54 species of zooplankton were identified in the samples from the study area.



Subtidal benthic organisms: The density of macrobenthic organisms varied from 720 to 1040 nos./m² at all stations (SB1 to SB10).

Intertidal benthic organisms: The density of intertidal benthic organisms varied between 345 and 420 Nos./m². Arthropoda and Mollusca dominated at all the stations than Polychaeta.

Coastal vegetation: The present study reveals that sand dunes are present within a 10 km radius and height ranges from 0.5 to 5 m with moderate vegetation. Existing sand dunes will not be affected by the proposed project for elevated pipeline facilities.

Seagrasses and Seaweeds: Seagrass species were absent within the project region.

Sea turtles: The proposed LFP comes under Thammanampettai to Sothikuppam 8.0 km stretch, on the southern side Thammanampettai to Ayyampettai 3 km stretch and Ayyampettai to Samiyar pettai 3 km stretch and northern side Rasapettai 4.8 km stretch nesting area.

The proposed project location is approximately 14 km north of Devanampatnam, where the Forest Department Cuddalore has been developing turtle nesting hatcheries from 2021 to 2023. The proposed construction of the elevated pipeline does not impact the ground area.

Marine Mammals: Marine mammals were not observed within the project region.

Mangroves: During the study period, true mangrove species of *Avicennia marina*, *Rhizophora mucronata* and *Excoecaria agallocha* mangrove associate species (salt marsh) such as *Arthrocnemum indicum*, *Suaeda maritima* and *Sesuvium portulacastrum* were observed in the project area.

According to CRZ, mangroves only present 1530 m south and 2080 m north of the proposed elevated trestle pipeline. The construction of an elevated pipeline trestle will not damage or uproot the existing mangroves.

Coral reefs: Coral species were absent within the project region.

Fisheries: The estimated marine fish production of Cuddalore district was 5,47,615 lakh tonnes in 2020-21. There are 43 fishing villages comprising 12,988 fishing families and 12,577 traditional fishermen families. Among the total fishing families 46,090 fisherfolk population are engaged in fishing (Marine Fisheries Census 2016, Tamil Nadu).

11.3 ANTICIPATED ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

Air environment:



Construction activities such as handling and transport of materials, operation of machinery, welding, and concrete mixing may generate fugitive dust and vehicular emissions. These are **short-term, negative, and reversible** in nature.

Mitigation: Regular water sprinkling, covering of material transport vehicles, use of DG sets conforming to CPCB norms, and maintaining ambient air quality within NAAQS.

Noise Environment:

Use of excavation equipment, piling, dredging, and vehicular movement may generate temporary noise.

Mitigation: Provision of PPE (earmuffs/earplugs), restricting construction during high wind (>25 mph), scheduling noisy operations, and ensuring DG sets conform to CPCB standards.

Water Environment:

Construction and dredging may cause turbidity, sediment resuspension, and alteration of water quality. Operation phase discharges, particularly brine reject from desalination, may raise local salinity and affect benthic communities.

Mitigation: No discharge into Uppanar River/CRZ; provision of STP for sewage; proper drainage aligned to natural flow; adoption of suitable dredging technology; net enclosures and booms to limit turbidity; scheduling dredging outside sensitive breeding seasons; post-dredging monitoring; controlled disposal of brine with adequate mixing.

Marine Ecology:

Activities like piling, trestle construction, and pipeline laying may disturb benthic habitats, plankton, fish migratory patterns, and shorebird feeding grounds. Brine discharge could alter primary productivity and impact intertidal fauna.

Mitigation: Strict construction schedules, avoidance of sensitive spawning/breeding periods, shoreline stabilization measures, restoration and greenbelt development, and expert-guided shore protection.

Terrestrial Ecology and Socio-Economics:

Temporary worker housing and solid waste generation may stress land resources and aesthetics. However, there will be a positive impact in terms of local employment generation.

Mitigation: Proper solid waste and wastewater management, prohibition of waste disposal in marine waters, adequate greenbelt development before construction, and strict adherence to waste segregation and disposal practices.

General Mitigation Practices:

- Construction waste and scrap shall not be disposed of in seawater.
- Construction materials must be handled carefully without dropping on the seafloor.
- Use efficient construction techniques to minimize time and exposure.



- Regular shoreline monitoring and adoption of protective measures when needed.
- All existing mitigation practices of CCVL shall be strengthened and extended to the expansion project.

11.4 ENVIRONMENTAL MONITORING PROGRAMME

M/s Chemplast Cuddalore Vinyls Limited (CCVL) will ensure that the environmental performances of all the activities are monitored throughout the execution of the various project activities. Monitoring will include all the aspects and parameters related to the process emissions from the manufacturing process, storage area, work zone area, quantities of waste generated, effluent generation and its characteristics, Environmental quality of components like Air, water, Soil, Noise are being verified that they meet the prescribed standards. Occupational health and safety monitoring will include Effective Health and safety management of the workers engaged, periodic health check up, reporting of all the incidents in the plant during the installation and operation phase. All the reports will be periodically submitted to the concerned regulatory authorities as compliance, audit reports.

11.5 ADDITIONAL STUDIES

Additional studies such as Hydrodynamic Modelling, Sediment transport model – MIKE 21 ST, Shoreline Changes Study, Traffic Survey, Vessel Tranquility study, Risk Assessment and Disaster Management Plan have been carried out and given in detail in the EIA report and Volume II - Draft Environmental Impact Assessment Report For “Expansion of the Existing SPVC Plant from 600 KTA to 1200 KTA, with backward integration of the raw material VCM of 750 KTA capacity” by M/s. Chemplast Cuddalore Vinyls Limited.

11.6 PROJECT BENEFITS

The construction of the infrastructures will have both direct and indirect impacts on the economic development of the country. The project is expected to stimulate the participation of private businesses in industrial and transport sector development. There will be many ancillary industries coming up. Private investments will create employment opportunities which will ultimately create income opportunities and alleviate poverty and consequently improve the standard of living of the people.

- Based on project particulars and the existing environmental conditions, potential positive impacts likely to result from the proposed MTF development are identified below.
- Better Sea transport facilities/State of the art MTF.
- Revenue Generation
- Employment Opportunities – skilled, semi-skilled and unskilled labour during construction and operation phases of the project with specific attention to employment potential of local population



- Improvement in Physical Infrastructure like project infrastructure and ancillary facilities
- Improvement in social infrastructure like roads, railways, townships, housing, water supply, electrical power, drainage, educational institutions, hospitals, improved environmental conditions etc.
- Reduction of material costs due to reduction of transport cost.

11.7 ENVIRONMENT MANAGEMENT PLAN

Development of any infrastructure in the coastal environment includes both social and environmental impacts. To address the anticipated impacts and to implement the mitigation measures, the Environment Management Plan (EMP) needs to be formulated. EMP identifies the approach, procedures and methods that will be used to control and minimize the environmental and social impacts of construction and operational activities associated with project development. It is intended to reduce the negative impact and to enhance the positive benefits from the project.

The main objectives of Environmental Management are to:

- Identify key environmental issues anticipated to be encountered during construction and operation phases of the project
- Provide guidelines for appropriate mitigation measures
- Ensure the mitigation measures are implemented
- Establish systems and procedures for implementing mitigation measures
- Monitor the effectiveness of mitigation measures
- Take necessary prompt action when unforeseen impacts occur

The proposed project involves construction of approach trestle, mooring dolphins, tug berth, laying of intake and outfall pipeline and construction of desalination plant. The impacts due to construction and operation of MTF were described in **Chapter 4**. This chapter details a management plan formulated to manage environmental impacts likely to arise during construction and operational phase.

A capital cost of ₹ 91 lakhs and recurring cost of ₹ 65 lakhs /year will be separated as EMP budget.

More details on EMP including budget allocation for various activities is provided in Chapter 10 of the EIA report.

11.8 CONCLUSION

Comprehensive baseline environment study has been done to establish the baseline status of the study area within 10 km from the project site. The significant environment parameters for the terrestrial and marine environment are compared with the available National Standards. The impact assessment shows that there are no significant negative impacts due to proposed project activities on the surrounding environment. The implementation of suggested mitigation measures



and environment management plan will ensure to keep the anticipated impacts to minimum so that the project will be completed without any significant change in baseline environment status.

12. DISCLOSURE OF CONSULTANTS ENGAGED

About Environmental Consultant

Indomer Coastal Hydraulics (P) Ltd. is NABET-QCI accredited EIA consultant appointed for the proposed project “EIA & EMP study to obtain EC and CRZ clearance for upgradation of existing MTF and proposed 20 MLD desalination plant at Chithirapettai, Semmankuppam and Thiyagavalli villages, Cuddalore district, Tamil Nadu”.

Indomer is an ISO 9001:2008 certified company with QCI – NABET Accreditation for Sector 27: Oil & gas transportation pipeline (crude and refinery/petrochemical products), passing through National Parks/sanctuaries/coral reefs/ecologically sensitive Areas including LNG Terminal and Sector 33: Ports, Harbours, jetties, marine terminals, breakwaters and dredging. Certificate of accreditation is given below.

All data is collected at site using the latest technology, equipment and analysis was done by Indomer inhouse laboratory Chennai, which is accredited laboratory by NABL. The report is prepared with involvement of EIA coordinator and Functional Area Expert (FAE). Based on the impacts identified, appropriate mitigation measures and EMP were suggested. We stand on the authenticity of data submitted in this EIA report.

ACCREDITATIONS OBTAINED

- ISO-9001:2015 Certification
- QCI – NABET Scheme for Accreditation of EIA Consultant Organizations

Table 108 . List of Functional Area Experts

S. No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
1.	EIA Coordinator	Dr. P. Chandramohan	I had visited the site with the FAEs to assess the project site and the study area. Coordinated With the experts and prepared the impact assessment methodology. Identification and Prediction of the impact assessment, Formulation of the Environment Management Plan, Technical Review. February 2024 - Till date
2	WP, EB	Prof. (Dr). T. Balasubramanian	Field investigation, identification of water sampling locations, sample analysis and Ecology & Biodiversity assessment, Impact and Mitigation Measures (Feb - July 2024)



S. No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
3	EB	Dr. S. Sundaramoorthy	Field investigation, Ecology and Biodiversity assessment, Impact and Mitigation Measures (Feb - July 2024)
4	EB	Dr. P. Venkadeswaran	Study on Ecology & Biodiversity, involved in the study on Mangroves and preparation of EIA report. (Feb - July 2024)
5	SE	Dr. Sarmistha Mohanty	Baseline data collection on Socio-Economic environment and report preparation (Feb - July 2024)
6	HG	Dr. P. Chandramohan	Hydrological pattern analysis of the project region (Feb - July 2024)
7	GEO, LU	Dr. Terry Machado	Field investigations, geological classification of the project site (Feb - July 2024)
8	NV, RH (Marine)	Mr. J. Guru Prasath	Selection of sampling location, Impact Assessment and Mitigation Measures, identification of potential risk and hazards (Feb - July 2024)
9	WP, RH	Mr. V. Kesava Das	Field investigations, identification of sampling locations, sample analysis & report preparation (Feb - July 2024)
10	AP	Mr. Santosh Gupta	Field investigations, assessment of air quality, fixing air quality sampling locations, Impact Assessment and Mitigation Measures (Feb - July 2024)
11	SC	Dr. B. K. Patel	Field investigation, identification of soil sampling locations, soil analysis and report preparation
12	HS, SC	Mr. R. C. Bragath	Hydrological pattern analysis of the project region (Feb - July 2024)
13	NV	Mr. Vivek P. Navare	Field investigations, assessment of noise quality, fixing noise sampling locations and Impact Assessment & Mitigation Measures (Feb - July 2024)
14	RH, HW	Mr. Anil L. Choumal	Field investigation, suggestion of hazardous waste management, its Impact & Mitigation Measures (Feb - July 2024)
15	AQ	Dr. Dibyendu Banerjee	Field investigations, fixing of air quality sampling locations, assessment of air quality (Feb - July 2024)



Table 109. List of Functional Area Experts

S. No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
1.	WP, SHW	Mr. M. Parthiban	Preparation and verification of water sampling locations, sampling analysis, identification of Solid and Hazardous Waste in the project site and report preparation under the guidance of FAE. (Feb - July 2024)
2	AP, AQ	Mrs. R. Hamridha	Preparation and verification of air quality sampling locations, assessment of air quality and report preparation under the guidance of FAE. (Feb - July 2024)
3	SE	Mr. Santanu Swain	Baseline data collection on Socio-Economic environment and report preparation with the help of EC and FAE (Feb - July 2024)

Table 110. List of Team Members

S. No	Functional Areas	Name of Expert(s)	Involvement (Period & Task)
1	LU	Dr. U. Kumara Ganesh	Site Visit, coordinate with EC and FAEs, preparation of report. (Feb - July 2024)
2	WP	Mrs. R. Rekha Dhanasekran	Site Visit, coordinate with EC and FAEs, preparation of report. (Feb - July 2024)
3	SHW	Mrs. R. Surya	Site Visit, coordinate with EC and FAEs, preparation of report. (Feb - July 2024)

