C25014
DL003, Rev 0

Expansion of Cuddalore Port, Cuddalore district, Tamil Nadu

Draft EIA/EMP Report

Study Period July to October, 2025

May, 2026

mahathi **Cuddalore Port & Maritime Private Limited**

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CIN NO.: U52292TN2025PTC181365

Undertaking by Project Proponent

1. Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL) has carried out Environmental Impact assessment (EIA) study for the Expansion of Cuddalore Port, Cuddalore district, Tamil Nadu

2. As per MoEFCC Office Memorandum Number: J-11013/41/2006-IA dated October 05,2011, Cuddalore port herewith agrees to the contents (Information and data) of this EIA/EMP Report

For Mahathi Cuddalore Port & Maritime Pvt. Ltd.

Director

Document Control

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	Prepared	**Reviewed**	**Approved**

Declaration by the Experts contributing to the EIA/EMP Study for Expansion of Cuddalore Port, Cuddalore District, Tamil Nadu.

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

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Name: Mrs. Susruta Mamidanna

Signature and Date: 07-05-2026

Period of involvement: 2025-Ongoing

Contact information: Falcon Resilient Infra Consultants
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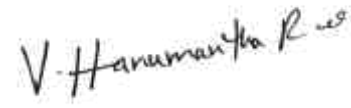
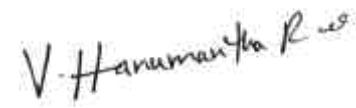
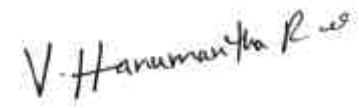
Functional Area Experts:

S. No.	Functional areas	Name of the Expert/s	Involvement (Period and Task)	Signature and Date
1	AP	Susruta Mamidanna	Period:2025-Ongoing Task: Review of baseline ambient air quality and assessment of sources of air emissions in the project. Impact assessment and mitigation measures are suggested.	07-05-2026
2	WP	Srilatha Vellori	Period:2025-Ongoing Task: Review of baseline water quality data and analysis of associated impacts, preparation of EMP and budget. Impact assessment and mitigation measures are suggested.	07-05-2026
		With Support from: A. Ravi Chandra		

S. No.	Functional areas	Name of the Expert/s	Involvement (Period and Task)	Signature and Date
3	SHW	Susruta Mamidanna	Period: 2025-Ongoing Task: Identified hazardous and non-hazardous. Prepared solid waste management practices for the project.	 07-05-2026
4	SE	C.J Paul	Period:2025-Ongoing Task: Analysis of Socio-economic data and social impact assessment.	 07-05-2026
		Dr. Sumbramanyam VRM Nambarru	Period:2025-Ongoing Task: Compilation of Socio-economic data and social impact assessment.	 08-04-2026
		Support from Veerababu Pitchikala		
5	EB	Hanumantha Rao V Varapu	Period:2025-Ongoing Task: Primary survey and analyzed the primary surveyed data with secondary data and suggested species for greenbelt development. Impact assessment and mitigation measures are suggested.	 07-05-2026
		Dr. Sumbramanyam VRM Nambarru	Period:2025-Ongoing Task: Inventory of Flora and Fauna and Bio-diversity Assessment.	 07-05-2026
		<u>With Support from:</u> K Mallikarjuna		
6	HG	G. Rama Chandra Reddy	Period:2025-Ongoing Task: Review of Hydrological data and drainage patterns in the	 07-05-2026

S. No.	Functional areas	Name of the Expert/s	Involvement (Period and Task)	Signature and Date
			project study area. Impact assessment and mitigation measures are suggested.	
		With Support from: A. Ravi Chandra		
7	GEO	G. Rama Chandra Reddy	Period:2025-Ongoing Task: Analysis of Geological and Geomorphological data of project study area and review of maps.	 07-05-2026
8	SC	Hanumantha Rao V Varapu	Period:2025-Ongoing Task: Identified sampling locations. Assessment of soil fertility by nutrient availability. Analysis of baseline soil quality data.	 07-05-2026
		Dr. Sumbramanyam VRM Nambarru	Period:2025-Ongoing Task: Soil Baseline Assessment, Identification of Impacts and Suggestion of Mitigation Measures.	 07-05-2026
		With Support from: K Mallikarjuna		
9	AQ	Susruta Mamidanna	Period:2025-Ongoing Task: Review of secondary data on meteorology and climatic conditions.	 07-05-2026
10	NV	Srilatha Vellori	Period:2025-Ongoing Task: Review of baseline noise monitoring data. Identified probable noise and vibration	 07-05-2026

S. No.	Functional areas	Name of the Expert/s	Involvement (Period and Task)	Signature and Date
			impacts by the proposed project.	
		With Support from: A. Ravi Chandra		
11	LU	Hanumantha Rao V Varapu	Period:2025-Ongoing Task: Prepared GIS based Thematic Maps.	 07-05-2026
		With Support from: Srilatha Vellori		
12	RH	Susruta Mamidanna	Period:2025-Ongoing Task: Prepared on-site Emergency preparedness plan and offsite Disaster Management Plan.	 07-05-2026

Declaration by Head of the Accredited Consultant Organisation

I, Susruta Mamidanna, hereby, confirm that the above-mentioned experts prepared the Draft EIA/EMP Study Report for Expansion of Cuddalore Port. I also confirm that the consultant organization shall be fully accountable for any mis-leading information.

Signature:

07-05-2026

Name: Susruta Mamidanna

Designation: Director

Name of the EIA Consultant Organization: Falcon Resilient Infra Consultants

NABET Certificate Number & Issue Date: NABET/EIA/23-26/SA 0236 issued on March 18, 2025.

Certificate of Plagiarism Check

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Name of the Accredited Organization	Falcon Resilient Infra Consultants
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Name of the EIA Co-Coordinator (EC)	Mrs. Susruta Mamidanna
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Designation: Director – Technical

Date and Sign of Head of Accredited Organization: (07.01.2026)
Name of the EIA consultant organization: Falcon Resilient Infra Consultants, Hyderabad

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Acronyms

AcSIR	:	Academy of Scientific & Innovative Research
AAGR	:	Average Annual Geometric Growth Rate
AAQ	:	Ambient Air Quality
ADCP	:	Acoustic Doppler Current Profiler
ADT	:	Average Daily Traffic
AEGLs	:	Acute Exposure Guideline Levels
ALOHA	:	Areal Locations of Hazardous Atmospheres
ATCC	:	Automatic Traffic Counter and Classifier
BIS	:	Bureau of Indian Standards
BLEVE	:	Boiling Liquid Expanding Vapor Explosion
BOD	:	Biological Oxygen Demand
C&D	:	Construction and Demolition
CASMB	:	Centre for Advanced Study in Marine Biology
CBWTF	:	Common Bio-medical Waste Treatment Facility
CGWB	:	Central Ground Water Board
CMSWMF	:	Common Municipal Solid Waste Management Facility
CMSWMF	:	Common Municipal Solid Waste Management Facility
CO	:	Carbon monoxide
COD	:	Chemical Oxygen Demand
COLREGS	:	Convention Of The International Regulations For Prevention Of Collision At Sea 1972
CPCB	:	Central Pollution Control Board
CRZ	:	Coastal Regulation Zone
CZMP	:	Coastal Zone Management Plan
DEM	:	Digital Elevation Model
DGCG	:	Director General Coast Guard
DMP	:	Disaster Management Plan
EC	:	Environmental Clearance
ECC	:	Emergency Control Centre
ECRT Leader	:	Emergency Control Room Team Leader
ECT	:	Emergency Control Team
EIA	:	Environmental Impact Assessment

EMC	:	Environmental Management Cell
EMP	:	Environmental Management Plan
ENVIS	:	Environmental Information System
EPZ	:	Export Processing Zone
ERPG	:	Emergency Response Planning Guidelines
ERT	:	Emergency Response Team
ESZ	:	Eco- Sensitive Zone
ETP	:	Effluent Treatment Plant
FFS	:	Fire Fighting system
FRICS	:	Falcon Resilient Infra Consultants
GCT	:	Gati Shakti Multi-modal Cargo Terminal
GDP	:	Gross Domestic Product
GIS	:	Geographical Information System
GLCs	:	Ground Level Concentrations
GoI	:	Government of India
HAZOP	:	Hazard and Operability Studies
HOS	:	Head of Marine Operations
HRDD	:	Heat Radiation Damage Distance
HSD	:	High Speed Diesel
HWM	:	Hazardous Waste Management
IC	:	Incident Controller
IDLH	:	Immediate Dangerous to Life or Health
IMD	:	Indian Meteorological Department
IR	:	Infrared
IUCN	:	International Union for Conservation of Nature
KLD	:	Kilo Litres Per Day
LEL	:	Lower Explosive Limit
LOC	:	Loss of Containment
LULC	:	Land Use Land Cover
M.Cum	:	Million Cubic Metre
MARPOL	:	International Convention for the Prevention of Pollution from Ships.
MCACA	:	Maximum Credible Accident and Consequence Analysis
MCPMPL	:	Mahathi Cuddalore Port and Maritime Pvt Ltd
MHC	:	Mobile Harbour Crane
MLD	:	Million Litres Per Day
MMTPA	:	Million Metric Tonne Per Annum
MOEFCC	:	Ministry of Environment, Forest, and Climate Change
MSDS	:	Material Safety Data Sheets
MSW	:	Municipal Solid Waste
MULA	:	Marine Unloading Arm
NAAQS	:	National Ambient Air Quality Standards
NABET	:	National Accreditation Board for Education & Training
NABL	:	National Accreditation Board for Testing and Calibration Laboratories
NDZ	:	No Development Zone
NEBA	:	Net environmental Benefit Analysis
NFPA	:	National Fire Protection Association
NH	:	National Highway
NH_3	:	Ammonia
NIO	:	National Institute of Oceanography
NO_2	:	Nitrogen dioxide
NSDP	:	Net State Domestic Product
OASTC	:	Ocean and Atmospheric Science & Technology
OHSAS	:	Occupational Health and Safety Assessment
OPDD	:	Over Pressure Damage Distance
OSCP	:	Oil Spill Contingency Plan
OSR	:	Oil Spill Response
OSRA	:	Oil Spill Risk Analysis

PCBs	:	Polychlorinated Biphenyls
PCU	:	Passenger Car Unit
PHA	:	Preliminary Hazard Analysis
PIA	:	Project Influencing Area
$PM_{2.5}$	:	Particulate Matter 2.5
PM_{10}	:	Particulate Matter 10
POWO	:	Plants of the World Online
PPE	:	Personnel Protection Equipment
PUC	:	Pollution under control
QCI	:	Quality Council of India
RA	:	Risk Assessment
REET	:	Rare, Endangered, Endemic, Threatened
ROB	:	Road Over Bridge
ROW	:	Right of Way
RWH	:	Rainwater Harvesting
SEZ	:	Special Economic Zone
SO2	:	Sulphur dioxide
SoI	:	Survey of India
STP	:	Sewage Treatment Plant
SWM	:	Solid Waste Management
TEEL	:	Temporary Emergency Exposure Levels
TFA	:	Tank Farm Area
TLOC	:	Total loss of containment
TNMB	:	Tamil Nadu Maritime Board
TNPCB	:	Tamil Nadu Pollution Control Board
ToR	:	Terms of Reference
TPD	:	Tonnes Per Day
UEL	:	Upper Explosive Limit
UNCLOS	:	United Nations Convention On Law Of The Sea 1982
UV	:	Ultraviolet

Chapter 1
Introduction

1 Introduction

1.1 Background

Tamil Nadu is one of the maritime states of our country, historically known for Ports and Harbors with its ~1,076 km of coastal length. The 14 coastal districts of Tamil Nadu are bounded by the Bay of Bengal in the East, the Arabian Sea in the west and the Indian Ocean in the south.

Cuddalore district which is on coromandel coast has been in the industrialization pathway in the last one decade which has seen a coastal thermal power plant, multi fold enhancement in the coal mining capacity of nearby NLCIL (40 Km, West) and nearby Puducherry (20km, North) with multi varied development.

Cuddalore Port is an existing port located at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal. The port at Cuddalore was an ancient anchorage (open roadstead) port developed and used by various regional kingdoms, subsequently by British and currently under administrative control of Tamil Nadu Maritime Board (TNMB).

Tamil Nadu Maritime Board (TNMB) was the nodal agency of Government of Tamil Nadu for operating the Cuddalore Port. Previously the operation of Cuddalore Port was restricted to Uppanar with a port craft wharf and handling 0.37 MTPA of multiple cargos with consent from Tamil Nadu pollution Control Board (TNPCB) through consent order no. 160812082497 dated February 15, 2016 for Water Act and consent order no. 160822082497 dated February 15, 2016 for Air Act.

TNMB obtained Environmental & CRZ Clearance from MoEFCC through vide File no. 10-35/2017-IA-III dated August 20, 2020 for transforming the Cuddalore port into all-weather Multi Cargo Handling Port with increase in cargo handling capacity upto 5.68 MTPA with additional Wharf/berth construction (2 Numbers; 120 X 21 m each) dredging for 18,73,476 Cu.m, increase in depth for approach channel upto -11m CD and Turning Circle upto -11 m CD, additional cargo storage areas, extension of North Breakwater is 395m and South Breakwater is 650m. The approved cargo includes Coal, Fertilizer, Slag, Cement, Containers and Clean Cargo.

Consent for establishment was obtained from TNPCB through Consent Order No. 2101134781653 dated March 23, 2021 for Water act and through Consent Order No. 2101234781653 dated March 23, 2021 for Air act.

TNMB on ground has developed all the proposed infrastructure including the berth construction, dredging and reclamation activities as per accorded EC&CRZ clarence for cargo handling of 5.68 MTPA.

M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL) has entered into a concession agreement with TNMB for development and operation of the Cuddalore Port, Tamil Nadu for 40 years under the PPP Model vide Agreement dated July 04,2025.

MCPMPL, obtained Transfer of Environmental and CRZ Clearance from Ministry of Environment, Forest and Climate Change (MoEFCC) vide EC Identification No. EC25A3501TN5833411T and order no. File No. 10-35/2017/-IA-III dated December 01,2025. Environmental & CRZ Clearance from MoEFCC through vide File no. 10-35/2017-IA-III dated August 20, 2020 and EC transfer is enclosed as **Appendix A**.

In the Present proposal, Cuddalore port is proposing for the increase in cargo handling capacity from 5.68 MTPA to 11.48 MTPA and ship building and repair activities within the notified port limits with following developmental works:

- Construction of additional Two Bulk berths 2x270 (540m) berths and 200m extension of existing multipurpose berths (440m).
- Capital dredging to -16 m CD in the inner channel and -18m CD in the outer channel, to handle fully loaded Handymax, Supramax, and Panamax vessels.
- Proposed to handle the cargo including Coal, Cement, Fertilizers, Container, Cereals, Wood, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron Ore, Slag and Limestone.
- Development of stacking yards, storage yards, container freight station, and internal roads.
- Procurement and installation of port equipment and cargo-handling systems, including mobile harbour cranes, forklifts, and other supporting machinery.
- Ship building and repair facilities.
- Road and Rail connectivity.

1.2 Details of Project Proponent

The contact details of authorised person at MCPMPL are provided below.

Address for correspondence:

Sri. Ravi Shankar Yendapalli
Director,
Mahathi Cuddalore Port & Maritime Private Limited,
Cuddalore Port
Tamil Nadu – 607003.

1.3 Project Chronology

Following are the major events of the Cuddalore Port development with respect to Environmental and CRZ Clearance of the project:

S. No.	Milestones	Remarks
1	Earlier Port operations	• Pre-EIA notification • Handling capacity - 0.37 MTPA
2	Tamil Nadu Pollution Control Board (TNPCB) consent	• Consent order no. 160812082497 dated February 15, 2016 for Water Act

S. No.	Milestones	Remarks
	orders for Port operation by TNMB	• Consent order no. 160822082497 dated February 15, 2016 for Air Act
3	CRZ recommendations for Capacity Expansion of Cuddalore Port from TNCZMA	Letter No. 19510/EC-3/2018-1 dated November 14, 2018
4	EC & CRZ Clearance for Capacity Expansion of Cuddalore Port	• File no. 10-35/2017-IA-III dated August 20, 2020 • Cargo handling capacity - 5.68 MTPA
5	Consent for establishment orders from TNPCB	• Consent Order No. 2101134781653 dated March 23, 2021 for Water act • Consent Order No. 2101234781653 dated March 23, 2021 for Air act.
6	Transfer of Environmental and CRZ Clearance from M/s Tamil Nadu Maritime Board (TNMB) to M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL)	• EC Identification No. EC25A3501TN5833411T and order no. File No. 10-35/2017/-IA-III dated December 01,2025 • Cargo handling capacity - 5.68 MTPA

1.3.1 Developed Facilities

- Two multipurpose berth construction (120 X 21 m each) constructed on Paravanar riverbank
- Dredging for Turning Circle area with depth -11 m CD, Diameter 300 m,
- Dredging for Approach channel length 1500m, width 60m, depth to -11m CD
- Additional cargo storage areas
- Dredging quantity - 18,73,476 Cu.m
- Land levelling/reclamation behind the berths
- Northern Breakwater: Length (395m)
- Southern Breakwater: Length (650m)

1.4 Applicable Legal and Policy Framework

The proposed expansion attracts the Environment Impact Assessment (EIA) Notification, 2006 (as amended) under 7(e) Ports, harbours, break waters and dredging of EIA notification, 2006 (as amended) under 'A' category. Environmental Impact Assessment Report has been prepared as per Appendix III of EIA Notification, 2006.

The EIA/EMP study has been carried out based on the approved ToR accorded vide TOR Identification No. TO26A3501TN5213902N and File No: **10-35/2017/-IA-III** dated 05.03.2026, which is attached as **Appendix B** and compliance to ToR is provided in **Section 1.8.1**.

The project being of Category 'A', the applicable regulations are listed in **Table 1-1**.

Table 1-1: Applicable Environmental Regulations

Applicable GoI Policies & Regulations	Year	Applicability	Compliance/Application
Environmental (Protection) Act	1986 and amendments	Yes	To protect and improve overall environment
Environmental Impact Assessment Notification (as amended)	2006 as amended	Yes	EIA notification for more effective Environmental clearance process.
Air (prevention and control of pollution) Act	1981& 1987as Amended	Yes	To control air pollution by controlling emission and air

Applicable GoI Policies & Regulations	Year	Applicability	Compliance/Application
			pollutants according to prescribed standards
Noise Pollution (Regulation and Control) rules 2000. Noise Pollution (Regulation and Control) (Amendment) Rules 2010	2001 & 2010 as amended	Yes	Noise pollution regulation and control of noise pollution
Water (Prevention and Control of Pollution) Act and Cess Act of 1977	1974 (amended upto 2024)	Yes	To control water pollution by controlling discharge of water pollutants as per the prescribed standards
Hazardous and other wastes (Management and Transboundary Movement) Rules	2016 as amended	Yes	Hazardous wastes management
Solid Waste Management Rules	2026 as amended	Yes	Handling, treatment and disposal of solid waste generated
E-Waste (Management) Rules	2022 as amended	Yes	Management of E-Waste as a consumer
Battery Waste Management Rules	2022 as amended	Yes	For appropriate handling of used batteries
The Construction and Demolition (C&D) Waste Management Rules	2016 as amended	Yes	Management of construction waste and materials as per the provisions of the storage and disposal of the Construction and Demolition (C&D) Waste Management Rules.
The Manufacture, Storage and Import of Hazardous Chemical Rules (as amended)	2000 as amended	Yes	For appropriate handling and storage of hazardous materials.
Wildlife (Protection) Act	1972 and amendments	No	No eco-sensitive areas in the project site. But however, the conservation of wildlife needs to be undertaken.
Forest (Conservation) Act	1980 and amendments	No	No forest land is involved in the project site.
Biological Diversity Act	2002	Yes	For Conservation Biological diversity.
Ancient Monuments and Archaeological Sites & Remains Act	1958 and amendments	No	No archaeological monument located within 10 km of the project site area boundary
Plastic Waste Management Rules	2016 as amended	Yes	In case of plastic waste generation during the project construction and operation phases
Merchant Shipping Act	1958 as amended	Yes	To prevent the waste arising out of the operation from ships and to Limit the effects.
LAAR Act	2013	Yes	In respect of land acquisition. The Puducherry Land Reforms (Fixation of Ceiling on Land) Act, 1973 and The Right to Fair Compensation and

Applicable GoI Policies & Regulations	Year	Applicability	Compliance/Application
			Transparency in Land Acquisition, Rehabilitation and Resettlement Rule, 2016 (LARR Rule, 2016) as applicable need to be followed.
MARPOL Convention (International Convention for the Prevention of Pollution from Ships)	1973 as amended	Yes	To prevent pollution of the marine environment by ships.

1.5 Project Location

The Cuddalore Port is located at the Uppanar Estuary, a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal at latitude $11^0$42'22.43'' N and longitude $79^0$46'30.52''E with Sea. The proposed expansion has a land area of 59.09 Ha (146.01 Acres) [which includes port backup area of 45.21 Ha (111.72 Ac) in the town survey number 1944 and shipbuilding area of 13.88 Ha (34.29 Ac)] in the survey numbers of 120 (Part/Subdivision 3), 121 (Part/Subdivision 1A, 1B, 1C, 1C1A, 1C1B, 1C2, 2, 3, 54/2671/1 & 2) and 131 belongs to Government land. The proposed expansion is envisaged to be developed within the notified limits of Cuddalore Port. Cuddalore port limits were declared by Highways & Minor Ports (HN2) Department, Govt. of Tamil Nadu through G.O. (Ms) No. 110 dated June 18, 2009 (**Appendix C**). Cuddalore port limits are shown in **Figure 1-1**.

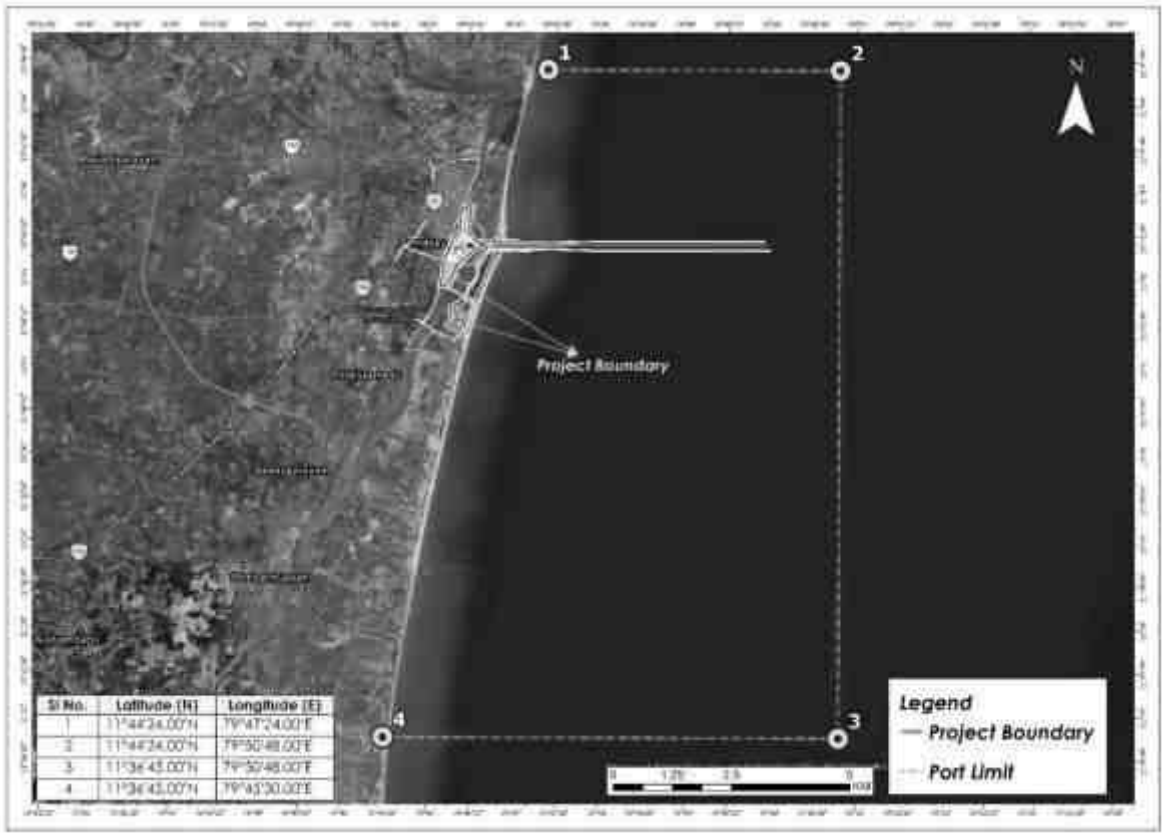


Figure 1-1: Cuddalore Port Limits

Cuddalore Port is located at ~180 kilometres south of Chennai and ~25 kilometres south of Puducherry. Geographically, it is uniquely positioned at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal. These rivers drain into a backwater estuary system, which then opens into the Bay of Bengal.

Figure 1-2: Project Location

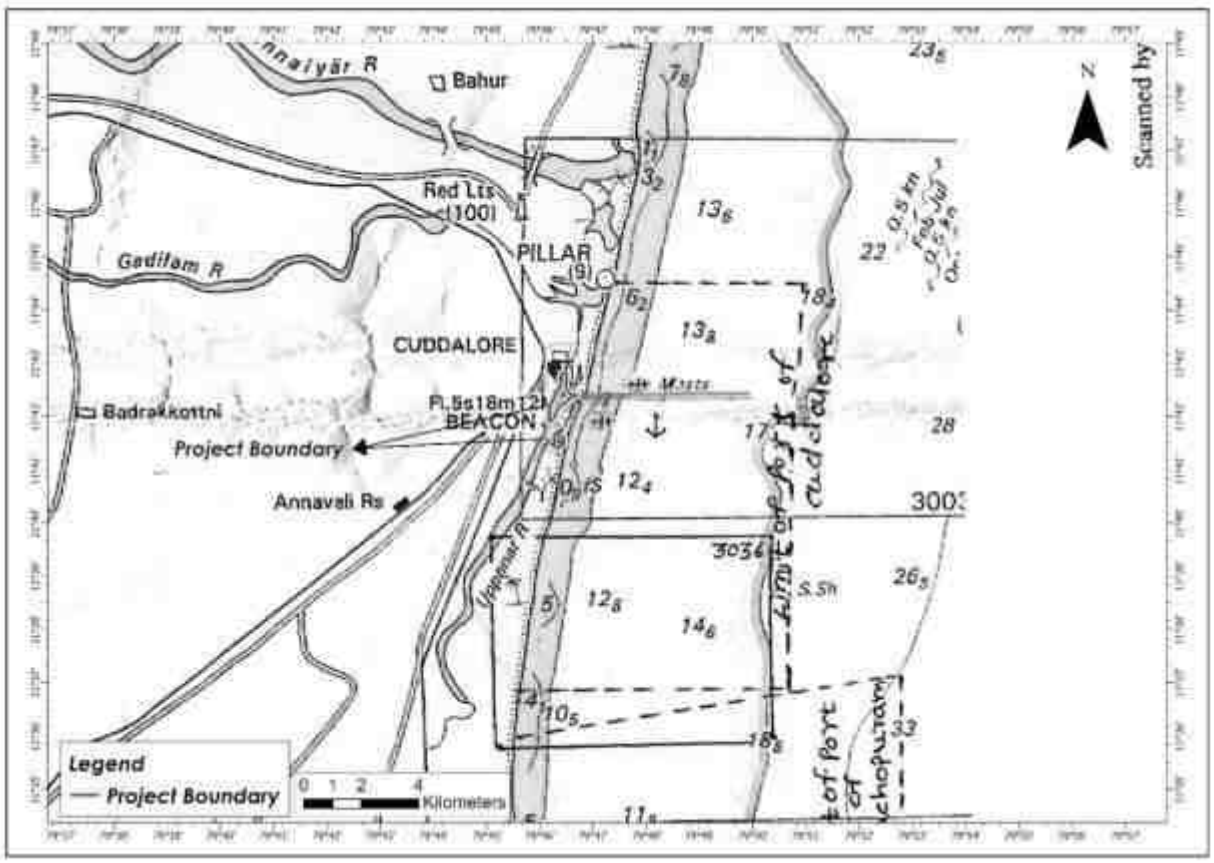


Figure 1-3: Port Boundary on NHO Chart

1.5.1 Salient Features of Project Site

S. No	Item	Details
1	Location	At the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal at latitude 11^{0}42'22.43'' N and longitude 79^{0}46'30.52''E
2	District	Cuddalore
3	State	Tamil Nadu
4	Topography	Relatively flat coastal terrain, with ground levels ranging from approximately 0.5 meters to 7.3 meters
5	Current land use	Scrubland with scattered bushes and trees, followed by Barren / Wasteland, Low Intensity Built-up Activity (port buildings and wharf) surrounded by Water Bodies
6	Nearest Road Connectivity	NH32 (old NH45A) at 0.61 km, West; NH532 at 1.10km, West; SH9 at 4.90km, West; SH68 at 4.10km West; SH138 at 3.20km West
7	Nearest Rail Connectivity/RS	Cuddalore port junction – 0.78km, West
8	Nearest Airport	Puducherry Airport – 28.47km, North
9	Seismicity	Project site falls under Seismic Zone II (low risk zone). During the design stage, the effects from natural disasters will be considered as per IS:1893.
10	National parks/wildlife sanctuaries	Nill

1.6 Need for Port Expansion

Non-major ports are witnessing faster growth than major ports, indicating a structural shift in cargo movement patterns. These ports are increasingly capturing a larger share of maritime traffic, with a significant portion of cargo traditionally handled by major ports now being routed through non-major ports. As of FY25 (up to October, 2024), non-major ports accounted for 46.97% of the total cargo traffic, underscoring their rising prominence in India's port logistics landscape.

Cuddalore has a major Chemical Industrial Complex and Puducherry union territory is located on North. There is a huge demand for seaport to ease out the transportation demand for bulk minerals and chemicals as huge industrial developments have taken place in and around the Cuddalore and also few in-pipeline with respect to Power, Chemical and Processing industries (fertilizer and also clean and container cargo).

The port is strategically located between Chennai and Tuticorin ports which gives it easy access to the industrially rich hinterland of Central Tamil Nadu. So many new prospective users and new cargoes in the hinterland of the Cuddalore port will be facilitated. The port poised to become the most preferred port in South India.

In view of the above, there is a need for expansion plan for the Cuddalore port and thereby enhancing the port facilities.

Based on the growth of business and cargo ramp up, the need of further expansion has arisen. To cater the above-mentioned needs of Cuddalore Port, MCPMPL proposes to develop by adding new berths and port infrastructure, ship building and repair facilities along with railway siding facilities. Hence, expansion for Cuddalore

port is proposing for the increase of cargo handling from consented capacity from 5.68 MTPA to 11.48 MTPA with an increase of 5.80 MTPA and in addition, ship building and repair activities were also proposed. The proposed project expansion is envisaged within the notified limits of Cuddalore Port.

1.6.1 Overview of Port Sector in India

India's seaport infrastructure plays a pivotal role in driving trade and economic growth, acting as the primary conduit for international commerce. With nearly 95% of the country's trade by volume and 68% by value moving through maritime routes, the sector holds significant strategic and commercial importance.

The Country is home to 12 major ports and ~200 non-major (minor and intermediate) ports. Major ports are predominantly managed by autonomous Port Trusts under the central government, except for Kamarajar Port in Tamil Nadu, which is operated as a government-owned company under the Companies Act, 1956. Non-major ports fall under the jurisdiction of state governments and are largely developed through public-private partnerships (PPPs), joint ventures, or other collaborative models, offering considerable opportunities for private sector participation and investment.

1.6.2 National Scenario

India's long-term economic trajectory provides a strong basis for adopting a 7% growth assumption for EXIM traffic in port projections. Over the decades, India's GDP has expanded consistently—from about USD 275 billion in 1991 to USD 3.4 trillion in the year 2022—reflecting an average annual growth rate of over 6.5%, among the fastest sustained growth paths for any large economy. This strong historical momentum is mirrored in India's improved global trade standing: the country has risen to 17th place among merchandise exporters, with its export basket diversified across more than 115 countries.

During the year 2023–24, Indian ports both major and non-major handled ~1,540 million Metric Tonnes (MMT) of cargo, marking a 7.5% increase over the 1,434 MMT recorded in 2022–23.

Ports	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25*
	MMT						
Major Ports	699	705	672	720	784	819	621
Non-Major Ports	583	613	575	598	650	721	551
Total	1282	1318	1247	1318	1434	1540	1172

Source: Ministry of Shipping - GOI, Indian Ports Association, *till October 2024

With the intention of propelling India to the forefront of the Global Maritime Sector, the Ministry of Ports, Shipping and Waterways has formulated the Maritime India Vision 2030 (MIV 2030), a blueprint to ensure coordinated and accelerated growth of India's maritime sector in the next decade.

Maritime Amrit Kaal Vision 2047 encompasses the aspirations in Logistics, Infrastructure, and Shipping supporting India's 'Blue Economy', builds on the Maritime India Vision 2030 and aims to develop world-class ports and promote inland water transport, coastal shipping, and a sustainable maritime sector. It aims to modernize

ports, enhance shipping capabilities, and develop shipbuilding, with an investment of ₹80 lakh crores for sustainable, technology-driven growth. Key goals include 10,000 MTPA port capacity, green initiatives, and improved logistics.

1.6.3 Tamil Nadu Port Scenario

Tamil Nadu has the second longest coastline (1,076 km) with 3 major ports and 15 notified minor ports.

Tamil Nadu has exhibited equally compelling growth momentum. Its real GSDP growth averaged around 8.1% between year 2021–22 and year 2023–24, with rebound from 7.9% → 8.1% → 8.2% at constant prices, while the overall average since the year 2012 has been about 6% It then surged to a stellar 9.69% in year 2024–25, the highest in the country.

Furthermore, latest estimates by the Tamil Nadu government show growth reaching 11.19% in 2025 placing the state firmly ahead of all peers and well above the national average. This momentum is underpinned by robust performance across services, manufacturing, and logistics sectors, which inherently drive port trade volumes.

1.6.4 Cuddalore Port

The interior districts of Tamil Nadu and Puducherry Union territory face significant logistical challenges due to their distance from the nearest major ports. In particular, the distance from these interior regions to the major ports of Chennai and Tuticorin typically exceeds 300 kilometres, leading to increased transportation time and cost for industries reliant on maritime trade. This logistical gap highlights the critical need for strengthening and developing non-major ports that are geographically closer to these industrial zones.

The port is surrounded by major production and consumption centres ranging from textile hubs and engineering clusters to cement, thermal power plants, Agro-processing, and leather industries. Further, the Cuddalore Port lies well within a 130 – 310 km radius of multiple cargo generating districts, which significantly reduces inland transportation time and cost when compared to alternative ports like Chennai or Tuticorin.

1.6.5 Traffic Forecast

Based on the available hinterland the cargo forecast for the Cuddalore port has been worked out and same has been summarized **in Table 1-2** and **Table 1-3**.

Table 1-2: Traffic Forecast for Proposed Expansion Plan

S. No	Berth type	Cargo Mix	Cargo Handling Capacity (MTPA)
1	Multipurpose berth-1	Container cargo	1.33
2	Multipurpose berth-2	Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate,	1.61

S. No	Berth type	Cargo Mix	Cargo Handling Capacity (MTPA)
		Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc.	
3	Bulk berth (two no)	Coal, Fertilizers, Cement, Clean cargo, Slag, Iron ore and Limestone	8.54
Total			**11.48**

Table 1-3: Traffic Forecast for Ship Building and Repair

S. No	Location	Activity	Units/year
1	Ships (upto 50,000 DWT)	Building	20
		Repair	20
Total			**40**

1.7 Proposed Development

The traffic forecast shows that there is requirement of the capacity enhancement of port for additional 5.80 MTPA cargo as a part of development plan. Cumulative Cargo Handling Capacity will be 11.48 MTPA which includes existing approved 5.68 MTPA of cargo handling capacity. Existing and proposed development plan is given in **Table 1-4**.

Table 1-4: Approved and Proposed Expansion Plan

S. No	Description	Unit	Approved	Proposed	Total	Remarks
1	**Multipurpose Berths**	No.	2	1	3	Increase in quay length and depth
	Quay length	m	240 (120x2)	200	440	
	Depth	m	-11	-16	-16	
	Width	m	21	-	21	
2	**Port craft berth/Wharf**	No.	1	-	1	No change
	Length	m	300	-	300	
	width	m	30	-	30	
3	**Bulk Berth**	No.	-	2	2	Increase in quay length
	Length	m	-	540 (270x2)	540	
	Width	m	-	21	21	
4	**Shipyard/repair jetty**	m	-	1	1	New proposal
	Length	m	-	200	200	
	Width	m	-	21	21	
5	Increase Depth at Protected area/Inner channel	mCD	-11	-16	-16	Increase in depth
6	Increase Depth at unprotected area/outer channel	mCD	-11	-18	-18	Increase in depth

S. No	Description	Unit	Approved	Proposed	Total	Remarks
7	Ship Building and Repair Yard	Acres	-	34.29	34.29	New proposed area
8	**Total Port area** including Backup & shipyards	Acres	111.72	34.29	146.01	Increase in depth
9	**Breakwater total**	m	1045	0	1045	No change
	Breakwater North	m	395	0	395	
	Breakwater South		650	0	650	
10	**Retaining walls** North	m	180	0	180	No change
	South	m	230	0	230	No change
11	**Turning Circle** Diameter	m	310.0	90	400	Increase in diameter and depth
	Depth	mCD	-10	-16	-16	
12	**Approach Channel** Length	m	1500	5000	5000	Increase in approach channel length and width at Protected Area Curved portion of channel Unprotected
	Width	m	60	-	-	
	Protected Area/Inner Channel	m	-	100	100	
	Curved portion of channel/Inner Channel	m	-	130	130	
	Unprotected area/outer channel	m	-	160	160	
13	Cargo handling capacity	MTPA	5.68	5.8	11.48	Increase in cargo handling capacity
14	Capital Dredging	M. Cum	1.87	5.0	5.0	Capital dredging of 1.87 M.Cum is already carried out, now during expansion 5 M.cum of dredging will be carried out.
15	Capital dredge disposal/Level Raising/ Reclamation	M. Cum	1.87	5.0	5.0	During current expansion, reclamation at port back up area/beach nourishment (utilising 2 MCM for level raising and remaining 3

S. No	Description	Unit	Approved	Proposed	Total	Remarks
						MCM for beach nourishment towards north side of north breakwater and south side of south breakwater)
16	Maintenance Dredge disposal	M. Cum	0.0187	0.237	0.237	Beach nourishment towards north side of north breakwater and south side of south breakwater
17	Cargo type	-	Coal, Cement, Fertilizers and Clean Cargo like containers	Coal, Cement, Fertilizers, container, Cereals, wood, clean cargo, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcock, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron ore, Slag and Limestone		Change in cargo mix
18	Water requirement	KLD	100	-	100	Desalination plant
19	Desalination plant	KLD	100	-	100	No change, 100 KLD will be sufficient.
20	Power	KVA	373	3965	4338	Increase in power requirement
21	Effluent Treatment Plant	KLD		25	25	New proposal
22	Sewage Treatment Plant	KLD	-	3.5	3.5	New proposal

1.8 Environmental Impact Assessment Study

The proposed expansion of port attracts the Environment Impact Assessment (EIA) Notification, 2006 (as amended) under 7(e) Ports, harbours, break waters and dredging of EIA notification, 2006 (as amended) under 'A' category. Environmental Impact Assessment Report has been prepared as per Appendix III of EIA Notification, 2006.

The EIA study has been carried out based on the approved ToR accorded vide TOR Identification No. TO26A3501TN5213902N and File No: **10-35/2017/-IA-III** dated 05.03.2026 (**Appendix B**).

1.8.1 Compliance to ToR

S. No	ToR Conditions	Compliance to Specific/Standard ToR
1. Specific Conditions		
1.1	PP shall furnish documentary proof clearly delineating the port limits and submit an official letter from the concerned Maritime Board explicitly confirming that the additional 13.88 hectares of land has been allotted to the PP for the proposed shipbuilding facility.	Cuddalore port limits were declared by Highways & Minor Ports (HN2) Department, Govt. of Tamil Nadu through G.O. (Ms) No. 110 dated June 18, 2009 (**Appendix C**). Cuddalore port limits are shown in **Figure 1-1**.
1.2	The Project Proponent shall not undertake storage of materials within the CRZ area unless the same is specifically permissible under the applicable provisions of the CRZ Notification, as amended. Therefore the PP shall identify and develop alternative storage locations outside the CRZ area in compliance with the applicable CRZ provisions.	Storage areas are within the port boundary only. Proposed cargo to be handled is Coal, Cement, Fertilizers, container, Cereals, wood, clean cargo, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron ore, slag and Limestone. Excluding the Class A Hazardous (Petroleum) products. Details are presented in **Section 2.5.1** of **Chapter 2** and **Section 7.2.1.2** of **Chapter 7**. Cargo storage area is within the Cuddalore port boundary and are permissible as per the CRZ Notification, 2011.
1.3	As Committed by the PP port shall not handle Class A Hazardous (Petroleum) products.	Shall be complied. Cargo to be handled are presented in **Section 2.5.1** of **Chapter 2** and **Section 7.2.1.2** of **Chapter 7**.
1.4	PP shall explore the possibility for a fully enclosed conveyor belt system from port to rail siding to ensure safe, efficient, and environmentally sound operations, while minimizing dust emissions and spillage.	Shall be complied. Conveyor belt system details are provided in **Section 2.8.22** of **Chapter 2**.

S. No	ToR Conditions	Compliance to Specific/Standard ToR
1.5	The detailed cargo evacuation plan, including transportation through the existing port access road and the proposed rail connectivity, shall be submitted as part of the EIA/EMP report.	Traffic and transportation study details are provided in **Section 7.6** of **Chapter 7**.
1.6	PP shall clearly specify the products proposed under the project. Details of the product types, quantities, and their end-use should be provided to enable proper assessment of the project scope. This information is essential for evaluating the associated environmental impacts, storage and handling requirements, and overall feasibility of the proposed activities.	Proposed cargo to be handled is Coal, Cement, Fertilizers, container, Cereals, wood, clean cargo, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron ore, slag and Limestone. Excluding the Class A Hazardous (Petroleum) products. Product type and cargo details. • Container cargo (1.33 MTPA); • Liquid cargo such as non-hazardous and and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc. (1.61 MTPA) • Coal, Fertilizers, Cement, Clean cargo, Iron ore, slag and Limestone (8.54 MTPA) • Ships (upto 50,000 DWT) Building (20 units/year) and Repair (20 units/year) Details are presented in **Section 2.5.1** of **Chapter 2**
1.7	Considering the proposed expansion of Cuddalore Port involving handling of liquid cargo including Class A, B and C chemicals, coal, fertilizers and other bulk materials, along with shipbuilding and repair activities, the PP shall incorporate in the EMP regular training and awareness programmes on chemical safety, port security and coastal water stewardship. These programmes shall address risks related to storage, transfer and transport of liquid and bulk cargo, spill prevention, emergency preparedness, supply-chain	Risk Assessments, Integrated mitigation planning and training for Multi-Hazard Preparedness was incorporated in EMP of the Cuddalore port, details are provided in **Section 10.6.5** of **Chapter 10**. Oil Spill Assessment details are provided in in **Section 7.4** of **Chapter 7**. For imparting training to workforce for containing risk assessment and appropriate mitigation related to cargo handling an amount of INR 0.2 million as

S. No	ToR Conditions	Compliance to Specific/Standard ToR
	vulnerabilities and protection of marine and coastal ecosystems. The programmes shall be implemented in association with reputed NGO-Darpan registered NGOs or recognised academic institutes of eminence, with adequate budgetary provision, to strengthen operational preparedness and minimise environmental and security risks.	a part of capital cost and INR 0.05 million as a part of recurring cost was allocated. Details are provided in **Section 10.11** Of **Chapter 10**.
1.8	The CRZ IA area within the project site is located between the proposed Ship Repair Unit and other development components, including the storage area. The Project Proponent shall undertake a detailed study with a nationally reputed institute to assess the potential environmental impacts arising from the proximity, particularly with respect to coastal ecology and CRZ provisions. Based on the findings of the study, appropriate mitigation measures shall be drawn and the same shall be incorporated in the EIA/EMP report.	Physical demarcation of HTL, LTL and delineation of CRZ boundaries for the project site were carried out by Council of Scientific and Industrial Research - National Institute of Oceanography (CSIR-NIO), Goa, R.C Visakhapatnam which is one of the MoEFCC authorized agencies. Proposed activities are falling CRZ-II, CRZ-III (NDZ), CRZ-III (200 to 500m from HTL), CRZ IV(A) & CRZ IV(B). CRZ IA area is not part of the development. Details of proposed facilities falling in CRZ areas Permissibility and Applicable Clauses as per CRZ Notification 2011, amended till date are provided in **Section 2.13** of **Chapter 2**. The CRZ IA area falling in project area is excluded from the project development plan and appropriate mitigation measures shall be considered during the planning stage itself.
1.9	To assess the impact of proposed expansion at the confluence of the Paravanar River and Uppanar Estuary with the Bay of Bengal the PP shall conduct the 2D/3D numerical modelling study covering tidal currents, wave dynamics, sediment transport, and shoreline evolution, including pre- and post-project scenarios, to assess impacts on morphology and coastal stability and as per the findings/ recommendations of the study necessary amendment in the project layout and mitigation plan shall be suggested.	Details are provided in **Section 2.7** of **Chapter 2**.
1.10	An assessment of cyclone, storm surge, extreme rainfall, and flood scenarios, including climate change considerations, and preparation of a Disaster Management Plan.	A preliminary disaster management plan was formulated for Cuddalore port including the Classification of Emergencies, Identification of Potential Risks/ Emergencies, Port facilities for handling emergency management, Emergency Management Team and their regular training, Emergency
1.11	The Project Proponent shall incorporate appropriate mitigation and environmental management measures	

S. No	ToR Conditions	Compliance to Specific/Standard ToR
	based on the findings of the above studies.	Response Flow Chart, Firefighting Equipment, Tentative Evacuation plan for Emergency and Assembly Points are detailed in **Section 7.3.7** of **Chapter 7**.
1.12	The Project Proponent shall submit a detailed list of all chemicals proposed to be handled as a cargo indicating their quantities, intended use, and designated storage locations.	Storage areas are within the port boundary only. Proposed cargo to be handled is Coal, Cement, Fertilizers, container, Cereals, wood, clean cargo, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron ore, slag and Limestone. Excluding the Class A Hazardous (Petroleum) products. Details are presented in **Section 2.5.1** of **Chapter 2** and **Section 7.2.1.2** of **Chapter 7**. Cargo storage area is within the Cuddalore port boundary and are permissible as per the CRZ Notification, 2011.
1.13	Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scales.	Physical demarcation of HTL, LTL and delineation of CRZ boundaries for the project site were carried out by Council of Scientific and Industrial Research - National Institute of Oceanography (CSIR-NIO), Goa, R.C Visakhapatnam which is one of the MoEFCC authorized agencies. Proposed activities are falling CRZ-II, CRZ-III (NDZ), CRZ-III (200 to 500m from HTL), CRZ IV(A) & CRZ IV(B). CRZ IA area is not part of the development. Details of proposed facilities falling in CRZ areas Permissibility and Applicable Clauses as per CRZ Notification 2011, amended till date are provided in **Section 2.13** of **Chapter 2**. The CRZ IA area falling in project area is excluded from the project development plan and appropriate mitigation measures shall be considered during the planning stage itself.
1.14	Recommendation of the Tamil Nadu SCZMA shall be obtained and submitted.	Shall be complied
1.15	Submit superimposing of latest CZMP as per CRZ (2011) on the CRZ map.	Project layout on the approved CZMP was given as **Figure 2-40** in **Chapter 2**.

S. No	ToR Conditions	Compliance to Specific/Standard ToR
1.16	Submit a complete set of documents required as per Para 4.2 (i) of CRZ Notification, 2011.	Shall be complied
1.17	Hydrodynamics study on impact of dredging on flow characteristics shall be carried out.	Details are provided in **Section 2.7** of **Chapter 2**.
1.18	Erosion and accretion studies shall be carried out and outcome of the studies shall be incorporated in the EIA/EMP report.	Complied Historical Shoreline Changes and shoreline evolution studies with proposed development are provided in in **Section 4.2.3** of **Chapter 4**.
1.19	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).	**Water:** Water required during construction phase will be met through the bowsers and existing water supply system. Water requirement during construction activity will be ~50 KLD. Water requirement during operation phase will be ~100 KLD. Water shall be sourced from approved 100 KLD Desalination plant which is yet to be developed. Water balance diagram is given as **Figure 2-37**. Water requirement details are provided in **Section 2.8.26.2** and Desalination plant details are provided in **Section 2.8.26** of **Chapter 2**. **Power:** The electric power requirement during construction phase will be ~1 MVA which will be sourced from the existing power source and during the operation phase, the power requirement will be around 4.338 MVA (4338 KVA) and will be sourced from the existing Substation. The power back up in the form of DG sets will be available to the tune of 1.5 MVA to 2.0 MVA. As a backup arrangement, 3000 KVA diesel generator sets are planned to ensure uninterrupted supply during outages and to cater to peak load conditions. Details are provided in **Section 2.8.26.4**of **Chapter 2**. **Employment Generation** During the construction phase, approximately 500 workers will be employed (Direct 10 and Indirect 490). During operation phase, approximately 205 workers will be employed (Direct 82 and Indirect 123). Details are provided in **Section 2.12** of **Chapter 2**.
1.20	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 balance water available. This should be specified separately for ground water and surface water sources, ensuring that there is no impact on other users.	
1.21	A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project.	
1.22	A certificate from the competent authority handling municipal solid wastes, indicating the existing civic capacities of	The anticipated municipal solid waste generation construction phase is ~0.13 TPD and during operation phase is ~0.06

S. No	ToR Conditions	Compliance to Specific/Standard ToR
	handling and their adequacy to cater to the M.S.W. generated from the project.	TPD of which 60% will be bio-degradable and 40% will be non-biodegradables. Used oil, spent oil, Wastes/Residue containing oil, Oil-soaked rags, Cotton waste, discarded containers, barrels & Used Battery and Sludge from ETP will be collected and disposed to approved vendors and same will be continued to proposed project. • Solid waste management including refuse collection in the dustbins and separated from the construction waste adhering under guidelines of Hazardous and Other Wastes Rules, 2016 as amended and its amendments, • The collected biodegradable waste shall be subjected to composting, and the compost will be used as manure for the development of green belt within the port. The non-biodegradable waste like plastic shall be disposed to approved vendors. • Construction and demolition waste shall be handled as per C&D waste management rules, 2016. • Solid waste generated should be properly collected and disposed of safely as per Solid Waste Management Rules, 2026 • STP sludge will be used as manure in green belt. • No waste shall be burned at site. • Used cans or any hazardous waste such as waste oil and used oil shall be sent to approved TNPCB recyclers Details are provided in **Section 2.8.26.6** of **Chapter 2** and **Section 4.8** of Chapter **4**.
1.23	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 0.5 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.	Traffic management plan was provided in **Section 7.6.8** of **Chapter 7**.
1.24	A tabular chart with index for point-wise compliance of above ToRs. The specific	Complied

S. No	ToR Conditions	Compliance to Specific/Standard ToR
	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.	
1.25	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 (earlier), shall include all the activities required to be taken to fulfil these commitments in the Environment Management Plan along with cost estimates of these activities, in addition to the activities proposed as per recommendations of EIA Studies and the same shall be submitted to the ministry as part of the EIA Report. The EMP shall be implemented at the project cost or any other funding source available with the project proponent.	Environmental Management Plan (EMP) for anticipated adverse impacts likely to accrue because of the proposed project. The approach for formulation of an Environmental Management Plan (EMP) is to maximize the positive environmental impacts and minimize the negative ones. The budgetary estimate for Capital Environmental Management Cost for Master Plan is ~INR 64.80 crores and the annual budgetary estimate during operational phase is ~INR 3.86 crore and the details are provided in **Section 10.11** of **Chapter 10**
1.26	In pursuance of Ministry's OM no. stated above the project proponent shall add one annexure in the EIA Report indicating all the commitments made by the PP to the public during public hearing and submit it to the Ministry and the EAC.	Public hearing details shall be included after PH completion in **Section 7.1** of **Chapter 7**.
1.27	The Action Plan on the compliance of the recommendations of the CAG as per Ministry's Circular No. J-11013/71/2016-IA.I (M), dated 25th October, 2017 needs to be submitted at the time of appraisal of the project and included in the EIA/EMP Report.	Shall be complied
Standard Terms of Reference for (Ports, harbors, breakwaters, dredging)		
1. Project details		
1.1	Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection.	Cuddalore Port is an existing port located at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal. Cuddalore port is proposing for the increase in cargo handling capacity from 5.68 MTPA to 11.48 MTPA and ship building and repair activities within the notified port limits. Development plan will consist of improvement in material handling area, cargo storage area, operational and utility area, internal connectivity, drainage, greenbelt and various utilities and amenities within the existing port which is already an integrated part of earlier approved EC and CRZ Clearance therefore the study of alternative sites is not envisaged
1.2	The examination should justify site suitability in terms of environmental angle, resources sustainability associated with selected site as compared to rejected sites.	
1.3	The analysis should include parameters considered along with weightage criteria for short-listing selected site.	

S. No	ToR Conditions	Compliance to Specific/Standard ToR
		Details are provided in **Chapter 5**.
1.4	Submit the status of shoreline change at the project site	Complied Historical Shoreline Changes and shoreline evolution studies with proposed development are provided in in **Section 4.2.3** of **Chapter 4**.
1.5	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.	Noted and shall be adhered
1.6	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Environmental Management Plan (EMP) for anticipated adverse impacts likely to accrue because of the proposed project. The approach for formulation of an Environmental Management Plan (EMP) is to maximize the positive environmental impacts and minimize the negative ones. The budgetary estimate for Capital Environmental Management Cost for Master Plan is ~INR 64.80 crores and the annual budgetary estimate during operational phase is ~INR 3.86 crore and the details are provided in **Section 10.11** of **Chapter 10**
1.7	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry.	Noted and shall be adhered
2. Land use, Land Acquisition and R&R		
2.1	Details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site.	Existing port is located in an area of 45.21 ha (111.72 Ac) which was in complete possession of Cuddalore Port and proposed development is within the existing port land only. The present land use of the project site is scrubland with scattered bushes and trees, followed by Barren/Wasteland, Low Intensity Built-up Activity (port buildings and wharf) surrounded by Water Bodies. At Cuddalore port two berths/wharfs were constructed (2 x 120 X 21 m each = 240 m) with Breakwaters, Approach Channel & Turning Circle, and capital dredging of 1.88 million Cubic meter were carried out to increase the depth to -11m CD and Turning Circle. The land use / land cover for the study area is presented in **Section 3.7.1** of **Chapter 3**.

S. No	ToR Conditions	Compliance to Specific/Standard ToR
2.2	Submit details regarding R&R involved in the project	Area required for the proposed development is calculated considering all the facilities essential for envisaged operations such as material handling area, cargo storage/backup area, operational and utility area, internal connectivity, drainage, greenbelt and buildings etc. and by focusing on possibility of limiting the extent of land area requirement. Accordingly, layout has been prepared. Hence, no rehabilitation and resettlement (R&R) is envisaged. Existing port is located in an area of 111.72 Ac along which is completely in possession of Cuddalore Port and proposed shipbuilding area of 34.29 Ac belongs to Government is an open scrub land without any settlements which will be acquired. Details are provided in **Section 2.2.1** of **Chapter 2**.
3. ESZ, CRZ, International Boundary and Acts		
3.1	Examine and submit detail of land use around 10 km radius of the project site and map of the project area and 10 km area from boundary of the proposed/existing project area, delineating project areas notified under the 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 land use / land cover for the study area is presented in **Section 3.7.1.2** of **Chapter 3**. Project site does not contain environmentally sensitive areas such as National parks / marine parks, sanctuaries, wildlife habitats, corals / coral reefs.
3.2	Erosion and accretion study at the mouth of the creek which is adjacent to the proposed site be carried out and submitted	Complied. Historical Shoreline Changes and shoreline evolution studies with proposed development are provided in in **Section 4.2.3** of **Chapter 4**.
3.3	Detailed modelling studies to understand whether the selected site can withstand severe cyclones and develop design in accordance to due safety measures.	Proposed project is a cyclone prone area. Previous cyclone details are provided in **Section 3.8.1** of **Chapter 3**. Mathematical modelling details are provided in **Section 2.7** of **Chapter 2**.
3.4	Submit superimposing of latest CZMP as per CRZ Notification (2011) on the CRZ map. And also submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scales.	Project layout on the approved CZMP was given as **Figure 2-40** in **Chapter 2**. Physical demarcation of HTL, LTL and delineation of CRZ boundaries for the project site were carried out by Council of Scientific and Industrial Research - National Institute of Oceanography (CSIR-NIO), Goa, R.C Visakhapatnam which is one of the MoEFCC authorized agencies.

S. No	ToR Conditions	Compliance to Specific/Standard ToR
		Proposed activities are falling CRZ-II, CRZ-III (NDZ), CRZ-III (200 to 500m from HTL), CRZ IV(A) & CRZ IV(B). Details of proposed facilities falling in CRZ areas Permissibility and Applicable Clauses as per CRZ Notification 2011, amended till date are provided in **Section 2.13** of **Chapter 2**. The CRZ IA area is excluded from the project development plan and appropriate mitigation measures shall be considered during the planning stage itself.
3.5	Submit a complete set of documents required as per para 4.2 (i) of CRZ Notification, 2011.	Noted and shall be adhered
3.6	Hydrodynamics study on impact of dredging on flow characteristics shall be carried out.	Mathematical modelling details are provided in **Section 2.7** of **Chapter 2**.
3.7	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 required mitigation plan be submitted.	Mangrove Biodiversity conservation & Management Plan and Sea Turtle Conservation & Management Plan was given in **Section 10.6.1** of **Chapter 10**.
3.8	A management plan for the area under which mangroves are or likely to be removed and compensatory mangrove plantation plan be submitted.	
4. Remote Sensing & GIS		
4.1	Analysis should be made based on latest satellite imagery for land use with raw images.	The land use / land cover for the study area is presented in **Section 3.7** of **Chapter 3**. Project site does not contain environmentally sensitive areas such as National parks / marine parks, sanctuaries, wildlife habitats, corals / coral reefs.
5. Forest and Wildlife		
5.1	Submit the present land use and permission required for any conversion such as forest, agriculture etc.	The present land use of the project site is scrubland with scattered bushes and trees, followed by Barren / Wasteland, Low Intensity Built-up Activity (port buildings and wharf) surrounded by Water Bodies. The land use / land cover for the study area is presented in **Section 3.7** of **Chapter 3**. No forest land is involved in the project site.
5.2	Land acquisition status, rehabilitation of communities/ villages and present status of acquiring Forest and Agricultural activities.	Area required for the proposed development is calculated considering all the facilities essential for envisaged operations such as material handling area, cargo storage/backup area,

S. No	ToR Conditions	Compliance to Specific/Standard ToR
		operational and utility area, internal connectivity, drainage, greenbelt and buildings etc. and by focusing on possibility of limiting the extent of land area requirement. Accordingly, layout has been prepared. Hence, no rehabilitation and resettlement (R&R) is envisaged. Existing port is located in an area of 111.72 Ac along which is completely in possession of Cuddalore Port and proposed shipbuilding area of 34.29 Ac belongs to Government is open scrub land without any settlements which will be acquired. Details are provided in **Section 2.2.1** of **Chapter 2**.
5.3	Submit details of the trees to be cut including their species and whether it also involves any protected or endangered species.	Project site does not contain environmentally sensitive areas such as National parks / marine parks, sanctuaries, wildlife habitats, corals / coral reefs/protected or endangered species. It is envisaged that all the trees in port area will be retained and integrated in greenbelt development plan. Eco-sensitive areas in and around the project site was given in **Section 3.5** in **Chapter 3**.
5.4	Measures taken to reduce the number of the trees to be removed should be explained in detail.	
5.5	Submit the details of compensatory plantation.	Greenbelt will be developed in an area of 6.15 Ha. Treated sewage will be used for irrigating greenbelt. Existing details of Greenbelt Development (Coverage, Species, budget, monitoring etc.) are given as part of Greenbelt Development Plan in **Section 2.9** of **Chapter 2** and **Section 10.5** of **Chapter 10**. Approximately 15375 numbers of trees are proposed to be planted in Cuddalore port. The survival of the plantation shall be monitored frequently and survival rate of the plantation during operational phase shall not be less than 80%. A capital cost of INR 1.8 million (0.18 Crores) shall be earmarked for this purpose and INR of 0.18 million (0.018 Crores) shall be allocated for recurring expenses per annum towards green belt development and maintenance. Recommended Species such as *Azadirachta indica, Acacia nilotica, Cassia fistula, Casuarina equisetifolia* etc. for Plantation are provided in **Section 10.5.5** of **Chapter 10**.
5.6	Explore the possibilities of relocating the existing trees.	
5.7	Examine the details of afforestation measures indicating land and financial outlay	
5.8	Landscape plan, 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.	
5.9	The identification of species/ plants should be made based on the botanical studies.	

S. No	ToR Conditions	Compliance to Specific/Standard ToR
6. Water Environment/Quality Analysis/ Hydrology and Water Bodies		
6.1	Examine the details of water requirement, impact on competitive user, treatment details, use of treated wastewater. Prepare a water balance chart.	Water required during construction phase will be met through the bowsers and existing water supply system. Water requirement during construction activity will be ~50 KLD. Water requirement during operation phase will be ~100 KLD. Water shall be sourced from approved 100 KLD Desalination plant which is yet to be developed. Water balance diagram is given as **Figure 2-37** . Water requirement details are provided in **Section 2.8.26.2** of **Chapter 2**. The wastewater generated from the port area during construction as well as operational phases will be collected through a wastewater collection network and sent to the Sewage Treatment Plant and Effluent Treatment Plant for treatment. ETP of 25 KLD is proposed for treatment and treated wastewater will be reused for dust suppression. STP of 3.5 KLD is proposed for treatment of sewage and treated wastewater will be used for irrigation of greenbelt areas. Treated Sewage and effluents shall be reused for dust suppression, irrigating greenbelt and other requirements.
6.2	Examine and submit the water bodies including the seasonal ones within the corridor of impact along with their status, volumetric capacity, quality likely impacts on them due to the project.	Cuddalore Port is an existing port located at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal. Nearby water bodies Paravanr River – adjacent Buckinghham canal - adjacent Pennai River ~6.65km, N Gadilam River ~ 2.7 km, N Bay of Bengal - Adjacent Eco-sensitive areas in and around the project site was given in **Section 3.5** in **Chapter 3**.
6.3	Submit the details of fishing activity and likely impacts on the fishing activity due to the project.	Common Marine Fish resources in the study are ais presented in **Section 3.15.5** and Fishermen activity profile was discussed in **Section 3.18.4** and **Section 3.18.5** in **Chapter 3**. Impact on Fisheries was discussed in **Section 4.4.1.9** in **Chapter 4** and mitigation measure during construction and operation phase was given in **Section 7.7.1.4** and **Section 7.7.2.1** in **Chapter 7**.

S. No	ToR Conditions	Compliance to Specific/Standard ToR
6.4	Specific study on effects of construction activity and pile driving on marine life	Potential Impacts due to construction such as Impacts due to Land Acquisition, change in Land Use Pattern, Movement of Construction materials, Construction Worker Camps, Impact on Existing Port Facilities were assessed and mitigation measures such as strengthening of existing roads, Transportation Management, use of Vehicles conforming to emission norms (air/noise) of CPCB. Construction area shall be earmarked, and activities shall be confined within that area. All the necessary safety precautions shall be implemented while doing the construction activities were proposed details are provided in **Section 4.2.1** and **Section 4.4** of **Chapter 4**.
7. Waste Management, Drainage and STPs		
7.1	Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area	Contour plan with slopes, drainage pattern of the site and surrounding area are detailed in **Section 3.6.4** of **Chapter 3**.
7.2	Examine details of Solid waste generation treatment and its disposal.	The anticipated municipal solid waste generation construction phase is ~0.13 TPD and during operation phase is ~0.06 TPD of which 60% will be bio-degradable and 40% will be non-biodegradables. Used oil, spent oil, Wastes/Residue containing oil, Oil-soaked rags, Cotton waste, discarded containers, barrels & Used Battery and Sludge from ETP will be collected and disposed to approved vendors and same will be continued to proposed project. • Solid waste management including refuse collection in the dustbins and separated from the construction waste adhering under guidelines of Hazardous and Other Wastes Rules, 2016 and its amendments, • The collected biodegradable waste shall be subjected to composting, and the compost will be used as manure for the development of green belt within the port. The non-biodegradable waste like plastic shall be disposed to approved vendors. • Construction and demolition waste shall be handled as per C&D waste management rules, 2016. • Solid waste generated should be properly collected and disposed of safely as per Solid Waste Management Rules, 2026

S. No	ToR Conditions	Compliance to Specific/Standard ToR
		• STP sludge will be used as manure in green belt. • No waste shall be burned at site. • Used cans or any hazardous waste such as waste oil and used oil shall be sent to approved TNPCB recyclers Details are provided in **Section 2.8.26.6** of **Chapter 2** and **Section 4.8** of Chapter **4**.
7.3	Details of oil spill contingency plan.	Oil Spill Assessment details and oil spill contingency plan implementation will be imparted to workforce including Regular exercises and drills are provided, details are given in **Section 7.4** of **Chapter 7**.
7.4	Details of the layout plan including details of channel, breakwaters, dredging, disposal and reclamation.	The proposed development will consist of material handling area, cargo storage/backup area, operational and utility area, internal connectivity, drainage, greenbelt and buildings etc. The proposed land use for development of Cuddalore port is given in **Table 2-10** and Project layout is shown in **Figure 2-35** and attached as **FD201** in **Section 2.8** of **Chapter 2**
8. Terrain and Topography		
8.1	Submit the details of terrain, level with respect to MSL, filling required, source of filling materials and transportation details etc.	The port site ground levels ranging from approximately 0.5 meters to 7.3 meters, referenced to established Temporary Benchmarks (TBMs) across the site. Most of the terrain lies within the 3.0-to-4.5-meter elevation band, with an average ground level of about 3.8 meters. There is no major filling requirement is envisaged as the major infrastructure facilities like North Breakwater, South Breakwater, Retaining Wall, two berths were already constructed. The dredged material of 2 MCM will be utilised for level raising/reclamation and remaining 3 MCM for beach nourishment towards north of north breakwater and south of south breakwater. Details are provided in **Section 2.8.1** and **Section 2.8.17** in **Chapter 2**.
8.2	Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scale along with the recommendation of the SCZMA.	Shall be complied Project layout on the approved CZMP was given as **Figure 2-40** in **Chapter 2**. Physical demarcation of HTL, LTL and delineation of CRZ boundaries for the project site were carried out by Council of Scientific and Industrial Research - National Institute of Oceanography (CSIR-NIO), Goa, R.C Visakhapatnam

S. No	ToR Conditions	Compliance to Specific/Standard ToR
		which is one of the MoEFCC authorized agencies. Proposed activities are falling CRZ-II, CRZ-III (NDZ), CRZ-III (200 to 500m from HTL), CRZ IV(A) & CRZ IV(B). Details of proposed facilities falling in CRZ areas Permissibility and Applicable Clauses as per CRZ Notification 2011, amended till date are provided in **Section 2.13** of **Chapter 2**. CRZ The CRZ IA area is excluded from the project development plan and appropriate mitigation measures shall be considered during the planning stage itself. SCZMA recommendation shall be obtained before applying for EC
8.3	Details of bathymetry study.	Water depths in the study area ranges from a minimum of 1.9 meters to a maximum of 19.6 meters below the Chart Datum (CD). In Harbour area Minimum water depth of 0.1m is recorded near the shore. Bathymetry details are provided in **Section 2.6.1** of **Chapter 2**.
8.4	Details of ship tranquillity study.	Details are provided **Section 2.7** of **Chapter 2**
8.5	The ecologically fragile area including CRZ 1A area etc. shall be demarcated and superimposed on the layout plan and submitted.	A small patch of mangroves were noticed out of the project area (~60m) at shipbuilding and repair facility in Paravanr river. Details are provided in **Section 3.16.6** of **Chapter 3**.
9. Road/Transport Connectivity and Traffic measures		
9.1	Examine road/rail connectivity to the project site and impact on the existing traffic network due to the proposed project/activities	Traffic and transportation plan details are provided in **Section 7.6** in **Chapter 7**.
9.2	A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.	
9.3	Details of handling of each cargo, storage, transport along with spillage control, dust preventive measures.	Proposed cargo to be handled are Container cargo (1.33 MTPA), Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc. (1.61 MTPA), Coal, Fertilizers, Cement, Clean cargo, Iron ore, slag and Limestone (8.54 MTPA) and Ships (upto 50,000 DWT) Building (20

S. No	ToR Conditions	Compliance to Specific/Standard ToR
		units/year) and Repair (20 units/year). Cargo Handling details are provided in **Section 2.8.22** in **Chapter 2**. Cargo storage details including Bulk Storage yard (11.07 Ac), Container Area (12.31 Ac), Multi Storage Yard (7.96 Ac) and Liquid Storage Area (8.28 Ac) are provided in **Section 2.8.18**, in **Chapter 2**. Designated training pertaining to oil spill contingency plan implementation will be imparted to workforce including Regular exercises and drills are provided, details are given in **Section 7.4** of **Chapter 7**. Dust suppression details including the Dust Suppression measures at loading/unloading points, wagon tippler complex, Track Hoppers, transfer points, stock yards, rapid loading system and at internal roads. Use of specialised ship loaders/unloaders, wagon tippler, track Hopper, covered conveyors and rapid loading system through silos Material unloading should be carefully planned to use hydraulic vehicles with lower height to ensure efficiency and safety. Use of tarpaulin covers and speed regulations for vehicles/wagons engaged in transportation. Pollution under control (PUC) certified vehicles only be permitted. Vehicle engine idling will be avoided. Greenbelt development etc. are provided in **Section 2.8.26.5** in **Chapter 2** and in **Section 10.3** in **Chapter 10**. Greenbelt Development Plan in **Section 2.9** of **Chapter 2** and **Section 10.5** of **Chapter 10**.
9.4	In case of coal, mineral cargo, details of storage and closed conveyance, dust suppression and prevention filters.	Coal will be stored in stockpile in open storage area of 11.04 Ac details are given in **Section 2.8.18.2** of **Chapter 2**. The mechanized coal handling system has been proposed for 21 Hr/Day operation to achieve the maximum unloading rate. Rail and Truck Loading Facilities Adjacent to the Stack Yards. Sufficient capacity unloaders at the berths. Sufficient capacity conveyor systems connecting the Berths to the stack Yards. Stackers and Reclaimers plus conveyor system inside the Stack Yards, Support Back up Infrastructure for operations and maintenance of the Port facilities (Buildings, services, utilities and

S. No	ToR Conditions	Compliance to Specific/Standard ToR
		amenities including Fire Fighting, Dust suppression system, safety and security systems and environment protection measures) etc. for Coal handling details are provided in **Section 2.8.26.5** in **Chapter 2**.
9.5	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. 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.	Traffic and transportation plan details are provided in **Section 7.6** in **Chapter 7**.
10. Rainwater Harvesting		
10.1	Details of rainwater harvesting and utilization of rainwater.	It is estimated that 40073.0 volume/year of run-off can be Harvested and Rainwater Harvesting details are provided in **Section 10.8** of **Chapter 10**
11. Baseline data		
11.1	Examine baseline environmental quality along with projected incremental load due to the proposed project/activities.	Details are provided in **Section 4.6.2** in **Chapter 4**
12. Air Environment		
12.1	The air quality monitoring should be carried out according to the notification issued on 16th November, 2009.	The ambient air quality status within the study area has been assessed through 8 monitoring locations as per the NAAQ monitoring notification, 2009. • PM_{10} ranged between 36.4 (AAQ-2) to 42.9µg/m^3 (AAQ-4). NAAQS stipulated standard for PM_{10} for 24 hr is 100µg/m^3. • $PM_{2.5}$ values varied from 18.5 (AAQ-1) to 28.5 µg/m^3 (AAQ-8) NAAQS stipulated standard for $PM_{2.5}$ for 24 hr is 60 µg/m3. • SO_2 values varied from 9.4 (AAQ-1) to 19.8 µg/m^3 (AAQ-8). NAAQS stipulated standard for SO_2 for 24 hr is 80 µg/m^3. • NO_2 ranged between 15.4 (AAQ-2) to 29.1 µg/m^3 (AAQ-8). NAAQS stipulated standard for NO_2 for 24 hr is 80 µg/m^3. Observed parameters are well within the prescribed standards. Details are provided in **Section 3.11** in **Chapter 3**.
13. Environment Management/ Monitoring, Mitigative Measures and Risk Assessment details		
13.1	Examine separately the details for construction and operation phases both for Environmental Management Plan and	Detailed Monitoring plan during construction phase was formulated including Marine Water Quality, Marine

S. No	ToR Conditions	Compliance to Specific/Standard ToR
	Environmental Monitoring Plan with cost and parameters.	Ecology, Marine Sediment quality, Ground water Quality, Surface water quality, Soil, Meteorology, Air Quality, Noise Levels, Stack Monitoring, Bathymetry (During Dredging), Turbidity Monitoring, Shoreline Change Assessment, Health Check-up Camps provided in **Section 6.2** of **Chapter 6** and Detailed Monitoring plan during Operation phase including Marine Water Quality, Marine Ecology, Marine Sediment quality, Ground water Quality, Surface water quality, Soil, Meteorology, Air Quality, Noise Levels, STP/ETP, Desalination Plant, Bathymetry (During Maintenance dredging), Shoreline Change Assessment, Health Check-up Camps etc. in **Section 6.3** of **Chapter 6**. Environment Management Plan details are presented **Chapter 10** and the budgetary estimate for Capital Environmental Management Cost for Master Plan is ~INR 64.80 crores and the annual budgetary estimate during operational phase is ~INR 3.86 crore and the details are provided in **Section 10.11** of **Chapter 10**
13.2	Submit details of a comprehensive Risk Assessment and Disaster Management Plan including emergency evacuation during natural and man-made disasters.	Details of risk assessment and disaster management plan was provided in **Section 7.2** of **Chapter 7**.
13.3	Details of desalination plant and the study for outfall and intake	Environmental Clearence was accorded previously to develop desalination Plant with a capacity of 100 KLD to meet the freshwater demand to the consumers within the port backup area and downstream users. Sea water intake of 222 KLD and reject brine of 122 KLD will be discharged through marine outfall identified through model studies. Desalination plant will be developed in the port backup area as per the accorded EC & CRZ clearance through vide File no. 10-35/2017-IA-III dated August 20, 2020.
14. Court/ Litigation records		
14.1	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	No pending court cases.
15. Environment Responsibility		
15.1	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	Noted and shall be adhered

S. No	ToR Conditions	Compliance to Specific/Standard ToR
	include all the activities required to be taken to fulfil these commitments in the Environment Management Plan along with cost estimates of these activities, in addition to the activities proposed as per recommendations of EIA Studies and the same shall be submitted to the ministry as part of the EIA Report. The EMP shall be implemented at the project cost or any other funding source available with the project proponent.	

1.8.2 Study Area

Area within 10 km radius from port boundary for primary data generation and 15 km radius as the general study area for secondary data generation is considered. The study area map is given as **Figure 1-4** and **FD102**.

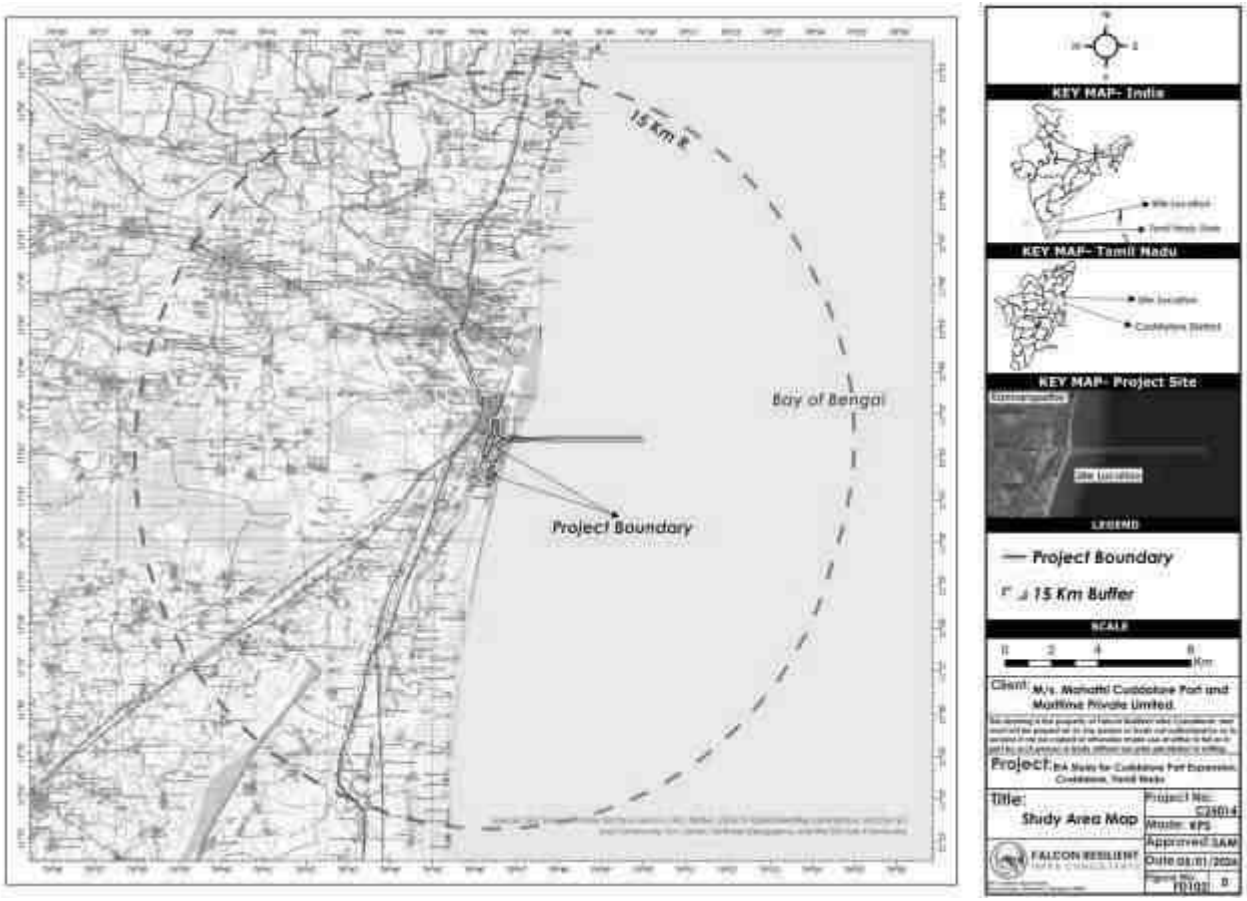


Figure 1-4: Study Area

1.8.3 Study Period

1.8.3.1 Terrestrial Environmental Surveys

The baseline terrestrial environmental surveys were carried out during the Pre-Monsoon season i.e., July to October 2025 by NABL accredited laboratory Enviro Care, Madurai, Tamil Nadu.

1.8.3.2 Marine Environmental Surveys

Marine environmental surveys covering marine water quality, sediment quality and marine biology (plankton, benthos) was carried out once during the study period in September, 2025 by Centre for Advanced Studies in Marine Biology (CASMB), Annamalai University.

1.8.4 Coastal Regulation Zone (CRZ) Demarcation

The physical demarcation of HTL, LTL and CRZ was carried out by National Institute of Oceanography (NIO), Goa which is an authorised agency by MoEFCC. Based on the survey, the CRZ set back lines were demarcated and port layout was superimposed to assess the CRZ permissibility as per CRZ notification, 2011 (as amended).

1.9 Structure of EIA Report

The outline of the report is as follows:

Chapter 1: Introduction- This chapter gives the brief description of project nature, size, location of the project and its importance, study objective, scope and details of applicable regulations etc.

Chapter 2: Project Description - This chapter gives the description of project development plan, layout, Infrastructure facilities, road network, utility and amenities, Greenbelt area, Wastewater treatment and reuse, soil waste management, project cost and implementation schedule.

Chapter 3: Description of Environment- This chapter describes the study area, methodology adopted, establishment of baseline study for valued environmental components as identified in the scope. The information presented in this chapter is based on primary as well as secondary data collection.

Chapter 4: Anticipated Environmental Impacts and Mitigation Measures- Impact identification and prediction are essential part of EIA study that might expected to occur as a result of the construction and operation of the proposed project. Hence, anticipated positive and negative impacts likely to occur during construction and operation phases of the project were presented in this chapter. Corresponding mitigation measures have been described in relevant sections.

Chapter 5: Analysis of Alternatives- This chapter covers the details of various alternatives in respect of both location of site and layout to be developed to ensure sustainable development under given conditions.

Chapter 6: Environmental Monitoring Programme- Environmental Monitoring Programme for implementation during construction and operation phases of the project is discussed in this chapter.

Chapter 7: Additional Studies- Risk assessment in terms of hazard identification during construction and operational phases, quantitative risk analysis is discussed and Disaster management plan (DMP) with roles and responsibilities for action

during any unforeseen event, social impact assessment and Traffic assessment including management is discussed in this chapter.

Chapter 8: Project Benefits- This chapter provides proposed improvements in the physical infrastructure, improvements in the social infrastructure, Employment potential, other tangible benefits.

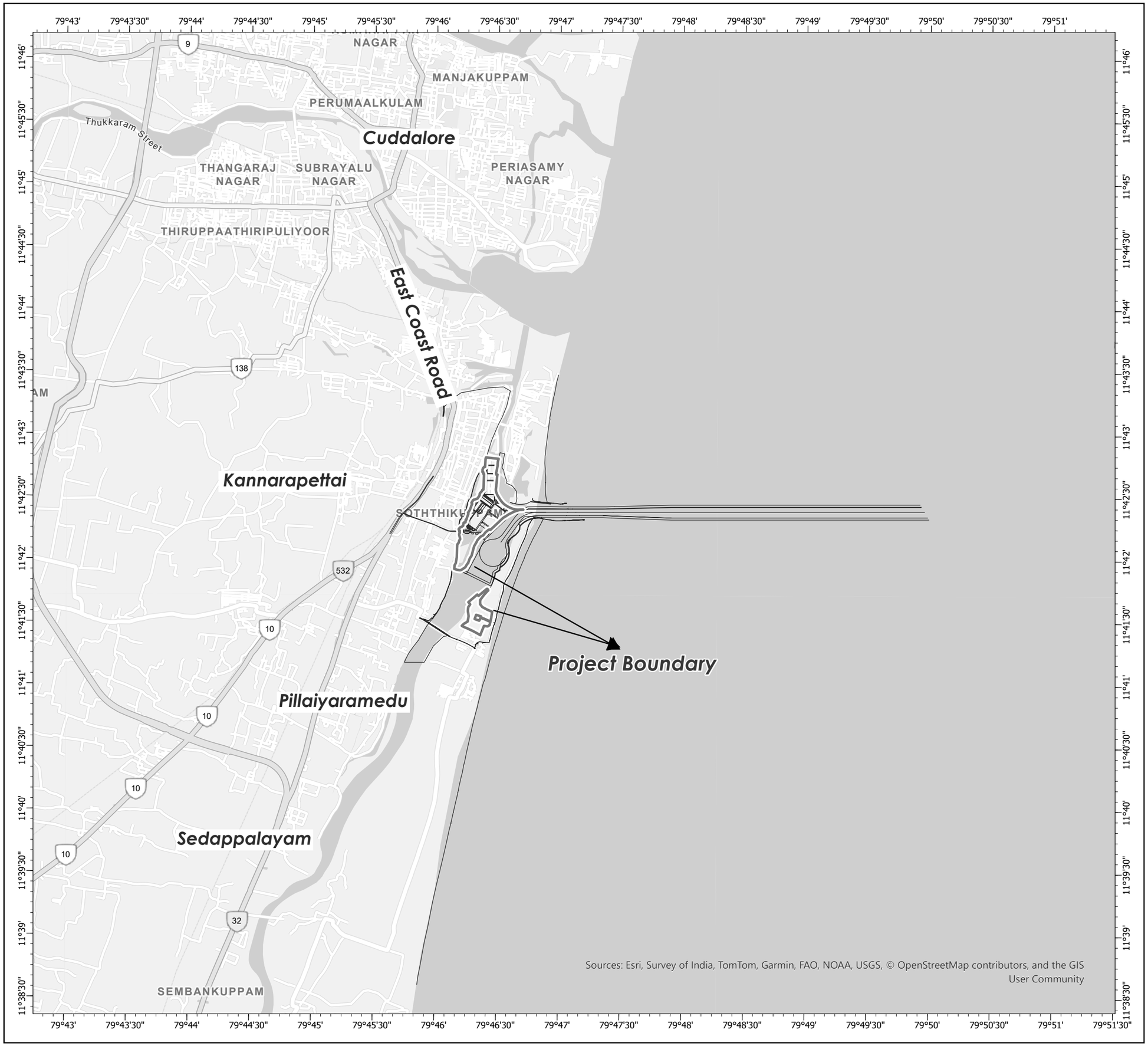
Chapter 9: Environmental Cost Benefit Analysis- This chapter need to be attempted in case of prescription during ToR approval, this is not prescribed during ToR approval.

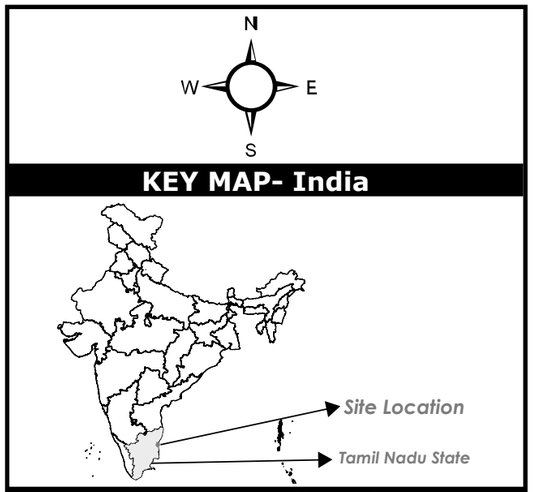
Chapter 10: Environment Management Plan (EMP)- Environmental Management Plan (EMP) for anticipated adverse impacts likely to accrue because of the proposed project. The approach for formulation of an Environmental Management Plan (EMP) is to maximize the positive environmental impacts and minimize the negative ones. After selection of suitable environmental mitigation measures, cost required for implementation of various management measures is also estimated.

Chapter 11: Summary and Conclusion- This chapter includes overall summary of the project and its impact on environment and mitigation measures covered in EIA study.

Chapter 12: Disclosure of Consultants Engaged- Consultants engaged for the project and their experience and nature of consultancy is explained in this chapter.

Figures





LEGEND

— Project Boundary

SCALE

0 0.75 1.5 3 Km

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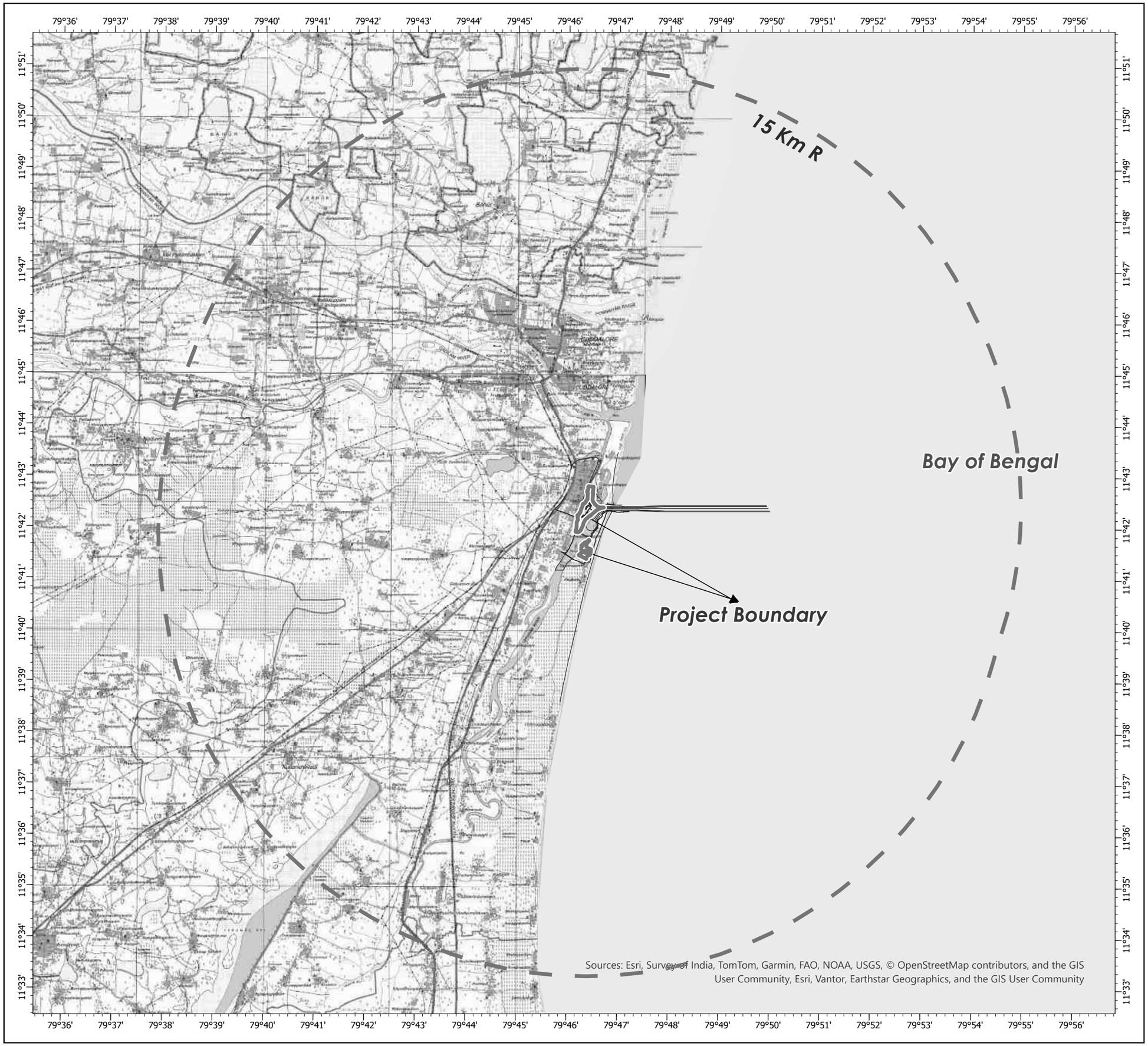
Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: Location Map

Project No:	C25014
Made:	KPS
Approved:	SAM
Date:	05/01/2026
Figure No:	FD101 0

FALCON RESILIENT INFRA CONSULTANTS
801 A, Sudheer Tapars Towers,
Himayat Nagar, Hyderabad, Telangana, 500029



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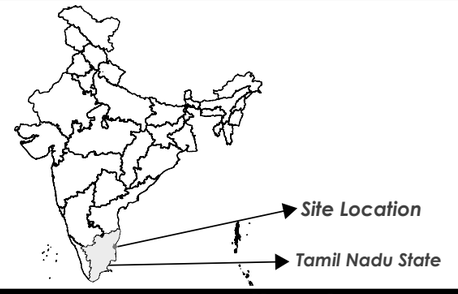
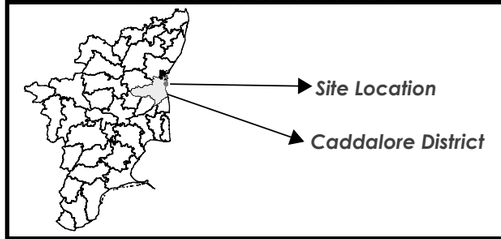
KEY MAP- India



KEY MAP- Tamil Nadu



KEY MAP- Project Site

LEGEND

Project Boundary

15 Km Buffer

SCALE

0 2 4 8 Km

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: Study Area Map

Project No: C25014

Made: KPS

Approved: SAM

Date: 05/01/2026

Figure No: FD102 0

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Chapter 2
Project Description

2 Project Description

2.1 General

This chapter describes the salient features of existing port facilities, proposed development, infrastructure facilities, utilities & amenities and wastewater management and solid waste collection. This chapter also covers project land, estimated cost of project and project implementation schedule.

2.2 Cuddalore Port Location

The Cuddalore Port is located at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal at latitude $11^0$42'22.43'' N and longitude $79^0$46'30.52''E with Sea and has a Land area of 59.09 Ha (146.01 Ac) [which includes port backup area of 45.21 Ha (111.72 Ac) and shipbuilding and repair area of 13.88 Ha (34.29 Ac)].

2.2.1 Land Ownership

Area required for the proposed development considers all the facilities essential for envisaged operations such as material handling area, cargo storage/backup area, operational and utility area, internal connectivity, drainage, greenbelt and buildings etc. and by focusing on possibility of limiting the extent of land area requirement.

Existing port is located in an area of 45.21 ha (111.72 Ac) which was in complete possession of Cuddalore Port and proposed development is within the existing port land only. Shipbuilding and repair activity was proposed in an area of 13.88 ha (34.29 Ac) belongs to Government and same shall be acquired.

2.3 Existing Connectivity to Site

Cuddalore Port region is well-connected by road, rail, and air from various parts of the country.

2.3.1 Road Connectivity

Cuddalore Port is well connected through an established network of National Highways (NH) and State Highways (SH), which provide vital linkages to the port from various parts of the state and neighbouring regions. The road infrastructure enhances the accessibility of the port to major industrial clusters and hinterland areas.

National and State Highways providing access to Cuddalore Port are presented below

National Highway

- NH-32 (old name NH45A) (Chennai – Puducherry – Cuddalore – Chidambaram – Karaikal – Nagapattinam – Thoothukudi) at a distance of 0.61km from Cuddalore port

- NH-532 (Cuddalore – Vadalur – Vridhachalam – Chinnasalem) at a distance of 1.10km from Cuddalore port

State Highway

- SH-9 (Cuddalore – Nellikuppam – Panruti – Tirukkoyilur – Tiruvannamalai – Chittoor) at a distance of 4.90km from Cuddalore port
- SH-68 (Cuddalore – Palur – Panruti – Arasur – Thirukovilur – Sankarapuram) at a distance of 4.90km from Cuddalore port

2.3.2 Rail Connectivity

A meter-gauge railway line previously connected from Cuddalore Old Port to the Cuddalore Port Junction railway station, serving as a vital link for cargo movement between the port and the broader Indian Railways network in the past.

The nearest rail connectivity is Cuddalore Port Junction station connecting Chennai central Railway station. Road and rail connectivity to the power plant and port is shown in **Figure 2-1**.

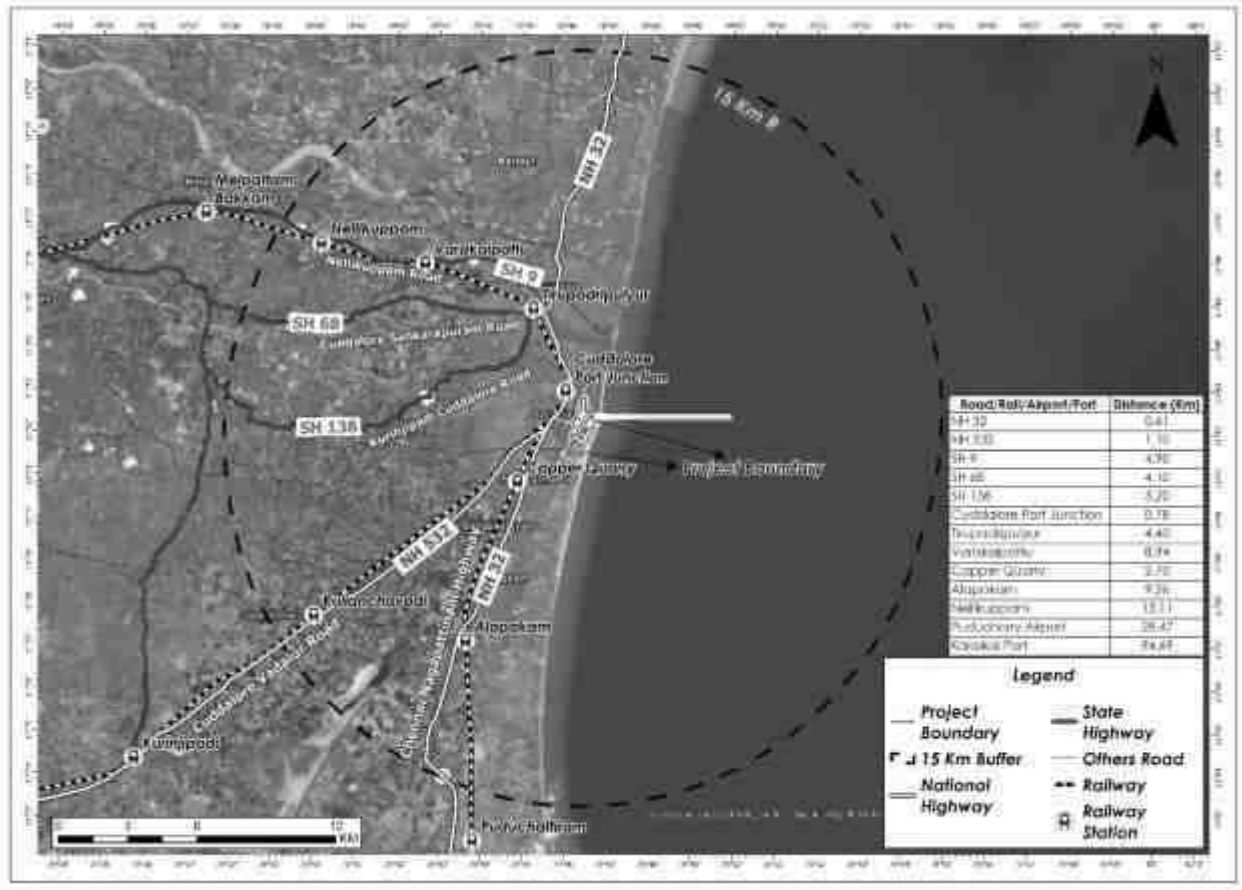


Figure 2-1: Cuddalore Port Connectivity

2.3.3 Air Connectivity

Chennai International Airport is the nearest international airport located at 180 km from the Cuddalore port. Puducherry Airport is a domestic airport located near the Cuddalore Port.

2.4 Existing Port Facilities

The features of existing port are as follows:

Breakwater

- North Breakwater: 395m
- South Breakwater: 650m

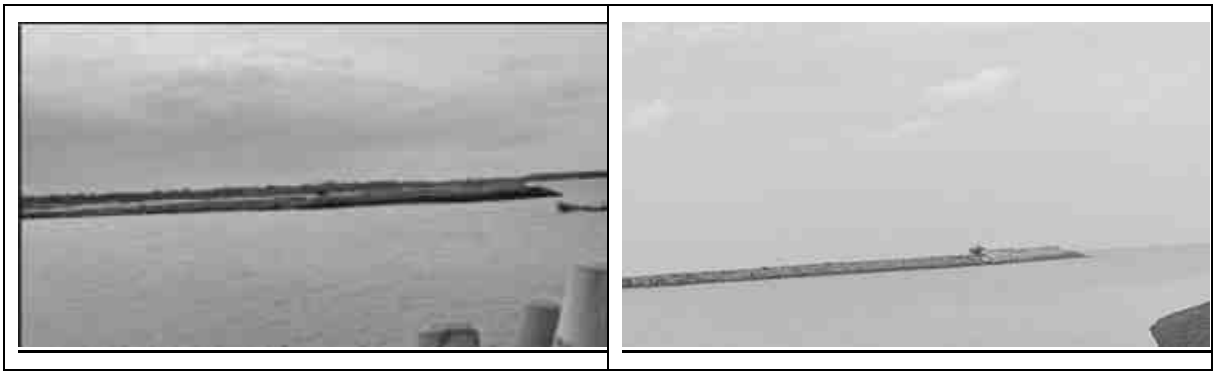


Exhibit 2-1: Northern Breakwater

Exhibit 2-2: Southern Breakwater

Exhibit 2-3: Retaining Wall

Approach Channel:

- Length: 1500m
- Width: 60 m
- Depth: (-) 11m CD
- Turning circle Diameter: 300 m
- Depth at Turning circle: (-) 11m CD
- Depth at Berth pockets: (-) 11 m CD

Berths/Wharfs:

A total of two berths/wharfs have been built for cargo handling at Cuddalore Port.

Table 2-1: Details of Existing Berths

S. No	Name of the Berth	Length (m)	Width (m)	Draft (m CD)
1	Multipurpose berth-1 & 2	240 (120x2)	21	-11

Exhibit 2-4: Existing Berths/Wharfs

Existing storage facility & other infrastructure facilities:

- Internal roads and Road connectivity to NH32
- Dedicated water supply and power distribution systems, both of which play a vital role in the day-today functioning of the port
- A 75,000-litre capacity underground sump
- An overhead tank with a capacity of 10,000 litres was constructed
- An 11 kV transformer at near the junction of the New Jetty Approach Road

Exhibit 2-5: Port Backup Area

Exhibit 2-6: Proposed Shipbuilding/Repair Area

2.5 Project Development Plan

Cuddalore Port with its berths/Wharfs and proposed infrastructure facilities will act as gateway port to the existing as well as Greenfield projects planned in the hinterland. The port provides a vital sea link for the rich hinterland thus holding the

key for accelerated growth of the entire region. The nearest major habitation is Periyar Nagar in Cuddalore OT (Old Town) which is located at 0.13 km from the port site. Cuddalore port is connected to NH32 by a metallic road.

Cuddalore port has two constructed berths/Wharfs presently with an approved handling capacity of **5.68 MTPA** of varied cargo comprising bulk cargo like Coal, Cement, Fertilizers and Agro Products; and also, Clean Cargo like Containers etc. The total length of the two berths is 240m with adequate backup storage and material handling facilities.

Approved and Proposed Expansion Plan The traffic forecast shows that there is requirement of the capacity enhancement of port for additional 5.80 MTPA cargo as a part of development plan. Cumulative Cargo Handling Capacity will be 11.48 MTPA which includes existing approved 5.68 MTPA of cargo handling capacity. Existing and proposed development plan is given in **Table 1-4**.

Table 2-2: Approved and Proposed Expansion Plan

S. No	Description	Unit	Approved	Proposed	Total	Remarks
1	Multipurpose Berths	No.	2	1	3	Increase in quay length and depth
	Quay length	m	240 (120x2)	200	440	
	Depth	mCD	-11	-16	-16	
	Width	m	21	21	21	
2	Port craft berth/Wharf	No.	1	-	1	No change
	Length	m	300	-	300	
	width	m	30	-	30	
3	Bulk Berth	No.	-	2	2	Increase in quay length
	Length	m	-	540 (270x2)	540	
	Width	m	-	21	21	
4	Shipyard/repair jetty	m	-	1	1	New proposal
	Length	m	-	200	200	
	Width	m	-	21	21	
5	Depth in protected area/inner channel	mCD	-11	-16	-16	Increase in depth
6	Depth in unprotected area/outer channel	mCD	-11	-18	-18	Increase in depth
7	Ship Building and Repair Yard	Acres	-	34.29	34.29	Newly proposed area
8	Total Port area including Backup & shipyards	Acres	111.72	34.29	146.01	Increase in depth
9	Breakwater total	m	1045	0	1045	No change
	Breakwater North	m	395	0	395	

S. No	Description	Unit	Approved	Proposed	Total	Remarks
	Breakwater South		650	0	650	
10	Retaining walls North	m	180	0	180	No change
	South	m	230	0	230	No change
11	Turning Circle Diameter	m	310.0	90	400	Increase in diameter and depth
	Depth	mCD	-10	-16	-16	
12	Approach Channel Length	m	1500	5000	5000	Increase in approach channel length and width at Protected Area Curved portion of channel Unprotected
	Width	m	60	-	-	
	Protected Area/Inner Channel	m	-	100	100	
	Curved portion of channel/Inner Channel	m	-	130	130	
	Unprotected area/outer channel	m	-	160	160	
13	Cargo handling capacity	MTPA	5.68	5.8	11.48	Increase in cargo handling capacity
14	Capital Dredging	M. Cum	1.87	5.0	5.0	Capital dredging of 1.87 M.Cum is already carried out, now during expansion 5 M.cum of dredging will be carried out.
15	Levelling/Reclamation/Disposal	M. Cum	1.87	5.0	5.0	During current expansion, the capital dredged material of 2 MCM will be utilised for level raising/reclamation and remaining 3 MCM for beach nourishment towards north of north breakwater and south of south breakwater

S. No	Description	Unit	Approved	Proposed	Total	Remarks
16	Maintenance Dredge disposal	M. Cum	0.0187	0.237	0.237	Beach nourishment towards north side of north breakwater and south side of south breakwater
17	Cargo type	-	Coal, Cement, Fertilizers and Clean Cargo like containers	Coal, Cement, Fertilizers, container, Cereals, wood, clean cargo, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron ore, slag and Limestone		Change in cargo mix
18	Water requirement	KLD	100	-	100	Desalination plant
19	Desalination plant	KLD	100	-	100	No change, 100 KLD is not being consumed yet.
20	Power	KVA	373	3965	4338	Increase in power requirement
21	Effluent Treatment Plant	KLD		25	25	New proposal
22	Sewage Treatment Plant	KLD	-	3.5	3.5	New proposal

2.5.1 Cargo Handling Capacity

Based on the available hinterland the cargo forecast for the Cuddalore port has been worked out and same has been summarized **in Table 1-2**.

Table 2-3: Traffic Forecast for Proposed Expansion Plan

S. No	Berth type	Cargo Mix	Cargo Handling Capacity (MTPA)
1	Multipurpose berth-1	Container cargo	1.33
2	Multipurpose berth-2	Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc.	1.61
3	Bulk berth (two no)	Coal, Fertilizers, Cement, Clean cargo, Iron ore, slag and Limestone	8.54
Total			**11.48**

Table 2-4: Traffic Forecast for Ship Building and Repair

S. No	Location	Activity	Units/year
1	Ships (upto 50,000 DWT)	Building	20
		Repair	20
Total			**40**

2.6 Field Surveys and Investigations

Hydrographical survey of the port area using a Single Beam Echo Sounder, Seismic Survey, and Side Scan Sonar Survey.

2.6.1 Bathymetry

The coastline is inclined at an angle 65^0 with regarding to north. Most of the waves approach the coast from southeast direction. The coast has a bay like formation. The beach slope in this stretch up to 10m depth is nearly 1:200. The surveyed corridor's bathymetric profile generally represents a gentle slope from West to East in the survey corridor. Water depths in the corridor ranges from a minimum of 1.9 meters to a maximum of 19.6 meters below the Chart Datum (CD). In Harbour area Minimum water depth of 0.1m is recorded near the shore. Shipwreck was recorded in the approach area & minimum water depth was recorded is 6.2m over the wreck. Bathymetry survey was carried out for the entire port limits and given as **Appendix D**. Bathymetry map of Port Area is given as **Figure 2-2**.

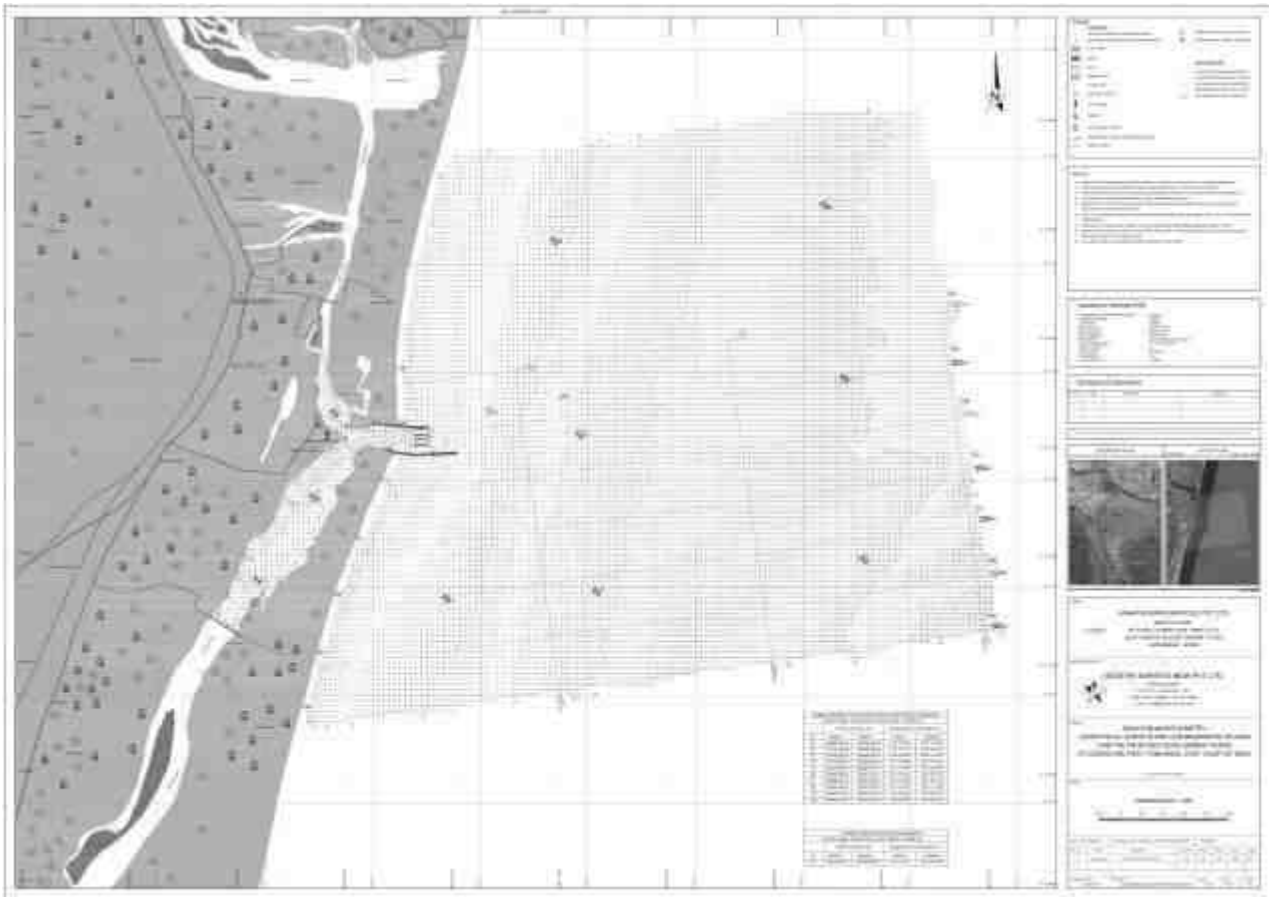


Figure 2-2: Bathymetry Map of Port Area

2.6.2 Seabed Features

SIDESCAN SONAR SYSTEM

The EdgeTech 4200 MP Series High-Definition Dual-frequency Side Scan Sonar System is a frequencymodulated (FM), dual-frequency side scan sonar that uses Edge Tech's proprietary Full Spectrum "chirp" and multi-Pulse technologies to generate high-resolution side scan imagery at longer ranges than conventional continuous wave (CW) systems.

SUB BOTTOM PROFILER

To delineate surficial layers clearly and for recording high resolution data, surveys were carried out by deploying Geoacoustics Sub-bottom profiler. The transducer was mounted on a pole which was fixed on the out-board of the survey vessel. The energy, adjustable between 1 and 10 KW at a frequency output of between 3.5 to 14 K Hz, was released from transducer and the returning seismic energy was received by receiver system and passed through internal amplifiers and filters system built inside the receiver. The power output `Time Variable Gain' Amplifier and Filter settings were field selected to give optimum resolution and necessary seabed penetration for the prevailing geological conditions. The system was operated following recommended manufacturers procedures. Event marks, corresponding to position fixes at regular intervals, were generated automatically by the navigation computer and were passed to the digital data recording system Sonarwiz. The

output data was stored in the root directory of Sonarwiz and the same was copied on multiple disks.

In general, Side scan sonar reveals a seabed of varying reflectivity to 100 KHz frequency in Harbour area and approaches area within the survey corridor, which can be broadly categorized as follows:

Type 1: Low Reflective Sediments (Fine to medium silty sand) - These were low to medium reflective sediments were observed predominantly throughout the survey corridor. These areas are interpreted as fine to medium silty sand.

Type 2: Medium to High reflective compact sediments (Stiff Clayey Sand) - These were observed with moderate to high mottled reflectivity at north west, north east, southwest and central part of the approaches area within the survey corridor.

Type 3: Scattered gravel bed - These were observed predominantly across various sections of the approaches area, including North and West part of the approaches area within the survey corridor.

2.6.2.1 Drag Marks

Linear Drag Marks: Occasional linear drag marks were recorded in both harbour and approaches area. In Harbour area, the drag marks were recorded near South Jetty (Cuddalore New port) and in approaches area, the drag marks were recorded at southern part. i.e., within the survey corridor. These can be attributed to anchor drag marks due to fishing activity.

2.6.2.2 Sand Ripples

The sand ripples (wave like seabed feature) in the Northwest and Northeast part of the approach area on seabed recorded in the side scan sonar data, formed by the action of ocean currents or wave-induced water movement, indicating sediment transport in the survey area.

2.6.2.3 Sonar Contacts

Sonar contacts on seabed are typically referring to sonar detections or echoes that indicate the presence of objects or anomalies on the seafloor. These contacts can be anything from natural formations to man-made objects or obstructions. Three (3nos.) of sonar contacts were recorded in the approaches area within the survey corridor.

2.6.2.4 Linear Contacts

A linear contact in Side Scan Sonar data recorded on harbour area and approaches area is defined as a narrow, elongated sonar return that appears as a continuous or segmented lines, indicating the presence of a distinct linear object or feature on or just above the sediment surface. Seven (7Nos) of linear contacts were recorded in both the harbour and approaches area.

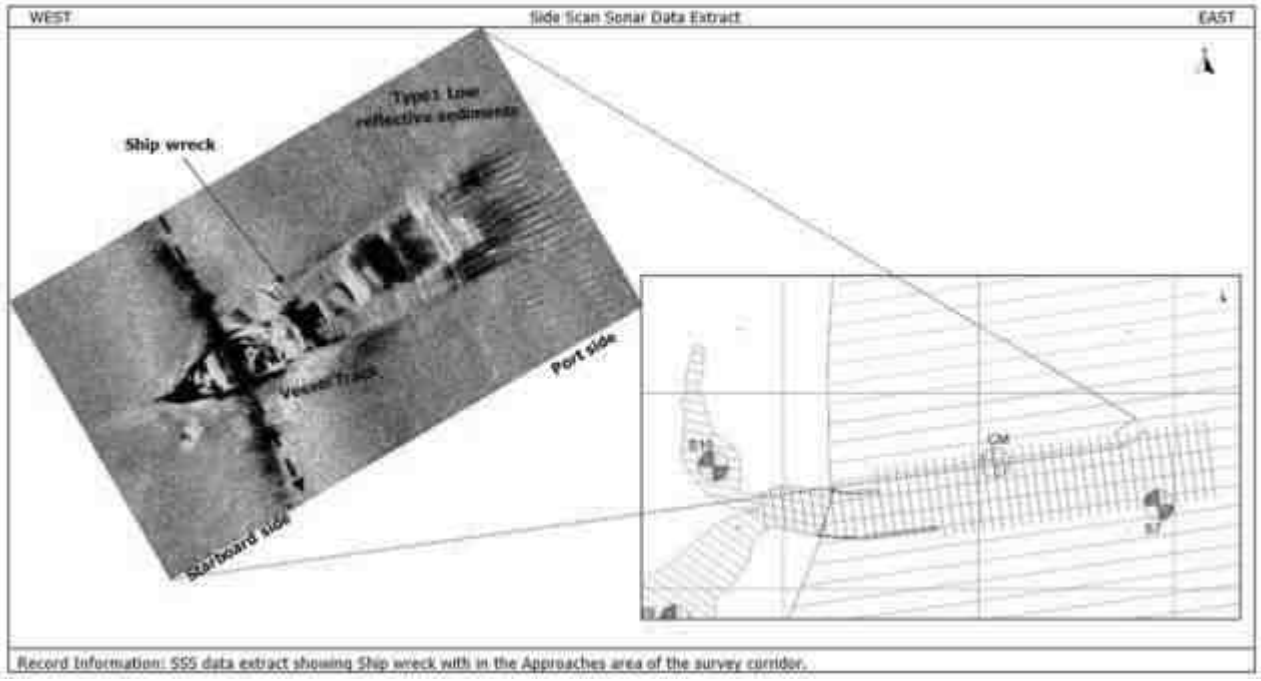


Figure 2-3: Side Scan Sonar Extract Showing Shipwreck

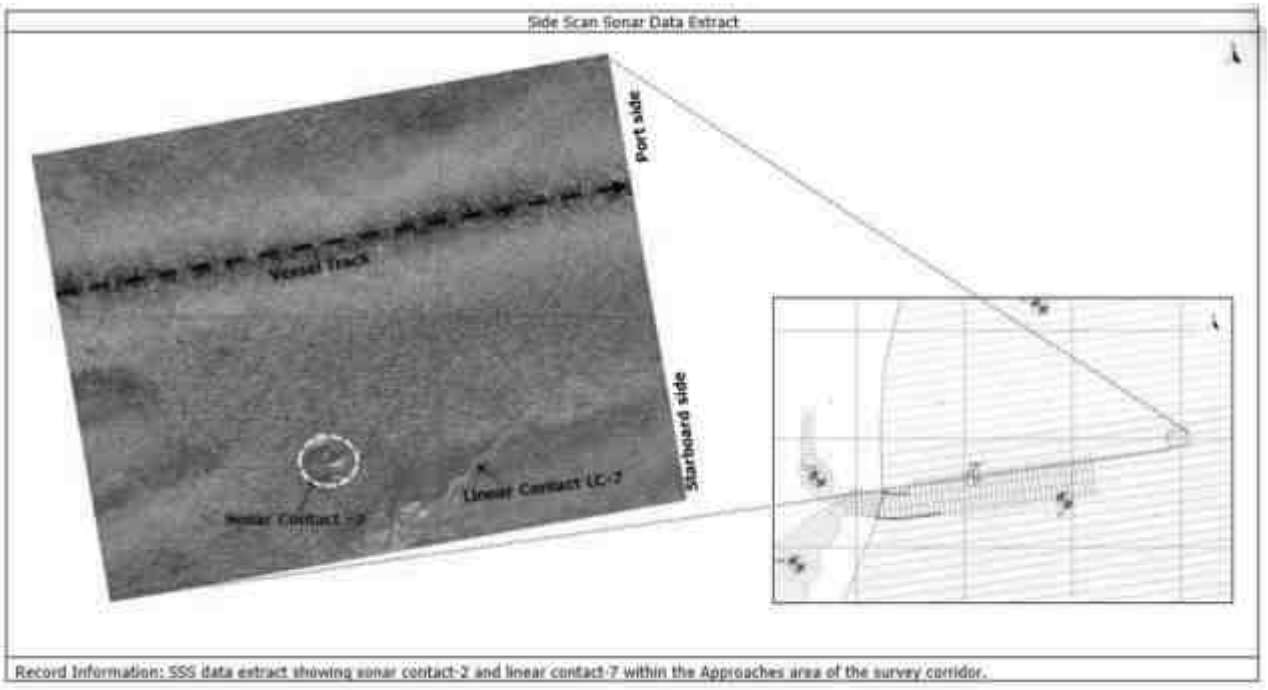


Figure 2-4: Side Scan Sonar Extract Showing Sonar Contact and Linear Contact

Figure 2-5: Side Scan Sonar Image Superimposed on Google Earth Showing Jetty

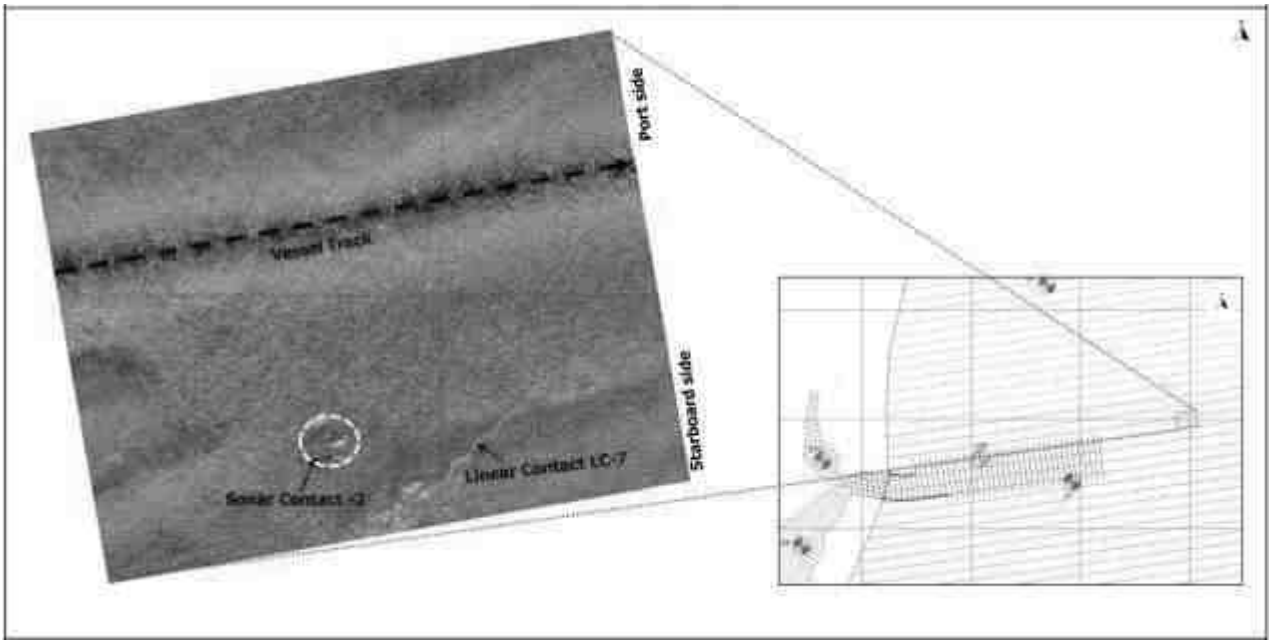


Figure 2-6: Side Scan Sonar extract showing sonar contact, linear contact and plain seabed within the Approach area

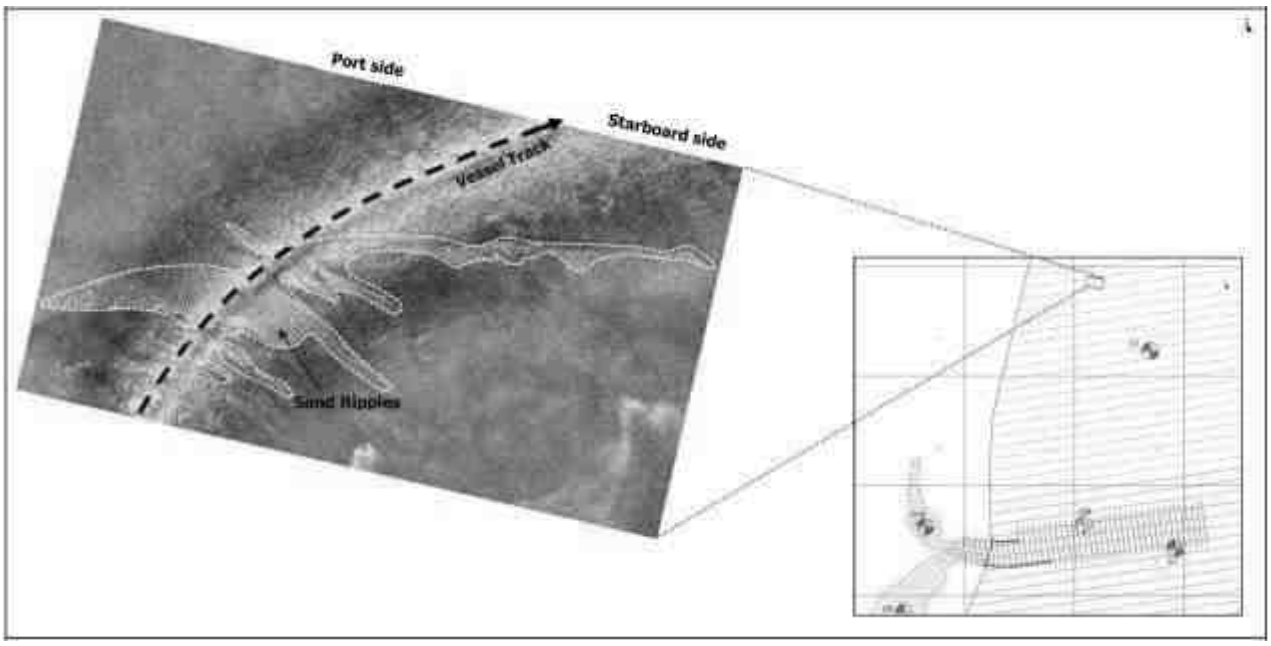


Figure 2-7: Side Scan Sonar extract showing Sand ripples recorded in the north west part of the Approach area

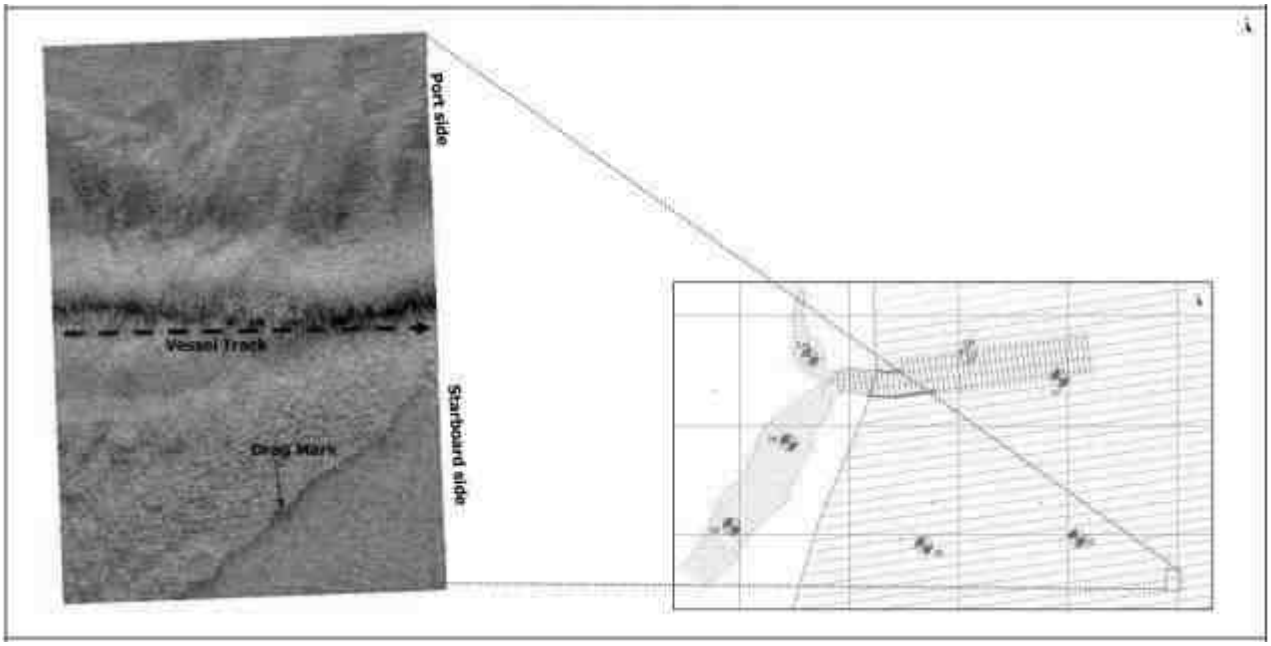


Figure 2-8: Side Sc /. BVJHY98 an Sonar extract showing Drag marks recorded in the south part of the Approaches area

2.6.3 Geotechnical Investigations

From particle size distribution test for the samples collected in project area, it is observed that more than 95% of the sample consists of sand.

Fine to Medium Silty Sands: It is the uppermost sediment layer and identified occurring all over within the survey corridor. This unit is identified as transparent with low acoustic impedance to the seismic energies and base of this unit undulates 21RWwithin survey corridor.

- Capacity Expansion of Cuddalore port Approach Area (layer thickness varies between 0.6 meters to 5.4 meters)
- Harbor Area (layer thickness varies between 0.8 meters to 2.6 meters)

Throughout most of the survey area, the seabed exhibits sand ripples and beneath these, well-defined internal reflectors composed of mixture of sands and silts observed at varying depths.

Compact Silty Sands: This occurs directly below the Fine to Medium Silty Sands exhibiting high acoustic impedance to the seismic energies, thus inhibiting the further penetration of the acoustic signals and it is interpreted as compact silty sands. This unit was recorded all along the survey area corridor.

It is interpreted as indurated sediments, composed of stiff silty sand. The faint internal reflections within these sediments are likely due to variations in stiffness, sediment composition (sand and silt), and increasing density with depth. This subsurface unit is recorded to the maximum depth of acoustic signal penetration.

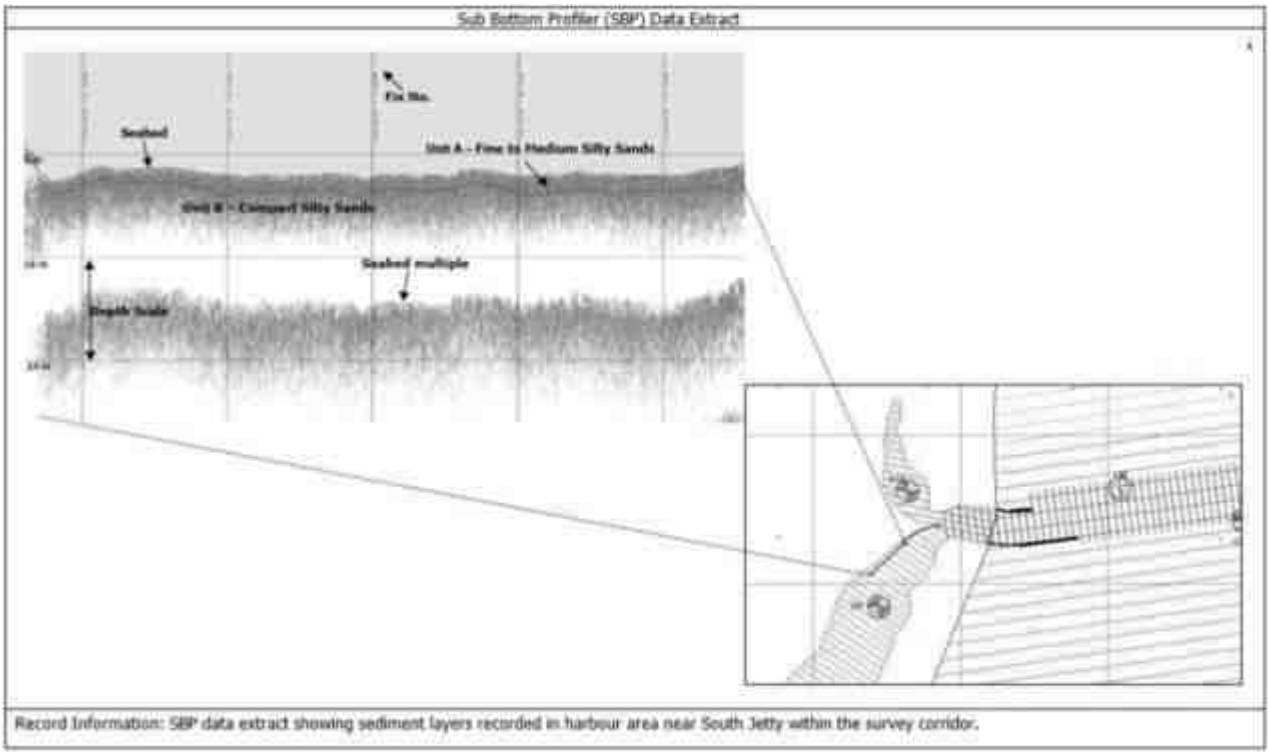


Figure 2-9: SBP Data Extract Showing Seabed Features

Apart from the above, no other significant features or anomalies associated with existing cables or existing pipelines or with shallow gas were evident from the records within the survey corridor, which could be hazardous to the marine construction activities.

2.6.4 Oceanographic Investigations

2.6.4.1 Currents

An Acoustic Doppler Current Profiler (ADCP) is a hydro acoustic current meter similar to sonar to measure water current velocities over a depth range using the Doppler

effect of sound waves scattered back from particles within the water column. ADCP contains piezoelectric oscillators to transmit and receive sound signals. It consists of four transducers at its head. The traveling time of sound waves gives an estimate of the distance, the red or blue shift can be converted to a velocity.

Acoustic Doppler Current Profiler (ADCP) for measuring currents was deployed near cuddalore port, Nortek Signature 500 ADCP Current Meter was utilized to acquire the currents data. Current meter observations were carried out for a period of 15 days from 29th Aug to 13th Sep 2025 (then processed in the Nortek software/Ocean Counter). ADCP was installed on the seabed. ADCP frame on the seabed "Upward looking mode". A watch keeping boat was deployed during the current measurement for safeguard of ADCP.

Current measurement was carried out for the duration of 15 days from 30th August, 2025 to 13th September, 2025 by deploying Acoustic Doppler Current Profiler (ADCP).

Summary of current measurement is as follows:

- The Maximum current speed is 1.1 m/s and the minimum current speed is 0.01 m/s at the Surface level.
- The Maximum current speed is 0.62 m/s and the minimum current speed is 0.01 m/s at the Middle level.
- The Maximum current speed is 0.60 m/s and the minimum current speed is 0.01 m/s at the bottom level.

The maximum current speed of 1.17 m/s at Surface layer and minimum current speed (still current) of 0.01m/s is observed. Upon analyzing the currents directions speed is varying in the seabed and surface current is higher about only 0.57m/s.

Rose Diagram

Rose Plots are drawn speed which is taken as a scalar quantity and the direction as vector quantity. All the current directions are plotted with respect to the true north. Speed circles are drawn as from 0.2 m to over and above 0.90m speed circle facilitates easy visualization of the logged speed in any given direction. The cardinal direction facilitates easy visualization of the logged direction for any given speed. In addition to the above, the degree range of 22.5° flanking each cardinal direction is marked in colour.

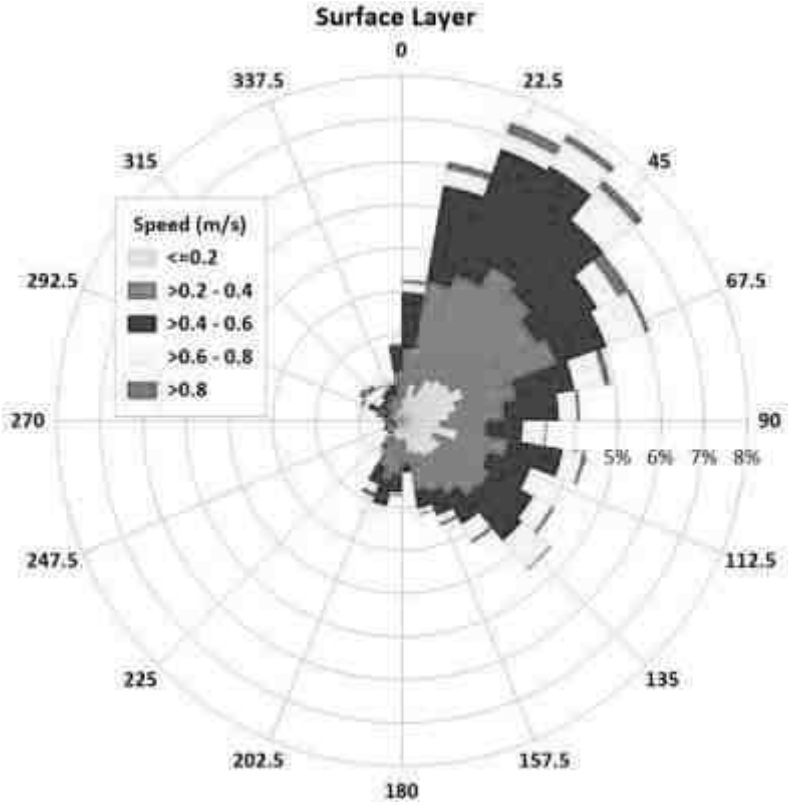


Figure 2-10: Rose Plot of Surface Layer Current Speed Against Direction

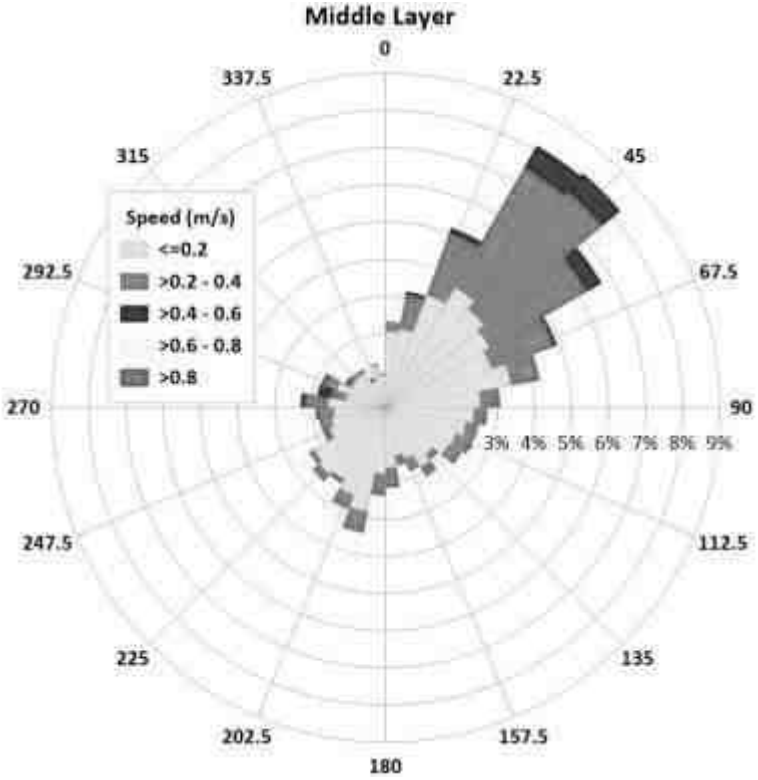


Figure 2-11: Rose Plot of Middle Layer Current Speed Against Direction

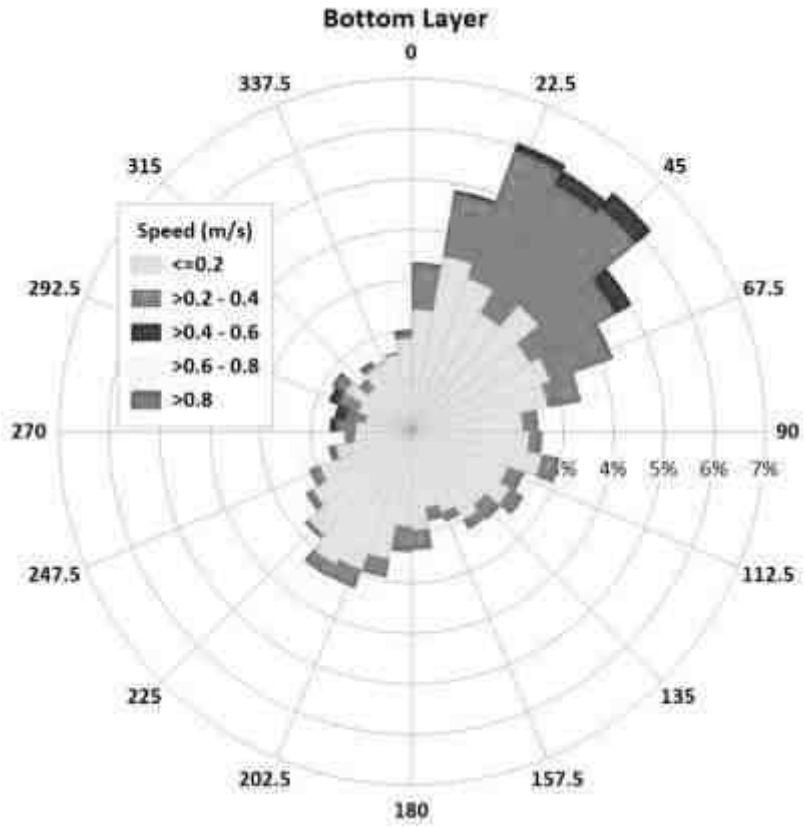


Figure 2-12: Rose Plot of Bottom Layer Current Speed Against Direction

2.6.4.2 Waves

The wave characteristics play a vital role in the design and operation of the open sea marine terminal. It also governs the orientation of the unloading pier to obtain number of operable days in a year.

The deepwater wave climate is dominated by north-easterly and south-westerly conditions associated with the (south-westerly) monsoon and the post-monsoon respectively. As the waves travel into progressively shallower water, they are modified by depth-refraction and their crests become progressively more aligned with the bed contours. This causes a reduction in the spread of wave directions in the wave climate with reduction in water depth. Moving into depths of 10m and below, the height of the largest waves is reduced due to the combined effects of refraction and wave breaking. The average wave height prevailing is 1.40m with periods varying from 7 to 10sec.

The observation period at Cuddalore port crosses one neap and one spring tide. It shows that the significant wave height varies from 0.4m to 1.1m. The peak wave period varies between 1.7s to 11.3s.

Significant Wave Height (Hs):

The maximum significant wave height observed is 1.1m and the minimum is observed around 0.4 m is observed. In general, significant wave height is 90% in between 0.0-0.8m amplitude and only 10% are above 0.8m.

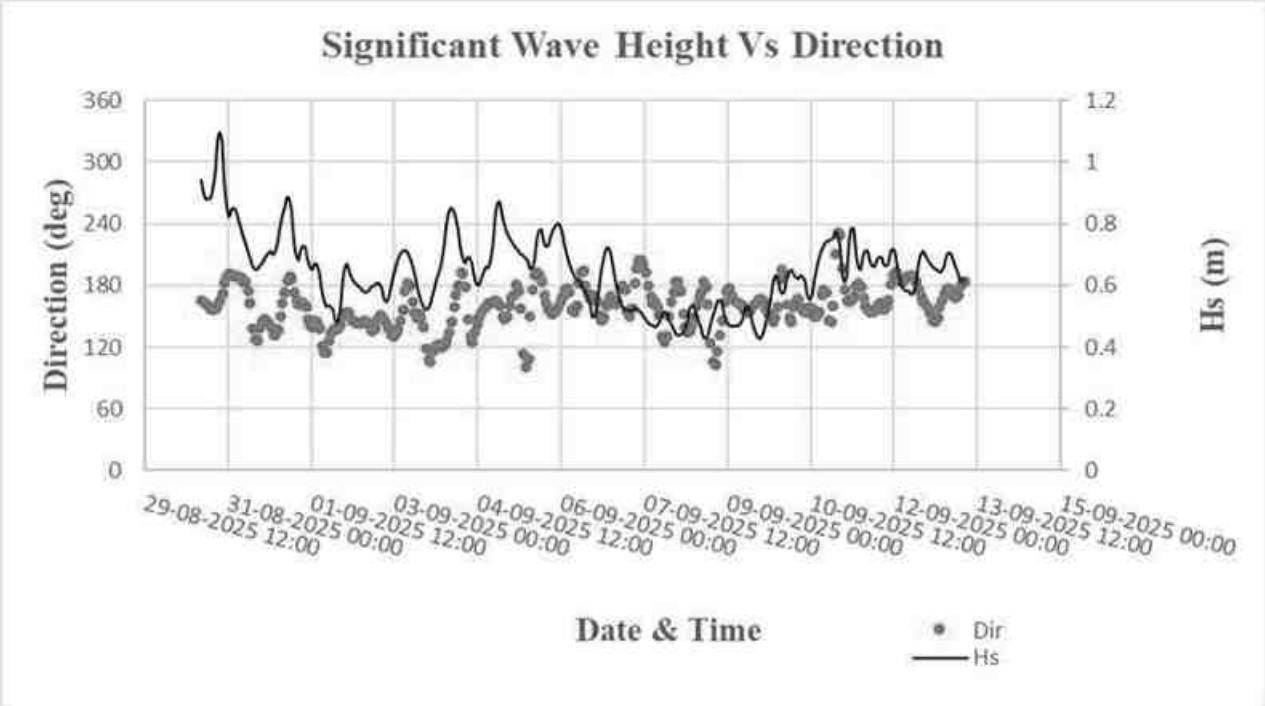


Figure 2-13: Significant Wave Height Vs Direction

Peak Wave Period (Tp):

Peak wave period between a minimum of 1.7sec to 8.5sec, 77% is dominant in below 10sec. & only 23.0% of peak wave period is in between 10s to 12s.

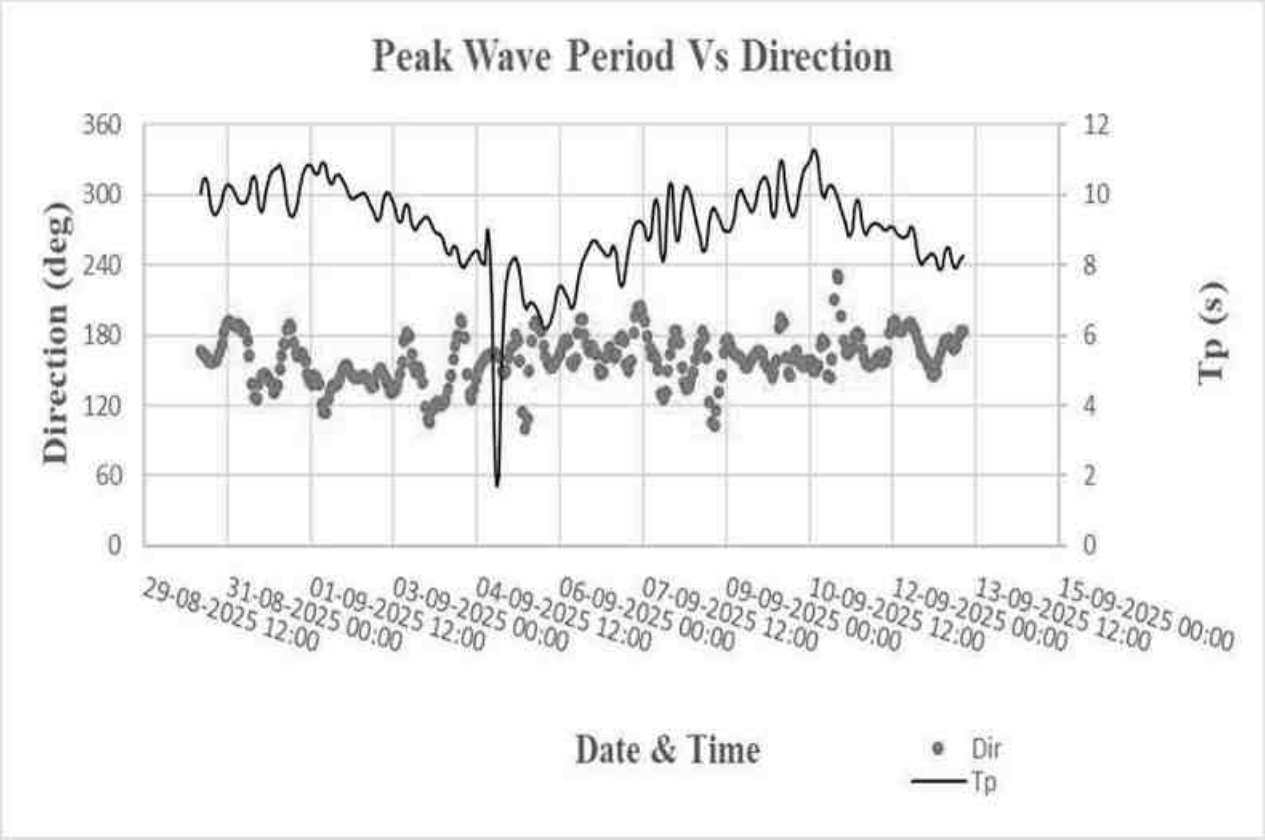


Figure 2-14: Time Series Peak Time Period Vs Direction

2.6.4.3 Tides

Tidal observations were carried out at Cuddalore port by deploying ADCP along with wave and current measurement at the same location. Tides were observed at every 5 min interval. The difference in the water level is 1.2m at a depth of 7.0m depth.

Semi-Diurnal tidal regime observed at Parangipettai, Cuddalore coast produces two sets highs and lows during the day. The tide levels during spring and neap tides of Parangipettai, Cuddalore coast are given below:

- Mean High Water Spring (MHWS) : + 1.1m CD
- Mean High Water Neap (MHWN) : + 0.9m CD
- Mean Sea Level (MSL) : + 0.7m CD
- Mean Low Water Neap (MLWN) : + 0.6m CD
- Mean Low Water Spring (MLWS) : + 0.3m CD

2.6.4.4 Wind

The maximum cyclonic and non-cyclonic wind speed in the 10 year data period is 26 m/s and 14–16 m/s respectively. The annual average wind climate exhibits two distinct peaks in its directional distribution, centered approximately on south-west and northeast. Examination of the seasonal climate tables shows that these correspond to the (south-west) monsoon period and the post-monsoon (also referred to as north-east monsoon) period, respectively.

2.6.4.5 Littoral Drift

The wave atlas data has been analyzed to obtain the monthly averaged wave height, wave period and wave direction. These are offshore wave climate and are transformed to the near shore location of Pudhukuppam, Cuddalore using Snell's law. The average breaking wave characteristics were derived from the available wave data. The results indicate that the mean breaker height varies from about 0.84m to 1.65m. The breaker height is observed to be a maximum during December and minimum during April. The maximum surf width of about 102m occurs in the month of December. The net sediment transport drift is found to be about 82336.5578m^3 per annum and directed towards North.

2.7 Mathematical Model Studies

This section provides details of Mathematical Model Studies carried out on hydrodynamic aspects, nearshore wave transformation processes, sediment transport pattern and shoreline changes.

2.7.1 Hydrodynamic Modelling

The two-dimensional hydrodynamic model using MIKE 21 HD was established to simulate the water levels and current pattern along the cuddalore coast. The hydrodynamic model is based on the solution of the three-dimensional incompressible Reynolds averaged Navier-Stokes equations, subject to the

assumptions of Boussinesq and of hydrostatic pressure. The mutual interaction between waves and currents using a dynamic coupling between the hydrodynamics and wave is carried out for estimation of nearshore circulation.

Continuity Equation

$$\frac{\partial h}{\partial t}+\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=S$$

- The two equations of momentum for the two components x and y, respectively, are:

$$\frac{\partial u}{\partial t}+\frac{\partial u^2}{\partial x}+\frac{\partial vu}{\partial y}+\frac{\partial wu}{\partial z}=fv-g\frac{\partial \eta}{\partial x}-\frac{1}{\rho_o}\frac{\partial p_a}{\partial x}-$$

$$\frac{g}{\rho_o}\int_z^\eta \frac{\partial \rho}{\partial x}dz-\frac{1}{\rho_o h}\left(\frac{\partial s_{xx}}{\partial x}+\frac{\partial s_{xy}}{\partial y}\right)+F_u+\frac{\partial}{\partial z}\left(\upsilon_t\frac{\partial u}{\partial z}\right)+u_sS$$

$$\frac{\partial v}{\partial t}+\frac{\partial v^2}{\partial y}+\frac{\partial uv}{\partial x}+\frac{\partial wv}{\partial z}=-fu-g\frac{\partial \eta}{\partial y}-\frac{1}{\rho_o}\frac{\partial p_a}{\partial y}-$$

$$\frac{g}{\rho_o}\int_z^\eta \frac{\partial \rho}{\partial y}dz-\frac{1}{\rho_o h}\left(\frac{\partial s_{yx}}{\partial x}+\frac{\partial s_{yy}}{\partial y}\right)+F_v+\frac{\partial}{\partial z}\left(\upsilon_t\frac{\partial u}{\partial z}\right)+v_sS$$

Where,

t is the time;

x, y and z are the Cartesian coordinates;

η is the surface elevation;

d is the still water depth;

h=η+d is the total water depth;

u,v and w are the velocity components in the x, y and z direction;

f = 2ΩsinΦ s the Coriolis parameter (Ω is the angular rate of velocity and Φ is the geographic latitude);

g is the gravitational acceleration;

ρ is the density of water;

s_{xx}, s_{xy}, s_{yx} and s_{yy} are components of the radiation stress tensor;

ν_t is thevertical turbulence (or eddy) viscosity;

pa is the atmospheric pressure;

ρ_o is the reference density of water;

S is the magnitude of the discharge due to point source and

(u_s,v_s) is the velocity by which the water is discharge into the ambient water.

The environmental forcing and processes include bottom shear stress, windshear stress, barometric pressure gradients, Coriolis force, momentum dispersion, sources and sinks, evaporation, flooding and drying and wave radiation stresses.

Model domain was established using the surveyed bathymetry within the cuddalore port limits and GEBCO bathymetry at the offshore**. Figure 2-15** shows the model domain and bathymetry used for the hydrodynamic modelling in the existing scenario. **Figure 2-16** shows the directional distribution of wind speed used for the model simulation.

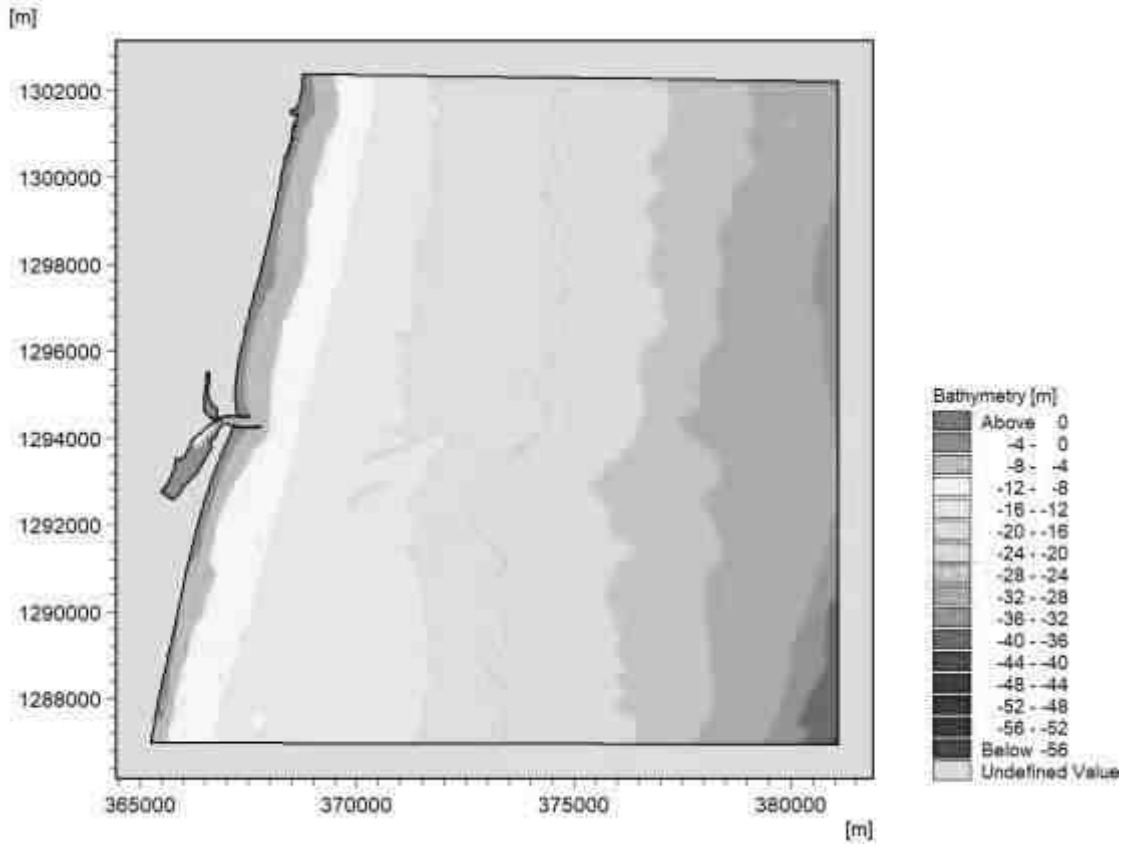


Figure 2-15: Model domain for hydrodynamic model – Existing Port layout

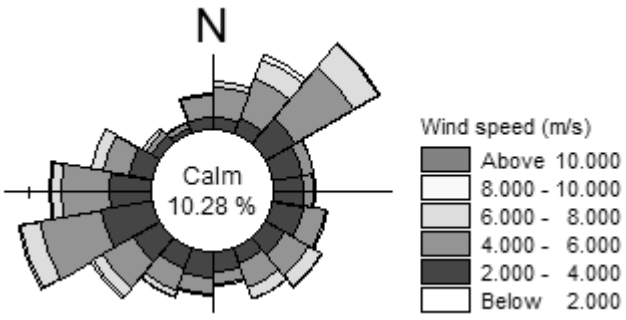


Figure 2-16: Wind used for the simulation (Source: IMD)

Eddy viscosity was applied using Smagorinsky formulation with coefficient of 0.28. The boundaries of the model were forced with predicted water level based on the tidal constituents obtained from the DHI global tide model. The simulation was carried out with tide for a period of 15 days which covers spring and neap tidal cycles. The water level and current speed data were measured at cuddalore during September, 2025 at predetermined location as shown in **Figure 2-17**. Time series comparison of measured and simulated water level is presented in **Figure 2-18**. The

scatter plot of simulated water levels and measured water levels shows a good agreement with correlation coefficient of 0.86 as presented in **Figure 2-19**.

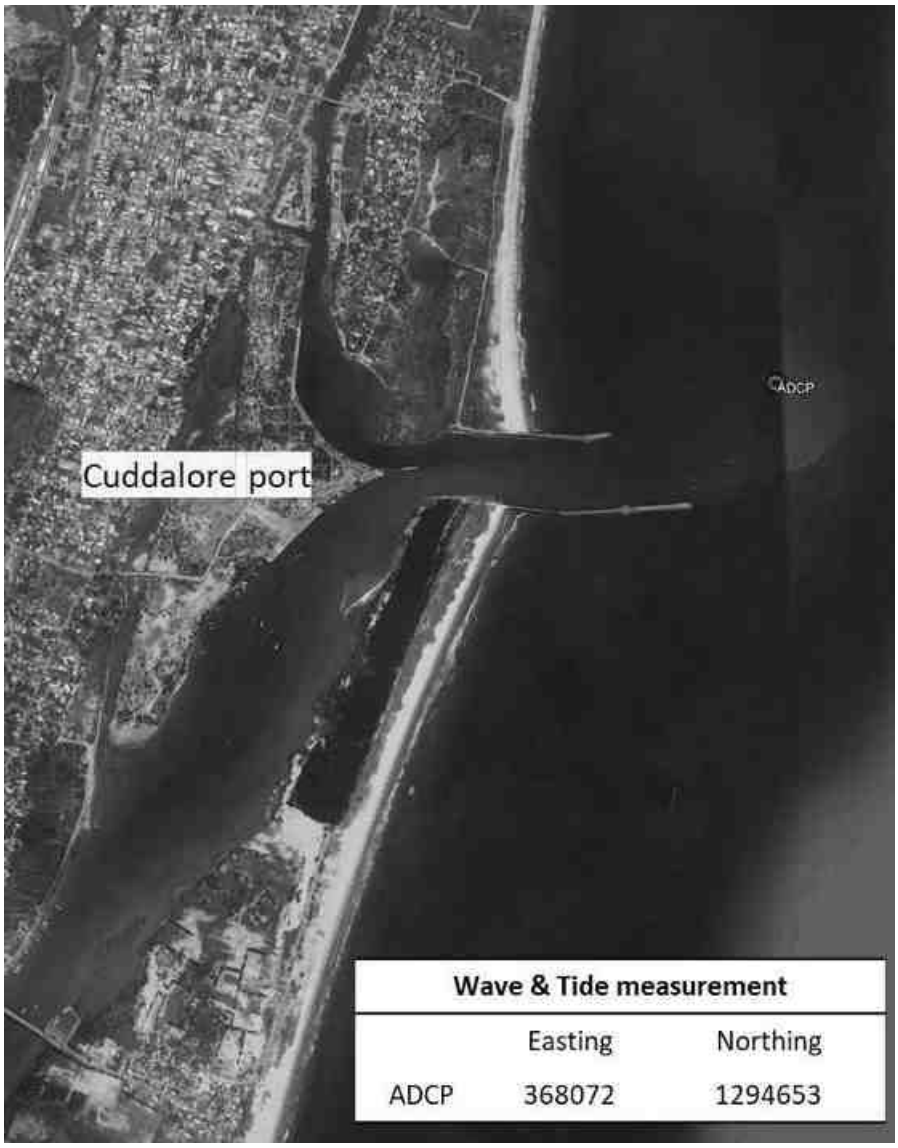


Figure 2-17: Tide & Current measurement locations

Similarly, the modelled u and v components of current speed is compared with the current velocity components observed at the location. The current speed during spring and neap high tide and low tide is shown in **Figure 2-19** & **Figure 2-20** respectively. It is observed that the tidal range varies from 1.1 m during the spring tide to 0.4 m during the neap tide.

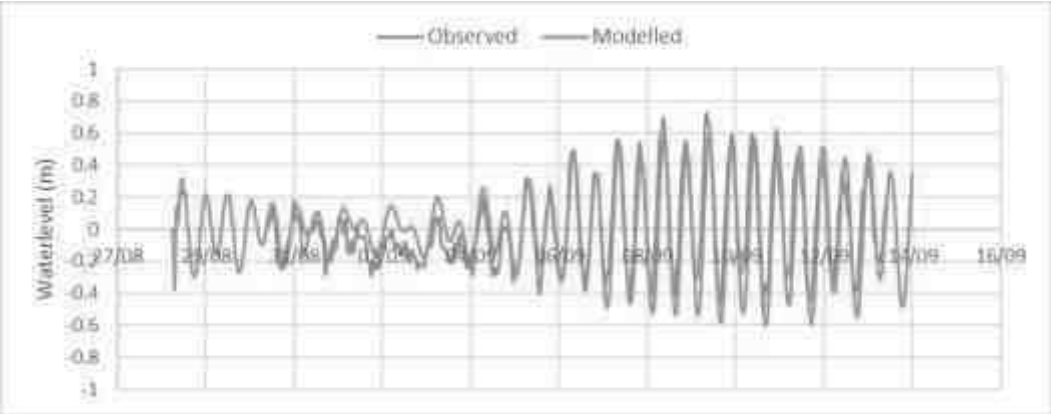


Figure 2-18: Comparison of measured tide data with the modelled data

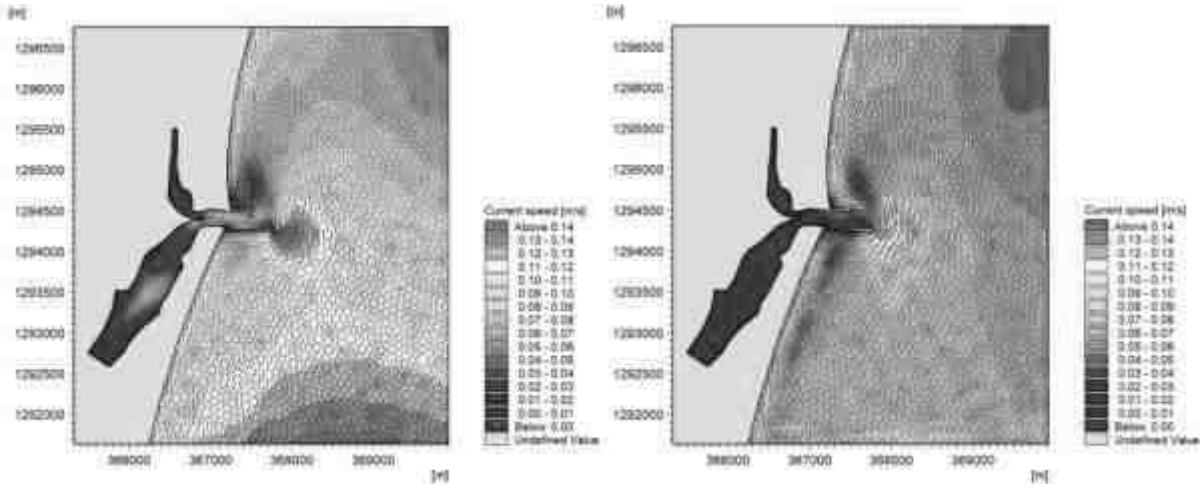


Figure 2-19: Current speed in Existing port layout a) Spring High tide b) Neap High tide

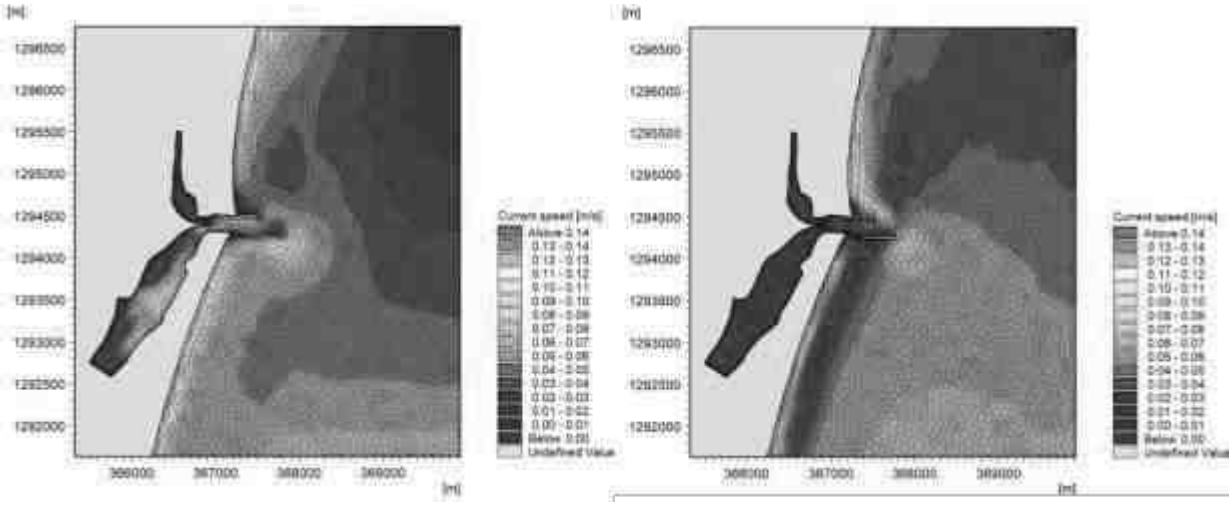


Figure 2-20: Current speed in Existing port layout a) Spring Low tide b) Neap Low tide

2.7.2 Nearshore wave transformation model

Nearshore wave models help to predict the evolution of the wind-generated waves by using numerical approaches to translate offshore conditions in shallower coastal environments. Spectral wind-wave model is used for prediction and analysis of wave climates in offshore and coastal areas. The model simulates the growth,

decay and transformation of wind-generated waves and swells in offshore and coastal areas. The governing equation for the model is the wave action conservation equation formulated. The conservation equation for wave action can be written as

$$\frac{\partial N}{\partial t} + \nabla.(\tilde{v}.N) = \frac{S}{\sigma}$$

Where,

N ($\underset{x}{\rightarrow}$, σ, θ, t) is the action density,

t is the time;

$\tilde{v}$ is wave group velocity and;

S is the source term for the energy balance equation.

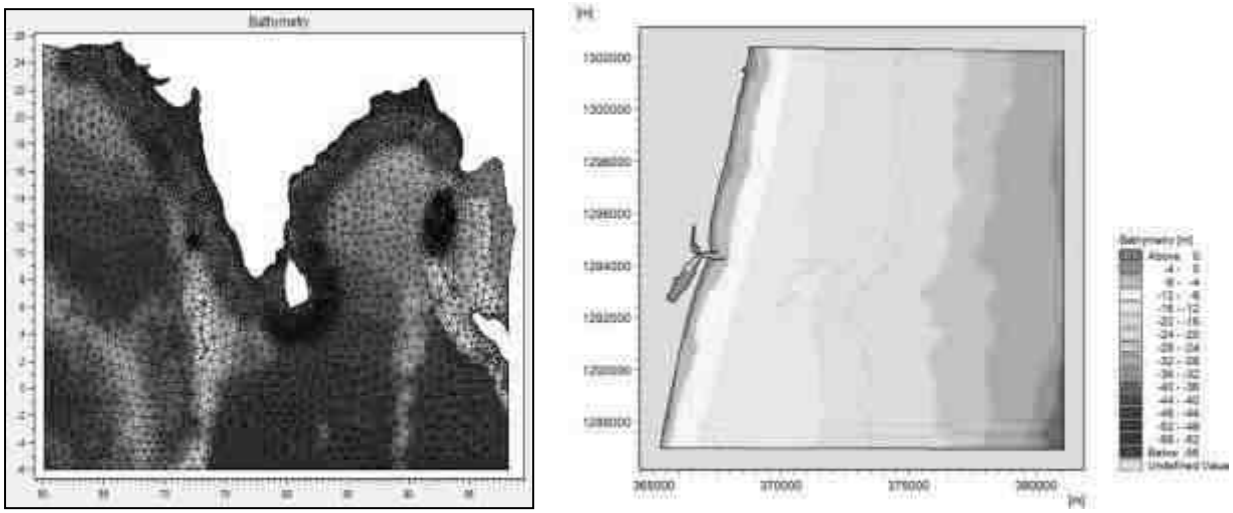


Figure 2-21: Model domain and Bathymetry (a) Regional wave model (b) nearshore wave model

The spectral wave model is based on an unstructured cell centred finite volume method and uses an unstructured mesh in geographical space. The model domain for wave generation is considered in regional scale and is forced using the ERA 5 wind from ECMWF. The GEBCO data for deep water regions and bathymetry data sets of measured data are applied to shallow water regions in the study area. The model is simulated for the period of 2020 with a time step of 3600 seconds, as wave buoy data for this period is available for validation. The horizontal datum is referenced to World Geodetic System 1984(WGS -84) and the vertical datum is referenced to Mean Sea Level (MSL). The model extent and the bathymetry used for the spectral wave modelling is provided in **Figure 2-21**. The wind generated regional model is validated with the INCOIS wave rider buoy data at BD11 location (13.53˚ Latitude and 84.17˚ Longitude. The observed significant wave height is in good agreement with the measured data with correlation index agreement of 0.88 as shown in **Figure 2-22.**

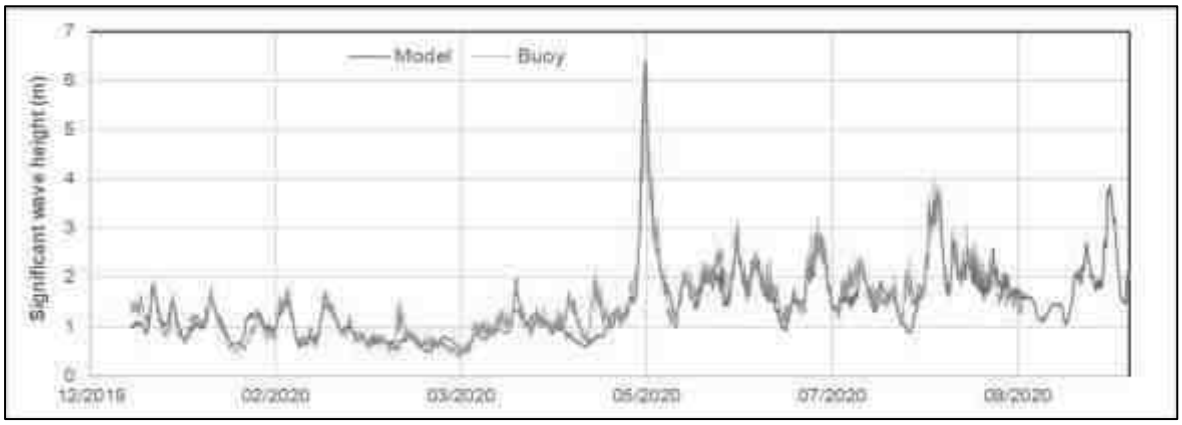


Figure 2-22: Comparison of measured wave data with the modelled wave data

A high-resolution nearshore wave model was developed to simulate wave transformation processes such as shoaling, refraction, and breaking. The offshore boundary conditions for the nearshore model were derived from the validated regional wave model at a water depth of approximately 30 m off cuddalore Port. These boundary conditions included spectral wave parameters necessary to force the nearshore model. The nearshore wave model was validated by comparing simulated wave parameters with measured data collected during period of 12th February 2026 to 28th February 2026. The time series of significant wave height obtained from the nearshore wave model has been compared with field measurements, as presented in **Figure 2-23**. The modelled wave heights show good agreement with the observed data, indicating that the wave model is reliable for analysis.

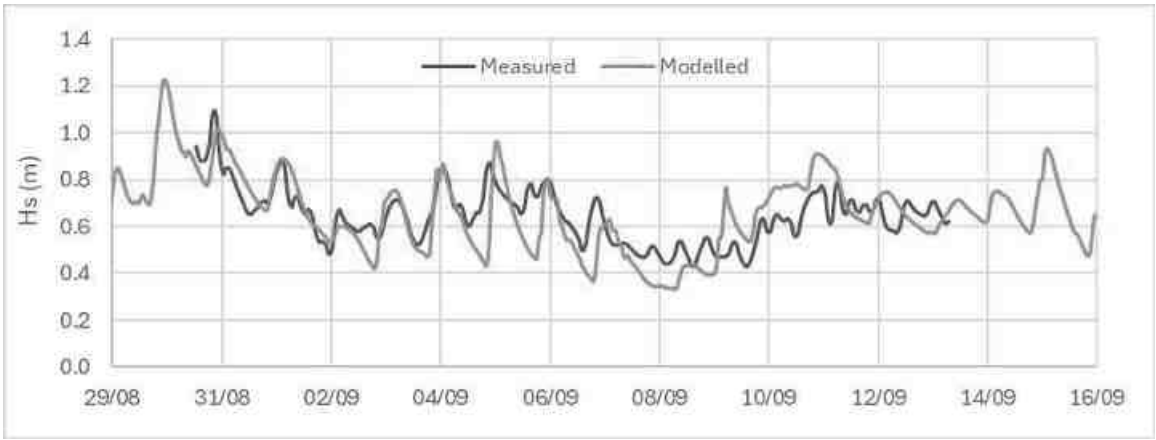
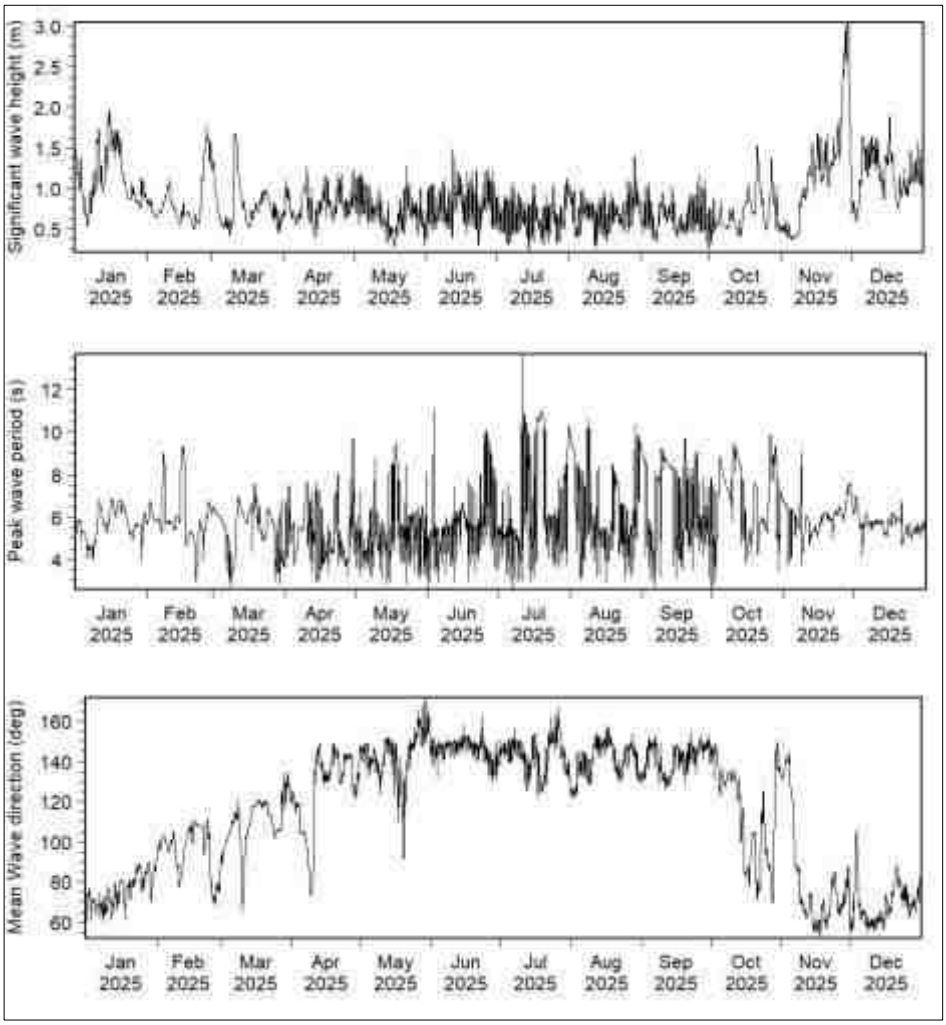


Figure 2-23: Comparison of measured wave data with the modelled wave data – Nearshore wave parameters

The validated nearshore wave model was further utilized to understand the nearshore wave characteristics. The model outputs were analysed to derive key wave parameters such as significant wave height (Hs), peak wave period (Tp), and wave direction. The annual distribution of wave hindcast indicates that during November – December the waves are mostly from northeast and remaining months, the waves are from southeastt. The significant wave height in the range of 0.5m to 3m and peak wave period of4 to 10s is predominant. The spatial variation of

significant wave height during Northeast and southwest monsoon is depicted in **Figure 2-24.**



Annual time series of nearshore wave characteristics

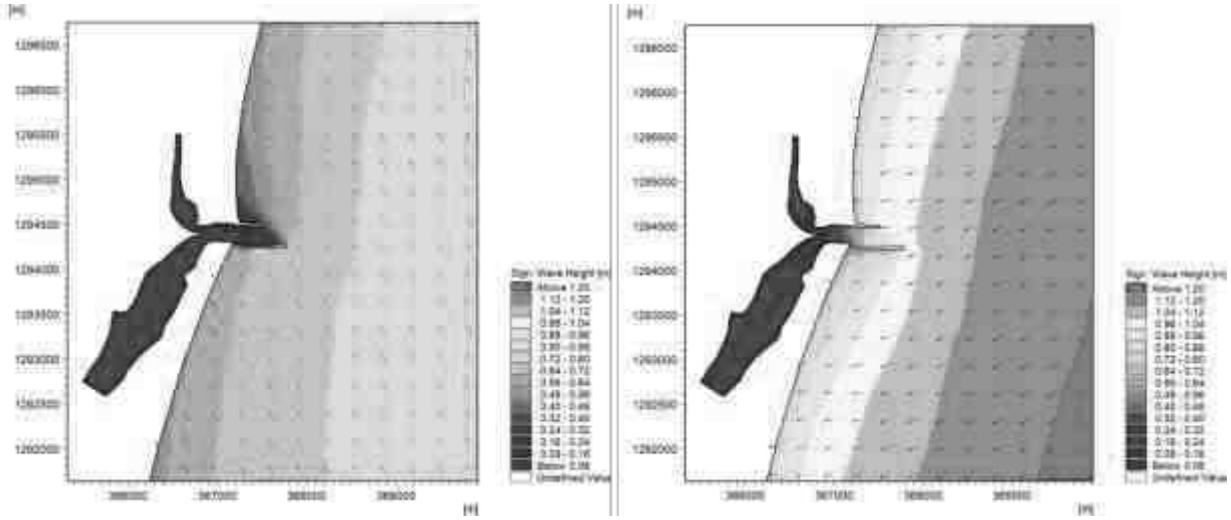


Figure 2-24: Spatial distribution of significant wave height a) Northeast monsoon b) southwest monsoon

The annual wave rose plot extracted at 15m water depth off cuddalore port is shown in **Figure 2-25**. Similarly, the monthly wave rose plots extracted were depicted in **Figure 2-26**.

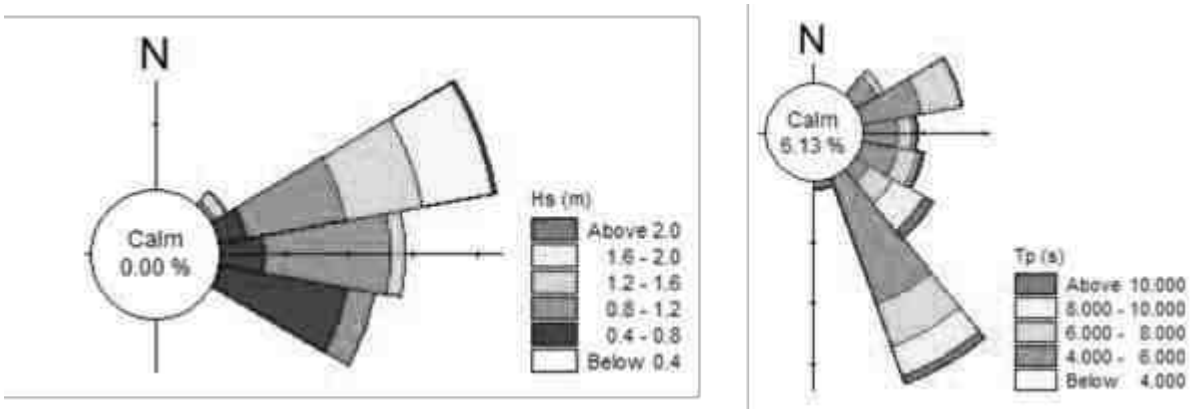


Figure 2-25: Annual wave rose plots (a) Significant wave height (b) Peak wave period

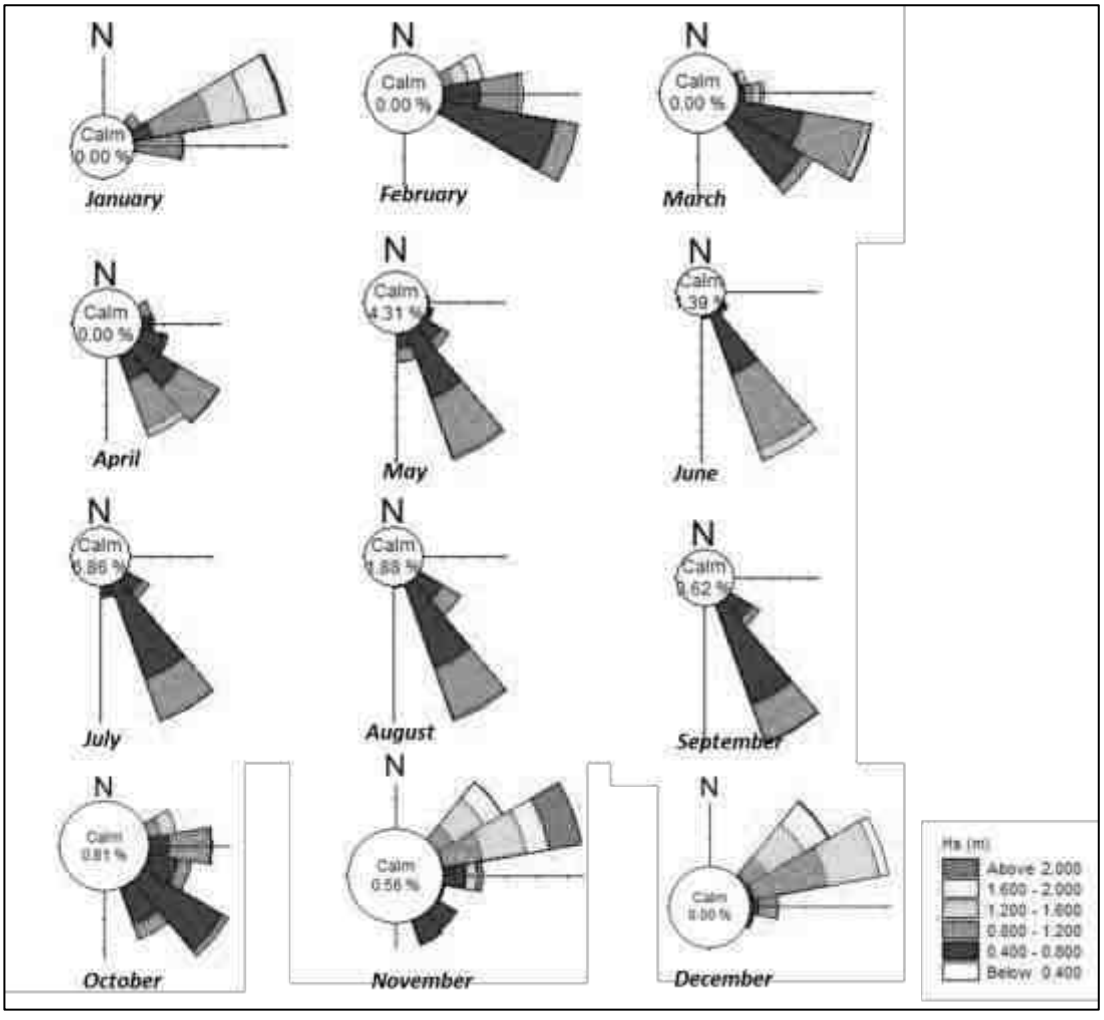


Figure 2-26: Monthly wave rose plots - Significant wave height

From the above plots, it is observed that the significant wave heights are mostly in the range of 0.4 m – 1.5 m during non-monsoon period and it reaches around 3m during monsoon period.

It can be observed that wave direction throughout the period is mostly between 140^0 to 160^0 with respect to true North. The predominant wave direction is observed to be from SSE. During monsoon season (October to January) the direction is mainly from NNE.

2.7.3 Wave Tranquillity Study

This section assesses the wave disturbance in the basin and berthing area of the proposed Cuddalore port expansion using phase resolved Wave model. The numerical model solves the Boussinesq type equations using a flux-formulation with improved linear dispersion characteristics. DHI MIKE 21 Boussinesq wave model is a phase resolved, two-dimensional wave model for analysis of short and long period wave disturbances in Ports and harbours. The boussinesq equations include nonlinearity as well as frequency dispersion. The frequency dispersion is introduced in the momentum equations by considering the effect of vertical accelerations on the pressure distribution. Boussinesq wave model can reproduce the combined effects of all important wave phenomena of interest in port, harbour and coastal engineering. These include,

- Shoaling
- Refraction
- Diffraction
- Wave breaking
- Bottom friction
- Moving shoreline
- Partial reflection and transmission
- Non-linear wave-wave interaction
- Frequency spreading
- Directional spreading

Phenomenon such as wave grouping, generation of bound sub-harmonics and super-harmonics and near-resonant triad interactions are implicitly captured using MIKE 21 BW. The Boussinesq wave module solves the enhanced Boussinesq equations expressed in one or two horizontal dimensions in terms of the free surface elevation, and the depth integrated velocity components, by an implicit finite difference techniques.

2.7.3.1 Computational Model domain

The model domain includes proposed Cuddalore port layout and the adjoining area and discretized with the cartesian grid with an extent of 6250m by 7500m. Bathymetry data for the entire domain was used from the survey data based on field observations. The maximum water depths restrict the minimum wave period and water depth of 15m was maintained for the entire computational domain. The computational domain for the Boussinesq wave modelling is shown in **Figure 2-27**.

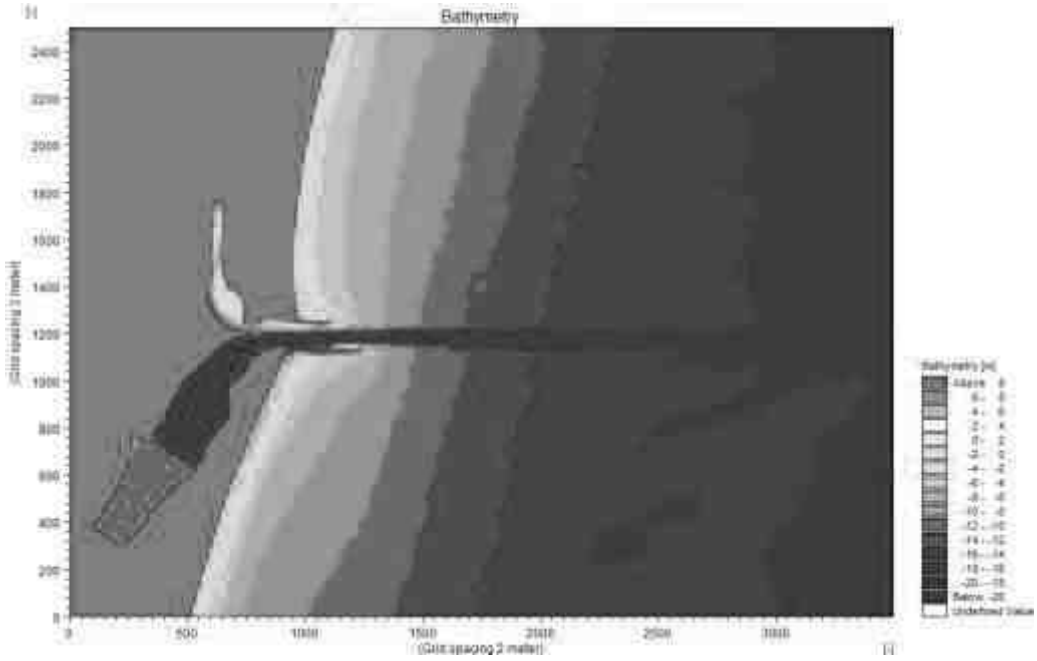


Figure 2-27: Model Domain

2.7.3.2 Wave Reflection – Porosity and Sponge layer

Sponge (or absorbing) layers are used as wave absorbers along the open boundaries to provide radiation boundary conditions, which absorb wave energy propagating out of the model area. All wave energy reaching these model boundaries were absorbed by sponge layers to avoid waves being reflected into the model domain.

Porosity values are used to model either partial reflection and/or transmission through structures. Partial wave reflection was applied along the port structures such as breakwaters and seawall by providing porosity values along the structures. The reflection properties were estimated and modelled based on the actual structure type and the wave conditions. The sponge layer and the porosity map considered for the wave tranquillity study was illustrated in **Figure 2-28** and **Figure 2-29** respectively.

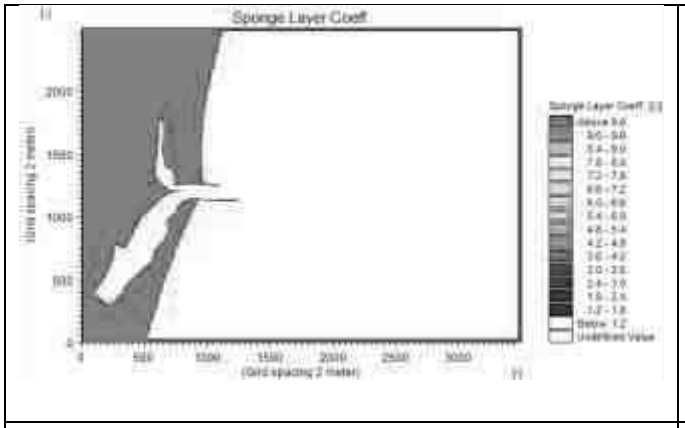


Figure 2-28: Sponge layer map

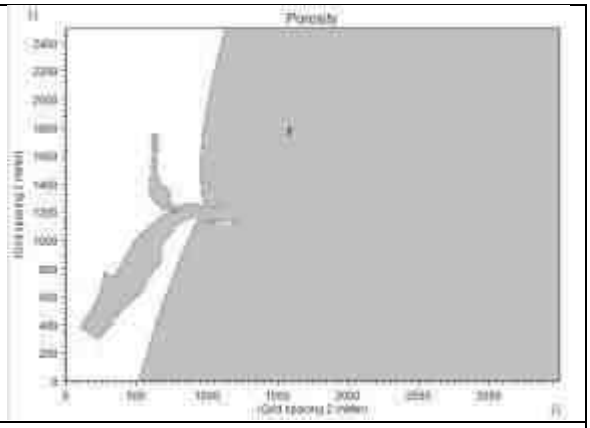


Figure 2-29: Porosity layer map

2.7.3.3 Wave Characteristics

Wave conditions off Cuddalore Port was arrived based on the hindcast wave data and the combined occurrences of wave height, wave period and wave incidence direction were shown in **Table 2-5** and **Table 2-6**. According to the occurrence probability of wave height of the table, the cumulative occurrence of the incident waves between 0.5m to 1.5m is about 98.6 % at cuddalore port. Incidence directions of the waves show higher occurrence probability in NNE, NE, SE and wave occurrence is mainly concentrated in the zone of wave period of between 6 -10 seconds.

Table 2-5: Scatter table between Mean wave direction and Significant wave height

	<0.5	**0.5**	**1**	**1.5**	**2**	**2.5**	**>2.5**	
Below	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
40	0.00	0.00	0.55	1.47	0.35	0.00	0.00	**2.37**
70	0.00	1.24	11.06	8.28	1.96	0.27	0.55	**23.37**
100	0.00	8.40	7.02	0.63	0.01	0.05	0.00	**16.11**
130	0.00	16.71	11.38	0.18	0.00	0.00	0.00	**28.28**
160	0.06	14.44	14.70	0.66	0.00	0.00	0.00	**29.87**
	0.06	**40.80**	**44.72**	**11.22**	**2.33**	**0.32**	**0.55**	

Table 2-6: Scatter table between significant wave height and Peak wave period

	<0.5	**0.5**	**1**	**1.5**	**2**	**2.5**	**>2.5**	
Below	0.00	0.00	0.31	0.00	0.00	0.00	0.00	**0.31**
4	0.00	8.62	11.66	0.40	0.00	0.00	0.00	**20.68**
6	0.00	17.59	26.25	10.29	2.18	0.18	0.00	**56.49**
8	0.00	9.37	3.14	0.42	0.15	0.14	0.55	**13.77**
10	0.06	4.09	3.47	0.11	0.00	0.00	0.00	**7.73**
12	0.00	0.81	0.21	0.00	0.00	0.00	0.00	**1.02**
	0.00	0.00	0.01	0.00	0.00	0.00	0.00	**0.01**
	0.06	**40.48**	**45.04**	**11.22**	**2.33**	**0.32**	**0.55**	

Based on the statistical analysis of the wave characteristics, the following wave periods and wave directions were included in the wave disturbance simulations

- Significant wave height: 0.5m,1.0m and 1.5m
- Peak wave period: 6s, 8s and 10s
- Mean wave direction: 70°,130° and 160°

Directional irregular waves of above wave conditions were defined using a JONSWAP spectrum and directional spreading of 30° has been used in defined the wave spectrum. **Table 2-7** shows the run matrix of BW model for the present tranquillity study based on the combined occurrences of wave height, wave period and wave directions.

Table 2-7: Boussinesq Model wave simulation matrix

Wave Conditions		
H	**T**	**Theta**
0.5	6	160
0.5	8	130
1	6	160
1	10	130
1.5	6	70
2	6	70

2.7.3.4 Wave Disturbance Coefficients – Operational wave condition

Wave disturbance coefficients can be defined as the ratio of wave height relative to the incident wave height. Wave disturbance coefficient of 0.5 m indicates a reduction of incident wave height by 50%. The typical contour plots of surface elevation and wave disturbance coefficients for operational wave condition (Hs = 0.5m; Tp =6s; Theta =160), (Hs = 1m; Tp =10s; Theta =130) and (Hs = 1.5m; Tp =6s; Theta =70) is represented in **Figure 2-30** to **Figure 2-32** respectively.

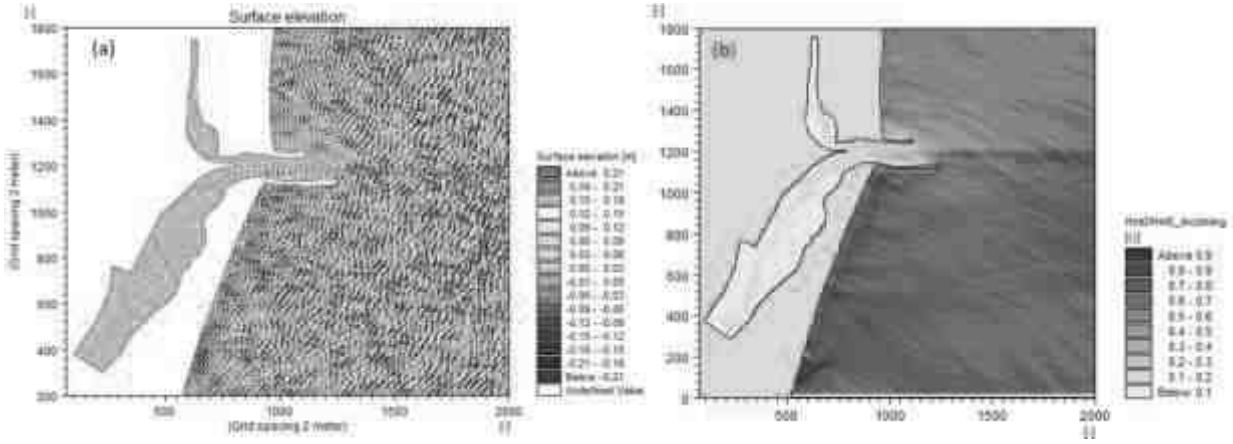


Figure 2-30: Contour plots of (a) surface elevation (b) Wave disturbance coefficient (Hs = 0.5m; Tp =6s; Theta =160)

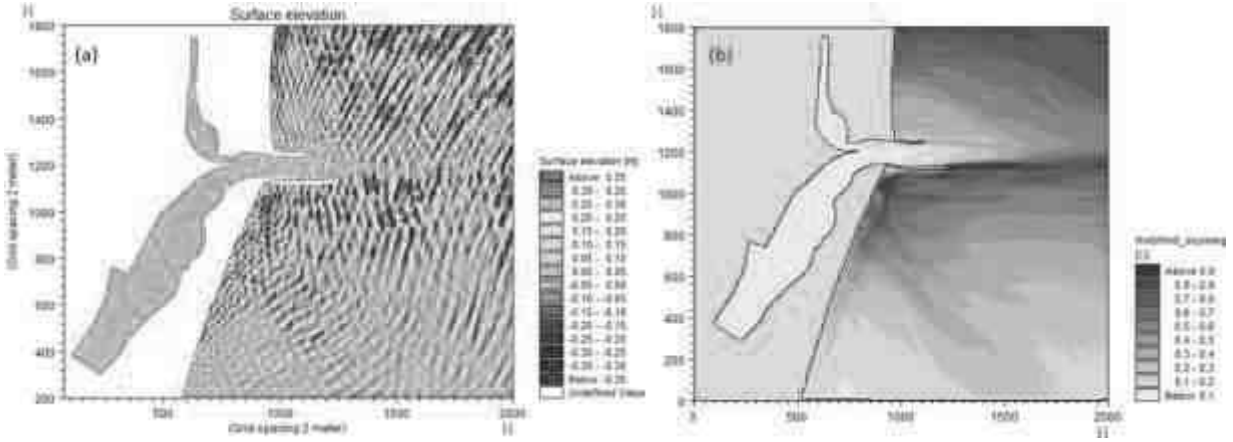


Figure 2-31: Contour plots of (a) surface elevation (b) Wave disturbance coefficient (Hs = 1m; Tp =10s; Theta =130)

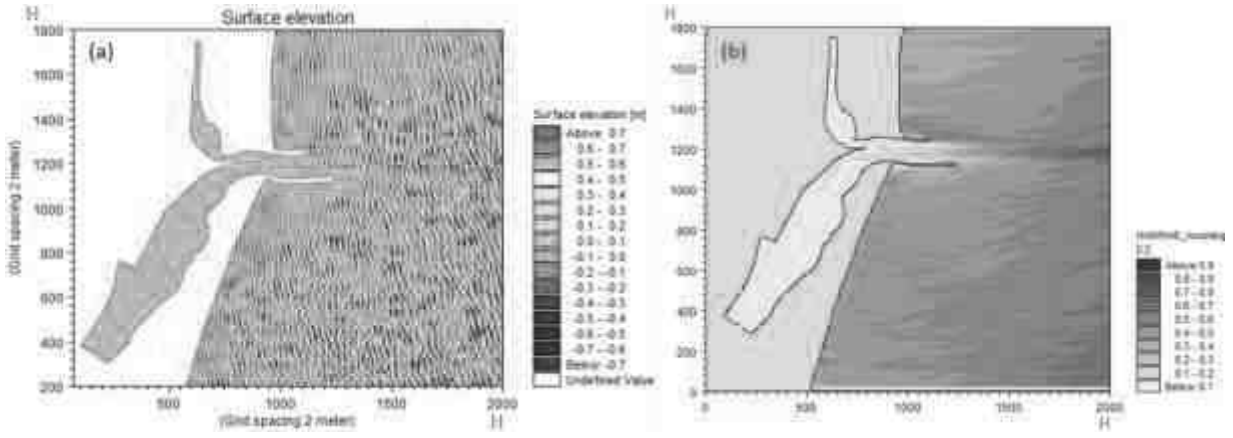


Figure 2-32: Contour plots of (a) surface elevation (b) Wave disturbance coefficient (Hs = 1.5m; Tp =6s; Theta =70)

To assess the wave tranquillity of proposed port expansion during extreme wave conditions, offshore wave climate of 2m has been considered for the analysis. The typical contour plots of surface elevation and wave disturbance coefficients for extreme wave condition (Hs = 2m; Tp =6s; Theta =70), (Hs = 6m; Tp =12s; Theta =170) is represented in **Figure 2-30** to **Figure 2-32** respectively.

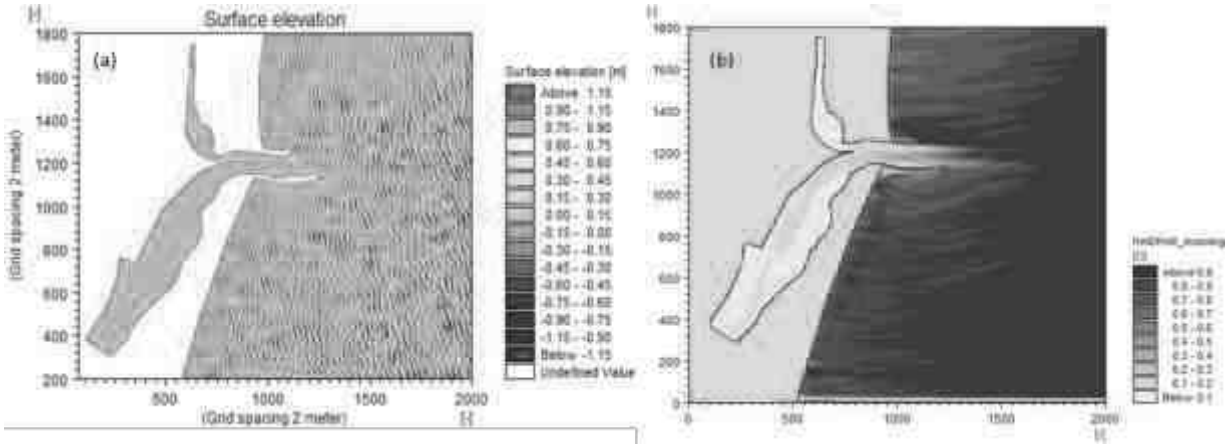


Figure 2-33: Contour plots of (a) surface elevation (b) Wave disturbance coefficient (Hs = 2m; Tp =6s; Theta =70)

2.7.3.5 Results

Numerical modelling was successfully employed to assess the tranquillity inside the proposed Cuddalore port expansion. The wave transformation studies using Spectral wave model enabled to arrive at the design wave conditions for the wave tranquillity.

The results of wave transformation studies indicated that the predominant incident wave directions are 70°N, 160°N with incident wave height of 0.5m, 1 m and 1.5m with wave periods between 6s, 8s and 10s.For extreme wave conditions, wave heights of 2m with wave period 6s respectively was analysed.

The assessment of wave tranquillity using Boussinesq wave modelling in the Cuddalore Port indicated that wave heights inside the port and at the approach channel and turning circleis less than 15% of the incident wave height for all the predominant wave directions for both operating and extreme wave conditions. The tranquillity assessment indicates that the port layout with proposed dredging effectively maintains calm conditions within the harbour basin during both seasonal scenarios. Wave penetration into the port is minimal, and the breakwater configuration provides adequate protection against incident wave energy during both monsoon and non-monsoon conditions.

2.8 Proposed Development Plan

For conceptualizing layout plans for the proposed facility, the requirements such as navigation parameters, number of berths, cargo handling facilities, operational

parameters, etc. has been identified. Based on above, suitable locations within the port site have been identified where these facilities are to be developed.

The basic navigational aids for servicing the vessels are as given below.

- Sufficient water depths and widths in approach channel
- Harbour basin and jetty for the cargo handling operation
- Tranquillity conditions
- Adequate stopping distance for vessels of largest size
- Sufficient water area for easy manoeuvrability of vessels throughout the year
- Efficient fenders and mooring systems, etc.

Limiting criteria for marine operations:

While planning the layout of the port, care shall be taken to ensure that the port basin is suitably protected against external waves, so that required tranquillity is available inside the harbour to carry out cargo handling operations without interruption. Further, for the pilot to board the ship in the anchorage and for the tugs to be fastened to the ship in the outer channel, significant (limiting) wave height (Hs) should not exceed a certain value.

2.8.1 Topographic Features

The topographical survey of the Cuddalore Port area indicates a relatively flat coastal terrain, with ground levels ranging from approximately 0.5 meters to 7.3 meters, referenced to established Temporary Benchmarks (TBMs) across the site. Most of the terrain lies within the 3.0-to-4.5-meter elevation band, with an average ground level of about 3.8 meters. Higher elevations are observed toward the northwestern side and built-up areas, while the land gradually slopes eastward and southeast ward toward the Bay of Bengal.

2.8.2 Existing Land Use Pattern

Existing port is located in an area of 45.21 ha (111.72 Ac) which was in complete possession of Cuddalore Port and proposed development is within the existing port land only.

The present land use of the project site is scrubland with scattered bushes and trees, followed by Barren / Wasteland, Low Intensity Built-up Activity (port buildings and wharf) surrounded by Water Bodies.

At Cuddalore port two berths/wharfs were constructed (2 x 120 X 21 m each = 240 m) with Breakwaters, Approach Channel & Turning Circle, and capital dredging of 1.88 million Cubic meter was carried out to increase the depth to -11m CD and Turning Circle.

2.8.3 Protection Against Waves

For the protection of the port, the existing basin where proposed developments are planned to provide shelter from currents and waves by a breakwater. This will

increase tranquillity. The alignment and orientation of the breakwater have been determined by:

- Bottom depth contours
- Approach channel
- Nautical aspects
- Wave and current climate
- Sediment transport
- Provision of sufficient harbour space within the port.
- Operability in channel

The port features rubble-mound breakwaters that were initially constructed to protect the harbour basin and ensure safe vessel navigation. As part of development, both breakwaters have been extended to improve harbour protection and operational efficiency.

The maximum acceptable wave conditions for cargo handling operations at the berth are dependent on ship size, the type and method of cargo handling and the direction of the wave attack. Beam waves cause the vessel to roll and affect the cargo handling operations more than head waves. As per IS-4651 Part-V, maximum significant wave height (Hs) permitted within the harbour cargo handling operations.

Table 2-8: Significant Wave Height Limits in Harbour

S. No	Type of Ship	Significant Wave height in m		
		At Berth	Turning Basin	Offshore Mooring
1	General Cargo	0.65	0.90	1.50
2	Bulk Cargo	0.9	1.20	1.5 for berthing & 2.5 for operations
3	Container Cargo	0.65	1.20	-
4	Supervisors Boats	0.60	0.60 – 1.20	-

Existing Two breakwaters are protecting harbour i.e. North and South drawings; the existing length of north break was approximately 395m and South breakwater was approximately 650m.

Table 2-9: Breakwater Details at Cuddalore Port

Breakwater	Original Length (m)	Extended Length (m)	Total Length (m)
Northern Breakwater	310	85	395
Southern Breakwater	440	210	650

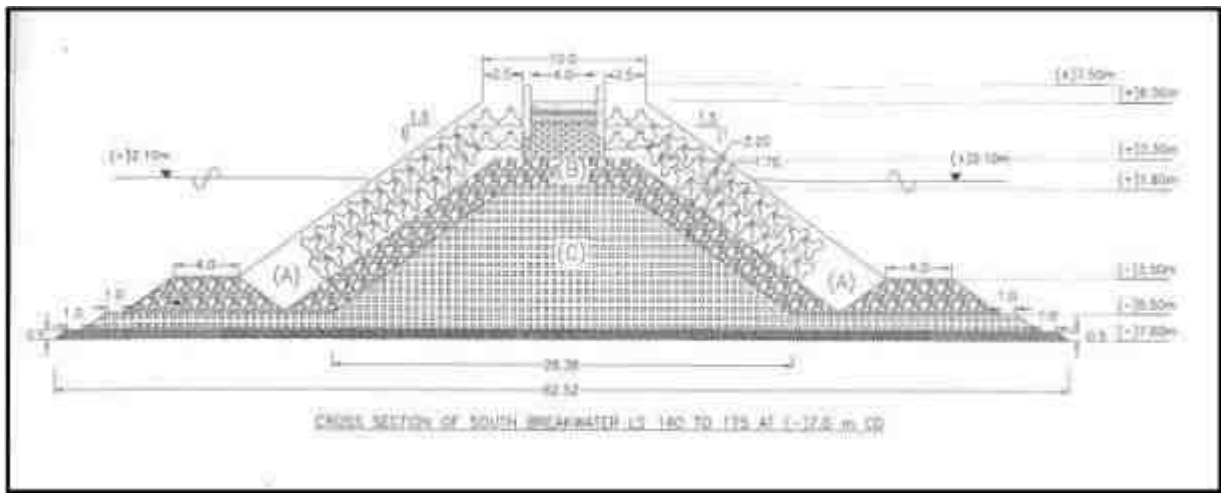


Figure 2-34: Typical Cross Section of Existing Breakwater

2.8.4 Conceptual Layout Planning

For conceptualizing layout plans for the proposed facility, the requirements like cargo handling facilities, operational parameters, etc. have been identified. Based on the above, suitable locations within the proposed port site have been identified where these facilities are to be developed.

The development plan of any port will be based on the facility requirements in terms of number and specifications of berths, channel requirements, cargo handling equipment, storage area required for each type of cargo, road and rail access for the receipt and evacuation of cargo, and other utilities and service facilities. This section deals with the assessment of the facilities required for handling the project traffic at berths and its associated back-up area.

The project envisages the creation of a comprehensive set of port and facilities to ensure efficient operations, compliance with Statutory requirements, and provision of modern logistics services. The proposed facilities include:

- Construction and extension of Berth
- Increase in depth
- Desalination plant
- Effluent treatment plant & Seage treatment plant
- Stacking yards
- Warehouses
- Container Freight Station
- Shipbuilding and repair yard
- Administrative Building
- Amenities & Restrooms
- Internal roads
- High Mast Lighting systems
- Boundary wall

The civil works for the project shall comprise the following facilities and associated utilities, designed for 24x7 port operations and compliant with relevant IS/ IRC/ IEC/IMO/NBC codes and statutory approvals:

- Container cargo
- General cargo
- Liquid storage facilities
- Container Freight Station/ Transit sheds
- Coal/ Bulk/liquid storage

Apart from the above, the port includes adequate space for parking, landscaping, internal roads and admin building. capital dredging across the approach channel, turning circle, and berth pockets, thereby ensuring navigable depth for design vessels.

The berth/wharf length will be extended to 440 meters, which will enable safe berthing of larger vessels and improve operational efficiency. Construction of 540m bulk births.

These enhancements are particularly relevant for the handling of coal carriers, as the deeper draft and longer berth will support Panamax-class and similar design vessels commonly deployed for bulk coal transportation. The improved marine infrastructure will allow the terminal to accommodate higher-capacity vessels, achieve faster turnaround times, and enhance berth productivity.

2.8.4.1 Proposed Layout Plan

The proposed development will consist of material handling area, cargo storage/backup area, operational and utility area, internal connectivity, drainage, greenbelt and buildings etc. The proposed land use for development of Cuddalore port is given in **Table 2-10** and Project layout is shown in **Figure 2-35** and attached as **FD201.**

Table 2-10: Land use Break up

S. No.	Category	Area in Ac.	%
1	Bulk Storage yard	11.07	7.58
2	Container Area	12.31	8.43
3	Multi Storage Yard	7.96	5.45
4	Liquid Storage Area	8.28	5.67
5	CFS Area	1.46	1.00
6	Transit Shed	7.64	5.23
7	Buildings	1.16	0.79
8	Desalination plant	0.02	0.01
9	Common Utility Area	0.69	0.47
10	Parking Area	3.68	2.52
11	Road	17.1	11.71
12	Rail siding area	7.01	4.80
13	Greenery / Landscaping	15.2	10.41
	Total	93.58	
14	Future Development area	18.14	12.40
	Total Port Backup area	111.72	
15	Shipbuilding and Repair area	34.29	23.51

S. No.	Category	Area in Ac.	%
	Grand Total	**146.01**	

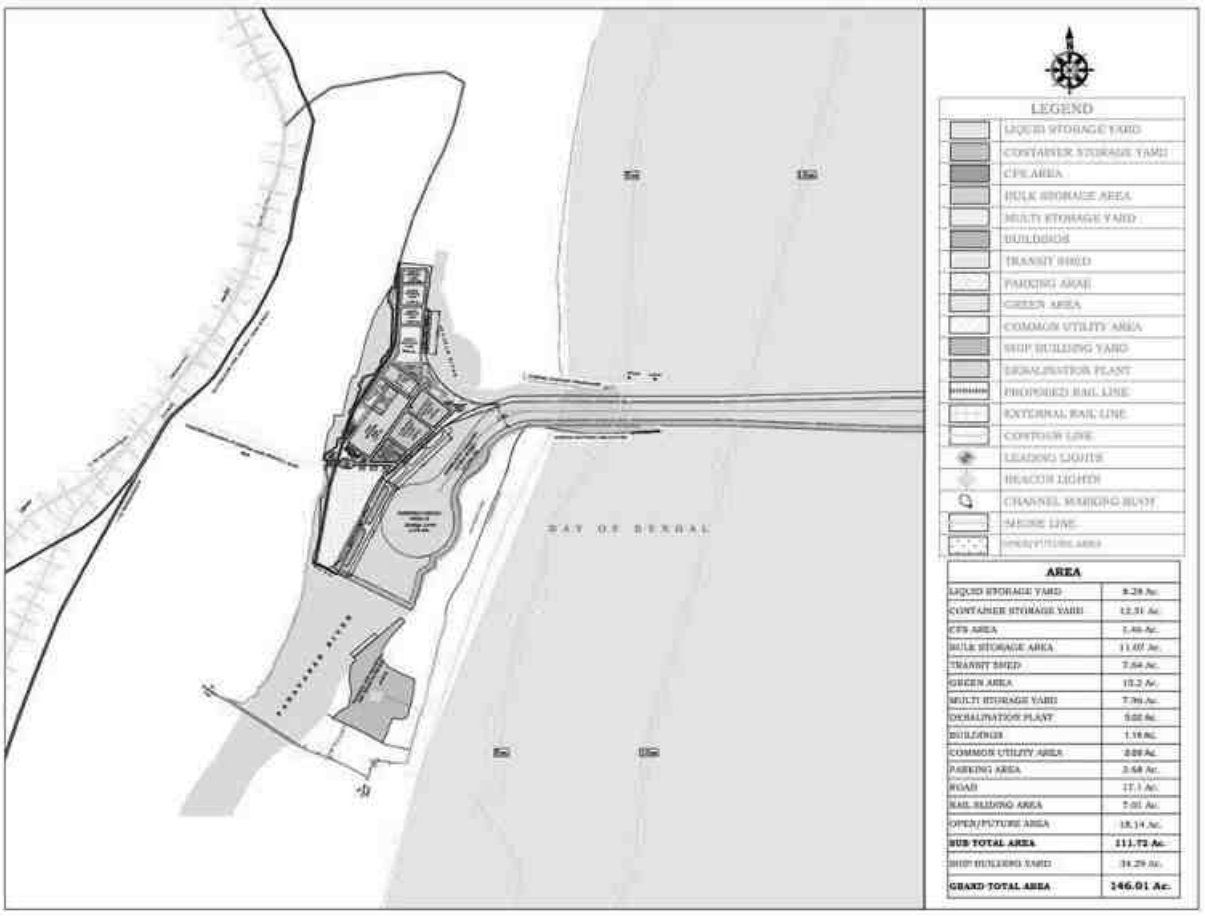


Figure 2-35: Proposed Land use for Port backup and Shipbuilding Areas

Provision for shipbuilding and ship repair facilities has been proposed at Cuddalore Port, with an area of 34.29 Ac. allocated for these facilities.

2.8.5 Design Size vessel

An important aspect of port planning is to determine the types, sizes and numbers of ships that may expected to call the port for shipping forecast traffic. Specialized ships are used for carriage of containers, break bulk, and dry bulk cargos.

The size of ship usually depends on voyage and trade related factors. Considerable reduction in freight rates is possible, using largest vessels. Considering various factors, the likely size of ships calling at Cuddalore Port has been assessed. It is presumed that the Handymax and Panamax type ships will be catered. Typical Vessel Types and Key Parameters are given in **Table 2-11**.

Table 2-11: Typical Vessel Types and Key Parameters

Vessel class	Type	Capacity	LOA (m)	Beam (m)	Typical draft (m)
Handysize	Bulk carrier	10,000 – 40,000 DWT	130 - 180	23-30	9 – 10 (loaded)
Handymax/Supramax	Bulk carrier	40,000-65,000 DWT	180-200	30-32	11-13 (loaded)

Vessel class	Type	Capacity	LOA (m)	Beam (m)	Typical draft (m)
Panamax	Bulk carrier	65,000-80,000 DWT	225 - 245	32.2	13-14 (loaded)
Feeder	Container vessel	up to 1,500 - 2,000 TEU	150-180	23-28	8-10 (operating)

With the existing -11 m CD draft, the port can accommodate Handysize bulk carriers whereas the proposed dredging operation of -16 m CD in inner harbour can handle larger Handymax/Supramax/ Panamax classes.

2.8.6 Multipurpose Cargo Ships

It is difficult to predict the size or type of general cargo ship that will use the port as it depends on what industries establish in the hinterland.

The General cargo commodities such as Fertilizers, Argo Products, Container, Textiles, Cement, Clinkers, Timber, Liquid Cargos and Other are likely to be handled in the ships, which is range of 10,000 DWT to 45,000 DWT.

For Port Planning purpose, it is recommended with a design size of Handymax general cargo. Accordingly, general cargo vessel sizes, ranging from smaller to larger capacities, along with their principal dimensions considered for planning purposes are given in **Table 2-12**.

Table 2-12: Multipurpose Cargo Vessel Sizes

Cargo	Vessel Size (DWT)	Dimensions		
		Length (m)	Beam (m)	Max. Draft (m)
General Cargo Vessel	10,000	100	16	8
	45,000	180	28.4	10.5

2.8.7 Bulk Cargo Ships

A Panamax size vessel is recommended as the ship design. Accordingly, general cargo and bulk cargo ranging from smaller to larger capacities have been considered. Based on this, the design vessel sizes together with their main dimensions considered for planning purposes are given in **Table 2-13**.

Table 2-13: Bulk Cargo Vessel Sizes

Cargo	Vessel Size (DWT)	Dimensions		
		Length (m)	Beam (m)	Max. Draft (m)
General Cargo Vessel	45,000	180	32.0	12.0
Bulk Cargo				
Coal	45,000	180	28.4	10.5
Iron Ore	50,000	180	32.0	12.0
Limestone	40,000	180	30.0	11.0
Coal/Iron/Limstone	65,000	225	32.2	13.0
Coal/Iron/Limstone	80,000	229	32.3	14.5

2.8.8 Container Cargo Ship

Based on the container cargo projects, the maximum vessel size at the port is likely to de driven by the hinterland cargo traffic. The design ship size considered as feeder Max vessel. Based on the above, ship sizes together with their main dimensions considered for planning purposes are given in **Table 2-14**.

Table 2-14: Container Vessel Sizes

Cargo	Capacity (TEUs)	Dimensions		
		Length (m)	Beam (m)	Max. Draft (m)
Feeder	1500	150	22	8.0
Feeder Max	2000	180	28	10.0

2.8.9 Liquid Tankers

The edible oil, chemicals and other liquid cargo are generally handled in small ships of sizes varying 5000 DWT to 30,000 DWT.

Currently, Nearby Ports handles liquid bulk vessels of up to 30,000 DWT. The design parcel size of liquid cargo is less because handling of volatile chemical is difficult and limitation of creek width.

Considering the above, it is proposed that design ship size is up to 30,000 DWT. Based on the above, ship sizes together with their main dimensions considered for planning purposes are given in **Table 2-15**.

Table 2-15: Liquid Tanker Sizes

Cargo	Capacity (TEUs)	Dimensions		
		Length (m)	Beam (m)	Max. Draft (m)
Liquid Tankers	5,000	105	16	6.3
Liquid Tankers	30,000	175	29	9.5

2.8.10 Governing Parameters of Design Ships

2.8.10.1 Range of Ship Sizes

Based on the outcome of ship size analysis for major commodities carried out in the preceding paragraphs, the design ship sizes considered for Cuddalore Port is presented in below.

Table 2-16: Summary of Design Vessels (parcel sizes)

S. No	Commodity	Design Ship Size		Design Vessel dimensions		
		DWT (TEU)		LOA (m)	Beam (m)	Max. Draft(m)
1	Multipurpose Cargo	Min	10,000	100	16	8
		Max	45,000	180	32	12
2	Dry Bulk - Coal	Min	45,000	200	32	12
		Max	80,000	230	32.5	14.3
3	Container	Min	1500	150	23	8.0
		Max	2000	180	28	10.0
4	Liquid Tanker	Min	5000	105	16	6.3
		Max	30,000	175	29	9.5

2.8.10.2 Governing Parameters of Design Ships

Parameters of design ship considered for estimating the navigational requirements (dredging depths, channel widths, safe stopping distance etc.) of the channel and harbour basin for Cuddalore Port, is presented in **Table 2-17**.

Table 2-17: Governing Parameters of design ship

S. No	Commodity	Design Ship Size	Design Vessel dimensions		
		DWT (TEU)	LOA (m)	Beam (m)	Max. Draft(m)
1	Bulk Cargo	80,000	230	32.5	14.3

Conclusion for arriving at coal vessel size:

80,000 DWT / 14.3 m draft design gives lower cost per tonne, fewer ship calls, better attraction for cargo, and is future ready.

2.8.10.3 Operational Time

It is assumed that proposed development facilities will work round the clock, seven days a week. Allowing 15 days weather downtime, the effective number of working days will be 350 days / year, subject to limiting current and tide conditions.

2.8.11 Berth Requirements

The number of berths required is a function of cargo type and volume and the expected cargo handling rates. Certain cargoes can be handled at the same (multi-purpose) berth, while others require dedicated facilities. Other factors that would influence are as given below.

- Vessel sizes and parcel sizes
- Number of operational days per year
- Number of working hours per day
- Time required for peripheral activities and
- Allowable berth occupancy.

The number of berths required to handle the anticipated cargo traffic has been calculated based on parcel size, cargo handling rate, number of berth-days, and optimized berth occupancy. Two Multipurpose cargo berths with additional 200m extension of existing general cargo berth (i.e., 440m quay length) to handle two Handymax vessel and two bulk berths (540m quay length) shall be developed considering the projected traffic of 11.48 MTPA. The detailed evaluation of number of berths required scenario is presented in **Table 2-18**.

Table 2-18: Berth Requirement Scenario

Particulars	Units	MPB -1	MPB-2	Bulk berth (Two no)
Throughput Rate	T/hr (or) Moves/hr	20	200	1200
No. of equipment (Cranes)	m	1	1	2
Equipment availability	%	90%	90%	90%
Other Efficiency	T	95%	95%	95%
Net Working hours per annum	hr	4818	4818	4818
Turnaround Time	hrs	36	30	78

Particulars	Units	MPB -1	MPB-2	Bulk berth (Two no)
Maximum Vessel Calls per annum	Nos	133	160	61
Parcel Size	Tons	5000	5000	70,000
Annual berth Capacity	TPA	13,21,562	16,03,878	85,53,268
Annual berth Capacity	MTPA	1.33	1.60	8.56
No. of Vessel per each berth	Nos	2	2	2
Total	**MTPA**	**11.48**		

2.8.11.1 Time Required for Peripheral Activities

Apart from the time involved in the handling of cargo, additional time will be required for other activities such as the berthing and de-berthing of the vessels, customs clearance, cargo surveys, positioning and hook up of equipment, waiting for clearance to sail, etc. As per industry standards, these activities are assumed to take on an average, 6 (six) hours per vessel call. However, this does not include downtime due to currents and tidal conditions.

2.8.11.2 Allowable Level of Berth Occupancy

Berth occupancy is expressed as the ratio of the total number of days per year that a berth is occupied by a vessel (which includes the time lost in peripheral activities), to the number of port operational days in a year. The berth occupancy percentage is an indication of the time that a vessel calling at the port will have to wait on an average for a berth – higher berth occupancy will entail a longer pre-berthing detention, and lower-level berth occupancy will ensure the least waiting time.

The main consideration while planning the number of berths, is to ensure that the ratio of waiting time to service time is kept at an acceptable level, to avoid paying demurrage. Therefore, 65% of berth occupancy will be maintained.

2.8.12 Berthing Area Dimensions

The size of berthing area and the berth depend upon the dimensions of the largest ship and the number of ships to use the proposed facility. The berth layout is affected by many factors such as given below.

- The size of the port basin for manoeuvring.
- Satisfactory arrival and departure of ships to and from the harbour.
- Whether the ships are equipped with stern and bow thrusters.
- Availability of tugs, direction and magnitude of wind, waves and current.

2.8.12.1 Location and Orientation of Existing & New Berths

Based on the berth requirement presented in previous section, three berths (2-Multipurpose Cargo berths [440m length] & 2- Break Bulk Cargo berths [540 m length to accommodate Handymax vessels]) are proposed alongshore on Paravanar River side. Existing port craft berth of 230x21m will be used for parking tugs, pilot launch and mooring launch.

2.8.12.2 Berth Geometry

The characteristics for the berths are presented below

Berth Length

Berth length depends upon the dimension of the largest design vessel size. Based on the design vessel sizes for dry bulk cargo at Cuddalore Port are presented in **Table 2-19**, the minimum length for berths required calculated as per IS: 4651-2000.

Table 2-19: Required length of Cargo Berths

Vessel Type	Design Vessel Size (DWT)	Overall Length LOA (m)	Minimum Berth Length (m)
Container Vessel	2000 (TEUs)	180	210
Handymax	45,000	180	210
Panamax	80,000	230	270

Deck Top Level

The principal criterion for determining the deck top level of a cargo berth is related to optimum position of the cargo transfer equipment to cater for two extreme situations, i.e. with the largest vessel in light displacement condition at high water and with the smallest vessel fully laden at low water. Based on the Indian Standard IS: 4651 (PartV), the deck elevation should normally be at or above highest highwater spring plus half height of an incident wave at the berth location plus a clearance of 1 m.

The deck elevation for the proposed cargo berths has been fixed at (+) 4.50 m CD. Apron Width Berth Apron is required for the movement of cargo handling equipment for loading and unloading of cargo from the vessel at the berth. The apron should be wide enough to allow cargo handling equipment to be operated efficiently and safely on it.

2.8.12.3 Berth Pocket

Berth pocket is the berthing area for the vessel at the berth. The planning of berth pocket depends upon the dimension of the largest design vessel size. The length and width of the berthing area are planned as per the Indian standard IS: 4651 – 2000 (Part-V) and is presented in **Table 2-20**.

Table 2-20: Required Width and Depth of Berth Pockets

Particulars	Unit	Barges	Handymax	Panamax
Overall Length (LOA) of design vessel	m	120	180	230
Beam (B) of design vessel	m	18	28.4	32.5
Draft (D) of design vessel	m CD	-8	-10.2	-14.3
Length of Berth pocket	m	144	216	276
Width of Berth Pocket	m	21	33	37
Depth at Berth Pocket	m CD	-8.8	-11.3	-15.8

2.8.12.4 Berth Furniture

Berth furniture is used for regular operations and protection of berth, and this includes various components such as Bollards, Fenders, QRMH, ladders, etc. which

is required at the berth to facilities smooth berthing/de-berthing and cargo handling operations.

Bollard

Bollards is a vital component for the mooring of cargo vessels. It is the anchor point for mooring lines to be fixed to secure the vessels and protects the vessel from sway in case of strong wind or current. Existing berth is planned and designed to handle the 10,000 DWT vessel with 40 T bollards. A detailed bollard pull capacity required for each vessel type is provided in **Table 2-21**.

Table 2-21: Required Bollard Line Pull Based on Design Vessel

Vessel Type	Vessel (DWT)	Line Pull (T)
Handymax	45,000	80
Panamax	80,000	100

Larger fitting or corner posts may be installed at the outshore corner of the pier or wharf for handling bow and stern mooring line.

Spacing of bollards may be varied to cater for special conditions. Suitable strengthening of berth would be carried as per IS 4651 if required.

Fenders

Fenders are an integral part of a ship's safety system, designed to reduce shocks to the quay or the hull. They absorb the kinetic energy of the vessel. Fenders shall be installed along the length of the berth. Various types of fenders are as presented below:

- Cone fenders
- Cell fenders
- Pneumatic fenders
- Arch fenders
- Cylindrical fenders
- D type fenders
- Dock corner rubber fenders
- Rubber tyre fenders

Currently, Fender SCN 1400 is installed at the existing Multipurpose berth and shall be sufficient for operational Phase.

2.8.13 Port Craft Berth

Considering the operational requirement of a single channel, the port require 2 Tugs with a bollard pull capacity of about 45T, 1 pilot launch and 1 mooring launch.

All vessel-handling operations inside the port area will be assisted by tugs. The number and capacity of the tugs will depend upon the size of the largest vessel, and number of vessels to be handled. The effect of wind on container vessels is highest. The largest vessel likely to be handled will be a 7000 TEU container vessel. These tugs will be sufficient to handle vessels up to 70000 TEU or 1,50,000 DWT vessels.

Table 2-22: Details of Port Craft requirement

Type of Craft	Nos
45T bollard pull Tugboat	2
Pilot Launch	1
Mooring Launch	1

2.8.14 Harbour Basin and Navigational Channel

2.8.14.1 Harbour Basin

The Harbour basin area is planned in such a way that, there will be minimum hindrance to vessels and berths during maneuvering and operations. The water depth required for the movement of design vessel has been planned based on the largest vessel envisaged at the port, in accordance with IS: 4651 (Part-V). The depth has been worked out as phase-wise development plan and is presented in **Table 2-23**.

Table 2-23: Required Depth of Harbour Basin

Particulars	Units	
Overall Length of Design Vessel (LOA)	m	230
Beam (B)	m	32.5
Draft	m	14.3
Depth of Harbour basin	m	-16.0

2.8.14.2 Turning Circle

The turning circle is one of the most critical aspects required for maneuvering of the cargo vessels. The turning circle for the cargo berths is planned based on the Indian Standard IS: 4651 (Part-V). The specification of the required turning circle for the cargo port is presented in **Table 2-24**.

Table 2-24: Specifications of Turning Circle for Cargo Port

Particulars	Units	
Overall Length of Design Vessel (LOA)	(m)	230
Beam (B)	(m)	32.5
Draft (D)	(m)	14.3
Required Stopping distance for design vessel	(m)	1725
Proposed Stopping distance	(m)	1800
Required width of approach channel (inner harbour – one way movement)	(m)	107
Proposed width of approach channel (inner harbour)	(m)	110
Depth in the entrance channel	(m CD)	(-) 16.0

A channel width of 110 m (bottom width) has been proposed, considering the favourable hydrodynamic conditions in the area and the assistance of tugs and speed control measures to safely accommodate Panamax vessels under all operating conditions. Nevertheless, the adequacy of the proposed width will be validated through detailed ship simulation studies for maneuvering in the channel.

2.8.14.3 Approach Channel (outer channel/Unsheltered)

The navigational/approach channel shall be planned from the required natural water depth up to the mouth of the breakwater. Based on the assessment, the navigational channel begins approximately 5.0 km from the mouth of the harbour basin, where the available water is about 18 m. The specification of approach channel for the cargo berths based on design vessels is presented in **Table 2-25**.

Table 2-25: Specifications of Approach Channel (Unsheltered)

Particulars	Units	
Overall Length of Design Vessel (LOA)	(m)	230
Beam (B)	(m)	32.5
Draft (D)	(m)	14.3
Tentative Length of Navigational / Approach Channel	(m)	5000
Required width of Navigational/Approach channel (for one way movement)	(m)	160
Proposed width of Navigational /Approach channel (for one way movement)	(m)	160
Depth in the Approach channel	(m CD)	-18.0

Considering the number of ship calls, the width of the navigation channel has been planned for one way movement. Based on the IS 4651, the width of one lane channel is specified as five times the beam width, (i.e., 5x32=160). Accordingly, 160m wide navigational channel is proposed for cargo berths. Further, extra widening has been planned at the bends in the navigation channel, as per IS 4651. The distance between north and south breakwater forming the existing opening the harbour entrance is ~ 246 m (considering the safe distance as per IS 4651).

2.8.15 Revetment / Shore Protection

Revetments are generally required to protect the shore from the erosion. The requirement of shore protection work may be finalized with respective to location and type of protection for development through numerical/physical modelling studies.

2.8.16 Navigational Aids

Navigational aids for the harbour are required to be provided to ensure safe and efficient navigation of the vessels to and from the port/harbour. These aids will assist the captains and pilots in determining the position of vessel while transiting the navigational channel and maneuvering inside the harbour. In accordance with IALA guideline the following aids to navigation are proposed.

Both approach channels & turning circle will have (-) 16.0 m CD depth in protected area and approach channel will have (-) 18.0 m CD depth for unprotected area. These areas will be delineated by appropriate navigational aids. Also, it will be quite useful to establish a well-marked navigation line, by installing navigation marks / leading light towers, in the front near the high-water line and at the rear. These marks will distinctly demarcate the channel.

The height and spacing in between the towers must be designed suitably with adequate day marks and night leading lights, fulfilling the navigational needs of vessels approaching the port facility. The following navigational aids are available in existing approach channel.

- Channel marker buoys
- Fairway buoy and Turning circle buoys
- Front and rear leading light
- Berth corner lights

2.8.16.1 Fairway Buoy

Fairway buoy (FB) is proposed at the entry of the outer approach channel. Hence, the vessel calling at port should be able to detect the fairway buoy while approaching the port.

2.8.16.2 Channel Marker Buoys

Channel Marker Buoys are provided along the channel at a spacing of every 1 km along the outer channel and 200m in the harbour.

2.8.16.3 Beacons (Breakwater Lights)

To enhance navigational safety, beacons are proposed at the heads of both breakwaters, clearly delineating the harbour entrance.

2.8.16.4 Leading Lights

The leading lights will be controlled by a sun-switch to ensure that the light operate only during darkness or bad visibility. Power supply will be provided by batteries, to be recharged by solar panel systems mounted on the supporting structure, and / or by power supply from the port distribution system. The battery banks shall be sized to ensure 24 hours continuous operation of the lighting system.

Two leading light towers are planned on the shore, along the direction of approach/navigation channel. These towers shall be placed on the shore in a straight alignment to the navigation channel with approximately 800m to 1000m spacing between them. The front leading light tower, located on the shore, is designed to be 20m high. The second tower, positioned approximately 800-1000m offshore, is currently under engineering assessment to finalize detailed specification for implementation.

2.8.16.5 Vessel Traffic Services (VTS)

For the purposes of improving the safety and efficiency of maritime traffic and protection of marine environment, International Maritime Organization (IMO) has laid down establishment of vessel traffic services at port consistent with the volume of traffic and the degree of risk. In accordance with this and keeping in view the international ship and port facility security (ISPS) requirements of security, it is proposed to make a modest beginning with the establishment of vessel traffic services designed to provide first level of service i.e. Information service,

expandable later to navigational assessment service and traffic organisation service as per the demand of traffic build-up.

2.8.16.6 Outer Anchorage

During the time, when the berth is fully occupied or in bad weather conditions, vessels shall wait at the anchorage area in the open sea. The anchorage area has been planned at a water depth of approximately (-) 18.0 m CD. The diameter of the anchorage area is proposed to be around 1000 m. The distance of anchorage point from the cargo berths is ~5.0 km. Considering the vessel speed to be 6 Knots i.e., 10.8 km/hr., one vessel would be requiring approximately 40 min travel from anchorage to the berth and vice versa.

2.8.17 Dredging and Disposal

Capital dredging will be carried out at proposed berthing & approach channel areas for which quantity is around 5.0 M.cum. The capital dredged material of 2 MCM will be utilised for level raising/reclamation and remaining 3 MCM for beach nourishment towards north of north breakwater and south of south breakwater. Regular maintenance dredging of about 0.237 million Cum will be used for shore protection works/ beach nourishment towards north of north breakwater and south of south breakwater.

2.8.18 Open Storage Area Requirement

2.8.18.1 Container

Ground Slots

A ground spot holds one Twenty-Foot Equivalent Unit (TEU). The dimension of a TEU is 20ft X 8ft = 160 sq. ft., i.e. 14.86 sqm. For ease of operation, avoiding damage to the containers and for safety purposes, some clearance shall be provided between consecutive slots. Hence, as per UNCTAD / industry practice, the area considered to be 17 sqm per ground slot/TEU. Further, considering the smooth operations and the movement of equipment like reach stacker, trailer tractors, an allowance of additional 100% area can be considered.

The containerised cargo is categorised under three (3) major categories i.e., Containers, Reefers, and Empty Containers. Assumptions made for the planning of open storage area for container cargo are presented below:

- Outbound and Inbound cargo volume is contributing about 65% and 35% of the Cargo respectively.
- Reefer containers are contributing 25% of the cargo.
- Expected Empties is considered as 15% of the total traffic.
    - Average dwell time is considered as 7 days for inbound/ outbound, reefers and empty container respectively.
    - The average stacking height for container is considered as 3, whereas for reefers it is considered as 2.

- An additional reserve capacity factor of 1.25 is considered for calculation of number of ground slots for containers, reefers, and empty containers.

The planning of the container storage area has been evaluated based on the following criteria:

- 1.5 times the capacity of largest vessel size expected
- Average throughput per month/ weekly throughput
- Average annual throughput

Based on the above assumptions, the total number of ground slots required for the containers, Reefers and empty containers are presented in **Table 2-26**.

Table 2-26: Ground Slots Requirement for Containerised Cargo

Sl. No.	Particulars	No. of Ground Slots
1	Loaded Containers	610
2	Reefers Containers	283
3	Empty Containers	140

Container Yard Area

Container yard will form the key storage / stacking area where the outbound containers are aggregated prior to dispatch to port / destination, inbound containers shall be stored till customs clearance and where empty containers await onward movement. Likewise, some stacking areas are earmarked for keeping special containers/ reefers. A provision is also made for container stripping/screening station as well as container washing area near the container and reefers storage area.

Considering the ground slots shown in **Table 2-26** above and additional area required for the movement of container handling equipment at the yards, the area required for each type of containerised cargo categories are presented in **Table 2-27**.

Table 2-27: Area Requirement for Container Cargo

Sl. No.	Particulars	Units	Area Requirement
1	Loaded Containers + Empty Containers	Acres	7.37
2	Reefers Containers	Acres	4.90

A typical container storage open yard is shown in **Exhibit 2-7**.

Exhibit 2-7: Typical Image of Container Yard

2.8.18.2 Bulk Cargo Storage Yard

Coal

Storage area is an important interface between the receipt and dispatch of cargo for the efficient operation of a port. It plays a vital role for the following reasons:

- For safe storage of cargoes during its transit time.
- Loading and unloading of the cargo vessels without interruption at the time of arrival of vessels.
- To provide adequate capacity to meet the throughput of respective commodities.
- Additional facilities are proposed to meet the seasonal accelerated arrivals from hinterland or cater to the increased throughput within a shorter span of time.

The area required depends on factors like ship parcel size, ship arrival distribution, hinterland transport distribution and ship loading and unloading rates.

The storage capacity of various commodities is planned based on the maximum of:

- 5 % of the annual cargo throughput
- 15 days storage
- 1.5 times the Average Parcel size

Other Bulk Cargo

The bulk cargo is brought to the port in trailers and unloaded at the yard using heavy duty forklift trucks or mobile cranes. Other export cargo is also brought to the port area in trailers by exporters and are stored in the open storage area.

The port operations are supported by optimal storage arrangement. The major cargo traffic for Bulk berths includes import and export dry bulk cargo, hence, it is planned to be stored in stockpile in open storage area of 11.04 Ac.

Liquid Tanks

The bulk Liquid is unloaded from the tankers by means of marine unloading arms and transferred to the tank farms through the pipelines. The unloading rates mainly

depend upon the capacity of the onboard ships provided the matching capacity of unloading arms and pipelines provided.

The average handling rates achieved at berth for bulk liquid are 6000 TPD and total of 8.24 Ac. of liquid storage has been proposed.

2.8.19 Closed Storage Area Requirements

Cement, Textile, Fertilizers, other general cargo, and agricultural products are proposed to stored together having separate storage space in the same transit shed.

Considering the criteria mentioned in the above section, the total area of transit sheds required for the storage of cement, textiles, fertilizers, other general cargo, and agricultural products has been calculated. The transit time considered for the cargo is 10 days, while the stacking height is assumed to be 4m. Further to the stacking height, there should be a minimum effective clearance of 2 meters between the stacked bags and the roof truss. An inspection area having a width of 1m is planned along the periphery of the transit shed. Two stacks have been proposed to be separated with 5m wide space for the movement of Forklifts and labours within the Transit Shed.

Further, additional space has also provided for the movement of forklifts and cargo inspection space. Considering the above-mentioned criteria, the total transit shed area required is worked out to be 7.59 Ac.

2.8.20 Ship Building and Repair Yard

Provision for shipbuilding and ship repair facilities has been proposed at Cuddalore Port, with an area of 34.29 Ac. allocated for these facilities.

2.8.21 Compound wall and Fencing

To secure the port premises from intruders and squatters, a 1,250-metre-long compound wall is proposed along the landside boundary of Cuddalore Port. It is proposed to provide a compound wall on the landside and wire fencing near the water side to provide security for the cargo berths complex. Provision of compound wall with barbed fencing of approximately 2240 m is proposed for the cargo back-up facility area.

2.8.22 Cargo Handling

The planned facilities are projected to handle annual capacities of 62,00,000 tonnes (bulk), 9,88,800 tonnes (containers), and 12,40,000 tonnes (liquid)[1].

[1] Preparation of Techno Economic Viability Report for Operation and Maintenance of Cuddalore Port by ITCOT limited (Section 4.8.1)

2.8.22.1 Coal Cargo Handling

The mechanized coal handling system has been proposed for 21 Hr/Day operation to achieve the maximum unloading rate. However, the rate at which the transit storage behind the berth could be cleared would govern the average unloading rate to be adopted at these berths. The road connecting stackyard to the berths need to be a two-lane bituminous paved road to allow uninterrupted flow of traffic.

However, in the case of cape size ships a higher average rate was achieved. In addition to berths the following facilities are planned for dedicated coal terminal.

- Sets of Stack Yards for Coal.
- Rail and Truck Loading Facilities Adjacent to the Stack Yards.
- Sufficient capacity unloaders at the berths.
- Sufficient capacity conveyor systems connecting the Berths to the stack Yards.
- Stackers and Reclaimers plus conveyor system inside the Stack Yards.
- Support Back up Infrastructure for operations and maintenance of the Port facilities (Buildings, services, utilities and amenities including Fire Fighting, Dust suppression system, safety and security systems and environment protection measures).
- Electric and Water supply systems, storm drainage and sewage systems.

2.8.22.2 Container Terminals

Container terminals near side of the berths are proposed. Terminal will have paved ground surface and TGS for storage of sufficient numbers of container

Container Terminal, in addition to Quays, shall have the following main elements

- Container yard
- Container rail yard (for ICD operations)
- Workshop
- Administration and operational building complex
- Gate complex
- Separate yards for longstanding, Hazardous and damage containers as well as empties.
- Reefer yard (within container yard)
- Utilities, amenities and bunkering facilities
- Firefighting, security and safety systems
- Communication networks
- Software and supporting hardware for operations of the terminals
- Container handling equipment
- Internal roads etc & Enclosure fencing

Container handling operations shall be designed to meet world class standards and shall be the state- of- the- art. The major equipment for the container terminals will be:

- Mobile harbour Cranes, Cranes capable of servicing 6500 TEU vessels
- Rubber Tyre Gantry Cranes for Container yard operations
- Rail Mounted Gantry Cranes for container rail operations
- Reach stackers
- Forklifts
- ITVs

Each terminal shall have a support rail yard for handling ICD traffic. Each yard shall have 4 lines. The terminals shall have an adequate number of full ground slots including slots for refrigerated containers (Reefers).

The container terminals shall have heavy duty concrete blocks paving and RTGCs shall run on specially designed concrete tracks and Turning pads located at suitable places. The Quay side, Container yards, Container Rail yards, Internal and external roads shall have area lighting, mostly using High masts, ensuring illumination conforming standard norms.

2.8.22.3 Break bulk/General Dry Cargo terminals

It is proposed to have multipurpose terminals to cater cargo demand. The terminal will have an open storage area. This terminal shall be used as a multipurpose facility for dry bulk and miscellaneous cargo, handled in conventional manner. Berth design provides the flexibility for easy conversion of this facility into a container terminal for feeder vessels in the long term, should the market conditions so warrant.

2.8.22.4 Liquid Terminals

It is proposed to have one liquid terminal. The berth shall connect with tank terminal via a Pipe rack running along the break water up to common user manifold. ROW for the Pipe rack shall be 20 m and pipelines shall be on a multi-tier rack. Berth shall be equipped with sufficient loading and unloading arms. It shall also have manifolds for hose connections to serve smaller tankers. Pigging arrangements shall be installed. The berth shall comprise an ensemble of breasting and mooring dolphins and capable of serving designed size tankers. Firefighting, safety, security and alarm systems shall confirm to OISD guidelines and Indian standards.

Quick release, electric driven, remote operated mooring hooks shall be provided for handling emergency situations. Berth shall have standalone firefighting system. All electric fittings shall be flame-proof on Water curtain system and monitors / sprinkles shall be operated from a control room located on Break water side at a suitable distance.

2.8.22.5 Break Bulk Cargo

Mobile Harbour Cranes (MHC) were proposed to handle loading and unloading of cargo to and from vessel at the berth, while reach trackers, forklifts and tractor trailers are proposed for handling the cargo on the landside.

Mobile Harbour Cranes (MHC)

MHCs are used for loading and unloading of cargo to and from the vessel. Four Mobile harbour crane have been planned for loading and unloading of break bulk cargo and container cargo on each berth to cater to the cargo traffic. Based on the industry practice, efficiency of equipment is about 90%. The board specification of Mobile Harbour Crane is provided in **Table 2-28**. A typical Mobile harbour cranes for loading / Unloading operations is presented in **Exhibit 2-8**.

Table 2-28: Specifications of Mobile Harbour Crane

Particulars	Units	Specification
Lifting Capacity	Tonnes	64
Minimum Outreach	m	8
Maximum Outreach	m	35
Design handling rate	TPH	800 (Bulk Cargo)
Container Rows Max	No.	11

Exhibit 2-8: Mobile Harbour Cranes (MHC) with Grab and Spreader Fittings Forklifts

Forklifts

Forklifts are used for the movement of the break bulk cargo between the transit shed/warehouses/open storage. For handling the anticipated breakbulk cargo traffic, 5 no. of forklift of 5T – 10T capacity are being proposed based on cargo demand. A typical image of Forklift is presented in **Exhibit 2-9**.

Exhibit 2-9: A typical Forklift for handling Break Bulk Cargo

Tractor Trailer

Tractor trailer shall be used for the movement of break bulk cargo from one place to another within the cargo backup area. 5 number of Tractor-trailers have been proposed. However, if any additional requirements of tractor trailers arise due to increase in traffic, the same can be deployed suitably (can be purchased or leased)

At the transit shed, forklift shall be utilised for the transfer of bagged cargo from the transit sheds to the trucks/tractor trailers, which can used for the movement of cargo to/from the cargo berths.

Reach Stacker

Reach Stackers are proposed to stack the containers in one over another in layers. Considering the project requirement, two (2) number of reach stacker have been planned. However, if any additional requirements of reach stacker arise due to increase in traffic, the same can be deployed suitably (can be purchased or leased). The proposed reach stacker is planned to stack the containers up to four stacking heights. The image of typical reach stackers is shown in **Exhibit 2-10**.

Exhibit 2-10: Typical Reach Stackers for stacking Container Cargo

Bulk Cargo

Mobile Harbour Cranes (MHC) is proposed for handle loading and unloading of cargo to and from vessel at the berth using, while and tipper trailers are proposed for handling the cargo on the landside.

Mobile Harbour Crane (MHC)

Mobile Harbour Cranes (MHC) are used for both loading and unloading of cargo to and from the vessel. MHCs can be equipped with various kinds of lifting components such as grab, hooks etc. Multiple combinations of MHCs are used are assessed for understanding the berth utilization / occupancy. The mobile harbour cranes (MHCs) assessed for General Cargo are of 1200 TPH for Initial Phase. The broad specification is provided in **Table 2-29**. Typical image of MHC during bulk cargo handling is presented in **Exhibit 2-11**.

Table 2-29: Specification of Mobile Harbour Cranes (MHC)

Particulars	Units	Specification
Lifting Capacity	Tonnes	84
Minimum Outreach	m	10
Maximum Outreach	m	40
Design handling rate	TPH	1200

Exhibit 2-11: Typical Bulk Cargo Unloading Cranes

Mobile Hopper

Mobile Hopper is used at the berths to receive bulk material from the mobile harbour cranes (MHC) grab and transfer the cargo on the truck or belt conveyor for the movement of cargo from the berth to the stockyard. Each MHC is provided with one mobile hopper for discharging of cargo and its moves along with MHC during the operation. A mobile hopper with a storage capacity of 250 tonnes has been envisaged to ensure smooth cargo handling. A typical mobile hopper for bulk cargo handling is shown in **Exhibit 2-12**.

Exhibit 2-12: Typical Image of Mobile Hopper

Berth Conveyor Belt

The conveyor system is designed with the view to standardizing / modernizing the components as much as possible without much human intervention. The berth conveyor belt is an intermediate conveyor system placed parallel to the berth

which is used to receive import cargo from the MHC through the mobile hopper and transfers the cargo to the yard conveyor belt. The main conveyor belt moves the cargo from the berth to the stockyard.

The design capacity of the conveyor system shall be 20% to 30% higher than the rate capacity of the feeding equipment such as MHC and mobile hopper, to cater to the surges associated with unloading operations.

Transfer Tower at berth

Transfer tower works as a junction between the berth conveyor system and main conveyor system for transferring the cargo from one belt of berth conveyor system to another conveyor belt of main conveyor system. This is made up of steel structures supported on concrete structure.

Transfer Towers

Transfer towers work as an interchange between transfer of bulk cargo from one conveyor belt to another, when two conveyors meet or when the conveyor needs to make a turn. These towers are made up of steel structures supported on RCC foundation / substructure. A typical transfer tower is presented **Exhibit 2-13**.

Exhibit 2-13: Typical image Transfer Tower

Stacker cum Reclaimer

Stacker cum reclaimers is equipment used to pile the cargo from the conveyor belt at the stockyard as stockpile or picking and loading of cargo from the stockyard on to the conveyor system. It is designed to operate on rail track running for adequate length to cover the entire stockyard. The rated capacity of the stacker cum reclaimer shall be matching with the design capacity of the ship loading / unloading rate.

Based on the MHC & conveyor belt requirement, stacker cum reclaimer shall be planned for the handling the cargo at the stockyard. A typical stacker cum reclaimer is presented in **Exhibit 2-14**.

Exhibit 2-14: Typical Image of Stacker cum Reclaimer

Tipper Trucks

Tipper trucks are used for cargo collection from the Mobile Harbour Crane (MHC) through mobile hopper and transfer the cargo to the stockyard or directly to the storage of the end importer. It is also used for moving the cargo from the stockyard to the intermediate backup area near the berth in case of manual mechanization scheme for handling export cargo. The tipper trucks are also used in the truck loading station (if installed in the backup area) to collect the cargo and transport it to end user. A typical tipper truck is presented in **Exhibit 2-15**.

Exhibit 2-15: Typical Image of Tipper Truck

Wheel Loader

Wheel loader, commonly known as payloader, is required at the stockyard for loading of bulk materials on to the trucks, which further moves the export cargo to the intermediate stockyard at berth for the loading operation, and vice-versa. Wheel loaders will also be utilized for the stockpiling during the manual mechanization scheme. A typical wheel loader is presented in **Exhibit 2-16**.

Exhibit 2-16: Typical Image of Wheel Loader

Baby Dozers

A baby dozer (also called a crawler) is a motorized machine equipped with a metal blade to the front for pushing material: soil, dry bulk cargo in the yard. During the unloading operation of the bulk material from the vessel, as the hatch gets emptied, the remaining cargo is to be heaped at one place by a baby dozer to be lowered into the hatch. The baby dozer moves around shifting the scattered coal into a heap sufficient for the grab to bite into and lift. A typical baby dozer is presented in **Exhibit 2-17**.

Exhibit 2-17: Typical Image of Baby Dozers

Excavator

Excavators are heavy equipment consisting of a boom, dipper, bucket, and cab on a rotating platform known as the "house". The house sits atop an undercarriage with tracks or wheels. This is used to excavate the cargo in the yard, lifting of heavy equipment parts inside the yard, loading of cargo into dumber trucks etc. A typical excavator is presented in **Exhibit 2-18**.

Exhibit 2-18: Typical Image of Excavator

2.8.22.6 Liquid Cargo Handling

Liquid cargo is generally handled by small ships, with sizes up to 10,000 DWT. The cargo is proposed to be unloaded at the existing multipurpose berth through a pipeline system and handled using unloading Hoses.

The Existing berth is designed to handle vessels up to 10,000 DWT. To accommodate bigger parcel vessels, the Client must strengthen the existing berth as per IS 4651.

Liquid discharge is assumed to be via flexible hose and ships pump at sufficient capacity. Pumping rates are assumed to grow with vessel sizes so that a typical time alongside is not more.

Proposed Facilities

The proposed facilities include the following plant and machinery:

Description	Quantity	Capacity
Container crane	1	40 tonnes
Transfer crane	1	40 tonnes
Forklift truck	1	40 tonnes
Conveyors, loading / unloading systems		1,000-2,000 TPH
Desalination plant	1	100
Effluent Treatment Plant	1	25 KLD
ISPS equipment	1	-
Mobile harbour crane (Tyre mounted)	1	100 - 124 tonnes
Tug	2	45 tonnes
Patrol / Pilot / mooring Launch	1	-
Fire Fighting systems	1	-
Sprinkler systems	1	-
Payloaders	5	3 tonnes
Transfer truck	1	25 tonnes

2.8.23 Buildings

2.8.23.1 Port Administrative Building

Administrative office is necessary for the management and maintenance of harbour facilities, for regulating activities relating to cargo industry such as container/break bulk cargo in and out of the harbour. Administrative officer along

with his supporting staff is expected to work from this office to look after the day-to-day activities. The Cargo administrative office provides for staff rooms, record room, toilet etc. If additional building area is required at a later stage, additional floors may be added.

2.8.23.2 Customs Office

Customs office is proposed to provide a workplace of customs officers and support staff. An exclusive customs office workplace will be provided.

2.8.23.3 Canteen

Canteen is proposed in the cargo harbour premises to provide refreshment and food for the port staff and visitors. The proposed restaurant is planned with kitchen, store, and other provision for public conveniences like wash basins, water closet/urinals etc.

2.8.23.4 Port Maintenance Workshop

A maintenance workshop is proposed near the berthing structure. This workshop is required to cater for the repairs of yard equipment and to store various machinery, tools and consumables associated port facility management.

2.8.23.5 Gate Complex Building

Gate complex building is proposed to accommodate port security staff and port entry/exit records. The proposed building is two storey building, in which ground floors are planned for public access to obtain entry/exit permits first floor is to accommodate security staff. An external parking area is also planned near the gate complex building outside the compound wall, which facilitates workers to collect their gate pass before entering to the port premise.

2.8.23.6 Security / Guard House

Security/guard house is provided to accommodate the security staff to check the entry and exit of vehicles and visitors entering Cargo port. One guard house is proposed at the entry and exit gate of the Cargo land side facility complex.

2.8.23.7 Port Operation Building

An efficient and effective operation of a cargo terminal requires the provision of reliable and adequate communication facilities. Communication is usually required between the outside world and the terminal, within the terminal and between the authority personnel and the terminal operators for navigational support. The efficiency of cargo terminal operations depends on a speedy flow of information between the key personnel who are directly involved in handling of cargo. A radio communication system shall be developed to manage the flow of information between the personnel involved in the following operations:

- Ship working duties
- Quay cranes and mobile equipment operations

- Shore side duties
- Control office
- Terminal engineering services

For Effective operations management and supervision through a reliable radio communication network, the terminal is divided into the following three organisational segments, each requiring dedicated radio channel(s):

- Ship work.
- Quay and Stack work.
- Control (base station).

The system will need to reflect the importance of establishing and maintaining contact between the following areas of operation:

- Ship and crane.
- Ship and quay / stack.
- Ship and base station.
- Base station and engineers.
- Engineers and supervisors.
- Supervisors and all foremen, ship, and quay / stack.
- Base station and supervisors.
- Management and supervisors.
- Management and base station.

In planning the radio communication system, it is essential that the installations can be readily expanded in response to the future growth of the terminal.

2.8.23.8 Port Berth Control Room

Port berth control room is proposed to accommodate the quay staff supervisors and to maintain vessel records.

2.8.23.9 Utilities Services to Vessels

Utility building near the quay is proposed to house the staff and records to coordinate/organise the required bunkering services to the vessels.

2.8.23.10Public Toilets

From the sanitation point of view and essentially for maintaining a cleaner cargo harbour, adequate lavatories, urinals and washing facilities need to be provided near places where people tend to concentrate in large numbers. For this purpose, public toilet blocks of 2x67.7 Sq.m each, are proposed. The interior details of the toilet block shall be modelled to operate on pay and use basis so that toilets are managed and maintained in a clean and hygienic manner. The toilet provides for public conveniences like lavatories, urinals and washing facilities to both sections of ladies and gents.

2.8.24 Internal Roads

The approach road leading to the Container Terminal, Dry Bulk, Liquid Terminals will be constructed with provision of future widening of these roads.

2.8.24.1 Road Structure

The approach roads to the Container terminal and dry bulk, liquid bulk terminal area are designed taking into consideration the density of traffic and the wheel pressure of the tractor trailers, tankers, trucks, etc. All roads are designed to IRC class A.

2.8.24.2 Maintenance of Road

Road maintenance work is to be carried out as per IRC Code 82-1982. The Maintenance work will involve following tasks.

- Restoration of rain cuts
- Maintenance of earthen shoulders
- Maintenance and Repairs work in connection with Bituminous work viz Filling potholes and patch repairs, Fog seal, Crack fill, resurfacing of carriageway, etc.

However, major maintenance by resurfacing the carriageway will be required every 5 years.

2.8.25 Shipbuilding and Repairing Facilities

Shipping related initiatives focus on growing sectors related to ship building, recycling & repair as well as growing India's global stature as a maritime power. Several initiatives have also been identified to grow Indian flagged fleet, number of Indian seafarers through quality maritime education as well as supporting growth of nascent sectors like cruise tourism in the country.

Shipbuilding is a strategic industry that underpins national economic development, maritime security, and industrial growth. Often referred to as the "mother industry" for heavy engineering, shipbuilding has strong forward and backward linkages with sectors such as steel, electronics, logistics, and marine equipment manufacturing. Its multiplier effect on employment and industrial output makes it a cornerstone of coastal and regional development.

MIV 2030 has identified domestic demand channelization for ship building; development of common platforms for ancillary and marine design ecosystem; creation of ship repair clusters; and, promoting waste to wealth through increased scrap usage in Steel industry as key interventions to enhance the country's market share.

As part of Vision 2030, key targets have been defined to promote domestic ship building, repair and recycling. India needs to channelize domestic demand for ship building and ship repair leveraging Atmanirbhar PPP provisions and RoFR rules effectively. Also, ship repair clusters to be developed for enhancing repair capacity in India. India's ship recycling sector to be promoted through modification of BIS

regulations, re-development of ship recycling infrastructure at Alang, and creation of a ship recycling cluster on the East Coast.

Shipbuilding is not just an industrial activity it is a strategic imperative. It supports economic independence, enhances national security, creates employment, and enables India to assert its presence in global maritime trade. With the right policy support, infrastructure investment, and stakeholder collaboration, India can transform its shipbuilding industry into a pillar of Viksit Bharat 2047.

Shipbuilding and ship repair facility at Cuddalore port will support the port itself, as coastal vessels, tugs, dredgers, and barges require regular maintenance.

2.8.25.1 Ship Building

Global ship building market is estimated to be approx. USD 70 Billion, primarily dominated by China, South Korea and Japan currently. Ship building industry has been going through an extended global downturn for the past few years, with world's leading shipyards facing financial troubles due to lack of orders. With IMO 2020 Sulphur regulations and world fleet renewals, the global shipbuilding prospects have seen modest recovery. It is expected that these regulations will create significant technology requirements for both new and existing ships, leading to a positive effect for suppliers and shipyards.

Added demand for the replacement of old ships, given that the average age of ships in the region is high and this is a positive indicator of a demand increase. Also, there are additional opportunities such as offshore support vessels, which are currently providing significant work for yards in the region.

Ship building is a manufacturing industry endowed with the unique feature of having nearly 65 percent value addition coming from other technology/ancillary industries such as steel, electronics, engineering, port infrastructure, etc. Being an order driven industry where each vessel is custom built, building an orderbook is essential for growth and sustenance of the shipbuilding industry.

Channelizing domestic demand for Indian shipbuilding leveraging Atmanirbhar Bharat PPP provisions and minimizing ship-building cost by focusing on labour productivity, materials and financing costs.

Ship construction is a complex activity. Fabrication in shipbuilding faces essential requirements from a quality point of view. The advancements in technology and improved planning have enabled the construction of vessels in modules that already incorporate integrated utilities and systems. As a result, these modules can be interconnected with relative ease.

This approach offers numerous benefits, including faster construction timelines, cost savings, and enhanced quality control (**Figure 2-36**).

A target of 20 vessels upto 50,000 DWT capacity per annum is envisaged in the present proposal.

Generally, shipbuilding falls under the classification of an assembly-based industry and can be divided into three main components:

Steelwork: This involves the pre-construction, assembly, and erection of the steel construction of the ship.

Steel Fabrication includes the cutting, welding (Fusion welding, In electric arc welding, Submerged arc welding (SAW), Gas metal arc welding (GMAW), Gas tungsten arc welding (GTAW), Flux core arc welding (FCAW), Plasma-arc welding (PAW), Gas welding, brazing and soldering), Painting and Finish Coating.

Outfit: The primary emphasis is placed on the installation of diverse systems, equipment, and fixtures within the ship.

Outfitting at each stage of construction is planned to make the process flow smoothly throughout the shipyard. For simplicity, outfitting can be divided into three main stages of construction once the steel structure of the block has been assembled:

- Unit outfitting
- On-block outfitting
- On-board outfitting

Testing: Most system testing and operations occur while the ship is docked at pier side. Once all preliminary pier side testing is performed, the ship is sent to sea for a series of fully operational tests and sea trials before the ship is delivered.

The shipbuilding process can be divided into five broad manufacturing stages:

- **Raw Material Transformation:** At this initial level, raw materials such as steel bars, steel plates, sheet metal, pipes, and electrical components are transformed into individual parts.
- **Subsection and Sub-Assembly:** The next level of the process entails the assembly and connection of these individual components and steel elements to form subsections and sub-assemblies. This includes the integration of steel, electrical components, piping, ventilation systems, and outfitting elements.
- **Hull Blocks or Units:** The third manufacturing level results in the formation of hull blocks or units, which are larger assemblies composed of the previously created subsections and sub-assemblies.
- **Erection:** In the fourth stage, the hull blocks or units are conveyed within the shipyard and assembled onboard to form the complete ship.
- **Final Installation and Completion:** The fifth and final stage of shipbuilding involves the installation, completion, and trial of internal systems and mechanisms. This critical phase ensures that all the required components are properly installed and operational, ensuring the ship is ready for delivery to the owner.

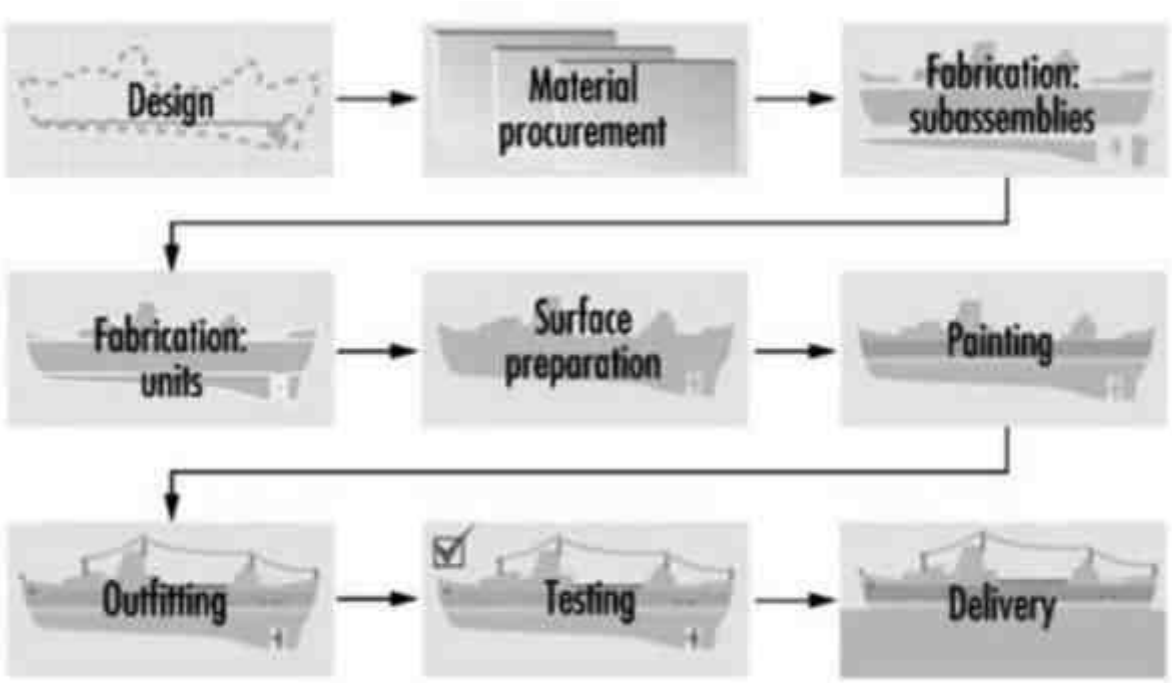


Figure 2-36: Shipbuilding flow chart

2.8.25.2 Ship Repair Yard

Ship repair is a location-dependent business. Ships tend to repair close to their operating routes to avoid expensive deviations, and location in relation to the available market is of paramount importance.

Global ship repair market is approx. USD 12 billion. Shipyards in China, Singapore, Bahrain, Dubai and Middle East account for a major share of this market. These locations have achieved a dominant position despite higher cost of ship repair services compared to other Asian counties, largely due to the availability of a skilled workforce and the latest technology which allows these shipyards to attract demand from other low-cost locations like India, Malaysia and Indonesia.

Every ship after construction requires periodic maintenance to maintain its fitness to trade. This keeps the ship repair industry afloat with lots of opportunities. Channelizing domestic demand for Indian repair leveraging Atmanirbhar Bharat PPP provisions, RoFR rules, and development of ship repair clusters.

Rise in number of industries especially in Tamil Nadu is expected to attract more vessels to Indian coast As a part of the Indian Navy expanding their fleet, more vessels are expected to be constructed which will boost Indian shipyards The industry expects a massive policy initiative from the government for developing ancillaries to ship building and ship repair industry so that it could trigger a high growth in the Indian industrial sector.

Provision for shipbuilding and ship repair facilities has been proposed at Cuddalore Port, with an area of 34.29 acres allocated for these facilities. Due to the strategic location of the Cuddalore, it is anticipated that the new ship repair yard will attract ship repair contracts. Throughput for ship repair is measured by the number of

scheduled vessel dry dockings that the shipyard handles per annum. The following Ship docking facilities are ideal for the ship repair yards

- Small dry docks to dock ships, medium dry docks to target vessels larger than 10000 DWT
- Minimum draft near the docks to be maintained as per the requirements of vessels coming for repair
- Warehousing facilities to meet needs of the repair facilities
- Ship Repair Equipment and Cranes

The opportunity for Cuddalore lies in the general international/national commercial sector & the niche international/national market for the shipyard is the mid-size sector of Handy to Panamax size plus a local market share of small ships size of up to 150 m length. In the long term, further capacity could be considered if the yard is highly successful, taking the Handy and Panamax annual total above 20 dockings per annum for the vessels up to 50,000 DWT capacity.

Ship building and ship repair the facilities of the shipyard shall comprise:

- Shipbuilding jetty shall have the capacity accommodate Handysize ships up to 210 m long
- Spillway to accommodate Handymax and small ships.
- The dredged depth required for the ships within the harbour is -8m CD to -11.0 mCD. Marine access to the shipyard marine facilities shall be from the navigation channel to the harbour through the manoeuvring area. Facilities for repair and launching new small ships
- Ship repair with capacity up to Panamax ship size

Ship repair process

Process Name	Activity
Docking	The process of lifting or placing a ship to be repaired
Ship Cleaning	The process of cleaning the ship from barnacles, rust and etc.
Ship Repair	The process of checking the damaged parts, repair and replacement (cutting porous parts and replacing them with new ones), welding.
Smoothing	Grinding process results from welding and rust cleaning with a blasting process
Machine maintenance and repair	Process or repair work of ship engines and equipment on board
Repair of electronic devices	The process of repairing electrical devices, cables and etc
Painting	The process of painting the walls of the ship
Launching	After the entire process is complete, the ship launches into the sea and tests

2.8.25.3 Shipbuilding Fire Safety

The shipyard firefighting system will comply with international and local regulations. The firefighting strategy to be adopted for the shipyard should be in accordance with the NFPA Codes of Practice. The most applicable standard is NFPA 307 which is the "Standard for the Construction and Fire Protection of Marine Terminals Piers and Wharves" - 2021 Edition. This code is supported by NFPA 20, 14, 22, 24 and 307

and associated standards. The firefighting system at each location shall comprise one main fire pump, one standby fire pump and one jockey pump. The main pumps would be electrically driven vertical turbine pumps.

2.8.26 Amenities/Facilities

2.8.26.1 Communications & Automation Facilities

Provisions will be made in the civil works for the installation of fibre optic data and telephone cables by the installation of ducts and draw pits to allow connection between the operation area, administration building, the gate house, Customs, and all other major installations. In general duct runs for data cables will follow the main service routes.

The Automation system at the port will be designed for controlling and safety of the port facilities. Dedicated control rooms are proposed in Material Handling facilities, container terminal facility and overall port operation center, which will be designed to monitor and controlling the process, utility, jetty, fire and other port operational area as per OISD & Port guidelines.

Port Operation related automation like Fuel Management system, Port Information Management system, GPS, Tugs, RTGs and Dredger Fleet Management System will be provided.

2.8.26.2 Water Supply

Water supply planned for existing port will be extended to cater to proposed facilities covering the following.

- Potable water for domestic consumption
- Potable water for ships calling at the port
- Water for dust suppression system
- Water for fire fighting
- Water for greenery

Water required during construction activity will be met through the bowsers and existing water supply system. Water requirement during construction activity will be ~50 KLD. Water requirement during operation phase will be ~100 KLD. Water shall be sourced from approved 100 KLD Desalination plant which is yet to be developed. The estimated water requirement for Cuddalore Port during operation period is given in **Table 2-30**.

Table 2-30: Water Requirement

S. No	Particulars	Water Requirement in KLD
1	Port Domestic demand	4.0
2	Fire Water	6.0
3	Ship Supply	25.0
4	Gardening/Landscaping & Miscellaneous	22.5
5	Sprinkler System & Tank washing	27.5
6	Dust Suppression	15.0
Total		100.0

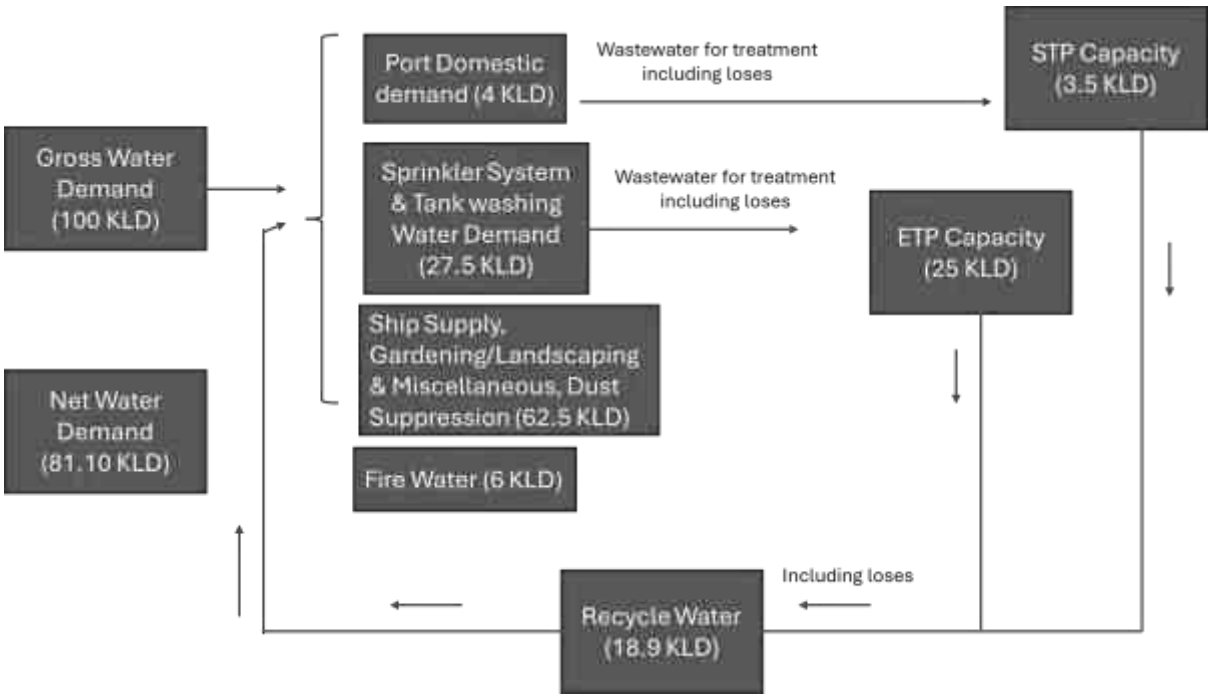


Figure 2-37: Water Balance

2.8.26.3 Desalination Plant

Environmental Clearence was accorded previously to develop desalination Plant with a capacity of 100 KLD to meet the freshwater demand to the consumers within the port backup area and downstream users. Sea water intake of 222 KLD and reject brine of 122 KLD will be discharged through marine outfall identified through model studies. Desalination plant will be developed in the port backup area as per the accorded EC & CRZ clearance through vide File no. 10-35/2017-IA-III dated August 20, 2020.

2.8.26.4 Power Supply

The power distribution system planned is simple to operate and maintain high reliability, being accessible for inspection and repair with safety.

The designing of the electrical distribution system ensures that the Voltage at the utilization equipment is maintained within the tolerance limits under all load conditions since poor voltage regulation is detrimental to the life and operation of the equipment. Power required for port expansion during construction phase will be sourced from existing port MRSS or through nearby Substation.

The electric power requirement during construction phase will be ~1 MVA which will be sourced from the existing power source and during the operation phase, the power requirement will be around 4.338 MVA (4338 KVA) and will be sourced from the existing Substation. The power back up in the form of DG sets will be available to the tune of 1.5 MVA to 2.0 MVA.

Table 2-31: Power Availability

S. No	Particulars	Connected Load (kW)
1	Bulk Berth – Electric MHC	750

S. No	Particulars	Connected Load (kW)
2	Container Berth – Electric MHC	750
3	Liquid Berth – Transfer Pump	300
4	Fire Water – 1 Electric Duty + Jockey	400
5	Reefer Bank – 50 plugs × 7 kW	350
6	Yard & Wharf Lighting (LED)	400
7	Office & Admin Facilities	120
8	IT/Communication Systems	50
9	Security Systems	30
10	Navigation/Jetty Utilities	70
11	Workshops & Maintenance Utilities	150
12	Miscellaneous/Standby Loads	100
	Total	3470
	In KVA	4338

Considering the connected load requirements, it is proposed to install a 5000 KVA transformer for meeting the port's primary power demand. As a backup arrangement, 3000 KVA diesel generator sets are planned to ensure uninterrupted supply during outages and to cater to peak load conditions.

2.8.26.5 Dust Suppression System

Storage and handling of Coal, Iron ore and other dry bulk cargo berth and stockyard. An efficient dust suppression system will contain dust particles before it is airborne.

A common system consisting of suitable pump, storage tank, nozzles for dust suppression at discharge / feeding points of belt conveyors have been proposed at each transfer tower for efficient dust control system. In addition to above suitable spray system shall also be provided at ship unloader, stockyards & wagon loading station. Dust control is envisaged at the following locations.

- Ship unloader discharging into hoppers
- Stockyards
- Discharge and feeding points of conveyors
- Rapid loading system
- Sprinklers / nozzles will be provided to control dust emission at various points or areas

2.8.26.6 Solid Waste Management

Most of the waste likely to be generated at the port is bio-degradable type like road sweepings, food waste etc., and subjected to composting for use as manure for green belt within the port. The anticipated municipal solid waste generation during construction phase is ~0.13 TPD and during operation phase is ~0.06 TPD of which 60% will be bio-degradable and 40% will be non-biodegradables.

A well-established Integrated Waste Management system shall be implemented and all wastes are being handled inline to 5R principle (Reduce, Reuse, Reprocess, Recycle & Recover).

All the wastes (non-hazardous and hazardous) generated from the port activities are collected, segregated and stored.

Non-Hazardous Waste Management

All types of non-hazardous wastes like paper, wood, metal scraps, etc., generated from port area will be handled, stored, and disposed thorough vendors in line with 5R principle. The method of non-hazardous waste disposal is presented below.

Type of Waste	Method of Disposal
Dry Waste (Paper, Plastic, Meta waste, etc.)	• Material recovery • Sent for Recycling
Wet Waste (Food Waste)	Reprocess
Solid waste Dry and Wet	Dry and Wet Waste separately for material recovery and composting respectively.

Hazardous & Other Waste Management

Hazardous wastes that include used oil and filters contaminated with oil. Used oil and the filters contaminated with oil generated during various maintenance activities are collected in barrels and kept in Integrated Waste Management Shed and are disposed through TNPCB authorized recyclers in line to Hazardous & other wastes (management &transboundary) Rules 2016, (as amended).

Used oil is mainly generated from Rubber tyred gantry cranes and diesel generators. Used oils are collected and stored in barrels and are being mechanically processed to recover oil at TNPCB authorized recyclers facility. It is estimated that hazardous waste generation will be ~1.0 TPD during construction and ~4.36 TPD during the operational phases.

Other hazardous wastes such as used batteries and E–waste are also stored in Integrated Waste Management Shed and disposed through approved vendor in line to 5 R principle.

All types of hazardous wastes generated from port operation and maintenance activity are being handled, stored and disposed as follows:

Type of Waste	Method of Disposal
Oil Contaminated Cotton Waste	Disposed to authorized recycler
Used Oil	Disposed to authorized Recycler
E-Waste	Sold to Registered recycler / reprocessor
Battery Waste	Sold to Registered recycler / reprocessor
Bio Medical Waste	Sent to Common Bio-medical Waste Treatment Facility (CBWTF) for scientific disposal

Used oil, spent oil, Wastes/Residue containing oil, Oil-soaked rags, Cotton waste, discarded containers, barrels & Used Battery and Sludge from ETP will be collected and disposed to approved vendors and same will be continued to proposed project.

Reuse/disposal/management of waste shall be as under: -

- Construction wastes and road sweepings, dust, would be used for land fill
- Food waste would be recycled as compost
- Non-biodegradable (plastic waste, used oils) wastes shall be disposed through TNPCB authorized vendors
- Used batteries shall be disposed by insisting on buy back while procuring.

- Cargo spillages shall be collected and same shall be returned to storage yards.
- Treated water from ETP/STP will be recycled for plantation and dust suppression purposes and sludge generated from STP shall be used as manure.

The nearest designated Common Hazardous Waste Treatment Storage & Disposal Facility is at Gummidipoondi, Thiruvallur Dist., Tamil Nadu.

2.8.26.7 Wastewater Management

2.8.26.7.1 Storm Water Management and Treatment

The water used for dust suppression at bulk yard area in the conveyor transfer points and the stockyards will get absorbed to the extent of the property of the material and remaining water will be collected through proper drainage. During the rainy season the rainwater over vast stockyard area will also to be collected. For this purpose, the stockyard ground level will be provided with a slope from the center to the sides.

For collecting water draining out of the stockyards RCC toe drains will be constructed along the length of each row and interconnected to finally lead it to a settlement pond. Concrete settling ponds will be constructed. Lime will be added to the settling pond for neutralization, if any in the runoff from the stockyard. The settled materials will be retrieved and sent back to respective cargo stockyard. The supernatant water will be further reused for dust suppression.

For all the storm water drain parallel to road will also get connected to the main drainage system and discharged into the sea.

2.8.26.7.2 Sewage and Effluent Treatment

The sewage and effluent generated from office buildings, work shops, toilet blocks, canteens, liquid tank washing etc. will be treated in Sewage treatment plant and effluent treatment plant respectively. Wastewater treatment facilities such as Sewage Treatment Plant (STP), Effluent Treatment Plant (ETP) will be developed based on the requirements and locations will be identified during the detailed design stage. All the STP & ETP will be developed in the operation area. The treated water will be used for irrigating greenbelt development.

Domestic wastewater generation will be 3.2 KLD which will be treated in 3.5 KLD STP and effluent generation will be 22.0 KLD which will be treated in 25 KLD ETP.

Sewage Treatment Plant

Sewage generation of ~3.2 KLD is envisaged and STP of Sequencing Batch Reactor (SBR) Sewage Treatment Plant (STP) Technology shall be proposed designed to treat sewage water with influent characteristics. STP shall be designed to treat effluent cum sewage generated having the following characteristics.

Influent Sewage Parameters

- BOD 400 mg/l

- COD 800 mg/l
- SS 300 mg/l
- Oil and Grease 10 mg/l

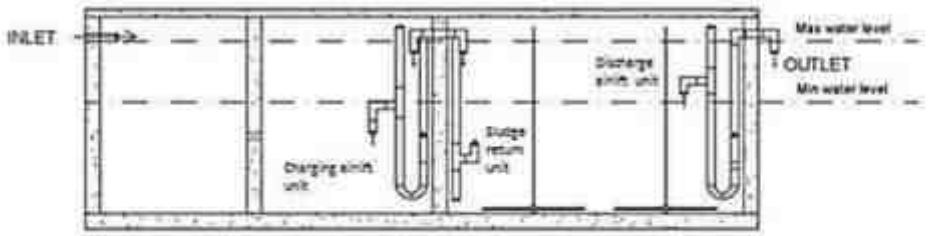
Expected Treated Sewage Characteristics

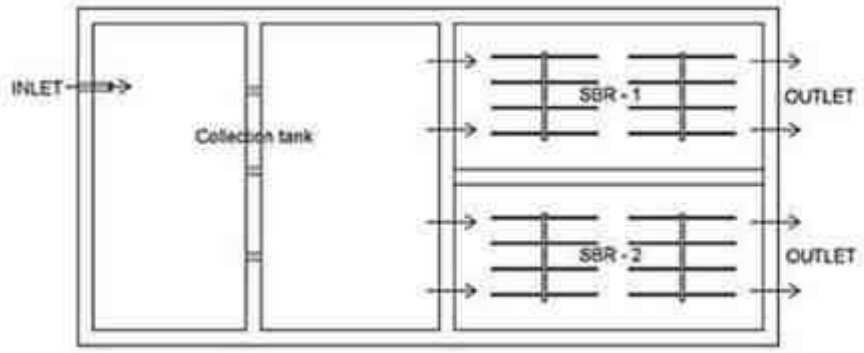
- PH - 6.5 – 8.5
- BOD < 10 mg/l
- COD l < 50 mg/l
- TSS l < 10 mg/l
- Turbidity l > 2mg/l

The sewage treatment plant comprises of the tanks in civil works with each of the following tank having its role in treatment,

- Raw water inlet/Collection tank/ Sludge storage tank
- SBR tank
- Treated water tank (optional)
- Tertiary treated water tank (Optional)

The tanks required for the SBR plants are constructed on-site as per design in concrete with a rectangular shape. The below diagram illustrates a small SBR series collection tanks and SBR reactor.





Treated wastewater from STP shall be used for dust suppression and Greenbelt development.

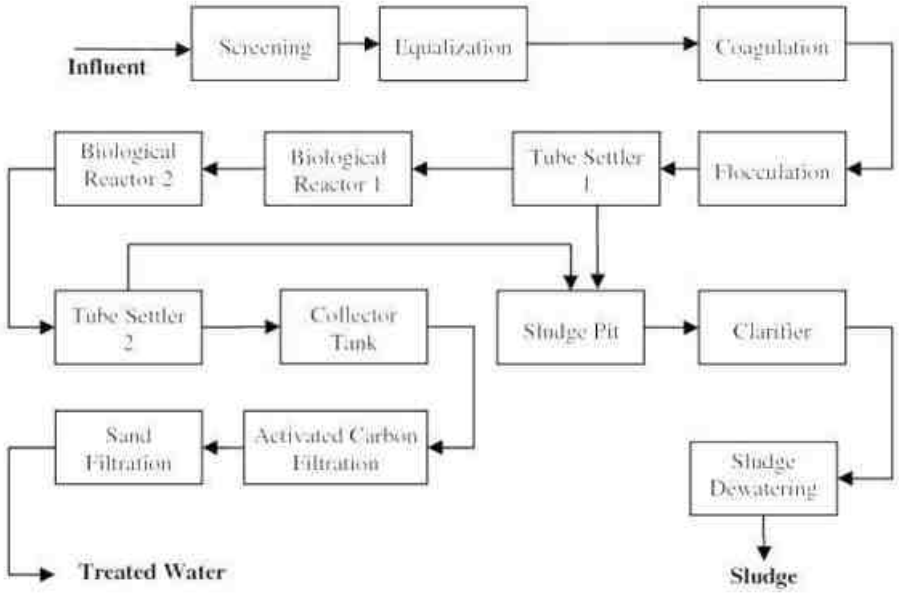
Effluent Treatment Plant

Effluent Treatment plant consist of following treatment phases

- Preliminary treatment: Removal of Solids, Oil & Grease.
- Primary: Removal of floating & settable (Suspended solids, Organic Matter)
- Secondary: Removal of Biodegradable organic matter (BOD).

- Tertiary: Removal of residual suspended solids, Dissolved solids.

Typical ETP flow chart



ETP Outlet Parameters (Treated Effluent Standards as per CPCB)

Sludge Treatment:

- Dewatering: The accumulated sludge from the primary and secondary treatment stages is dewatered using systems such as filter presses, centrifuges, or drying beds to reduce its volume.
- Sludge Disposal: Dewatered sludge can be reused for composting, energy generation, or disposed of as per regulatory standards.

2.8.26.7.3 Leachate Collection and Treatment

Water used for dust suppression in the stockyards will get absorbed to the extent of the property of the material. No runoff is expected during normal operations since the use of specialised (atomised) sprinklers. Excess water if any, will be collected through drainage.

During rainy season the rainwater over vast stockyard area will also to be collected. For this purpose, the stockyard ground level will be provided with a slope in each of each stockyard from the centre to the sides. For collecting water draining out of the stockyards RCC toe drains will be constructed along the length of each row and interconnected to finally lead it to a settlement pond. Settling ponds will be constructed out of concrete. Lime will be added in the settling pond to neutralise the heavy metal, if any in the runoff from the stockyard. The settled materials will be retrieved and sent back to respective cargo stockyard. The supernatant water will be reused for dust suppression.

2.8.27 Lightning Protection

Lightning protection will be provided for all structures in accordance with Indian Standard code of practice IS: 2309-1969 or other internationally recognized

standards. The system will be complete with air-terminations, down conductors, testing joints and electrodes.

2.8.27.1 Area Lighting

Adequate provision for general and security lighting of the jetties and other port areas, and access roads etc. will be provided. The plant lighting system includes the normal AC lighting and emergency AC lighting which contributes together 100% lighting as well as emergency DC lighting in selected areas of the plant during plant emergency conditions. The emergency AC lighting will provide about 30 % of the total AC lighting in select areas.

The plant lighting (illumination level) varies at different locations of the plant depending on the utility and nature of work expected to be carried out at that area.

Following approximate average levels of illumination will be ensured while designing the lighting system.

- Terminal and Stacking area : 10 Lux
- Roads and Permanent ways : 15 Lux
- Parking Area : 10 Lux
- Container Yard : 15 Lux
- Control Room and Equipment : 100 Lux
- Office Rooms, Relay Rooms : 150 Lux
- Switchgear Rooms, MCC Rooms : 50 Lux

2.8.28 Fire-Fighting Facilities

2.8.28.1 Firefighting in Coal/Bulk/General cargo Terminal

The firefighting system at the port will be capable of both controlling and extinguishing fires. It is proposed to install Fire Hydrant System, which will be designed to give adequate fire protection for the facility based on Indian Standard or equivalent and conform to the provisions of the Tariff Advisory Committee's fire protection manual.

Fire hydrant system is proposed at the following areas, which are classified as ordinary hazard areas.

- Proposed bulk import / Export berths
- Bulk import and bulk export stockyards
- All galleries of bulk import and bulk export conveyors

The fire hydrant system will be designed to ensure that adequate quantity of water is always available, at all areas of the facility where a potential fire hazard exists Each hydrant connection will be provided with suitable length of hoses and nozzles to permit effective operation.

The hydrant service will consist of ring mains to cover the facility, with its pump, located in a common pump house. Adequate arrangement with jockey pumps,

pressure switches, etc. will be provided to maintain the required pressure in the hydrant system. The operation of pumps provided for the system will be automatic.

2.8.28.2 Firefighting in Container Terminal

The firefighting system will be designed to give suitable fire protection for the containerized cargo and container handling facilities in the terminal and shall conform to the provision of Tariff Advisory Committee's fire protection manual. The firefighting system shall be a combination of water hydrants, fire alarm system and fire extinguishers.

The fire hydrant system will be sea water based and designed to ensure that an adequate quantity of water is always available, at all areas of the facility where a potential fire hazard exists. There will be provision for connecting the system to the potable water supply in order that the system can be flushed and rested on potable water after a fire-fighting event.

The fire-fighting system will consist of an underground ring main with spur lines to cover the facilities in the yard. Hydrants will be provided at sufficient spacing. Each hydrant connection will be provided with a suitable length of hose and nozzle to permit effective operation. The main firefighting pumps will be provided in the pump house located at the western end of the berth.

2.8.28.3 Firefighting in Liquid Jetty and Tank Farm

The liquid jetty will be provided with fixed fire-fighting facilities according to the requirements of OISD Guidelines. Sea water will be used for firefighting facilities. The facilities will include a pump house on trestle, tower mounted water/foam monitors as well as hydrants and water curtains. The proposed firefighting facility for the jetty broadly consists of the following.

- A sea water pump house with a control room on top along the approach trestle at adequate safety distance from the loading platform / manifold.
- Two tower mounted foam/water monitors
- Monitors of standpipe type at Jetty service platform
- Water curtain system at jetty service platform and on the two breasting dolphins.
- Fire hydrants on the jetty service platform, breasting and mooring dolphins and on the pile trestle.
- Leak detection/ Alarm system.

On the fire hydrant line standard double headed hydrants are proposed for installation on each of the breasting, mooring dolphins and on the service platform. In addition, it is proposed to provide similar fire hydrants on the pile trestle from the pump room to the jetty along with pipeline at a required spacing.

At any given point of time the fire hydrant pipeline will be capable of supplying water enough for feeding hydrants and the water curtains located on the service platform, breasting, and mooring dolphins.

For the jetty and pipeline trestle it is proposed to have fire gas detector and an air sampling type detector. A sampling type detector consists of piping or tubing distribution from the detector unit to the areas to be protected. An air pump draws air from the protected area back to the detector through the air sampling ports and piping. At the detector the air is analyzed for the fire products.

It is also proposed to have an alarm system which comes into operation automatically through the fire gas detector and the sampling type detector. This can also be manually operated for conveying fire alert message.

The firefighting system inside the tank farms will be as per the norms of OISD. The firefighting system will comprise of a jockey pump (electric driven), main pumps (diesel engine driven), fire water ring main with monitors & spray, foam system for storage Tanks. Besides, the fire alarm system consisting of break glass type manual call points at field & Fire Alarm Panel in the Fire Pump-house/control room.

The fire water header is kept pressurized with the jockey pump and on loss of pressure due to opening of hydrants on the header, the pressure switches activate the pump contacts & main pump start in sequence to ensure adequate pressure and flow is maintained in the system.

The storage tanks have spray rings with nozzle on shell and foam chamber attached to foam nozzle of the Tank. The foam chamber is connected by foam water line to the fixed foam Tank outside the dyke. In the

event of fire to the liquid in two of the storage Tanks, the foam system is activated & foam poured on the top of the burning liquid surface. For the other tanks in the vicinity of this affected tank, the spray system is activated, and the tank surface kept cool. Further the small water monitors, hydrants help in large quantity of water being poured onto the Tank roof / shell. Small fires are doused with portable wheeled extinguishers. The manual call points provided in the various areas are for fire warning. In the event of fire being noticed by any personnel, the break glass type call button if pressed activates the hooter & alarm at the fire alarm panel in pump-house.

2.9 Greenbelt Development

Greenbelt will be developed in an area of 6.15 Ha. Treated sewage will be used for irrigating greenbelt. Existing details of Greenbelt Development (Coverage, Species, budget, monitoring etc.) are given as part of Greenbelt Development Plan in **Section 10.8** of **Chapter 10**.

2.10 Connectivity

2.10.1 Internal Road Connectivity

The approach road leading to the Container Terminal, Dry Bulk, Liquid Terminals will be constructed with provision of future widening of these roads.

2.10.1.1 Road Structure

The approach roads to the Container terminal and dry bulk, liquid bulk terminal area are designed taking into consideration the density of traffic and the wheel pressure of the tractor trailers, tankers, trucks, etc. All roads are designed to IRC class A.

2.10.1.2 Proposed Four Lane Road

A four-lane road from Cuddalore Port to NH-45A under PM Gati Shakti project is being initiated and the implementing agency is the National Highways Authority of India (NHAI) considering the following components to be taken up under the Port Connectivity Scheme of the Government of India.

- Four-laning of the Port Office Road (erstwhile Salt Office Road) from the Port main gate to NH-45A (1 km).
- Four-laning of NH-45A (Cuddlore to Chidambaram Road) from the junction with the Port Office Road to the proposed New East Coast Road (ECR) joining.
- Construction of a four-lane spur road from the Port Office Road junction with NH-45A to the New ECR.

2.10.1.3 Maintenance of Road

Road maintenance work is to be carried out as per IRC Code 82-1982. The Maintenance work will involve following tasks.

- Restoration of rain cuts
- Maintenance of earthen shoulders
- Maintenance and Repairs work in connection with Bituminous work viz Filling potholes and patch repairs, Fog seal, Crack fill, resurfacing of carriageway, etc.

However, major maintenance by resurfacing the carriageway will be required every 5 years.

2.10.2 Railway Siding

The nearest railway station is Cuddalore Port Junction, and it connects between Villupuram – Cuddalore Port Section falling in Tiruchchirappalli Division under Southern Railway. The approximate length of the connectivity line is 3.8 km from take-off at port.

For the proposed GCT, Cuddalore Port Railway Station has been identified as the preferred serving station. Located at Km 209.20 (F/CSTM) on the Villupuram–Cuddalore Port section of Tiruchchirappalli Division, Southern Railway, Cuddalore Port Junction is an electrified station equipped with electrically operated points and multi-aspect colour light signals, all interlocked through Electronic Interlocking and controlled from the panel in the Station Master's office.

The Gati Shakti Multi-modal Cargo Terminal (GCT) siding will be required to handle approximately 4 – 5 rakes per day of outward coal traffic. Total Track length will be 5.5 km with a Broad-Gauge of 1676 mm. A Road Over Bridge (ROB) is proposed

across NH-32. The proposed GCT will primarily handle outward movement of Coal, with provision for handling outward movement of POL in the future phase.

The following facilities are proposed to be provided at the GCT yard in order to meet the handling of traffic at Terminal.

Line No.	Function	Proposed CSR/CSL
Line no. – 1A	Pre-Coal Loading Line	720.00 m (SILO to DE)
Line no. – 1	Post-Coal Loading Line	743.00 m (FM to FM)
Line no. – 2	Engine Escape Line	743.00 m (FM to FM)
Line no. – 3	Future POL Line	720.00 m (FM to DE)

2.11 Rehabilitation and Resettlement (R&R)

Existing port is located in an area of 111.72 Ac along which is completely in possession of Cuddalore Port and proposed shipbuilding area of 34.29 Ac belongs to Government is open scrub land without any settlements which will be acquired.

Area required for the proposed development is calculated considering all the facilities essential for envisaged operations such as material handling area, cargo storage/backup area, operational and utility area, internal connectivity, drainage, greenbelt and buildings etc. and by focusing on possibility of limiting the extent of land area requirement. Accordingly, layout has been prepared. Hence, no rehabilitation and resettlement (R&R) is envisaged.

2.12 Employment Generation

During the construction phase, approximately 500 workers will be employed (Direct 10 and Indirect 490). During operation phase, approximately 205 workers will be employed (Direct 82 and Indirect 123).

2.13 Coastal Regulation Zone

Physical demarcation of HTL, LTL and delineation of CRZ boundaries for the project site were carried out by Council of Scientific and Industrial Research - National Institute of Oceanography (CSIR-NIO), Goa, R.C Visakhapatnam which is one of the MoEFCC authorized agencies. Following are the observations of the demarcation carried out by CSIR-NIO:

- Project site does not contain environmentally sensitive areas such as National parks / marine parks, sanctuaries, wildlife habitats, corals / coral reefs.
- Facilities proposed such as breakwaters, berths, reclamation/level raising areas, cargo handling, rail & road, green areas and storage facilities are falling in CRZ IB, CRZ II, CRZ III A, CRZ IIIB, CRZ IVA and CRZ IVB.
- The activities proposed within CRZ area are permissible as per CRZ notification, 2011.

The CRZ compatibility of the proposed facilities with respect to CRZ Notification, 2011 given in **Table 2-32**. The CRZ map as per approved CZMP is given as **Figure 2-38**, CRZ map as per the site survey is given as **Figure 2-39** and port layout on Approved CZMP was shown in **Figure 2-40**.

Table 2-32: CRZ Compatibility of the proposed facilities as per CRZ Notification, 2011

S. No	Proposed Facilities	Falling in CRZ area with Classification	Permissible/Not permissible as per CRZ Notification 2011, amended till date	Applicable Clause no. of CRZ Notification 2011, amended till date
1	Multipurpose berths, Bulk Berth & Port craft berth/Wharf	CRZ-II & CRZ IV(B)	Permissible	Clause 3 (i) (a), 3 (ii) (a), 3 (iv) (a, b), 4 (i) (a) (f), 8 (i) I (ii) (b), 8 (i) (II) (vi), 8 (i) (IIV)
2	Shipyard/repair jetty	CRZ-IV(B)	Permissible	
3	Shipyard/repair facility	CRZ-III(NDZ), CRZ-III (200 to 500m from HTL)	Permissible	Clause 3 (i) (a), 4 (i) (f), 8 (i) III (A) (i)
4	Desalination Plant	CRZ II	Permissible	Clause 3 (i) (a, c); 4 (ii) (d, h); 8 (II) (v);
5	Seawater intake/outfall and its pipelines for desalination plant	CRZ-II, CRZ IV(A) & CRZ IV(B)	Permissible	Clause 3 (i) (a); 4 (ii) (d), 8 I (i) (b)
6	Breakwater	CRZ-I(B), CRZ II, CRZ IV(A) & CRZ IV(B)	Permissible	Clause 3 (i) (a), 4 (i) (f), 8 (i) III (A) (i)
7	Protection Bund	CRZ IV(B)	Permissible	
8	Railway line	CRZ – IA, CRZ – IB, CRZ – II & CRZ IV (B)	Permissible	CRZ notification clauses are not applicable
9	Green Areas	CRZ-I(B), CRZ-III & CRZ IV(A)	Permissible	Clause 3 (Xiii), 8 III (iii) (a)

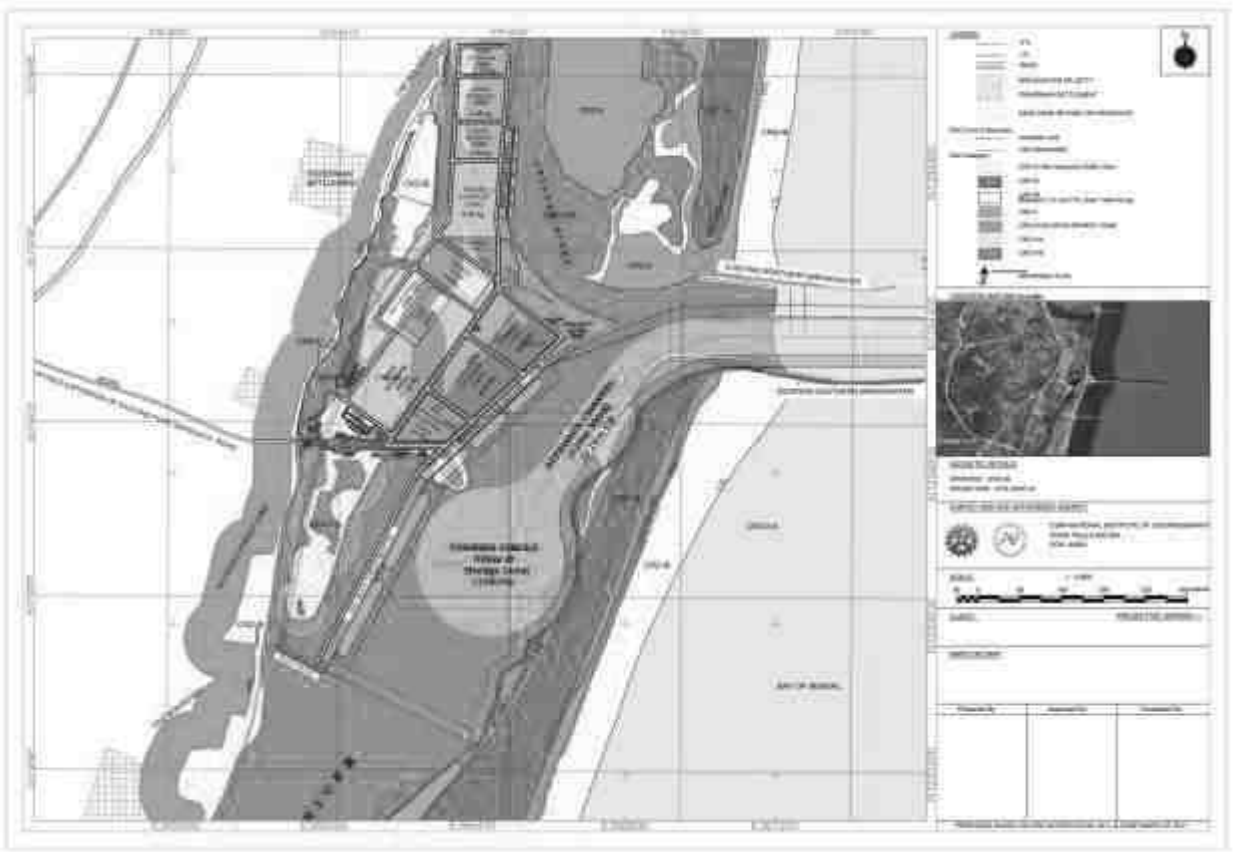


Figure 2-38: CRZ Map (1:4000 scale) as per Approved CZMP

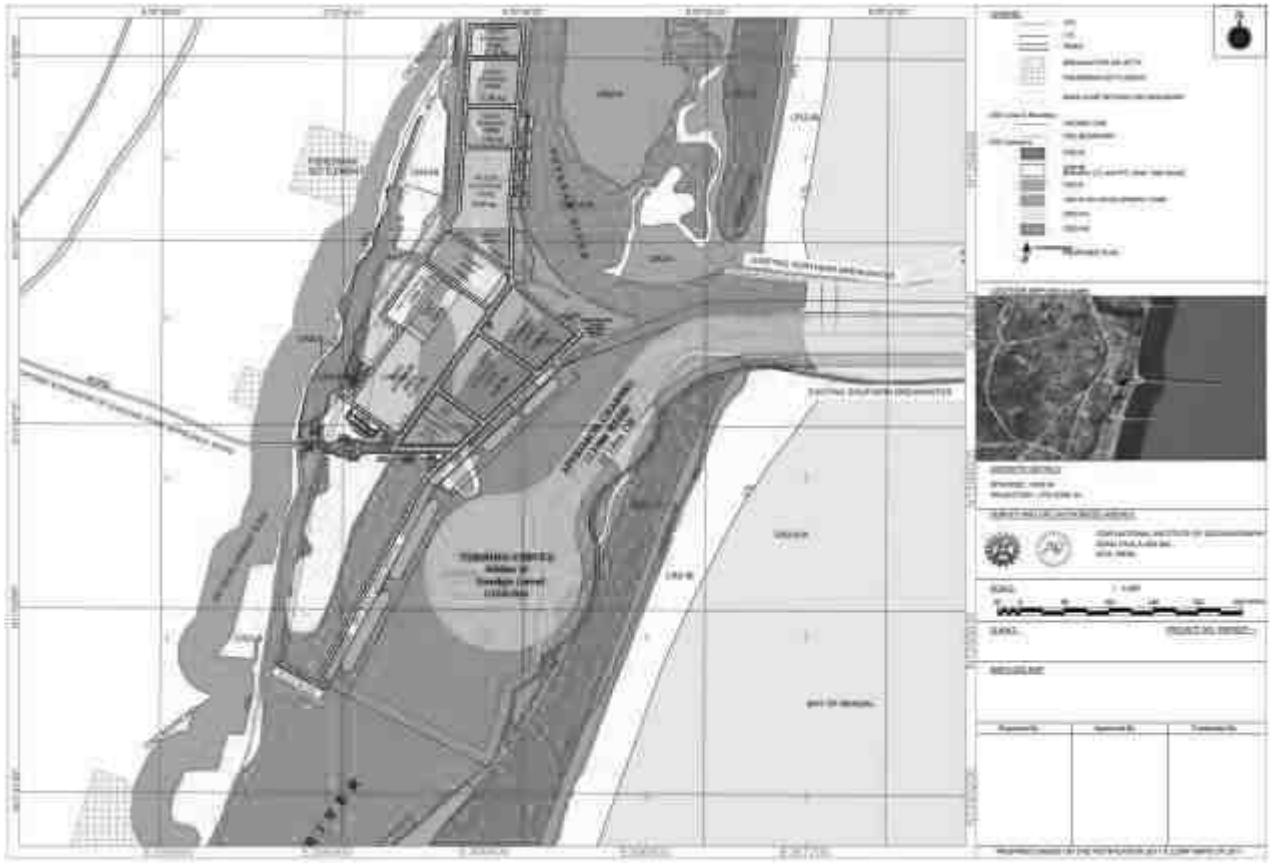


Figure 2-39: CRZ Map (1:4000 scale) as per Site Survey

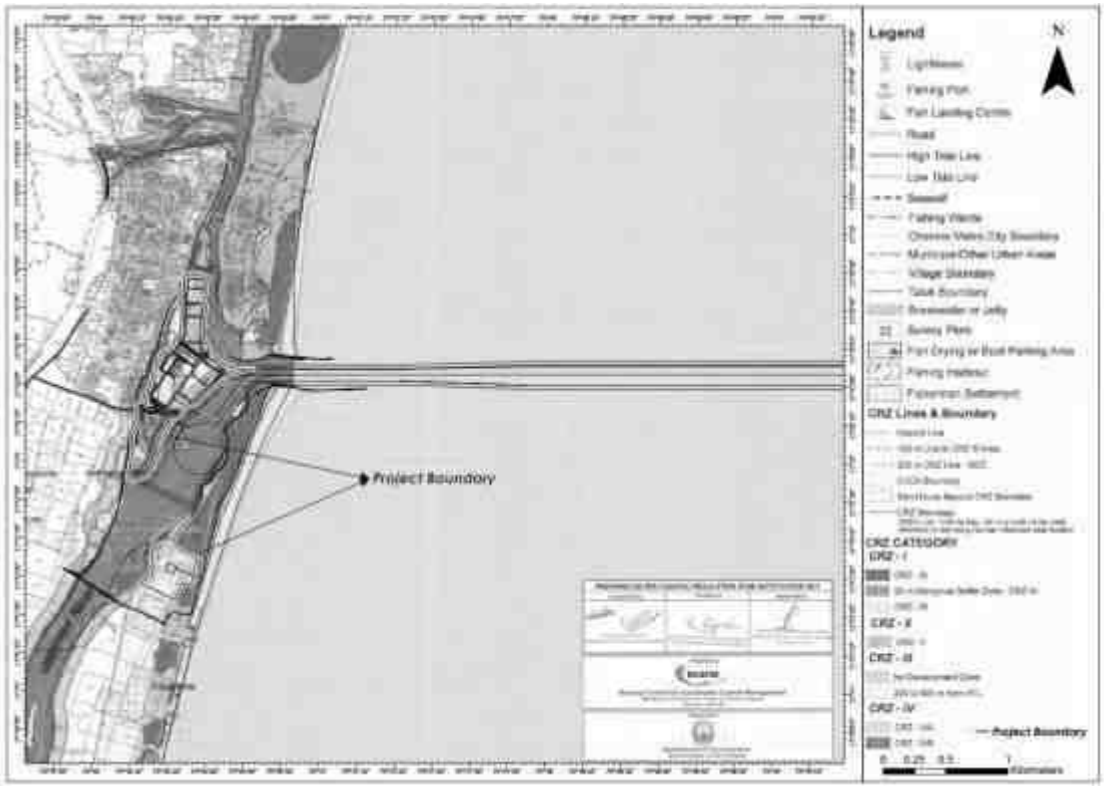


Figure 2-40: Port Layout on Approved CZMP Map

2.14 Project Schedule and cost estimation

2.14.1 Project Schedule

The schedule is prepared considering all the items of the project, the various activities involved and the duration of each activity. The complete port construction is expected to take about 18 months from the date of start of construction.

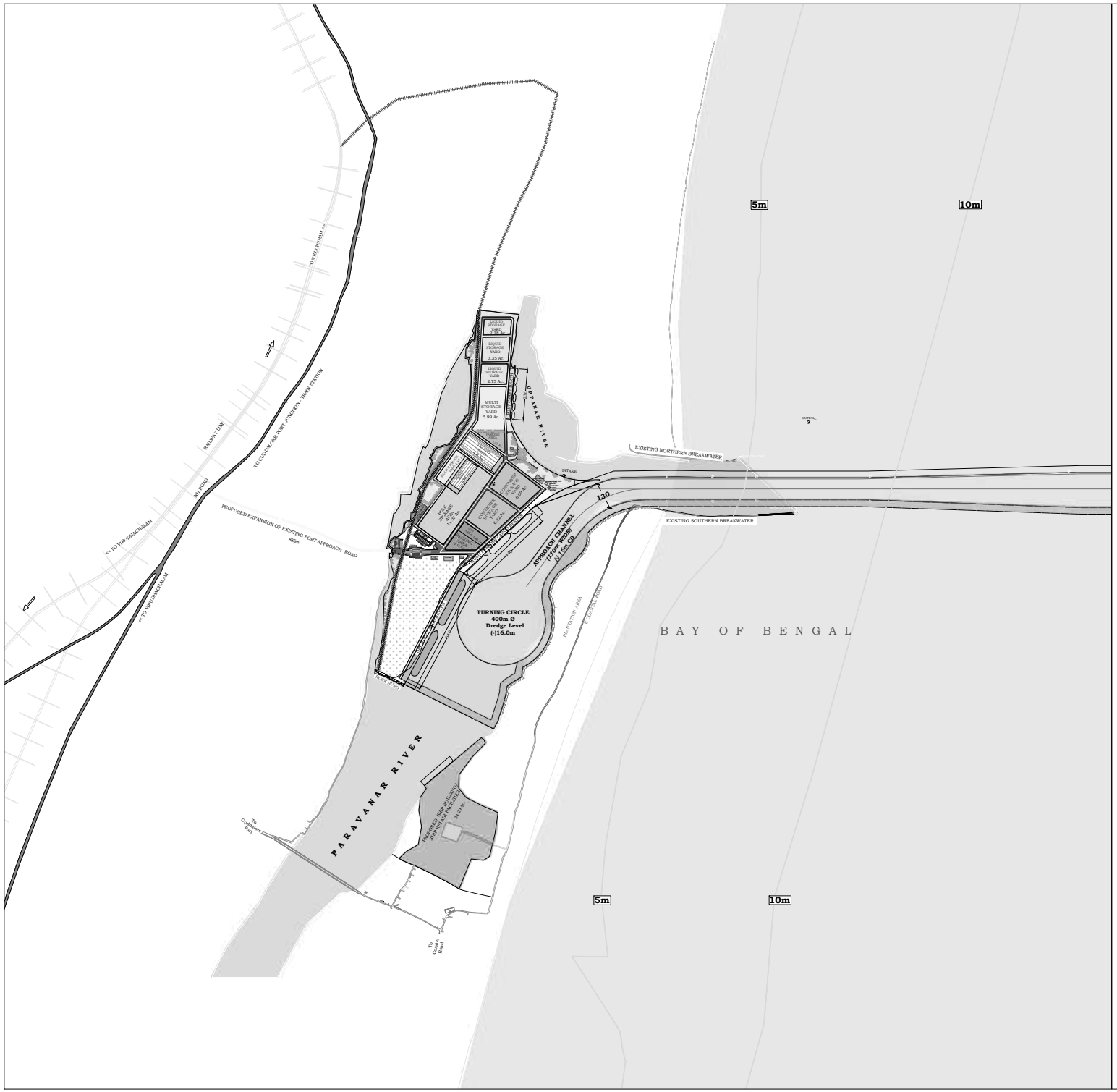
2.14.2 Cost Estimation

The capital cost estimates have been prepared for the proposed development of the project. The basis of the costing is as follows:

- The cost estimates of civil works have been prepared based on current rates for various items of work prevailing in the region.
- The costs of equipment and machinery are based on budgetary quotations with the manufacturers and in-house data. The costs include all taxes and duties.
- All costs towards overheads, labour, tools, materials, insurance, financing costs, etc., are covered in the rates for individual items.
- The costs for plant and machinery include manufacture, supply, installation and commissioning of the respective items.
- Provision towards contingencies, engineering and establishment has been included separately.

Total capital cost for the proposed development is estimated to be approximately **Rs. 650.0 Crores.**

Figures



FD 201

LEGEND	
	LIQUID STORAGE YARD
	CONTAINER STORAGE YARD
	CFS AREA
	BULK STORAGE AREA
	MULTI STORAGE YARD
	BUILDINGS
	TRANSIT SHED
	PARKING ARAE
	GREEN AREA
	COMMON UTILITY AREA
	SHIP BUILDING YARD
	DESALINATION PLANT
	PROPOSED RAIL LINE
	EXTERNAL RAIL LINE
	CONTOUR LINE
	LEADING LIGHTS
	BEACON LIGHTS
	CHANNEL MARKING BUOY
	SHORE LINE
	OPEN/FUTURE AREA

AREA	
LIQUID STORAGE YARD	8.28 Ac.
CONTAINER STORAGE YARD	12.31 Ac.
CFS AREA	1.46 Ac.
BULK STORAGE AREA	11.07 Ac.
TRANSIT SHED	7.64 Ac.
GREEN AREA	15.2 Ac.
MULTI STORAGE YARD	7.96 Ac.
DESALINATION PLANT	0.02 Ac.
BUILDINGS	1.16 Ac.
COMMON UTILITY AREA	0.69 Ac.
PARKING AREA	3.68 Ac.
ROAD	17.1 Ac.
RAIL SLIDING AREA	7.01 Ac.
OPEN/FUTURE AREA	18.14 Ac.
SUB TOTAL AREA	**111.72 Ac.**
SHIP BUILDING YARD	34.29 Ac.
GRAND TOTAL AREA	**146.01 Ac.**

Chapter 3
Description of Environment

3 Description of Environment

3.1 General

The baseline/ existing environmental conditions in the study area were established based on field surveys, investigations and review of data collected from various secondary sources. The baseline environmental data covers one season (pre-monsoon) of terrestrial and marine environments.

- Pre-monsoon Season (PM)-July to October, 2025.

3.2 Description of Project Area

The proposed expansion of Cuddalore Port is for increase the cargo handling capacity from 5.68 MTPA to 11.48 MTPA within the Cuddalore port limits, Cuddalore Town, Cuddalore District, Tamil Nadu. The existing land use of the proposed expansion area is seaside and area with scrub vegetation.

3.3 Study area

Area within 10 km radius from port boundary for primary data generation and 15 km radius as the general study area for secondary data generation is considered. The study area map is given as **Figure FD102**. The study area is Relatively flat coastal terrain, with ground levels ranging from approximately 0.5 meters to 7.3 meters with some undulations and gentle slope towards Bay of Bengal falling in Cuddalore District, Tamil Nadu. The study area map is given as **Figure 3-1.**

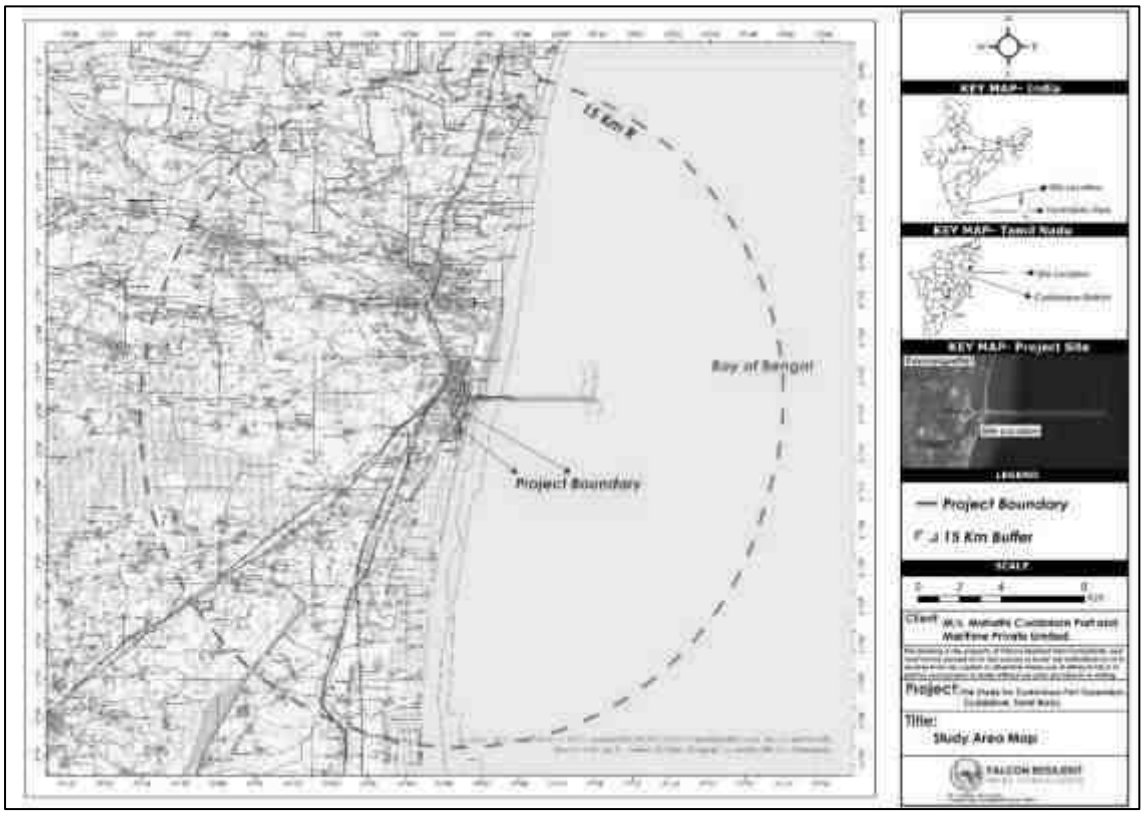


Figure 3-1: Study area

3.4 Study Period

Terrestrial Environment

The baseline terrestrial environment surveys were carried out by NABL Accredited lab M/s. Enviro Care India Private Limited. The baseline surveys were carried out during the Pre-monsoon season i.e., July-October, 2025. Site specific hourly meteorological data, ambient air quality monitoring, hourly noise levels, inland water quality (surface and groundwater) and soil quality sampling data were collected.

Marine Environment

The baseline marine environment survey was carried out by Centre for Advanced Studies in Marine Biology (CASMB), Annamalai University during Pre-monsoon season (July-October), 2025 in the study area, Marine environmental surveys covering marine water quality, sediment quality and marine biology (plankton, benthos) was carried out once during the study period.

3.5 Environmentally/Ecologically Sensitive Areas

The environmental and ecologically sensitive areas covering an aerial distance of 15 km from project boundary are given in **Table 3-1.**

Table 3-1:Environmental Sensitive Areas

S. No	Classification	Environmentally Sensitive Areas	Distance (kilometre)	Azimuth Direction
1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	No	-	-
2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	No	-	-
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration.	No		
4	Inland, coastal, marine, or underground waters	Paravanr River	Adjacent	S
		Pennai River	~6.65	N
		Vellar River	~24.72	S
		Gadilam River	Adjacent	N
		Kollidam River	~35.37	S
		Bay of Bengal	~1.10	E
5	State, National and International boundaries	Nil	-	-
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	NH-32	~1.07	W
		Cuddalore Port Junction	~1.47	NW
7	Defence installations	Nil	-	-

S. No	Classification	Environmentally Sensitive Areas	Distance (kilometre)	Azimuth Direction
8	Densely populated or built-up area	Cuddalore old Town	~0.65	W
9	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)	ST Hospitals	~1.19	N
		Urban Primary Health Centre	~1.51	NW
		Alagananda Hospitals	~1.73	S
10	Areas containing important, high quality or scarce resources, (groundwater resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	Sonangkuppam Beach	~2.09	N
		Saint David Fort	~3.71	N
11	Areas already subjected to pollution or environmental damage. (Those where existing legal environmental standards are exceeded)	NO	-	-
12	Areas susceptible to natural hazard which could cause the project to present environmental problems, (earthquakes, subsidence, landslides, erosion or extreme or adverse climatic conditions)	Proposed project falls under Seismic Zone II (Low Seismic disturbance) as per IS 1893 (Part I) of Indian Seismic Map. It is a cyclone prone area.		

3.6 Physical Conditions

The Physical Conditions[2] of the Cuddalore district is discussed in the following sections:

3.6.1 Study Period

Terrestrial Environment

The baseline terrestrial environment surveys were carried out by NABL Accredited lab M/s. Enviro Care India Private Limited. The baseline surveys were carried out during the pre-monsoon season July-October, 2025. Site specific hourly meteorological data, ambient air quality monitoring, hourly noise levels, inland water quality (surface and groundwater) and soil quality sampling data were collected.

Marine Environment

The baseline marine environment survey was carried out by Centre for Advanced Studies in Marine Biology (CASMB), Annamalai University during Pre-monsoon season (July-October), 2025 in the study area, Marine environmental surveys covering marine water quality, sediment quality and marine biology (plankton, benthos) was carried out once during the study period.

[2] DISTRICT SURVEY REPORT FOR SAND CUDDALORE DISTRICT -

3.6.2 Physical Conditions

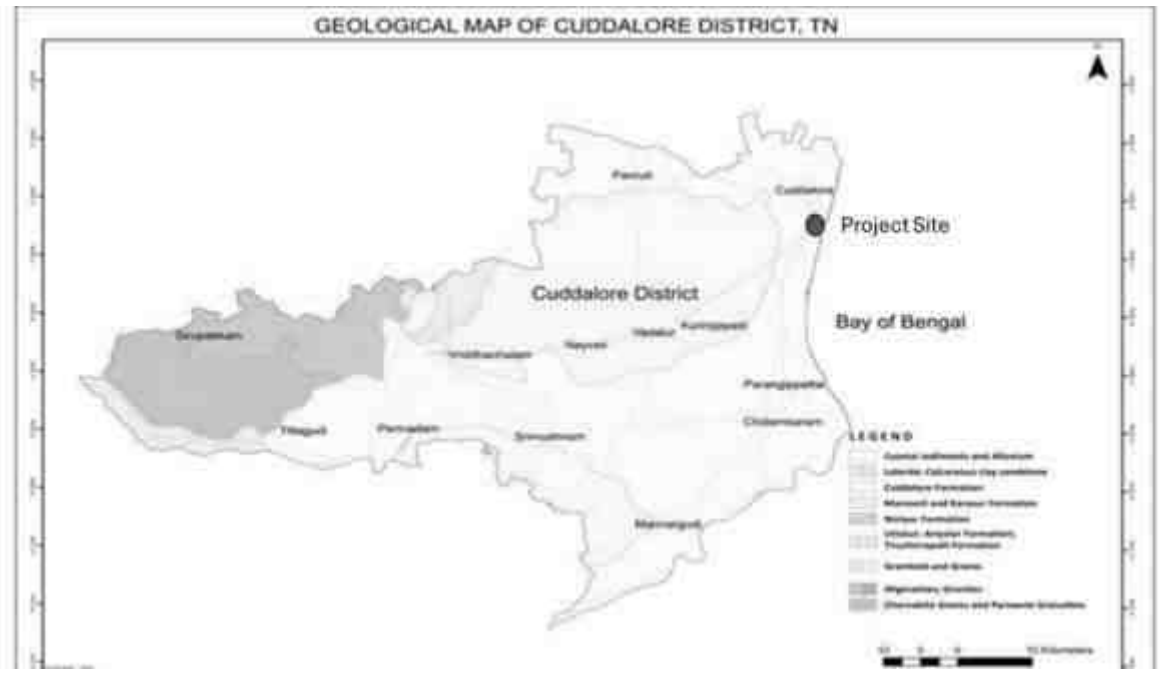
The Physical Conditions of the Cuddalore district is discussed in the following sections:

3.6.2.1 Topography

Cuddalore District has an average elevation of about 6 meters (20 feet) and is characterized by a uniformly flat terrain.

3.6.2.2 Geology

The area is occupied by Tertiary and Quaternary Formations. The district's geological formation is relatively straightforward. At its foundation lie metamorphic rocks of the gneiss family. Resting upon these are three major groups of sedimentary rocks, each from different geological periods, arranged in a regular succession from the eastern coast to the western hills. The lowest group consists of fossil-bearing Cretaceous limestone, found prominently around Puducherry and Vriddhachalam. Above this lies a younger formation, represented by the Red Hills near Puducherry and the Mount Capper Hills southwest of Cuddalore. The uppermost layer is formed by the alluvial deposits of river deltas. Cuddalore sandstones and there are a number of flowing wells in this area. Gneiss, trap and sandstone are the main minerals of the district. Gneiss is used for building purposes with excellent results especially in the temples. rap is scarcely used for building purposes because of its intractable hardness and inherent moisture absorbing quality. Sandstone is used for building purposes as well as for making mortars, troughs, etc. There are a large number of clay deposits in the district. White clay occurs in many places. It is exposed in the deep ravines below an overburden of 35 feet of sandstones and grits at Pannikappam, south of Panruti and just south of the Gadilam River.



Source: District Survey Report, Cuddalore District

Figure 3-2: Geology map of the Cuddalore district

3.6.2.3 Geomorphology

Cuddalore District mostly consists of flat plain, gently sloping from north to south and from west to east, towards the sea. The only hill in the district is the Mount Capper hill near Cuddalore. The geomorphology of the Cuddalore coastal stretch includes the coastal plain with an average width of 6 km. Its coastal landforms include strand-lines, raised beaches, sand dunes, mangrove swamps and tidal flats with predominantly sandy beaches on the northern side and mangrove swamps to the south. The coastal towns of Cuddalore in the North and Porto Novo (Parangipettai) in the South are the most densely populated along this region. The Cuddalore area mainly attained its present morphological configuration due to the action of Paravanr river, wave action of Bay of Bengal, wind and other erosional or weathering activities.

3.6.3 Hydrology

Hydrogeologically the district can be divided into two broad sectors based on the depth and quality of ground water occurrence. The eastern part of district covered with coastal dunal complexes have shallow ground water source at a depth of 22 to 25 feet (water bearing horizon coarse sand) with limited yield. The water becomes saline at depths greater than 25 feet as the sandy horizon is underlain by sandy clay and sticky black clay of marine origin. The water table depth in sandy areas varies from 6 to 8 feet and is associated in silica sand. The water occurring at these depths is being extracted from broad shallow pits for irrigation. The floodplain and pediplain terrain occurring on the western side is underlain by weathered lateritised Cuddalore sandstone formation which holds a good amount of fresh water. In the areas of Kullanchavadi, Chintamanikuppam, Palliodai and

Sambareddipallayam 2 to 3m of sandy horizon occurs at depth of 120 feet and 140 feet. The pressure surface depth is 45 to 55 feet during summer. In the entire region the overall quality of water is potable and no severe salinity problem is encountered. The area also does not experience any ground water overdraft pollution etc. Normal average rainfall is 1600 to 1800mm per year which takes care of recharge. The low lying floodplain and sandy flat areas gets flooded during heavy rains as Perumal Eri and other canals are already silted up and breached at places.

3.6.4 Drainage

The land is completely flat with large deposits of black and alluvial soil inland and coarse sand near the seashore. The Pennayar River runs north of the town, while the Gadilam rivers joins it. These rivers are ephemeral, meaning they only flow during the monsoon season and typically carry floodwaters. The district is drained by Gadilam and Pennaiyar rivers in the North, Vellar and Coleroon rivers in the south. The Ponnaiyar River, originating in the Nandi Hills of Karnataka, drains the northern part of the district, with tributaries like the Thurinjalar and Musukundah rivers. The Malattar river is a distributary of the Ponnaiyar. In the south, the Vellar River drains a major portion of the region, with tributaries such as Manimuktha, Gomukhi, and Mayura. The eastern coastal part, near Porto-Novo, is characterized by lagoons and backwaters, further enhancing the district's unique landscape. The rivers' seasonal flow and the coastal features significantly influence the region's ecology and agriculture.

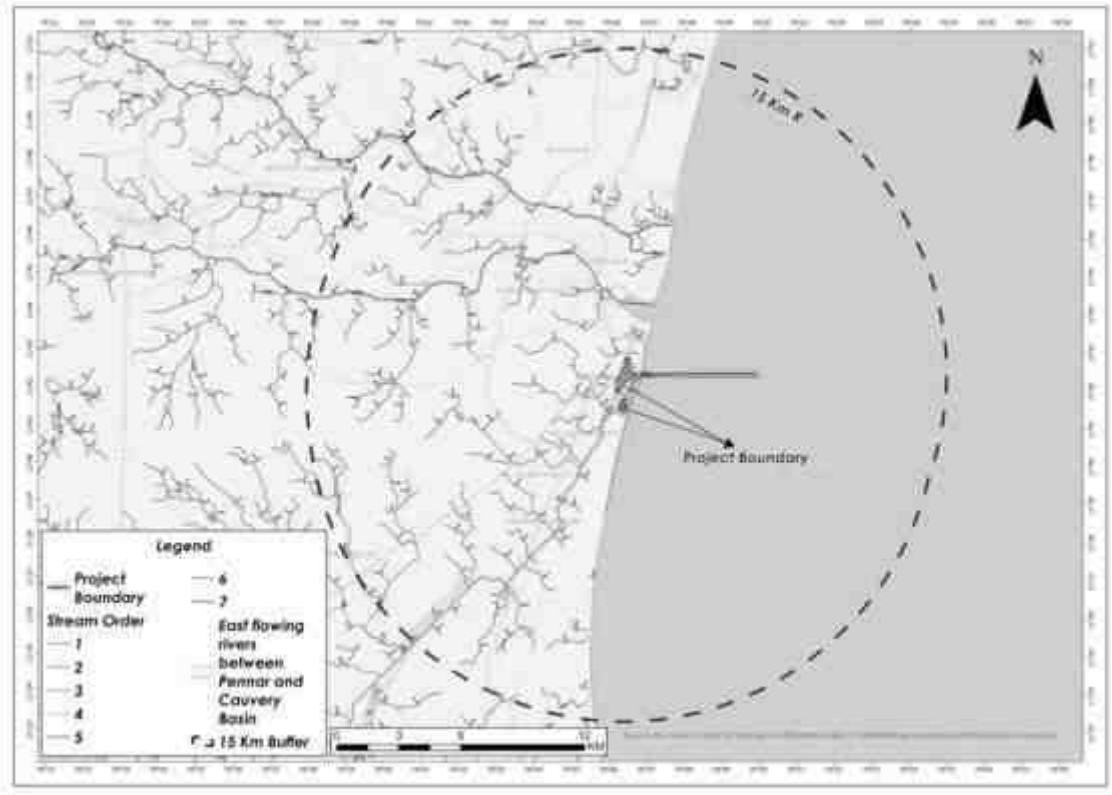


Figure 3-3:Drainage Map

3.6.5 Soil

The soils of the district can be divided into three main classes namely, the black soil, the red ferruginous and the Arenaceous. The black soil prevails largely in the Chidambaram, Vriddhachalam and Cuddalore Taluks. The Arenaceous occurs chiefly near the coast in the Taluks of Chidambaram and Cuddalore. Black clay is the most fertile kind of soil, the loam is the next best and the red sand & Arenaceous soils are the poorest. The total red soil comprises of -3,67,791 hectare, Sandy clay loam -1,28,573 hectare, Clay loam -1,15,565 hectare, sandy loam -91,679 hectare and sandy soil -31,974 hectare in Cuddalore district.

3.7 Land Environment

3.7.1 Land use Land Cover

The land use / land cover for the study area is carried out using satellite imageries. The satellite data is processed using ArcGIS software supported with ground checks and ground truth verification. Area and distance calculations have been carried out using Geographical Information System (GIS) software after geo-referencing the interpreted data with the help of Survey of India (SoI) Toposheets (scale 1:50,000).

3.7.1.1 Land Use and Land Cover within Port Area

Land use of the project site is given in **Table 3-2** and land use map of proposed project site is presented as **Figure 3-4.**

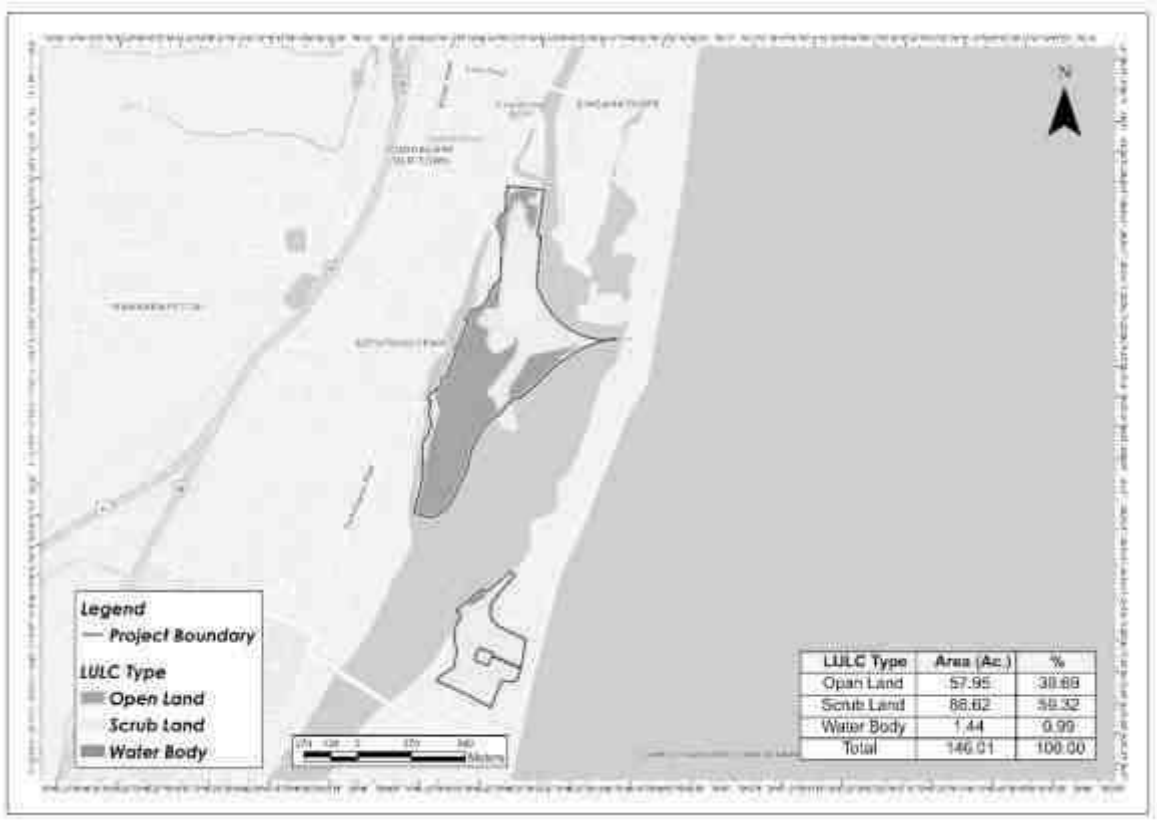


Figure 3-4: Land use and land cover within the Project Site

Table 3-2: Land use and land cover Pattern within the Project Site

LULC Type	Area (Ha)	Area (Acre)	% of LULC
Bare ground	23.51	57.95	39.68
Scrub Land	35.63	88.06	60.32
Total	**59.14**	**146.01**	**100.00**

3.7.1.2 Land Use and Land Cover within Study Area

A map depicting major land use / land cover classes comprising built up lands, forest lands, waste lands and water bodies along project corridor within 15 km radius of study area is shown in **Figure 3-5** and **Table 3-3.**

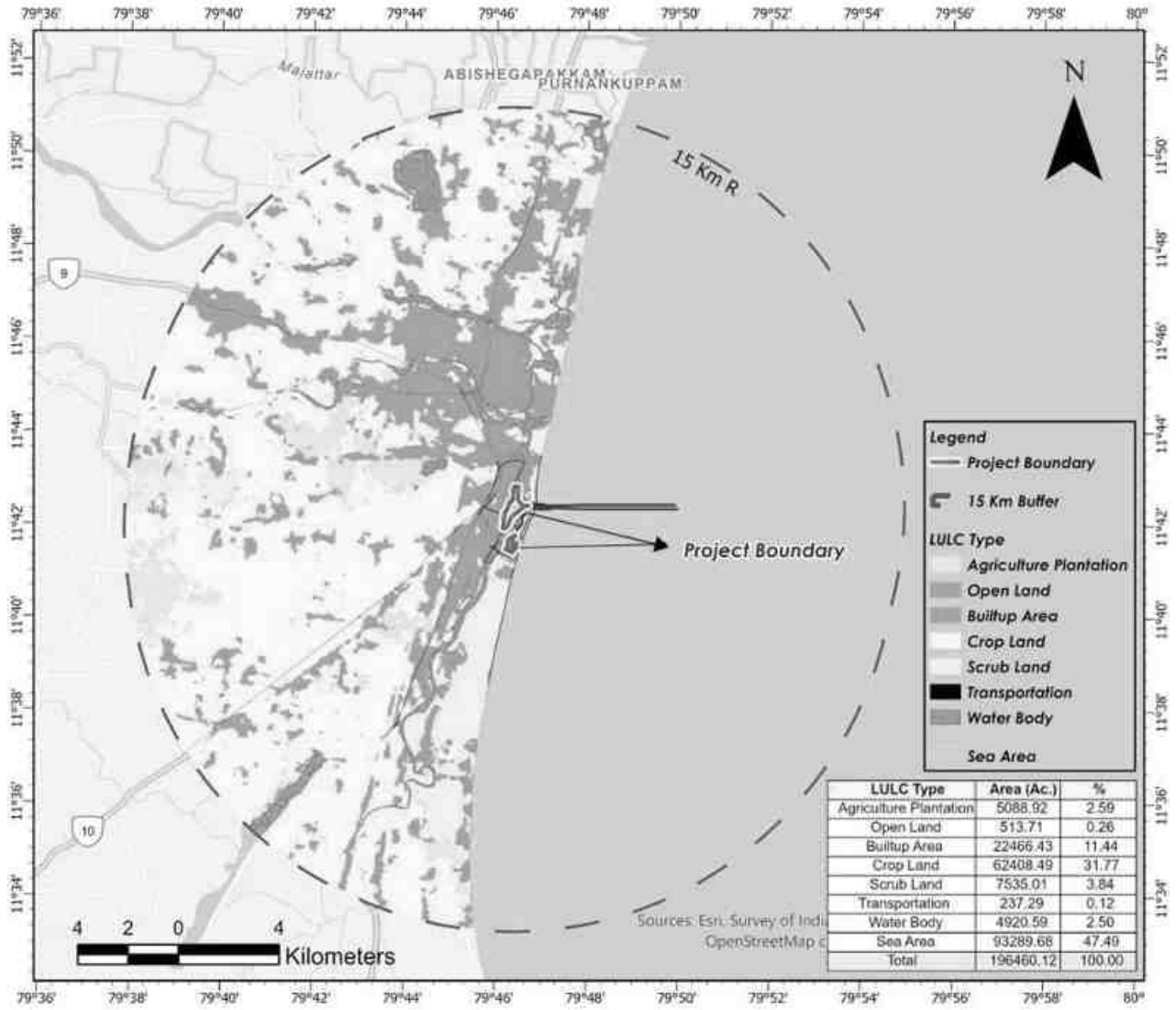


Figure 3-5: Land use and land cover within 15 km radius of Cuddalore Port Expanision

Based on output, area statistics were calculated for different land use classes within 15 Km radius is given in **Table 3-3.**

Table 3-3: Land use and land cover Pattern 15 km

Land Use & Land Cover	Area (Acres)	% of LULC
Agriculture Plantation	5088.92	2.59
Open land	513.71	0.26

Land Use & Land Cover	Area (Acres)	% of LULC
Built-up Area	22466.43	31.77
Crop Land	62408.49	60.49
Scrub Land	7535.01	3.84
Transportation	237.29	0.12
Water Body	4920.59	2.50
Sea	93289.68	47.49
Grand Total	**103170.44**	**100.00**

3.7.2 Agricultural Resources

Cuddalore district is predominantly agricultural district with coastal line stretching from Puducherry Union Territory in the North to the mouth of river coleroon (or Kollidam) in the south[3]. The Agriculture department policy and objectives have been framed to ensure stability in agricultural production and to increase the agricultural predicting in a sustainable manner to meet the food requirement of growing population and also to meet the raw materials needed for agro based industries, thereby providing employment opportunities to the rural population. he Major agricultural crops cultivated in the district are Paddy, Cumbu, Maize, Varagu, Blackgram, Greengram, Sugarcane, Groundnut, Gingelly and Cotton. In the total area under cultivation, 59% area is irrigated and 41% is under rainfed cultivation. Total normal area cultivated is 247582 Ha.

3.8 Natural Hazards

3.8.1 Cyclones and Depressions

A cyclone (or more properly called Tropical Cyclones) [4] is a system of wind with very low pressure at the centre and surrounded by high pressure outward that occurs over the ocean near the tropics.

Cuddalore has always been classified as a multi-hazard prone district. Cyclones and flood have wreaked havoc in the district several times in the past few centuries. The district has a long coastline and therefore the district is vulnerable to the cyclonic depressions and the resultant rains which cause floods. The Bay of Bengal experiences severe tropical cyclones during Northeast Monsoon [October, November and December]. The cyclone surges are well known for their destructive potential and impact on human activities due to associated strong winds along the coast and heavy rainfall. Nisha in 2008 and Cyclone Thane in December 2011 created surge heights of waves between 1 and 5m. Cyclonic Storm Thane was the strongest tropical cyclone of 2011 with in the North Indian Ocean. Thane made landfall, on the north Tamil Nadu coast between Cuddalore and Puducherry. A low

[3] https://cuddalore.nic.in/agriculture-2/
[4] https://cuddalore.nic.in/disaster-management/

Pressure formed on 30.11.2024 over Southeast Bay of Bengal and intensified into a cyclonic depression named Fengal and crossed the Tamil Nadu coast on 01.12.2024. This low pressure brought extremely heavy, very heavy rainfall in the Upper catchment area of Krishnagiri, Thiruvannamalai, Villupuram and Cuddalore district in short period of interval.

Figure 3-6: Wind Hazard Map of Cuddalore District

3.8.2 Seismicity

As per the seismic zones of Indian map IS: 1893 (Part 1) 2002 of Bureau of Indian Standards (BIS), the project area and study area fall in the Zone-III and is described as moderate damage risk zone.

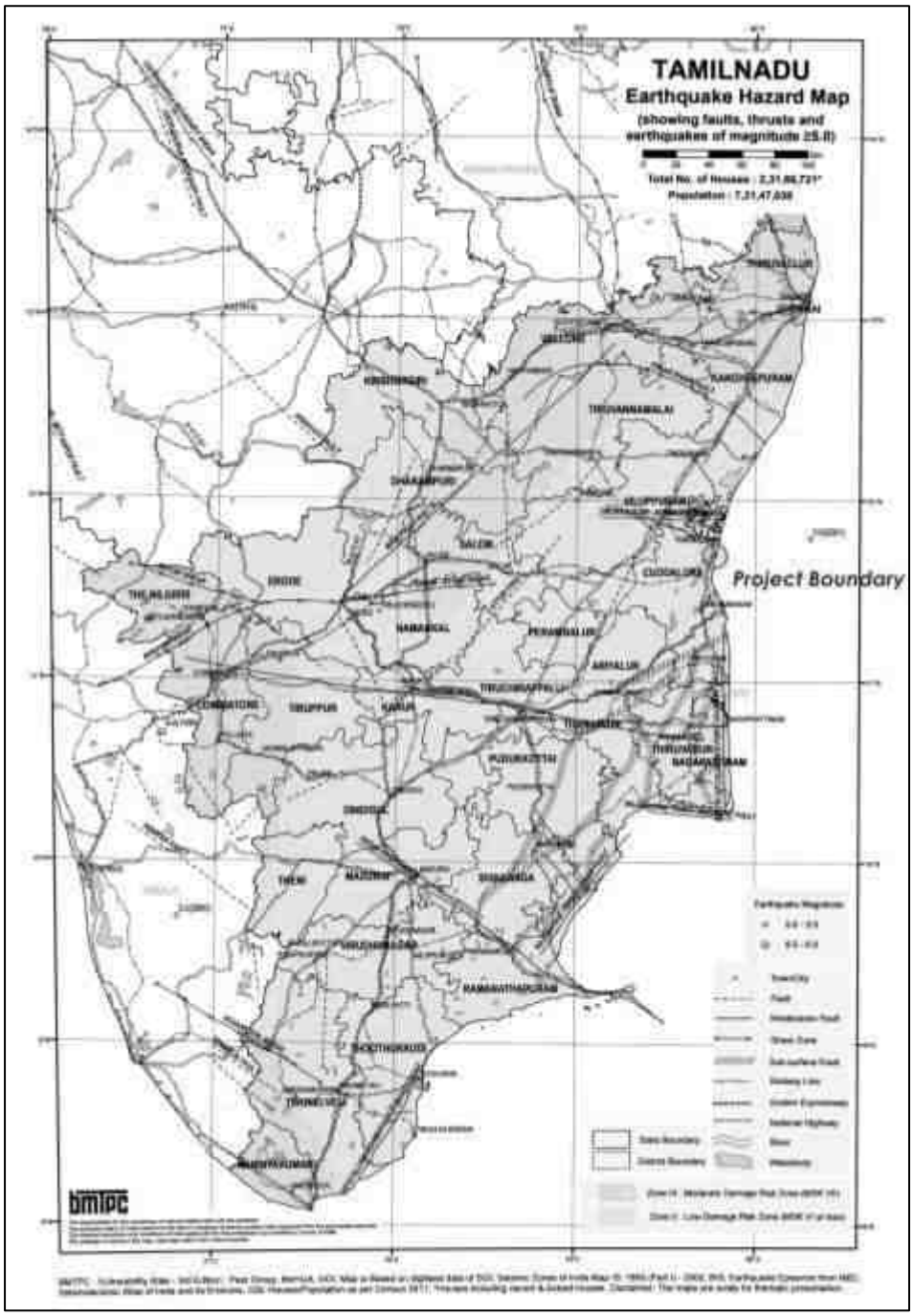


Figure 3-7: Earthquake Hazard Map of Cuddalore District

3.8.3 Flood

The district suffers from flooding when excess water flows down the local rivers and over the field due to northeast monsoon rains in the district. Cuddalore Town and 11 Villages such as District Collector office, Manjakuppam, Gunduuppalavadi, Om Sakthi Nagar, Poonthendral Nagar, Kandakadu, Thazhanguda, Periyakanaganankuppam, Uchimedu, Nanamedu and Subauppalavadi are located nearby the estuary of pennaiyar river. Since these are low lying areas, frequent inundation occurs during every monsoon season. In recent past years, the maximum discharge in pennaiyar river occurred in the years 2021 was 159270 cusecs only. Due to Fengal Cyclone, heavy rainfall had occurred at catchment

areas of pennaiyar basin and thereby all the tributaries of Pennaiyar river (in Tiruvannamalai, Villupuram and Cuddalore Districts) was also with heavy runoff. Due to this, heavy discharge of around 2.54 lakhs were realized which is more than the original carrying capacity (1.80 Lakhs). This has caused heavy damage to the already existing bund and overtopping of water occurred in many portions of the both side of the bund[5].

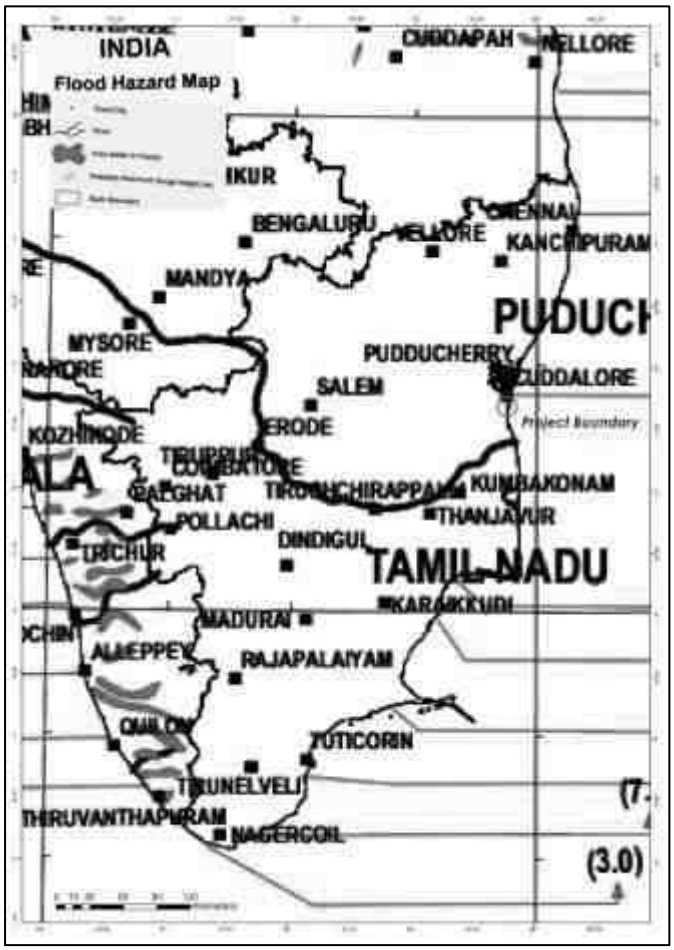


Figure 3-8: Earthquake Hazard Map

3.9 Oceanographic Survey Data

3.9.1 Tides

The Consultant has collected the tidal data from the NHO (National Hydrographic Office) chart, which is issued by the Indian Naval Hydrographic Department (INHD), Ministry of Defence, Government of India.

The tide levels during spring and neap tides of Cuddalore coast are given below:

[5] https://cuddalore.nic.in/disaster-management/

- MHWS (Mean High Water Springs) (+) 1 m CD
- MHWN (Mean High Water Neaps) (+) 0.8 m CD
- MLWN (Mean Low Water Neaps) (+) 0.6 m CD
- MLWS (Mean Low Water Springs) (+) 0.4 m CD
- MSL (Mean Sea Level) (+) 0.7 m CD

3.9.2 Current

The current speed and direction recorded at 20 minutes interval for 15 days at the 6 locations which are given below: C1 – 0.18 m/s, C2 – 0.24 m/s, C3 – 0.35 m/s, C4 – 0.22 m/s, C5 – 0.26 m/s and C6 – 0.24 m/s. In general currents appeared to be more dominated by tides than the influence of wind and general circulation in the area.

3.9.3 Bathymetry

The coastline is inclined at an angle 65° w.r.t north. Most of the waves approach the coast from southeast direction. The coast has a bay like formation. The beach slope in this stretches up to 10 m depth is nearly 1:200.

3.10 Meteorological Conditions

3.10.1 General Meteorological Scenario

The climatological table for the IMD station at Cuddalore, published by the Indian Meteorological Department (IMD) based on daily observations at 08:30 and 17:30 hrs IST for a 30-year period from 1991 to 2020 forms the basis for the following sections on the meteorological conditions in the project region as shown in the **Table 3-4.**

Table 3-4: Summary of Meteorological Parameters

Month	Temp (°C)		Rainfall (mm)		Relative Humidity (%)		Station Level Pressure hPa		Mean Wind Speed (km/h)	Predominant Wind Directions (From)*	
	Daily Max.	Daily Min.	Total	No. of days	08:30	17:30	08:30	17:30		08:30	17:30
Jan	29.7	20.8	26.2	1.3	86	71	1013.4	1010.2	5.5	NW,N	NE,E
Feb	31.0	21.5	13.6	0.8	84	70	1010.2	1009.1	5.0	NW,N	E, SE
Mar	32.7	23.3	15.1	0.4	81	71	1011.0	1007.2	5.3	NW, SW	SE,E
Apr	34.5	25.9	19.8	1.0	75	73	1008.9	1004.8	5.9	SW,S	SE, E
May	36.9	26.9	49.8	2.1	70	73	1005.8	1002.0	6.9	SW,S	SE,S
Jun	37.0	26.5	53.9	2.9	68	66	1004.6	1001.1	7.4	SW,W	SE, SW
Jul	35.9	25.8	62.6	4.0	71	64	1005.1	1001.6	6.5	SW, W	SE, SW
Aug	35.1	25.4	118.2	5.7	75	68	1006.1	1002.4	6.2	SW, W	SE, SW,S
Sep	34.2	25.2	112.7	5.8	77	74	1007.2	1003.4	5.6	SW, W	SE, S
Oct	32.2	24.5	272.3	9.9	84	78	1009.0	1005.5	4.3	SW, NW	SE, E
Nov	30.0	23.1	389.5	12.2	88	80	1010.8	1007.7	4.8	N,NW	NE, E
Dec	29.1	21.7	236.1	6.4	87	76	1012.6	1009.5	5.8	N,NW	NE,E

As per the above climatological table the following are the observations drawn for the study period (pre-monsoon season).

- Daily Maximum temperature during the study period is 35.9 °c and minimum temperature is 32.2 °c.

- Maximum and Minimum relative humidity of 84% and 71 % were recorded at 8:30 hours in the months of October and July.
- Maximum and minimum relative humidity of 78% and 64% were recorded at 17:30 hours in the months of October and July.
- Maximum and minimum rainfall of 272.2 mm and 62.6 mm were recorded in the months of October and July.
- Mean Wind Speed during this season was 5.8 kmph.
- The predominant wind direction is Southeast (SE).

3.10.2 Climatic Conditions

The climate of the region is primarily influenced by two seasonal monsoons, the Southwest Monsoon which occurs from June to October and brings significant rainfall, and the Northeast Monsoon which typically occurs in November and contributes additional precipitation along the east coast.

3.10.3 Rainfall

The average annual rainfall in the region is 1337 mm, with an average of 53 rainy days per year. The wettest months are from October to December, each receiving more than 200 mm of rainfall on average. November records the maximum monthly rainfall, averaging 458 mm. February and March are the driest months, with monthly rainfall averages below 25 mm.

3.10.4 Temperature

The mean daily maximum temperature varies from 28°C and 37°C with the highest occurring in June. Mean daily minimum temperature varies between 23°C and 27°C, with the lowest occurring in December/ January.

3.10.5 Wind

3.10.5.1 Wind Speed and Direction

The overall Windrose pattern observed during winter season i.e. from July-October is shown in **Figure 3-9**.The frequency occurrence of wind at various speeds was calculated on the basis of total number of observations recorded in the respective wind speed category. The predominant wind direction during the study period observed to be Southwest (SE). The average wind speed during the study period was found to be 3.60 m/s i.e.,28.7 % of the total time. The various wind speed class frequency distribution during the study period is given in **Table 3-5.**

Table 3-5: Details of Wind Speed Class Frequency Distribution

S. No	Wind Speed Class (m/s)	% of Total Time
1	0.50-20.10	9.7
2	20.10-3.60	28.7
3	3.60-5.70	49.5
4	5.70-8.80	10.6
5	8.80-11.10	0.1
6	>=11.10	0.0

S. No	Wind Speed Class (m/s)	% of Total Time
7	Calms	1.5

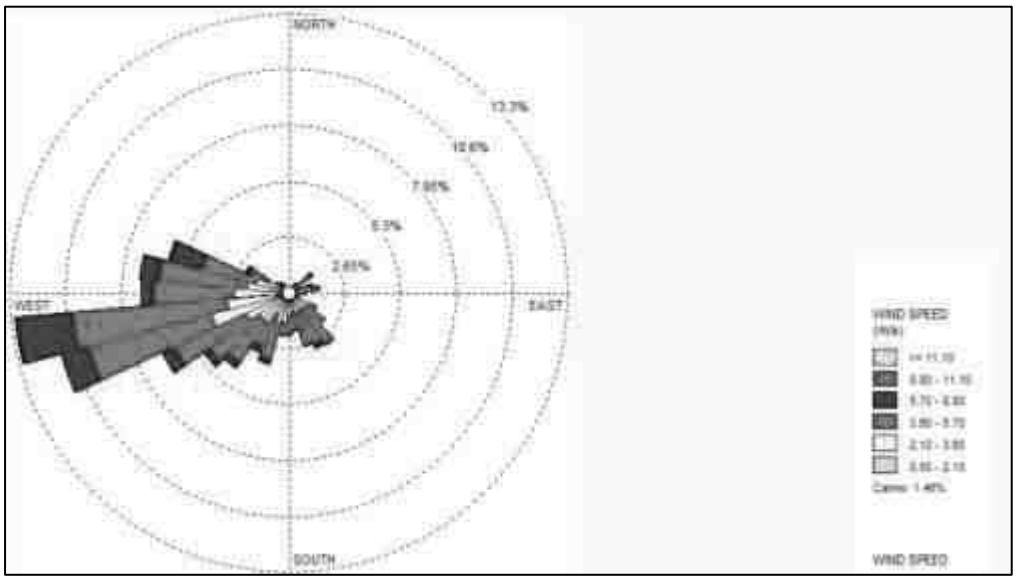


Figure 3-9: Windrose diagram for the Pre-monsoon Season

3.11 Ambient Air Quality

The monitoring locations were selected based on the following:

- Topography/Terrain
- Meteorological conditions; predominant wind direction
- Residential and sensitive areas within the study area
- Representatives of regional background air quality/pollution levels and
- Representation of likely impacted areas

3.11.1 Ambient Air Quality Monitoring Stations

The ambient air quality status within the study area has been assessed through 8 monitoring locations. A map showing the monitoring locations is given as **Figure FD302** and the details of the locations are given in **Table 3-6**.

Table 3-6: Ambient Air Quality Monitoring Locations

Station No.	Name of the Monitoring Location	Distance w.r.t project site (Km)	Direction w.r.t project site	Core Area/ Study Area	Environmental Setting
AAQ1	Project site	-	-	Core Area	Port Area
AAQ2	Sothikuppam	1.80	S	Study Area	Residential Area
AAQ3	Akkarai Gori	0.95	N	Study Area	Residential Area
AAQ4	Manjakupam	0.81	NW	Study Area	Residential Area
AAQ5	Pachchyankuppam	1.28	W	Study Area	Residential Area
AAQ6	Sangakuppam	2.40	N	Study Area	Residential Area
AAQ7	Cuddalore	4.46	NW	Study Area	Residential Area
AAQ8	Seddappayam	4.71	SW	Study Area	Residential Area

Exhibit 3-1: Ambient Air Sampling locations

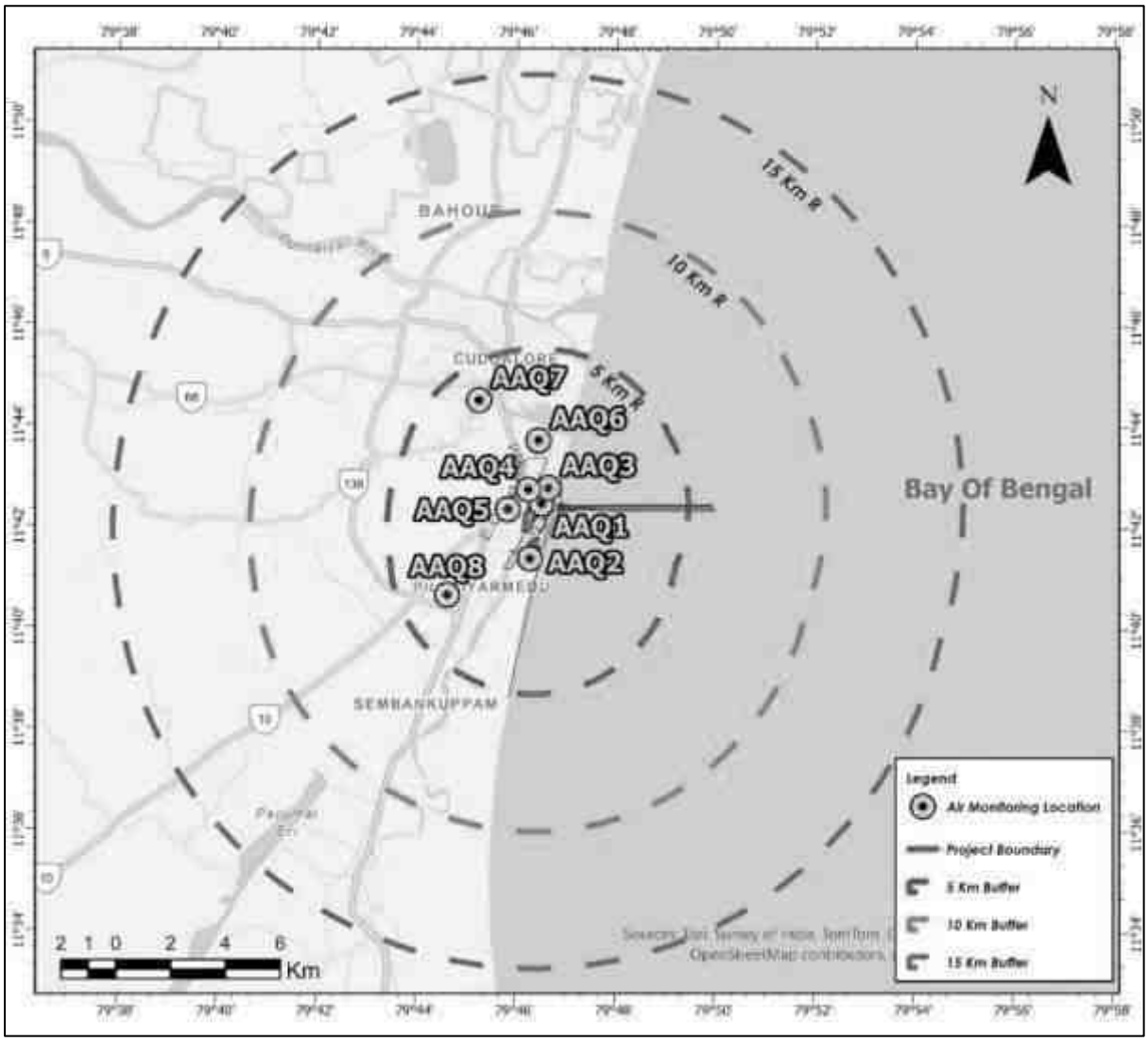


Figure 3-10: Ambient Air Quality Monitoring Locations

3.11.2 Sampling Parameters and Frequency

The ambient air quality parameters along with their frequency of sampling are given in **Table 3-7.**

Table 3-7: Parameters and Frequency of Sampling

S.No	Parameters	Sampling Frequency
1	Particulate Matter (PM_{10})	24 hourly sample twice a week for three months.
2	Particulate Matter, ($PM_{2.5}$)	24 hourly sample twice a week for three months.
3	Sulphur dioxide (SO_2)	24 hourly samples twice a week for three months.
4	Nitrogen dioxide (NO_2)	24 hourly samples twice a week for three months.
5	Carbon monoxide (CO)	8 hourly samples for 24 hours twice a week for three months
6	Ozone	8 hourly samples for 24 hours twice a week for three months
7	Lead	24 hourly samples twice a week for three months.
8	Ammonia	24 hourly samples twice a week for three months.
9	Arsenic	24 hourly samples twice a week for three months.
10	Nickel	24 hourly samples twice a week for three months.
11	Benzene	24 hourly samples twice a week for three months.

S.No	Parameters	Sampling Frequency
12	Benzo(a)pyrene	24 hourly samples twice a week for three months.

The ambient air quality status observed during study period is presented in terms of percentiles. All the 12 parameters (Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Ozone (O_3), Lead (Pb), Ammonia (NH_3), Benzene (C_6H_6), Benzo (a) Pyrene (BaP) – Particulate phase only, Arsenic (As), Hydrocarbons and Nickel (Ni)) are monitored as per NAAQS. The monitoring and analysis were carried out as per CPCB standard methods of measurements.

3.11.3 Results and Discussions

The variations of PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, and O_3 are compared with National Ambient Air Quality Standards (NAAQS), MoEFCC Notification of November 2009. The analytical results of Ambient Air Quality Monitoring for the study area are given in **Table 3-8, Table 3-9** and **Table 3-10** and graphically presented from **Figure 3-11 to Figure 3-14**.

Table 3-8: Ambient Air Quality Results (A)

Parameter	PM_{10} (µg/m³)				$PM_{2.5}$ (µg/m³)				SO_2 (µg/m³)				NO_2 (µg/m³)			
NAAQS	100				60				80				80			
Location	Min	Max	Avg	98th %	Min	Max	Avg	98th %	Min	Max	Avg	98th %	Min	Max	Avg	98th %
AAQ-1	37.4	41.2	39.3	41.1	18.5	24.1	21.3	24	9.4	15.3	12.4	30.6	16.8	22.4	19.6	22.3
AAQ-2	36.4	42.1	39.3	42	20.2	23.7	22	23.6	9.7	15.2	12.5	15.2	15.4	22.1	18.8	22
AAQ-3	37.9	42.7	40.3	42.6	20.8	24.8	22.8	24.7	10.2	15.4	12.8	15.3	16.9	23.5	20.2	23.4
AAQ-4	38.1	42.9	40.5	42.8	21.9	24.7	23.3	24.6	10.8	16.3	13.6	16.2	17.1	23.2	20.2	23.1
AAQ-5	38.9	42.4	40.7	42.3	19.1	24.9	22	24.8	11.2	18.2	14.7	18.1	18.5	23.8	21.2	23.7
AAQ-6	37.4	40.6	39.0	40.5	22.4	24.6	23.5	24.6	11.2	15.1	13.2	15	21.9	24.6	23.3	24.5
AAQ-7	38.7	41.2	40.0	41.2	23.5	25.9	24.7	25.9	11.8	16.2	14	16.1	22.4	26.1	24.3	26
AAQ-8	40.1	42.1	41.1	42.1	25.1	28.5	26.8	28.4	13.2	19.8	16.5	19.7	23.9	29.1	26.5	29

Table 3-9: Ambient Air Quality Results (B)

Parameter	CO (µg/m³)				O3 (µg/m³)				Pb (µg/m³)				NH_3 (µg/m³)			
NAAQS	4				180				1				400			
Location	Min	Max	Avg	98th %	Min	Max	Avg	98th %	Min	Max	Avg	98th %	Min	Max	Avg	98th %
AAQ-1	< 1.2	< 1.2	< 1.2	< 1.2	< 9.8	< 9.8	< 9.8	< 9.8	< 0.1	< 0.1	< 0.1	< 0.1	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-2	< 1.2	< 1.2	< 1.2	< 1.2	< 9.8	< 9.8	< 9.8	< 9.8	< 0.1	< 0.1	< 0.1	< 0.1	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-3	< 1.2	< 1.2	< 1.2	< 1.2	< 9.8	< 9.8	< 9.8	< 9.8	< 0.1	< 0.1	< 0.1	< 0.1	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-4	< 1.2	< 1.2	< 1.2	< 1.2	< 9.8	< 9.8	< 9.8	< 9.8	< 0.1	< 0.1	< 0.1	< 0.1	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-5	< 1.2	< 1.2	< 1.2	< 1.2	< 9.8	< 9.8	< 9.8	< 9.8	< 0.1	< 0.1	< 0.1	< 0.1	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-6	< 1.2	< 1.2	< 1.2	< 1.2	< 9.8	< 9.8	< 9.8	< 9.8	< 0.1	< 0.1	< 0.1	< 0.1	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-7	< 1.2	< 1.2	< 1.2	< 1.2	< 9.8	< 9.8	< 9.8	< 9.8	< 0.1	< 0.1	< 0.1	< 0.1	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-8	< 1.2	< 1.2	< 1.2	< 1.2	< 9.8	< 9.8	< 9.8	< 9.8	< 0.1	< 0.1	< 0.1	< 0.1	< 1.0	< 1.0	< 1.0	< 1.0

Table 3-10: Ambient Air Quality Results (c)

Parameter	As(µg/m³)				Ni (µg/m³)				C6H6 (µg/m³)				Benzo (a)pyrene (µg/m³)			
NAAQS	6.0				20				5.0				1			
Location	Min	Max	Avg	98th %	Min	Max	Avg	98th %	Min	Max	Avg	98th %	Min	Max	Avg	98th %
AAQ-1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-2	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-3	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-4	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-5	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-6	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-7	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
AAQ-8	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

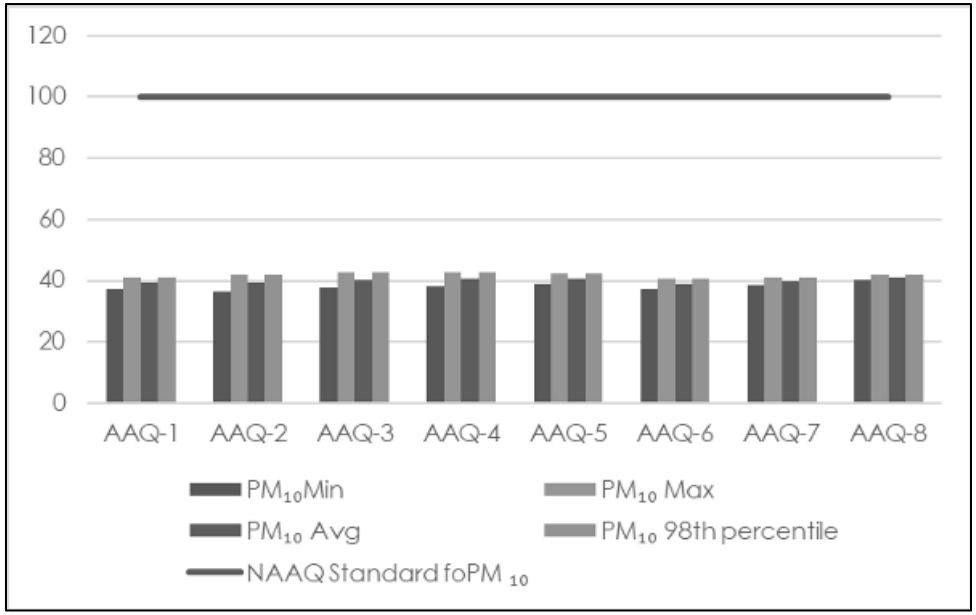


Figure 3-11: Ambient PM_{10} Levels

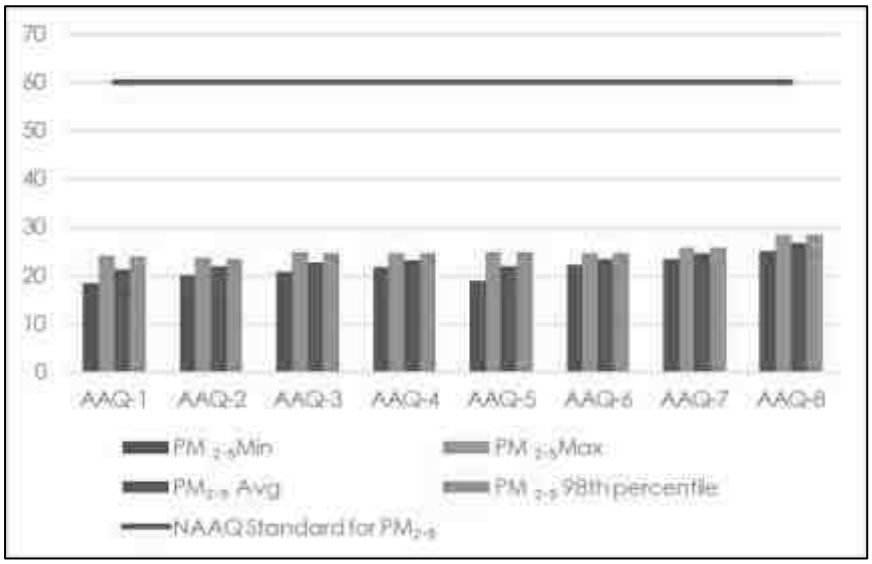


Figure 3-12: Ambient $PM_{2.5}$ Levels

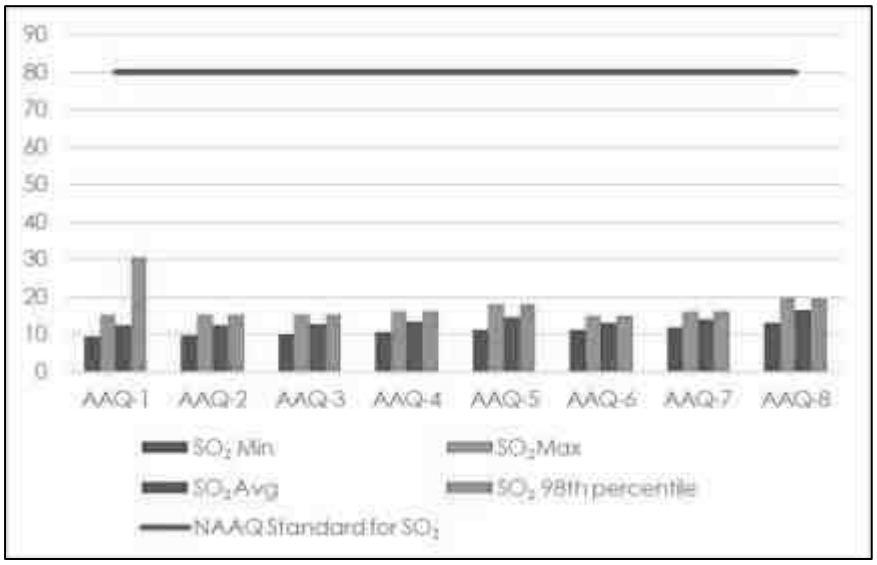


Figure 3-13: Ambient SO_2 Levels

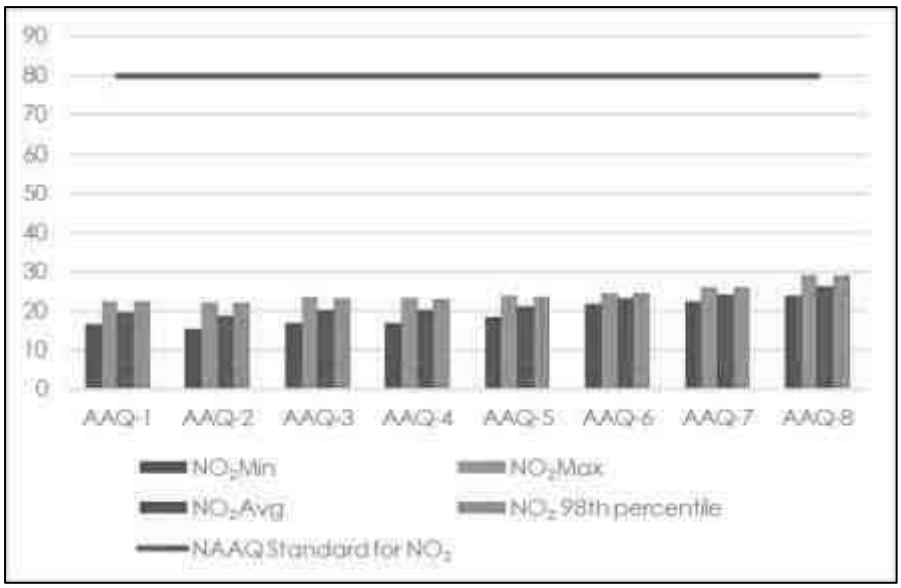


Figure 3-14: Ambient NO_2 Levels

3.11.4 Observations

- PM_{10} ranged between 36.4 µg/m^3 (AAQ-2) to 42.9 µg/m^3 (AAQ-4). NAAQS stipulated standard for PM_{10} for 24 hr is 100µg/m^3.
- $PM_{2.5}$ values varied from 18.5 µg/m^3 (AAQ-1) to 28.5 µg/m^3 (AAQ-8). NAAQS stipulated standard for $PM_{2.5}$ for 24 hr is 60 µg/m^3.
- SO_2 values varied from 9.4 µg/m^3 (AAQ-1) to 19.8 µg/m^3 (AAQ-8). NAAQS stipulated standard for SO_2 for 24 hr is 80 µg/m^3.
- NO_2 ranged between 15.4 µg/m^3 (AAQ-2) to 29.1 µg/m^3 (AAQ-8). NAAQS stipulated standard for NO_2 for 24 hr is 80 µg/m^3.
- O_3 were found to be below detectable limits in all the locations. NAAQS stipulated standard for O_3 for 8 hourly is 100 µg/m^3.
- Hydrocarbons such as Benzene and Benzo (o) pyrene were found to be below detectable limits in all the locations.
- Heavy metals like Lead, Arsenic and Nickel were found to be below detectable limits in all locations.

3.12 Ambient Noise

Baseline ambient noise quality has been established by monitoring noise levels at 8 locations. The noise monitoring locations in the study area were selected after giving due consideration to the various land use categories. The land use categories include commercial, Industrial and residential areas. The map showing the noise monitoring locations is given in **FD303** and the details of the same are given in the **Table 3-11.** Noise levels were recorded on an hourly basis for one complete day at each location using pre- calibrated noise levels.

Table 3-11: Details of Noise Level Monitoring Locations

Station No.	Name of the Monitoring Location	Distance w.r.t project site (Km)	Direction w.r.t project site	Core Area/ Study Area	Environmental Setting
N1	Project site	-	-	Core Area	Port Area
N2	Sothikuppam	1.80	S	Study Area	Residential Area
N3	Akkarai Gori	0.95	N	Study Area	Residential Area
N4	Manjakupam	0.81	NW	Study Area	Residential Area
N5	Pachchyankuppam	1.28	W	Study Area	Residential Area
N6	Sangakuppam	2.40	N	Study Area	Residential Area
N7	Cuddalore	4.46	NW	Study Area	Residential Area
N8	Seddappayam	4.71	SW	Study Area	Residential Area

Exhibit 3-2: Noise Monitoring Location

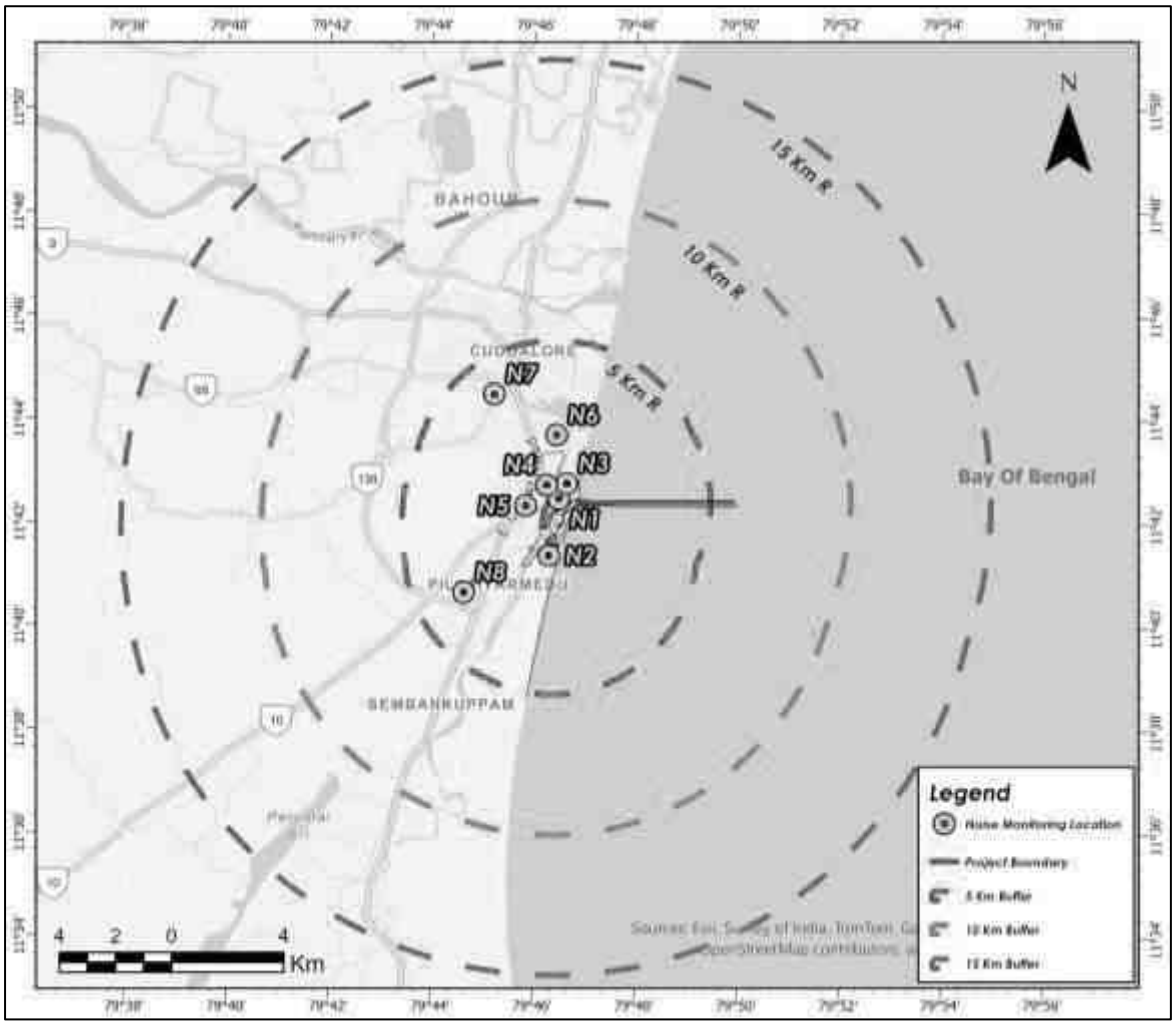


Figure 3-15: Noise Level Monitoring Locations

3.12.1 Results and Discussion

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

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

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

Station	Name of The Monitoring Locations	Ld	Ln	CPCB Standards		Environmental Setting
				Day	Night	
N1	Project site	42.5	37.4	75	70	Industrial
N2	Sothikuppam	45.2	37.2	55	45	Residential
N3	Akkarai Gori	45.7	35.9	55	45	
N4	Manjakupam	44.2	34.7	55	45	
N5	Pachchyankuppam	42.6	35.1	55	45	
N6	sangakuppam	42.4	32.8	55	45	
N7	Cuddalore	42.8	39.1	55	45	
N8	Seddappayam	44.9	39.8	55	45	

The comparison of day equivalent noise levels (Ld) and night equivalent noise levels (Ln) with the respective CPCB stipulated noise standards for residential and Commercial land use category are graphically shown below

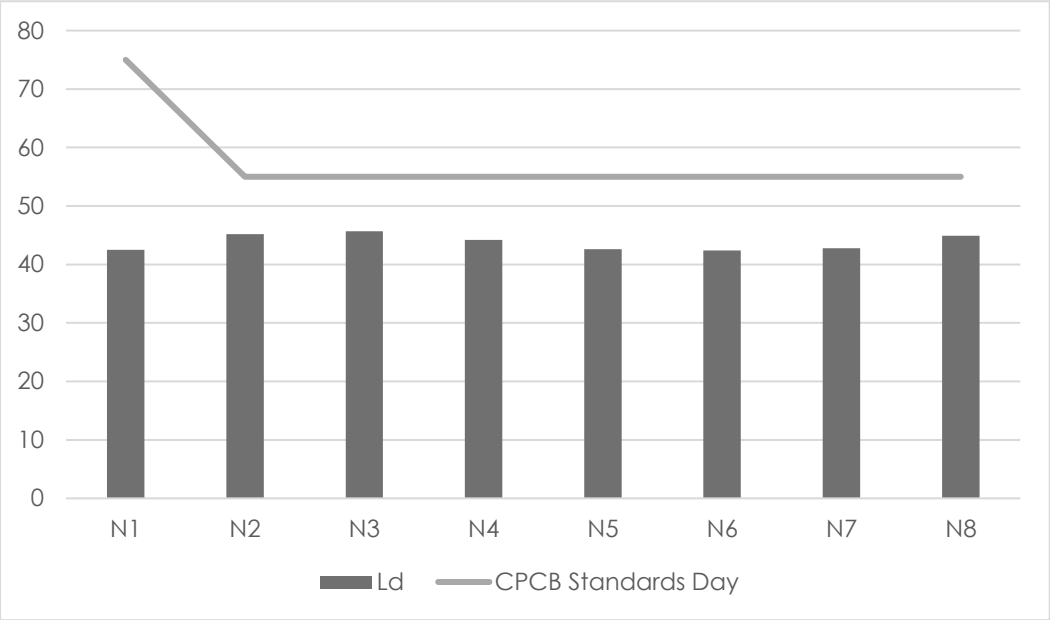


Figure 3-16: Comparison of Ld with CPCB Standards

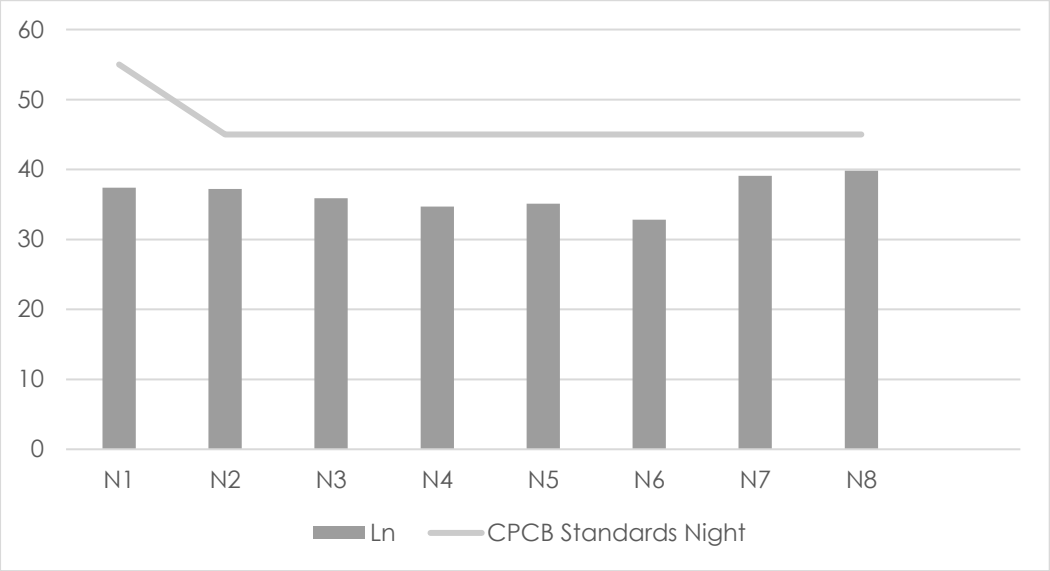


Figure 3-17: Comparison of Ln with CPCB Standards

3.12.2 Observations

It is observed that the day and night equivalent noise levels at all locations are well within the prescribed CPCB standards.

- Day equivalent noise levels (Ld) ranged between 42.4 dB(A) to 45.7 dB (A).
- Night equivalent noise levels (Ln) ranged between 32.8 dB(A) to 39.8 dB (A)

3.13 Inland Water Quality

Inland water quality in the study area was assessed at 4 groundwater locations and 4 surface water locations. The map showing the inland water quality locations is given as **FD 304**. The details of water sampling locations are presented in the and **Table 3-12** and **Table 3-13.** The ground water samples collected during the month of September, 2025.

Table 3-12: Details of Groundwater Sampling locations

Station Code	Name of the Monitoring Location	Distance w.r.t project site (Km)	Direction w.r.t project site	Source
GW1	Sothikuppam	1.80	S	Borewell
GW2	Akkarai Gori	0.95	N	Borewell
GW3	Manjakupam	0.81	NW	Borewell
GW4	Cuddalore	4.46	NW	Borewell

Table 3-13: Details of Surface water Sampling locations

Station Code	Name of the Monitoring Location	Distance w.r.t project site (Km)	Direction w.r.t project site	Source
SW1	Akkarai Gori	1.37	S	River
SW2	Raasapettai Village	2.42	N	River
SW3	Manjakupam	0.57	NW	Pond
SW4	Thirupapuliyur	4.46	NW	River

Exhibit 3-3: Groundwater Sampling Locations

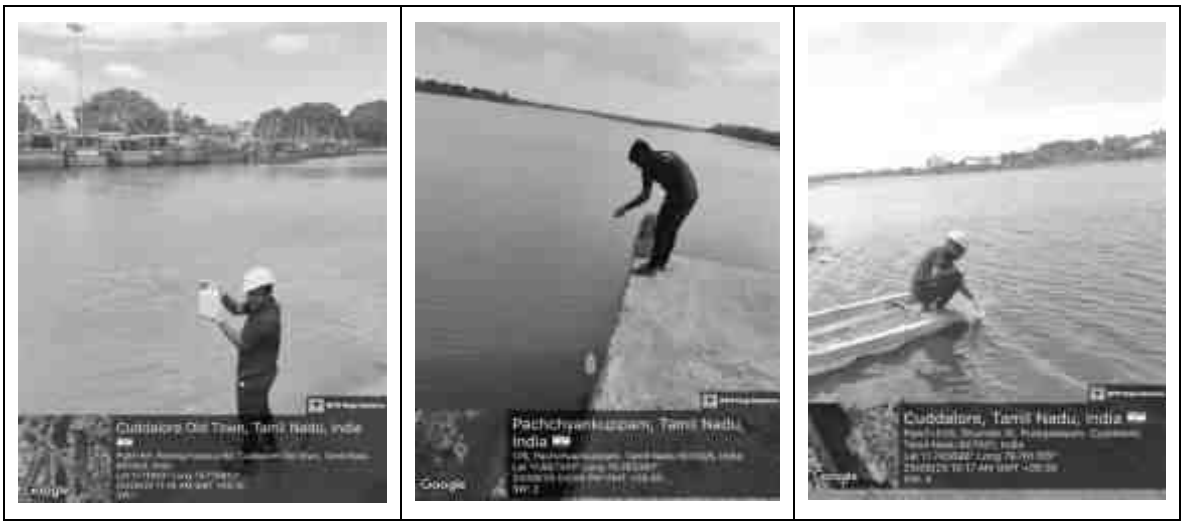


Exhibit 3-4: Surface water sampling locations

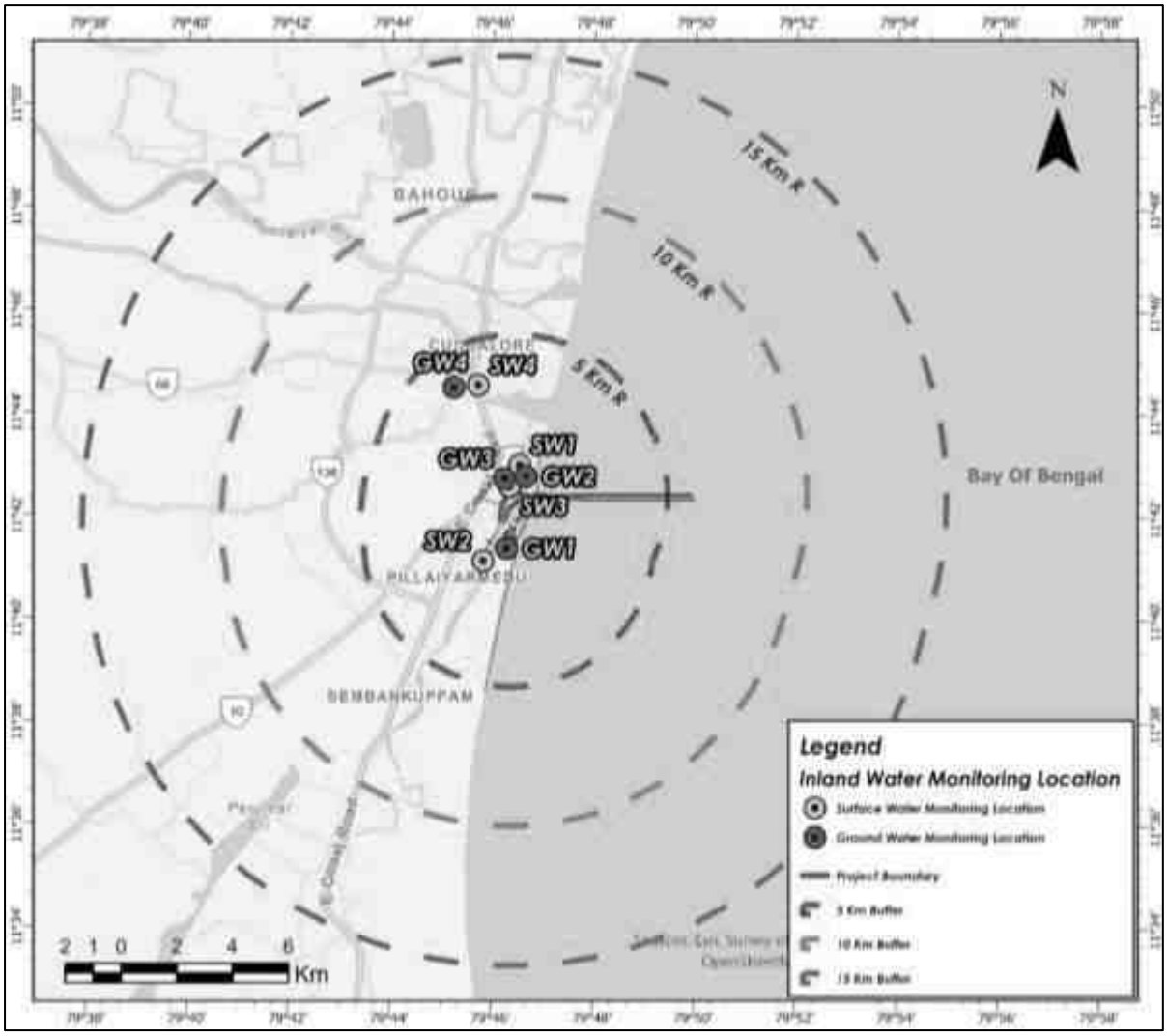


Figure 3-18: Inland Water Sampling Locations

3.13.1 Results and Discussions

Table 3-14: Groundwater Results

S. No	Parameters	Units	Test Method	GW1	GW2	GW3	GW4
1	Colour	Hazen	IS 3025: Part 04	< 1.0	< 1.0	< 1.0	< 1.0
2	Odour		IS 3025: Part 05	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste		IS 3025: Part 08	Not applicable	Not applicable	Not applicable	Not applicable
4	Turbidity	NTU	IS 3025: Part 10	< 0.5	< 0.5	< 0.5	< 0.5
5	pH		IS 3025: Part 11	7.5	7.7	7.9	7.9
6	Temperature	°C	IS 3025: Part 09	25	25	25	25
7	Electrical conductivity	µmhos/cm	IS 3025: Part 14	894	985	743	1001
8	Salinity	%	Lab Internal Method	1.8	5.9	2.4	5.9
9	Total solids	mg/L	IS 3025: Part 15	1610	1790	538	1720
10	Total Hardness as $CaCO_3$	mg/L	IS 3025: Part 21	258	745	267	663
11	Calcium as Ca	mg/L	IS 3025: Part 41	71	73	63	55
12	Magnesium as Mg	mg/L	IS 3025: Part 46	42	82	32	72
13	Chlorides as Cl^-	mg/L	IS 3025: Part 58	118	665	407	584
14	Manganese as Mn	mg/L	IS 3025: Part 59	< 0.03	< 0.03	<0.03	<0.03
15	Copper as Cu	mg/L	IS 3025: Part 42	BDL (DL = 0.03)	BDL (DL = 0.03)	BDL (DL = 0.03)	BDL (DL = 0.03)
16	Total Alkalinity as HCO_3	mg/L	IS 3025: Part 23	186	190	188	192
17	Total Dissolved Solids	mg/L	IS 3025: Part 16	735	684	432	568
18	Sulphates as SO4-2-	mg/L	IS 3025: Part 24	84	62	35	75
19	Nitrate as NO3	mg/L	IS 3025: Part 34	< 1.0	< 1.0	< 1.0	< 1.0
20	Total Iron as Fe	mg/L	IS 3025: Part 53	BDL (DL= 0.01)	0.03	<0.01	0.02
21	Fluorides as F-	mg/L	IS 3025: Part 60	< 0.1	< 0.1	< 0.1	< 0.1
22	Total Hexavalent Chromium as Cr+6	mg/L	IS 3025: Part 43	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)
23	Cyanide as CN^-	mg/L	IS 3025: Part 27	Absent	Absent	Absent	Absent
24	Zinc as Zn	mg/L	IS 3025: Part 17	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)
25	Phenolic Compounds as Phenols	mg/L	IS 3025: Part 43	< 0.001	< 0.001	< 0.001	< 0.001
26	Residual Free Chlorine (RFC)	mg/L	IS 3025: Part 26	< 0.1	< 0.1	< 0.1	< 0.1
27	Sodium as Na	mg/L	IS 3025: Part 45	125	145	135	106
28	Total Nitrogen as N	mg/L	IS 3025: Part 31	<1.0	<1.0	<1.0	<1.0
29	Phosphorus as P	mg/L	APHA22ndEdition4500	<0.1	<0.1	<0.1	<0.1
30	Free Ammonia as NH_3	mg/L	APHA22nd4500 NH3 C	<1.0	<1.0	<1.0	<1.0
31	Mercury (as Hg),	mg/L	IS 3025: Part 48	BDL (DL = 0.001)	BDL (DL = 0.001)	BDL (DL = 0.001)	BDL (DL = 0.001)
32	Cadmium as Cd	mg/L	IS 3025: Part 41	BDL (DL = 0.001)	BDL (DL = 0.001)	BDL (DL = 0.001)	BDL (DL = 0.001)
33	Selenium (as Se),	mg/L	IS 3025: Part 56	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)
34	Arsenic (as As)	mg/L	IS 3025: Part 37	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)
35	Lead as Pb	mg/L	IS 3025: Part 58	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)

S. No	Parameters	Units	Test Method	GW1	GW2	GW3	GW4
36	Chemical Oxygen Demand	mg/L	IS 3025: Part 04	<4.0	<4.0	<4.0	<4.0
37	Biological Oxygen Demand (BOD)	mg/L	IS 3025: Part 44	<1.0	<1.0	<1.0	<1.0
38	Anionic Detergent (as MBAS)	mg/L	IS 13428 (Annex K)	< 0.01	< 0.01	< 0.01	< 0.01
39	Potassium	mg/L	IS 3025: Part 02	30.0	29	35.0	25
Microbial Parameters							
1	Faecal Coliforms (MPN)	MPN/100ml	S:1622	BDL	BDL	BDL	BDL
2	Total coliform (MPN)	MPN/100ml	S:1622	BDL	BDL	BDL	BDL

Note: GW1: Sothikuppam, GW2: Akkarai Gori, GW3: Manjakupam, GW4: Cuddalore

Table 3-15: Surface water Results

S. No	Parameters	Units	Test Method	SW1	SW2	SW3	SW4
1	Colour	Hazen	IS 3025: Part 04	< 1.0	< 1.0	< 1.0	< 1.0
2	Odour		IS 3025: Part 05	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste		IS 3025: Part 08	Not applicable	Not applicable	Not applicable	Not applicable
4	Turbidity	NTU	IS 3025: Part 10	4.7	6.7	9.1	3.4
5	PH		IS 3025:Part 11	7.9	8.1	7.9	7.8
6	Temperature	°C	IS 3025: Part 09	31	30	29	30
7	Electrical conductivity	µmhos/cm	IS 3025: Part 14	2079	2248	1863	3056
8	Salinity	%	Lab Internal Method	99.7	60.1	8.1	27.3
9	Total solids	mg/L	IS 3025: Part 15	1983	1970	1560	1050
10	Total Hardness as $CaCO_3$	mg/L	IS 3025: Part 21	1152	1243	984	553
11	Calcium	mg/L	IS 3025: Part 41	72.1	68.3	56.3	55.3
12	Magnesium as Mg	mg/L	IS 3025: Part 46	48	42	37	32
13	Chlorides as Cl^-	mg/L	IS 3025: Part 58	1057	1106	1357	875
14	Manganese as Mn	mg/L	IS 3025: Part 59	<0.03	< 0.03	< 0.03	<0.03
15	Copper as Cu	mg/L	IS 3025: Part 42	BDL (DL = 0.03)	BDL (DL = 0.03)	BDL (DL = 0.03)	BDL (DL = 0.03)
16	Total Alkalinity as HCO_3	mg/L	IS 3025: Part 23	145	156	453	286
17	Total Dissolved Solids	mg/L	IS 3025: Part 16	1594	1097	870	950
18	Sulphates as SO_4^{-2}	mg/L	IS 3025: Part 24	109	114	130	124
19	Nitrate as NO_3	mg/L	IS 3025: Part 34	11	10	9	10
20	Total Iron as Fe	mg/L	IS 3025: Part 53	1.9	1.12	0.04	0.20
21	Fluorides as F^-	mg/L	IS 3025: Part 60	0.18	0.12	<0.1	< 0.1

S. No	Parameters	Units	Test Method	SW1	SW2	SW3	SW4
22	Total Hexavalent Chromium as Cr^{+6}	mg/L	IS 3025: Part 43	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)
23	Cyanide as CN^-	mg/L	IS 3025: Part 27	<1.0	<1.0	<1.0	<1.0
24	Zinc as Zn	mg/L	IS 3025: Part 17	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)
25	Phenolic Compounds as Phenols	mg/L	IS 3025: Part 43	< 0.001	< 0.001	< 0.001	< 0.001
26	Residual Free Chlorine (RFC)	mg/L	IS 3025: Part 26	< 0.1	< 0.1	< 0.1	< 0.1
27	Sodium as Na	mg/L	IS 3025: Part 45	135	105	78	96
28	Total Nitrogen as N	mg/L	IS 3025: Part 31	<1.0	<1.0	4.4	3.1
29	Phosphorus as P	mg/L	APHA22ndEdition4500	5.6	3.0	<0.1	3.8
30	Free Ammonia as NH_3	mg/L	APHA22nd4500 NH3 C	<1.0	<1.0	<1.0	<1.0
31	Mercury (as Hg)	mg/L	IS 3025: Part 48	BDL (DL = 0.001)	BDL (DL = 0.001)	BDL (DL = 0.001)	BDL (DL = 0.001)
32	Cadmium as Cd	mg/L	IS 3025: Part 41	BDL (DL = 0.001)	BDL (DL = 0.001)	BDL (DL = 0.001)	BDL (DL = 0.001)
33	Selenium (as Se)	mg/L	IS 3025: Part 56	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)
34	Arsenic (as As)	mg/L	IS 3025: Part 37	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)
35	Lead as Pb	mg/L	IS 3025: Part 58	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)	BDL (DL = 0.01)
36	Chemical Oxygen Demand	mg/L	IS 3025: Part 04	11	10	15	9
37	Biological Oxygen Demand (BOD)	mg/L	IS 3025: Part 44	3.2	2.9	5.0	3.7
38	Dissolved Oxygen	mg/L	IS 3025: Part 04	4.5	5.2	5.5	4.8
39	Anionic Detergent (as MBAS)	mg/L	IS 13428 (Annex K)	< 0.01	< 0.01	< 0.01	< 0.01
Microbial Parameters							
41	Faecal Coliforms (MPN)	MPN/100ml	S:1622	28	45	<2.0	<2.0
42	Total coliform (MPN)	MPN/100ml	S:1622	90	130	60	70

Note: SW1-Akkarai Gori, SW2- Raasapettai Village, SW3- Manjakupam, SW4- Thirupapuliyur

3.13.2 Observations

Ground Water Quality:

- pH is ranges 7.5 at between GW-1 and 7.9 at GW -4 indicating slightly alkaline in nature and within the permissible limit (6.5-8.5) of IS:10500 Standard.
- Electrical Conductivity (EC) was found to be in the range of 743 µmhos/cm at GW-3 to 1001 µ mhos/cm at GW-4.
- Temperature is constant at 25 ^{0}C.
- Total Dissolved Solids (TDS) found to be 1538 mg/l at GW-3 and 1790 mg/l) at GW-2.
- Chloride concentrations are between 118 mg/l at GW-1and 665 mg/l at GW-2 respectively and well within permissible limits (1000 mg/l).
- Sodium concentrations are between 106 mg/l at GW-4 and 145 mg/l at GW-2 respectively.
- Total Alkalinity ranged between 186 mg/l at GW-1 to 192 mg/l at GW-4 respectively.
- Total hardness (as $CaCo_3$) ranged between 258 mg/l at GW-1 to 745 mg/l at GW-2 respectively.
- Fluoride concentrations are below acceptable limits.
- Heavy metal like Mercury (Hg), Cadmium (Cd), Arsenic (As), Selenium (Se), Cyanides (CN) were below detectable limits.

Surface Water Quality:

- pH ranged from 7.8 at SW-4 to 8.1 at SW-2 indicating slightly alkaline in nature and within the permissible limit (6.5-8.5) of IS:10500 Standard.
- Electrical Conductivity (EC) was found to be in the range of 1863 µmhos/cm at SW-3 to 3056 µ mhos/cm at SW-4.
- Temperature varies from 29.1^{0}C at SW-03 to 31 ^{0}C at SW-01.
- Total Dissolved Solids (TDS) found to be 870 mg/l at SW-3 to 1594 mg/l at SW-1.
- Chloride concentrations are between 875 mg/l at SW-4 to 1357 mg/l at SW-3 respectively.
- Biochemical Oxygen Demand concentration ranged between 2.9 mg/L at SW-2 to 5 mg/L at SW-3.
- Chemical Oxygen Demand (COD) concentration ranged between 9 mg/L at SW-4 to 15 mg/L at SW-3.
- Sodium concentrations are between 78 mg/l at SW-3 to 135 mg/l at SW-1 respectively.
- Total Alkalinity ranged between 145 mg/l at SW-1 to 453 mg/l at SW-3 respectively.
- Total hardness (as $CaCo_3$) ranged between 553 mg/l at SW-4 to 1243 mg/l at SW-2 respectively.
- Heavy metal like Mercury (Hg), Cadmium (Cd), Arsenic (As), Selenium (Se), Cyanides (CN) were below detectable limits.

- Total Coliform was found to be 60 MPN/100ml at SW-3 to 130 MPN/100ml at SW-2.

3.14 Soil Quality

The soil in the study area is predominantly sandy Loam. The soil quality in the study area was assessed through collection and analysis of samples from Six locations. These samples were collected from each location, homogenised, and analysed for important parameters. The soil sampling locations are given below

Table 3-16: Soil Monitoring Locations

Station No.	Name of the Monitoring Location	Distance w.r.t project site (Km)	Direction w.r.t project site
S1	Project site	-	-
S2	Panchiyankuppam Village	1.80	S
S3	Singarathope	1.30	N
S4	Sandar Palayam	1.36	NW
S5	Mulai Nagar	0.85	SW
S6	Kannarapettai	4.01	SW

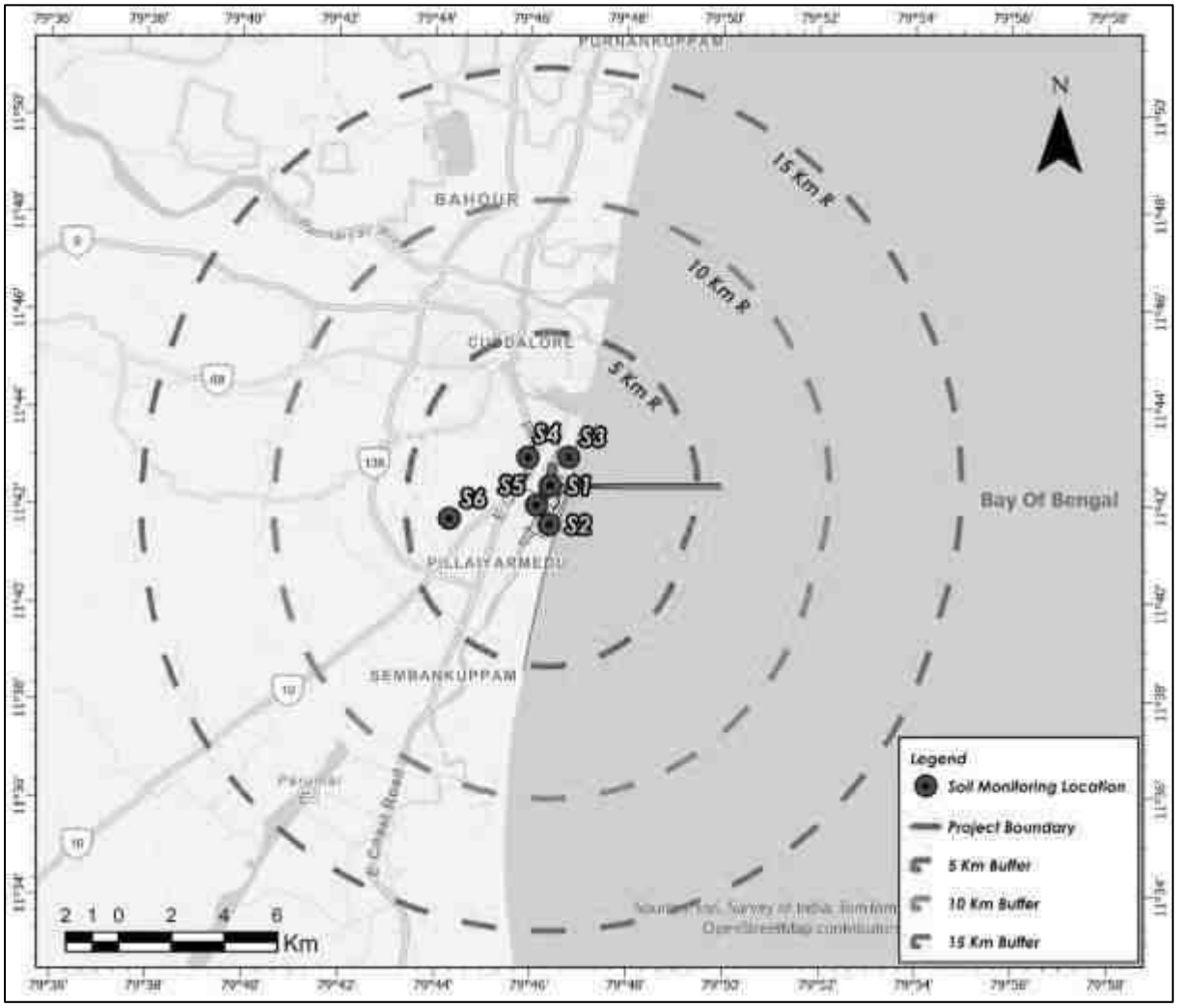


Figure 3-19: Soil Monitoring Locations

3.14.1 Results and Discussions

Table 3-17: Soil Quality

S. No	Parameter	Method	Unit	S1	S2	S3	S4	S5	S6
1	PH	IS 2720 Part 26: 2021	--	7.73	7.22	7.77	7.96	7.68	7.4
2	Bulk Density	IS 2720 Part 29: 1975	g/cc	1.54	1.62	1.58	1.52	1.57	1.62
3	Electrical Conductivity	IS 14767: 2021	µhom/cm	99	173.9	191.7	131.7	162.2	172.7
4	Particle Size Distribution	Department of Agriculture & Cooperation Ministry of Agriculture, Government of India	micron	0.425	0.425	0.425	0.425	0.425	0.425
5	Water Holding Capacity		%	20.8	22.4	20.6	21.8	20.7	20.4
6	Porosity	FAO Method 2007	%	0.453	0.467	0.438	0.457	0.468	0.453
7	Infiltration	ASTM D3385	mm/hr	25	24	26	25	24	28
8	Nitrogen as N	IS 14684: 2019	mg/kg	76	112	80	168	78	123
9	SAR	By calculation method	meq/gm	0.792	0.824	0.761	0.729	0.934	0.953
10	Potassium as K	IS 9497: 2024	mg/kg	94.8	124.2	102.4	124.3	140	78.6
11	Sulphur	IS2720 Part 27	%	0.028	0.032	0.024	0.026	0.031	0.028
12	Total Organic Carbon	IS 2720 Part 22: 2020	%	0.624	0.598	0.645	0.627	0.596	0.632
13	Organic Matter	IS 2720 Part 22: 2020	%	1.076	1.031	1.112	1.081	1.028	1.090
14	phosphorus as P	Department of Agriculture & Cooperation Ministry of Agriculture, Government of India: 2011	mg/kg	160	165	79.5	85	120	120
15	Magnesium as Mg		mg/kg	156	145	167	154	149	138
16	Boron	USEPA:30508 (Acid Digestion) &70008 AAS: 2007	mg/kg	1.45	1.24	1.46	1.67	1.45	1.57
17	Copper		mg/kg	3.98	3.44	2.78	3.12	3.56	3.78
18	Iron		mg/kg	5.67	4.32	5.67	5.87	5.34	5.26
19	Lead		mg/kg	1.24	1.45	1.46	1.23	1.67	1.45
20	Cadmium		mg/kg	1.87	1.67	1.43	1.57	1.35	1.67
21	Chromium		mg/kg	2.12	2.45	2.56	2.67	2.89	2.34
22	Manganese		mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
23	Zinc		mg/kg	7.82	6.56	7.12	7.45	7.87	7.12
24	Nickel		mg/kg	1.08	0.89	0.87	1.04	1.08	1.12
25	Alkali metalic Permeability	By calculation method	meq/gm	0.0034	0.0056	0.0078	0.0065	0.0078	0.0054
26	Cation Exchange Capacity	By calculation method	meq/gm	0.0145	0.0146	0.0152	0.0157	0.0145	0.01432

S. No	Parameter	Method	Unit	S1	S2	S3	S4	S5	S6
27	Type of Soil	---	---	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam
	Sand	Hydrometer Method	%	65.8	69.8	70.4	69.7	70.3	72.4
	Silt		%	18.6	13.5	11.8	16.4	17.8	16.9
	Clay		%	15.6	16.7	17.8	13.9	11.9	10.7

Note: S1- Project site, S2- Panchiyankuppam Village, S3-Singarathope, S4- Sandar Palayam, S5-Mulai Nagar, S6- Kannarapettai.

3.14.2 Observations

- The pH of the soils ranged between 7.22 and 7.96 indicating "alkaline" in nature.
- The texture of the soil seems to be Sandy loam.
- The electrical conductivity was found to be in the range of 99 µmhos/cm to 191.7 µmhos/cm.
- The Organic Carbon was observed to be in the range of 0.596% to 0.645%.
- The infiltration rate was found to be between 24 mm/hr and 28 mm/hr.
- Bulk density of the soils ranged from 1.52 g/cc to 1.62 g/cc.
- The water holding capacity of the soils varied from 20.4 % to 22.4 %.
- Porosity of the soils varied from 0.438% to 0.468 %
- Heavy metal concentration for metals like, Copper (as Cu) varied from 2.78 mg/Kg to 3.98 mg/kg, Iron (as Fe) varied from 4.32 mg/kg to 5.87 mg/kg and Lead (as Pb) is varied from 1.23 mg/Kg to 1.67 mg/kg in the soils.
- Nitrogen concentration in soil varied from 76 mg/kg to 168 mg/kg.
- Potassium concentration varied from 78.6 mg/kg to 140 mg/kg.
- Phosphorus percentage varied from 79.5 mg/kg to 165 mg/kg.

3.15 Marine Environment

The existing marine environmental conditions around the proposed expansion of Cuddalore Port locations were determined by collecting and analysing of water and sediment samples at selective sampling locations. The following sections represent the sampling locations, discussions of the analysis carried out as a part of the study. Sampling locations are shown in **Table 3-18** and corresponding locations map is given as **FD 306.**

Table 3-18: Marine sampling locations

S. No	Sampling Location	Latitudes	Longitudes
1	MSL-1	11°42'22.26"N	79°46'56.24"E
2	MSL-2	11°42'22.19"N	79°47'27.42"E
3	MSL-3	11°42'56.80"N	79°47'32.85"E
4	MSL-4	11°41'47.86"N	79°47'20.77"E
5	MSL-5	11°42'25.95"N	79°49'11.49"E
6	MSL-6	11°43'44.38"N	79°48'36.25"E
7	MSL-7	11°41'13.49"N	79°48'24.24"E
8	MSL-8	11°44'8.79"N	79°47'26.44"E
9	ITL-1	11°41'49.32"N	79°46'39.63"E
10	ITL-2	11°42'59.21"N	79°46'54.73"E

Exhibit 3-5: Marine Sampling locations

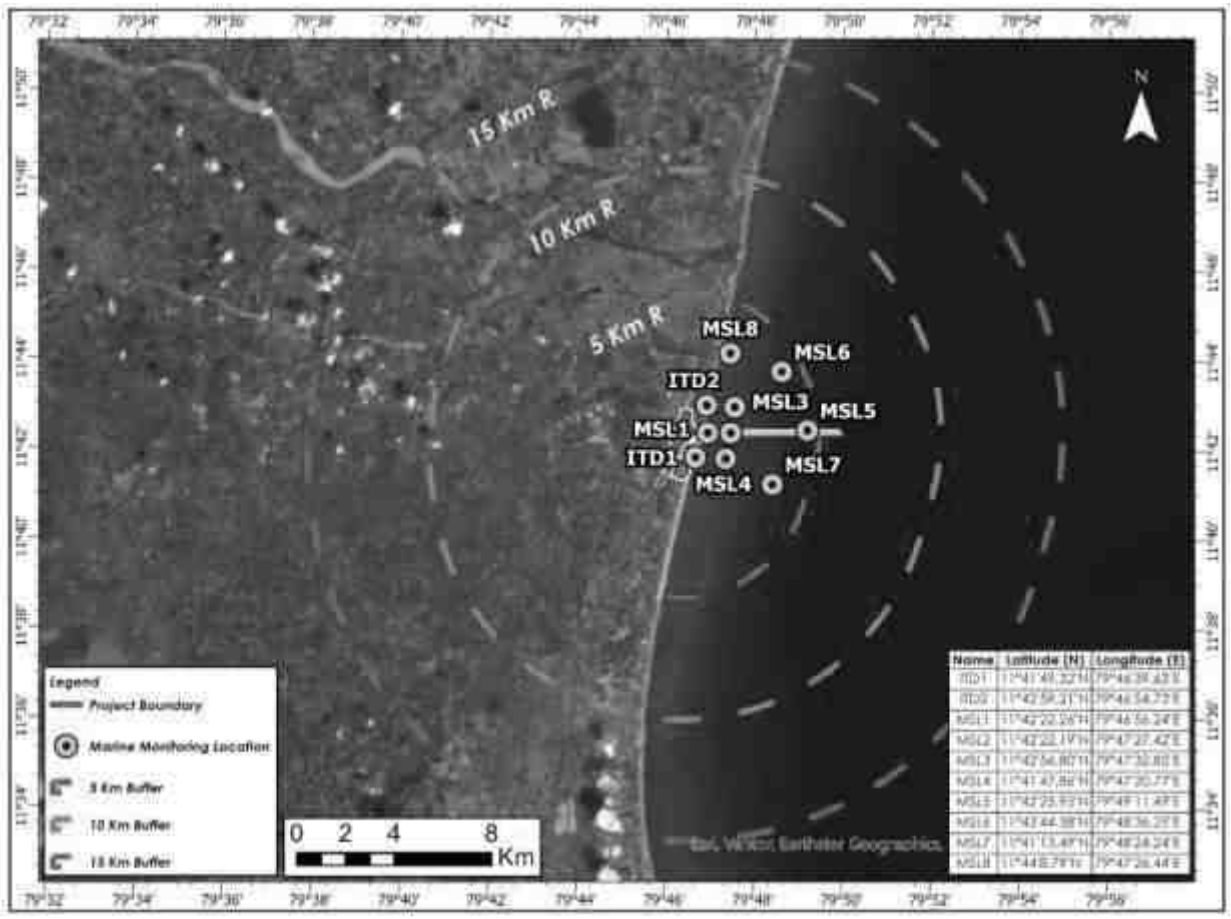


Figure 3-20: Marine sampling locations

3.15.1 Methodology adopted for Various Analysis

Water samples were collected at the surface and sub-surface level using Universal water sampler and transferred to the pre-cleaned polypropylene and glass containers. Sediment samples were collected using van Veen Grab, transferred to clean polythene bags and transported to the shore. The samples were air-dried, and the plant root and other debris were removed and stored for further analysis.

3.15.1.1 Water Analysis

Temperature, Salinity and pH

The physical parameters such as temperature, salinity and pH were measured in-situ in the field. The sub-surface temperature was measured with a mercury thermometer ((±0.02°C accuracy) and the pH was measured by a calibrated pH pen (pH ep-3 model). Salinity was estimated using a Hand Refractometer (Atago, Japan). Water samples collected for dissolved oxygen estimation were transferred carefully to DO bottles. The DO was immediately fixed and brought to the shore for further analysis. TSS was measured using Millipore vacuum filtration unit and the values are expressed in ppm. Turbidity was measured using turbidity meter and expressed in NTU.

Preservation and Laboratory Analysis

After collection, the samples were immediately cooled to 4^0C and then brought to the Lab, in an insulated thermocool box.

Dissolved Oxygen

The modified Winkler's method as described by Strickland and Parsons (1972) was adopted for the estimation of dissolved oxygen. The values are expressed in mg/l.

Sulphate

The sulphates content of samples was analysed by following the method described by APHA (1995).

Nutrients: Nitrate and Nitrite

The nitrate, nitrite, Ammonia, Total nitrogen, Total Phosphorus and Reactive Silicate were estimated by adopting the method described by Grasshoff et al. (1999).

3.15.1.2 Sediment Analysis

For the analysis of soil textural composition and pH, the air-dried sediment samples were used as such. For all other analyses, sediment samples were ground to fine powder and dried in an oven at 110^0C to constant weight for an hour and the parameters such as soil texture, TOC, PHC, Heavy metals were analysed using the sediment samples.

Total Organic Carbon

The estimation of total organic carbon in sediment was performed by adopting the method of El Wakeel and Riley (1956).

3.15.1.3 Chlorophyll `a' & Phaeo-pigments

The detailed methodology as described in APHA manual (1989) was followed for estimating Chlorophyll'a' and phaeo-pigments content.

3.15.1.4 Phytoplankton

Phytoplankton samples were collected from the surface waters of the study area by towing a plankton net (mouth diameter 0.35 m) made of bolting silk [No.30 mesh size 48 µm) for half an hour. These samples were preserved in 5% neutralized formalin and used for qualitative analysis. For the quantitative analysis of phytoplankton, the settling method as described by Sukhanovo (1978) was adopted. Numerical plankton analysis was carried out using Utermohl's inverted plankton microscope.

Phytoplankton species was identified using the standard works of Hustedt (1930-1966), Venkataraman (1939), Cupp (1943), Subramanian (1946), Prescott (1954), Desikachary (1959 and 1987), Hendey (1964), Steidinger and Williams (1970) and Taylor (1976) and Anand et al. (1986).

3.15.1.5 Zooplankton

Zooplankton samples were collected from the surface waters of the study area by horizontal towing of plankton net with mouth diameter of 0.35 m, made of bolting silk (No. 70 mesh size 200 µm) for half an hour. After collection, the samples were preserved in 5% neutralized formalin and used for quantitative analysis. The zooplankton collected were identified to the species level using the classical works of Dakin and Colefax (1940).

3.15.1.6 Benthic Community

For studying the benthic organisms, sediment samples were collected using Van veen grab which covered an area of 0.1m^2. The wet sediment was sieved with varying mesh sizes (0.5mm -macrofauna and 0.062mm-meiofauna) for segregating the organisms. The organisms retained in the sieve were fixed in 5-7% formalin and stained further with Rose Bengal solution for easy spotting at the time of sorting. The number of organisms in each grab sample was expressed as number per meter square. All the species were sorted, enumerated and identified to the advanced taxonomic level possible with the consultation of available literature. The works of Fauvel (1953), Day (1967) were referred for polychaetes; Barnes (1980) and Lyla et al. (1999) for crustaceans; Subba Rao et al. (1991) and Ramakrishna (2003) for molluscs.

3.15.2 Water Quality

The physical parameters like pH, temperature and salinity were measured on-site under field conditions. Water samples collected for dissolved oxygen estimation were transferred carefully to BOD bottles. The DO is immediately fixed, and the samples were taken to the laboratory for further analysis. All the analysis were carried out as per suitable standardisation procedures. The details of the parameters monitored are listed in the **Table 3-19.** Equipment used for sample collection and sampling is shown in **Figure 3-6.**

Table 3-19: Details of Water Quality Parameters

S.NO	Attributes	Parameters
1	Physical Parameters	Temperature, pH, Salinity, Turbidity, TSS, TDS
2	Chemical Parameters	Dissolved Oxygen (DO), BOD, COD, Oil & Grease, Tota Nitrogen, Sulphates, Phosphates, Total Phosphorus Nitrates, Nitrites, Chlorides, Potassium, Sodium, Reactive Silicates and Ammonia
3	Heavy metals	Lead, Cadmium, Copper, and Zinc.
4	Biological Parameters	Primary Productivity, Phytoplankton, Zooplankton Diversity

Exhibit 3-6: Equipment used for sampling

3.15.2.1 Physical Parameters

Water Temperature(^{0}C):

The surface temperature ranged Physical Parameters between 30.3°C and 31.4°C. The minimum temperature was recorded at MSL- 2 while maximum temperature was recorded at MSL-7&ITL1. The bottom depth layers temperature ranged between 29.8^{0}C and 31^{0}C. The minimum temperature was recorded at MSL-2 while maximum temperature was recorded at MSL-8. The variations in the water temperature at different sampling locations are graphically presented in the **Figure 3-21.**

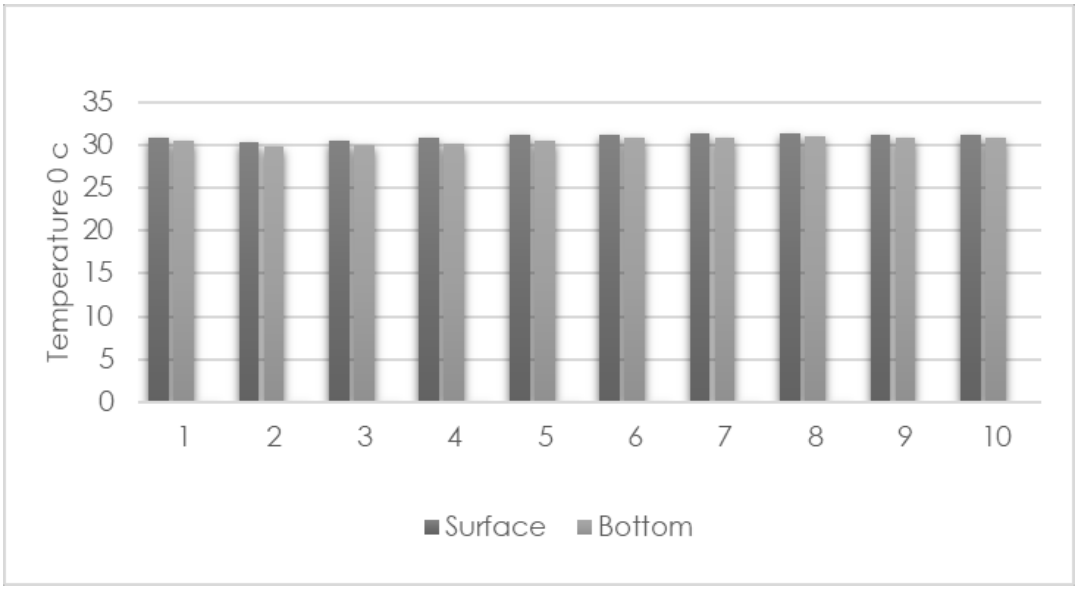


Figure 3-21: Variations in Temperature

pH:

The combined pH measurements of both Surface and bottom depth of pH are found to be alkaline at all the sampling locations. The pH value ranges from 8.2 to 8.3 which is constant at every station. The variations in pH at different sampling locations are graphically presented in **Figure 3-22.**

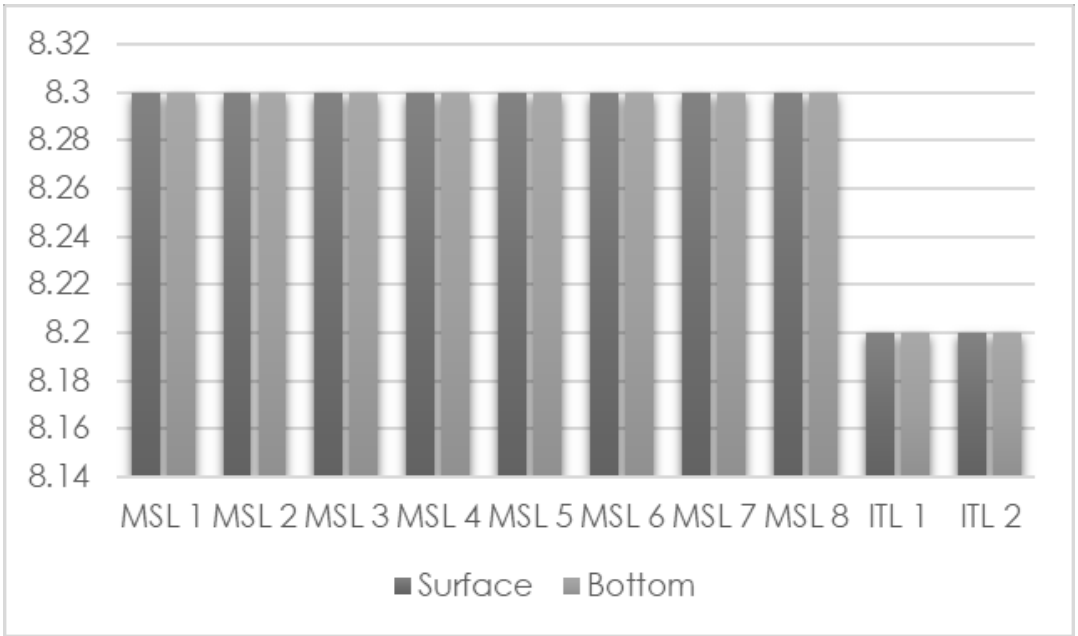


Figure 3-22: Variations in pH

Salinity:

The surface salinity levels were found to be in the range of 33.5 PSU to 34.5 PSU. The minimum salinity was recorded at MSL-1 and maximum salinity was recorded at MSL-5,6&7. The bottom depth salinity levels were found to be in the range of 34 PSU to 35 PSU. The minimum salinity was recorded at MSL- 2 and maximum salinity was recorded at MSL6 & MSL7. The variations in salinity at different sampling locations are graphically presented in **Figure 3-23.**

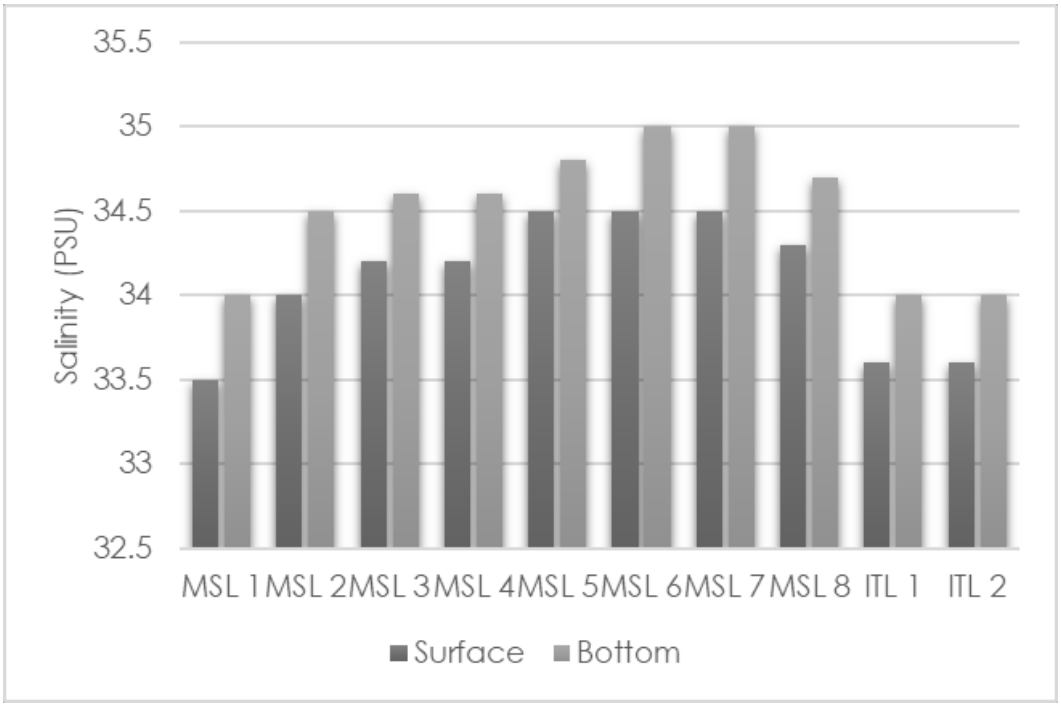


Figure 3-23: Variations in Salinity

Turbidity:

Turbidity values ranged from 1 to 30 NTU at the surface and 5 to 34 NTU at the bottom. In most stations, bottom waters showed relatively higher turbidity compared to surface waters, which may be attributed to sediment resuspension due to tidal currents and local hydrodynamic disturbances. The variations in turbidity at different sampling locations are graphically presented in **Figure 3-24.**

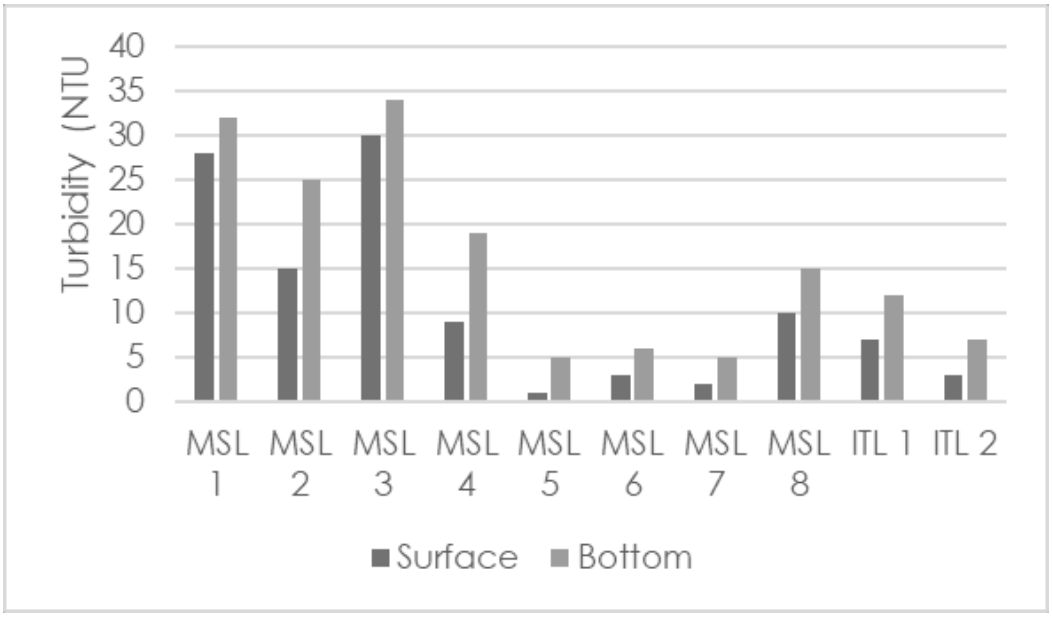


Figure 3-24: Variations in Turbidity

Electrical Conductivity (EC);

Electrical conductivity (EC) showed a range of values from 51.0 to 52.5 mS/cm at the bottom and 50.2 to 51.8 mS/cm at the surface. The Variations in the Electrical

conductivity (EC) at different sampling locations are graphically presented in **Figure 3-25.**

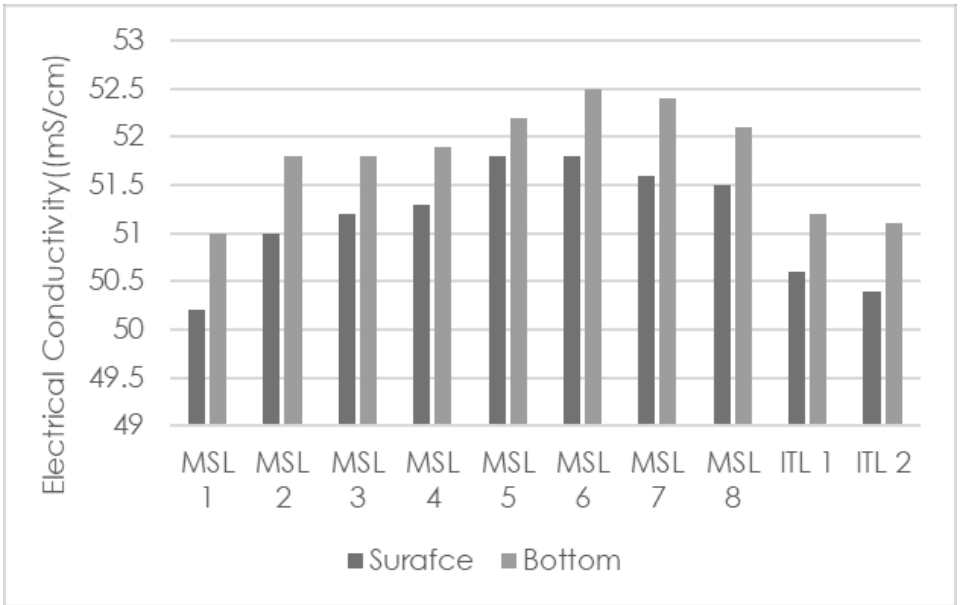


Figure 3-25: Variations in Electrical Conductivity

Total suspended solids (TSS):

Total Suspended Solids (TSS) ranged from 3.81 to 10.25 mg/L at the surface and 3.26 to 11.10 mg/L at the bottom. Higher TSS values at selected stations further support the role of sediment disturbance and tidal action, particularly in mid-shore level (MSL) locations. The variations in Total suspended solids at different sampling locations are graphically presented in **Figure 3-26.**

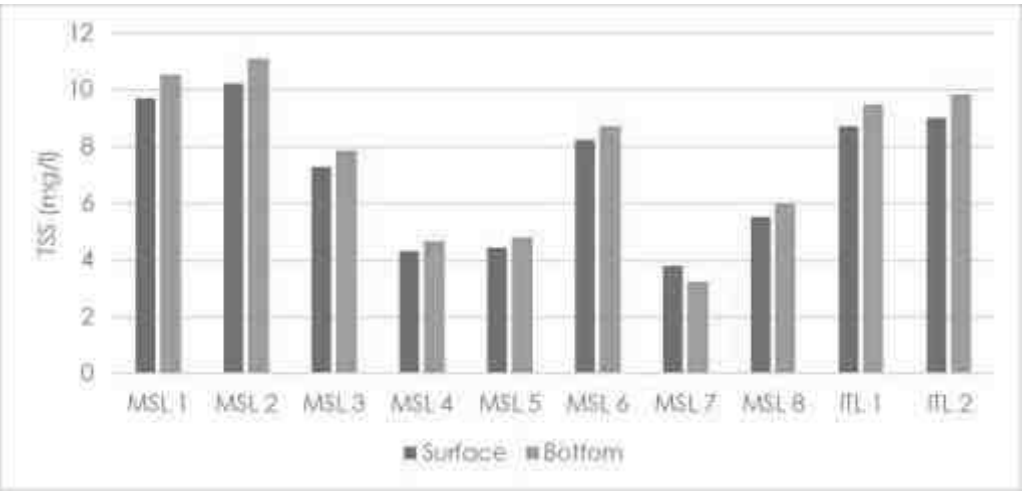


Figure 3-26: Variations in Total Suspended Solids

Total Dissolved Solids:

Total Dissolved Solids concentrations varied between 33,450 and 34,530 mg/L at the surface and 34,020 to 34,800 mg/L at the bottom. Slightly elevated TDS levels at bottom levels indicate higher ionic concentrations, likely driven by saline intrusion and mixing processes. The variations in Total Dissolved solids at different sampling locations are graphically presented in **Figure 3-27.**

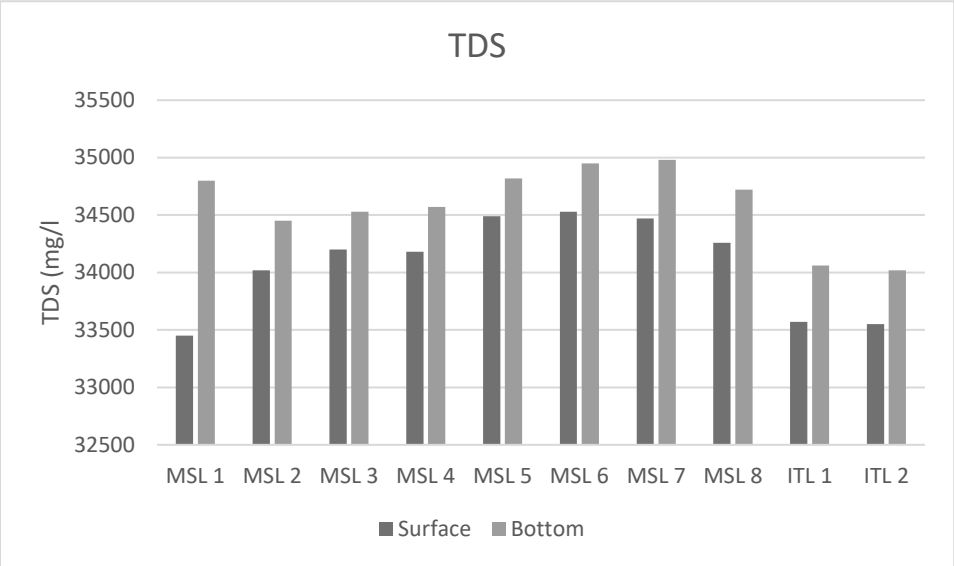


Figure 3-27: Variations in Total Dissolved Solids

3.15.2.2 Chemical Parameters

Dissolved Oxygen:

Dissolved Oxygen (DO) concentrations ranged from 5.44 to 7.20 mg/L at the surface and 4.40 to 5.93 mg/L at the bottom across all stations. Surface waters generally exhibited higher DO levels compared to bottom waters, likely due to atmospheric diffusion and photosynthetic activity. The slightly reduced DO in bottom waters may be attributed to organic matter decomposition and limited vertical mixing near the sediment–water interface. The variations in Dissolved Oxygen at different sampling locations are graphically presented in **Figure 3-28.**

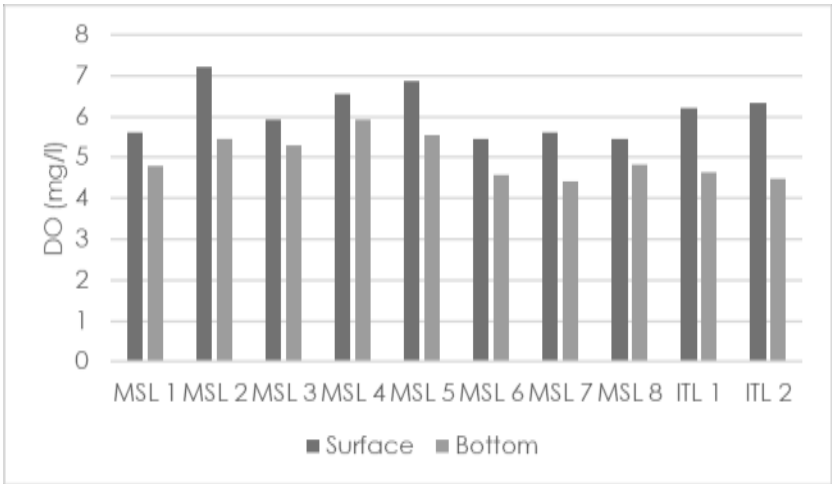


Figure 3-28: Variations in Dissolved Oxygen

Biological Oxygen Demand:

Biological Oxygen Demand (BOD) ranged between 0.64 and 5.60 mg/L at the surface and 0.67 to 5.82 mg/L at the bottom. The generally moderate BOD levels reflect low to moderate biodegradable organic load within the study area. Lower BOD was recorded at MSL3 and MSL 8 indicating relatively cleaner conditions, the

higher BOD values recorded at MSL1 & ITL 2. The variations in Biological Oxygen Demand at different sampling locations are graphically presented in **Figure 3-29.**

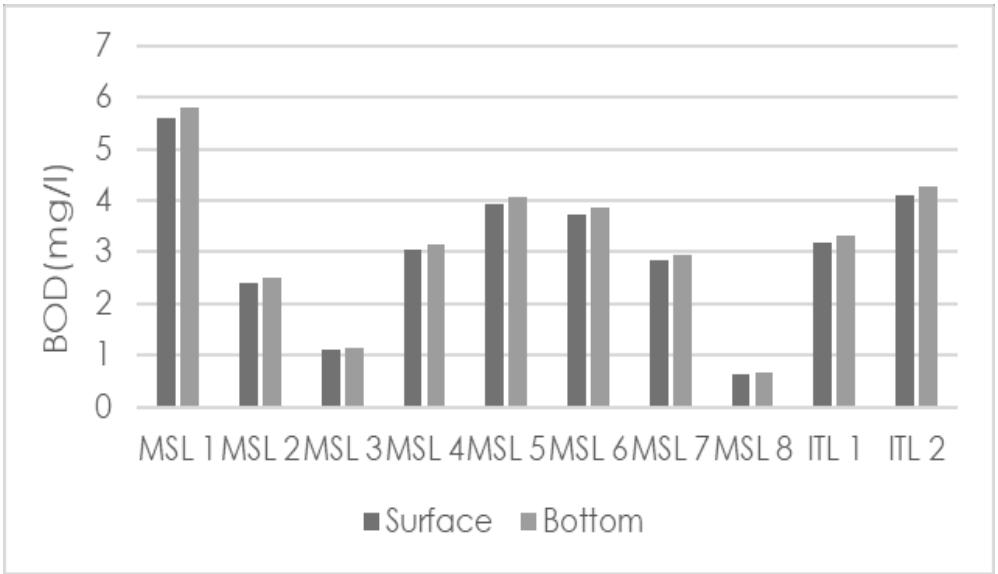


Figure 3-29: Variations in BOD Concentration

Chemical Oxygen Demand:

Chemical Oxygen Demand (COD) values varied from 6.4 to 12.8 mg/L at the surface and 7.53 to 18.28 mg/L at the bottom. The variations in Chemical Oxygen Demand at different sampling locations are graphically presented in **Figure 3-30.**

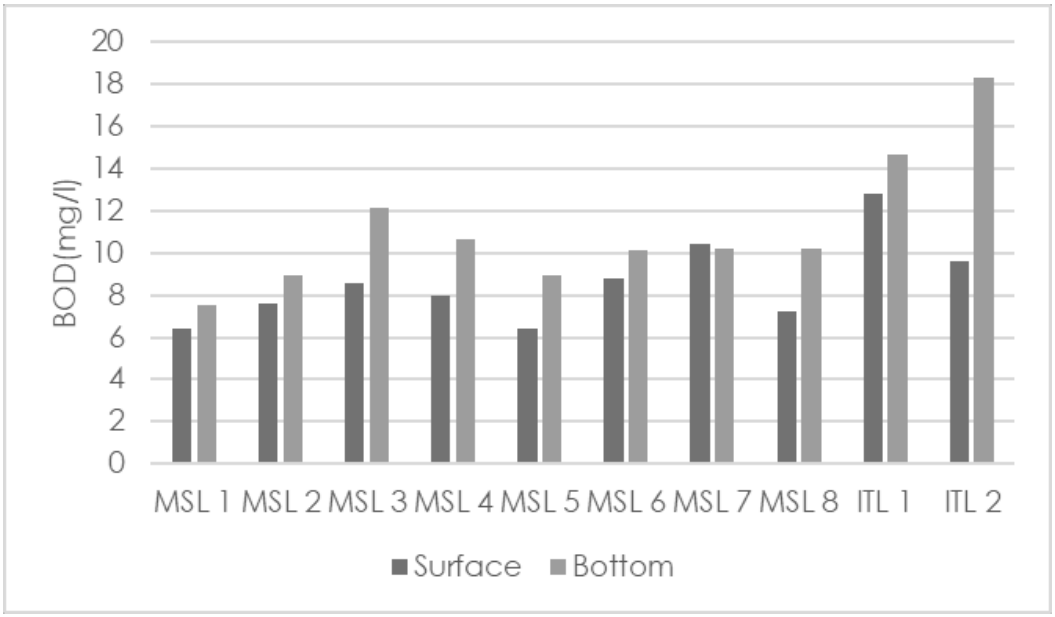


Figure 3-30: Variations in COD Concentration

Total Hardness:

The Total Hardness values ranged from 6,220 to 6,430 mg/L at the surface and 6,300 to 6,500 mg/L at the bottom (as $CaCO_3$). Slightly higher hardness in bottom waters was consistently observed across stations, reflecting elevated ionic concentration due to marine dominance. The variations in Total Hardness values at different sampling locations are graphically represented in **Figure 3-31.**

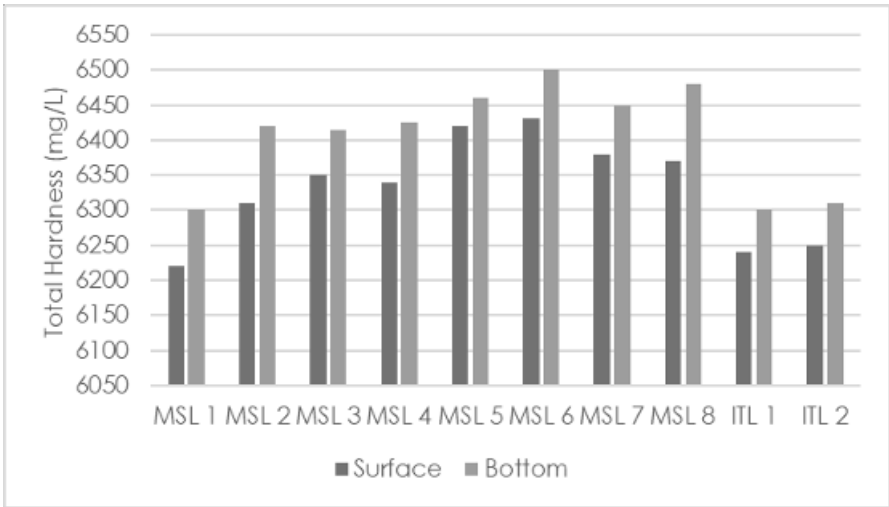


Figure 3-31:Variations in Total Hardness

Total Alkalinity:

Total Alkalinity concentrations ranged from 110–113 mg/L at the surface and 112–115 mg/L at the bottom**.** The slightly higher alkalinity in bottom waters corresponds with marginally elevated salinity and ionic strength. The Variations in the Total Alkalinity at different locations are graphically represented in **Figure 3-32.**

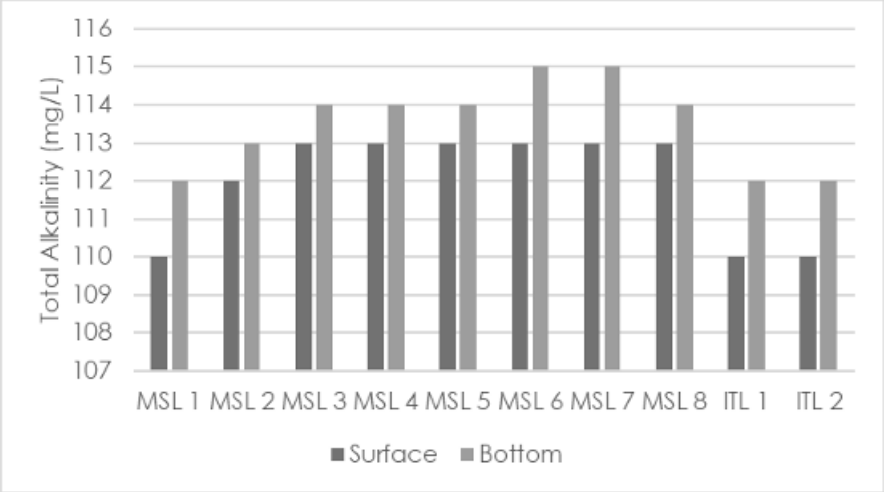


Figure 3-32: Variations in Total Alkalinity

Total Nitrogen:

Total nitrogen (TN) ranged from 6.42 to 16.56 µmol/L at the surface and 7.25 to 18.87 µmol/L at the bottom. The variations in Total nitrogen at different sampling locations are graphically presented in **Figure 3-33**.

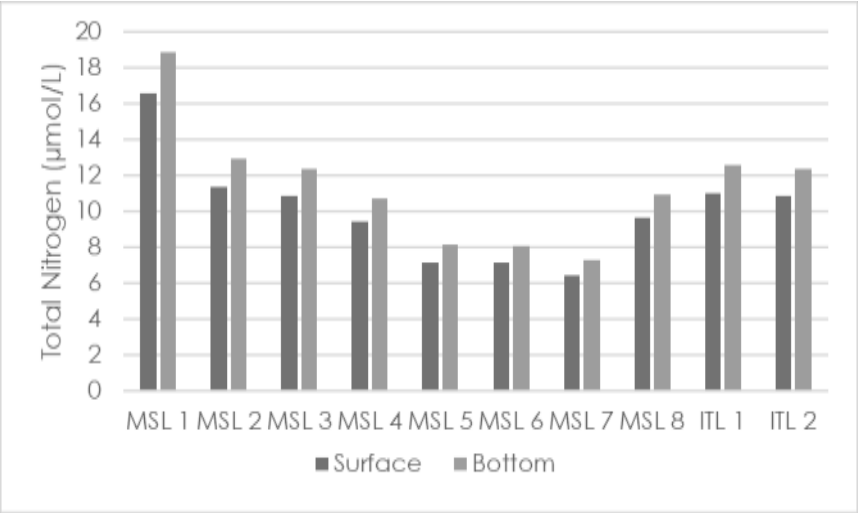


Figure 3-33: Variations in Total Nitrogen Concentration

Nitrate:

Nitrate concentrations ranged from 0.73 to 2.46 µmol/L at the surface and 0.83 to 2.79 µmol/L at the bottom. Bottom waters generally showed slightly higher nitrate levels, suggesting possible nitrification processes and remineralization of organic matter near the sediment–water interface. Higher nitrate values recorded at MSL 1, MSL 3, and MSL 8 indicate localized nutrient input or enhanced microbial activity. The variations in nitrate at different sampling locations are graphically presented in **Figure 3-34.**

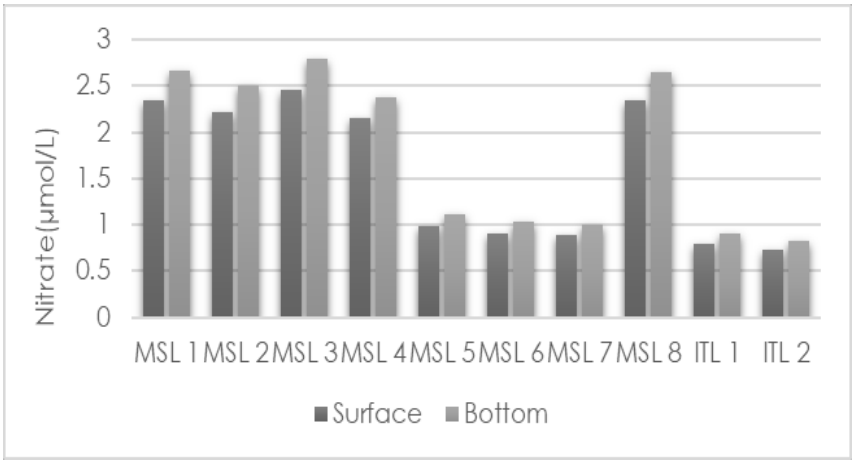


Figure 3-34: Variations in Nitrate Concentration

Free Ammonium:

Free ammonium (NH_4^+) concentrations varied between 0.25 and 0.47 µmol/L at the surface and 0.22 to 0.62 µmol/L at the bottom for all locations except at MSL 1

Chloride:

Chloride concentrations varied from 18,195 and 18,730 mg/L at the surface and 18,440 to 19,040 mg/L at the bottom. Higher chloride concentrations in bottom waters correspond with increased salinity, confirming strong marine influence and limited freshwater dilution. The variations in Chloride at different sampling locations are graphically presented in **Figure 3-35.**

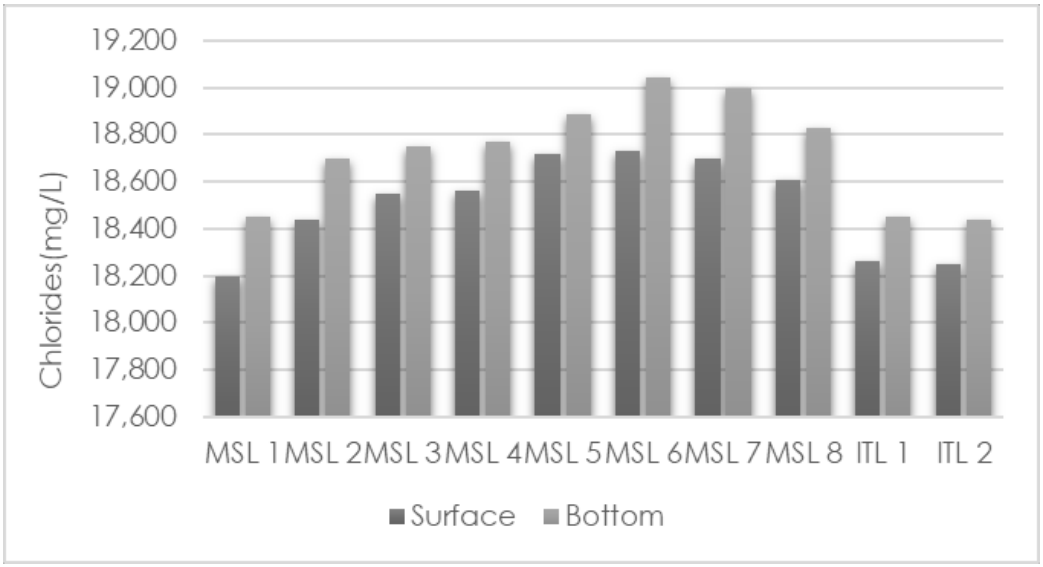


Figure 3-35: Variations in Chloride Concentration

Sulphate:

Sulphate concentrations ranged from 2,585 to 2,660 mg/L at the surface and 2,600 to 2,700 mg/L at the bottom. Slightly higher bottom values were consistently observed, corresponding with marginally elevated salinity and indicating strong marine influence. The variations in Sulphate at different sampling locations are graphically presented in **Figure 3-36.**

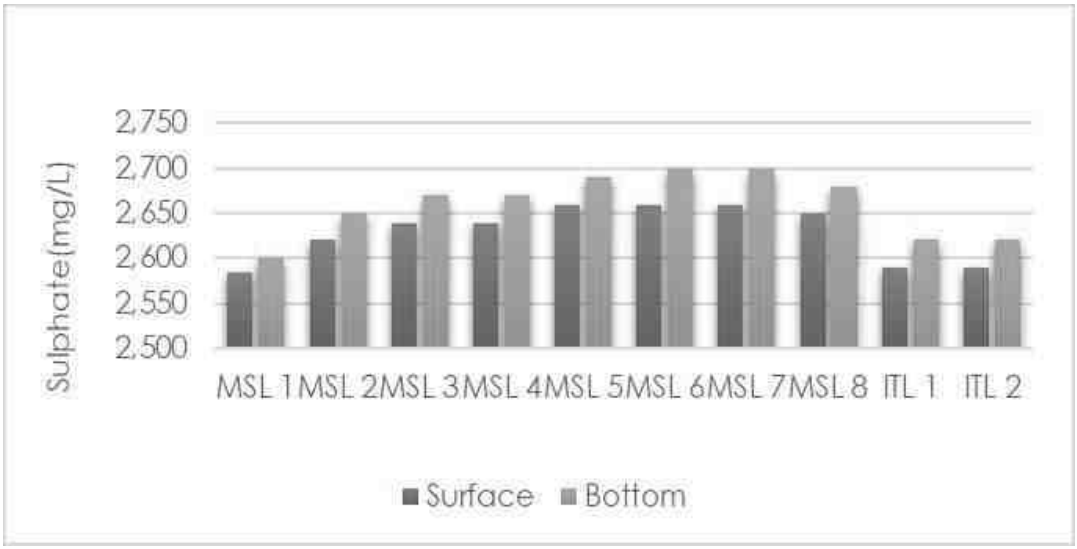


Figure 3-36: Variations in Sulphate Concentration

Sodium:

The sodium levels were consistently high, ranging from 8,650 to 9,100 mg/l at the surface and 8,700 to 9,200 mg/l at the bottom, indicating a strong marine influence and the saline nature of the region's waters. Slightly elevated concentrations at bottom layers may result from limited vertical mixing and ion accumulation. The variations in Sodium at different sampling locations are graphically presented in **Figure 3-37.**

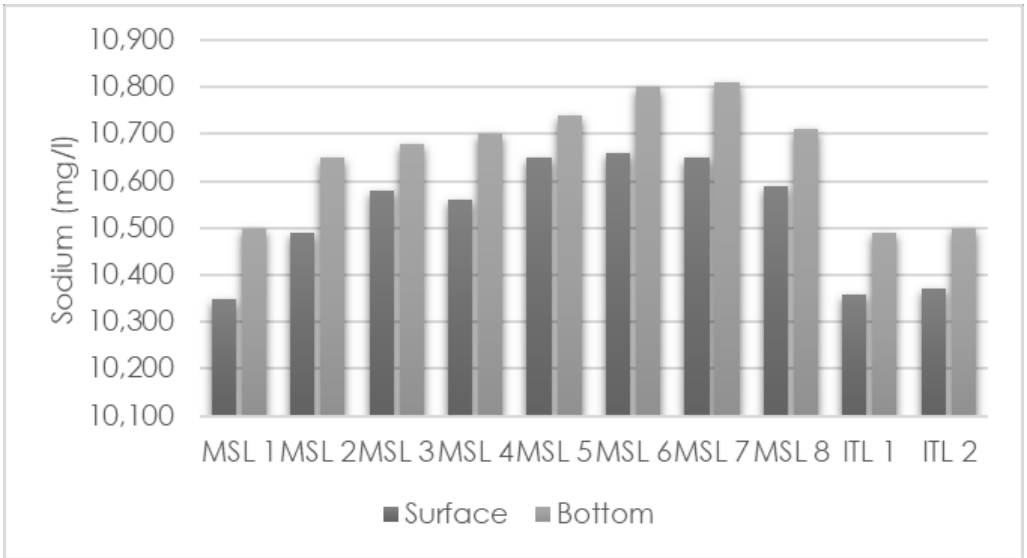


Figure 3-37: Variations in Sodium Concentration

Potassium:

Potassium concentrations ranged from 383 to 395 mg/L at the surface and 389 to 402 mg/L at the bottom. Slightly elevated bottom values indicate marginal ionic enrichment near the seabed, likely influenced by tidal mixing and sediment and water interaction. The variations in Potassium at different sampling locations showing relatively uniform distribution across layers and stations. The variations in Potassium at different sampling locations are graphically presented in **Figure 3-38**.

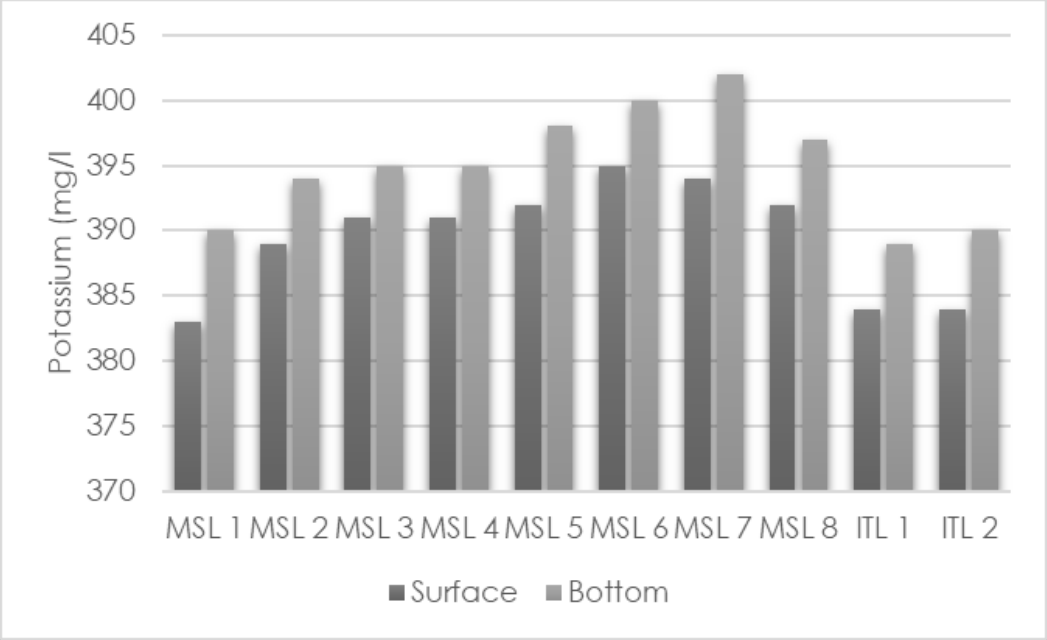


Figure 3-38: Variations in Potassium Concentration

Calcium:

Calcium levels varied between 392 and 404 mg/L at the surface and 398 to 410 mg/L at the bottom. The variations in Calcium at different sampling locations are graphically presented in Reactive Silicate **Figure 3-39.**

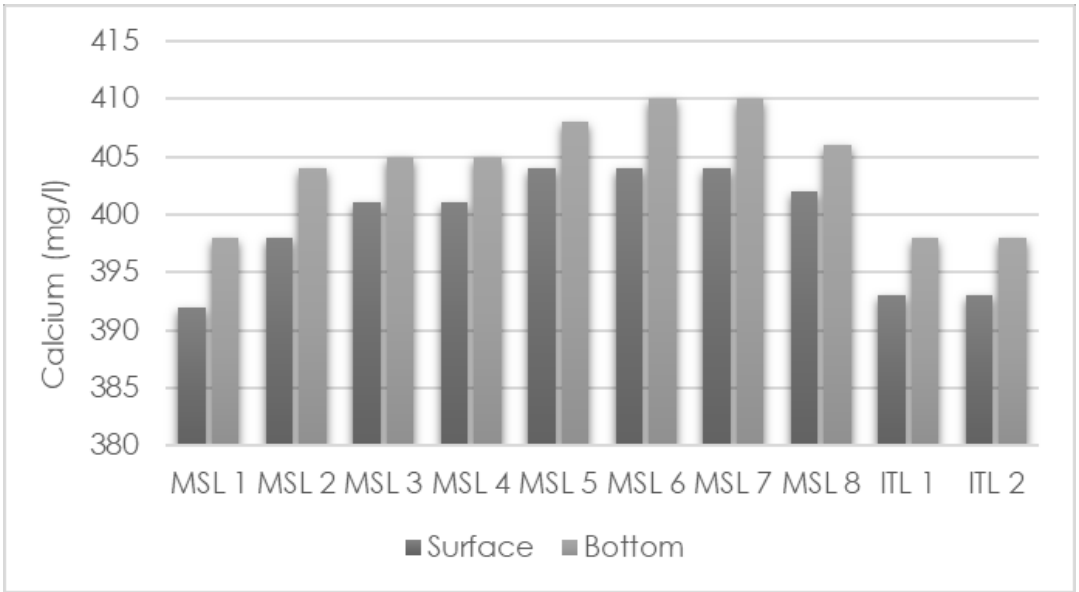


Figure 3-39: Variations in Calcium Concentration

Magnesium:

Magnesium concentrations ranged from 1,240 to 1,280 mg/L at the surface and 1,260 to 1,310 mg/L at the bottom. The variations in Calcium at different sampling locations are graphically shown in **Figure 3-40**.

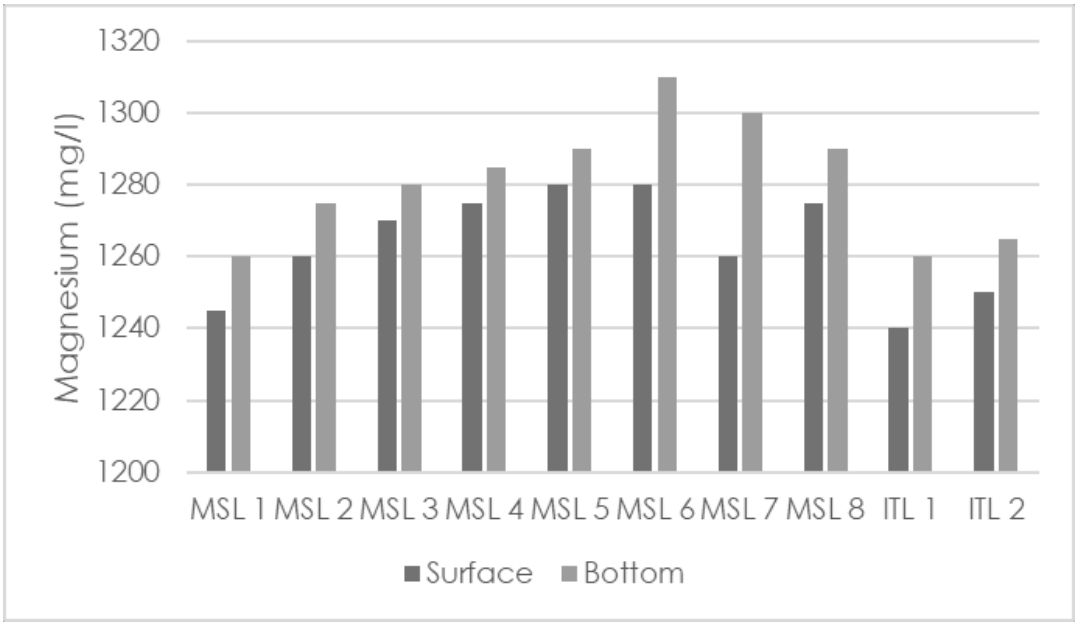


Figure 3-40: Variations in Magnesium Concentration

3.15.2.3 Heavy metals for Marine water

Total Boron:

Total Boron ranged from 4.31 to 4.44 mg/L at the surface and 4.37 to 4.50 mg/L at the bottom**.** The variations in Total Boron at different sampling locations are graphically shown in **Figure 3-41.**

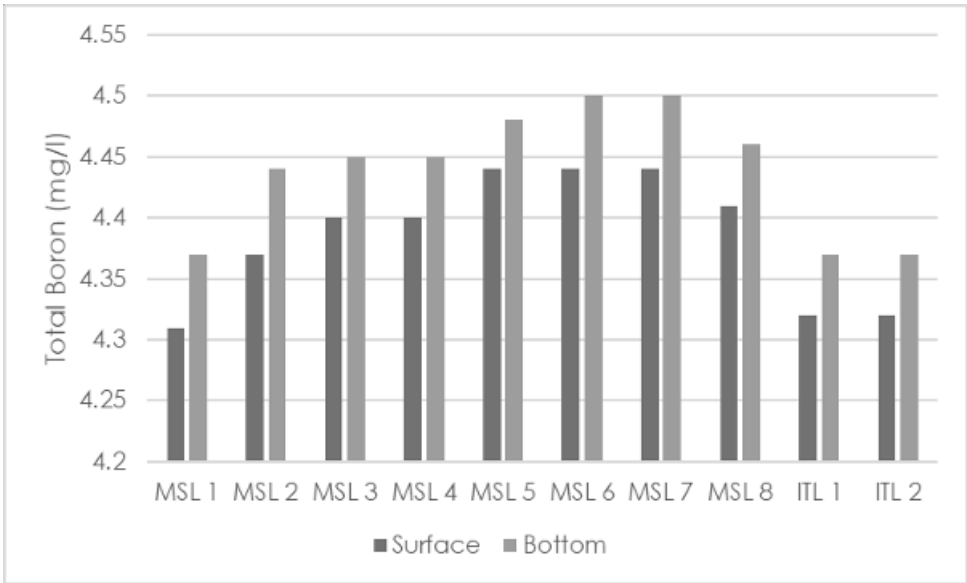


Figure 3-41:Variation in Total Boron Concentration

Lead:

Lead was found to be below detection limits (BDL) in both surface and bottom layers across all stations, indicating no apparent lead contamination in the study area.

Cadmium:

Cadmium (Cd) was detected only at a few stations (MSL 1–3, MSL 8, ITL 1 and ITL 2), with concentrations ranging from 0.01 to 0.05 mg/L, while remaining BDL at other locations. The low and sporadic occurrence suggests minor localized inputs rather than widespread contamination.

Copper:

Copper (Cu) concentrations ranged from 1.46 to 4.03 mg/L at the surface and 1.33 to 4.38 mg/L at the bottom. The variations in copper at different sampling locations are graphically presented in **Figure 3-42.**

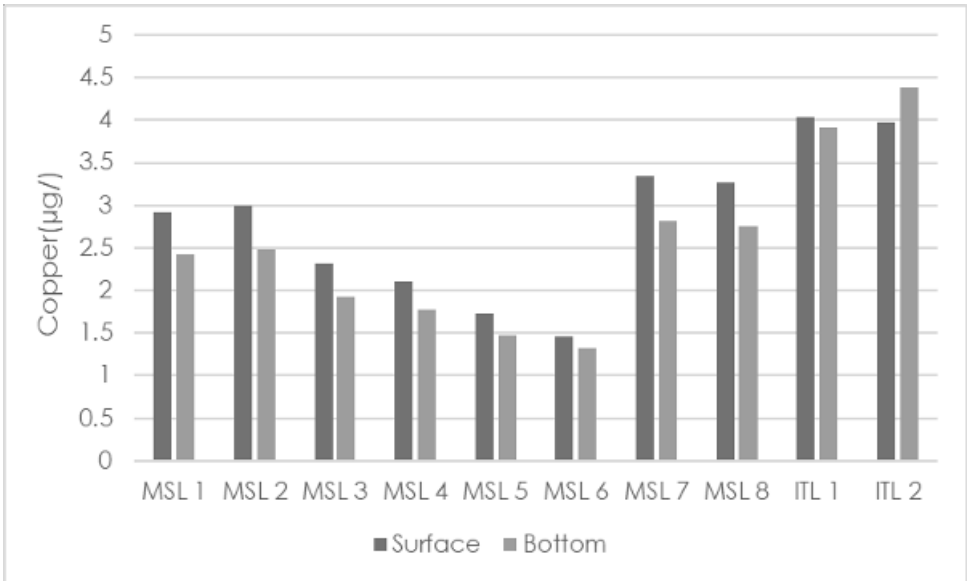


Figure 3-42: Variations in Copper Concentration

Zinc:

Zinc (Zn) levels varied between 3.53 and 7.11 mg/L at the surface and 7.21 to 13.81 mg/L at the bottom. The consistently higher bottom concentrations indicate possible sediment–water interaction and resuspension effects, as zinc commonly associates with particulate matter. The variations in copper at different sampling locations are graphically presented in **Figure 3-43.**

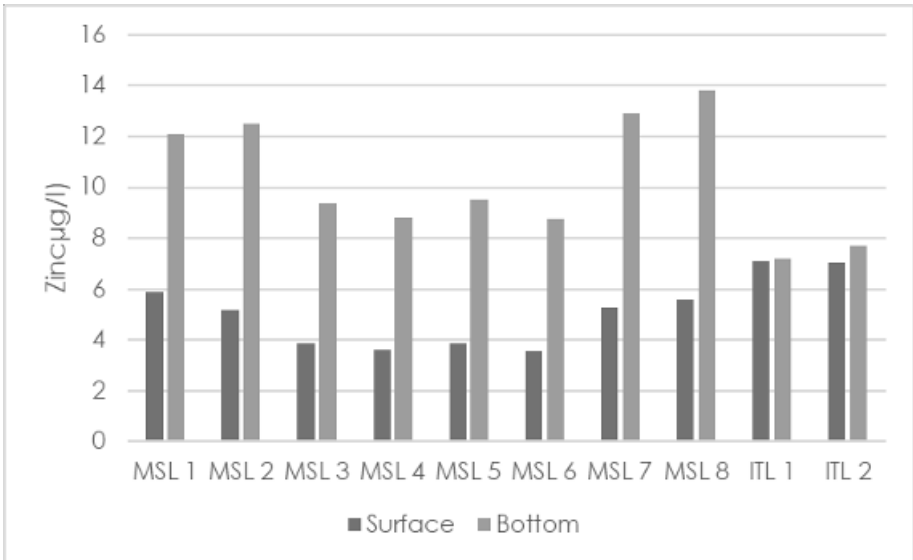


Figure 3-43: Variations in Zinc Concentration

Iron:

Iron (Fe) concentrations ranged from 47.30 to 90.12 mg/L at the surface and 52.88 to 105.01 mg/L at the bottom. Bottom waters consistently showed higher Fe levels, suggesting sediment–water interaction and resuspension effects, as iron is commonly associated with particulate matter and benthic processes. The variations in copper at different sampling locations are graphically presented in **Figure 3-44.**

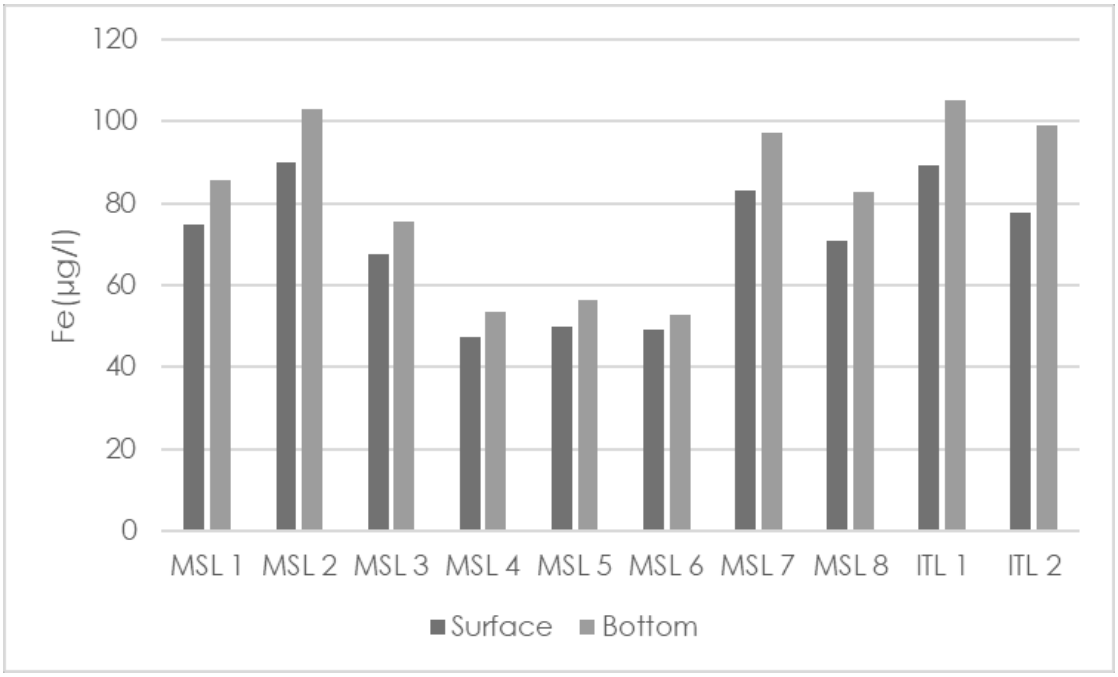


Figure 3-44: Variations in Iron Concentration

Arsenic:

Arsenic (As) was detected at a few stations, ranging from 0.92 to 1.68 mg/L at the surface and 1.15 to 1.93 mg/L at the bottom, while remaining BDL at other locations. Slightly higher bottom concentrations may reflect natural geochemical contributions from sediment.

Chromium

Chromium (Cr) concentrations varied between 10.29 and 20.72 mg/L at the surface and 12.55 to 24.79 mg/L at the bottom s. The variations in Arsenic at different sampling locations are graphically presented in **Figure 3-45.**

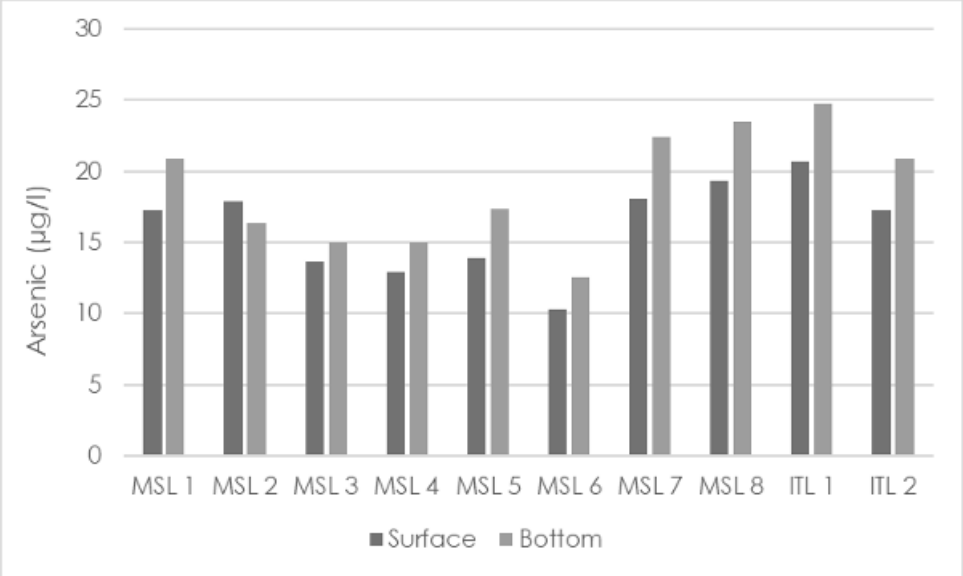


Figure 3-45: Variations in Iron concentration

Mercury and Selenium:

Mercury (Hg) and selenium (Se) were recorded as below detection limit (BDL) at all stations in both surface and bottom waters, indicating the absence of detectable contamination from these toxic trace elements.

3.15.2.4 Biological Parameters

The details of the various biological parameters monitored, and the range of values observed are given in the paragraphs below.

Microbial populations:

Microorganisms play a pivotal role in marine and brackish environments, contributing significantly to the decomposition and mineralization of organic matter. However, the presence of pathogenic bacteria poses a potential threat to the ecosystem.

Table 3-20: Bacterial Levels in the coastal waters

Station name	THB (CFU/ml)	Total Coliforms (CFU/ml)	Faecal coliforms (CFU/ml)	E. coli (CFU/ml)	*V. parahaemolyticus* (CFU/ml)	*V. cholerae* (CFU/ml)
MSL 1	270000	750	235	120	23	2

Station name	THB (CFU/ml)	Total Coliforms (CFU/ml)	Faecal coliforms (CFU/ml)	E. coli (CFU/ml)	*V. parahaemolyticus* (CFU/ml)	*V. cholerae* (CFU/ml)
MSL 2	120000	530	190	93	18	1
MSL 3	104000	480	186	86	15	
MSL 4	94000	425	150	78	6	
MSL 5	86000	439	142	74	2	
MSL 6	78000	421	118	69		
MSL 7	72000	460	130	83	3	
MSL 8	110000	525	147	92	12	
ITL 1	200000	638	182	110	22	
ITL 2	109000	626	169	98	18	

Table 3-21: Bacterial Levels in the marine sediments

Station name	THB(CFU/ml)	*V. parahaemolyticus* (CFU/ml)	*V. cholerae* (CFU/ml)
MSL 1	1200000	231	17
MSL 2	980000	54	13
MSL 3	760000	31	
MSL 4	690000	28	
MSL 5	450000	19	
MSL 6	370000		
MSL 7	460000	47	
MSL 8	830000	129	

Total Heterotrophic Bacteria (THB):

The Total Heterotrophic Bacteria (THB) concentrations in both coastal water and sediment play a crucial role in understanding the microbial ecology of marine ecosystems.

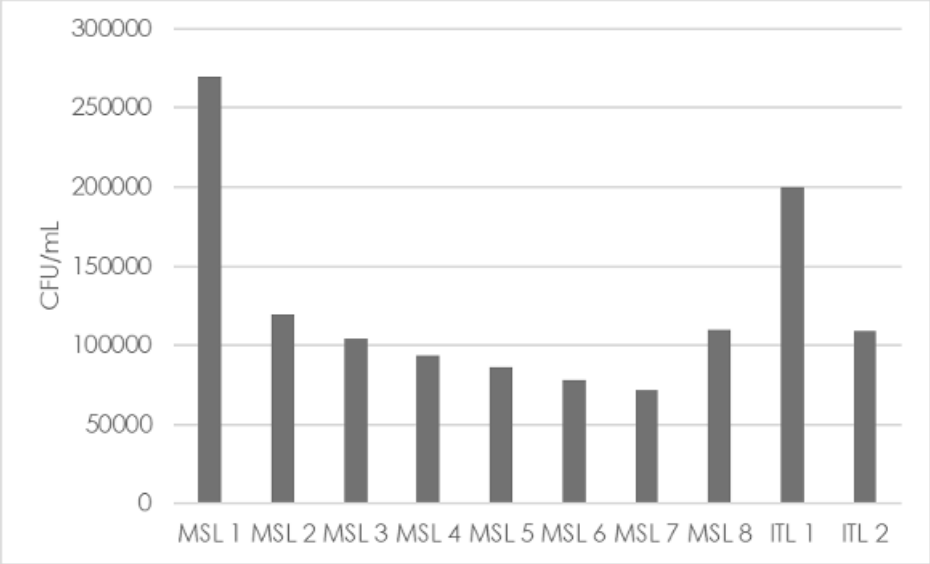


Figure 3-46: Total Heterotrophic Bacteria (TBH) populations in coastal water of different stations

Total heterotrophic bacterial (THB) counts ranged between 72,000 and 270,000 CFU/mL. The highest concentration was observed at station MSL 1 (270,000 CFU/mL), followed by ITL 1 (200,000 CFU/mL). Comparatively lower counts were recorded at

mid-shore locations such as MSL 6 and MSL 7, indicating reduced organic load in those areas.

The abundance of Total Heterotrophic Bacteria (THB) in sediments across the study stations ranged from 576,000 to 2,400,000 CFU/g.

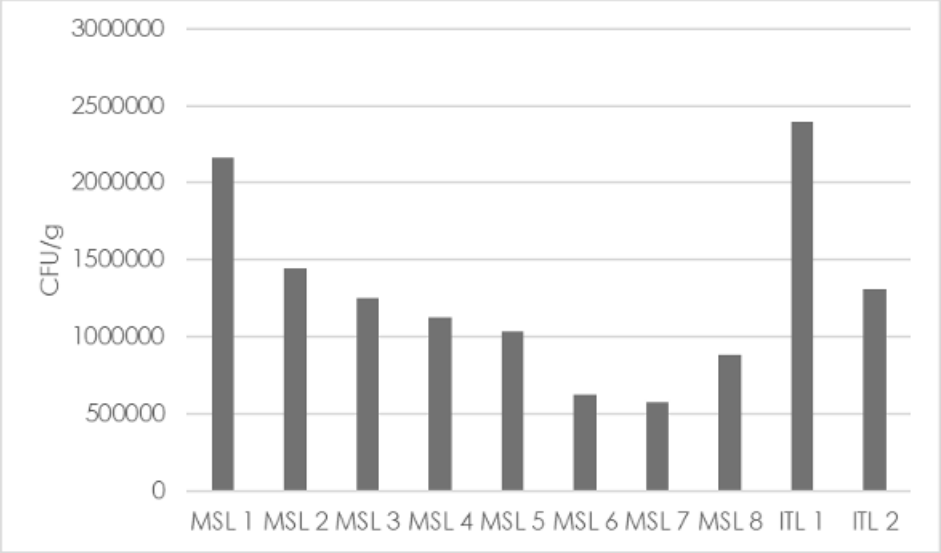


Figure 3-47: Total Heterotrophic Bacteria (THB) populations in coastal sediments of different stations

Total Coliforms:

Total coliform levels varied between 421 and 750 MPN/100 mL, with notably higher values at MSL 1 (750 MPN/100 mL) and ITL stations (626 to 638 MPN/100 mL), indicating localized organic or domestic inputs.

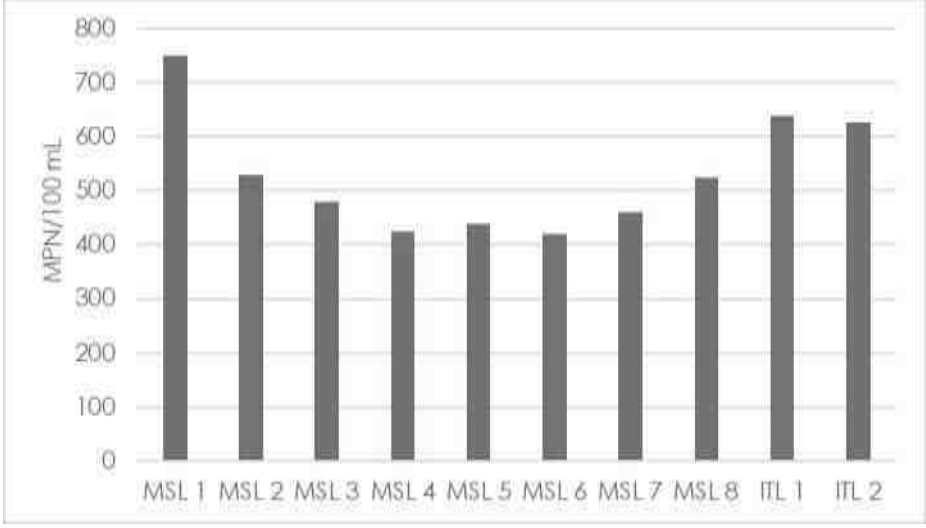


Figure 3-48: Total coliforms (TC) populations in coastal water of different Stations

Vibrio Parahaemolyticus.:

Vibrio Parahaemolyticus was detected at several stations, with counts ranging from 0 to 23, showing higher prevalence at MSL 1 and ITL 1. The occurrence of this species is typical in marine and estuarine environments, particularly under warmer temperature conditions.

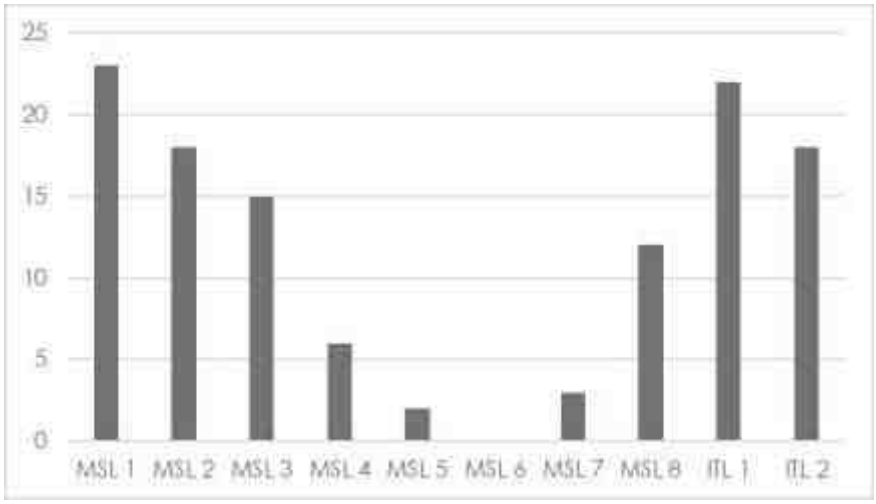


Figure 3-49: *Vibrio Parahaemolyticus* populations in coastal water of different stations

Vibrio cholerae was detected only at MSL 1 and MSL 2 and was absent in the remaining stations. This limited detection suggests no widespread pathogenic contamination in the study area.

Primary Productivity:

Primary productivity values ranged from 1.09 to 2.24 g C/m²/day. The Lower productivity was recorded at MSL 5 and MSL 6 may reflect localized nutrient or hydrodynamic limitations.

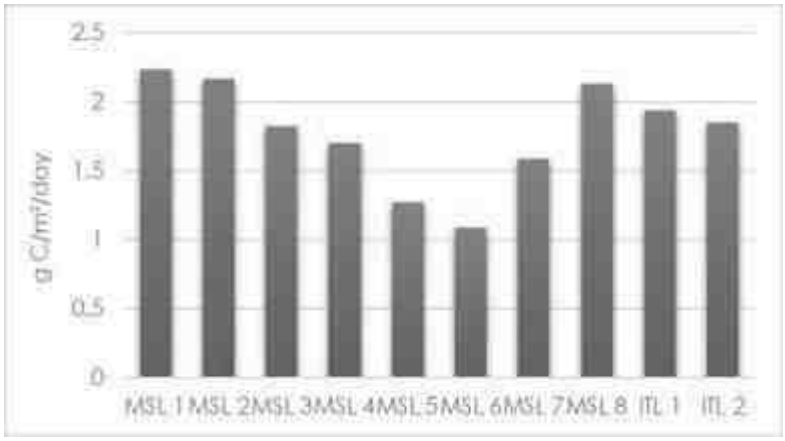


Figure 3-50: Primary Productivity

Chlorophyll:

Station name	Chlorophyll-a	Chlorophyll- b	Chlorophyll-c
MSL 1	6.85	1.18	1.03
MSL 2	6.25	1	0.86
MSL 3	5.84	0.84	0.73
MSL 4	5.71	0.6	0.52
MSL 5	5.44	0.47	0.41
MSL 6	5.09	0.42	0.36
MSL 7	6.05	0.82	0.71
MSL 8	6.51	0.92	0.81
ITL 1	7.21	0.97	0.88
ITL 2	6.98	0.93	0.84

The chlorophyll content in coastal waters, measured in terms of chlorophyll a, chlorophyll b, and chlorophyll c concentrations, provides valuable insights into the phytoplankton abundance and overall health of marine ecosystems. The analysis of seven coastal stations (MSL-1 to MSL-8) reveals varying levels of chlorophyll pigments. Among the chlorophylls, chlorophyll a is a key indicator of primary productivity.

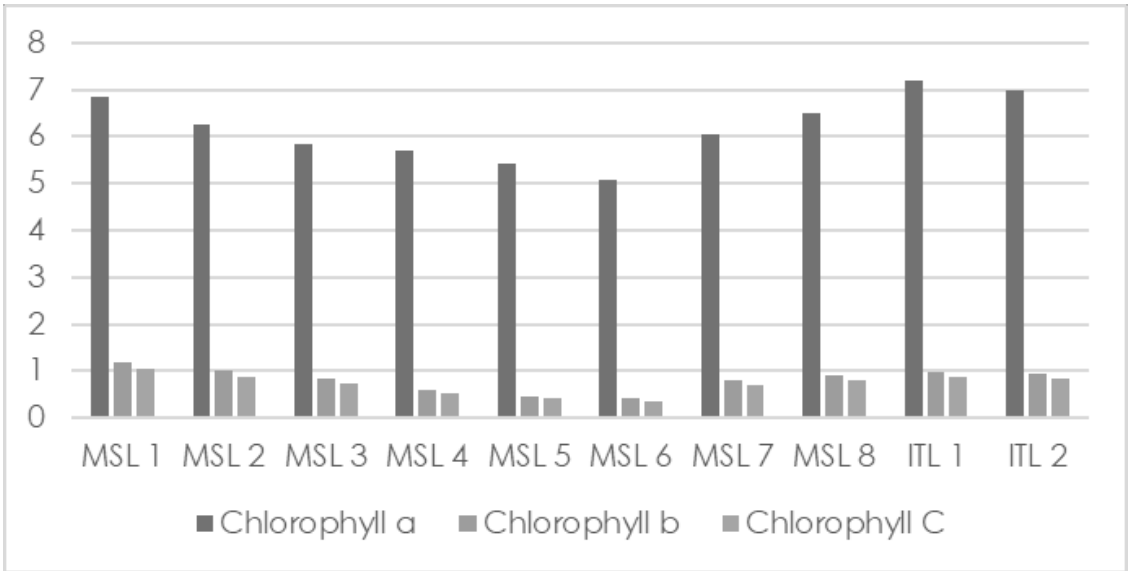


Figure 3-51: Chlorophyll content in all stations

Chlorophyll 'a'

Chlorophyll-a ranged from 5.09 to 7.21 mg/m³, with the highest value recorded at ITL 1 (7.21 mg/m³), followed by ITL 2 (6.98 mg/m³) and MSL 1 (6.85 mg/m³). The lowest concentration was observed at MSL 6 (5.09 mg/m³). The spatial variation indicates moderate phytoplankton biomass, with relatively enhanced productivity at intertidal and select mid-shore locations.

Chlorophyll 'b'

Chlorophyll-b varied between 0.42 and 1.18 mg/m³,

Chlorophyll 'c'

The chlorophyll values recorded ranged from 0.9 µg/L to 1.3 µg/L.

Phenolic Compounds:

Phenolic compounds ranged from 0.18 to 0.35 mg/kg, with the highest values recorded at ITL 1 (0.35 mg/kg) and MSL 1 (0.32 mg/kg). Lower concentrations at MSL 5 and MSL 6 suggest relatively reduced organic contamination at these stations. The variations in Phenolic compounds are graphically shown in **Figure 3-52**.

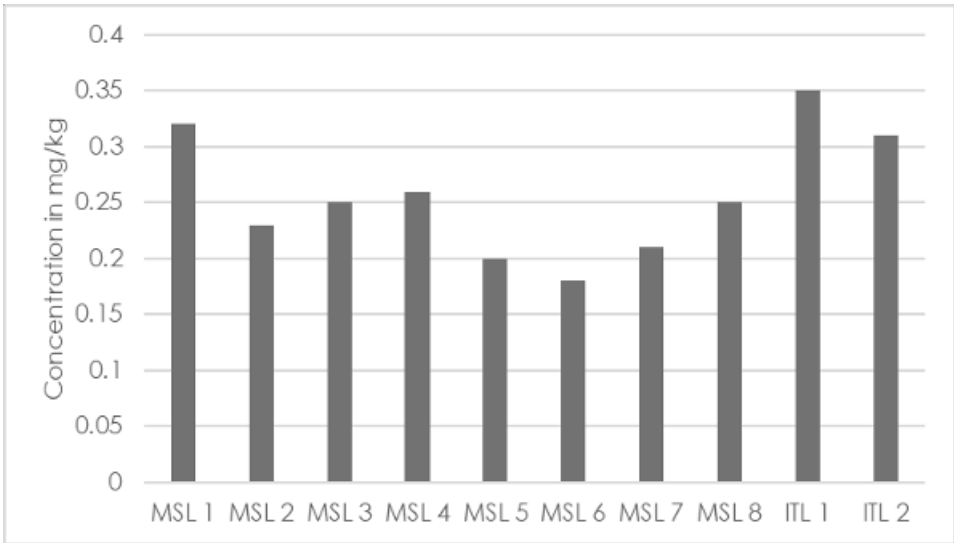


Figure 3-52:Variations in Phenolic Compounds

Phytoplankton:

The phytoplankton community in the study area was represented by three main classes: Dinophyceae, Bacillariophyceae, and Cyanophyceae. A total of 28 species were recorded, among which Bacillariophyceae was the dominant class, followed by Dinophyceae and Cyanophyceae.

Table 3-22: Phytoplankton population density (Cells/ m³), in eight different samples

Phytoplankton Species	MSL1	MSL2	MSL3	MSL4	MSL5	MSL6	MSL7	MSL8
Bacillariophyceae (Diatoms)								
Asterionella japonica	49	1	55	315	30	34	143	29
Bacteriastrum hyalinum	234	53	25	87	383	1334	597	63
Bellerochea malleus	-	119	40	19	440	350	462	44
Biddulphia reticulata	350	22	413	217	1273	22	176	0
Chaetoceros coarctatus	68	132	212	3	172	75	59	3859
Chaetoceros curvisetus	100	189	18	8	286	14	115	24
Chaetoceros lorenzianus	91	76	14	46	61	48	87	211
Eucampia zodiacus	233	46	20	32	124	470	4354	30
Hemidiscus hardmanianus	949	36	65	47	272	112	101	217
Planktoniella sol	18	1605	41	46	177	71	1005	240
Pleurosigma sp.	2196	57	25	14	31	127	89	6
Rhizosolenia sp.	1748	32	192	88	3504	6	32	192
Skeletonema costatum	74	97	78	2	436	6043	8	407
Thalassiothrix frauenfeldii	161	11	49	633	29	31	73	6
Thalassiothrix nitzschioides	26	22	18	50	170	575	17	141

Phytoplankton Species	MSL1	MSL2	MSL3	MSL4	MSL5	MSL6	MSL7	MSL8
Triceratium favus	9	69	1096	167	203	113	319	1
Triceratium reticulatum	824	13	7	32	265	37	128	91
Triceratium robertsianum	67	152	38	151	88	212	13	52
Cyanophyceae (Blue-green algae)								
Oscillatoria sp.	669	3	11	21	96	218	73	10
Dinophyceae (Dinoflagellates)								
Trichodesmium erythraeum	42	613	3647	76	2807	635	253	8
Ceratium extensum	1131	62	108	67	33	37	2385	9
Ceratium furca	253	6	50	5	95	328	186	1407
Ceratium macroceros	199	20	191	62	16	35	31	24
Ceratium trichoceros	2	73	2356	2045	68	67	62	194
Ceratium tripos	10	6	41	10	136	197	7	62
Dinophysis caudata	4324	23	151	2	235	12	118	142
Protoperidinium oceanicum	634	114	24	236	170	120	138	56
Protoperidinium sp.	133	524	167	124	90	159	19	-
Total Abundance	**14594**	**4176**	**9152**	**4605**	**11690**	**11482**	**11050**	**7525**

Species Composition

The phytoplankton assemblage was strongly dominated by diatoms. Key species such as *Skeletonema costatum*, *Chaetoceros coarctatus*, *Bellerochea malleus*, and *Pleurosigma* sp. were the most abundant and widely distributed, serving as indicators of nutrient-rich, well-mixed waters. The pronounced presence of *Skeletonema costatum* at MSL 6 suggests a localized peak in nutrient availability or a recent mixing event.

Cyanophyceae (blue-green algae), represented primarily by *Trichodesmium erythraeum*, exhibited notable pulses in abundance, particularly at MSL 3 and MSL 5, reflecting warm and stable surface water conditions.

Members of Dinophyceae, including *Ceratium extensum*, *Ceratium trichoceros*, and *Dinophysis caudata*, occurred at lower relative abundance compared to diatoms but maintained a consistent presence across most stations. The elevated count of *Dinophysis caudata* at MSL 1 is noteworthy, as this genus is often monitored in coastal productivity assessments.

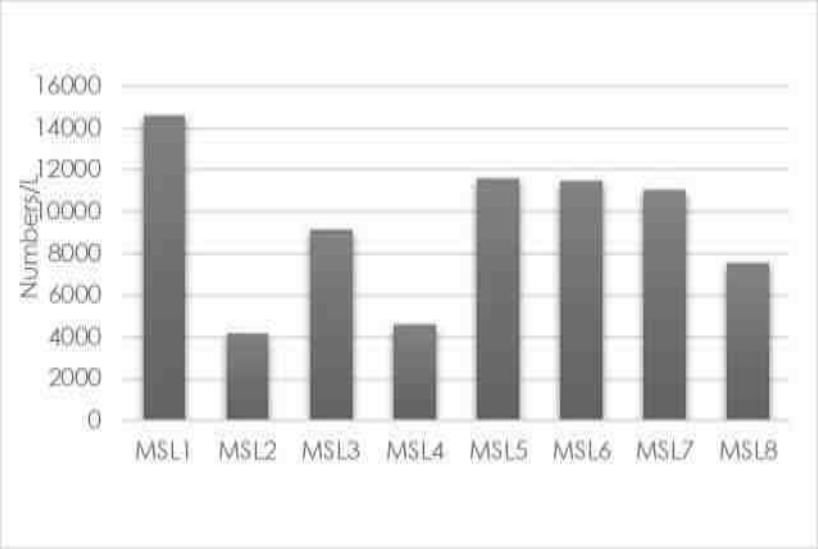


Figure 3-53: Phytoplankton density observed across the sampling locations

composition of phytoplankton:

The phytoplankton community was dominated by Bacillariophyceae (Diatoms), which constituted 60.99% of the total abundance. This highlights their role as the primary producers in the Cuddalore coastal ecosystem. Dinophyceae (Dinoflagellates) were the second most abundant group, contributing 26.65%, followed by Cyanophyceae (Blue-green algae) at 12.36%. The leading population of diatom indicating Cuddalore coast experiences frequent vertical mixing or terrestrial runoff. The significant presence of Dinophyceae (26.65%) indicates that the environment is not exclusively turbulent. Since many marine cyanobacteria are nitrogen-fixers, their presence indicates the system may occasionally face nitrogen limitation, which these species bypass by fixing atmospheric nitrogen.

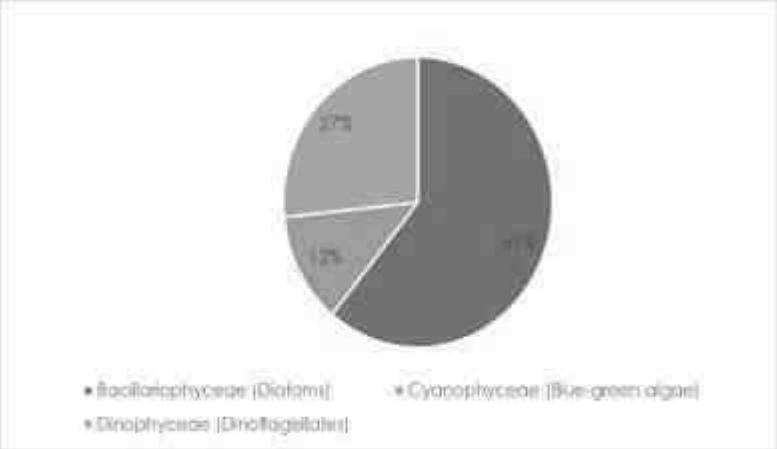


Figure 3-54: Phytoplankton composition in eight different stations

Zooplankton:

Zooplankton play a vital role in the marine food web, serving as a crucial link between primary producers and higher trophic levels. The zooplankton community in the study area was diverse, comprising taxa such as *Copepoda, crustacean larvae, Chaetognatha, Appendicularia, Tintinnida*, and polychaete larvae. Zooplankton composition is shown in **Table 3-23**.

Table 3-23: Zooplankton population densities (Nos/m³) in eight different samples

Species	MSL1	MSL2	MSL3	MSL4	MSL5	MSL6	MSL7	MSL8
Arthropoda (Copepoda)	**Zooplankton (Nos/M³)**							
Acartia danae	184	2287	37	345	118	77	2195	1853
Acartia spinicauda	5956	306	231	2579	3324	153	109	113
Acrocalanus gracilis	13	405	39	693	204	13	51	89
Copepod nauplii	50	752	37	28	236	190	12	213
Euterpina acutifrons	84	7	205	49	80	233	13	152
Nannocalanus minor	1051	5778	3065	83	9	95	97	2242
Oithona brevicornis	63	114	113	78	114	14	1465	20
Oithona nana	657	130	7	16	164	206	443	34
Oithona rigida	82	28	97	81	330	542	88	36
Oithona similis	368	200	14	192	16	1776	55	27
Oithona simplex	2021	234	3681	77	420	231	29	285
Oncaea venusta	353	576	135	145	306	1918	89	26
Paracalanus parvus	189	475	327	51	89	120	90	51
Undinula sp.	256	44	2	204	96	127	31	48
Arthropoda (Crustacea Larvae)								
Lucifer hanseni	266	134	497	6079	8	51	699	472
Euphausiid zoea	38	145	457	82	2746	948	31	175
Ciliophora (Tintinnida)								
Eutintinnus tenuis	2	437	3168	68	1044	616	776	158
Tintinnopsis butschlii	163	221	20	68	31	36	147	84
Tintinnopsis cylindrica	200	27	85	56	47	17	31	14
Tintinnopsis mortensenii	40	35	127	38	65	14	160	73
Tintinnopsis nordqvistii	223	282	387	1255	19	269	266	323
Tintinnopsis tubulosa	139	101	30	199	140	175	107	140
Chaetognatha								
Sagitta bipunctata	278	13	481	181	3	299	256	2071
Chordata (Appendicularia)								
Oikopleura dioica	88	164	2983	24	94	2366	38	128
Oikopleura parva	4268	628	14	407	112	105	94	119
Miscellaneous								
Polychaete larvae	117	3539	616	586	-	4796	47	165
Ophiothrix larvae	312	21	575	100	88	182	227	25
Spionid sp.	22	166	985	385	246	103	60	121
TOTAL ABUNDANCE	**17483**	**17249**	**18415**	**14149**	**10149**	**15672**	**7706**	**9257**

Species composition:

Among copepods, species such as *Acartia spinicauda, Nannocalanus minor, Oithona simplex* and *Acartia danae* were the most abundant and widely distributed across all stations. High densities, particularly at MSL 1 (5,956 individuals of *A. spinicauda*) and MSL 2 (5,778 individuals of *N. minor*), reflect favourable environmental conditions and rich phytoplankton availability supporting their populations. Crustacean larvae, notably *Lucifer hanseni* and euphausiid zoea, were also well represented, indicating active reproductive and recruitment processes in the region. The exceptionally high count of *Lucifer hanseni* at MSL 4 (6,079) highlights localized zones of elevated secondary productivity. Appendicularians (*Oikopleura dioica* and *O. parva*) and chaetognaths (*Sagitta bipunctata*) contributed to a

balanced planktonic food web. The substantial densities of *O. parva* at MSL 1 (4,268) and *O. dioica* at MSL 3 (2,983) suggest efficient energy transfer through the microbial loop.

Overall, the zooplankton community was dominated by copepods, with peak abundances at MSL 3 (18,415) and MSL 1 (17,483).

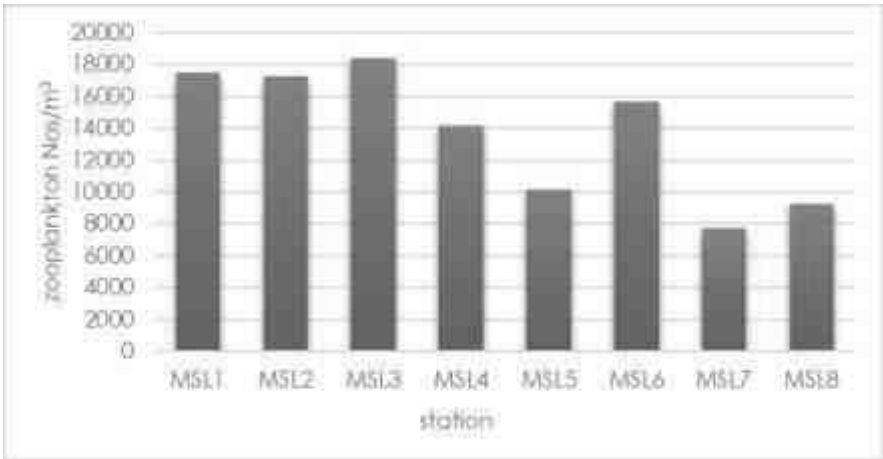


Figure 3-55: Zooplankton density observed across the sampling locations

composition of Zooplankton:

The zooplankton community is primarily dominated by Arthropoda (Copepoda), which accounts for over 50% of the total population. The significant presence of copepods, along with sub-dominant groups like Tintinnida and Crustacea Larvae, highlights a robust and healthy secondary productivity within the coastal ecosystem. Total density peaks at MSL3 (18,415 cells/m³), driven by a diverse assemblage of both adult and larval forms. The high spatial variation and concentration of various larvae across stations suggest that these waters serve as a vital nursery and recruitment ground. The zooplankton community structure reflects a stable, diatom-driven food web where primary production is efficiently channeled to higher trophic levels. The heavy dominance of copepods (nearly 51%) indicates a well-oxygenated environment with high grazing efficiency.

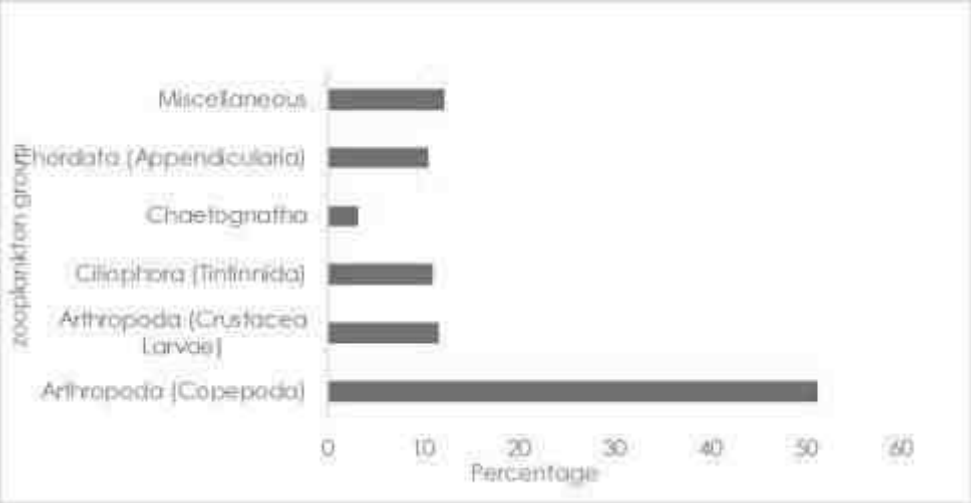


Figure 3-56: Percentage composition of zooplankton population observed across the sampling locations

3.15.3 Sediment Quality

Sediment samples were collected using a Peterson Grab, transferred to clean polythene bags, and transported to the laboratory.

3.15.3.1 Sediment Parameters

Sediment analysis of Ten marine sampling locations (MSL 1 to ITL 2) reveals significant spatial variation in sediment composition.

Sediment texture analysis across the MSL and ITL stations revealed a strong dominance of the sand fraction, ranging from 88.1% to 100%. The highest sand content (100%) was recorded at MSL 5, MSL 6, MSL 7, and ITL 2, while the lowest was observed at MSL 1 (88.1%), which corresponded with a comparatively higher silt fraction. Silt content varied between 0% and 11.9%, with the maximum recorded at MSL 1 (11.9%), followed by MSL 2 (9.88%). All other stations exhibited very low silt levels (<4%).

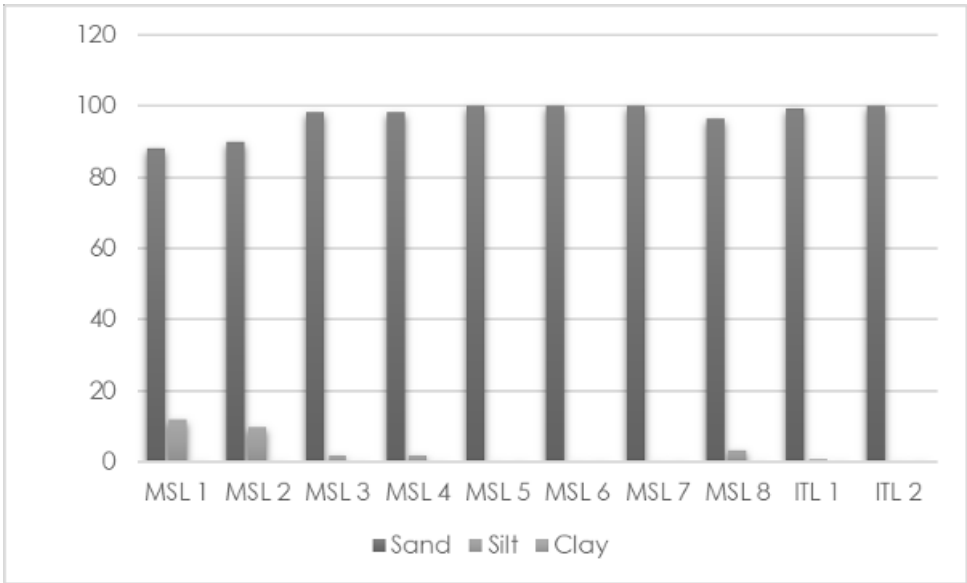


Figure 3-57: Sediment Texture within the Sampling Sites

Ph:

Sediment pH ranged from 7.5 to 8.2, reflecting slightly alkaline conditions typical of marine sandy sediments. The variations in sediment pH are graphically shown below

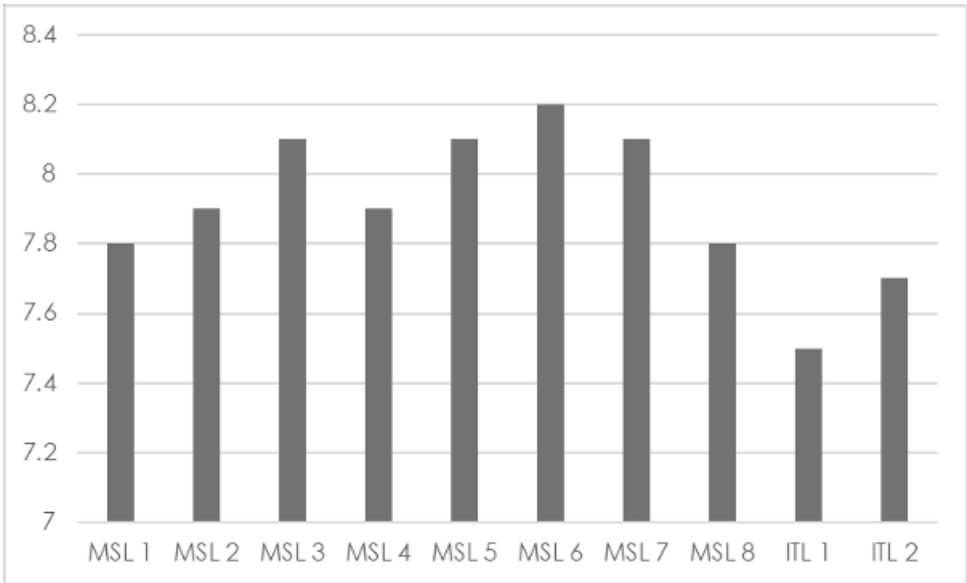


Figure 3-58: Variations in pH

Total Organic Carbon:

Total Organic Carbon (TOC) varied between 1.54 and 2.67 mg/kg, with comparatively higher values at MSL 1 (2.67 mg/kg) and ITL stations. Lower TOC at MSL 5 and MSL 6 corresponds with reduced phenolic concentrations, indicating a relationship between organic content and trace organic compounds

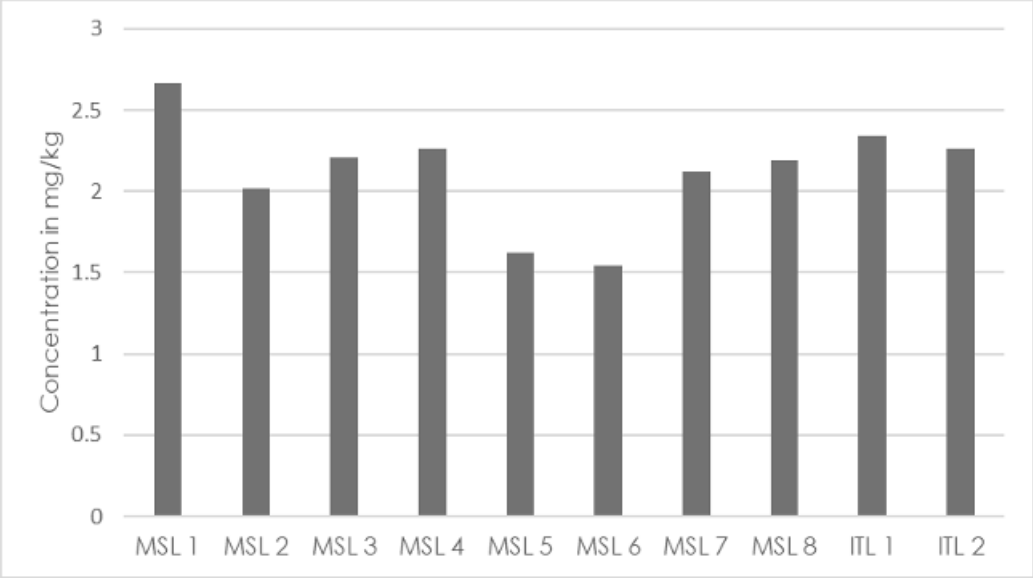


Figure 3-59:Variations in Total Organic Carbon

Oil and Grease

The concentration of Oil and Grease in sediments across the study stations ranged from 11.04 to 23.45 mg/kg. The highest value was recorded at MSL 1 (23.45 mg/kg), followed by MSL 4 (22.73 mg/kg) and MSL 8 (21.06 mg/kg). The lowest concentrations were observed at the intertidal stations, ITL 2 (11.04 mg/kg) and ITL 1 (12.73 mg/kg).

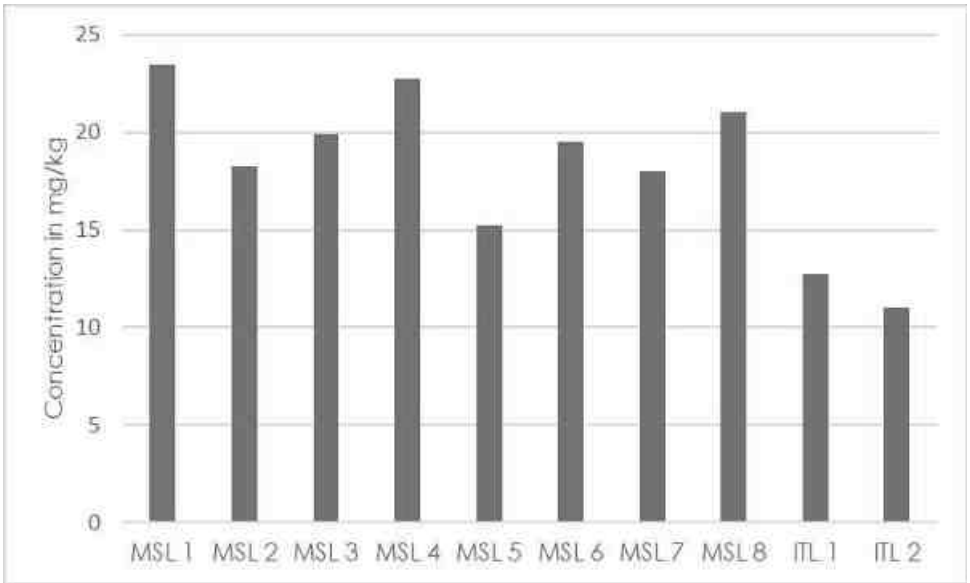


Figure 3-60: Variations in Oil and Grease

Chromium:

Chromium levels varied from 26 to 54 mg/g, with higher concentrations observed at MSL 1 and ITL 1, and lower values at MSL 5 and MSL 6. The variations in Chromium concentration are graphically shown below

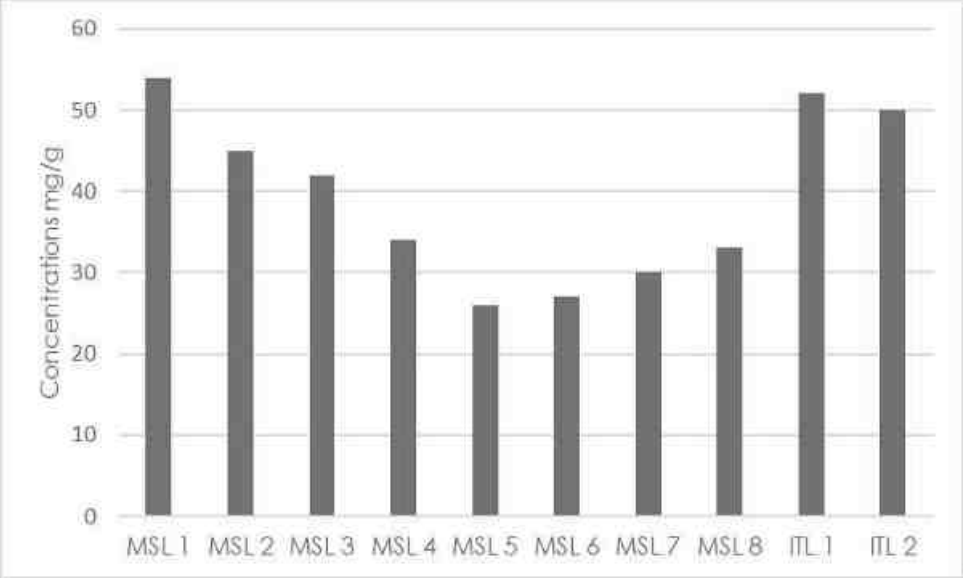


Figure 3-61: Variations in Chromium Concentration

3.15.3.2 Sediment Nutrients

Total Nitrogen

Total Nitrogen ranged from 0.13 to 0.35 mg/g, with the highest values recorded at ITL 1 (0.35 mg/g) and MSL 1 (0.34 mg/g). Lower concentrations at MSL 6 (0.13 mg/g) suggest comparatively reduced organic matter accumulation. The variations of Total Nitrogen in Sediment at different locations is shown graphically in

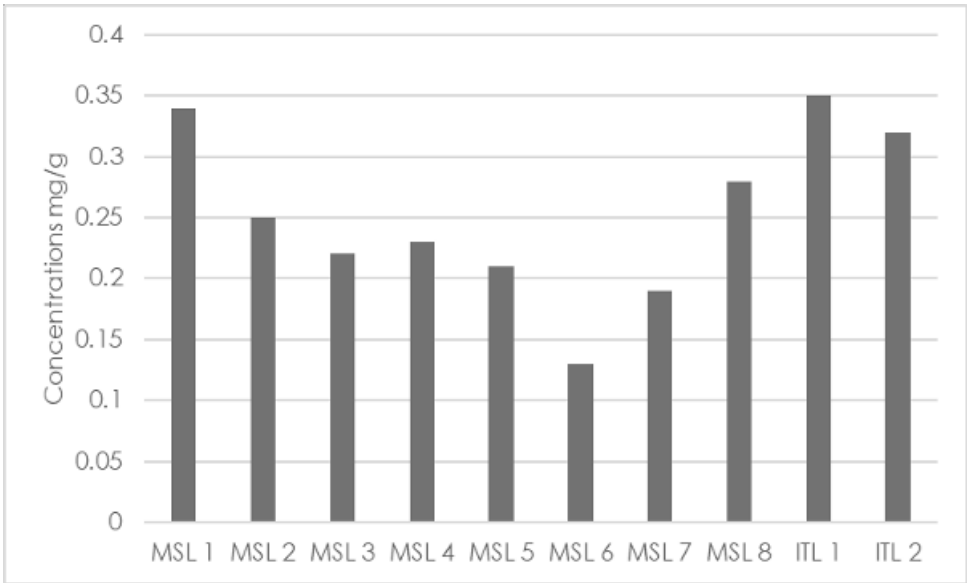


Figure 3-62: Variations in Total Nitrogen concentration

Total Phosphorous:

Total Phosphorus varied between 0.07 and 0.17 mg/g, with elevated levels at ITL 1 and MSL 1, indicating moderate nutrient enrichment possibly influenced by organic deposition. The Variations of Total Phosphorous in sediment at different locations is graphically shown below

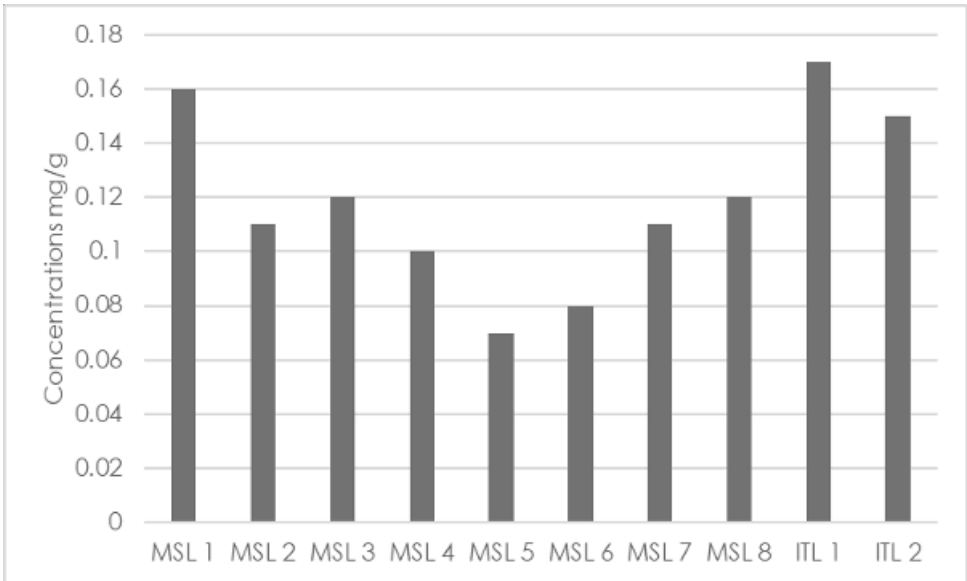


Figure 3-63: Variations in Total Phosphorous concentration

Potassium:

Potassium concentrations ranged from 329 to 380 mg/g. The variations of Potassium in sediment at different locations are graphically shown below

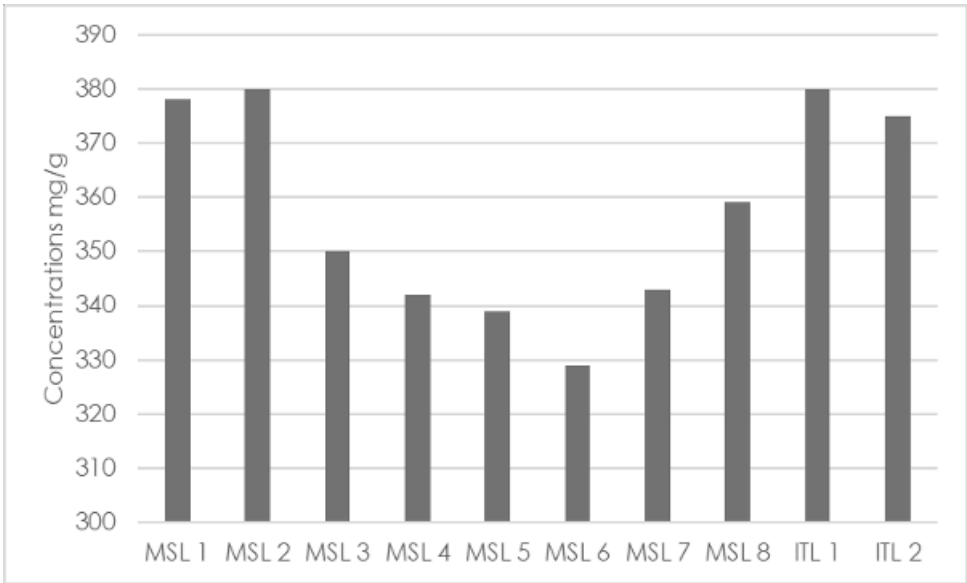


Figure 3-64:Variations in Potassium Concentration

Sodium:

Sodium concentrations ranged from 706 and 806 mg/g. The consistently elevated sodium content reflects strong marine influence and salt accumulation in sandy coastal sediments. The Variations in the sodium are graphically shown below

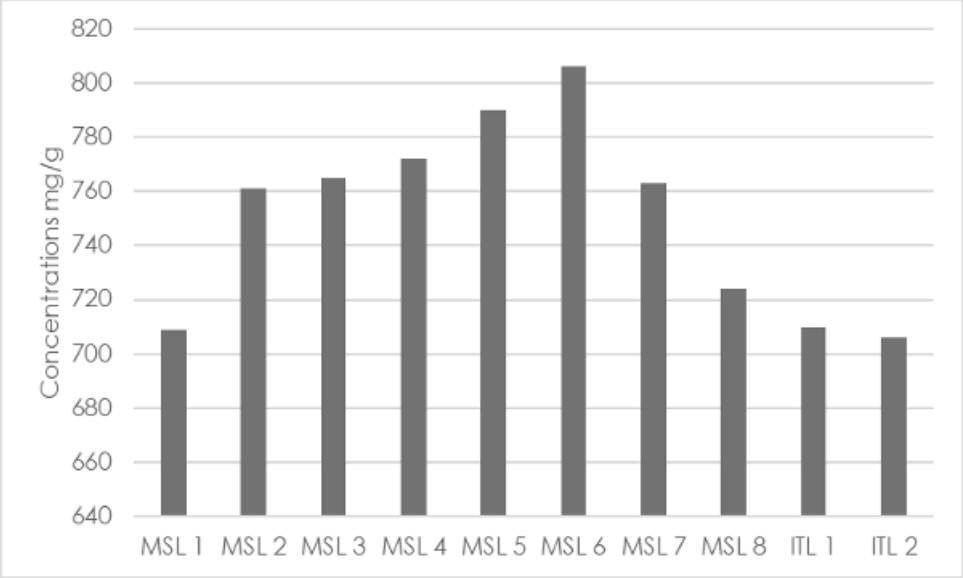


Figure 3-65:Variations in Sodium concentration

3.15.3.3 Heavy Metals

Iron (Fe):

Iron (Fe) showed comparatively high concentrations, ranging from 4754 to 7722 µg/g, reflecting the natural mineralogical composition of coastal sediments. Higher Fe values at MSL 1, MSL 8, and ITL stations may be attributed to geogenic sources and sediment characteristics.

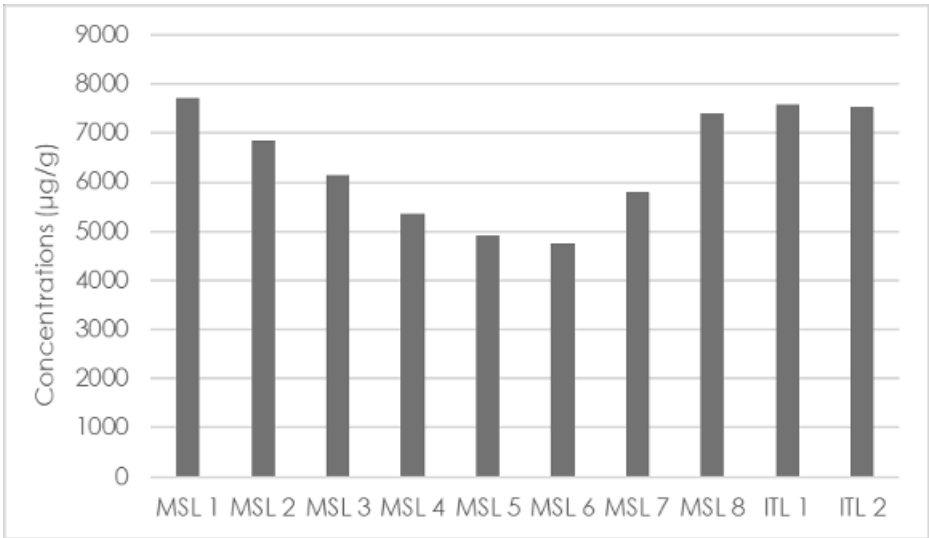


Figure 3-66: Variations in Iron Concentration

Copper (Cu):

Copper (Cu) concentrations ranged from 134 to 193 µg/g, with higher values recorded at ITL 1 (189 µg/g) and ITL 2 (193 µg/g). The variations in copper at different sampling locations are graphically represented in the

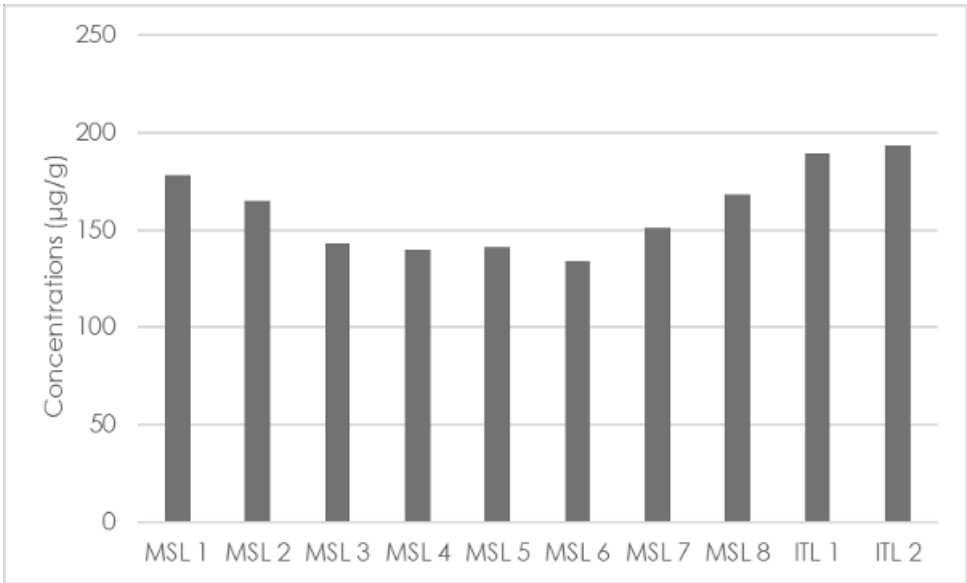


Figure 3-67: Variations in Copper Concentration

Zinc:

Zinc (Zn) varied between 590 and 1059 µg/g, with relatively elevated concentrations at MSL 7, MSL 8, ITL 1, and ITL 2, indicating possible localized enrichment. The variations of Zinc concentration in sediment is graphically shown below

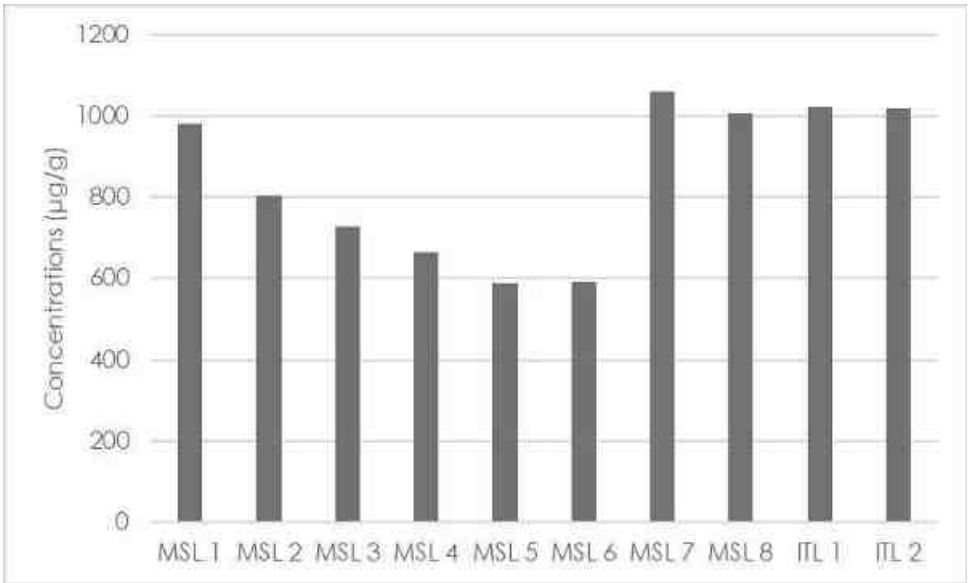


Figure 3-68: Variations in zinc Concentration

Lead (Pb), Mercury (Hg), Arsenic (As), and Boron (B) were recorded as below detection limit (BDL) at all locations, indicating no detectable contamination from these elements during the study period. Cadmium (Cd) was detected at low levels ranging from BDL to 0.10 µg/g, with the highest concentration observed at MSL 1 (0.10 µg/g). The generally low Cd levels suggest minimal anthropogenic influence.

3.15.4 Benthos

3.15.4.1 Macro Benthos:

Four groups of benthic organisms namely Polychaetes, Bivalves, Gastropods, and Crustaceans were recorded across various stations in the Cuddalore coastal waters. Among these, Polychaetes represented the dominant group, followed sequentially by Bivalves, Gastropods, and Crustaceans.

Table 3-24: Meio-benthic Fauna at different sampling stations

S. No	Macrofauna Species	Macro Benthos Nos/10 cm²									
		MSL 1	MSL 2	MSL 3	MSL 4	MSL 5	MSL 6	MSL 7	MSL 8	ITD 1	ITD 2
1	*Amphictesis gunneris*	75	50	175	-	125	75	125	-	-	25
2	*Armandia longicaudata*	-	25	50	50	75	50	50	50	25	-
3	*A. intermedi*	50	75	50	50	25	50	150	50	-	25
4	*Boccardia polybranchia*	75	25	75	75	125	50	175	75	25	-
5	*Capitella capitata*	-	25	100	50	25	25	50	25	-	25
6	*Chone filicaudata*	50	25	-	125	25	-	25	75	-	-
7	*Cirratulus chrysoderma*	-	-	25	-	150	75	50	150	-	-
8	*C. cirratus*	75	25	50	25	25	25	125	75	25	25
9	*Cossura coasta*	-	150	50	25	100	75	25	25	-	25
10	*Dorvillea rudolphi*	-	25	-	50	125	25	125	50	-	-

S. No	Macrofauna Species	Macro Benthos Nos/10 cm²									
		MSL 1	MSL 2	MSL 3	MSL 4	MSL 5	MSL 6	MSL 7	MSL 8	ITD 1	ITD 2
11	*D. gardineri*	-	-	50	125	50	50	50	50	-	25
12	*Euchone rosea*	75	25	25	50	-	25	50	75	-	-
13	*Euclymene lumbricoides*	-	100	-	50	150	50	25	75	-	-
14	*Exogone clavator*	50	75	25	25	-	25	50	50	-	25
15	*Glycera benguellana*	-	25	25	-	50	50	25	50	-	-
16	*Goniada emeriti*	50	100	-	25	225	-	50	50	25	-
17	*Notomastus aberans*	-	25	25	150	75	25	-	-	-	25
18	*Nephtys dibranchis*	-	-	50	75	50	125	175	75	-	-
19	*Nereis sp.*	75	25	50	-	25	50	50	-	-	-
20	*Onuphis gracilis*	50	75	25	-	-	75	-	50	25	50
21	*Pisione africana*	-	150	50	50	50	50	125	-	-	-
22	*Pista cristata*	-	125	-	100	50	125	50	25	25	25
23	*Polydora capensis*	50	50	25	-	175	125	100	50	-	-
24	*Prionospio cirrifera*	75	25	25	75	225	100	150	25	25	25
25	*Pygospio elegans*	-	150	-	50	50	125	75	50	-	-
26	*Scolelepis squamata*	25	75	125	75	-	75	-	-	25	-
27	*Syllis gracilis*	-	25	50	25	125	25	150	50	25	25
28	*Terebellides stroemi*	25	50	75	-	50	100	25	50	-	-
29	*Ampithoe rubricata*	50	50	25	50	75	50	50	25	-	-
30	Angeliera phreaticola	50	150	25	50	125	50	125	50	25	50
31	*Campylaspis sp.*	-	125	50	25	150	75	50	25	50	-
32	*Copepod nauplii*	25	25	-	50	50	100	-	-	-	-
33	*Meretrix casta*	25	-	75	100	50	75	25	100	125	175
34	*M. meretrix*	75	25	-	225	125	-	75	50	175	150
35	*Perna viridis*	-	25	50	25	275	175	100	-	25	-
36	*Crassostrea madrasensis*	50	25	50	75	50	-	50	-	-	25
37	*Cardium veligers*	25	-	50	125	150	125	25	50	25	25
38	*Donax scortum*	100	50	75	25	25	-	-	125	50	75
39	*Perna indica*	-	-	100	50	50	25	50	-	50	-
40	*Cerithidea cingulata*	-	25	150	125	-	50	25	25	25	50
41	*Bullia vitta*	150	75	-	100	25	75	50	50	75	-
42	*Murex trapa*	25	50	-	75	125	50	50	-	-	25
44	*Turritella attenuata*	-	75	50	25	50	-	25	25	25	-
45	*Umbonium vestiarium*	75	-	75	-	75	100	50	50	-	25
	Total	1450	2225	1975	2450	3550	2600	2800	1875	875	925

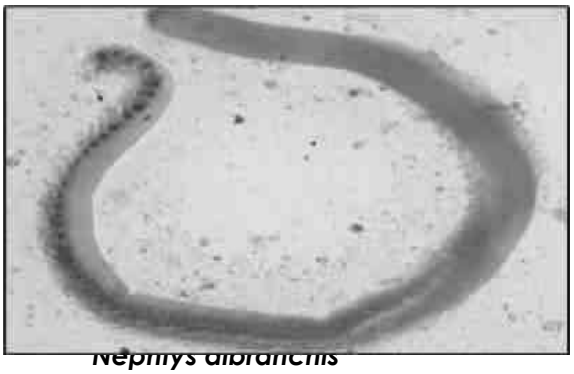
Macro benthic faunal composition

A total of 45 species of macrofauna were recorded from the surveyed stations. Polychaetes were the most diverse group, represented by 28 species. Bivalves ranked next in abundance with 7 species, followed by Gastropods with 5 species and Crustaceans with 4 species.

The population density varied from 625 to 1150 No m^2 with maximum was at MS3 and minimum MS8.

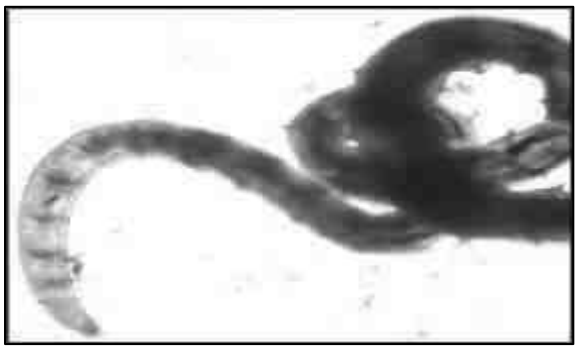
Percentage Composition

The percentage composition of benthic fauna are polychaetes constituted the maximum with 60% to the total benthic organisms, Bivalves, Gastropods and Crustaceans contributed to 20%, 11% and 9% respectively to the total benthic faunal community.



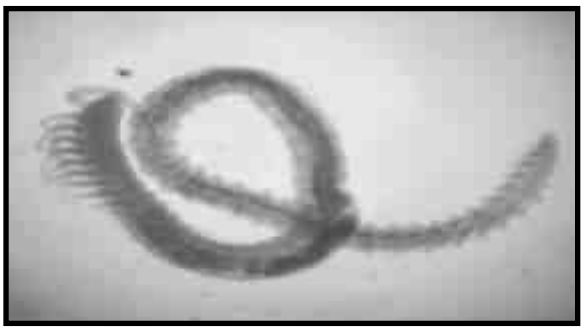
Nephtys dibranchiis

Cossura coasta



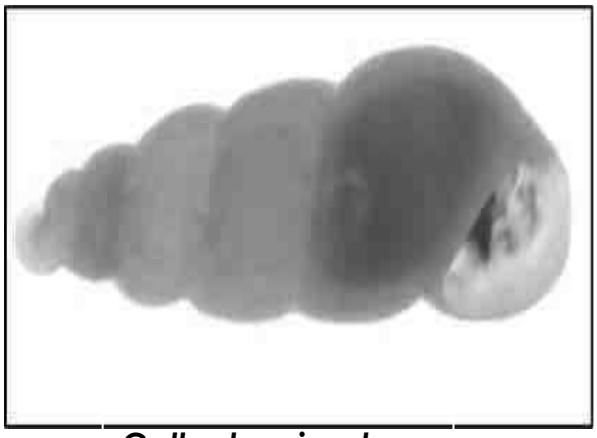
Nereis sp.

Onuphis gracilis

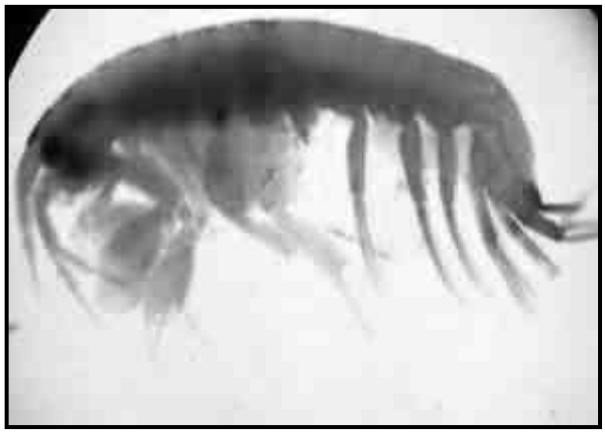


Prionospio cirrifera

Armandia intermedia



Galba longiscata

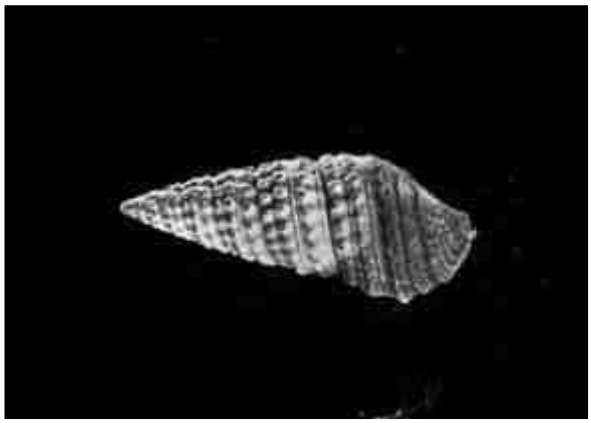


Ampithoe ramondi

Anadara rhombea

Dosinia victoriae

Meretrix casta



Cerithidea cingulata

Exhibit 3-7: Macro Benthos

3.15.4.2 Meio Benthos

Table 3-25: Meiobenthic Fauna at different sampling stations

S. No	Meiofauna Species	Meio benthos Nos/10 cm²									
		MSL 1	MSL 2	MSL 3	MSL 4	MSL 5	MSL 6	MSL 7	MSL 8	ITD 1	ITD 2
Nematodes											
1	*Daptonema conicum*	4	6	5	8	8	5	10	-	10	10
2	*Astomonema jenneri*	7	--	12	8	10	14	9	10	6	6
3	*Epsilonema steiner*	7	10	7	6	4	10	-	7	-	-
4	*Neochromadora craspedota*	8	-	12	-	10	-	8	5	-	6
5	*Halalaimus filum*	-	6	8	8	4	9	10	2	-	8
6	*Oxystomina clavicauda*	7	8	10	6	9	6	8	8	8	6
7	*Rhychonema sp.*	8	-	8	-	6	8	6	-	6	-
8	*Pandolaimus latilaimus*	8	-	-	8	8	4	6	-	12	6
Foraminifera											
9	*Asterorotalia dentata*	8	12	10	12	28	8	8	6	10	-
10	*Ammonia beccarii*	12	20	14	16	18	26	12	-	6	8
11	*A. tepida*	6	12	8	6	26	10	6	8	4	6
12	*Bolivina limbata*	10	12	10	6	10	6	8	12	6	4
13	*B. tortuosa*	-	8	4	-	8	10	10	6	8	8
14	*Elphidium clavatum*	-	8	10	4	8	8	10	10	-	-
15	*E. texanum*	-	6	4	6	6	-	6	6	-	-
16	*Globorotalia hirsuta*	-	-	10	4	4	8	8	6	-	-
17	*Lagena lacunata*	-	10	6	6	12	4	12	4	4	-
18	*L. semistriata*	-	6	4	8	-	8	6	8	-	-
19	*Nonion grateloupi*	4	-	-	6	4	2	12	10	-	6
20	*Pararotalia ozawai*	6	6	6	6	4	4	6	-	-	-
21	*Miliolinella subrotunda*	6	4	-	10	8	6	-	6	-	4
22	*Rosalina globularis*	-	-	6	-	10	4	8	4	6	-
23	*Spirillina lateseptata*	6	6	-	4	16	4	6	4	-	4
24	*Spiroloculina excavata*	6	-	8	4	4	-	10	-	8	4
25	*S. depressa*	4	8	4	6	6	6	6	6	4	6

S. No	Meiofauna Species	Meio benthos Nos/10 cm²									
		MSL 1	MSL 2	MSL 3	MSL 4	MSL 5	MSL 6	MSL 7	MSL 8	ITD 1	ITD 2
26	*Textilaria foliacea*	8	6	6	4	12	8	-	8	6	4
Ostracodes											
27	*Basslerites liebaui*	4	6	-	6	8	12	8	4	8	4
28	*Bairdoppilata scaura*	-	8	4	8	10	6	6	6	-	-
29	*Cytheromorpha fuscata*	4	4	-	10	6	6	4	6	6	8
30	*Keijella reticulata*	6	4	8	6	4	4	12	8	4	-
31	*Paijenborchella cymbula*	4	6	4	8	4	2	6	8	-	2
32	*Stenocypris major*	8	9	12	4	-	8	4	4	4	-
33	*Tanella gracilis*	4	-	6	-	9	6	7	-	6	-
Harpacticoid											
34	*Macrosetella gracilis*	-	7	8	6	8	10	6	9	4	-
35	*Canuella perplexa*	4	6	12	12	16	10	16	9	8	4
36	*Euterpina acutifrons*	9	8	-	8	8	8	6	-	6	6
37	*Tisbe furcata*	8	14	8	-	8	10	6	6	-	4
	Total	**176**	**226**	**234**	**220**	**324**	**260**	**272**	**196**	**150**	**124**

Meio-benthic faunal composition:

A total of 37 species of meio-benthic organisms were recorded, representing four groups: Foraminiferans, Nematodes, Ostracodes, and Harpacticoids. Foraminiferans were the most diverse group with 18 species, followed by Nematodes with 8 species. Ostracodes and Harpacticoids contributed 7 and 4 species respectively.

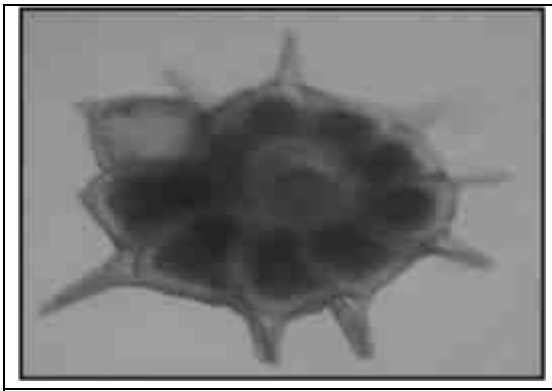
A diverse assemblage of meio-benthic organisms was recorded across the surveyed stations. Among the Foraminiferans, species such as *Asterorotalia dentata*, *Ammonia beccarii*, *A. tepida*, *Bolivina limbata*, *B. tortuosa*, *Elphidium clavatum*, *E. texanum*, *Globorotalia hirsuta*, *Lagena lacunata*, *L. semistriata*, *Nonion grateloupi*, *Pararotalia ozawai*, *Miliolinella subrotunda*, *Rosalina globularis*, *Spirillina lateseptata*, *Spiroloculina excavata*, *S. depressa*, and *Textilaria foliacea* were commonly encountered. With respect to Nematodes, *Astomonema jenneri*, *Daptonema conicum*, *Epsilonema steineri*, *Halalaimus filum*, *Neochromadora craspedota*, *Oxystomina clavicauda*, and *Pandolaimus latilaimus* were frequently observed. The Ostracodes community included species such as *Basslerites liebaui*, *Bairdoppilata scaura*, *Cytheromorpha fuscata*, *Keijella reticulata*, *Paijenborchella cymbula*, *Stenocypris major*, and *Tanella gracilis*. Among Harpacticoids, *Macrosetella gracilis*,

Canuella perplexa, *Euterpina acutifrons*, and *Tisbe furcata* were the common species.

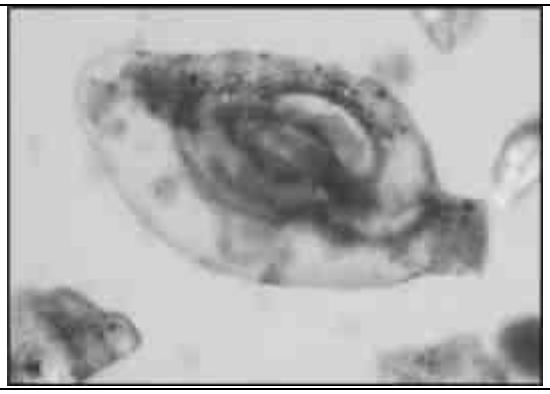
The population density of Meio-benthic fauna varied from 124 to 312 Nos.10cm^{-2} with maximum was recorded at MSL-5 and minimum at ITD-2.

Percentage composition:

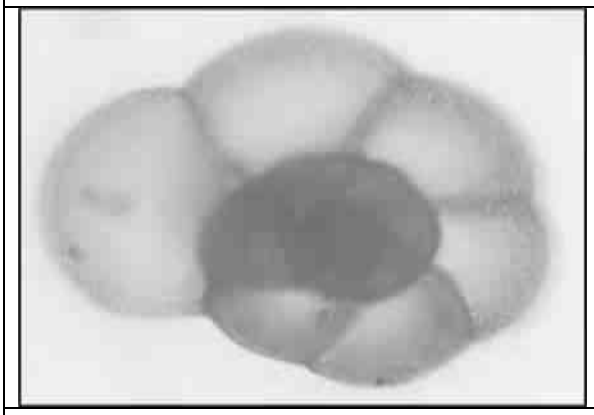
Foraminiferans were the dominant group, comprising 49% of the total meio-benthic organisms. Nematodes contributed 22%, while Ostracodes and Harpacticoids accounted for 16% and 13% respectively.



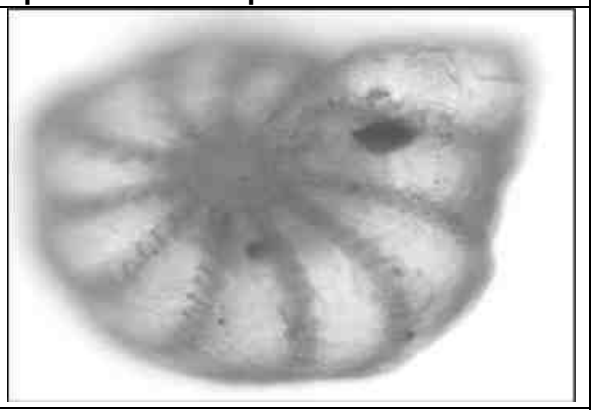
Asterorotalia dentata



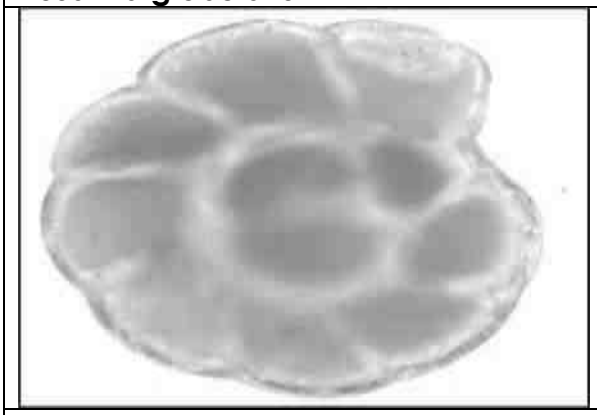
Spiroloculina depressa



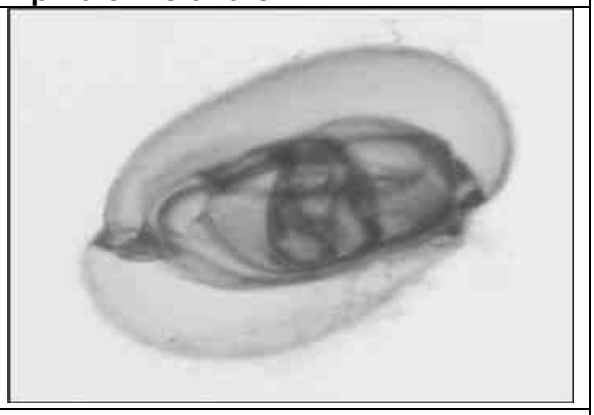
Rosalina globularis



Elphidium clavatum



Ammonia beccarii



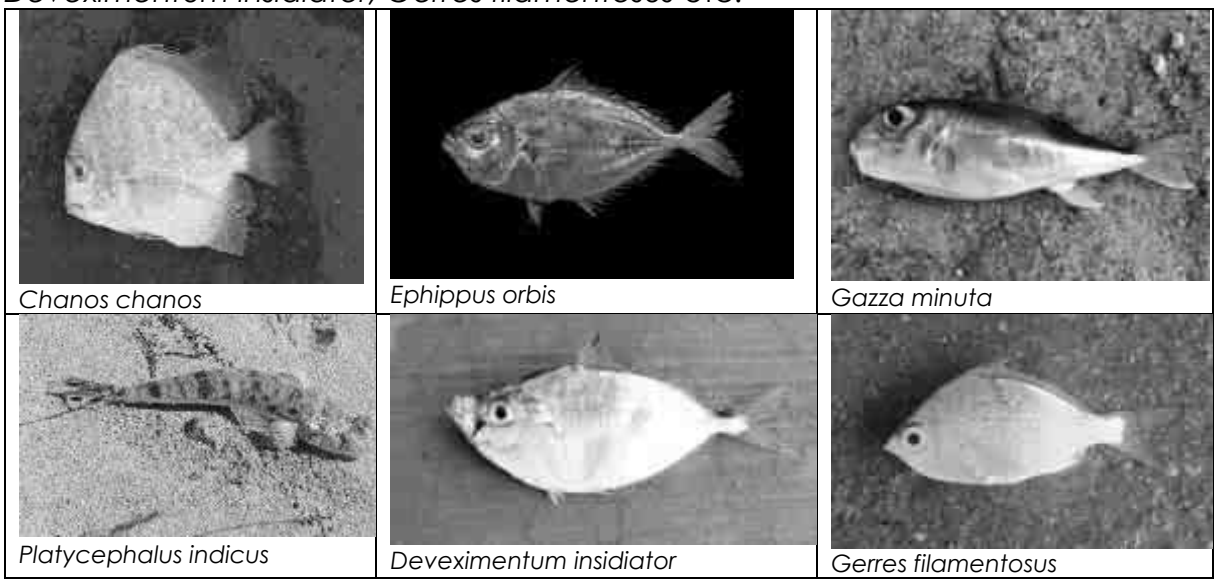
Miliolinella subrotunda

Exhibit 3-8: Meio-benthos

3.15.5 Common Marine Fish Species at Cuddalore

Cuddalore district have a coastline that extends 57.5 Kms and has significant economic activity yielding out of the fishermen population associated with fishing

activity. At Fishing Harbour and local markets of Cuddalore, commonly occurring fish species captured and sold depending on their availability. Field visits were made during October 2025 to record the marine species collected from coastal waters and sold in local fish markets. Further, secondary information available from Fisheries Department of Cuddalore was also collected. In this inventory, the marine species were categorized into fishes, crustaceans, and molluscans, and accordingly the species were listed. *Alectis indica, Ambassis commersoni, Boleophthalmus boddarti, Caranx sem, Chanos chanos, Ephippus orbis, Gazza minuta, Platycephalus indicus, Deveximentum insidiator, Gerres filamentosus* etc.



(Source: Fishbase.se)

Exhibit 3-9: Common marine fishes recorded near the Cuddalore Coast

3.16 Ecology & Biodiversity

3.16.1 Description of the study area

The study of flora and fauna, often referred to as biodiversity assessment, is a crucial component of environmental impact assessments (EIAs) for following reasons:

- **Understanding Ecosystem Health:** Flora and fauna are integral parts of ecosystems. Studying them helps in assessing the overall health and functioning of these ecosystems.
- **Indicator of Environmental Health:** The presence, abundance, and diversity of different species can serve as indicators of environmental health.
- **Protection of Endangered Species:** Conducting a biodiversity assessment allows for the identification of such species and their habitats, which can be crucial for their protection and conservation.
- **Mitigation and Management:** Biodiversity assessments provide data that can be used to design effective mitigation measures.
- **Long-Term Planning:** Biodiversity assessments are not just about the immediate impact of a project but also about its long-term consequences. Understanding how a project might affect the local flora, and fauna can help in planning for the sustainability of the environment beyond the project's completion.

In this context, a biodiversity assessment was undertaken to study the distribution patterns of flora and fauna within various habitat types in a 15 km radius around the park premises. The field survey was conducted during study period during September, 2025 a period considered optimal for such ecological studies due to the visibility and activity of many species

For better understanding the habitat setup and identification impacts, the study area was categorized into Core area and Buffer area

Core Area study: The proposed Expansion of Cuddalore Port area is considered as core area. Quantification has been done for the trees, shrubs, herbs, grasses and terrestrial & arboreal fauna in the core area. Status of natural vegetation, greenbelt plantation type, soil type, and associated services were recorded. Maximum effort has been taken to assess the damage caused by the activity (if any) in the core area and suggest appropriate implementable conservation action plan (if any)

Buffer Area study: 15 km radius from the project boundary is considered as buffer area. The following habitats are investigated in the buffer area.

- Vegetation type (Agriculture, Avenue Plantation types)
- Terrain type (Plain & Undulating)
- Aquatic Habitat (lentic and lotic)

The study area showing the sampling locations for flora and fauna in the study area are shown in **Figure 3-69** and as **FD307.**

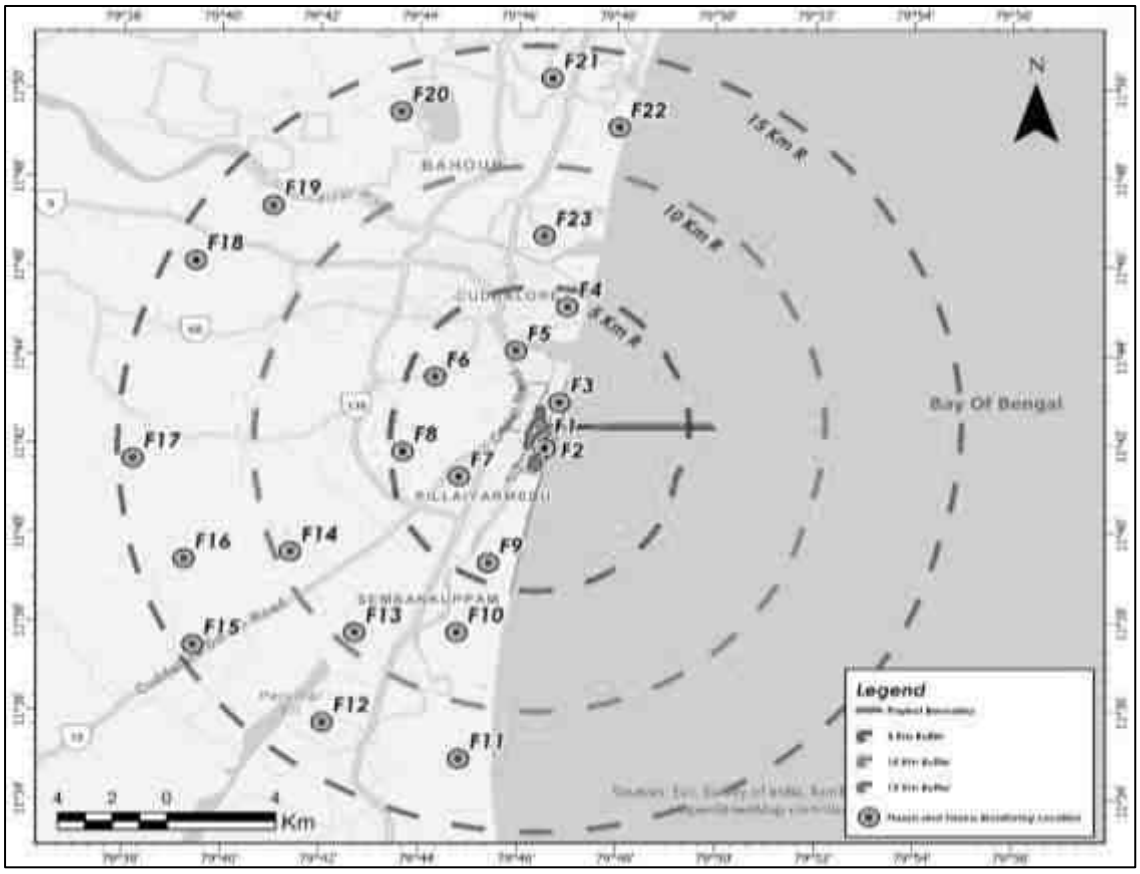


Figure 3-69:Flora and Fauna sampling locations

3.16.2 Methodology for Biodiversity Survey

Conducting a comprehensive assessment of flora and fauna requires a systematic, scientific approach to accurately capture the diversity, abundance, and distribution of plant and animal species within the study area. The methodology for this biodiversity survey involved the following key component.

Desk Study and Preliminary Assessment:

Collated existing information from sources including the Tamil Nadu Forest Department, Forest Survey of India (FSI) reports, and scientific literature. Extracted Reserve/Protected Forest boundaries using Survey of India toposheets, Bhuvan portal, and other geospatial datasets. Identified key habitats and ecological features for focused field surveys.

Field Surveys:

Collected data using a combination of methods, such as transect surveys, quadrat sampling, point counts, camera traps, and acoustic monitoring. Document the presence, abundance, and diversity of plant species (flora) and animal species (fauna). Record details about each species, such as scientific name, common name, habitat preferences, behaviour, and signs of activity.

Flora: The phyto-sociological study of flora was conducted through a systematic sampling approach, combined with field perambulation across the study area. The primary objective was to document plant species diversity and ensure representation of all major vegetation types. To achieve this, sample plots were carefully selected and distributed across different ecological zones and habitat types within the region, maximizing the spatial and ecological coverage of the survey.

Sampling was carried out using standard quadrat methods, with different plot sizes designated based on the growth form of vegetation. For trees, 10 m × 10 m quadrats were used to capture larger canopy species. Shrubs were surveyed using 5 m × 5 m plots, while herbaceous vegetation was sampled within 1 m × 1 m quadrats. This stratified approach allowed for a comprehensive assessment of vertical and horizontal vegetation structure.

Plant species encountered within the plots were identified in the field using regional floras, supplemented by verification through the Plants of the World Online (POWO) database (https://powo.science.kew.org), which provides up-to-date taxonomic information and nomenclature. This ensured the scientific accuracy of species identification and allowed for standardization in data recording.

Fauna: Surveys to assess faunal diversity were carried out using a systematic approach, with particular emphasis on covering all major habitat types within the study area. The primary method employed was transect walks, wherein transects ranging from 500 to 1000 meters in length were established across different ecosystems such as forests, wetlands, and agricultural zones. These surveys aimed to capture both direct and indirect evidence of animal presence. Direct

observations included visual sightings and auditory cues, while indirect signs such as tracks, droppings, nests, burrows, and feeding marks were also recorded to ensure comprehensive documentation.

Species identification was conducted using standard field guides, ensuring accurate classification across taxa. Key references included Vivek Menon (2003) for mammals, Whitaker and Captain (2004) for reptiles, Daniel (2005) for amphibians, Grimmett *et al*. (1998) for birds, and Kehimkar (2008), data base (https://www.ifoundbutterflies.org) for butterflies. This allowed for reliable identification of species in the field, supported by photographic evidence where possible.

To evaluate the conservation status of the recorded fauna, species were cross-referenced with the schedules listed under the Indian Wildlife (Protection) Act, 1972 (as amended), and the International Union for Conservation of Nature (IUCN) Red List. This helped identify species that are considered Rare, Endangered, Endemic, Threatened (REET), thus providing insights into the ecological sensitivity of the area. Beyond species identification, ecological observations were made to understand key behavioural and habitat-use patterns. Data on foraging, nesting, breeding, and general habitat preferences were recorded. Migratory routes of birds and mammals were also explored through discussions with local communities and personnel from the Forest Department, offering valuable traditional and institutional knowledge that supplemented field findings.

Quantitative assessments of faunal populations were not undertaken during this survey, as such evaluations require species-specific and seasonal data collection over an extended period. However, the current approach provides a foundational baseline for future detailed studies. Information on fish diversity was gathered through field interactions with local fishing communities, visits to fish markets, and consultations with the local fisheries department. These sources provided insights into the commonly occurring species and their distribution, contributing to the overall understanding of aquatic biodiversity in the region.

Species Identification and Documentation:

Species identification, either through direct observation, photography, Document the species using field notes, photographs, and GPS coordinates.

Habitat Assessment:

Evaluate the various habitats within the study area, including forests, wetlands, grasslands, aquatic ecosystems, etc. Record habitat characteristics such as vegetation type, soil composition, water sources, and disturbances.

Data Analysis:

Analysing the data to determine species richness, diversity indices, and community structure. Identify any patterns or trends in species distribution and abundance.

The primary data recorded on number of individuals of a species and girth was analysed for secondary attributes like density and frequency following standard

phyto-sociological methods of Mishra (1968). Relative values were calculated by following Philips (1959).

Important Value Index (IVI): IVI was calculated by adding up the three relative values of relative frequency, relative density and relative dominance (Curtis, 1959). Trees were analysed in 10 × 10m plots; shrub and climbers in 5 × 5m plots and Herbaceous species were analysed in 1 × 1m plot nested within 10 × 10m plot. Individuals of each species for tree, shrubs, climbers and herbs were recorded. Vegetation data were quantitatively analysed for density, frequency and abundance using standard methodologies Curtis & McIntosh (1950) and Mueller-Dombois & Ellenberg (1974).

$$\text{Abundance} = \frac{\text{Total number of individuals in all sampling units}}{\text{Total number of sampling units in which species occur}}$$

$$\text{Density} = \frac{\text{Total number of individuals in all sampling units}}{\text{Total number of sampling units studied}}$$

$$\text{Frequency} = \frac{\text{Number of sampling units in which species occur}}{\text{Total number of sampling units}} \times 100$$

The important value Index (IVI) was determined as the sum of the relative density (Rd) relative frequency (Rf) and relative abundance (Ra) were calculated for each species following Curtis & McIntosh (1950).

IVI = Rd + Rf + Ra

$$\text{Rd} = \frac{\text{Density value of species}}{\text{Sum of density value of all species}} \times 100$$

$$\text{Rf} = \frac{\text{Frequency value of species}}{\text{Sum of frequency value of all species}} \times 100$$

$$\text{Ra} = \frac{\text{Abundance value of species}}{\text{Sum of abundance value of all species}} \times 100$$

Sum of abundance value of all species

Species Diversity Index: The species indices were calculated to know variations of flora in different areas. The species diversity indices were calculated by using Shannon-Wiener Index (H`) & Simpson Index (I) (Kerbs, 1972 and Magurran, 1988).

Simpson Index (Simpson, 1949)

The species dominance was measured by using Simpson's index. It is a measure of dominance since it weighted towards the abundances of commonest species. It is estimated by using formula:

$$\mathbf{Cd = \sum (ni/N)^2}$$

Shannon - Wiener index (Shannon and Weaver, 1963)

Shannon's index of diversity is the measure of the average degree of uncertainty in predicting to what species individuals chosen at random from a collection of 'S' species and 'N' individuals will belong. This average uncertainty increases as the number of species increases and as the distribution of individuals among the species becomes even. Thus, H'=0 when all species are represented by the same number of individuals. It is estimated by using the formula:

The species diversity was determined by Shannon – Wiener index

$$\mathbf{H' = - \sum (ni/N) \log (ni/N)}$$

Where, ni = number of individuals belonging to the species

N = Total number of individuals in the sample.

Threat Assessment:

Evaluating potential threats to biodiversity, including habitat loss, pollution, invasive species, climate change, and anthropogenic activities. Assessing the impacts of these threats on different species and habitats.

Protected Areas: Protected areas (PAs) are those in which human occupation or at least the exploitation of resources is limited. Protected areas include National Parks, Wildlife Sanctuaries, Conservation Reserves, Community Reserves & Marine Protected Areas. PAs present in the 15 km radius are enquired from Protected Area Gazette Notification Database and WII-ENVIS portal.

Key Biodiversity Area: Key Biodiversity Areas (KBA) are specific to geographic locations that are identified as being critical for the conservation of biodiversity. These areas are typically chosen based on the presence of one or more species or ecosystems of high conservation value. KBAs are recognized for their importance in safeguarding biodiversity and are often used as focal points for conservation efforts. https://www.keybiodiversityareas.org.

3.16.3 Status of the flora

3.16.3.1 Core Area

Core area was with natural scrubland vegetation with species such as *Neltuma juliflora*, *Vachellia nilotica*, *Azadirachta indica, Borassus flabellifer*, *Ficus religiosa, Morinda pubescens* and *Ziziphus mauritiana* etc. According to growth forms Trees are 16 Spp., Shrubs 7 Spp., Herbs 13 Spp., and Climbers are 3 Spp.

Mixed vegetation near cuddalore port

Neltuma juliflora near cuddalore port

Scrub land with shrubs, herbs and grasses

Exhibit 3-10: Habitat features in the project site

Phytosociological studies in Core Area:

Among trees species *Neltuma juliflora* showed highest IVI (23.77) followed by *Butea monosperma* (21.24), *Morinda pubescens* (21.24) and *Delonix regia* (20.90), these four tree species were significant in occupying majority of space in sampled area. Among shrub species *Calotropis procera* showed highest IVI (49.90) followed by *Carissa spinarum* (46.16) and *Calotropis gigantea* (45.54). Among herbaceous species, *Ipomoea pes-caprae* (23.93), *Tridax procumbens* (23.55), *Tribulus terrestris* (22.78) and *Solanum nigrum* (20.70) showed highest IVI in the core area. IVI values for the top 10 species of trees, shrubs and herbs are shown in **Figure 3-70** to **Figure 3-72.**

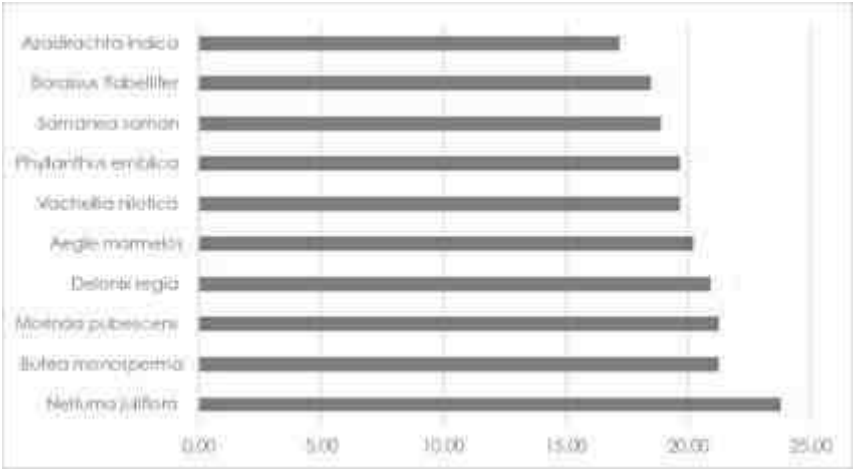


Figure 3-70: IVI of top 10 trees species in Core Area

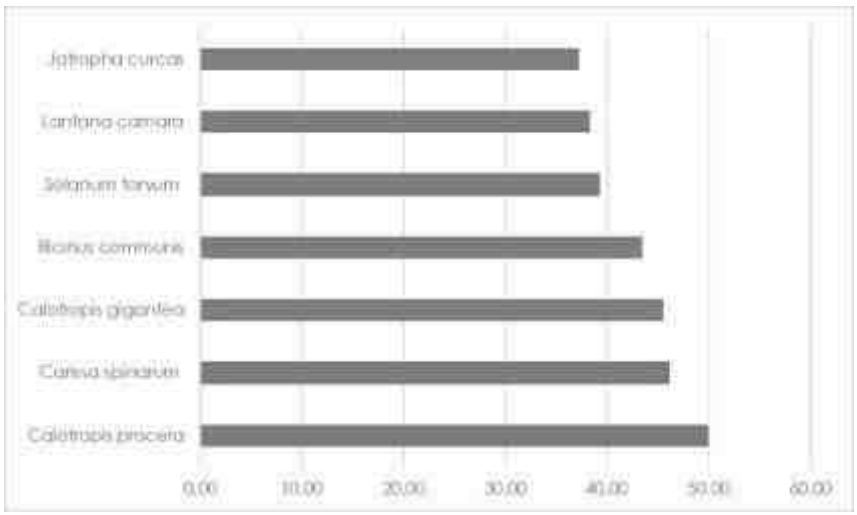


Figure 3-71: IVI of top 10 shrubs species in Core Area

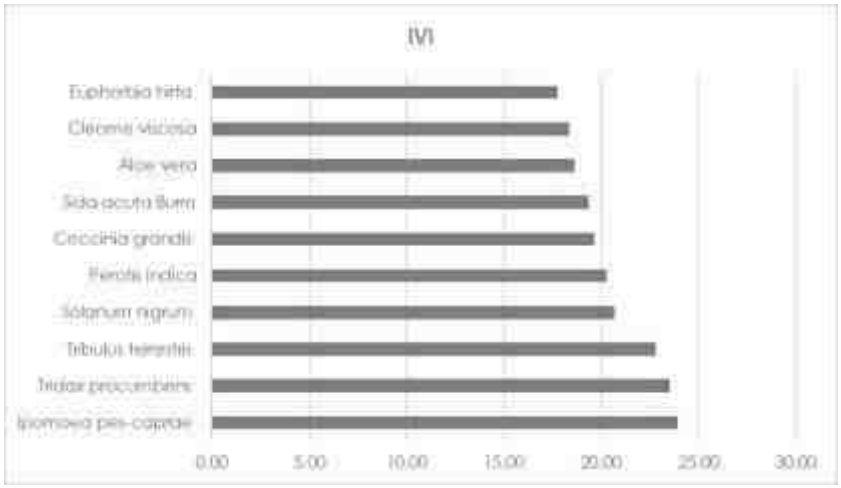


Figure 3-72: IVI of top 10 herb species in Core Area

Species Diversity Index in Core area

There are two important indices to denote the diversity such as Shannon Wiener Index (H') and Simpson Index (λ). The trees in core area showed Shannon Wiener Index (H') value as 1.20 and Simpson Index (λ) values as 0.65. The shrubs/climbers in core area showed Shannon Wiener Index (H') value as 1.22 and Simpson Index (λ) values as 0.62. The herbs in core area showed Shannon Wiener Index (H') value as 1.18 and Simpson Index (λ) values as 0.68.

3.16.3.2 Buffer Area

The 15 km radial buffer area around the project site predominantly comprises Coastal vegetation and on left side of the port there is predomination of urban settlements along with agricultural lands.

Buffer area was with natural scrubland,agricultural vegetation with species such as *Neltuma juliflora*, *Borassus flabellifer, Azadirachta indica, Samanea saman*, Vachellia farnesiana, Vachellia nilotica and Ziziphus mauritiana etc. According to growth forms Trees are 49 Spp., Shrubs 20 Spp., Herbs 28 Spp., and Climbers are 10 Spp.

Paddy crop along with Coconut trees

Casuarina and Borassus flabellifer Near North Break water

Coconut trees in Chithiraipettai Beach

Vegetation along Gadilam River

Exhibit 3-11: Habitat features in the buffer Area

Phytosociological studies in Buffer area:

Among trees species *Borassus flabellifer* showed highest IVI (8.13) followed by *Albizia saman (Jacq.) F.Muell.* (7.87), *Anacardium occidentale* (7.66) and *Limonia acidissima* (7.66). These four tree species were significant in occupying majority of space and resources being representing sampled area. Among shrub species *Calotropis procera* showed highest IVI (25.86) followed by *Ricinus communis* (23.25) and *Nerium oleander* (20.82). Among *Cardiospermum halicacabum* (13.33), *Clitoria ternatea* (12.33), *Gloriosa superba* (11.84), *Justicia adhatoda* (10.89) and *Reissantia indica* (10.50) showed highest IVI in the buffer area.

Species Diversity Index in Buffer area

The trees in Buffer area showed Shannon Wiener Index (H') value as 1.68 and Simpson Index (λ) values as 0.21. The shrubs/climbers in Buffer area showed Shannon Wiener Index (H') value as 1.22 and Simpson Index (λ) values as 0.68. The herbs in Buffer area showed Shannon Wiener Index (H') value as 1.55 and Simpson Index (λ) values as 0.33. The species diversity in the buffer area interprets moderate diversity in plant composition **Figure 3-73.**

Detailed checklist of flora in the study area was given as **Appendix E**

Exhibit 3-12: Flora found in core and buffer area

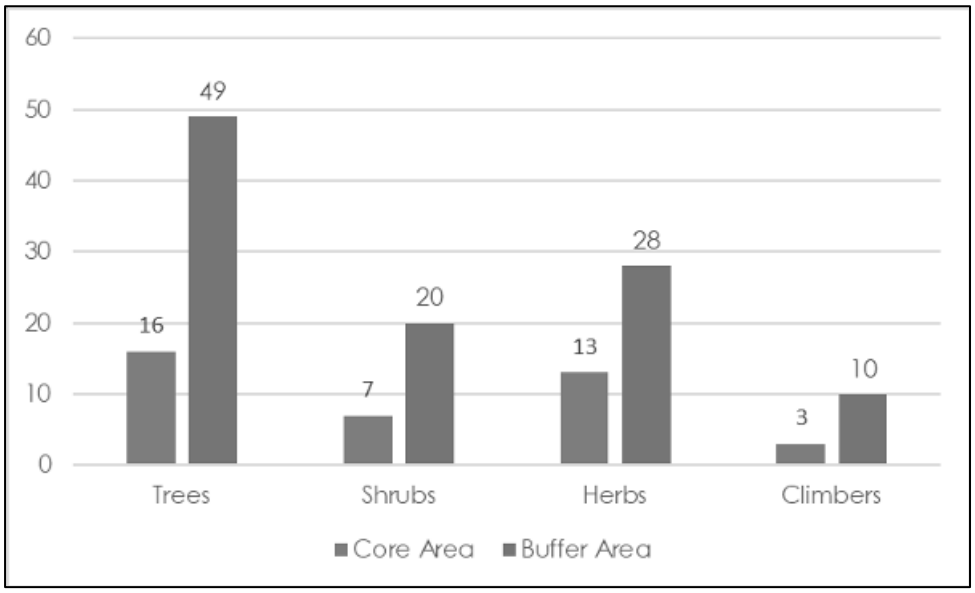


Figure 3-73: Flora composition in core and buffer area

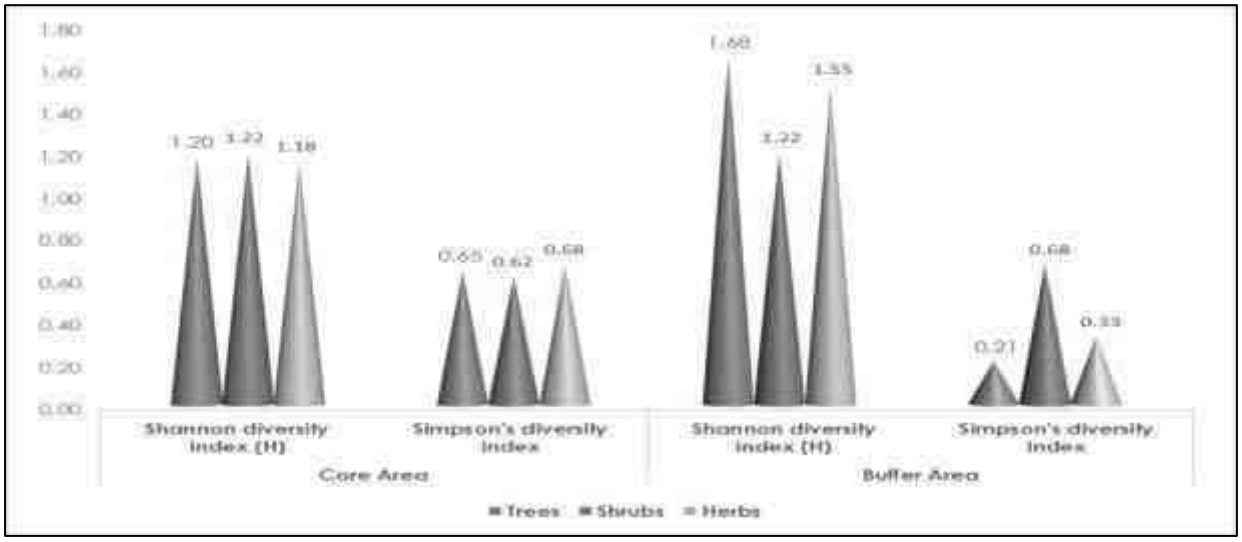


Figure 3-74: Species diversity index of core and buffer area

3.16.4 Status of Faunal Diversity

Core Area: During the study period, species such as *Lepus nigricollis, Funambulus palmarum, Ardeola greyii, Bubulcus ibis, Corvus splendens, Merops orientalis*. were recorded in the project site core area.

Buffer Area: As the study area is mostly influenced by urban settlements there is no direct evidence of major wild animal observed, except few pug marks of Indian wild boar and Indian fox were observed near the coastal areas.

Mammals: A total of 7 species of mammals were recorded. The species includes *Lepus nigricollis, Lepus nigricollis, Hystrix indica, Rattus rattus and Funambulus palmarum*.

Birds: Among the birds, 29 species were recorded. The common bird species of the area include Egretta garzetta, Spotted dove, Black Drango, Laughing dove, House Sparrow.

Herpetofauna: The herpetofauna represented with 17 species belonging to 12 families. Species includes Calotes versicolor, Ptyas mucosus, Hemidactylus flaviviridis, Chamaeleo zeylanicus, Mabuya carinata and Bungarus caeruleus.

Among the fauna in study area the species richness is Mammals (7 sp.), Birds (29 sp.) followed by Herpetofauna (17 sp.). Detailed checklist of fauna in the study area was given as **Appendix E.**

Exhibit 3-13: fauna in study area

3.16.5 Endangered/Threatened/Protected species

Flora: Among the 107 plant species reported from the study area, none of the species is listed in IUCN threatened category.

However, considering vulnerable habitat features of the mangroves, all the true mangrove species are considered as locally threatened. Three mangroves' species (*Avicennia officinalis, Avicennia marina and Rhizophora mucronata*) identified in the buffer area.

Fauna: Among the 53 documented fauna species, two are listed under Schedule of the Indian Wildlife (Protection) Act (IWPA), Indian crested porcupine (*Hystrix indica*), and Indian Monitor Lizard (*Varanus bengalensis*). IUCN/IWPA listed Fauna species reported in the study area are given in **Table 3-31**.

S. No	Common Name	Scientific Name	IUCN	IWPA Schedule
1	Indian crested porcupine	Hystrix indica	LC	I
2	Indian Monitor Lizard	Varanus bengalensis	NT	I

Except from the above listed species as per IUCN and IWPA Schedule no other endangered, endemic species were observed.

3.16.6 Mangrove Areas Around the Project Area

Importance of Mangroves

Mangroves are salt tolerant plants. They are found in tropical and subtropical coastal areas. The word mangrove may be derived from Portuguese and English. 'Mangue' means tree, and 'grove' means group of trees. The vegetation in Mangrove consists of many species. It may be a woody plant in the form of a tree or a shrub. The ability to live in brackish to seawater conditions vary with species.

Mangroves play a critical ecological role in coastal protection and environmental stability. They act as natural barriers against cyclonic storms, shielding inland areas from wind and wave damage. Additionally, mangroves serve as buffers against flooding and help prevent coastal erosion by stabilizing shorelines with their dense root systems. They also trap fine sediments carried by floodwaters into the coastal zone, contributing to land formation and water clarity.

Ecologically, mangroves are vital in nutrient cycling. They export significant amounts of nutrients to the coastal waters, enriching marine ecosystems and supporting biodiversity. Moreover, mangroves help retain inorganic nutrients that might otherwise be lost through fast-moving terrestrial runoff by absorbing them and converting them into organic matter. In general, the mangrove tree vegetation constitutes the family Avicenniaceae is the only dominant tree found all over the swampy areas. The six species belongs to genus Avicennia, Acanthus and Suaeda of the families Avicenniaceae, Acanthaceae and Chenopodiaceae include Avicennia officinalis, Avicennia marina, Avicennia alba, *Acanthus ilicifolius*, Suaeda maritime and Suaeda monoica respectively (Ushakiranmai and Rajsekhar 2015).

During the environmental monitoring emphasis is given on the identification of existing mangroves areas in and around the project location.

A small patch of mangroves were noticed away from the project location (~60m) near to shipbuilding and repair facility in Parvanar river. The mangrove *Avicennia officinalis, Avicennia marina* are the dominated species.

Exhibit 3-14: Mangroves around the Project site

Pichavaram Mangrove

Pitchavaram mangroves are located at a distance of ~22 Km from the project site and impacts due to project development on Pichavaram mangroves are not envisaged.

Pichavaram mangrove spanning 1478 Ha, is located between two prominent estuaries, the Vellar estuary in the north and Coleroon estuary in the south of Cuddalore district. The mangrove was declared as a Reserve Forest on February 11, 1893 (Government notification B.P. No. 98 and 430). The Vellar-Coleroon estuarine complex forms the Killai backwater and Pichavaram mangroves. The backwaters are interconnected by the Vellar and Coleroon river systems and offer abundant scope for water sports such as rowing, kayaking, and canoeing.

The Pichavaram Mangrove Forest was designated as a "wetland of international importance" by the Ramsar Convention in July 2022[6].

Pichavaram Mangrove supports spawning and nursing ground for commercially important prawns, mainly white prawn (*Penaeus indicus*) and tiger prawn (*P. monodon*), crabs and fish.

In addition to this exceptional biodiversity, the Site supports the livelihoods of over 1,000 families through artisanal fishing, firewood collection, non-timber forest product harvesting, and grazing lands for livestock. The mangroves are revered by the local communities due to the significant spiritual value associated with *Excoecaria agallocha*, a mangrove with toxic properties commonly known as "Tillai". Nearly 23 species of mangroves were recorded, including Avicennia and Rhizophora species.

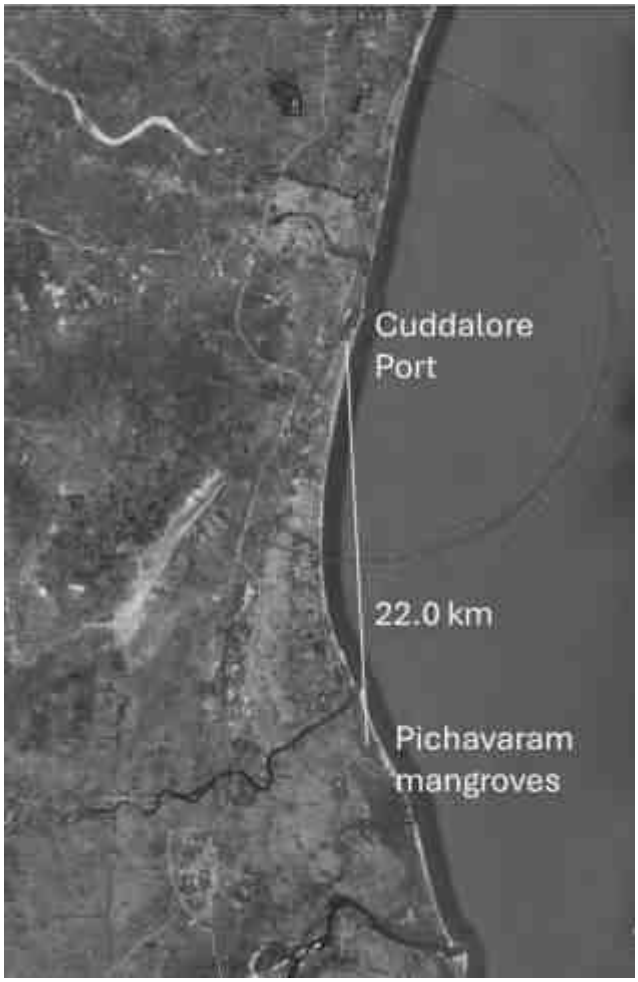


Figure 3-75: Pichavaram Mangroves from Project Site

[6] https://rsis.ramsar.org/ris/2482?__goaway_challenge=meta-refresh&__goaway_id=3eafcfe4f8ff24218dcd884d3b4e7dd7&__goaway_referer=https%3A%2F%2Fwww.google.com%2F

3.16.6.1 Mangroves Propagation Activities around the Project Site

Mangroves in India are coastal ecosystems characterized by salt-tolerant trees and shrubs, found predominantly along the eastern and western coastlines of india.

At Kudikadu Village in Cuddalore-where the Parvanar River and Gadilam River meet the Bay of Bengal a remarkable mangrove island has emerged as a model of ecological restoration.

(Source: The Print News)

In 2023, the Tamil Nadu Forest Department planted 37,500 mangrove saplings across 25 hectares under the Green Tamil Nadu Mission. The project adopted an innovative modified fishbone canal design to enhance tidal exchange, enabling optimal growth conditions and forming a natural "bio-shield" along the coast. This restoration effort is already yielding significant ecological and socio-economic benefits. It is revitalizing fish populations, supporting the livelihoods of local fishing communities, and strengthening resilience against climate change impacts such as coastal erosion and storm surges. The dominant mangrove species established in the area include Avicennia marina and Rhizophora.

Building on this success, the Tamil Nadu Forest Department has undertaken large-scale mangrove restoration with active community participation. Between 2022–23 and 2024–25, approximately 95 hectares of new mangroves have been developed under initiatives supported by NABARD, the Green Tamil Nadu Mission, and National Highways Authority of India, further expanding the use of modified fishbone designs for sustainable coastal protection and ecosystem recovery.

(Source: August 19, 2025, The Hindu Newspaper)

3.16.7 Brief Note on the Distribution of Olive Ridley (Sea Turtle)

Turtle nesting areas in and around the project location were assessed, consultations with TN forest department and Local fishermen communities were undertaken to know the status in the study area. Animal Husbandry, Dairying and Fisheries Department, Government of Tamil Nadu, published Tamil Nadu Government Gazette Extraordinary on September 27, 2016[7] in exercise of the powers conferred by clause (a) of sub-section (1) of section 5 of the Tamil Nadu Marine Fishing Regulation Act, 1983 (Tamil Nadu Act 8 of 1983), prohibiting the fishing by mechanized fishing vessels, motorized country crafts and those using mechanized fishing techniques in a radius of 5 (five) nautical miles around the following potential nesting and breeding sites of sea turtles identified by Central Marine Fisheries Research Institute and Department of Forest in the coastal areas of Cuddalore District of Tamil Nadu during the turtle breeding season i.e., for a period of four months from the 1st January to 30th April of every year (both days inclusive).

Sporadic turtle nesting (*Lepidochelys olivacea* - Olive ridley) was reported towards the north and south of the study area. There are no reported or observed nesting areas in the proposed port and shipbuilding/repair facilities.

The reported nearest Turtle nesting area Gori (Akkarai Gori) is located at a distance of ~1.0 km towards north from the north breakwater and Sothikuppam is located as a distance of ~2.13 km towards south from the south breakwater. Rest of the places

[7] https://www.stationeryprinting.tn.gov.in/extraordinary/2016/230_Ex_II_1.pdf

are more than 3 km north of the proposed project boundary (**Figure 3-77** and **Figure 3-76**). Turtle nesting is not observed in around project area.

Figure 3-76: Reported Turtle Nesting Areas in Study Area

Figure 3-77: Reported Turtle nesting areas near to Port Location

3.17 Socio -Economic Conditions

3.17.1 Cuddalore, Villupuram and Puducherry district Profile

3.17.1.1 Demographic profile

The project site is falling in Cuddalore district, Tami Nadu. Study area of 15km radius is falling in two districts (Cuddalore and Villupuram) in Tamil Nadu and one Union territory (Puducherry district). In Cuddalore district, there are 7 Taluks, 828 villages, In Villupuram district comprises of 2 Revenue Divisions, 9 Administrative Taluks, 928 Revenue Villages, 2 Municipalities, 8 Town Panchayats, 13 Blocks and 688 Village Panchayats and in Puducherry district there are 2 Revenue divisions, 4 Taluks, 11 and 81 revenue villages. The Total area of Cuddalore district is 3703 Sq.km and Puducherry has total area of 294 Sq.km. Cuddalore district has total population of 26,05,914 in which male population is 50.33% Female Population is 49.67% and Puducherry district has total population of 9,50,289 in which male population is 49.27% and Female population is 50.27.

Table 3-26: Demographic Profile of Cuddalore, Villupuram and Puducherry Districts

S. No	Indicators	Cuddalore	Villupuram	Puducherry
1	Area (sq.km)	3703	3715.33	294
2	Actual Population (Lakhs)	26.059	34.632	9.502
3	Male (Lakhs)	13.11	17.45	4.68
4	Female (Lakhs)	1.94	17.18	4.82
5	Density/Km^2	707	482	3232
6	Sex Ratio (Per 1000)	984	985	1,029
7	Schedule Cast population (Lakhs)	7.64	1,015,716	1.52
8	% of SC Population to Total population	29.32%	29.3%	16.03%
9	Schedule Tribe population (Lakhs)	0.157	74859	_
10	% of ST population to total population	0.6%	2.16%	_

3.17.1.2 Occupational pattern[8]

Cuddalore

In Cuddalore District agriculture continues to be the dominate sector in the economic development sustaining 80% of population.

Villupuram

The main occupation of the people of Villupuram district is Agriculture. More than 86% of the main workers in the district are engaged in Agriculture. The main working population of the district is over 7 lakhs which constitutes 27.4% of the district

[8] https://viluppuram.nic.in/about-district/district-profile

population well below the level of State average of 40.8 %. There is a good potential existing for tapping unskilled labour force.

Puducherry [9]

The fishing activity is the prominent occupation of Puducherry region after agriculture. The manufacturing sector plays vital role in the generation of employment and also major contributor for the economic development of the region though this sector is very limited in study area. Hence, People from Puducherry region are also employed in neighboring regions for their livelihoods due to the nature of scattered landform settlements.

3.17.1.3 Infrastructure

Cuddalore is connected to other routs of Tamil Nadu through a very good rail and road Network. National Highways covered 194.80 Kms. National Highway NH45A Road links Villupuram and Nagapattinam district, NH45C Road connects the district with Trichy district. The state Highways links the various parts of the district with the nearby urban areas and they cover 1899.10 Kms. Three railways' lines are diverging from Cuddalore junction connecting 27 railway stations in the district. The district has two ports, one being Cuddalore Old Town (O.T.) and the other at Parangipettai. While there is no activity at Parangipettai port, limited imports and exports being are carried out at Cuddalore O.T port. The exports at iron ore and imports of chemicals and fertilizers.

Villupuram district has more than 30 km of coastal line and well connected by rail and the total length of railway lines in the district is about 180km. Good network of roads for surface transport is also available. The total road length is about 2961 km of which national highway accounts for 124km Villupuram district enjoys the nearby location of union territory Puducherry, Trichy, Salem and Thiruvannamalai which plays a vital role in marketing of agriculture produces.

3.17.1.4 Industrialization

Cuddalore

The Cuddalore industrial complex is a home to a number of chemical, biotech, pharmaceutical and fertilizer companies. A new harbuor for ship building industry is under construction Further Cuddalore district hosts energy industries and also has got strong base on handicrafts industries. Traditional handicrafts units are spread over across the district. Cashews, cashew kernel, organic chemicals, marine products, ceramics and jeweelries are exported to other countries.There are 3 Private sugar factories at Nellikuppam and Pennadam and Sithur one co-operative Sugar mill at Sethiathope. These factories are not only producing Sugar but also

[9] Puducherry Comprehensive Development Plan 2036

produce rectified spirit and carbonic gas. E.I.D. PARRY Company Ltd,Nellikuppam is producing confectionary. Ceramic factories at Vridhachalam and Vadalur are producing crockery and Sanitaryware.

Villupuram

The industrial sector's contribution to the Villupram district is limited, with only a few major industries operating in the area. These include the Cooperative Sugar Mill at Periyasevalai in Thiruvennainallur Taluk, and Rajshree Sugars Mills (Private Sector) at Mundiyampakkam in Viluppuram Taluk and Semmedu in Gingee Taluk.

3.17.2 Demographic profile of study area

The socio-economic aspect of the study area of the project is presented in this section. It helps in identifying the Corporate Environment Responsibilities and Corporate Social Responsibility activities. The data for the study area is extracted from Census of India 2011, related official website, site observations, interaction, etc. The Proposed project is situated in the Cuddalore, Villupuram and Puducherry districts.

3.17.2.1 List of villages falling in study area

Project site is falling in Cuddalore Municipality Limits and Pachchyankuppam villages in Cuddalore District, Tamil Nadu.

In the study area of 15 km, 97 villages with 4 Sub districts in Cuddalore district ,1 subdistrict in Villupuram and 2 subdistricts in Puducherry district are falling and the corresponding map showing all the 97 villages is shown in **Figure 3-78**.

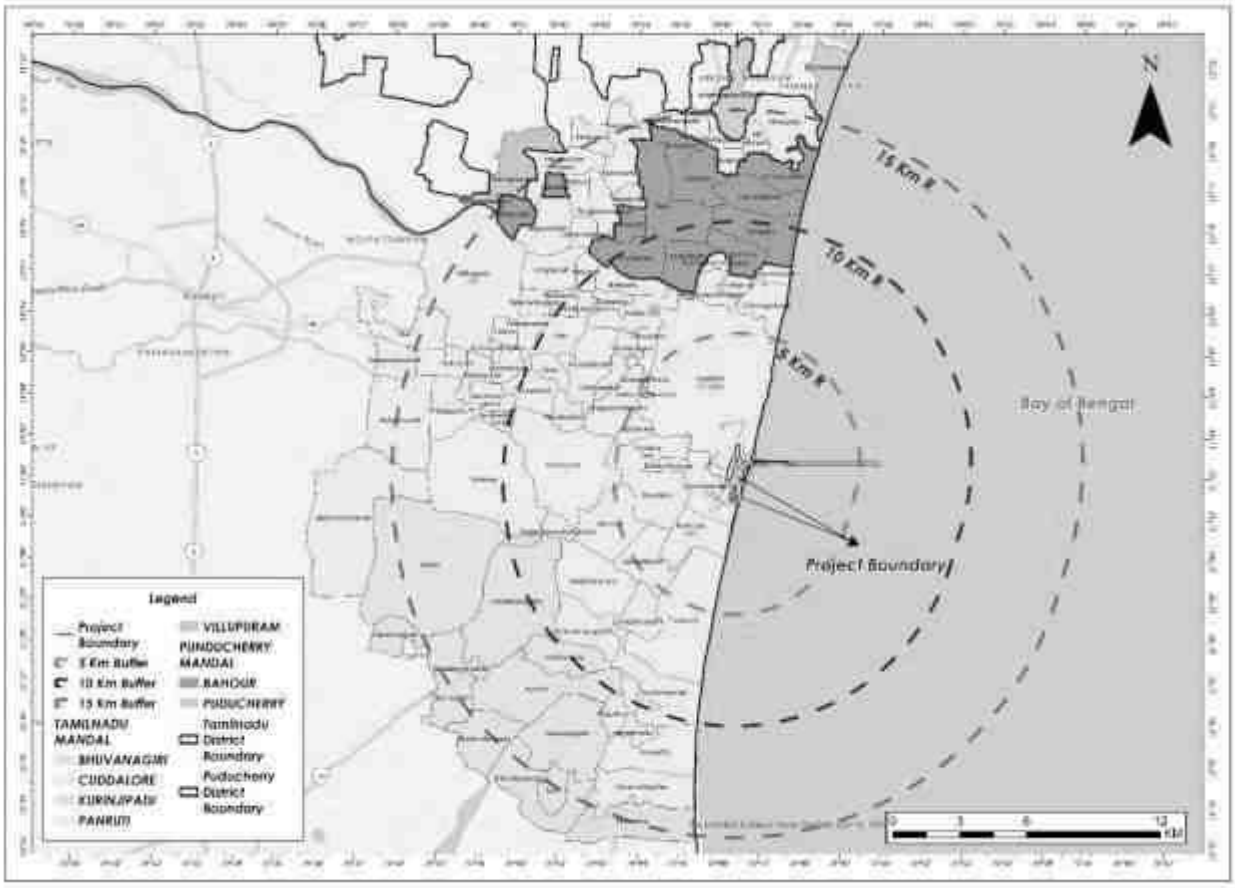


Figure 3-78: Villages falling in the Study Area

Table 3-27: Villages falling in the study Area

S.No	District	0-5 Km Radius	District	5-10 Km Radius	District	10-15 Km
1	Cuddalore	Karaiyeravittakuppam	Cuddalore	Senjikumarapuram	Cuddalore, Tamil Nadu	Vellakarai
2		Karaikkadu		Subauppalavadi		Vilangalpattu
3		Cuddalore Port		Gangamanayakkankuppam		Irandayiravilagam
4		Pachchyankuppam		Kodandaramapuram		Tiruchchepuram
5		Vettukkulam		Kondur (CT)		Vanamadevi
6		Ponnaiyankuppam		Otteri		Vanamadevi
7				Uchchimedu		Malaipperumal Agaram
8				Tondamanatham		Alappakkam
9				Periyakanganankuppam		Naduvirappattu
10				Kumarapettai		Karanapatu
11				Arisipperiyankuppam		Nagappanur
12				Ramapuram		Marudadu
13				Ramapuram		Kalaiyur
14				Chinnakanganankuppam		Pillali
15				Tiruvandipuram		Ulleripattu
16				Sembankuppam		Kil Alinjipattu
17				Gunduuppalavadi (Part)		Karamanikuppam

S.No	District	0-5 Km Radius	District	5-10 Km Radius	District	10-15 Km
18				Gunduuppalavadi (CT)		Tiyagavelli
19				Tottappattu		Udalappattu
20				Annavalli		Alagiyanatham
21				Mavadipalayam		Vellapakkam
22				Nattapattu		Sedappalayam
23				Padirikuppam (CT)		Pallippattu
24				Cuddalore (M)		Kudikkadu
25						Tiruppanambakkam
26						Kambalimedu
27						Melalinjippattu
28						Tirumanikkuli
29						Karaimedu
30						Madalpattu
31						Kilkumaramangalam
32						Varakalpattu
33						Konamangalam
34						Andarmullippallam
35						Ambalavanamppettai
36						Tanur
37						Anukkambattu
38						*Ayikuppam*
39						Krishnankuppam
40						Puliyur(west)
41						Puliyur
42						Adinarayanapuram
43						Agaram
44						Agaram
45						Eidanur
46						Kilakuppam
47						Nellikuppam (M)
48						Adinarayanapuram
49						Pallavarayanatham
50						Sundaravandi
51						Silambinathanppettai
52						Palur
53						Kilarungunam
54					Puducherry, UT	Irulansandy
55						Manapattu
56						Kirumampakkam
57						Aranganur
58						Kaduvanur
59						Manamedu
60						Outchimedu

S.No	District	0-5 Km Radius	District	5-10 Km Radius	District	10-15 Km
61						Kuruvinatham
62						Seliamedu
63						Pillaiyarkuppam
64						Bahour
65						Purnankuppam
66					Villupuram, Tamil Nadu	Perichchambakkam
67						Krishnapuram

3.17.2.2 Secondary Census Data of the Project Study Area

Socio-economic assessment of the study area villages was carried out by interpreting Census of India DDW_PCA3306_2011_MDDS Villupuram, DDW_PCA3316_2011_MDDS, and DDW_PCA3402_2011_MDDS Puducherry with UI with data along with various other statistical sources of Puducherry and Tamil Nadu governments. The study covers around 97 villages of 15 km radius from the proposed project site.

3.17.2.3 Census profile of study area

The census study has been carried out for the 15 Km Radius, there are 121756 households, and population is 503332 out of which male population is 49.86% and female population is 50.14%. The sex ratio of the study area is 1006 females over 1000 males. In the in 5-10 Km Radius, sex ratio was recorded as highest and in 0-5 Km Radius it was noticed as least. The detailed population, households, gender wise data and sex ratio is presented in **Table 3-28**

Table 3-28: Households and Population of Study Area

Boundary(km)	No of Households	Total Pop	Male	%	Female	%	Sex Ratio
0-5	6404	26874	13791	51.32	13083	48.68	949
05-10km	66612	273210	135594	49.63	137616	50.37	1015
10-15km	48740	203248	101576	49.98	101672	50.02	1001
Total	**121756**	**503332**	**250961**	**49.86**	**252371**	**50.14**	**1006**

3.17.2.4 Population of Below 6 years Children

The category wise assessment of population–Child (aged 0-6), In the study area, the total Child population is 53973 that is around 10.72% of total population in study area. The child sex ratio of study area is 925 females over 1000 males. In 0-5 Km Radius sex ratio is highest and 10-15 Km Radius the sex ratio is least. Gender wise population and sex ratios is shown in **Table 3-29**

Table 3-29: Population of <6 Years Children

Boundary (km)	No of Households	Total Pop	<6yra pop	%	<6yrs male	%	<6yrs female	%	Sex Ratio
0-5	6404	26874	3084	11.48	1573	51.01	1511	48.99	961
05-10km	66612	273210	27744	10.15	14317	51.6	13427	48.4	938
10-15km	48740	203248	23145	11.39	12143	52.46	11002	47.54	906
Total	**121756**	**503332**	**53973**	**10.72**	**28033**	**51.94**	**25940**	**48.06**	**925**

3.17.2.5 Population of Schedule caste

The Schedule Caste population of the study area is 123340 which constitute to be 24.5% of total population in study area. The sex ratio of the SC population is 1010 females over 1000 males. In the 5-10Km Radius villages' sex ratio is highest and 0-5 km Radius sex ratio is least. The schedule caste details are shown in **Table 3-30**

Table 3-30: Population of Schedule Caste

Boundary (km)	No of Households	Total Pop	SC Pop	Total SC%	SC male	%	SC female	%	Sex Ratio
0-5	6404	26874	5142	19.13	2605	50.66	2537	49.34	974
05-10km	66612	273210	44051	16.12	21801	49.49	22250	50.51	1021
10-15km	48740	203248	74147	36.48	36961	49.85	37186	50.15	1006
Total	**121756**	**503332**	**123340**	**24.5**	**61367**	**49.75**	**61973**	**50.25**	**1010**

3.17.2.6 Population of Schedule Tribe

The Schedule Tribe population is which aggregate to 0.51% of total population in study area. Sex ratio of the ST population is 989 females over 1000 males. In 10-15 km Radius village's sex ratio is highest and 0-5 Km Radius sex ratios is least. The ST Population, gender data and ratio are shown in **Table 3-31**.

Table 3-31: Population of Schedule Tribe

Boundary (km)	No of Households	Total Pop	ST Pop	Total ST%	ST Male	%	ST Female	%	Sex Ratio
0-5	6404	26874	176	0.38	102	57.95	74	42.05	725
05-10km	66612	273210	702	0.26	357	50.85	345	49.15	966
10-15km	48740	203248	1708	0.84	841	49.24	867	50.76	1031
Total	**121756**	**503332**	**2586**	**0.51**	**1300**	**50.27**	**1286**	**49.73**	**989**

3.17.2.7 Literacy and Illiteracy population of study area

The literate population in the study area is 361597 which constitute to be 71.84% of the total population. The total percentage of male literate population is 53.67% and total female percentage of literate population is 46.33%. Sex ratio of the Literacy population is 863 females over 1000 males. Detailed literacy population and percentages are shown in **Table 3-32**

Table 3-32: Population of Literate in the study Area

Boundary (km)	No of Households	Total Pop	Total literacy	%	Male Literacy	%	Female Literacy	%	Sex Ratio
0-5	6404	26874	17798	66.23	10099	56.74	7699	43.26	762
05-10km	66612	273210	208807	76.43	109601	52.49	99206	47.51	905
10-15km	48740	203248	134992	66.42	74353	55.08	60639	44.92	816
Total	**121756**	**503332**	**361597**	**71.84**	**194053**	**53.67**	**167544**	**46.33**	**863**

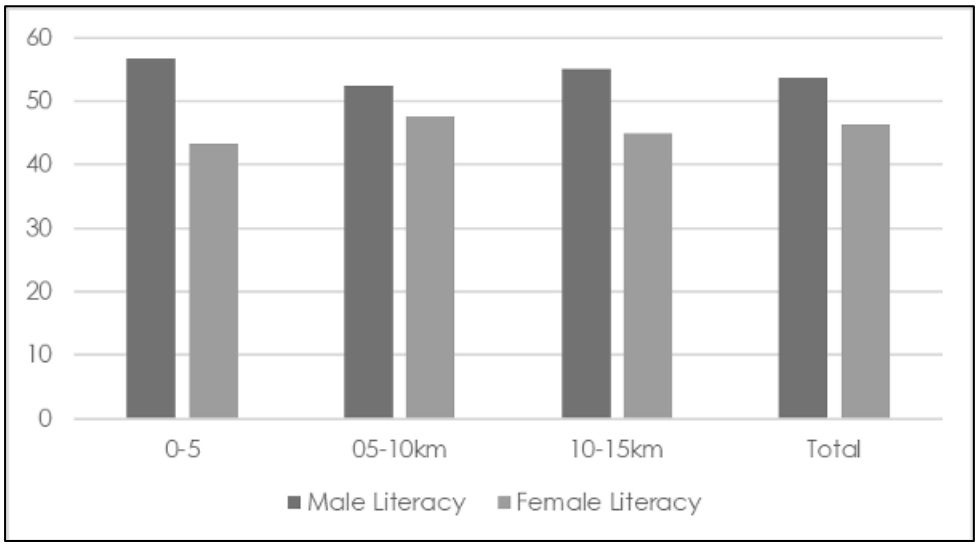


Figure 3-79: Population of Literate in the study Area

The illiterate population in the study area is 141735 which constitute to be 28.16% of the total population of the study area. Total percentage of male Illiterate population is 40.15% and total female percentage of illiterate population is 40.15%. Sex ratio of the Illiteracy population is 1491 females over 1000 males, which is very high in illiteracy ratio of female. Women educations are to be improved and considered by appropriate government and concern authorities. The detailed illiteracy data is shown in **Table 3-33**

Table 3-33: Population of Illiterate data in the study area

Boundary (kmR)	No of Households	Total Pop	Total illeterate	%	Male illeterate	%	Female illerates	%	Sex Ratio
0-5	6404	26874	9076	33.77	3692	40.68	5384	59.32	1458
05-10km	66612	273210	64403	23.57	25993	40.36	38410	59.64	1478
10-15km	48740	203248	68256	33.58	27223	39.88	41033	60.12	1507
Total	**121756**	**503332**	**141735**	**28.16**	**56908**	**40.15**	**84827**	**59.85**	**1491**

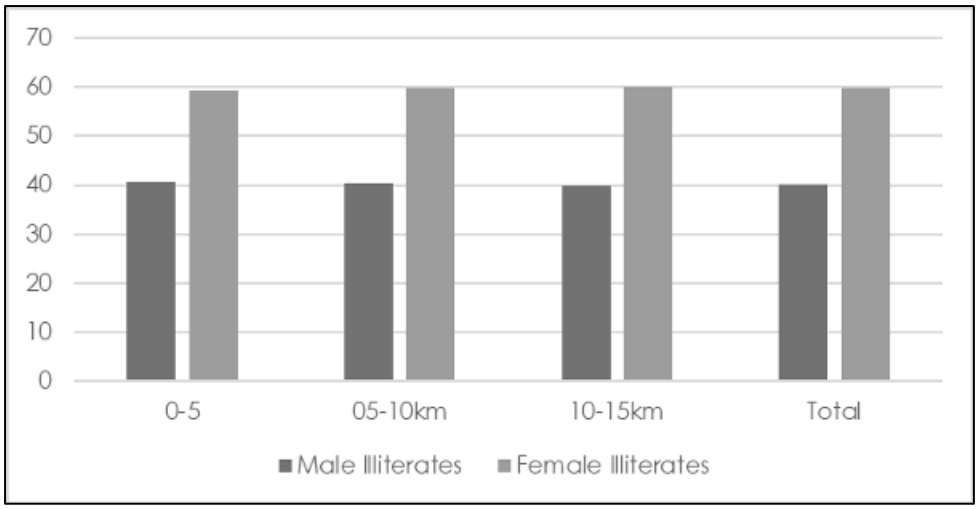


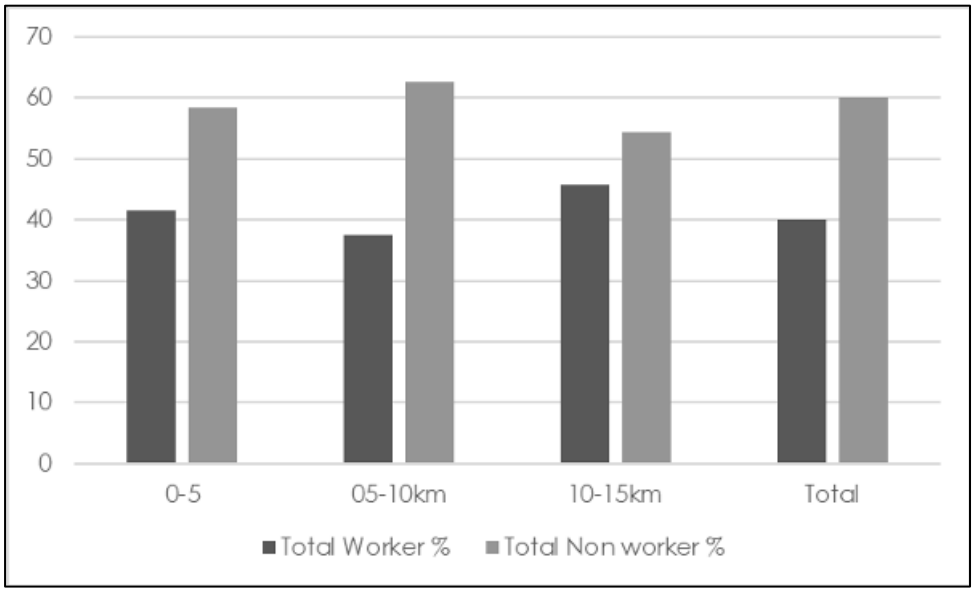
Figure 3-80: Population of Illiterate data in the study area

3.17.2.8 Working and non-working population Profile

The Working population in the project study area is 208711 which are around 41.47%; and non-working population in the 4294621 which are 58.53 %. Working ratio of study area is very less and this should be raised by providing opportunities and skill development programs to the educated and non-educated of locales. The highest working population is in10 to 150Km Radius area and least in 5-10 Km Radius. Detailed study and population details are provided in **Table 3-34** and**.** The non-working population includes, children, old age people, dependents, and other disabled persons/ physical and mentally challenged and unemployed.

Table 3-34: Working & Non-Working population Profile

Boundary (kmR)	No of Households	Total Population	Total of work force	%	Total non-work force	%
0-5	6404	26874	11177	41.59	15697	58.41
05-10	66612	273210	104693	38.32	168517	61.68
10-15	48740	203248	92841	45.68	110407	54.32
Total	121756	503332	208711	41.47	294621	58.53



3.17.2.9 Main and marginal workforce

The total working population has been categorised into two types as 1) Main Working Population - in which a person works for more than 6 months 2) Marginal Working Population - in which a person works for less than 6 months.

Main-Working population in the study area are which are around 30.99% and the sex ratio is 342 females for 1000 males and Marginal-Working population in the study area is 52711 which are around 10.47% and the sex ratio is 978 females for 1000 males. The details are presented in **Table 3-35** and **Table 3-36**

Table 3-35: Main and marginal working Population profile

Boundary (kmR)	Total Main worker Population	%	Total marginal work force	%
0-5	7161	26.65	4016	14.94
05-10	82638	30.25	22055	8.07
10-15	66201	32.57	26640	13.11
Total	**156000**	**30.99**	**52711**	**10.47**

Table 3-36: Main and marginal (male and female) working Population profile

Boundary (kmR)	Main work					Marginal Work				
	Male	%	Female	%	Sex Ratio	Male	%	Female	%	Sex Ratio
0-5	6081	84.92	1080	15.08	178	1906	47.46	2110	52.54	1107
05-10	64395	77.92	18243	22.08	283	12098	54.85	9957	45.15	823
10-15	45775	69.15	20426	30.85	446	12646	47.47	13994	52.53	1107
Total	**116251**	**74.52**	**39749**	**25.48**	**342**	**26650**	**50.56**	**26061**	**49.44**	**978**

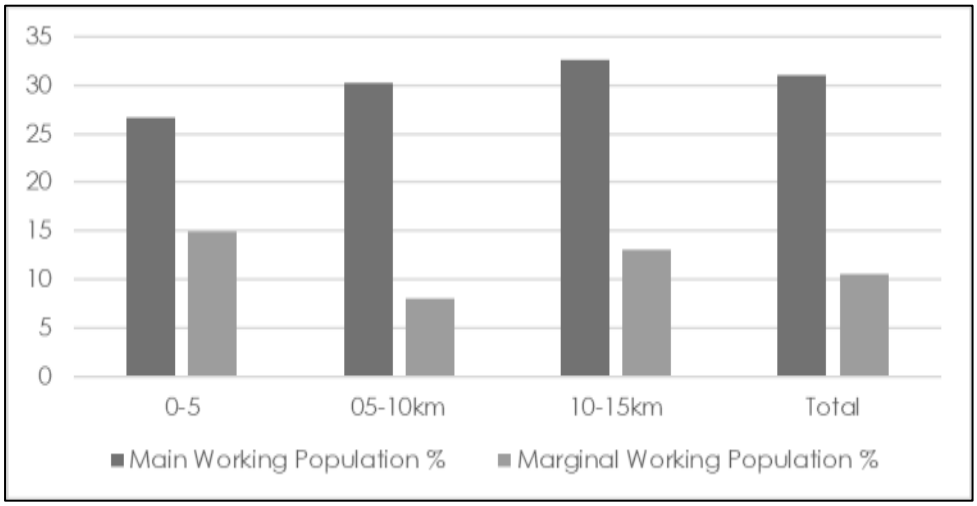


Figure 3-81: Main and marginal working Population profile

3.17.2.10Casual labour and Agriculture labour population profile

The total working Casual Labour (CL) are 13858 and total working Agricultural labour (AL) are 4038. The details are mentioned in the below in **Table 3-37**

Table 3-37: Casual labour and Agriculture labour population profile

Boundary (kmR)	Casual Labour			Agriculture Labour		
	CL Population	CL Male	CL Female	AL Population	AL Male	AL Female
0-5	346	295	51	1905	628	1277
05-10	4450	3471	979	566	272	294
10-15	9062	6738	2324	1567	814	753
Total	13858	10504	3354	4038	1714	2324

3.17.3 Estimating population Growth Rate

3.17.3.1 Estimating Cuddalore and Puducherry Growth Rate

Historical Data (Cuddalore):

2001 Population: 2285395

- 2011 Population: 2605914
- Decadal Growth (2001-2011): 14.2%
- Average Annual Geometric Growth Rate (AAGR) 2001-2011: ~ 0.0132 or 1.2%

3.17.3.2 Estimating Puducherry Growth Rate

2001 Population: 735332

- 2011 Population: 950289

- Decadal Growth (2001-2011): 29.23%
- Average Annual Geometric Growth Rate (AAGR) 2001-2011: ~ 0.0260 or 1.4%

3.17.3.3 Assumptions

Growth Rate: The Average Annual Growth Rate (AAGR) for Cuddalore district between 2001 and 2011 (0.0132) & for Puducherry district is (0.0260) assumed to continue unchanged for the period 2011-2025.

- Model: Growth follows a standard compound annual growth formula.
- Stability: No major localized demographic events (beyond the general district trend) are assumed to have drastically altered growth patterns in these specific locations between 2011 and 2025.
- Estimating Population in 2025:1.2(Cuddalore)
- Estimating Population in 2025:1.4(Puducherry)

Calculations:

Table 3-38: Estimated Average Annual Growth Rate (AAGR) for villages falling in 5 km radius

Name	Tot-p (2011)	Growth Factor	Est Pop (2025)
Karaiyeravittakuppam	1800	1.2	1800*1.2≈ 2160
karaikkadu	6277	1.2	3277*1.2≈ 7532
Cuddalore Port	7911	1.2	1911*1.2≈ 9493
Pachchyankuppam	7857	1.2	7857*1.2≈ 9428
Vettukkulam	1044	1.2	1044*1.2≈ 1253
Ponnaiyankuppam	1985	1.2	1985*1.2≈ 2382
	26874		32249

TOT_P: Total Population

Table 3-39: Estimated Average Annual Growth Rate (AAGR) for villages falling in 10 km radius

Name	Tot-p (2011)	Growth Factor	Est-P (2025)
Senjikumarapuram	1102	1.2	1102*1.2≈ 1322.4
Subauppalavadi	398	1.2	398*1.2≈ 477.6
Gangamanayakkankuppam	446	1.2	446*1.2≈ 535
Kodandaramapuram	2898	1.2	2898*1.2≈ 3478
Kondur (CT)	12506	1.2	12506*1.2≈ 15007
Otteri	711	1.2	711*1.2≈ 853
Uchchimedu	2388	1.2	2388*1.2≈ 2866
Tondamanatham	6626	1.2	6626*1.2≈ 7951
Periyakanganankuppam	1543	1.2	1543*1.2≈ 1852
Kumarapettai	1208	1.2	1208*1.2≈ 1450
Arisipperiyankuppam	776	1.2	776*1.2≈ 931
Ramapuram	8900	1.2	8900*1.2≈ 10680
Ramapuram	4244	1.2	4244*1.2≈ 5093
Chinnakanganankuppam	870	1.2	870*1.2≈ 1044
Tiruvandipuram	8991	1.2	8991*1.2≈ 10789

Name	Tot-p (2011)	Growth Factor	Est-P (2025)
Sembankuppam	3042	1.2	3042*1.2≈ 3650
Gunduuppalavadi (Part)	1639	1.2	1639*1.2≈ 1967
Gunduuppalavadi (CT)	7281	1.2	7281*1.2≈ 8737
Gunduuppalavadi (CT) WARD NO.-0001	7281	1.2	7281*1.2≈ 8737
Tottappattu	2309	1.2	2309*1.2≈ 2771
Annavalli	5781	1.2	5781*1.2≈ 6937
Mavadipalayam	323	1.2	323*1.2≈ 388
Nattapattu	6847	1.2	6847*1.2≈ 8216
Padirikuppam (CT)	18745	1.2	18745*1.2≈ 22494
Padirikuppam (CT) WARD NO.-0001	18745	1.2	18745*1.2≈ 22494
Cuddalore (M)	173636	1.2	173636*1.2≈ 208363
	299236		**359083**

TOT_P: Total Population

Table 3-40: Estimated Average Annual Growth Rate (AAGR) for villages falling in 15 km radius

Name	Tot-p (2011)	Growth Factor	Est-P (2025)
Irulansandy	1670	1.4	1670*1.4≈ 2338
Manapattu	8227	1.4	8227*1.4≈11518
Kirumampakkam	10133	1.4	10133*1.4≈14186
Aranganur	2426	1.4	2426*1.4≈3396
Kaduvanur	819	1.4	819*1.4≈1147
Manamedu	2345	1.4	2345*1.4≈3283
Outchimedu	3959	1.4	3959*1.4≈5543
Kuruvinatham	7289	1.4	7289*1.4≈10205
Seliamedu	5984	1.4	5984*1.4≈8378
Pillaiyarkuppam	2744	1.4	2744*1.4≈3842
Bahour	10927	1.4	10927*1.4≈15298
Purnankuppam	6766	1.4	6766*1.4≈9472
	63289		**88605**

TOT_P: Total Population

Disclaimer: These are estimates based on historical trends and clearly stated assumptions. The actual population figures in 2025 could differ due to real-world factors not captured in this simple projection model (like varying local migration, development differences between the town and villages, etc.). Official Census data is the definitive source.

3.18 Fishmen Village Census

The details of the fishing community/households and fish landing centre, marine fishing village census, population details, activity details, education details, occupation details, craft owned details and Fishing craft details are discussed in the section. The details of the fishing villages and landing centres are presented in **Table 3-41**.

Table 3-41: List of Marine Fishing Villages and Landing Centres in 15 km Radius

Fishing Villages			Landing centres
District	**S.No**	**Villages**	**Villages**
Puducherry	1	Moorthykuppam Pudukuppam	Moorthykuppam Pudukuppam
	2	Narambai	Narambai
	3	Pannittittu	Pannittittu
	4	Pudukuppam (Poornakuppam)	Pudukuppam (Poornakuppam)
Cuddalore	1	Akkairaikori	-
	2	Annappanpettai	Annappanpettai
	3	Ayyam Pettai	Ayyam Pettai
	4	Chitirai Pettai	Chitirai Pettai
	5	Cuddalore Port	Cuddalore Port
	6	Devanampattinam	Devanampattinam
	7	Kinjam Pettai	-
	8	Maniyar Pettai	-
	9	Nanjalingam Pettai	Nanjalingam Pettai
	10	Nayakkar Pettai	Nayakkar Pettai
	11	Periyakuppam	Periyakuppam
	12	Pettodai	Pettodai
	13	Rajapettai	-
	14	Reddiyar Pettai	Reddiyar Pettai
	15	Singara Thoppu	Singara Thoppu
	16	Sonankuppam	Sonankuppam
	17	Sothikuppam	Sothikuppam
	18	Thaikkalthonidurai	Thaikkalthonidurai
	19	Thammanam Pettai	Thammanam Pettai
	20	Thazhanguda	Thazhanguda

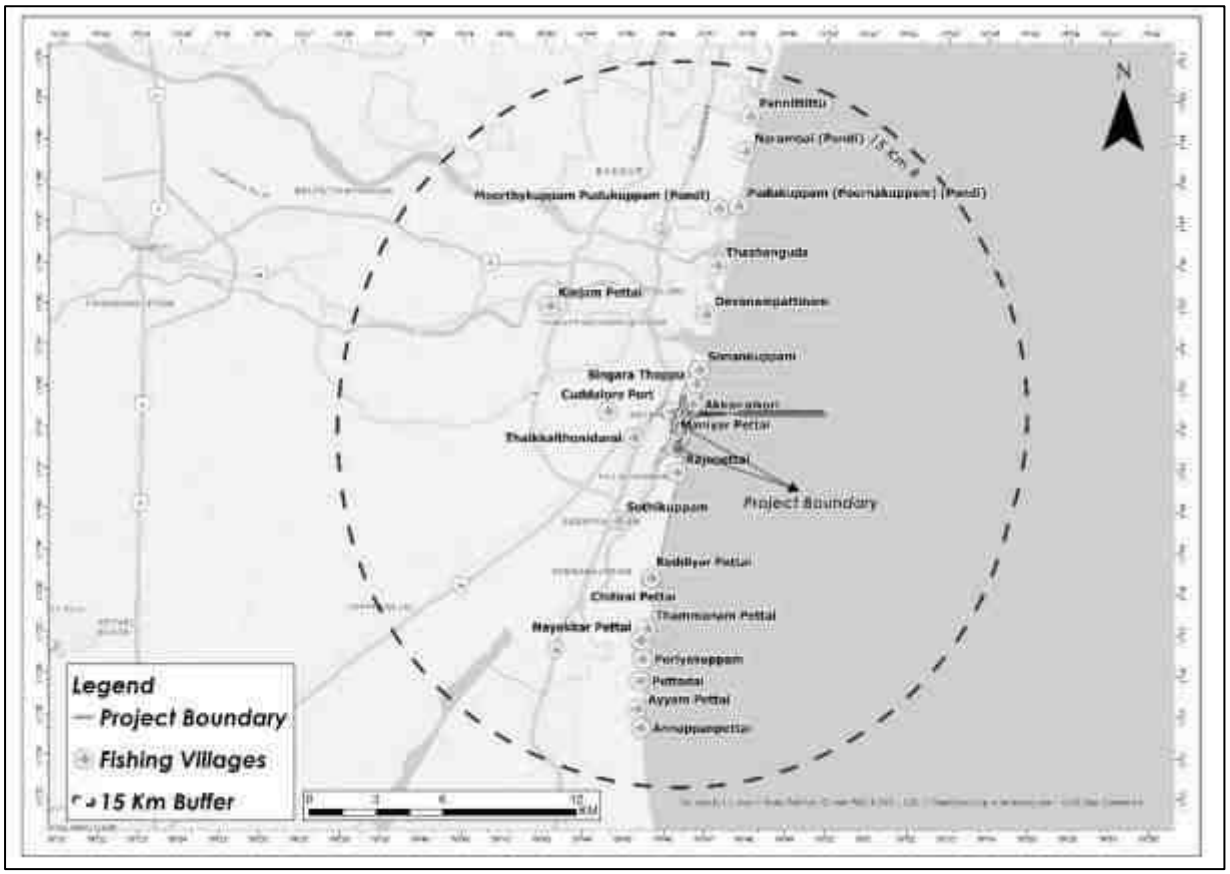


Figure 3-82:Fishing villages

3.18.1 Fishermen households' details of study area

The project study area fishermen households are 9321, and Fisher folk population is 33329 from 24 villages of from Puducherry district, Puducherry UT and Cuddalore district, Tamil Nadu. The population and household details are provided in **Table 3-42**.

Table 3-42: Fishermen household's details

Fishing Villages			Fishermen Households and Household Details			
District	S.No	Villages	Fishermen Households	Traditional fishermen Households	BPL households	Fisher folk population
Puducherry	1	Moorthykuppam Pudukuppam	354	354	338	1171
	2	Narambai	330	330	329	1151
	3	Pannittittu	437	437	425	1466
	4	Pudukuppam (Poornakuppam)	271	271	271	986
Cuddalore	1	Akkairaikori	765	765	764	2556
	2	Annappanpettai	230	230	230	759
	3	Ayyam Pettai	120	120	59	474
	4	Chitirai Pettai	269	269	269	1044
	5	Cuddalore Port	296	24	295	1259
	6	Devanampattinam	1155	1153	790	4115
	7	Kinjam Pettai	253	253	253	852
	8	Maniyar Pettai	95	95	74	307
	9	Nanjalingam Pettai	110	110	110	424
	10	Nayakkar Pettai	63	63	63	219
	11	Periyakuppam	475	475	475	1803

Fishing Villages			Fishermen Households and Household Details			
District	S.No	Villages	Fishermen Households	Traditional fishermen Households	BPL households	Fisher folk population
	12	Pettodai	230	229	215	788
	13	Rajapettai	462	445	462	1689
	14	Reddiyar Pettai	175	175	175	639
	15	Singara Thoppu	1069	1069	1039	4178
	16	Sonankuppam	825	825	825	2920
	17	Sothikuppam	489	489	489	1588
	18	Thaikkalthonidurai	192	191	192	691
	19	Thammanam Pettai	169	169	169	589
	20	Thazhanguda	487	487	487	1661
		Total	**9321**	**9028**	**8798**	**33329**

3.18.2 Population details of fishermen community

The fishermen community population is 33329 out of which males are constituted to 51.54% and females account to 48.46 % which is detailed in **Table 3-43.** The sex-ratio of the fishing community population is 940 females for 1000 males.

Table 3-43: Population details of Fishermen community

Fishing Villages	Male			Female			Total	Others	
Villages	Adults	up to 5 years	above 5 years	Adults	up to 5 years	above 5 years		Average household size	Sex Ratio
Puducherry									
Moorthykuppam Pudukuppam	394	50	160	391	41	135	1171	3	939
Narambai	349	32	183	384	40	163	1151	3	1041
Pannittittu	371	53	341	421	57	223	1466	3	916
Pudukuppam (Poornakuppam)	378	37	82	369	26	94	986	4	984
Cuddalore									
Akkairaikori	944	91	238	939	135	209	2556	3	1008
Annappanpettai	274	30	104	263	24	64	759	3	860
Ayyam Pettai	213	18	16	172	25	30	474	4	919
Chitirai Pettai	381	56	125	345	45	92	1044	4	858
Cuddalore Port	447	45	129	472	44	122	1259	4	1027
Devanampattinam	1415	174	446	1468	150	462	4115	4	1022
Kinjam Pettai	319	33	61	318	51	70	852	3	861
Maniyar Pettai	133	9	23	113	10	19	307	3	861
Nanjalingam Pettai	150	25	59	136	8	46	424	4	812
Nayakkar Pettai	90	9	15	81	17	7	219	3	921
Periyakuppam	644	63	189	661	56	190	1803	4	1012
Pettodai	316	37	81	266	35	53	788	3	816
Rajapettai	556	46	280	532	52	223	1689	4	915

Fishing Villages	Male			Female			Total	Others	
Villages	Adults	up to 5 years	above 5 years	Adults	up to 5 years	above 5 years		Average household size	Sex Ratio
Reddiyar Pettai	270	29	42	247	29	22	639	4	874
Singara Thoppu	1447	374	379	1294	305	379	4178	4	899
Sonankuppam	1089	122	283	1020	114	292	2920	4	954
Sothikuppam	475	80	295	495	52	191	1588	3	868
Thaikkalthonidurai	275	36	78	248	15	39	691	4	776
Thammanam Pettai	162	3	139	168	2	115	589	3	938
Thazhanguda	508	134	243	508	106	162	1661	3	877
	11600	**1586**	**3991**	**11311**	**1439**	**3402**	**33329**	**84**	**21958**

3.18.3 Education details of fishermen community

The literate population of the fishing community is 15752 which constitute to be 47.26 % of the total population of the study area given in **Table 3-44**.

Table 3-44: Education details of fishermen community

Education Details								
Fishing Villages			Primary		Higher secondary		Above Higher Secondary	
Mandal	S No	Villages	Male	Female	Male	Female	Male	Female
Puducherry	1	Moorthykuppam Pudukuppam	79	65	58	60	17	24
	2	Narambai	172	148	38	34	23	19
	3	Pannittittu	147	143	54	49	41	34
	4	Pudukuppam (Poornakuppam)	105	104	142	95	45	28
Cuddalore	1	Akkairaikori	140	97	184	148	67	113
	2	Annappanpettai	43	33	95	46	36	25
	3	Ayyam Pettai	133	134	48	44	14	4
	4	Chitirai Pettai	135	87	168	132	42	14
	5	Cuddalore Port	130	98	159	168	66	57
	6	Devanampattinam	652	620	383	405	115	102
	7	Kinjam Pettai	62	69	174	140	23	8
	8	Maniyar Pettai	92	94	21	23	11	1
	9	Nanjalingam Pettai	45	32	62	59	29	14
	10	Nayakkar Pettai	13	9	20	20	12	2
	11	Periyakuppam	173	195	290	262	110	102
	12	Pettodai	138	120	109	80	63	22
	13	Rajapettai	376	293	279	270	75	36
	14	Reddiyar Pettai	75	64	63	70	64	18
	15	Singara Thoppu	176	159	323	232	105	91
	16	Sonankuppam	222	243	499	456	91	62
	17	Sothikuppam	194	166	247	201	97	53
	18	Thaikkalthonidurai	95	76	110	76	45	42

Education Details								
Fishing Villages			Primary		Higher secondary		Above Higher Secondary	
Mandal	S No	Villages	Male	Female	Male	Female	Male	Female
	19	Thammanam Pettai	9	4	18	23	14	16
	20	Thazhanguda	156	112	121	112	38	25
			3562	**3165**	**3665**	**3205**	**1243**	**912**

3.18.4 Fishermen activity profile

The fishermen community activities population in the project area are **8790** which are around **26.94 %.** The project affected area involves fulltime activities fish seed collections activities. The detail of the activities and population is provided in **Table 3-45.**

Table 3-45: Fishermen activity profile

Fishing villages			Actual fishing		Fish seed Collection				Total
			Full time	Part time	Full time		Part time		
Mandal	S.No	Villages			Male	Female	Male	Female	
Puducherry	1	Moorthykuppam Pudukuppam	256	0	0	0	0	0	256
	2	Narambai	316	0	0	0	0	0	316
	3	Pannittittu	385	3	0	0	0	0	388
	4	Pudukuppam (Poornakuppam)	205	23	0	0	0	1	229
Cuddalore	1	Akkairaikori	859	0	0	0	0	0	859
	2	Annappanpettai	139	24	0	0	0	0	163
	3	Ayyam Pettai	90	15	0	0	0	0	105
	4	Chitirai Pettai	286	5	0	0	0	0	291
	5	Cuddalore Port	290	28	1	0	0	0	319
	6	Devanampattinam	1203	28	0	0	0	0	1231
	7	Kinjam Pettai	227	9	0	0	0	0	236
	8	Maniyar Pettai	67	18	0	0	0	0	85
	9	Nanjalingam Pettai	119	0	0	0	0	0	119
	10	Nayakkar Pettai	60	0	0	1	0	0	61
	11	Periyakuppam	441	29	0	0	0	0	472
	12	Pettodai	152	79	0	0	0	0	231
	13	Rajapettai	498	0	0	0	0	0	498
	14	Reddiyar Pettai	165	52	0	0	0	0	217
	15	Singara Thoppu	1301	0	0	3	0	0	1304
	16	Sonankuppam	933	29	0	0	0	0	962
	17	Sothikuppam	517	0	0	0	0	0	517
	18	Thaikkalthonidurai	57	169	0	0	0	0	226
	19	Thammanam Pettai	133	41	0	0	0	0	174
	20	Thazhanguda	463	0	0	0	0	0	463
			9162	**552**	**1**	**4**	**0**	**1**	**9722**

3.18.5 Occupation profile for fishermen

Among the affected fishermen community persons, the total occupation is **41.15 %** and total non-occupation which includes not in the workforce, dependent, children and unemployed constitutes to be **58.85 %** of the total fishing community

population. Most of the population is engaged in fishing, marketing, repairing, peeling, and labouring.

Table 3-46: Fishermen occupation profile

S.No	Fishing villages	occupation profile								
		No.of members involved in fishing allied activities								
	Villages	Active fishermen	Marketing of fish	Making/Repairing net	Curing/processing	Peeling	Labourer	Others	Other than fishing	Total occupied
	Puducherry									
1	Moorthykuppam Pudukuppam	256	100	0	0	0	0	0	0	356
2	Narambai	316	80	0	0	3	0	0	0	399
3	Pannittittu	388	114	0	0	1	30	0	0	533
4	Pudukuppam (Poornakuppam)	229	40	1	0	0	110	1	3	443
	Cuddalore									
1	Akkairaikori	859	44	0	0	0	0	274	6	1183
2	Annappanpettai	163	93	52	9	0	0	0	8	325
3	Ayyam Pettai	105	65	18	0	0	3	0	1	192
4	Chitirai Pettai	291	53	24	1	0	55	0	3	427
5	Cuddalore Port	319	177	41	22	1	81	7	14	662
6	Devanampattinam	1231	266	70	5	0	83	17	6	1678
7	Kinjam Pettai	236	198	0	0	0	4	0	0	438
8	Maniyar Pettai	85	19	7	0	0	0	9	0	120
9	Nanjalingam Pettai	119	0	9	0	0	0	2	0	130
10	Nayakkar Pettai	61	45	0	0	0	0	0	1	107
11	Periyakuppam	472	301	7	62	5	132	13	60	1052
12	Pettodai	231	40	9	13	1	71	1	4	370
13	Rajapettai	498	57	0	0	0	35	0	0	590
14	Reddiyar Pettai	217	67	0	0	0	0	4	3	291
15	Singara Thoppu	1304	0	11	0	0	0	10	0	1325
16	Sonankuppam	962	132	86	0	0	0	24	0	1204
17	Sothikuppam	517	31	3	0	2	14	49	3	619
18	Thaikkalthonidurai	226	10	11	2	0	3	0	2	254
19	Thammanam Pettai	174	0	0	0	0	0	0	2	254
20	Thazhanguda	463	165	39	7	2	80	8	0	764
		9722	**2097**	**388**	**121**	**15**	**701**	**419**	**116**	**13716**

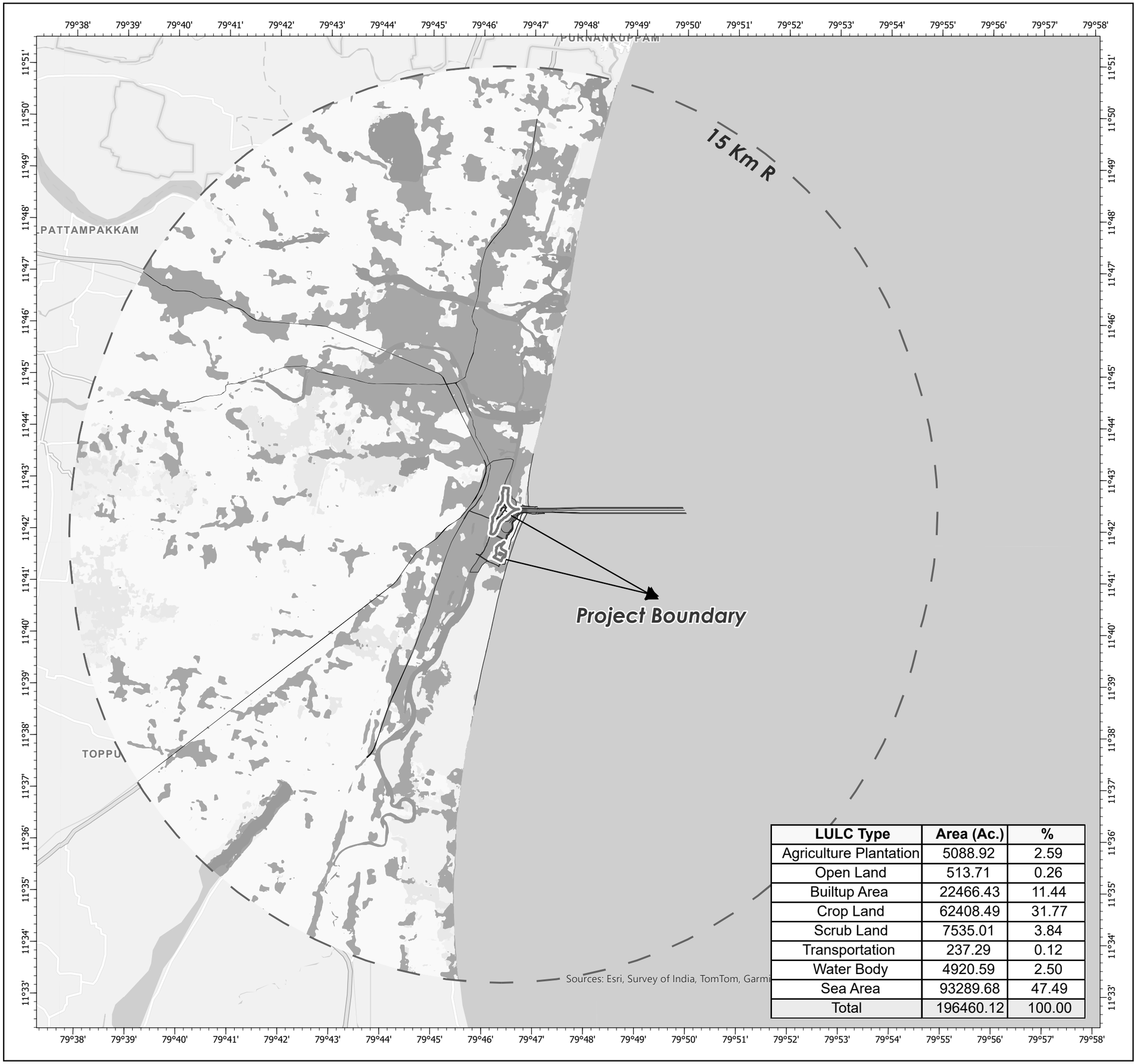
3.18.6 Craft owned and fishing profile of fishermen

Craft and Fishing Profile: Among the fishing community households the craft owned by the fishing community is outboard with **424** households, and non-motorized households are **181**. **Table 3-47** shows fishermen craft owned and fishing profile of the affected fishing community area.

Table 3-47: Fishermen craft owned and fishing profile

S.No	Villages	Mechanized	Inboard	Outboard	Non-motorized	Total
Puduchey						
1	Moorthykuppam Pudukuppam	0	0	13	0	13
2	Narambai	0	5	43	51	99
3	Pannittittu	0	24	116	72	212
4	Pudukuppam (Poornakuppam)	4	15	18	26	63
Cuddaloe						
1	Akkairaikori	8	4	164	249	425
2	Annappanpettai	0	0	6	136	142
3	Ayyam Pettai	0	0	5	22	27
4	Chitirai Pettai	2	0	51	26	79
5	Cuddalore Port	2	9	33	0	44
6	Devanampattinam	52	11	305	272	640
7	Kinjam Pettai	0	0	0	161	161
8	Maniyar Pettai	0	0	1	6	7
9	Nanjalingam Pettai	0	0	1	45	46
10	Nayakkar Pettai	0	0	1	19	20
11	Periyakuppam	0	0	18	83	101
12	Pettodai	0	15	2	20	37
13	Rajapettai	0	10	76	29	115
14	Reddiyar Pettai	0	0	3	34	37
15	Singara Thoppu	3	7	14	4	28
16	Sonankuppam	29	1	209	21	260
17	Sothikuppam	6	0	153	44	203
18	Thaikkalthonidurai	2	0	19	15	36
19	Thammanam Pettai	0	0	0	67	67
20	Thazhanguda	0	0	22	76	98
		108	**101**	**1273**	**1478**	**2960**

Figures



LULC Type	Area (Ac.)	%
Agriculture Plantation	5088.92	2.59
Open Land	513.71	0.26
Builtup Area	22466.43	11.44
Crop Land	62408.49	31.77
Scrub Land	7535.01	3.84
Transportation	237.29	0.12
Water Body	4920.59	2.50
Sea Area	93289.68	47.49
Total	196460.12	100.00

N
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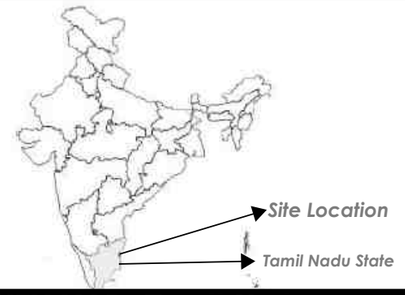
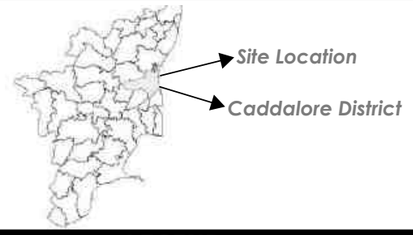
S

KEY MAP- India



KEY MAP- Tamil Nadu



LEGEND

- Project Boundary

LULC Type

- Agriculture Plantation
- Open Land
- Builtup Area
- Crop Land
- Scrub Land
- Transportation
- Water Body
- Sea Area
- 15 Km Buffer

SCALE

2 1 0 2 4 Kilometers

Client: M/s. Mahathi Cuddalore Port and Maritime Private Limited.

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: Landuse Landcover in 15 Km Radius

Project No: C25014

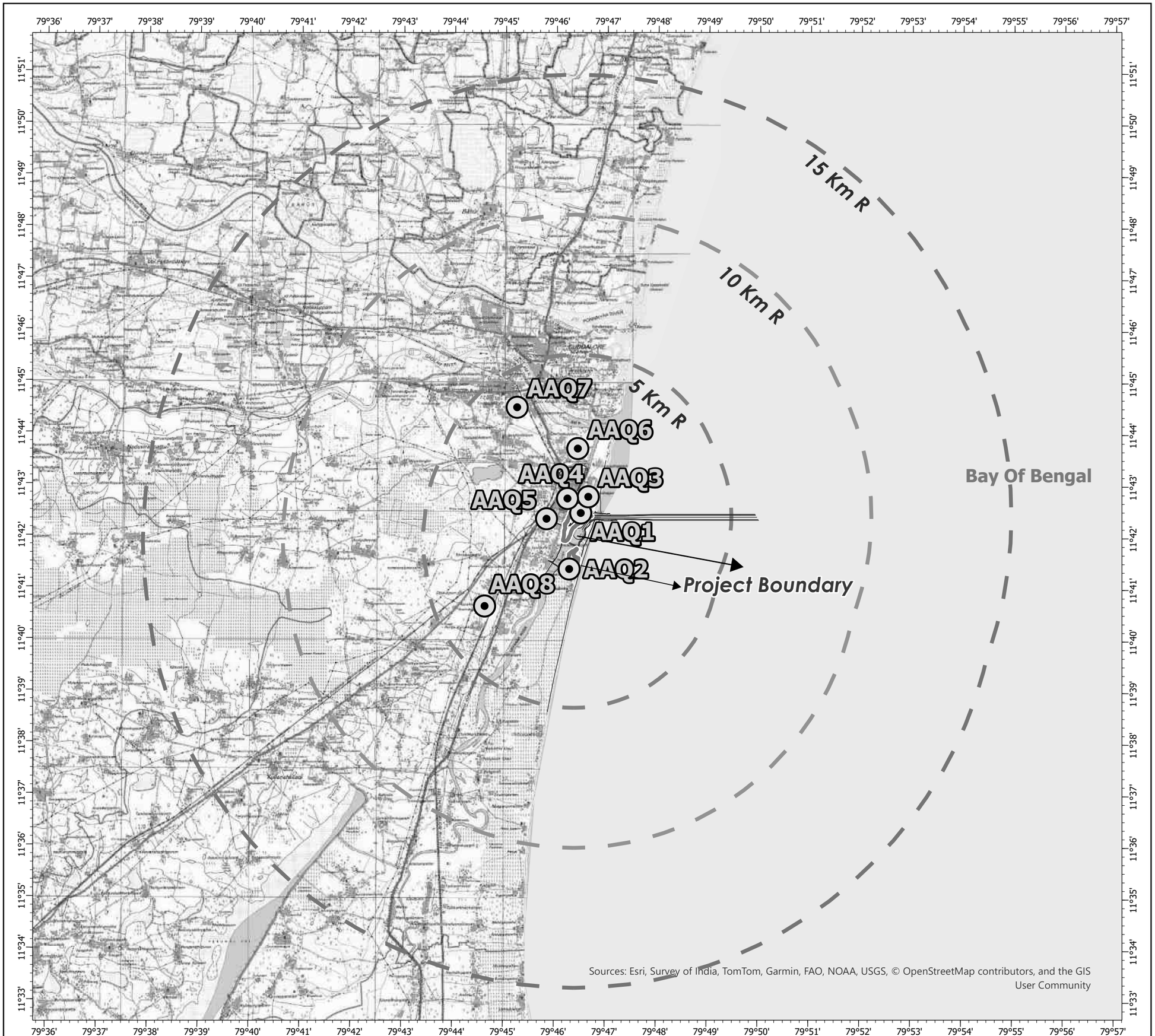
Made: KPS

Approved: SAM

Date: 20/01/2026

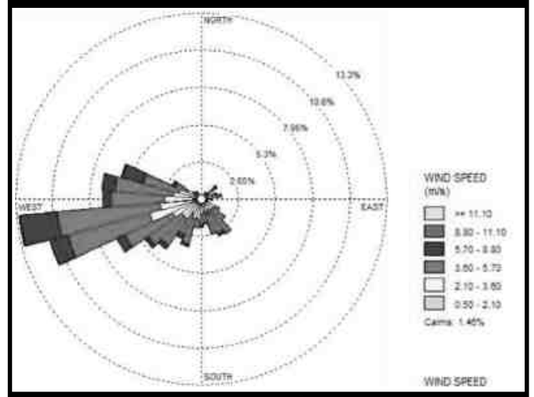
Figure No: FD301 0

FALCON RESILIENT INFRA CONSULTANTS
001 A, Sudheer Tapara Towers,
Himayat Nagar, Hyderabad, Telangana, 500029



Key Map- Project Site

Wind Rose



Legend

- Air Monitoring Location
- Project Boundary
- 5 Km Buffer
- 10 Km Buffer
- 15 Km Buffer

Scale

0 2 4 8 Km

Air Monitoring Locations

Name	Name of the Monitoring Location	Latitude (N)	Longitude (E)
AAQ1	Cuddalore Port(Main Site)	11°42'27.57"N	79°46'29.95"E
AAQ2	Pachaiyankuppam Village	11°41'22.37"N	79°46'16.55"E
AAQ3	Akkarai Gori	11°42'46.46"N	79°46'38.74"E
AAQ4	Manjakuppam	11°42'44.36"N	79°46'14.2"E
AAQ5	Cuddalore (M Corp)	11°42'20.71"N	79°45'49.6"E
AAQ6	Sunami Nagar	11°43'42.48"N	79°46'26.17"E
AAQ7	Thirupapuliyur	11°44'30.17"N	79°45'14.42"E
AAQ8	Karaikadu Village	11°40'38.97"N	79°44'36.97"E

Client:
M/s. Mahathi Cuddalore Port and Maritime Private Limited

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Project:
EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title:
Air Monitoring Locations

Project No: C25014
Made: KPS
Approved: SAM
Date: 20/01/2026
Figure No: FD302 0

FALCON RESILIENT INFRA CONSULTANTS
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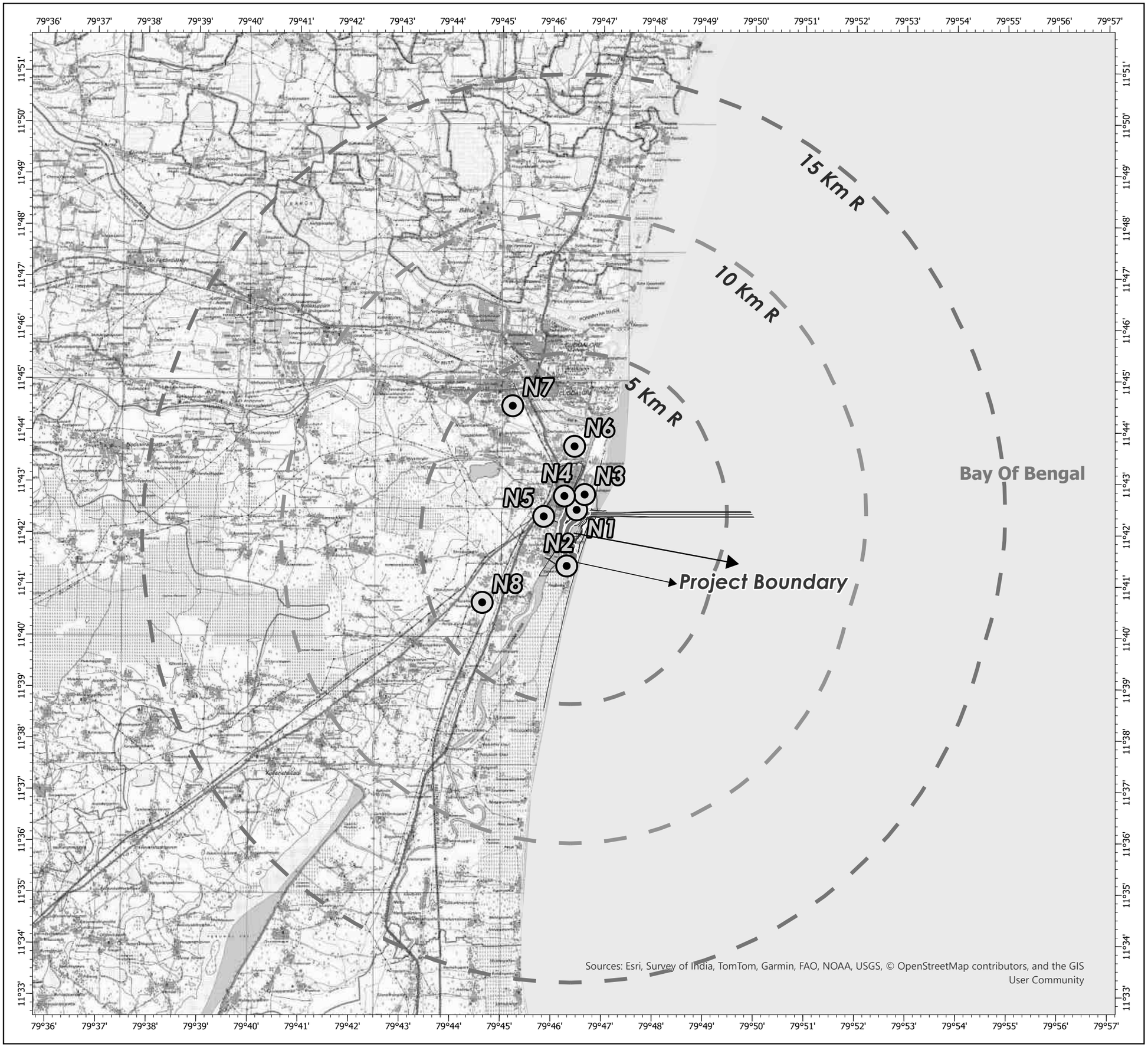

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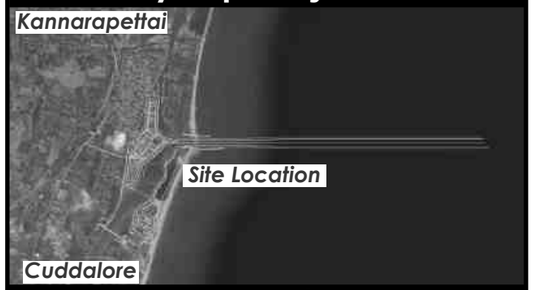
Key Map- Project Site



Legend

- Project Boundary
- Noise Monitoring Location
- 5 Km Buffer
- 10 Km Buffer
- 15 Km Buffer

Scale

0 2 4 8 Km

Noise Monitoring Location

Name	Name of the Monitoring Location	Latitude (N)	Longitude (E)
N1	Cuddalore Port(Main Site)	11°42'28.05"N	79°46'29.25"E
N2	Pachaiyankuppam Village	11°41'22.42"N	79°46'17.71"E
N3	Akkarai Gori	11°42'45.98"N	79°46'38.66"E
N4	Manjakuppam	11°42'44.18"N	79°46'14.64"E
N5	Cuddalore (M Corp)	11°42'20.25"N	79°45'50.22"E
N6	Sunami Nagar	11°43'42.25"N	79°46'26.46"E
N7	Thirupapuliyur	11°44'29.37"N	79°45'12.9"E
N8	Karaikadu Village	11°40'39.44"N	79°44'37.62"E

Client:

M/s. Mahathi Cuddalore Port and Maritime Private Limited

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: Noise Monitoring Location

Project No: C25014
Made: KPS
Approved: SAM
Date: 20/01/2026
Figure No: FD303 0

FALCON RESILIENT INFRA CONSULTANTS
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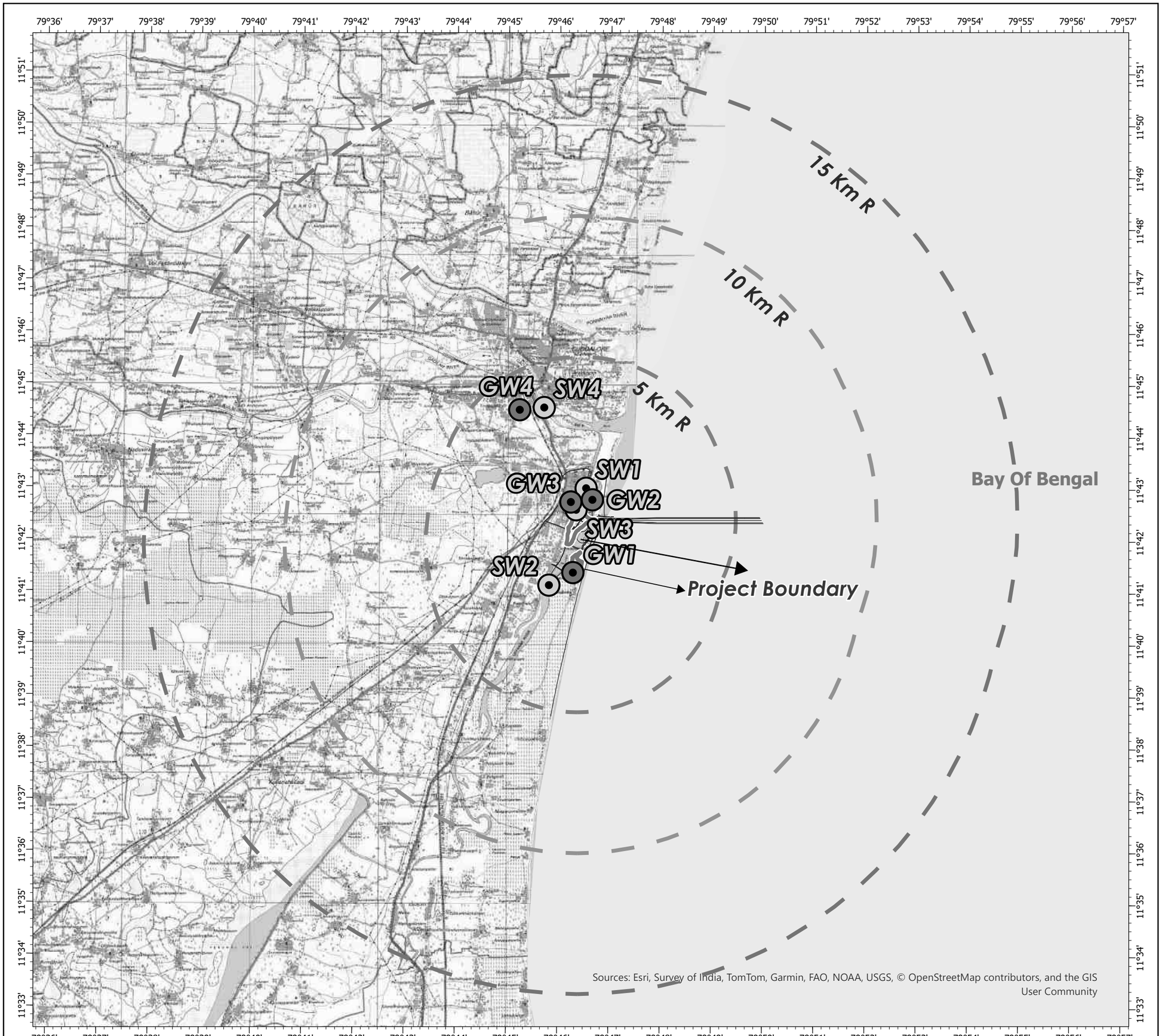
Himayat Nagar, Hyderabad, Telangana, 500029



N

W E

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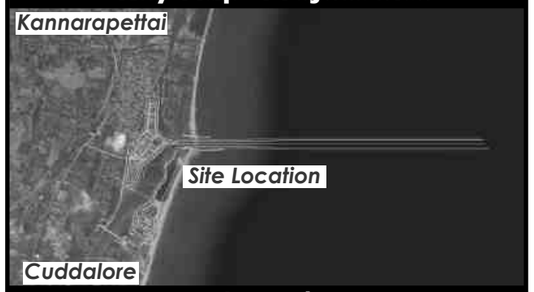
Key Map- Project Site



Legend

Inland Water Monitoring Location

- *Surface Water Monitoring Location*
- *Ground Water Monitoring Location*
- *Project Boundary*
- *5 Km Buffer*
- *10 Km Buffer*
- *15 Km Buffer*

Scale

0 2 4 8 Km

Inland Water Monitoring Location

Name	Name of the Monitoring Location	Latitude (N)	Longitude (E)
SW1	Akkarai Gori	11°42'59.91"N	79°46'31.99"E
SW2	Raasapettai Village	11°41'7.83"N	79°45'48.81"E
SW3	Manjakuppam	11°42'35.01"N	79°46'20.34"E
SW4	Thirupapuliyur	11°44'32.97"N	79°45'42.47"E
GW1	Pachaiyankuppam Village	11°41'22.4"N	79°46'16.84"E
GW2	Akkarai Gori	11°42'46.58"N	79°46'39.39"E
GW3	Manjakuppam	11°42'43.95"N	79°46'14.13"E
GW4	Thirupapuliyur	11°44'30.25"N	79°45'13.8"E

Client:

M/s. Mahathi Cuddalore Port and Maritime Private Limited

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: Inland Water Monitoring Location

Project No: C25014

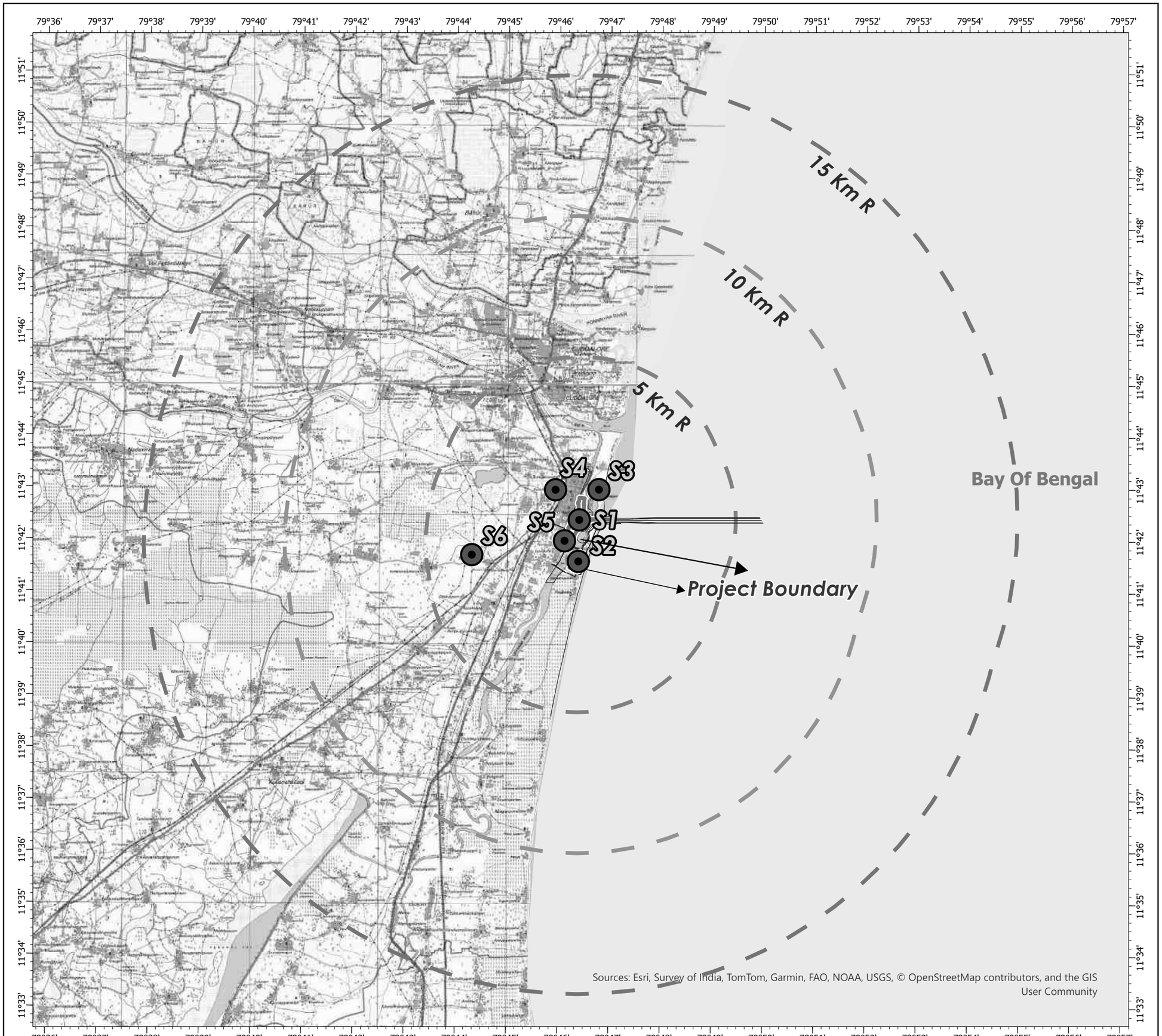
Made: KPS

Approved: SAM

Date: 20/01/2026

Figure No: FD304 0

FALCON RESILIENT INFRA CONSULTANTS
301 A, Sudheer Tapasvi Towers,
Himayat Nagar, Hyderabad Telangana, 500029

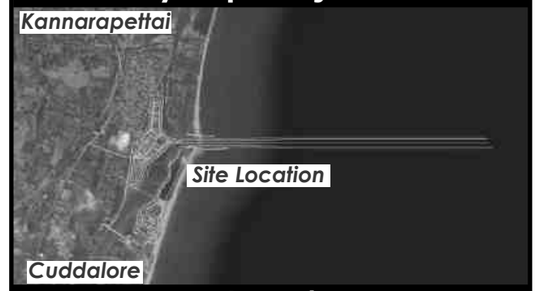


N

W E

S

Key Map- Project Site



Legend

- Project Boundary
- Soil Monitoring Location
- 5 Km Buffer
- 10 Km Buffer
- 15 Km Buffer

Scale

0 2 4 8 Km

Soil Monitoring Location

Name	Name of the Monitoring Location	Latitude (N)	Longitude (E)
S1	Cuddalore Port(Main Site)	11°42'23.33"N	79°46'24.1"E
S2	Pachaiyankuppam Village	11°41'35.36"N	79°46'23.17"E
S3	Singarathope	11°42'58.35"N	79°46'46.97"E
S4	Sandror Palayam	11°42'58.02"N	79°45'56.17"E
S5	Mullai nagar	11°41'59.11"N	79°46'6.86"E
S6	Kannarapettai	11°41'42.68"N	79°44'18.22"E

Client:

M/s. Mahathi Cuddalore Port and Maritime Private Limited

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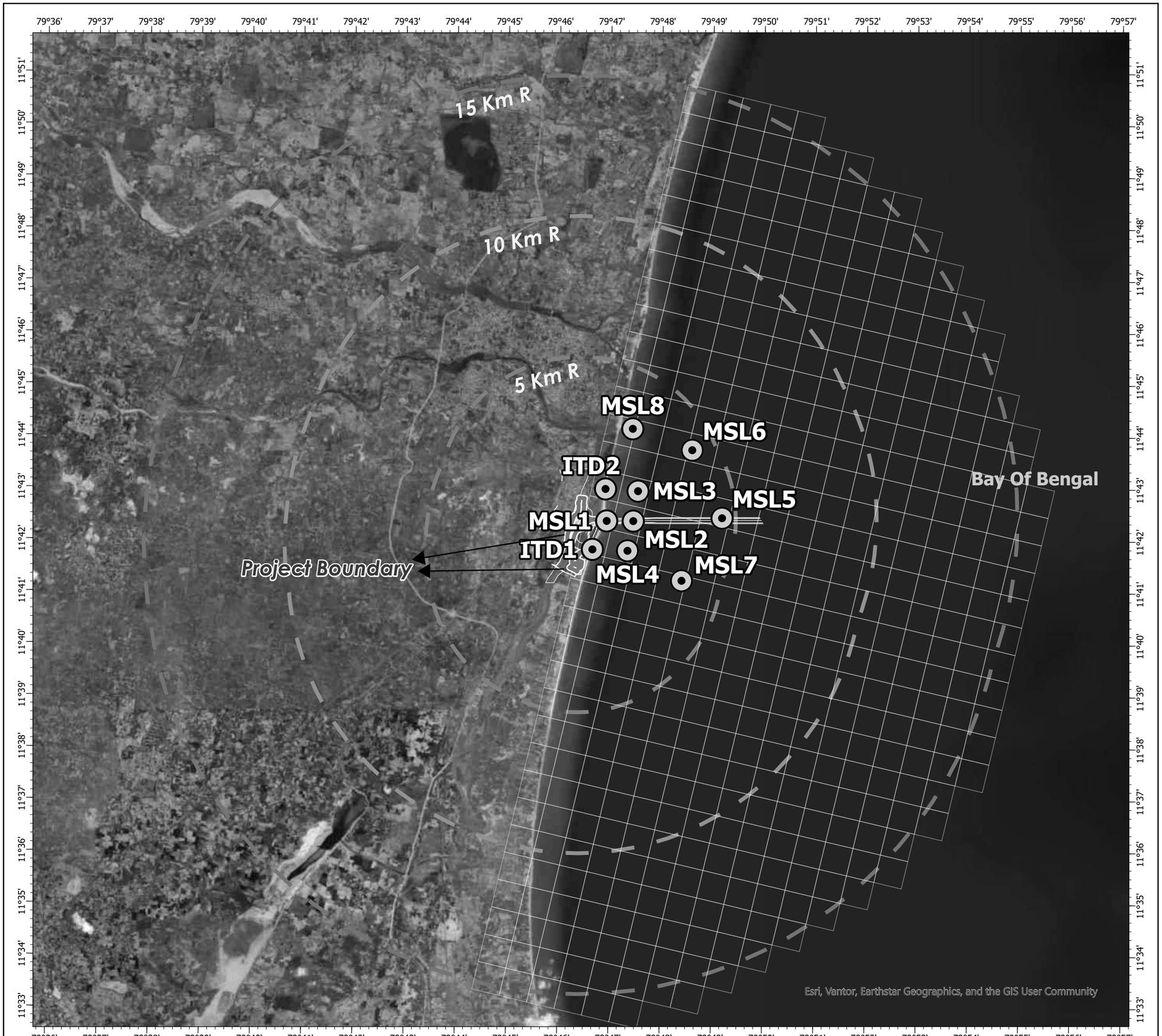
Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: Soil Monitoring Location

Project No: C25014
Made: KPS
Approved: SAM
Date: 20/01/2026
Figure No: FD305 0

FALCON RESILIENT INFRA CONSULTANTS
301 A, Sudheer Tapasvi Towers, Himayat Nagar, Hyderabad, Telangana, 500029



N

W E

S

Key Map- Project Site

Legend

- Project Boundary
- Marine Monitoring Location
- 5 Km Buffer
- 10 Km Buffer
- 15 Km Buffer
- Grid 1X1 Km

Scale

0 2 4 8 Km

Marine Monitoring Location

Name	Latitude (N)	Longitude (E)
ITD1	11°41'49.32"N	79°46'39.63"E
ITD2	11°42'59.21"N	79°46'54.73"E
MSL1	11°42'22.26"N	79°46'56.24"E
MSL2	11°42'22.19"N	79°47'27.42"E
MSL3	11°42'56.80"N	79°47'32.85"E
MSL4	11°41'47.86"N	79°47'20.77"E
MSL5	11°42'25.95"N	79°49'11.49"E
MSL6	11°43'44.38"N	79°48'36.25"E
MSL7	11°41'13.49"N	79°48'24.24"E
MSL8	11°44'8.79"N	79°47'26.44"E

Client:

M/s. Mahathi Cuddalore Port and Maritime Private Limited

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Project:

EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title:

Marine Monitoring Location

Project No:	C25014
Made:	KPS
Approved:	SAM
Date:	20/01/2026
Figure No:	FD306 0

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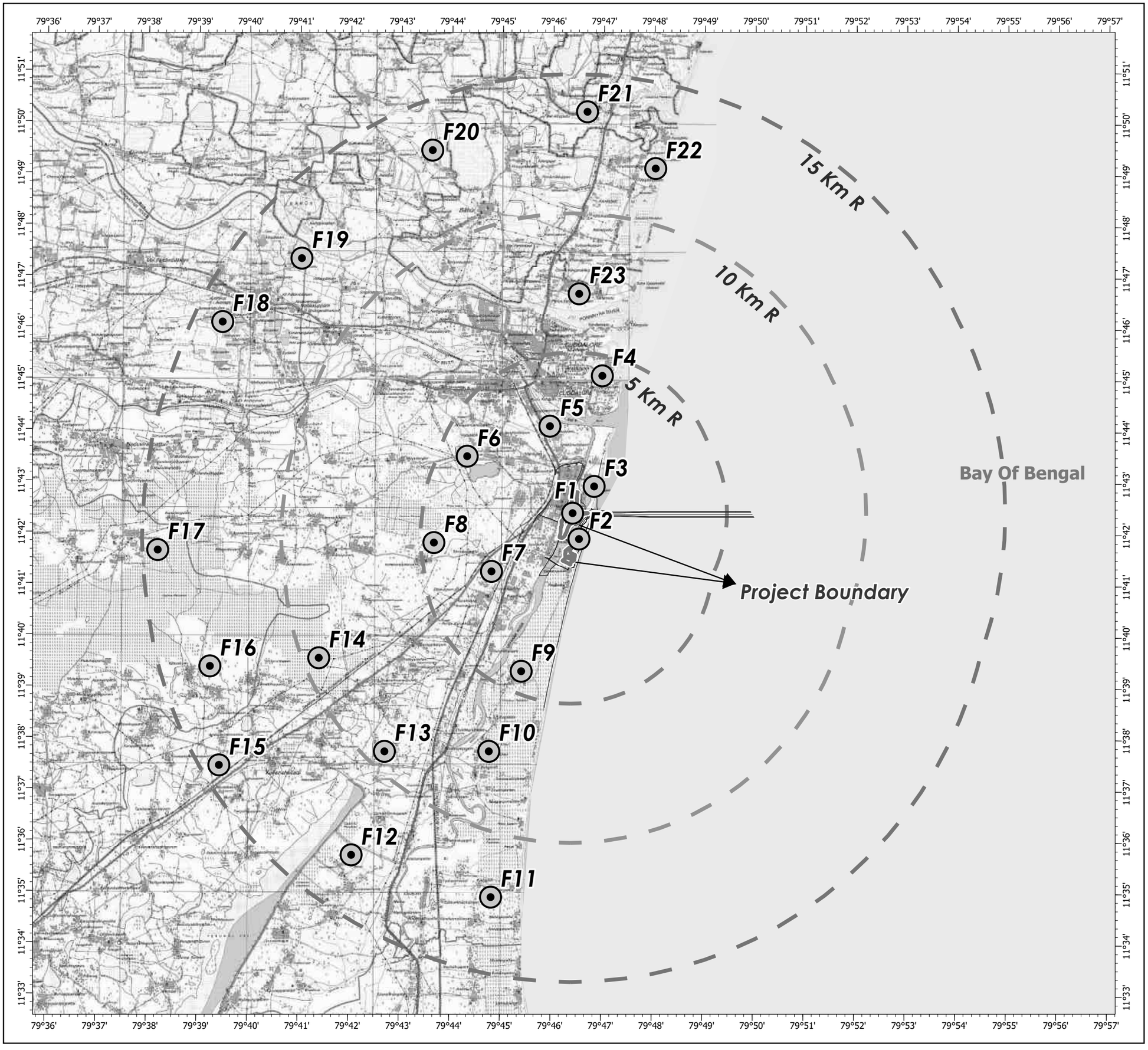

N
W E
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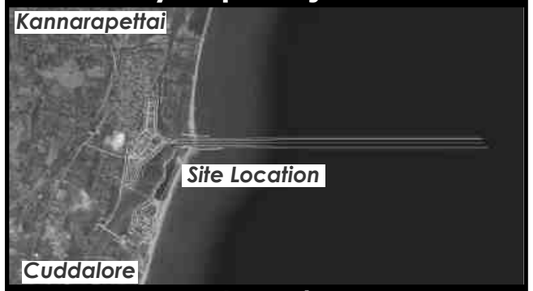
Key Map- Project Site



Legend

- Floora and Fauna Monitoring Location
- Project Boundary
- 5 Km Buffer
- 10 Km Buffer
- 15 Km Buffer

Scale

0 2 4 8 Km

Flora and Fauna Monitoring Location

Name	Latitude (N)	Longitude (E)
F1	11° 42' 23.82" N	79° 46' 24.46" E
F2	11° 41' 53.62" N	79° 46' 32.17" E
F3	11° 42' 55.2" N	79° 46' 49.88" E
F4	11° 45' 4.53" N	79° 46' 59.08" E
F5	11° 44' 5.41" N	79° 45' 57.14" E
F6	11° 43' 29.9" N	79° 44' 19.06" E
F7	11° 41' 15.35" N	79° 44' 48.5" E
F8	11° 41' 48.72" N	79° 43' 40.02" E
F9	11° 39' 18.71" N	79° 45' 24.25" E
F10	11° 37' 44.89" N	79° 44' 46.24" E
F11	11° 34' 54.45" N	79° 44' 49.13" E
F12	11° 35' 43.17" N	79° 42' 3.5" E
F13	11° 37' 44.35" N	79° 42' 42.43" E
F14	11° 39' 33.42" N	79° 41' 24.0" E
F15	11° 37' 27.67" N	79° 39' 26.12" E
F16	11° 39' 23.36" N	79° 39' 14.89" E
F17	11° 41' 39.09" N	79° 38' 12.35" E
F18	11° 46' 6.06" N	79° 39' 28.19" E
F19	11° 47' 20.62" N	79° 41' 1.88" E
F20	11° 49' 27.6" N	79° 43' 36.58" E
F21	11° 50' 13.23" N	79° 46' 40.13" E
F22	11° 49' 7.21" N	79° 48' 1.36" E
F23	11° 46' 40.34" N	79° 46' 31.18" E

Client:
M/s. Mahathi Cuddalore Port and Maritime Private Limited

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: Flora and Fauna Monitoring Location

Project No: C25014
Made: KPS
Approved: SAM
Date: 20/01/2026
Figure No: FD307 0

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Chapter 4
Anticipated Environmental Impacts and Mitigation Measures

4 Anticipated Environmental Impacts and Mitigation Measures

4.1 General

In this chapter, anticipated impacts of proposed development on environmental attributes have been identified, assessed and presented. Appropriate mitigation strategies are formulated and included as part of the planning process to lessen likely environmental impacts during construction and operation phases due to landside and marine side activities. The impacts have been assessed both quantitatively and qualitatively for various terrestrial and marine environmental components and impact specific mitigation measures are proposed.

4.2 Land Environment

4.2.1 Potential Impacts due to construction

4.2.1.1 Impacts due to Land Acquisition

The project site is a notified Port area and was allocated for Cuddalore Port and the proposed development is well within the port limits.

Existing port is located in an area of 45.21 ha (111.72 Ac) which was in complete possession of Cuddalore Port and proposed development is within the existing port land only. Shipbuilding and repair activity was proposed in an area of 13.88 ha (34.29 Ac) belongs to Government and same shall be acquired.

4.2.1.2 Impacts due to change in Land Use Pattern

The change in land use pattern will be as per the requirement of development plan and within the port limits. No settlements are present in the land identified for shipbuilding and repair facility of the port. The existing land use of the proposed development area is scrubland with scattered bushes and trees, followed by Barren / Wasteland, Low Intensity Built-up Activity (port buildings and wharf) surrounded by Water Bodies. Change in land use pattern will be limited to the proposed development area and will be carried out in such a way that to ensure the proper drainage by providing surface drainage systems including storm water network etc.

4.2.1.3 Impacts due to Level Raising/Disposal

Capital dredging will be carried out at proposed berthing & approach channel areas for which quantity is around 5.0 M.cum. The dredged material will be of 2 MCM will be utilised for level raising/reclamation and remaining 3 MCM for beach nourishment towards north of north breakwater and south of south breakwater. Regular maintenance dredging of about 0.237 M.cum will be used for shore protection/beach nourishment works towards north or north breakwater and south of south breakwater.

If the dredged material is used for level raising in the land ward side of port area, there will be impact on ground water quality and land area due to salinity ingress from the dredged material. In this development, MCPMPL is proposed to utilise the dredge material for reclamation/level raising/disposal near to north and south breakwaters.

4.2.2 Impact on Local Infrastructure

a) Movement of Construction materials:

Construction of berths/wharfs, breakwaters, amenities etc. require huge quantities of construction materials. Thus, transportation of these construction materials results in use of public infrastructure like roads, railways, drainage, water and power supply which in turn results in congestion.

The basic raw materials such as sand, coarse aggregates and stone are readily available in the vicinity of the port. Ready mixed concrete will be made from the basic raw material on site itself. Batching plants of respective size and capacity as per requirement will be installed at the site.

Thus, transportation of raw materials from nearby areas is likely to result in increased road traffic but only temporary during construction phase.

b) Construction Worker Camps:

During construction phase, approximately 500 people will be employed in the form of skilled and semi-skilled labourers. These workers will be hired from surrounding villages. They will be transported to and from the construction site by the construction contractors. Hence, there will not be any workers camp setup in the port.

4.2.2.1 Mitigation Measures- Construction Phase

- The existing roads shall be used for the construction material transportation and if necessary, roads shall be strengthened by MCPMPL.
- Transportation Management will be adopted for movement of dumpers transporting construction materials and traffic will be regulated.
- Dumpers and trucks will comply with standards for exhaust emissions and noise levels.
- Trucks with construction material susceptible for fugitive suspension will be covered with tarpaulin sheets.
- Vehicles deployed will conform to emission norms (air/noise) of CPCB and with valid Pollution Under Control (PUC) certificates.
- Ready mix concrete will be made from the basic raw material on site itself. Batching plants of respective size and capacity as per requirement will be installed at the site itself.
- If there are any accidental spillages of hazardous substances on soil that may pose the risk of contaminating run off, such areas will be immediately remediated.

- Medical facilities including first aid will be available for attending injured workers at the construction site.
- Construction area shall be earmarked, and activities shall be confined within that area.
- All the necessary safety precautions shall be implemented while doing the construction activities.
- Necessary sign boards and marker buoys shall be installed and shall be communicated to Port employees/Harbour master/Pilot etc., about the marker buoys indicating the areas of construction so that they may avoid those areas.

4.2.3 Potential Impacts due to Operation Phase

4.2.3.1 Discharges from ships on Land

No discharge of wastewater/waste from the ships calling at the port will be permitted into the port area. Ensuring ships visiting the port have onboard sewage treatment facilities and discharge sewage in deep seas according to MARPOL guidelines is crucial for protecting port areas from pollution. Providing reception facilities for solid waste, bilge, and waste oil at the port is also essential to prevent land contamination.

4.2.3.2 Soil Contamination

Improper management of hazardous and non-hazardous waste generated from various activities within the project area poses a significant risk of soil contamination. The land environment may be adversely affected by waste disposal, including sludge, residues, toxic chemical waste, used or waste oil, oil slurry, spent solvents, and CETP sludge. Proper waste handling and disposal measures are essential to mitigate these environmental impacts.

4.2.3.3 Mitigation Measures – Operation Phase

- Management and Disposal of Wastes (Storage, Segregation and Transport of Waste)
- Waste Reception Facility/arrangement with approved vendor
- Develop specific Waste Management Plan (WMP) and manage through project EMS.
- Reduce waste generation and maximise reuse and recycling.
- Waste identification and classification.
- Waste collection, storage and segregation on-board vessels.
- Use of specified waste transport containers only.
- All wastes to be transported in a safe manner, in accordance with Material Safety Data Sheet information and via well maintained, legally compliant and suitable vehicles or vessels, with appropriate documentation and driven/crewed by fully trained operators.
- Waste to be transported by approved waste contractors only.
- Appropriate treatment and disposal routes for different waste streams to be defined as part of the WMP.

- Waste study to identify potential options for medium- and long-term waste treatment of hazardous wastes where in-country solutions have not been identified
- Support national efforts to improve waste management standards.

4.2.3.4 Historical Shoreline Changes

GIS techniques were used to estimate historical shoreline changes. Long-term Shoreline change analysis was carried out for the Cuddalore coast as per the methodology adopted by National Center for Coastal Research (NCCR) for the period of 34 years (1990-2024). Satellite data were used to understand the spatial variation of the coast. From the long-term shoreline analysis, the coastal stretch with more than 1 km of continuous erosion was identified and categorised into different erosion classes. Satellite data understand the changes on shoreline using Resource Sat-II LISS-IV, Landsat, Cartosat - I) satellite images. Based on NCCR report, the rate of shoreline changes from 1990-2024, signifies that in Cuddalore coast of 14 km of the coast is experiencing low erosion of the coast is considered to be stable.

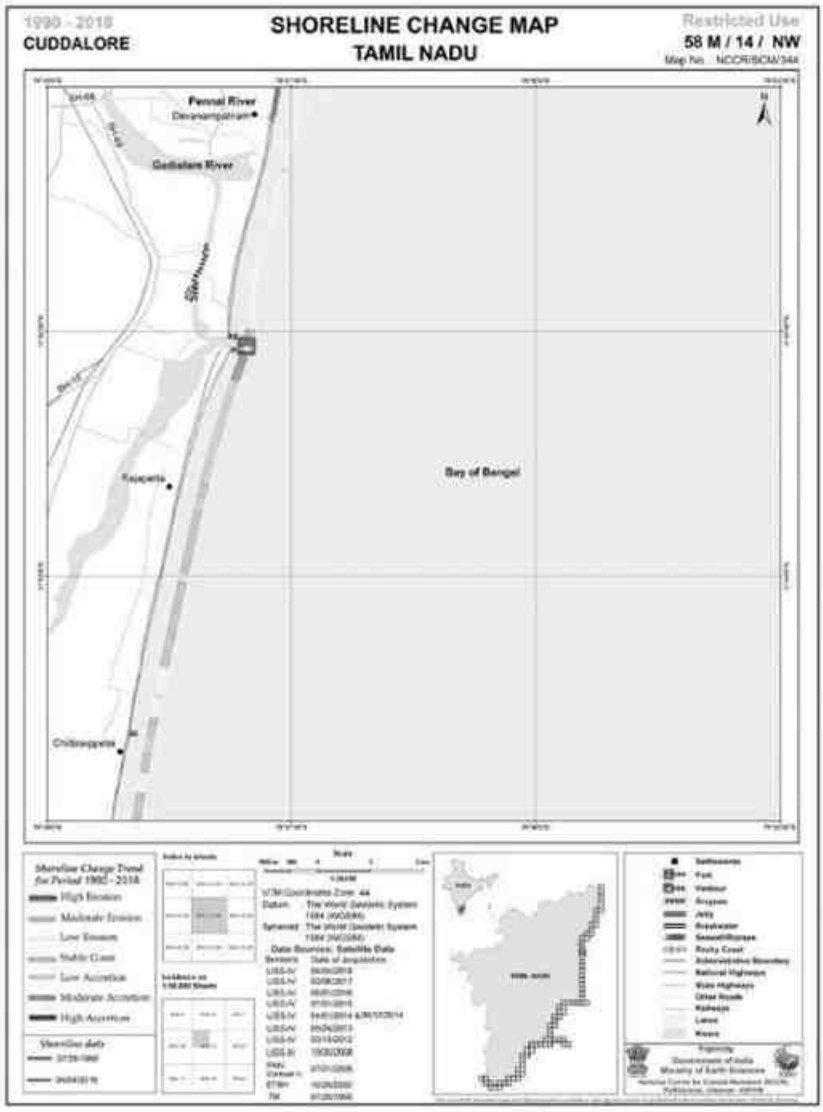


Figure 4-1: Shoreline Assessment of Cuddalore Port

4.3 Water Environment

4.3.1 Potential Impact due to Construction

4.3.1.1 Impact on Existing Water Resources

Based on the land use and land cover studies it was identified that study area (15.0 Km radius) mostly covered with Sea (47.49%), crop land (31.77%), built-up area 11.44%, Scrub land 3.84%, Agriculture Plantation (2.59%).

Only 2.5% of the study area is covered with Water bodies such as rivers and streams. The following are the rivers and creeks observed in the study area.

- Uppanar Estuary ~ Adjacent
- Parvanar – Adjacent S
- Gadilam River~0.34 N
- Pennai River~6.65 N

No water will be tapped from the groundwater and surface water resources existing in the project region.

The Port has an approved Sea Water Based Reverse Osmosis of total capacity 100 KLD. For proposed development, water requirement during construction activity will be approximately 50 KLD and during operation phase will be approximately 100 KLD. Water required during construction activity will be met through the bowsers and existing water supply system.

4.3.1.2 Impact due to Wastewater generated in Port Area

The wastewater generated from the port area during construction as well as operational phases will be collected through a wastewater collection network and sent to the Sewage Treatment Plant and Effluent Treatment Plant for treatment. It is proposed to reuse the treated wastewater for the irrigation of greenbelt and dust suppression within the port.

4.3.1.3 Mitigation Measures – Construction Phase

Wastewater Management:

- No wastewater shall be disposed directly on land or on existing surface water resources without appropriate treatment.
- An adequate drainage system will be provided at the site with separate collection streams to segregate the storm run-off from roads, open areas, material storage areas, vehicle wash water and other wastewater streams. Suitable measures will also be taken to prevent the washing away of construction materials into the drainage system.
- The storm water drain parallel to road will also get connected to the main drainage system and discharged into the sea.
- Sewage generated from port will be treated in STP of 3.5 KLD.
- Effluent generated from port will be treated in ETP of 25 KLD.

- The waste reception facilities shall be developed as per the Guidelines issued by Government of India (GoI).
- The collected wastewater will be treated in ETP / sent to approved vendors for further treatment and the bilge water will be collected by authorized Waste recycler and taken for further treatment.
- Treated wastewater will be used for greenbelt development.

4.3.2 Potential Impacts due to Operation Phase

4.3.2.1 Impact on Water Quality due to Cargo Operations

The proposed development of Cuddalore port will handle cargo such as Coal, Cement, Fertilizers, container, Cereals, wood, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron ore, slag and Limestone and Ship building and repair facilities.

4.3.2.2 Mitigation Measures- Operation Phase

- It is proposed to develop STP of 3.5 KLD capacity. Biological treatment is considered for STP and considering recycling in irrigation/horticulture area.
- Similarly, ETP will be developed of 25 KLD capacity.
- The sewage and effluent generated from office buildings, workshops, toilet blocks, canteens, liquid tank washing etc. will be treated in Sewage treatment plant (STP) and Effluent treatment plant (ETP) respectively. The two facilities will be developed on modular basis.
- The treated water will be used for irrigating greenbelt development.

The proposed cargo is to be handled with specialized handling systems and equipment and hence there will be very little chances of spill. However, in case of accidental spill of cargo during handling, spills will be contained and wash water or surface runoff containing spills will be collected separately and will be treated to avoid any further impact on water quality. Storm water runoff from the cargo storage areas and other areas of the project facilities may contaminate marine water quality if not regulated properly.

4.4 Marine Environment

4.4.1 Potential Impacts due to Construction Phase

Developmental activities such as capital dredging and construction of cargo berths will result in disturbance to marine habitat. During these activities, particularly dredging, localised and short-term impacts on marine water quality are likely to occur due to increased turbidity from suspended sediment. Further, marine sediment quality indicates that it is free from any significant pollution.

4.4.1.1 Impact due to Trenching and Laying of Sub Seabed Pipeline

The installation of submarine pipeline in coastal water involves trenching to create pipeline trench for approved desalination plant. Based on the available geotechnical data it is observed that material to be trenched is predominantly sand/clayey and hence there will be suspended sediments due to trenching which will increase turbidity levels and thus cause impact to marine life. This impact is temporary and will cease upon completion of laying activity and shall retain to normal condition.

4.4.1.2 Impact due to Dredging

Capital dredging to -16 m CD in the inner channel and -18m CD in the outer channel of Cuddalore port, enabling the port to handle fully loaded Handymax, Supramax, and Panamax vessels.

Capital dredging will be carried out at proposed berthing & approach channel areas for which quantity is around 5 M.cum and inline requirements of proposed development and dredge material of 2 Mcum will be used for level raising and reclamation activities within the port area and remaining 3 Mcum will be utilised for beach nourishment towards north of north breakwater and south of breakwater..

Deepening the approach channel will most likely increase the amount of deposition in the channel there by increasing the needed maintenance dredging. The predicted quantities of maintenance dredging with the proposed Master Plan are around 0.237 Million cu.m/yr of predominantly fine material from the approach channel, turning circle and berth area.

The fine material will be dredged using Trailer Suction Hooper Dredger and will be used for shore protection works.

4.4.1.3 Model Study during Dredging

The model domain covers the proposed dredging at turning circle, proposed dredging and the navigational channel. High resolution mesh was implemented in the vicinity of dredging and the dumping area to capture the sediment dynamics. MIKE 21 Hydrodynamic model is forced using the tidal conditions and the model is simulated for the period of 1 month to cover tidal variations during the spring and neap tide and to give the overall pattern of dispersion and deposition.

Capital dredging of 5 M cu,m is considered at proposed berthing & approach channel areas, and the dredged material will be used for reclamation of backup areas. The dredging will focus on 2 target sites (Turning Circle/Approach channel and Navigation channel) within the dredging area as shown in **Figure 4-2** to understand the sediment suspended concentration due to dredging operation. The sediment composition as collected from the field indicates that the material to be dredged is predominantly a silty sand. The model simulates the fate of the material from the dredger by releasing particles into the water column at a source 0.5m above the bed and tracking each particle throughout the simulation process.

The sediment in the project area is predominantly silt. Considering the use of a Trailer Suction Hopper Dredger (TSHD), a spill rate of 3% has been assumed during dredging. The study is carried out for sediments having particle size smaller than 74 µm, which are suspended during dredging. The sediments suspended during dredging is incorporated as area source at the rate of 8kg/s during the simulation.

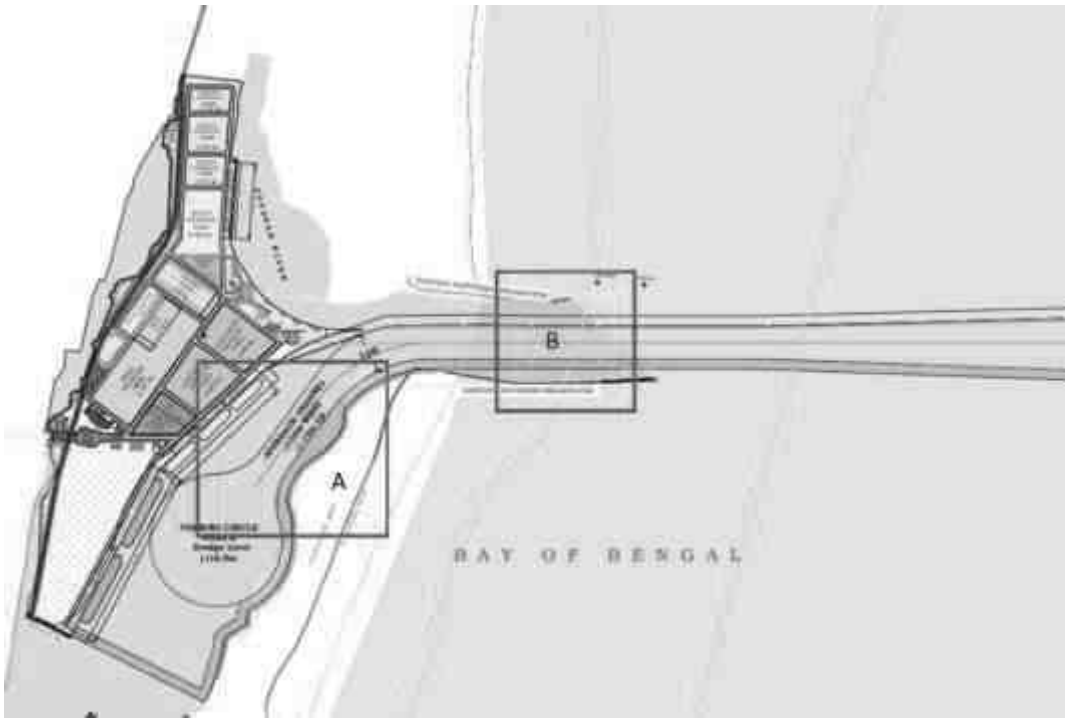


Figure 4-2: Target Areas (A-B) for Capital Dredging

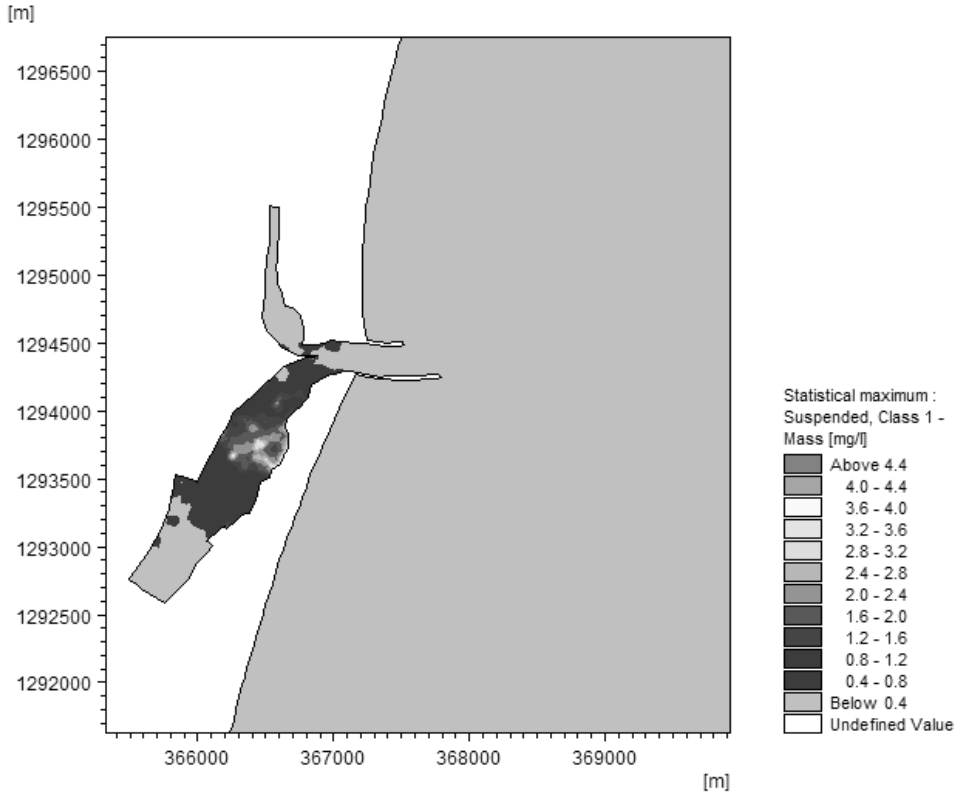


Figure 4-3: Maximum Suspended Sediment Concentrations during Dredging Operations at Turning Circle and Approach Channel

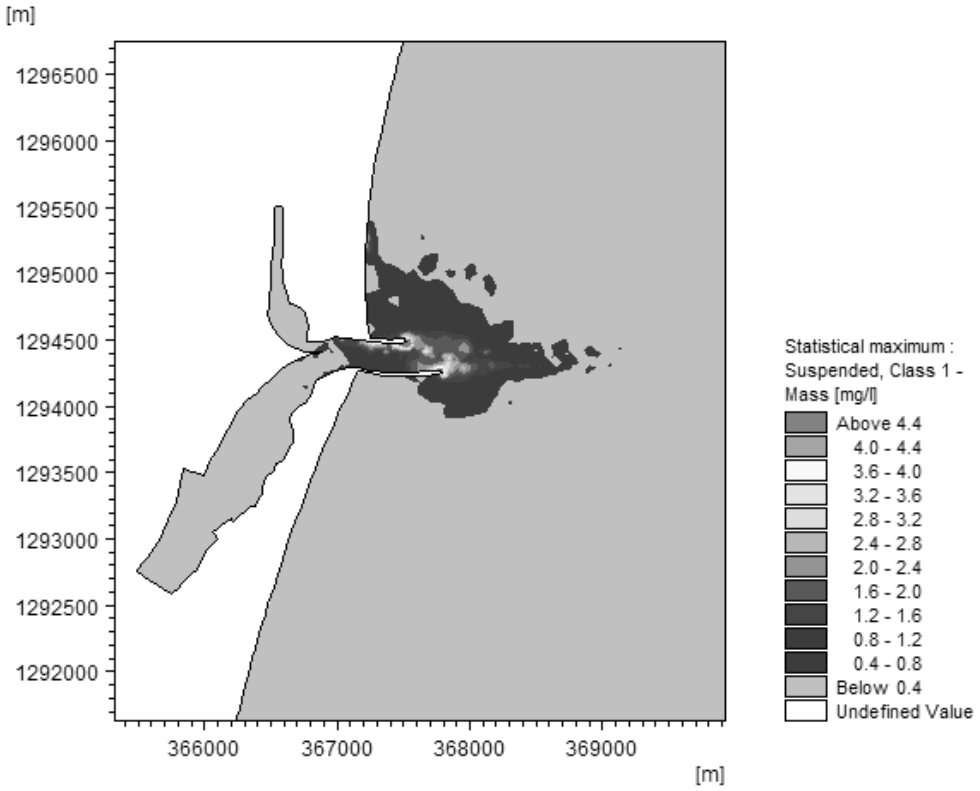


Figure 4-4: Maximum Suspended Sediment Concentrations during Dredging Operations at Navigation Channel

The maximum suspended sediment concentration (SSC) observed within all identified dredging target areas is found to be less than **4.4 mg/l**, indicating a relatively low level of sediment disturbance. The modelling results clearly demonstrate that the increase in suspended sediment concentration due to dredging activities is highly localized, occurring predominantly in the immediate vicinity of the dredging operation. Beyond this zone, the sediment plume rapidly disperses and dilutes under the influence of ambient hydrodynamic conditions, including tidal currents and river flow, resulting in negligible increases in SSC in the surrounding areas. This limited spatial extent of sediment dispersion suggests that the potential environmental impact of dredging-induced turbidity is minimal and confined to a small area around the dredger.

4.4.1.4 Impact due to Dredging and Disposal on Benthic Organisms

Capital dredging of 5 Mcum will be carried out inline requirements of proposed development and dredge material of 2 Mcum will be used for level raising and reclamation activities within the port area and remaining 3 Mcum will be utilised for beach nourishment towards north of north breakwater and south of south breakwater. Biodiversity assessment has revealed that four groups of macro benthic organisms namely Polychaetes, Bivalves, Gastropods, and Crustaceans were recorded across various stations in the Cuddalore coastal waters. The microbenthic population density varied from 625 to 1150 No m^2. Meiobenthic organisms were recorded, representing four groups: Foraminiferans, Nematodes, Ostracodes, and Harpacticoids. The population density of Meio-benthic fauna varied from 124 to 312 Nos.$10cm^{-2.}$

Localised and short-term impacts on marine water quality are anticipated from increased turbidity during dredging and dumping activities. As all precautionary measures are being adopted, no significant impact is anticipated from dredging on water quality except locally due to suspension of bottom sediment resulting in increased turbidity levels. Dredged material is being utilised for level raising and reclamation activities within the port area.

4.4.1.5 Impact on Marine Water Quality

The change in water-column turbidity during dredging, laying of pipelines and is a short-term impact. The increase in turbidity lasts as long as the material is being dredged. The turbidity level returns to the pre-project level on completion of dredging and backfill of material. In the proposed project, it is suggested that dredging and construction activities be done in a controlled manner and confined to the agreed development area which will be properly demarcated as it does not provide adequate time for the elemental transfer between the sediments and the water phase. Thus, no major change in marine water quality due to transfer of ions from sediments to water is anticipated. It has minimal environmental impacts as far as increase in water turbidity is concerned. Apart from short-term increase in turbidity levels, no other significant effect on marine quality is anticipated due to construction activity in the proposed project.

4.4.1.6 Impact on Benthic Organisms

During dredging and construction activities, removal of silt from the seabed will also removes the living organisms in the sediments. Except for some mobile surface animals that may survive through avoidance, dredging in general, may initially result in the complete removal of the benthic community from the excavation site. In areas under existing operation of the port, well-developed benthic communities are not expected to occur in or around the area.

None of macro-and meio-faunal species occurring in the study area are rare, endangered or threatened species and are common benthic organisms. Since, significant macro-and meio-fauna is not developed in the area, dredging and construction activities are not expected to lead to significant adverse impacts. The project site is on inter-tidal area, sea ward only and not in protected zone for which no major impacts are anticipated on marine ecology. The benthic organisms which get disturbed get re-colonized in short duration after the cessation of the construction activities.

4.4.1.7 Impact on Phytoplankton and Primary Productivity

Biomass of phytoplankton depends mainly on the availability of light in nutrient rich waters. Dredging, disposal and construction in marine environment may lead to increased turbidity and consequent reduction of light penetration for short periods. This may affect primary productivity and plankton biomass. However, the impact is in a localised area and only for a short duration. Hence impacts due to dredging

and construction activities are expected to be marginal in nature which will be offset over a period.

4.4.1.8 Inter Tidal Fauna

In general, 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 and hence impact during dredging and other construction activities on intertidal fauna is anticipated.

4.4.1.9 Impact on Fisheries

The most important potential impact will be on suspended solid load or changes in the food chain. The high turbidity due to heavy suspended solid load during construction can results in clogging of gills of fishes thereby causing asphyxiation. But since fishes in the water column are free swimming in nature, they will tend to avoid turbid areas and move to safer zones. Once the turbidity increase gets reversed due to sedimentation and dispersion by current and wave influences, the fishes are expected to come back. Hence there will be virtually no impact on fishes due to construction activity in the long term. As the area is not designated as significant breeding ground for fisheries, no significant impact on marine ecology is anticipated.

4.4.2 Mitigation Measures – Construction Phase

- Silt Curtains can be used to contain sediment and prevent it from spreading into surrounding waters.
- Closed Grab Dredgers reduces sediment dispersion during dredging activities.
- Controlled Dredging Rates, limiting the dredging rate minimizes disturbances to marine ecosystems.
- Chemical Spill Prevention to prevent accidental chemical spills and construction site runoff protects marine life.
- No dumping/fall/spill of construction materials, debris, fuel, wastes like garbage, municipal solid waste, etc., is to be ensured.
- Installation of marker buoy to warn the fishermen about ongoing construction activities.
- Installation of proper marker lights indicating obstructions if any.
- It is proposed to check turbidity levels with baseline turbidity levels as a reference during dredging and at disposal site.
- Currently, there are no standards in India to regulate turbidity levels during dredging. It is proposed to check turbidity levels during construction phase with baseline turbidity levels as a reference during dredging.
- It will be ensured that suitable dredging equipment is deployed to minimise the suspension of fine sediments at the dredge site. The turbidity at the dredged site will also be minimised through adoption of less intrusive dredging techniques along with timing of the dredging activity (avoiding sensitive periods).

- Dredging activity will be regulated during rough sea conditions.
- Environmental Monitoring Programme comprising of monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of dredging and will be carried out throughout dredging period.
- It will be ensured that barges/workboats have slop tanks for collection of liquid/solid waste generated on board. Discharge of wastes into sea will be prohibited.
- Spill control measures will be adopted while fuelling dredgers, barges, workboats, etc.
- Pre and post dredge material disposal bathymetry survey at disposal location shall be carried out
- Based on the TSS/Turbidity monitoring results during dredging, nearby receptors if any impacted would be provided with suitable mitigations measures such as silt screen to contain the turbidity.

4.4.3 Potential Impacts due to Operation Phase

4.4.3.1 Impact on Marine Water Quality and Ecology in Harbour Basin

Due to Aqueous Discharges: During the operation phase there will be continuous movement of cargo vessels and port crafts will operate round the clock, potentially leading to aqueous discharges such as ship wastes, sewage, bilge water, and solid wastes. Cuddalore port shall provide facilities to receive residues and oily mixtures from ships, in line with the International Convention for the Prevention of Pollution from Ships (MARPOL) provisions. Facilities for garbage, waste oil, and bilge water will also be available, with bilge water collected by authorized waste recyclers for further treatment.

Runoff from cargo berths, wastewater, and sewage from port operations could affect marine water and sediment quality if not properly treated. Maintenance dredging will be carried out to maintain the required draft for vessel movement. The estimated dredge quantity for the development plan is 0.237 Mm^3 per annum. During maintenance dredging, impacts on water quality is increase in turbidity levels due to suspended bottom sediment are expected.

Cargo will be handled by mechanized ship-loaders/unloaders to prevent spills during normal operations. Accidental spills could impact marine water quality, sediment quality, and ecology in the harbour basin. While oil spills are not expected during normal fuelling operations, accidental spills could impact marine water quality. Recovery efforts will follow oil spill contingency plan.

Due to Maintenance Dredging: During maintenance dredging of the approach channel and the harbour basin is to be carried out in order to maintain the required draft in the channel for the free movement of the vessels. The annual maintenance dredge quantity for port will be 0.237 M.cum per year. The magnitude of impact due to the maintenance dredging and disposal is dependent on the quality of the dredged material, which is in turn dependent on the pollution control facilities.

provided. Localised and short-term impacts on marine water quality are anticipated from increased turbidity during maintenance dredging.

As all precautionary measures are being adopted, no significant impact are anticipated from maintenance dredging on water quality except locally due to suspension of bottom sediment resulting in increased turbidity levels. Dredged material is being disposed at the identified disposal location; the dredger hopper will be shifted to minimise the increase in turbidity/suspended solids concentration and built up of the bed material.

Due to Cargo Spills during Handling: Spills are not anticipated to occur during normal operations, as the cargo will be handled by specialised equipment. In the event of accidental spills of cargo during transfer from / to the ships, the marine water quality, sediment quality and ecology in the harbour basin will be impacted.

In order to avoid any spillage of cargo into the sea, it is essential to handle the entire operation in more controlled manner with sophisticated hoisting equipment. The trained and certified crane operators have been employed. In order to avoid wind drift, it has been planned that all stack yards are on the down drift side after studying the predominant wind direction.

Due to Oil Spills: Oil spills are not anticipated to occur during normal operations. In the event of accidental oil spills during fuelling of port crafts and accidental spillage of oil from ships visiting the port, the marine water, sediment quality and ecology in the harbour basin will be impacted. During towing and berthing of the ships, owing to natural calamity or piloting errors, there can be remote possibility of mishap of one-to-one ship collusion or ship hitting against the wharf or ship getting grounded.

During such events, the ship may sink/break and lead to oil spill inside the port basin or in the vicinity. To minimise the impact due to oil spill, under the directive issued by Maritime States Development Council (MSDC), to all coastal States, Cuddalore port will implement operational oil spill contingency plan covering response mechanism, control methods and equipment, sensitivity mapping etc. To minimise the impacts on marine water quality, the spills will be recovered.

In line with the Health, Safety and Environment (HSE) Policy and under the directive issued by Maritime States Development Council (MSDC), to all coastal States that every port under their jurisdiction must prepare a Contingency Plan, Cuddalore port will implement the contingency plans in exigencies.

The primary objectives of Oil Spill Contingency Plan is to be part of National Oil Spill Contingency Plan (NOSDCP) hierarchy outlined NOSDCP at the apex level to coordinate significant or disaster type spills, the Regional Oil Spill Disaster Contingency Plan (ROSDCP) to coordinate spill in the Eastern seaboard, utilizing the resources available within the region.

The District Oil Spill Disaster Contingency Plan (DOSDCP) coordinates minor oil spills that affect maritime area within the coastal state limits. The Cuddalore Port –Oil Spill contingency Plans is integrated with respective DOSDCP o that a combined effort is made for oil spill response.

4.4.4 Mitigation Measures – Operation Phase

- The drains and outfall should be cleaned regularly to avoid anaerobic decomposition and also for proper flow of water/wastewater. This will also enable the characterization of wastewater and calculation of waste load
- Domestic and canteen wastewater should be discharged only after proper treatment
- The solid waste generated from the canteen and other sources should be collected and disposed off properly.
- The discharge of oil waste into the sea should be controlled.
- The discharge of solid waste and sewage from ships should be controlled. It should be disposed/discharged only after proper treatment.
- Bulk material should not be disposed into the sea. All drains and roads should be cleaned before the rainy season to avoid runoff from land to sea carrying a myriad of pollutants including chemicals.
- Temporary bunds should be constructed to contain surface runoff from land sites. Collected runoff should be passed through retention ponds to collect suspended solids before discharge.
- Oily wastewaters (from fuel storage tanks, maintenance shops, ships' bilge water, tank washings) and runoff from dirty areas of the port (vehicle marshalling, parking and fuel storage areas) should all be collected and passed through an oil water separator before discharge.
- Regular monitoring of water quality should be carried out within the port and in adjacent waters during operation to identify adverse environmental changes

Ballast Water Management Guidelines for Ships: Guidelines issued by DG Shipping, following the International Maritime Organisation (IMO) standards, emphasize several key practices

- **Ballast Water Exchange**: Ships must conduct ballast water exchange at least 200 nautical miles from the nearest land and in water at least 200 meters deep before arriving at a port. If this isn't possible, the exchange should occur at least 50 nautical miles from the nearest land and in water at least 200 meters deep.
- **Efficiency**: The exchange must achieve at least 95% volumetric efficiency.
- **Shipboard Procedures**: The master and crew must be familiar with essential procedures related to ballast water management.

Record Keeping: Each ship must maintain a ballast water record book, which can be electronic. Port officers may inspect this record book and request relevant copies.

4.5 Biological Environment

4.5.1 Potential Impacts during Construction Phase

Project site and its study area does not contain Wildlife Sanctuaries, National Parks, Ecologically Sensitive Areas (ESA) or biosphere reserves and other protected areas.

The project site is not situated within or adjacent to any cultural heritage sites, buffer areas of protected areas, or special areas for protecting biodiversity.

Impact on Ecology during Construction Activities

The impacts caused due to construction activities include the following:

- Exhaust emissions from diesel run engines, construction machinery and vehicles
- Dust suspension during site preparation, construction, trenching and material transport
- Noise caused by vehicles transporting construction material
- Noise caused by handling of construction materials
- Noise & exhaust emissions from diesel run engines of construction machinery
- Interference to fishermen and fishing activities during seaside construction activities.

During construction the transport of construction material will cause dust emission, emission of exhaust gases from vehicles such as CO2, CO and NOx. The fugitive dust may coat the leaves of plants and trees. Fauna that occur in the study area may get disturbed with the sound of vehicles, construction and construction equipment.

4.5.1.1 Impact on Terrestrial Flora and Fauna due to proposed development

Baseline status on flora and fauna conducted at the proposed development suggests that the port site does not have any plant and animal species of higher conservation significance like IUCN red list species. Vegetation in the proposed area include *Prosopis juliflora, Azadirachta indica and Morinda tinctoria* and other seasonal herbaceous flora.

Dust generation during the transportation of construction materials, dust will deposit on the adjacent trees. Disturbance to the local resident birds such as Indian Cormorant, Little Egret, Grey heron, Great egret, Common Quail, Indian cuckoo, House Crow is envisaged due to movement of vehicles. Construction can introduce invasive plant species, which may outcompete native flora, altering the local plant community and ecosystem balance.

During construction the transport of construction material will cause dust emission, emission of exhaust gases from vehicles such as CO_2, CO and NO_x. The fugitive dust may coat the leaves of plants and trees. Fauna that occurs in the project area and surroundings may be disturbed by the sound of vehicles, construction and construction equipment.

Impact on Mangrove Areas

Mangrove area is located near to shipbuilding and repair facility at distance of (~60m). These areas will be impacted if proper control/mitigation measures are not taken up during construction and operation phases.

Impact on Turtle Nesting Near the Project Area

The reported nearest Turtle nesting area Gori (Akkarai Gori) is located at a distance of ~1.0 km towards north from the north breakwater and Sothikuppam is located as a distance of ~2.13 km towards south from the south breakwater. Rest of the places are more than 3km north of the proposed project boundary (**Figure 3-77** and **Figure 3-76**). Turtle nesting is not reported in project area.

4.5.1.2 Mitigation Measures during construction Phase

Biodiversity conservation

Biodiversity must be conserved to ensure it survives, continuing to provide services, values and benefits for current and future generations. The following approach shall be adopted by MCPMPL:

1) Avoidance of irreversible loss of biodiversity.

2) Seeking alternative solutions to minimize biodiversity losses.

3) Use of mitigation to restore biodiversity resources.

4) Compensation for unavoidable loss by providing substitutes of at least similar biodiversity value.

5) MCPMPL undertakes to enforce and strictly adhere to the provisions of the following acts and legislations for conservation of biodiversity as applicable:

- The Environment (Protection) Act (1986)
- The Biological Diversity Act (2002)
- The Wildlife (Protection) Act (1972)

Mitigations measures suggested

- Immediate replanting in areas where construction has been completed, initiate immediate replanting with native vegetation to stabilize soil and promote ecosystem recovery.
- Avoid cutting tree roots, plan construction activities to avoid cutting into the root systems of mature trees, which could lead to their decline or death.
- Clearing vegetation in phases as construction progresses helps to reduce large-scale habitat destruction and allows for better management of the disturbed areas.
- Restrict the movement of heavy machinery to designated green belt development paths or use lightweight equipment to minimize soil compaction, allowing for better plant root growth.
- Remove and store topsoil separately during excavation, so that it can be replaced during the post-construction phase for revegetation purposes.
- Water sprinkling during construction material transportation.
- Implementing erosion control measures, such as silt fences and retaining walls, can minimize soil loss and its impact on plant life.
- Construction restrictions during nighttime

- Discharge of effluent into the water bodies during the construction and operation would not be allowed
- Prevent soil erosion by using mulch or planting ground cover vegetation.

Sporadic vegetation is present in port site and vegetation clearance planned, topsoil should be preserved through effective soil conservation measures. Implementing sustainable strategies will be key to maintaining soil integrity and supporting ecological balance in the region.

Topsoil Conservation:

Topsoil Recovery: Topsoil having true biological values in the top 10 to 15 mm of the soil profile will be stripped to a depth of 20 cm from the areas proposed for buildings, roads, pavements and external services will be recovered.

Direct Lay of Topsoil: The preferred use for recovered topsoil is to transport fresh topsoil directly to the suitable locations in the project sites that have been prepared and are ready for rehabilitation. This topsoil can then be directly laid at the site to enhance rehabilitation.

Storage of Topsoil: If immediate rehabilitation site the not available topsoil is preserved for future green belt management. Where possible, stockpile sites will be selected to maximize protection from `the prevailing winds, particularly if the material is friable in nature.

Drainage from higher areas will be diverted around stockpile areas to prevent erosion. As required, sediment controls will be installed downstream of stockpile areas to collect any run-off. Topsoil stockpile locations will be strategically located to assist the sequence of future rehabilitation.

Spraying of water during handling of construction materials like sand and gravel will minimise dust emission. Properly maintained vehicles will produce reduced noxious emission. And the temporary labour camps must have proper sanitation facilities. The impacts caused by construction to fauna are temporary and not long term and most (if not all) the observed and documented flora and fauna of the project area will adapt to these impacts.

4.5.2 Potential Impact during Operation Phase

The major impacts anticipated during operation phase are follows:

- Dust emissions leading to deposition on trees and shrubs. Further these emissions if not properly handled, might respired by fauna which may affect them.
- Possibility of aqueous discharges from the cargo vessels such as dumping of ship wastes (sullage) / sewage, bilge water, solid wastes, etc. if not regulated.
- Waste disposal to local ecological environment if not properly managed.
- Accidental spills of cargo during transfer from / to the ships may impact marine water quality, sediment quality and ecology
- Excessive noise generations from diesel run engines, machineries etc., cause fleeing of fauna.

- Dust from the dry bulk cargo transported from the berths to stockyard through conveyors and transportation via road and rail may be respired by the fauna, if not handled properly.
- Dry Bulk cargo dust coating the leaf surfaces of vegetation results in blockage stomata (leaf pores responsible for gaseous exchange and water vapour exchange) and reduced photosynthetic performance
- Dry bulk dust may be ingested by herbivorous species since the Particulate matter may coat the surface of vegetation.
- The glare of the port complex lighting system is likely to cause adverse impacts on the Nocturnal fauna and marine creatures.
- During the hatching of eggs laid by Olive Ridely turtle, the glare of light may destruct hatchlings movement to landward side causing desiccations and death.

4.5.2.1 Mitigation Measures

- On the periphery of the proposed activity native plantation shall be raised to improve the green cover and act as barrier to reduce the impact of sound pollution. Native perennial shrubs and soil binders such as perennial grasses shall be planted.
- Towards the coast, all outdoor lighting, roadway lighting, wharf lighting, and lighting mounted will be of the minimum lamp wattage to achieve required safety within the lighted area especially during breeding season of birds, mammals and reptiles.
- Underground cables are proposed for power supply which will reduce the impact of bird collision
- Discharge of wastewater is not allowed into the water bodies.
- Awareness will be given to workers about the importance and conservation of terrestrial ecology and biodiversity
- The dust pollution must be reduced by sprinkling of water on the roads used for vehicular movement for construction activity.

Improvement of Habitats for Higher Vertebrates:

It is imperative to protect, restore, manage and maintain biodiversity existing along the coast. The measures recommended for improvement of habitats are:

- Plantation of native trees to support local biodiversity.
- Creating awareness on environment and wildlife amongst the adjoining villages. Education and awareness tours/ visits for school children and celebration of wildlife week
- Periodic monitoring of wildlife moment

Table 4-1: Summary of measures for each ecological threatened category

Significant value/Category	Details of the Species	Overall risk with no specific mitigation measures implemented	Summary of measures	Overall residual risk	Implementing Agency
Core Area-Project Site					

Significant value/Category	Details of the Species	Overall risk with no specific mitigation measures implemented	Summary of measures	Overall residual risk	Implementing Agency
IUCN Listed Flora	No IUCN listed Flora recorded in the project site.	LOW	Native plant species will be planted in the Green Belt Management Plan	LOW	Project Proponent
Mangrove area and mangrove buffer area	Avicennia officinalis, Avicennia marina	LOW	Mangrove are conserved by Forest Department and Port will implement the conservation activities	LOW	Forest department/project proponent
IUCN/IWPA listed Fauna	No IUCN/ IWPA listed fauna recorded in the project site.	LOW	-	LOW	-
Buffer Area-15 km Radius from the project site					
IUCN Listed Flora	No IUCN listed Flora recorded in buffer area.	LOW	Mangrove are conserved by Forest Department	LOW	Forest/Wildlife Department
IUCN/ IWPA Listed Fauna	Indian peafowl *(Pavo cristatus)* Indian Monitor Lizard *(Varanus bengalensis)*	MEDIUM	Proper surface water mitigation Proper Noise mitigation Safeguarding nesting trees Planting Fruit bearing tree	LOW	Project Proponent at Project site Forest/Wildlife Department in surrounding forest areas

Mitigation/Mangrove conservation measures

- Dust suppression measures, closed conveying system, wagon and truck loading silos etc., will also act as a buffer to prevent the likely fugitive emissions from dry bulk cargo storage areas and handling
- Awareness will be given to workers in the Barge/vessel loading facility about the importance of mangroves and their conservation
- Discharge of handling materials during the construction and operation would not be allowed
- During dredging the water quality near the mangrove area will be ensured by adopting suitable mitigation measures.

4.6 Air Environment

4.6.1 Potential Impacts during Construction Phase

Site levelling and transportation of construction material results in use of public infrastructure like roads and during material transportation, there is a possibility of

impact on air quality along the route due to exhaust emissions, fugitive dust suspension and traffic congestion.

The sources of potential impacts on the air quality at the construction site can be categorised as follows:

- Exhaust emissions from diesel run engines, construction machinery and vehicles
- Dust suspension during site preparation, construction and material transport
- Soil grading and compaction as part of site preparation by using mechanical shovels and earthmovers for site clearance, cut & fill and other site levelling activities.

The construction phase initially involves clearance of the vegetation and thereafter levelling of the site. These activities involve emissions of dust into the air to some extent resulting air pollution. Furthermore, movement of construction materials such as cement, steel, sand, etc. will cause disturbance to the adjoining communities. Emissions from diesel power generators, construction equipment and transport vehicles will affect the air quality within the work areas, if not adequately managed. However, the build-up of pollutants in the ambient air during construction phase is temporary in nature and will be localised. Suitable mitigation measures can be employed to render these impacts insignificant.

4.6.1.1 Impact due to Drilling

In case of drilling involved during construction, there will be slight increase in particulate matter concentrations in ambient air mostly within the active operational areas only.

4.6.1.2 Mitigation Measures during Construction

- Vehicles transporting soil and aggregate to be covered by using tarpaulins or covers that prevent the escape of dust and prohibiting such vehicles from stopping near settlements.
- Keeping site roads and approaches to watercourse crossings free from deposits of mud and silty material
- Using windbreaks, netting screens or semi-permeable fences to reduce dust emissions from working areas close to sensitive, residential or agricultural locations or natural habitats.
- Water sprinkling on the surface of the access road reduce dust emissions.
- On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic. However, such an impact can be minimized by restricting entry only to PUC certified vehicles.
- The construction equipment and transport vehicles will be periodically washed to remove accumulated dirt.
- Drilling machines will be equipped with wet drilling arrangements or dust collector
- Regular sprinkling of water will suppress dust at points/places of generation
- Regular maintenance of vehicles and machinery

- Proper training and provision of PPEs such as dust masks or enclosure to workmen involved in drilling, welding etc.

4.6.2 Potential Impacts due to Operation Phase

The impact on air environment due to the operation of the port facilities has been predicted based on air quality modelling studies by considering following types of sources with mitigation measures and without mitigation measures:

Point Sources	Area Sources	Volume Sources	Line Sources
Emissions from Ships/Vessels during Berthing and DG sets	Dry Bulk Cargo Storage (Coal and Iron Ore Stockyards for Particulate Matter)	(Un)loading points at the berths, transfer points and truck & train loading areas	Increased vehicular activity due to normal and generated traffic on the existing external road

4.6.2.1 Point Sources

Emissions from Ships/Vessels visiting Cuddalore Port: During the operational phase, there will be an increase in the vessel traffic and hence, emissions from the vessels will also increase. The exhaust from tugs, launches, diesel operated small boats, dredgers etc. will add to pollution load during operational phase. With the increase in the number of ships and boats, their operation and movement of cargo in and out will also increase. These activities will increase the pollution load in the atmosphere. Number of ships/vessels will visit Cuddalore Port has been arrived based on the cargo handling capacity and berth occupancy. Potential sources of emissions of vessels are from the Main Engine (ME) and Auxiliary Engines (AE) and others such as boilers, emergency diesel engines and waste incinerators and emissions from are relatively very small and can be considered negligible. MEs will be used primarily for ship propulsion. Normally MEs are shut down in port. The pollutants emitted as a result of a vessel's in-port operations have been identified as a threat to the air quality. During the berthing time, the main engine of the ships will be turned off and the Auxiliary engines will be turned on to meet the auxiliary power requirement. It is assumed that the auxiliary engines will be running continuously during berthing. The vessel auxiliary engine power is assumed based on the type of cargo handled at the berth.

The anticipated emissions considered from the vessels visiting the port daily and from the diesel generator with mitigation and without mitigation are given in **Table 4-2** to **Table 4-4**.

Table 4-2: Emission details from vessels the port without mitigation

Stack Details				Emissions (g/s)			
Stack Height (m)	Stack Velocity (m/s)	Stack Dia (m)	Exit Temp (K)	PM_{10}	$PM_{2.5}$	SO_2	NO_2
18	25	0.8	593	0.077	0.029	0.702	0.429
18	25	0.8	593	0.058	0.023	0.377	0.928

Table 4-3: Emission details from vessels visiting the port with mitigation

Stack Details				Emissions (g/s)			
Stack Height (m)	Stack Velocity (m/s)	Stack Dia (m)	Exit Temp (K)	PM_{10}	$PM_{2.5}$	SO_2	NO_2
18	25	0.8	593	0.053	0.020	0.484	0.296
18	25	0.8	593	0.040	0.016	0.260	0.640

Table 4-4: Emission details from DG sets

Capacity of DG Set	Stack Details				Emissions (g/s)			
	Stack Height (m)	Stack Velocity (m/s)	Stack Dia (m)	Exit Temp (K)	PM_{10}	$PM_{2.5}$	SO_2	NO_2
320 KVA	3.6	1.2	98	740	0.002	0.001	0.300	0.650
1250 KVA	7.1	3.7	200	850	0.019	0.008	0.293	1.626
800 KVA	5.7	2.3	200	812	0.010	0.004	0.700	1.530

4.6.2.2 Area Sources

The Dry Bulk cargo such as Coal and Iron other Dry Bulk to be imported or exported are being stored at the designated stockyards in the port. The proposed storage will generate fugitive dust emissions due to wind. Due to the fugitive dust emissions from the stockpile, the dust particles will be carried by the wind and causes pollution. This would pollute other clean areas of the port. The Dry Bulk Cargo dust particles carried by the wind likely to cause dust emission in the neighbouring villages also.

The dry bulk cargo (represented in terms of coal and iron ore) handling system in the form of covered conveyer system and transfer points for the transportation from the berths to the stockyard are proposed to be provided. Since the fugitive emissions from the existing areas are considered in the baseline monitoring, the same is not considered as a part of air quality modelling for the proposed development plan. The details of likely emission from storage area with mitigation and without mitigation are given in **Table 4-5**.

Table 4-5: Emission details from Area sources

S. No.	Details of Emission	Coal Stockyard	Iron Ore Stockyard
1	Silt Content (%)	1	1
2	Storage Duration (Days)	365	365
3	PM_{10} Emissions after incorporating the control measures ($g/s/m^2$)	0.0000021	0.0000086
4	$PM_{2.5}$ Emissions after incorporating the control measures ($g/s/m^2$)	0.00000056	0.00000048

4.6.2.3 Volume Sources

Loading points to Truck/train at stockyard: Wagon loader for train loading and silos arrangement for truck loading are proposed to be provided. Loading points are likely to generate fugitive dust emissions. The covered and mechanized unloading points with dust suppression system are provided which will reduce the fugitive emissions to the minimum. Fixed cone nozzles will be installed, at regular intervals, at discharge point of shuttle conveyor on Rapid loading System. Since the fugitive emissions from the existing loading points are considered in the baseline monitoring,

the same is not considered as a part of air quality modelling for the proposed development. The details of the emissions from the proposed conveyor transfer points, unloading from ships and loading to wagon & truck at stockyards are given in **Table 4-6** to **Table 4-7** respectively.

Table 4-6: Emission details due to Conveyor Transfer Points

S. No.	Details of Emission	Transfer Points
1	No. of Transfer points	1 nos
2	Total Emission due to transfer points (kg/year)	2869.42
3	PM_{10} (70% Control with covered unloading including water sprinkling) with Control (g/s)	0.0160
4	$PM_{2.5}$ With Control (g/s)	0.0068

Table 4-7: Emission details due to unloading from ship at berths

S. No.	Details of Emission	Ship at Berth
1	Dry Bulk Handling capacity MTPA	8.54
2	Unloading Emission Factor (kg/t)	0.0025
3	Emission due to unloading points from ships (kg/year)	2500
4	PM_{10} (70% Control with covered unloading including water sprinkling) With Control	0.0750
5	$PM_{2.5}$ With Control	0.0346

Table 4-8: Emission details due to Loading by wagon loader and truck loader at stockyard

S. No.	Details of Emission	Wagon Loader	Truck Loader
1	Unloading Emission Factor (kg/t)	0.00014	
2	PM_{10} (70% Control with covered unloading including water sprinkling) With Control (g/s)	0.0422	0.01687
3	$PM_{2.5}$ With Control (g/s)	0.01608	0.0675

4.6.2.4 Line Sources

Vehicular traffic generated on NH 32 (Puducherry–Nagapattinam stretch) road due to the existing traffic and the proposed development has been considered for Air Quality Modelling. The raw materials, products/ finished goods etc. will be evacuated/ transported through the existing road network. The number of vehicle trips per day due to heavy vehicles on the above roads are estimated and has been considered for air quality modelling

The details of the emissions from 2/3 wheelers, light and heavy vehicles on the road NH 32 estimated are given in **Table 4-9**.

Table 4-9: Emission details of Vehicles

Parameter	Units	NH 32		
		2/3 Wheelers	Light	Heavy
Vehicle Trips per Day	Nos.	7326	1081	898
Emission rate of SO_2	g/s	0.0075	0.0049	0.00093
Emission rate of PM_{10}	g/s	0.0725	0.0009	0.00395
Emission rate of $PM_{2.5}$	g/s	0.0290	0.0004	0.00156
Emission rate of NOx	g/s	0.2538	0.0847	0.1506

4.6.2.5 AERMOD CLoud™

The objective of air quality modelling is to predict the possible impacts that would arise due to the proposed development in the port. The air quality modelling was undertaken using AERMOD CLoud™ which is an Integrated Graphical User Interface (GUI) of AERMOD, ISCST3, AERMAP and AERMET. The application incorporates popular U.S. EPA air dispersion models AERMOD and ISCST3 into one integrated graphical interface. AERMOD and ISCST3 models are used extensively for Environmental Impact Assessment (EIA) studies to assess air pollution concentration. ISCST3 (Industrial Source Complex Short Term) is a Gaussian plume model and is widely used to assess pollution concentration and/or deposition flux on receptors from a wide variety of sources. AERMOD is the next generation air dispersion model which incorporates planetary boundary layer concepts.

AERMOD is a regulatory steady-state plume modelling system with three separate components: AERMOD (AERMIC Dispersion Model), AERMAP (AERMOD Terrain Preprocessor), and AERMET (AERMOD Meteorological Preprocessor). The AERMOD model includes a wide range of options for modelling air quality impacts of pollution sources, making it a popular choice among the modelling community for a variety of applications.

The following are the assumptions for the air quality modelling:

- Uses Rural dispersion
- Stack-tip downwash
- Model assumes receptor on flat terrain
- Uses calms processing routine
- Uses missing data processing routine
- No exponential decay
- No Dry and Wet Depletion

The modelled predicted Ground Level Concentrations (GLCs) are compared with the NAAQS for identifying the impacts in the study area.

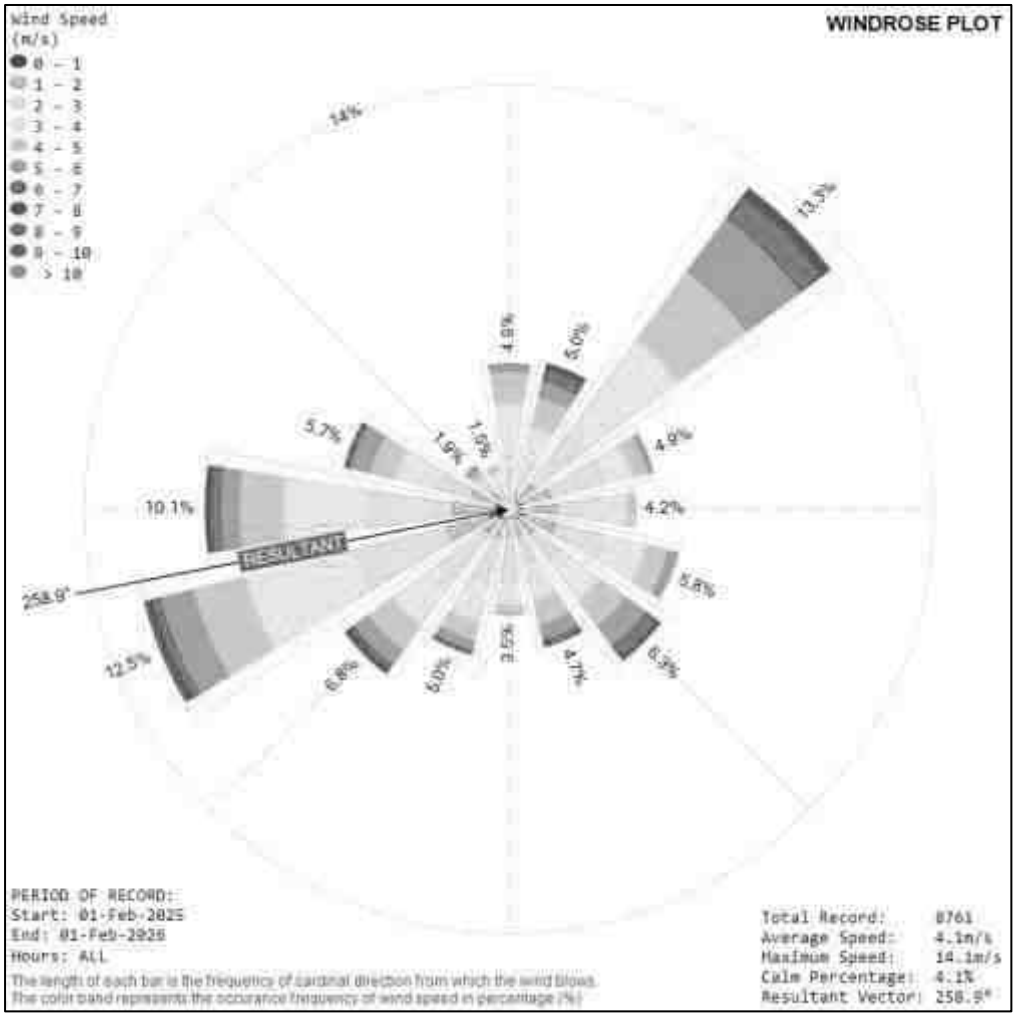
4.6.2.6 Meteorological Data

For the purpose of carrying out the air quality modelling study, site specific meteorological data AERMET Model-Ready Met Data for the Year 2025-2026 (1st Feb.2025 to 1st Feb.2026) obtained from envitrans® was used. The surface and upper air data purchased were directly used as inputs to AERMOD

4.6.2.7 Windrose Plots for Wind Speed and Direction

The wind roses were drawn for the met files obtained on an Eight-point compass (N, NE; E, SE; S, SW; W, NW;). Wind pattern representing 24 hours for the entire year Feb.25 – Feb. 26 is discussed. The frequency occurrence of wind at various speeds was calculated on the basis of total number of observations recorded in the respective wind speed category. The overall wind pattern recorded for 24 hours during the tenure is given below.

The predominant wind directions observed were, The resultant vector is 258.9°, which corresponds roughly to **West-Southwest (WSW).**The average wind speed was 4.1 m/s, with a maximum of **14.1 m/s,** and about **4.1%** of the time was calm (no significant wind).



Model Results

The 1st highest 24-hour, resultant concentration and annual average incremental concentrations for PM_{10}, $PM_{2.5}$, SO_2 and NO_2 are given in **Table 4-10** to **Table 4-14**

Table 4-10: 1st 24-hour Average and Annual Average incremental concentrations of PM_{10}

Location No.	Receptor	1st 24 Hour Average Incremental Concentration (µg/m³)	Baseline Concentration (µg/m³)	1st 24Hour-Resultant Concentration (µg/m³)	NAAQ Standards µg/m³	
					24 Hour	Annual
AAQ1	Project site	1.66	41.2	42.86	100	60
AAQ2	Sothikuppam	0.39	42.1	42.49		
AAQ3	Akkarai Gori	0.25	42.7	42.95		
AAQ4	Manjakupam	0.22	42.9	43.12		
AAQ5	Pachchyankuppam	0.18	42.4	42.58		
AAQ6	Sangakuppam	0.11	40.6	40.71		
AAQ7	Cuddalore	0.08	41.2	41.28		
AAQ8	Seddappayam	0.07	42.1	42.17		

Table 4-11: 1st 24-hour Average and Annual Average incremental concentrations of $PM_{2.5}$

Location No.	Receptor	1st 24 Hour Average Incremental Concentration (µg/m³)	Baseline Concentration (µg/m³)	1st 24Hour-Resultant Concentration (µg/m3)	NAAQ Standards µg/m³	
					24 Hour	Annual
AAQ1	Project site	0.19	24.1	24.29	60	40
AAQ2	Sothikuppam	0.15	23.7	23.85		
AAQ3	Akkarai Gori	0.12	24.8	24.92		
AAQ4	Manjakupam	0.1	24.7	24.8		
AAQ5	Pachchyankuppam	0.09	24.9	24.99		
AAQ6	Sangakuppam	0.08	24.6	24.68		
AAQ7	Cuddalore	0.08	25.9	25.98		
AAQ8	Seddappayam	0.08	28.5	28.58		

Table 4-12: 1st 24-hour Average and Annual Average incremental concentrations of SO_2

Location No.	Receptor	1st 24 Hour Average Incremental Concentration (µg/m³)	Baseline Concentration (µg/m³)	1st 24Hour-Resultant Concentration (µg/m3)	NAAQ Standards µg/m³	
					24 Hour	Annual
AAQ1	Project site	0.48	15.3	15.78	80	50
AAQ2	Sothikuppam	0.28	15.2	15.48		
AAQ3	Akkarai Gori	0.31	15.4	15.71		
AAQ4	Manjakupam	0.1	16.3	16.4		
AAQ5	Pachchyankuppam	0.22	18.2	18.42		
AAQ6	Sangakuppam	0.1	15.1	15.2		
AAQ7	Cuddalore	0.11	16.2	16.31		
AAQ8	Seddappayam	0.12	19.8	19.92		

Table 4-13: 1st 24-hour Average and Annual Average incremental concentrations of NO_2

Location No.	Receptor	1st 24 Hour Average Incremental Concentration (µg/m³)	Baseline Concentration (µg/m³)	1st 24Hour-Resultant Concentration (µg/m3)	NAAQ Standards µg/m³	
					24 Hour	Annual
AAQ1	Project site	0.98	22.4	23.38	80	40
AAQ2	Sothikuppam	0.74	22.1	22.84		
AAQ3	Akkarai Gori	0.58	23.5	24.08		
AAQ4	Manjakupam	0.36	23.2	23.56		
AAQ5	Pachchyankuppam	0.72	23.8	24.52		
AAQ6	Sangakuppam	0.62	24.6	25.22		
AAQ7	Cuddalore	0.16	26.1	26.26		
AAQ8	Seddappayam	0.52	29.1	29.62		

Table 4-14: Annual Average Incremental concentrations of PM_{10}, $PM_{2.5}$, SO_2, and NO_2

Location No.	Receptors	Annual Average incremental concentrations				NAAQ Standards (µg/m3)- Annual concentrations			
		PM_{10}	$PM_{2.5}$	$S0_2$	NO_2	PM_{10}	$PM_{2.5}$	$S0_2$	NO_2
AAQ1	Project site	1.66	0.19	0.48	0.98	**60**	**40**	**50**	**60**
AAQ2	Sothikuppam	0.39	0.15	0.28	0.74				
AAQ3	Akkarai Gori	0.25	0.12	0.31	0.58				
AAQ4	Manjakupam	0.22	0.1	0.1	0.36				

Location No.	Receptors	Annual Average incremental concentrations				NAAQ Standards (µg/m3)- Annual concentrations			
		PM_{10}	$PM_{2.5}$	SO_2	NO_2	PM_{10}	$PM_{2.5}$	SO_2	NO_2
AAQ5	Pachchyankuppam	0.18	0.09	0.22	0.72				
AAQ6	Sangakuppam	0.11	0.08	0.1	0.62				
AAQ7	Cuddalore	0.08	0.08	0.11	0.16				
AAQ8	Seddappayam	0.07	0.08	0.12	0.52				

Isopleths

The Isopleths showing 1st 24-hour average incremental concentrations of all the parameters are given in **Figure 4-5** to **Figure 4-8**.

Figure 4-5: Isopleth for 1st 24-Hr Average Incremental Concentration of PM_{10}

Figure 4-6: Isopleth for 1st 24-Hr Average Incremental Concentration of $PM_{2.5}$

Figure 4-7: Isopleth for 1st 24-Hr Average Incremental Concentration of SO_2

Figure 4-8: Isopleth for 1st 24-Hr Average Incremental Concentration of NO_2

4.6.2.8 Observations at Receptors

The 1st highest 24-hour average and incremental concentrations of PM_{10} at port site is above the standard limits of NAAQS, 2009. However,1st highest 24-hour average

and incremental concentrations of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 for remaining AAQ receptor locations are found to be well within NAAQS 2009.

4.6.3 Mitigation Measures – Operation Phase

- Cargo traffic is majorly (nearly 80%) is proposed to be handled through dedicated rail network and thus stress on road connectivity and its impact on environment will be significantly reduced.
- The vessels visiting the port are required to comply with the regulations and should have the "International Air Pollution Prevention Certificate". Cuddalore Port shall take all measures to comply exhaust emission from vessels in accordance with MARPOL regulations and Euro Emission standard norms so as to reduce pollution load in the air environment.
- The Annex VI of MARPOL Convention deals with the "Regulations for the Prevention of Air Pollution from Ships". It sets limits on NO_2 and SO_2 emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances. It also prohibits the incineration on board ships of certain products, such as contaminated packaging materials and polychlorinated biphenyls (PCBs).
- Trucks with cargo susceptible for fugitive suspension will be covered with tarpaulin. All the vehicles will be periodically checked to ensure compliance to the emission standards
- Plantation shall be considered all along the periphery of the dusty cargo handling premises.
- Mechanical dust suppression system shall be adopted from berth to storage areas.
- Vehicles are major sources of air pollution, so better maintenance of vehicles and control of vehicular emissions, as for as possible, should be achieved
- No vehicle should be allowed without proper pollution under control certificate in the port area and highly polluting vehicles (especially heavy trucks) should be avoided.
- The plantations and green belts all around the port area and also in the open area should be increased. This reduces air and noise pollution.
- Burning of waste materials should be avoided Emissions from construction operations can be reduced by wet suppression
- Ambient air quality monitoring should be further strengthened.
- Exposure or health related monitoring of sensitive population subgroups like workers and residents etc. should be conducted as a safety measure.

Mitigation measures are shown in various photographs.

Representative pictures of Wind screens, Sprinklers, canons and covering of tarpaulin cover.

4.7 Noise Environment

In sea port operation, various heavy machinery will be used. Key sources include ships, port machinery, and associated infrastructure like cranes and vehicles.

- **Ships, Vessels, Tugboats:** Engine noise, propeller cavitation, and auxiliary systems contribute to underwater and airborne noise 80-100 dB.
- **Cranes and Loaders:** Container cranes, bulk loaders, and forklifts generate mechanical noise, typically ranging from 80-100 dB.
- **Conveyor Systems:** Used for coal and iron ore handling, conveyors produce continuous noise around 75-90 dB.
- **Trucks and Trains**: Transport vehicles moving cargo within the port generate noise levels between 85-95 dB.
- **Pumps and Compressors:** Essential for port operations, these machines can produce noise in the range of 70-85 dB.

Noise generation in ports handling coal and iron ore can be categorized into line sources and point sources, each contributing to overall sound pollution.

- **Line sources** include continuous noise emitters such as trucks and trains transporting materials, conveyor belts moving coal and iron ore, and ships navigating port routes. These sources produce sustained noise along defined pathways, affecting larger areas.
- **Point sources** originate from specific locations, including cranes and loaders used for cargo handling, engines and generators powering ships and pumps and compressors used in port operations.

Identifying these noise sources is crucial for developing effective noise models and implementing mitigation strategies such as sound barriers, optimized machinery use,

and controlled operational schedules to reduce their impact on workers and nearby communities.

4.7.1 Potential Impacts due to Construction Phase

4.7.1.1 Impacts due to Port Construction Activities

Construction activities increase ambient noise levels significantly. Rise in noise levels is due to the following activities during construction phase:

- Vehicles transporting construction material.
- Unloading of construction materials from the vehicles.
- Handling of construction materials at the port site.
- Diesel run engines of construction machinery and dredgers.
- Pile driving activities during construction of cargo berths and extension of breakwaters.

As noise is an inherent part of construction activity, response of species / communities would be either attracted or diverted away from the region. Noise generated from diesel engines of dredgers, workboats, etc. could result in movement of mobile faunal species away from area of operation.

There would be a degree of avoidance behaviour (flight) exhibited by marine species initially and they would eventually be expected to return once they become acclimatized to increased noise levels or once the noise source has moved or ceased. Noise generating sources are mobile and the impact will be short-term in nature.

Noise generated from construction activities will be predominantly confined within port site and will impact construction workers at site. Impacts due to these activities would be short-term in nature and localised.

4.7.1.2 Impacts due to vibrations

During the construction activities, vibrations may be envisaged. The vibrations could be result of activities like excavation, piling, blasting (if required), movement of heavy equipment, etc.

4.7.2 Mitigation Measures – Construction Phase

The following mitigation measures will be followed to minimise the noise generation and the associated impacts.

- During construction, noise levels will be maintained below threshold levels stipulated by Central Pollution Control Board (CPCB) by selecting appropriate equipment, machinery and using enclosures. Procurement of machinery/construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A).
- Any equipment producing high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors.

- Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. The attenuation devices will be properly maintained throughout the construction period.
- High noise generating activities such as piling and drilling will be scheduled to minimise noise impacts.
- Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. especially construction personnel involved in pile driving operations. Rotation of personnel will also be adopted.
- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced, and rotating parts will be lubricated to minimise noise emissions.
- Ambient noise levels will be monitored at regular intervals during construction phase of the project.
- All haul roads (for truck transport and other vehicles) within the boundary and outside will be sealed and maintained properly to avoid excessive noise levels from Engine acceleration and deceleration.

4.7.3 Potential Impact due to Operation

During the operational phase, noise will be generated due to the operation of the generators, pumps, engines of boats and ships, cranes for handling of goods, cargo, and shipment vehicles. Noise will also be generated considerably from the repair and maintenance block, service area, cargo loading and unloading point. Activities like cargo equipment handling and gantry loading, tanker movement; periodic maintenance dredging, vehicle movement on internal road etc. will also contribute to increase in ambient noise levels.

4.7.3.1 Noise Modelling

For an approximate estimation of dispersion of noise in the ambient air from the point source, a standard mathematical model for sound wave propagation is used. The noise generated by equipment decreases with increased distance from the source due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected due to atmospheric effect or its interaction with objects in the transmission path.

4.7.3.2 Input for Model for sound wave propagation

Base Map, Point Source and Receptors:

Base maps identifying the location of the site, noise sources, receptors and other important characteristics of the surrounding area is the foremost requirement. In this study jpeg raster maps created in Google map showing the locations of the harbour and port and port backup area has been captured and imported for registering the map and setting up of the scale. The point source is the location where the earth mover equipment i.e. the point source of noise is to be operated. Since the port and harbour are contiguous to one another and the construction and operations shall

be carried out simultaneously in all of them, the machinery and other equipment / crusher shall be constituting sole source for each of the activity area. The receptors are the nearby settlements and also the point located in the port backup area where the impact of propagation of noise is to be evaluated.

Hourly noise level

Hourly nose levels observed for 24 hours at different point sources and other receptors have been observed and adopted in studies. In the present case the receptors have been selected at ten based on the activity and areas identified nearest settlements to the Harbour and Port backup area as well as at the boundary and within 1000 m. The noise levels to be generated intermittently due to running of equipment for different hours have also been incorporated. Besides this, the background level at the receptors have been entered into the corresponding windows.

Standard Values of Noise Levels of Operation Equipment

In order to assess the worst-case noise levels, a combined noise source having cumulative equivalent noise reference level of 120 dBA is considered to be located within the Harbour area.

Base maps identifying the location of the site, noise sources, receptors and other important characteristics of the surrounding area is the foremost requirement. In this study jpeg raster maps created in Google map showing the locations of the Port and its backup area has been captured and imported for registering the map and setting up of the scale. The point source is the location where the equipment i.e. the point source of noise is to be operated. Since the Port activities are contiguous to one another, the loading/unloading machinery and other equipment shall be constituting sole source for each of the activity area. The receptors are nearby settlements and the noise point sources considered near berths, loading/unloading of cargo, operation of various equipment and back up area with a range of 75 dB (A) to 100 dB (A) where the impact of propagation of noise is evaluated. Also, traffic to be generated due to port operation has been considered as line source. Cumulative source model studies have been carried out.

Hourly noise levels observed for 24 hours with different point/line sources and other receptors have been included in studies.

4.7.3.3 Model Output

The noise levels during the operation of port activities in daytime scenario without mitigation measures is shown in **Figure 4-9**and in case of adopting mitigation measures such as green belt, acoustic measures etc. is shown in **Figure 4-10**.

The noise levels during the operation of port activities in nighttime scenario without mitigation measures is shown in **Figure 4-11** and in case of adopting mitigation measures such as green belt, acoustic sheets etc is shown in **Figure 4-12**.

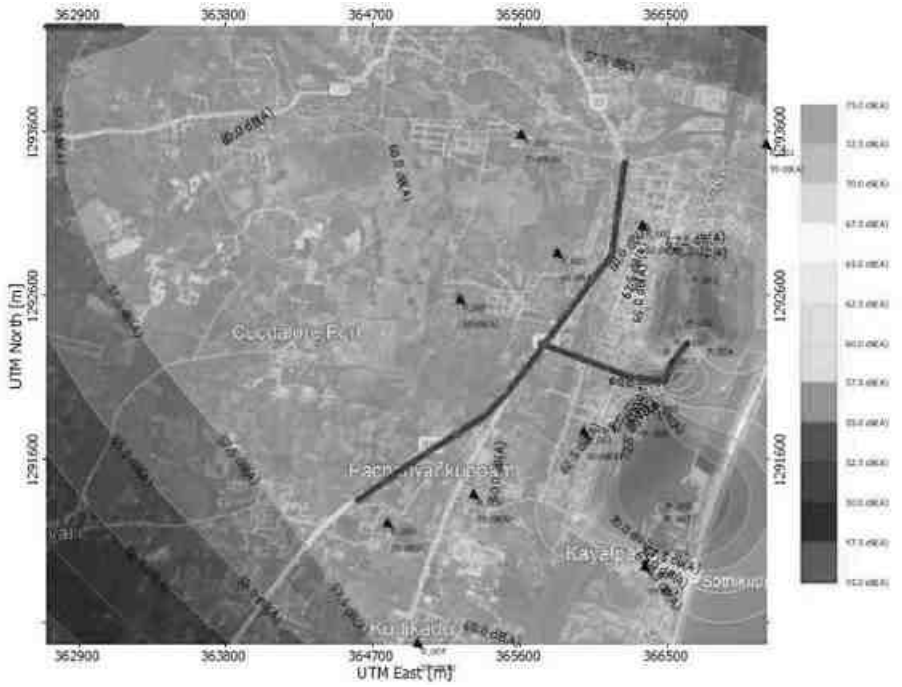


Figure 4-9: Isopleths showing noise levels during daytime (without mitigation)

Figure 4-10: Isopleths showing noise levels during daytime (with mitigation)

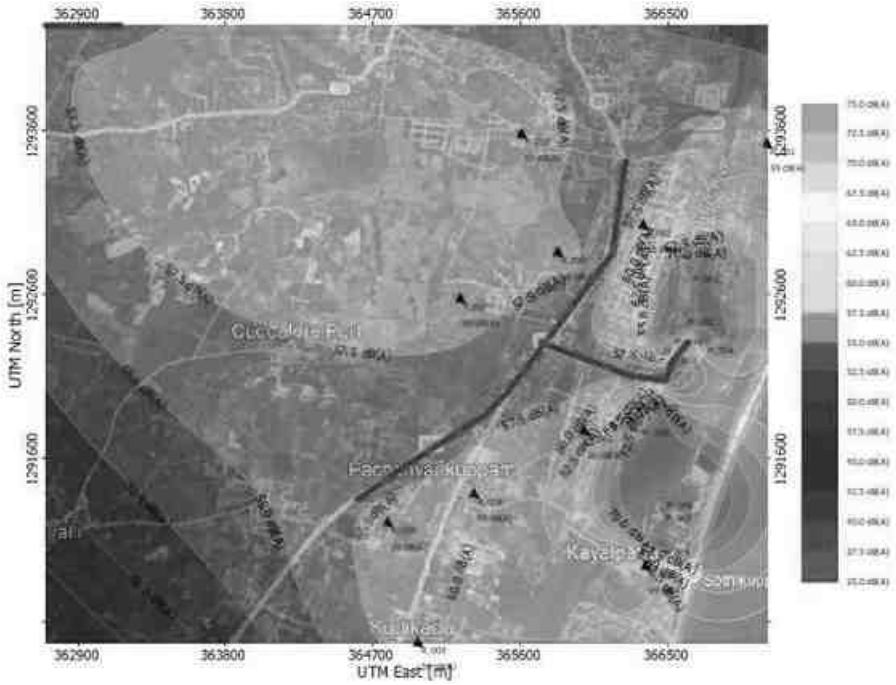


Figure 4-11: Isopleths showing noise levels during nighttime (without mitigation)

Figure 4-12: Isopleths showing noise levels during nighttime (with mitigation)

The noise levels prediction during the operation without mitigation and with mitigation measures is given in **Table 4-15** and **Table 4-16.**

Table 4-15: Summary Report for Discrete Receptor Points – Without Mitigation

S. No	Name of Receptor ID	X-Coordinate in m	Y-Coordinate in m	Predicted Level in dB(A)	Baseline in dB(A)	Resultant in dB(A)
1	R_001	367102	1293518	58.7	45	58.9
2	R_002	366351	1293024	60.1	45	60.2
3	R_003	365985	1291766	59.5	45	59.7
4	R_004	364976	1290472	58.7	45	58.9

S. No	Name of Receptor ID	X-Coordinate in m	Y-Coordinate in m	Predicted Level in dB(A)	Baseline in dB(A)	Resultant in dB(A)
5	R_005	366363	1290936	58.9	45	59.1
6	R_006	365319	1291381	59.4	45	59.6
7	R_007	365234	1292573	59.5	45	59.7
8	R_008	365607	1293578	59.1	45	59.3
9	R_009	364790	1291205	59.4	45	59.6
10	R_010	365827	1292852	59.5	45	59.7

Table 4-16: Summary Report for Discrete Receptor Points – With Mitigation

S. No	Name of Receptor ID	X-Coordinate in m	Y-Coordinate in m	Predicted Level in dB(A)	Baseline in dB(A)	Resultant in dB(A)
1	R_001	367102	1293518	52	45	52.8
2	R_002	366351	1293024	56.3	45	56.6
3	R_003	365985	1291766	52.3	45	53.1
4	R_004	364976	1290472	49.1	45	50.5
5	R_005	366363	1290936	50	45	51.2
6	R_006	365319	1291381	53.5	45	54.1
7	R_007	365234	1292573	55.3	45	55.7
8	R_008	365607	1293578	52.9	45	53.6
9	R_009	364790	1291205	54.1	45	54.6
10	R_010	365827	1292852	55.3	45	55.7

4.7.4 Mitigation Measures – Operation Phase

- The occupational noise exposure to the workers in the form of 8 hourly time weighted average will be maintained within the prescribed OSHA standard limits.
- Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. The attenuation devices will be properly maintained.
- Workers exposed to excessive noise will use appropriate Personal Protecting Equipment (PPE) including ear plugs, muffs, or both when engineering and administrative controls are not feasible to reduce exposure.
- Rotation of personnel will be adopted to minimize the exposure to high noise levels.
- Periodic maintenance of the equipment to be used will be carried out. Worn out parts will be replaced, and rotating parts will be lubricated to minimise noise emissions.
- Ambient noise levels will be monitored at regular intervals during operation phase of the project.
- Greenbelt will attenuate the increase in noise levels at landside facility.
- To ensure that all the transportation vehicles construction machinery will be periodically checked for minimal noise generation to comply Occupational Health and Safety Assessment Series (OHSAS) and ambient noise standards in the surrounding area.
- Machines, equipment and vehicles must have criteria to control noise and vibration.

- The machine and equipment likely to generate vibration shall be fixed based on the detail designing of foundation.
- The machinery equipped with latest vibration-reduction technology shall be used which will help minimise the vibrations.
- The vibration dampers shall be provided around the source of generation.

4.8 Solid Waste Management

4.8.1 Potential Impact due to Construction

Significant amounts of solid waste are expected to be generated during the construction phase. Therefore, appropriate measures must be taken to ensure the adequate disposal of this waste. The solid waste generated during construction will include debris, discarded metal items from construction utilities, spare parts, equipment, dry cells/batteries etc. Additionally, domestic waste will be produced from the temporary workers at the project site.

4.8.1.1 Mitigation Measures

- Refuse generated in the site will be collected in the dustbins and separated from the construction waste.
- Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms.
- Hazardous wastes generated at the site shall be disposed through authorized vendors duly adhering under guidelines of Hazardous and Other Wastes Rules, 2016 and its amendment.
- The burning of refuse at construction sites will be prohibited.
- Medical facilities including first aid will be available for attending to injured workers Occupational Health Construction Equipment and waste.

4.8.2 Potential impact due to Operation

The quantity of municipal solid waste generated from canteen and administrative areas is estimated at about Municipal solid waste from canteen and administrative areas during operation is estimated at about 0.06 TPD and hazardous wate is ~4.36 TPD. Used oil, spent oil, Wastes/Residue containing oil, Oil-soaked rags, Cotton waste, discarded containers, barrels & Used Battery and Sludge from STP will be collected and disposed to approved vendors and same will be continued to proposed project. Zero Waste to Landfill for non-hazardous waste and single-use plastic free port etc.

4.8.2.1 Mitigation Measures

- The collected biodegradable waste shall be subjected to composting, and the compost will be used as manure for the development of green belt within the port.
- The non-biodegradable waste like plastic shall be disposed to approved vendors.

- Hazardous waste materials should be separately collected and disposed of at the designated site. Health related monitoring should be performed on the workers who are working in bulk storage area and handling chemicals.
- Waste management facilities need to be brought to the attention of shippers and encourage them to use. The location of the treatment or disposal facilities needs to be carefully planned so as not to give rise to negative environmental impacts elsewhere, particularly in the case of garbage disposal.

Adopting mitigation techniques for reducing the pollutant concentration like green belt/plantation, conservation of water and energy etc.

4.9 General Impact Matrix

The project during construction and operational phase includes various activities like berthing facilities, offshore structures, civil construction and mechanical erection of facilities, onsite infrastructure development, backup area development, movement of barges, etc. All of these activities contribute to different types of impacts. **Table 4-1** presents the general/typical activities and its associated nature/extent of potential impacts envisaged due to the proposed port.

Table 4-1: General Impact Matrix

Activity	Degree of Impacts		Duration of Impact	
	Positive	Negative	Short Term	Long Term
CONSTRUCTION PHASE				
Site clearance		Yes		
Generation of debris		Yes	Yes	
Non-Concrete waste		Yes	Yes	
Hot Mix/Ready Mix Concrete waste		Yes	Yes	
Transportation of construction material		Yes	Yes	
Material storage		Yes	Yes	
Natural drainage		Yes	Yes	
Construction of jetty		Yes	Yes	
Overall port development/construction works		Yes	Yes	
Environmental Attributes				
Air		Yes	Yes	
Water		Yes	Yes	
Noise		Yes	Yes	
Soil		Yes	Yes	
OPERATION PHASE (Vessel/Ship movement, cargo movement by road/rail)				
Environmental Attribute				
Vessel movements (discharge of bilge, cargo residues, operational wastes, wastewater, impacts to fishing activities, etc. are likely impacts; ships/vessels calling at the port will not be permitted to dump the wastes/bilge water during the berthing period)				
Social Environment				
Increase in property Value	Yes			Yes
Employment Opportunities	Yes			Yes

Chapter 5
Analysis of Alternatives

5 Analysis of Alternatives

5.1 Site Alternatives

Current proposal is for the approval of EC & CRZ Clearance for Expansion of Cuddalore Port as per the requirement of the expansion plan including shipbuilding/repair activities shall be carried out within declared port limits.

Port expansion is proposed to handle cargo such as Coal, Cement, Fertilizers, Container, Cereals, Wood, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron ore, slag and Limestone and shipbuilding and repair facilities. Development of support infrastructure such as stacking yards, storage yards, container freight station, and internal roads. The development will be strictly restricted to approved port limits.

Development plan will consist of improvement in material handling area, cargo storage area, operational and utility area, internal connectivity, drainage, greenbelt and various utilities and amenities within the existing port which is already an integrated part of earlier approved EC and CRZ Clearance therefore the study of alternative sites is not envisaged.

Chapter 6
Environmental Monitoring Programme

6 Environmental Monitoring Programme

6.1 General

For proper implementation of the suggested Environmental Management Plan (EMP), an effective monitoring programme must be in place which is to be carried out by the project proponent. Monitoring is a mandatory task for sustainability of any developmental project and is relevant to any process of environmental assessment. When a development project introduces complex inter-relationships in the project area among people, various natural resources and other developing forces, a new environment evolves for which it becomes difficult to predict the accurate post project environmental scenario with complete assurance. Hence, post-project monitoring of critical parameters becomes essential. Monitoring results of environmental indicators gives the status of the environmental conditions and identifies the potential parameters / issues which needs observation and timely remedial intervention. The monitoring programme surrounds the following broad objectives.

- Evaluation of the effectiveness of the mitigation measures proposed in the EMP.
- Evaluation of the adequacy of the EIA
- Suggesting improvements in the EMP, if required
- Enhancing the overall environmental quality
- Statutory compliance
- Serve as a basic component of a periodic environmental regulatory auditing program for the proposed project.
- Serves as a tool to monitor and modify the mitigation measures and implementation arrangements, if any.

The project proponent shall implement an environmental monitoring program throughout the construction and operation phases. Furthermore, all significant potential impacts and corresponding mitigation measures will be closely monitored to ensure environmental sustainability and regulatory adherence.

The environmental attributes to be monitored, sampling locations and frequency of monitoring during construction and operational phases for master plan development of the project are presented in **Table 6-1** and **Table 6-2.**

6.2 Monitoring plan during Construction Phase

Table 6-1: Environmental Monitoring Programme during Construction Phase

Attributes	Parameters to be monitored	Sampling Locations	Monitoring Frequency	Methods for Sampling & Analysis	Compliance
Marine Water Quality	Physico-chemical and biological parameters	Four locations (4) • Near Entrance channel (inner	Monthly once during high tide and low tide	Water sampler (using NISKIN Sampler) and analysis by using standard methods.	Primary water quality standards. Baseline data shall also be compared.
Marine Ecology	Plankton and Benthic Communities				

Attributes	Parameters to be monitored	Sampling Locations	Monitoring Frequency	Methods for Sampling & Analysis	Compliance
Marine Sediment quality	Physico-chemical and biological parameters	approach channel) • 500 m from Entrance Channel (outer Approach Channel) • 500 m south of South break water • 500m north of north break water		Plankton net of diameter of 0.35 m, No.25 mesh size 63 micron and analysis by using standard methods. Grab Sampling and analysis by using standard methods.	
Ground water Quality	Physico-chemical and biological parameters and ground water level	Three locations (3) • Sothikuppam/Pachaiyankuppam Village, • Akkarai Gori, • Manjakupam	Once in a month during entire construction period	Grab sampling and analysis as per Bureau of Indian Standards-IS:3025	IS10500: 2012 drinking water standards for Groundwater potable water which is given as **Appendix F**
Surface water quality	Physico-chemical and biological parameters	Three locations (3) • Akkarai Gori, • Raasapettai Village, • Manjakupam	Once in a month during entire construction period	Grab sampling and analysis as per Bureau of Indian Standards-IS:3025	ISI-IS2296-1982 standards for use-based classification of surface water given as **Appendix G**
Soil	Soil texture, type, electrical conductivity, pH, infiltration, porosity, etc.	Three locations (3) • Project site/Port Site, • Panchiyankuppam Village, • Singarathope	Once in a month during entire construction period	Collection and analysis of samples as per IS 2720	Baseline monitoring data
Meteorology	Wind speed, wind direction, rainfall, temperature, humidity	Meteorological station at Cuddalore port	Hourly measurement during construction	IMD/CPCB guidance manual	_
Air Quality	All Twelve parameters as per NAAQS, 2009	Five locations (5) • Project site • Sothikuppam • Akkarai Gori	Once in a month during entire construction period	Fine Particulate Samplers for PM_{10}, $PM_{2.5}$, and Respirable	National Ambient Air Quality Standards released during

Attributes	Parameters to be monitored	Sampling Locations	Monitoring Frequency	Methods for Sampling & Analysis	Compliance
		• Manjakupam • Pachchyankuppam		Dust Sampler for SO_2 and NO_2, CO analyser/portable CO meter for CO as per standard methods.	November 2009 and given as **Appendix H**
Noise Levels	Day and night noise levels	Five locations (5) • Project site • Sothikuppam • Akkarai Gori • Manjakupam • Pachchyankuppam	Once in a month during entire construction period	Portable hand-held noise level meter.	National Ambient Noise Standards, GSR 1063 (E), 1989 given as **Appendix I**
Stack Monitoring	PM, SO_2, NO_2, NMHC (as C) and CO and CO	DG sets	Once in a month	Standard Stack emission monitoring and analysis methods	Emission limits for new diesel engine more than 800 kW for generator set
Turbidity Monitoring	Turbidity	Two locations Dredging area Harbour basin	Once in two weeks during pre-dredging, and post dredging	Standard method of marine water sampling	_
Shoreline Change Assessment	Erosion/accretion	7 km radius	Once in a year	Satellite imagery with GIS/Remote sensing techniques	-
Health Check-up camps	Spirometry, Pulse Oxymetry, Blood Test, Lung Function Test, Eye test, Physical fitness tests	Labour Camps	Once in a year during construction period	_	_

6.3 Monitoring plan during Operation phase

Map showing the environment monitoring locations is shown as **FD601.**

Table 6-2: Environmental Monitoring programme during operation phase

Attributes	Parameters to be monitored	Sampling Locations	Monitoring Frequency	Methods for Sampling & Analysis	Compliance
Marine Water Quality	Physico-chemical and biological parameters	Four locations (4) • Near Entrance channel (inner approach channel) • 500 m from Entrance Channel (outer Approach Channel) • 500 m south of South break water • 500m north of north break water	Monthly once during high tide and low tide	Water sampler (using NISKIN Sampler) and analysis by using standard methods. Plankton net of diameter of 0.35 m, No.25 mesh size 63 micron and analysis by using standard methods. Grab Sampling and analysis by using standard methods.	Primary water quality standards. Baseline data shall also be compared. Primary water quality standards for harbour water- given as **Appendix J**
Marine Ecology	Plankton and Benthic Communities				
Marine Sediment quality	Physico-chemical and biological parameters				
Ground water Quality	Physico-chemical and biological parameters and ground water level	Three locations (3) • Sothikuppam/ Pachaiyankuppam Village, • Akkarai Gori, • Manjakupam	Once in a month	Grab sampling and analysis as per Bureau of Indian Standards-IS:3025	IS10500: 2012 drinking water standards for Groundwater potable water which is given as **Appendix F**
Surface water quality	Physico-chemical and biological parameters	Three locations (3) • Akkarai Gori, • Raasapettai Village, • Manjakupam	Once in a month	Grab sampling and analysis as per Bureau of Indian Standards-IS:3025	ISI-IS2296-1982 standards for use-based classification of surface water given as **Appendix G**
Soil	Soil texture, type, electrical conductivity, pH, infiltration,	Three locations (3) • Project site/Port Site, • Panchiyankuppam Village, • Singarathope	Once in a month	Collection and analysis of samples as per IS 2720	Baseline monitoring data

Attributes	Parameters to be monitored	Sampling Locations	Monitoring Frequency	Methods for Sampling & Analysis	Compliance
	porosity, etc.				
Meteorology	Wind speed, wind direction, rainfall, temperature, humidity	Meteorological station at Cuddalore port	Hourly measurement	IMD/CPCB guidance manual	_
Air Quality	All Twelve parameters as per NAAQS, 2009 VOC and HC	Five locations (5) • Project site • Sothikuppam • Akkarai Gori • Manjakupam • Pachchyankuppam	Twice a week (24hour monitoring)	Fine Particulate Samplers for PM10, PM2.5, and Respirable Dust Sampler for SO2 and NO2, CO analyser/portable CO meter for CO as per standard methods.	National Ambient Air Quality Standards released during November 2009 and given as **Appendix H**
Noise Levels	Day and night noise levels	Five locations (5) • Project site • Sothikuppam • Akkarai Gori • Manjakupam • Pachchyankuppam	Once in a month	Portable hand-held noise level meter.	National Ambient Noise Standards, GSR 1063 (E), 1989 given as **Appendix I**
STP/ETP	Physico-chemical Parameters	• STP and ETP outlets	Once in a month	Sampling and analysis by using standard methods	STP outlet standards. General standards for discharge of Environmental Pollutants, G.S.R 422 (E) -The Environmental (Protection) Rules 1986 given as **Appendix K**
Desalination Plant	Physical, Chemical and Biological Parameters	Desalination Plant Intake and Outfall.	Once in a month for all Physical, Chemical and Biological Parameters.	Grab Sampling and analysis by using standard methods.	As per TNPCB stipulation in CTE/CTO

Attributes	Parameters to be monitored	Sampling Locations	Monitoring Frequency	Methods for Sampling & Analysis	Compliance
Shoreline Change Assessment	Erosion/accretion	7 km radius	Once in two years	Satellite imagery with GIS/Remote sensing techniques	-
Health Check-up Camps	Spirometry, Pulse Oxymetry, Blood test Lung Function test Eye test Physical fitness tests	All Employees	Once in a Year	_	_

6.4 Compliance and Reporting

- As a part of environmental monitoring programme, following compliance reports shall be submitted to TNPCB and Regional Office of MoEFCC, (as applicable): Half yearly compliance report in respect of the prior environmental clearance/PCB conditions on 1st June and 1st December of every calendar year.
- Environmental statement for the financial year ending 31st March to TNPCB on or before 30th September every year.
- Annual returns in Form 4 as per Hazardous and other Waste (Management and Transboundary movement) Rules, 2016 on or before 30th June.
- Format for maintaining records of hazardous waste, if any, in Form 3 as per Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016.
- Format for maintaining hazardous waste imported and exported, if any, in Form 10 as per Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016.
- Format for maintaining records of E-waste in Form 2 as per E-Waste (Management) Rules, 2016.
- Compliance to the Labour laws of the respective states

MCPMPL shall conduct regular monitoring of air quality, noise levels, water quality, sediment quality, biological parameters, primary conductivity, chlorophyll estimation and bacterial estimation. Monitoring during construction and operation phases will be carried out by NABL and MoEFCC accredited laboratories.

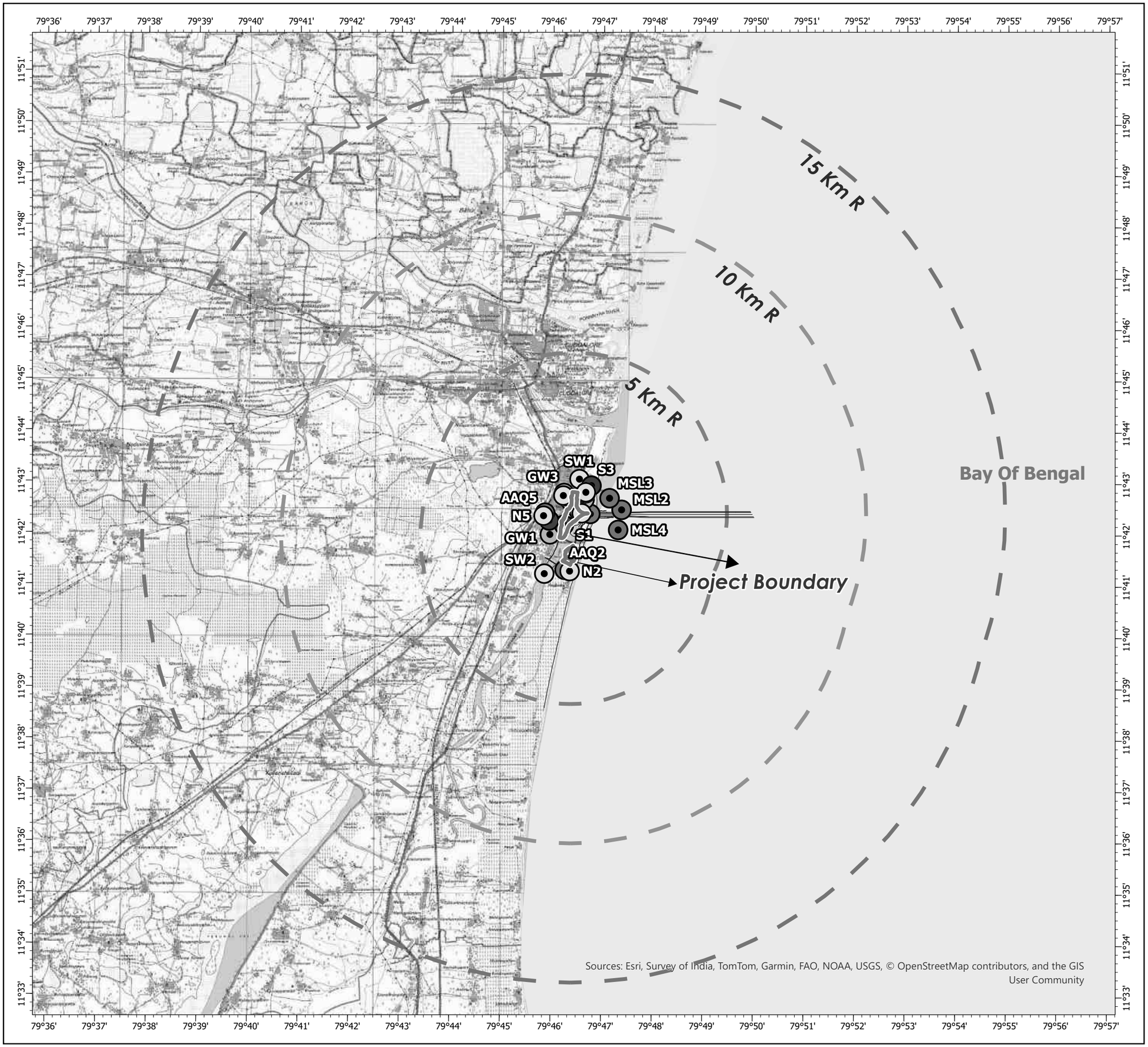
6.5 Plantation Monitoring Programme

During operation phase periodic monitoring of plantation growth, manuring, watering, pruning, and replacement will be performed in order to properly maintain vegetation, greenbelt and green cover. A green belt area of 6.15 hectares has been proposed with a total of 15375 trees to be planted.

6.6 On-Site Mock Drill Requirements

- Mock drills conducted on the job site are crucial because they teach staff members how to follow safety protocols and respond in an emergency.
- Regularly holding simulated exercises improves readiness and verifies the effectiveness of environmental and disaster management plans (DMPs).
- In the event of unforeseen occurrences like cyclones, floods, earthquakes and power breakdown, bomb threats and war alerts/terrorist attacks etc, the project proponent is required to periodically perform on-site mock exercises to guarantee effective environmental disaster management preparedness.
- Additional support from Hospitals, the police, the fire department, the fisheries department, and other departments or agencies required to offer emergency support should also be involved in mock drills. Recording the results of practice exercises is crucial since it makes it easier to make changes to the current strategy.

Figures



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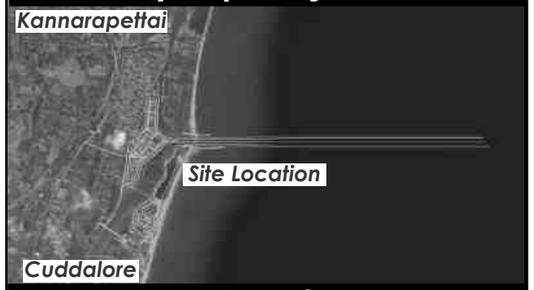
Key Map- Project Site



Legend

- Project Boundary
- 5 Km Buffer
- 10 Km Buffer
- 15 Km Buffer
- Marine water quality
- Ground water quality
- Surface water quality
- Soil
- Air
- Noise

Scale

0 2 4 8 Km

Client:

M/s. Mahathi Cuddalore Port and Maritime Private Limited

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: Monitoring plan during construction and operational phase

Project No:	C25014
Made:	KPS
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Chapter 7
Additional Studies

7 Additional Studies

7.1 Public Hearing

As per EIA Notification, 2006 and its subsequent amendments, the Ports and Harbours fall under Activity 7 (e). As proposed Cuddalore Port Expansion Plan capacity addition is > 5 MTPA, the project falls under Category A. Hence the Public hearing will be carried out as per the prevailing guidelines and procedure based on this Draft EIA report. The details of Public Hearing, queries raised, and the project proponent responses will be provided in the Final EIA/EMP report.

7.2 Risk Analysis

Risk Assessment study was carried out to assess risks associated with the Expansion Plan Development of Cuddalore Port. Risk Analysis/Assessment (RA) will help in identification of the hazards and associated risk in the unloading/loading operations and storage of hazardous chemicals. The RA thus carried out also provides inputs for formulating the onsite Disaster Management Plan (DMP). The RA can be broadly divided into three basic steps:

- Hazard Identification
- Risk Analysis
- Discussion and Recommendations/Risk Mitigation Measures

Individual Risk: The individual risk results show the geographical distribution of risk. It is the frequency at which an individual may be expected to sustain a given level of harm from the realization of specified hazards and is normally taken as risk of death (fatality). It is expressed as risk per year. This is the risk to a hypothetical individual being present at that location continuously there for 24 hours a day and 365 days a year. Individual Risk levels for worker between 1×10^{-3} and 1×10^{-6} per year will be reduced to levels as low as reasonably practicable (ALARP). Individual Risk for public between 1×10^{-4} per year to 1×10^{-6} per year will be considered to be in the ALARP region.

Societal Risk: Societal Risk is the risk experienced in a given time period by the whole group of personnel exposed, reflecting the severity of the hazard and the number of people in proximity to it. It is defined as the relationship between the frequency and the number of people suffering a given level of harm (normally taken to refer to risk of death) from the realization of the specified hazards.

7.2.1 Hazard Identification

Identification of hazards is of primary significance in the analysis, quantification and cost-effective control of accidents. Potential Hazards identified in the proposed development have been broadly classified as below:

Hazards during Construction Phase

- Mechanical Hazards
- Transportation Hazards

- Physical Hazards
- Storage and Handling of Hazardous Materials

Hazards during Operation Phase

- Material Hazards
- Handling Hazards
- Hazard for hazardous inventory (Chemicals, Lubes etc.)
- Storage Inventory Hazard
- Hazards due to Natural Calamities
- Earthquake
- Tsunami
- Cyclone
- Flood

7.2.1.1 Hazards during Construction Phase

Potential hazards during the construction phase of the project could be due to the mechanical hazards, navigation/transportation hazards, physical hazards and storage and handling of hazardous materials.

Mechanical Hazards: Mechanical hazards during the construction phase arise due to the moving parts in the machinery, especially the belts and bolts of the construction equipment, which are heavy and pose a threat to the work personnel. Other hazards include falling (during working at heights), falling objects like handheld tools, wooden shuttering, welding gas cylinders etc., failure of slips and traps created for scaffolding, and due to faulting of electrical equipment.

Transportation/Navigation Hazards: The planning of access/egress to the construction site also plays a significant role in minimizing the associated hazards such as vehicles/ barges collision.

Physical Hazards: The noise and vibrations generated during the construction phase may affect the worker's health, hinder effective communication, and may jeopardise sensitive organs. In addition to noise and vibration, hot works also pose a considerable hazard to the workers.

Storage and Handling of Hazardous Materials: During the construction period, storage of hazardous materials like fuel for the engines, lubricants, paints, and other flammable materials is likely to pose a fire and explosion risk. Due care shall be taken in locating these materials away from the workplace, free of any influence of temperature or sparks or fire. Proper wiring of the electrical appliances like lights, exhausts, etc., would be made to ensure that there are no live wires causing short circuits to ignite these materials.

7.2.1.2 Hazards during Operation Phase

The following are the cargo proposed to be handled at Cuddalore port and its storage type during the Expansion Plan development and is shown in **Table 7-1**.

Table 7-1: Cargo to be Handled and Storage Details

Cargo type	Cargo Mix	Storage Details
Multipurpose including Liquid cargo	Coal /Iron ore / limestone & other dry bulk	Open
	Fertilizers and raw materials for manufacture of fertilizer / food grains / cement / Project cargo / timber & wood / machines/ Iron steel products / Bulk/Break Bulk etc./Container	Open/Covered
	Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc.	Tank Farms etc. and Handling &Transportation by Pipeline

Material Hazards: The above-mentioned cargo/materials will be handled at the Cuddalore Port facility as a part of proposed development plan. Liquid cargo can be classified as hazardous cargo based on its characteristics such as flammability, explosiveness, toxicity or corrosiveness etc. hence these cargoes are considered for risk assessment.

In any installation, the primary hazard arises from the loss of containment during the handling of flammable and toxic chemicals. These chemicals are classified based on their properties and hazard classes, as defined by the National Fire Protection Association (NFPA).

The ratings for a large number of chemicals based on flammability, reactivity and toxicity are given in NFPA (National Fire Protection Association) Codes and Material Safety Data Sheets (MSDS).The NFPA is responsible for developing and maintaining over 704 codes and standards aimed at minimizing the risk and consequences of fire. These standards establish essential criteria for building construction, process design, equipment installation, and service operations to ensure safety and prevent fire-related incidents.

Electrical and Fire hazards

Electrical accidents are caused due to improper wiring and equipment damage. The electrical accident can lead to fire explosion when a spark contacted with flammable liquids.

Handling Hazards: Development Plan of Cuddalore Port involves handling of various materials in the form of Solid and Liquids. The hazards related to material transport and (un)loading may be due to accidents of vehicles, breaking of (un)loading arms, failure in mechanical transmission components, etc. The handling hazards include:

- Insufficient knowledge on hazardous nature of chemical in use leading to inappropriate handling of the chemical.

- Failure to use appropriate control measures and Personal Protective Equipment (PPE)
- Use of expired/worn Personal Protective Equipment (PPE)
- Failure of liquid/solid delivery tools
- Possible hazards during ship movements at the port are collision, grounding, etc.
- Likely hazards during loading and unloading of cargo.
- During ship unloading operations, the possible hazard may arise due to collision by another vessel and others.

Liquid Cargo handling: A fully mechanized ship loading/unloading system is planned at the berths. The major components of the mechanised ship loading/unloading system are marine unloading/loading arms, pipelines etc.

Ship movements/Navigation Hazards: The navigation hazards during operation phase are grounding and collision of vessels at Cuddalore Port area. However, these would be controlled by suitable vessel traffic management by Cuddalore Port.

Ship (un)loading: During ship unloading operations, the possible hazard may arise due to collision by another vessel and others.

Transfer operation: The transfer operation involves transfer of cargo through chutes/ marine (un)loading arms into Pipelines. During this operation there is a possibility of mal operation/non-synchronisation/ misalignment leading to cargo spillage.

Conveyor system: The main hazards related to belt conveyors are mechanical. Other hazards are produced by non-compliance with ergonomic principles when workers operate near the conveyor (operation station, control of the process, loading and unloading); failure or malfunction or safety-related control systems; electrical hazards; and thermal phenomena (such as heat, fire or explosion). The mechanical hazards are mostly related to:

- Mechanical power transmission components (e.g., drive shaft, reducing gears) that can cause damage by entrainment (by a belt or on nip points), crushing or entanglement (human body entangled around a rotating part) on contact with rotating components.
- Other moving components (e.g., idlers, pulleys, belt) that can cause damage by entrainment in nip points, abrasion and burns.
- Pinching zones (e.g., feeder, skirt-board, skirt-board seal) that can cause damage by shearing and crushing.
- Moving loads that can cause damage by shearing and crushing between the load and a fixed component, or an impact.
- Moving sub-assemblies (e.g., ejectors, switches, transfer mechanism) that can cause damage by shearing and crushing.

Slip and Trip Hazards: Workers performing cleaning operations are exposed to slippery working surfaces and tripping hazards. This places workers at risk of:

- Slipping off oily and greasy ladders

- Slipping and falling on oily decks
- Tripping over equipment, hoses, and vessel structures

7.2.1.3 Hazardous Material Inventories

Identification of hazards is the most important step to improve the safety of any process /operation. The hazard study is designed to identify the hazards in terms of chemicals, inventories, and vulnerable processes/operations.

Except (un)loading, transfer and storage of Liquid cargo such as petroleum products and other chemicals, no manufacturing process or reaction is involved in the operations at Cuddalore Port. The operation at the port involves transfer of various products from ships to storage tanks with the help of pumps installed at ships with the help of mechanical (un)loading arms at jetties.

The primary step in hazard analysis of any process is to know the chemical inventories and hazardous properties. Some of the important liquid cargos to be stored in the port, along with hazardous properties, are given in **Table 7-2.**

Table 7-2: Flammable and Toxic Properties of Chemicals

Cargo Name	Flammability Limits Vol %age		Details of Tank				Operating conditions	
	LEL	UEL	Capacity KL/MT/M^3	Dia (m)	Ht (m)	Type	Temp. °C	Pressure kg/cm^2/atm
Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc.	6	36	1,610,000 Kilolitres per annum	30	16	External Floating roof/internal floating roof/ Fixed roof (Dome/Cone) Pressure Vessels/ Horizontal vessels	0-160	atm+0.05 bar (g)

LEL – Lower Explosive Limit; UEL – Upper Explosive Limit

Chemical process industries and petroleum refineries use checklists as a first step in the hazard evaluation procedure. Dow and Mond Fire and Explosion Indices, which make use of past experience to develop relative ranking of hazards are also extensively used. For predictive hazard analysis, Hazard and Operability Studies (HAZOP), Fault Tree Analysis, Event Tree Analysis, Maximum Credible Accident and Consequence Analysis etc. are employed.

In the present study the following procedures are used to identify the hazards.

- Preliminary Hazard Analysis (PHA)
- Maximum Credible Accident and Consequence Analysis (MCACA), which is used for determining the damage distances

7.2.1.4 Preliminary Hazard Analysis (PHA)

A Preliminary Hazard Analysis is carried out initially to identify the major hazards associated with storages and the processes at Cuddalore Port. This is followed by consequence analysis to quantify these hazards. Finally, the vulnerable zones are plotted for which risk reducing measures are deduced and will be implemented. Preliminary Hazard analysis for Process and Storages Area details is given in **Table 7-3.**

Table 7-3: Preliminary Hazard analysis for Process and Storages Area

Equipment	Process/Operation	Potential Hazard	Provision
Marine (Un) Loading Arms/ Pipelines	Unloading of material from carrier ship and transportation of material from Jetty to Storage tanks in Tank Farm Area (TFA)	Fire & Explosion	Regular maintenance and inspection of pipelines as per OISD-124 and 140
Storage tanks	Storage of material for import and export	Fire & Explosion	Tanks design as per IS API / EN / Other International Codes & Other prevailing norms and fire protection facilities as per OISD-117, 118, 156 & 236, other international codes.

7.2.2 Natural disasters

Natural disasters are inevitable in nature. In case of natural disasters occurring at the Cuddalore port site such as Tsunami, Cyclone, Lightening, Thunders, Hurricane and Earthquake etc., no source of software exists for calculation of damage zones. However, scenarios leading to fire & explosions for line rupture; catastrophic failure of storage tanks and other equipment's can be estimated. The damage consequences will be same as domino effects (cascading effects) as one scenario will lead to initiation of another scenario of catastrophic failure of storage vessels and pipelines.

The only recommendation to avoid the maximum damage due to natural disasters is to design and construct the facility and equipment as per Indian Codes and standards, international codes and standards, best engineering practices, port early warning system and by taking maximum allowance for natural disasters into consideration.

7.2.3 Ignition sources

The pipeline route from berths/jetties to storage tanks will be provided with sufficient buffer on land, no sources of ignition are identified. However, at berthing areas where working personnel and hot surfaces such as chimney of ship, pose a threat of ignition source.

7.2.4 Risk Modelling

Risk analysis has to be carried out by considering the hazards associated with handling of various chemicals, based on nature of process and inventory. Thus, risk modelling has been carried out considering certain chemicals that are majorly used in the industries.

A chemical is called hazardous if it has characteristics like consequences for toxic vapour spread and/or is flammable and catches fire and radiates heat with damaging intensities and/or the produced vapour travel and meeting a fire source can explode causing pressure waves of damaging nature. When such hazardous chemicals leak out from its storage accidentally or due to sabotage, such consequences can be caused.

In the present case the analysis has been done by using ALOHA. Predictions has been done assuming most unfavourable meteorological conditions like wind speed of 3.6 miles/hour and stable atmospheric condition F. Three situations were modelled as mentioned below:

1. Leaking tank, chemical is not burning and forms an evaporating puddle.

- Toxic Vapours
- Flammable Area
- Overpressure

2. Leaking tank, chemical is burning and forms a pool fire.

3. BLEVE, tank explodes and chemical burns in a fireball.

Proposed bulk drug park involves handling of various solvents and chemicals considered for risk analysis are Acetone, Hexane, Methanol, Propane, Propanol, Toluene, Tetrahydrofuran and diameter 5 m and length 10 m. The selection criteria for chemicals are based on their availability as raw materials with most of the industries and their hazardous nature.

The limits of toxicity, heat radiation and pressure wave are published in various documents and Manufacture, Storage and Import of Hazardous Chemical Rules, 1989, Government of India. When such hazardous chemicals leak out from its storage accidentally or due to sabotage, such consequences can be caused.

Simulation of each identified hazardous characteristics of chemical for consequence analysis can be done by mathematical modelling if the characteristics of these chemicals are known or software. In the present case the analysis has been done by using ALOHA (Areal Locations of Hazardous Atmospheres). ALOHA is a computer program designed to model chemical releases

Damage Criteria used in the project

The hazardous categories modelled are given in **Table 7-4**.

Table 7-4: Hazard Categories modelled in ALOHA

Scenario/Source	Tank	Puddle
Vapour cloud (flash fire)	Flammable area	Flammable area
Vapour cloud (explosion)	Overpressure	Overpressure
Vapour cloud (Dispersion of Toxic vapour)	Toxic vapours	Toxic vapours
Pool fire	Thermal Radiation	Thermal Radiation
BLEVE (fireball)	Thermal Radiation	NA

A. Thermal Damage

The thermal radiation effects on people depend upon the length of time they are exposed to a specific thermal radiation level. ALOHA uses three threshold values (measured in kilowatts per square meter) to create the default threat zones:

- Red: >10 kW/ m^2. -- potentially lethal within 60 sec;
- Orange: >5 kW/ m^2 -- second-degree burns within 60 sec; and
- Yellow: >2 kW/ m^2 -- pain within 60 sec.

Longer exposure durations, even at a lower thermal radiation level, can produce serious physiological effects. The threat zones displayed by ALOHA represent thermal radiation levels of certain hazardous chemicals in the environment in case it is under fire.

B. Overpressure

This is a case of explosion due to overpressure in tank or a vapour cloud explosion when it meets a spark on the way. The threat zones are as follows:

- Red: 8.0 psi (Destruction to Buildings)
- Orange: 3.5 psi (Serious Injury Likely)
- Yellow: 1.0 psi (Shatters Glass)

C. Toxic Releases

For toxic release, there are several hazard classification systems in use. Some chemicals have not been classified in every system. ALOHA determines its default toxic Level of Concern (LOC) values based on the following:

PACs: Protective Action Criteria

This dataset combines all three common public exposure guideline systems like Acute Exposure Guideline Levels (AEGLs), the Emergency Response Planning Guidelines (ERPGs), Temporary Emergency Exposure Levels (TEELs) and Immediate Dangerous to Life or Health (IDLH). AEGLs are used preferentially, followed by ERPGs,

and then TEELs. If ALOHA is defaulting to the PAC values, it means that there are no AEGL or ERPG values in the ALOHA chemical library for that substance. In this case, the PAC values will be the TEEL values. TEELs are derived using existing LOCs and by manipulating current data. This process is less intensive than the AEGL or ERPG process, and TEELs have been defined for more than 3,000 chemicals.

1. Acute Exposure Guideline Levels (AEGLs)

Acute Exposure Guideline Levels (AEGLs) are Toxic Levels of Concern (LOCs) that is used to predict the area where a toxic gas concentration might be high enough to harm people. The guidelines define three tiered AEGLs as follows:

AEGL-1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL-2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL-3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

2. The Emergency Response Planning Guidelines (ERPGs)

The American Industrial Hygiene Association (AIHA) has issued three levels of ERPG values based on toxic effect of the chemical for use in evaluating the effects of accidental chemical releases on the general public. The Emergency Response Planning Guidelines (ERPGs) are Toxic Levels of Concern (LOCs) that is used to predict the area where a toxic gas concentration might be high enough to harm people. The ERPGs are three-tiered guidelines with one common denominator: 1-hour contact duration. Each guideline identifies the substance, its chemical and structural properties, animal toxicology data, human experience, existing exposure guidelines, the rationale behind the selected value, and a list of references.

ERPG 1: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour.

ERPG 2: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

ERPG 3: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life threatening health effects.

The most important point about the ERPGs is that they do not contain safety factors usually incorporated into exposure guidelines. Rather, they estimate how the general public would react to chemical exposure. Just below the ERPG-1, for example, most people would detect the chemical and may experience temporary mild effects. Just below the ERPG-3, on the other hand, it is estimated that the effects would be severe, although not life-threatening. The ERPG should serve as a planning tool, not a standard to protect the public.

3. Temporary Emergency Exposure Levels (TEELs)

There are three TEEL levels that are important for responders to consider:

TEEL-1: Maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient health effects or perceiving a clearly defined objectionable odour.

TEEL-2: Maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

TEEL-3: Maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing life-threatening health effects.

4. Immediate Dangerous to Life or Health (IDLH)

Immediately Dangerous to Life or Health (IDLH) level is a limit originally established for selecting respirators for use in workplaces by the National Institute for Occupational Safety and Health (NIOSH). A chemical's IDLH is an estimate of the maximum concentration in the air to which a healthy worker could be exposed without suffering permanent or escape-impairing health effects. It was recommended that appropriate respirator (as per NIOSH) be kept handy/easily available.

The IDLH was not designed to be an exposure limit for the general population. It does not take into account the greater sensitivity of some people, such as children and the elderly.

For AEGLs, ERPGs and TEELs, the rank number increase with the hazard level, so that AEGL-3 is more hazardous than AEGL-1. Typically, the “3” values are used for the most hazardous (red) threat zones because they represent the threshold concentration above which health effects may be life threatening.

7.2.4.1 Input Used for Aloha Modelling

SITE DATA:

Location: Cuddalore Port, INDIA

Wind Speed: 3.6 mph Temperature: 36.5 ^{0}C

Stability Class: F Relative humidity: 77%

Consequence Analysis for Failure Scenarios of Hazardous Chemicals

1. ETHANOL

Chemical Name: Ethanol	CAS Number: 64-17-5
Molecular Weight: 46.07 g/mol	ERPG-1: 1800 ppm
ERPG-2: 3300 ppm	IDLH: 3300 ppm
LEL: 33000 ppm	UEL: 190000 ppm
Vapour Pressure at Ambient Temperature: 0.15 atm	Ambient Boiling Point: 78.3^{0}C
Ambient Saturation Concentration: 147,997 ppm or 14.8%	
Air Temperature: 36.5° C	Wind: 3.6 miles/hour from SW at 10 meters
Relative Humidity: 77%	

Source Strength:

Leak from hole in vertical cylindrical tank	Circular Opening Diameter: 10 centimetres
Opening is 20 centimetres from tank bottom	Flammable chemical escaping from tank (not burning)
Release Duration: ALOHA limited the duration to 1-hour	Max Average Sustained Release Rate: 184 kilograms/min (averaged over a minute or more)
Total Amount Released: 6,729 kilograms	The puddle spread to a diameter of 70 meters.

PART I: TOXIC AREA OF VAPOUR CLOUD

Model Run: Heavy Gas	Yellow: 381 meters --- (1800 ppm = ERPG-1)
Orange: 276 meters --- (3300 ppm = ERPG-2)	Red: No recommended LOC value --- (N/A = ERPG-3)

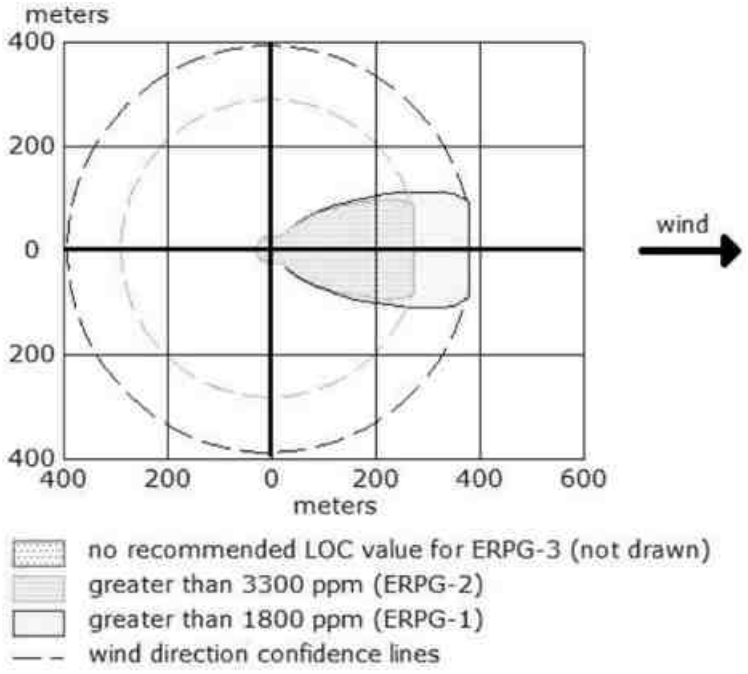


Figure 7-1: Toxic Area of Vapour Cloud-Ethanol

PART II: FLAMMABLE AREA OF VAPOR CLOUD

Model Run: Heavy Gas	Yellow: 276 meters --- (3300 ppm = 10% LEL)
Orange: 69 meters --- (33000 ppm = LEL)	Red: 99 meters --- (19800 ppm = 60% LEL = Flame Pockets)

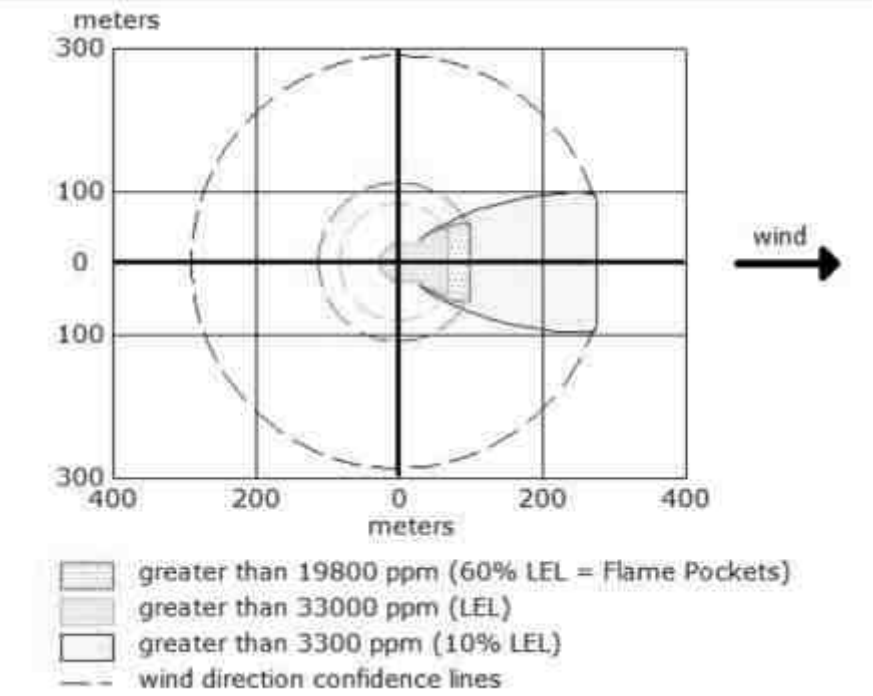


Figure 7-2: Flammable Area of Vapour Cloud-Ethanol

CASE B: LEAKING TANK, CHEMICAL IS BURING AND FORMS A POOL FIRE

THERMAL RADIATION FROM POOL FIRE

Yellow: 38 meters --- (2.0 kW/(sq m) = pain within 60 sec)	Orange: 24 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
Red: 17 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)	

SOURCE STRENGTH

Leak from hole vertical cylindrical tank	Circular Opening Diameter: 10 centimetres (Assumed)
Opening is 20 centimetres from tank bottom (assumed)	Flammable chemical is burning as it is escaping from tank
Burn Duration: ALOHA limited the duration to 1 hour	Max Burn Rate: 360 kilograms/min
Total Amount Burned: 20,850 kilograms	The puddle spread to a diameter of 16.5 meters.

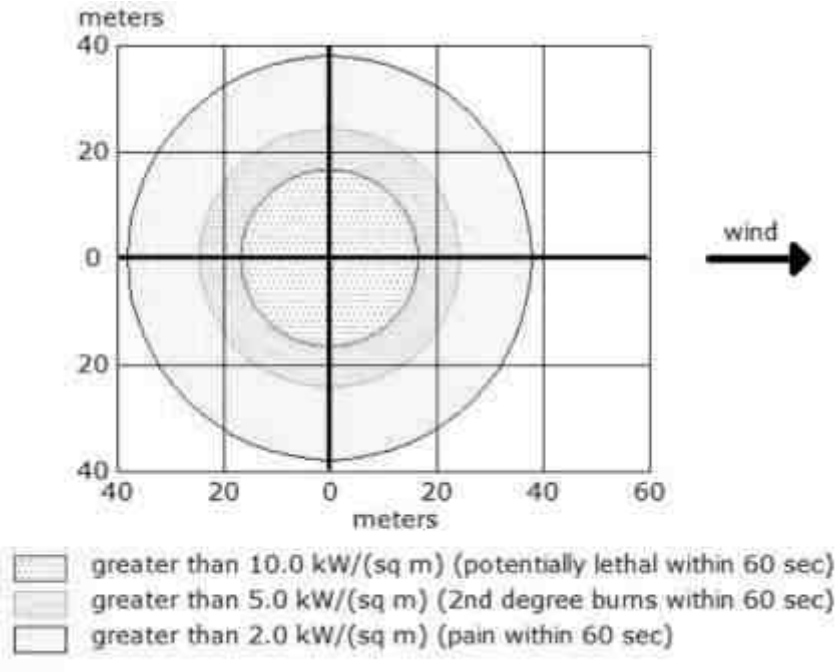


Figure 7-3: Thermal Radiation from Pool Fire-Ethanol

CASE C: BLEVE, TANK EXPLODES & CHEMICAL BURNS IN A FIREBALL

THREAT ZONE

Threat Modelled: Thermal radiation from fireball	Red: 419 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
Orange: 599 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)	Yellow: 940 meters --- (2.0 kW/(sq m) = pain within 60 sec)

SOURCE STRENGTH

Leak from hole vertical cylindrical tank	Circular Opening Diameter: 10 centimetres (Assumed)
Opening is 20 centimetres from tank bottom (assumed)	BLEVE of Flammable liquid in vertical cylindrical tank
Fireball Diameter: 268 meters	Burn Duration:16 Seconds

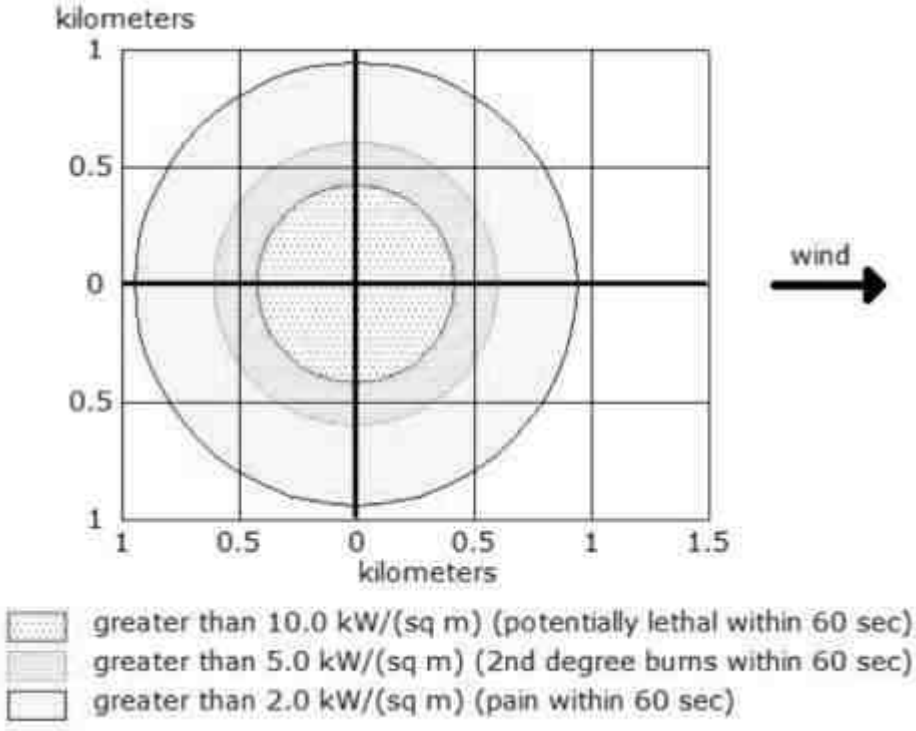


Figure 7-4: BLEVE-Ethanol

Summary of ALOHA Results – Ethanol

Situation		Affected Distance (m)		
		Red	Orange	Yellow
Leaking Tank, Chemical is not burning &forms an evaporating puddle	Toxic Area or Vapour Cloud	99	69	276
	Flammable Area or Vapour Cloud	_	276	381
	Blast: Vapour Cloud Explosion	_	_	_
Leaking Tank, Chemical is burning & forms a pool fire.	Thermal Radiation	17	24	38
BLEVE, tank explodes & Chemical burns in a fireball.	Thermal Radiation	419	599	940

2. ETHYLENE DICHLORIDE

Chemical Name: ETHYLENE DICHLORIDE	CAS Number: 107-6-2
Molecular Weight: 98.96 g/mol	ERPG-1: 50 ppm
ERPG-2: 200 ppm	IDLH: 3: 300 ppm
LEL: 45000 ppm	UEL: 160000 ppm
Vapour Pressure at Ambient Temperature: 0.18 atm	Ambient Boiling Point: 83.4^{0}C
Ambient Saturation Concentration: 177,118 ppm or 17.7%	
Air Temperature: 36.5° C	Wind: 3.6 miles/hour from SW at 10 meters
Relative Humidity: 77%	

Source Strength:

Leak from hole in vertical cylindrical tank	Circular Opening Diameter: 10 centimetres
Opening is 6.4 centimetres from tank bottom	Flammable chemical escaping from tank (not burning)
Release Duration: ALOHA limited the duration to 1-hour	Max Average Sustained Release Rate: 47 kilograms/min (averaged over a minute or more)
Total Amount Released: 2,698 kilograms	The puddle spread to a diameter of 70 meters.

PART I: TOXIC AREA OF VAPOUR CLOUD

Model Run: Heavy Gas	Yellow: 736 meters --- (50 ppm = ERPG-1)
Orange: 335 meters --- (200 ppm = ERPG-2)	Red: 269 meters --- (50 ppm = ERPG-1)

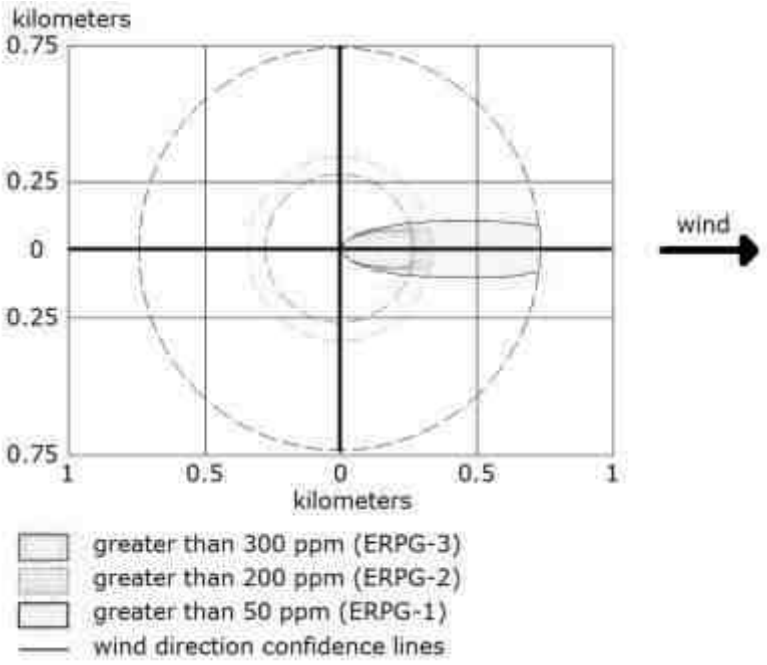


Figure 7-5: Toxic Area of Vapour Cloud- Ethylene Dichloride

PART II: FLAMMABLE AREA OF VAPOR CLOUD

Model Run: Heavy Gas	Yellow: 66 meters --- (4500 ppm = 10% LEL)
Orange: -	Red: 25 meters --- (27000 ppm = 60% LEL = Flame Pockets)

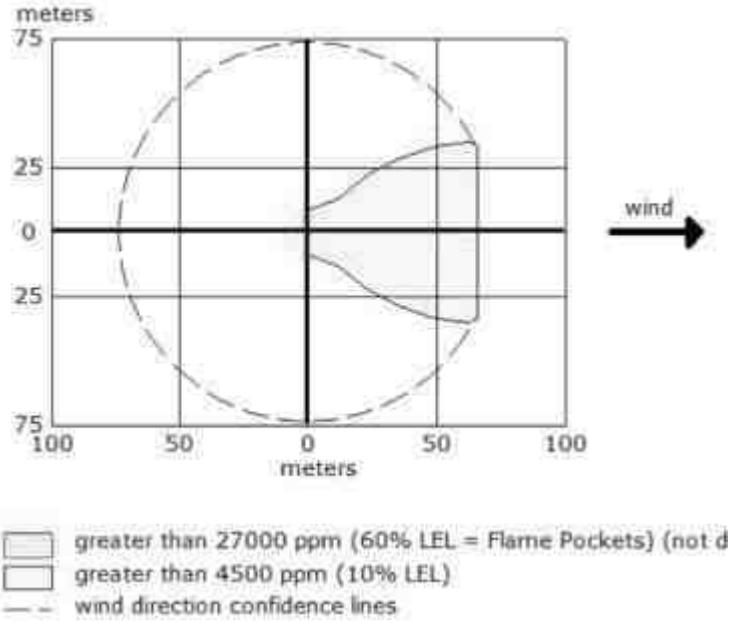


Figure 7-6: Flammable Area of Vapour Cloud- Ethylene Dichloride

CASE B: LEAKING TANK, CHEMICAL IS BURING AND FORMS A POOL FIRE

THERMAL RADIATION FROM POOL FIRE

Yellow: 21 meters --- (2.0 kW/(sq m) = pain within 60 sec)	Orange: 12 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)

Red: less than 10 meters (10.9 yards) --- (10.0 kW/(sq m)

SOURCE STRENGTH

Leak from hole vertical cylindrical tank	Circular Opening Diameter: 10 centimetres (Assumed)
Opening is 6.4 centimetres from tank bottom (assumed)	Flammable chemical is burning as it is escaping from tank
Burn Duration: ALOHA limited the duration to 22 minutes	Max Burn Rate: 252 kilograms/min
Total Amount Burned: kilograms	The puddle spread to a diameter of 13.5 meters.

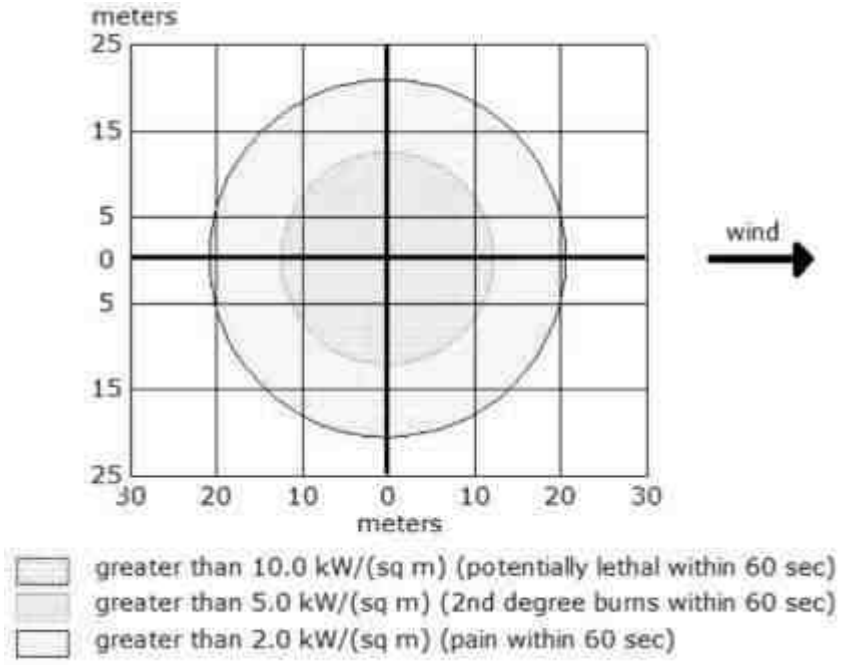


Figure 7-7: Thermal Radiation from Pool Fire - Ethylene Dichloride

CASE C: BLEVE, TANK EXPLODES & CHEMICAL BURNS IN A FIREBALL

THREAT ZONE

Threat Modelled: Thermal radiation from fireball	Yellow: 707 meters --- (2.0 kW/(sq m) = pain within 60 sec)
Orange: 438 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)	Red: 288 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)

SOURCE STRENGTH

Leak from hole vertical cylindrical tank	Circular Opening Diameter: 10 centimetres (Assumed)
Opening is 20 centimetres from tank bottom (assumed)	BLEVE of Flammable liquid in vertical cylindrical tank
Fireball Diameter: 313 meters	Burn Duration:18 Seconds
Chemical Mass in Tank: 156,963 kilograms	

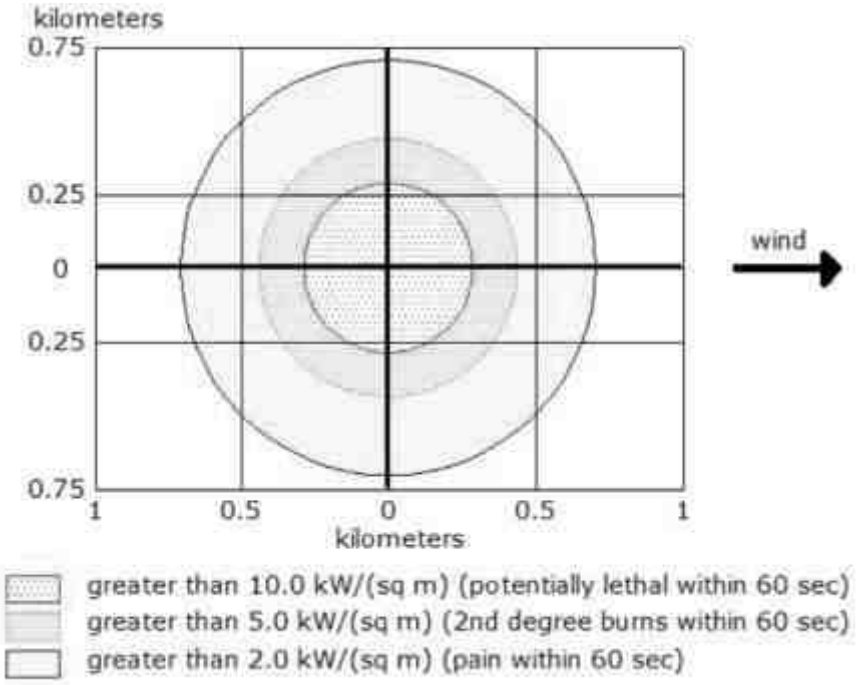


Figure 7-8: BLEVE- Ethylene Dichloride

Summary of ALOHA Results – Ethylene Dichloride

Situation		Affected Distance (m)		
		Red	Orange	Yellow
Leaking Tank, Chemical is not burning &forms an evaporating puddle	Toxic Area or Vapour Cloud	736	335	269
	Flammable Area or Vapour Cloud	25	-	66
	Blast: Vapour Cloud Explosion	-	-	-
Leaking Tank, Chemical is burning & forms a pool fire.	Thermal Radiation	10	12	21
BLEVE, tank explodes & Chemical burns in a fireball.	Thermal Radiation	288	438	707

3. METHANOL

Chemical Name: Methanol	CAS Number: 67-56-1
Molecular Weight: 32.04 g/mol	AEGL-1: 530 ppm
AEGL-2: 2100 ppm	AEGL-3: 7200 ppm
LEL: 71800 ppm	UEL: 365000 ppm
Vapour Pressure at Ambient Temperature: 0.30 atm	Ambient Boiling Point: 64.7^{0}C
Ambient Saturation Concentration: 295,896 ppm or 29.6%	
Air Temperature: 36.5° C	Wind: 3.6 miles/hour from SW at 10 meters
Relative Humidity: 77%	

Source Strength:

Leak from hole in vertical cylindrical tank	Circular Opening Diameter: 10 centimetres
Opening is 6.4 centimetres from tank bottom	Flammable chemical escaping from tank (not burning)
Release Duration: ALOHA limited the duration to 1-hour	Max Average Sustained Release Rate: 3.15 kilograms/min (averaged over a minute or more)
Total Amount Released: 126 kilograms	The puddle spread to a diameter of 9.0 meters.

PART I: TOXIC AREA OF VAPOUR CLOUD

Model Run: Heavy Gas	Yellow: 104 meters --- (530 ppm = AEGL-1 [60 min])
Orange: 50 meters --- (2100 ppm = AEGL-2 [60 min])	Red: 23 meters --- (7200 ppm = AEGL-3 [60 min])

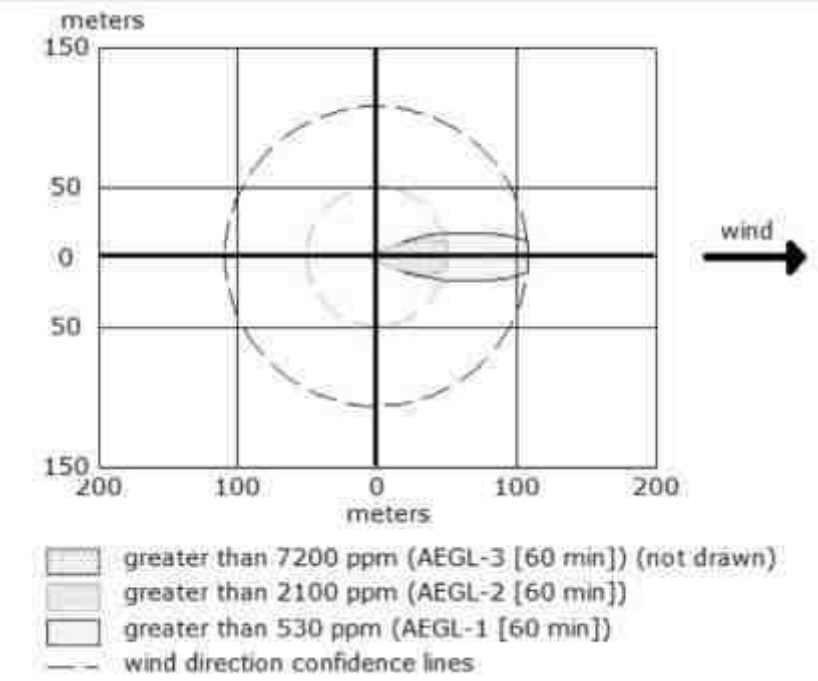


Figure 7-9: Toxic Area of Vapour Cloud- Methanol

PART II: FLAMMABLE AREA OF VAPOR CLOUD

Model Run: Heavy Gas	Yellow: 23 meters --- (7180 ppm = 10% LEL)
Orange:	Red: less than 10 meters (10.9 yards) --- (43080 ppm = 60% LEL = Flame Pockets)

CASE B: LEAKING TANK, CHEMICAL IS BURING AND FORMS A POOL FIRE

THERMAL RADIATION FROM POOL FIRE

Yellow: less than 10 meters (10.9 yards) --- (2.0 kW/(sq m)	Orange: less than 10 meters (10.9 yards) --- (5.0 kW/(sq m)
Red: less than 10 meters(10.9 yards) --- (10.0 kW/(sq m)	

SOURCE STRENGTH

Leak from hole vertical cylindrical tank	Circular Opening Diameter: 10 centimetres (Assumed)
Opening is 20 centimetres from tank bottom (assumed)	Flammable chemical is burning as it is escaping from tank
Burn Duration: ALOHA limited the duration to 1 minutes	Max Burn Rate: 6.27 kilograms/min
Total Amount Burned: 353 kilograms	The puddle spread to a diameter of 2.8 meters.

CASE C: BLEVE, TANK EXPLODES & CHEMICAL BURNS IN A FIREBALL

THREAT ZONE

Threat Modelled: Thermal radiation from fireball	Yellow: 811 meters --- (2.0 kW/(sq m) = pain within 60 sec)

Orange: 514 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)	Red: 354 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)

SOURCE STRENGTH

Leak from hole vertical cylindrical tank	Circular Opening Diameter: 10 centimetres (Assumed)
Opening is 20 centimetres from tank bottom (assumed)	BLEVE of Flammable liquid in vertical cylindrical tank
Fireball Diameter: 267 meters	Burn Duration: 16 Seconds
Chemical Mass in Tank: 97,847 kilograms	

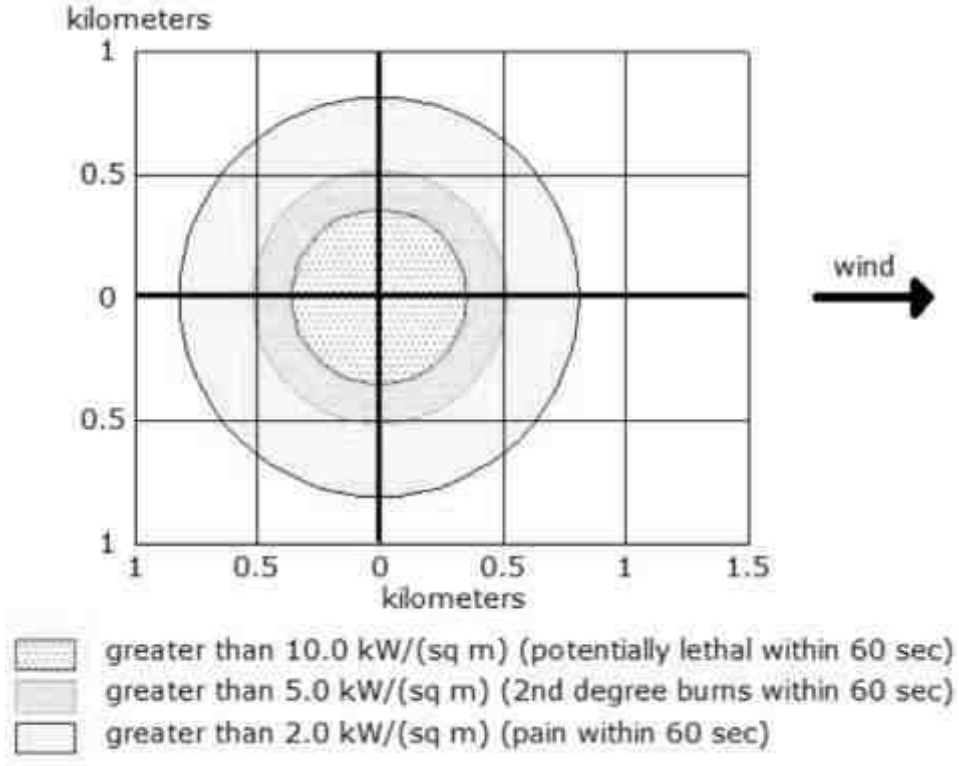


Figure 7-10: BLEVE- Methanol

Summary of ALOHA Results – Methanol

Situation		Affected Distance (m)		
		Red	Orange	Yellow
Leaking Tank, Chemical is not burning &forms an evaporating puddle	Toxic Area or Vapour Cloud	23	50	104
	Flammable Area or Vapour Cloud	10	-	23
	Blast: Vapour Cloud Explosion	-	-	-
Leaking Tank, Chemical is burning & forms a pool fire.	Thermal Radiation	-	-	-
BLEVE, tank explodes & Chemical burns in a fireball.	Thermal Radiation	354	514	811

4. High Speed Deiseal

Chemical Name: High Speed Deiseal	Molecular Weight: 200.00 g/mol
Vapour Pressure at Ambient Temperature: atmospheres (atm)	Ambient Boiling Point: 220^{0}C
LEL: 6000 ppm	UEL: 65000 ppm
Ambient Saturation Concentration: 56.3 ppm or 0.0056%	
Air Temperature: 36.5° C	Wind: 3.6 miles/hour from SW at 10 meters

Relative Humidity: 77%	

Overpressure Damage Distances for 18inch HSD (High Speed Diesel) Pipeline with 10cm leak have Overpressure Distance for 0.03 Bar - 83 m, for 0.1 Bar - 29 m and 0.3 Bar - 13 m

Overpressure Damage Distances (OPDD) for Tank Farm Area (TFA) with Catastrophic rupture of the Tank have Overpressure Distance for 0.03 Bar - 128 m, for 0.1 Bar - 45 m and 0.3 Bar – 21 m.

Heat Radiation Damage Distances (HRDD) for Tank Farm Area (TFA) with 10cm leak have Heat Flux Damage Distance for 4.0 kW/m^2 – 415 m and for 12.5 kW/m^2 – 212m.

7.2.5 Summary of Impact Distances (in m) for various Hazardous Situations

Summary of Impact Distances (in m) for various Hazardous Situations is given in **Table 7-5** and Representative damage distances are shown in **RD001** to **RD008**.

Table 7-5: Summary of Impact Distances (in m) for various Hazardous Situations

Situation	Consequences	Ethanol			Ethylene Dichloride			METHANOL			HSD		
		Red	Orange	Yellow	Red	Orange	Yellow	Red	Orange	Yellow	Red	Orange	Yellow
Leaking Tank, Chemical is not burning & forms an evaporating puddle	Toxic Area of Vapour Cloud	99	69	276	736	335	269	23	50	104	-	-	-
	Flammable Area of Vapour Cloud	–	276	381	25	-	66	10	-	23	-	-	-
	Blast: Vapour Cloud Explosion	–	–	–	-	-	-	-	-	-	-	-	-
Leaking Tank, Chemical is burning & forms a pool fire.	Thermal Radiation	17	24	38	10	12	21	-	-	-	212	415	-
BLEVE, tank explodes & Chemical burns in a fireball.	Thermal Radiation	419	599	940	288	438	707	354	514	811	21	45	128

7.2.5.1 Hazards and Mitigation Measures due to Port Activities

Details of Anticipated Risks with Proposed activities are given below

Anticipated Risks

- Emissions of NO_2, SO_2, and odour into the air.
- Contamination of water resources
- Soil contamination

Proposed Risk Reduction Measures

- Wind indicator should be provided at the highest level of the plant to know the wind direction.
- Automatic sprinkler system for the flammable material tanks (over ground tanks only) may be provided as knock on effect in case of fire is possible.
- Containment dykes with proper sloping and collection sumps should be provided
- Inspection of the storage tanks as per prefixed inspection schedule for thickness measurement, joint and weld efficiency etc.
- Provision of flameproof electrical fittings / equipment's.
- Strict enforcement of no smoking.
- Periodic training and refresher courses to train the staff in safety fire fighting.
- Emergency drills should be carried out periodically to ensure preparedness must continue.
- Many operations involve use of highly toxic/flammable materials and these needs to be documented as SOPs. These must be made and kept updated on priority.
- A fire alarm system (heat and smoke detection) should be provided for the storage area where the material is stored as toxic fumes arise on combustion.
- Adequate number of caution boards highlighting the hazards of chemicals should be provided at critical locations.
- Monitoring of occupational hazards like noise, ventilation, chemical exposure etc. is carried out regularly and its record is maintained.
- Good housekeeping, use of PPE, Engineering controls, Enclosure processes, scrubber system, display of safety boards, SOP of loading / unloading, local exhaust ventilation, safety shower etc. are important safety measures have taken to keep these chemicals within TLV.
- Water storage of adequate capacity to meet the requirements of water for firefighting purposes.
- Fire hydrants and automatic sprinkler system. Diesel driven pumps and headers to supply water to fire hydrant network.
- Adequate Portable fire extinguishers, sand bucket, wheeled fire & safety equipment should be provided at the required places.
- Equipment required for personal safety like blankets, gloves, apron, gum boots, face mask helmets, safety belts, first aid boxes etc. are provided.

SOP's with DO'S and DONT'S for Handling of Chemicals, Material Handling and Fire Prevention shall be prepared and made familiar to the employees.

7.3 Disaster Management Plan (DMP)

The Disaster Management Plan (DMP) for Cuddalore port shall be devised to match the requirements of port activities Plan. The disaster management plan mainly deals with continuous and integrated process of planning, organising, coordinating and implementing measures for

- Prevention of danger or threat and loss of life
- Mitigation or reduction of risk of any disaster or its severity or consequences
- Capacity building
- Preparedness to deal with any disaster.
- Prompt response to any threatening disaster situation or disaster.
- Assessing the severity of magnitude of effect of every disaster
- Evacuation rescue and relief
- Rehabilitation and reconstruction
- Continuity of business during the crisis
- Return of normal working after the crisis
- Plan also delegates specific assignments to available manpower with a view to avoid over-lapping of activities between various groups

The key objectives of the plan are:

- Provide the framework for an integrated multi-agency crisis response to a significant disaster incident within the Cuddalore Port.
- Clarify specific roles and responsibilities
- Port community preparedness for any emergency incident
- Provide members of the port community affected by a significant emergency incident with
  - Timely advice
  - Safest possible environment during the resolution of the incident
  - Reduce the adverse impacts of an emergency incident on personal, business and the general port community
  - Provide a management framework for the sub plans and associated specific response plan
  - Provide continued education review and testing

7.3.1 Causes of Disaster

Disaster arising from human activities and shipping incidents.

- Handling and storage of dangerous goods
- Collision of ships
- Grounding of ships
- Sinking of ships
- Oil spillage

Disaster due to natural calamities

- Cyclones
- Floods

- Earthquakes
- Tsunami
- Others
- Sabotage/Social disorder.
- Contamination of food/water
- Structural failures

7.3.2 Preliminary DMP of Cuddalore Port

The preliminary emergency response plan is created for Cuddalore port with an aim of providing management plan for any crisis with minimum possible impact to the human lives, society and the organization as a whole. This plan is to outline the measures that must be put in place to deal with any emergency that may arise at the port area. These guidelines enable personnel to react promptly and effectively to an emergency incident with the Port Area or to natural calamities such as earthquakes, cyclones or tsunamis. Cuddalore Port aims to achieve this through systematic process, efficient training, mock drills and practicing the right full emergency procedures.

The Disaster Management Plan has three essential elements namely Preparedness, Execution and Rehabilitation which cover the following concepts.

Preparedness	Execution	Rehabilitation
• Crisis Management Team. • Emergency Response Team • Mock Drills Training & Practices. • Inventory of human resources. • Inventory of materials resources. • Communication Systems. • Medical arrangements. • Preparation of contingency plans for anticipated emergencies. • Identifying vulnerable areas. • Co Ordination with external agencies. • Transport facilities.	• Activating Crisis management & Emergency Response Team. • Implementing Contingencies as per plan. • Issuing updated warning. • Provision Of medical assistances. • Resource mobilization. • Providing Administrative support. • Organizing external assistances. • Record activities.	• Restoring essential services. • Providing Relief Centers. • Engaging agencies on insurance, salvage & investigation. • Victim relief and benefits. • Construction of new centers (If needed). • Identifying & clearing wastages. • Record activities.

This response plan will identify what needs to be done during various situations and how it needs to be done.

7.3.2.1 Classification of Emergencies

Different types of emergencies that may arise at port can be broadly classified as:

Category 1: Incident

An emergency condition - possibly involving first aid injury or damage to the facility - which can be handled by local resources.

Category 2: Accident

An emergency condition involving serious injury or damage to one of the facilities, which can be handled effectively using resources available in the Port Area.

Category 3: Major Accident

An emergency condition - involving fatalities, serious injuries and/or major damage to the facilities beyond the resources available in the Port Area and requiring mutual aid from other facilities.

Category 4: Crisis & Natural Calamities

An emergency condition - escalate beyond the port and other immediate resources of mutual aid, thus requiring activation of the district crisis management plan involving the civil authorities. Natural Calamities are Emergency occurrences caused by natural phenomena, such as an earthquake, cyclone, Flood, Tsunami and Bomb or terrorist threat.

Among these four Categories, Categories 1, 2 and 3 are considered as Emergencies while Category 4 is considered as Disaster.

7.3.2.2 Identification of Potential Risks/ Emergencies

The emergency situations, besides natural / man-made calamities, which have potential to cause serious injuries or loss of lives, damage to property and serious disruption inside and outside the organization or to environment, have been identified as fire, explosion and toxic/corrosive liquid release due to following locations / reasons – apart from physical common hazards e.g., fall from height, electrocution, fall of material, drowning etc. The main risks/emergencies identified at port are given in **Table 7-6**.

Table 7-6: Main risks as identified in the operational risk assessment of Cuddalore Port

Risk/Emergencies	Category	likelihood	Consequence	Mitigation	Precautions
Incident / Accident during Routine Operations	1/2/3	Medium	Injury to personnel at times leading to loss of life, Property damage.	Safe working Practices. Standard Operating Procedures, Medical facilities.	Frequent awareness creation is a must
Ship collision and grounding	2 / 3	Low	Damage to hull	Anchorage 3 km from port. Pilotage/tugs, buoyed channel, Navigational aids& HPU.	One movement carried out at a time. Ensuring well maintained tugs are available for shipping

Risk/Emergencies	Category	likelihood	Consequence	Mitigation	Precautions
					movements. Traffic monitored by MCT. HPU useful in poor visibility
Vessel hitting while passing breakwaters	2	Low	Damage to vessel	Stern tug made fast prior entering breakwater. Appropriate speed. Channel marking, leading lights	Stop movements in case of inclement weather conditions.
Fire in coal yard	2	Medium	Damage to cargo and installation	Fixed Firefighting system. Sprinkling of water frequently.	Constant cargo monitoring to be done.
Fire in admin block	2 / 3	Low	Damage to structure, loss of life& assets	Fixed, Automated Firefighting system and evacuation plan.	Periodical maintenance& training to be done
Fire in warehouses	2 / 3	Low	Damage to structure, loss of life & assets.	Fixed, Firefighting system and evacuation plan	Periodical maintenance & training to be done
Fire in Sub-Station /Other building structures	2 / 3	Low	Damage to structure, loss of life & assets	Fixed & Portable Firefighting system.	Periodical maintenance& training to be done
Fire on board vessel	2/3	Low/ med	Main risk to v/l. Possible spread of fire to shore.	Ship crew fight fire with ships facility. Shore Firefighting facilities and tugs augment.	Remove vessel from berth depending on circumstances
Fire in Tank farm	2 / 3 / 4	Low	Damage to structure, Environmental pollution & loss on assets.	Fixed, Firefighting system.	Periodical maintenance & continuous monitoring to be done.
Fire in mobile transport	2/3/4	Low	Damage to equipment, loss of life & assets.	First aid firefighting equipment/ Mobile fire tender	Isolating affected transport& training
Oil spill from Vessel	2/3	Low	Water Pollution and Possible Fire Hazard of	Standard operating procedures. checklist prior operation,	Oil spill cleaning equipment kept in readiness during liquid

Risk/Emergencies	Category	likelihood	Consequence	Mitigation	Precautions
			spilled oil/vapour	Double hull construction, high level arms. Constant monitoring	cargo operations.
Vessel's Mooring failure at berth.	2	Low	Damage to vessels /Jetty	Weather monitored round the clock. Tugs assisting at such times	Can occur during storm conditions. Vessel put out to sea on approach of cyclone. Follow the safe mooring practices.
Bomb / Terrorist Threat	4	Low	Damage to Installation, Fire, Injury / loss of life	Pass system, Security check at gate. Security Plan. Boundary wall, CCTV access control.	Port Facility security Plan
Sabotage / Civil Disturbance / Riots.	3/4	Low to Med	Damage to Property. Loss of business hrs/ Fire. Injury / loss of life	Port security. Police station inside port premises. Access control	Port Facility security Plan
Cyclone	2 to 4 depends on damage	Low to Med	Damage to Property. Risk for vessels in port. Cargo loss	Emergency preparedness. Early warning from Meteorological centre.	Training on evacuation.
Flood	2 to 4 depends on damage	Low	Damage to Property. Loss of Life	Emergency Preparedness. Early Warning from Meteorological Centre	Training on Evacuation
Tsunami	2 to 4 depends on damage	Low	Damage to Property. Loss of life, Risk for vessels in port	Emergency Preparedness. Early warning from Tsunami warning centre.	Training on evacuation
Earthquake	2 to 4 depends on damage	Low	Damage to Property. Loss of life.	Emergency Preparedness. Nominate Assembly points clear of buildings.	Training on evacuation
Epidemic Breakout	Depends on severity.	Low	Possible loss of life. Permanent disability	Emergency medical preparedness. Medical aid centre in port.	Training on prevention methods/ periodical inspection by medical team

Risk/Emergencies	Category	likelihood	Consequence	Mitigation	Precautions
				Awareness of medical facilities & nearby hospitals.	

7.3.3 Port facilities for Emergency Management

7.3.3.1 Roles & Responsibilities

In the event of an emergency that exceeds the capacity of immediate resources and necessitates the activation of the emergency response plan, the Emergency Command System will be implemented. The roles and responsibilities of key personnel at Cuddalore port are given below.

Emergency Organizations and Functions

The organizational set-up necessary for chain of commands during emergency situation, which may arise in the premises. Industry will have environment management cell headed by a senior manager supported by managers and other supporting staff which shall perform the following functions:

- Achieve objectives of the 'Environment Protection Policy' of the management
- Collect information from regular monitoring and create a database
- Analyze the data and decide thrust area
- Based on the data collected, decide target for each thrust area
- Discuss the reports of study on environment and disseminate the information
- Work out 'Action plan' for implementation of the recommendations made in the reports
- Prepare Management Information System (MIS) reports and budget for environment management program

Generic hierarchy of Environment Management Cell is shown in Figure 7.5

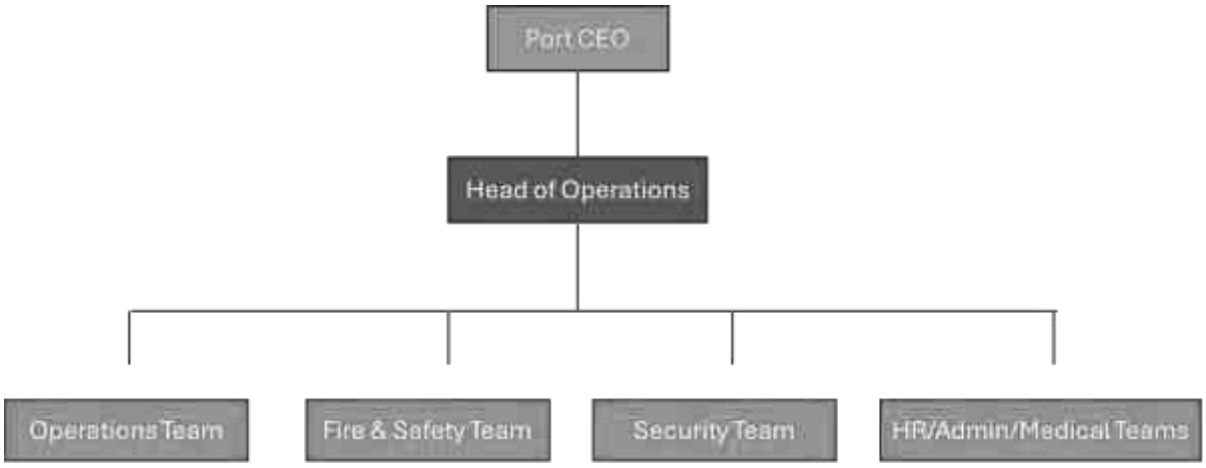


Figure 7-11: Organizational Set-up

The primary role of the emergency response organization in an emergency shall be:

- Determine the degree to which the emergency response organization shall be activated.
- Determine extent of actual action required, organize and render assistance to Site Incident Controller.
- Coordinate with all other concerned.

7.3.3.2 Firefighting Equipment

The list of some of the firefighting equipment stored at Fire Station includes Multi-Purpose Fire Tender, Fire Hydrants (Single & Dual Headed), Monitors, Manual Sprinklers, Fire Hose Reels, Sand Buckets, Portable Fire Extinguishers (CO_2, DCP & Foam), Fire pump House, Fire water gel blanket, SCBAs, Fire Entry Suits etc.

7.3.4 Emergency Standard Operating Procedures (SOP) for Evacuation

Scope

This SOP is for evacuating both the human beings as well as the material asset of the port, intended to provide the essential guidelines to employees for safe, efficient and expeditious evacuation.

Need for Evacuation

The need for evacuation can arise due to anyone or more of the following.

- Natural Crisis
- Manmade Crisis
- On Management Requirements.

Either actual or simulated, the procedure to be followed or actions taken will be the same as specified in succeeding paragraphs.

The measures to be taken and decisions depend upon the intensity of the emergency. It can be minor, major or serious. The responsibility on decision lies with the Incident Commander, Head of Port, in his absence Head -Marine.

The emergency may take place during normal working hrs, Shift Hrs or on operational hrs. Actions list in this SOP have all the contingencies, taken into consideration of the personnel present in certain situation.

Emergency Reporting

- The Emergency could come to notice as a result of one or more of the following reason and response action will be as followed.
- The magnitude of emergency may be so large like earthquake or an explosion, that everyone becomes aware of it instantly.
- Emergency which is noticed by one or more employees or port users and invariably intimated to Port Fire & Safety department.
- The person informing Fire & Safety department about the emergency will give the location, time and brief description of the emergency.

- The person on the duty at Fire & Safety department will immediately get the approval either from HOD fire safety or the next in hierarchy to initiate primary alarm or evacuation procedures

Raising an Alarm

The need to raise general or local alarm will be decided by Head Port/Head marine. The alarm can be raised in the following manner.

- Emergency Siren
- Public addressing system.
- Manual alert. *Normally can be avoided since human voice is not likely audible in any emergency like situation.
- Hand Siren may be operated by Fire & Safety department as and when required.

Action Team Mobilization

- In normal working hours during emergency Head Port in his absence Head - marine will take over as Incident Commander. He will pass the Emergency / Evacuation instructions to the Fire & Safety department.
- All HOD's and the emergency services like Fire & Safety, Security & Port Medical Facilities through the relay message from Fire & Safety will report to Incident Commander.
- The zone wise on scene commanders shall assume their respective roles as per the laid down procedure and will report to Incident Commander.
- The Emergency Response Team of the respective zones will report to their respective on scene commander.
- In case of Bomb threat or other security threats may be routed through security department instead of Fire & Safety department.
- Simultaneously all offshore emergencies will be channelized through POC.

Immediate Action & Evacuation

When the decision has been taken to either evacuate the entire port or part of it the following actions will be taken immediately through emergency control centre.

- Inform the local police station, fire station and hospitals.
- Inform to any other local body deemed a necessity
- Disable all the elevators.
- Switch off the electric mains
- Strict control at the exits to enable effective enforcements of the rescue teams.
- Try to control the cause of the emergency, not to take risk on lives.
- Interact with the neighbouring units in any mutual aid plan is being rehearsed.
- Other than the designated emergency response team and emergency services team, rest all to be evacuated.
- Decision to be taken to displace tankers and other potential hazardous vehicle to safer area.
- Proper head counts to be taken and tally with the attendance of the day (HR functionary).

- Decision will be taken to evacuate even the ERT team and the emergency services team in case the situation goes beyond the control.

General guidelines to the Employees/ Contractors

- Do not panic and create panic situation.
- Do not crowd the areas
- Do not engage phones and other communication channels unnecessarily.
- Guide the visitors, guests and women to reach the safe assembly point.
- Do not spread rumours.
- Act as per guidelines provided and practiced.
- Do not enter/run in the area where the emergency team is being engaged.
- Assemble at nearest assembly point

The DMP do recognise the continuous improvement of different strengths and capacities that different groups use to prepare for, cope with and respond to a disaster and DMP shall be revised periodically by improving, strengthening and upgrading the approach (including facilities) and adding new dimensions to be more useful and effective in addressing the difficult challenges of disaster risk reduction requirements of proposed development.

7.3.5 Training

All and selective personnel in the port area shall be fully conversant with the safety procedures and trained in numerous training methods as follows

- Basic fire safety and rescue
- Basic life safety and first aid
- Emergency Response Training
- Advanced fire safety training
- Walkie-Talkie (communication Training)
- Mock Drills
- Mechanical & electrical safety and
- Safety induction to all Port users.

7.3.5.1 Emergency Response Team's Training

Emergency Response Team at port will go through the following training schedules:

- Fire fighting
- Medical Emergency
- Bomb or other security threats
- Flood Risk Management
- Oil Spill Response
- Other Crisis.

7.3.5.2 Drills & Exercises

Drills &Exercises shall be conducted as per schedule, which shall include realistic scenarios for the above-mentioned emergencies. The drill & exercises record to be maintained by Fire & Safety Department.

7.3.6 Mutual Aid

A mutual aid system shall be in place with the companies operating at present in Cuddalore port area. In the event of a major incident at category 3 level and above the management shall call upon other companies in the area to render assistance within their resources and make them available as required. Similarly, Cuddalore port shall reciprocate with its own equipment and personnel in the event of an incident at another facility in the area and when called upon.

7.3.7 Tentative Evacuation plan for Emergency and Assembly Points

Cuddalore port layout showing emergency escape route and assembly points for Port are given in **Figure 7-12**.

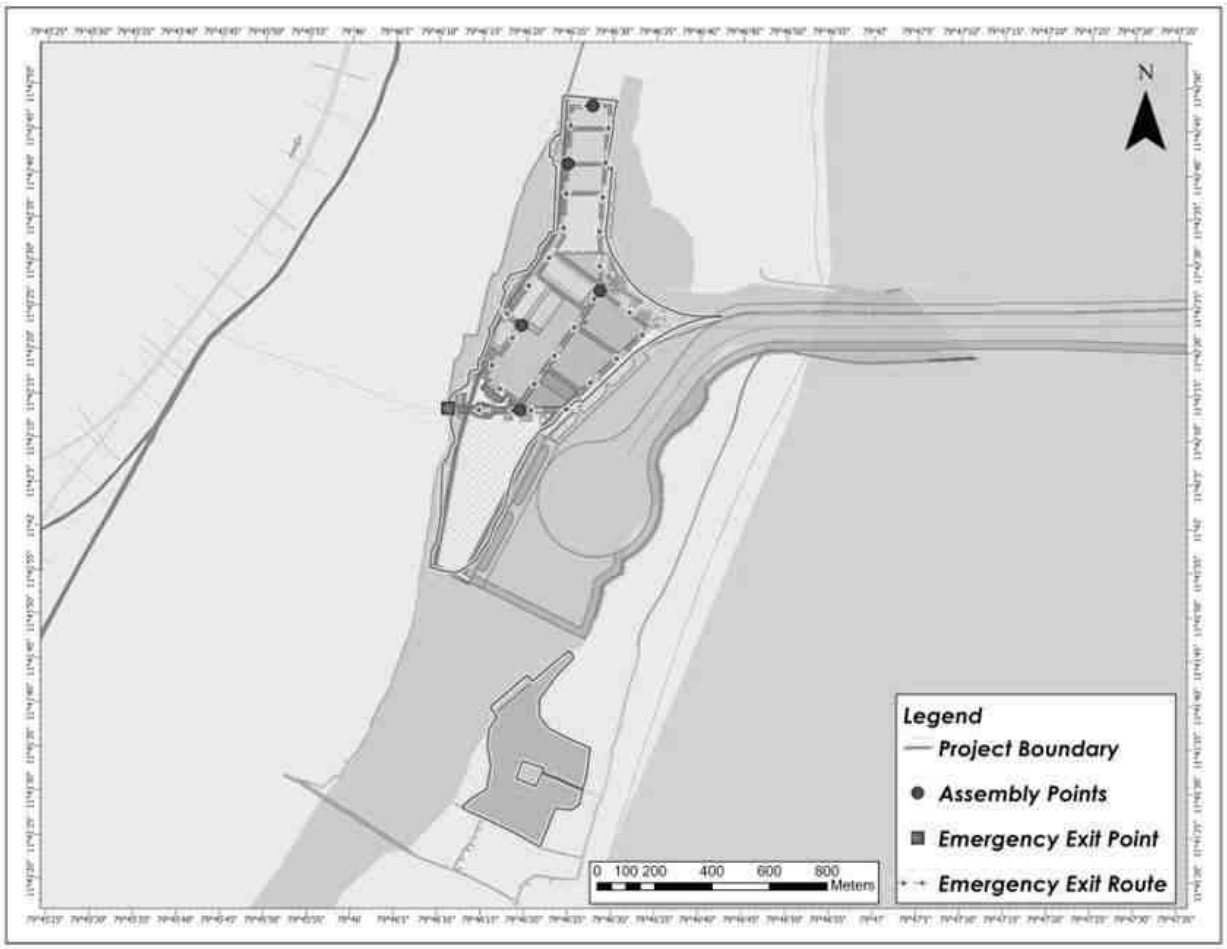


Figure 7-12: Proposed Evacuation Plan

7.4 Oil Spill Assessment and Contingency Plan

Oil spill assessment is undertaken to assist with oil spill contingency plan for the proposed expansion of Cuddalore port. Oil spill mathematical model was used to predict the trajectory and the fate of oil spills. The MIKE 21 model including hydrodynamic (HD) and oil spill (OS) models is applied to estimate the spread, volume, location and occurrence time of oil resulting from accidental spillage in the vicinity of proposed port facility. The oil is represented as Lagrangian particles being advected with the surrounding water body and exposed to weathering processes.

The advection (drift) of the individual particles is determined by the combined effects of current, wind and bed drag. The model provides information on oil slicks, the amount of oil left on the sea surface, the slick mobility and the evolution of the physiochemical properties of the oil.

7.4.1 Oil Spill Processes

Oil spilled in the water surface immediately spreads over a slick of few millimetres. The spreading is especially promoted by gravity and surface tension. Advection of currents and wind affects both surface oil and droplets dispersed in the water body. Due to evaporation, emulsification, dispersion, dissolution, photooxidation, sedimentation and biodegradation the oil changes its physical and chemical properties and may disappear from the sea surface. All processes are dependent on each other and are referred to as oil weathering.

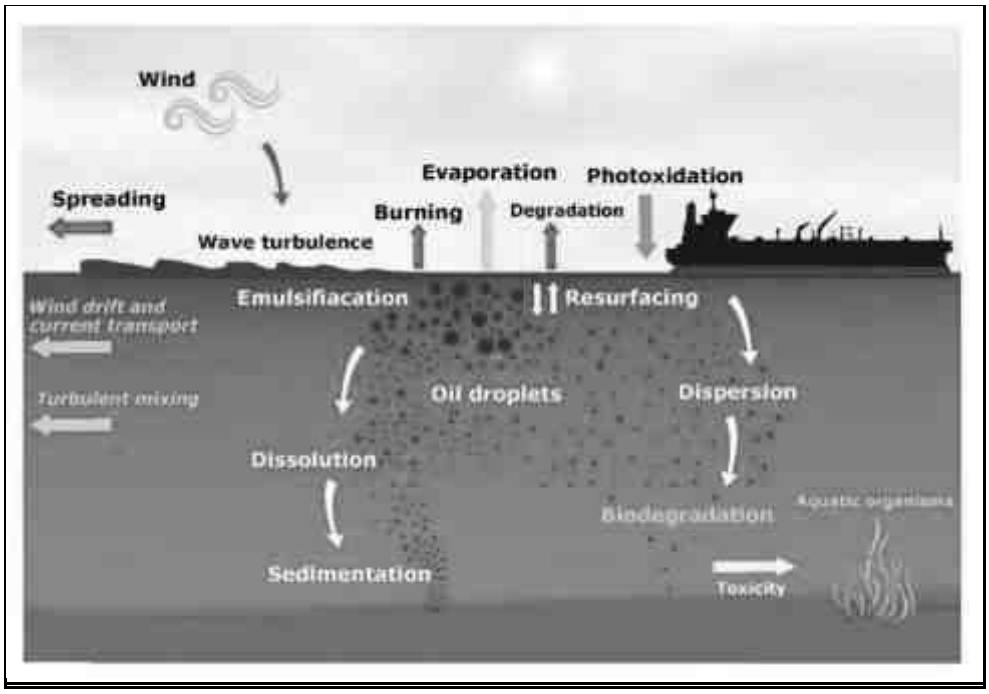


Figure 7-13: Typical processes acting on spilled oil from Fate of Marine Oil Spills

The physical and chemical changes that spilled oil undergoes are collectively known as weathering. Although the individual processes causing these changes may act simultaneously, their relative importance varies with time. Together they affect the behaviour of the oil and determine the fate. These processes are illustrated in **Figure 7-14** for a spill of a typical medium crude oil under moderate sea conditions. Sedimentation only occurs for very heavy oils in connection with mineral particles (sand/clay). Biodegradation and photo -oxidation only affect oil spills in the longer term (i.e. weeks to months or years).

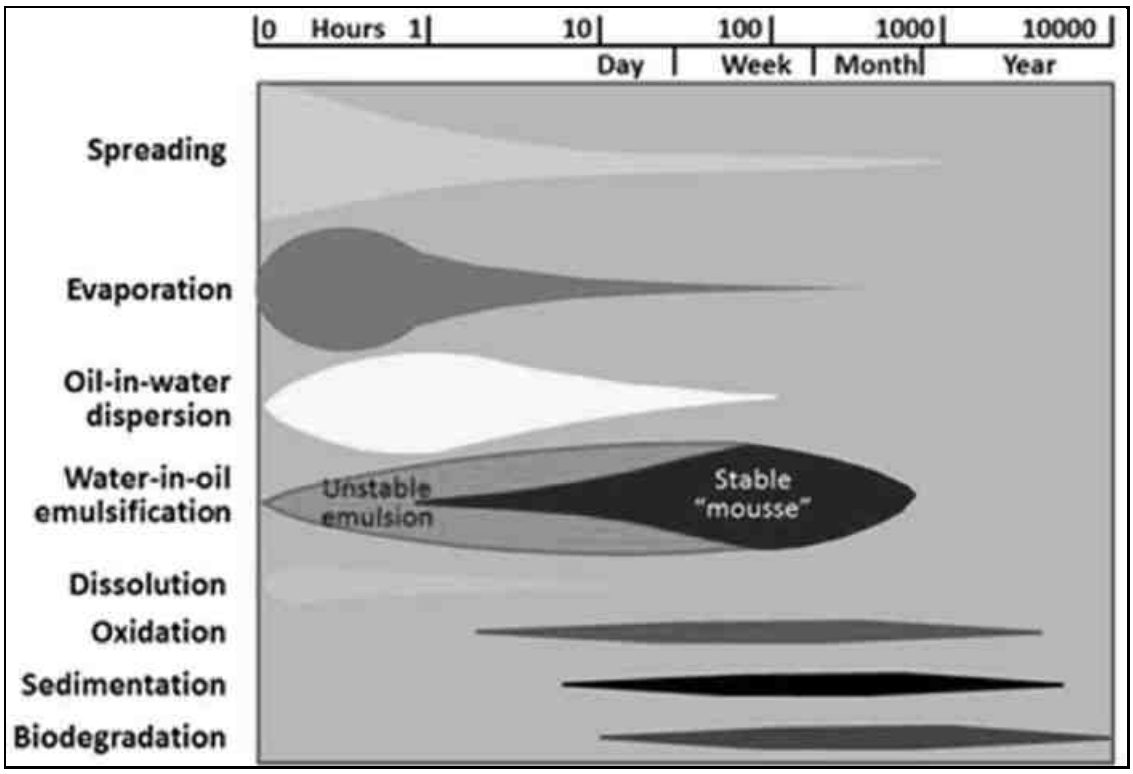


Figure 7-14: A schematic representation of the fate of a crude oil showing changes in the relative importance of weathering processes with time

7.4.2 Oil Spill Processes

The different parameters applied for the oil spill processes are listed below.

a) **Spreading -** Spreading over the sea surface begins as soon as oil is spilled. The rate at which oil spreads is determined by oil characteristics and the prevailing environmental conditions such as temperature, water currents, tidal flows and wind speeds.
b) **Evaporation** -The rate of evaporation and the speed at which it occurs depend upon the volatility of the oil. The rate of evaporation can increase as the oil spreads, due to the increased surface area of the slick. Rougher seas, high wind speeds and high temperatures also tend to increase the rate of evaporation.
c) **Dispersion** - Waves and turbulence at the sea surface can cause oil slick to break up into fragments and droplets of varying sizes. Dispersed oil droplets have a greater surface area to volume ratio than floating oil and other natural processes such as dissolution, biodegradation and sedimentation tends to occur. The speed at which an oil disperses is largely dependent upon the nature of the oil and the sea state.
d) **Emulsification -** Emulsification of crude oils refers to the process whereby sea water droplets become suspended in the oil to form a water-in-oil emulsion. This occurs by physical mixing promoted by turbulence at the sea surface. This slows and delays other oil weathering processes and can complicate the response. Emulsions may separate into oil and water again if heated by the sun under calm conditions or when stranded on shorelines.

e) **Dissolution -** Water soluble compounds in an oil may dissolve into the surrounding water. This occurs most quickly when the oil is dispersed in the water column.
f) **Oxidation -** Oils react chemically with oxygen either breaking down into soluble products or forming persistent compounds. This process is promoted by sunlight but is very slow process.
g) **Sedimentation -** When floating oil gets close to the shore, sedimentation can occur. When all the lighter compounds have evaporated and the slick has weathered at sea, some oils can be close to the density of seawater. When floating, semi submerged or dispersed oil comes into contact with suspended sediment, the sediment gets bind to it.
h) **Biodegradation -** Sea water contains a wide range of micro-organisms that use hydrocarbons as a source of energy and can partially or completely degrade oil to water soluble compounds and eventually to carbon dioxide and water. The main factors affecting the efficiency of biodegradation, are the levels of nutrients (nitrogen and phosphorus) in the water, the temperature, and the level of oxygen present. As biodegradation of oil requires oxygen, this process can only take place at the oil-water interface since no oxygen is available within the oil itself.

Spreading, evaporation, dispersion and dissolution can be defined as short-term weathering processes whereas emulsification, biodegradation and photochemical oxidation are recognised as long-term weathering processes.

7.4.3 Oil Spill Scenarios

A single surface spill scenario is defined in terms of the spill location, oil properties, rate, duration, and temperature. The oil is divided into five fractions each characterized by a vapour pressure, water solubility, viscosity, and density. Accidental oil spills at three locations inside the port as shown in **Figure 7-15** was simulated.

1. Location 1 – Collision in the approach channel
2. Location 2 – Collision in the turning circle
3. The spill at each location is modelled for both Northeast and Southwest monsoon. Each spill simulates the Gas oil and Heavy fuel oil as a conservative approach. Hence total of 8 oil spill scenarios have been modelled. Each spill event will involve simulation of 6000 discrete oil spill particles (100 particles per 5 minutes for 5 hours) whose advection, dispersion and weathering were simulated over a period of 7 days. Details of the individual oil spill scenarios are given in **Table 7-7**.

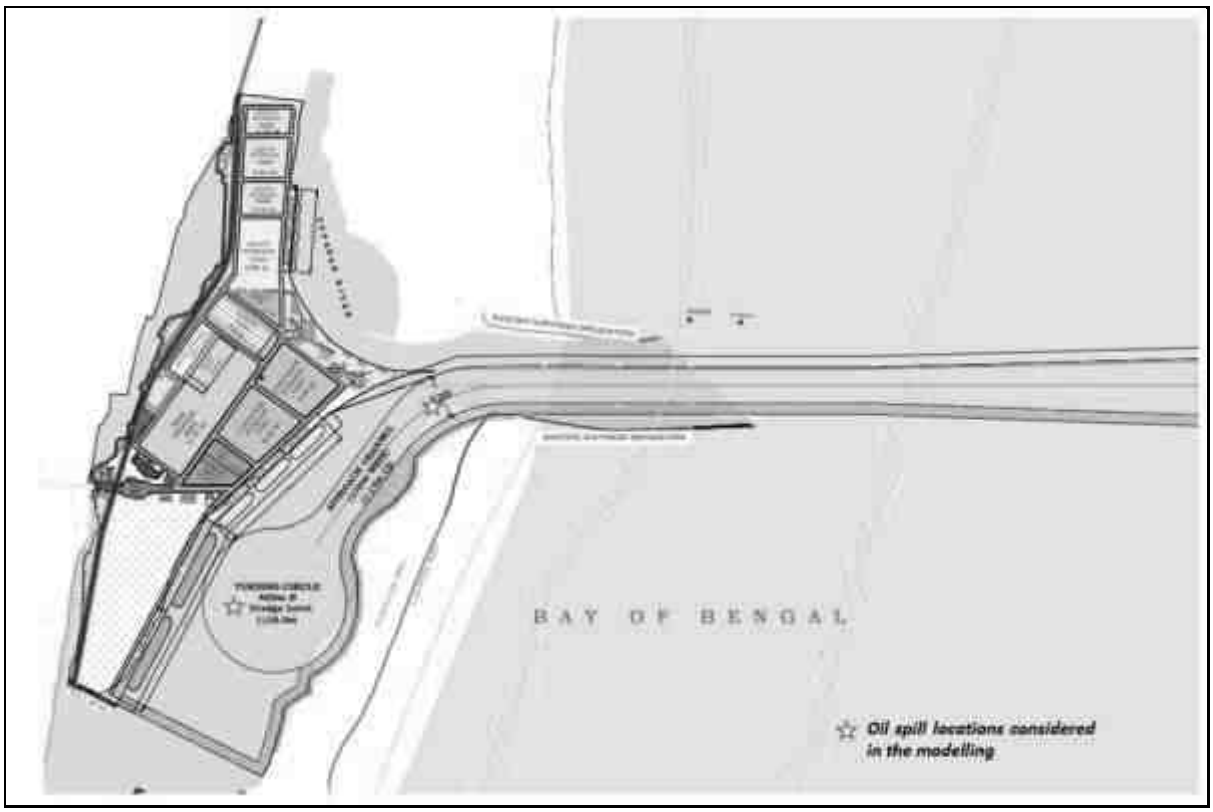


Figure 7-15: Oil Spill Locations considered in the Simulations

Table 7-7: Spill Parameters for Scenarios

S. No	Location	Location(id)	Oil type	Monsoon
Scenario 1	Turning circle	L1	Heavy Fuel	Northeast
Scenario 2	Approach channel	L2	Heavy Fuel	Northeast
Scenario 3	Turning circle	L1	Heavy Fuel	Southwest
Scenario 4	Approach channel	L2	Heavy Fuel	Southwest
Scenario 5	Turning circle	L1	Heavy Fuel	Northeast
Scenario 6	Approach channel	L2	Heavy Fuel	Northeast
Scenario 7	Turning circle	L1	Gas oil	Southwest
Scenario 8	Approach channel	L2	Gas oil	Southwest

7.4.3.1 Model Setup

Model domain was established with the proposed layout for the Cuddalore port using the surveyed bathymetry. The oil spill model is established coupled with pre-calibrated Hydrodynamic model of the study area. The HD model provided spatially and temporally varying fields of water levels and currents, incorporating tidal forcing at the open boundaries and river discharge at the upstream boundary. Meteorological forcing, including wind speed and direction, was applied to account for wind-induced drift. Oil spill scenarios were defined by specifying spill location, release duration, and volume, along with appropriate oil properties (e.g., density, viscosity, evaporation characteristics) for gas oil and heavy fuel oil. Simulations were performed for a 15days, and suspended surface slick thickness was analysed to assess spill behaviour and potential environmental impact.

During Northeast Monsoon from October to January, the predominant wind direction is NNE and during Southwest Monsoon from June to September, the predominant wind direction is SSW as shown in **Figure 7-16**.

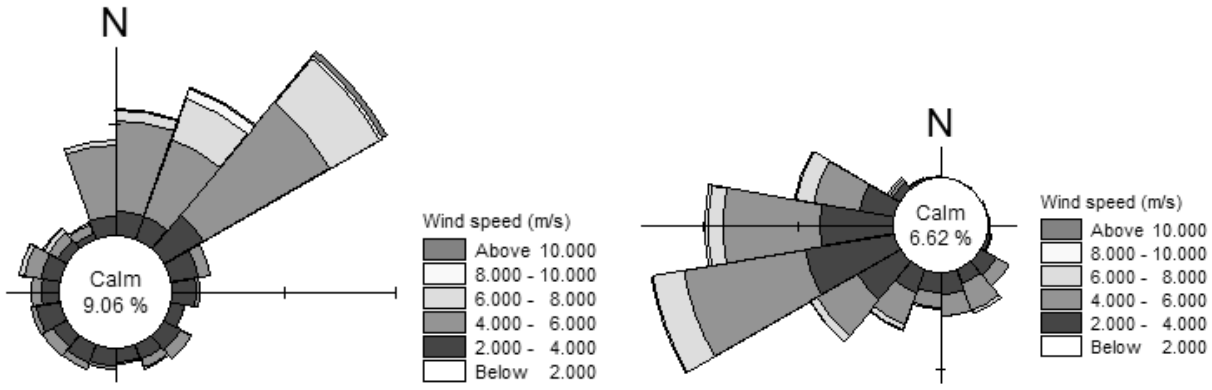


Figure 7-16: Left: Wind speed – NE monsoon, right: Wind speed – SW monsoon

7.4.3.2 Oil Spill Modelling Results

The results from the combination of 8 spill scenarios within the two monsoon seasons are presented in terms of suspended slick thickness. The cuddalore port is located in the confluence of Paravanar river and the Gadilam river and hence the discharge of rivers plays a major role in the dispersion. The South west monsoon is simulated considering no discharge from river and the North east monsoon with discharge of 20m3/s from the river.

The maximum oil thickness with area of extent with and without river discharge for dispersion of Gas oil and Heavy Fuel oil is presented is presented in **Figure 7-17** and **Figure 7-20.**

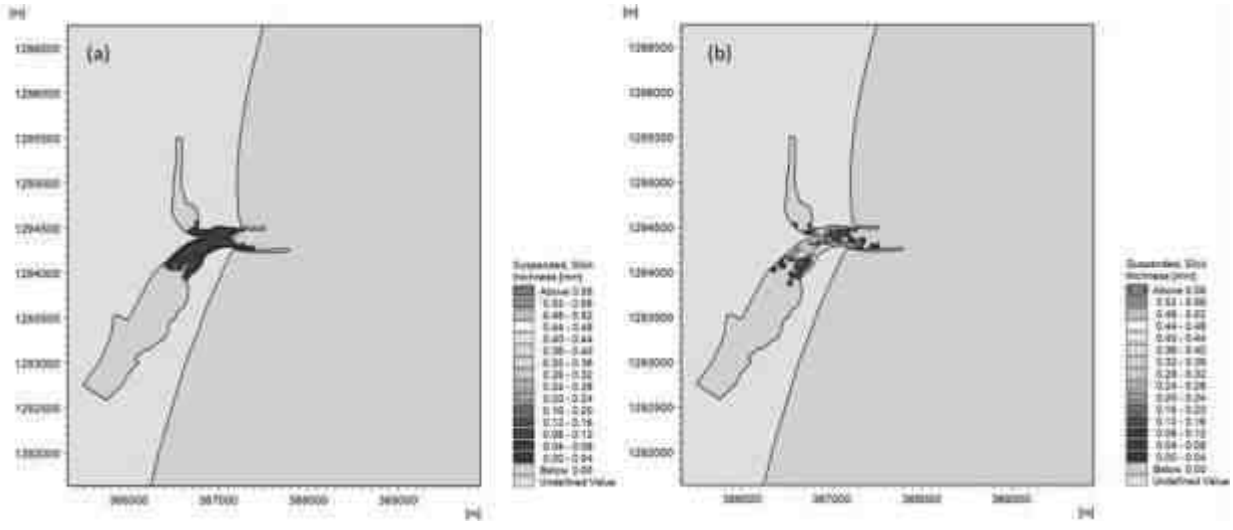


Figure 7-17: Scenario 1 – Maximum oil slick thickness (Approach Channel, SW monsoon, without discharge after 2 days) a) Gasoline b) Heavy Fuel oil

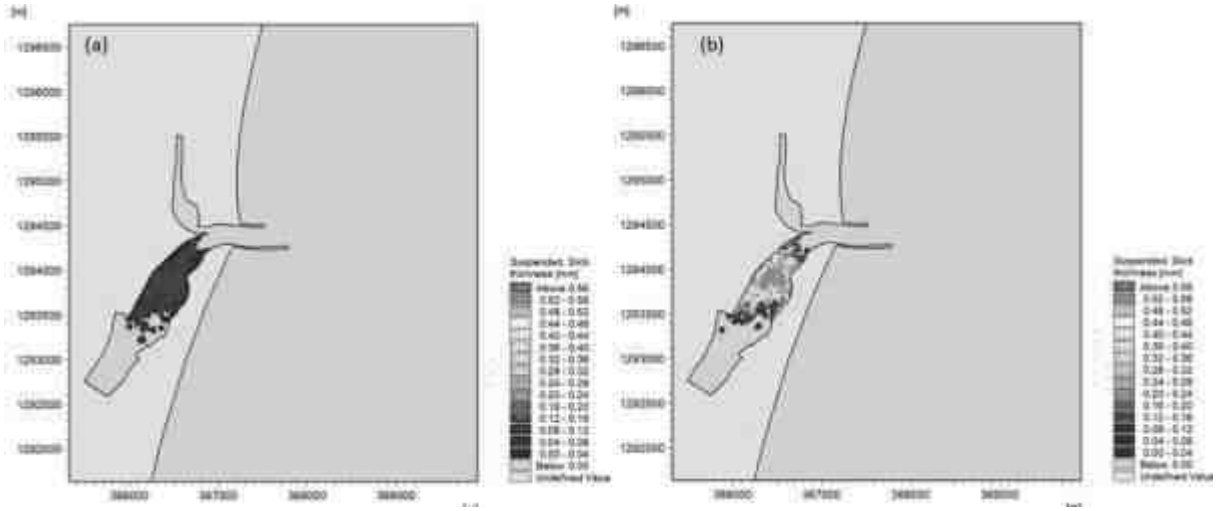


Figure 7-18: Scenario 2 – Maximum oil slick thickness (Turning Circle, SW monsoon, without discharge after 2 days) a) Gasoline b) Heavy Fuel oil

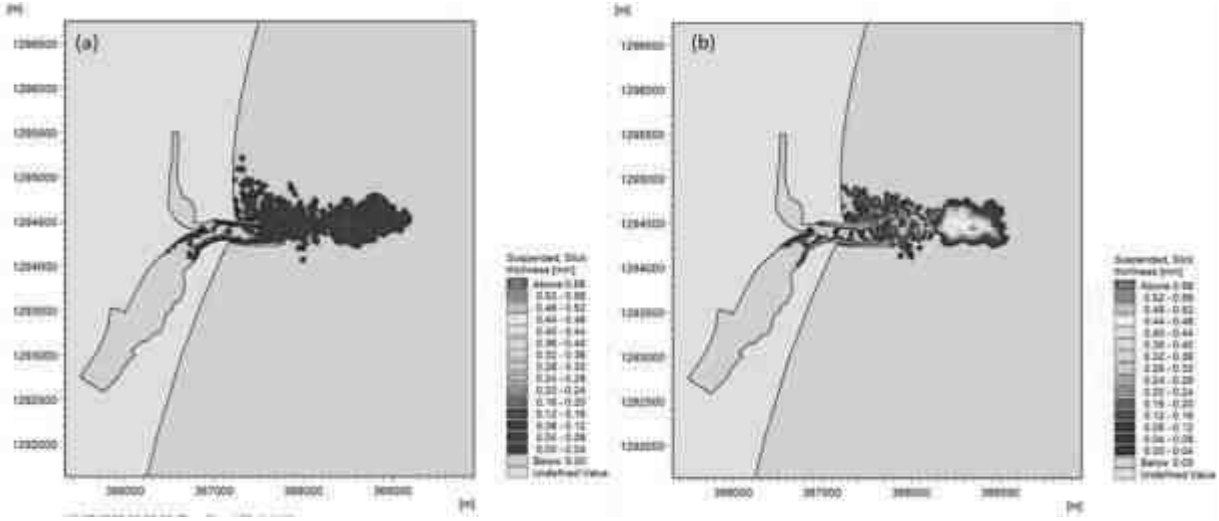


Figure 7-19: Scenario 3 – Maximum oil slick thickness (Approach channel, NW monsoon, with discharge after 2 days) a) Gasoline b) Heavy Fuel oil

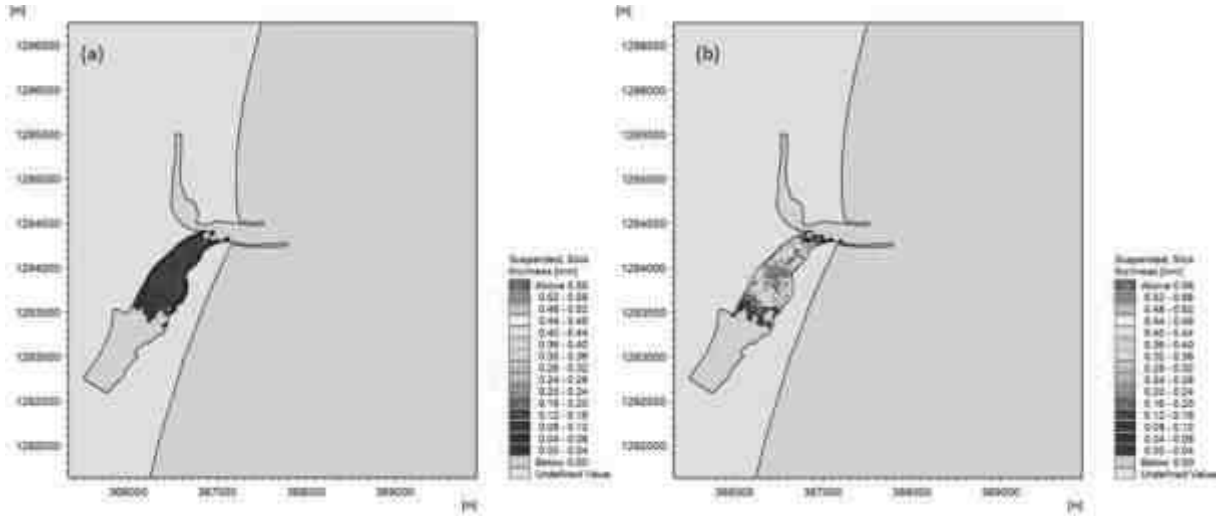


Figure 7-20: Scenario 4 – Maximum oil slick thickness (Turning Circle, NW monsoon, with discharge after 2 days) a) Gasoline b) Heavy Fuel oil

7.4.4 Observations

Occurrence of accidental oil spills inside the Cuddalore port is of critical concern, as the port is situated within a riverine environment. Any spill must be treated as an emergency due to the combined influence of river discharge and tidal dynamics, which can significantly enhance the rate of oil spreading. From the results the following observations arrived.

The modelling results indicate that, although the spatial extent of the spill remains similar for both oil types, the maximum suspended oil thickness is significantly higher for HFO (0.56 mm) compared to gas oil (0.120 mm). HFO retains a larger fraction of oil mass within the system due to its low evaporation and high persistence, resulting in higher localized concentrations. In contrast, gas oil undergoes substantial evaporation and dissolution, leading to reduced concentration despite covering the same area.

Spills occurring in the Approach channel pose a significant risk due to stronger currents associated with the river flow, which can quickly spread oil to adjacent areas. To prevent shoreline impact, immediate action should be taken on emergency measure, with cleanup efforts prioritized within 2 days of the oil spill occurrence.

7.4.5 Oil Spill Contingency Plan

An Oil Spill Contingency Plan (OSCP) for a port is a mandatory framework required to mitigate environmental impacts and ensure rapid response during maritime operations. For a new facility, this plan must be vetted by the Indian Coast Guard (ICG) to ensure compliance with the **National Oil Spill Disaster Contingency Plan (NOSDCP)**.

The Oil Spill Contingency Plan (OSCP) outlines the steps required for the management of responses to marine oil spills that are the responsibility of the Cuddalore Port. A Contingency is an event, which may happen, the timing of which is obscure or unknown. Oil Spill Contingency Plan is a set of instructions to help Cuddalore Port to ready itself in response to any contingencies related to marine oil spill incident / accident in their area of operation. This OSCP has been specifically made for Cuddalore Port for their port operation at Cuddalore, Tamil Nadu. It takes care of their range of present activities, expansion plans and the local weather and other natural conditions.

The purpose and objective of this oil spill contingency plan is to

- Establish procedures to follow in the event of any oil spill contingency in the area of operation.
- Provide a reference document with information, to support the procedures.
- Provide a basis for suggesting and imparting training to the relevant personnel in relation to one specific emergency/contingency i.e., Oil Spill Contingency

7.4.5.1 Oil Spill Classification of Tiered Response

The Oil Spills are always unpredictable and different situation requires different response. The severity of oil spill incident is largely based on the quantity of oil-spilled, its distance from the shore, i.e., location and its timing. If there is a big spill close to coast, the number of outside agencies involved and urgency of their notification increases. The resources required and the degree of organization needed to deal with an oil spill, increase with size of spill and the proximity to the shore.

Tier 1 (Within Port's capability)

Tier-1 is concerned with preparedness and response to a small spill within the capability of an individual facility or port authority. 700 tons is often cited as the upper limit of Tier 1, however the circumstances of the spill and the surrounding environment will determine the actual level of response preparedness. The Combat Agency will generally be able to respond to and clean up a spill utilizing local resources. In cases where additional resources are required, these will generally be available from the local port authority or from adjacent industry operators under mutual aid arrangements or locally from the Indian Coast Guard.

Tier 2 (Beyond Port's capability)

Tier–2 is concerned with preparedness and response to a spill that requires the coordination of more than one source of equipment and personnel. For a tier-2 response, assistance can come from a number of entities within a port area or from sources outside the immediate geographic area. Tier-2 describes a wide range potential spill scenarios and deals with operational spills upto 10,000 tons. The resource of the Combat Agency will need to be supplemented by other local, regional and national resources a) Inform Indian Coast Guard and district administration.

Tier 3 (Beyond National Resources)

Tier-3 is concerned with a major spill requiring the mobilization of all available national resources and depending upon the circumstances will likely involve mobilization of regional and international systems. It deals with the spills of more than 10,000 tons. The Combat agency will require local, regional, national and possibly international assistance.

7.4.5.2 INITIAL ACTION IN THE EVENT OF SPILL

- Receive brief from person, who first noticed the oil spill.
- Assess the situation & take appropriate steps to - Establish the source of leak spill - Reduce / prevent further leak / spill - Deal with spill.
- Post an oil spill observer, who will continuously monitor the direction of oil spread
- mobilize team to handle OSR equipment. Raise alarm and stop the operation as necessary.
- Report immediately to the Superior
- Initiate initial pollution report

- Handle any associated emergency with wider implication in accordance with disaster management plan

7.4.5.3 PROBABLE FATE OF SPILLED OIL

Spilled oil is likely to be carried by the predominant tidal stream and during slack water wind will have major effect on the drift of the slick. During ebb tide major part of oil slick will flow out along the channel and drift south or north along the coast depending on the prevailing coastal current/ counter current at that time. A small part will be carried by eddies in the harbour and accumulate in slack areas like north and south parts of port areas etc. The spilled oil would be contained and collected effectively by deploying Oil Booms and Skimmers of sufficient capacity. Subsequently, recovered oil would be collected in the OSRV"s tank on which the OSR equipments are mounted. Any oil spill inside the port shall be collected in 10T capacity flex barge. The likelihood of oil spill taking place is due to Pipeline Rupture, Bunkering or Grounding /Collision. The spill is likely to move along with the current/wind direction upstream depending upon the tide conditions, location of spill and weather state at that time.

7.4.5.4 RISK ASSESSMENT

Collision: This plan relates to a collision between two vessels within Port limit. This includes navigation channels, areas adjacent to navigation channels, berths, anchorages and areas immediately adjacent through which vessels will navigate whilst approaching the port or in which they may anchor whilst awaiting berthing instructions.

Aim and Objectives of the plan: Site Main Controller will have control of the incident. Precautions to be taken to preserve the safety of the vessel(s) in the interim and measures to be taken for the prevention of environmental damage as well as safety of crews onboard vessel(s).

Immediate Action: In the event of a collision between two vessels within the port limits, the following action should be taken:

- in-charge should be informed of the incident
- The movement of all other vessels in the port should be stopped and alternative orders issued as necessary.
- Immediately contact the emergency services and request the standby of all functional services that may be of assistance.
- Determine the extent and seriousness of any injuries sustained by the vessels crews and arrange medical assistance if necessary.
- Ascertain the details of the incident, including the location of the vessels, proximity to the navigation channel and the condition of the vessels in relation to hull damage and watertight integrity.
- If either vessel is in danger of sinking, determine action to be taken including moving it to a place where it can rest on the bottom, clear of the navigation channel

Safety Issues: The need to evacuate passengers and/or crew should be conferred with the Masters.

Post Emergency Actions:

- Review the effectiveness of Port Emergency Response Plans.
- Inform alerted agencies that the incident is over.
- Pipeline Leakage Master of the Tanker Should:
- Raise alarm and shut off the ship transfer pump immediately.
- Shut off the isolation valves on the pipelines.
- Activate emergency procedures.

Terminal personal at the berth should:

- Shut off an isolation valve in the pipeline.
- Inform the terminal in charge.
- Activate Oil Spill Contingency Plan.

Availability of a fire tender at the jetty at all times. Hose can be laid and water curtain can be activated. The Incident Controller will reach to the affected site of emergency and assess the situation. Any person affected should be shifted to the Port Hospital.

Identification of activities and risks

Activity	Risk	Likelyhood
Loading / Discharging oil cargo	1 Overflow from tanks while topping off.	Med
	2 Leak from burst hose or loading arm	Low/med
	3 COW line rupture during crude oil washing	Low
	4 Pressure surge causing pipe line joints to leak due to sudden closure of valves	Low
	5 Failure to drain loading arms completely prior disconnecting.	Low
Navigation	1 Vessel grounding and rupturing cargo tanks, bunker tanks	Low
	2 Collision between vessel causing rupture of oil/ bunker tanks	Low
Mooring operation	1 Leak from hydraulic system of mooring winches	Low
	2 Tug impact in the vicinity of bunker tanks damaging shell plating	Low
Tank cleaning	Accidental discharge of oily water	Low
Reception of MARPOL-Annex1 (oily water/ waste oil)	Leak from hose	Med

HAZARDS OF THE TANKER OPERATION

- The main hazards of the tanker operation are Fire, Oil Pollution, Environmental pollution and toxicity.
- Preparedness in emergency: Each tanker berth is capable of firefighting and Oil Spill Response as per port Disaster Management plan.
- Shall conduct regular fire drills at the tanker terminals.

MARINE OIL SPILL RESPONSE EQUIPMENTS

The Oil Spill Response Equipments proposed to be used are Four 20 TPH brush type, Skimmers with power pack and pump, 900 meters of Oil Spill Booms, 500 meters Shore, Sealing Booms, 500 meters Absorbent Booms and absorbent pads. At the time of Oil Spill, OSRV can be moved quickly to the site of incident. Same ORSV can be used as a floating storage tank for the oil recovered through the skimmer.

CRISIS MANAGEMENT CELL

- Establish emergency control center
- Convene Local Contingency Committee
- Co-ordinate with outside agencies
- Approve information to Press.

TRAINING/ SAFETY SCHEDULES AND DRILL/ EXERCISE PROGRAMME

Oil pollution drill to be conducted as per quality manual of Port Oil pollution drill/exercise to be conducted every six months Periodic training to be imparted to crew of tugs/ mooring boat/ fire service etc on IMO level 1, 2 and 3 courses conducted by Coast Guard.

7.5 Strom Surge modelling

7.5.1 Tropical Cyclone tracks

The number of cyclones that have occurred within the vicinity of 100km of the Cuddalore port for the period of 2000 to 2024 from Cyclone eAtlas (IMD, India) is shown in **Figure 7-21.**

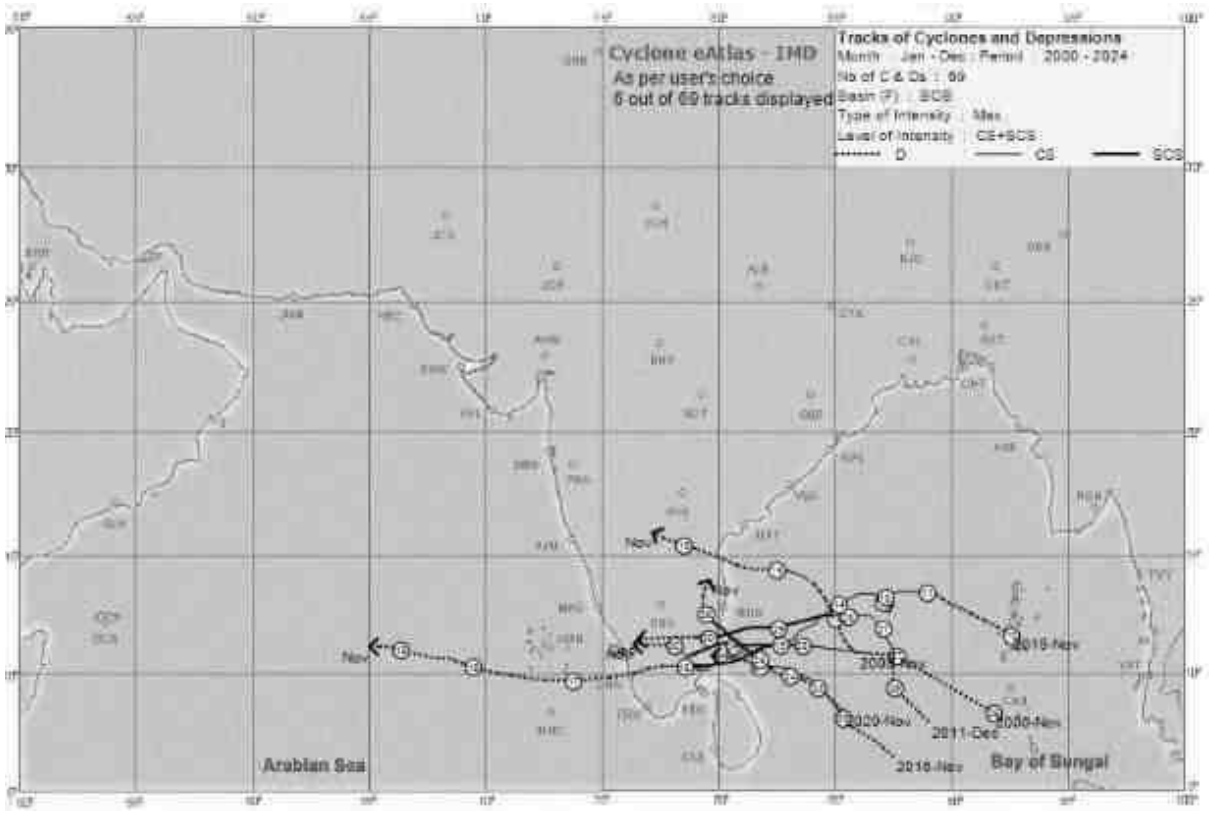


Figure 7-21: Tracks of the cyclones in the vicinity of 100km to the study area from 2000 to 2024

For model simulations, six cyclonic events were selected for simulation. **Figure 7-21** represents the year of occurrence of cyclones, maximum wind speed of selected cyclones.

Table 7-8: Cyclones, maximum wind speed

S.No	Year of Occurrence	Name	Intensity	Maximum Wind speed (knots)
1	2000	2000 cyclone	ESCS	102
2	2008	Nisha	CS	45
3	2011	Thane	VSCS	75
4	2016	Nada	CS	40
5	2018	Gaja	VSCS	70
6	2020	Nivar	VSCS	65

7.5.2 Wind and Pressure fields

The snapshot of wind field and pressure fields of 2011 Thane cyclone generated using MIKE 21 cyclonic wind field generation tool are given in **Figure 7-22**.

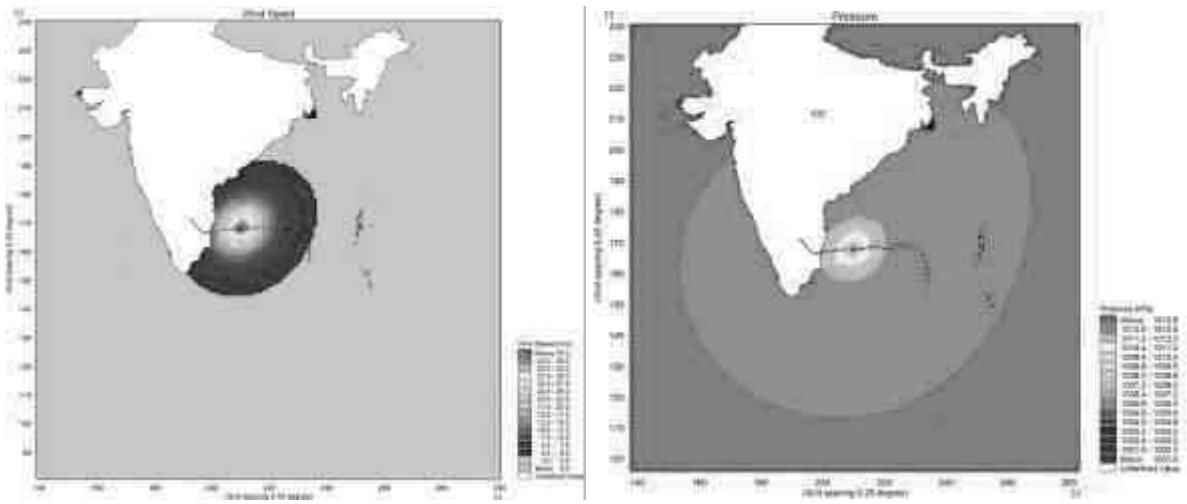


Figure 7-22: Wind and Pressure field map for 2011 Thane cyclone

Model results:

The snapshots of results obtained from storm surge simulation for 2011 Thane cyclone are presented in **Figure 7-23**. The storm wave height for the 06 cyclones at the study area extracted and presented in **Table 7-9**.

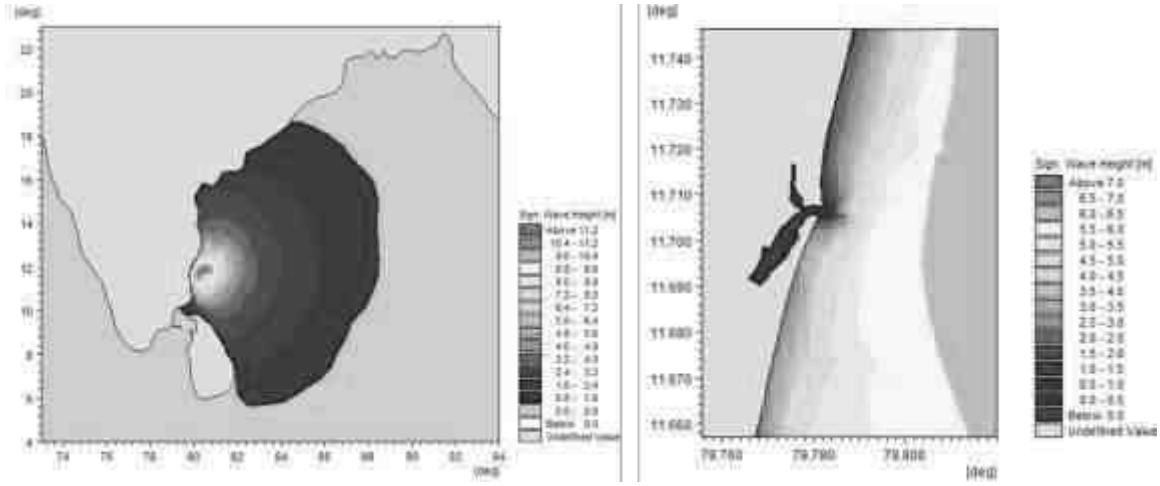


Figure 7-23: Storm wave

Table 7-9: Maximum storm wave height at Cuddalore Port due to 6 cyclones

S.No	Month & Year	Name of the cyclone	Storm wave height (m) at Port entrance within breakwaters
1	November - 2000	TC03B2000	1.26
2	November- 2008	Nisha	1.1
3	December - 2011	Thane	1.15
4	November - 2016	Nada	0.6
5	November - 2018	Gaja	1.0
6	November - 2020	Nivar	0.75

7.6 Traffic and Transportation Study

Traffic survey studies were conducted carried out in accordance with the IRC guidelines and requirements. Based on the study, traffic management and traffic

decongestion plan has been drawn up. The details of the study, outcome and recommendations are presented in following section.

7.6.1 Project Location

The Cuddalore Port is located at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal at latitude $11^0$42'22.43'' N and longitude $79^0$46'30.52''E with Sea.

7.6.2 Proposed Development

In the Present proposal, Cuddalore port is proposing for the increase in cargo handling capacity from 5.68 MTPA to 11.48 MTPA and ship building and repair activities.

Table 7-10: Cargo Forecast for Proposed Expansion Plan

S. No	Berth type	Cargo Mix	Cargo Handling Capacity (MTPA)
1	Multipurpose beth-1	Container cargo	1.33
2	Multipurpose beth-2	Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc.	1.61
3	Bulk berth (two no)	Coal, Fertilizers, Cement, Clean cargo, Iron ore, slag and Limestone	8.54
Total			**11.48**

Breakup of the cargo evacuation is given below

Bulk Cargoes: (90% Coal & 10% other bulk cargo)

- Coal evacuation by rail (85%) and by road (15%)
- Other bulk cargo 70% by road and 30% by rail

Liquid Cargoes:

- 100 % by road

Container and General Cargoes:

- 100% by road

7.6.3 Road & Rail Network

Cuddalore port was directly connected to NH-32 (Cuddlore to Chidambaram Road) at the junction near to Pachchyankuppam, Cuddalore, Tamil Nadu through

1 km length x 7m wide bitumen road viz. Cuddalore port road (erstwhile salt office road).

The nearest railway station is Cuddalore Port Junction, and it connects between Villupuram – Cuddalore Port Section falling in Tiruchchirappalli Division under Southern Railway. The approximate length of the connectivity line is 3.8 km from take-off at port.

Figure 7-24: Port Connectivity

Provision of access points to load/unload have been planned to facilitate efficient circulation and dispersal of traffic. These access points shall provide entry / exit facility to parking and drop off locations and are strategically located and designed in such a way that it not only adds efficacy to circulation and accessibility but also helps in safety, security and traffic management. Rail and Road Access Points provided for the project is illustrated in **Figure 7-25**.

Figure 7-25: Rail and Road Access Points

7.6.4 Road Traffic Surveys

Traffic surveys are necessary to gather base data information about existing traffic and travel pattern on surrounding roads. Road network from the project location is considered for traffic study is shown below. The traffic surveys included classified traffic volume counts. Traffic survey was conducted at Cuddalore port road (erstwhile salt office road).

Pachchyankuppam

Pachchyankuppam

Saltpan Office Road

Base Traffic

Traffic survey was conducted for 24 hours during September 2025 to understand the hourly traffic variation for the Cuddalore port road. The observed peak hour volume for Cuddalore port road has been illustrated below.

Table 7-11: Hourly Traffic Volume on Saltpan Office Road

Time Period	2W	3W	Cars	Buses	LCV	2 Axle	Multi Axle	Total Vehicles	Total PCU
8 to 9	5	2	1	1	2	0	0	11	11.9
9 to 10	8	3	2	1	3	1	1	19	23.8
10 to 11	6	2	1	0	2	0	0	11	9.4
11 to 12	3	1	1	2	1	1	0	9	14.2
12 to 13	2	1	0	1	1	0	0	5	6.7
13 to 14	3	0	0	0	1	0	0	4	3
14 to 15	2	0	0	0	0	0	0	2	1
15 to 16	3	2	1	0	0	0	0	6	4.9
16 to 17	2	1	0	0	1	0	0	4	3.7
17 to 18	8	2	1	1	2	0	0	14	13.4
18 to 19	9	3	2	1	3	0	0	18	17.6
19 to 20	7	1	1	0	1	1	0	11	10.2
20 to 21	3	1	0	0	0	0	1	5	6.4
22 to 23	4	0	1	0	0	0	0	5	3
24 to 1	2	0	0	0	0	0	0	2	1
2 to 3	0	0	0	0	0	0	0	0	0
3 to 4	0	0	0	0	0	0	0	0	0
4 to 5	0	0	0	0	0	0	0	0	0
5 to 6	2	0	0	1	0	0	0	3	4
7 to 8	6	0	1	1	3	1	0	12	14.5
Total	75	19	12	9	20	4	2	141	148.7

Based on preliminary analysis it was observed that:

- Peak morning traffic was observed between 9 and 10 AM and peak evening traffic was observed between 6 to 7 PM.
- The vehicular traffic predominantly consists of Car, two wheelers and LCV.

7.6.5 Road Traffic Forecast

Traffic forecasting is the process of estimating the total number of trips generated and attracted by each land-use. Traffic forecasting is done using trip generation rates which are developed to estimate the number of trips generated from specific household and/or land use. The no of trips includes visitors, services and other trips attracted by residential, educational and commercial land use.

After commissioning of project additional trips will be generated during day and peak hours. The trips generated by the project are given in table below:

Based on the average payload and the number of daily trips for each cargo type:

Cargo Type	Avg. Payload (Tons)	Daily Trips	Total Daily Tonnage
Liquid	25.0	185	4,602.5 Tons
Container	24.0	159	3,808.0 Tons
Bulk	20.0	206	4,110.0 Tons

Cargo Type	Avg. Payload (Tons)	Daily Trips	Total Daily Tonnage
GRAND TOTAL	—	550	12,520.5 Tons

Hourly Peak Traffic Flow

The Peak Hour Volume (PHV) is typically estimated using a "K-factor," which represents the percentage of daily traffic occurring during the busiest hour. Traffic Peak Flow will be ~72 vehicles per hour equivalent of 2,694 passenger car trips per day (A traffic growth of 5% is considered per year for the surrounding network. Based on this, the traffic has been forecasted).

Daily Volume in PCU

Using standard conversion factors for heavy vehicles (3.0 for 2-3 axle trucks and up to 4.5 for multi-axle trailers), total daily "car equivalent" load was estimated

Cargo Type	Daily Trips (assumed)	PCU Factor	Total Daily PCU
Liquid (2/3-Axle)	263	3.0	789
Container (Multi-Axle)	224	4.5	1,008
Bulk (4+ Axle)	411	4.0	1,644
2 wheeler	62	0.5	31
3-Wheelers	17	1.0	17
Buses	3	3.0	9
Total Daily PCU	980	—	3498

This project being of commercial land use, once commissioned will be generating predominantly outgoing and incoming truck traffic during evening peak hours. There will be various modes of vehicles contributing to the traffic.

7.6.6 Road Traffic Impact Analysis

The traffic on existing road network was analyzed to assess its impact on the existing roads. The road traffic has been forecasted for year 2030. This total traffic on the road is compared with its capacity. This V/C ratio of peak traffic volume and capacity is used as an index to determine level of congestion on link which is likely to occur when projected traffic is operative on link. Pedestrian traffic is assumed to use footpaths and not affect the road capacity.

For a typical 2-lane undivided urban road, the standard capacity is approximately 1,500 PCU per hour[10].

[10] IRC Guidelines (IRC 106-1990): Specifies a capacity of 1,500 PCU/hour for 2-lane undivided urban roads.

Interpretation & Level of Service (LOS)

For a typical 2-lane undivided urban road, traffic impact is primarily measured through the Level of Service (LOS), which categorizes the quality of traffic flow based on the Volume-to-Capacity (V/C) ratio and average travel speeds.

Typical Level of Service (LOS) for Urban Roads

The following table outlines the standard LOS thresholds used in traffic impact studies, based on guidelines like IRC 64:1990 and the Highway Capacity Manual (HCM).

LOS	V/C Ratio	Performance Description	Flow Nature	Typical Avg. Speed
A	0.0 – 0.2	Excellent	Free flow; high freedom to maneuver	50 km/h
B	0.2 – 0.4	Very Good	Stable flow; negligible delays	40 km/h
C	0.4 – 0.6	Good/Fair	Stable flow; acceptable delays	30 km/h
D	0.6 – 0.8	Poor	Approaching unstable flow; tolerable delays	25 km/h
E	0.8 – 1.0	Very Poor	Unstable flow; intolerable delays; at capacity	< 25 km/h
F	> 1.0	Worst	Forced flow; breakdown/heavy congestion	Stop-and-go

For a 2-lane undivided Cuddalore port road, a total traffic volume of 3,646.7 PCU/hr results in a V/C ratio of 2.39, pushing the road deep into Level of Service (LOS) F (Forced Flow/Breakdown).

Conclusion:

A 2-lane road could not accommodate higher traffic volume in a single peak hour and will lead to total breakdown and to avoid this following are the possible suggestions.

- Stagger the 3,498 PCUs over a minimum of 4-5 hours to bring the hourly load down to a manageable level for a 2-lane road (approx. 700-800 PCU/hr total) this will be very difficult for management.
- Upgrade to 4 lane road have the design capacity of 3,600 PCU/hr (per IRC:106-1990) for a 4-lane divided road and Implementing a Staggered Dispatch Schedule for upgraded four lane road, the 980 trips/3498 PCUs are distributed over at least 2 hours. The hourly volume drops to 1,749 PCU/hr, resulting in a V/C ratio of 0.486. This successfully brings the road's performance to LOS C, ensuring "Stable Flow" where drivers have reasonable freedom to maneuver.

Proposed Mitigation:

A four-lane road from Cuddalore Port to NH-32 (old NH-45A) under PM Gati Shakti project is being initiated and the implementing agency is the National Highways Authority of India (NHAI).

The road's performance shall be maintained to fall in the LOS C, ensuring "Stable Flow" where drivers have reasonable freedom to maneuver by implementing the suitable traffic control strategies.

7.6.7 Proposed Road and Rail Connectivity

7.6.7.1 Proposed Four Lane Road from Cuddalore Port to MH-32 by NHAI

A four-lane road from Cuddalore Port to NH-32 (old NH-45A) under PM Gati Shakti project is being initiated and the implementing agency is the National Highways Authority of India (NHAI) considering the following components to be taken up under the Port Connectivity Scheme of the Government of India.

- Four-laning of the Port Office Road (erstwhile Salt Office Road) from the Port main gate to NH-45A (1 km).
- Four-laning of NH-45A (Cuddlore to Chidambaram Road) from the junction with the Port Office Road to the proposed New East Coast Road (ECR) joining.
- Construction of a four-lane spur road from the Port Office Road junction with NH-45A to the New ECR.

Cuddalore Port requested for four lane connectivity to NH 32 (old NH 45A) deails are provided in **Appendix L**.

7.6.7.2 Proposed Widening and Improving of NH32 (old NH 45A) by NHAI

Widening and improvement of existing carriage way to 4-Laning of Villupuram to Nagapattinam in 4-Packages. Villupuram – Puducherry (29 Km)-Pkg-1, Puducherry – Poondiyankuppam (38 km)- Pkg-2, Poondiyankuppam – Sathanathapuram (56.80 Km)- Pkg-3 and Sathanathapuram – Nagapattinam (55.755 Km) – Pkg-4 in the State of Tamil Nadu and Puducherry (UT) on Hybrid Annuity Mode[11].

Salient Features Of The Project

Project is Widening and improvement of existing carriage way to 4-laning of Villupuram (Km 0.000) - Nagapattinam (179.555) Section of NH32 (old NH 45A) in the State of TN/UT Puducherry under NHDP Phase-IV.

- Total length of the project in Tamil Nadu is 144.655 and Puducherry UT is 34.90 Km with 45-60 m Right of Way (RoW).

[11] Pre – Feasibility Report - Four Laning of Villupuram to Nagapattinam section from Design Ch. 0+000 to Design Ch. 179+555 of NH-45A in the State of Tamil Nadu and Puducherry (UT)

- The project is widening and improvement of existing 2 lane with/without Paved Shoulder & 4 lane divide carriageway at Puducherry, Cuddalore & Nagapattinam town to 4-lane divided carriageway of entire project road.
- The project starts at design CH 0+000 (11°54'21.40"N, 79°28'6.16"E) near Villupuram and ends at CH 179+555 (10°45'26.08"N, 79°49'29.06"E) near Nagapattinam The project road traverses through the States of Tamil Nadu and Puducherry (UT).
- Project alignment is passing through the districts of Villupuram, Cuddalore and Puducherry (UT), Karaikal and Nagapattinam.
- Bypasses (Villupuram, Puducherry & Cuddalore Combined bypass, B.Mutlur, Chidambaram, Kollidam, Sattanathapuram, Tirukkadayur & Kaliyappanallur, Karaikkal, & Vanjur) are proposed along the project road.

Average Daily Traffic (ADT)

	Km 15.100	Km 94.650	Km 152.200	Total
Total Vehicles	13840	13228	11070	38138
Total PCU	15182	18750	12004	45936

Future Traffic Estimations

It is estimated that across various sections of the project, the following traffic will be generated up the year 2044:

Projected Traffic

	Km 15.100		Km 94.650		Km 152.200	
Year	Vehicle Nos.	PCUs	Vehicle Nos.	PCUs	Vehicle Nos.	PCUs
Upto 2044	53753	58719	51447	72638	42788	46253

Traffic Management Measures

Traffic management measures will have to be adopted to cater to the increasing traffic. The following measures have been proposed.

- Provide adequate traffic signs and signage to notify residents
- Install safety mirrors to aid visibility in conflict points
- Prevent on street parking
- Provide speed humps to regulate speed of vehicles on local streets
- Provide pedestrian crossings and dedicated footpath to cater to the walking population
- Assign traffic wardens to regulate flow of project traffic during peak hours

7.6.7.3 Railway Siding

The nearest railway station is Cuddalore Port Junction, and it connects between Villupuram – Cuddalore Port Section falling in Tiruchchirappalli Division under Southern Railway. The approximate length of the connectivity line is 3.8 km from take-off at port.

For the proposed GCT, Cuddalore Port Railway Station has been identified as the preferred serving station. Located at Km 209.20 (F/CSTM) on the Villupuram–Cuddalore Port section of Tiruchchirappalli Division, Southern Railway, Cuddalore

Port Junction is an electrified station equipped with electrically operated points and multi-aspect colour light signals, all interlocked through Electronic Interlocking and controlled from the panel in the Station Master's office.

The Gati Shakti Multi-modal Cargo Terminal (GCT) siding will be required to handle approximately 4 – 5 rakes per day of outward coal traffic. Total Track length will be 5.5 km with a Broad-Gauge of 1676 mm. A Road Over Bridge (ROB) is proposed across NH-32. The proposed GCT will primarily handle outward movement of Coal, with provision for handling outward movement of POL in the future phase.

Type Of Wagon Used For Outward Traffic

- Coal BOXN
- POL BTPN

CUDDALORE PORT RAILWAY STATION

Cuddalore Port Railway Station has been identified as the preferred serving station. Located at Km 209.20 (F/CSTM) on the Villupuram–Cuddalore Port section of Tiruchchirappalli Division, Southern Railway, Cuddalore Port Junction is an electrified station equipped with electrically operated points and multi-aspect colour light signals, all interlocked through Electronic Interlocking and controlled from the panel in the Station Master's office.

Sign convention for Chainage measurements

All the chainages for the existing & proposed facilities along alignment for Railway siding & Inplant yard are reckoned by considering the center line of Cuddalore Port Junction building is considered as zero chainage for all the proposed GCT.

Proposed facilities at GCT yard:

The following facilities are proposed to be provided at the GCT yard in order to meet the handling of traffic at Terminal.

Line No.	Function	Proposed CSR
Line no. – 1A	Pre-Coal Loading Line	720.00 m (SILO to DE)
Line no. – 1	Post-Coal Loading Line	743.00 m (FM to FM)
Line no. – 2	Engine Escape Line	743.00 m (FM to FM)
Line no. – 3	Future POL Line	720.00 m (FM to DE)

- The track gauge shall be 1676mm (Broad Gauge).
- Maximum permissible speed on proposed GCT shall be up to 15 Kmph since this is a dead-end terminal and extension of existing station yard.
- All the culverts and bridges will be built to maximum axle load of 25 tonnes.
- Gradient of GCT yard 1 in 1200/Level.

Cuddalore Port requested for rail connectivity to Indian Railways details are provided in **Appendix L**.

7.6.8 Traffic Management Plan

The improvements to maintain the required level of service can be implemented by adopting traffic management measures for efficient traffic operations. Traffic

Management Plan (TMP) indicates traffic routes and the measures for traffic regulation. It indicates the roads for use of certain classes of traffic, the location of traffic control i.e. signage and markings and the directions in which traffic should move. These are necessary for safe and efficient movement of vehicles and pedestrians.

Traffic Calming

Traffic calming is intended to slow and control motor-vehicle traffic in order to improve safety for pedestrians and bicyclists. Traffic calming measures are of various types like speed tables, curb extension, chicane etc. These are mitigation measures to ensure safety.

Traffic Control Measures

The internal roads are undivided to maintain flexibility of traffic lanes. Minimum 6m wide roadway width has been provided for the movement of vehicles. Recommended design speed on the internal road is 15kmph and on the turn is 10kmph. Speed tables will be provided near the entrance/exit point to control traffic and regulate speed of vehicles. Additionally, the following shall be required to maintain traffic flow at required level of service.

- **Road Markings and Signages:** Proper Road markings (edge, median, arrows, turning, Kerb) and signages (direction, turning, speed, and pedestrian crossings) will be installed and maintained on all roads in the vicinity of project premises.
- On-street parking will be prohibited on all external and internal streets.
- Pick and drop at designated places only.
- Preferably no U-Turn on roadway
- Traffic calming measures – speed tables, signage

Apart from internal signage – it will be requested to provide necessary signage and traffic control measures, on neighboring roads, – such as Speed limit, Left hand curve, pedestrian crossing etc.

Pedestrian Interaction

Pedestrian interaction with Port vehicles shall be minimized as far as practicable through a number of traffic control measures, including but not limited to:

- Designated walkways (colour coded)
- Footpath for pedestrian movement
- High-visibility clothing night/day (PPE)
- Audible tones (reversing alarms)
- Speed limits
- Reversing indicators & Reversing cameras
- Restricted areas
- Fencing, delineation, and barriers

All personnel entering operational areas are required to wear high-visibility clothing and complete safety equipment.

All operators onsite are required to ensure their trucks, mobile plant such as forklifts and loaders are fitted with reverse beepers and flashing roof lights.

Lighting and visibility

Adequate lighting shall be ensured during night operations for both truck operators and pedestrians at the Berths, Cargo Storage Sheds, Stack yard, Container yard, etc. An average of 40 lux illumination shall be provided during night to ensure smooth operations.

Hazard & Incident Reporting

Port shall strive to maintain a hazard and incident free working environment. All personnel have a duty of care to report hazards and incidents, including near misses. All hazards and incidents are to be reported immediately to Cuddalore Port health & safety department and an incident report must be filled within 24 hours.

Monitoring compliance to traffic controls

Port Security Team shall conduct regular patrols 24hours a day 7days a week. Security personnel shall assist with monitoring traffic compliance. Additionally, the Port management, supervisor team, and H&S committee conduct regular reviews and assist with compliance.

Port shall run a system to assist with enforcement of rules to individuals and operations within Port areas.

Signage

Road markings perform the important function of guiding and controlling traffic on a road. The markings serve as psychological barriers and signify the delineation of traffic paths and their lateral clearance from traffic hazards for safe movement of traffic. Road markings are therefore essential to ensure smooth and orderly flow of traffic and to promote road safety.

The Road signs i.e. Mandatory, Cautionary and Informatory are proposed for main port road, internal roads, access roads and other project facilities in accordance with the IRC: 67-2012.

The Road Markings shall be provided as per IRC: 35 such as Centre, edge line, stop line, give way line, diagonal/chevron markings, etc. They shall be painted with hot applied thermoplastic paints with reflectorizing glass beads as per MORTH specification.

Transverse bar marking made of thermoplastic markings is a treatment to alert and to reduce the speed. Each set comprises of 6 bars, 200 to 300 mm wide 600 mm apart of 5 mm high and of 300 mm wide 1000 mm apart of 15 mm high which may be selected based on the location depending on speed control.

The cat's eye or road studs shall be provided to improve the visibility in the nighttime and wet-weather conditions. Road studs are proposed at the edge lane marking, channelizing islands, etc.

Hazard markers shall be provided to define obstructions like guardrails, physical obstacles, abutment, etc., adjacent to carriageway.

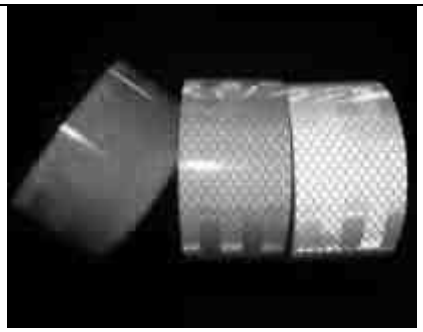
3m (Cats Eye) 290Series with Polymer Shank	**Convex Mirror**
Speed Breaker (PVC) 250X300X50 Mm	**Median Marker**
	
Reflective Sheeting & Tapes	**Pipe Delineator**
Traffic Road Barriers	**Dual Reflector Delineator**

Figure 7-26: Road Safety and Traffic management Products

Maintenance

Roads shall be monitored regularly to ensure the proper maintenance of carriageways, traffic signs and pavement markings. Adopt necessary measures to

provide safety to traffic movement from spillage of cargo, effluents, etc., on roads which are likely to cause accidents.

Access roads with paver blocks are observed to be damaged at many locations and drainage problems such as pooling of water is observed. Such damaged sections shall be repaired, and proper measures shall be adopted to avoid the inundation on the access roads. Routine and periodic maintenance of roads shall be carried out with monitoring and inspection.

Railway lines at crossing locations shall be regularly inspected and monitored to identify the likely defects to rails and its support system due to continuous heavy truck movements and shall be rectified in stipulated time frame to avoid accidents.

Storm water

The existing storm water drains and its associated pipeline facilities installed for the disposal of water shall be regularly checked for chocking and cleaning of the same shall be ensured.

Stacking areas

Unorganized and over capacity stacking of cargo and other materials at cargo storage sheds, stacking yards, etc., shall be monitored and maintained to provide unobstructed access to the traffic movement.

Recommendations

The detail of measures to be implemented as part of Traffic Management plan is discussed in the above sections. The summary of the proposals made to facilitate smooth, safe flow of traffic and speedy evacuation of cargo are presented below:

- Maintain the carriageways in proper condition and provide adequate traffic signs, pavement markings and necessary traffic calming measures to provide delineation to the traffic and also alert the road users.
- All the roads shall be provided with necessary Traffic signages including Mandatory, Cautionary and Informatory signs shall be provided at necessary locations to guide the road users.
- Speed control measures such as rumble strips, transverse bar markings and necessary traffic signs such as speed limit, curve signs, median opening, give way, etc shall be provided at major junctions and crossing locations.
- Install safety barriers such as precast New Jersey barrier, etc., in Cargo Storage Sheds areas at necessary locations to bifurcate the outbound from the inter cart movement and provide necessary road furniture to facilitate smooth flow of traffic.
- Develop surrounding areas and approach roads of all Road Weigh Bridges with proper carriageway path at approach of weigh bridges to avoid queuing.
- Provide railway crossings with proper information signs to road traffic so as to avoid accidents and ensure smooth flow of traffic.
- Identify separate parking spaces jointly by Safety and Operations teams in the vicinity of Cargo storage sheds, stacking yards and approaches to Road Weigh

Bridges, etc., to have an organized movement of both inter cargo and outbound traffic.
- Plan a speedy and proper disposal of storm water from the access roads.
- Provide adequate lighting of average 40 lux during night at the locations involving major activities such as Berth areas, Cargo storage sheds, Stacking yards, Railway line crossings and approaches to Road Weigh Bridges, etc.

7.6.9 Proposal of Parking

A parking provision of 6-8 Trucks per MMTPA is a sufficient provision. The area requirements have been calculated based on an average area of 150 sq.m per parking lot.

7.7 Social Impact Assessment

The main objective of the Social Impact Assessment Study in the project area is to assess the impacts of the Cuddalore port Expansion development and support the efforts of Cuddalore Port in designing the Corporate Social Responsibility framework and socio-economic programmes in study area comprising of 15km radius from the project site.

7.7.1 Social Impacts during Construction Phase

7.7.1.1 Land Acquisition

The expansion development plan of Cuddalore port will be in an area of 45.21 ha which is completely in possession of Cuddalore Port. Additionally, an area of 13.88 ha is required for the Expansion development based on consideration of shipbuilding and repair facility which will be acquired from government.

7.7.1.2 Impact on Families

There are no settlements in the project site and project doesn't attract resettlement and rehabilitation (R&R).

7.7.1.3 Impact on nearby settlements and mitigation measures

During construction of port expansion plan, the anticipated impact on nearby settlements during the construction phase will be due to air pollution and the noise-generating activities. The dust suppression measures and enclosures around the high noise generating areas will be provided. The noise generating equipment will be provided with enclosures such that cumulative noise will be within permissible limits.

Measures will be taken to control dust, and barriers will be installed around areas that generate high noise during construction. Ambient noise levels will be regularly monitored. Equipment that produces noise will be enclosed to ensure overall noise remains within permissible limits. Vehicles will operate only during non-peak hours, and speed limits will be strictly followed. Noise and pollution from construction

activities will mostly remain within the project site. The impact of these activities will be temporary and will cease on completion of construction period.

7.7.1.4 Fishing Activity

The following are the observations made in the socio-economic profile of the fishermen in the Project Influencing Area (PIA) region.

- Total of 24 fishing villages and 22 fish landing centers are falling in the study area in which Twenty (20) villages and 18 fish landing centers are under Cuddalore district and other Four (04) villages are under Puducherry district.
- Total fishermen community population is 33329 out of which males are constituted to 51.54% and females account to 48.46%.
- Average Sex ratio (females per 1000 males) is 940 for entire fisher men community.
- Among the fishing community households, 1273 own outboard motorized crafts, while 1478 rely on non-motorized crafts.

The construction activities necessary for the development of ports and harbours includes dredging, berth construction, installation of handling equipment, development of storage areas, and access channel. These activities may disturb the existing fishing activity of the area adjacent to the project if not planned properly. The following are the concerns/impacts likely to arise due to master plan development of Cuddalore Port.

- Displacement of house holds
- Restriction of Access to Sea
- Reduced fish catch/ income
- Loss of beach and landing centres
- Loss of fishing grounds

The above aspects were carefully studied and following mitigation measures were Suggested:

- Development is within the notified Port Limits of Cuddalore Port issued by Government of Tamil Nadu
- No R&R is envisaged for the Expansion plan development of Cuddalore port.
- To avoid any disturbance to the fishermen movement, signboards will be placed at the construction activities in order to make fishermen aware of the ongoing activities.
- Proper Planning execution of offshore construction activities to ensure completion of the construction as per schedule.
- Ensure that slop tanks will be provided to barges/ workboats for collection of liquid/ solid waste during construction phase.
- All the discharges and Air Emissions will be maintained with in the stipulated standards by adopting appropriate methods as committed.
- No fishing grounds are reported in the proposed areas for master Plan development.

Positive Impacts

The project will bring several positive impacts, including improved educational facilities, enhanced healthcare services, the development of rural infrastructure, and the promotion of sustainable livelihood opportunities. These advancements will contribute to overall community development, fostering better living standards and long-term economic growth.

7.7.2 Social Impacts during Operational Phase

7.7.2.1 Fishing Activity

In addition to the discussion in above sections, designated safe navigation routes will be established for the movement of fishing vessels. However, since the port activities during the operational phase will be confined to the project area, no disruption to fishing activities is expected.

7.7.2.2 Employment Potential

During construction phase, approximately 500 workers will be employed respectively.

7.7.2.3 Employment Potential

During the operational phase of the port, there will be a significant demand for skilled, semi-skilled, and unskilled workers. It is essential that local individuals are primarily employed, with selection based on their skills and educational qualifications.

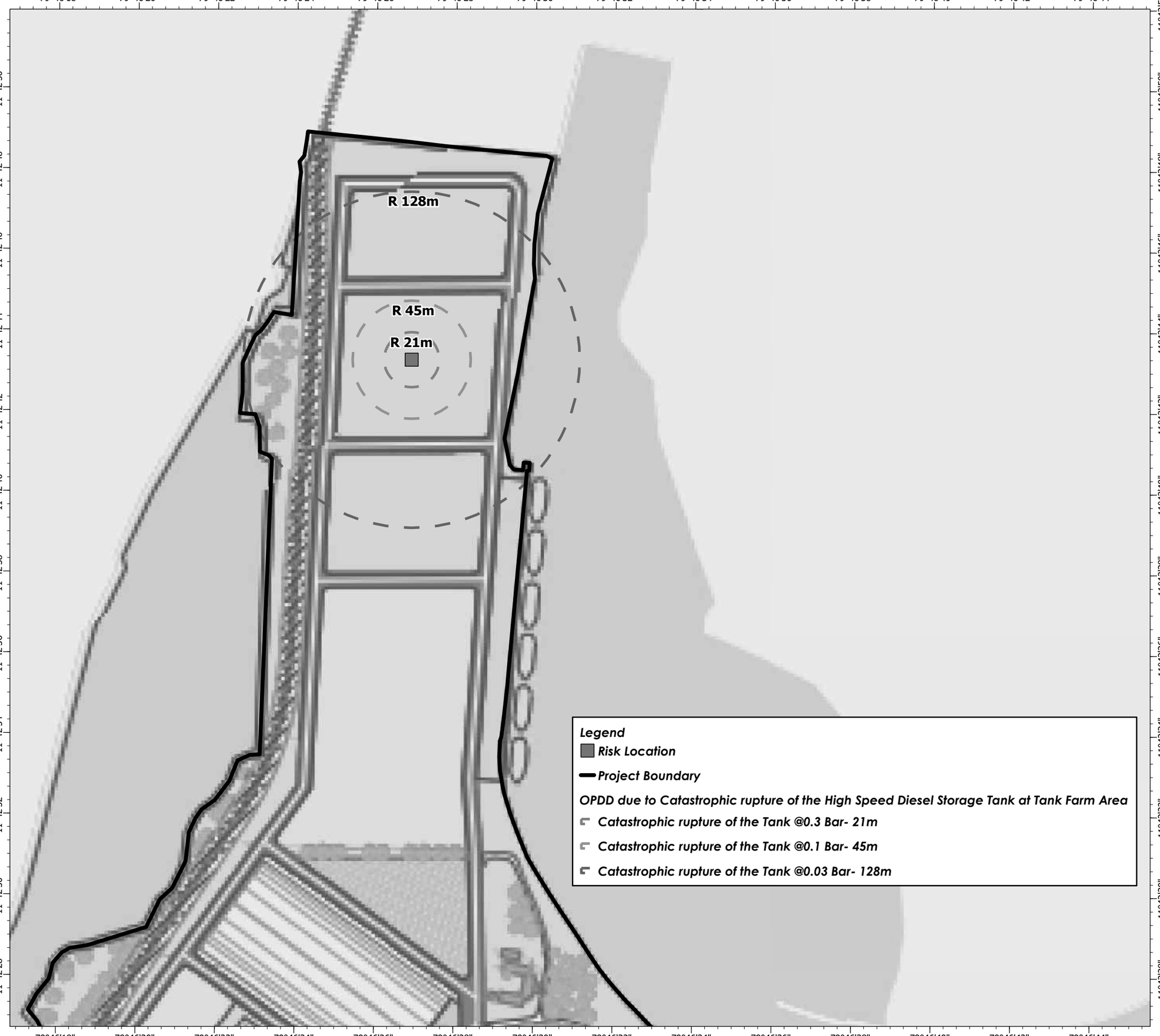
The direct and indirect employment will be 82 and 123. Hence, the proposed project is likely to have positive impact on socioeconomic condition of the region overall.

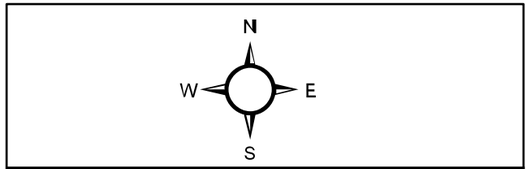
7.7.2.4 Public Health and Safety

The proposed development plan of Cuddalore Port will accommodate dry bulk, break bulk/general cargo, containers, and liquid cargo, classified as either hazardous or non-hazardous materials. The handling and transportation of dry bulk cargo to and from the project site, as well as exposure to dry bulk dust, are expected to have minimal impact on public safety and health. Cuddalore Port will implement appropriate safety measures during the handling, transportation, and storage of cargo to ensure compliance with safety standards.

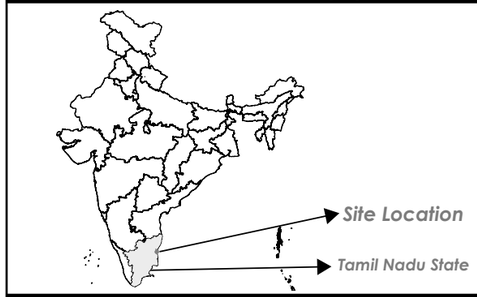
An effective Disaster Management Plan (DMP), including both Onsite and Offsite emergency plans, will be developed and implemented to reduce the occurrence of emergencies and mitigate their potential impacts.

Figures

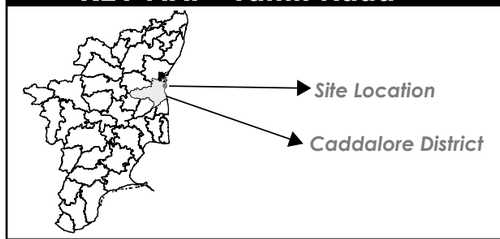




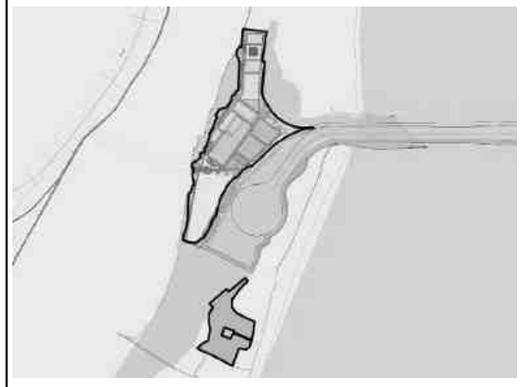
KEY MAP- India



KEY MAP- Tamil Nadu



KEY MAP- Project Site



SCALE

0 20 40 80 120 160 Meters

Client: M/s. Mahathi Cuddalore Port and Maritime Private Limited.

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: OPDD due to Catastrophic rupture of the High Speed Diesel Storage Tank at Tank Farm Area

Project No: C25014

Made: KPS

Approved: SAM

Date: 05/01/2026

Figure No: RD001 0

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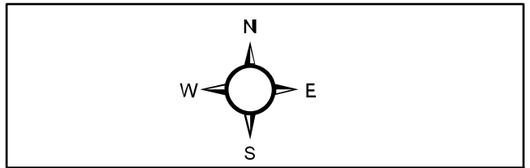
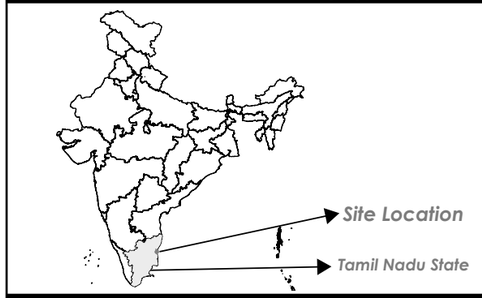
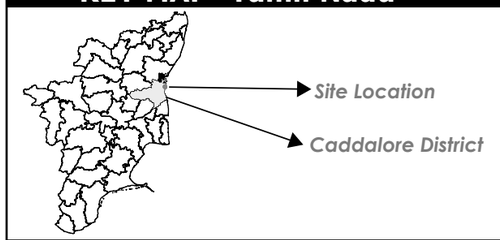
Nimayat Nagar, Hyderabad, Telangana, 500029



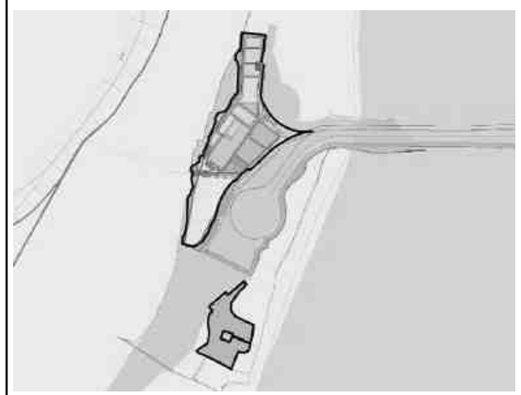
KEY MAP- India



KEY MAP- Tamil Nadu



KEY MAP- Project Site



SCALE

0 20 40 80 120 160 Meters

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: OPDD due to 100mm Leak in Pipeline from Berth/Jetty to Storage Tanks (Tank Farm Area)

Project No:	C25014
Made:	KPS
Approved:	SAM
Date:	05/01/2026
Figure No:	RD002 0

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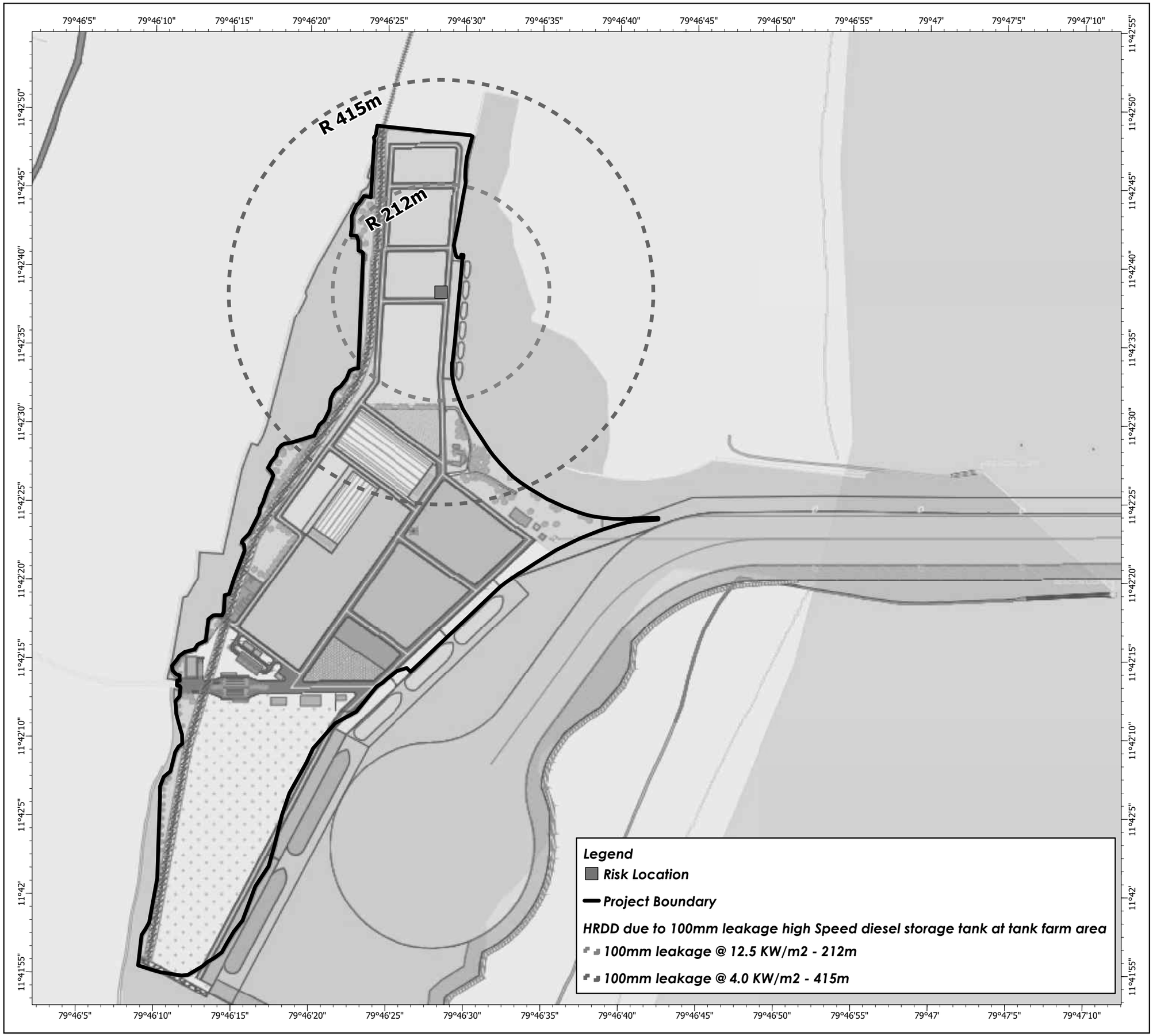
501 A, Sudheer Tapars Towers,
Himayat Nagar, Hyderabad, Telangana, 500029



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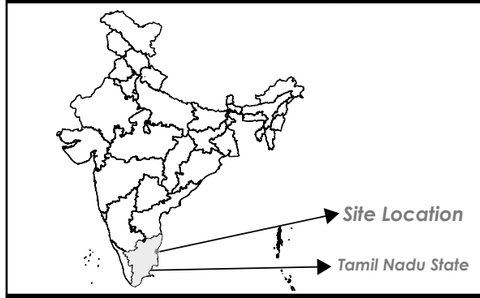
KEY MAP- India



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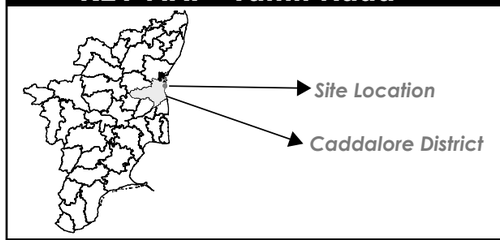

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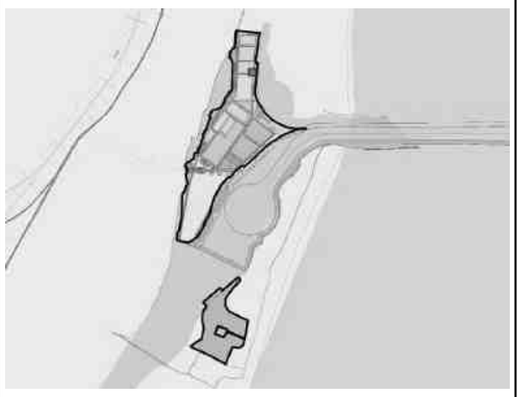

SCALE

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Client: M/s. Mahathi Cuddalore Port and Maritime Private Limited.

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: HRDD due to 100mm leakage high Speed diesel storage tank at tank farm area

Project No: C25014

Made: KPS

Approved: SAM

Date: 05/01/2026

Figure No: RD003 0

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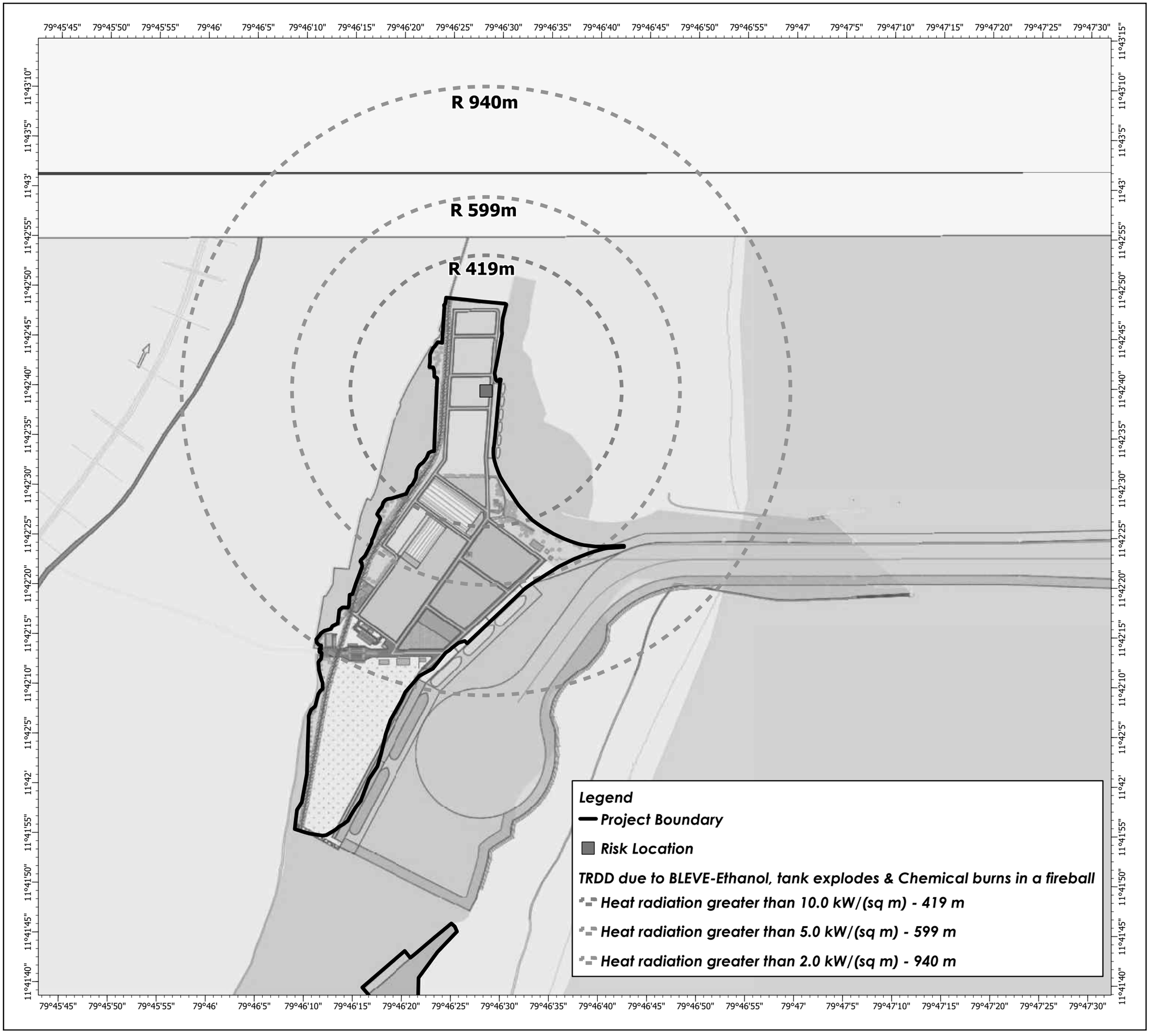

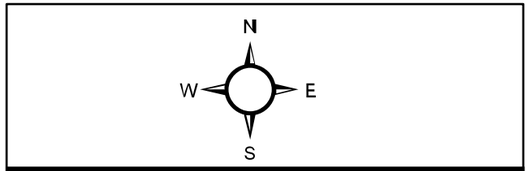

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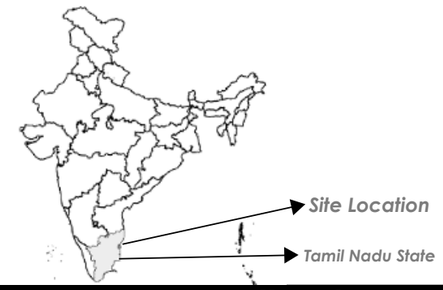

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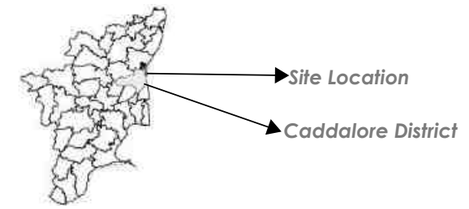

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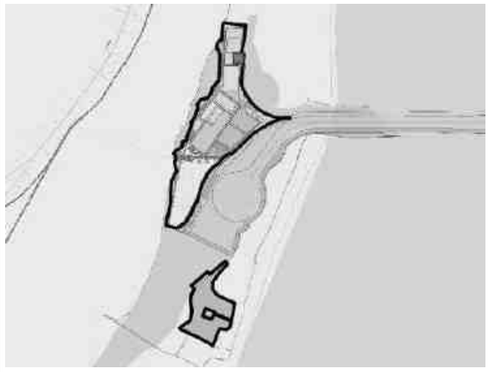

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: TRDD due to BLEVE-Ethanol, tank explodes & Chemical burns in a fireball

Project No:	C25014
Made:	KPS
Approved:	SAM
Date:	05/01/2026
Figure No:	RD004 0

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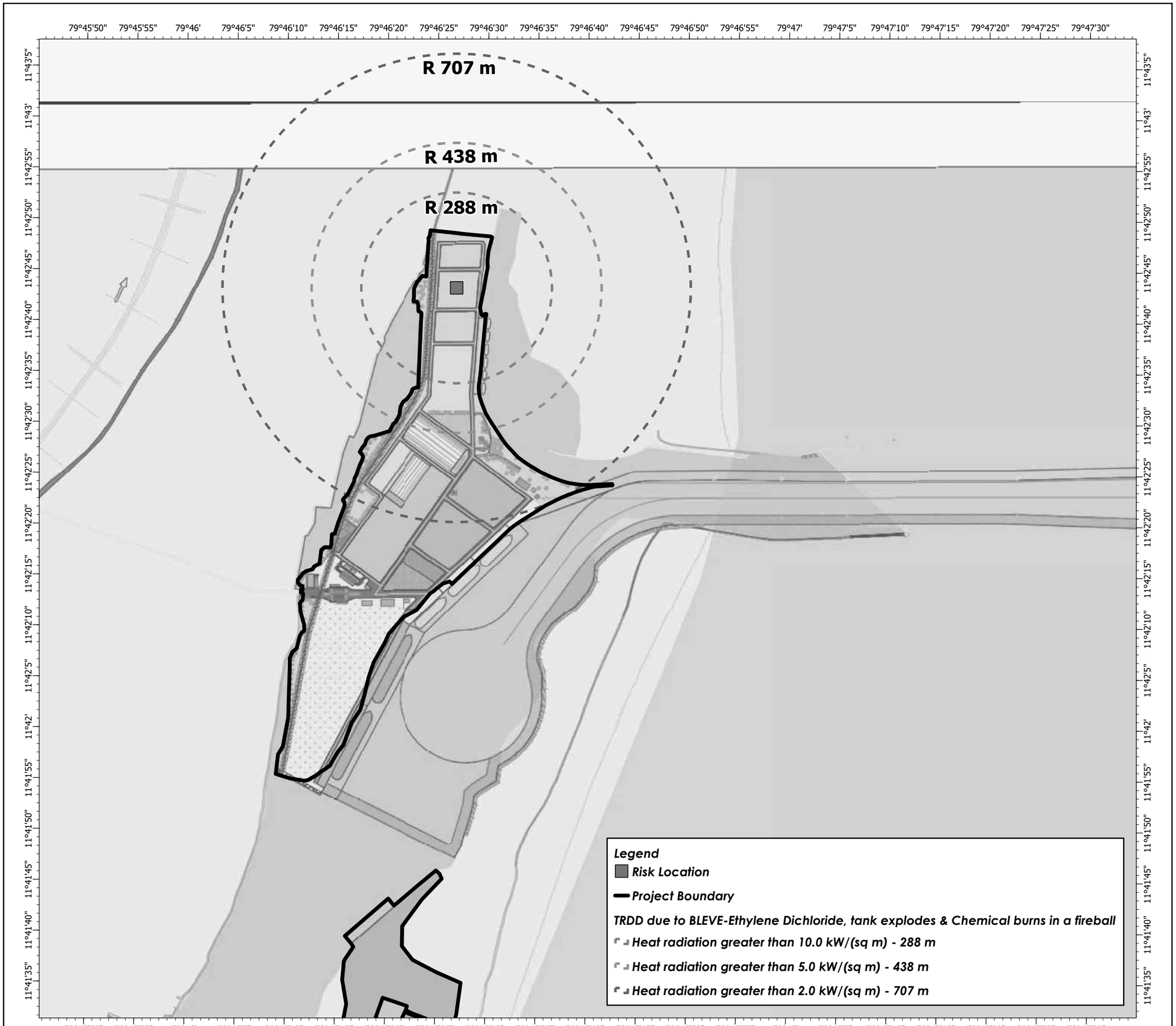
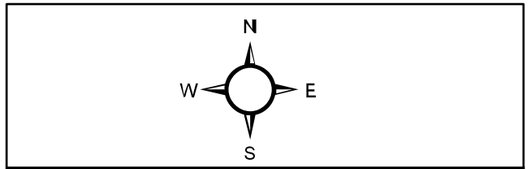
Himayat Nagar, Hyderabad, Telangana, 500029





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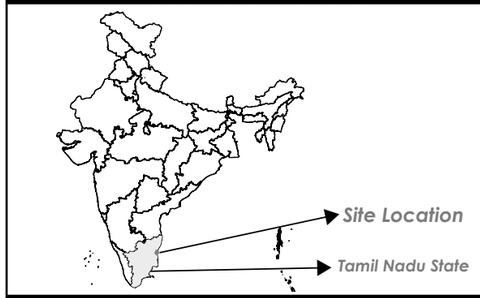

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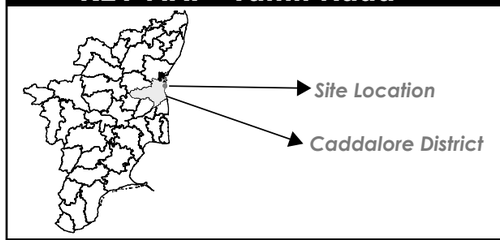

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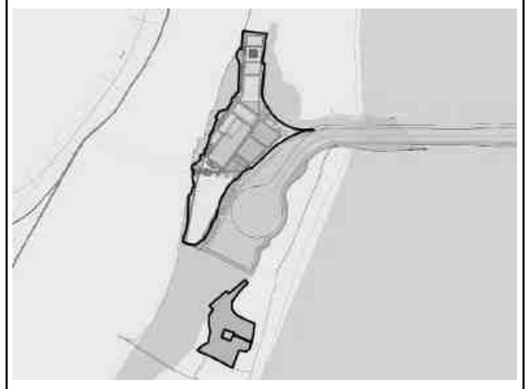

SCALE

0 85 170 340 510 680 Meters

Client: M/s. Mahathi Cuddalore Port and Maritime Private Limited.

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: TRDD due to BLEVE-Ethylene Dichloride, tank explodes & Chemical burns in a fireball

Project No:	C25014
Made:	KPS
Approved:	SAM
Date:	05/01/2026
Figure No:	RD005 0

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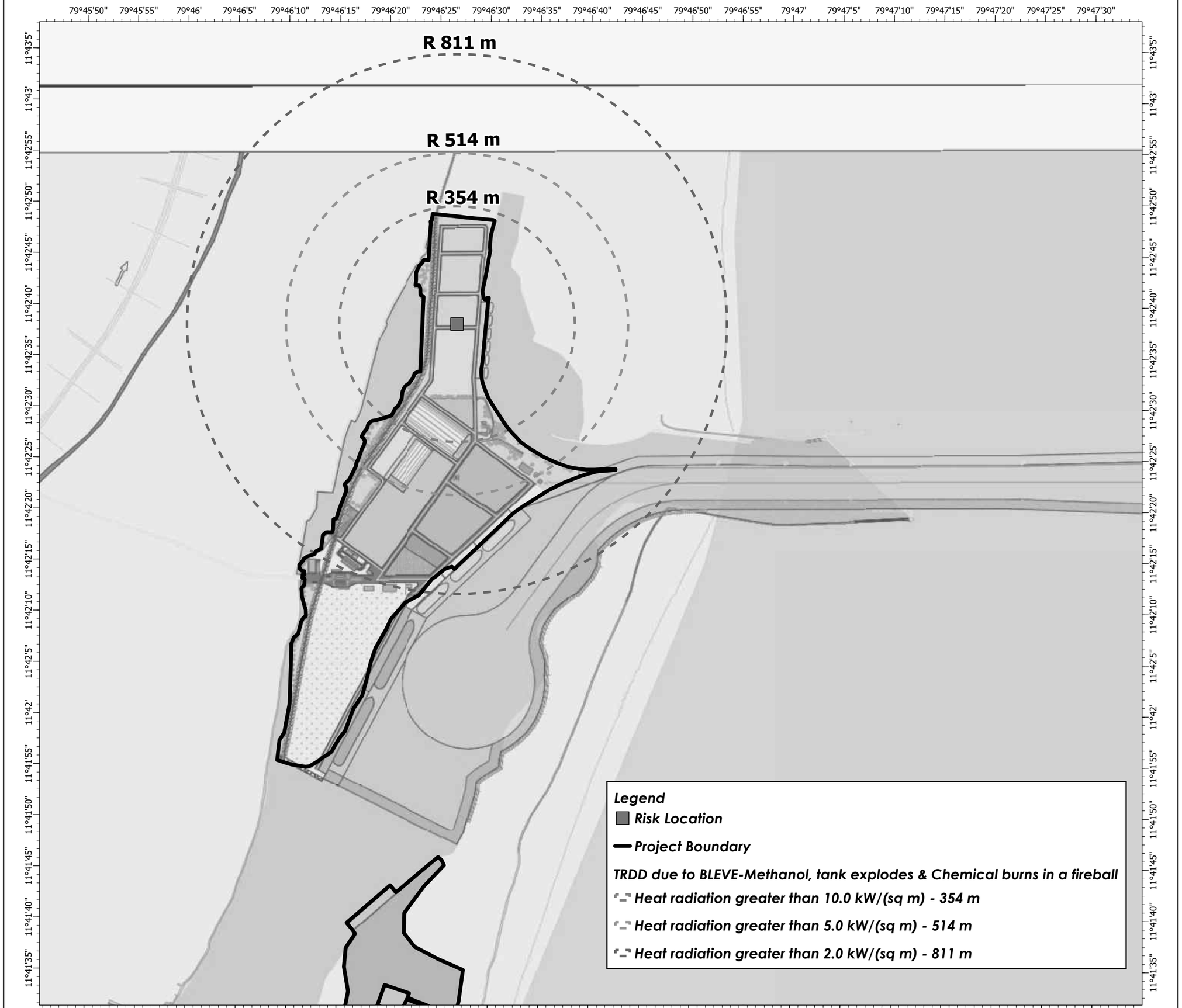

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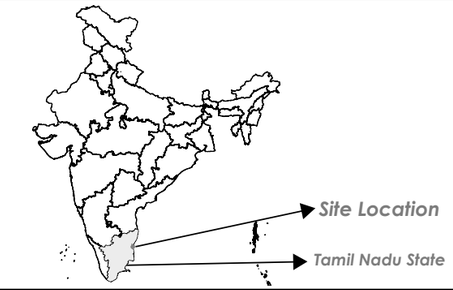

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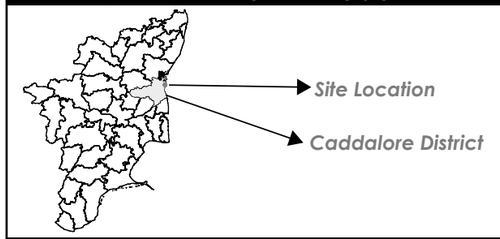

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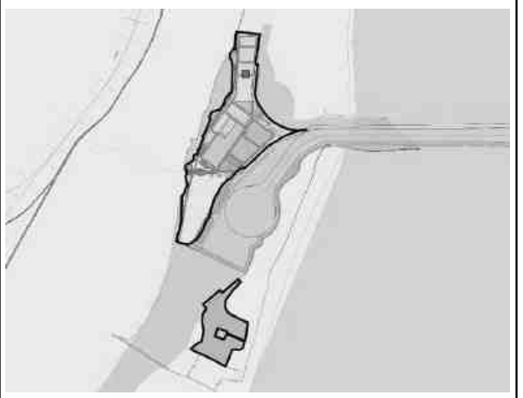

SCALE

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: TRDD due to BLEVE-Methanol, tank explodes & Chemical burns in a fireball

Project No:	C25014
Made:	KPS
Approved:	SAM
Date:	05/01/2026
Figure No:	RD005 0

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Himayat Nagar, Hyderabad, Telangana, 500029

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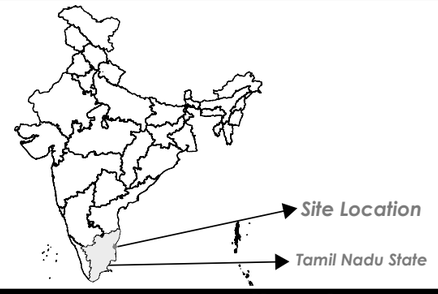

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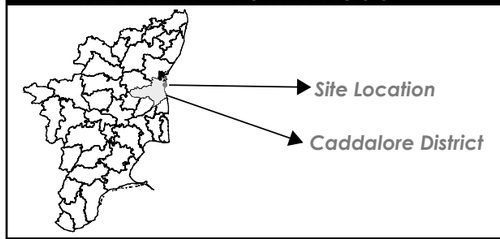

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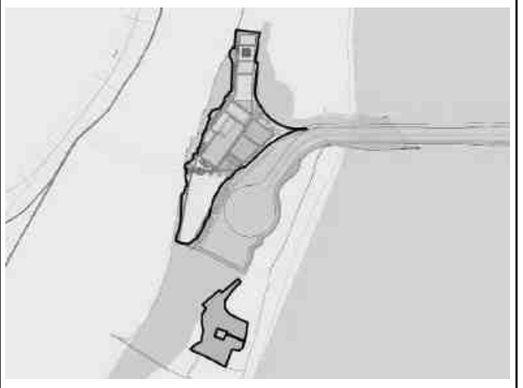

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title:
TRDD due to BLEVE-Ethanol, tank explodes & Chemical burns in a fireball

Project No: C25014
Made: KPS
Approved: SAM
Date: 05/01/2026
Figure No: RD007 0

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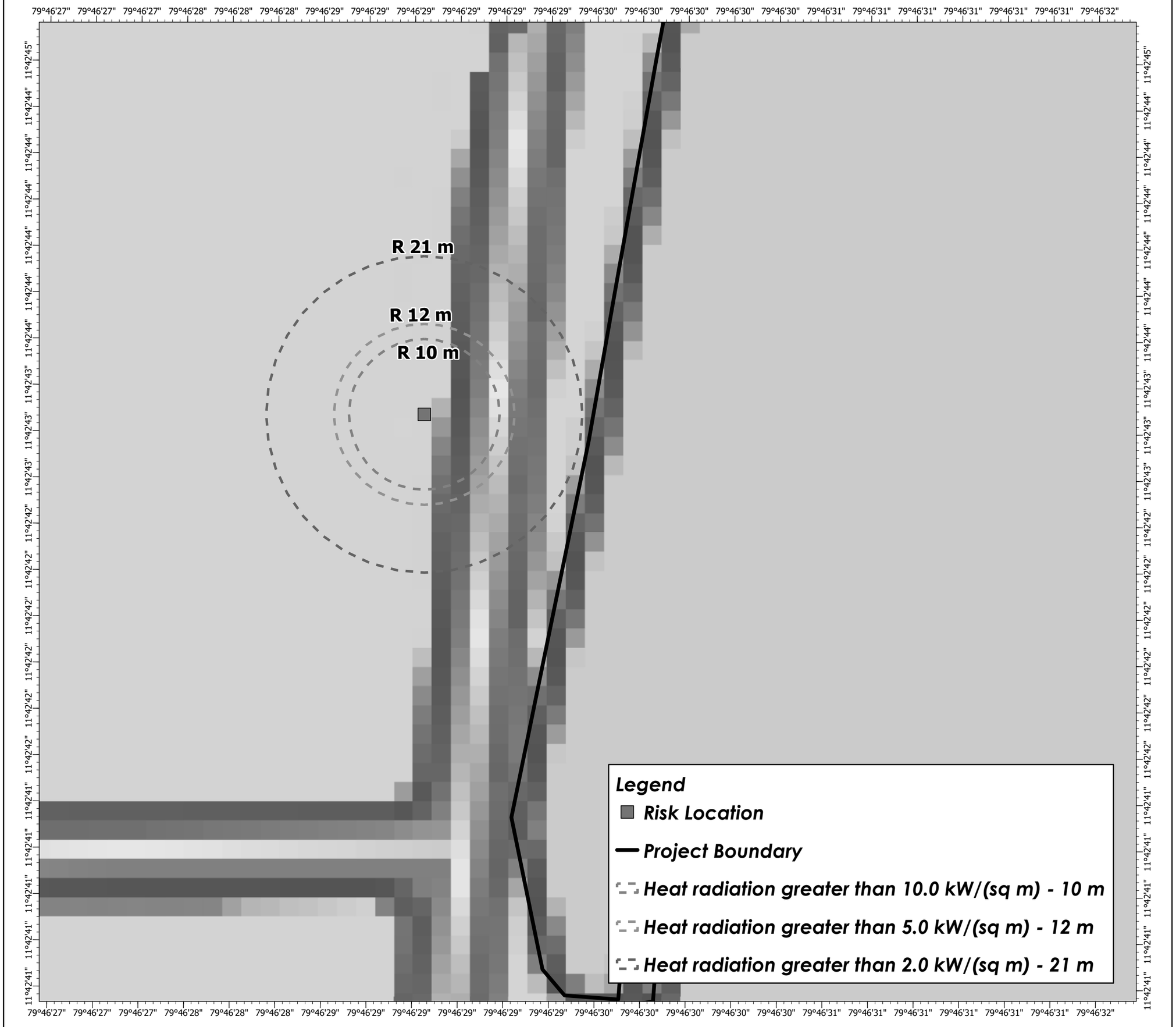
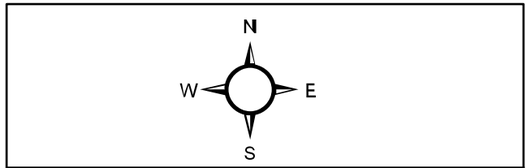
501 A, Sudheer Tapars Towers,
Himayat Nagar, Hyderabad, Telangana, 500029





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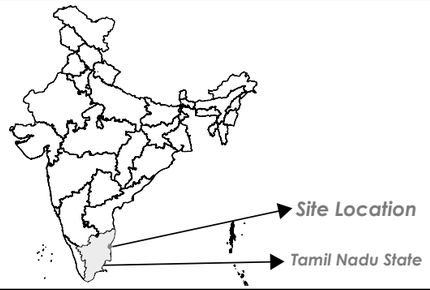

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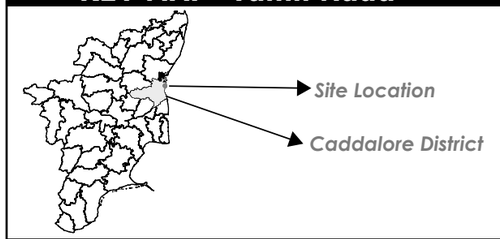

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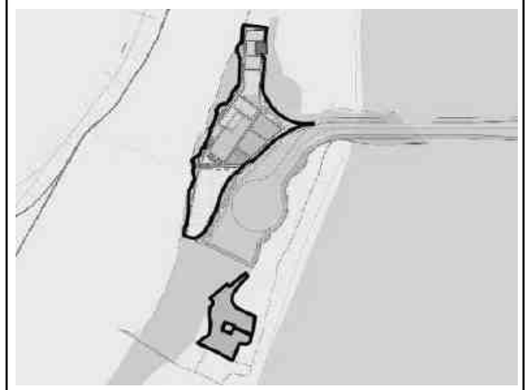

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Client: M/s. Mahathi Cuddalore Port and Maritime Private Limited.

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Project: EIA Study for Cuddalore Port Expansion, Cuddalore, Tamil Nadu

Title: TRDD due to BLEVE-Ethylene Dichloride, tank explodes & Chemical burns in a fireball

FALCON RESILIENT INFRA CONSULTANTS
801 A, Sudheer Tapars Towers,
Himayat Nagar, Hyderabad, Telangana, 500029

Project No:	C25014
Made:	KPS
Approved:	SAM
Date:	05/01/2026
Figure No:	RD008 0

Chapter 8
Project Benefits

8 Project Benefits

8.1 Preamble

Cuddalore Port is an anchorage minor port in Tamil Nadu, India, located at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal, about 180 km south of Chennai. Erstwhile Tamil Nadu Maritime Board (TNMB) was the nodal agency of Government of Tamil Nadu for operating the Cuddalore Port. TNMB on ground has developed all the proposed infrastructure including the berth construction, dredging activities as per accorded EC & CRZ clearance for cargo handling of 5.68 MTPA.

Currently, Mahathi Cuddalore Port and Maritime Pvt Ltd (MCPMPL) has entered into a concession agreement with TNMB for development and operation of the Cuddalore Port, Tamil Nadu for 40 years under the PPP Model vide Agreement dated 04.07.2025. Now, MCPMPL proposed to increase cargo handling capacity from 5.68 MTPA to 11.48 MTPA along with ship building and repair activities within the notified port limits of Cuddalore Port.

The Cuddalore port's revitalization marks a significant step in bolstering the coastal trade and logistics network of the region.

8.2 Infrastructure Development

The expansion specifically supports the chemical, industrial, and agricultural sectors in the region by providing better import/export infrastructure, which is expected to attract further investments. With the increased cargo handling, the project is poised to enhance the region's industrial potential.

8.3 Improved Socio-Economic Conditions

The proposed project is likely to have a positive impact on the socio-economic conditions of the region. The project will create jobs in construction, operation, logistics, and maintenance of the port. The people will have higher incomes due to direct as well as indirect employment and will have higher earning and buying capacities.

8.4 Employment Generation

Expansion of Cuddalore port expected employment of approximately 500 workers (Direct 10 and Indirect 490) during construction phase. During operation phase, approximately 205 workers will be employed (Direct 82 and Indirect 123).

There will be a demand for skilled, semi-skilled and unskilled workforce during the operation phase of the Port and mostly local people would be employed based on their skills and educational qualification. The ship repair activities will provide specialized jobs and services for vessels. The proposed project is likely to have a positive impact on the socio-economic condition of the region overall. With the

addition of this employment potential, the indirect employment will be increased by many folds.

8.5 Revenue Generation

The proposed project transforms the port into a competitive, all-weather facility for increased, cost-effective trade generating significant revenue. The development is designed to support the local manufacturing industry by providing faster, more efficient cargo handling, boosting overall trade throughput and related logistics revenue.

With better port infrastructure and increased cargo handling capacity, the Cuddalore port is expected to become a vital node in Tamil Nadu's maritime economy.

8.6 Corporate Environment Responsibility/Social Upliftment Activities

Cuddalore Port is deeply committed for supporting the community and promoting sustainable development. The company integrates corporate environmental responsibility (CER) as a core business model, adopting a holistic approach that directly benefits the communities it impacts. Through this approach, Cuddalore Port fosters balanced growth, ensuring that development aligns with both ecological and economic stability within the study area.

The proposed Expansion development of the port allows for increased export/import activity for local industries, directly enhancing the income levels of the local population. The port expansion shall focus on sustainable livelihood opportunities, improving the status of health and education and broadening the range of choices by creating rural infrastructure. The social upliftment will be broadly in the following areas:

- Education
- Community Health
- Sustainable Livelihood Development
- Rural Infrastructure Development

8.6.1 Education Support

- Providing computers and infrastructure for schools
- Supplying furniture for educational institutions
- Constructing school and Anganwadi buildings with toilets
- Building compound walls for schools
- Establishing tuition centres
- Providing school buses for children

8.6.2 Health Programs

- Organizing medical camps, including eye and general health camps
- Setting up sub-health centres for improved healthcare access

- Enhancing public confidence in healthcare services

8.6.3 Sanitation & Drinking Water Initiatives

- Constructing toilets for households and integrated sanitary complexes
- Installing RO plants to ensure clean drinking water
- Digging bore wells for water supply.

8.6.4 Other Initiatives

- Improving roads for better connectivity
- Constructing community halls for social gatherings
- Supporting self-help groups (SHGs) for women in neighbouring villages
- Promoting tree plantations for a greener environment
- Implementing rainwater harvesting and watershed management initiatives
- Offering skill training programs for economic empowerment
- Providing sports equipment to promote physical activities
- Adopting villages for community development
- Encouraging agriculture, horticulture, and animal husbandry
- Supporting watershed programs for sustainable land use

8.6.5 CER/Social upliftment activities interventions

Proposed social upliftment activities along with timeline for implementation of CER/social upliftment interventions are given below:

S. No.	Sector
A.	**EDUCATION**
1	Providing Computers & Supply of Furniture
2	Additional classrooms to Schools
3	Construction of Anganwadi Buildings with Toilets
4	School Construction of Compound wall
B.	**VILLAGE LEVEL INFRASTRUCTURE**
1	Provision of drinking water to villages
2	Bore well
3	Sanitation- Household toilets
4	Construction of Community Hall
5	Better road facility
6	HEALTH –Sub health centres & health camps
C.	**YOUTH DEVELOPMENT**
1	Youth motivation programmes
2	Skill Training specific to the Port & industries
3	Promoting ancillary units through Youth Entrepreneur development programmes
4	Sports Equipment's
D.	**WOMEN EMPOWERMENT**
1	**Women empowerment motivation programmes**
2	Skill Training
3	Promoting service units (Job order/ Finishing contract jobs/Gardening/Horticulture/ Catering/canteen) through SHG Entrepreneur development programmes
E.	**ENVIRONMENT/SUSTAINABLE DEVELOPMENT**
1	Tree plantation
2	Agriculture, Horticulture, Animal Husbandry support programmes
3	Rainwater harvesting and water shed programmes

Chapter 9
Environmental Cost Benefit Analysis

9 Environmental Cost Benefit Analysis

Not prescribed in ToR by MoEFCC. Hence Environmental Cost Benefit Analysis is not mentioned in EIA Study.

Chapter 10
Environmental Management Plan (EMP)

10 Environment Management Plan

10.1 General

An Environmental Management Plan (EMP) provides a structured approach to ensuring that a project's development aligns with environmental regulations and port best practices. It covers crucial aspects such as environmental monitoring, reporting, emergency response, waste management, and pollution control. To mitigate environmental and social impacts, the EMP must be applied during both the construction and operational stages of the project.

The Environmental Management Plan was created on a site-specific basis to guarantee that the project is carried out in a way that is environmentally sustainable and that all parties involved, including the project's proponent, users, contractors, and subcontractors including any consultants understand any potential environmental risks associated with the project and take the necessary precautions to reduce them.

The main objectives of EMP are:

- To ensure better environment in & around the project site.
- Effective EMP is developed separately for construction and operational phase.
- Ensure that the mitigation measures are being implemented effectively.
- Monitor the effectiveness of mitigation measures.
- Act upon when unforeseen impacts occur.
- Define a set of policies and objectives for environmental performance and continual enhancement of performance.
- Recommend an organizational structure for effective implementation of the EMP
- Draw up an implementation plan and cost schedule for EMP.

10.2 EMP-Construction phase

Table 10-1: Impacts and Mitigation Measures during Construction Phase

S.no	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores	Time frame	Responsible agency
1	Material transport and construction activities	Air Quality	• Air pollution in the vicinity of project site due to vehicular emissions, DG set emissions, windblown dust from material movement • Fugitive emissions from material unloading. • Dust during site preparation works	• Water sprinkling • Material unloading should be carefully planned to use hydraulic vehicles with lower height to ensure efficiency and safety • All the vehicles and construction machinery shall be periodically checked to ensure compliance to the emission standards. • Vehicles with construction material shall be covered with tarpaulin covers. • Pollution under control (PUC) certified vehicles shall be used for material transportation and other activities.	54.75	During entire Construction phase	Cuddalore Port
2	Vehicular movement, operation of DG set engines and construction activities	Noise and Vibrations	• Noise pollution is anticipated due to operation of construction machinery, piling, movement of vehicles and construction activities.	• Regular servicing and maintenance of construction machineries, equipment and vehicles to control noise. • DG set will be provided with acoustic enclosure. • High noise generating activities such as piling and drilling will be scheduled at daytime	As per the project need and prevailing rates	During entire construction phase	Cuddalore Port

S.no	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores	Time frame	Responsible agency
				• Noise levels shall be maintained below threshold levels stipulated by Central Pollution Control Board (CPCB) time to time • Working personnel will be provided with personal protective equipment			
3	Solid/construction waste generation during the construction phase	Soil Quality	Soil contamination due to disposal of waste onto land.	• Construction and demolition waste shall be handled as per C&D waste management rules, 2016. • Solid waste generated should be properly collected and disposed of safely as per Solid Waste Management Rules, 2026 • STP sludge will be used as manure in green belt. • No waste shall be burned at site. • Used cans or any hazardous waste such as waste oil and used oil shall be sent to approved TNPCB recyclers.	0.04	During entire construction phase	Cuddalore Port
4	Aqueous discharges in harbour basin	Marine Water Quality	• Increase in turbidity Change in marine water quality/ecology due to discharge ship wastes (sullage), sewage, bilge water, Desalination Plant reject water. Change in marine water quality/ecology due	• Check turbidity levels with baseline levels as reference during entire monitoring programme • Ships are prohibited from discharging wastewater, bilge, oil wastes, etc. into the near shore as well as harbour waters.	0.44	During entire construction phase	Cuddalore Port

S.no	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores	Time frame	Responsible agency
			to discharge ship wastes (sullage), sewage, bilge water, Desalination Plant reject water.	• As a mitigation measure for spillages, an Oil spill contingency plan is prepared and will be implemented. • Marine environmental monitoring as per environmental monitoring programme to check the pollution, if any.			
	Capital dredging/ Reclamation/ level raising/dredg disposal Construction of Berths and other offshore structures such as seawater intake/ outfall	Marine ecology	Marine Ecology of this environment is already subjected to the changes due to maintenance dredging activities and hence the net impact will be minimal. Few of the likely impacts are: • Decrease in DO levels. • Disturbance to benthic communities. • Changes in species diversity and density in areas adjoining to dredging site.				
5	Handling of Hazardous wastes	Human safety, property loss and contamination of soil quality	Fire accidents during handling of hazardous waste and health issues	Adequate safety measures as per OSHA standards will be adopted.	As per the project need and prevailing rates	During entire construction phase	Cuddalore Port
6	Usage of water resources	Water Quality	Impacts to the surface water bodies and ground water due to excess usage of water	Optimized utilization of the water, recycle and reuse shall be adopted. reuse shall be adopted. Wastewater and sewage generated shall be treated at modular STP or septic tank with soak pits	As per the project need and prevailing rates	During entire construction phase	Cuddalore Port
7	Management of solid and liquid wastes to be	Accidental discharges	Contamination of water in the waterbodies	Strictly to avoid disposal of liquid and solid muck/waste	As per the project need and	During entire construction phase	Cuddalore Port

S.no	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores	Time frame	Responsible agency
	generated due to construction activities	into the Water bodies		generated during construction activities in the waterbody.	prevailing rates		
7	Surface and ground water quality	Water Quality	Deterioration of water quality in case of discharge of untreated wastewater on ground and in water bodies.	• No untreated wastewater will be sent out. • Collection of runoffs from stockpiles and directing into settling ponds.	0.108	During entire Construction period.	Cuddalore Port
8	Welfare of people	Socio-economic condition Environmental conditions	No negative impact	Preference shall be given to local people for employment during construction phase. This is a positive impact. Environmental monitoring to check the pollution levels During the construction phase, approximately 500 workers will be employed based on the qualification and requirements.	As per the project need and prevailing rates	During entire construction phase	Cuddalore Port

10.3 EMP - Operational Phase

S. No	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores/Annum	Time frame	Responsible agency
1	Cargo handling and Inland Cargo movement and storage areas	Air Quality	• Emissions from loading/unloading equipment, DG sets, vehicular dust emissions, fugitive emissions from storage areas. • Emissions from vessels visiting Port, Vehicular emissions due to cargo transport, spillage of cargo etc., Fugitive	• Wind screens towards settlements. • Water sprinkling will be carried out to suppress fugitive dust along the approach roads. • Regularization of truck movement. • Dust Suppression measures at loading/unloading points, wagon tippler complex, Track Hoppers, transfer	2.74	During entire operation phase	Cuddalore Port

S. No	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores/Annum	Time frame	Responsible agency
			emissions from material unloading/loading.	points, stock yards, rapid loading system and at internal roads. • Native plantation shall be raised to improve the green cover and act as barrier to reduce the impact of sound pollution. • Use of specialised ship loaders/unloaders, wagon tippler, track Hopper, covered conveyors and rapid loading system through silos Material unloading should be carefully planned to use hydraulic vehicles with lower height to ensure efficiency and safety. • Use of tarpaulin covers and speed regulations for vehicles/wagons engaged in transportation. • Pollution under control (PUC) certified vehicles only be permitted. Vehicle engine idling will be avoided. • Greenbelt development			
2	Breakwaters/ dredge disposal near to Northe and south breakwaters	Coastal shoreline	• Erosion and loss of land	• Beach nourishment in case of erosion	0.25	During entire operation phase	Cuddalore Port

S. No	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores/Annum	Time frame	Responsible agency
3	Operation of generators, Pumps and handling equipment	Noise and Vibrations	Excessive noise from vehicular movement DG set operations and equipment handling. Due to Regasification Process and equipment operation.	Acoustic Barriers and Enclosures shall be fixed Personnel Protection Equipment (PPE) Greenbelt Development Traffic Regulation Vibration dampers shall be provided around the source of generation	As per the project need and prevailing rates	During entire operation phase	
4	Solid Waste Management.	Soil Quality	Soil contamination due to disposal of waste onto land.	• STP sludge will be used as manure in green belt. • Organic Waste Convertor will be provided. Composted bio-degradable waste will be used as manure in greenbelt/ gardens • Other recyclable wastes will be sold to TNPCB authorised vendors • No waste shall be burned at site. • Native perennial shrubs and soil binders such as perennial grasses shall be planted	0.004	During entire Operation period.	Cuddalore Port
5	Aqueous discharges in harbour basin	Marine Water Quality and ecology	Change in marine water quality/ecology due to discharge ship wastes (sullage), sewage, bilge water, Desalination Plant reject water	• Ships are prohibited from discharging wastewater, bilge, oil wastes, etc. into the near shore as well as harbour waters. • As a mitigation measure for spillages, an Oil spill contingency plan is prepared and will be implemented.	0.088	During entire Operation period.	Cuddalore Port
6	Maintenance dredging	Marine water quality/Marine Ecology	• Increase in turbidity • Decrease in DO levels		As per the project need and	During entire Operation period.	Cuddalore Port

S. No	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores/Annum	Time frame	Responsible agency
				• Provision of waste reception facility for bilge water and waste oil will be explored. • Marine environmental monitoring as per environmental monitoring programme to check the pollution levels. • Pre and post dredge material disposal bathymetry survey at disposal location shall be carried out. • /beach nourishment/disposal near to north and south breakwaters • Based on the TSS/Turbidity monitoring results during dredging, nearby receptors if any impacted would be provided with suitable mitigations measures such as silt screen to contain the turbidity.	prevailing rates		
7	Wastewater Management	Water Quality	Deterioration of water quality in case of discharge of untreated wastewater in water bodies. Impact due to discharge of brine (reject from Desalination plant) runoff from stockpiles and	• No untreated wastewater will be sent out. • Collection of runoffs from stockpiles and directing into settling ponds. • ETP of 25 KLD is proposed for treatment and treated wastewater will be reused for dust suppression.	0.03	During entire Operation period.	Cuddalore Port

S. No	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores/Annum	Time frame	Responsible agency
			disposal of untreated sewage.	• STP of 3.5 KLD is proposed for treatment of sewage and treated wastewater will be used for irrigation of greenbelt areas. • Treated Sewage and effluents shall be reused for dust suppression, irrigating greenbelt and other requirements.			
8	Handling of hazardous materials/wastes	Fire accidents due to products handling and other health hazards/ Groundwater and soil contamination	• Human life and loss of property. • Impact on Terrestrial and Marine Environment	• Adequate safety measures as per OSHA standards will be adopted. • Hazardous and other waste Management Rules, 2016 (as amended) will be followed for environmental sound management of hazardous waste. • Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms. • Medical facilities including first aid will be made available for attending to injured workers. • Handling and storage as per statutory guidelines. • Risk analysis has been carried out and suggested	As per the project need and prevailing rates	During entire construction phase	Cuddalore Port

S. No	Activity	Aspects	Impacts	Mitigation Measures	Budget (In Rs. Crores/Annum	Time frame	Responsible agency
				risk mitigation measures shall be adopted. • Effective Disaster Management Plan (DMP) which covers onsite and offsite emergency plans.			
9	Operation of port	Socio-economic conditions Environmental conditions	Positive impact in terms of improved socio-economic conditions	• Direct and indirect employment will be created. • Project will help to Enhance the socioeconomic conditions of the region with high standard infrastructure facilities that will trigger overall economic development in the region.	During entire operation phase		Cuddalore Port
		Induced Development	Enable increased investments in manufacturing and industrial activities in the vicinity of the port.				

10.4 Environmental Management Practices

10.4.1 Administrative Setup

An Environmental Management Plan (EMP) is a site-specific strategy designed to ensure the project's implementation is environmentally sustainable while identifying and addressing potential environmental risks. It outlines appropriate measures to effectively manage these risks. To support this, a structured administrative framework is essential, clearly defining roles and responsibilities for personnel during construction and operational phases.

The port operations will be supervised and controlled by a Managing Director (MD) supported by adequate team of technically and statutorily qualified personnel apart from the operating staff of skilled, semi-skilled, unskilled and other categories.

MCPMPL shall appoint specific management representative, Environmental Head and a Site Environmental Officer who have defined roles, responsibilities and authority for:

- Ensuring that an environmental management system is established, implemented and maintained in accordance with the requirements of ISO.
- Reporting to top management on the performance of the environmental management system for review, including recommendations for improvement.

Personnel responsible for overall Environmental Management should possess strong qualifications and expertise in the field. Candidates should have at least a graduate-level education in the relevant discipline and a minimum of seven years of experience in the industry to ensure effective environmental oversight and implementation.

10.4.2 Institutional Mechanism for Implementation and Mitigation Measures

Effective implementation of mitigation measures arises when all proposed mitigation measures are completely and adequately implemented. To achieve this, an institutional mechanism should be in place. The proposed institutional mechanism recommended for the implementation of the mitigation measures is presented in **Figure 10-1.**

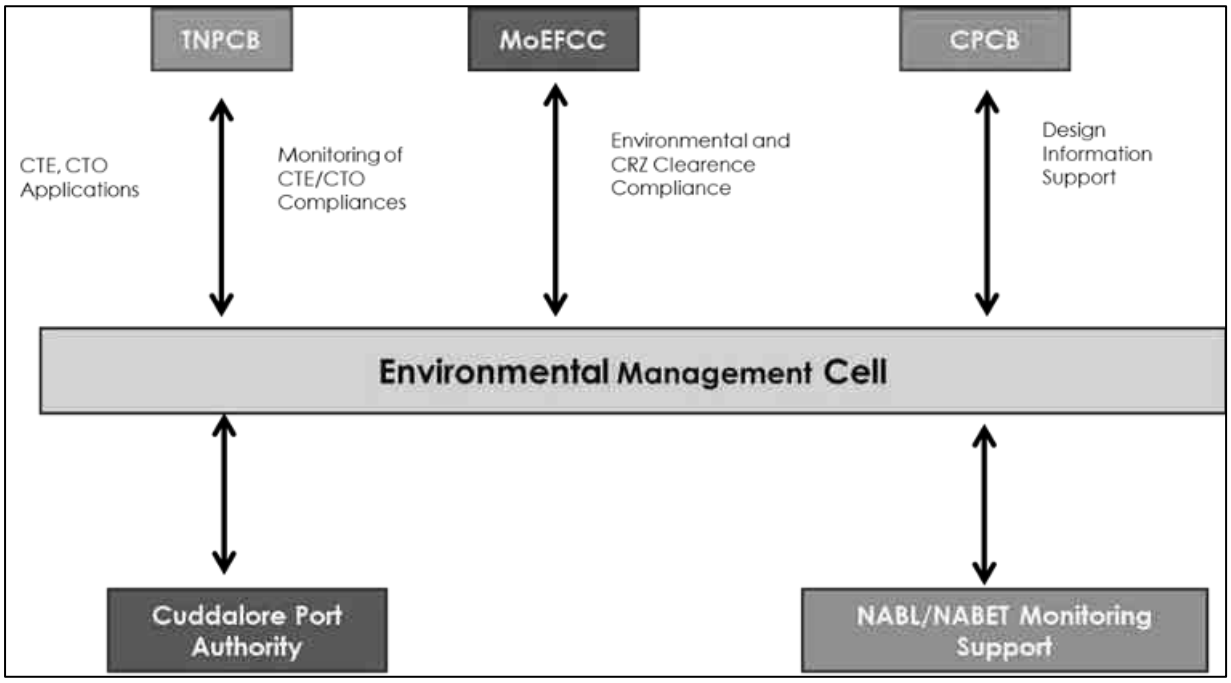


Figure 10-1: Institutional Mechanism for Implementing Mitigation Measures

Cuddalore port shall adopt an Environmental Management System which can be proposed to be certified under ISO 14001 The objective of ISO 14001 is to establish a system to assess, monitor and manage environmental performances, which can be used to promote continual environmental improvement and the prevention of pollution.

10.4.2.1 Approach towards Voluntary Compliance

The objective is to establish a system to assess, monitor and manage environmental performances, which can be used to promote continual environmental improvement and prevention of pollution.

The typical procedure adopted in formulating the EMS is presented below.

- Identify and list out environmental aspects due to the operation of the proposed project
- Determine the key operations that have significant environmental impacts
- Formulate/practice an Environmental Management System
- Ensure implementation of standard operating procedures as updated from time to time.
- Evaluate any non-conformity to the environmental standards, as stipulated by different regulatory agencies.
- Establish procedures for reporting, document and record control.
- Investigation and root cause analysis and prescribe corrective action.

For successful implementation of the formulated Environmental Management System, MCPMPL shall ensure that the essential resources (with defined roles and responsibilities) are made available to implement, maintain and improve the Environmental Management System.

10.4.3 Environmental Management Cell (EMC)

Apart from having an Environmental Management Plan, it is so also necessary to have a permanent organizational set up charged with the task of ensuring its effective implementation of mitigation measures and to conduct environmental monitoring. MCPMPL shall implement a well-structured Environmental Monitoring Cell (EMC), staffed with qualified manpower. The EMC is responsible for overall environmental activities of the Port and implementation of the Environmental Management Plan (EMP).

The organizational setup for Environmental Management Cell (EMC) for Cuddalore Port is given as **Figure 10-2.**

Figure 10-2: Organizational Setup for Environmental Management Cell

The EMC's responsibility for implementing the EMP also requires regular interaction with the environment regulatory authorities such as MoEF&CC, Tamil Nadu Pollution Control Board (TNPCB), Central Pollution Control Board (CPCB), State Forest and Wildlife organisation and the Indian Coast Guard.

The major duties and responsibilities of Environment Management Cell are;

- To implement the environmental management plan
- Risk identification and control of environmental problems
- Evaluating the efficacy of the Environmental Impact Assessment (EIA), mitigation measures, as stipulated in the EMP.
- Coordination with MoEFCC and other central/state pollution control boards for prevention and control of pollution.
- To assure regulatory compliance with all relevant rules and regulations
- To ensure regular operation and maintenance of pollution control devices
- To minimize environmental impacts of operations as by strict adherence to the EMP

- To initiate environmental monitoring as per approved schedule
- Review and interpretation of monitoring as per approved schedule
- Review and interpretation of monitoring results and corrective measures in case of monitored results are above the specified limit
- Maintain documentation of good environmental practices and applicable environmental laws as ready reference
- Maintain environmental related records
- Coordination with regulatory agencies, external consultant, monitoring laboratories
- Maintain log of public complaints regarding environmental issues and the action taken
- Plantation/green belt development and monitoring.

The proposed environmental management cell shall have all basic record keeping facilities such as hardware/software facilities, adequate space, vehicle (transport) and basic furniture and all simple instruments such as GPS, Digital camera, Handheld noise metre etc. The cell should have all basic environmental management data of the project that includes but not limited to the following

- Environmental Impact Assessment Reports
- All valid and up to date environmental clearances papers
- All latest Environmental legislations, policies, codes and manuals for ready references
- A list of consultants on environmental management need to be kept with yearly revision of the list. This will help to receive proper advice in case of an emergency or a requirement and also to implement day to day environmental management activities.

10.4.4 Compliance

The Environment Department shall take care for submission of the following statutory returns/compliance reports to the concerned departments:

- Submission of half yearly compliance report in respect of the stipulated Environmental Clearance& Consent for Operation to MoEF&CC and State Pollution Control Board (TNPCB).
- Submission of E-waste annual returns (Form – 3) as per Rule 22 (2) of the Hazardous Wastes (Management, Handling & Transboundary Movement) Rules, 2016 and amendments thereof to TNPCB
- Submission of Hazardous Wastes annual returns (Form – IV) as per Rule 22 (2) of the Hazardous Wastes (Management, Handling & Transboundary Movement) Rules, 2016 and amendments thereof to TNSPCB.
- Submission of Environmental Statement (Form –V) to the TNPCB

10.5 Greenbelt Development Plan

Green infrastructure is essential for reducing temperatures and purifying the air, contributing to better human health. Trees are fundamental to the ecosystem, as

they help to prevent the horizontal spread of contaminants to surrounding areas. They are highly effective in detecting, identifying, reducing, and regulating air pollution while also mitigating noise pollution, preventing soil erosion, and enhancing ecosystem stability and productivity. Trees should be employed as indicators of the biological consequences of pollutants due to their huge surface area and bio aesthetic qualities.

10.5.1 Objectives of Greenbelt Plan

- Mitigation of Fugitive dust Emissions and improve ambient air quality
- Provide a shelter belt around the project area for dust absorption and noise reduction
- Prevention of land degradation due to activities during construction phase
- Enhancement of the overall environmental quality
- Enhancing the ecological equilibrium of the area
- Providing aesthetic value to the project area
- Conserve soil quality and improve moisture level in ambient atmosphere
- Create awareness for environmental conservation and tree planting
- Generate employment for the local people

10.5.2 Choice of Species

The selection of plant species for the development depends on various factors such as climate, elevation and soil. The plant species should exhibit the following desirable characteristic in order to be selected for plantation

- Should be fast growing and providing optimum penetrability.
- Should be wind-firm and deep-rooted.
- Should be tolerant to salinity
- Should form a dense canopy
- Species should be indigenous and locally available.
- Species tolerant to air pollutants like PM, SO_2 and NO_2 should be preferred
- Should be permeable to help create air turbulence and mixing within the belt
- Plants will be preferably indigenous and would be native of the area.
- Introduction of monocultures and alien plant species would be avoided to the maximum possible extent

10.5.3 Proposed Greenbelt Area

The total green cover proposed for expansion Cuddalore plan is 6.15 (10.41 %) hectares. Greenbelt is normally desirable in 3 tiers i.e. Trees, Shrubs and Small bushes. These 3-tier plantation comprises of native species as lower tier, bushes and shrubs as middle tier and trees as upper tier with an objective to establish biodiversity and food chain; and to improve the local climate regime.

Combination of various species is sought while selecting trees for green belt / vegetation cover. The green belt will be strategically planted near the area requiring protection, ensuring optimal attenuation while accommodating physical constraints. This approach maximizes environmental benefits, including air

purification, noise reduction, and improved biodiversity. Locally growing varieties with fast growth rate and ability to flourish even in poor quality soils will be selected for plantation.

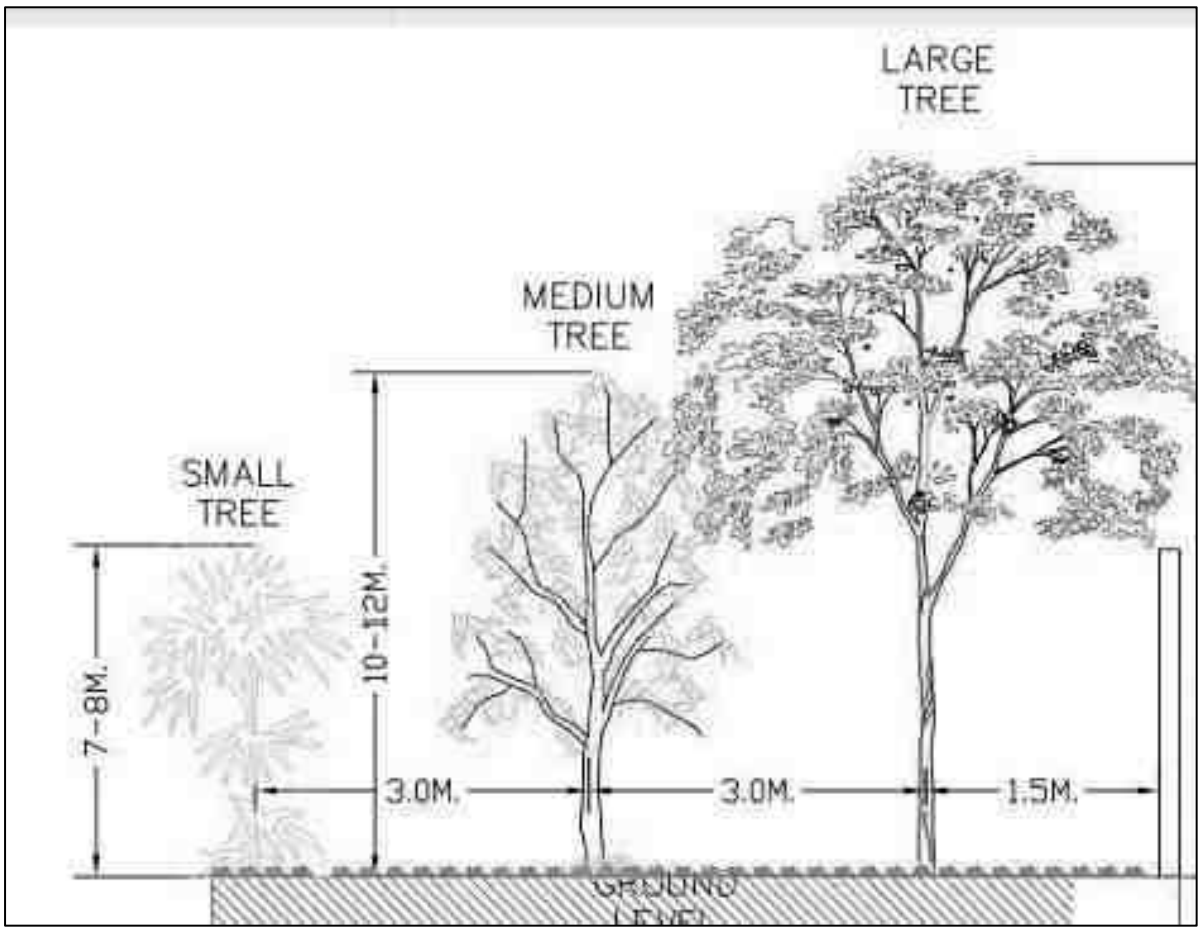


Figure 10-3: Indicative Sketch of Three Tier Greenbelt Development

10.5.4 Cost Estimates for Greenbelt Development

An area of 15.20 ac. (6.15 ha) is earmarked for green areas and greenbelt development. Approximately 15375 numbers of trees are proposed to be planted in Cuddalore port. The survival of the plantation shall be monitored frequently and survival rate of the plantation during operational phase shall not be less than 80%.

A capital cost of INR 1.8 million (0.18 Crores) shall be earmarked for this purpose and INR of 0.18 million (0.018 Crores) shall be allocated for recurring expenses per annum towards green belt development and maintenance. The capital and recurring cost will be spent over a period of time.

Figure 10-4: Proposed Greenbelt Development Plan

10.5.5 Recommended Species for Plantation

Based on climate and soil characteristics of the study area, some species are recommended for plantation. The species selected for provision of green areas at various locations in the project site are as follows:

Table 10-2: Recommended Plants for Greenbelt Development

S. No.	Botanical name	Local name	Importance in selection of species
Greenbelt Trees			
1	*Acacia auriculiformis*	Arasi Maram	Salt resistant and fast growing
2	*Acacia nilotica*	Karuvelam	Native, Shady, Pollutant absorbing
3	*Alstonia scholaris*	Ezilai Paalai	Evergreen and Fast growing
4	*Anthocephalus cadamba*	Vellai Kadambu	Broad leaved & Fast growing
5	*Azadirachta indica*	Vembu	Shady, Pollutant absorbing & Fast growing
6	*Bixa orellana*	Varugamanjal	Shady, Native & Fast growing
7	*Bombax ceiba*	Ilavam	Attractive & Tall growing
8	*Bambusa vulgaris*	Vellai Moongil	Fast growing plant and highly tolerant to air pollution
9	*Butea monosperma*	Purasu	intermediately tolerant to moderately tolerant
10	*Cassia fistula*	Konrai	Native, Shady, Fast growing
11	*Casuarina equisetifolia*	Savukku	Wind resistance
12	*Cocos nucifera*	Thennai	Fruit bearing

S. No.	Botanical name	Local name	Importance in selection of species
13	*Delonix regia*	Semmayir-kondrai	effectively traps fugitive dust and absorbs gaseous pollutants
14	*Dendrocalamus strictus*	Kal Moongil	Tall growing, Sound barrier
15	*Ficus benghalensis*	Aalamaram	Native, fast growing and Drought resistance
16	*Ficus carica*	Seemaiyathi	Native, High tolerance for drought and saline soils.
17	*Ficus religiosa*	Bodhi	Native, fast growing and Drought resistance
18	*Gmelina arborea*	Kumizh Maram	Broad leaved & Fast growing
19	*Lannea coromandelica*	Uthiyan	Native, Fast growing
20	*Mangifera indica*	Maa Maram	Fruiting bearing
21	*Manilkara zapota*	Sapota	Fruiting bearing
22	*Mitragyna parvifolia*	Neer Kadambu	Shady, Native & Fast growing
23	*Peltophorum pterocarpum*	Iyal Vaagai	tolerant to moderately tolerant
24	*Phoenix sylvestris*	Eechamaram	Fruiting bearing and Drought resistance
25	*Phyllanthus emblica*	Nelli	Native, Drought resistance
26	*Pongamia pinnata*	Pungai	Fast growing and Drought resistance
27	*Psidium guava*	Koyya	Fruiting bearing
28	*Semecarpus anacardium*	Kalakam	Fruiting bearing and Drought resistance
29	*Spathodea campanulata*	Thaneerkaai	Ornamental avenue tree
30	*Syzygium cumini*	Naaval	Shady, Fruiting bearing & Fast growing
31	*Tabebuia rosea*	Vasantha Rani	Ornamental, Drought resistance
32	*Tectona grandis*	Thekku	Timber yielding
33	*Terminalia arjuna*	Venn Maruthu	Timber and shade tree
34	*Terminalia bellirica*	Thantri	Native
35	*Wrightia tinctoria*	Veppaalai	Native, Drought resistance
Shrubs/Bushes recommended for Median plantation in the Project site			
1	*Agave cylindrica*	Kattrazhai	Drought resistance
2	*Aloe vera*	Kattrazhai	Drought resistance
3	*Caesalpinia pulcherrima*	Mayil Konrai	Red/Yellow Flowers
4	*Cascabela thevetia*	Thanga Arali	Yellow Flowers
5	*Cassia glauca*	Kannimaram	Yellow Flowers
6	*Jatropa podagarica*	Kaattu Aamanakku	Red Flowers
7	*Nerium oleander*	Arali	Pink Flowers
8	*Plumeria alba*	Eezhaththalari	Native having aesthetic value
9	*Plumeria obtusa*	Plumeria	White Flowers
10	*Tecoma stans*	Naaga Senbagam	Yellow Flowers
11	*Vitex negundo*	Karunochi	Native having medicinal Importance

10.6 Marine Biodiversity Management Plan

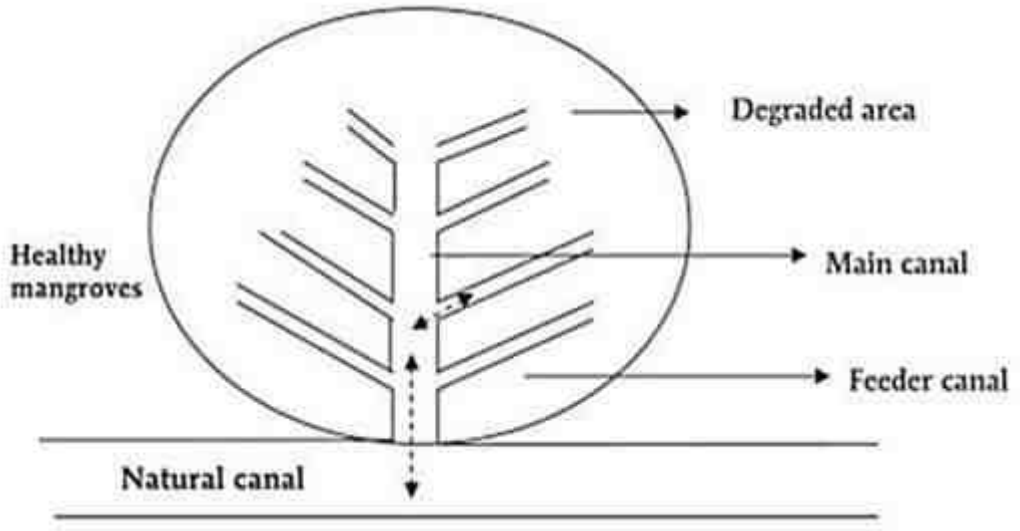
Centre of Advanced Study (CAS) in Marine Biology, Annamalai University has been appointed for conducting Marine Baseline Monitoring studies. Baseline studies were conducted under the supervision of Associate Professor dated September, 2025. Following are the mitigation measures suggested by CAS.

The Marine Biodiversity Management Plan for Cuddalore Port emphases to mitigating the ecological impacts arising from port operations while encouraging the preservation of the delicate marine and coastal environments that surround the port. Cuddalore Port is an existing port located at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal is close to shoreline and estuarine ecosystems that sustain a variety of plants and animals, such as benthic communities, fish nurseries, mangrove patches, and bird nesting sites. An efficient Marine Biodiversity Management Plan is important to preserve these ecosystems, encourage the sustainable use of marine resources, and increase resilience to environmental changes. Key biodiversity areas will be identified, their ecological and socioeconomic significance will be evaluated, and conservation strategies will be put into action through habitat restoration, scientific monitoring, and active community involvement. The preservation of vital habitats, such as mangroves, estuaries, nesting grounds etc. which are vital to the existence and procreation of numerous marine species, will receive particular attention.

10.6.1 Mangrove Biodiversity Conservation & Management Plan

The proposed Mangrove Biodiversity Management Plan for the Cuddalore Port region focuses on the restoration and conservation of estuarine biodiversity at Uppanar river and Paravanar river mouths.

The port authorities could contemplate taking up mangrove plantation or rehabilitation activities in appropriate areas with assistance of forest department or reputed institutes. The following fish bone model can be suggested for the restoration of mangroves.



Fish Bone diagram of Mangrove plantation

The management plan recommends conducting a detailed baseline survey to assess salinity levels, tidal regimes, soil characteristics, and anthropogenic pressures. Based on site suitability, native species such as *Rhizophora mucronata*, *Avicennia marina*, *Excoecaria agallocha*, and *Bruguiera cylindrica* will be selected for phased plantation during the monsoon season to maximize establishment success. Preventive measures must be enforced to control sewage discharge, plastic pollution, and encroachment in these sensitive zones. Community engagement will be key, with awareness programs, eco-volunteering, and involvement of local stakeholders in monitoring and maintenance. Regular biodiversity audits and collaboration with forest and research institutions will guide adaptive management. This plan aims to enhance habitat diversity, protect the shoreline from erosion, support local livelihoods, and contribute to the long-term ecological resilience of the Cuddalore coastal zone.

10.6.2 Sea Turtle Conservation & Management Plan

Cuddalore port is located on east coast and near to the declared turtle nesting areas which needs to pay special care and attention to ensure that their project do not pose even a slightest of threats to the visiting sea turtles.

In the present study, sea turtles are not reported in project area. Even though there is no turtle nesting, some measures for the protection of sea turtles in association with Forest department and local groups working on turtle conservation in anticipation of turtle movement in the study area can be undertaken, if required.

The Sea Turtle Biodiversity Management Plan for the Cuddalore Port region focuses on the conservation of Olive Ridley (*Lepidochelys olivacea*).

Nesting Site Protection

Although nesting activity not observed or very low in this region is relatively low, the presence of sandy beaches and estuarine influence provides a suitable habitat for sporadic nesting. The plan includes regular monitoring of nesting activity between December and April, identification of active nesting sites, and protection of nests through community-managed hatcheries. Artificial lighting near beaches should be minimized to prevent disorientation of nesting females and hatchlings. Engagement with local fishing communities is essential for implementing Turtle Excluder Devices (TEDs) in trawl nets, promoting the safe release of entangled turtles, and conducting regular beach clean-up drives to remove ghost nets and plastic debris.

However, necessary steps will be taken to avoid disruptions if any turtle nesting is reported.

Dredging Management

The channel area is well away from the turtle congregation area and hence there is no regular movement of turtle into the channel area to avoid accidental take, Cuddalore port shall implement the dredge management plan..

Protection of Eggs

However, in future, if some sporadic nesting is reported, in coordination with Forest department, these nesting grounds will be protected and it will be ensured that these nesting grounds are free from predators, poaching, and natural threats, especially the stray dogs.

Lighting Management

The glare of the port complex lighting system is likely to cause adverse impacts on the Nocturnal fauna and marine creatures. During the hatching of eggs laid by Olive Ridely turtle, the glare of light may destruct their movement to landward side causing desiccations and death. Considering these ecological issues, Cuddalore port shall adopt DARK SKY LIGHTING SYSTEM an exemplary activity for the coastal eco system.

Lighting Mitigation Efforts

- All outdoor lighting, roadway lighting, wharf lighting, and lighting mounted on masts or other elevated structures will be of the minimum lamp wattage to achieve required safety within the lighted area.
- No area lighting or any lighting mounted on masts or other elevated structures will include fluorescent lamps, mercury vapour (MV) lamps, metal halide (MH) lamps, or other broad spectrum high-intensity discharge lamp types.
- No lighting of grounds, building walls, signs, cranes, or other elevated structures will employ flood lighting, up-lighting, or other forms of directional lighting aimed above the horizon.
- Wherever possible, use low-pressure sodium vapour lamps or other light sources that exclude wavelengths less than 520 nm.

Bycatch Reduction

- Organize awareness programs and educate fishermen in association with forest and fisheries department about responsible fishing practices including the use of Turtle Excluder Devices (TEDs).
- Work with forest and fisheries department to enforce the use of Turtle Excluder Devices (TEDs) in fishing gear to prevent accidental capture of sea turtles.

Research and Monitoring

Support studies on sea turtle behaviour, migration patterns, and population dynamics, if required. This research study, if required, will mainly focus on nesting site monitoring, tracking sea turtle migration and threats posed to them particularly in the port vicinity

Marine Debris Reduction

Organize to conduct coastal clean-ups to remove plastic and other debris that can entangle or harm sea species. Raise awareness about reducing plastic use to keep beaches and oceans clean.

Community Engagement and Education

Educate local communities, tourists, and schoolchildren about marine organisms conservation and sponsor awareness programs, workshops, campaigns, and eco-tourism.

The Cuddalore port shall implement the project in a manner that will not have significant adverse impact on the wildlife exists within the study area. The company strives for ecologically sustainable development and has adopted the improved practices to ensure continual improvement of its environmental preferences. It is required to create awareness among the employees and the local community regarding importance of wildlife in sustenance of life on earth and to be responsible for conservation of nature.

10.6.3 Fishery resources Biodiversity Management Plan

The Cuddalore district has a coastal Length of 57.5 Km. comprising of 49 fishing villages with total marine fishermen population of 47000. Among them 23840 are active fishermen and nearly 15000 fisherwomen are engaged in fishing related activities. There are 235 Mechanized fishing boats and 2345 FRP boats, Non motorised boats 1906 are operating in this district. There are 36 Marine Fishermen Coop Societies, and 41 Marine Fisherwomen Coop societies, 22 Inland Fishermen Co-op. Societies and 6 Inland Fisherwomen Co-op. Societies are functioning in Cuddalore District. Various welfare schemes are being implemented through the coop societies. Fishing boats are berthed at Cuddalore fishing harbour, Mudasalodai Fish landing centre, Samiyarpettai Fish Landing Centre, MGR Thittu Fish Landing Centre, Parangipettai-Annankoil Fish landing centre and Pettodai Fish Landing Centre doing fishing. The annual total Marine fish production is 25,000 tons[12]. The fishes caught are being sold in local market and also to nearby Districts and to Kerala State.

Creating a biodiversity plan for fishery resources involves developing strategies that promote the conservation and sustainable use of aquatic biodiversity.

The goal is to balance fishery productivity with the health of aquatic ecosystems, preserving biodiversity while ensuring that fisheries can meet the needs of communities and economies.

10.6.3.1 Biodiversity Plan for Fishery Resources

- Assessment of Fishery Resources and Ecosystems Fish Stock Surveys
- Evaluation of health of aquatic ecosystems
- Assess water quality, habitat degradation, and the impact of human activities like pollution and climate change.

[12]https://cuddalore.nic.in/fisheries/#:~:text=MARINE%20FISHERIES%20ACTIVITIES,Districts%20and%20to%20Kerala%20State.

- A comprehensive database on fish species, breeding patterns, migration routes, and habitat preferences.
- Sustainable harvest limits for different fish species based on scientific data.
- Implement measures to prevent overfishing and protect spawning populations.
- Promote the use of environmentally friendly fishing techniques that minimize bycatch, such as selective fishing gear (e.g., fish traps, hook and line fishing).
- Preserve and restore key habitats such as mangroves, and wetlands, which are essential for many fish species.
- Protect riverbanks, floodplains, and estuarine ecosystems to maintain healthy water quality and habitat for freshwater fish species.
- Develop and implement habitat restoration projects in areas degraded by overfishing, pollution, or development
- Establish monitoring programs to track fish stock status, biodiversity, and habitat conditions.
- Support research into the biology, ecology, and behaviour of fish species, as well as the socioeconomic impacts of fisheries, to inform sustainable management practices.
- Involve local communities, fishermen, and other stakeholders in the decision-making process.
- Provide training to fishermen on sustainable practices, eco-friendly fishing gear, and the importance of biodiversity conservation.
- Educational campaigns to raise awareness about the importance of aquatic biodiversity and the role of sustainable fisheries in ecosystem health.

10.6.4 Other Management Plan to Conserve the Biodiversity

10.6.4.1 Aqueous Discharges including Accidental Spills

Accidental Spill Dynamics: Port operations are inherently associated with the handling of various liquid products, including petroleum, chemicals, and other hazardous substances. Accidental spills during berthing can result in immediate and long-term environmental consequences, necessitating a thorough understanding of spill behaviour and effective response mechanisms.

Product Behaviour and Environmental Response at Berth Operations: During berth operations in ports and harbours, the risk of accidental spills of petroleum products and chemicals poses a significant threat to the marine environment. The behaviour and environmental fate of these spills are governed by a complex interplay of physical, chemical, and biological processes (Fingas, 2011). Understanding these dynamics is essential for designing effective spill response and mitigation strategies.

Factors Influencing Spill Behaviour: The behaviour of a spilled substance is primarily determined by the product's physicochemical properties—namely density, viscosity, volatility, and solubility—alongside ambient environmental conditions such as temperature, salinity, wave action, and wind speed (NRC, 2003).

Spill Scenarios and Product Behaviour

A. Light and Volatile Products: Light hydrocarbons such as gasoline rapidly form thin films on the water's surface due to low viscosity. High vapor pressure facilitates swift evaporation of lighter fractions, potentially leading to:

A decrease in spill volume: Formation of toxic vapors, which pose acute risks to human health and marine life (ITOPF, 2021).

Heavy Oils and Crude Products: Heavier products like crude oil and heavy fuel oil exhibit slower spreading rates, forming thicker slicks. Their behavior is influenced by weathering processes, which include:

Evaporation of volatile components: Emulsification, where water becomes entrained in oil, forming viscous emulsions ("chocolate mousse")

Natural dispersion and oxidation: These emulsified slicks are particularly problematic due to increased viscosity and resistance to cleanup efforts, posing long-term ecological hazards (Etkin, 1999).

Non-Oil Chemical Spills: Non-oily hazardous chemicals exhibit diverse behaviours: Dense Non-Aqueous Phase Liquids (DNAPLs) may sink and infiltrate sediments, affecting benthic ecosystems and groundwater (Schwarzenbach et al., 2006).

Water-soluble chemicals can dissolve and disperse, potentially becoming bioavailable and causing chronic toxicity to aquatic organisms.

Environmental Conditions and Spill Fate

Environmental variables play a critical role in the transport and transformation of spilled substances:

- High temperatures increase evaporation and microbial biodegradation.
- Wave action and current velocity enhance dispersion but may extend the contamination zone.
- Calm conditions slow dispersion and increase shoreline retention, heightening risks for intertidal biota and humans (NRC, 2003).

Spill Response Measures

Given the environmental sensitivity of berthing areas, ports often implement proactive spill response mechanisms:

- Containment booms to encircle and limit surface spread
- Skimmers and sorbents to recover spilled material
- Emergency response planning, including regular drills and personnel training (IMO, 2018)
- These strategies are critical to minimizing ecological damage and ensuring rapid, coordinated action in the event of an incident.

10.6.4.2 Ballast Water Discharge and Management Plan

Ballast water discharge from ships poses significant environmental risks by introducing invasive species, pathogens, and pollutants into marine ecosystems.

Ships take on ballast water in ports to maintain stability and discharge it at different locations as they travel, which can lead to the spread of non-native species and diseases, disrupt local biodiversity, and cause pollution.

To manage these risks, the Ballast Water Management Convention (BWM Convention) by the International Maritime Organization (IMO) mandates the treatment of ballast water to eliminate harmful organisms before discharge. Ships are required to follow Ballast Water Management Plans that include ballast water exchange at high seas before entering the harbour and the use of treatment technologies such as filtration, UV radiation, and chemical disinfection.

National and regional regulations further enforce these standards to reduce the risk of invasive species and pathogens. Additionally, ballast water treatment systems are installed on ships to ensure compliance with discharge standards. Monitoring and enforcement through inspections and sampling at ports are critical to ensure the effectiveness of these measures.

The management of ballast water discharge is essential for preserving marine biodiversity and ecosystem health, requiring continued technological advancements, regulatory enforcement, and international cooperation.

Ships shall conduct ballast water exchange at least 200 nautical miles from the nearest land and in water at least 200 m in depth prior to calling at a port.

Where ballast water exchange at 200 nautical miles to nearest land is not possible, the exchange should take place at least 50 nautical miles from nearest land and in water at least 200 m in depth.

10.6.5 General Mitigation Measures for Cuddalore Port Operations

1. **Risk Assessments and Integrated Planning:** At Cuddalore Port, which is situated along a cyclone-prone stretch of the southeastern Indian coast, a comprehensive hazard analysis must address not only routine port activities such as dredging, cargo handling, and construction, but also natural calamities like cyclones, storm surges, coastal flooding, and seismic risks. Emergency response plans should include clearly defined roles for port authorities, municipal agencies, and first responders, ensuring swift communication and coordinated action during incidents.
2. **Engineering Controls and Resilient Infrastructure:** Port facilities at Cuddalore, particularly storage tanks, container yards, fuel bunkering zones, and dredging areas must incorporate advanced safety engineering. This includes double-walled storage units for hazardous substances, reinforced berthing structures designed to resist wave and wind forces, and vibration-dampening foundations to withstand seismic activity. Dredging equipment should be regularly inspected and fitted with spill-prevention valves and alarms to minimize accidental discharges.
3. **Environmental Monitoring and Early Warning Systems:** Given the proximity to sensitive marine habitats, Cuddalore Port should establish a real-time

environmental monitoring system that tracks sea level changes, water quality, meteorological conditions, and port structural integrity. Sensors and weather forecasting tools should be integrated with regional early warning systems operated by the Indian Meteorological Department (IMD) and the Indian National Centre for Ocean Information Services (INCOIS), enabling proactive response to cyclonic events and storm surges.

4. **Training and Drills for Multi-Hazard Preparedness:** Port personnel, contractors, and emergency teams must undergo regular training tailored to the operational and environmental risks specific to Cuddalore. Emergency drills should simulate scenarios involving oil and chemical spills, dredging equipment failure, fire outbreaks, and natural disasters like cyclones. This ensures all stakeholders are familiar with response protocols and are capable of swift action under real-world pressures.
5. **Rapid Deployment of Emergency Equipment:** Cuddalore Port should maintain strategically located stocks of spill response kits, oil booms, absorbents, firefighting equipment, and mobile structural repair units. These should be accessible both onshore and onboard harbour vessels. Additionally, pre-positioned flood barriers and pumps can help mitigate damage during high-intensity rainfall and tidal surges common to this coastal zone.
6. **Collaboration, Compliance, and Periodic Reviews:** Collaborative engagement with the Government Disaster Management Authority, Central Pollution Control Board (CPCB) & Tamil Nadu Pollution Control Board, and local environmental organizations is essential. Regular compliance audits, joint exercises, and reviews of Emergency Preparedness and Response Plans (EPRPs) will ensure Cuddalore Port remains aligned with the Coastal Regulation Zone (CRZ) guidelines, ISPS Code, and Major Ports Safety Protocols. This adaptive, multi-tiered approach ensures resilience in the face of both operational and environmental challenges.

10.6.6 Environmental Management and Mitigation Measures for Cuddalore Port

A comprehensive Environmental Management Plan (EMP) is vital for ensuring that the development of Cuddalore Port proceeds sustainably, minimizing adverse impacts on the surrounding ecosystems, particularly sensitive coastal and marine habitats. The following mitigation measures focus on proactive management, habitat protection, and continuous monitoring.

Baseline Environmental Monitoring:

Ecological Survey: A detailed ecological survey should be conducted to assess the health and distribution of mangrove ecosystems, seagrasses, and other critical habitats in nearby estuaries, creeks, and intertidal zones. This will include species inventories, water quality parameters (e.g., salinity, pH, dissolved oxygen), sedimentation rates, and biodiversity assessments.

Monitoring Stations: Establish reference stations within the port vicinity and surrounding areas for continuous monitoring of key ecological indicators such as water quality, sediment quality, and species diversity. These data will serve as baselines for assessing the impacts of port operations on local ecosystems.

Design and Construction Controls:

Eco-sensitive Infrastructure: The port design should prioritize minimizing disruption to natural hydrological systems and local habitats. Construction should incorporate green infrastructure solutions, such as permeable surfaces and natural drainage patterns, to prevent soil erosion and manage runoff effectively.

Sediment and Run-off Management: During dredging and disposal activities, employ silt screens, temporary bunds, and sediment traps to control sediment dispersal. This will mitigate the risk of sedimentation impacting sensitive habitats, particularly mangroves and coastal wetlands.

Construction Timing: Avoid construction during the monsoon season when the region's ecosystems, particularly intertidal zones, are most vulnerable to disturbances.

Sediment and Water Quality Management: Employ techniques like silt curtains during dredging to prevent sedimentation from impacting sensitive aquatic habitats. Continuous water quality monitoring will ensure that turbidity levels remain within safe limits for marine life.

Noise and Vibration Control: Implement noise-reduction technologies, such as bubble curtains, to minimize disruption from underwater construction activities. Schedule such activities outside peak fish migration and spawning periods to minimize disturbances.

By incorporating these environmental management and mitigation measures, Cuddalore Port will not only contribute to the region's economic growth but also ensure the long-term protection of its valuable coastal ecosystems and biodiversity.

10.7 Management Plan for Schedule-I species

10.7.1 List of IWPS Scheduled/IUCN Species in Study area

Flora: Among the 187 plant species reported from the study area, none of the species is listed in IUCN threatened category.

However, considering vulnerable habitat features of the mangroves, all the true mangrove species are considered as locally threatened. No activity has been proposed near to the mangroves to safeguard these sensitive species.

Fauna: Among the 104 fauna species reported. Five species were listed in the are listed in IWPA schedule.

Table 10-3: IUCN/IWPA listed Fauna species reported in 15 km buffer area

S. No	Common Name	Scientific Name	IUCN	IWPA Schedule
1	Indian Monitor Lizard	Varanus bengalensis	NT	I

S. No	Common Name	Scientific Name	IUCN	IWPA Schedule
2	Indian crested porcupine	*Hystrix indica*	LC	I

10.7.2 Conservation Plan for IUCN/IWPA Scheduled I listed Fauna in the Study Area

10.7.2.1 Conservation plan for Indian monitor lizard *(Varanus bengalensis)*

Geographic Range:

This is a wide-ranging monitor lizard found in Afghanistan, Pakistan, Bangladesh, Nepal, India, Sri Lanka, southern China, Myanmar, Viet Nam, southeastern Iran, and as far as Java and the Anambas Islands in Indonesia. In Lao PDR, it has been reported from Nakai Plateau and is considered to have been locally extirpated in recent years in one area of Phou Louey NBCA. Global distribution of Indian monitor lizard is shown in the **Figure 10-5.**

Habitat and Ecology:

This diurnal and largely terrestrial species inhabit forests and forests edges, as well as plantations (Das 2010), including oil palm, and agricultural areas (Auffenberg 1994). It has been recorded from a variety of habitats, both arid and moist, and from scrubland to forests, at moderate to high elevations (Auffenberg 1994, Pianka 2004), although it is absent from swampy areas. It feeds on insects, spiders, snails, crabs, frogs, small mammals, birds, lizards and snakes; also known to scavenge (Das 2010). Clutches comprise 8–32 eggs, with 1–2 clutches laid per year (Auliya and Koch in press), which may be laid in termitaria (Das 2010); hatchlings measure 94 mm (Das 2010). The average age at reproduction may be 11 years, as the species has an age at maturity of three and maximum longevity of 20 years (M. Cota pers. comm. 2017).

Threats:

The greatest threat to this species is hunting, as it is hunted commercially for its skin (domestically), and its meat is commonly eaten; the fat is also used in traditional medicine (Papenfuss et al. 2010), and in India the hatha jodi trade represents an additional impact. Although hunting for local use has historically been a subsistence-level activity in India, the recent emergence of festivals in which thousands gather to hunt animals (e.g. in West Bengal - Rajpoot *et al.* 2018) can be expected to have serious impacts on local subpopulations. The Bengal Monitor has been declining "for several decades" in India, attributed to harvesting for the illegal skin trade (Traffic Post 2013), and Rajpoot et al. (2018) suggest that Indian Monitor species (including the Bengal Monitor) "could go extinct very soon" without protection, although do not specify the evidence for this expectation.

Use and Trade:

This species is harvested for a few uses: the skins are commercially valuable, the meat is eaten, and the fat is used in traditional medicine (Papenfuss et al. 2010). In India there is an illegal trade in hemipenes of the Bengal and Yellow Monitors

(termed "hatha jodi"), which are marketed as plant roots with magical powers (D'Cruze *et al.* 2018; Sharma *et al.* 2019).

Conservation Actions:

This species occurs in many protected areas across its extensive range, and it is protected in a few countries by national legislation because it is currently listed on Appendix I of CITES which prohibits legal export. While there are reports of some cross-border illegal trade - including the hatha jodi trade from India - this listing is likely to be effective in limiting exploitation for the international leather industry (M. Cota pers. comm. 2017). Nevertheless, penalties for violating the Indian Wildlife Protection Act are not required to be strict.

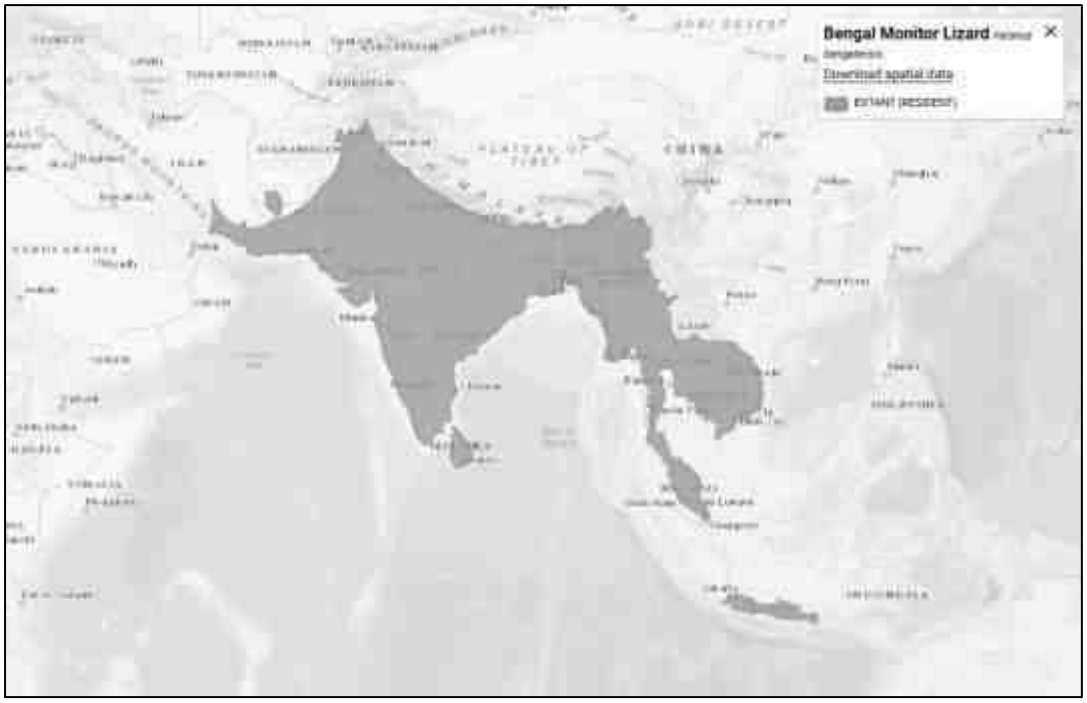


Figure 10-5: Global distribution of Indian monitor lizard

10.7.2.2 Conservation plan for Indian Crested Porcupine *(Hystrix indica Kerr, 1792)*

Geographic Range:

The species is categorized as Least Concern globally on the IUCN Red List and has been recorded in Turkey and the eastern Mediterranean through southwest and central Asia (including Afghanistan and Turkmenistan) to Pakistan, India, Nepal, China and Sri Lanka. In the Himalayan mountains they reach altitudes of up to 2,400 meters (Gurung and Singh 1996). Global distribution of Indian crested porcupine is shown in the **Figure 10-5.**

Habitat and Ecology:

This species has a broad habitat tolerance, occupying rocky hillsides, tropical and temperate shrubland, grasslands, forests, arable land, plantations, and gardens.

Threats:

Porcupines are considered agricultural pests by locals who trap and use them for food (Qumsiyeh 1996). Human Persecution: Frequently killed as an agricultural pest because it destroys crops like maize, potatoes, and saffron. Hunting & Poaching: Hunted for its meat (considered a delicacy) and quills, which are used in traditional medicine, ornaments, or as good luck charms. Habitat Loss: Urbanization and infrastructure development are gradually reducing suitable denning and foraging areas. Environmental Factors: Exposure to pesticides in agricultural landscapes.

Use and Trade:

The species is increasingly targeted for various commercial and traditional uses:

- Medicinal "Bezoars": The most valuable trade item is the porcupine bezoar (stone-like masses of undigested plant material found in the gut). These are highly sought after in Traditional Chinese Medicine (TCM) for purportedly treating cancer, diabetes, and dengue.
- Quill Trade: Quills are traded for use as hairpins, ornaments, and "talismans" to ward off black magic. Tribal communities, such as the Birhor in West Bengal, use them as biopesticides and traditional tools.
- Meat Consumption: Their meat is considered a delicacy and is consumed as a primary protein source in some regions, leading to localized population declines.
- Handicrafts: Body parts and quills are sold to non-tribal markets for making souvenirs and handicrafts.

Conservation Actions:

Under the Wildlife (Protection) Amendment Act, 2022, Hystrix indica was moved from Schedule IV to Schedule I. This grants it the highest level of protection in India, making hunting and trade strictly forbidden with severe penalties.

Figure 10-6: Global distribution of Indian Crested Porcupine

Table 10-4: Budget Estimation for wildlife conservation

S. No.	Activity	Duration	Total Amount (INR) for 5 years
1.	Awareness programs about the wildlife conservation among the local people, distribution of poster, pamphlets, fixing of signage and organizing awareness camp etc.	5 Years	5,00,000
2	Habitat improvement activities for reptiles along the coast vegetation	5 Years	5,00,000
3	Plantation of Suitable native trees for bird nesting near the water bodies	5 Years	5,00,000
	Total		**15,00,000**

10.8 Rainwater Harvesting

Rainwater harvesting (RWH) involves collecting and utilizing rainwater before it flows away as runoff, making it a valuable resource for various beneficial purposes. According to the "Dynamic Ground Water Resources of India, 2024" report, Cuddalore district is classified under the "safe category" in terms of groundwater resources. However, to further enhance groundwater levels in the region, MCPMPL has proposed the implementation of rainwater harvesting.

Adopting rainwater harvesting and conservation techniques offers several advantages, including minimizing soil erosion, increasing soil moisture, and facilitating groundwater recharge. Additionally, it helps reduce dependence on mains water supply, lowers water-related costs, and contributes to environmental sustainability. The concept of rainwater harvest is shown **Table 10-5.**

Table 10-5: Rainwater Harvesting Phenomena

Concept	Mode of Use
Tapping from where it falls	Direct use: process of collecting and storing the rainwater by construction of sump through filters for future productive use.
Techniques of rainwater harvesting involve	Artificial recharge to groundwater: Recharge the rainwater in a scientifically planned way by construction of rain / roof top water harvesting structures to augment the groundwater.

10.8.1 Objectives of Rainwater Harvesting

- Provide a reliable water source
- Rainfall - runoff management
- Control soil erosion
- Increase the soil moisture
- Prevent rush of surface flow of water
- Recharge to groundwater in favourable areas
- Direct use of harvested rainwater

- Saving in pumping cost
- Reduce flooding and erosion
- Support gardening

10.8.2 Estimation of Rainwater Harvesting potential

The proposed master plan includes rainwater harvesting as a crucial strategy for water conservation, identifying rooftops, greenbelts, paved areas, and open spaces as key collection points to maximize rainwater capture and efficient utilization.

The approximate quantities of rainwater that can be harvested at Cuddalore Port are given in **Table 10-6**. The equation used for runoff estimation is based on CPCB guidelines on 'Concepts and Practices for Rainwater Harvesting'- Oct 2001.The calculations are based on following:

• Average annual rainfall is 1369.3 mm based on 1991-2020 IMD data.

• Average No of rainy days are 52.4

Run of co-efficient are considered as given by CPCB guidelines

Table 10-6: Estimated Volume of run-off can be Harvested

S. No	Land Use	Area in Acres	Area (m^2)	Volume (m^3)	Coefficient	Volume/year
1	Backup Area	7.308	29574.20	40504.82	0.1	3506.0
2	Parking Area	0.552	2233.85	3059.48	0.4	1427.0
3	Green area	2.28	9226.76	9432.52	0.1	1100.0
4	Others	11.7615	47596.73	48658.14	0.6	34040.0
	Total	21.9015	88631.54	101654.95		40073.0

10.8.3 Rainwater Harvesting Plan

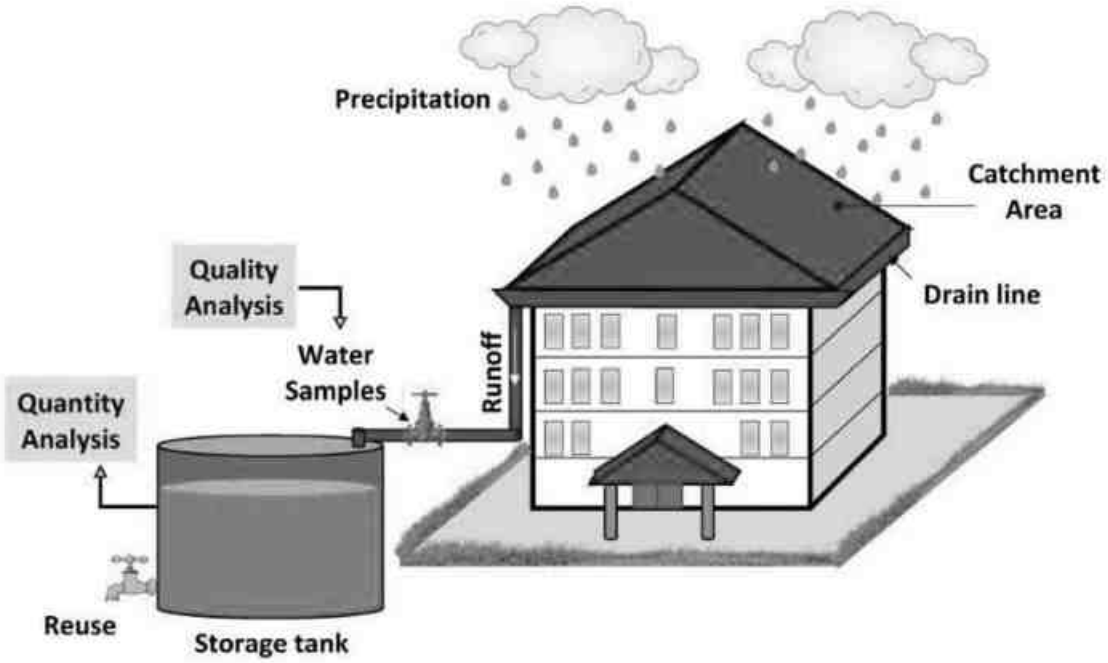
Rainwater Harvesting Plan outlines strategies to collect, store, and utilize rainwater efficiently, contributing to water conservation, groundwater recharge, and environmental sustainability.

10.8.3.1 Roof-top Rainwater Harvesting

Roof-top rainwater harvesting is an effective method for enhancing groundwater recharge and storage, especially in areas where natural infiltration is limited and land availability for artificial recharge measures is constrained. In a typical system, rainwater is collected from rooftops and directed into storage tanks or vessels for utilization during water-scarce periods. The setup consists of a roof, a storage tank, and a network of gutters that channel the water from the roof to the tank. Additionally, a first flush system is incorporated to discard initial runoff containing accumulated debris and pollutants, while a filtration unit ensures that only clean water enters the storage facility, making it suitable for various applications. Therefore, a typical Roof top Rainwater Harvesting System comprises following components:

• Roof catchment	• Collection sump

• Filter unit	• Down pipe
• Drainpipes	• Pump unit
• Storage tank.	• First flush pipe
• Gutters	



(Source: Feasibility of roof top rainwater harvesting potential - A case study of South Indian University, https://www.sciencedirect.com/science/article/pii/S266679082100166X)

Figure 10-7: A Typical Rainwater Harvesting System

Filtration is a key process in water purification, removing impurities through mechanical straining, sedimentation, and biological metabolism, while also improving chemical and bacterial quality based on the filtration method used. Filters are used for the treatment of water to effectively remove turbidity, color, and microorganisms. After the first flushing of rainfall, water should pass through filters

There are three types of filters:

i. Sand Gravel Filters,

ii. Charcoal Filter

iii. PVC –Pipe filter

iv. Sponge Filter

10.8.3.2 Storage Ponds/Tanks

Along with rooftop rainwater harvesting, expansion plan will implement a storage tank/pond system for collecting stormwater and rainwater. These civil structures efficiently store harvested water, which can then be pumped to areas of demand or distributed via overhead tanks. To ensure water quality, silt trap pits and filter beds

must be maintained before directing water into the storage tanks or ponds. Proper cementing of the storage tanks will prevent leakage or seepage into the ground. The recommended dimensions for these structures are 5 m x 5 m.

Figure 10-8: Representative Roof Top rainwater collection tank

10.9 Energy Conservation Initiatives at Cuddalore port

Energy conservation measures including utilization of renewable energy sources, and continuous optimization of operations, the port aims to minimize its environmental footprint. These initiatives not only enhance energy efficiency but also contribute to long-term sustainability.

Solar energy can be effectively integrated into various elements of port infrastructure, providing both environmental and operational benefits. Installing solar panels on rooftops and parking structures not only produces clean energy but also maximizes available space. Additionally, solar-powered lighting and navigation systems enhance safety while significantly reducing energy consumption. Furthermore, incorporating solar energy into vessel power systems decreases dependence on conventional fuel sources, presenting a more sustainable and eco-friendlier alternative.

Basic components that are used to build a solar PV system are as follows:

- Flat Roof Solar PV Panel mounting systems
- Solar PV Panels and solar modules
- Solar PV Charge Controllers

- Solar Batteries
- PV Junction Boxes/PV Combiner Boxes
- Off-Grid Solar PV Power Inverters
- Solar PV Cables & Connectors
- Solar PV Generation Meters
- AC & DC Isolators
- Solar PV System monitoring

Actual Area	Installation capacity (Considering 100 sqm for 10kWP) kWp	Installation capacity in MW	Cost for installation (considering Rs.4 cr/ MW) Rs. Crores
4436	444	0.44	1.77
Considering 15% of the total area			

Total cost for the installation of the solar power system is 1.77 crores with the capacity of 0.44 MW in the port premises.

The above-mentioned roof top areas are approximate and can be firmed up after the concrete design and engineering. Based on various technology options considered, it is recommended that the solar PV cells shall be installed in the available area of roof tops within the port premises for the purpose of harnessing solar power by means of utilizing the available roof top area.

10.10 Occupational Health and Safety

Occupational health and safety (OHS) is crucial for any development, industrial, or port-related activity, requiring careful attention during construction, operation, and maintenance phases. This section outlines a broad framework for implementing effective OHS measures to ensure a safe and healthy work environment.

Cuddalore port shall provide the infrastructure facilities in compliance to national and international safety regulations.

In order to achieve the objectives, the emergency management policy therefore, will evolve three essential components as follows.

- Preparedness
- Execution
- Rehabilitation

Preparedness:

- Crisis Management Team
- Emergency Response Team
- Mock Drills Training & Practices
- Inventory of human resources
- Inventory of materials resources
- Communication Systems
- Medical arrangements
- Preparation of contingency plans for anticipated emergencies

- Identifying vulnerable areas
- Co Ordination with external agencies
- Transport facilities

Execution:

- Activating Crisis management & Emergency Response Team
- Implementing Contingencies as per plan
- Issuing updated warning
- Provision Of medical assistances
- Resource mobilization
- Providing Administrative support
- Organizing external assistances
- Record activities

Rehabilitation:

- Restoring essential services
- Providing Relief Centers
- Engaging agencies on insurance, salvage & investigation
- Victim relief and benefits
- Construction of new centers (If needed)
- Identifying & clearing wastages
- Record activities

10.10.1 Emergency Management at Port

A Systematic approach needed at management level to assess the potential a dangerous situation, to identify the probable risk areas which may get affected, to formulate the strategies to deal any such crisis and to work out mechanism of emergency management operations.

The organizational structure refers to command and control the structure of the port management sub-divided into two division for an effective emergency management plan.

- Crisis Management Team (CMT)
- Emergency Response Team (ERT)

10.10.2 Crisis Management Team

The Head of Port shall appoint a Crisis Management Team (CMT) consisting of officers from each operating department. He shall also ensure that an effective means of interaction with the Head Office in Chennai is in place. The CMT shall also include the sub-contractors when applicable. The configuration of Crisis Management Team is also posted in the Muster areas, Emergency Control Rooms, Canteen, Medical Centre & other relevant places. POC to communicate with external parties for resources/ information.

Crisis Management Team consist of – Port Head and All Departmental HOD's

- They will maintain the ultimate control and authority for the Emergency Management
- They will design strategy plan to protect the assets control the media, preserve the evidence, reputation and insurance claim
- They will keep a track record on all the decision made prior and during the emergencies
- They will organize rehabilitation measures on operational continuity

10.10.3 Emergency Response Team

- Fire Fighting & Safety Personnel
- Security team
- Medical team
- HR & Admin Team
- Facility Management Team and
- Other Trained Resources.

In case of emergency the emergency response team will coordinate and Implement the Operation Plan, Liaise with Emergency Control Centre and seek support, Evaluate Risk &Establish Control, Establish a communication structure, Ensuring the premises Security & Safety and Liaise with external emergency services including Local Fire Station (Cuddalore), Local Police Station, Nearest hospitals, District Fire Officer (Cuddalreo & Puducherry), Divisional Fire Officer (Cuddalreo & Puducherry), District Police Head Quarters, District Collector (Cuddalreo & Puducherry), Coast Guards (Cuddalreo & Puducherry), Local Civic Bodies, Nearby Industries, Any other regulatory agencies (as required) and Costal Police through Crisis Management Team.

10.10.4 Emergency Services

To simplify easier access on all emergencies in Port, a Control Centre shall be established at Fire & Safety Department.

10.10.5 Fire Fighting & Preventive Systems

List of firefighting equipment shall include Mobile Fire Tender, Floating Crafts, Hydrant Systems to cover entire port, Sprinkler System to appropriate closed areas, Sprinkler System to coal yards, Fire Water Tanks, Fire Pumps, Fire Alarm, Smoke Detectors, Heat Detectors, Tower Monitors & Ground Monitors, Terminal Fire Pump House for Foam Operations, Jumbo Water Curtain Lane, Portable Fire extinguishers, Manual Call Points, PA Systems and Floor wise evacuation plan

10.10.6 Pollution Control & Preventive Systems

Pollution control and prevention systems shall include Oil Spill Recovery Equipment's, Floating crafts, Ground Monitors, Sprinklers, Hydrants, Sewage Treatment Plant, Storm Water Treatment System, Green Belt System, Air Monitoring Systems.

Fire protection/dust suppression in the coal yard is by means of a sprinkler system at each corner and in the centre a tower mounted system provides a 360-degree water spray.

10.10.7 Medical Facilities

Medical facilities shall include Medical Centre and Ambulance

10.10.8 Communication

An effective system of communications shall be put in place. This shall primarily be on the designated UHF marine channel and set up between the Command Centre, Port Operation Centre (POC), On Scene Commander and other communicable departments. Telephone and emergency hotlines shall also be installed as a secondary means of communication.

10.10.9 Human Resources

Huan resources shall include Trained fire fighters, Security Personnel, Swimmers/Divers for Flood, Doctor and Medical Stewards, First aid trained personnel, Maintenance Staffs, ERT Members, IMO trained personnel, Vehicle retrieval team, House Keeping Personal, Administrative Staffs.

10.10.10 Other Resources

- PPE's
- Fire Fighting & Rescue Equipment's
- CCTV
- Support Craft

Tugs to provide support in the event of a fire; at least one is capable of providing firefighting capability. These tugs shall provide assistance in the towage of vessels in emergency situations. In addition, a mooring boat & a pilot launch are available for dealing with emergencies.

10.10.11 Occupational Hazards/Proposed Mitigation Measures and Personal Protection Equipment

S. No	Occupation Health Hazard	Areas associated with Hazards	Mitigation Measures	Provision of PPE to Workers
1	Excessive Noise	Construction activities such as infrastructure development, storage and transportation and, operational activities such as operation of pumps, vehicles and DG sets.	• Provision of sound insulated control rooms with noise levels less than 60 dB(A). • Procurement of generators to meet applicable occupational noise levels. • Facilitating workers with PPE while working in high noisy areas.	• Earmuffs • Ear plugs
		Excessive noise which can lead to irreparable hearing		

S. No	Occupation Health Hazard	Areas associated with Hazards	Mitigation Measures	Provision of PPE to Workers
		damage and increased stress.		
2	Electrical Hazards	Electrical shocks from power lines and activated equipment.	• Deactivation and correct grounding of distribution lines and live power equipment in accordance with applicable laws and regulations. • Specialized training in electrical safety to workers.	• Leather gloves • Asbestos gloves • Electrical resistance gloves • Canvas gloves • Safety belts, jackets, lanyards, full body suits etc.
3	Dust emissions	Construction activities produce dust emissions.	• Usage of dust control machines • Use of PPEs	• Masks • Welding shields • Safety goggles/glasses
4	Slips, Trips and Falls	Malfunctioning of lifting equipment	• Good housekeeping practices shall be in place. • Regular maintenance of lifting equipment shall be undertaken.	• Leg guards • Safety boots made of leather/asbestos • Fibre Helmet • Bump caps

10.11 Budgetary Estimates

The budgetary estimate for Capital Environmental Management Cost for Master Plan is ~INR 64.80 crores and the annual budgetary estimate during operational phase is ~INR 3.86 crore. The breakup of cost is given in **Table 10-7** and **Table 10-8**.

Table 10-7: Environmental Management - Capital Cost

S. No.	Purpose	Cost items	Amount (Rs.)	Million (INR)	CRORE (INR)
1	Solid Waste Management	Waste dustbin	73,006	0.073	0.01
2	Greenbelt development	Tree planatation	17,68,125	1.768	0.18
3	Air pollution control	Dust suppression system and air pollution control	547542712.5	547.5	54.75
4	Wastewater Treatment	STP of 3.5 KLD	151669	0.2	0.02
		ETP of 25 KLD	35778000	35.80	3.58
5	Organic Waste Converter	Organic Waste Converter	302500	0.30	0.03
6	Training Workshop	Workshop	150000	0.20	0.02
7	Occupational Health Safety	Glares, Breathing Masks, Gloves, Boots, Helmets, Safety Belt, Safety Ladder, Self-contained suit, Ear Plugs	615000	0.60	0.06
8	Solar power	Solar power	42300000	42.30	4.23

S. No.	Purpose	Cost items	Amount (Rs.)	Million (INR)	CRORE (INR)
9	Environmental Monitoring Construction Phase	Terrestrial and Marine Environment	19196000	19.20	1.92
	Total Capital Cost		**647877012.20**	**647.941**	**64.80**

Table 10-8: Environmental Management - Annual Recurring Cost

S. No.	Purpose	Items	Amount (Rs.)	Million (INR)	CRORE (INR)
1	EMC Running expenditure	Salary of Env. Eng.	200000	0.2	0.02
		Doc Asst.	125000	0.13	0.01
		Support Staff	100000	0.1	0.01
		Office Expenses	1200000	1.2	0.12
		House Keeping	500000	0.5	0.05
2	Greenbelt Development	Maintenance	176812.5	0.18	0.02
3	Maintenance of Dust bins	Maintenance	10,951	0.01	0.001
4	Maintenance of Air pollution control	General Maintenance	2,73,77,136	27.38	2.74
5	STP maintenance		7583.45	0.01	0.001
6	ETP maintenance		1788900	1.79	0.18
7	Organic Waste Convertor		30250	0.03	0.003
8	Training Workshop		50000	0.05	0.01
9	Solar Power	Maintenance	1057500	1.06	0.11
10	Occupational Health Safety	Maintenance	153750	0.15	0.02
11	Statutory compliance for environmental protection	Environmental Monitoring	5641000	5.64	0.56
	Total		**38418882.43**	**38.43**	**3.86**

Budget Estimation for wildlife conservation is 15 lakhs for 5 years

Chapter 11
Summary and Conclusions

11 Summary and Conclusions

11.1 Introduction

Tamil Nadu is one of the maritime states of our country, historically known for Ports and Harbors with its ~1,076 km of coastal length.

Cuddalore Port is an existing port located at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal. The port at Cuddalore was an ancient anchorage (open roadstead) port developed and used by various regional kingdoms, subsequently by British and currently under administrative control of Tamil Nadu Maritime Board (TNMB).

TNMB obtained CRZ recommendations for Capacity Expansion of Cuddalore port from Tamil Nadu Coastal Zone Management Authority (TNCZMA) through vide letter No. 19510/EC-3/2018-1 dated November 14, 2018 and obtained Environmental & CRZ Clearance from MoEFCC through vide File no. 10-35/2017-IA-III dated August 20, 2020 for transforming the Cuddalore port into all-weather Multi Cargo Handling Port with increase in cargo handling capacity upto 5.68 MTPA with additional Wharf/berth construction (2 Numbers; 120 X 21 m each) established in Paravanar river, dredging for 18,73,476 Cu.m, increase in depth for approach channel upto -11m CD and Turning Circle upto -11 m CD, additional cargo storage areas, extension of North Breakwater is 395m and South Breakwater is 650m.

M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL) has entered into a concession agreement with TNMB for development and operation of the Cuddalore Port, Tamil Nadu for 40 years under the PPP Model vide Agreement dated 04.07.2025.

MCPMPL, obtained Transfer of Environmental and CRZ Clearance from Ministry of Environment, Forest and Climate Change (MoEFCC) vide EC Identification No. EC25A3501TN5833411T and order no. File No. 10-35/2017/-IA-III dated 01.12.2025 (**Appendix A**) from M/s Tamil Nadu Maritime Board (TNMB).

In the Present proposal, Cuddalore port is proposing for the increase in cargo handling capacity from 5.68 MTPA to 11.48 MTPA and ship building and repair activities within the notified port limits with following developmental works:

- Construction of additional Two Bulk berths 2x270 (540m) berths and 200m extension of existing multipurpose berths (440m).
- Capital dredging to -16 m CD in the inner channel and -18m CD in the outer channel, to handle fully loaded Handymax, Supramax, and Panamax vessels.
- Proposed to handle the cargo including Coal, Cement, Fertilizers, Container, Cereals, Wood, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron Ore, slag and Limestone.

- Development of stacking yards, storage yards, container freight station, and internal roads.
- Procurement and installation of port equipment and cargo-handling systems, including mobile harbour cranes, forklifts, and other supporting machinery.
- Ship building and repair facilities.
- Road and Rail connectivity

11.2 Project Site

The Cuddalore Port is located at the Uppanar Estuary a confluence of two rivers viz., Paravanar and Gadilam (through Buckingham Canal) with Bay of Bengal at latitude 11^{0}42'22.43'' N and longitude 79^{0}46'30.52''E with Sea and has a Land area of 59.09 Ha (146.01 Ac) [which includes port backup area of 45.21 Ha (111.72 Ac) in the town survey number 1944 and shipbuilding area of 13.88 Ha (34.29 Ac)] in the survey numbers of 120 (Part/Subdivision 3), 121 (Part/Subdivision 1A, 1B, 1C, 1C1A, 1C1B, 1C2, 2, 3) and 131 belongs to Government. The proposed project expansion is envisaged to be developed within the notified limits of Cuddalore Port. Cuddalore port limits were declared by Highways & Minor Ports (HN2) Department, Govt. of Tamil Nadu through G.O. (Ms) No. 110 dated June 18, 2009.

11.3 Need for Master Plan Development

India's long-term economic trajectory provides a strong basis for adopting a 7% growth assumption for EXIM traffic in port projections. With the intention of propelling India to the forefront of the Global Maritime Sector, the Ministry of Ports, Shipping and Waterways has formulated the Maritime India Vision 2030 (MIV 2030), a blueprint to ensure coordinated and accelerated growth of India's maritime sector in the next decade.

Cuddalore has a major Chemical Industrial Complex and Puducherry union territory is located on North. There is a huge demand for seaport to ease out the transportation demand for bulk minerals and chemicals as huge industrial developments have taken place in and around the Cuddalore and also few in-pipeline with respect to Power, Chemical and Processing industries (fertilizer and also clean and container cargo).

The port is surrounded by major production and consumption centres ranging from textile hubs and engineering clusters to cement, thermal power plants, Agro-processing, and leather industries. Further, the Cuddalore Port lies well within a 130 – 310 km radius of multiple cargo generating districts, which significantly reduces inland transportation time and cost when compared to alternative ports like Chennai or Tuticorin.

Based on the growth of business and cargo ramp up, the need of further expansion has arisen. To cater the above-mentioned needs of Cuddalore Port, MCPMPL proposes to develop by adding new berths and port infrastructure, ship building and repair facilities along with railway siding facilities. Hence, expansion for Cuddalore port is proposing for the increase of cargo handling from consented capacity from

5.68 MTPA to 11.48 MTPA with an increase of 5.80 MTPA and in addition, ship building and repair activities were also proposed. The proposed project expansion is envisaged within the notified limits of Cuddalore Port.

11.4 Project Description

The traffic forecast shows that there is requirement of the capacity enhancement of port for additional 5.80 MTPA cargo as a part of development plan. Cumulative Cargo Handling Capacity will be 11.48 MTPA which includes existing approved 5.68 MTPA of cargo handling capacity. Existing and proposed development plan is given in **Table 11-1**.

Table 11-1: Approved and Proposed Expansion Plan

S. No	Description	Unit	Approved	Proposed	Total	Remarks
1	**Multipurpose Berths**	No.	2	1	3	Increase in quay length and depth
	Quay length	m	240 (120x2)	200	440	
	Depth	m	-11	-16	-16	
	Width	m	21	-	21	
2	**Port craft berth/Wharf**	No.	1	-	1	No change
	Length	m	300	-	300	
	width	m	30	-	30	
3	**Bulk Berth**	No.	-	2	2	Increase in quay length
	Length	m	-	540 (270x2)	540	
	Width	m	-	21	21	
4	**Shipyard/repair jetty**	m	-	1	1	New proposal
	Length	m	-	200	200	
	Width	m	-	21	21	
5	Increase Depth at Protected area/Inner channel	mCD	-11	-16	-16	Increase in depth
6	Increase Depth at unprotected area/outer channel	mCD	-11	-18	-18	Increase in depth
7	Ship Building and Repair Yard	Acres	-	34.29	34.29	New proposed area
8	**Total Port area** including Backup & shipyards	Acres	111.72	34.29	146.01	Increase in depth
9	**Breakwater total**	m	1045	0	1045	No change
	Breakwater North	m	395	0	395	
	Breakwater South		650	0	650	
10	**Retaining walls** North	m	180	0	180	No change
	South	m	230	0	230	No change

S. No	Description	Unit	Approved	Proposed	Total	Remarks
11	**Turning Circle** Diameter	m	310.0	90	400	Increase in diameter and depth
	Depth	mCD	-10	-16	-16	
12	**Approach Channel** Length	m	1500	5000	5000	Increase in approach channel length and width at Protected Area Curved portion of channel Unprotected
	Width	m	60	-	-	
	Protected Area/Inner Channel	m	-	100	100	
	Curved portion of channel/Inner Channel	m	-	130	130	
	Unprotected area/outer channel	m	-	160	160	
13	Cargo handling capacity	MTPA	5.68	5.8	11.48	Increase in cargo handling capacity
14	Capital Dredging	M. Cum	1.87	5.0	5.0	Capital dredging of 1.87 M.Cum is already carried out, now during expansion 5 M.cum of dredging will be carried out.
15	Level raising/ Reclamation	M. Cum	1.87	5.0	5.0	During current expansion, reclamation at port back up area/beach nourishment (utilising 2 MCM for level raising and remaining 3 MCM for beach nourishment towards north side of north breakwater and south side of south breakwater)
16	Maintenance Dredge disposal	M. Cum	0.0187	0.237	0.237	Beach nourishment north side of north breakwater

S. No	Description	Unit	Approved	Proposed	Total	Remarks
						and south side of south breakwater
17	Cargo type	-	Coal, Cement, Fertilizers and Clean Cargo like containers	Coal, Cement, Fertilizers, container, Cereals, wood, clean cargo, Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcoke, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc., Iron ore, slag and Limestone		Change in cargo mix
18	Water requirement	KLD	100	-	100	Desalination plant
19	Desalination plant	KLD	100	-	100	No change, 100 KLD is not being consumed yet.
20	Power	KVA	373	3965	4338	Increase in power requirement
21	Effluent Treatment Plant	KLD	-	25	25	No change
22	Sewage Treatment Plant	KLD	-	3.5	3.5	New proposal

11.5 Traffic Forecast

Based on the available hinterland the cargo forecast for the Cuddalore port has been worked out and same has been summarized in **Table 11-2** and **Table 11-3**.

Table 11-2: Traffic Forecast for Proposed Expansion Plan

S. No	Berth type	Cargo Mix	Cargo Handling Capacity (MTPA)
1	Multipurpose berth-1	Container cargo	1.33

S. No	Berth type	Cargo Mix	Cargo Handling Capacity (MTPA)
2	Multipurpose berth-2	Liquid cargo such as non-hazardous and Class A, B, C chemicals including Methanol, Ethylene Di Chloride, Sulphuric Acid 98%, Caustic Soda Lye 48%, Linear Alkyl Benzene, Acetic Acid, Palm Fatty Acid Distillate, Glycerine, Ethanol, Petcock, Bitumen, Low Sulphur Fuel Oil, Marine Gas Oil (NFPA Class II or Class IIIA), Motor Spirit (Class 1A), HSD (Class B Chemical) and Furnace Oil etc.	1.61
3	Bulk berth (two no)	Coal, Fertilizers, Cement, Clean cargo, Iron ore, slag and Limestone	8.54
Total			**11.48**

Table 11-3: Traffic Forecast for Ship Building and Repair

S. No	Location	Activity	Units/year
1	Ships (upto 50,000 DWT)	Building	20
		Repair	20
Total			**40**

11.6 Salient Features of Existing and Proposed Development

The traffic forecast shows that there is requirement of the capacity enhancement of port for additional 5.80 MTPA cargo as a part of development plan. Cumulative Cargo Handling Capacity will be 11.48 MTPA which includes existing approved 5.68 MTPA of cargo handling capacity. Existing and proposed development plan is given in **Table 11-1**.

11.6.1 Cargo Handling Capacity

Based on the available hinterland the cargo forecast for the Cuddalore port has been worked out and same has been summarized in **Table 11-2**.

11.7 CRZ Compatibility

Physical demarcation of HTL, LTL and delineation of CRZ boundaries for the project site were carried out by Council of Scientific and Industrial Research - National Institute of Oceanography (CSIR-NIO), Goa, R.C Visakhapatnam which is one of the MoEFCC authorized agencies. Following are the observations of the demarcation carried out by CSIR-NIO:

- Project site does not contain environmentally sensitive areas such as National parks / marine parks, sanctuaries, wildlife habitats, corals / coral reefs.
- Facilities proposed such as breakwaters, berths, level raising areas, cargo handling, rail & road, green areas and storage facilities are falling in CRZIB, CRZ II, CRZ III A, CRZ IIIB, CRZ IVA and CRZ IVB.

- The activities proposed within CRZ area are permissible as per CRZ notification, 2011.
- The activities proposed within CRZ area are permissible as per CRZ notification, 2011.

11.8 Description of Environment

area for baseline environmental surveys. The baseline status of ambient air quality, noise levels, water quality and soil quality in the study area are presented in the following sections.

11.8.1 Marine Environment

The existing marine environmental conditions around the Cuddalore port established through collection and analysis of water and sediment at eight locations.

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Water Parameters

- The surface temperature ranged between 30.3°C and 31.4°C, the bottom depth layers temperature ranged between 29.80C and 310C.
- The combined pH measurements of both Surface and bottom depth of pH are found to be alkaline at all the sampling locations. The pH value ranges from 8.2 to 8.3.
- The surface salinity levels were found to be in the range of 33.5 PSU to 34.5 PSU. The bottom depth salinity levels were found to be in the range of 34 PSU to 35 PSU.
- Turbidity values ranged from 1 to 30 NTU at the surface and 5 to 34 NTU at the bottom.
- Total suspended solids surface values ranging from 3.81 to 10.25 mg/L and bottom values from 3.26 to 11.10 mg/L.
- Total Dissolved Solids concentrations varied between 33,450 and 34,530 mg/L at the surface and 34,020 to 34,800 mg/L at the bottom.
- Dissolved Oxygen (DO) varied from 5.44 to 7.20 mg/L at the surface and 4.40 to 5.93 mg/L at the bottom.
- Biological Oxygen Demand ranged from 0.64 and 5.60 mg/L at the surface and 0.67 to 5.82 mg/L at the bottom.
- Chemical Oxygen Demand (COD) showed a surface range of 6.4 to 12.8 mg/L and bottom range of 7.53 to 18.28 mg/L.
- The ammonia was present in moderate amounts (0.25 and 0.47 µmol/L) and 0.22 to 0.62 µmol/L at the bottom, with slightly higher values at depth, suggesting organic matter decomposition and release.
- The nitrate concentrations showed a declining gradient from 0.73 to 2.46 µmol/L at the surface and 0.83 to 2.79 µmol/L at the bottom.

- Nitrite ranged from 0.73 to 2.46 µmol/L at the surface and 0.83 to 2.79 µmol/L at the bottom, with slightly elevated levels at deeper depths.
- Total Nitrogen varied from 6.42 to 16.56 µmol/L at the surface and 7.25 to 18.87 µmol/L at the bottom.
- The sulphate concentrations ranged from 2,585 to 2,660 mg/L at the surface and 2,600 to 2,700 mg/L at the bottom.
- Chloride concentrations were consistently high, ranging from 18,195 and 18,730 mg/L at the surface and 18,440 to 19,040 mg/L at the bottom.
- The sodium levels were consistently high, ranging from 8,650 to 9,100 mg/l at the surface and 8,700 to 9,200 mg/l at the bottom.
- Potassium concentrations ranged between 383 to 395 mg/L and 389 to 402 mg/L at the bottom
- Lead was found to be below detection limits (BDL) in both surface and bottom.
- The Copper concentrations ranged from 1.46 to 4.03 mg/L at the surface and 1.33 to 4.38 mg/L at the bottom.
- The Zinc was the most abundant of the measured metals, with concentrations ranging from 3.53 and 7.11 mg/L at the surface and 7.21 to 13.81 mg/L at the bottom.
- The Iron concentrations ranged from 47.30 to 90.12 mg/L at the surface and 52.88 to 105.01 mg/L at the bottom.
- The Mercury and selenium below detection limits (BDL) in all samples.
- Total heterotrophic bacterial (THB) counts ranged between 72,000 and 270,000 CFU/mL
- Total coliform levels varied between 421 and 750 MPN/100 mL
- Primary productivity values ranged from 1.09 to 2.24 g C/m²/day
- Phenolic compounds ranged from 0.18 to 0.35 mg/kg
- The phytoplankton assemblage was strongly dominated by diatoms
- The zooplankton community is primarily dominated by Arthropoda (Copepoda)

Sediment Parameters

- Sediment texture analysis revealed a strong dominance of the sand fraction, ranging from 88.1% to 100%
- Sediment pH ranged from 7.5 to 8.2
- Total Organic Carbon (TOC) varied between 1.54 and 2.67 mg/kg
- Oil and Grease in sediments across the study stations ranged from 11.04 to 23.45 mg/kg
- Chromium levels varied from 26 to 54 mg/g
- Total Nitrogen ranged from 0.13 to 0.35 mg/g
- Total Phosphorus varied between 0.07 and 0.17 mg/g
- Potassium concentrations ranged from 329 to 380 mg/g
- Sodium concentrations ranged from 706 and 806 mg/g
- Iron (Fe) showed comparatively high concentrations, ranging from 4754 to 7722 µg/g
- Copper (Cu) concentrations ranged from 134 to 193 µg/g
- Zinc (Zn) varied between 590 and 1059 µg/g

- Lead (Pb), Mercury (Hg), Arsenic (As), and Boron (B) were recorded as below detection limit (BDL) at all locations
- Four groups of macro benthic organisms namely Polychaetes, Bivalves, Gastropods, and Crustaceans were recorded across various stations
- Meiobenthic represented by four groups Foraminiferans, Nematodes, Ostracodes, and Harpacticoids

11.8.2 Terrestrial Environment

11.8.2.1 Ambient Air Quality

The ambient air quality status within the study area has been assessed through 8 monitoring locations.

The ambient air quality status observed during study period is presented in terms of percentiles. All the 12 parameters (Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Ozone (O_3), Lead (Pb), Ammonia (NH_3), Benzene (C_6H_6), Benzo (a) Pyrene (BaP) – Particulate phase only, Arsenic (As), Hydrocarbons and Nickel (Ni)) are monitored as per NAAQS. The monitoring and analysis were carried out as per CPCB standard methods of measurements.

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- PM_{10} ranged between 36.4 µg/m^3 (AAQ-2) to 42.9µg/m^3 (AAQ-4). NAAQS stipulated standard for PM_{10} for 24 hr is 100µg/m^3.
- $PM_{2.5}$ values varied from 18.5 µg/m^3 (AAQ-1) to 28.5 µg/m^3 (AAQ-8) NAAQS stipulated standard for $PM_{2.5}$ for 24 hr is 60 µg/m^3.
- SO_2 values varied from 9.4 µg/m^3 (AAQ-1) to 19.8 µg/m^3 (AAQ-8). NAAQS stipulated standard for SO_2 for 24 hr is 80 µg/m^3.
- NO_2 ranged between 15.4 µg/m^3 (AAQ-2) to 29.1 µg/m^3 (AAQ-8). NAAQS stipulated standard for NO_2 for 24 hr is 80 µg/m^3.
- O_3 were found to be below detectable limits in all the locations. NAAQS stipulated standard for O_3 for 8 hourly is 100 µg/m^3.
- Hydrocarbons such as Benzene and Benzo (o) pyrene were found to be below detectable limits in all the locations.
- Heavy metals like Lead, Arsenic and Nickel were found to be below detectable limits in all locations.

11.8.2.2 Ambient Noise

Baseline ambient noise quality has been established by monitoring noise levels at 8 locations.

- Day equivalent noise levels (Ld) ranged between 42.4 dB(A) to 45.7 dB (A).
- Night equivalent noise levels (Ln) ranged between 32.8 dB(A) to 39.8 dB (A)

11.8.2.3 Soil Quality

The soil in the study area is predominantly sandy sand. The soil quality in the study area was assessed through collection and analysis of samples from 8 locations.

- The pH of the soils ranged between 7.22 and 7.96 indicating "alkaline" in nature.
- The texture of the soil seems to be Sandy loam.
- The electrical conductivity was found to be in the range of 99 µmhos/cm to 191.7 µmhos/cm.
- The Organic Carbon was observed to be in the range of 0.596% to 0.645%.
- The infiltration rate was found to be between 24 mm/hr and 28 mm/hr.
- Bulk density of the soils ranged from 1.52 g/cc to 1.62 g/cc.
- The water holding capacity of the soils varied from 20.4 % to 22.4 %.
- Porosity of the soils varied from 0.438% to 0.468 %
- Heavy metal concentration for metals like, Copper (as Cu) varied from 2.78 mg/Kg to 3.98 mg/kg, Iron (as Fe) varied from 4.32 mg/kg to 5.87 mg/kg and Lead (as Pb) is varied from 1.23 mg/Kg to 1.67 mg/kg in the soils.
- Nitrogen concentration in soil varied from 76 mg/kg to 168 mg/kg.
- Potassium concentration varied from 78.6 mg/kg to 140 mg/kg.
- Phosphorus percentage varied from 79.5 mg/kg to 165 mg/kg.

11.8.2.4 Inland Water Quality

Groundwater Quality:

- pH is ranges 7.5 at between GW-1 and 7.9 at GW -4 indicating slightly alkaline in nature and within the permissible limit (6.5-8.5) of IS:10500 Standard.
- Electrical Conductivity (EC) was found to be in the range of 743 µmhos/cm at GW-3 to 1001 µ mhos/cm at GW-4.
- Temperature is constant at 25 0C.
- Total Dissolved Solids (TDS) found to be 1538 mg/l at GW-3 and 1790 mg/l) at GW-2.
- Chloride concentrations are between 118 mg/l at GW-1and 665 mg/l at GW-2 respectively and well within permissible limits (1000 mg/l).
- Sodium concentrations are between 106 mg/l at GW-4 and 145 mg/l at GW-2 respectively.
- Total Alkalinity ranged between 186 mg/l at GW-1 to 192 mg/l at GW-4 respectively.
- Total hardness (as CaCo3) ranged between 258 mg/l at GW-1 to 745 mg/l at GW-2 respectively.
- Fluoride concentrations are below acceptable limits.

- Heavy metal like Mercury (Hg), Cadmium (Cd), Arsenic (As), Selenium (Se), Cyanides (CN) were below detectable limits.

Surface water Quality:

- pH ranged from 7.8 at SW-4 to 8.1 at SW-2 indicating slightly alkaline in nature and within the permissible limit (6.5-8.5) of IS:10500 Standard.
- Electrical Conductivity (EC) was found to be in the range of 1863 µmhos/cm at SW-3 to 3056 µ mhos/cm at SW-4.
- Temperature varies from 29.10C at SW-03 to 31 0C at SW-01.
- Total Dissolved Solids (TDS) found to be 870 mg/l at SW-3 to 1594 mg/l at SW-1.
- Chloride concentrations are between 875 mg/l at SW-4 to 1357 mg/l at SW-3 respectively.
- Biochemical Oxygen Demand concentration ranged between 2.9 mg/L at SW-2 to 5 mg/L at SW-3.
- Chemical Oxygen Demand (COD) concentration ranged between 9 mg/L at SW-4 to 15 mg/L at SW-3.
- Sodium concentrations are between 78 mg/l at SW-3 to 135 mg/l at SW-1 respectively.
- Total Alkalinity ranged between 145 mg/l at SW-1 to 453 mg/l at SW-3 respectively.
- Total hardness (as CaCo3) ranged between 553 mg/l at SW-4 to 1243 mg/l at SW-2 respectively.
- Heavy metal like Mercury (Hg), Cadmium (Cd), Arsenic (As), Selenium (Se), Cyanides (CN) were below detectable limits.
- Total Coliform was found to be 60 MPN/100ml at SW-3 to 130 MPN/100ml at SW-2.

11.8.3 Socioeconomic Conditions

The project site is falling in Cuddalore district, Tami Nadu. Study area of 15km radius is falling in two districts (Cuddalore and Villupuram) in Tamil Nadu and one Union territory (Puducherry district).

- The census study has been carried out for the 15 Km Radius, there are 121756 households, and population is 503332 out of which male population is 49.86% and female population is 50.14%. The sex ratio of the study area is 1006 females over 1000 males.
- The literate population in the study area is 361597 which constitute to be 71.84% of the total population. The total percentage of male literate population is 53.67% and total female percentage of literate population is 46.33%. Sex ratio of the Literacy population is 863 females over 1000 males.
- The Working population in the project study area is 208711 which are around 41.47%; and non-working population in the 4294621 which are 58.53 %. Working ratio of study area is very less and this should be raised by providing opportunities and skill development programs to the educated and non-educated of locales.

- The project study area fishermen households are 9321, and Fisher folk population is 33329 from 24 villages of from Puducherry district, Puducherry UT and Cuddalore district, Tamil Nadu.

11.9 Anticipated Environmental Impacts and Social impacts with Mitigation Measures

Anticipated impacts on the environmental and social attributes, which are likely to arise due to construction and operation of proposed project have been identified, predicted and mitigation measures are evaluated.

Summary of possible impacts and appropriate mitigation measures are discussed below.

11.9.1 Land Environment

Existing port is located in an area of 111.72 Ac along which is completely in possession of Cuddalore Port and proposed shipbuilding area of 34.29 Ac belongs to Government is an open scrub land without any settlements which will be acquired.

Area required for the proposed development is calculated considering all the facilities essential for envisaged operations such as material handling area, cargo storage/backup area, operational and utility area, internal connectivity, drainage, greenbelt and buildings etc. and by focusing on possibility of limiting the extent of land area requirement. Accordingly, layout has been prepared. Hence, no rehabilitation and resettlement (R&R) is envisaged.

The land environment may be adversely affected by spillage of construction materials during construction activities. During port operations, accidental discharges from ships during loading/unloading cargo, industrial waste, including sludge, residues, toxic chemical waste, used or waste oil, oil slurry, spent solvents, and ETP sludge may contaminate land if not properly managed.

Mitigation Measures:

- Management and Disposal of Wastes (Storage, Segregation and Transport of Waste)
- All wastes to be transported in a safe manner, in accordance with Material Safety Data Sheet information and via well maintained, legally compliant and suitable vehicles or vessels, with appropriate documentation and driven/crewed by fully trained operators.

11.9.2 Marine Environment

Developmental activities such as capital dredging, level raising, disposal and construction of cargo berths will result in disturbance to marine habitat. In addition, potential marine environmental impacts during construction phase may arise due to laying of pipeline of marine intake/ outfall and transportation of construction

equipment and storage of construction materials. Port operation activities like loading and unloading of cargo, vessel movements may hinder marine habitat.

Mitigation Measures:

- Controlled Dredging Rates, limiting the dredging rate minimizes disturbances to marine ecosystems
- Closed Grab Dredgers reduces sediment dispersion during dredging activities.
- Chemical Spill Prevention to prevent accidental chemical spills and construction site runoff protects marine life.
- Environmental Monitoring Programme comprising of monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of dredging and will be carried out throughout dredging period.
- Spill control measures will be adopted while fuelling dredgers, barges, workboats, etc.
- The discharge of solid waste and sewage from ships should be controlled. It should be disposed/discharged only after proper treatment.
- Oily wastewaters (from fuel storage tanks, maintenance shops, ships' bilge water, tank washings) and runoff from dirty areas of the port (vehicle marshalling, parking and fuel storage areas) should all be collected and passed through an oil water separator before discharge.

11.9.3 Water Environment

The untreated wastewater from the port activities flows into the harbour results in stagnation of water during construction activities. Wastewater generation at construction site includes surface runoff also which may contain pollutants and traces of solvents, paints, metal compounds, etc. which may impact the groundwater and nearby surface water resources, if not managed properly.

During operation phase, bilge oil released from commercial ships handling non-oil cargo as well as the more common threat from oil tankers is one of the significant environmental hazards.

Mitigation Measures:

- No wastewater shall be disposed directly on land or on existing surface water resources without appropriate treatment.
- An adequate drainage system will be provided at the site with separate collection streams to segregate the storm run-off from roads, open areas, material storage areas, vehicle wash water and other wastewater streams. Suitable measures will also be taken to prevent the washing away of construction materials into the drainage system.
- Sewage generated from port will be treated in STP of 3.5 KLD during Master Plan development. Effluent generated from port will be treated in ETP of 25 KLD during Master Plan development.
- The proposed cargo is to be handled with specialized handling systems and equipment and hence there will be very little chances of spill. However, in case

of accidental spill of cargo during handling, spills will be contained and wash water or surface runoff containing spills will be collected separately and will be treated to avoid any further impact on water quality. Storm water runoff from the cargo storage areas and other areas of the project facilities may contaminate marine water quality if not regulated properly.

11.9.4 Air Quality

11.9.4.1 Movement of Construction Materials and Vehicular Traffic

Site levelling, drilling, blasting, expansion of onshore facilities and transportation of construction material results in use of public infrastructure like roads and during material transportation, there is a possibility of impact on air quality along the route due to exhaust emissions, fugitive dust suspension and traffic congestion.

Mitigation Measures:

- Vehicles transporting soil and aggregate to be covered by using tarpaulins or covers that prevent the escape of dust and prohibiting such vehicles from stopping near settlements.
- No blasting under unfavourable wind and atmospheric conditions.
- Drilling machines will be equipped with wet drilling arrangements or dust collector
- Proper training and provision of PPEs such as dust masks or enclosure to workmen involved in drilling, welding etc.

11.9.4.2 Air Modelling

AERMOD, steady state" Gaussian model was used to predict the incremental concentration of air pollutants at the receptors in the study area. Results show that predicted incremental/resultant concentrations are within the NAAQS.

Some of the operation phase impacts and appropriate mitigation measures during the operation phase of the Proposed Master Plan are discussed below.

Mitigation Measures:

- Cuddalore Port shall take all measures to comply exhaust emission from vessels in accordance with MARPOL regulations and Euro Emission standard norms so as to reduce pollution load in the air environment.
- Trucks with cargo susceptible for fugitive suspension will be covered with tarpaulin. All the vehicles will be periodically checked to ensure compliance to the emission standards
- No vehicle should be allowed without proper pollution under control certificate in the port area and highly polluting vehicles (especially heavy trucks) should be avoided.
- The plantations and green belts all around the port area and also in the open area should be increased. This reduces air and noise pollution.
- Ambient air quality monitoring should be further strengthened.

- Exposure or health related monitoring of sensitive population subgroups like workers and residents etc. should be conducted as a safety measure.

11.9.5 Noise

Construction activities increase ambient noise levels significantly. Rise in noise levels is envisaged due to diesel run engines of construction machinery, speedy movement of vehicles, construction works, pile driving movement etc.

Mitigation Measures:

- Personnel Protection Equipment (PPE) shall be provided to the workforce for safety.
- Personnel Protection Equipment (PPE) such as earplugs, muffs etc shall be provided to the workers who will expose to high noise generating construction activities.
- Acoustic enclosers, vibration dampers, insulators shall by installed for noisy equipment.
- The effects of vibrations will be minimized by ensuring construction works during daytime and weekdays.

11.9.6 Solid Waste Management

Significant amounts of solid waste are expected to be generated during the construction phase of master plan development. During Operation phase, quantity of municipal solid waste generated from canteen and administrative areas is estimated at about Municipal solid waste from canteen and administrative areas during operation is estimated at 0.06 TPD and hazardous wate is ~4.36 TPD. Improper handling of solid waste may lead to contamination of soil and the environment.

Mitigation Measures:

- Hazardous wastes generated at the site shall be disposed through authorized vendors duly adhering under guidelines of Hazardous and Other Wastes Rules, 2016 and its amendment.
- The collected biodegradable waste shall be subjected to composting and the compost will be used as manure for the development of green belt within the port.
- Waste management facilities need to be brought to the attention of shippers and encourage them to use. The location of the treatment or disposal facilities needs to be carefully planned so as not to give rise to negative environmental impacts elsewhere, particularly in the case of garbage disposal.

11.10 Analysis of Alternatives

Cuddalore Port is the existing operational port. So, no other site selection criteria considered for Development Plan. The development includes capacity enhancement along with additional berths, extension of breakwaters, diversion of creek within project boundary and other facilities.

11.11 Environmental Monitoring Programme

Environmental monitoring programme has been formulated. Monitoring is a mandatory task for sustainability of any developmental project and is relevant to any process of environmental assessment. When a development project introduces complex inter-relationships in the project area among people, various natural resources and other developing forces, a new environment evolves for which it becomes difficult to predict the accurate post-project environmental scenario with complete assurance. Hence, post-project monitoring of critical parameters becomes essential. Monitoring results of environmental indicators gives the status of the environmental conditions and identifies the potential parameters / issues which needs observation and timely remedial intervention.

11.12 Additional studies

11.12.1 Risk Analysis

Risk Assessment study was carried out to assess risks associated with the construction and operation of the proposed development. Evaluated the probable risks associated to the development and operation of the proposed Multipurpose/ liquid / cargo. For liquid cargo handling a fully mechanized ship loading/unloading system is planned at the berths.

11.12.2 Disaster Management Plan

A Disaster Management Plan (DMP) is a critical component of the overall loss prevention strategy. It is essential to identify the types, patterns, and potential severity of hazards that could lead to loss of life, property damage, and environmental harm. The plan also assesses the associated vulnerabilities and risks, aiming to establish a comprehensive response mechanism. The DMP covers both administrative and operational procedures to mitigate the risk of hazardous events during both the construction and operational phases of the project. Since disasters can occur at any time, it is crucial to have a mitigation plan in place and ensure proper protection for all staff in the event of an emergency.

11.12.3 Oil Spill Contingency Plan

A contingency plan has been developed to increase the effectiveness, efficiency, and speed of cleanup operations in the event of an oil spill, and simultaneously protect areas of biological, social, and economic importance. This document shall be in place to educate and train own staff and crew members about various oil spill scenarios and how to deal with the situation when any incident / accident occurs.

11.12.4 Traffic and Transportation Study

The detailed traffic survey was conducted around Cuddalore port in line to ToR requirement for assessment of the cumulative impact of master plan development. The traffic management and traffic decongestion plan has been drawn up accordingly.

11.12.5 Social Impact Assessment

- The proposed development for Cuddalore port will be in an area of 59.09 Ha (146.01 Ac)
- No R&R is envisaged as there are no settlements in the project site.
- The impact on nearby settlements during construction phase will be due to air pollution and the noise generating activities. However, the activities are limited to the construction phase and will cease upon completion of the construction.
- Measures will be taken to control dust, and barriers will be installed around areas that generate high noise during construction.
- No fishing grounds reported in the proposed areas for master Plan development.
- However, to avoid any disturbance to the fishermen movement in the vicinity, signboards will be placed at the construction activities in order to make fishermen aware of the ongoing activities.

11.13 Project benefits

- Enhance socio-economic conditions by attracting new investments and improving infrastructure in surrounding areas.
- Employment opportunities to the people in surrounding villages, i.e. approximately to 215 people including both skilled and unskilled labour.
- Through CER, Cuddalore Port proposed to provide education support, skill training activities, organizing medical camps and other allied welfare initiatives.
- During the construction phase, around 500 workers will be employed. Once operational, the port is expected to generate approximately 215 job opportunities, comprising 82 direct employment and 123 indirect employment opportunities.

11.14 Environmental Management Plan

Environmental monitoring programme has been formulated. Monitoring is a mandatory task for sustainability of any developmental project and is relevant to any process of environmental assessment. The parameters to be monitored for the various environmental components along with their applicable standards, frequency and supervising responsibilities are given in the subsequent sections.

The environment management plan consists of Greenbelt Development Plan; Marine Biodiversity Management Plan; Wildlife Conservation Awareness Programme; Exploring Renewable Source of Energy in terms of Solar and Wind. Cuddalore port Measures towards India's Commitment for Climate Change; Occupational health and Safety etc., Apart from these the designed inbuilt components such as Air pollution abatement measures, water and wastewater treatment measures, Storm water management Plan, Stockyard runoff management plan, Noise abatement measures, Solid and hazardous waste management measures, selection of suitable outfall locations etc., which will ensure effective environment management.

11.15 Budgetary Estimates for Environmental Management

The budgetary estimate for Capital Environmental Management Cost for Proposed Master Plan **~INR 64.8 crores** and the annual budgetary estimate during operational phase is **~INR 3.86 crores**.

11.16 Social Upliftment Activities

Cuddalore Port is deeply committed to supporting the community and promoting sustainable development. The company integrates Social Upliftment Activities as a core business model, adopting a holistic approach that directly benefits the communities it impacts.

Through this approach, Cuddalore Port fosters balanced growth, ensuring that development aligns with both ecological and economic stability.

The key interventions introduced in the project area are as under:

- Education Support
- Healthcare Programmes
- Sanitation and Drinking Water Initiatives
- Supporting self-help groups (SHGs) for women in neighbouring villages
- Other welfare activities like skill training programs, promoting sports by providing equipment, tree plantations etc.
- Adopting villages for community development

Chapter 12
Disclosure of Project Consultants

12 Disclosure of Project Consultants

12.1 Brief Profile of FRICS

Falcon Resilient Infra Consultants (FRICS), a nascent company launched by a group of engineers having rich experience in Environmental Engineering, Master Planning, Infrastructure planning, Design and Financial Analysis delivering professional services in Ports and Marine structures, Roads and Highways, Thermal Power Plants, Industrial Parks, Area Development and Building Sector. Our solutions are tailored to meet the specific needs of our client, whether they are a small business or a large enterprise providing infrastructure solutions at all stages of the project life cycle.
Having experience of working in all types of terrain, climate, topographic, geologic, and social set-up within the sub-continent, FRICS have developed a vast network of professionals and formed a pool of experienced consultants having expertise in diverse functional areas. We are focusing on sustainability, health & safety, social responsibility, and environmental conservation in all our work.

12.2 FRICS Field of Expertise

FRICS are expertise in making development efforts more pleasant, environmentally friendly, and socially acceptable solutions. We assist our clients to comply with environmental and social safeguard requirements during all phases of the project cycle viz. preparatory, construction and operation.

- Environmental Due Diligence
- Environment and Social Impact Assessment
- Environment and Social Management Plan and Management Frameworks
- Biodiversity Management Plan
- Environmental Audits
- RS/GIS based Mapping and Analysis
- Social Impact Assessment
- Training & Capacity Building

12.3 QCI-NABET-EIA Accreditation

National Accreditation Board for Education & Training (NABET) is a constituent board of the Quality Council of India (QCI). QCI, NABET has accredited FRICS with certificate no. NABET/EIA/2326/IA 0123 valid up to August 16, 2026 attached as **Appendix M** for carrying out EIA studies in the following sectors:

- Ports, Harbours, Break Waters and Dredging
- Industrial Estates/Parks/Complexes/Areas, Export Processing Zone (EPZs), Special Economic Zones (SEZs), Biotech Parks and Leather Complexes
- Airports
- River Valley projects
- Bulk drug and speciality chemicals
- Thermal Power Plants
- Highways

- Common Municipal Solid Waste Management Facility (CMSWMF)
- Building and construction projects
- Townships and Area development projects

12.4 Sub Consultants Engaged

12.4.1 Brief profile of "Enviro Care India Private Limited":

Nature of Consultancy Services Rendered: Terrestrial Baseline Environmental Surveys.
Enviro Care India Private Limited is one of the leading environmental organisations of Tamil Nadu, working in different states of India. Enviro Care India Private Limited helps clients to protect the environment by implementing environmental management plans to keep it safe forever as well as ensure nature's balance on this planet to continue the existence of life.
Recognized by Govt of India, MoEFCC, Accredited to NABL with Certificate Number TC:6226 attached as **Appendix N.**
Enviro Care offers customized laboratory services, delivering precise testing, reliable results, and industry-compliant solutions tailored to client needs.

Enviro Care India Private Limited is dedicated to offer the following services.

- Water Analysis
- Ambient / Workplace Air Quality Survey
- Stack Monitoring
- Weather Monitoring
- Soil Testing
- Food Testing
- Lab Services
- Noise & Illumination Monitoring

12.4.2 CSIR-National institute of Oceanography

Nature of Consultancy Services Rendered: Demarcation of HTL\LTL and CRZ Area.

National Institute of Oceanography CSIR-NIO was established on 1 January 1966 following the International Indian Ocean Expedition (IIOE) in the 1960s. The institute has since grown into a multi-disciplinary oceanographic research institute of international repute. The principal focus of research has been on observing and understanding special oceanographic characteristics of the Indian Ocean. The major research areas include the four traditional branches of oceanography - biological, chemical, geological/geophysical, and physical as well as ocean engineering, marine instrumentation, and marine archaeology. In addition to basic research, the institute also carries out applied research sponsored by the industry. These studies include oceanographic data collection, environmental impact assessment, and modelling to predict environmental impact. The institute also provides consultancy on several issues including marine environmental protection and coastal zone regulations. CSIR-NIO serves as an advanced center of education in ocean sciences and has a School of Oceanography under the Academy of

Scientific & Innovative Research (AcSIR). Further details on the agency may be seen in the following website:
https://www.indiascienceandtechnology.gov.in/organisations/ministry-and departments/council-scientific-industrial-research-csir/csir-national.

12.4.3 Centre for Advanced Study in Marine Biology (CASMB), Annamalai University

Nature of Consultancy Services Rendered: Marine Baseline Environmental Surveys for marine chemical, physical and biological parameters from marine water and sediment monitoring studies.

The Centre of Advanced Study (CAS) in Marine Biology is a reputed Marine Institute in India which is actively engaged in teaching, research and extension activities in Marine Sciences. The advantage of the Centre is the ideal location and easy access to different biotopes such as estuary, mangrove, backwaters and coastal waters.

The Ministry of Environment and Forests, Government of India, established Environmental Information System (ENVIS) Centre during 1992, as one among the 76 Centres. The Centre assigned to document the present status of coastal biodiversity along the east coast of India. The Ministry of Earth Sciences (formerly known as Department of Ocean Development), Government of India, established Ocean and Atmospheric Science & Technology Cell (OASTC) and based on the accomplishments the Cell has been upgraded as DOD-Centre of Excellence in Marine Biology during 2004. The letter from Centre for Advanced Study in Marine Biology (CASMB), Annamalai University was attached as **Appendix O**.

Appendices

Appendix A
Previous EC&CRZ Clearances

F.No. 10-35/2017-IA-III
Government of India
Ministry of Environment, Forest and Climate Change
(IA.III Section)

Indira Paryavaran Bhawan,
Jor Bagh Road, New Delhi - 3

Date: 20th August, 2020

To,

M/s Tamilnadu Maritime Board,
171, South Kesavaperumal puram Off Greenways Road,
Raja Annamalai puram Chennai, Mylapore Triplicane,
Chennai - 600028, Tamil Nadu
E- Mail: portcuddalore@gmail.com

Subject: Capacity Expansion, Cuddalore Port, Tamil Nadu by M/s Tamilnadu Maritime Board - Environmental and CRZ Clearance reg.

Sir,

This has reference to your online Proposal No. IA/TN/MIS/64666/2017 dated 31 January, 2019, submitted to this Ministry for grant of Environmental and CRZ Clearance in terms of the provisions of the Environment Impact Assessment (EIA) Notification, 2006 and Coastal Regulation Zone (CRZ) Notification, 2011, under the Environment (Protection), Act, 1986.

2. The proposal for 'Capacity Expansion, Cuddalore Port, Tamil Nadu by M/s Tamilnadu Maritime Board was considered by the Expert Appraisal Committee (Infra-2) in the Ministry in its 49th meeting held during 25-26 February, 2020, 51st meeting held during 21-22 May, 2020, 52nd meeting held during 18-19 June, 2020 and 53rd meeting held during 23-24 July, 2020.

3. The project/activity is covered under category 'A' of item 7 (e) i.e. 'Ports, harbours, break waters, dredging' of the schedule to the EIA Notification, 2006 and its subsequent amendments, and requires appraisal at Central level by sectoral EAC.

4. The details of the project, as per the documents submitted by the project proponent, and also as informed during the above said EAC meeting, are reported to be as under:-

(i) Tamilnadu Maritime Board (TNMB) operates the Cuddalore Port in Cuddalore in the location where two estuarine rivers Viz., Paravanar and Uppanar have their confluence with Bay of Bengal. The Cuddalore Port is almost defunct for want of dredging to make the existing wharf to become operational for multi Cargo handling for 5.68 MTPA. The Port is pre-EIA Notification and has valid Consent for operation from State Pollution Control Board.

(ii) TNMB intended to enhance the Cargo handling capacity with additional berth construction (2 Numbers; 120 X 21 m each) with required modifications in the existing Breakwaters, Approach Channel & Turning Circle, additional Cargo Storage systems and dredging for 18,73,476 Cu.m TNMB availed the services of the Department of Ocean Engineering, Indian Institute of Technology-Madras for the preparation of Detailed Project Report with feasibility studies for the proposed Capacity Expansion Project of Cuddalore Port. The detailed engineering and structural designs are within the scope of services from IIT-M.

(iii) The proposed cargo is multiple systems as there is a requirement to coalmining, thermal power plants and general industrial growth in the project location. The proposed additional Cargo handling is envisaged for 5.68 MTPA of varied cargo of Coal, Fertilizer, Cement, and Containers and Clean Cargo.

(iv) The proposed berths are to be established in Paravanar with approach Channel for -10 to -11m CD with a Turning Circle for -11 m. The break waters will be further extended with slight change in the existing alignments.

(v) The dredged material will be used for land reclamation behind the proposed berths, erosion prevention on the northern side of the North Breakwater and also in the Off shore area.

(vi) Terms of Reference was granted by MoEFCC vide letter F.No. 10-35/017-IA-III dated 17 August, 2017.

(vii) Public Hearing was conducted by Tamil Nadu Pollution Control Board on 22 February, 2018 at Cuddalore Port in Cuddalore.

(viii) Tamil Nadu Coastal Zone Management Authority (TNCZMA) has recommended the project vide letter No. 19510/EC-3/2018-1 dated 14 November, 2018.

(ix) Investment/Cost of the project is Rs. 135 Crores.

(x) Employment potential: 2500 (Both direct & indirect).

(xi) Benefits of the project: Enhanced utility of Coastal compatibility for Port operation, Improving the operational capability of the existing Fishing Harbor.

5. In the 49th meeting held during 25-26 February, 2020, the EAC during deliberation noted that the project proponent has not provided copy of EIA/EMP report to all the members in the stipulated time. The EAC also noted that there are so many discrepancies in the presentation submitted by the project proponent. Accordingly, the EAC asked the project proponent to submit additional information. The project proponent submitted/uploaded the additional information on 05 May, 2020 on 'Parivesh' Portal. Accordingly, proposal was re-considered by EAC in its 51st meeting held during 21-22 May, 2020, however, project proponent did not attend the meeting and as such, the proposal was deferred.

6. On request of project proponent, proposal was again considered by EAC in its 52nd meeting held during 18-19 June, 2020, the EAC deliberated on the information provided by the PP and further noted that the Environment and Forest (EC.3) Department, Secretariat, Chennai vide letter No. 19530/EC.3/2018-1 dated 14 November, 2018 forwarded the proposal to the Ministry for grant of CRZ clearance to the project under CRZ Notification, 2011. The project proponent also submitted point-wise ToR Compliance along with Annexures, copy of CZMA recommendations given by Tamil Nadu Coastal Zone Management Authority (TNCZMA) and Plan for Corporate Environment Responsibility (CER) as specified under Ministry's Office Memorandum issued vide letter F.No. 22-65/2017-IA.III dated 01 May, 2018. However, PP had not uploaded signed copy of the EIA/EMP Report on PARIVESH porta. Further, the reply given by the Consultant to the query of EAC regarding validity of his accreditation certificate, the EAC observed that accreditation given to Center for Environment Health and Safety (the Consultant) stood expired with effect from February, 2019. They have applied for accreditation and NABET is yet to award accreditation certificate. As per provisions of EIA Notification, 2006, only accredited consultants are eligible to make the presentation. Therefore, the EAC recommended to defer the proposal to seek Valid accreditation certificate of the EIA Consultant M/s Centre for Environment, Health and Safety, Annamalai University and Signed copy of EIA/EMP report containing signature of all the team members. The project proponent submitted a letter dated 02 July, 2020 issued by QCI-NABET regarding validity of accreditation certificate for the consultant. As per the letter, QCI NABET has endorsed the accreditation of the Environmental Consultant. The EAC also noted that the project proponent has also submitted signed portion of the EIA Report. In view, proposal was re-considered by EAC in its 53rd meeting held during 23-24 July, 2020.

7. The EAC in its 53rd meeting held during 23-24 July, 2020, based on the information submitted and clarifications provided by the Project Proponent and detailed discussions held on all the issues, recommended the project for grant of environmental and CRZ clearance with stipulated specific conditions along with other Standard EC Conditions as

specified by the Ministry vide OM dated 04 January, 2019 for the said project/activity. As per recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords Environmental and CRZ Clearance to the project 'Capacity Expansion, Cuddalore Port, Tamil Nadu by M/s Tamilnadu Maritime Board, under the provisions of the EIA Notification, 2006 and amendments/circulars issued thereon and CRZ Notification, 2011, and subject to the specific and standard conditions as under:-

A. Specific Conditions:

(i) The Environmental and CRZ Clearance to the project is primarily under provisions of EIA Notification, 2006 and CRZ Notification, 2011. It does not tantamount to approvals/consent/permissions etc required to be obtained under any other Act/Rule/regulation The Project Proponent is under obligation to obtain approvals /clearances under any other Acts/ Regulations or Statutes as applicable to the project.

(ii) The project proponent shall abide by all the commitments and recommendations made in the Form-II, EIA and EMP report, submissions made during Public Hearing and also that have been made during their presentation to EAC.

(iii) Construction activity shall be carried out strictly according to the provisions of the CRZ Notification, 2011. No construction works other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.

(iv) All the recommendations and conditions specified by the Tamil Nadu Coastal Zone Management Authority (TNCZMA) vide letter No. 19510/EC-3/2018-1 dated 14 November, 2018 shall be complied with.

(v) The project proponent shall ensure that the project is in consonance with the new CZMP prepared by the State Government under the provisions of CRZ Notification, 2011.

(vi) The Project proponent shall ensure that no creeks or rivers are blocked due to any activities at the project site and free flow of water is maintained.

(vii) Dredging shall not be carried out during the fish breeding season. Dredging, etc. shall be carried out in confined manner to reduce the impacts on marine environment. Turbidity should be monitored during the dredging. While dredging, sediment should be monitored fortnightly at source and disposal location of dredging.

(viii) Dredged material shall be used for beach nourishment and left out material should be disposed safely in the designated areas so that the dumped dredged material does not enter the channel. With the enhanced quantities, the impact of dumping on the coastal environment should be studied and necessary measures shall be taken on priority basis if any adverse impact is observed.

(ix) No underwater blasting is permitted.

(x) An independent monitoring be carried out by any Government Agency/Institute to evaluate the impact during dredging. Impact of dredged material on coastal environment along with shore line changes should be studied by the PP and necessary mitigation measures be taken in case any adverse impact is observed. The details shall be submitted along with the six-monthly monitoring report.

(xi) The fresh water requirement of 100 KLD shall be met from desalination plant using RO.

(xii) Sewage generated will be collect from the conveniences and rest rooms. This will be mixed with all other liquid waste streams from washing and service yard and will be taken to ETP.

(xiii) Marine ecological studies and its mitigation measures for protection of phytoplankton, zooplanktons, macrobenthos, estuaries, mangroves, coral reefs and sea-grass beds etc. as given in the EIA-EMP Report shall be complied with in letter and spirit.

(xiv) Marine ecology shall be monitored regularly also in terms of sea weeds, sea grasses, mudflats, sand dunes, fisheries, echinoderms, shrimps, turtles, corals, coastal vegetation, mangroves and other marine biodiversity components as part of the management plan. Marine ecology shall be monitored regularly also in terms of all micro, macro and mega floral and faunal components of marine biodiversity.

(xv) A copy of the Marine and riparian biodiversity management plan duly validated by the State Biodiversity Board shall be obtained and implement in letter and spirit.

(xvi) A continuous monitoring programme covering all the seasons on various aspects of the coastal environs need to be undertaken by a competent organization available in the State or by entrusting to the National Institutes/renowned Universities/accredited Consultant with rich experiences in marine science aspects. The monitoring should cover various physico-chemical parameters coupled with biological indices such as microbes, plankton, benthos and fishes on a periodic basis during construction and operation phase of the project. Any deviations in the parameters shall be given adequate care with suitable measures to conserve the marine environment and its resources.

(xvii) Continuous online monitoring of air and water covering the total area shall be carried out and the compliance report of the same shall be submitted along with the 6 monthly compliance report to the regional office of MoEF&CC.

(xviii) The project proponent shall comply with the air pollution mitigation measures as submitted.

(xix) Suitable preventive measures be taken to trap spillage of fuel / engine oil and lubricants from the construction site. Measures should be taken to contain, control and recover the accidental spills of fuel during cargo handling.

(xx) All the recommendations mentioned in the rapid risk assessment report, disaster management plan and safety guidelines shall be implemented.

(xxi) Necessary arrangement for general safety and occupational health of people should be done in letter and spirit.

(xxii) All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to the RO, MoEF&CC along with half yearly compliance report.

(xxiii) The company shall draw up and implement Corporate Social Responsibility Plan as per the Company's Act of 2013.

(xxiv) As per the Ministry's Office Memorandum F. No. 22-65/2017-IA.III dated 01 May, 2018, project proponent has proposed that an amount of Rs. 1.10 Crores (0.75% of the project expansion cost i.e. Rs. 135 Crores) shall be earmarked under Corporate Environment Responsibility (CER) Plan for the activities such as Potable Water Supply, Village Roads, Domestic Solid Waste Management, Primary Health and Primary Education etc. The activities proposed under CER shall be restricted to the affected area around the project. The entire activities proposed under the CER shall be treated as project and shall be monitored. The monitoring report shall be submitted to the regional office as a part of half yearly compliance report, and to the District Collector. It should be posted on the website of the project proponent.

B. Standard Conditions:

I. Statutory compliance:

i. The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1980, in case of the diversion of forest land for non-forest purpose involved in the project.

ii. The project proponent shall obtain clearance from the National Board for Wildlife, if applicable. No dredging is allowed in protected habitat areas without prior permission from NBWL.

iii. The project proponent shall prepare a Site-Specific Conservation Plan & Wildlife Management Plan and approved by the Chief Wildlife Warden. The recommendations of the approved Site-Specific Conservation Plan / Wildlife Management Plan shall be implemented in consultation with the State Forest Department. The implementation report shall be furnished along with the six-monthly compliance report (in case of the presence of schedule-I species in the study area).

iv. Construction activity shall be carried out strictly according to the provisions of CRZ Notification, 2011 and the State Coastal Zone Management Plan as drawn up by the State Government. No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.

v. All the recommendations and conditions specified by State Coastal Zone Management Authority for the project shall be complied with.

vi. The project proponent shall obtain Consent to Establish / Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the concerned State Pollution Control Board/ Committee.

vii. The project proponent shall obtain the necessary permission from the Central Ground Water Authority, in case of drawl of ground water / from the competent authority concerned in case of drawl of surface water required for the project.

viii. All excavation related dewatering shall be as duly authorized by the CGWA. A NOC from the CGWA shall be obtained for all dewatering and ground water abstraction

ix. A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project should be obtained.

x. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Coast Guard, Civil Aviation Department shall be obtained, as applicable by project proponents from the respective competent authorities.

II. Air quality monitoring and preservation:

i. The project proponent shall install system to carryout Ambient Air Quality monitoring for common/criterion parameters relevant to the main pollutants released (e.g. PM_{10} and $PM_{2.5}$ in reference to PM emission, and SO_2 and NOx in reference to SO_2 and NOx emissions) within and outside the project area at least at four locations (one within and three outside the plant area at an angle of 120°each), covering upwind and downwind directions.

ii. Appropriate Air Pollution Control (APC) system shall be provided for all the dust generating points including fugitive dust from all vulnerable sources, so as to comply prescribed emission standards.

iii. Shrouding shall be carried out in the work site enclosing the dock/proposed facility area. This will act as dust curtain as well achieving zero dust discharge from the site. These curtain or shroud will be immensely effective in restricting disturbance from wind in affecting the dry dock operations, preventing waste dispersion, improving working conditions through provision of shade for the workers.

iv. Dust collectors shall be deployed in all areas where blasting (surface cleaning) and painting operations are to be carried out, supplemented by stacks for effective dispersion.

v. The Vessels shall comply the emission norms prescribed from time to time.

vi. Diesel power generating sets proposed as source of backup power should be of enclosed type and conform to rules made under the Environment (Protection) Act,

1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Use of low sulphur diesel. The location of the DG sets may be decided with in consultation with State Pollution Control Board.

vii. A detailed traffic management and traffic decongestion plan shall be drawn up to ensure that the current level of service of the roads within a 05 kms radius of the project is maintained and improved upon after the implementation of the project. This plan should be based on cumulative impact of all development and increased habitation being carried out or proposed to be carried out by the project or other agencies in this 05 Kms radius of the site in different scenarios of space and time and the traffic management plan shall be duly validated and certified by the State Urban Development department and the P.W.D./ competent authority for road augmentation and shall also have their consent to the implementation of components of the plan which involve the participation of these departments.

III. Water quality monitoring and preservation:

i. The Project proponent shall ensure that no creeks or rivers are blocked due to any activities at the project site and free flow of water is maintained.

ii. Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality. Silt curtains shall be used to contain the spreading of suspended sediment during dredging within the dredging area.

iii. No ships docking at the proposed project site will discharge its on-board waste water untreated in to the estuary/ channel. All such wastewater load will be diverted to the proposed Effluent Treatment Plant of the project site.

iv. Measures should be taken to contain, control and recover the accidental spills of fuel and cargo handle.

v. The project proponents will draw up and implement a plan for the management of temperature differences between intake waters and discharge waters.

vi. Spillage of fuel / engine oil and lubricants from the construction site are a source of organic pollution which impacts marine life. This shall be prevented by suitable precautions and also by providing necessary mechanisms to trap the spillage.

vii. Total fresh water use shall not exceed the proposed requirement as provided in the project details. Prior permission from competent authority shall be obtained for use of fresh water.

viii. Sewage Treatment Plant shall be provided to treat the wastewater generated from the project. Treated water shall be reused for horticulture, flushing, backwash, HVAC purposes and dust suppression.

ix. A certificate from the competent authority for discharging treated effluent/ untreated effluents into the Public sewer/ disposal/drainage systems along with the final disposal point should be obtained.

x. No diversion of the natural course of the river shall be made without prior permission from the Ministry of Water resources.

xi. All the erosion control measures shall be taken at water front facilities. Earth protection work shall be carried out to avoid erosion of soil from the shoreline/boundary line from the land area into the marine water body.

IV. Noise monitoring and prevention:

i. Noise level survey shall be carried as per the prescribed guidelines and report in this regard shall be submitted to Regional Officer of the Ministry as a part of six-monthly compliance report.

ii. Noise from vehicles, power machinery and equipment on-site should not exceed the prescribed limit. Equipment should be regularly serviced. Attention should also be given to muffler maintenance and enclosure of noisy equipments.

iii. Acoustic enclosures for DG sets, noise barriers for ground-run bays, ear plugs for operating personnel shall be implemented as mitigation measures for noise impact due to ground sources.

iv. The ambient noise levels should conform to the standards prescribed under E(P)A Rules, 1986 viz. 75 dB(A) during day time and 70 dB(A) during night time.

V. Energy Conservation measures:

i. Provide solar power generation on roof tops of buildings, for solar light system for all common areas, street lights, parking around project area and maintain the same regularly;

ii. Provide LED lights in their offices and residential areas.

VI. Waste management:

i. Dredged material shall be disposed safely in the designated areas.

ii. Shoreline should not be disturbed due to dumping. Periodical study on shore line changes shall be conducted and mitigation carried out, if necessary. The details shall be submitted along with the six monthly monitoring report.

iii. Necessary arrangements for the treatment of the effluents and solid wastes must be made and it must be ensured that they conform to the standards laid down by the competent authorities including the Central or State Pollution Control Board and under the Environment (Protection) Act, 1986.

iv. The solid wastes shall be managed and disposed as per the norms of the Solid Waste Management Rules, 2016.

v. Any wastes from construction and demolition activities related thereto shall be managed so as to strictly conform to the Construction and Demolition Waste Management Rules, 2016.

vi. A certificate from the competent authority handling municipal solid wastes should be obtained, indicating the existing civic capacities of handling and their adequacy to cater to the M.S.W. generated from project.

vii. Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/ rules of the regulatory authority to avoid mercury contamination.

viii. Oil spill contingency plan shall be prepared and part of DMP to tackle emergencies. The equipment and recovery of oil from a spill would be assessed. Guidelines given in MARPOL and Shipping Acts for oil spill management would be followed. Mechanism for integration of terminals oil contingency plan with the overall area contingency plan under the co-ordination of Coast should be covered

VII. Green Belt:

i. Green belt shall be developed in area as provided in project details with a native tree species in accordance with CPCB guidelines. The greenbelt shall inter alia cover the entire periphery of the plant.

ii. Top soil shall be separately stored and used in the development of green belt.

VIII. Marine Ecology:

i. Dredging shall not be carried out during the fish breeding and spawning seasons.

ii. Dredging, etc shall be carried out in the confined manner to reduce the impacts on marine environment.

iii. The dredging schedule shall be so planned that the turbidity developed is dispersed soon enough to prevent any stress on the fish population.

iv. While carrying out dredging, an independent monitoring shall be carried out through a Government Agency/Institute to assess the impact and necessary measures shall be taken on priority basis if any adverse impact is observed.

v. A detailed marine biodiversity management plan shall be prepared through the NIO or any other institute of repute on marine, brackish water and fresh water ecology and biodiversity and submitted to and implemented to the satisfaction of the State Biodiversity Board and the CRZ authority. The report shall be based on a study of the impact of the project activities on the intertidal biotopes, corals and coral communities, molluscs, sea grasses, sea weeds, sub-tidal habitats, fishes, other marine and aquatic micro, macro and mega flora and fauna including benthos, plankton, turtles, birds etc. as also the productivity. The data collection and impact assessment shall be as per standards survey methods and include underwater photography.

vi. Marine ecology shall be monitored regularly also in terms of sea weeds, sea grasses, mudflats, sand dunes, fisheries, echinoderms, shrimps, turtles, corals, coastal vegetation, mangroves and other marine biodiversity components including all micro, macro and mega floral and faunal components of marine biodiversity.

vii. The project proponent shall ensure that water traffic does not impact the aquatic wildlife sanctuaries that fall along the stretch of the river.

IX. Public hearing and Human health issues:

i. The work space shall be maintained as per international standards for occupational health and safety with provision of fresh air respirators, blowers, and fans to prevent any accumulation and inhalation of undesirable levels of pollutants including VOCs.

ii. Workers shall be strictly enforced to wear personal protective equipments like dust mask, ear muffs or ear plugs, whenever and wherever necessary/ required. Special visco-elastic gloves will be used by labour exposed to hazards from vibration.

iii. In case of repair of any old vessels, excessive care shall be taken while handling Asbestos & Freon gas. Besides, fully enclosed covering should be provided for the temporary storage of asbestos materials at site before disposal to CTSDF.

iv. Safety training shall be given to all workers specific to their work area and every worker and employee will be engaged in fire hazard awareness training and mock drills which will be conducted regularly. All standard safety and occupational hazard measures shall be implemented and monitored by the concerned officials to prevent the occurrence of untoward incidents/ accidents.

v. Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.

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

vii. Occupational health surveillance of the workers shall be done on a regular basis.

X. Corporate Environment Responsibility:

i. The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental / forest /wildlife norms/ conditions. The company shall have defined system of reporting infringements / deviation / violation of the environmental / forest / wildlife norms / conditions and / or

shareholders / stake holders. The copy of the board resolution in this regard shall be submitted to the MoEF&CC as a part of six-monthly report.

ii. A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly report to the head of the organization.

iii. Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.

iv. Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

XI. Miscellaneous:

i. The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.

ii. The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.

iii. The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.

iv. The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the ministry of Environment, Forest and Climate Change at environment clearance portal.

v. The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.

vi. The criteria pollutant levels namely; $PM_{2.5}$, PM_{10}, SO_2, NOx (ambient levels) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.

vii. The project proponent shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities, commencing the land development work and start of production operation by the project.

viii. The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.

ix. No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forests and Climate Change (MoEF&CC).

x. Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.

xi. The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.

xii. The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.

xiii. The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.

xiv. The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.

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

8. This issues with the approval of the Competent Authority.

(Dr. Vinod K. Singh)
Scientist E

Copy to:

1) The Secretary, Department of Environment, No.1, Jeenis Road, Panagal Building, Ground Floor, Saidapet, Chennai-600 015, Tamil nadu.

2) Addl. Principal Chief Conservator of Forests (Central), Ministry of Environment, Forests and Climate Change, Ist and IInd Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai-34.

3) The Member Secretary, Central Pollution Control Board Parivesh Bhavan, CBD-cum-Office Complex, East Arjun Nagar, New Delhi - 110 032.

4) The Member Secretary, Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai - 600 032.

5) Monitoring Cell, MoEF&CC, Indira Paryavaran Bhavan, New Delhi.

6) Guard File/ Record File/ Notice Board.

7) MoEF&CC Website.

(Dr. Vinod K. Singh)
Scientist E

सत्यमेव जयते

File No:10-35/2017-IA-III
Government of India
Ministry of Environment, Forest and Climate Change
IA Division
****

Dated **01/12/2025**

To,

KALYAN SWAROOP YANDAPALLI
TAMIL NADU MARITIME BOARD
Mahathi Cuddalore Port & Maritime Private Limited Cuddalore Port, Port Office, Cuddalore-607003, Tamil Nadu
yks@mahathiinfra.com

Subject: **Transfer of Environmental and CRZ Clearance from M/s Tamil Nadu Maritime Board (TNMB) to M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL)-regarding.**

Sir/Madam,

This is in reference to your application submitted to MoEF&CC vide proposal number IA/TN/INFRA1/553077/2025 dated 20/11/2025 for grant of transfer of Environmental and CRZ Clearance (EC) to the project under the provision of para 11 of the EIA Notification 2006 and CRZ Notification, 2011 as amended thereof.

2. The particulars of the proposal are as below :

(i) EC Identification No.	EC25A3501TN5833411T
(ii) File No.	10-35/2017-IA-III
(iii) Clearance Type	Transfer of EC
(iv) Category	A
(v) Project/Activity Included Schedule No.	7(e) Ports, harbors, breakwaters, dredging
(vi) Sector	INFRA-1
(vii) Name of Project	Capacity Expansion, Cuddalore Port
(viii) Location of Project (District, State)	CUDDALORE, TAMIL NADU
(ix) Issuing Authority	MoEF&CC
(x) EC Date	20/11/2025
(xi) Details of Transferee	Cuddalore Port, Port Office, ,Cuddalore ,570,33,607003
(xii) Details of Transferor	TAMIL NADU MARITIME BOARD, 171, South Kesavaperumal puram, Greenways Road, Raja Annamali Puram, ,Mylapore

3. The following documents have been submitted for the transfer of Environmental Clearance.

i. Form No.7 for transfer of Environmental and CRZ clearance.

ii. Copy of letter no nil dated nil seeking the transfer of EC and CRZ clearance from M/s Tamil Nadu Maritime Board (TNMB) to M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL).

iii. Copy of environmental and CRZ clearance vide letter no.10-35/2017-IA.III dated 20th August, 2020 granted for 'Capacity expansion, Cuddalore Port, Tamil Nadu by M/s Tamilnadu Maritime Board.

iv. Undertaking by M/s Mahathi Cuddalore Port & Maritime Private Limited (MCPMPL) in a non-judicial stamp paper dated 24th September, 2025 stating that MCPMPL will comply with the environmental safeguards mentioned in the environmental clearance letter no.10-35/2017-IA.III dated 20th August, 2020.

v. No objection Certificate in non-Judicial stamp paper dated 23rd October, 2025 stating that M/s Tamil Nadu Maritime Board (TNMB) have obtained the Environmental and CRZ clearance from Ministry vide letter no.10-35/2017-IA.III dated 28.08.2020 and that TNMB has entered into a Concession Agreement for development and operation of the Cuddalore Port, TamilNadu with M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL) on 04.07.2025 and M/s Tamil Nadu Maritime Board has no objection to transfer the environmental and CRZ clearance vide letter no.10-35/2017-IA.III dated 20.08.2020 to M/s Mahathi Cuddalore Port and Maritime Private Limited.

vi. Certificate of Incorporation stating that Mahathi Cuddalore Port &Maritime Private Limited is incorporated on this Eleventh Day of June Two Thousand Twenty Five under the Companies Act, 2013 (18 of 2013) and the Corporate Identity Number of the company is U52292TN2025PTC181365.

vii. Mohathi Cuddalore Port & Maritime Private Limited letter dated 04th November, 2025 has submitted that TNMB is a State Government Organisation under Government of TamilNadu and not incorporated under the companies Act (Tamil Nadu Maritime Board Act, 1995).

viii. Mohathi Cuddalore Port & Maritime Private Limited letter dated 04th November, 2025 submitted that there is no change in the ownership of the organization, only operational arrangement between Tamilnadu Maritime Board(TNMB) and M/s Mahathi Cuddalore Port and Maritime Private Limited(MCPML) through concession agreement dated 04.07.2025.

ix. Concession agreement AGT No:01/TNMB/51/2025 dated 04.07.2025 stating that the M/s Tamil Nadu Maritime Board (TNMB)" has obtained Environmental & CRZ Clearance from Ministry of Environment, Forest and Climate Change (MoEFCC) vide order no.10-35/2017-IA-III dated 20.08.2020 for Cuddalore Port at Cuddalore. Tamil Nadu. Now, M/s. Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL) has entered into a concession agreement with TNMB for development and operation of the Cuddalore Port, Tamil Nadu under the PPP Model vide Agreement dated 04.07.2025. Therefore, TNMB would like to transfer the Environmental and CRZ clearance in favour of MCPMPL". In this regard, (MCPMPL) undertake that will comply with all the conditions, directions and norms as stipulated in the Environmental and CRZ clearance dated 20.08.2020 issued by Ministry of Environment, Forest and Climate Change (MoEFCC) to M/s. Tamil Nadu Maritime Board (TNMB).

x. The Tamil Nadu Pollution Control Board (TNPCB) has issued a Consent for Establishment (CFE) to M/s. Tamil Nadu Maritime Board (TNMB) for the Cuddalore Port Expansion Project located at S.F.No.2670 (Part) and 1944 (Part), Cuddalore Village, Cuddalore Taluk, Cuddalore District, under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974, as amended vide letter no. Consent Order No. 2101134781653 DATED: 23/03/2021 which is valid up to 31st March, 2027.

xi. M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL), email dated 20.11.2025, has furnished the acknowledgement Application No.71638294 pertaining to the name-change application for CTE.

4. The Ministry of Environment, Forest and Climate Change (MoEF&CC) has examined the request submitted by you. It is noted that the change pertains only to the name of the company, with no change in ownership.

5. This Ministry has no objection for transfer of Environment and CRZ Clearance accorded vide letter no. letter 10-35/2017-IA.III dated 20th August, 2020, from M/s Tamil Nadu Maritime Board (TNMB) to M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL) subject to satisfactory compliance to all stipulated specific and general conditions.

6. M/s MCPMPL shall comply with all specific and general conditions stipulated in the Environment and CRZ Clearance letter no.10-35/2017-IA.III dated 20th August, 2020.
7. The name change is being granted for the original proposals for which Environment and CRZ Clearance letters no.10-35/2017-IA.III dated 20th August, 2020 was granted earlier.
8. PP shall obtain the CTE/CTO in the name of M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL).

9. The project proponents will not make any changes in the project nature, structure or configuration and limit themselves to activities for which the Environmental clearance has been given earlier and the activities completed within the validity period of EC vide letter no. M/s Mahathi Cuddalore Port and Maritime Private Limited (MCPMPL).

10. In case, there is a change in the scope of the project, fresh Environmental Clearance shall be obtained.
11. This issue with the approval of the Competent Authority.

Copy To

1. The Principal Secretary, Department of Environment, Climate Change and Forests Department, Government of Tamil Nadu, Environment, Climate Change and Forests Department Secretariat, Chennai-600 009, Tamil Nadu.
2. The Principal Chief Conservator of Forests, Head of Department, Forest Headquarters Building, Near Kannikapuram Checkpost, Guindy-Velacherry Main Road, Guindy, Chennai-600 032, Tamil Nadu.
3. The Deputy Director General of Forests (Central), Ministry of Environment, Forest and Climate Change (MoEF&CC), Integrated Regional Office Chennai, 1st Floor, Additional Office Block for GPOA, Shastri Bhawan, Haddows Road, Nungambakkam, Chennai–600 006, Tamil Nadu.
4. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi–110 032.
5. The Member Secretary, Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai-600 032, Tamil Nadu.
6. Compliance and Monitoring Division, Ministry of Environment, Forest and Climate Change (MoEF&CC), Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi-110 003.
7. Parivesh Portal.
8. Guard File/ Monitoring File/ Record File.

Send Approval Copy To (In case of multiple use comma as separator)

Appendix B
Grant ToR Order

सत्यमेव जयते

File No: 10-35/2017/-IA-III
Government of India
Ministry of Environment, Forest and Climate Change
IA Division
****

Dated: **05/03/2026**

To,

KALYAN SWAROOP YANDAPALLI
MAHATHI CUDDALORE PORT & MARITIME PRIVATE LIMITED
MAHATHI CUDDALORE PORT & MARITIME PRIVATE LIMITED Cuddalore Port, Port Office, Cuddalore-607003, Tamil Nadu, CUDDALORE, TAMIL NADU, 607003
yks@mahathiinfra.com

Subject: **Expansion of Cuddalore Port cargo handling capacity from 5.68 MTPA to 11.48 MTPA and ship building and repair activities in an area of 59.09 ha (146.01 Ac) by M/s Mahathi Cuddalore Port & Maritime Private Limited. Terms of References regarding.**

Sir/Madam,

This is in reference to your application for Grant of Terms of Reference under the provision of the EIA Notification 2006-regarding in respect of project Expansion of Cuddalore Port, Tamil Nadu submitted to Ministry vide proposal number IA/TN/INFRA1/564208/2026 dated .

2. The particulars of the proposal are as below:

(i) TOR Identification No.	TO26A3501TN5213902N
(ii) File No.	10-35/2017/-IA-III
(iii) Clearance Type	TOR
(iv) Category	A
(v) Project/Activity Included Schedule No.	7(e) Ports, harbors, breakwaters, dredging
(vi) Sector	INFRA-1
(vii) Name of Project	Expansion of Cuddalore Port, Tamil Nadu
(viii) Name of Company/Organization	MAHATHI CUDDALORE PORT & MARITIME PRIVATE LIMITED
(ix) Location of Project (District, State)	CUDDALORE, TAMIL NADU
(x) Issuing Authority	MoEF&CC
(xi) Applicability of General Conditions	no
(xii) Applicability of Specific Conditions	no

3. The proposal is for expansion of Cuddalore port cargo handling capacity from 5.68 MTPA to 11.48

MTPA and ship building and repair activities in an area of 59.09 ha (146.01 Ac) located at Cuddalore, Tamil Nadu by M/s Mahathi Cuddalore Port & Maritime Private Limited.

4. The Cuddalore port is strategically located at the confluence of the Paravanar River and the Uppanar Estuary with the Bay of Bengal, lies at the geographical coordinates of latitude $11^0$42'22.43'' N and longitude $79^0$46'30.52''E.

5. The proposed project falls under Schedule 7(e) Ports, harbors, breakwaters, dredging Category 'A' as per the EIA Notification 2006 the cost of the project is estimated to be Rs. 650.0crores.

6. Details of Environmental and CRZ clearance: Environmental CRZ clearance for Cargo handling capacity of 5.68 MTP has been obtained from Ministry vide letter no. 10-35/2017-IA-III dated on 20th August, 2020. Subsequently, MCPMPL has obtained the transfer of Environmental and CRZ Clearance from Ministry vide letter file No. 10-35/2017/-IA-III dated on 01.12.2025.

7. The details of existing port infrastructure facilities along with the proposed expansion facilities are given below:

S. No	Description	Unit	Approved	Proposed	Total	Remarks
1.	Multipurpose Berths	No.	2	1	3	Increase in quay length and depth
	Quay length	m	240 (120x2)	200	440	
	Depth	m	-11	-16	-16	
	Width	m	21	21	21	
2.	Port craft berth/Wharf	No.	1	-	1	No change
	Length	m	300	-	300	
	width	m	30	-	30	
3.	Bulk Berth	No.	-	2	2	Increase in quay length
	Length	m	-	540 (270x2)	540	
	Width	m	-	21	21	
4.	Shipyard/repair jetty	m	-	1	1	New proposal
	Length	m	-	200	200	
	Width	m	-	21	21	
5.	Depth in protected area/inner channel	mCD	-11	-16	-16	Increase in depth
6.	Depth in unprotected area/outer channel	mCD	-11	-18	-18	Increase in depth
7.	Ship Building and Repair Yard	Acres	-	34.29	34.29	New proposed area
8.	Total Port area including Backup & shipyards	Acres	111.72	34.29	146.01	Increase in depth
9.	Breakwater total	m	1045	0	1045	No change
	Breakwater North	m	395	0	395	
	Breakwater South		650	0	650	

10.	Retaining walls North	m	180	0	180	No change
	South	m	230	0	230	No change
11.	Turning Circle Diameter	m	310.0	90	400	Increase in diameter and depth
	Depth	mCD	-10	-16	-16	
12.	Approach Channel Length	m	1500	5000	5000	Increase in approach channel length and width at Protected Area Curved portion of channel Unprotected
	Width	m	60	-	-	
	Protected Area/Inner Channel	m	-	100	100	
	Curved portion of channel/Inner Channel	m	-	130	130	
	Unprotected area/outer channel	m	-	160	160	
13.	Cargo handling capacity	MTPA	5.68	5.8	11.48	Increase in cargo handling capacity
14.	Capital Dredging	M. Cum	1.87	5.0	5.0	Capital dredging of 1.87 M.Cum is already carried out, now during expansion 5 M.cum of dredging will be carried out.
15.	Reclamation	M. Cum	1.87	5.0	5.0	During current expansion, levelling/reclamation at port back up area/beach nourishment
16.	Maintenance Dredging	M. Cum	0.187	0.237	0.237	During current expansion, Increase in maintenance dredging
17.	Dredge disposal	M. Cum	0.0187	0.237	0.237	Beach nourishment
18.	Cargo type	-	Coal, Cement, Fertilizers and Clean Cargo like containers	Coal, Cement, Fertilizers, container, Cereals, wood, liquid cargo such as class A,B,C chemicals, Iron ore and Limestone		Change in cargo mix
19.	Water requirement	KLD	100	-	100	Desalination plant
20.	Desalination plant	KLD	100	-	100	No change, 100 KLD is not being consumed yet.
21.	Power	KVA	373	3965	4338	Increase in power

						requirement
22.	Effluent Treatment Plant	KLD	25	-	25	No change
23.	Sewage Treatment Plant	KLD	-	3.5	3.5	New proposal

8. Land Use/Land cover : Land use/Land cover of project site is as follows:

Description	Area in Ha	Percentage (%)
Bulk storage yard	4.47	7.56
Container Area	4.97	8.40
Multi Storage Yard	3.18	5.39
Liquid Storage Area	3.33	5.64
CFS Area	0.59	1.00
Transit Shed	3.07	5.20
Buildings	0.45	0.76
Desalination Plant	0.01	0.01
Common Utility Area	0.24	0.41
Parking Area	1.47	2.49
Road	6.89	11.66
Rail Sliding Area	2.80	4.73
Greenery/Landscape	6.13	10.38
Total	37.89	-
Future Development Area	7.32	12.40
Total Port Backup Area	45.21	76.52
Shipbuilding and Repair Area	13.88	23.48
Grand Total	59.09	100

9. Terrain and topography: The topography of Cuddalore Port is relatively flat coastal terrain, with ground levels ranging from approximately 0.5 meters to 7.3 meters, Most of the terrain lies within the 3.0-to-4.5-meter elevation band, with an average ground level of about 3.8 meters. Higher elevations are observed toward the northwestern side and built-up areas, while the land gradually slopes eastward and southeast ward toward the Bay of Bengal.

10. Details of water bodies, impact on drainage: The Cuddalore port is located at the confluence of the Paravanar River and the Uppanar Estuary with the Bay of Bengal. These rivers drain into a backwater estuary system, which opens into the Bay of Bengal. Site drainage will be developed in such a way natural drainage in the surroundings will not be impacted.

11. Water Requirement: The water requirement during the construction phase is estimated to be approximately 50 KLD. During the operational phase, the total water demand is estimated at approximately 100 KLD. The requisite water supply shall be sourced from a proposed desalination plant of 100 KLD capacity, which is yet to be developed.

12. Details of Tree Cutting and Green Belt Development: Approximately 175 trees are proposed to be felled during the proposed expansion of the port. Out of which, about 15 trees are proposed to be transplanted and over an area of 10.41ha is proposed to develop the greenbelt under the proposed expansion project.

13. Diversion of forestland: The instant proposal does not involved any forestland hence no forest clearance

is required. The project is not located within the Eco-Sensitive Zone (ESZ) or Eco-Sensitive Area (ESA) notified by the MoEF&CC.

14. Waste Management: Most of the waste likely to be generated at the port is biodegradable type like road sweepings, food waste etc., and subjected to composting for use as manure for green belt within the port. The anticipated municipal solid waste generation during construction phase is ~12 kg/day and during operation phase is ~20.5 kg/day of which 60% will be biodegradable and 40% will be non-biodegradables. An ETP is proposed with a capacity of 25 KLD for treatment of Effluents and Proposed installation of a Sewage Treatment Plant (STP) with a capacity of 3.5 KLD. Used oil, spent oil, Wastes/Residue containing oil, Oil-soaked rags, Cotton waste, discarded containers, barrels & Used Battery and Sludge from ETP will be collected and disposed to approve vendors and same will be continued to proposed project. Construction wastes and road sweepings, dust, would be used for land fill, Food waste would be recycled as compost Non-biodegradable (plastic waste, used oils) wastes shall be disposed through PPCC authorized vendors Used batteries shall be disposed by insisting on buy back while procuring, Cargo spillages shall be collected and same shall be returned to storage yards. Treated water from ETP/STP will be recycled for plantation and dust suppression purposes and sludge generated from STP shall be used as manure. Hazardous wastes generated at the port shall be disposed of through authorized vendors duly adhering under guidelines of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and its amendment.

15. Details of CRZ area: As per CZMP, project site falls under CRZ 1A, CRZ1B, CRZ II, CRZ III, CRZ IVA & CRZ IVB.

16. Traffic Forecast for Proposed Expansion Plan

S.No	Berth type	Cargo Mix	Cargo Handling Capacity (MTPA)
1	Multipurpose beth-1	Container cargo	1.33
2	Multipurpose beth-2	Liquid cargo such as non-hazardous and Class A, B, C chemicals	1.61
3	Bulk berth (two no)	Coal, Fertilizers, Cement, Clean cargo, Iron ore and Limestone	8.54
Total			11.48

17. Traffic Forecast for Ship Building and Repair.

S. No	Location	Activity	Units/year
1	Ships (upto 50,000 DWT)	Building	20
		Repair	20
Total			40

18. According to the “National Shoreline Changes along the Indian Coast, Volume 1 - East Coast” by the National Centre for Coastal Research, Cuddalore Port area features low accretion to stable. Port has an existing approach channel of length 1.5 km and this will be extended to 5.0 km during the proposed development. Capital dredging of 5.0 million cubic metres (MCM) of material is estimated. The dredged material shall be utilized for land levelling in areas behind the berths and for undertaking erosion prevention measures.

19. Land acquisition and R&R issues involved: The existing port is located in an area of 45.21 ha (111.72 Ac) which is in complete possession of Cuddalore Port and proposed development is within the existing port land only. Shipbuilding and repair activity was proposed of 13.88 ha (34.29 Ac) in an open scrub and without any settlements belonging to private owners and the same shall be acquired. No R&R is envisaged

in the proposed Development.
20. Employment Opportunity: The project will employ approximately 500 workers during construction phase and (Direct 10 and Indirect 450) and during operation phase, approximately 205 workers will be employed (Direct 82 and Indirect 123).
21. Benefits of the project: Employment generation, Enhancement in Regional, Economy and Socio-Economic, Conditions of the people. MCPMPL shall initiate the following activities as part of CSR programme: Education, Community Health, Sustainable Livelihood, Development, Rural Infrastructure, Development.
22. Details of court cases: There is no court case involved in the project.

23. The EAC observed that the Project Proponent (PP) has proposed an additional land area of 13.88 hectares for the development of the shipbuilding facility and has informed that the said land falls within the notified port limits and has been allotted to the PP. However, no documentary evidence in support of the same has been submitted. Accordingly, the PP shall furnish documentary proof clearly delineating the port limits and submit an official letter from the concerned Maritime Board explicitly confirming that the additional 13.88 hectares of land has been allotted to the PP for the proposed shipbuilding facility.
24. The PP has proposed storage within the CRZ area; however, such storage may not be permissible for all the components. Thus, the Project Proponent shall not undertake storage of materials within the CRZ area unless the same is specifically permissible under the applicable provisions of the CRZ Notification, as amended, for components not permissible within the CRZ area, the PP shall identify and develop alternative storage locations outside the CRZ area in compliance with the applicable CRZ provisions.
25. The CRZ IA area within the project site is located between the proposed Ship Repair Unit and other development components, including the storage area. The Project Proponent shall undertake a detailed study with a nationally reputed institute to assess the potential environmental impacts arising from such proximity, particularly with respect to coastal ecology and CRZ provisions. Based on the findings of the study, appropriate mitigation measures shall be drawn and the same shall be incorporated in the EIA/EMP report.
26. The proposed expansion at the confluence of the Paravanar River and Uppanar Estuary with the Bay of Bengal may likely to have potentially altered hydrodynamic regimes, sedimentation patterns, tidal prism, flushing characteristics of the estuary, and may lead to shoreline erosion/accretion, salinity intrusion upstream, and impacts on aquatic ecology and fisheries.

27. The Committee also observed that such confluence areas are prone to complex tidal dynamics, sediment transport processes, shoreline changes, and salinity variations, and are often associated with ecologically productive habitats including intertidal areas, mudflats, mangroves, and fish breeding grounds.

28. Thus, PP may conduct the 2D/3D numerical modelling study covering tidal currents, wave dynamics, sediment transport, and shoreline evolution, including pre- and post-project scenarios, to assess impacts on morphology and coastal stability.

29. An assessment of cyclone, storm surge, extreme rainfall, and flood scenarios, including climate change considerations, and preparation of a Disaster Management Plan.
30. The Project Proponent shall incorporate appropriate mitigation and environmental management measures based on the findings of the above studies.
31. PP had categorically mentioned during deliberations that Class A hazardous (petroleum) products handling is not being considered now.
32. The project proponent shall submit a detailed list of all chemicals proposed to be used and stored during construction and operation phases, along with their quantities, storage locations, Material Safety Data

Sheets (MSDS), and safety measures, to ensure compliance with applicable environmental and safety regulations.

33. The EAC based on the information submitted and clarifications provided by the project proponent and detailed discussions held on all the issues during 434th meeting of the Expert Appraisal Committee (Infra–1) held during 30th January 2026 **recommended** the project for grant of Terms of Reference (ToR) with stipulated specific conditions and other Standard ToR Conditions.

34. The Ministry of Environment, Forest and Climate Change has considered the proposal based on the recommendations of the Expert Appraisal Committee (Infrastructure, CRZ and other Miscellaneous projects) and hereby decided to grant Terms of Reference for 'expansion of Cuddalore port cargo handling capacity from 5.68 MTPA to 11.48 MTPA and ship building and repair activities in an area of 59.09 ha (146.01 Acres) by M/s Mahathi Cuddalore Port & Maritime Private Limited' and for preparation of EIA/EMP report with public consultations under the EIA Notification, 2006 as amended, subject to strict compliance of the following specific conditions, in addition to all standard ToR conditions applicable for such projects.

35. A detailed draft EIA/EMP report shall be prepared in terms of the above additional TOR and should be submitted to the State Pollution Control Board for Public Hearing. Public Hearing to be conducted for the project in accordance with the provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing shall be conducted based on the TOR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the website.

36. The project proponent shall submit the detailed final EIA/EMP report prepared as per TOR including issues raised during Public Hearing to the Ministry for considering the proposal for environmental clearance before expiry of validity of ToR.

37. The consultants involved in preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other Organization(s)/Laboratories including their status of approvals etc. vide notification of the MoEF dated 19th July, 2013.

38. The prescribed TOR would be valid for a period of four years for submission of the EIA/EMP Reports.

39. This issues with the approval of Competent Authority.

Copy To

2. 1. The Deputy Director General of Forests (Central), Ministry of Environment, Forest and Climate Change (MoEF&CC), Integrated Regional Office Chennai, 1st Floor, Additional Office Block for GPOA, Shastri Bhawan, Haddows Road, Nungambakkam, Chennai–600 006, Tamil Nadu.

2. 1. The Member Secretary, Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai-600 032, Tamil Nadu.

3. 1. PARIVESH Portal.

4. 1. Guard File/Record File.

Annexure 1

Specific Terms of Reference s for (Ports, Harbors, Breakwaters, Dredging)

1. Specific Conditions

S. No	Terms of Reference
1.1	PP shall furnish documentary proof clearly delineating the port limits and submit an official letter from the concerned Maritime Board explicitly confirming that the additional 13.88 hectares of land has been allotted to the PP for the proposed shipbuilding facility.
1.2	The Project Proponent shall not undertake storage of materials within the CRZ area unless the same is specifically permissible under the applicable provisions of the CRZ Notification, as amended. Therefore the PP shall identify and develop alternative storage locations outside the CRZ area in compliance with the applicable CRZ provisions.
1.3	As Committed by the PP port shall not handle Class A Hazardous(Petrolium) products.
1.4	PP shall explore the possibility for a fully enclosed conveyor belt system from port to rail siding to ensure safe, efficient, and environmentally sound operations, while minimizing dust emissions and spillage.
1.5	The detailed cargo evacuation plan, including transportation through the existing port access road and the proposed rail connectivity, shall be submitted as part of the EIA/EMP report.
1.6	PP shall clearly specify the products proposed under the project. Details of the product types, quantities, and their end-use should be provided to enable proper assessment of the project scope. This information is essential for evaluating the associated environmental impacts, storage and handling requirements, and overall feasibility of the proposed activities.
1.7	Considering the proposed expansion of Cuddalore Port involving handling of liquid cargo including Class A, B and C chemicals, coal, fertilizers and other bulk materials, along with shipbuilding and repair activities, the PP shall incorporate in the EMP regular training and awareness programmes on chemical safety, port security and coastal water stewardship. These programmes shall address risks related to storage, transfer and transport of liquid and bulk cargo, spill prevention, emergency preparedness, supply-chain vulnerabilities and protection of marine and coastal ecosystems. The programmes shall be implemented in association with reputed NGO-Darpan registered NGOs or recognised academic institutes of eminence, with adequate budgetary provision, to strengthen operational preparedness and minimise environmental and security risks.
1.8	The CRZ IA area within the project site is located between the proposed Ship Repair Unit and other

S. No	Terms of Reference
	development components, including the storage area. The Project Proponent shall undertake a detailed study with a nationally reputed institute to assess the potential environmental impacts arising from the proximity, particularly with respect to coastal ecology and CRZ provisions. Based on the findings of the study, appropriate mitigation measures shall be drawn and the same shall be incorporated in the EIA/EMP report.
1.9	To assess the impact of proposed expansion at the confluence of the Paravanar River and Uppanar Estuary with the Bay of Bengal the PP shall conduct the 2D/3D numerical modelling study covering tidal currents, wave dynamics, sediment transport, and shoreline evolution, including pre- and post-project scenarios, to assess impacts on morphology and coastal stability and as per the findings/ recommendations of the study necessary amendment in the project layout and mitigation plan shall be suggested.
1.10	An assessment of cyclone, storm surge, extreme rainfall, and flood scenarios, including climate change considerations, and preparation of a Disaster Management Plan.
1.11	The Project Proponent shall incorporate appropriate mitigation and environmental management measures based on the findings of the above studies.
1.12	The Project Proponent shall submit a detailed list of all chemicals proposed to be handled as a cargo indicating their quantities, intended use, and designated storage locations.
1.13	Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scales.
1.14	Recommendation of the TamilNadu SCZMA shall be obtained and submitted.
1.15	Submit superimposing of latest CZMP as per CRZ (2011) on the CRZ map.
1.16	Submit a complete set of documents required as per Para 4.2 (i) of CRZ Notification, 2011.
1.17	Hydrodynamics study on impact of dredging on flow characteristics shall be carried out.
1.18	Erosion and accretion studies shall be carried out and outcome of the studies shall be incorporated in the EIA/EMP report.

S. No	Terms of Reference
1.19	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).
1.20	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 balance water available. This should be specified separately for ground water and surface water sources, ensuring that there is no impact on other users.
1.21	A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project.
1.22	A certificate from the competent authority handling municipal solid wastes, indicating the existing civic capacities of handling and their adequacy to cater to the M.S.W. generated from the project.
1.23	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 0.5 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.
1.24	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.
1.25	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 (earlier), shall include all the activities required to be taken to fulfil these commitments in the Environment Management Plan along with cost estimates of these activities, in addition to the activities proposed as per recommendations of EIA Studies and the same shall be submitted to the ministry as part of the EIA Report. The EMP shall be implemented at the project cost or any other funding source available with the project proponent.
1.26	In pursuance of Ministry's OM no. stated above the project proponent shall add one annexure in the EIA Report indicating all the commitments made by the PP to the public during public hearing and submit it to the Ministry and the EAC.
1.27	The Action Plan on the compliance of the recommendations of the CAG as per.

Standard Terms of Reference for (Ports, harbors, breakwaters, dredging)

1. Project Details

S. No	Terms of Reference
1.1	Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection.
1.2	The examination should justify site suitabilityin terms of environmental angle, resources sustainability associated with selected site as compared to rejected sites.
1.3	The anlysis should include parameters considered along with weightage criteria for short-listing selected site.
1.4	Submit the status of shore line change at the project site
1.5	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.
1.6	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.
1.7	Any further clarification on carrying out the above studies including anticipated impacts due to theproject and mitigative measure, project proponent can refer to the model ToR available on Ministry.

2. Land Use,land Acquisition And R&r

S. No	Terms of Reference
2.1	Details of the land use break-up for the proposed project. Details of land use around 10 km radiusof the project site.
2.2	Submit details regarding R&R involved in the project

3. Esz, Crz, International Boundary And Acts

S. No	Terms of Reference
3.1	Examine and submit detail of land use around 10 km radius of the project site and map of the project area and 10 km area from boundary of the proposed/existing project area, delineating project areas notified under the wild life (Protection) Act, 1972/critically polluted areas as identifiedby the CPCB from time to time/notified eco-sensitive areas/interstate boundaries and international boundaries.
3.2	Erosion and accretion study at the mouth of the creek which is adjacent to the proposed site be carried out and submitted
3.3	Detailed modelling studies to understand whether the selected site can withstand severe cyclones

S. No	Terms of Reference
	and develop design in accordance to due safety measures.
3.4	Submit superimposing of latest CZMP as per CRZ Notification (2011) on the CRZ map. And also submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scales.
3.5	Submit a complete set of documents required as per para 4.2 (i) of CRZ Notification, 2011.
3.6	Hydrodynamics study on impact of dredging on flow characteristics shall be carried out.
3.7	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 required mitigation plan be submitted.
3.8	A management plan for the area under which mangroves are or likely to be removed and compensatory mangrove plantation plan be submitted.

4. Remote Sensing & Gis

S. No	Terms of Reference
4.1	Analysis should be made based on latest satellite imagery for land use with raw images.

5. Forest And Wildlife

S. No	Terms of Reference
5.1	Submit the present land use and permission required for any conversion such as forest, agriculture etc.
5.2	land acquisition status, rehabilitation of communities/ villages and present status of acquiring Forest and Agricultural activities.
5.3	Submit details of the trees to be cut including their species and whether it also involves any protected or endangered species.
5.4	Measures taken to reduce the number of the trees to be removed should be explained in detail.
5.5	Submit the details of compensatory plantation.
5.6	Explore the possibilities of relocating the existing trees.
5.7	Examine the details of afforestation measures indicating land and financial outlay
5.8	Landscape plan, 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.
5.9	The identification of species/ plants should be made based on the botanical studies.

6. Water Environment/quality Analysis/ Hydrology And Water Bodies

S. No	Terms of Reference
6.1	Examine the details of water requirement, impact on competitive user, treatment details, use oftreated waste water. Prepare a water balance chart.
6.2	Examine and submit the water bodies including the seasonal ones within the corridor of impactsalong with their status, volumetric capacity, quality likely impacts on them due to the project.
6.3	Submit the details of fishing activity and likely impacts on the fishing activity due to the project.
6.4	Specific study on effects of construction activity and pile driving on marine life

7. Waste Management, Drainage And Stps

S. No	Terms of Reference
7.1	Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area
7.2	Examine details of Solid waste generation treatment and its disposal.
7.3	Details of oil spill contingency plan.
7.4	Details of the layout plan including details of channel, breakwaters, dredging, disposal and reclamation.

8. Terrain And Topography

S. No	Terms of Reference
8.1	Submit the details of terrain, level with respect to MSL, filling required, source of filling materials and transportation details etc.
8.2	Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agencyon 1:4000 scale along with the recommendation of the SCZMA.
8.3	Details of bathymetry study.
8.4	Details of ship tranquillity study.
8.5	The ecologically fragile area including CRZ 1A area etc. shall be demarcated and superimposed on the layout plan and submitted.

9. Road/transport Connectivity And Traffic Measures

S. No	Terms of Reference
9.1	Examine road/rail connectivity to the project site and impact on the existing traffic network due tothe proposed project/activities
9.2	A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.
9.3	Details of handling of each cargo, storage, transport along with spillage control, dust preventivemeasures.
9.4	In case of coal, mineral cargo, details of storage and closed conveyance , dust suppressionand prevention filters.
9.5	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. 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.

10. Rain Water Harvesting

S. No	Terms of Reference
10.1	Details of rainwater harvesting and utilization of rain water.

11. Baseline Data

S. No	Terms of Reference
11.1	Examine baseline environmental quality along with projected incremental load due to the proposedproject/activities.

12. Air Environment

S. No	Terms of Reference
12.1	The air quality monitoring should be carried out according to the notification issued on 16th November, 2009.

13. Environment Management/ Monitoring, Mitigative Measures And Riskassessment Details

S. No	Terms of Reference
13.1	Examine separately the details for construction and operation phases both for EnvironmentalManagement Plan and Environmental Monitoring Plan with cost and parameters.
13.2	Submit details of a comprehensive Risk Assessment and Disaster Management Plan includingemergency evacuation during natural and man-made disasters.

S. No	Terms of Reference
13.3	Details of desalination plant and the study for outfall and intake

14. Court/ Litigation Records

S. No	Terms of Reference
14.1	Details of litigation pending against the project, if any, with direction /order passed by any Court ofLaw against the Project should be given.

15. Environment Responsibility

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

Additional Terms of Reference

GENERAL GUIDELINES

(i) The EIA document shall be printed on both sides, as for as possible.

(ii) All documents should be properly indexed, page numbered.

(iii) Period/date of data collection should be clearly indicated.

(iv) Authenticated English translation of all material provided in Regional languages.

(v) The letter/application for EC should quote the MoEF&CC File No. and also attach a copy of the letter prescribing the TOR.

(vi) The copy of the letter received from the Ministry on the TOR prescribed for the project should be attached as an annexure to the final EIA-EMP Report.

(vii) The final EIA-EMP report submitted to the Ministry must incorporate the issues in TOR and that raised in Public Hearing. The index of the final EIA-EMP report, must indicate the specific chapter and page no. of the EIA-EMP Report where the specific TOR prescribed by Ministry and the issue raised in the P.H. have been incorporated. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at the time of applying for EC.

(viii) Grant of TOR does not mean grant of EC.

(ix) Grant of TOR/EC to the present project does not mean grant of approvals in other regulations such as the Forest (Conservation) Act 1980 or the Wildlife (Protection) Act, 1972.

(x) Grant of EC is also subject to Circulars and Office Memorandum issued under the EIA Notification 2006 and subsequent amendments, which are available on the MoEF&CC website: www.envfor.nic.in.

(xi) The status of accreditation of the EIA consultant with NABET/QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the sector for which this EIA is prepared.

(xii) On the front page of EIA/EMP reports, the name of the consultant/consultancy firm along with their complete details including their accreditation, if any shall be indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed TOR (TOR proposed by the project proponent and additional TOR given by the MoEF) have been complied with and the data submitted is factually correct (Refer MoEF office memorandum dated 4th August, 2009).

(xiii) While submitting the EIA/EMP reports, the name of the experts associated with/involved in the preparation of these reports and the laboratories through which the samples have been got analysed should be stated in the report. It shall clearly be indicated whether these laboratories are approved under the Environment (Protection) Act, 1986 and the rules made there under (Please refer MoEF&CC office memorandum dated 4th August, 2009). The project Coordinator of the EIA study shall also be mentioned.

(xiv) All the TOR points as presented before EAC shall be covered.

Annexure 2

Details of Products & By-products

Name of the product /By-product	Product / By-product	Existing	Proposed	Total	Unit	Mode of Transport / Transmission
Shipbuilding and repair	Shipbuilding and repair	0	40	40	shipbuilding of 20 ships per annum and ship repair of 20 ships per annum	Combination of two or three modes
Proposed project is an expansion of Cuddalore Port.	Proposed project is an expansion of Cuddalore Port.	5.68	5.8	11.48	million tonnes per annum	Combination of two or three modes

Appendix C
Port Limits G.O

©

GOVERNMENT OF TAMIL NADU
2009

[Regd. No. TN/CCN/467/2009-11.
[Price: Rs. 3.20 Paise.

TAMIL NADU GOVERNMENT GAZETTE

PUBLISHED BY AUTHORITY

No. 28] CHENNAI, WEDNESDAY, JULY 22, 2009
Aadi 6, Thiruvalluvar Aandu–2040

Part II–Section 2

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NOTIFICATIONS BY GOVERNMENT

HIGHWAYS AND MINOR PORTS DEPARTMENT

Declaration of New Ports are to be consolidated incorporating all the port limits of the existing Minor Ports in Tamil Nadu under Indian Ports Act, 1908.

[G.O.Ms. No.110, Highways and Minor Ports (HN 2), 18th June 2009, ஆனி 4, திருவள்ளுவர் ஆண்டு–2040.]

No. II(2)/HWMP/359/2009.—In exercise of the powers conferred by clause (a) of sub-section (1) of Section 4 of the Indian Ports Act, 1908 (Central Act XV of 1908) and in supersession of the Public Works (Marine) Department Notification No. 21 published at pages 627 to 632 in Part I of the Fort St. George Gazette, dated the 29th April 1953 subsequently amended from time to time, on the subject in so far as they apply to the minor ports in the State of Tamil Nadu, the Governor of Tamil Nadu hereby extends, with effect on and from the date of publication of this notification, the provisions of the said Act to the ports mentioned in column (2) of the Schedule below and defines the limits of such ports specified in column (3) thereof:—

THE SCHEDULE

Sl. No.	*Name of the Port.*	*Port Limits*			
(1)	*(2)*	*(3)*			
		THIRUVALLUR DISTRICT			
1	**Kattupalli**	(1) Latitude	13°	18'	57.26" N
		Longitude	80°	20'	45.68" E
		(2) Latitude	13°	20'	45.33" N
		Longitude	80°	22'	54.72" E
		(3) Latitude	13°	20'	45.41" N
		Longitude	80°	23'	27.96" E
		(4) Latitude	13°	17'	40.15" N
		Longitude	80°	23'	28.01" E
		(5) Latitude	13°	17'	39.76" N
		Longitude	80°	20'	49.00" E
2	**Ennore Minor Port**	(1) Latitude	13°	12'	43" N
		Longitude	80°	19'	40" E
		(2) Latitude	13°	12'	59" N
		Longitude	80°	19'	43" E
		(3) Latitude	13°	13'	30" N
		Longitude	80°	21'	22" E
		(4) Latitude	13°	12'	05.4" N
		Longitude	80°	21'	48.3" E
		CUDDALORE DISTRICT			
3	**Cuddalore**	(1) Latitude	11°	44'	24" N
		Longitude	79°	47'	24" E
		(2) Latitude	11°	44'	24" N
		Longitude	79°	50	48" E
		(3) Latitute	11°	36'	45" N
		Longitude	79°	50	48" E
		(4) Latitute	11°	36'	45" N
		Longitude	79°	45'	30" E
4	**Thiruchopuram**	(1) Latitude	11°	36'	00" N
		Longitude	79°	45'	40" E
		(2) Latitude	11°	37'	00" N
		Longitude	79°	53'	00" E
		(3) Latitude	11°	33'	00" N
		Longitude	79°	53'	00" E
		(4) Latitude	11°	34'	00" N
		Longitude	79°	45'	42" E
5	**Silambi-mangalam**	(1) Latitude	11°	34'	00" N
		Longitude	79°	45'	30" E
		(2) Latitude	11°	33'	30" N
		Longitude	79°	49'	00" E
		(3) Latitude	11°	31'	00" N
		Longitude	79°	49'	00" E
		(4) Latitude	11°	31'	42" N
		Longitude	79°	46'	00" E
6	**Py-3 Oil Field**	(1) Latitude	11°	19'	14" N
		Longitude	80°	03'	33" E
		(2) Latitude	11°	20'	16" N
		Longitude	80°	01'	00" E
		(3) Latitude	11°	18'	17" N
		Longitude	79°	58'	38" E
		(4) Latitude	11°	14'	07" N
		Longitude	79°	58'	13" E
		(5) Latitude	11°	13'	45" N
		Longitude	80°	02'	12" E
		NAGAPATTINAM DISTRICT			
7	**Thirukkadaiyur**	(1) Latitude	1°	04'	27.5" N
		Longitude	79°	51'	29.3" E
		(2) Latitude	11°	05'	31.0" N
		Longitude	79°	52'	32.5" E

Sl. No.	*Name of the Port.*	*Port Limits*				
(1)	*(2)*	*(3)*				
7	**Thirukkadaiyur-** cont.	(3) Latitude	11°	05'	31.0"	N
		Longitude	79°	56'	02.5"	E
		(4) Latitude	11°	03'	18.0"	N
		Longitude	79°	56'	02.5"	E
		(5) Latitude	11°	03'	18.0"	N
		Longitude	79°	52'	32.5"	E
		(6) Latitude	11°	04'	22.7"	N
		Longitude	79°	51'	28.9"	E
8	**Nagapattinam**	(1) Latitude	10°	49'	36"	N
		Longitude	79°	51'	06"	E
		(2) Latitude	10°	49'	36"	N
		Longitude	79°	57'	06"	E
		(3) Latitude	10°	44'	51"	N
		Longitude	79°	57'	30"	E
		(4) Latitude	10°	44'	51"	N
		Longitude	79°	51'	06"	E
9	**Thirukkuvalai**	(1) Latitude	10°	35'	00"	N
		Longitude	79°	51'	24"	E
		(2) Latitude	10°	35'	00"	N
		Longitude	79°	59'	00"	E
		(3) Latitude	10°	33'	18"	N
		Longitude	79°	59'	00"	E
		(4) Latitude	10°	33'	18"	N
		Longitude	79°	51'	36"	E
	RAMANATHAPURAM DISTRICT					
10	**Pamban**	(1) Latitude	9°	21'	30"	N
		Longitude	79°	13'	13"	E
		(2) Latitude	9°	17'	13"	N
		Longitude	79°	13'	13"	E
		(3) Latitude	9°	15'	31"	N
		Longitude	79°	15'	43"	E
		(4) Latitude	9°	13'	30"	N
		Longitude	79°	15'	43"	E
		(5) Latitude	9°	11'	45"	N
		Longitude	79°	08'	54"	E
		(6) Latitude	9°	16'	30"	N
		Longitude	79°	08'	54"	E
		(7) Latitude	9°	17'	04"	N
		Longitude	79°	09'	16"	E
		(8) Latitude	9°	21'	30"	N
		Longitude	79°	09'	16"	E
11	**Rameswaram**	(1) Latitude	9°	19'	30"	N
		Longitude	79°	19'	48"	E
		(2) Latitude	9°	19'	30"	N
		Longitude	79°	29'	00"	E
		(3) Latitude	9°	14'	00"	N
		Longitude	79°	29,	00"	E
		(4) Latitude	9°	14'	00"	N
		Longitude	79°	21'	18"	E
12	**Valinokkam**	(1) Latitude	9°	11'	24"	N
		Longitude	78°	43'	00"	E
		(2) Latitude	9°	05'	00"	N
		Longitude	78°	43'	00"	E
		(3) Latitude	9°	05'	00"	N
		Longitude	78°	38'	30"	E
		(4) Latitude	9°	09'	24"	N
		Longitude	78°	38'	30"	E
	THOOTHUKUDI DISTRICT					
13	**Punnakayal**	(1) Latitude	8°	37'	47.1"	N
		Longitude	78°	07'	38.2"	E
		(2) Latitude	8°	39'	30"	N
		Longitude	78°	15'	00"	E
		(3) Latitude	8°	36'	00"	N
		Longitude	78°	15'	00"	E
		(4) Latitude	8°	37'	30.5"	N
		Longitude	78°	07'	37.6"	E
14	**Manappad**	(1) Latitude	8°	21'	36"	N
		Longitude	78°	02'	12"	E
		(2) Latitude	8°	21'	12"	N
		Longitude	78°	00'	57"	E
		(3) Latitude	8°	18'	00"	N
		Longitude	77°	59'	00"	E
		(4) Latitude	8°	19'	00"	N
		Longitude	78°	05'	00"	E
	THIRUNELVELI DISTRICT					
15	**Koodankulam**	(1) Latitude	8°	10'	24"	N
		Longitude	77°	44'	00"	E
		(2) Latitude	8°	07'	00"	N
		Longitude	77°	44'	00"	E
		(3) Latitude	8°	07'	00"	N
		Longitude	77°	39'	24"	E
		(4) Latitude	8°	09'	30"	N
		Longitude	77°	39'	24"	E

Sl. No.	*Name of the Port.*	*Port Limits*			
(1)	*(2)*	*(3)*			
		KANYAKUMARI DISTRICT			
16	**Kanyakumari**	(1) Latitude	8°	05'	30" N
		Longitude	77°	35'	00" E
		(2) Latitude	8°	04'	00" N
		Longitude	77°	35'	00" E
		(3) Latitude	8°	04'	00" N
		Longitude	77°	33'	00" E
		(4) Latitude	8°	05'	30" N
		Longitude	77°	33'	00" E
17	**Colachel**	(1) Latitude	8°	10'	20" N
		Longitude	77°	15'	36" E
		(2) Latitude	8°	09'	27" N
		Longitude	77°	15'	36" E
		(3) Latitude	8°	09'	14" N
		Longitude	77°	14'	15" E
		(4) Latitude	8°	10'	24" N
		Longitude	77°	14'	48" E

K. ALLAUDIN,
Principal Secretary to Government.

HOME DEPARTMENT

Notifications under Code of Criminal Procedure

Declaration of certain local areas cease to form part of local areas of certain Police Stations in certain Districts.

Virudhunagar District.

[G.O. Ms. No. 519, Home (Pol.XIV), 1st July 2009]

No.II(2)/HO/360/2009.—Under clause (s) of Section 2 of the Code of Criminal Procedure, 1973 (Central Act 2 of 1974), the Governor of Tamil Nadu hereby declares that with effect on and from the 1st July 2009, the traffic points specified in column (3) of the Schedule below, shall cease to form part of the local area of the Police Stations specified in column (2) and shall form the local area of the Police Station specified in column (4) thereof.

THE SCHEDULE

District.	*Police Station to which at present attached.*	*Name of the Traffic Points.*	*Police Station to which hereafter to be attached.*
(1)	*(2)*	*(3)*	*(4)*
Virudhunagar	Sattur Town	North Bye-Pass Junction	National Highway Traffic Police Station Sattur.
	Sattur Town	Padanthal Junction	
	Sattur Taluk	South Bye-Pass Juction	
		Sadayampatti Junction (S.R.N.M. College)	
		Vanni Vinayagar Koil Junction	
		Thoothilovanpatti - Kovilpatti, Virudhunagar District Border	

Namakkal District.

[G.O. Ms. No. 520, Home (Pol.XIV), 1st July 2009]

No.II(2)/HO/361/2009.—Under clause (s) of Section 2 of the Code of Criminal Procedure, 1973 (Central Act 2 of 1974), the Governor of Tamil Nadu hereby declares that with effect on and from the 1st July 2009, the traffic points specified in column (3) of the Schedule below, shall cease to form part of the local area of the Police Stations specified in column (2) and shall form the local area of the Police Station specified in column (4) thereof.

THE SCHEDULE

District	*Police Station to which at present attached.*	*Name of the Traffic Points.*	*Police Station to which hereafter to be attached.*
(1)	*(2)*	*(3)*	*(4)*
Namakkal	Vennandur	Attaiyampatti Privu Road	Puduchatram Highway Traffic Police Station
	Rasipuram	Rasipuram Privu Road (ATC Depot)	
	Senda-mangalam	Pudanchandai	
	Nallipalayam	Muthalaipatti Bye-Pass entrance to Namakkal	
	Nallipalayam	Vallipuram Bye-Pass entrance to Namakkal	
	Paramathi	Paramathi Privu Road (Entrance to Paramathi)	
	Paramathi	Paramathi Privu Road (Entrance into Paramathi towards NKL)	
	Velur	Velur Privu Road (Kandar College)	
	Velur	Four Roads at Velur	

S. MALATHI,
Principal Secretary to Government.

Secretariat, 22nd July 2009

Notifications under Tamil Nadu Protection of Interests of Depositors (in Financial Establishments) Act.

Rescission of Notification

No. II(2)/HO/362/2009.

[Tamil Nadu Protection of Interests of Depositors (in Financial establishments) Act, 1997 (Tamil Nadu Act 44 of 1997) - Thiruvalargal V.R.M.S. Finance & Investment, K.G. Chavadi, Coimbatore-Ad-interim order of attachment of properties of said Financial Establishments under Section 3 of the said Act - Ordered - Raising the Ad-interim order of attachment - Orders - Issued.]

The following Government Order is published:—

[G.O. Ms. No. 343, Home (Police XIX), 24th April 2009.]

READ AGAIN:

(1) G.O.Ms.No.816, Home, (Courts IIA), dated 4th September 2006.

(2) Orders of the Special Judge under TNPID Act, Chennai-104, in O.A.Nos. 48/2007, 51/2007 and 52/2007, dated 2nd November 2007.

(3) Orders of the Special Judge under TNPID Act, Chennai-104, in O.A.Nos. 49/2007, 50/2007 and 53/2007, dated 20th November 2007.

READ ALSO:—

(4) From the Competent Authority and District Revenue Officer, Coimbatore Lr.No. 11309/2004/J1, dated 3rd November 2007.

(5) From the Inspector General of Police, Economic Offences Wing, Chennai Lr.No.C2/1719/EOW/2008, dated 6th May 2008 and 29th October 2008.

Order: No. 343, Home (Police XIX), 24th April 2009

In the Government Order first read above, Government have issued orders for the ad-interim attachment of properties mentioned in the Schedule to the said Order, belonging to Thiruvalargal V.R.M.S. Finance & Investments, K.G. Chavadi, Coimbatore.

2. In the Order second and third read above, the Special Court under Tamil Nadu Interests of Depositors (in Financial Establishments) Act, 1997, Chennai has raised the ad-interim order of attachment on the properties effected by Government in the order first read above.

3. The Competent Authority and District Revenue Officer, Coimbatore in his letter fourth read above, has sent the Special Court orders second and third read above and requested the orders of Government. The Inspector General of Police, Economic Offences Wing, Chennai has also endorsed the above proposal.

4. In compliance to the Orders of the Special Court, Tamil Nadu Protection of Interest of Depositors (in Financial Establishments) Act, 1997 (Tamil Nadu Act 44 of 1997), Chennai, second read above and in exercise of the powers conferred by Section 3 of the Tamil Nadu Protection of Interests of Depositors (in Financial Establishments) Act, 1997 (Tamil Nadu Act 44 of 1997), the Governor of Tamil Nadu hereby rescinds the said Government Order issued in G.O.Ms. No.816, Home (Courts IIA) Department, dated, the 4th September 2006.

(By Order of the Governor)

S. MALATHI,
Principal Secretary to Government.

HOUSING AND URBAN DEVELOPMENT DEPARTMENT

Notifications under Tamil Nadu Town and Country Planning Act.

Exemption for Renewal of Planning Permission for the construction of Residential Apartments at Telungupalayam Village, Coimbatore Corporation, Coimbatore under the Act.

[G.O. Ms. No. 103, Housing and Urban Development (UD4(1), 3rd July 2009.]

No. II(2)/HOU/363/2009.—In exercise of the powers conferred by Section 113 of the Tamil Nadu Town and Country Planning Act, 1971 (Tamil Nadu Act 35 of 1972), the Governor of Tamil Nadu hereby exempts the land in S.F.No.548 Pt, Coimbatore Corporation, from the provisions of Section 50 the Tamil Nadu Town and Country Planning Act, 1971 for renewal of Planning Permission for construction of Basement Floor + Ground Floor + 3 Floors for Residential apartments at the above site.

Variations to the Approved Master Plan for the Coimbatore Local Planning Area under the Act.

[G.O.(2D)No. 200, Housing and Urban Development (UD4(1), 14th July 2009.]

No. II(2)/HOU/364/2009.—In exercise of the powers conferred by sub-section (4) of Section 32 of the Tamil Nadu Town and Country Planning Act, 1971 (Tamil Nadu Act 35 of 1972) , the Governor of Tamil Nadu hereby makes the following variations to the master plan for the Coimbatore Local Planning Area approved under the said Act and published with the Housing and Urban Development Department Notification No. II(2)/HOU/4377/94 at page 1078 of Part II-Section 2 of the *Tamil Nadu Government Gazette,* dated the 9th November 1994.

VARIATIONS.

In the said Master plan, in the “LAND USE SCHEDULE”, under the heading “SINGANALLUR D.D.P. No. 21”, under the sub-heading "No. 56, RAMANATHANPURAM VILLAGE”,-

(i) against the entry “Residential”, for the expression “482 to 501” the expression “482 to 488, 489/2 part, 3 Part, 490 to 501” shall be substituted; and

(ii) against the entry “Industrial”, for the expression “489”, the expression “489 (Except 489/2 part, 3 part)” shall be substituted.

SURJIT K CHAUDHARY,
Principal Secretary to Government.

தொழிலாளர் மற்றும் வேலைவாய்ப்புத் துறை

Disputes between Workmen and Managements referred to Labour Court for adjudication.

தமிழ்நாடு அரசு போக்குவரத்துக்கழகம், தருமபுரி.

[அரசாணை (டி) எண் 403, தொழிலாளர் மற்றும் வேலைவாய்ப்பு (சி)த் துறை, நாள்: 6 ஜூலை 2009.]

No.II(2)/LE/365/2009.—இந்த ஆணையின் இணைப்பில் குறிப்பிட்டுள்ள பொருள் தொடர்பாக தமிழ்நாடு அரசு போக்குவரத்துக் கழகம், தருமபுரி என்ற நிர்வாகத்திற்கும் செயலாளர், சேலம், தருமபுரி, ஈரோடு, நாமக்கல் மாவட்ட போக்குவரத்துத் துறை மற்றும் பொதுத் தொழிலாளர் சங்கத்திற்குமிடையே தொழிற் தகராறு எழுந்துள்ளது என்று அரசு கருதுவதாலும்;

மேற்சொன்ன தகராறை நீதிமன்றத் தீர்ப்புக்காக அனுப்புவது அவசியமென்று தமிழ்நாடு ஆளுநர் அவர்கள் கருதுவதாலும்;

1947ஆம் ஆண்டு தொழில் தகராறுகள் சட்டத்தின் (மத்திய சட்டம் XIV/1947) 10(1)(C) பிரிவிலும், 10(1)(d) பிரிவின் வரம்பு நிபந்தனையிலும் வழங்கியுள்ள அதிகாரங்களைக் கொண்டு தமிழ்நாடு ஆளுநர் அவர்கள் மேற்சொன்ன தகராறு, சேலம் தொழிலாளர் நீதிமன்ற தீர்ப்புக்காக அனுப்பப்பட வேண்டும் என்று இதனால் ஆணையிடுகிறார்.

மேலும் 1947ஆம் ஆண்டு தொழிற்தகராறுகள் சட்டத்தின் 10(2ஏ) பிரிவின்கீழ், இந்த ஆணையைப் பெற்றுக்கொண்ட நாளிலிருந்து மூன்று மாதங்களுக்குள் தீர்ப்பு அளிக்குமாறு சேலம் தொழிலாளர் நீதிமன்றம் கேட்டுக்கொள்ளப்படுகிறது.

இணைப்பு

எழுவினா

நடத்துநர், திரு. டி. ராஜனுக்கு அடிப்படை ஊதியத்தை 3 நிலைகள் குறைத்து 10 ஆண்டுகள் தொடர்ந்து நடைமுறைப்படுத்த உத்தரவிட்ட நிர்வாகத்தின் உத்தரவை இரத்து செய்யவும் கிடைக்க வேண்டிய பணப்பயன்களை நிலுவையுடன் வாங்கவும் கோரியுள்ள தொழிற்சங்கக் கோரிக்கை நியாயமானதுதானா? ஆமெனில் கிடைக்க வேண்டிய நிவாரணம் என்ன? உரிய உத்தரவுகளை பிறப்பிக்கவும்.

ச. ஆறுமுகம்,
அரசு துணைச் செயலாளர்.

Notification under Minimum Wages Act

Draft Notification regarding Revision of Minimum rates of Wages for employment in Agriculture and works allied to Agriculture under the Act.

[G.O. (2D) No. 59, Labour and Employment, 30th June 2009.]

No. II(2)/LE/366/2009.—The following draft of a Notification, which it is proposed to be issued in exercise of the powers conferred by clause (b) of sub-section (1) of Section 3 and sub-section (2) of Section 5 of the Minimum Wages Act, 1948 (Central Act XI of 1948), is hereby published for information of all persons likely to be affected thereby, as required by clause (b) of sub-section (1) of Section 5 of the said Act.

2. Notice is hereby given that the draft Notification will be taken into consideration on or after the expiry of two months from the date of publication of this Notification in the *Tamil Nadu Government Gazette* and that any objection or suggestion, which may be received from any person with respect thereto before the expiry of the aforesaid period will be considered by the Government of Tamil Nadu. Objection and suggestion, if any, should be addressed to the Principal Secretary to Government of Tamil Nadu, Labour and Employment Department, Fort St.George, Secretariat, Chennai-600 009 through the Commissioner of Land Administration and Commissioner of Land Reforms, Chennai-600 005.

DRAFT NOTIFICATION

In exercise of the powers conferred by clause (b) of sub-section (1) of Section 3 and sub-section (2) of Section 5 of the Minimum Wages Act, 1948 (Central Act XI of 1948) and in supersession of the Labour and Employment Department Notification No.II(2)/LE/573(b-1)/2005 published at pages 1-2 of Part II-Section 2 of the *Tamil Nadu Government* Gazette Extraordinary, dated the 8th July 2005, the Governor of Tamil Nadu hereby revises the minimum rates of wages payable to the classes of employees, employed in agriculture and works ancillary to agriculture as specified in Part-II of the Schedule to the said Act, in the State of Tamil Nadu, specified in column (1) of the Schedule below and as specified in the corresponding entries in column (2) thereof:—

THE SCHEDULE

Classes of Employees.	*Minimum rates of wages per day.*
(1)	*(2)*
(1) Employees engaged in ploughing with bullocks and ploughs supplied by him.	Rs. 185/-
(2) Employees engaged in ploughing with bullocks and ploughs not supplied by him	Rs. 100/-
(3) Employees engaged in harvest of paddy reaping, carrying to thrashing floor, thrashing, winnowing, measuring and bagging.	Rs.100/- per day for men workers, who do the work for six hours and Rs.85/- per day for women workers who do the work for five hours or in kind to the extent of 1/8th of the gross yield of produce whichever is higher, per day.
(4) Employees engaged in harvest of crops other than paddy.	Rs.100/- per day for men workers, who do the work for six hours and R5.85/- per day for women workers who do the work for five hours.
(5) Employees engaged in sowing, plucking of seedling, re-planting of seedlings and for weeding operations.	Rs.100/- per day for men workers, who do the work for six hours and Rs.85/- per day for women workers who do the work for five hours.
(6) Employees engaged in other agricultural operations, namely trimming bunds and fields, bee- keeping, poultry farming, dairy farming and climbing trees.	Rs.100/- per day for men workers who do the work for six hours and Rs.85/- per day for women workers who do the work for five hours.

Explanations I.— (1) The above revised minimum rates of wages shall also apply to the Agricultural labourers employed in Colleges and Research Stations under the Tamil Nadu Agricultural University and Agricultural Farms maintained by the Agriculture, Horticulture and other Government Departments.

(2) Where there is no difference in the daily hours of work and where the same work or work of a similar nature is performed no distinction in the payment of wages should be made between men and women workers as per the Equal Remuneration Act, 1976.

(3) For the purpose of this Notification, minimum rate of wages specified above shall be all inclusive of rate allowing for the basic rate, cost of living allowance and the cash value of concession, if any, but it does not include the cost of food, if any, supplied to the employees and hence the cost of food shall not be deducted from the minimum rates of wages paid to the employees.

Constitution of Committee for Fixation of Minimum rates of Wages for employment in Sculpture in Stone and other materials under the Act.

[G.O. Ms. No. 17, Labour and Employment (J2), 23rd February 2009.]

No. II(2) /LE/367/2009—In exercise of the powers conferred by clause (a) of sub-section (1) of Section 5 read with Section 9 of Minimum Wages Act, 1948 (Central Act XI of 1948), and in supersessions of the Labour and Employment Department Notification No. II(2)/LE/192/2006 published at pages 145 and 146 Part II-Section 2 of *Tamil Nadu Government Gazette,* dated the 29th March 2006. The Governor of Tamil Nadu hereby appoints a Committee consisting of the following members to hold enquiries and advise the Government in respect of fixation of minimum rates of wages for the employment in Sculpture in Stone and other materials:—

Independent Persons:

(1) Deputy Commissioner of Labour, Tiruchirappalli .. Chairman

(2) Inspector of Labour, Tiruchirappalli .. Secretary

(3) Assistant Director, Office of the Commissioner of Economics and Statistics, Chennai-600 006. .. Member

Employer's Representatives:

(1) Thiru A.R. Prameswaran, Owner, Sree Tharaikudi Amman Sculpture, Jeeva Street, (Via Murugan Koil), Poondi, Coimbatore-641 652. .. Member

(2) Thiru A.P.S. Andro, Owner, Arulannantha Granite and Marbles, Muthalak kurichi, Thakalai-629 175. Kanyakumari District. .. Member

(3) Thiru V. Viswanathan, Owner, Visu Architecher and Sculptures, 6, Madha Koil Street, Mamallapuram. .. Member

Employees' Representatives:

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ON BEHALF OF THE GOVERNMENT OF TAMIL NADU

Appendix D
Bathymetry of port

BATHYMETRY AND GEOPHYSICAL SURVEYS AND OCEANOGRAPHIC STUDIES AT CUDDALORE PORT, TAMILNADU, EAST COAST OF INDIA FOR MAHATHI INFRA SERVICES PRIVATE LIMITED

FINAL REPORT ON BATHYMETRY & GEOPHYSICAL SURVEYS AND OCEANOGRAPHIC STUDIES

GSIPL DOCUMENT No. GSIPL_JO38_2025_FinRep (Rev.0)

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REV	ISSUE DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	CLIENT'S APPROVAL

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Client Reference No.:	**Q114/BS&GEOPHY/2025/01 Dated 18 August 2025**
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DRAWING NUMBER	DESCRIPTION	SCALE	No. of Charts	Rev.
JO38_25/MIS/CUDDALORE/BATHY/2025/01/2433	BATHYMETRY	1:10000	1 OF 2	0
JO38_25/MIS/CUDDALORE/BATHY/2025/02/2434	BATHYMETRY	1:10000	2 OF 2	0
JO38_25/MIS/CUDDALORE/SBF/2025/01/2435	SEABED FEATURES	1:10000	1 OF 1	0
JO38_25/MIS/CUDDALORE/SBP/2025/01/2436	SUB BOTTOM PROFILE	1:10000	1 OF 3	0
JO38_25/MIS/CUDDALORE/SBP/2025/02/2436	SUB BOTTOM PROFILE	1:10000	2 OF 3	0
JO38_25/MIS/CUDDALORE/SBP/2025/03/2436	SUB BOTTOM PROFILE	1:5000	3 OF 3	0
Total Number of Drawings			**06**	

DEFINITIONS OF THE TERMINOLOGY USED

Terminology	Definition
Client	Mahathi Infra Services Private Limited
Survey Contractor	Geostar Surveys India Pvt. Ltd., Navi Mumbai, India
Azimuth	This is a horizontal angle measured in degrees from the north direction to the direction of the satellite.
Bearing	Refers to a direction from one point to another on a chart right rotated from Grid North.
CM	Central Meridian. The meridian that defines the central line of longitude of the chart projection. It is a zone constant used in chart projections.
CMG	Course Made Good
Convergence	Clockwise angle in a pint between True North and Grid North.
CRP	Central Reference Point is the origin of all vessel co-ordinates. It is also referred to as the Vessel Datum. It often corresponds to the COG of the survey vessel.
Datum Rotation	Defined as the anti-clockwise rotation around the X-axis, Y-axis and Z-axis (Rx, Ry and Rz) in the origin of 2 spheroids in terms of the Cartesian or geocentric co- ordinates.
Datum Shift	Defined as the difference (dX, dY, dZ) in the origin of 2 spheroids in terms of the Cartesian or geocentric co-ordinates.
DGPS	Differential Global Positioning System. GPS being used in the differential mode of operation, i.e. with the application of range corrections from a known position
Differential Positioning	Determination of relative co-ordinates between two or more satellite receivers that are simultaneously tracking the same satellite signal.

Terminology	Definition
DOP	Dilution of Precision. This is a measure of the strength of the satellites geometry at the receiver.
Ellipsoid/Spheroid	In geodesy, unless otherwise specified, a mathematical figure formed by revolving an ellipse about its minor axis. It is often used interchangeably with spheroid. Two quantities define an ellipsoid, these are usually given ad the length of the semi-major axis (a) and the Inverse Flattening [1/f = a/(a-b)], where b is the length of the semi-minor axis.
False Easting/False Northing	Defined projection co-ordinates at the origin point of the projection.
Geoid	The particular equipotential surface which coincides with mean sea level and which may be imagined to extend through the continents. This surface is everywhere
Geodetic Datum	A mathematical model designed to best-fit part or all of the Geoid. It is defined by an ellipsoid and the relationship between the ellipsoid and a point on the topographic
Geoid Separation	The separation between the ellipsoidal height and the orthometric height.
Heading	Course of a ship measured with a (magnetic) compass.
HDOP	Horizontal DOP is a two dimensional measure of the accuracy of the horizontal position.
Offset	A station offset from the main survey station. Defined by an azimuth and distance or ±dX, ±dY, ±dZ or Starboard. /Port, Forward/Aft, Above/Below.
PDOP	Positional Dilution of Precision which is an accuracy measure in 3D position of both the Horizontal and Vertical DOP's.
PRN	Pseudo Random Noise code – this is a unique identification number for each GPS satellite.
SNR	Signal to Noise Ratio – this is a measure of the power of a received satellites carrier signal at a GPS receiver.
SOG	Speed over the Ground.
Vessel Datum	The vessel datum is the origin of all vessel co-ordinates. It is also referred to as the Central Reference Position or CRP.
ABBREVIATION/ DEFINITIONS	
L x B x H	Length X Breadth X Height
SSS	Side Scan Sonar
SBES	Single Beam Echo Sounder
SBP	Sub-Bottom Profiler
UTM	Universal Transverse Mercator
ADCP	Acoustic Doppler Current Profiler

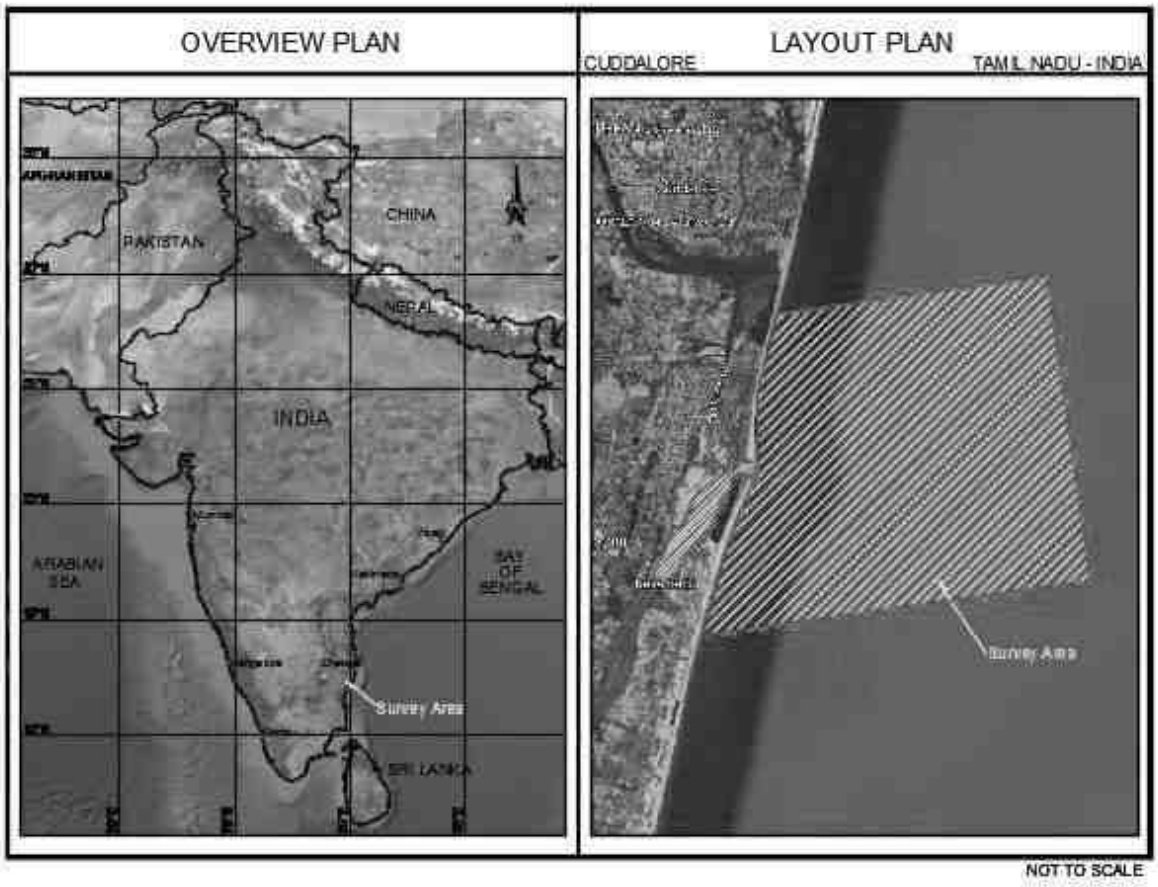


FIGURE 1 LOCATION MAP

1 SUMMARY OF RESULTS

The bathymetric data presented in the relevant charts and sections below refers to depth in meters and decimeters, measured with respect to the Chart Datum (CD). Observed tide for Cuddalore Port was used for reducing the raw water depths to Chart Datum (CD). The Contours are drawn at 2m interval for clear representation.

1.1 BATHYMETRY

The surveyed corridor's bathymetric profile generally represents a gentle slope from West to East in the survey corridor. Water depths in the corridor ranges from a minimum of 1.9 meters to a maximum of 19.6 meters below the Chart Datum (CD).

Approaches Area:

Bathymetry from Northing 1298000 to Northing 1296000:

Bathymetry represent gentle slope from west to east in the survey corridor. The maximum water depth of 16.4m is observed in the eastern part of survey area. Minimum water depth is 6.2m is observed in the western part of survey area.

Bathymetry from Northing 1296000 to Northing 1294000:

Bathymetry represent gentle slope from west to east in the survey corridor. The maximum water depth of 17.9m is observed in the eastern part of survey area. Minimum water depth is 1.9m is observed near the river mouth in the western part of survey area.

Bathymetry from Northing 1294000 to Northing 1292000:

Bathymetry represent gentle slope from west to east in the survey corridor. The maximum water depth of 19.6m is observed in the eastern part of survey area. Minimum water depth is 2.7m is observed in the western part of survey area.

Ship wreck was recorded in the Approaches area & minimum water depth was recorded 6.2m over the wreck.

Harbour area:

Bathymetry represents deeper section towards the centre of the river. Maximum water depth is 9.2m in the southern portion jetty. Minimum water depth of 0.1m is recorded near the shore. Drying heights were also recorded in the northern shore of the Harbour area. Maximum drying height -0.5m was recorded near the shoreline. Water depth near the jetty varies between 8.3m & 9.2m.

Apart from the above, no other bathymetric observations were recorded at any point within the surveyed area which could be hazardous to the further marine operations. The minimum depths are observed at the edges of survey corridor.

1.2 SEABED FEATURES

In general, Side scan sonar reveals a seabed of varying reflectivity to 100 KHz frequency in Harbour area and approaches area within the survey corridor, which can be broadly categorized as follows:

Type 1 : Low Reflective Sediments (Fine to medium silty sand)
Type 2 : Medium to High reflective compact sediments (Stiff Clayey Sand)
Type 3 : Scattered gravel bed

- Type 1 Sediments (Low Reflective Sediments /Fine to medium silty sand): These low to medium reflective sediments were observed predominantly throughout the survey corridor. These areas are interpreted as fine to medium silty sand.

- Type 2 Medium to High reflective compact sediments (Interpreted as stiff clayey sand on Type 1 Sediments): These were observed with moderate to high mottled reflectivity at north west, north east, south west and central part of the approaches area within the survey corridor.

- Type 3 Sediments (Scattered gravel bed on Type 1 sediments): These were observed predominantly across various sections of the approaches area, including North and West part of the approaches area within the survey corridor.

Drag Marks:

- Linear Drag Marks: Occasional linear drag marks were recorded in both harbour and approaches area. In Harbour area, the drag marks were recorded near South Jetty (Cuddalore New port) and in approaches area, the drag marks were recorded at southern part. i.e., within the survey corridor. These can be attributed to anchor drag marks due to fishing activity.

Sand Ripples:

- The sand ripples (wave like seabed feature) on seabed recorded in the side scan sonar data, formed by the action of ocean currents or wave-induced water movement, indicating sediment transport in the survey area.

- These sand ripples were recorded in the North West and North East part of the approaches area within the survey corridor.

Sonar Contacts:

- Sonar contacts on seabed are typically referring to sonar detections or echoes that indicate the presence of objects or anomalies on the seafloor. These contacts can be anything from natural formations to man-made objects or obstructions.

- Three (3nos.) of sonar contacts were recorded in the approaches area within the survey corridor. Table 7 represents the sonar contact center coordinates.

Linear Contacts:

- A linear contact in side scan sonar data recorded on harbour area and approaches area is defined as a narrow, elongated sonar return that appears as a continuous or segmented lines, indicating the presence of a distinct linear object or feature on or just above the sediment surface.

- Seven (7Nos) of linear contacts were recorded in both the harbor and approaches area. Table 8 represents the center location of the linear contacts.

1.3 SHALLOW STRATIGRAPHY

In the absence of any borehole information, all sedimentary properties defined below are based on assessment of the recorded acoustic characteristics of the material along with interpreted sedimentary structures. Additionally, appropriate reference to the echo sounder also taken where necessary.

The shallow geological successions within the surveyed area can be differentiated into essentially two major units viz. Unit A and Unit B.

UNIT A – Fine to Medium Silty Sands

Unit A is the uppermost sediment layer and identified occurring all over within the survey corridor. This unit is identified as transparent with low acoustic impedance to the seismic energies and base of this unit undulates within survey corridor.

Approaches Area: Unit-A layer thickness varies between 0.6 meters to 5.4 meters.
Harbour Area: Unit-A layer thickness varies between 0.8 meters to 2.6 meters.

However, internal reflection configuration is neither uniform nor present everywhere within the survey corridor.

Throughout most of the survey area, the seabed exhibits sand ripples and beneath these, well-defined internal reflectors composed of mixture of sands and silts observed at varying depths.

UNIT B – Compact Silty Sands

This unit occurs directly below the Unit A sediments exhibiting high acoustic impedance to the seismic energies, thus inhibiting the further penetration of the acoustic signals and it is interpreted as compact silty sands. This unit was recorded all along the survey area corridor.

It is interpreted as indurated sediments, composed of stiff silty sand. The faint internal reflections within these sediments are likely due to variations in stiffness, sediment composition (sand and silt), and increasing density with depth. This subsurface unit is recorded to the maximum depth of acoustic signal penetration.

Apart from the above, no other significant features or anomalies associated with existing cables or existing pipelines or with shallow gas were evident from the records within the survey corridor, which could be hazardous to the marine construction activities.

1.4 WATER SAMPLING

Water samples were collected by deploying Nansen Reversible Water Bottles. Ten (10) water samples were taken at mid water depths at each of the ten different locations using Nansen Reversible water bottles in the survey corridor.

1.5 SOIL SAMPLING

A total (10) soil samples are collected at ten locations, in the vicinity of the project site using soil grab sampler. Samples to be laboratory tested for grain size distribution in the surveyed area.

2 INTRODUCTION

2.1 GENERAL

M/s Mahathi Infra Services Pvt. Ltd. is in the process of developing Cuddalore Port in Tamil Nadu. As part of this development, it is proposed to conduct a hydrographical survey of the port area using a Single Beam Echo Sounder, Seismic Survey, and Side Scan Sonar Survey and oceanographic measurement. A comprehensive survey report, including a digitized survey report with CAD drawings, to be prepared in support of the proposed development plan.

Geostar Surveys India Pvt Ltd (GSIPL), have been awarded the survey works as a co-operation of services to M/s Mahathi Infra Services Pvt. Ltd. GSIPL provided the vessel, equipment and personnel for the provision of carrying out the bathymetry & geophysical surveys and oceanographic studies.

The bathymetry & geophysical survey was carried out from **29 August 2025 to 07 September 2025** from the vessels "KK Arasan-1'" and "VENKATESWARA". The oceanographic measurement was carried out from **29 August 2025 to 13 September 2025.**

This final report **GSIPL_J038_2025_FinRep (Rev.0)** deals with bathymetry & Geophysical surveys and Oceanographic studies for Cuddalore Port, Tamil Nadu State, East Coast of India.

2.2 SCOPE OF WORK

To carry out bathymetry, geophysical surveys, current & tidal observations, collection of soil & water samples, etc. as per the quantities mentioned in the Bill of Quantities.

Following are the deliverables required after conducting this survey for Cuddalore Port.:

1) Hydrographic Survey Report using Single beam Echo sounder
2) Seismic Survey Report
3) Side Scan Sonar Survey Report
4) Comprehensive Survey Report
5) Submission of required digital data for further analysis
6) Delivery of detailed CAD drawings in support of the proposed development plans

2.3 SURVEY REQUIREMENTS

The following were provided by Geostar to complete the job as per specifications.

- Survey equipment including single beam echo sounder, Sidescan Sonar System, Sub bottom profiler, Acoustic Doppler Current Profiler (ADCP) & Automatic Tide gauge (ATG).
- To provide and operate equipment and consumables for the entire period of the field survey.
- To provide sufficient qualified personnel as per relevant standard for operation of the survey equipment.

2.4 REFERENCES

References are made in accordance with the scope of work and the project information provided by Mahathi Infra Services Pvt Ltd.

3 RESOURCES OF WORK

3.1 PERSONNEL

PERSONNEL	NAME	FUNCTION
Onshore	Mr. Prem Singh	Project Manager
Off-shore	Mr. Dhiraj Gharat	Party Chief / Sr. Survey Engineer
----do----	Mr. T. Chaitanya Sai	Geophysicist
----do----	Mr. Thiren Patel	Survey Engineer
----do----	Mr. Abhijith V. Sudhan	Surveyor

TABLE 1 LIST OF PERSONNEL

3.2 EQUIPMENTS

a) Positioning & Navigation

1 x Hemisphere DGPS combined high performance beacon receiver
1 x Power supply for above
1 x Computer Systems with Hypack Navigation and Data logging Software
2 x Computer systems + monitors (one spare)

b) Single beam Echo sounder System

1 x Echotrac E20 Dual Frequency Echosounder
1 x Dual frequency transducer 24Khz + 200 kHz + mounting bracket & base plate
1 x Bar Check
1 x SMC 108 Motion Sensor / Heave Compensator
1 x Computer Interface, 12V Power Supply & Generator

c) Tidal Observation

1 x Valeport Automatic Tide Gauge (ATG)

d) Side Scan Sonar System

1 x EdgeTech 4200 MP Side scan sonar system
1 x Tow cable (100 m length)

e) Sub-bottom Profiler (Geoacoustics)

1 x Geoacoustics sub-bottom profiler Transceiver
1 x Geoacoustics Transducer c/w cables, mounting bracket, etc.
1 x Sonarwiz Digital Acquisition system

f) Current & Tidal measurements

1 x Nortek signature 500 Acoustic Doppler Current Profiler (ADCP) or equivalent
1 x Watch Keeping Boat

g) Soil Sampling

1 x Van Veen Grab Sampler
10 x Polyethene bags

h) Seawater Sampling

1 x Nansen reversible water bottles
10 x Water sample bottles

All associated spares and consumables for effective operation of the above.

3.3 VESSEL

A suitable survey vessel "K.K Arasan-1" with high maneuverability and deck space was deployed by Geostar for carrying out the bathymetry & geophysical surveys. A watch keeping boat was deployed during the current measurement for safeguard of ADCP.

SURVEY BOAT 'KK ARASAN-1'

SURVEY BOAT "VENKATESWARA"

4 METHODOLOGY

4.1 GENERAL

The survey works were conducted in accordance with the specifications and scope of work supplied by the Client, and the standard survey procedures of M/s. Geostar Surveys India Pvt. Ltd.

4.2 GEODESY

The Surveys were conducted in WGS 84 spheroid, Indian Datum, Grid co-ordinates are in terms of Universal Transverse Mercator (UTM) Projection. Details of Spheroid and Grid systems are as follows:

GEODETIC PARAMETERS	
Datum	WGS 84
Spheroid	WGS 84
Semi-Major Axis (a)	6378 137.000metres
Semi-Minor Axis (b)	6356752.314metres
First Eccentricity Squared (e^2)	0.006694380
Inverse Flattening (1/f)	298.257223563
PROJECTION PARAMETERS	
Grid Projection	Universal Transverse Mercator
Central Meridian (CM)	81.0° East (Zone 44)
Origin Latitude (False Lat.)	00.0°
Hemisphere	North
False Easting (FE)	500000.0 m
False Northing (FN)	0.0 m
Scale Factor on CM	0.999600
Units	Meters

TABLE 2 GEODETIC PARAMETERS AND CONVERSIONS

4.3 HORIZONTAL CONTROL

Position for the vessel during the survey was provided by Hemisphere Shore Beacon DGPS System. Differential correction signals were received on-board during survey operations continuously from the nearest DGPS beacon reference station (DGLL Station) set up closed to the survey area. These are maintained by Director General of Light Houses and Light Ship, Govt. of India. An integrated GPS/Beacon receiver with built-in antenna provided GPS differential corrections in NMEA-0183 format for navigation with high degree of accuracy.

The positioning data received have high reliability and integrity. The DGPS system was calibrated at Geostar office building stationed at Navi Mumbai prior to the mobilization in the field.

4.4 HYPACK NAVIGATION SOFTWARE

Hypack is a world's leading software solution provider for navigation, hydrographic survey, data acquisition and processing need. This was interfaced to all the data acquisition systems on board and the data logged was processed by using Hypack data processing software.

Hypack provides a user-friendly turnkey solution for all types of marine navigation, positioning and surveying activities. From survey planning to data collection, data cleaning, volume calculations and chart production, Hypack offers a seamless data flow from a large variety of hardware sensors, all the way to a complete chart product. Hypack runs on a standard PC platform under the Windows (NT/2000/XP) operating system. The software is not only independent of sensor manufacturer, but also hardware independent. One is free to buy his own off-the-shelf hardware components and Hypack was work with them. One is not tied to specific hardware in any way.

Extreme Versatility- Survey Applications

Its modular design and inherent flexibility make Hypack perfect for a wide variety of applications. For example, it can be configured to perform:

- Hydrographic and Oceanographic Surveys
- Offshore Bathymetry & Sub bottom Profiler and Pipe-laying
- Dredging, Marine construction including Offshore Oil and Gas
- ROV and AUV Tracking and Data Collection
- Chart and ENC Production

4.5 VERTICAL CONTROL

Automatic Tide Gauge (ATG) was setup at Cuddalore Harbour. The bench mark IBM-4 was shifted to ATG installation location. The zero of the ATG sensor was leveled with respect to the known GSIPL Temporary Bench Mark (TBM-7) at Cuddalore port Jetty. The value of the GSIPL TBM-7 is 4.79m above the Chart Datum (CD). The zero of the tide gauge was 0.1 meters below the Chart Datum (CD) and appropriate corrections were applied to the observed tide data. Tidal observations were recorded at every 10 minutes interval and used to reduce the raw water depth measurements to Chart Datum (CD).

The details of the Temporary Bench Mark are as tabulated below: -

TEMPORARY BENCH MARK CO-ORDINATES				
DATUM WGS 84, CM 81°, ZONE 44 N				
UTM CO-ORDINATES			GEOGRAPHICAL CO-ORDINATES	
ID	EASTING (m)	NORTHING (m)	LATITUDE	LONGITUDE
IBM-4 (3.266m above the chart datum)	366495.03 E	1294530.99 N	11° 42' 28"N	79° 46' 30" E

TABLE 3 TEMPORARY BENCHMARK LOCATION CO-ORDINATES

AUTOMATIC TIDE GUAGE INSTALLATION LOCATION CO-ORDINATES				
DATUM WGS 84, CM 81°, ZONE 44 N				
UTM CO-ORDINATES			GEOGRAPHICAL CO-ORDINATES	
ID	EASTING (m)	NORTHING (m)	LATITUDE	LONGITUDE
GSIPL TBM-7 (4.79m above the chart datum)	366480.29 E	1294190.72 N	11°42'16.92"N	79°46'29.51"E

TABLE 4 ATG INSTALLATION LOCATION CO-ORDINATES

4.6 SINGLE BEAM ECHO SOUNDER

Echotrac E20 integrated with a DGPS positioning system was used during the entire survey to record geographically referenced bathymetric data for measuring water depths. Digitized data was confirmed by the inspection of analogue records. Sea swell was eliminated by Motion Sensor / Heave Compensator.

Data reduction and presentation

The system was operated following recommended manufacturer procedures. The vertical paper scale was set at 1:100 and the appropriate phase was selected to display the seabed at all times. Transducer offset was logged and applied during subsequent processing. Event marks corresponding to position fixes was generated from the on-line navigation computer interface, and passed to the analogue recorder at a regular interval. Prior to the processing, the data files were backed up. The essential hydrographic data

thus obtained was tide corrected. The bathymetry was charted in decimal notation to the nearest one decimal place.

FIGURE 2 ECHOTRAC E20 SINGLE SINGLE BEAM ECHOSOUNDER

- Layback : 0.00 m
- Transverse offset : 0.00 m
- Transducer depth : 0.70 m

4.7 SUB BOTTOM PROFILER

To delineate surficial layers clearly and for recording high resolution data, surveys were carried out by deploying Geoacoustics Sub-bottom profiler. The transducer was mounted on a pole which was fixed on the out-board of the survey vessel. The energy, adjustable between 1 and 10 KW at a frequency output of between 3.5 to 14 K Hz, was released from transducer and the returning seismic energy was received by receiver system and passed through internal amplifiers and filters system built inside the receiver. The power output `Time Variable Gain' Amplifier and Filter settings were field selected to give optimum resolution and necessary seabed penetration for the prevailing geological conditions. The system was operated following recommended manufacturers procedures. Event marks, corresponding to position fixes at regular intervals, were generated automatically by the navigation computer and were passed to the digital data recording system Sonarwiz. The output data was stored in the root directory of Sonarwiz and the same was copied on multiple disks.

FIGURE 3 SUB BOTTOM PROFILER

The offsets of the sub-bottom Profiler from a central reference point (GPS Antenna) on the survey vessel was recorded for the following:

- Layback = 0.30 (Forward)
- Transverse offset = 0.00 m
- Transducer depth = 0.00 m

4.8 SIDESCAN SONAR SYSTEM

The EdgeTech 4200 MP Series High-Definition Dual-frequency Side Scan Sonar System is a frequency-modulated (FM), dual-frequency side scan sonar that uses Edge Tech's proprietary Full Spectrum "chirp" and multi-Pulse technologies to generate high-resolution side scan imagery at longer ranges than conventional continuous wave (CW) systems.

The 4200 Series is available in single-pulse (SP) and optional multi-pulse (MP) configurations and three dual-frequency choices: 100/400 kHz, 300/600 kHz, and 300/900 kHz. In both the SP and MP configurations, the two frequencies are transmitted simultaneously. In the MP configuration, multi-pulse operation doubles the repetition rate. This increased repetition rate allows for increased tow speeds of up to 9.6 knots while still meeting the NOAA and IHO-44S Shallow Water Survey Specification of three pings on a 1-meter cubed target at 100 meters.

The optimum configuration and frequency choices are dependent on the application. In both configurations, the frequencies are transmitted as linearly-swept, wide-band, high energy acoustic pulses. The received echoes are processed into high signal-to-noise (SNR) images that can be directly displayed as shades of gray or one of many varying color palettes on a computer monitor and printed on a continuous feed thermal printer. The data can also be stored in real-time onto a large capacity hard drive and archived onto a DVD.

FIGURE 4 PULSAR DOGITAL SIDESCAN SONAR SYSTEM

The recorder and data processing system included dual sweep facility. The system is capable of depicting the sonar images corrected for distortions due to tow fish height and vessel speed and at a scale, which clearly displays the resolution of the system. The width of the sea floor sonar image for each recording

channel not to be less than 10 cm. Image correcting system incorporated a continuous profile display of tow fish height as part of the display format.

The sonar data processing unit was interfaced to the survey computer to accept the following: -

a) Fix mark and identifiers generated synchronously with the logging of position data.
b) Smoothed vessel speed data.

Sufficient tow cable lengths were provided to permit towing of the sonar fish at a maximum height above seabed of 10% of the range selected, in all parts of the survey area. The available cable length was normally expected to exceed three times the maximum expected water depth in the survey area.

All tow cables were measured and marked at regular intervals for lay back determination. The Sidescan sonar sensor design towing characteristics, cable and vessel tow point was selected to ensure the towed fish is adequately decoupled from any vessel pitching and rolling motion.

All sonar data and associated fix mark and fix number information were stored, permanently, on an electronic medium.

The survey lines were run with a range setting of 100 meters either side at a scanning frequency of 100 KHz along the survey lines. The tow system was operated following recommended manufacturers procedures. The maximum towing speed did not exceed 5-6 kmph (3 knots). The records obtained by means of this equipment were suitable to form a complete morphological map of areas investigated. The tow fish towed astern of the survey vessel at a depth providing optimum seabed return. Layback and cable-out was logged from each survey line.

Total layback was applied during subsequent interpretation, accuracy. Event marks, corresponding to position fixes, regularly generated automatically by the navigation computer and passed on to the Sidescan sonar system. Records were clearly annotated and cross checked. The Sidescan sonar digital records reviewed to register any contacts during the survey. The layback of the towed fish was verified from reciprocal SSS lines over a well-defined contact with a constant layback.

Prior to acceptance of equipment, and at any other time requested by the Company Representative, the system was thoroughly tested. Verification tests include, but not be limited to: -

a) In water testing of the sonar tow fish and cable connectors.
b) Cross-talk evaluation by rub test.
c) Transducer output functionality tests.
d) Transducer sensitivity by reflection testing in air.
e) Interfacing verifications.

The Sidescan sonar digital records were reviewed to register any contacts during the survey. The lay back of the towed fish was verified from reciprocal SSS lines over a well-defined contact with a constant layback.

The offsets of the Sidescan sonar tow fish from Central Reference Point (GPS Antenna) on the survey vessel were recorded for the following:

- Layback : 7.8 m+ Cable out astern of the vessel
- Transverse offset: 2.0m (Starboard Side)
- Transducer depth: Variable

4.9 ACOUSTIC DOPPLER CURRENT PROFILER

An Acoustic Doppler Current Profiler (ADCP) is a hydro acoustic current meter similar to sonar to measure water current velocities over a depth range using the Doppler effect of sound waves scattered back from particles within the water column. ADCP contains piezoelectric oscillators to transmit and receive sound

signals. It consists of four transducers at its head. The traveling time of sound waves gives an estimate of the distance, the red or blue shift can be converted to a velocity.

Acoustic Doppler Current Profiler (ADCP) for measuring currents was deployed near cuddalore port, Nortek Signature 500 ADCP Current Meter was utilized to acquire the currents data. Current meter observations were carried out for a period of 15 days from 29th Aug to 13th Sep 2025 (then processed in the Nortek software/Ocean Counter). ADCP was installed on the seabed. ADCP frame on the seabed "Upward looking mode". A watch keeping boat was deployed during the current measurement for safeguard of ADCP.

Nortek's Signature 500 Acoustic Doppler Current Profiler (ADCP) with following specifications was used for carrying out the current and tidal measurements:

Frequency	:	600 kHz
Max Range	:	1 to 60 meters
Configuration	:	Self-contained or Direct Reading

FIGURE 5 NORTEK SIGNATURE 500 ACOUSTIC DOPPLER CURRENT PROFILER (ADCP)

4.10 WATER SAMPLING

Ten (10) water samples were collected at mid water depths at ten locations using Nansen Reversible water bottles in the survey corridor. The water samples are analyzed for their suspended load (ppm) and particle size distribution.

4.11 SOIL SAMPLING

A total (10) soil samples were collected at ten locations using grab sampler. Samples are laboratory tested for grain size distribution.

4.12 PRE-PLOTS / RUN-IN PLOTS

Survey lines were planned as discussed in the scope of work and pre-plots for the area were prepared prior to commencement of survey.

The pre-plots were run on the computer while doing the survey lines. Any deviation from the prefixed lines was flashed on the display along with the necessary course corrections to be made to adhere to the prefixed line. This enabled the Navigator to guide the vessel to the prefixed survey line all the times.

4.13 PROCESSING OF DATA

The survey data logged in Hypack file format was processed in Hypack software and finally presented in drawing using AutoCAD v.2016.

4.14 PROGRESS REPORT

While on location, survey Party Chief submitted daily progress report to Mahathi Infra Services representative and also conveyed the same to Geostar office in Navi Mumbai.

4.15 EVENT MARKS

The on-line computer system was interfaced for closure to the analogue traces on the survey vessel. Event marks corresponding to position fixes were generated automatically from the on-line navigation computer interface and passed to the analogue recorders at regular intervals across the ground.

5 IN FIELD CALIBRATIONS

The following calibrations / activities were conducted in field and prior to and during survey operations.

5.1 DGPS VERIFICATION

The positioning system was calibrated at Geostar office building established station at Navi Mumbai. The station is situated on the roof of the Geostar office building, Navi Mumbai. The DGPS system was placed on the specified station and the position was logged for duration of 5 hours & 30 minutes between 11:45Hrs and 17:15Hrs on 25th August 2025.

5.2 SINGLE BEAM ECHOSOUNDER CALIBRATION

Pre-mobilization Checks:

The echo sounder system was bench checked prior to mobilization. The outboard transducer pole was marked, from the base of the transducer shoe, at 0.1meter intervals (these marks will then be used to confirm transducer draft once the arrangements are deployed). The Bar Check checked to confirm the marks at regular one-meter intervals and that the marks are readily identifiable.

The Echo sounder was interfaced to the Navigation and Data Logging computer to confirm that the digitization of depths is operational.

Installation and Calibration:

The Echo sounder system was installed and operated in accordance with the manufacturer's instructions. Portable transducer was installed rigidly to a bracket at suitable location on the survey boat. The transducer shoe was sufficiently deep not to experience turbulence and aeration when the boat steams at survey speed. The depth of the transducer below water line was ascertained by reference to present marks on the pole.

Prior to commencing survey works, the Echo sounder was calibrated against a bar check. The procedure is to confirm the following constants:

Tx = To establish index error (combined effect of transducer depth and delays in the recorder)
Vp = To confirm velocity of propagation of sound in saline water.

With the vessel stationary in the water, the Bar was lowered to at least 2 m below the transducer and the nearest mark on the chain set at the water line. Once the transmission mark was set the apparent depth of the transducer was noted digitally and recorded in the deck log for future reference. Care was taken not to subsequently, inadvertently moves the transmission line. The Bar was then lowered at regular intervals to the maximum practical depth. The bar was allowed to settle at each depth. On recording the maximum obtainable depth, the bar was similarly stepped back to the surface. The digitized depth was to be checked during the Bar calibration.

5.3 SIDESCAN SONAR CALIBRATION

Prior to acceptance of SSS equipment, the system was thoroughly tested and following verification tests were carried out:

- In water testing of the sonar tow fish and cable connectors.
- Cross-talk evaluation by rub test.
- Transducer output functionality tests.
- Transducer sensitivity by reflection testing in air.
- Interfacing verifications.

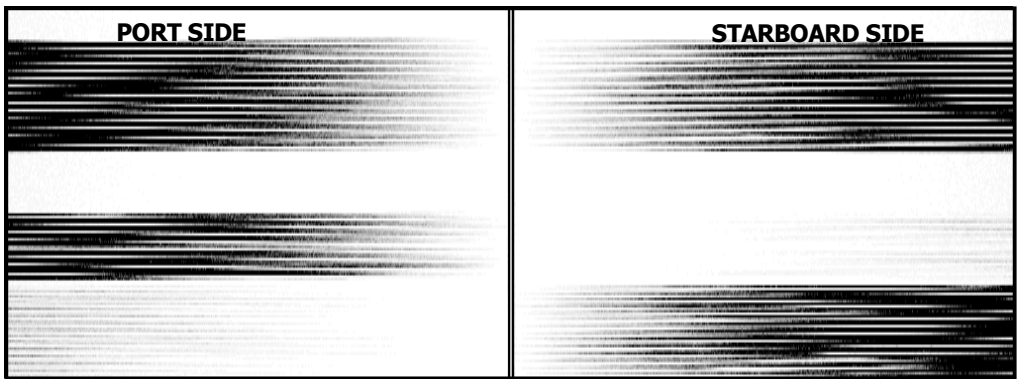


FIGURE 6 SIDESCAN SONAR CALIBRATION BY RUB TEST METHOD

Wherever possible the performance of the Sidescan Sonar system, in the area of operations, as part of mobilization acceptance trials, was verified using "known" seabed installations or features as test targets. Side Scan Sonar lay-back position calculation was verified with box-in survey of known seabed features prior to start of survey operation.

6 SURVEY EXECUTION

The following sections describe Geostar Surveys India Pvt. Ltd. approach to this project from award to the issue of Final Report.

Oceanographic survey was carried out between 29/08/2025 to 13/09/2025.

Bathymetry and geophysical survey work was carried out between 29/08/2025 to 07/09/2025.

- Longitudinal Lines were run perpendicular to the shore at an interval of 100m. DGPS, Single beam echosounder were deployed on these survey lines.
- Transverse Lines were run parallel to the shore at an interval of 1000m. DGPS, Single beam echosounder were deployed on these survey lines.
- The harbor area was surveyed with lines at interval of 50m.
- Automatic Tide Gauge was installed at Cuddalore Jetty for tidal observation at every 10min interval till the survey completion.

6.1 MOBILIZATION

The Project Manager liaised with operations staff, the client's representative and Party Chief to make the appropriate arrangements to mobilize the equipment & personnel on vessel. The port of mobilization and demobilization for all the phases of this project was Cuddalore port, Tamil Nadu and comprise only the boarding of client representatives with survey personnel and all other instrumentation having been previously mobilized onto the selected survey vessel.

All instrumentation was subject to in field tests which was carried out as follows:

- Satisfactory installation of the DGPS system and computation routines.
- Single Beam Echosounder Calibration
- Sub Bottom Profiler Calibration
- SSS sonar check [Rub Test]

Upon satisfactory completion of in jetty testing, the selected vessel proceeded to the initial work area. Upon arrival on site, survey sensors were deployed and acceptance tests were performed as required, in order to complete mobilization.

6.2 INSPECTION ACTIVITIES

Following completion of all offshore equipment calibration inspection activities were commenced and preceded in accordance with the project schedule.

6.3 SURVEY OPERATIONS

Mahathi Infra Services Pvt Ltd representative, in liaison with GSIPL's Party Chief/Geophysicist were determined and work out the actual survey program in accordance with Mahathi Infra Services Pvt Ltd specifications.

In order to advise the onboard Mahathi Infra Services Pvt Ltd representative intends to perform preliminary data interpretation. This preliminary interpretation/reporting was supervised and carried out on board by the Party Chief, geophysicist and survey engineer to assess any potential hazards within each surveyed area. Preliminary recommendations to that effect were given to Mahathi Infra Services Pvt Ltd representative on-board. All preliminary reporting was based on data acquired up to the time of reporting.

Upon the completion of all required works, the vessel was returned to the Port of mobilization for outward clearance and demobilization. All data was loaded and transported to GSIPL's office in Mumbai for final processing / reporting.

6.3.1 Bathymetry & Geophysical Survey

- Longitudinal Lines were run perpendicular to the shore at an interval of 100m. DGPS, Single beam echosounder, Sidescan Sonar & Sub bottom profiler were deployed on these survey lines.
- Transverse Lines were run parallel to the shore at an interval of 1000m. DGPS, Single beam echosounder, Sidescan Sonar & Sub bottom profiler were deployed on these survey lines.
- The inner river section was surveyed with long lines at interval of 50m & cross lines at 100m interval.
- Additional bathymetry survey lines of 50m were run in the approaches channel area.
- Automatic Tide Gauge (ATG) was setup at a location at Cuddalore jetty during the bathymetry survey operation.
- Current & wave measurements was carried out by deploying Nortek Signature 500 Acoustic Doppler Current Profiler (ADCP) at 01 location as per scope of work for 15 days duration.
- Bed sediment sampling to be carried out at Ten (10) locations in the vicinity of the project site using soil grab sampler. Samples to be laboratory tested for grain size distribution in the creek area.
- Ten (10nos) Water samples were collected by deploying Nansen Reversible water bottles.

6.4 SAFETY

Safety was observed on the vessel while carrying out the surveys according to Geostar's HSE plan submitted along with the survey procedures.

6.5 DATA QUALITY CONTROL

Geostar Surveys India Pvt Ltd. has fully documented Quality Assurance and Health, Safety and Environmental System procedures. Following procedures:

- Offshore Data Acquisition Procedure
- Quality Records Procedure

The experienced survey personnel provided by Geostar Surveys constantly monitored data quality as the survey progressed. A log sheet of all profiles was maintained and quality of data noted.

7 REPORTING

7.1 OFFSHORE REPORT

A high level of positive quality control was maintained throughout the project. Procedures detailed in the QMS ensure the required necessary high level of QC awareness in all personnel.

All survey data and information obtained by Contractor during the course of the survey was reported to the MAHATHI 's representative(s) progressively and/or at regular intervals. All records and daily logs of all operations, observations and measurements shall be readily available to Mahathi's upon completion of processing (on-site or in the office).

7.2 DATA PROCESSING AND INTERPRETATION

All required final data (digitally acquired or otherwise) processing, interpretation and reporting was carried out in GSIPL facility at Mumbai. Post plot positioning map(s) was done via GSIPL's integrated software/plotting system, operating on work-stations and HP Drafting A-0 sized Plotters.

Reporting

Reporting format and schedules was in accordance to Mahathi's specifications, as well as those outlined by Contractor, in their estimate of the work schedules contained in the 'Project Schedule' of this Proposal.

Final report

This final survey report includes any comments on the draft final report made by the owner and submitted immediately after receiving the comments to the draft report.

1. Instrument calibration details
2. Description of survey methods, procedure, equipment and instrument calibration data.
3. Bathymetric chart on a scale of 1:10000 & 1:5000.
4. Observed Tidal readings & graphs
5. Identification of shallow soft sediment/gas pockets, bed rock etc
6. Identification of any subsea obstructions and/or seafloor instability.
7. Presence of any metallic objects/or debris on the sea floor
8. Isopach, scale of 1:10000.
9. Photographic copies of raw survey recordings identifying features of interest such as subsea obstructions etc. and bathymetric and sub bottom discontinuities from the echo sounder and side scan sonar.

8 DETAILED RESULTS

8.1 HORIZONTAL CONTROL

Position for the vessel during the survey was provided from DGPS hemisphere combined beacon receiver system. Differential correction signals were received on-board during survey operations continuously from the nearest DGPS beacon reference station (DGLL station) setup close to the survey area. An integrated GPS/Beacon receiver with built-in antenna provided GPS differential corrections in NMEA-0183 format for navigation with high degree of accuracy.

The positioning data received have high reliability and integrity. The positioning system was verified at known location at Geostar surveys office building prior to mobilization in the field. (Refer 'Appendix C' for DGPS verification result).

8.2 VERTICAL CONTROL

Automatic Tide Gauge (ATG) was setup at Cuddalore port Jetty. The bench mark IBM-4 was shifted to ATG installation location. The zero of the ATG sensor was leveled with respect to the known GSIPL Temporary Bench Mark (TBM-7) at Cuddalore port Jetty. The value of the GSIPL TBM-7 is 4.79m above the Chart Datum (CD). The zero of the tide gauge was 0.1 meters below the Chart Datum (CD) and appropriate corrections were applied to the observed tide data.

Tidal observations were recorded at every 10 minutes interval and used to reduce the raw water depth measurements to Chart Datum (CD). (Refer Appendix 'E' for Tide readings and graphs).

8.3 BATHYMETRY

The following text should be read in conjunction with drawing no: -

a) J038_25/MIS/CUDDALORE/BATHY/2025/01/2433
b) J038_25/MIS/CUDDALORE/BATHY/2025/02/2434

The bathymetric data presented in the relevant charts and sections below refers to depth in meters and decimeters, measured with respect to the Chart Datum (CD). Observed tide for Cuddalore Port was used for reducing the raw water depths to Chart Datum (CD). The Contours are drawn at 2m interval for clear representation.

The surveyed corridor's bathymetric profile generally represents a gentle slope from West to East in the survey corridor. Water depths in the corridor ranges from a minimum of 1.9 meters to a maximum of 19.6 meters below the Chart Datum (CD).

Approaches Area:

Bathymetry from Northing 1298000 to Northing 1296000:

Bathymetry represent gentle slope from west to east in the survey corridor. The maximum water depth of 16.4m is observed in the eastern part of survey area. Minimum water depth is 6.2m is observed in the western part of survey area.

Bathymetry from Northing 1296000 to Northing 1294000:

Bathymetry represent gentle slope from west to east in the survey corridor. The maximum water depth of 17.9m is observed in the eastern part of survey area. Minimum water depth is 1.9m is observed near the river mouth in the western part of survey area.

Bathymetry from Northing 1294000 to Northing 1292000:

Bathymetry represent gentle slope from west to east in the survey corridor. The maximum water depth of 19.6m is observed in the eastern part of survey area. Minimum water depth is 2.7m is observed in the western part of survey area.

Harbour area:

Bathymetry represents deeper section towards the center of the river. Maximum water depth is 9.2m in the southern portion jetty. Minimum water depth of 0.1m is recorded near the shore. Drying heights were also recorded in the northern shore of the Harbour area. Maximum drying height -0.5m was recorded near the shoreline. Water depth near the jetty is vary between 8.3m & 9.2m.

Ship wreck was recorded in the Approaches area & minimum water depth was recorded 6.2m over the wreck

8.4 SEABED FEATURES

The following text should be read in conjunction with the following Drawing Nos.:

a) J038_2025/MIS/CUDDALORE/SBF/2025/01/2435
b) Annotated data examples placed at Appendix "F"

In general, Side scan sonar reveals a seabed of varying reflectivity to 100 KHz frequency in Harbour area and approaches area within the survey corridor, which can be broadly categorized as follows:

Type 1 : Low Reflective Sediments (Fine to medium silty sand)
Type 2 : Medium to High reflective compact sediments (Stiff Clayey Sand)
Type 3 : Scattered gravel bed

- Type 1 Sediments (Low Reflective Sediments /Fine to medium silty sand): These low to medium reflective sediments were observed predominantly throughout the survey corridor. These areas are interpreted as fine to medium silty sand.

- Type 2 Medium to High reflective compact sediments (Interpreted as stiff clayey sand on Type 1 Sediments): These were observed with moderate to high mottled reflectivity at north west, north east, south west and central part of the approaches area within the survey corridor.

- Type 3 Sediments (Scattered gravel bed on Type 1 sediments): These were observed predominantly across various sections of the approaches area, including North and West part of the approaches area within the survey corridor.

Drag Marks:

- Linear Drag Marks: Occasional linear drag marks were recorded in both harbour and approaches area. In Harbour area, the drag marks were recorded near South Jetty (Cuddalore New port) and in approaches area, the drag marks were recorded at southern part. i.e., within the survey corridor. These can be attributed to anchor drag marks due to fishing activity.

Sand Ripples:

- The sand ripples (wave like seabed feature) on seabed recorded in the side scan sonar data, formed by the action of ocean currents or wave-induced water movement, indicating sediment transport in the survey area.

- These sand ripples were recorded in the North West and North East part of the approaches area within the survey corridor.

Sonar Contacts:

- Sonar contacts on seabed are typically referring to sonar detections or echoes that indicate the presence of objects or anomalies on the seafloor. These contacts can be anything from natural formations to man-made objects or obstructions.

- Three (3nos.) of sonar contacts were recorded in the approaches area within the survey corridor. Table 7 represents the sonar contact center coordinates.

SONAR CONTACT LOCATION COORDINATES					
WGS 84, ZONE 44, CM 81					
Sonar contact ID	UTM CO-ORDINATES		GEOGRAPHICAL CO-ORDINATES		Dimensions (LxB) in m
	Easting(m)	Northing(m)	Latitude (N)	Longitude (E)	
SC-01	367979.5631 E	1293076.3829 N	11° 41' 40.8858"	079° 47' 19.1944"	18.4 x 6.8
SC-02	369969.1854 E	1294955.2577 N	11° 42' 42.3065"	079° 48' 24.6387"	10.5 x 2.6
Ship Wreck	368781.0855 E	1294785.514 N	11° 42' 36.6289"	079° 47' 45.425"	80.0 x 20.0

TABLE 5 SONAR CONTACT COORDINATES

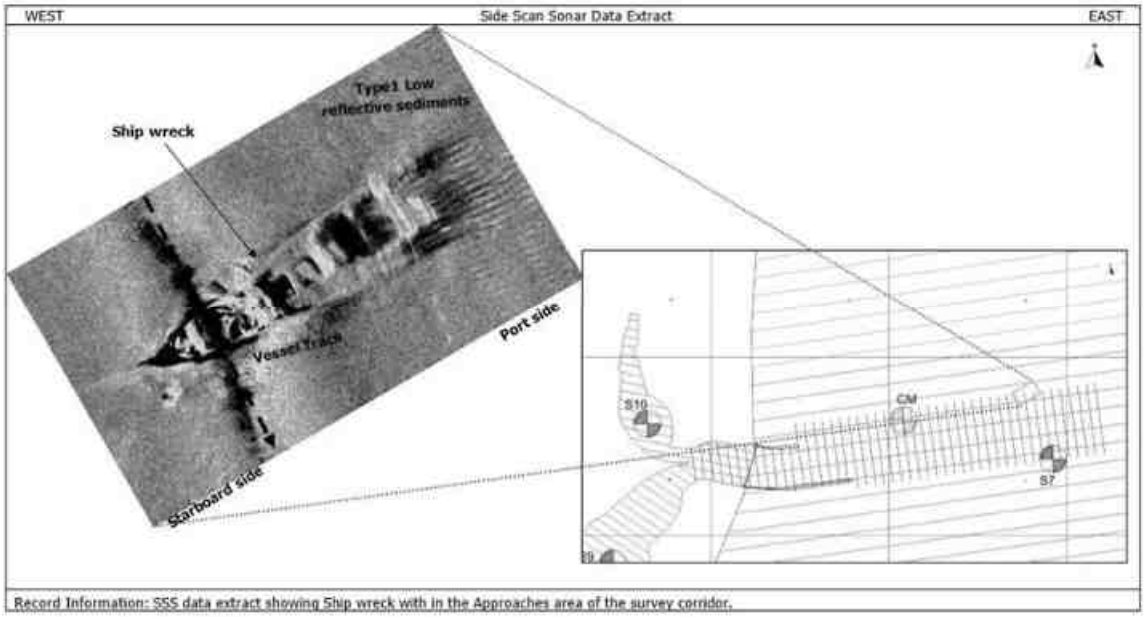


FIGURE 7 SIDESCAN SONAR EXTRACT SHOWING SHIP WRECK

Linear Contacts:

- A linear contact in side scan sonar data recorded on harbour area and approaches area is defined as a narrow, elongated sonar return that appears as a continuous or segmented lines, indicating the presence of a distinct linear object or feature on or just above the sediment surface.

- Seven (7Nos) of linear contacts were recorded in both the harbor and approaches area. Table 8 represents the center location of the linear contacts.

LINEAR CONTACT CENTER LOCATION CO-ORDINATES				
DATUM WGS 84, CM 81°, ZONE 44				
ID	UTM CO-ORDINATES		GEOGRAPHICAL CO-ORDINATES	
	Easting (m)	Northing (m)	Latitude	Longitude
LC-1	366571.83	1294118.09	11°42.42325′ N	079°46.54522′ E
LC-2	366599.35	1294210.27	11°42.29332′ N	079°46.55748′ E
LC-3	366738.76	1294310.24	11°42.34788′ N	079°46.63398′ E
LC-4	366823.60	1294293.73	11°42.33912′ N	079°46.68072′ E
LC-5	366862.58	1294356.10	11°42.37305′ N	079°46.70203′ E
LC-6	367362.00	1294324.92	11°42.35730′ N	079°46.97701′ E
LC-7	370013.38	1294950.72	11°42.70294′ N	079°48.43503′ E

TABLE 6 LINEAR CONTACT CENTER LOCATION CO-ORDINATES

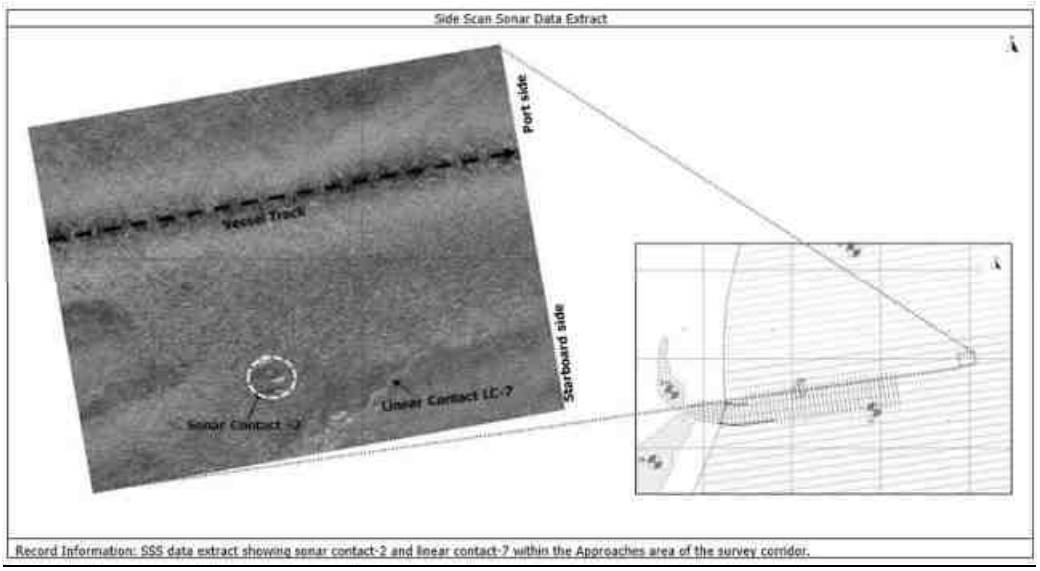


FIGURE 8 SIDESCAN SONAR EXTRACT SHOWING SONAR CONTACT AND LINEAR CONTACT

FIGURE 9 SSS IMAGE SUPERIMPOSED ON GOOGLE EARTH SHOWING JETTY

8.5 SHALLOW STRATIGRAPHY

The following text should be read in conjunction with the following Drawing Nos.:

c) J038_2025/MIS/CUDDALORE/SBF/2025/01/2435
d) Annotated data examples placed at Appendix "F"

The shallow geological successions within the surveyed area can be differentiated into essentially two major units viz. Unit A and Unit B.

In the absence of any borehole information, all sedimentary properties defined below are based on assessment of the recorded acoustic characteristics of the material along with interpreted sedimentary structures. Additionally, appropriate reference to the echo sounder also taken where necessary.

UNIT A – Fine to Medium Silty Sands

Unit A is the uppermost sediment layer and identified occurring all over within the survey corridor. This unit is identified as transparent with low acoustic impedance to the seismic energies and base of this unit undulates within survey corridor.

Approaches Area: Unit-A layer thickness varies between 0.6 meters to 5.4 meters.
Harbor Area: Unit-A layer thickness varies between 0.8 meters to 2.6 meters.

However, internal reflection configuration is neither uniform nor present everywhere within the survey corridor.

Throughout most of the survey area, the seabed exhibits sand ripples and beneath these, well-defined internal reflectors composed of mixture of sands and silts observed at varying depths.

UNIT B – Compact Silty Sands

This unit occurs directly below the Unit A sediments exhibiting high acoustic impedance to the seismic energies, thus inhibiting the further penetration of the acoustic signals and it is interpreted as compact silty sands. This unit was recorded all along the survey area corridor.

It is interpreted as indurated sediments, composed of stiff silty sand. The faint internal reflections within these sediments are likely due to variations in stiffness, sediment composition (sand and silt), and increasing density with depth. This subsurface unit is recorded to the maximum depth of acoustic signal penetration.

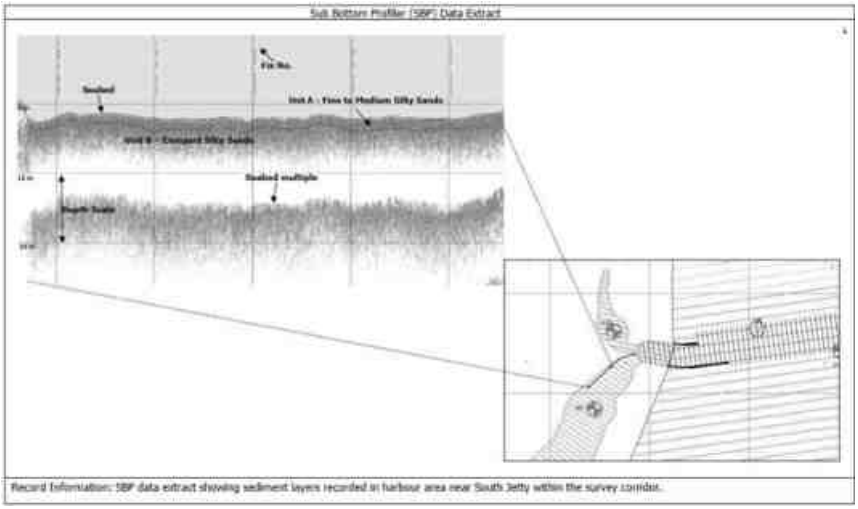


FIGURE 10 SBP DATA EXTRACT SHOWING UNIT-A, UNIT-B AND SEABED

Apart from the above, no other significant features or anomalies associated with existing cables or existing pipelines or with shallow gas were evident from the records within the survey corridor, which could be hazardous to the marine construction activities.

8.6 WATER SAMPLE ANALYSIS

Water samples were collected by deploying Nansen Reversible Water Bottles. Ten (10) water samples were taken at mid water depths at each of the ten different locations using Nansen Reversible water bottles in the survey corridor. (Refer **"Appendix G"** for Laboratory testing result)

FIGURE 11 NANSEN WATER SAMPLER AND COLLECTED WATER SAMPLES

Water samples were collected in plastic canes. Total ten (10) water samples were collected as per the scope of work. Samples were analyzed in laboratory for the parameters Suspended Load(ppm) and particle size distribution. (Refer **"Appendix G"** for Laboratory testing result of water samples).

The location co-ordinates of Water Samples are tabulated as below:

WATER AND SEABED SAMPLE LOCATION				
DATUM: WGS-84, CM-81°, Zone-44				
ID	UTM Co-ordinates (m)		Geographical Co-ordinates	
	Easting (m)	Northing (m)	LATITUDE	LONGITUDE
S-1	368692.82	1296226.08	11°43' 23.5065" N	073°47' 42.3066" E
S-2	371197.63	1296559.92	11°43' 34.718" N	073°49' 5.0" E
S-3	371380.69	1294949.39	11°42' 42.3204" N	073°49' 11.2627" E
S-4	371575.75	1293264.26	11°41' 47.4961" N	073°49' 17.9375" E
S-5	369077.89	1292967.97	11°41' 37.5096" N	073°47' 55.4832" E
S-6	367679.80	1292901.91	11°41' 35.1649" N	073°47' 9.3192" E
S-7	368922.84	1294427.62	11°42' 25.0" N	073°47' 50.1573" E
S-8	365924.94	1293074.74	11°41' 40.5435" N	073°46' 11.3387" E
S-9	366447.10	1293841.67	11°42' 5.5804" N	073°46' 28.4736" E
S-10	366640.00	1294625.87	11°42' 5.6076" N	073°46' 34.8445" E

TABLE 7 WATER AND SEABED SAMPLE COORDINATES

FIGURE 12 WATER AND SEABED SAMPLE LOCATIONS

8.7 SOIL SAMPLING

A total (10) soil samples are collected at ten locations, using grab sampler. Samples to be laboratory tested for grain size distribution in the creek area. (Refer **"Appendix G"** for Laboratory test results).

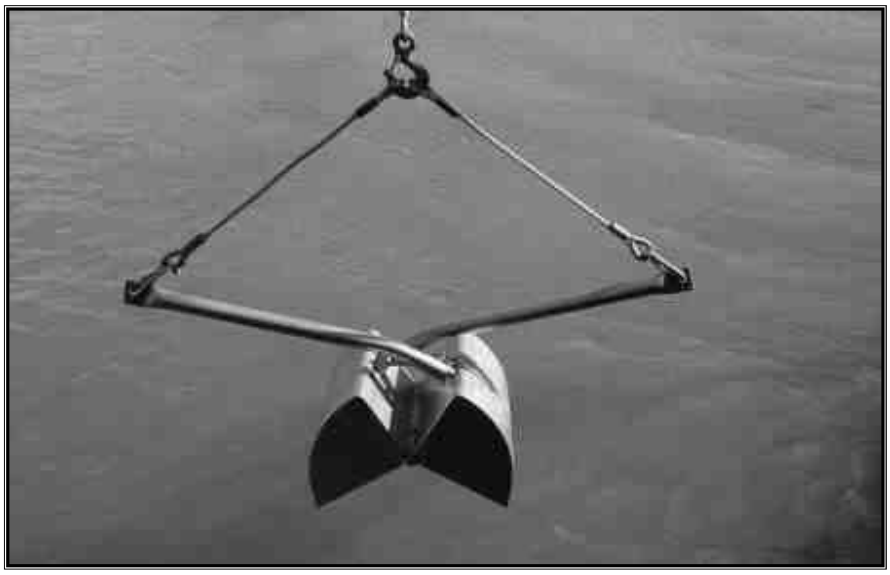


FIGURE 13 VAN VEEN GRAB SAMPLER

The Laboratory tests involved are as follows:

- Grain size distribution

From particle size distribution test performed on-shore laboratory, it is observed that majority of the soil samples, more than 95% of the sample consists of sand. (Refer **"Appendix G"** for Laboratory test results of grab soil samples).

APPENDIX A

CHRONOLOGICAL SUMMARY OF EVENTS

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD.	**Date:** 28-08-2025
Location: CUDDALORE PORT, OFF TAMIL NADU	**Sheet:** 01
Vessel: K.K.ARASAN-I	**Job No.:** JO38_2025
Job Description: BATHYMETRY & GEOPHYSICAL SURVEY	

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYA SAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	10:00	Standby at Accommodation.
10:00	11:00	Transit from accommodation to jetty.
11:00	12:00	Unloading of equipment from Tempo to jetty.
12:00	13:00	Loading of equipment from jetty to Vessel.
13:00	16:00	Mobilization of equipment carried out on the survey vessel.
16:00	17:30	Testing of equipment carried out, Verification done by client.
17:30	18:30	Transit from jetty to accommodation.
18:30	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks Certified for the works.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

CamScanner

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD.	**Date:** 29-08-2025
Location: CUDDALORE PORT, OFF TAMIL NADU	**Sheet:** 02
Vessel: K.K.ARASAN-I , R.GOPIKA	**Job No.:** JO38_2025
Job Description: BATHYMETRY & GEOPHYSICAL SURVEY	

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYA SAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	09:30	Standby at Accommodation.
09:30	10:30	Transit from accommodation to jetty.
10:30	11:00	Loading of equipment from Survey Vessel to ADCP Vessel.
11:00	13:00	Level Shifting done from Bench Mark to Berth. Tide Gauge deployment carried out.
13:00	13:30	Transit from jetty to proposed ADCP Deployment location.
13:30	14:00	Positioning on ADCP Deployment location. Verification of ADCP done.
14:00	14:30	Deployment of ADCP carried out at the location.
14:30	16:30	Bathymetry & Geophysical Survey carried out.
16:30	17:00	Transit from Survey location to jetty.
17:00	18:00	Transit from jetty to accommodation.
18:00	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks Certified for the Works.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

CamScanner

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD.	**Date:** 30-08-2025
Location: CUDDALORE PORT, OFF TAMIL NADU	**Sheet:** 03
Vessel: K.K.ARASAN-I , R.GOPIKA	**Job No.:** JO38_2025
Job Description: BATHYMETRY & GEOPHYSICAL SURVEY	

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYA SAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	07:30	Standby at Accommodation.
07:30	08:30	Transit from accommodation to jetty.
08:30	09:00	Transit from jetty to ADCP Deployment location.
09:00	11:00	Retrieval of Equipment for testing & redeployment at the location.
11:00	17:30	Bathymetry & Geophysical Survey carried out.
17:30	18:00	Transit from Survey location to jetty.
18:00	19:00	Transit from jetty to accommodation.
19:00	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks Certified for the Works.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

CamScanner

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD.	**Date:** 31-08-2025
Location: CUDDALORE PORT, OFF TAMIL NADU	**Sheet:** 04
Vessel: K.K.ARASAN-I , R.GOPIKA	**Job No.:** JO38_2025
Job Description: BATHYMETRY & GEOPHYSICAL SURVEY	

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYA SAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	07:00	Standby at Accommodation.
07:00	08:00	Transit from accommodation to jetty.
08:00	08:45	Transit from jetty to Survey Location.
08:45	17:45	Bathymetry & Side Sonar Survey carried out.
17:45	18:30	Transit from Survey location to jetty.
18:30	19:30	Transit from jetty to accommodation.
19:30	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks Certified for the works

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

CamScanner

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD.	**Date:** 01-09-2025
Location: CUDDALORE PORT, OFF TAMIL NADU	**Sheet:** 05
Vessel: K.K.ARASAN-I , R.GOPIKA	**Job No.:** JO38_2025
Job Description: BATHYMETRY & GEOPHYSICAL SURVEY	

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYA SAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	06:30	Standby at Accommodation.
06:30	07:30	Transit from accommodation to jetty.
07:30	08:00	Transit from jetty to Survey Location.
08:00	17:15	Bathymetry & Geophysical Survey carried out.
17:15	18:00	Transit from Survey location to jetty.
18:00	19:00	Transit from jetty to accommodation.
19:00	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks Certified for the works.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

CamScanner

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD.	**Date:** 02-09-2025
Location: CUDDALORE PORT, OFF TAMIL NADU	**Sheet:** 06
Vessel: K.K.ARASAN-I , R.GOPIKA	**Job No.:** JO38_2025
Job Description: BATHYMETRY & GEOPHYSICAL SURVEY	

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYA SAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	07:00	Standby at Accommodation.
07:00	08:00	Transit from accommodation to jetty.
08:00	08:45	Transit from jetty to Survey Location.
08:45	17:45	Bathymetry & Geophysical Survey carried out.
17:45	18:30	Transit from Survey location to jetty.
18:30	19:30	Transit from jetty to accommodation.
19:30	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks Certified for the works.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

CamScanner

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD.	**Date:** 03-09-2025
Location: CUDDALORE PORT, OFF TAMIL NADU	**Sheet:** 06
Vessel: K.K.ARASAN-I , R.GOPIKA	**Job No.:** JO38_2025
Job Description: BATHYMETRY & GEOPHYSICAL SURVEY	

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYA SAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	07:00	Standby at Accommodation.
07:00	08:00	Transit from accommodation to jetty.
08:00	08:45	Transit from jetty to Survey Location.
08:45	17:45	Bathymetry & Geophysical Survey carried out.
17:45	18:30	Transit from Survey location to jetty.
18:30	19:30	Transit from jetty to accommodation.
19:30	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks Certified for the works.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

CamScanner

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD.	**Date:** 04-09-2025
Location: CUDDALORE PORT, OFF TAMIL NADU	**Sheet:** 06
Vessel: K.K.ARASAN-I , R.GOPIKA	**Job No.:** JO38_2025
Job Description: BATHYMETRY & GEOPHYSICAL SURVEY	

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYA SAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	06:00	Standby at Accommodation.
06:00	07:00	Transit from accommodation to jetty.
07:00	07:45	Transit from jetty to Survey Location.
07:45	17:58	Bathymetry & Geophysical Survey carried out.
17:58	18:30	Transit from Survey location to jetty.
18:30	19:30	Transit from jetty to accommodation.
19:30	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks Certified for the works.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

CamScanner

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

05-09-2025

Client: MAHATHI INFRA SERVICES PVT. LTD.	**Date:** ~~04-09-2025~~
Location: CUDDALORE PORT, OFF TAMIL NADU	**Sheet:** 06
Vessel: K.K.ARASAN-I , R.GOPIKA	**Job No.:** JO38_2025
Job Description: BATHYMETRY & GEOPHYSICAL SURVEY	

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYA SAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	06:00	Standby at Accommodation.
06:00	07:00	Transit from accommodation to jetty.
07:00	07:45	Transit from jetty to Survey Location.
07:45	16:58	Bathymetry & Geophysical Survey carried out and sample collection of soil and water.
16:58	17:30	Transit from Survey location to jetty.
17:30	18:30	Transit from jetty to accommodation.
19:30	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks Ceodified for the works.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

CamScanner

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client:MAHATHI INFRA SERVICES PVT. LTD.**Date:**06-09-2025

Location:CUDDALORE PORT, OFF TAMIL NADU**Sheet:** 10

Vessel:K.K.ARASAN-I , R.GOPIKA **Job No.:** JO38_2025

Job Description: BATHYMETRY & GEOPHYSICAL SURVEY

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYASAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	07:00	Standby at Accommodation.
07:00	08:00	Transit from accommodation to jetty.
08:00	08:15	Transit from jetty to Survey Location.
08:15	14:18	Bathymetry carried out.
14:18	14:30	Transit from Survey location to jetty.
14:30	15:30	Transit from jetty to accommodation.
15:30	23:59	Standby at accommodation.

Geostar Remarks:

Client's Remarks: Certified for the works.

GEOSTAR SURVEYS PARTY CHIEF **CLIENT REP.**

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client:MAHATHI INFRA SERVICES PVT. LTD.**Date:**07-09-2025

Location:CUDDALORE PORT, OFF TAMIL NADU**Sheet:** 11

Vessel:K.K.ARASAN-I , R.GOPIKA **Job No.:** JO38_2025

Job Description: BATHYMETRY & GEOPHYSICAL SURVEY

Personnel:		**Equipment:**	
DHIRAJ GHARAT	PARTY CHIEF	HEMISPHERE ATLAS DGPS	LAPTOP
THIREN PATEL	SURVEY ENGINEER	TELLEDYNE E20 ECHOTRAC	VOLTAGE STABILIZER
ABHIJITH SUDAN	SURVEYOR	GEOPULSE SUB-BOTTOM PROFILER	NORTEK ADCP CURRENT PROFILER
T. CHAITANYASAI	GEOPHYSICIST	EDGETECH SIDE SCAN SONAR SYSTEM	SONARWIZ

Time (Hrs)		**Activity**
From	**To**	
00:00	06:15	Standby at Accommodation.
06:15	07:15	Transit from accommodation to jetty.
07:15	07:30	Transit from jetty to Survey Location.
07:30	09:50	Bathymetry carried out.
09:50	10:05	Transit from Survey location to jetty.
10:05	13:10	Demobilization of equipment carried out on Survey Vessel
13:10	14:10	Transit from jetty to accommodation.
14:10	23:59	Standby at accommodation.
		Bathymetry, Seismic & Side Scan Sonar Survey completed as required by the Client.

Geostar Remarks:

Client's Remarks: Certified for the works.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client:MAHATHI INFRA SERVICES PVT. LTD. **Date:**08-09-2025

Location:CUDDALORE PORT, OFF TAMIL NADU **Sheet:** 12

Vessel:K.K.ARASAN-I , ~~R.GOPIKA~~ **Job No.:** JO38_2025

Job Description: BATHYMETRY & GEOPHYSICAL SURVEY

Personnel:		**Equipment:**	
ABHIJITH V SUDHAN	HYDROGRAPHIC SURVEYOR	NORTEK ADCP CURRENT PROFILER	LAPTOP

Time (Hrs)		**Activity**
From	**To**	
00:00	23:59	Oceanographic survey Carried out(ADCP)

Geostar Remarks:

Client's Remarks: Certified for the works & one boat was engaged.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client:MAHATHI INFRA SERVICES PVT. LTD.**Date:**09-09-2025

Location:CUDDALORE PORT, OFF TAMIL NADU**Sheet:** 13

Vessel:K.K.ARASAN-I , ~~R.GOPIKA~~ **Job No.:** JO38_2025

Job Description: BATHYMETRY & GEOPHYSICAL SURVEY

Personnel:		**Equipment:**	
ABHIJITH V SUDHAN	HYDROGRAPHIC SURVEYOR	NORTEK ADCP CURRENT PROFILER	LAPTOP

Time (Hrs)		**Activity**
From	**To**	
00:00	23:59	Oceanographic survey Carried out (ADCP)

Geostar Remarks:

Client's Remarks: Certified for the works & One boat was engaged.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD. **Date:** 10-09-2025

Location: CUDDALORE PORT, OFF TAMIL NADU **Sheet:** 14

Vessel: K.K.ARASAN-I , ~~R.GOPIKA~~ **Job No.:** JO38_2025

Job Description: BATHYMETRY & GEOPHYSICAL SURVEY

Personnel:		**Equipment:**	
ABHIJITH V SUDHAN	HYDROGRAPHIC SURVEYOR	NORTEK ADCP CURRENT PROFILER	LAPTOP

Time (Hrs)		**Activity**
From	**To**	
00:00	23:59	Oceanographic survey Carried out (ADCP)

Geostar Remarks:

Client's Remarks: Certified for the works & one boat was engaged.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client:MAHATHI INFRA SERVICES PVT. LTD.**Date:**11-09-2025

Location:CUDDALORE PORT, OFF TAMIL NADU**Sheet:** 15

Vessel:K.K.ARASAN-I , ~~R.GOPIKA~~ **Job No.:** JO38_2025

Job Description: BATHYMETRY & GEOPHYSICAL SURVEY

Personnel:		**Equipment:**	
ABHIJITH V SUDHAN	HYDROGRAPHIC SURVEYOR	NORTEK ADCP CURRENT PROFILER	LAPTOP

Time (Hrs)		**Activity**
From	**To**	
00:00	23:59	Oceanographic survey Carried out (ADCP)

Geostar Remarks:

Client's Remarks: Certified for the works & one boat was engaged.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD. **Date:** 12-09-2025

Location: CUDDALORE PORT, OFF TAMIL NADU **Sheet:** 16

Vessel: K.K.ARASAN-I , ~~R.GOPIK~~A **Job No.:** JO38_2025

Job Description: BATHYMETRY & GEOPHYSICAL SURVEY

Personnel:		**Equipment:**	
ABHIJITH V SUDHAN	HYDROGRAPHIC SURVEYOR	NORTEK ADCP CURRENT PROFILER	LAPTOP

Time (Hrs)		**Activity**
From	**To**	
00:00	23:59	Oceanographic survey Carried out (ADCP)

Geostar Remarks:

Client's Remarks: Certified for the works & one boat was engaged.

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

GEOSTAR SURVEYS INDIA PVT. LTD.

DAILY STATUS REPORT

Client: MAHATHI INFRA SERVICES PVT. LTD. **Date:** 13-09-2025

Location: CUDDALORE PORT, OFF TAMIL NADU **Sheet:** 16

Vessel: K.K.ARASAN-I , ~~R.GOPIKA~~ **Job No.:** JO38_2025

Job Description: BATHYMETRY & GEOPHYSICAL SURVEY

Personnel:		**Equipment:**	
ABHIJITH V SUDHAN	HYDROGRAPHIC SURVEYOR	NORTEK ADCP CURRENT PROFILER	LAPTOP

Time (Hrs)		**Activity**
From	**To**	
00:00	09:30	Standby at hotel accomodation
09:30	10:45	Transit from hotel accommodation to jetty
10:45	11:30	Transit from jetty to ADCP location
11:30	12:30	Take ADCP from location and data collected
12:30	13:45	Demobilisation ADCP from boat
13:45	14:45	Transit from Jetty to hotel accommodation
14:45	23:59	Stand by at accommodation

Geostar Remarks:

Client's Remarks: As per Geostar Surveyor all their Survey works are over & leave the site on 13/09/25 at 13:45

GEOSTAR SURVEYS PARTY CHIEF

CLIENT REP.

APPENDIX B

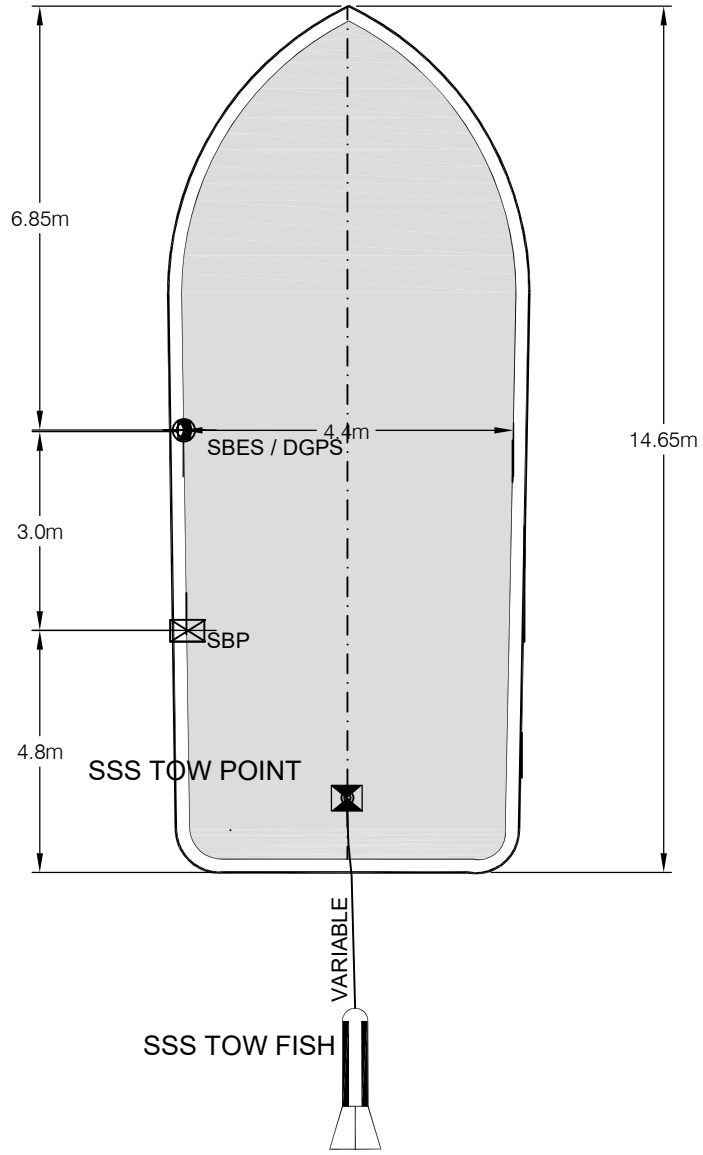
VESSEL OFFESTS

VESSEL OFFSET DIAGRAM

GEOSTAR SURVEYS INDIA PVT LTD.

JOB NO : J038_2025	DESCRIBED BY : GEOSTAR SURVEYS
CLIENT : MAHATHI INFRA SERVICES PVT LTD	SURVEY DATE : 29/08/2025 TO 07/09/2025
JOB TITLE : BATHYMETRY & GEOPHYSICAL SURVEY, AND OCEANOGRAPHIC STUDIES	REMARKS : GEOPHYSICAL SURVEY OCEANOGRAPHIC STUDIES
LOCATION : CUDDALORE, TAMIL NADU STATE, EAST COAST OF INDIA.	

VESSEL: MT KK ARASANI-1



LEGEND

- SBES TRANSDUCER
- DGPS
- SBP

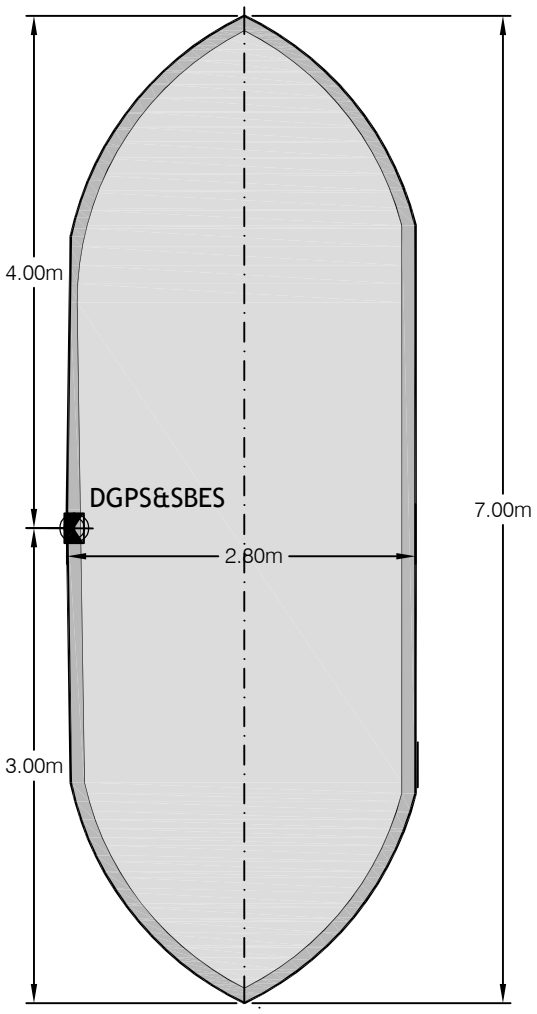
NOT TO SCALE

VESSEL OFFSET DIAGRAM

GEOSTAR SURVEYS INDIA PVT LTD.

JOB NO : J038_2025	DESCRIBED BY : GEOSTAR SURVEYS
CLIENT : MAHATHI INFRA SERVICES PVT LTD	SURVEY DATE : 29/08/2025 TO 07/09/2025
JOB TITLE : BATHYMETRY & GEOPHYSICAL SURVEY, AND OCEANOGRAPHIC STUDIES	REMARKS : GEOPHYSICAL SURVEY OCEANOGRAPHIC STUDIES
LOCATION : CUDDALORE, TAMIL NADU STATE, EAST COAST OF INDIA.	

VESSEL : MFB VENKATESHWARA



LEGEND

- SBES TRANSDUCER
- DGPS

NOT TO SCALE

APPENDIX C

DGPS CALIBRATION

Calibration of DGPS Positioning System at Geostar Office

The Hemisphere DGPS Positioning system was calibrated at Geostar office building established station known point at Navi Mumbai. The station is situated on the roof of the Geostar office building, Navi Mumbai. The DGPS system was placed on the specified station known location and the position was logged for duration of 5 hours & 30 minutes between 11:45 Hrs and 17:15Hrs on 25th Aug 2025. The observed co-ordinates were compared with the previous established station in the following table;

OBSERVED CO-ORDINATES AT GEOSTAR OFFICE STATION		
WGS 84, CM 75, ZONE 45, UTM CO-ORDINATES		
TIME	**EASTING(m)**	**NORTHING (m)**
11:45	290102.301	2110916.521
12:00	290102.221	2110916.112
12:15	290102.402	2110916.319
12:30	290102.224	2110916.229
12:45	290102.282	2110916.47
13:00	290102.414	2110916.557
13:15	290102.302	2110916.566
13:30	290102.462	2110916.658
13:45	290102.319	2110916.716
14:00	290102.245	2110916.816
14:15	290102.222	2110916.556
14:30	290102.435	2110916.242
14:45	290102.237	2110916.561
15:00	290102.266	2110916.790
15:15	290102.16	2110916.888
15:30	290102.553	2110916.249
15:45	290102.326	2110916.852
16:00	290102.251	2110916.721
16:15	290102.53	2110916.369
16:30	290102.359	2110916.258
16:45	290102.421	2110916.445
17:00	290102.260	2110916.571
17:15	290102.251	2110916.628
MEAN	**290102.323**	**2110916.526**

Comparison between observed co-ordinates and previous establish station of office building station is as below.

STATION: GEOSTAR OFFICE	**WGS 84, CM 75, Zone 45**	
	EASTING(m)	**NORTHING (m)**
OBSERVED CO-ORDINATES IN UTM	290102.323	2110916.526
OFFICE BUILDING STATION	290102.520	2110916.760
DIFFERENCE in UTM	**-0.197**	**-0.234**

APPENDIX D1

BENCH MARK DESCRIPTION

TEMPORARY BENCHMARK DETAILS

GEODETIC PARAMETERS		PROJECTION PARAMETERS	
Datum	WGS 84	Grid Projection	UTM
Semi-Major Axis (a)	6378 137.000m	Central Meridian (CM)	81.0° East (Zone 44)
Semi-Minor Axis (b)	6356752.314m	Origin Latitude (False Lat.)	00.0°
First Eccentricity Squared (e^2)	0.006694380	Hemisphere	North
Inverse Flattening (1/f)	298.257223563	False Easting (FE)	500000.0 m
Units	Meters	False Northing (FN)	0.0 m
		Scale Factor on CM	0.999600

BENCHMARK DETAILS		
BENCHMARK STATION	**CO-ORDINATES (UTM)**	
	Easting (m)	**Northing (m)**
IBM-4	366495.03 E	1294530.99 N
	CO-ORDINATES (GEOGRAPHICAL)	
Bench Mark Value:	**Latitude**	**Longitude**
3.266 above CD	11° 42' 28"N	79° 46' 30"E

Location and Access: Temporary Bench Mark (IBM-4) is located at near Cuddalore jetty, Tamil Nadu and can be approached by road. The value of TBM is 3.266 m with reference to CD.

APPENDIX D2

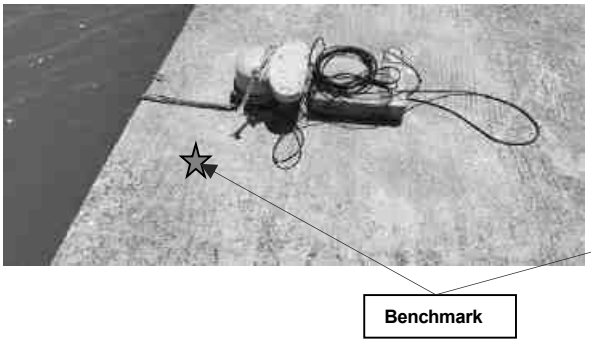
ATG LOCATION DETAILS

ATG LOCATION DESCRIPTION

GEODETIC PARAMETERS		PROJECTION PARAMETERS	
Datum	WGS 84	Grid Projection	UTM
Semi-Major Axis (a)	6378 137.000m	Central Meridian (CM)	81.0° East (Zone 44)
Semi-Minor Axis (b)	6356752.314m	Origin Latitude (False Lat.)	00.0°
First Eccentricity Squared (e^2)	0.006694380	Hemisphere	North
Inverse Flattening (1/f)	298.257223563	False Easting (FE)	500000.0 m
Units	Meters	False Northing (FN)	0.0 m
		Scale Factor on CM	0.999600

BENCHMARK DETAILS		
BENCHMARK STATION	**CO-ORDINATES (UTM)**	
GSIPL TBM-7	**Easting (m)**	**Northing (m)**
	366480.29 E	1294190.72 N
	CO-ORDINATES (GEOGRAPHICAL)	
Bench Mark Value: (4.79m above the chart datum)	**Latitude**	**Longitude**
	11°42'16.92"N	79°46'29.51"E

Location and Access: Temporary Bench Mark (TBM-7) is located at near Cuddalore jetty, Tamil Nadu and can be approached by road. The value of TBM-7 is 4.79 m with reference to CD.



APPENDIX D3

ATG INSTALLATION DIAGRAM

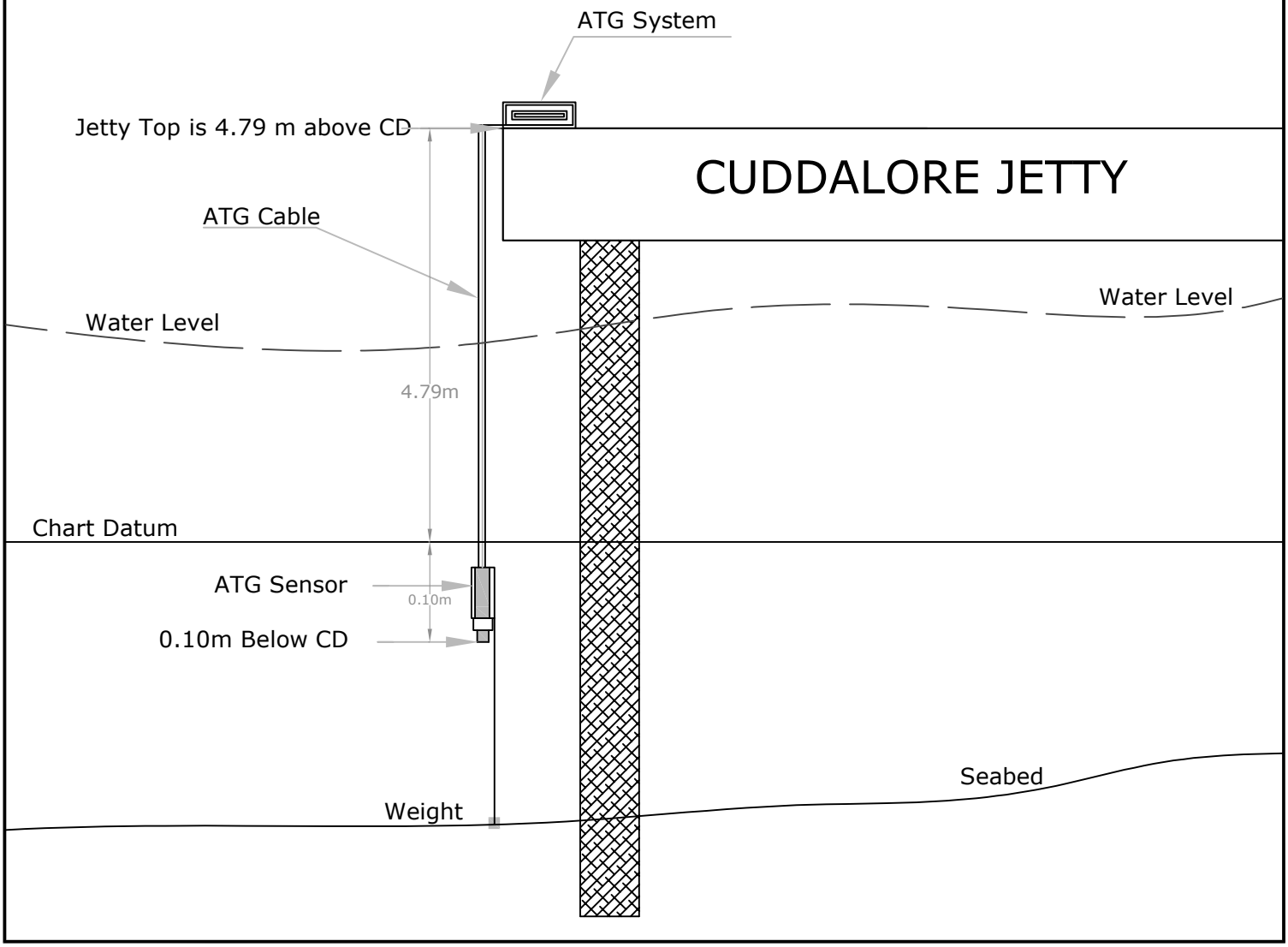
GEOSTAR SURVEYS INDIA PVT LTD.

AUTOMATIC TIDE GAUGE INSTALLATION DIAGRAM

JOB NO : JO38_2025 CLIENT : MAHATHI INFRA SERVICES PVT LTD. JOB TITLE : BATHYMETRY & GEOPHYSICAL SURVEYS LOCATION : CUDDALORE PORT, TAMIL NADU STATE, EAST COAST OF INDIA	DESCRIBED BY : GEOSTAR SURVEYS INDIA PVT. LTD. INSTALLATION DATE : 28/08/2025

NOT TO SCALE

AUTOMATIC TIDE GAUGE INSTALLATION DIAGRAM



APPENDIX E

OBSERVED TIDAL READINGS AND GRAPHS

28-08-2025	
Time	Tide
00:00	0.81
00:10	0.80
00:20	0.78
00:30	0.77
00:40	0.75
00:50	0.73
01:00	0.71
01:10	0.70
01:20	0.68
01:30	0.66
01:40	0.64
01:50	0.61
02:00	0.59
02:10	0.57
02:20	0.55
02:30	0.52
02:40	0.50
02:50	0.48
03:00	0.45
03:10	0.43
03:20	0.41
03:30	0.39
03:40	0.37
03:50	0.36

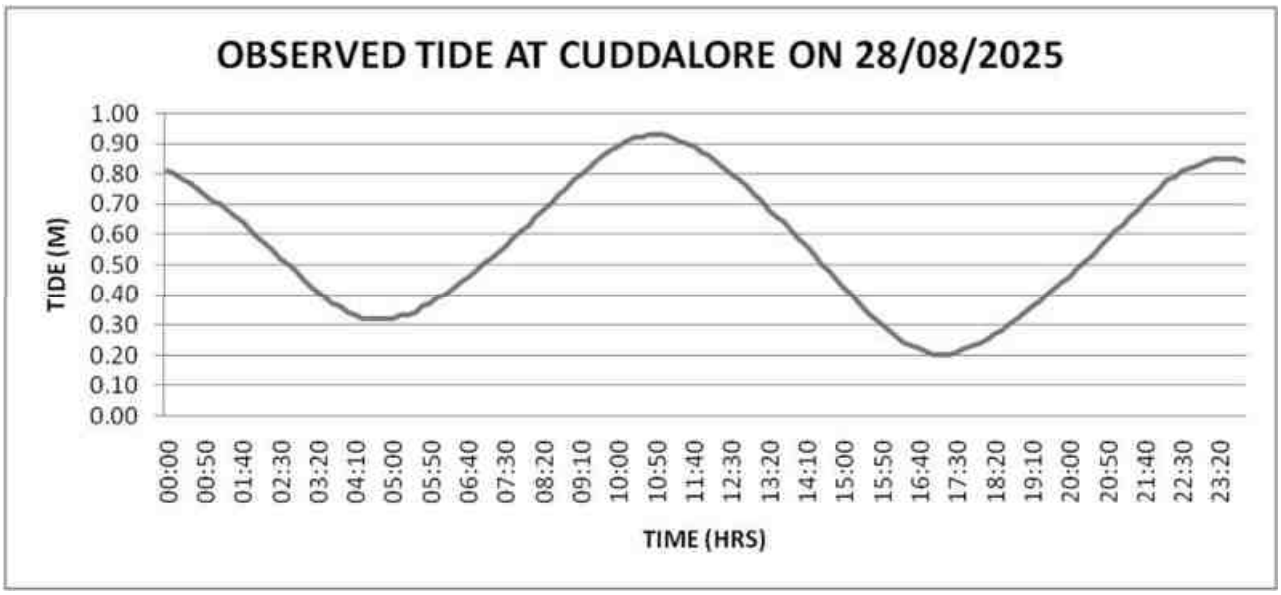
28-08-2025	
Time	Tide
04:00	0.34
04:10	0.33
04:20	0.32
04:30	0.32
04:40	0.32
04:50	0.32
05:00	0.32
05:10	0.33
05:20	0.33
05:30	0.34
05:40	0.36
05:50	0.37
06:00	0.39
06:10	0.40
06:20	0.42
06:30	0.44
06:40	0.46
06:50	0.48
07:00	0.50
07:10	0.52
07:20	0.54
07:30	0.56
07:40	0.59
07:50	0.61

28-08-2025	
Time	Tide
08:00	0.63
08:10	0.66
08:20	0.68
08:30	0.70
08:40	0.73
08:50	0.75
09:00	0.78
09:10	0.80
09:20	0.82
09:30	0.84
09:40	0.86
09:50	0.88
10:00	0.89
10:10	0.91
10:20	0.92
10:30	0.92
10:40	0.93
10:50	0.93
11:00	0.93
11:10	0.92
11:20	0.91
11:30	0.90
11:40	0.89
11:50	0.87

28-08-2025	
Time	Tide
12:00	0.86
12:10	0.84
12:20	0.82
12:30	0.80
12:40	0.78
12:50	0.76
13:00	0.73
13:10	0.71
13:20	0.68
13:30	0.66
13:40	0.64
13:50	0.61
14:00	0.58
14:10	0.56
14:20	0.53
14:30	0.50
14:40	0.48
14:50	0.45
15:00	0.42
15:10	0.40
15:20	0.37
15:30	0.34
15:40	0.32
15:50	0.30

28-08-2025	
Time	Tide
16:00	0.28
16:10	0.26
16:20	0.24
16:30	0.23
16:40	0.22
16:50	0.21
17:00	0.20
17:10	0.20
17:20	0.20
17:30	0.21
17:40	0.22
17:50	0.23
18:00	0.24
18:10	0.25
18:20	0.27
18:30	0.28
18:40	0.30
18:50	0.32
19:00	0.34
19:10	0.36
19:20	0.38
19:30	0.40
19:40	0.42
19:50	0.44

28-08-2025	
Time	Tide
20:00	0.46
20:10	0.49
20:20	0.51
20:30	0.53
20:40	0.56
20:50	0.58
21:00	0.61
21:10	0.63
21:20	0.66
21:30	0.68
21:40	0.71
21:50	0.73
22:00	0.75
22:10	0.78
22:20	0.79
22:30	0.81
22:40	0.82
22:50	0.83
23:00	0.84
23:10	0.85
23:20	0.85
23:30	0.85
23:40	0.85
23:50	0.84



29-08-2025	
Time	Tide
00:00	0.83
00:10	0.82
00:20	0.81
00:30	0.80
00:40	0.79
00:50	0.77
01:00	0.76
01:10	0.74
01:20	0.73
01:30	0.71
01:40	0.70
01:50	0.68
02:00	0.66
02:10	0.64
02:20	0.63
02:30	0.61
02:40	0.59
02:50	0.57
03:00	0.55
03:10	0.53
03:20	0.51
03:30	0.49
03:40	0.47
03:50	0.45

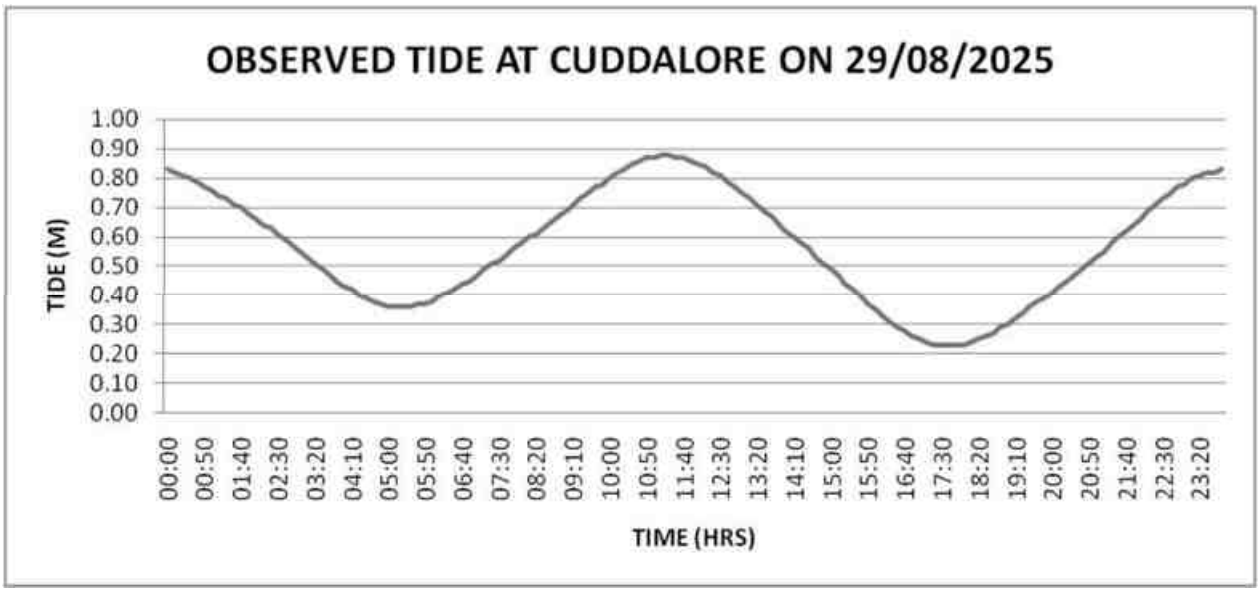
29-08-2025	
Time	Tide
04:00	0.43
04:10	0.42
04:20	0.40
04:30	0.39
04:40	0.38
04:50	0.37
05:00	0.36
05:10	0.36
05:20	0.36
05:30	0.36
05:40	0.37
05:50	0.37
06:00	0.38
06:10	0.40
06:20	0.41
06:30	0.42
06:40	0.44
06:50	0.45
07:00	0.47
07:10	0.49
07:20	0.51
07:30	0.52
07:40	0.54
07:50	0.56

29-08-2025	
Time	Tide
08:00	0.58
08:10	0.60
08:20	0.61
08:30	0.63
08:40	0.65
08:50	0.67
09:00	0.69
09:10	0.71
09:20	0.73
09:30	0.75
09:40	0.77
09:50	0.78
10:00	0.80
10:10	0.82
10:20	0.83
10:30	0.85
10:40	0.86
10:50	0.87
11:00	0.87
11:10	0.88
11:20	0.88
11:30	0.87
11:40	0.87
11:50	0.86

29-08-2025	
Time	Tide
12:00	0.85
12:10	0.84
12:20	0.82
12:30	0.81
12:40	0.79
12:50	0.77
13:00	0.75
13:10	0.73
13:20	0.71
13:30	0.69
13:40	0.67
13:50	0.64
14:00	0.62
14:10	0.60
14:20	0.58
14:30	0.56
14:40	0.53
14:50	0.51
15:00	0.49
15:10	0.47
15:20	0.44
15:30	0.42
15:40	0.40
15:50	0.37

29-08-2025	
Time	Tide
16:00	0.35
16:10	0.33
16:20	0.31
16:30	0.29
16:40	0.28
16:50	0.26
17:00	0.25
17:10	0.24
17:20	0.23
17:30	0.23
17:40	0.23
17:50	0.23
18:00	0.23
18:10	0.24
18:20	0.25
18:30	0.26
18:40	0.27
18:50	0.29
19:00	0.30
19:10	0.32
19:20	0.34
19:30	0.36
19:40	0.38
19:50	0.39

29-08-2025	
Time	Tide
20:00	0.41
20:10	0.43
20:20	0.45
20:30	0.47
20:40	0.49
20:50	0.51
21:00	0.53
21:10	0.55
21:20	0.58
21:30	0.60
21:40	0.62
21:50	0.64
22:00	0.66
22:10	0.69
22:20	0.71
22:30	0.73
22:40	0.75
22:50	0.77
23:00	0.78
23:10	0.80
23:20	0.81
23:30	0.82
23:40	0.82
23:50	0.83



30-08-2025	
Time	Tide
00:00	0.83
00:10	0.83
00:20	0.82
00:30	0.82
00:40	0.81
00:50	0.80
01:00	0.79
01:10	0.78
01:20	0.77
01:30	0.75
01:40	0.74
01:50	0.73
02:00	0.71
02:10	0.70
02:20	0.69
02:30	0.67
02:40	0.66
02:50	0.65
03:00	0.63
03:10	0.62
03:20	0.60
03:30	0.59
03:40	0.57
03:50	0.55

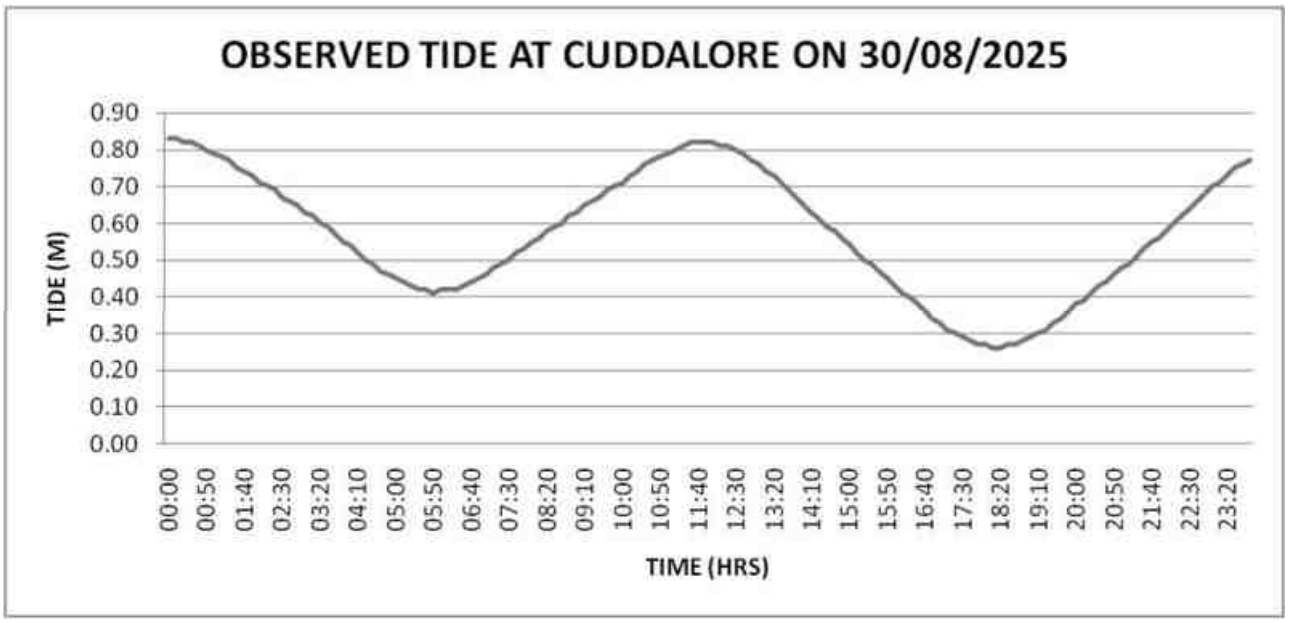
30-08-2025	
Time	Tide
04:00	0.54
04:10	0.52
04:20	0.50
04:30	0.49
04:40	0.47
04:50	0.46
05:00	0.45
05:10	0.44
05:20	0.43
05:30	0.42
05:40	0.42
05:50	0.41
06:00	0.42
06:10	0.42
06:20	0.42
06:30	0.43
06:40	0.44
06:50	0.45
07:00	0.46
07:10	0.48
07:20	0.49
07:30	0.50
07:40	0.52
07:50	0.53

30-08-2025	
Time	Tide
08:00	0.55
08:10	0.56
08:20	0.58
08:30	0.59
08:40	0.60
08:50	0.62
09:00	0.63
09:10	0.65
09:20	0.66
09:30	0.67
09:40	0.69
09:50	0.70
10:00	0.71
10:10	0.73
10:20	0.74
10:30	0.76
10:40	0.77
10:50	0.78
11:00	0.79
11:10	0.80
11:20	0.81
11:30	0.82
11:40	0.82
11:50	0.82

30-08-2025	
Time	Tide
12:00	0.82
12:10	0.81
12:20	0.81
12:30	0.80
12:40	0.79
12:50	0.77
13:00	0.76
13:10	0.74
13:20	0.73
13:30	0.71
13:40	0.69
13:50	0.67
14:00	0.65
14:10	0.63
14:20	0.61
14:30	0.59
14:40	0.58
14:50	0.56
15:00	0.54
15:10	0.52
15:20	0.50
15:30	0.49
15:40	0.47
15:50	0.45

30-08-2025	
Time	Tide
16:00	0.43
16:10	0.41
16:20	0.40
16:30	0.38
16:40	0.36
16:50	0.34
17:00	0.33
17:10	0.31
17:20	0.30
17:30	0.29
17:40	0.28
17:50	0.27
18:00	0.27
18:10	0.26
18:20	0.26
18:30	0.27
18:40	0.27
18:50	0.28
19:00	0.29
19:10	0.30
19:20	0.31
19:30	0.33
19:40	0.34
19:50	0.36

30-08-2025	
Time	Tide
20:00	0.38
20:10	0.39
20:20	0.41
20:30	0.43
20:40	0.44
20:50	0.46
21:00	0.48
21:10	0.49
21:20	0.51
21:30	0.53
21:40	0.55
21:50	0.56
22:00	0.58
22:10	0.60
22:20	0.62
22:30	0.64
22:40	0.66
22:50	0.68
23:00	0.70
23:10	0.71
23:20	0.73
23:30	0.75
23:40	0.76
23:50	0.77



31-08-2025	
Time	Tide
00:00	0.78
00:10	0.79
00:20	0.80
00:30	0.80
00:40	0.80
00:50	0.80
01:00	0.80
01:10	0.80
01:20	0.79
01:30	0.78
01:40	0.77
01:50	0.77
02:00	0.76
02:10	0.74
02:20	0.73
02:30	0.72
02:40	0.71
02:50	0.70
03:00	0.69
03:10	0.68
03:20	0.67
03:30	0.66
03:40	0.65
03:50	0.64

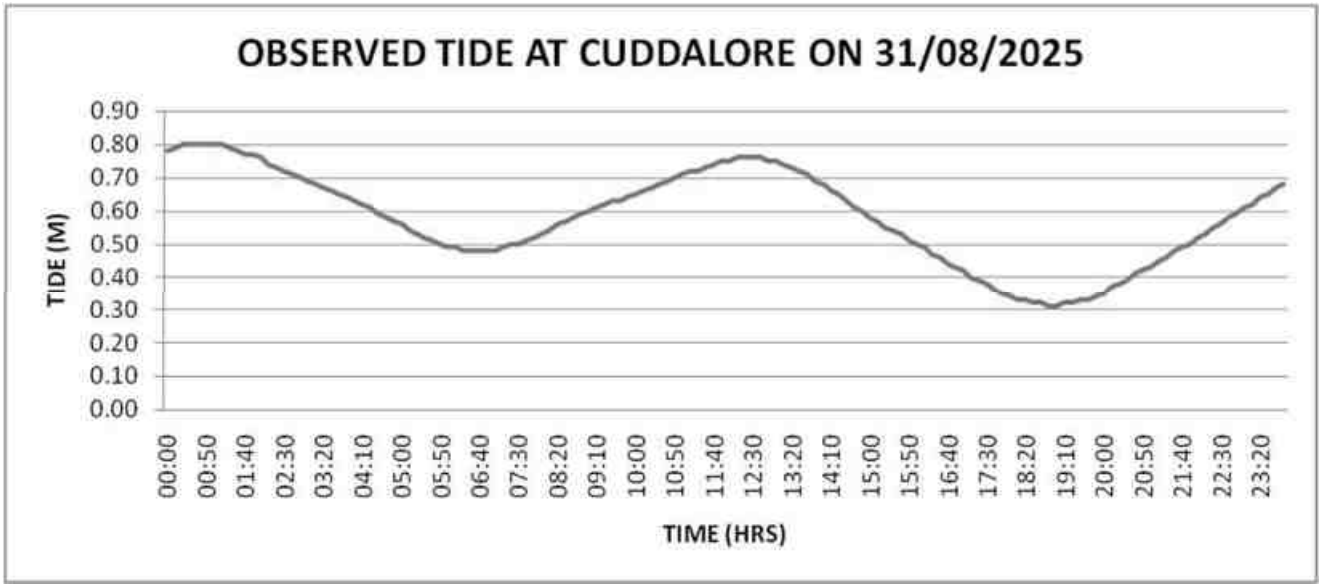
31-08-2025	
Time	Tide
04:00	0.63
04:10	0.62
04:20	0.61
04:30	0.59
04:40	0.58
04:50	0.57
05:00	0.56
05:10	0.54
05:20	0.53
05:30	0.52
05:40	0.51
05:50	0.50
06:00	0.49
06:10	0.49
06:20	0.48
06:30	0.48
06:40	0.48
06:50	0.48
07:00	0.48
07:10	0.49
07:20	0.50
07:30	0.50
07:40	0.51
07:50	0.52

31-08-2025	
Time	Tide
08:00	0.53
08:10	0.54
08:20	0.56
08:30	0.57
08:40	0.58
08:50	0.59
09:00	0.60
09:10	0.61
09:20	0.62
09:30	0.63
09:40	0.63
09:50	0.64
10:00	0.65
10:10	0.66
10:20	0.67
10:30	0.68
10:40	0.69
10:50	0.70
11:00	0.71
11:10	0.72
11:20	0.72
11:30	0.73
11:40	0.74
11:50	0.75

31-08-2025	
Time	Tide
12:00	0.75
12:10	0.76
12:20	0.76
12:30	0.76
12:40	0.76
12:50	0.75
13:00	0.75
13:10	0.74
13:20	0.73
13:30	0.72
13:40	0.71
13:50	0.69
14:00	0.68
14:10	0.66
14:20	0.65
14:30	0.63
14:40	0.61
14:50	0.60
15:00	0.58
15:10	0.57
15:20	0.55
15:30	0.54
15:40	0.53
15:50	0.51

31-08-2025	
Time	Tide
16:00	0.50
16:10	0.49
16:20	0.47
16:30	0.46
16:40	0.44
16:50	0.43
17:00	0.42
17:10	0.40
17:20	0.39
17:30	0.38
17:40	0.36
17:50	0.35
18:00	0.34
18:10	0.33
18:20	0.33
18:30	0.32
18:40	0.32
18:50	0.31
19:00	0.31
19:10	0.32
19:20	0.32
19:30	0.33
19:40	0.33
19:50	0.34

31-08-2025	
Time	Tide
20:00	0.35
20:10	0.37
20:20	0.38
20:30	0.39
20:40	0.41
20:50	0.42
21:00	0.43
21:10	0.45
21:20	0.46
21:30	0.48
21:40	0.49
21:50	0.50
22:00	0.52
22:10	0.53
22:20	0.55
22:30	0.56
22:40	0.58
22:50	0.59
23:00	0.61
23:10	0.62
23:20	0.64
23:30	0.65
23:40	0.67
23:50	0.68



01-09-2025	
Time	Tide
00:00	0.70
00:10	0.71
00:20	0.73
00:30	0.74
00:40	0.75
00:50	0.76
01:00	0.77
01:10	0.77
01:20	0.78
01:30	0.78
01:40	0.78
01:50	0.78
02:00	0.78
02:10	0.77
02:20	0.77
02:30	0.76
02:40	0.76
02:50	0.75
03:00	0.74
03:10	0.74
03:20	0.73
03:30	0.72
03:40	0.72
03:50	0.71

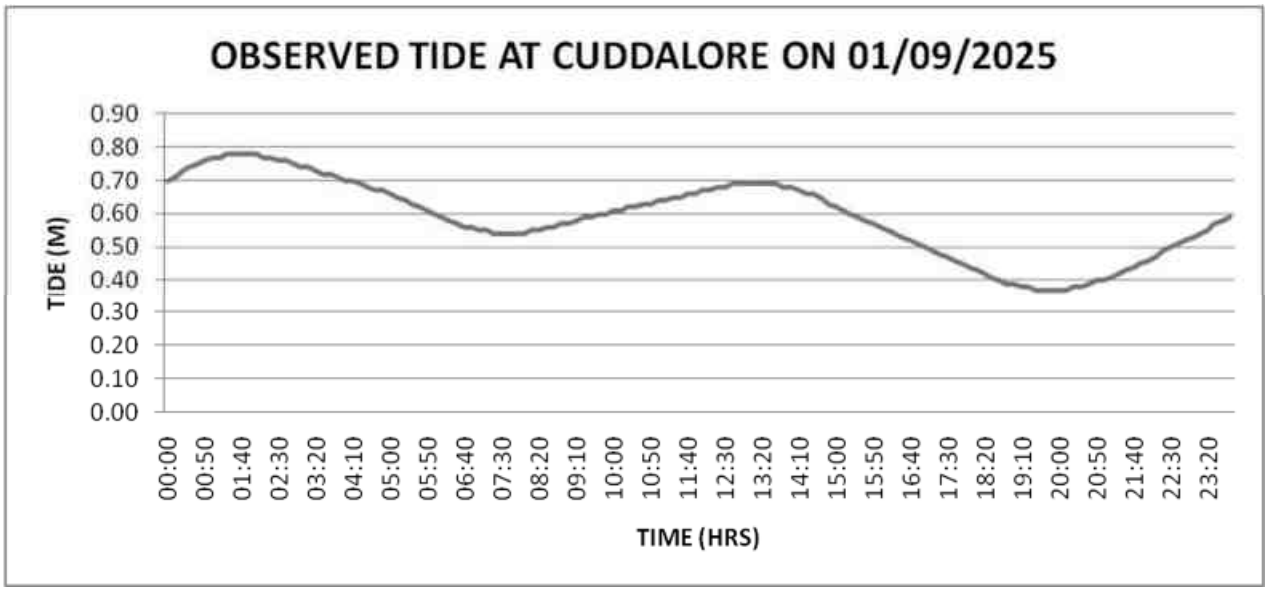
01-09-2025	
Time	Tide
04:00	0.70
04:10	0.70
04:20	0.69
04:30	0.68
04:40	0.67
04:50	0.67
05:00	0.66
05:10	0.65
05:20	0.64
05:30	0.63
05:40	0.62
05:50	0.61
06:00	0.60
06:10	0.59
06:20	0.58
06:30	0.57
06:40	0.56
06:50	0.56
07:00	0.55
07:10	0.55
07:20	0.54
07:30	0.54
07:40	0.54
07:50	0.54

01-09-2025	
Time	Tide
08:00	0.54
08:10	0.55
08:20	0.55
08:30	0.56
08:40	0.56
08:50	0.57
09:00	0.57
09:10	0.58
09:20	0.59
09:30	0.59
09:40	0.60
09:50	0.60
10:00	0.61
10:10	0.61
10:20	0.62
10:30	0.62
10:40	0.63
10:50	0.63
11:00	0.64
11:10	0.64
11:20	0.65
11:30	0.65
11:40	0.66
11:50	0.66

01-09-2025	
Time	Tide
12:00	0.67
12:10	0.67
12:20	0.68
12:30	0.68
12:40	0.69
12:50	0.69
13:00	0.69
13:10	0.69
13:20	0.69
13:30	0.69
13:40	0.69
13:50	0.68
14:00	0.68
14:10	0.67
14:20	0.66
14:30	0.66
14:40	0.65
14:50	0.63
15:00	0.62
15:10	0.61
15:20	0.60
15:30	0.59
15:40	0.58
15:50	0.57

01-09-2025	
Time	Tide
16:00	0.56
16:10	0.55
16:20	0.54
16:30	0.53
16:40	0.52
16:50	0.51
17:00	0.50
17:10	0.49
17:20	0.48
17:30	0.47
17:40	0.46
17:50	0.45
18:00	0.44
18:10	0.43
18:20	0.42
18:30	0.41
18:40	0.40
18:50	0.39
19:00	0.39
19:10	0.38
19:20	0.38
19:30	0.37
19:40	0.37
19:50	0.37

01-09-2025	
Time	Tide
20:00	0.37
20:10	0.37
20:20	0.38
20:30	0.38
20:40	0.39
20:50	0.40
21:00	0.40
21:10	0.41
21:20	0.42
21:30	0.43
21:40	0.44
21:50	0.45
22:00	0.46
22:10	0.47
22:20	0.49
22:30	0.50
22:40	0.51
22:50	0.52
23:00	0.53
23:10	0.54
23:20	0.55
23:30	0.57
23:40	0.58
23:50	0.59



02-09-2025	
Time	Tide
00:00	0.61
00:10	0.62
00:20	0.63
00:30	0.65
00:40	0.66
00:50	0.68
01:00	0.69
01:10	0.70
01:20	0.71
01:30	0.72
01:40	0.73
01:50	0.74
02:00	0.75
02:10	0.76
02:20	0.76
02:30	0.77
02:40	0.77
02:50	0.77
03:00	0.77
03:10	0.77
03:20	0.77
03:30	0.77
03:40	0.77
03:50	0.77

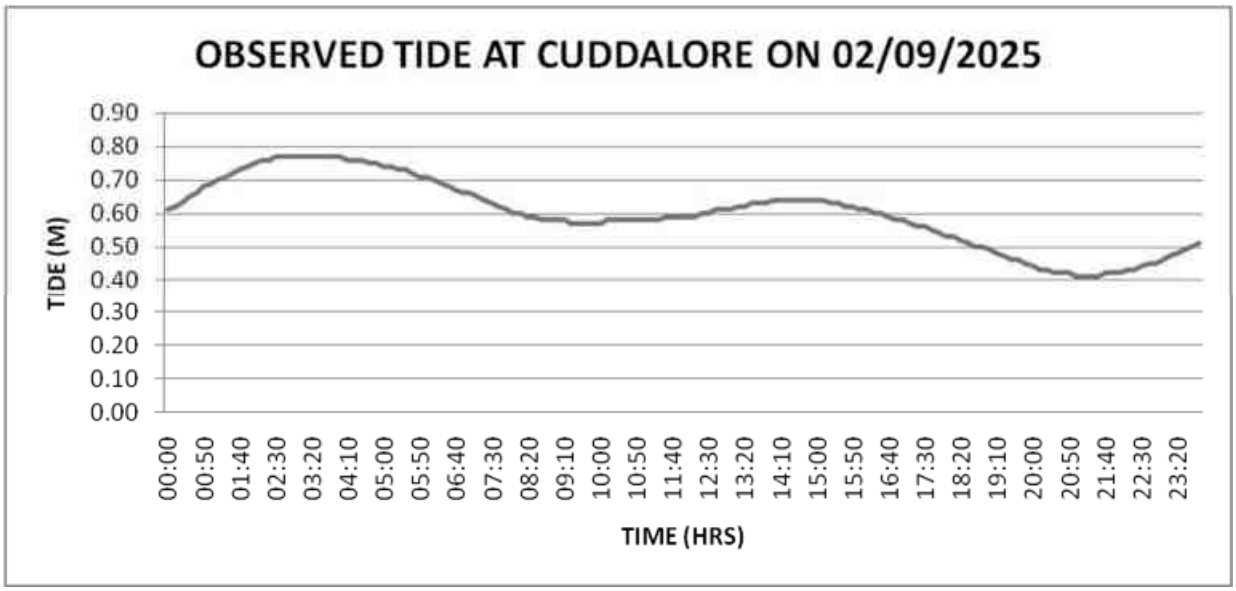
02-09-2025	
Time	Tide
04:00	0.77
04:10	0.76
04:20	0.76
04:30	0.76
04:40	0.75
04:50	0.75
05:00	0.74
05:10	0.74
05:20	0.73
05:30	0.73
05:40	0.72
05:50	0.71
06:00	0.71
06:10	0.70
06:20	0.69
06:30	0.68
06:40	0.67
06:50	0.66
07:00	0.66
07:10	0.65
07:20	0.64
07:30	0.63
07:40	0.62
07:50	0.61

02-09-2025	
Time	Tide
08:00	0.60
08:10	0.60
08:20	0.59
08:30	0.59
08:40	0.58
08:50	0.58
09:00	0.58
09:10	0.58
09:20	0.57
09:30	0.57
09:40	0.57
09:50	0.57
10:00	0.57
10:10	0.58
10:20	0.58
10:30	0.58
10:40	0.58
10:50	0.58
11:00	0.58
11:10	0.58
11:20	0.58
11:30	0.59
11:40	0.59
11:50	0.59

02-09-2025	
Time	Tide
12:00	0.59
12:10	0.59
12:20	0.60
12:30	0.60
12:40	0.61
12:50	0.61
13:00	0.61
13:10	0.62
13:20	0.62
13:30	0.63
13:40	0.63
13:50	0.63
14:00	0.64
14:10	0.64
14:20	0.64
14:30	0.64
14:40	0.64
14:50	0.64
15:00	0.64
15:10	0.64
15:20	0.63
15:30	0.63
15:40	0.62
15:50	0.62

02-09-2025	
Time	Tide
16:00	0.61
16:10	0.61
16:20	0.60
16:30	0.60
16:40	0.59
16:50	0.58
17:00	0.58
17:10	0.57
17:20	0.56
17:30	0.56
17:40	0.55
17:50	0.54
18:00	0.53
18:10	0.53
18:20	0.52
18:30	0.51
18:40	0.50
18:50	0.50
19:00	0.49
19:10	0.48
19:20	0.47
19:30	0.46
19:40	0.46
19:50	0.45

02-09-2025	
Time	Tide
20:00	0.44
20:10	0.43
20:20	0.43
20:30	0.42
20:40	0.42
20:50	0.42
21:00	0.41
21:10	0.41
21:20	0.41
21:30	0.41
21:40	0.42
21:50	0.42
22:00	0.42
22:10	0.43
22:20	0.43
22:30	0.44
22:40	0.45
22:50	0.45
23:00	0.46
23:10	0.47
23:20	0.48
23:30	0.49
23:40	0.50
23:50	0.51



03-09-2025	
Time	Tide
00:00	0.52
00:10	0.53
00:20	0.54
00:30	0.55
00:40	0.57
00:50	0.58
01:00	0.59
01:10	0.61
01:20	0.62
01:30	0.63
01:40	0.65
01:50	0.66
02:00	0.68
02:10	0.69
02:20	0.70
02:30	0.72
02:40	0.73
02:50	0.74
03:00	0.75
03:10	0.77
03:20	0.77
03:30	0.78
03:40	0.79
03:50	0.80

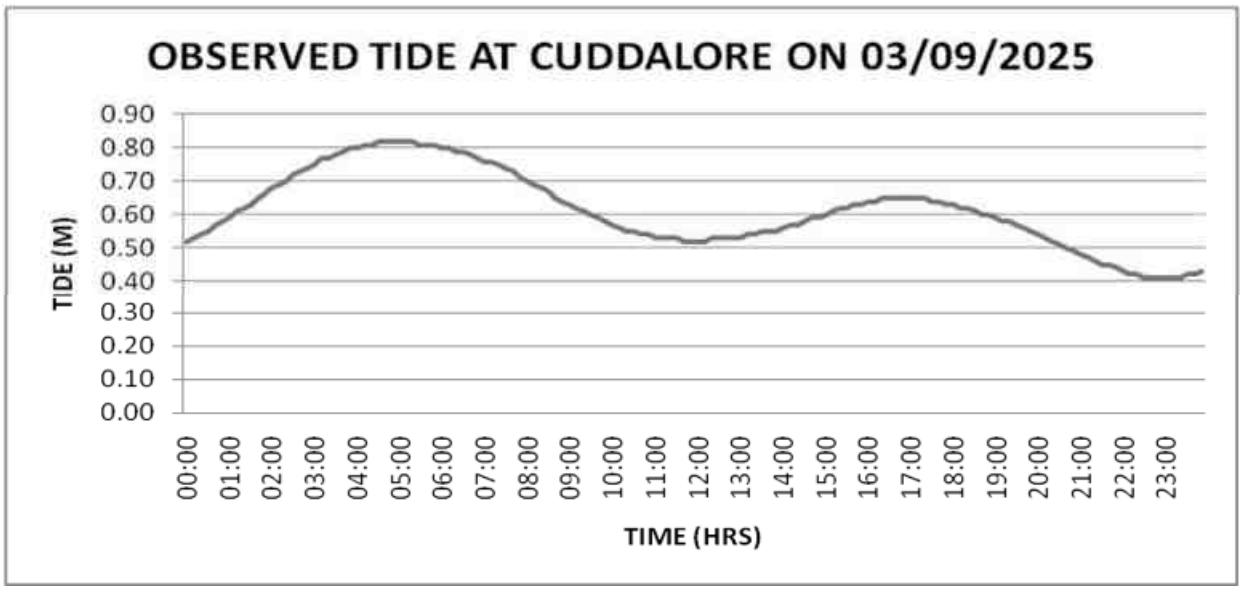
03-09-2025	
Time	Tide
04:00	0.80
04:10	0.81
04:20	0.81
04:30	0.82
04:40	0.82
04:50	0.82
05:00	0.82
05:10	0.82
05:20	0.82
05:30	0.81
05:40	0.81
05:50	0.81
06:00	0.80
06:10	0.80
06:20	0.79
06:30	0.79
06:40	0.78
06:50	0.77
07:00	0.76
07:10	0.76
07:20	0.75
07:30	0.74
07:40	0.73
07:50	0.71

03-09-2025	
Time	Tide
08:00	0.70
08:10	0.69
08:20	0.68
08:30	0.67
08:40	0.65
08:50	0.64
09:00	0.63
09:10	0.62
09:20	0.61
09:30	0.60
09:40	0.59
09:50	0.58
10:00	0.57
10:10	0.56
10:20	0.55
10:30	0.55
10:40	0.54
10:50	0.54
11:00	0.53
11:10	0.53
11:20	0.53
11:30	0.53
11:40	0.52
11:50	0.52

03-09-2025	
Time	Tide
12:00	0.52
12:10	0.52
12:20	0.53
12:30	0.53
12:40	0.53
12:50	0.53
13:00	0.53
13:10	0.54
13:20	0.54
13:30	0.55
13:40	0.55
13:50	0.55
14:00	0.56
14:10	0.57
14:20	0.57
14:30	0.58
14:40	0.59
14:50	0.59
15:00	0.60
15:10	0.61
15:20	0.62
15:30	0.62
15:40	0.63
15:50	0.63

03-09-2025	
Time	Tide
16:00	0.64
16:10	0.64
16:20	0.65
16:30	0.65
16:40	0.65
16:50	0.65
17:00	0.65
17:10	0.65
17:20	0.65
17:30	0.64
17:40	0.64
17:50	0.63
18:00	0.63
18:10	0.62
18:20	0.62
18:30	0.61
18:40	0.60
18:50	0.60
19:00	0.59
19:10	0.58
19:20	0.58
19:30	0.57
19:40	0.56
19:50	0.55

03-09-2025	
Time	Tide
20:00	0.54
20:10	0.53
20:20	0.52
20:30	0.51
20:40	0.50
20:50	0.49
21:00	0.48
21:10	0.47
21:20	0.46
21:30	0.45
21:40	0.45
21:50	0.44
22:00	0.43
22:10	0.42
22:20	0.42
22:30	0.41
22:40	0.41
22:50	0.41
23:00	0.41
23:10	0.41
23:20	0.41
23:30	0.42
23:40	0.42
23:50	0.43



04-09-2025	
Time	Tide
00:00	0.44
00:10	0.45
00:20	0.45
00:30	0.46
00:40	0.48
00:50	0.49
01:00	0.50
01:10	0.51
01:20	0.52
01:30	0.54
01:40	0.55
01:50	0.57
02:00	0.58
02:10	0.60
02:20	0.61
02:30	0.63
02:40	0.65
02:50	0.66
03:00	0.68
03:10	0.70
03:20	0.72
03:30	0.73
03:40	0.75
03:50	0.77

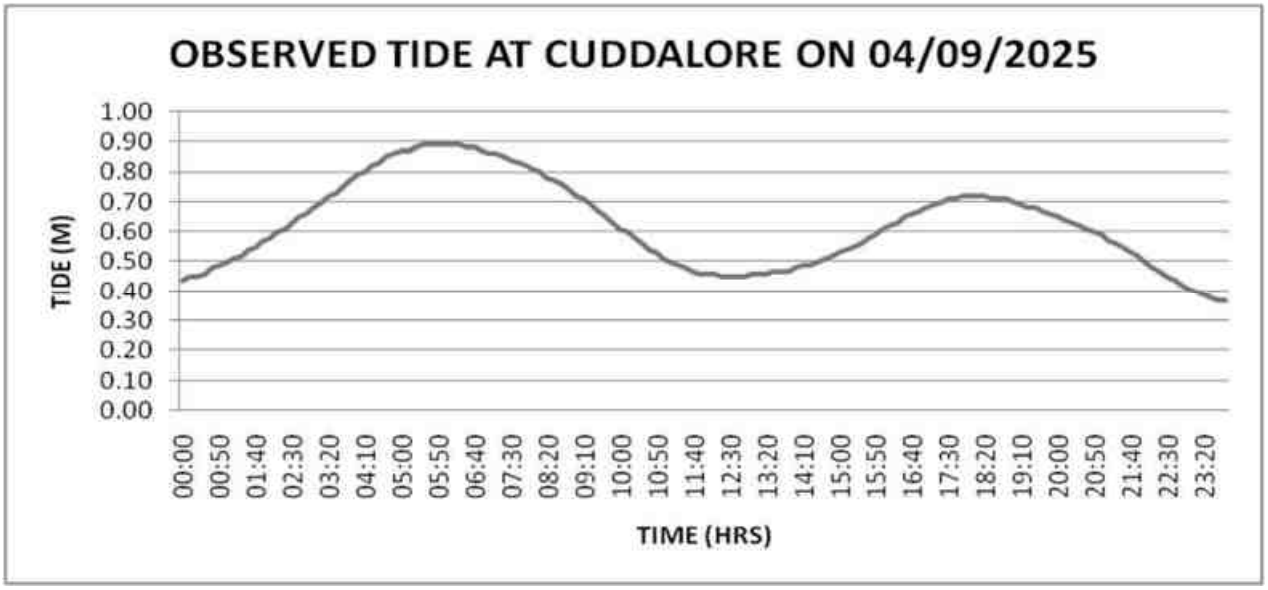
04-09-2025	
Time	Tide
04:00	0.79
04:10	0.80
04:20	0.82
04:30	0.83
04:40	0.85
04:50	0.86
05:00	0.87
05:10	0.87
05:20	0.88
05:30	0.89
05:40	0.89
05:50	0.89
06:00	0.89
06:10	0.89
06:20	0.89
06:30	0.88
06:40	0.88
06:50	0.87
07:00	0.86
07:10	0.86
07:20	0.85
07:30	0.84
07:40	0.83
07:50	0.82

04-09-2025	
Time	Tide
08:00	0.81
08:10	0.80
08:20	0.78
08:30	0.77
08:40	0.76
08:50	0.74
09:00	0.72
09:10	0.71
09:20	0.69
09:30	0.67
09:40	0.65
09:50	0.63
10:00	0.61
10:10	0.60
10:20	0.58
10:30	0.56
10:40	0.54
10:50	0.53
11:00	0.51
11:10	0.50
11:20	0.49
11:30	0.48
11:40	0.47
11:50	0.46

04-09-2025	
Time	Tide
12:00	0.46
12:10	0.46
12:20	0.45
12:30	0.45
12:40	0.45
12:50	0.45
13:00	0.46
13:10	0.46
13:20	0.46
13:30	0.47
13:40	0.47
13:50	0.47
14:00	0.48
14:10	0.49
14:20	0.49
14:30	0.50
14:40	0.51
14:50	0.52
15:00	0.53
15:10	0.54
15:20	0.55
15:30	0.56
15:40	0.58
15:50	0.59

04-09-2025	
Time	Tide
16:00	0.61
16:10	0.62
16:20	0.63
16:30	0.65
16:40	0.66
16:50	0.67
17:00	0.68
17:10	0.69
17:20	0.70
17:30	0.71
17:40	0.71
17:50	0.72
18:00	0.72
18:10	0.72
18:20	0.72
18:30	0.71
18:40	0.71
18:50	0.71
19:00	0.70
19:10	0.69
19:20	0.68
19:30	0.68
19:40	0.67
19:50	0.66

04-09-2025	
Time	Tide
20:00	0.65
20:10	0.64
20:20	0.63
20:30	0.62
20:40	0.61
20:50	0.60
21:00	0.59
21:10	0.57
21:20	0.56
21:30	0.55
21:40	0.53
21:50	0.52
22:00	0.50
22:10	0.48
22:20	0.47
22:30	0.45
22:40	0.44
22:50	0.42
23:00	0.41
23:10	0.40
23:20	0.39
23:30	0.38
23:40	0.37
23:50	0.37



05-09-2025	
Time	Tide
00:00	0.37
00:10	0.37
00:20	0.37
00:30	0.38
00:40	0.39
00:50	0.39
01:00	0.40
01:10	0.41
01:20	0.43
01:30	0.44
01:40	0.45
01:50	0.47
02:00	0.48
02:10	0.50
02:20	0.51
02:30	0.53
02:40	0.55
02:50	0.56
03:00	0.58
03:10	0.60
03:20	0.62
03:30	0.64
03:40	0.66
03:50	0.69

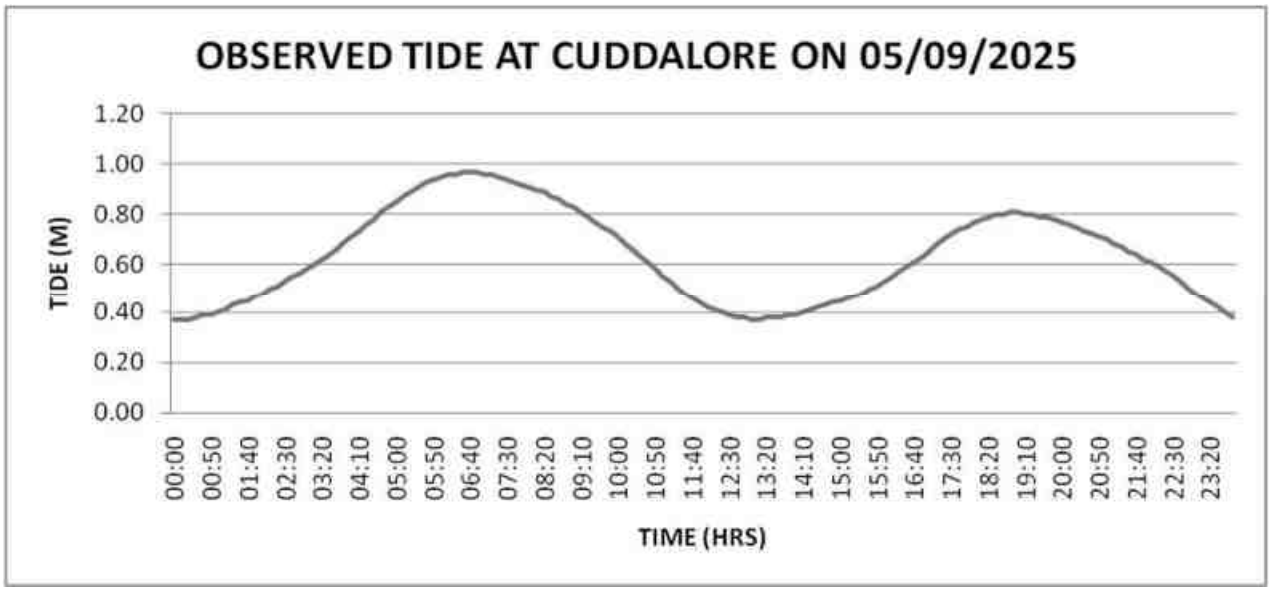
05-09-2025	
Time	Tide
04:00	0.71
04:10	0.73
04:20	0.76
04:30	0.78
04:40	0.81
04:50	0.83
05:00	0.85
05:10	0.87
05:20	0.89
05:30	0.91
05:40	0.93
05:50	0.94
06:00	0.95
06:10	0.96
06:20	0.96
06:30	0.97
06:40	0.97
06:50	0.97
07:00	0.96
07:10	0.96
07:20	0.95
07:30	0.94
07:40	0.93
07:50	0.92

05-09-2025	
Time	Tide
08:00	0.91
08:10	0.90
08:20	0.89
08:30	0.87
08:40	0.86
08:50	0.84
09:00	0.83
09:10	0.81
09:20	0.79
09:30	0.77
09:40	0.75
09:50	0.73
10:00	0.71
10:10	0.68
10:20	0.66
10:30	0.63
10:40	0.61
10:50	0.58
11:00	0.55
11:10	0.53
11:20	0.50
11:30	0.48
11:40	0.46
11:50	0.44

05-09-2025	
Time	Tide
12:00	0.42
12:10	0.41
12:20	0.40
12:30	0.39
12:40	0.38
12:50	0.38
13:00	0.37
13:10	0.37
13:20	0.38
13:30	0.38
13:40	0.38
13:50	0.39
14:00	0.39
14:10	0.40
14:20	0.41
14:30	0.42
14:40	0.43
14:50	0.44
15:00	0.45
15:10	0.46
15:20	0.47
15:30	0.48
15:40	0.50
15:50	0.51

05-09-2025	
Time	Tide
16:00	0.53
16:10	0.55
16:20	0.57
16:30	0.59
16:40	0.61
16:50	0.63
17:00	0.65
17:10	0.68
17:20	0.70
17:30	0.72
17:40	0.74
17:50	0.75
18:00	0.77
18:10	0.78
18:20	0.79
18:30	0.80
18:40	0.80
18:50	0.81
19:00	0.81
19:10	0.80
19:20	0.80
19:30	0.79
19:40	0.79
19:50	0.78

05-09-2025	
Time	Tide
20:00	0.77
20:10	0.76
20:20	0.75
20:30	0.73
20:40	0.72
20:50	0.71
21:00	0.70
21:10	0.68
21:20	0.67
21:30	0.65
21:40	0.64
21:50	0.62
22:00	0.61
22:10	0.59
22:20	0.57
22:30	0.55
22:40	0.53
22:50	0.50
23:00	0.48
23:10	0.46
23:20	0.44
23:30	0.42
23:40	0.40
23:50	0.38



06-09-2025	
Time	Tide
00:00	0.36
00:10	0.35
00:20	0.34
00:30	0.33
00:40	0.32
00:50	0.32
01:00	0.32
01:10	0.32
01:20	0.33
01:30	0.34
01:40	0.35
01:50	0.36
02:00	0.38
02:10	0.39
02:20	0.41
02:30	0.43
02:40	0.45
02:50	0.46
03:00	0.48
03:10	0.50
03:20	0.52
03:30	0.54
03:40	0.56
03:50	0.59

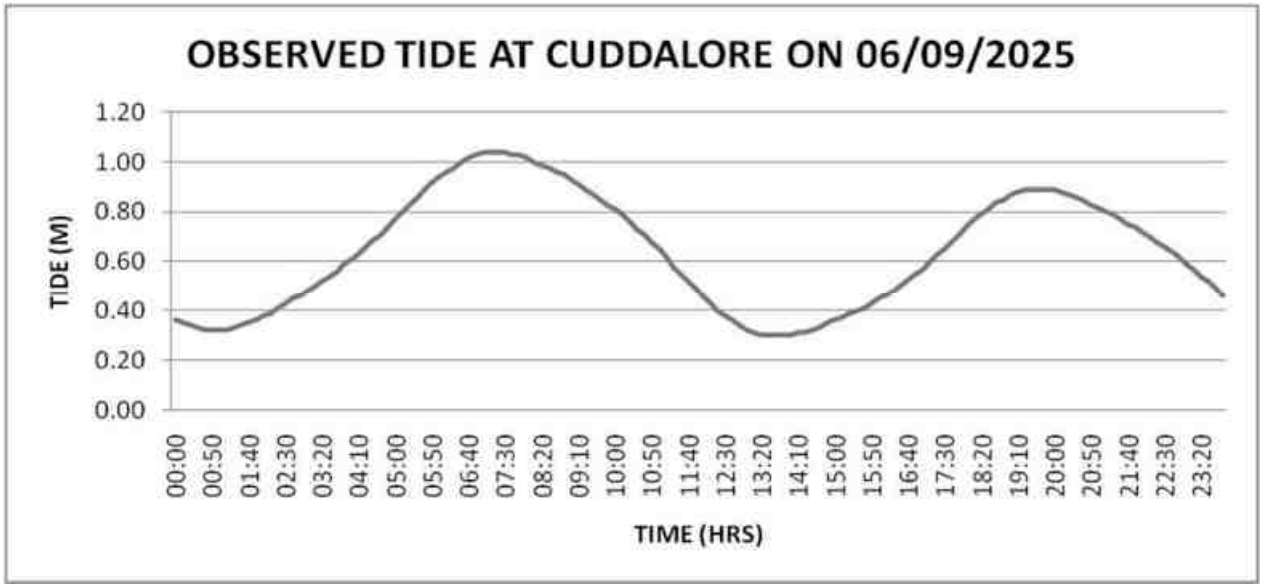
06-09-2025	
Time	Tide
04:00	0.61
04:10	0.63
04:20	0.66
04:30	0.69
04:40	0.71
04:50	0.74
05:00	0.77
05:10	0.80
05:20	0.83
05:30	0.86
05:40	0.89
05:50	0.92
06:00	0.94
06:10	0.96
06:20	0.98
06:30	1.00
06:40	1.02
06:50	1.03
07:00	1.04
07:10	1.04
07:20	1.04
07:30	1.04
07:40	1.03
07:50	1.03

06-09-2025	
Time	Tide
08:00	1.02
08:10	1.00
08:20	0.99
08:30	0.98
08:40	0.96
08:50	0.95
09:00	0.93
09:10	0.91
09:20	0.89
09:30	0.87
09:40	0.85
09:50	0.83
10:00	0.81
10:10	0.79
10:20	0.76
10:30	0.73
10:40	0.71
10:50	0.68
11:00	0.65
11:10	0.62
11:20	0.58
11:30	0.55
11:40	0.52
11:50	0.49

06-09-2025	
Time	Tide
12:00	0.46
12:10	0.43
12:20	0.40
12:30	0.38
12:40	0.36
12:50	0.34
13:00	0.32
13:10	0.31
13:20	0.30
13:30	0.30
13:40	0.30
13:50	0.30
14:00	0.30
14:10	0.31
14:20	0.31
14:30	0.32
14:40	0.33
14:50	0.35
15:00	0.36
15:10	0.37
15:20	0.39
15:30	0.40
15:40	0.41
15:50	0.43

06-09-2025	
Time	Tide
16:00	0.45
16:10	0.46
16:20	0.48
16:30	0.50
16:40	0.53
16:50	0.55
17:00	0.57
17:10	0.60
17:20	0.63
17:30	0.65
17:40	0.68
17:50	0.71
18:00	0.74
18:10	0.77
18:20	0.79
18:30	0.81
18:40	0.84
18:50	0.85
19:00	0.87
19:10	0.88
19:20	0.89
19:30	0.89
19:40	0.89
19:50	0.89

06-09-2025	
Time	Tide
20:00	0.89
20:10	0.88
20:20	0.87
20:30	0.86
20:40	0.85
20:50	0.83
21:00	0.82
21:10	0.80
21:20	0.79
21:30	0.77
21:40	0.75
21:50	0.74
22:00	0.72
22:10	0.70
22:20	0.68
22:30	0.66
22:40	0.64
22:50	0.62
23:00	0.59
23:10	0.57
23:20	0.54
23:30	0.52
23:40	0.49
23:50	0.46



07-09-2025	
Time	Tide
00:00	0.43
00:10	0.41
00:20	0.38
00:30	0.36
00:40	0.34
00:50	0.32
01:00	0.30
01:10	0.29
01:20	0.28
01:30	0.28
01:40	0.27
01:50	0.28
02:00	0.28
02:10	0.29
02:20	0.30
02:30	0.32
02:40	0.34
02:50	0.36
03:00	0.37
03:10	0.40
03:20	0.42
03:30	0.44
03:40	0.46
03:50	0.49

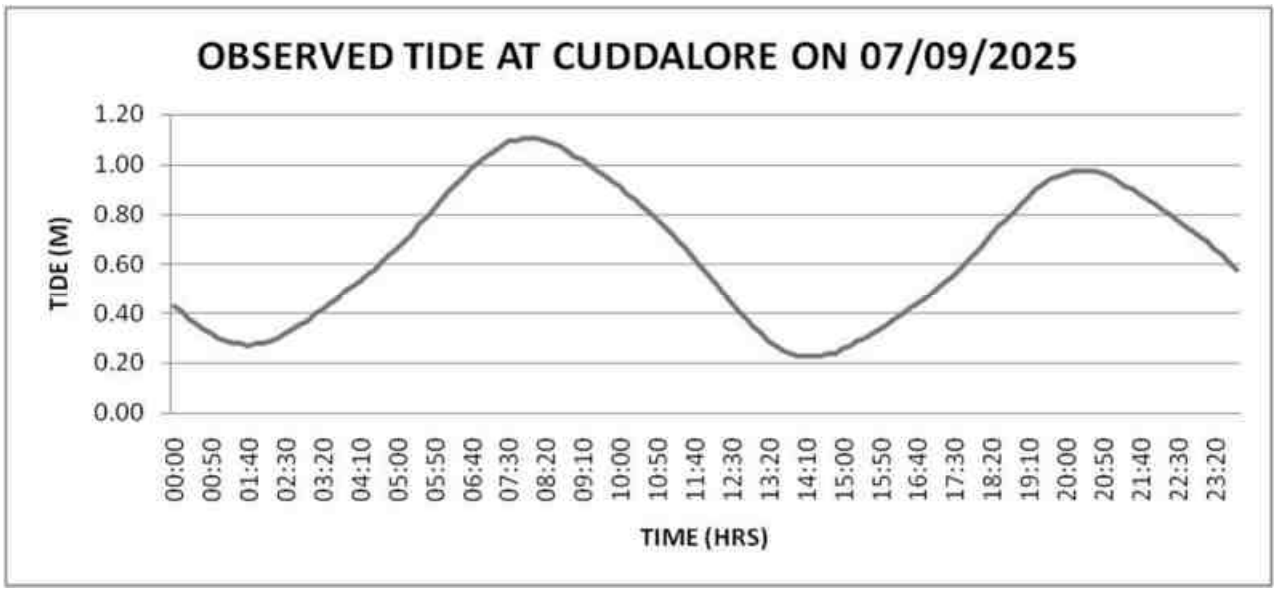
07-09-2025	
Time	Tide
04:00	0.51
04:10	0.53
04:20	0.56
04:30	0.58
04:40	0.61
04:50	0.64
05:00	0.66
05:10	0.69
05:20	0.72
05:30	0.76
05:40	0.79
05:50	0.82
06:00	0.86
06:10	0.89
06:20	0.92
06:30	0.95
06:40	0.98
06:50	1.01
07:00	1.03
07:10	1.05
07:20	1.07
07:30	1.09
07:40	1.09
07:50	1.10

07-09-2025	
Time	Tide
08:00	1.10
08:10	1.10
08:20	1.09
08:30	1.08
08:40	1.07
08:50	1.05
09:00	1.03
09:10	1.02
09:20	0.99
09:30	0.97
09:40	0.95
09:50	0.93
10:00	0.91
10:10	0.88
10:20	0.86
10:30	0.83
10:40	0.81
10:50	0.78
11:00	0.75
11:10	0.72
11:20	0.69
11:30	0.66
11:40	0.62
11:50	0.59

07-09-2025	
Time	Tide
12:00	0.55
12:10	0.52
12:20	0.48
12:30	0.44
12:40	0.41
12:50	0.38
13:00	0.35
13:10	0.32
13:20	0.29
13:30	0.27
13:40	0.25
13:50	0.24
14:00	0.23
14:10	0.23
14:20	0.23
14:30	0.23
14:40	0.24
14:50	0.24
15:00	0.26
15:10	0.27
15:20	0.29
15:30	0.30
15:40	0.32
15:50	0.34

07-09-2025	
Time	Tide
16:00	0.36
16:10	0.38
16:20	0.40
16:30	0.42
16:40	0.44
16:50	0.46
17:00	0.48
17:10	0.51
17:20	0.53
17:30	0.56
17:40	0.59
17:50	0.62
18:00	0.65
18:10	0.68
18:20	0.72
18:30	0.75
18:40	0.78
18:50	0.81
19:00	0.84
19:10	0.87
19:20	0.90
19:30	0.92
19:40	0.94
19:50	0.95

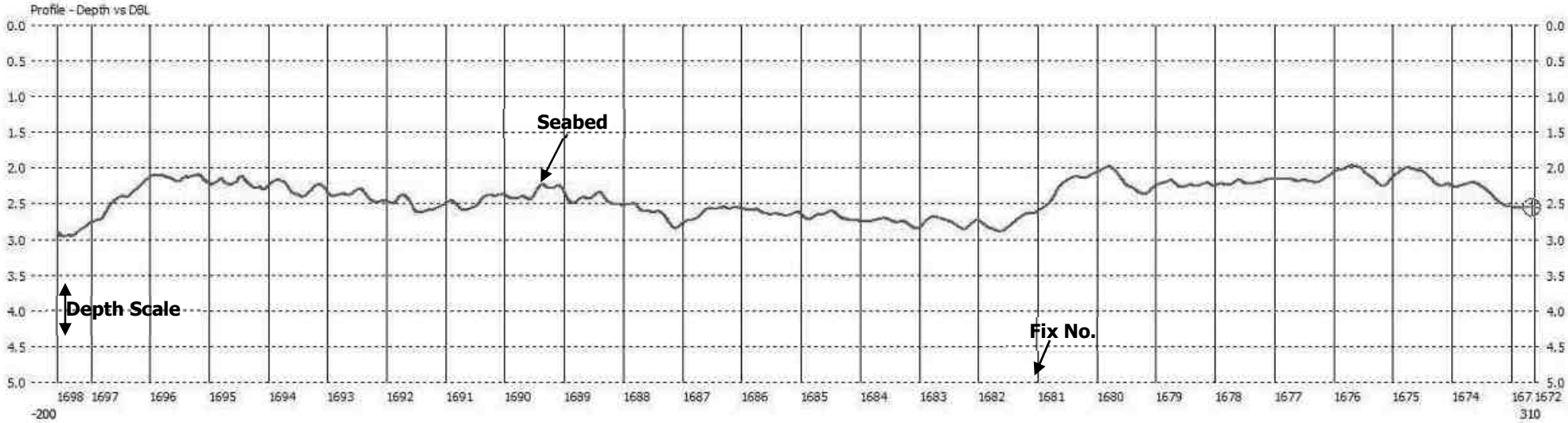
07-09-2025	
Time	Tide
20:00	0.96
20:10	0.97
20:20	0.97
20:30	0.97
20:40	0.97
20:50	0.96
21:00	0.95
21:10	0.93
21:20	0.91
21:30	0.90
21:40	0.88
21:50	0.86
22:00	0.84
22:10	0.82
22:20	0.80
22:30	0.78
22:40	0.75
22:50	0.73
23:00	0.71
23:10	0.69
23:20	0.66
23:30	0.64
23:40	0.61
23:50	0.58



APPENDIX F

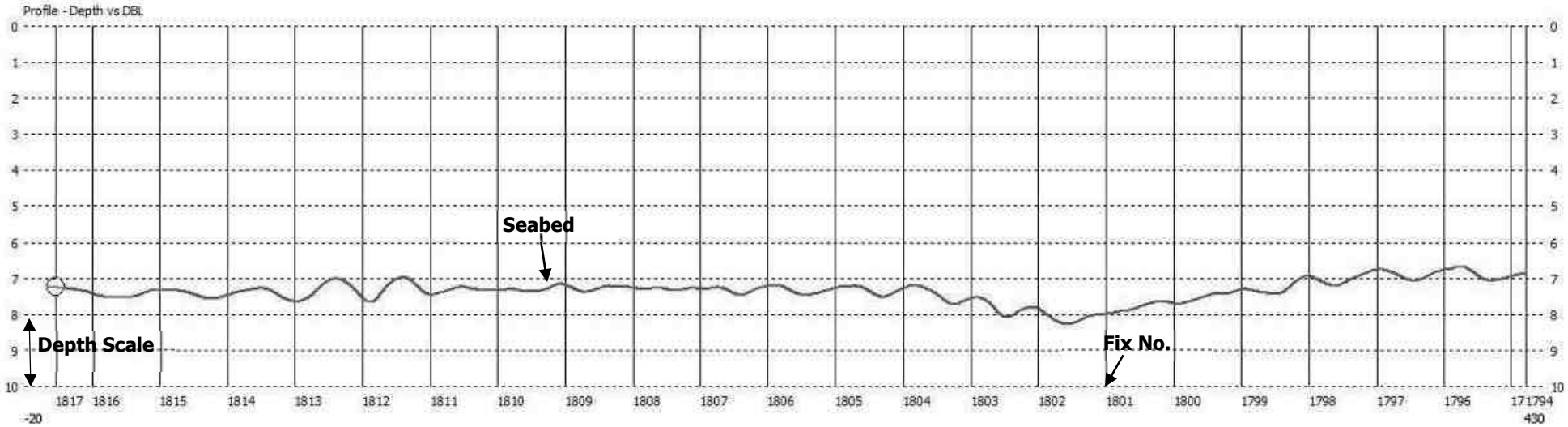
EXTRACTS FROM FIELD REORDS

East SBES Data Extract West



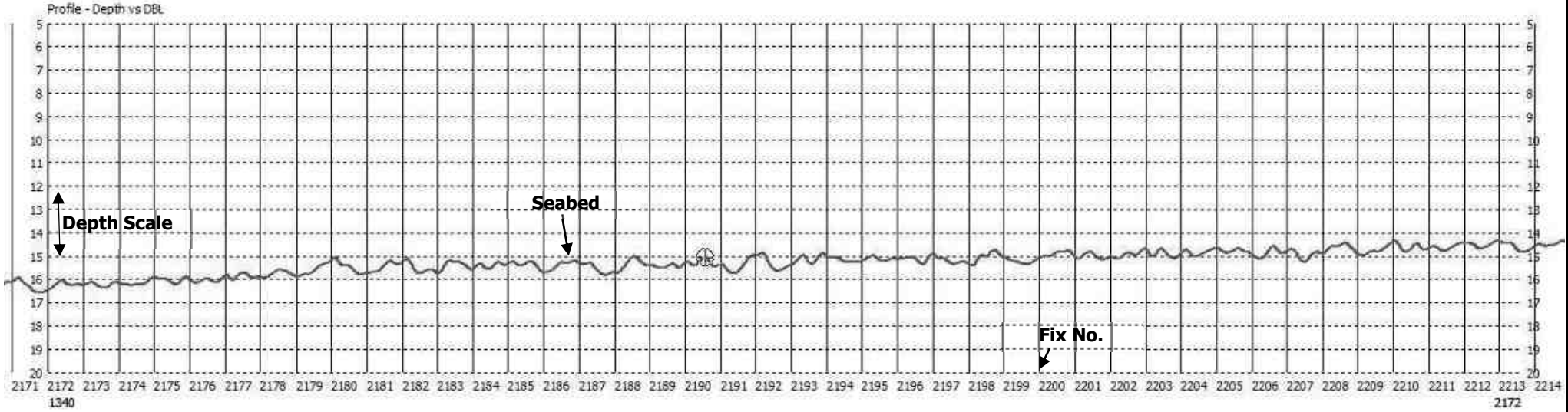
Record Information: SBES data extract showing Seabed from East to west in the North east part of the Survey corridor.

South SBES Data Extract North



Record Information: SBES data extract showing Seabed from South to North within the Survey corridor.

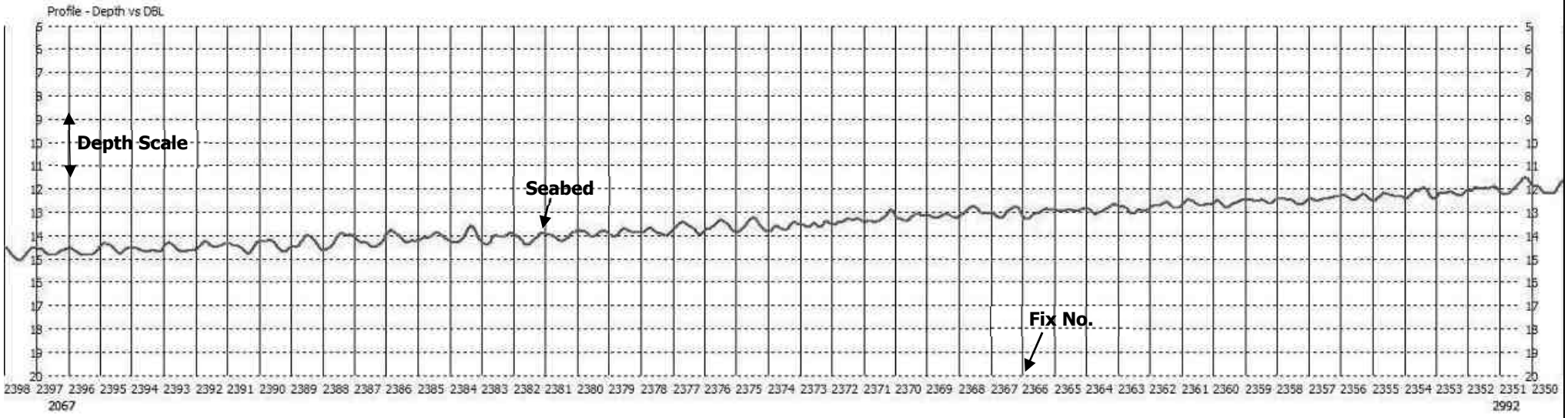
East SBES Data Extract West



Record Information: SBES data extract showing Seabed from East to West within the Survey corridor.

Project No.: GSIPL_J038_25	Location: Cuddalore port, Tamilnadu, East Coast of India	Figure 3

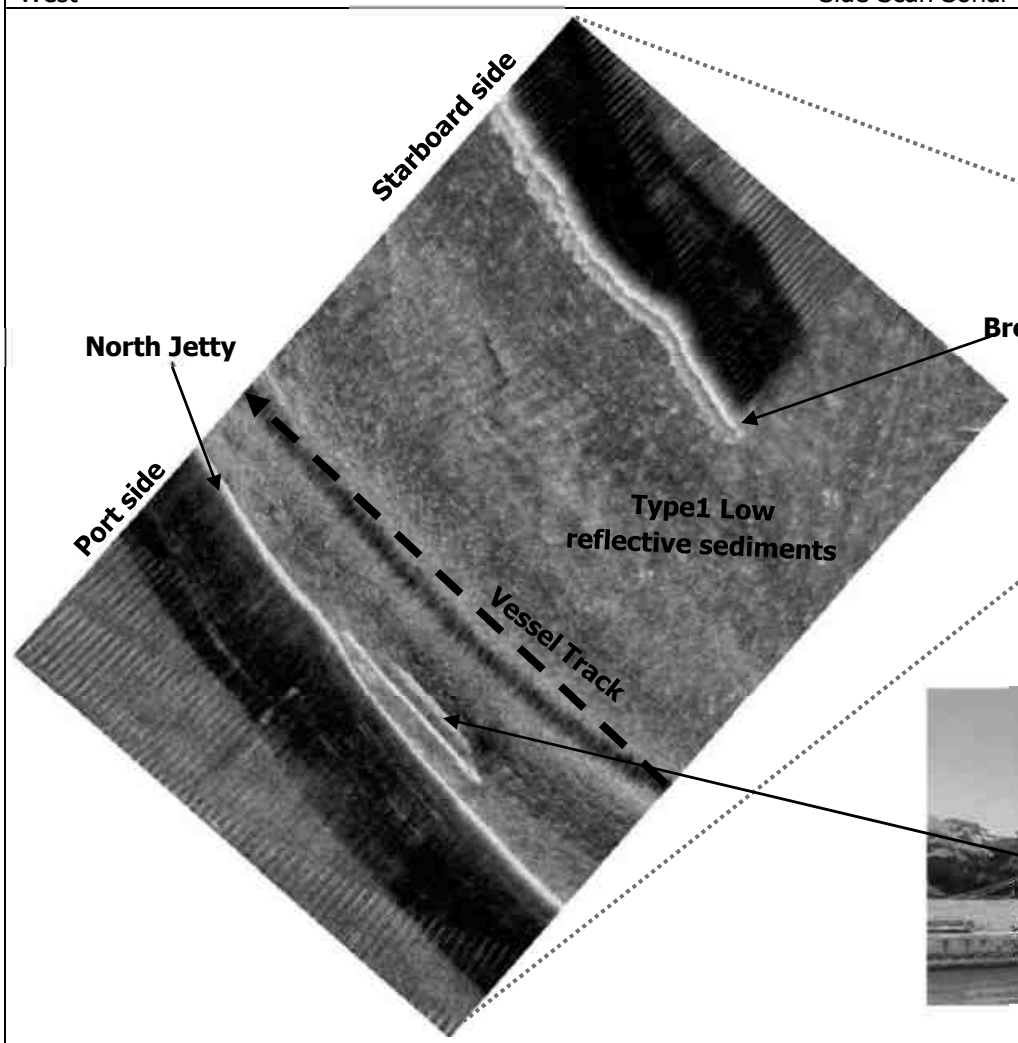
West SBES Data Extract East

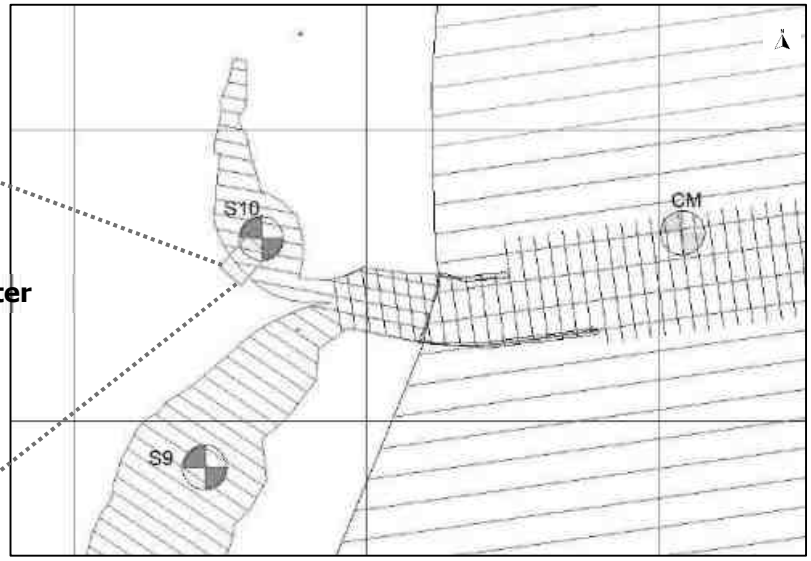


Record Information: SBES data extract showing Seabed from West to East within the Survey corridor.

Project No.: GSIPL_J038_25	Location: Cuddalore port, Tamilnadu, East Coast of India	Figure 4

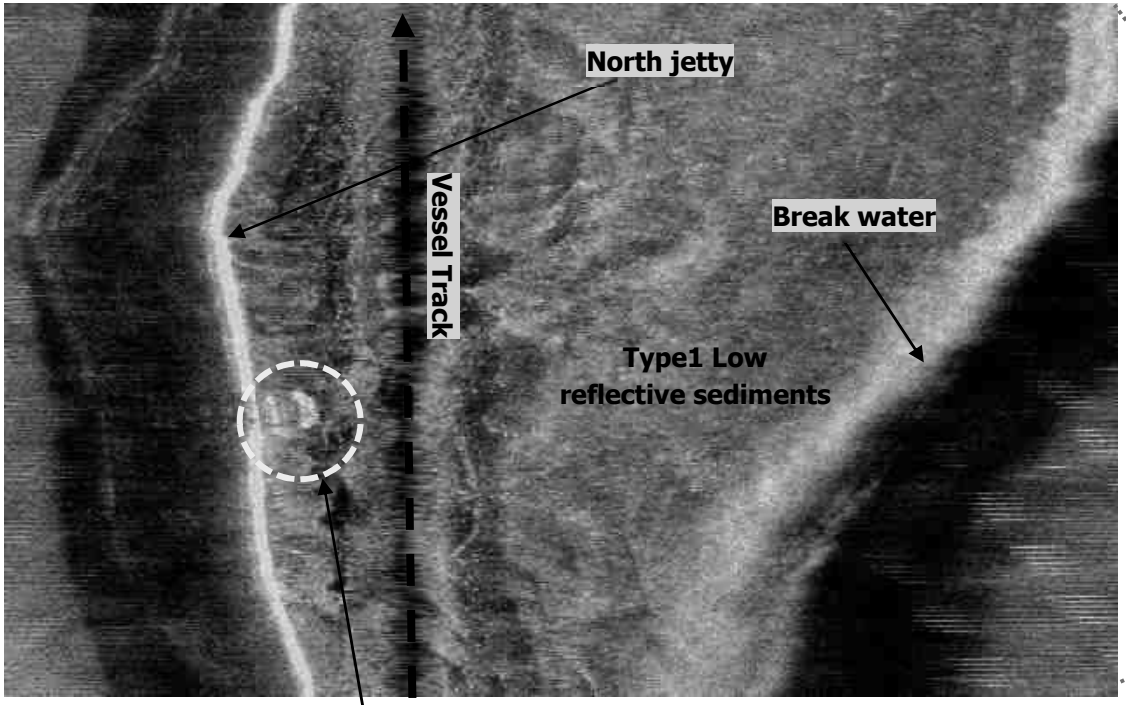
West — Side Scan Sonar Data Extract — East

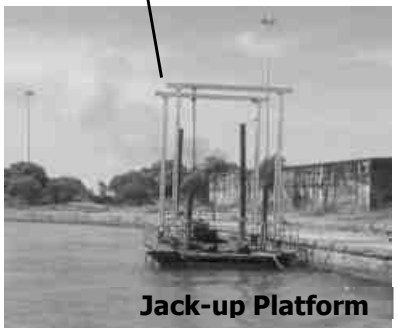


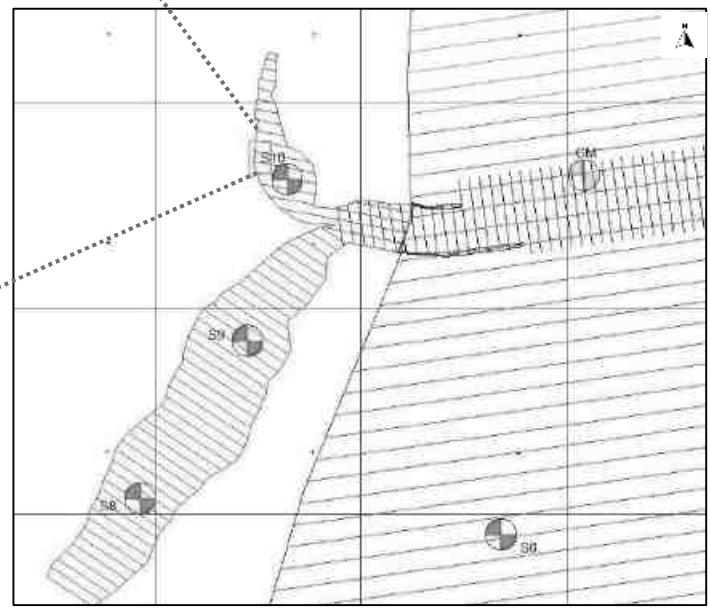


Record Information: SSS data extract showing plain seabed, North jetty, Break water & MSV Aadhesh berthed beside north jetty within the Harbor area of the survey corridor.

WEST | Side Scan Sonar Data Extract | EAST

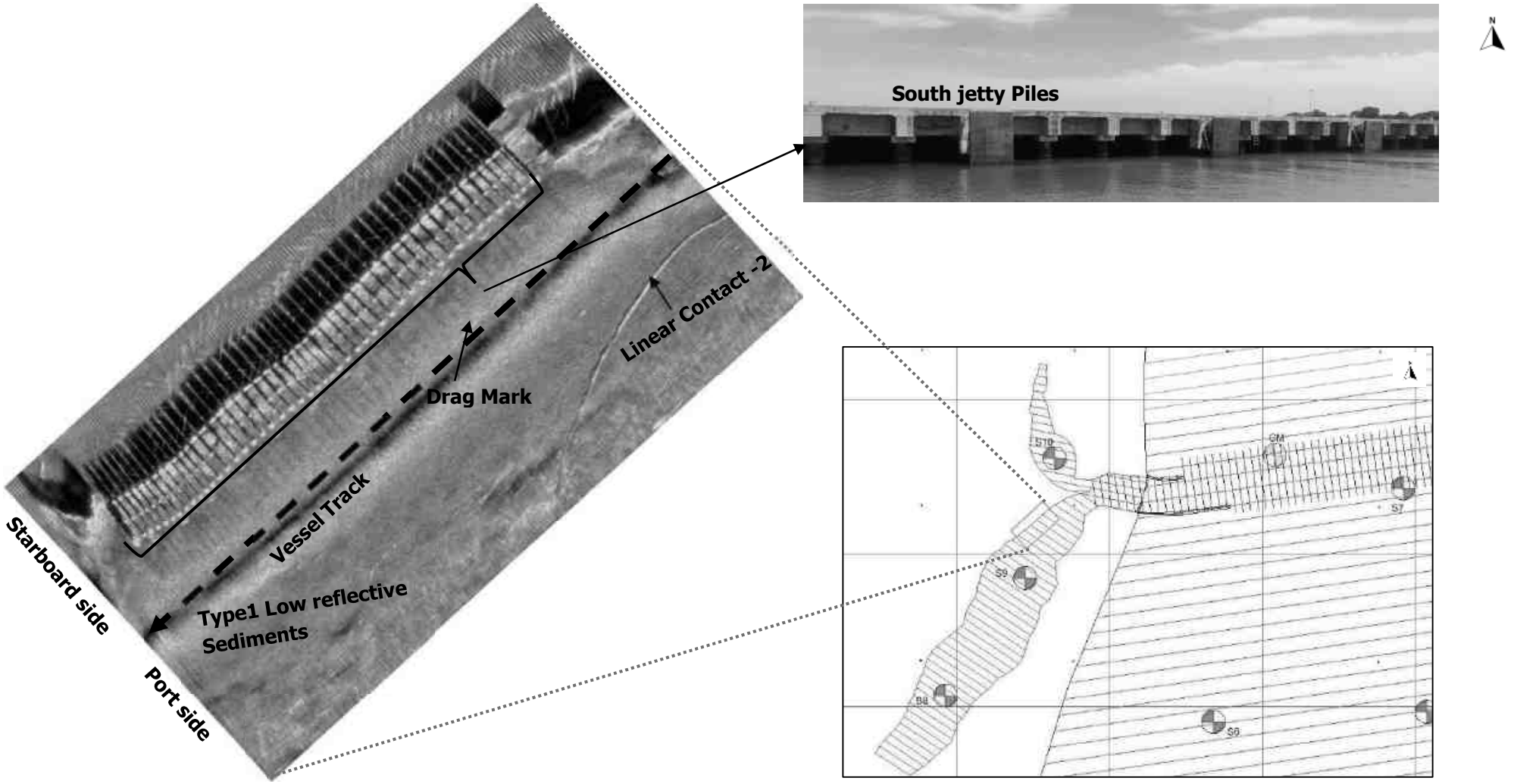






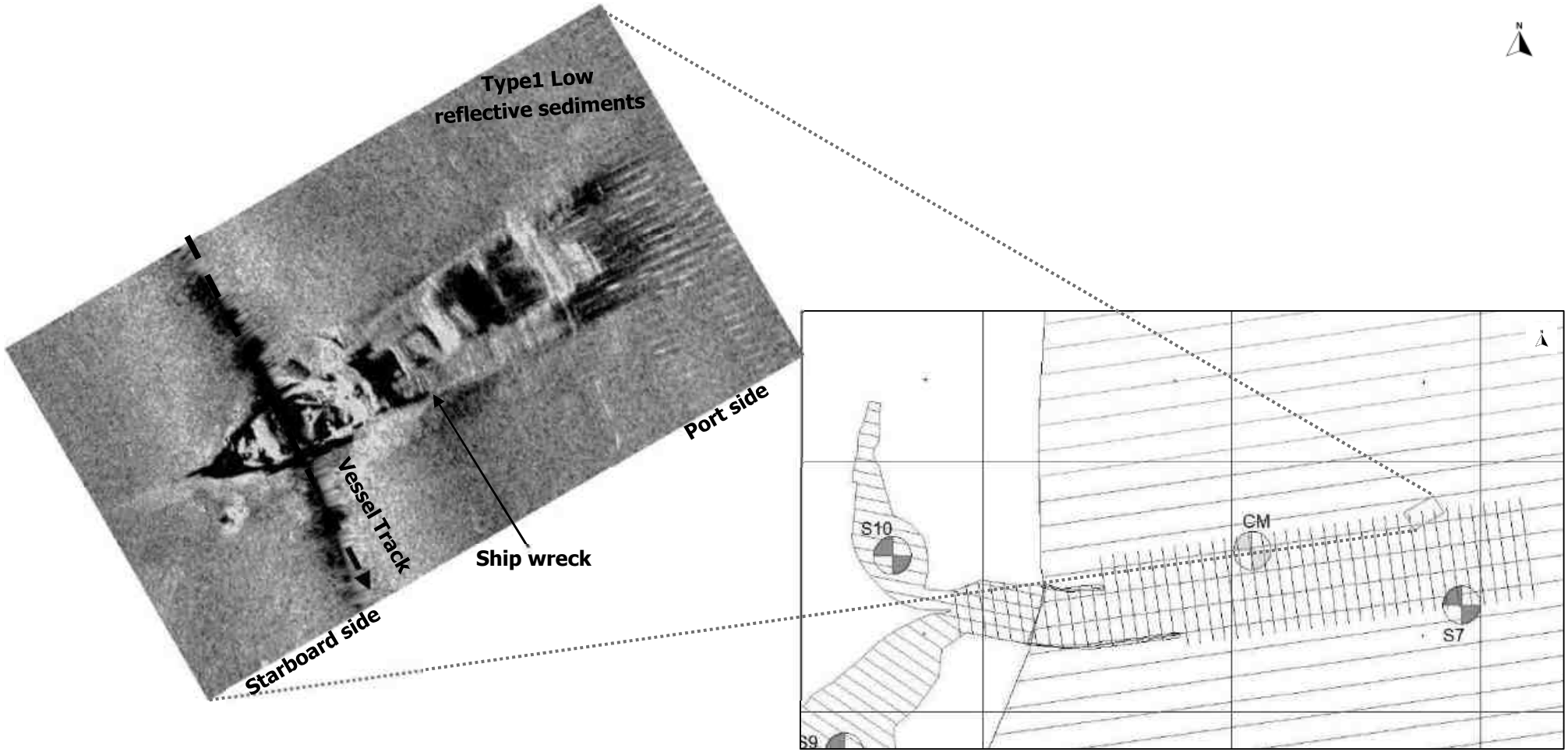
Record Information: SSS data extract showing Jack-up Platform beside North jetty within the Harbor area of the survey corridor.

WEST | Side Scan Sonar Data Extract | EAST



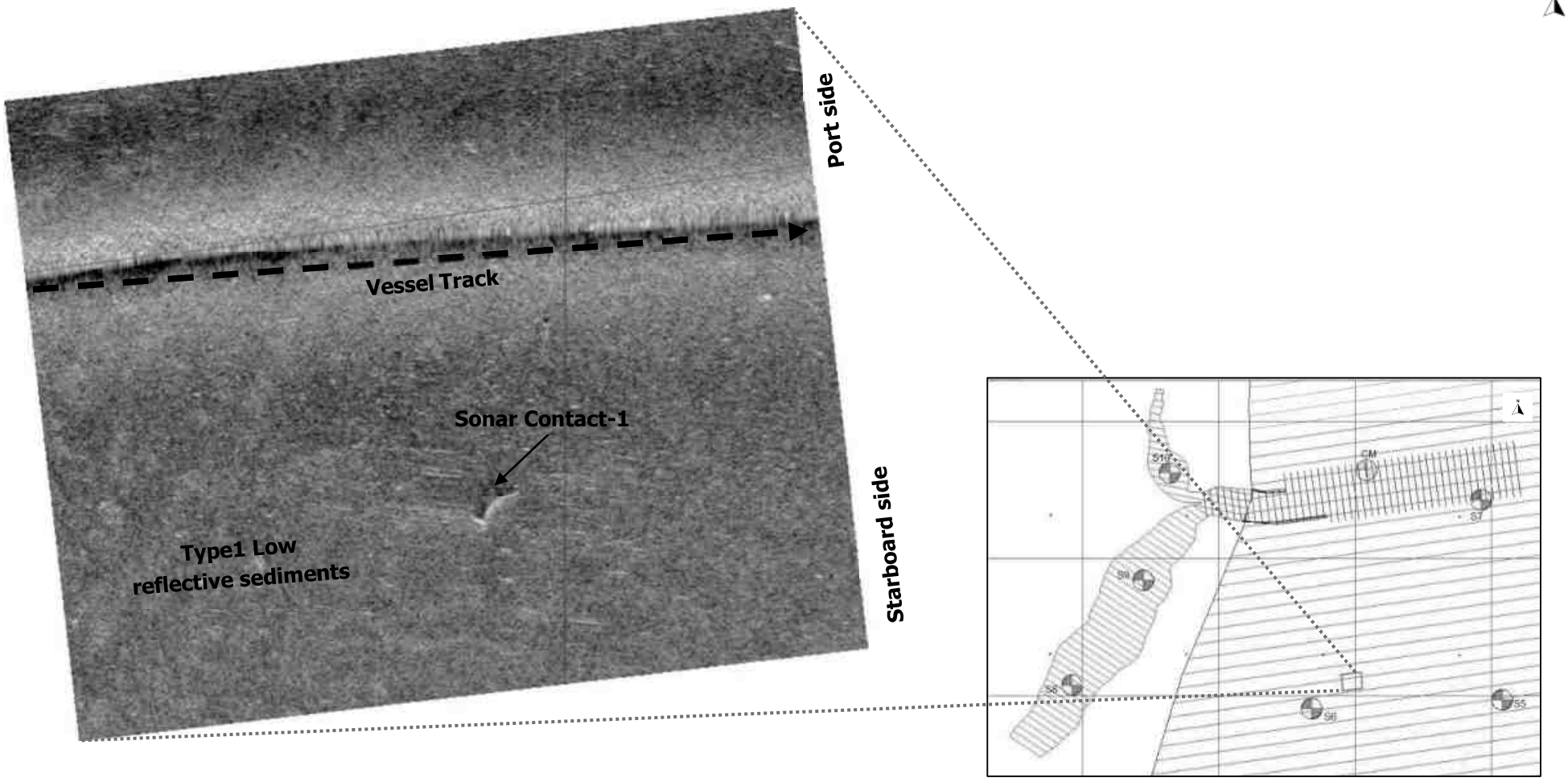
Record Information: SSS data extract showing South jetty piles, Drag Mark and linear contact-2 within the Harbour area of the survey corridor.

WEST Side Scan Sonar Data Extract EAST



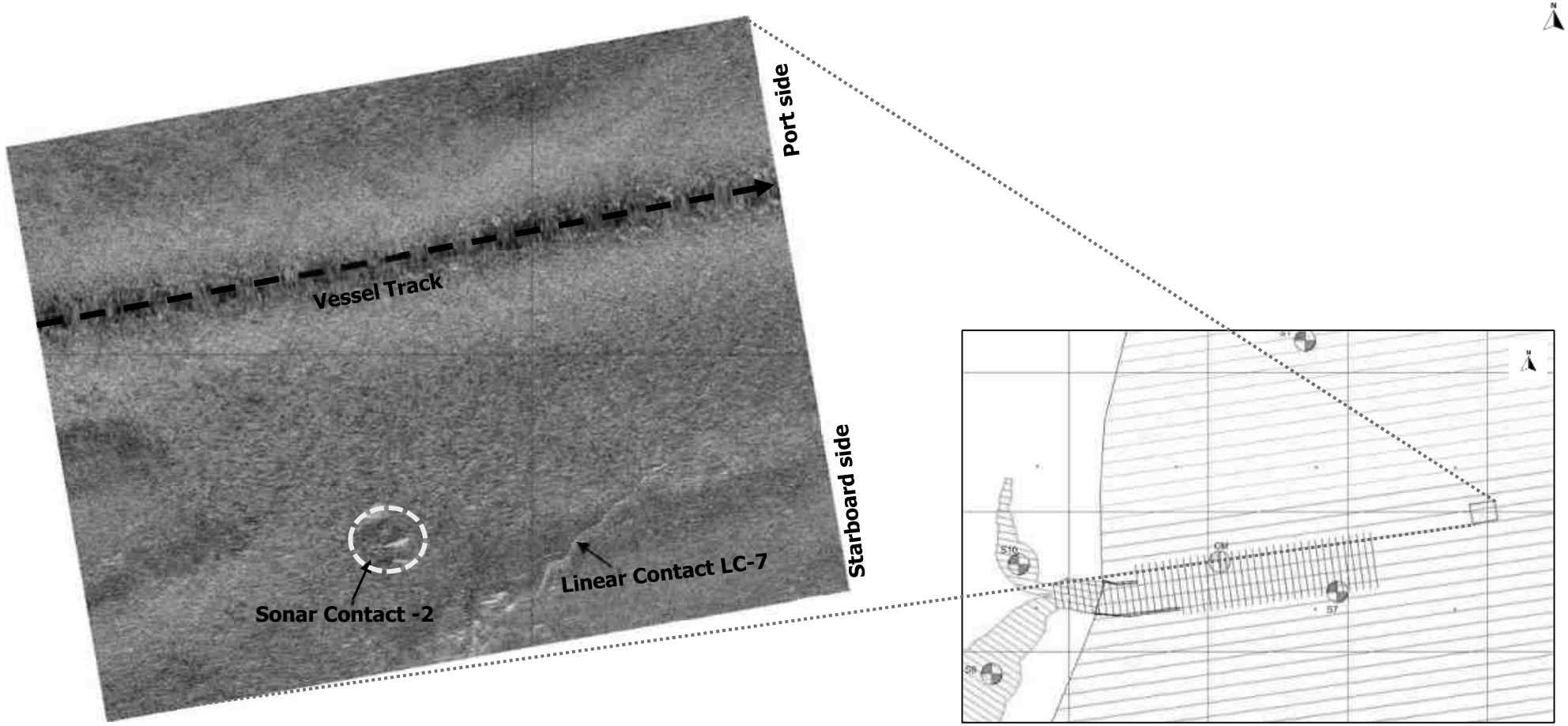
Record Information: SSS data extract showing Ship wreck within the Approaches area of the survey corridor.

WEST | Side Scan Sonar Data Extract | EAST



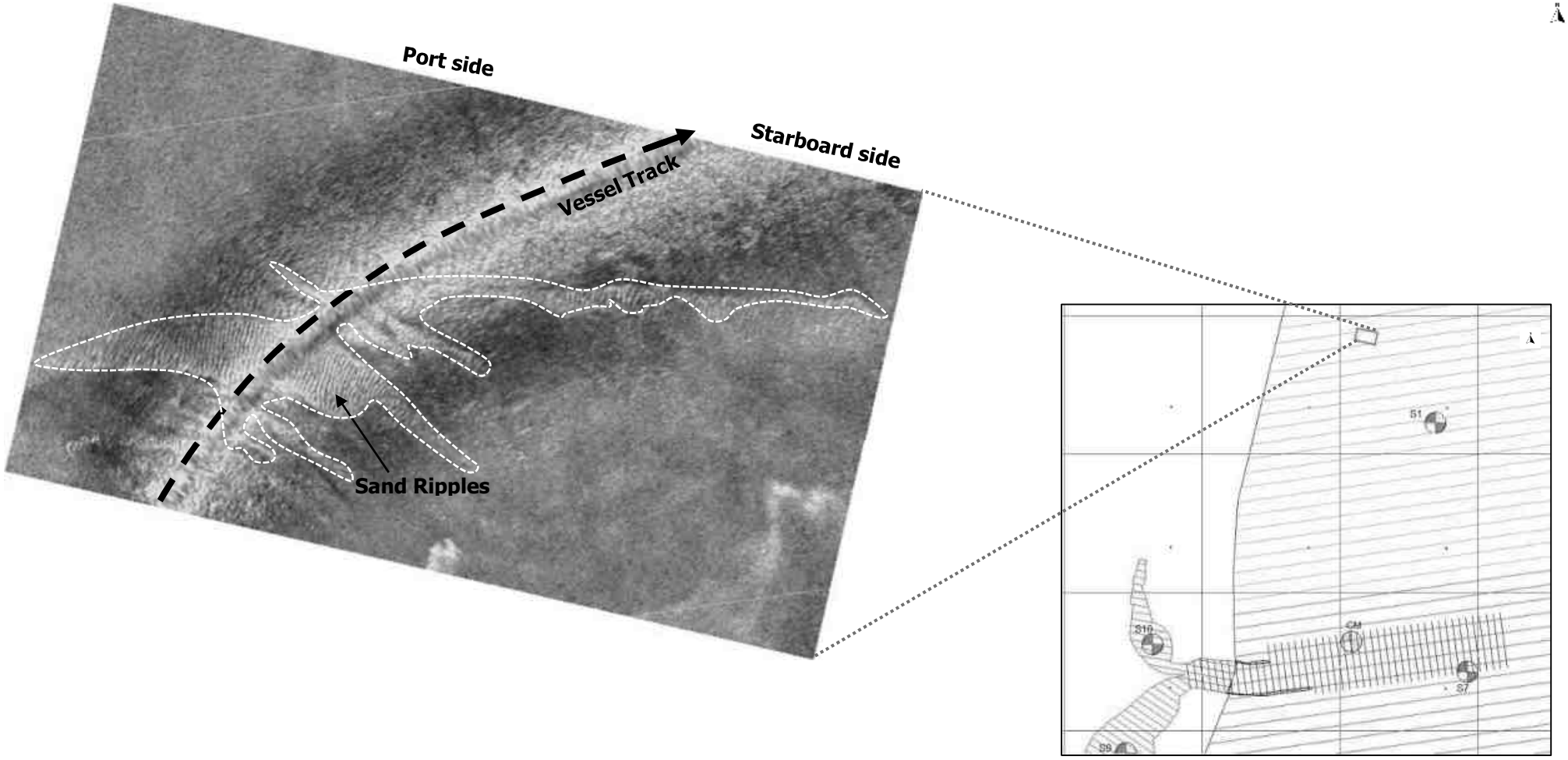
Record Information: SSS data extract showing sonar contact-1 and plain seabed within the Approaches area of the survey corridor.

Side Scan Sonar Data Extract



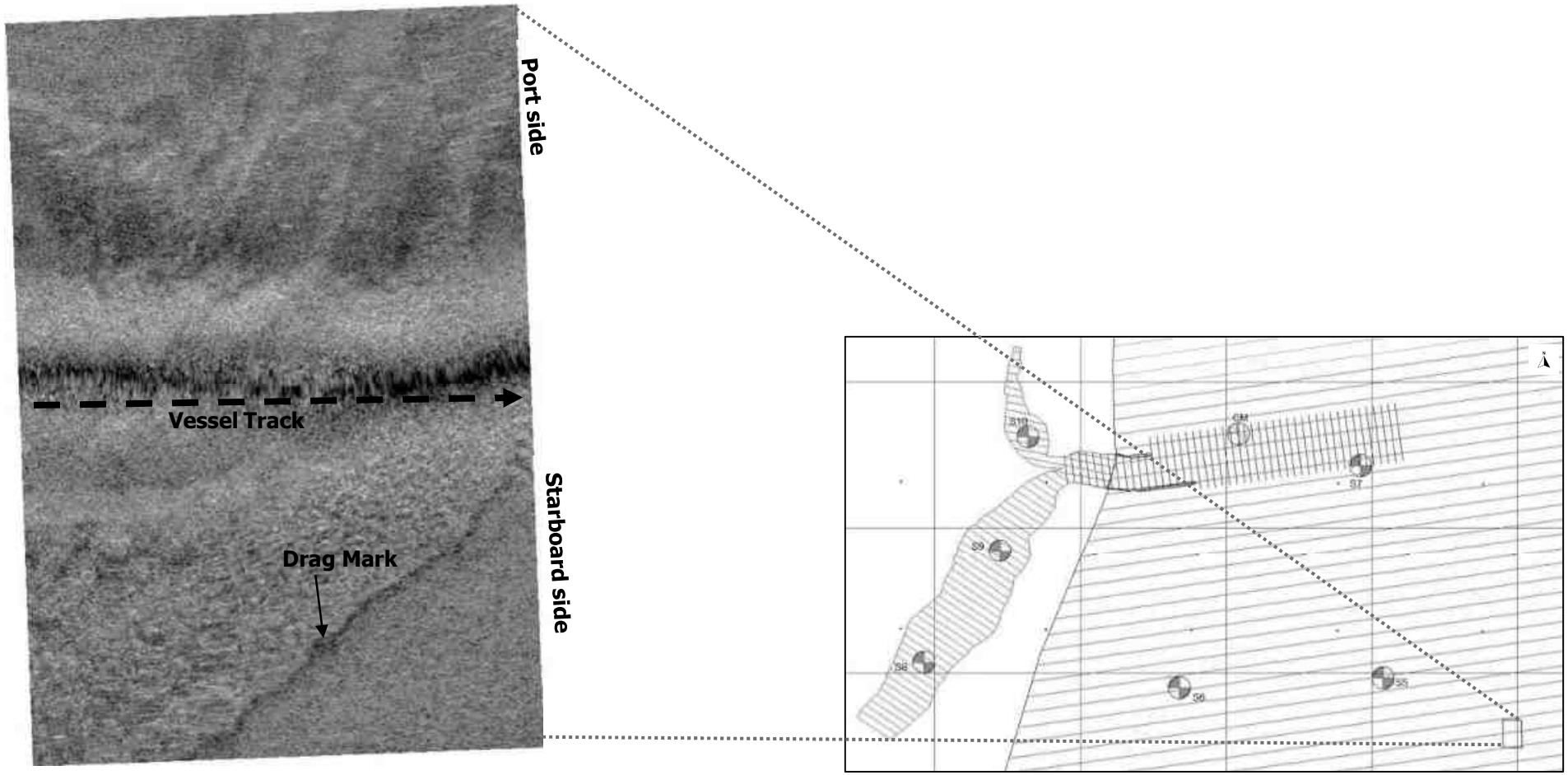
Record Information: SSS data extract showing sonar contact-2 and linear contact-7 within the Approaches area of the survey corridor.

WEST | Side Scan Sonar Data Extract | EAST



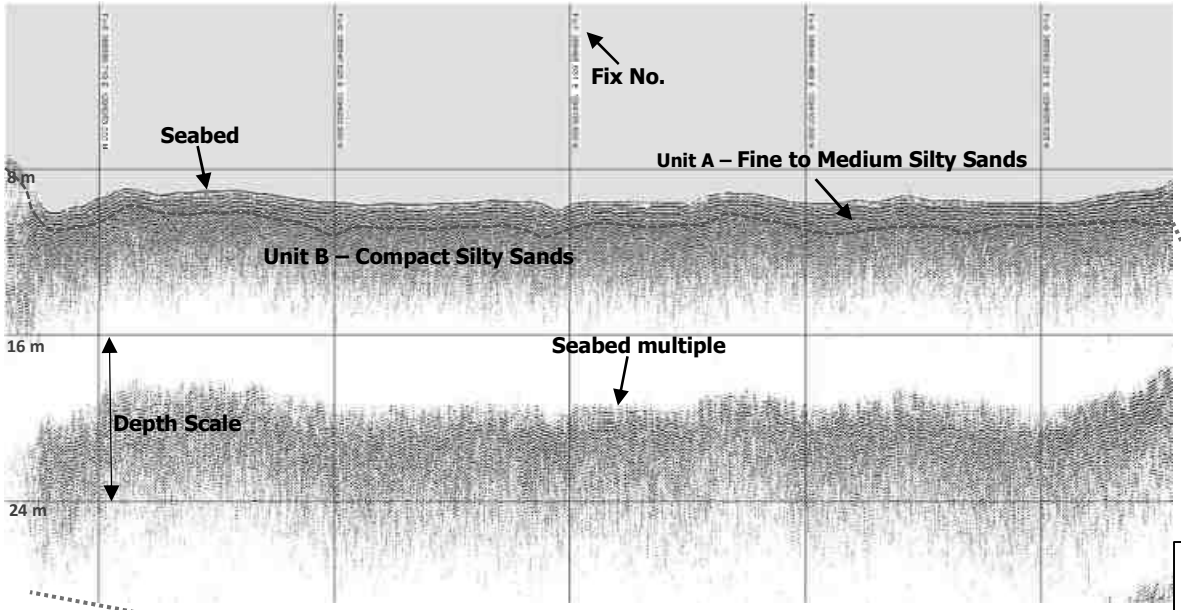
Record Information: SSS data extract showing Sand ripples recorded in the north west part of the Approaches area within the survey corridor.

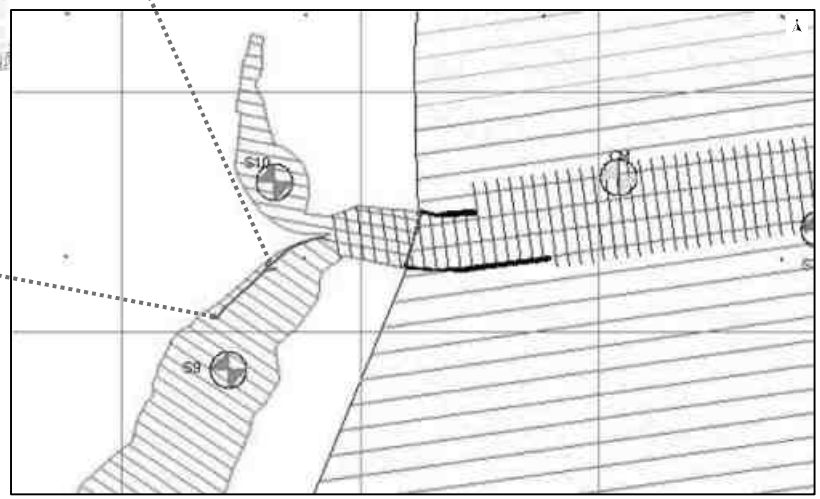
Side Scan Sonar Data Extract



Record Information: SSS data extract showing Drag marks recorded in the south part of the Approaches area within the survey corridor.

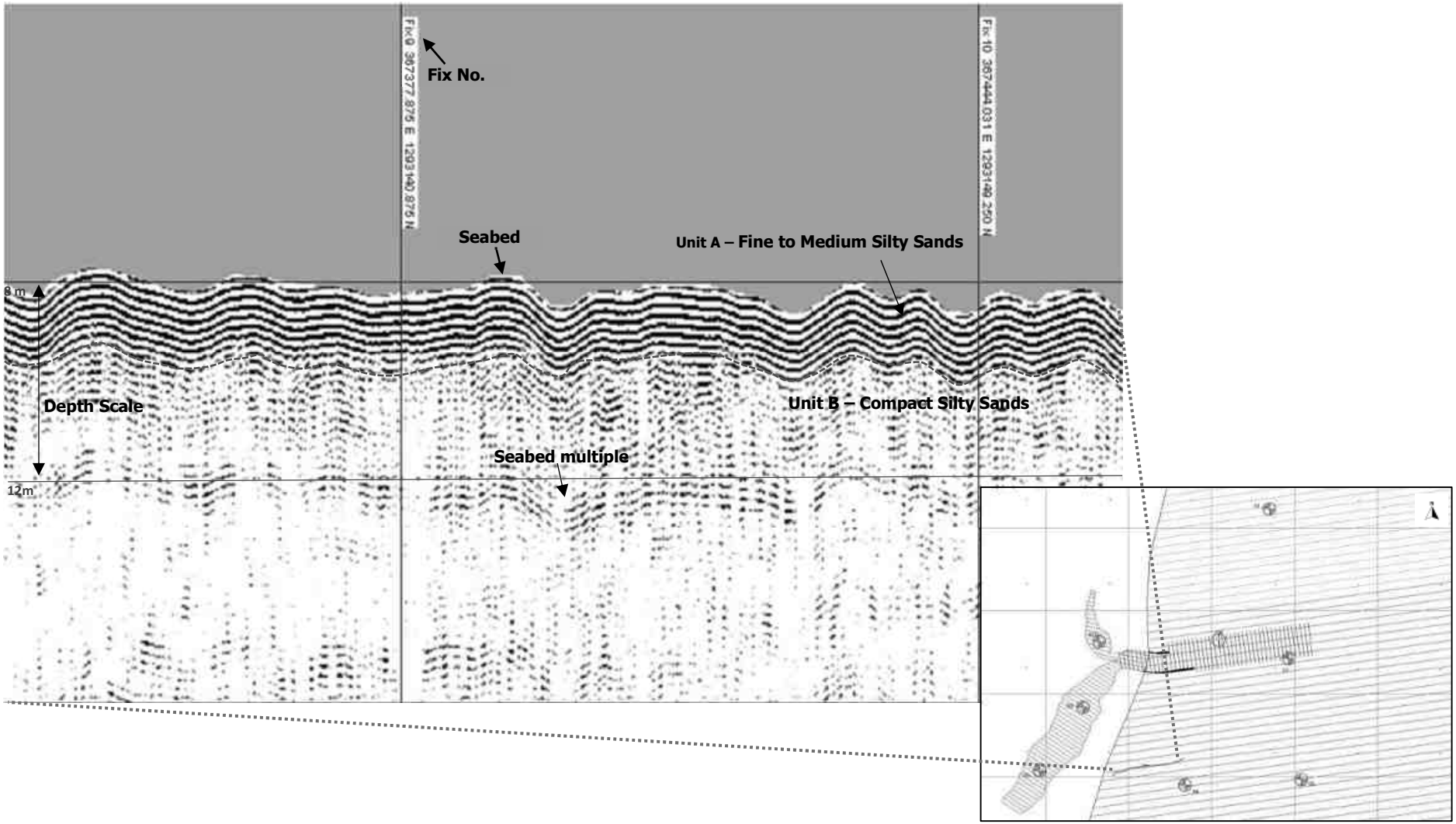
Sub Bottom Profiler (SBP) Data Extract





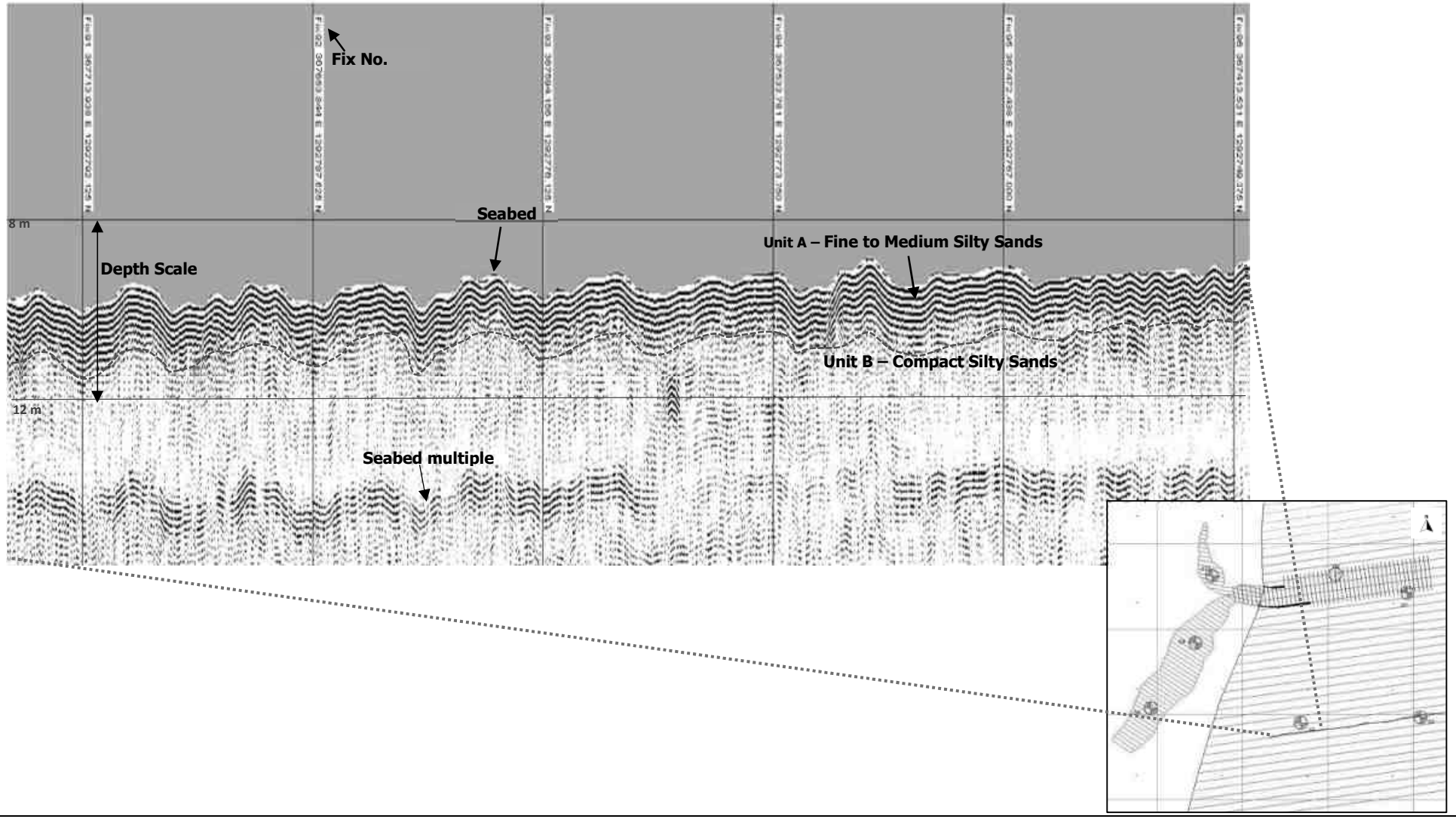
Record Information: SBP data extract showing sediment layers recorded in harbour area near South Jetty within the survey corridor.

Sub Bottom Profiler (SBP) Data Extract



Record Information: SBP data extract showing sediment layers recorded in the south west part of the approaches area within the survey corridor.

Sub Bottom Profiler (SBP) Data Extract



Record Information: SBP data extract showing sediment layers recorded in the south west part of the approaches area within the survey corridor.

APPENDIX G

SOIL & WATER SAMPLES ANALYSIS

Test Report No. : SKW / L0344 / 0493

Date : 13-09-2025

Client * : GEOSTAR SURVEYS INDIA PVT. LTD. (Geostar sadan, Plot No 46, Sector – 19C, Vashi , Navi Mumbai -400703.)

MECHANICAL TEST REPORT

Group	: Soil & Water
Source of sample	: Sample Supplied by client
Lab Reference Number	: 2025 / SEP / 0344
Project*	: Laboratory Testing of Van-Veen Grab samples, from Cuddalore, Tamil Nadu, East Coast of India for Mahathi Infra Services PVT. LTD.
Material*	: Soil & Water
Condition of Sample	: Satisfactory
Period of test	: 10-09-2025 to 13-09-2025

*As furnished by customer

Note:

The Results Relate only to the items tested.

Report shall not be reproduced except in full, without the written approval of the lab.

Any correction invalidates this report.

For SKW Soil and Surveys Pvt. Ltd.

(Technical Manager- Lab)

Authorised Signatory

SOIL TEST DATA SHEET

Project : *Laboratory Testing of Van-Veen Grab samples, from Cuddalore, Tamil Nadu, East Coast of India for Mahathi Infra Services PVT. LTD.*

Report Ref.:- *SKW/ GEOSTAR/SEP/01*

Sample ID	WGS -84 CM 750 E, Zone 43 UTM co-ordinates		Sample Type	Density gm/ cm^3 (IS 2720 Part 7-2016 & Part 8-2015)		Natural Moisture Content, % (IS 2720 Part 2-2015)	Soil Classification (I.S) (IS 1498-2016)	Mechanical Analysis (IS 2720 Part 4-2015)				Consistency Limits (IS 2720 Part 5-2015)			Shrinkage Limit % (IS 2720 Part 6-2016)	Direct Shear Test (IS 2720 Part 13-2016)			Unconfined Compression Test Kg/cm^2 (IS 2720 Part 10-2015)	Vertical Consolidation (IS 2720 Part 15-2016)		Specific Gravity (IS 2720 Part 3-2016)	Remarks
	Easting (m)	Northing (m)		Wet Density	Dry Density			Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index, I_p %		Type	Cohesion C_u kg/cm^2	Degree φ		Comp. Index C_{cv} (Lab)	Initial Void Ratio		
S - 1	368692.820	1296226.080	Grab sample	----	----	----	SP	0	96	4		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	
S - 2	371197.630	1296559.920	Grab sample	----	----	----	SP	0	98	2		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	

CHEM : Chemical Analysis
COMP : Compaction Test
DS : Direct Shear
K : Permeability Test
FSI : Free Swell Test

Tuu : Triaxial Test (Unconsolidated Undrained)
Tcu : Triaxial Test (Consolidated Undrained)
Tcd : Triaxial Test (Consolidated Drained)
NP : Non Plastic
SL : Shrikage Limit Test

SP : Swelling Pressure or Swelling Potential Test
SPT : Standard Penetration Test Sample
UDS : Undisturbed Soil Sample
VL : Laboratory Vane Shear Test
UC : Unconfined Compression Test

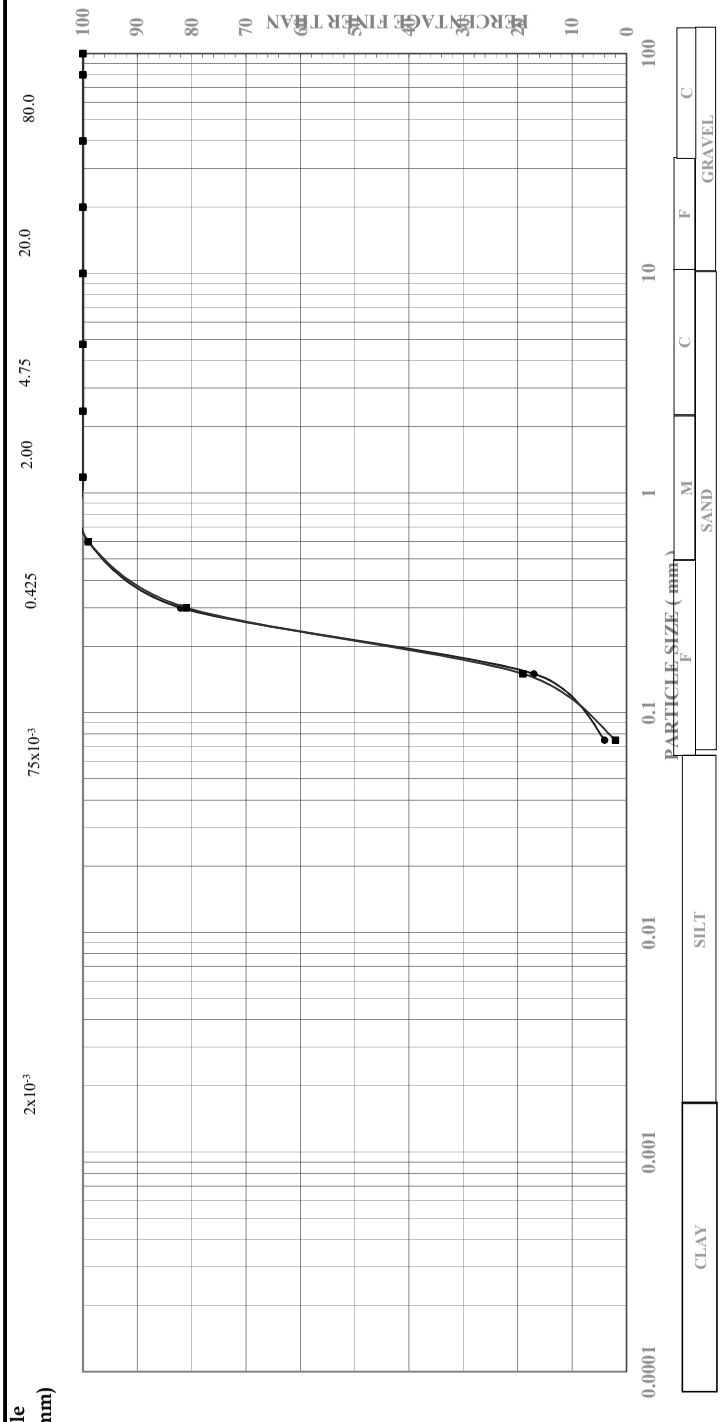
φ :
Cc :
φ' :
Cc' :
-----> :

SKW SOIL AND SURVEYS PVT. LTD.

GRAIN SIZE DISTRIBUTION CURVE

Project : *Laboratory Testing of Van-Veen Grab samples, from Cuddalore, Tamil Nadu, East Coast of India for Mahathi Infra Services PVT. LTD.*

Report Ref.:- *SKW/ GEOSTAR/SEP/01* | *Page No* *3 of 13*



Symbol	Sample ID	WGS -84 CM 75^0 E, Zone 43 UTM co-ordinates		Classifi--cation (IS)	Gravel	Sand	Silt	Clay	$\phi_{10\%}$	$\phi_{30\%}$	$\phi_{60\%}$	Coeff. of Uniformity, $C_u = D_{60} / D_{10}$	Coeff. Of Curvature C_c $D_{30}^2/(D_{60}*D_{10})$	Liquid Limit, W_l	Plastic Limit, W_p	Plasticity Index, I_p	Remarks
		Easting (m)	Northing (m)		%	%	%	%	mm	mm	mm						
●	S - 1	368692.82	1296226.08	SP	0	96	4		0.13	0.17	0.23	1.77	0.97	----	----	----	Grab sample
■	S - 2	371197.63	1296559.92	SP	0	98	2		0.14	0.17	0.23	1.64	0.90	----	----	----	Grab sample
▲																	
✳																	
◆																	

SKW SOIL AND SURVEYS PVT. LTD.

SOIL TEST DATA SHEET

Project : *Laboratory Testing of Van-Veen Grab samples, from Cuddalore, Tamil Nadu, East Coast of India for Mahathi Infra Services PVT. LTD.*

Report Ref.:- *SKW/ GEOSTAR/SEP/01*

Sample ID	WGS -84 CM 750 E, Zone 43 UTM co-ordinates		Sample Type	Density gm/ cm^3 (IS 2720 Part 7-2016 & Part 8-2015)		Natural Moisture Content, % (IS 2720 Part 2-2015)	Soil Classification (I.S) (IS 1498-2016)	Mechanical Analysis (IS 2720 Part 4-2015)				Consistency Limits (IS 2720 Part 5-2015)			Shrinkage Limit % (IS 2720 Part 6-2016)	Direct Shear Test (IS 2720 Part 13-2016)			Unconfined Compression Test Kg/cm^2 (IS 2720 Part 10-2015)	Vertical Consolidation (IS 2720 Part 15-2016)		Specific Gravity (IS 2720 Part 3-2016)	Remarks
	Easting (m)	Northing (m)		Wet Density	Dry Density			Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index, I_p %		Type	Cohesion C_u kg/cm^2	Degree φ		Comp. Index C_{cv} (Lab)	Initial Void Ratio		
S - 3	371380.690	1294949.390	Grab sample	----	----	----	SP	0	98	2		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	
S - 4	371575.750	1293264.260	Grab sample	----	----	----	SP	0	96	4		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	

CHEM : Chemical Analysis
COMP : Compaction Test
DS : Direct Shear
K : Permeability Test
FSI : Free Swell Test

Tuu : Triaxial Test (Unconsolidated Undrained)
Tcu : Triaxial Test (Consolidated Undrained)
Tcd : Triaxial Test (Consolidated Drained)
NP : Non Plastic
SL : Shrikage Limit Test

SP : Swelling Pressure or Swelling Potential Test
SPT : Standard Penetration Test Sample
UDS : Undisturbed Soil Sample
VL : Laboratory Vane Shear Test
UC : Unconfined Compression Test

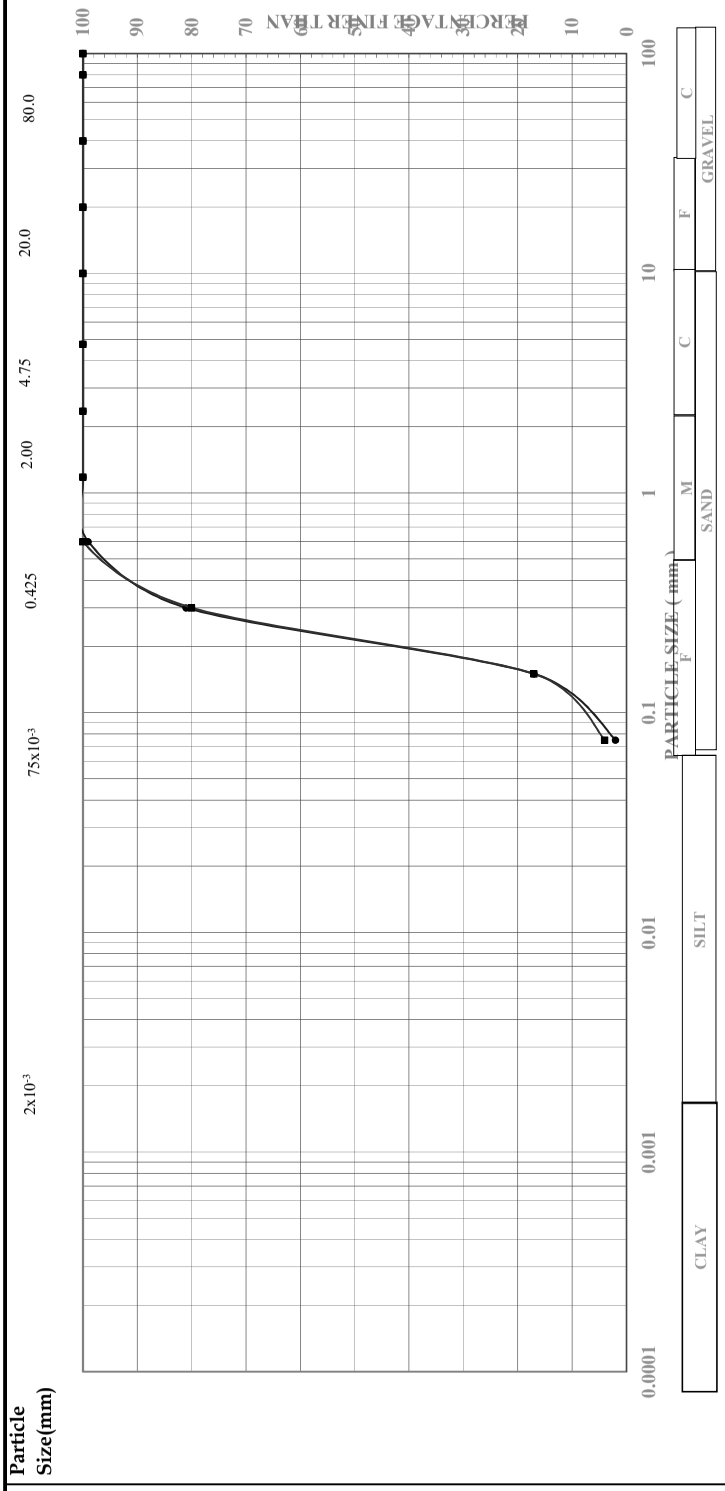
φ :
Cc :
φ' :
Cc' :
-----> :

SKW SOIL AND SURVEYS PVT. LTD.

GRAIN SIZE DISTRIBUTION CURVE

Project : *Laboratory Testing of Van-Veen Grab samples, from Cuddalore, Tamil Nadu, East Coast of India for Mahathi Infra Services PVT. LTD.*

Report Ref.:- *SKW/ GEOSTAR/SEP/01* | *Page No 5 of 12*



Particle Size(mm)

Symbol	Sample ID	WGS -84 CM 75^0 E, Zone 43 UTM co-ordinates		Classifi--cation (IS)	Gravel	Sand	Silt	Clay	ϕ_{10}		ϕ_{30}		ϕ_{60}		Coeff. of Uniformity, $C_u = D_{60} / D_{10}$	Coeff. Of Curvature C_c $D_{30}^2/(D_{60}*D_{10})$	Liquid Limit, W_l	Plastic Limit, W_p	Plasticity Index, I_p	Remarks
		Easting (m)	Northing (m)		%	%	%	%	mm		mm		mm							
●	S - 3	371380.69	1294949.39	SP	0	98		2	0.14		0.17		0.24		1.71	0.86	----	----	----	Grab sample
■	S - 4	371575.75	1293264.26	SP	0	96		4	0.13		0.17		0.24		1.85	0.93	----	----	----	Grab sample
▲																				
✳																				
◆																				

SKW SOIL AND SURVEYS PVT. LTD.

SOIL TEST DATA SHEET

Project : *Laboratory Testing of Van-Veen Grab samples, from Cuddalore, Tamil Nadu, East Coast of India for Mahathi Infra Services PVT. LTD.*

Report Ref.:- *SKW/ GEOSTAR/SEP/01*

Sample ID	WGS -84 CM 750 E, Zone 43 UTM co-ordinates		Sample Type	Density gm/ cm^3 (IS 2720 Part 7-2016 & Part 8-2015)		Natural Moisture Content, % (IS 2720 Part 2-2015)	Soil Classification (I.S) (IS 1498-2016)	Mechanical Analysis (IS 2720 Part 4-2015)				Consistency Limits (IS 2720 Part 5-2015)			Shrinkage Limit % (IS 2720 Part 6-2016)	Direct Shear Test (IS 2720 Part 13-2016)			Unconfined Compression Test Kg/cm^2 (IS 2720 Part 10-2015)	Vertical Consolidation (IS 2720 Part 15-2016)		Specific Gravity (IS 2720 Part 3-2016)	Remarks
	Easting (m)	Northing (m)		Wet Density	Dry Density			Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index, I_p %		Type	Cohesion C_u kg/cm^2	Degree φ		Comp. Index C_{cv} (Lab)	Initial Void Ratio		
S - 5	369077.890	1292967.970	Grab sample	----	----	----	SP	0	96	4		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	
S - 6	367679.800	1292901.910	Grab sample	----	----	----	SP	0	97	3		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	

CHEM : Chemical Analysis
COMP : Compaction Test
DS : Direct Shear
K : Permeability Test
FSI : Free Swell Test

Tuu : Triaxial Test (Unconsolidated Undrained)
Tcu : Triaxial Test (Consolidated Undrained)
Tcd : Triaxial Test (Consolidated Drained)
NP : Non Plastic
SL : Shrikage Limit Test

SP : Swelling Pressure or Swelling Potential Test
SPT : Standard Penetration Test Sample
UDS : Undisturbed Soil Sample
VL : Laboratory Vane Shear Test
UC : Unconfined Compression Test

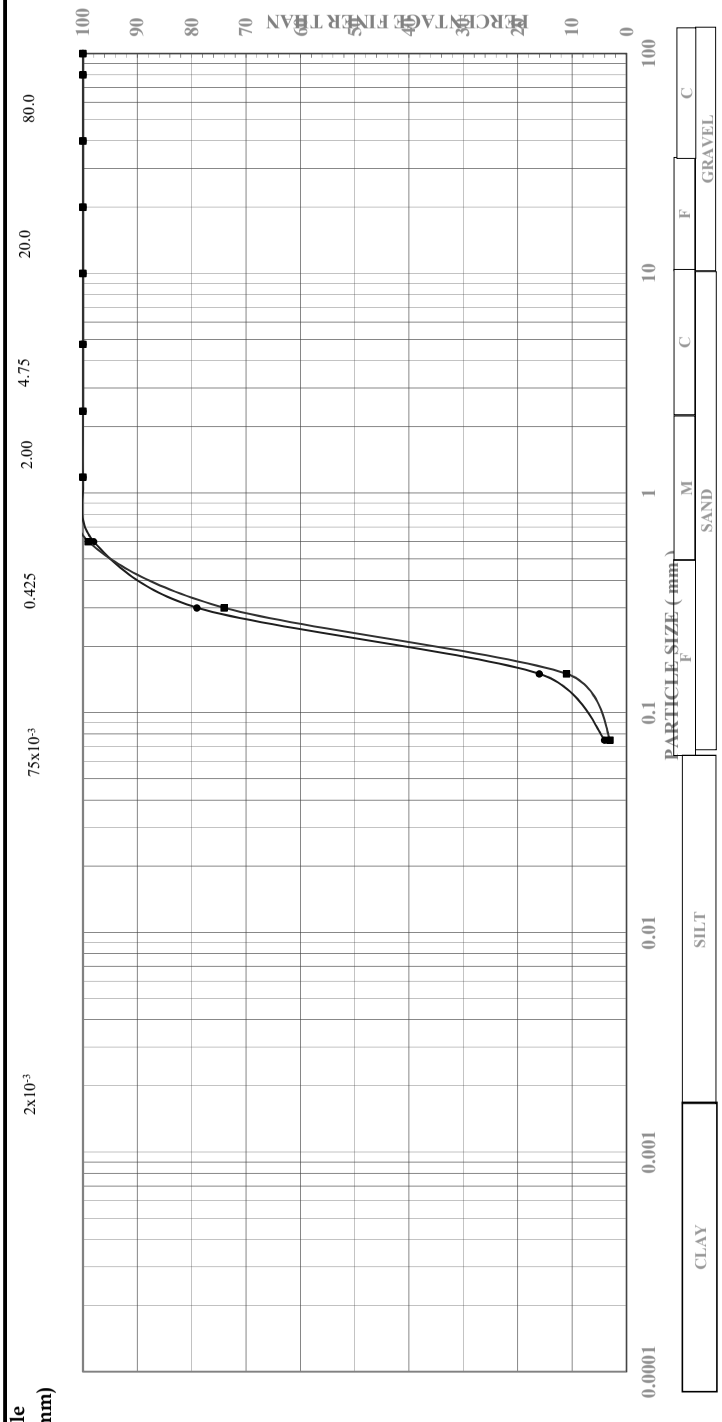
φ :
Cc :
φ' :
Cc' :
-----> :

SKW SOIL AND SURVEYS PVT. LTD.

GRAIN SIZE DISTRIBUTION CURVE

Project : *Laboratory Testing of Van-Veen Grab samples, from Cuddalore, Tamil Nadu, East Coast of India for Mahathi Infra Services PVT. LTD.*

Report Ref.:- *SKW/ GEOSTAR/SEP/01* | *Page No 7 of 12*



Symbol	Sample ID	WGS -84 CM 75^0 E, Zone 43 UTM co-ordinates		Classifi--cation (IS)	Gravel	Sand	Silt	Clay	ϕ_{10}%		ϕ_{30}%		ϕ_{60}%		Coeff. of Uniformity, $C_u = D_{60} / D_{10}$	Coeff. Of Curvature C_c $D_{30}^2/(D_{60}*D_{10})$	Liquid Limit, W_l	Plastic Limit, W_p	Plasticity Index, I_p	Remarks
		Easting (m)	Northing (m)		%	%	%	%	mm		mm		mm							
●	S - 5	369077.89	1292967.97	SP	0	96	4		0.13		0.17		0.24		1.85	0.93	----	----	----	Grab sample
■	S - 6	367679.80	1292901.91	SP	0	97	3		0.15		0.18		0.25		1.67	0.86	----	----	----	Grab sample
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SOIL TEST DATA SHEET

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	Easting (m)	Northing (m)		Wet Density	Dry Density			Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index, I_p %		Type	Cohesion C_u kg/cm^2	Degree φ		Comp. Index C_{cv} (Lab)	Initial Void Ratio		
S - 7	368922.840	1294427.620	Grab sample	----	----	----	SP	0	96	4		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	
S - 8	365924.940	1293074.740	Grab sample	----	----	----	SP-SM	0	94	6		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	

CHEM : Chemical Analysis
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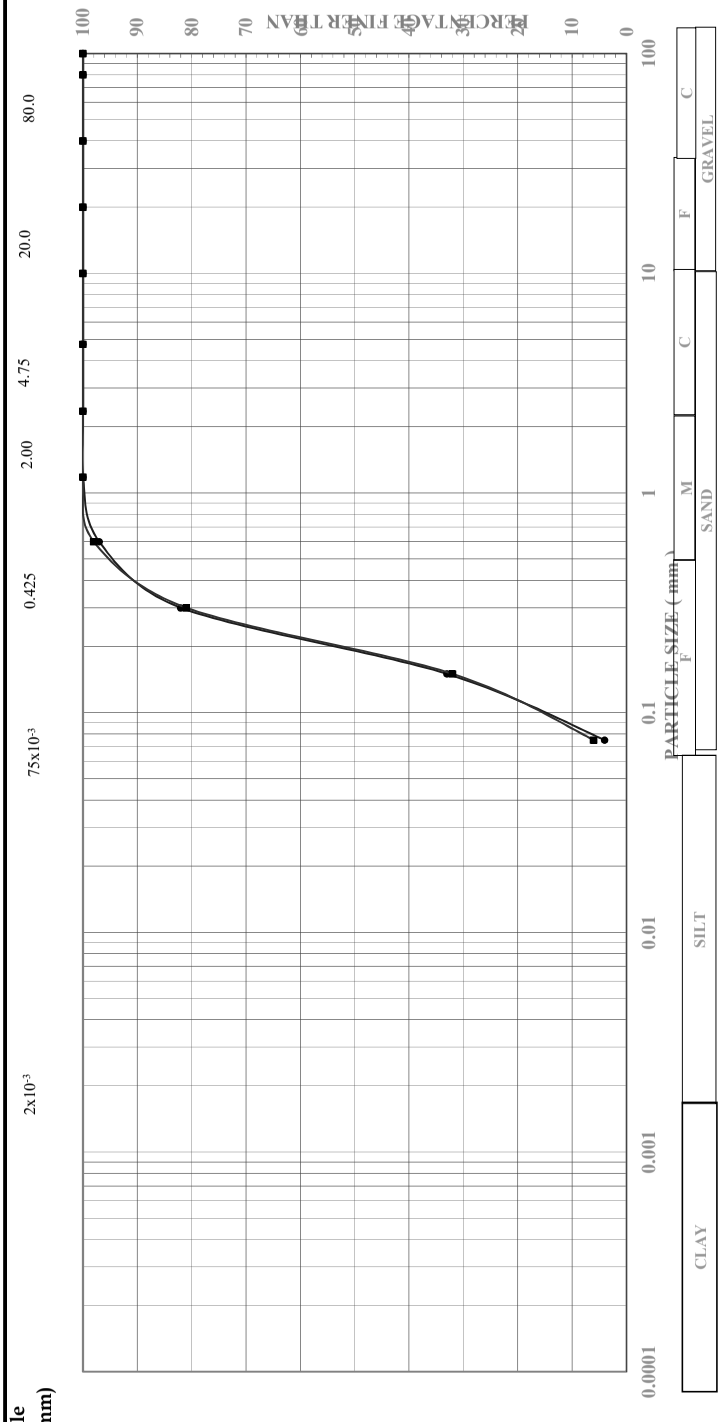
SKW SOIL AND SURVEYS PVT. LTD.

GRAIN SIZE DISTRIBUTION CURVE

Project : *Laboratory Testing of Van-Veen Grab samples, from Cuddalore, Tamil Nadu, East Coast of India for Mahathi Infra Services PVT. LTD.*

Report Ref.:- *SKW/ GEOSTAR/SEP/01* | *Page No 9 of 12*



Particle Size(mm)

Symbol	Sample ID	WGS -84 CM 75^0 E, Zone 43 UTM co-ordinates		Classifi--cation (IS)	Gravel	Sand	Silt	Clay	ϕ_{10}	ϕ_{30}	ϕ_{60}	Coeff. of Uniformity, $C_u = D_{60}/D_{10}$	Coeff. Of Curvature C_c $D_{30}^2/(D_{60}*D_{10})$	Liquid Limit, W_l	Plastic Limit, W_p	Plasticity Index, I_p	Remarks
		Easting (m)	Northing (m)		%	%	%	%	mm	mm	mm						
●	S - 7	368922.84	1294427.62	SP	0	96	4		0.085	0.14	0.23	2.71	1.00	----	----	----	Grab sample
■	S - 8	365924.94	1293074.74	SP-SM	0	94	6		0.088	0.14	0.22	2.50	1.01	----	----	----	Grab sample
▲																	
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SKW SOIL AND SURVEYS PVT. LTD.

SOIL TEST DATA SHEET

Project : *Laboratory Testing of Van-Veen Grab samples, from Cuddalore, Tamil Nadu, East Coast of India for Mahathi Infra Services PVT. LTD.*

Report Ref.:- *SKW/ GEOSTAR/SEP/01*

Sample ID	WGS -84 CM 750 E, Zone 43 UTM co-ordinates		Sample Type	Density gm/ cm^3 (IS 2720 Part 7-2016 & Part 8-2015)		Natural Moisture Content, % (IS 2720 Part 2-2015)	Soil Classification (I.S) (IS 1498-2016)	Mechanical Analysis (IS 2720 Part 4-2015)				Consistency Limits (IS 2720 Part 5-2015)			Shrinkage Limit % (IS 2720 Part 6-2016)	Direct Shear Test (IS 2720 Part 13-2016)			Unconfined Compression Test Kg/cm^2 (IS 2720 Part 10-2015)	Vertical Consolidation (IS 2720 Part 15-2016)		Specific Gravity (IS 2720 Part 3-2016)	Remarks
	Easting (m)	Northing (m)		Wet Density	Dry Density			Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index, I_p %		Type	Cohesion C_u kg/cm^2	Degree φ		Comp. Index C_{cv} (Lab)	Initial Void Ratio		
S - 9	366447.100	1293841.670	Grab sample	----	----	----	SP	0	96	4		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	
S - 10	366640.000	1294625.870	Grab sample	----	----	----	SP	0	97	3		----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	

CHEM : Chemical Analysis
COMP : Compaction Test
DS : Direct Shear
K : Permeability Test
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Tuu : Triaxial Test (Unconsolidated Undrained)
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SKW SOIL AND SURVEYS PVT. LTD.

GRAIN SIZE DISTRIBUTION CURVE

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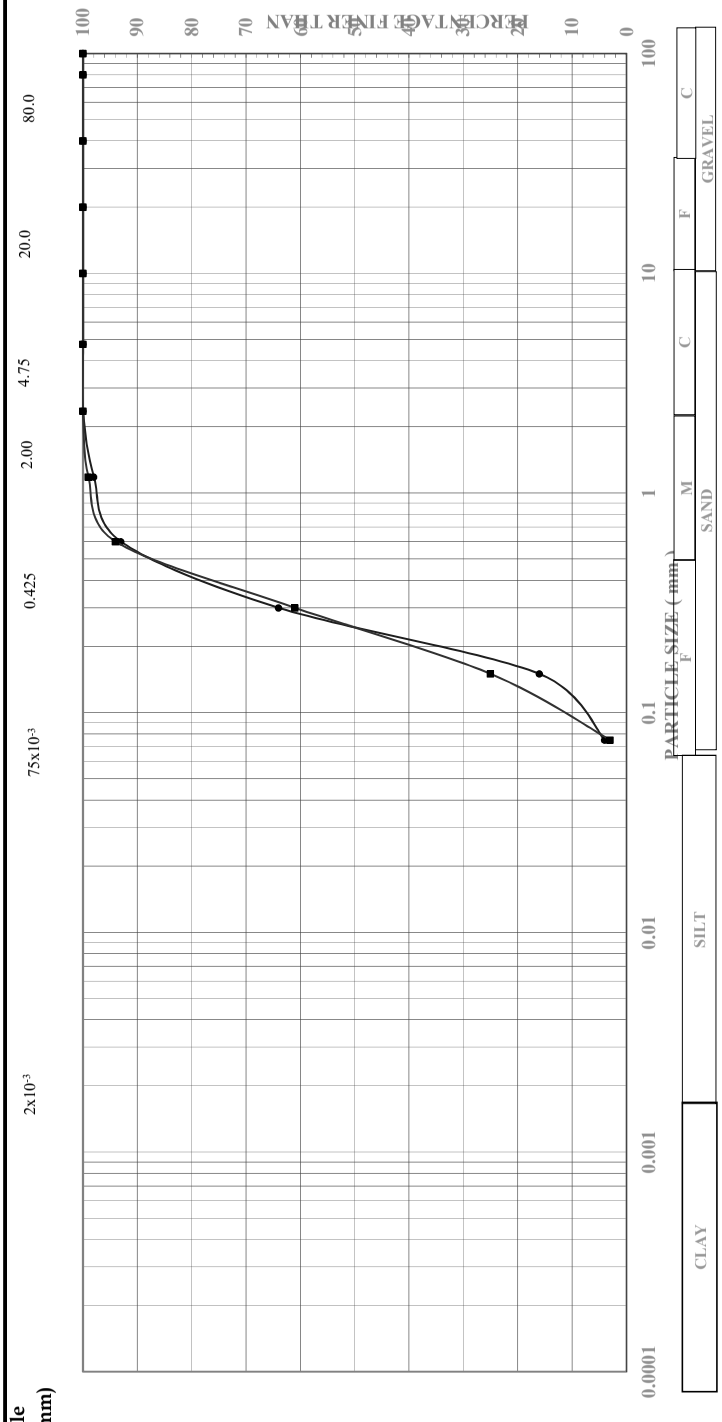
Report Ref.:- *SKW/ GEOSTAR/SEP/01* | *Page No* *11 of 12*



Particle Size(mm)

Symbol	Sample ID	WGS -84 CM 75^0 E, Zone 43 UTM co-ordinates		Classifi--cation (IS)	Gravel	Sand	Silt	Clay	ϕ_{10}	ϕ_{30}	ϕ_{60}	Coeff. of Uniformity, $C_u = D_{60}/D_{10}$	Coeff. Of Curvature C_c $D_{30}^2/(D_{60}*D_{10})$	Liquid Limit, W_l	Plastic Limit, W_p	Plasticity Index, I_p	Remarks
		Easting (m)	Northing (m)		%	%	%	%	mm	mm	mm						
●	S - 9	366447.10	1293841.67	SP	0	96	4		0.13	0.18	0.28	2.15	0.89	----	----	----	Grab sample
■	S - 10	366640.00	1294625.87	SP	0	97	3		0.098	0.16	0.30	3.06	0.87	----	----	----	Grab sample
▲																	
✱																	
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SKW SOIL AND SURVEYS PVT. LTD.

SKW SOIL AND SURVEYS PVT. LTD.

Pat Chem Laboratories

Cell : 9820066842 / 9757261429
Email: patchemlab@gmail.com
pancholipiyush696@gmail.com

Soil • Water • Rock • Concrete • Construction Materials • Geo- Chemical Testing & Certifications

Laboratories : Shop1, Ita Laxmi Estate, JVK Marg, Near Jeevan Vikas Hospital, Vile Parle (E), Mumbai - 400 057.

Ref. S K W / Lab. No. Sept. – 031 - 040 / 25. **Date : 13.09.2025.**

Certification of Water for Physical Tests

Name of the Party **M/s SKW Soil and Surveys Pvt. Ltd., Rabale MIDC Navi Mumbai.**

Nature of the Sample **W a t e r (G r a b S a m p l e s)**

Packing **PVC Can.**

Marks **As under**

Site **Cuddalore, TN East Coast, India**

Client **M/s Mahathi Infra Services Pvt. Ltd.**

R e s u l t s o f A n a l y s i s

U T M Co-Ordinates

Sr. No.	M a r k s	Easting	Northing	Suspended Load (ppm)	Particle size Distribution (%)
1	S – 1	368692.82	1296226.08	24	97.5
2	S – 2	371197.63	1296559.92	40	98.5
3	S – 3	371380.69	1294949.39	64	99.0
4	S – 4	371575.75	1293264.26	48	97.5
5	S – 5	369077.89	1292967.97	20	98.5
6	S – 6	367679.80	1292901.91	24	99.0
7	S – 7	368922.84	1294427.62	32	96.5
8	S – 8	365924.94	1293074.74	52	97.5
9	S – 9	366447.10	1293841.67	26	98.5
10	S – 10	366640.00	1294625.87	60	96.5

Analysed by : P. Pancholi

PAT-CHEM LABORATORIES MUMBAI ESTED - 1990

Pat Chem Laboratories

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Soil • Water • Rock • Concrete • Construction Materials • Geo- Chemical Testing & Certifications

Laboratories : Shop1, Ita Laxmi Estate, JVK Marg, Near Jeevan Vikas Hospital, Vile Parle (E), Mumbai - 400 057.

Ref. GSSIPL / Lab. No. Oct. – 030 - 039 / 25. ***Date : 15.10.2025.***

Certification of Water for Physical & Chemical Tests

Name of the Client **M/s Geostar Surveys India Pvt. Ltd.**

Nature of the Sample **W a t e r (G r a b S a m p l e s)**

Packing **PVC Can.**

Marks **As under**

Site **Cuddalore, TN East Coast, India**

Client **M/s Mahathi Infra Services Pvt. Ltd.**

R e s u l t s o f A n a l y s i s

	U T M Co-Ordinates		Physical test				Chemical test				
	Easting	Northing	p H By digital pH Meter	Color In Hazen Unit	Turbidity in NTU	Odor	Chloride as Cl	Salinity in ppm	Carbonate as CaCo3	Bi Carbonate as Hco3	Resistivity in Ohs/cm\
S-1	368692.82	1296226.08	7.43	4	**8**	Agreeable	21200	34950	600	804	1.01
S-2	371197.63	1296559.92	7.53	**6**	**6**	Agreeable	22450	37011	750	1005	1,07
S-3	371380.69	1294949.39	7.66	**5**	**10**	Agreeable	23600	24300	730	820	1.12
S-4	371575.75	1293264.26	7.84	4	**8**	Agreeable	24300	40061	820	1099	1.36
S-5	369077.89	1292967.97	7.75	**8**	**6**	Agreeable	24300	40061	790	1059	1.16
S-6	367679.80	1292901.91	7.64	4	5	Agreeable	24960.0	41149	930	1246	1.19
S-7	368922.84	1294427.62	7.43	5	***8***	Agreeable	26500	43688	830	1112	1.26
S-8	365924.94	1293074.74	7.32	6	***8***	Agreeable	25700	42369	1040	1394	1.22
S-9	366447.10	1293841.67	7.66	6	***10***	Agreeable	27600	26850	980	1120	1.31
S-10	366640.00	1294625.87	7.22	8	***6***	Agreeable	26850	44265	1120	1501	1.28

Analysed By

APPENDIX H

OCEANOGRAPHIC MEASUREMENTS

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FIGURE 1 LOCATION MAP

The co-ordinates of location where ADCP was deployed are as follows:

OCEANOGRAPHIC OBSERVATION'S LOCATION (ADCP)				
DATUM: WGS-84, CM-75°, Zone-43				
ID	**Easting (m)**	**Northing (m)**	**Latitude**	**Longitude**
ADCP	368072.48 m E	1294653.71 m N	11°42'32.22"N	79° 47'22.02"E

TABLE 1 CO-ORDINATES OF ADCP LOCATION

1 SUMMARY OF RESULTS

1.1 CURRENT MEASUREMENT

Current measurement was carried out for the duration of 15 days from 30 August 2025 to 13 September 2025 by deploying Acoustic Doppler Current Profiler (ADCP).

Summary of current measurement is as follows:

a) The Maximum current speed is 1.1 m/s and the minimum current speed is 0.01 m/s at the Surface level.
b) The Maximum current speed is 0.62 m/s and the minimum current speed is 0.01 m/s at the Middle level.
c) The Maximum current speed is 0.60 m/s and the minimum current speed is 0.01 m/s at the bottom level.

current speeds are observed in the range of 0.01 m/s to 1.2 m/s and directions are observed in the entire range from 000.0° to 360°

1.2 CURRENT OBSERVATION

The maximum current speed of 1.17 m/s at Surface layer on 03rd Sep 2025 at 21:55hr and minimum current speed (still current) of 0.01m/s is observed several times. Upon analyzing the currents directions speed is varying in the seabed and surface current is higher about only 0.57m/s.

Current meter observations were carried out for a period of 15 days from 30th August 2025 to 13th September 2025. However, in this period the current parameters were recorded Speed in m/s. current speeds are observed in the range of 0.01 m/s to 1.30 m/s and directions are observed in the entire range from 000.0° to 360°.

1.3 WAVE OBSERVATION

Wave observations were carried out for a period of approx. of 15 days from 30th August 2025 to 13th September 2025 at the above location. The observation period crosses one neap and one spring tide. It shows that the significant wave height varies from 0.4m to 1.1m. The peak wave period varies between 1.7s to 11.3s.

1.4 TIDE OBSERVATION

The data from the ADCP was plotted graphically. The water level collects in between 30th Aug 2025 to 13th Sep 2025 & the difference in the water level is 1.2m at a depth of 7.0m.

2 DETAILED RESULTS

2.1 CURRENT MEASUREMENT

Current measurement was carried out for the duration of 15 days from 30th August 2025 to 13th September 2025 by deploying Acoustic Doppler Current Profiler (ADCP).

Summary of current measurement is as follows:

a) The Maximum current speed is 1.1 m/s and the minimum current speed is 0.01 m/s at the Surface level.
b) The Maximum current speed is 0.62 m/s and the minimum current speed is 0.01 m/s at the Middle level.
c) The Maximum current speed is 0.60 m/s and the minimum current speed is 0.01 m/s at the bottom level.

current speeds are observed in the range of 0.01 m/s to 1.2 m/s and directions are observed in the entire range from 000.0° to 360°

2.2 SUMMARY OF CURRENT MEASUREMENT DATA

Occurrence Charts

Occurrence Charts are prepared using spread sheets for speed and direction using histogram by analysing the raw data. The interval for occurrence of current speed is taken in steps of 0.2m/s for the entire range of data. This range varies for every bin level for the deployed current meter. The analysed raw data is distributed as per these intervals categorically. Similarly, the interval of occurrence for current direction is taken in steps of 022.5 degrees (based on the interval of cardinal direction) for the entire range of data which is from 000° to 360° degrees. Occurrence charts are also presented using Grapher. The data is plotted for speed and direction on the ordinate and the time period on the abscissa. The units of speed data are in metres/sec and the direction is represented in degrees for the data represented in Grapher software.

Surface Joint probability distribution, Current Vs Direction (Occurrence%)																	
Speed (m/s)	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**Total**
<0.2	1.54	2.18	3.20	2.58	2.37	2.00	2.12	1.35	0.98	0.74	0.31	0.34	0.43	0.31	0.46	0.71	21.62
0.2-0.4	4.18	6.98	5.23	3.35	2.61	3.20	2.43	1.66	2.09	0.95	0.12	0.15	0.25	0.62	0.74	1.23	35.79
0.4-0.6	4.31	6.00	3.72	2.83	2.28	2.68	1.81	0.68	1.11	0.46	0.31	0.31	0.37	0.52	0.49	0.80	28.66
0.6-0.8	0.65	1.54	1.75	1.38	1.08	1.20	1.05	0.28	0.46	0.25	0.28	0.15	0.06	0.77	0.31	0.06	11.25
0.8-1.0	0.22	0.40	0.34	0.22	0.09	0.09	0.12	0.03	0.00	0.09	0.06	0.06	0.09	0.25	0.09	0.12	2.28
>1	0.00	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.12	0.00	0.03	0.00	0.40
Sum	10.89	17.19	14.33	10.36	8.43	9.16	7.53	4.00	4.67	2.52	1.08	1.01	1.32	2.46	2.12	2.92	100.00

TABLE 2 OCCURRENCE TABLE FOR SURFACE LAYER CURRENT SPEED VS DIRECTION

Middle Joint probability distribution, Current Vs Direction (Occurrence%)																	
Speed (m/s)	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	NNW	**Total**
<0.2	4.81	7.92	7.20	6.88	5.01	4.42	3.70	3.28	5.38	5.06	4.74	3.23	2.91	2.86	2.05	2.29	71.73
0.2-0.4	1.41	7.84	6.14	1.70	0.81	0.89	0.69	0.86	1.31	0.57	0.39	0.86	1.26	0.52	0.20	0.15	25.60
0.4-0.6	0.10	1.21	0.72	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.05	0.47	0.05	0.02	0.00	2.64
0.6-0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02
0.8-1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
>1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6.31	16.97	14.06	8.58	5.82	5.30	4.39	4.17	6.68	5.62	5.13	4.14	4.64	3.45	2.27	2.44	100.00

TABLE 3 OCCURRENCE TABLE FOR MIDDLE LAYER CURRENT SPEED VS DIRECTION

Bottom Joint probability distribution, Current Vs Direction (Occurrence%)																	
Speed (m/s)	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**Total**
<0.2	6.71	6.96	6.12	5.92	5.40	4.64	4.49	3.77	5.01	6.66	5.13	3.16	2.42	2.81	3.18	3.80	76.17
0.2-0.4	2.74	6.56	4.12	1.26	0.76	0.74	0.59	0.69	0.99	0.64	0.37	0.39	0.96	0.74	0.25	0.20	22.00
0.4-0.6	0.15	0.57	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.32	0.17	0.02	0.02	1.83
0.6-0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.8-1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
>1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	9.60	14.08	10.78	7.18	6.17	5.38	5.08	4.46	5.99	7.30	5.50	3.58	3.70	3.72	3.45	4.02	100.00

TABLE 4 OCCURRENCE TABLE FOR BOTTOM LAYER CURRENT SPEED VS DIRECTION

2.3 PERCENTAGE OF OCCURRENCE SPEED & DIRECTION

Occurrence distribution plot for Current Speed (%)			
Speed (m/s)	**Surface**	**Middle**	**Bottom**
0.0-0.2	21.62	71.73	76.17
0.2-0.4	35.79	25.60	22.00
0.4-0.6	28.66	2.64	1.83
0.6-0.8	11.25	0.02	0.00
0.8-1.0	2.28	0.00	0.00
>1	0.40	0.00	0.00

TABLE 5 OCCURRENCE TABLE OF FREQUENCY DISTRIBUTION OF CURRENT SPEED

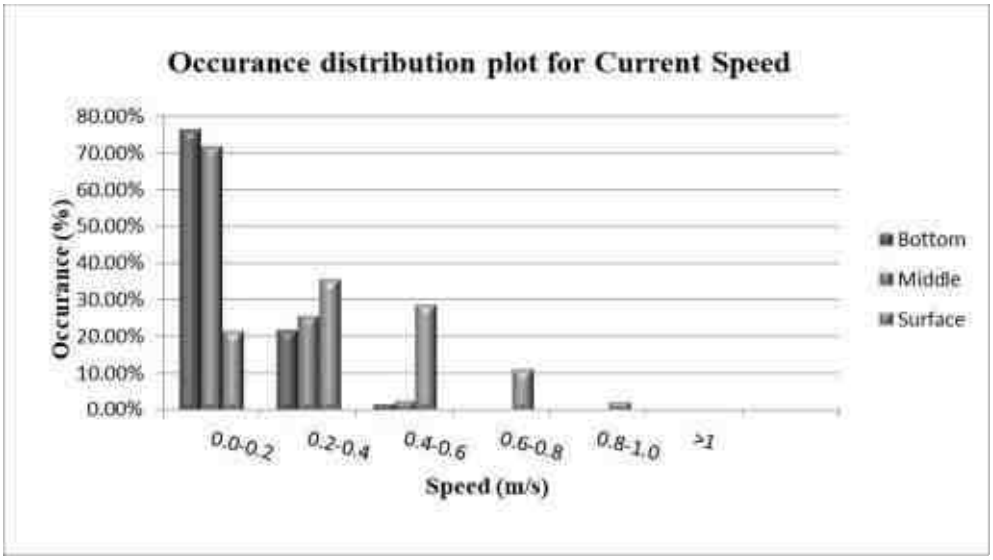

FIGURE 2 FREQUENCY DISTRIBUTION OF CURRENT SPEED

Occurrence distribution plot for Current Direction (%)			
Direction (deg)	**Surface**	**Middle**	**Bottom**
000.00°-022.5°	10.89%	6.31%	9.60%
022.51°-045.00°	17.19%	16.97%	14.08%
045.01°-067.50°	14.33%	14.06%	10.78%
067.51°-090.00°	10.36%	8.58%	7.18%
090.01°-112.50°	8.43%	5.82%	6.17%
112.51°-135.00°	9.16%	5.30%	5.38%
135.01°-157.50°	7.53%	4.39%	5.08%
157.51°-180.00°	4.00%	4.17%	4.46%
180.01°-202.50°	4.67%	6.68%	5.99%
202.51°-225.00°	2.52%	5.62%	7.30%
225.01°-247.50°	1.08%	5.13%	5.50%
247.50°-270.00°	1.01%	4.14%	3.58%
270.01°-292.50°	1.32%	4.64%	3.70%
292.50°-315.00°	2.46%	3.45%	3.72%
315.01°-337.50°	2.12%	2.27%	3.45%
337.51°-360.00°	2.92%	2.44%	4.02%

TABLE 6 OCCURRENCE TABLE OF FREQUENCY DISTRIBUTION OF CURRENT DIRECTION

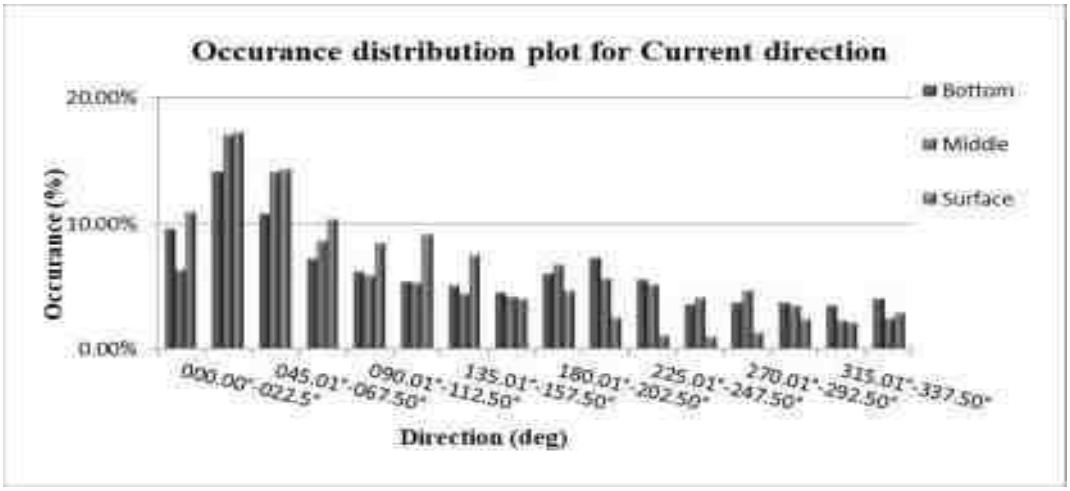

FIGURE 3 OCCURRENCE DISTRIBUTION PLOT FOR CURRENT DIRECTION

2.4 ROSE DIAGRAM

Rose Plots are drawn speed which is taken as a scalar quantity and the direction as vector quantity. The resultant data is generated as a series of lines with and their distribution is spread in radial direction with the density in any particular direction corresponding to the obtained raw data. All the current directions are plotted with respect to the true north. Speed circles are drawn as from 0.2 m to over and above 0.90m speed circle facilitates easy visualization of the logged speed in any given direction. The cardinal direction facilitates easy visualization of the logged direction for any given speed. In addition to the above, the degree range of 22.5° flanking each cardinal direction is marked in colour.

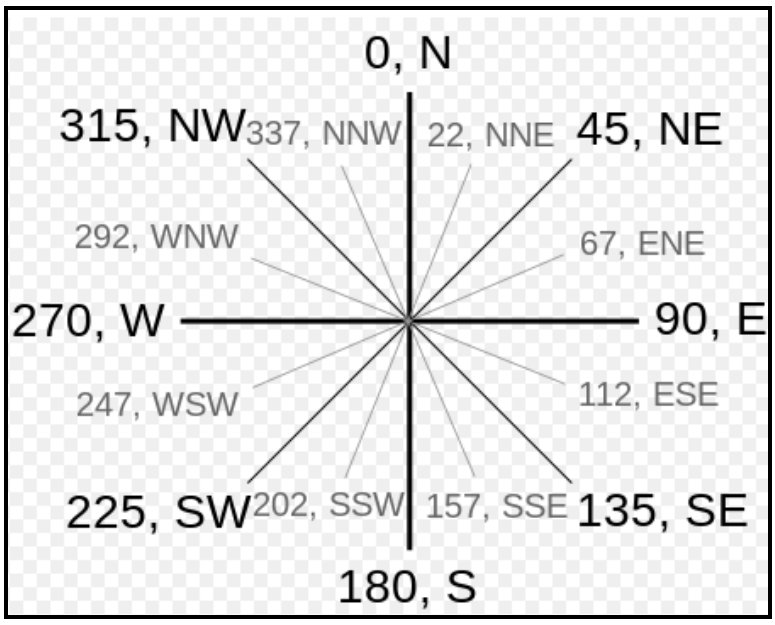

FIGURE 4 CARDINAL DIRECTION

The rose plot of current speed and direction at the surface, mid-level and Bottom level is shown below:

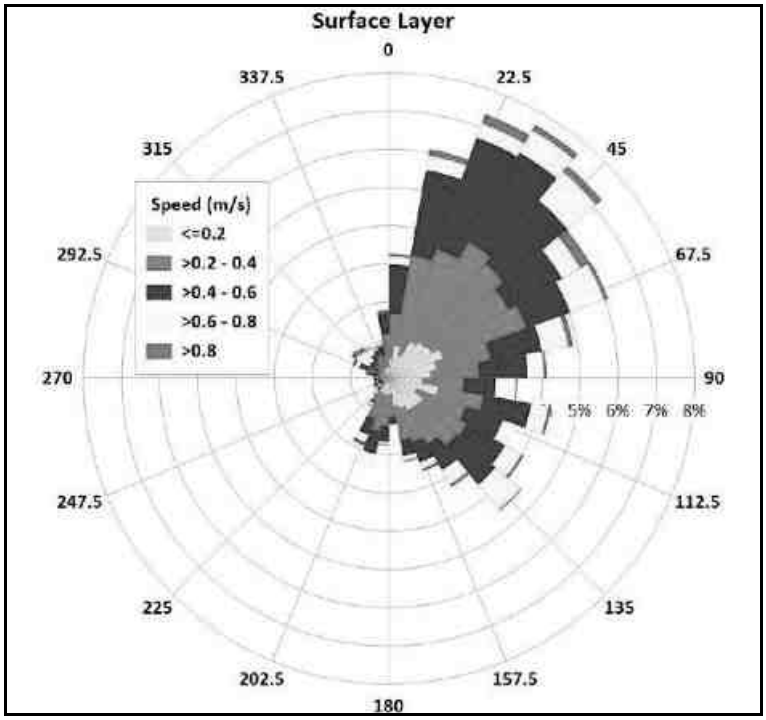

FIGURE 5 ROSE PLOT OF SURFACE LAYER CURRENT SPEED AGAINST DIRECTION

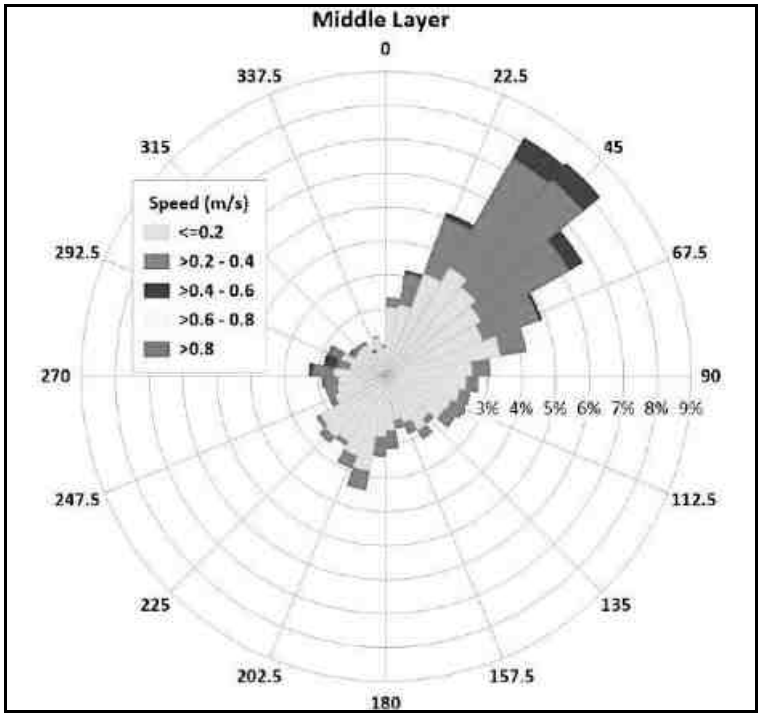

FIGURE 6 ROSE PLOT OF MIDDLE LAYER CURRENT SPEED AGAINST DIRECTION

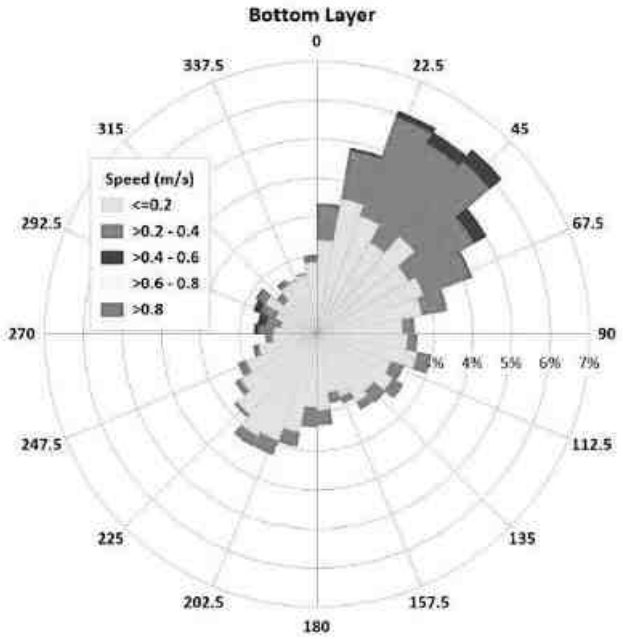

FIGURE 7 ROSE PLOT OF BOTTOM LAYER CURRENT SPEED AGAINST DIRECTION

2.5 SCATTER PLOT OF CURRENT SPEED VS DIRECTION

The time-series plot is a univariate plot: it shows only one variable. It is a 2-dimensional plot in which one axis, the time-axis, shows graduations at an appropriate scale (seconds, minutes, weeks, quarters, years), while the other axis shows the numeric values. Usually, the time-axis is displayed horizontally and the Current Speed and Direction are in the vertical. The time-series plot is an excellent way to visualize long sequences of data. Time series plots of current speed and direction against tide.

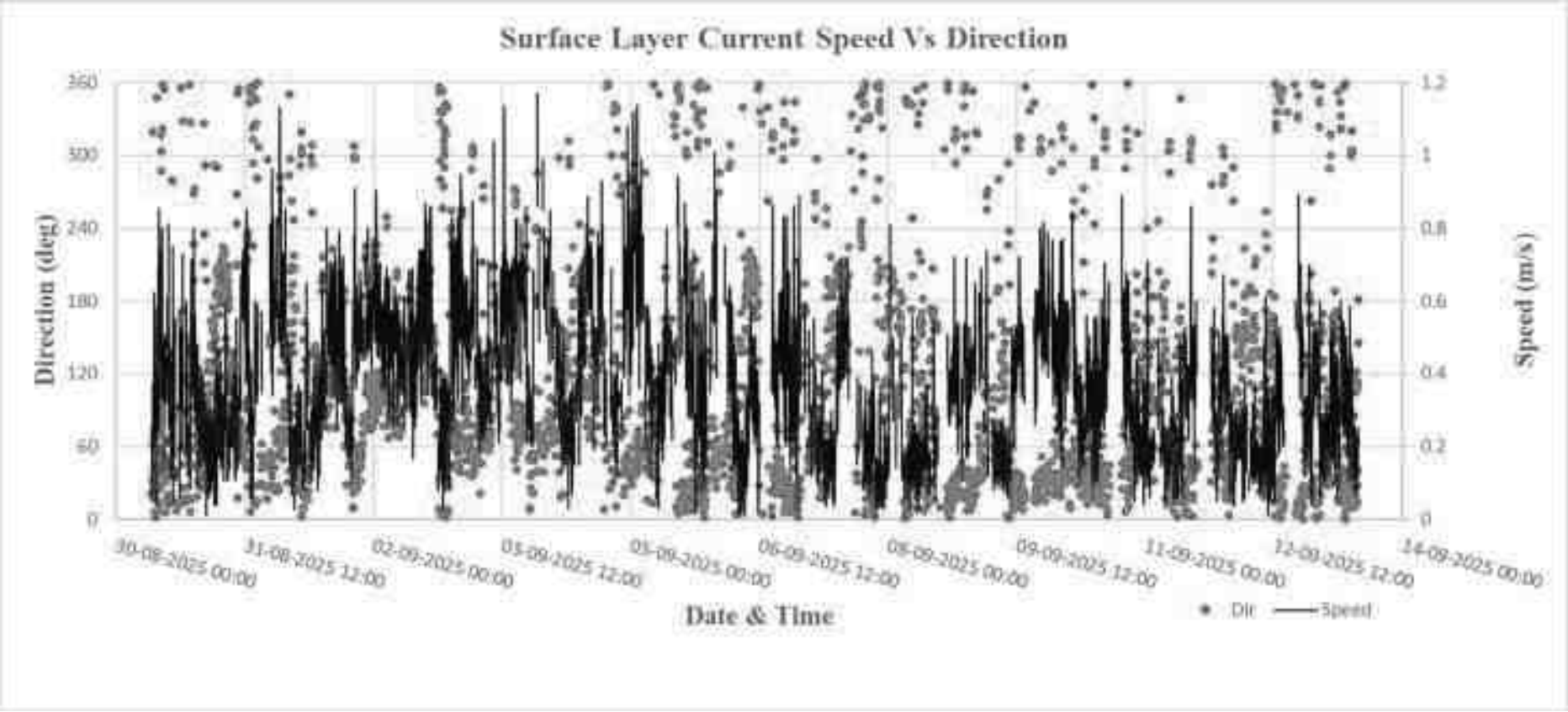

FIGURE 8 TIME SERIES PLOT OF SURFACE LAYER CURRENT SPEED AGAINST DIRECTION

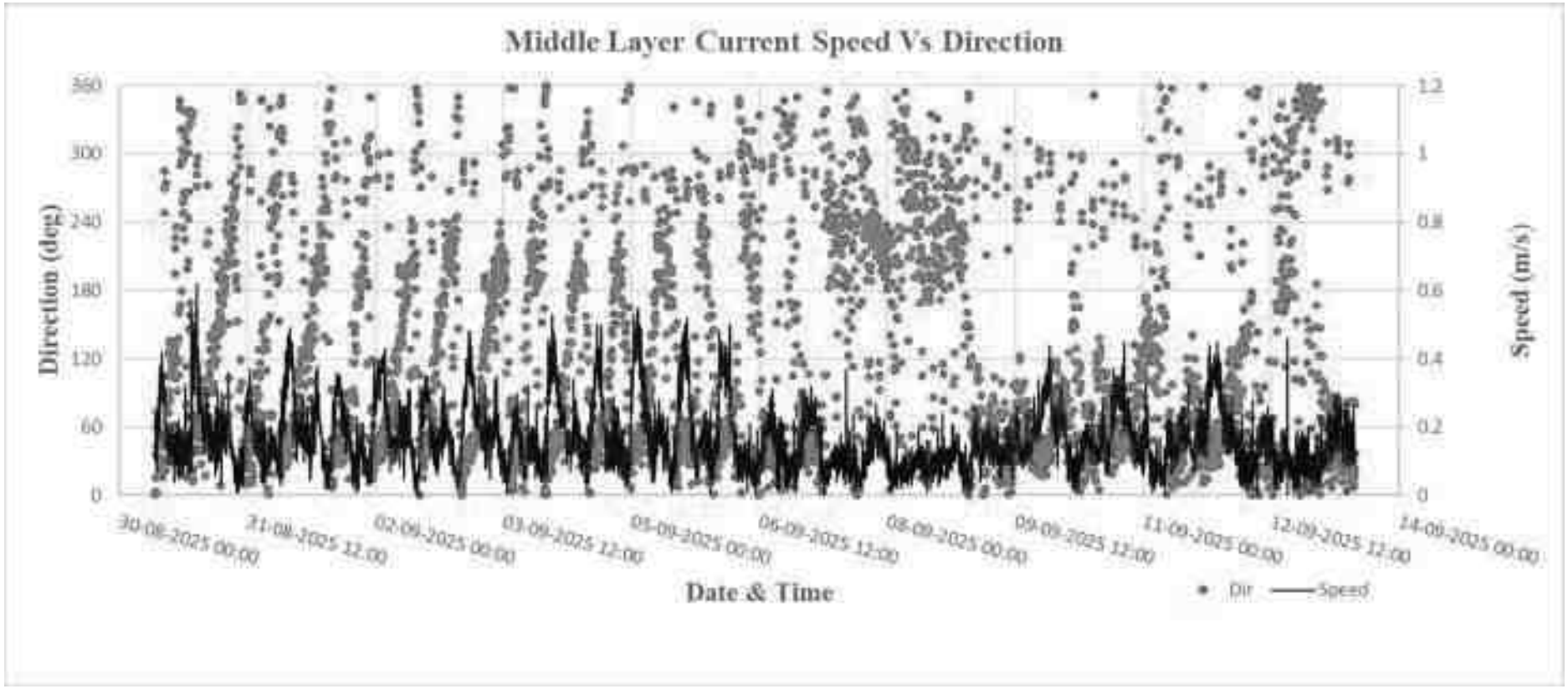

FIGURE 9 TIME SERIES PLOT OF MIDDLE LAYER CURRENT SPEED AGAINST DIRECTION

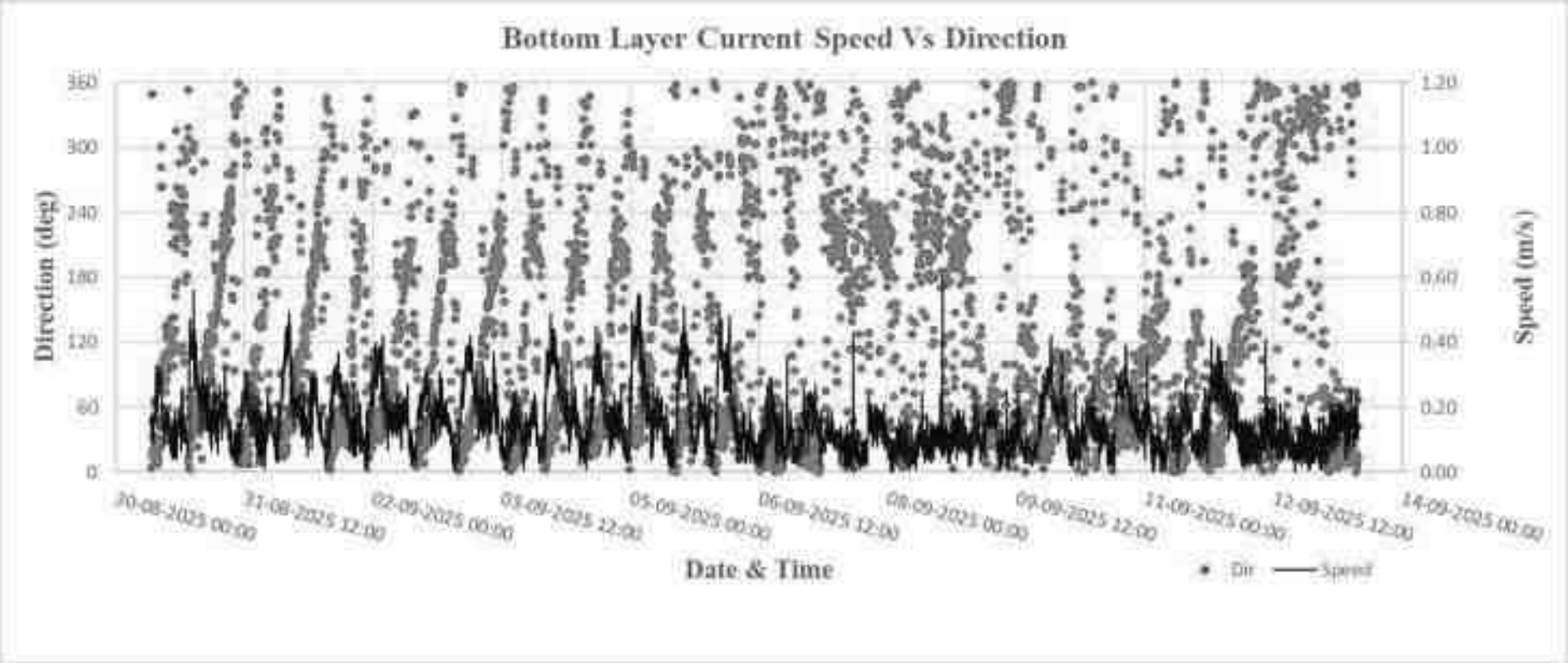

FIGURE 10 TIME SERIES PLOT OF BOTTOM LAYER CURRENT SPEED AGAINST DIRECTION

2.6 WAVE

Wave observations were carried out for a period of approx. 15 days between 30th August to 13th September 2025 at the above location. The observation period crosses one neap and one spring tide. It is shows that the significant wave height varies from 0.4 m to 1.1m. The peak wave period varies between 1.7s to 11.3s. Similarly, Graphs have been plotted between along the ordinate for significant wave height (Hs) in meters, Peak wave period (Tp) in seconds, Peak wave direction (Dp) in degrees and in meters against the observation period seconds.

Significant Wave Height (Hs):

The maximum significant wave height observed in the entire period is 1.1m on 30th August 20:40 hrs and the minimum is observed around 0.4 m is observed on 8th & 9th September at 14:40 & 13:40 hrs respectively. In general, significant wave height is 90% in between 0.0-0.8m amplitude and only 10% are above 0.8m.

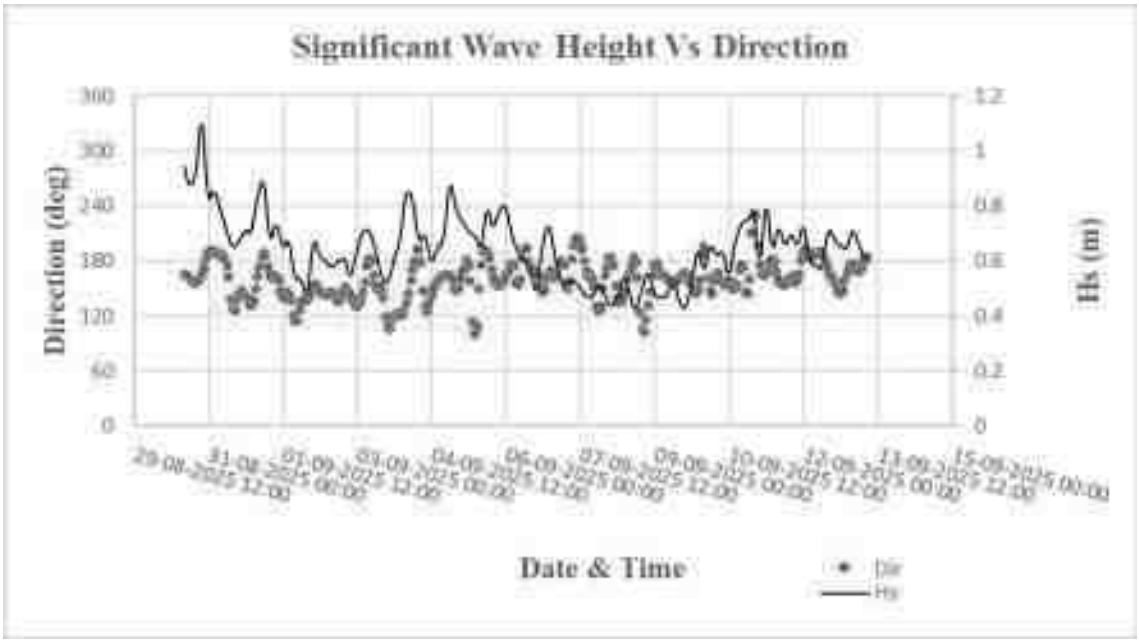

FIGURE 11 SIGNIFICANT WAVE HEIGHT VS DIRECTION

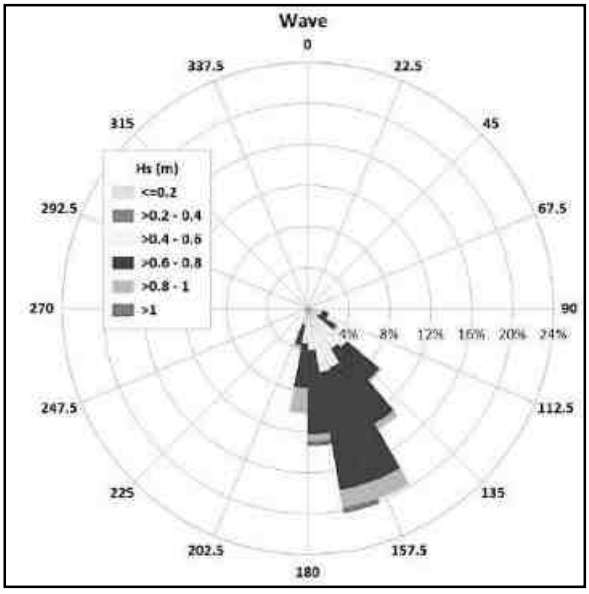

FIGURE 12 ROSE PLOT OF SIGNIFICANT WAVE HEIGHT

Peak Wave Period (Tp):

Peak wave period between a minimum of 1.7sec to 8.5sec, 77% is dominant in below 10sec. & only 23.0% of peak wave period is in between 10s to 12s.

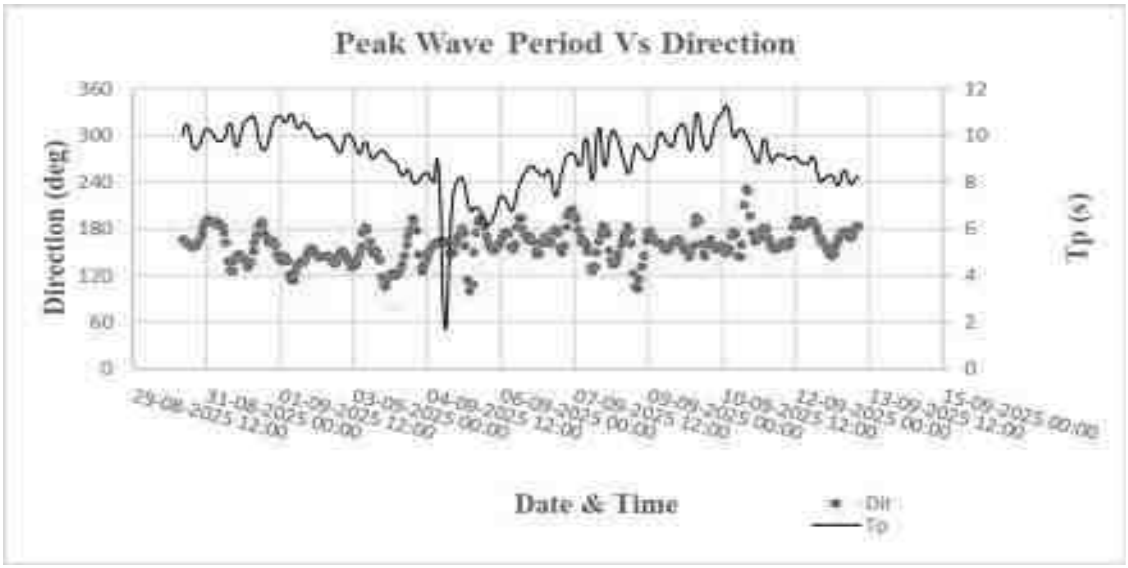

FIGURE 13 TIME SERIES PEAK TIME PERIOD VS DIRECTION

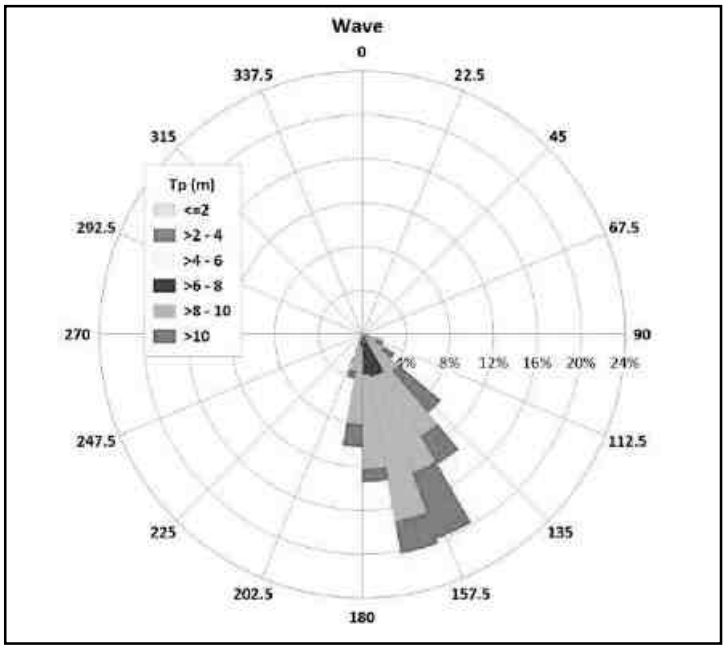

FIGURE 14 ROSE PLOT OF PEAK WAVE PERIOD

Joint probability distribution, Hs Vs Direction (Occurrence %)																	
Hs(m)	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**Total**
<0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.2-0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.4-0.6	0.00	0.00	0.00	0.00	1.36	4.32	11.36	12.95	5.23	0.68	0.00	0.00	0.00	0.00	0.00	0.00	35.91
0.6-0.8	0.00	0.00	0.00	0.00	0.68	4.32	19.09	23.41	6.36	0.23	0.68	0.00	0.00	0.00	0.00	0.00	54.77
>0.8	0.00	0.00	0.00	0.00	0.00	0.45	1.14	4.77	2.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.32
Sum	0.00	0.00	0.00	0.00	2.05	9.09	31.59	41.14	14.55	0.91	0.68	0.00	0.00	0.00	0.00	0.00	100.00

TABLE 7 JOINT PROBABILITY DISTRIBUTION FOR SIGNIFICANT WAVE HEIGHT (HS) VS DIRECTION (OCCURRENCE %)

Joint probability distribution, Tp Vs Direction (Occurrence %)																	
Tp(s)	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**Total**
<2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68
2.0-4.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
4.0-6.0	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
6.0-8.0	0.00	0.00	0.00	0.00	0.68	0.23	2.95	7.95	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.86
8.0-10	0.00	0.00	0.00	0.00	1.36	5.91	18.18	25.23	9.77	0.68	0.68	0.00	0.00	0.00	0.00	0.00	61.82
>10	0.00	0.00	0.00	0.00	0.00	2.95	10.23	7.05	2.73	0.23	0.00	0.00	0.00	0.00	0.00	0.00	23.18
Sum	0.00	0.00	0.00	0.00	2.05	9.09	31.59	41.14	14.55	0.91	0.68	0.00	0.00	0.00	0.00	0.00	100.00

TABLE 8 JOINT PROBABILITY DISTRIBUTION, PEAK WAVE PERIOD (TP) VS DIRECTION (OCCURRENCE %)

2.7 TIDAL OBSERVATIONS

Tidal observations were carried out by deploying ADCP along with wave and current measurement at the same location. Tidal observations were carried out from 30th August 2025 to 13th September 2025. Tides were observed at every 5 min interval.

The tidal data from the ADCP was plotted graphically. The water level collects in between 30th August 2025 to 13th September 2025 & the difference in the water level is 1.2m at a depth of 7.0m depth.

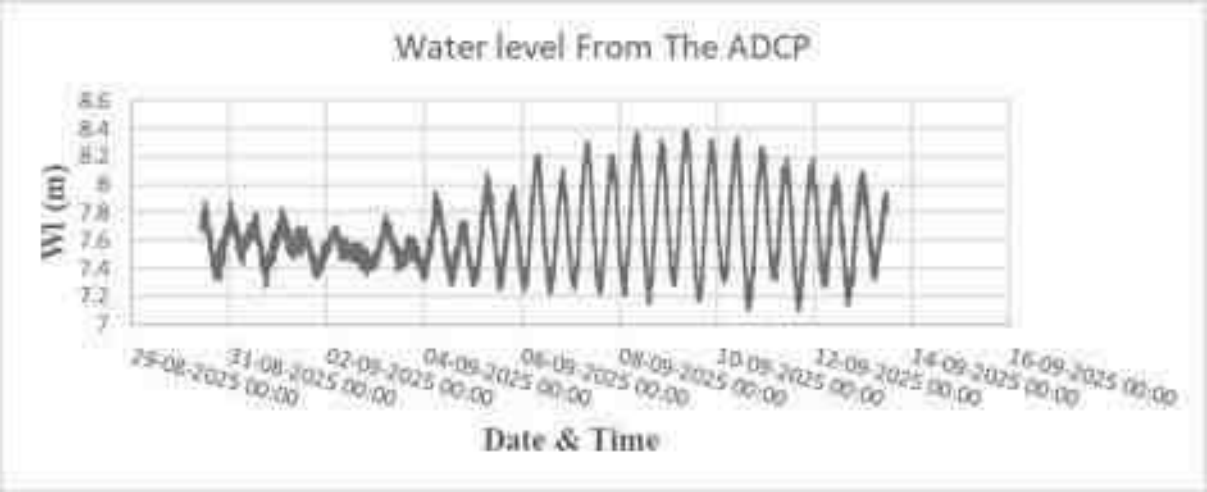

FIGURE 15 TIME SERIES OF TIDE/WATER LEVEL FROM ADCP

ADCP Pressure Censor Data Analysis			
S No.	**Tide Data (m)**	**Highest water (m)**	**Lowest Water (m)**
1	Tide observed	8.39 (09-09-2025 08:50)	7.1 (08-09-2025 14:25)

TABLE 9 TIDE DATA ANALYSIS

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
30-08-2025 10:00	7.67	29.01	237.02	-4.19	9.88	53.43	0.08	2.38	0.08	68.17	0.2
30-08-2025 10:05	7.72	28.95	237.13	-4.46	9.45	4.09	0.10	1.18	0.1	20.98	0.25
30-08-2025 10:10	7.74	28.93	237.18	-4.13	11.05	20.49	0.11	3.16	0.1	319.38	0.06
30-08-2025 10:15	7.79	28.91	237.55	-5.21	8.52	349.18	0.18	1.08	0.24		
30-08-2025 10:20	7.75	28.9	237.59	-4.72	9.78	15.44	0.14	15.25	0.14	23.1	0.37
30-08-2025 10:25	7.75	28.9	238.01	-5.93	7.68	46.95	0.11	36.2	0.11	31.1	0.15
30-08-2025 10:30	7.69	28.9	238.29	-5.09	10.88	47.09	0.09	60.07	0.14	62.59	0.14
30-08-2025 10:35	7.69	28.89	238.68	-6.44	7.54	32.61	0.13	42.86	0.07	19.26	0.27
30-08-2025 10:40	7.69	28.89	238.77	-6.28	8.57	34.04	0.13	73.49	0.12	16.9	0.22
30-08-2025 10:45	7.78	28.9	239.03	-6.81	7.29	10.69	0.15	16.92	0.24	6.52	0.62
30-08-2025 10:50	7.74	28.92	239.11	-6	9.96	62.81	0.17	58.48	0.22	34.42	0.44
30-08-2025 10:55	7.76	28.93	239.19	-6.46	8.82	23.67	0.16	33.29	0.21	28.09	0.36
30-08-2025 11:00	7.7	28.93	239.37	-6.68	8.21	65.61	0.16	65.32	0.21	41.51	0.52
30-08-2025 11:05	7.78	28.93	239.49	-7.14	6.98	25.04	0.20	34.67	0.29	23.33	0.58
30-08-2025 11:10	7.74	28.91	239.55	-7.78	5.43	47.89	0.18	50.42	0.16	29.61	0.41
30-08-2025 11:15	7.76	28.86	240.47	-11.18	-2.48	20.38	0.23	31.27	0.24	1.53	0.36
30-08-2025 11:20	7.74	28.85	240.79	-12.17	-4.63	29.43	0.16	55.51	0.2	41.76	0.04
30-08-2025 11:25	7.83	28.86	240.87	-11.91	-3.9	13.95	0.31	27.86	0.36	23.77	0.29
30-08-2025 11:30	7.75	28.85	240.96	-11.33	-2.22	11.21	0.22	34.12	0.23	15.52	0.24
30-08-2025 11:35	7.86	28.84	240.92	-11.94	-3.95	8.39	0.33	24.07	0.38	348.01	0.25
30-08-2025 11:40	7.87	28.83	241.11	-11.94	-3.6	12.05	0.32	19.23	0.31	7.67	0.35
30-08-2025 11:45	7.72	28.82	241.13	-11.4	-2.07	47.16	0.18	46.74	0.27	59.51	0.26
30-08-2025 11:50	7.83	28.81	240.24	-7.55	8.53	28.63	0.21	44.6	0.28	37.89	0.3
30-08-2025 11:55	7.86	28.81	240.26	-7.38	8.93	7.19	0.33	19.87	0.39	26.44	0.69
30-08-2025 12:00	7.73	28.81	240.39	-7.65	8.09	30.99	0.23	43.98	0.32	37.49	0.58
30-08-2025 12:05	7.87	28.81	240.76	-8.06	7.01	12.58	0.31	16.23	0.42	13.09	0.85
30-08-2025 12:10	7.8	28.82	241.28	-10.5	0.43	20.72	0.29	44.58	0.29	41.52	0.39
30-08-2025 12:15	7.8	28.84	241.56	-13.05	-6.46	27.89	0.25	47.1	0.29	25.46	0.22
30-08-2025 12:20	7.79	28.9	240.15	-7.67	8.49	25.88	0.30	45.96	0.29	45.11	0.48
30-08-2025 12:25	7.74	28.91	240.24	-5.64	13.93	42.37	0.30	51.2	0.27	53.57	0.44
30-08-2025 12:30	7.74	28.94	240.61	-6.45	11.78	49.11	0.32	51.46	0.36	54.26	0.74
30-08-2025 12:35	7.76	28.89	240.52	-6.18	12.47	42.54	0.30	53.09	0.28	45.81	0.55
30-08-2025 12:40	7.74	28.9	240.46	-5.96	13.06	300.57	0.31	284.4	0.3	303.25	0.72
30-08-2025 12:45	7.71	28.92	240.55	-6.29	12.19	281.57	0.32	269.73	0.32	287.58	0.48
30-08-2025 12:50	7.66	28.92	240.86	-7.08	9.99	263.83	0.24	247.7	0.21	316.51	0.46
30-08-2025 12:55	7.69	28.91	240.96	-7.49	8.84	263.38	0.23	274.88	0.23	322.16	0.8
30-08-2025 13:00	7.79	28.9	241.34	-9.35	3.86	25.67	0.23	21.63	0.22	358.84	0.33
30-08-2025 13:05	7.8	28.89	241.23	-9.65	3.01	26.97	0.20	30.84	0.17		
30-08-2025 13:10	7.66	28.89	241.25	-8.94	4.87	96.74	0.13	105.06	0.14	54.17	0.4
30-08-2025 13:15	7.68	28.9	241.22	-8.97	4.87	59.73	0.14	82.89	0.13		
30-08-2025 13:20	7.62	28.9	240.61	-6.82	10.79	104.13	0.21	88.18	0.19	39.32	0.42
30-08-2025 13:25	7.69	28.89	241.21	-8.04	7.32	87.35	0.14	79.25	0.15	50	0.13
30-08-2025 13:30	7.67	28.89	241.38	-8.49	6.1	81.81	0.17	80.18	0.2	30.24	0.49
30-08-2025 13:35	7.61	28.89	241.24	-8.13	7.13	102.44	0.09	82.28	0.17		
30-08-2025 13:40	7.65	28.89	241.26	-8.2	6.98	52.54	0.09	61.04	0.14	354.89	0.49
30-08-2025 13:45	7.64	28.89	241.24	-8.26	6.83	85.85	0.12	72.63	0.09	5.11	0.39
30-08-2025 13:50	7.6	28.89	241.12	-7.69	8.41	109.96	0.16	124.9	0.17	33.8	0.34
30-08-2025 13:55	7.64	28.88	241.21	-7.87	7.95	74.4	0.09	87.82	0.12	32.47	0.51
30-08-2025 14:00	7.64	28.87	241.11	-7.59	8.85	92.7	0.14	91.68	0.13		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
30-08-2025 14:05	7.54	28.87	241	-7.1	10.21	124.33	0.14	127.96	0.15	62.8	0.32
30-08-2025 14:10	7.63	28.88	241.22	-7.61	8.82	86.17	0.13	83.91	0.11	17.59	0.45
30-08-2025 14:15	7.54	28.88	241.13	-7.41	9.38	135.8	0.18	135.66	0.19		
30-08-2025 14:20	7.53	28.88	241.05	-7	10.52	132.53	0.19	132.76	0.2		
30-08-2025 14:25	7.68	28.88	241.43	-7.96	7.83	46.86	0.14	28.3	0.16	12.97	0.61
30-08-2025 14:30	7.52	28.88	240.8	-6.42	12.19	111.23	0.15	117.98	0.2	49	0.47
30-08-2025 14:35	7.55	28.88	241.27	-7.53	9.01	129.44	0.19	125.87	0.2		
30-08-2025 14:40	7.64	28.88	241.48	-8.04	7.64	59.75	0.14	59.76	0.17	13.81	0.81
30-08-2025 14:45	7.51	28.88	241.23	-7.49	9.2	135.96	0.16	110.89	0.17	44.95	0.51
30-08-2025 14:50	7.6	28.88	241.3	-7.71	8.58	106.98	0.09	103.54	0.13	44.19	0.25
30-08-2025 14:55	7.6	28.88	241.41	-7.92	8.08	95.22	0.10	36.2	0.13	20.16	0.49
30-08-2025 15:00	7.48	28.89	241.45	-7.93	8	107.71	0.18	107.09	0.18	42.29	0.33
30-08-2025 15:05	7.49	28.89	241.13	-7.08	10.45	108.15	0.15	129.72	0.12	66.38	0.39
30-08-2025 15:10	7.43	28.89	241.18	-7.13	10.25	126.66	0.15	112.44	0.1	12.93	0.47
30-08-2025 15:15	7.47	28.89	241.09	-7.01	10.71	99.07	0.12	61.2	0.1	35.47	0.46
30-08-2025 15:20	7.45	28.89	241.27	-7.3	9.85	116.05	0.09	125.9	0.14	67.29	0.22
30-08-2025 15:25	7.47	28.89	241.39	-7.6	9.03	118.42	0.12	135.15	0.15	82.29	0.12
30-08-2025 15:30	7.44	28.88	241.35	-7.49	9.3	141.26	0.06	105.82	0.04		
30-08-2025 15:35	7.41	28.88	241.42	-7.53	9.15	125.6	0.11	122.1	0.18	68.38	0.39
30-08-2025 15:40	7.46	28.88	241.33	-7.47	9.39	227.99	0.07	194.58	0.15	279.06	0.43
30-08-2025 15:45	7.51	28.88	241.18	-7.14	10.4	211.58	0.11	226.11	0.12		
30-08-2025 15:50	7.48	28.87	241.25	-7.43	9.69	241.81	0.12	217	0.12		
30-08-2025 15:55	7.41	28.87	241.13	-6.89	11.18	248.09	0.14	236.1	0.09	278.24	0.75
30-08-2025 16:00	7.43	28.87	241.38	-7.36	9.84	114.44	0.04	131.67	0.13	85.59	0.06
30-08-2025 16:05	7.37	28.88	241.29	-7.19	10.26	126.64	0.14	102.63	0.12	52.1	0.34
30-08-2025 16:10	7.43	28.87	241.08	-7.03	10.73	116.74	0.09	117.18	0.19	34.9	0.51
30-08-2025 16:15	7.36	28.88	241.11	-6.59	12.03	143.1	0.16	135.9	0.11		
30-08-2025 16:20	7.39	28.87	241.37	-7.31	10.03	118.75	0.13	92.08	0.19		
30-08-2025 16:25	7.43	28.87	241.52	-7.65	9	97.54	0.05	118.09	0.13	41.3	0.18
30-08-2025 16:30	7.41	28.87	241.15	-6.83	11.38	132.04	0.10	118.81	0.06	14.4	0.43
30-08-2025 16:35	7.37	28.88	241.14	-6.76	11.66	113.21	0.06	106.15	0.06	35	0.55
30-08-2025 16:40	7.35	28.87	241.17	-6.66	11.87	162.8	0.19	160.54	0.22		
30-08-2025 16:45	7.32	28.88	241.58	-7.63	9.18	172.09	0.17	138.27	0.12		
30-08-2025 16:50	7.32	28.88	241.83	-8.41	7.05	171.37	0.13	164.39	0.16	40.41	0.19
30-08-2025 16:55	7.41	28.88	241.91	-8.51	6.73	216.24	0.04	346.56	0.05		
30-08-2025 17:00	7.4	28.88	241.71	-7.91	8.47	315.93	0.04	340.32	0.09	7.33	0.49
30-08-2025 17:05	7.34	28.88	241.27	-6.84	11.44	233.73	0.09	167.26	0.2		
30-08-2025 17:10	7.4	28.88	241.69	-8	8.22	236.74	0.07	290.81	0.07		
30-08-2025 17:15	7.36	28.88	241.51	-7.48	9.67	207.23	0.05	321.5	0.06		
30-08-2025 17:20	7.37	28.88	241.72	-7.98	8.28	262.33	0.14	19.39	0.06		
30-08-2025 17:25	7.38	28.88	241.41	-7.18	10.52	245.81	0.13	293.57	0.07		
30-08-2025 17:30	7.34	28.88	241.16	-6.86	11.46	216.33	0.16	179.36	0.15		
30-08-2025 17:35	7.4	28.89	241.44	-7.21	10.46	176.01	0.15	303.48	0.12		
30-08-2025 17:40	7.33	28.89	241.15	-6.62	12.16	226.26	0.17	234.84	0.14		
30-08-2025 17:45	7.52	28.89	241.58	-7.53	9.77	285.18	0.20	321.2	0.19	13.68	0.57
30-08-2025 17:50	7.4	28.9	241.39	-7.02	11.11	230.36	0.18	248.1	0.14	92.53	0.07
30-08-2025 17:55	7.37	28.9	241.86	-8.11	8.05	240.52	0.17	257.76	0.13	11.74	0.22
30-08-2025 18:00	7.44	28.91	241.55	-7.35	10.26	261.87	0.17	297.98	0.15		
30-08-2025 18:05	7.41	28.92	241.36	-7.01	11.18	260.52	0.14	265.71	0.1	356.12	0.31

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
30-08-2025 18:10	7.33	28.92	241.13	-6.58	12.45	238.17	0.11	262.34	0.08	58.85	0.52
30-08-2025 18:15	7.36	28.92	241.39	-7.12	10.95	236.83	0.13	247.85	0.07		
30-08-2025 18:20	7.41	28.93	241.8	-7.93	8.57	256.45	0.13	224.59	0.15		
30-08-2025 18:25	7.41	28.94	241.32	-7.01	11.26	261.87	0.14	315.38	0.09	45.78	0.66
30-08-2025 18:30	7.42	28.94	241.63	-7.47	9.96	239.64	0.07	338.06	0.1		
30-08-2025 18:35	7.58	28.95	241.91	-8.46	7.35	299.73	0.25	320.36	0.32	25.59	0.53
30-08-2025 18:40	7.38	28.96	241.49	-7.47	9.99	116.86	0.23	113.36	0.25	172.06	0.19
30-08-2025 18:45	7.55	28.97	242.01	-8.35	7.64	33.97	0.19	16.38	0.26	328.14	0.73
30-08-2025 18:50	7.44	28.98	241.66	-7.74	9.26	110.09	0.21	80.81	0.12		
30-08-2025 18:55	7.46	28.99	241.35	-6.95	11.49	101.62	0.26	47.17	0.14		
30-08-2025 19:00	7.47	28.99	241.54	-7.33	10.45	230.67	0.14	199.24	0.09	114.25	0.4
30-08-2025 19:05	7.48	29	241.44	-7.12	11.02	224.64	0.10	310.62	0.13	17.33	0.4
30-08-2025 19:10	7.53	29.01	241.57	-7.34	10.42	255.9	0.17	301.16	0.18		
30-08-2025 19:15	7.47	29.02	241.5	-7.28	10.57	245.82	0.09	206.08	0.15		
30-08-2025 19:20	7.41	29.03	241.34	-6.96	11.59	217.62	0.10	243.73	0.1		
30-08-2025 19:25	7.4	29.04	241.66	-7.48	10.12	202.06	0.12	68.7	0.06		
30-08-2025 19:30	7.33	29.07	241.18	-6.5	12.8	176.03	0.16	146.18	0.16		
30-08-2025 19:35	7.46	29.1	241.51	-7.16	11.05	228.9	0.12	267.3	0.1	88.93	0.19
30-08-2025 19:40	7.53	29.09	241.84	-8.01	8.67	295.25	0.09	338.79	0.15	14.38	0.6
30-08-2025 19:45	7.52	29.12	241.48	-7.26	10.79	287.66	0.13	324.59	0.19		
30-08-2025 19:50	7.45	29.17	241.59	-7.45	10.21	212.02	0.12	158.79	0.1		
30-08-2025 19:55	7.45	29.19	241.61	-7.6	9.71	182.08	0.09	168.84	0.07		
30-08-2025 20:00	7.54	29.23	241.6	-7.45	10.21	289.76	0.09	327.52	0.14	54.17	0.51
30-08-2025 20:05	7.61	29.2	241.75	-7.93	8.88	308.97	0.09	332.55	0.11	26.83	0.12
30-08-2025 20:10	7.58	29.24	242.03	-8.37	7.72	352.81	0.10	21.83	0.17		
30-08-2025 20:15	7.56	29.22	241.51	-7.21	11.01	318.07	0.06	333.12	0.55	17.68	0.28
30-08-2025 20:20	7.56	29.22	241.85	-8.03	8.72	11.14	0.09	144.14	0.29		
30-08-2025 20:25	7.5	29.23	242.09	-8.45	7.58	51.54	0.08	68.21	0.18	69.04	0.64
30-08-2025 20:30	7.5	29.21	242.3	-9.08	5.76	13.92	0.11	336.35	0.07		
30-08-2025 20:35	7.44	29.29	242.17	-8.91	6.21	68.73	0.12	69.47	0.17		
30-08-2025 20:40	7.62	29.44	243.69	-12.36	-2.45	6.45	0.37	13	0.5	357.99	0.26
30-08-2025 20:45	7.47	29.57	247.31	-16.08	-9.77	28.82	0.29	37.29	0.44	6.06	0.09
30-08-2025 20:50	7.6	29.61	248.76	-17.72	-13.66	21.4	0.47	22.76	0.51	15.72	0.18
30-08-2025 20:55	7.56	29.63	246.99	-15.63	-8.06	2.88	0.36	14.21	0.43	327.14	0.12
30-08-2025 21:00	7.59	29.52	247.82	-16.73	-11	67.8	0.39	64.82	0.33	109.85	0.56
30-08-2025 21:05	7.44	29.43	246.69	-15.3	-7.25	76.32	0.35	91.46	0.35	137.01	0.48
30-08-2025 21:10	7.48	29.54	244.36	-11.72	2.33	57.93	0.41	61.75	0.31	140.81	0.71
30-08-2025 21:15	7.54	29.54	244.33	-11.84	2.1	61.24	0.38	70.69	0.37	142.31	0.67
30-08-2025 21:20	7.62	29.48	243.95	-11.3	3.54	50.21	0.41	58.14	0.4		
30-08-2025 21:25	7.67	29.44	243.92	-11.24	3.71	39.3	0.41	41.13	0.49	119.13	0.43
30-08-2025 21:30	7.69	29.48	243.82	-11.05	4.21	40.68	0.42	42.2	0.43	93.6	0.35
30-08-2025 21:35	7.57	29.5	243.53	-10.48	5.9	36.6	0.35	54.11	0.42	103.31	0.51
30-08-2025 21:40	7.67	29.46	244.02	-10.78	6.48	298.88	0.44	290.24	0.55	269.25	0.53
30-08-2025 21:45	7.61	29.43	244.53	-11.19	5.48	296.64	0.44	282.34	0.48	227.41	0.54
30-08-2025 21:50	7.57	29.45	244.29	-10.68	6.96	279.05	0.39	271.65	0.45	196.98	0.8
30-08-2025 21:55	7.63	29.49	243.79	-10.03	8.69	303.17	0.56	297.36	0.62	272.48	0.53
30-08-2025 22:00	7.61	29.5	243.71	-9.95	8.91	33.74	0.35	51.57	0.35	82.79	0.43
30-08-2025 22:05	7.57	29.47	243.77	-10.06	8.68	42.48	0.27	64.73	0.25	105.86	0.3
30-08-2025 22:10	7.6	29.5	244.29	-10.75	7.18	42.66	0.42	50.33	0.4	59.99	0.56

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
30-08-2025 22:15	7.59	29.6	244.77	-11.45	5.34	50.68	0.44	52.01	0.43	44.78	0.42
30-08-2025 22:20	7.62	29.56	244.64	-11.28	5.81	62.18	0.33	65.52	0.27	101.96	0.47
30-08-2025 22:25	7.67	29.44	244.69	-11.36	5.56	67.08	0.36	69.33	0.35	57.12	0.28
30-08-2025 22:30	7.63	29.58	244.94	-11.67	4.7	58.06	0.38	59.99	0.33	69.29	0.25
30-08-2025 22:35	7.72	29.6	244.67	-11.27	5.77	38.16	0.40	38.97	0.39	56.93	0.34
30-08-2025 22:40	7.73	29.52	243.75	-9.9	9.55	48.49	0.36	40.79	0.24	18.65	0.44
30-08-2025 22:45	7.72	29.51	244.31	-10.75	7.18	55.1	0.31	58.89	0.29	42.51	0.34
30-08-2025 22:50	7.7	29.59	244.6	-11.16	6.02	55.34	0.28	55.32	0.28	46.9	0.48
30-08-2025 22:55	7.7	29.56	243.76	-10	9.23	23.69	0.25	27.81	0.31	31.93	0.48
30-08-2025 23:00	7.74	29.51	244.11	-10.33	8.44	41.35	0.27	54.89	0.24	71.1	0.09
30-08-2025 23:05	7.71	29.5	243.46	-9.51	10.64	79.11	0.24	101.24	0.24	63.16	0.28
30-08-2025 23:10	7.68	29.58	243.87	-10.12	8.86	66.46	0.29	72.97	0.24	29.42	0.25
30-08-2025 23:15	7.67	29.58	243.96	-10.31	8.36	69.94	0.26	85.89	0.22	74.65	0.21
30-08-2025 23:20	7.75	29.59	244.14	-10.55	7.7	41.93	0.27	50.63	0.24	82.83	0.21
30-08-2025 23:25	7.77	29.59	243.97	-10.26	8.44	44.89	0.21	51.68	0.17	27.04	0.34
30-08-2025 23:30	7.73	29.4	243.32	-9.35	11.03	91.6	0.24	93.36	0.25	75.61	0.15
30-08-2025 23:35	7.7	29.34	243.78	-9.86	9.59	88.68	0.26	91.52	0.21	104.41	0.24
30-08-2025 23:40	7.73	29.36	243.69	-9.77	9.8	80.27	0.23	72.83	0.2	38.95	0.42
30-08-2025 23:45	7.73	29.48	243.77	-9.92	9.34	63.64	0.21	54.64	0.15	32.57	0.33
30-08-2025 23:50	7.7	29.61	243.57	-9.69	9.98	40.84	0.22	62.07	0.22	45.66	0.19
30-08-2025 23:55	7.66	29.62	244.4	-10.95	6.55	56.28	0.16	70.52	0.2	66.46	0.25
31-08-2025 00:00	7.83	29.6	244.97	-11.8	4.24	12.37	0.24	17.14	0.2		
31-08-2025 00:05	7.71	29.59	244.03	-10.45	7.88	100.86	0.11	101.7	0.12	53.15	0.26
31-08-2025 00:10	7.74	29.49	243.9	-10.19	8.61	74.9	0.14	92.34	0.15	63.55	0.2
31-08-2025 00:15	7.76	29.38	243.54	-9.66	10.09	96.7	0.18	79.47	0.16	36.65	0.33
31-08-2025 00:20	7.8	29.38	243.89	-10.18	8.71	48.37	0.24	54.53	0.27	45.14	0.39
31-08-2025 00:25	7.81	29.4	244.63	-11.11	6.12	54.18	0.27	59.47	0.21	34.69	0.16
31-08-2025 00:30	7.88	29.42	243.97	-10.2	8.59	49.2	0.29	40.56	0.27	25.44	0.37
31-08-2025 00:35	7.79	29.42	244.03	-10.26	8.4	59.28	0.28	78.23	0.23	47.79	0.31
31-08-2025 00:40	7.75	29.43	243.29	-9.27	11.14	230.21	0.21	221.07	0.31	210.99	0.21
31-08-2025 00:45	7.8	29.43	243.98	-10.21	8.51	286.94	0.23	272.38	0.2	326.26	0.16
31-08-2025 00:50	7.66	29.43	243.95	-10.16	8.63	229.6	0.27	222.21	0.3	234.78	0.24
31-08-2025 00:55	7.69	29.43	243.81	-10.1	8.8	236.54	0.27	232.24	0.23	292.06	0.28
31-08-2025 01:00	7.71	29.43	244.4	-10.92	6.46	95.73	0.19	103.82	0.15	35.18	0.17
31-08-2025 01:05	7.8	29.43	244.69	-11.21	5.71	76.73	0.19	68.5	0.16	57.81	0.32
31-08-2025 01:10	7.65	29.44	243.12	-9	11.79	114.49	0.23	115.22	0.24	59.62	0.22
31-08-2025 01:15	7.7	29.44	243.53	-9.62	10.04	106.98	0.24	116.27	0.22	78.93	0.17
31-08-2025 01:20	7.77	29.44	243.67	-9.8	9.61	72.06	0.13	108	0.1	197.1	0.01
31-08-2025 01:25	7.77	29.44	243.89	-10.2	8.39	74.8	0.14	90.26	0.15	75.5	0.2
31-08-2025 01:30	7.68	29.44	243.58	-9.63	9.95	118.44	0.20	128.88	0.2	103.43	0.19
31-08-2025 01:35	7.72	29.43	243.54	-9.56	10.12	124.67	0.23	126.23	0.18	61.98	0.23
31-08-2025 01:40	7.65	29.43	243.42	-9.36	10.66	125.26	0.29	142.07	0.24	122.52	0.19
31-08-2025 01:45	7.71	29.43	242.68	-8.35	13.54	108.76	0.20	137.5	0.15	96.63	0.27
31-08-2025 01:50	7.67	29.42	243.65	-9.74	9.53	129.74	0.26	140.83	0.22	110.87	0.2
31-08-2025 01:55	7.78	29.42	243.28	-9.26	10.98	81.09	0.13	63.89	0.1	39.88	0.3
31-08-2025 02:00	7.71	29.42	243.23	-9.03	11.54	98.67	0.18	126.28	0.19	129.95	0.06
31-08-2025 02:05	7.73	29.42	243.62	-9.68	9.68	100.58	0.17	95.96	0.17	64.07	0.31
31-08-2025 02:10	7.65	29.42	242.87	-8.69	12.52	125.57	0.25	127.23	0.21	76.83	0.23
31-08-2025 02:15	7.74	29.41	243.73	-9.85	9.25	83.53	0.14	96.91	0.16	69.85	0.25

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
31-08-2025 02:20	7.64	29.41	243.68	-9.75	9.4	123.61	0.16	140.75	0.16	121.69	0.15
31-08-2025 02:25	7.75	29.41	243.14	-9.05	11.44	94.47	0.15	93.89	0.18	51.73	0.3
31-08-2025 02:30	7.73	29.41	243.16	-8.99	11.56	122.11	0.11	97.99	0.13	81.59	0.2
31-08-2025 02:35	7.73	29.41	243.66	-9.7	9.65	106.09	0.19	93.26	0.14	62.15	0.16
31-08-2025 02:40	7.69	29.4	243.39	-9.42	10.26	117.12	0.09	136.35	0.1	162.97	0.08
31-08-2025 02:45	7.68	29.4	243.18	-9.11	11.21	98.59	0.13	119.68	0.15	103.71	0.11
31-08-2025 02:50	7.62	29.4	243.1	-8.97	11.55	125.51	0.17	113.96	0.16	88.63	0.16
31-08-2025 02:55	7.67	29.4	243.04	-8.91	11.7	144.24	0.19	148.35	0.19	141.16	0.27
31-08-2025 03:00	7.73	29.39	243.58	-9.55	9.84	89.26	0.07	90.81	0.06	144.59	0.11
31-08-2025 03:05	7.67	29.38	243.62	-9.61	9.66	128.03	0.14	119.99	0.1	129.97	0.13
31-08-2025 03:10	7.6	29.35	242.92	-8.55	12.64	137.39	0.24	143.64	0.26	156.08	0.24
31-08-2025 03:15	7.66	29.35	242.77	-8.49	12.83	139.27	0.18	149.56	0.15	174.47	0.19
31-08-2025 03:20	7.61	29.34	243.28	-9.11	11.02	137.65	0.18	130.49	0.16	155.52	0.25
31-08-2025 03:25	7.62	29.35	243.3	-9.14	10.96	120.49	0.17	140.3	0.11	160.46	0.22
31-08-2025 03:30	7.63	29.35	243.61	-9.54	9.76	123.39	0.17	138.56	0.19	153.7	0.26
31-08-2025 03:35	7.72	29.35	243.23	-9.11	10.98	135.82	0.12	118.91	0.08	291.62	0.04
31-08-2025 03:40	7.68	29.36	243.26	-9.15	10.84	208.02	0.19	206.31	0.16	150.75	0.26
31-08-2025 03:45	7.54	29.36	243.33	-9.24	10.61	191.26	0.29	190.73	0.31	166.49	0.39
31-08-2025 03:50	7.63	29.34	243.68	-9.74	9.13	211.36	0.20	194.82	0.16	168.17	0.38
31-08-2025 03:55	7.59	29.32	243.18	-8.97	11.32	185.85	0.25	177.26	0.29	148.16	0.49
31-08-2025 04:00	7.57	29.32	243.37	-9.3	10.39	145.13	0.18	161.4	0.19	186.05	0.45
31-08-2025 04:05	7.52	29.31	243.2	-9.01	11.2	144.96	0.19	147.22	0.24	184.22	0.38
31-08-2025 04:10	7.53	29.3	243.07	-8.86	11.61	142.9	0.18	153.21	0.16	186.89	0.22
31-08-2025 04:15	7.67	29.31	243.61	-9.6	9.64	67.85	0.09	8.42	0.1	290.03	0.04
31-08-2025 04:20	7.55	29.3	243.57	-9.63	9.44	146.88	0.18	158.46	0.17	206.74	0.27
31-08-2025 04:25	7.51	29.3	242.96	-8.68	12.26	155.25	0.19	174.94	0.25	202.34	0.36
31-08-2025 04:30	7.53	29.29	243.14	-8.91	11.46	142.78	0.18	171.24	0.17	203.82	0.29
31-08-2025 04:35	7.54	29.29	243.08	-8.87	11.59	164.34	0.17	154.17	0.14	194.53	0.4
31-08-2025 04:40	7.61	29.29	243.96	-10.23	7.81	153.82	0.06	188.06	0.08	183.67	0.37
31-08-2025 04:45	7.61	29.28	243.21	-9.02	11.16	162.31	0.10	143.51	0.04	138.02	0.17
31-08-2025 04:50	7.54	29.28	243.12	-8.93	11.37	161.11	0.15	169.65	0.18	196.7	0.34
31-08-2025 04:55	7.55	29.28	243.49	-9.48	9.76	141.92	0.18	148.64	0.14	168.9	0.23
31-08-2025 05:00	7.48	29.27	243.28	-9.06	10.99	171.21	0.25	179.65	0.3	196.14	0.47
31-08-2025 05:05	7.54	29.25	243.38	-9.26	10.44	175.87	0.17	177.47	0.19	209.88	0.33
31-08-2025 05:10	7.47	29.25	243.15	-8.92	11.35	168.07	0.27	168.2	0.25	177.93	0.4
31-08-2025 05:15	7.51	29.23	243.37	-9.26	10.35	183.83	0.22	178.9	0.29	182.55	0.43
31-08-2025 05:20	7.57	29.22	243.57	-9.56	9.49	186.43	0.24	177.55	0.22	183.86	0.34
31-08-2025 05:25	7.58	29.2	243.35	-9.31	10.2	211.89	0.16	199.92	0.16	194.91	0.2
31-08-2025 05:30	7.54	29.2	242.6	-8.17	13.33	177.27	0.22	176.08	0.2	190.13	0.14
31-08-2025 05:35	7.56	29.19	242.85	-8.48	12.45	184.09	0.18	191.63	0.15	214.82	0.19
31-08-2025 05:40	7.51	29.19	242.39	-7.85	14.23	175.98	0.20	177.13	0.16	199.45	0.25
31-08-2025 05:45	7.58	29.19	243.01	-8.84	11.42	219.69	0.10	232.62	0.13	224.22	0.27
31-08-2025 05:50	7.52	29.19	243.18	-9	10.94	197.07	0.20	203.59	0.23	199.74	0.29
31-08-2025 05:55	7.48	29.18	242.85	-8.45	12.47	182.14	0.18	184.32	0.16	210.44	0.17
31-08-2025 06:00	7.52	29.18	243.43	-9.35	9.93	191.72	0.20	190.6	0.2	186.17	0.34
31-08-2025 06:05	7.58	29.18	243.22	-8.97	11.06	238.18	0.14	240.61	0.12	219.61	0.27
31-08-2025 06:10	7.52	29.17	243.03	-8.68	11.79	207.3	0.22	213.18	0.22	204.83	0.22
31-08-2025 06:15	7.61	29.15	242.7	-8.3	12.88	228.13	0.13	251.84	0.12	199.02	0.11
31-08-2025 06:20	7.53	29.15	242.64	-8.15	13.31	216.66	0.18	203.22	0.25	203.07	0.36

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
31-08-2025 06:25	7.49	29.16	242.58	-8.07	13.46	202.56	0.23	202.01	0.24	220.1	0.28
31-08-2025 06:30	7.51	29.17	242.73	-8.17	13.26	208.5	0.17	207.74	0.22	208.15	0.4
31-08-2025 06:35	7.56	29.17	243.01	-8.61	11.94	236.42	0.17	229.29	0.22	218.55	0.28
31-08-2025 06:40	7.43	29.18	242.79	-8.27	12.9	137.89	0.33	151.3	0.36	148.93	0.6
31-08-2025 06:45	7.54	29.18	242.85	-8.39	12.6	96.99	0.22	87.15	0.22	118.31	0.37
31-08-2025 06:50	7.61	29.19	242.91	-8.53	12.22	71.87	0.25	71.31	0.21	116.24	0.25
31-08-2025 06:55	7.51	29.18	243.18	-8.9	11.15	110.75	0.20	102.78	0.22	140.9	0.55
31-08-2025 07:00	7.56	29.17	243.24	-8.96	10.96	241.19	0.20	227.02	0.18	191.79	0.34
31-08-2025 07:05	7.54	29.17	243.2	-8.99	10.87	206.83	0.15	220.59	0.14	189.64	0.2
31-08-2025 07:10	7.54	29.17	242.75	-8.27	12.92	231.69	0.21	226.17	0.22	204.37	0.28
31-08-2025 07:15	7.55	29.17	242.93	-8.6	11.95	223.37	0.17	227.61	0.18	196.88	0.11
31-08-2025 07:20	7.63	29.17	242.93	-8.58	12.05	276.15	0.14	275.12	0.17	209.52	0.16
31-08-2025 07:25	7.58	29.17	242.79	-8.41	12.48	246.74	0.15	250.58	0.16	173.07	0.11
31-08-2025 07:30	7.53	29.16	242.79	-8.29	12.85	213.51	0.16	213.81	0.18	185.34	0.21
31-08-2025 07:35	7.57	29.16	243.12	-8.81	11.35	256.83	0.12	252.6	0.11	176.16	0.17
31-08-2025 07:40	7.58	29.16	243.68	-9.69	8.83	254.03	0.10	233.82	0.14	182.29	0.21
31-08-2025 07:45	7.55	29.17	238.67	-3.84	9.58	211.46	0.15	214.29	0.12		
31-08-2025 07:50	7.61	29.17	229.38	8.87	4.05	236.75	0.12	260.47	0.15	109.16	0.14
31-08-2025 07:55	7.6	29.17	228.68	10.65	3.5	214.15	0.11	234.74	0.11	137.61	0.32
31-08-2025 08:00	7.62	29.18	227.48	11.25	1.46	244.86	0.13	245.48	0.1	112.55	0.29
31-08-2025 08:05	7.62	29.18	227.92	11.64	2.48	230.96	0.06	204.14	0.1	120.49	0.25
31-08-2025 08:10	7.64	29.18	227.34	11.24	1.47	247.6	0.16	225.77	0.14	121.45	0.24
31-08-2025 08:15	7.66	29.18	227.12	11.02	0.9	255.17	0.12	264.6	0.08	119.66	0.25
31-08-2025 08:20	7.65	29.18	227.67	11.53	2.13	249.75	0.13	243.51	0.12	119.27	0.28
31-08-2025 08:25	7.62	29.18	227.77	11.57	2.22	261.54	0.06	261.84	0.05	104.39	0.2
31-08-2025 08:30	7.58	29.19	227.86	11.64	2.45	163.19	0.06	204.63	0.1	107.67	0.2
31-08-2025 08:35	7.66	29.19	228.16	11.91	3.05	231.88	0.07	281.48	0.07	118.37	0.37
31-08-2025 08:40	7.65	29.19	227.69	11.54	2.16	276.4	0.04	247.8	0.04	126.41	0.35
31-08-2025 08:45	7.63	29.18	227.96	11.76	2.73	177.98	0.06	192.29	0.07	135.02	0.38
31-08-2025 08:50	7.64	29.18	227.49	11.31	1.63	275.15	0.07	270.49	0.06	111.92	0.2
31-08-2025 08:55	7.56	29.18	227.99	11.76	2.73	159.21	0.07	188.08	0.11	129.23	0.4
31-08-2025 09:00	7.63	29.18	228.04	11.79	2.77	307.56	0.08	314.29	0.03	120.64	0.22
31-08-2025 09:05	7.61	29.18	228.3	12.07	3.47	93.54	0.05	152.91	0.01	137.36	0.19
31-08-2025 09:10	7.63	29.18	227.87	11.7	2.6	283.24	0.05	181.67	0.02	126.82	0.25
31-08-2025 09:15	7.66	29.18	228.12	11.69	2.93	311.13	0.13	12.28	0.09	69.24	0.17
31-08-2025 09:20	7.67	29.18	228.91	12.13	4.7	339.02	0.06	298.48	0.03	91.05	0.12
31-08-2025 09:25	7.72	29.18	227.78	11.05	2.02	336.91	0.06	323.88	0.05	96.5	0.11
31-08-2025 09:30	7.67	29.18	227.91	11.16	2.34	329.25	0.02	323.83	0.01	115.18	0.24
31-08-2025 09:35	7.62	29.18	227.74	10.87	1.91	125.68	0.06	77.12	0.01	88.08	0.13
31-08-2025 09:40	7.67	29.18	228.26	10.62	2.95	336.78	0.06	306.68	0.03	210.2	0.37
31-08-2025 09:45	7.69	29.18	228.48	10.85	3.49	125.71	0.04	92.63	0.04	209.25	0.55
31-08-2025 09:50	7.68	29.18	227.79	10.33	2.2	303.65	0.12	288.57	0.14	243.74	0.46
31-08-2025 09:55	7.67	29.18	227.67	10.28	2.01	17.46	0.09	352.87	0.11	268.1	0.26
31-08-2025 10:00	7.64	29.18	228.38	10.84	3.47	176.66	0.03	119.23	0.03	93.12	0.14
31-08-2025 10:05	7.71	29.18	227.45	10.01	1.48	305.19	0.03	350.94	0.05	18.31	0.21
31-08-2025 10:10	7.69	29.18	227.73	10.16	1.98	339.74	0.10	345.7	0.09	351.71	0.3
31-08-2025 10:15	7.69	29.18	228.15	10.34	2.78	337.12	0.07	349.17	0.05	355.22	0.23
31-08-2025 10:20	7.71	29.17	227.74	9.72	1.75	345.73	0.15	346.4	0.14	72.47	0.18
31-08-2025 10:25	7.67	29.17	227.3	9.06	1	358.92	0.07	22.21	0.1	77.9	0.34

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
31-08-2025 10:30	7.67	29.17	228.14	8.78	2.14	52.82	0.08	99.36	0.08	50.76	0.34
31-08-2025 10:35	7.68	29.17	228.59	8.83	2.87	56.51	0.10	74.7	0.07	81.8	0.33
31-08-2025 10:40	7.69	29.18	228.16	7.58	1.57	43.85	0.06	47.94	0.03	76.41	0.35
31-08-2025 10:45	7.72	29.18	228.61	7.49	2.26	34.4	0.14	39.22	0.12	66.93	0.39
31-08-2025 10:50	7.71	29.17	228.89	7.79	2.94	9.93	0.09	24.48	0.14	53.72	0.3
31-08-2025 10:55	7.68	29.18	229.31	6.63	3.04	8.62	0.05	25.73	0.06	61.24	0.32
31-08-2025 11:00	7.66	29.18	230.11	5.44	3.6	7.63	0.13	13.68	0.15	66.75	0.58
31-08-2025 11:05	7.64	29.18	230.5	4.06	3.6	12.14	0.07	47.74	0.06	78.27	0.67
31-08-2025 11:10	7.6	29.17	231.52	3.43	4.77	51.31	0.08	67.92	0.08	68.84	0.64
31-08-2025 11:15	7.69	29.17	231.17	1.99	2.38	16.97	0.14	31.56	0.14	52.91	0.6
31-08-2025 11:20	7.74	29.17	231.52	1.98	3.07	12.32	0.19	9.91	0.23	49.72	0.71
31-08-2025 11:25	7.7	29.17	231.63	0.75	1.94	17.66	0.17	28.82	0.22	58.16	0.55
31-08-2025 11:30	7.7	29.2	232.02	0.63	2.39	30.26	0.23	29.78	0.24	64.68	0.59
31-08-2025 11:35	7.71	29.21	231.82	-0.07	1.48	25.69	0.23	41.04	0.28	60.32	0.72
31-08-2025 11:40	7.69	29.2	231.9	-0.31	1.42	19.22	0.25	32.32	0.26	57.62	0.74
31-08-2025 11:45	7.74	29.19	232.77	0.02	3.31	23.57	0.25	35.6	0.27	57.24	0.71
31-08-2025 11:50	7.68	29.18	232.78	-1.19	1.54	34.35	0.23	55.49	0.26	72.45	0.68
31-08-2025 11:55	7.69	29.17	233.35	-1.06	2.72	31.76	0.21	48.81	0.3	48.13	0.7
31-08-2025 12:00	7.7	29.18	233.28	-1.24	2.35	25.97	0.23	24.61	0.24	62.87	0.58
31-08-2025 12:05	7.68	29.17	233.08	-1.45	1.79	27.38	0.21	37.82	0.29	47.97	0.76
31-08-2025 12:10	7.64	29.16	233.38	-1.02	2.94	32.12	0.18	48.45	0.2	63.74	0.57
31-08-2025 12:15	7.7	29.14	233.42	-1.3	2.56	20.37	0.18	40.51	0.25	74.7	0.5
31-08-2025 12:20	7.79	29.14	232.84	-2.46	-0.1	352.06	0.31	13.04	0.32	46.37	0.69
31-08-2025 12:25	7.74	29.14	233.45	-1.62	1.97	10.83	0.25	39.41	0.28	91.01	0.49
31-08-2025 12:30	7.73	29.14	233.47	-1.53	2.26	19.53	0.24	23.78	0.3	42	0.38
31-08-2025 12:35	7.65	29.13	233.6	-1.25	2.92	36.39	0.22	51.54	0.24	95.58	0.65
31-08-2025 12:40	7.66	29.13	233.63	-1.3	2.91	293.83	0.24	281.63	0.34	235.82	0.85
31-08-2025 12:45	7.71	29.14	233.35	-2.24	1.22	306.07	0.29	286.62	0.34	230.03	0.62
31-08-2025 12:50	7.69	29.14	233.7	-1.74	2.48	283.75	0.30	266.48	0.32	233.19	0.78
31-08-2025 12:55	7.67	29.16	233.56	-1.9	2.07	283.97	0.31	267.74	0.37	213.78	0.8
31-08-2025 13:00	7.7	29.2	233.4	-2.14	1.48	25.24	0.27	38.78	0.25	115.86	0.68
31-08-2025 13:05	7.61	29.18	233.61	-1.8	2.32	42.64	0.17	56.15	0.26	92.13	0.62
31-08-2025 13:10	7.67	29.16	233.47	-1.27	3.59	33.94	0.22	28.12	0.23	99.31	0.25
31-08-2025 13:15	7.78	29.17	233.65	-1.74	2.46	7.39	0.26	10.82	0.26	26.96	0.22
31-08-2025 13:20	7.7	29.17	233.99	-1.24	3.74	16.28	0.16	23.67	0.19	352.87	0.37
31-08-2025 13:25	7.77	29.18	233.69	-1.81	2.33	7.62	0.27	11.35	0.27		
31-08-2025 13:30	7.6	29.21	234.08	-1.17	3.88	43.18	0.16	62.42	0.18	343.31	0.46
31-08-2025 13:35	7.61	29.25	233.95	-1.25	3.7	71.29	0.16	77.03	0.15	78.73	0.06
31-08-2025 13:40	7.65	29.29	233.87	-1.36	3.46	55.76	0.19	57.96	0.21	46.52	0.3
31-08-2025 13:45	7.71	29.25	234.05	-1.1	4.1	36.32	0.16	17.33	0.14	6.33	0.29
31-08-2025 13:50	7.57	29.22	234.3	-0.6	5.42	64.04	0.15	80.33	0.14	356.23	0.31
31-08-2025 13:55	7.65	29.23	233.26	-1.96	1.88	49.3	0.19	58.29	0.16	350.3	0.41
31-08-2025 14:00	7.65	29.22	233.85	-1.49	3.07	66.09	0.15	39.17	0.15		
31-08-2025 14:05	7.61	29.22	234.43	-0.23	6.28	85.33	0.19	88.78	0.18		
31-08-2025 14:10	7.63	29.21	233.93	-1.31	3.51	55.68	0.14	37.41	0.2	313.14	0.3
31-08-2025 14:15	7.58	29.21	234.69	0.51	8.29	103.79	0.19	93.04	0.22	225.33	0.06
31-08-2025 14:20	7.59	29.21	234.17	-0.92	4.57	89.55	0.17	60.44	0.13	323.36	0.09
31-08-2025 14:25	7.65	29.21	234.52	-0.09	6.71	60.53	0.11	51.45	0.17	294.1	0.21
31-08-2025 14:30	7.62	29.21	234.4	-0.4	5.9	90.58	0.15	94.21	0.14		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
31-08-2025 14:35	7.6	29.21	234.37	-0.57	5.46	109.83	0.14	104.64	0.19	13.6	0.34
31-08-2025 14:40	7.57	29.21	234.51	-0.18	6.47	110.98	0.25	107.34	0.19		
31-08-2025 14:45	7.6	29.21	234.49	-0.18	6.44	79.43	0.18	70.04	0.14	325.04	0.23
31-08-2025 14:50	7.62	29.22	234.54	0.01	6.93	77	0.15	64.47	0.14	11.5	0.49
31-08-2025 14:55	7.52	29.22	234.34	-0.63	5.23	99.62	0.19	85.45	0.12	357.95	0.6
31-08-2025 15:00	7.59	29.21	234.43	-0.44	5.78	57.96	0.14	50.17	0.13		
31-08-2025 15:05	7.53	29.22	234.25	-0.77	4.94	91.67	0.15	73.18	0.15	345.56	0.59
31-08-2025 15:10	7.51	29.21	234.42	-0.35	5.99	114.76	0.13	128.95	0.14		
31-08-2025 15:15	7.59	29.2	234.43	-0.33	6.05	68.45	0.08	88.23	0.1	326.13	0.24
31-08-2025 15:20	7.45	29.19	234.55	-0.08	6.73	108.06	0.19	104.53	0.19		
31-08-2025 15:25	7.5	29.18	234.79	0.57	8.35	104.85	0.14	107.74	0.12	359.95	0.32
31-08-2025 15:30	7.42	29.18	234.62	0.31	7.68	113.19	0.18	116.43	0.17	27.25	0.53
31-08-2025 15:35	7.51	29.17	234.63	0.36	7.77	137.56	0.14	104.1	0.12	15.09	0.34
31-08-2025 15:40	7.55	29.17	234.68	0.44	7.94	218.68	0.16	211.4	0.15	281.7	0.59
31-08-2025 15:45	7.58	29.16	234.38	-0.39	5.95	260.02	0.02	346.94	0.09		
31-08-2025 15:50	7.54	29.16	234.61	0.27	7.57	234.24	0.10	258.48	0.13	306.57	0.88
31-08-2025 15:55	7.42	29.15	234.67	0.47	8.05	183.85	0.25	201.38	0.22		
31-08-2025 16:00	7.56	29.15	234.46	-0.2	6.37	113.51	0.07	66.95	0.04		
31-08-2025 16:05	7.52	29.15	234.31	-0.37	5.93	63.84	0.05	347.74	0.05		
31-08-2025 16:10	7.39	29.14	234.81	0.94	9.35	134.11	0.17	128.36	0.14		
31-08-2025 16:15	7.37	29.14	234.69	0.54	8.23	142.6	0.14	144.22	0.17		
31-08-2025 16:20	7.38	29.14	234.68	0.39	7.89	137.31	0.17	150.82	0.19		
31-08-2025 16:25	7.46	29.14	234.45	-0.3	6.13	86.48	0.08	52.19	0.06		
31-08-2025 16:30	7.43	29.14	234.57	-0.06	6.76	133.58	0.18	126.46	0.14	52.1	0.32
31-08-2025 16:35	7.39	29.14	234.63	0.08	7.09	133.99	0.19	128.2	0.21		
31-08-2025 16:40	7.49	29.14	234.84	0.8	8.92	186.82	0.02	55.61	0.03	29.32	0.57
31-08-2025 16:45	7.39	29.14	234.63	0.32	7.66	143.74	0.17	137.28	0.2	41.96	0.44
31-08-2025 16:50	7.4	29.14	234.79	0.66	8.56	163.3	0.14	149.82	0.17	62.38	0.35
31-08-2025 16:55	7.4	29.14	234.67	0.3	7.65	142.97	0.15	135	0.12		
31-08-2025 17:00	7.37	29.14	234.8	0.81	8.94	138.61	0.17	130.2	0.17		
31-08-2025 17:05	7.38	29.14	234.5	-0.01	6.82	162.76	0.14	149.75	0.12		
31-08-2025 17:10	7.41	29.14	234.59	0.04	7.03	143.52	0.05	70.1	0.04	46.08	0.74
31-08-2025 17:15	7.35	29.14	234.78	0.76	8.88	142.83	0.15	109.92	0.19		
31-08-2025 17:20	7.37	29.15	234.46	-0.25	6.19	147.4	0.11	128.82	0.09		
31-08-2025 17:25	7.37	29.15	234.45	-0.31	6.07	134.81	0.10	135.23	0.08		
31-08-2025 17:30	7.47	29.15	234.45	-0.43	5.81	313.6	0.04	26.86	0.11		
31-08-2025 17:35	7.45	29.16	234.54	-0.19	6.38	48.2	0.02	6.27	0.08	27.79	1.01
31-08-2025 17:40	7.44	29.16	233.79	-0.45	5.7	49.01	0.03	31.03	0.08		
31-08-2025 17:45	7.27	29.16	234.5	-0.06	6.67	167.87	0.15	191.13	0.09		
31-08-2025 17:50	7.38	29.16	234.33	-0.33	6.01	155.81	0.01	176.2	0.06	25.69	0.59
31-08-2025 17:55	7.29	29.17	234.74	0.31	7.6	165.38	0.15	154.61	0.13		
31-08-2025 18:00	7.43	29.17	234.47	-0.34	6.02	250.7	0.06	1.49	0.08		
31-08-2025 18:05	7.46	29.16	234.38	-0.62	5.26	317.3	0.10	340.59	0.16		
31-08-2025 18:10	7.29	29.16	234.59	0.01	6.84	186.2	0.13	157.59	0.1		
31-08-2025 18:15	7.47	29.15	234.38	-0.52	5.55	304.81	0.12	324.17	0.14	17.19	0.86
31-08-2025 18:20	7.29	29.15	234.64	0.13	7.12	184.52	0.18	192.96	0.2		
31-08-2025 18:25	7.47	29.15	234.7	0.3	7.65	279.77	0.13	267.9	0.14	44.48	0.47
31-08-2025 18:30	7.35	29.17	234.8	0.62	8.4	233.2	0.09	234.51	0.09	51.32	0.51
31-08-2025 18:35	7.39	29.16	234.74	0.51	8.11	243.3	0.14	251.07	0.11		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
31-08-2025 18:40	7.46	29.16	234.69	0.36	7.75	52.71	0.25	34.36	0.16	296.49	0.78
31-08-2025 18:45	7.48	29.16	234.45	-0.28	6.14	48.16	0.25	19.1	0.2		
31-08-2025 18:50	7.42	29.15	234.59	0.1	7.05	76.43	0.16	71.95	0.14		
31-08-2025 18:55	7.4	29.14	234.51	-0.05	6.72	90.99	0.17	68.75	0.12		
31-08-2025 19:00	7.48	29.13	234.64	0.19	7.33	251.41	0.12	301.59	0.11		
31-08-2025 19:05	7.51	29.13	234.74	0.73	8.73	262.73	0.17	273.32	0.17	52.75	0.81
31-08-2025 19:10	7.43	29.13	234.83	0.91	9.2	233.04	0.18	239.93	0.15	55.19	0.67
31-08-2025 19:15	7.48	29.13	234.87	1.01	9.41	254.99	0.18	264.62	0.14	46.05	0.51
31-08-2025 19:20	7.47	29.12	234.74	0.5	8.1	258.17	0.17	278.6	0.15	41.37	0.51
31-08-2025 19:25	7.49	29.12	234.82	0.73	8.72	252.24	0.16	270.18	0.18	28.59	0.81
31-08-2025 19:30	7.42	29.13	234.75	0.51	8.11	207.24	0.21	214.75	0.18	50.17	0.41
31-08-2025 19:35	7.49	29.12	234.8	0.49	8.13	249.14	0.20	274.94	0.15	43.36	0.53
31-08-2025 19:40	7.41	29.12	234.7	0.32	7.7	213.28	0.17	248.75	0.14	26.84	0.96
31-08-2025 19:45	7.44	29.12	234.7	0.22	7.36	225.95	0.16	218.46	0.1	42.88	0.71
31-08-2025 19:50	7.46	29.13	234.71	0.16	7.25	232.98	0.16	246.41	0.17	35.27	0.34
31-08-2025 19:55	7.5	29.12	234.38	-0.61	5.26	243.87	0.11	245.6	0.11	42.43	0.64
31-08-2025 20:00	7.52	29.13	234.8	0.61	8.35	255.65	0.14	274.97	0.11	51.27	0.77
31-08-2025 20:05	7.5	29.13	234.69	0.38	7.86	235.26	0.12	254.51	0.11	43.28	0.83
31-08-2025 20:10	7.57	29.13	234.5	-0.37	5.91	263.86	0.17	270.7	0.17	24.73	0.74
31-08-2025 20:15	7.43	29.13	234.45	-0.32	6.05	199.5	0.14	185.58	0.14	89.43	0.64
31-08-2025 20:20	7.53	29.13	234.51	-0.28	6.14	258.3	0.10	274.85	0.07	42.44	0.65
31-08-2025 20:25	7.46	29.12	234.65	0.13	7.17	209.32	0.12	203.94	0.14	71.39	0.51
31-08-2025 20:30	7.55	29.13	234.63	-0.09	6.61	243.08	0.08	253.69	0.09	23.51	0.48
31-08-2025 20:35	7.46	29.13	234.84	0.69	8.65	196.56	0.11	193.11	0.1		
31-08-2025 20:40	7.49	29.13	234.75	0.45	7.96	216.58	0.09	228.67	0.06		
31-08-2025 20:45	7.56	29.12	234.33	-0.46	5.67	291.24	0.10	319.01	0.08		
31-08-2025 20:50	7.52	29.13	234.57	-0.14	6.49	210.7	0.06	190.51	0.09	63.49	0.62
31-08-2025 20:55	7.59	29.12	234.24	-0.87	4.61	284.2	0.04	282.07	0.05		
31-08-2025 21:00	7.58	29.12	234.44	-0.52	5.53	312.69	0.12	314.59	0.1	26.98	0.66
31-08-2025 21:05	7.44	29.12	234.72	0.4	7.8	165.67	0.10	152.95	0.11	67.82	0.56
31-08-2025 21:10	7.65	29.12	233.25	-2.33	0.85	329.41	0.17	342.79	0.22	26.66	0.83
31-08-2025 21:15	7.58	29.12	234.34	-0.65	5.21	351.47	0.04	25.32	0.09		
31-08-2025 21:20	7.54	29.12	234.34	-0.67	5.19	61.65	0.03	55.19	0.04	52.81	0.6
31-08-2025 21:25	7.51	29.12	233.91	-1.46	3.11	217.52	0.03	16.89	0.06	23.77	0.49
31-08-2025 21:30	7.57	29.13	234.14	-1.12	4.09	306.3	0.06	349.64	0.03	73.53	0.55
31-08-2025 21:35	7.59	29.13	234.2	-0.96	4.62	351.82	0.08	345	0.13		
31-08-2025 21:40	7.6	29.12	234.37	-1.05	4.8	327.78	0.21	322.71	0.3		
31-08-2025 21:45	7.57	29.13	234.37	-1.57	4.07	338.76	0.14	318.85	0.16	281	0.81
31-08-2025 21:50	7.63	29.12	234.29	-1.82	3.47	328.26	0.20	311.26	0.3	283.14	1.13
31-08-2025 21:55	7.48	29.12	234.65	-1.25	5.16	243.4	0.12	263.38	0.21	272.7	1.07
31-08-2025 22:00	7.58	29.12	234.89	-2.62	3.49	15.28	0.15	31.59	0.21	61.45	0.56
31-08-2025 22:05	7.45	29.15	235.35	-2.13	5.32	91.03	0.11	91.78	0.17	121.35	0.65
31-08-2025 22:10	7.56	29.19	235.42	-2.91	4.18	30.95	0.21	45.17	0.2	75.16	0.45
31-08-2025 22:15	7.53	29.26	235.92	-3.94	3.57	45.91	0.19	46.76	0.32	56.25	0.92
31-08-2025 22:20	7.6	29.3	236.22	-4.63	2.98	21.38	0.22	34.01	0.35		
31-08-2025 22:25	7.58	29.32	236.1	-5.25	1.6	37.89	0.19	46.03	0.32	63.2	0.7
31-08-2025 22:30	7.56	29.29	236.02	-5.72	0.58	22.63	0.18	44.28	0.19	84.38	0.59
31-08-2025 22:35	7.64	29.25	236.16	-5.71	0.79	19.41	0.28	34.22	0.33		
31-08-2025 22:40	7.66	29.24	236.18	-5.64	1.04	13.87	0.32	24.6	0.34		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
31-08-2025 22:45	7.6	29.24	236.8	-6.31	0.94	15.09	0.31	34.67	0.3	87.67	0.73
31-08-2025 22:50	7.62	29.25	237.39	-8.9	-3.31	21.78	0.30	41.82	0.42	49.57	0.43
31-08-2025 22:55	7.58	29.25	238.48	-11.23	-6.63	34.97	0.26	38.34	0.35	89.82	0.59
31-08-2025 23:00	7.53	29.23	240.13	-12.47	-7.15	39.55	0.23	54.58	0.31	93.2	0.63
31-08-2025 23:05	7.59	29.23	240.48	-13.81	-9.91	33.85	0.30	50.95	0.39	84.04	0.56
31-08-2025 23:10	7.62	29.26	241.18	-15.24	-12.39	39.35	0.28	61.87	0.28	97.25	0.66
31-08-2025 23:15	7.66	29.26	241.26	-15.05	-11.85	16.04	0.35	28.65	0.4	91.15	0.62
31-08-2025 23:20	7.6	29.29	240.93	-16.05	-14.47	41.73	0.31	54.24	0.42	83.24	0.72
31-08-2025 23:25	7.66	29.3	240.48	-16.14	-14.7	23.21	0.38	32.13	0.46	72.65	0.85
31-08-2025 23:30	7.65	29.32	239.53	-17.01	-16.97	32.45	0.33	36.4	0.32	69.87	0.64
31-08-2025 23:35	7.67	29.34	239.8	-17.18	-17.04	17.88	0.38	34.29	0.46	65.26	0.58
31-08-2025 23:40	7.72	29.34	240.18	-16.83	-16.07	19.87	0.43	35.01	0.47	68.38	0.4
31-08-2025 23:45	7.61	29.36	239.74	-17.16	-16.92	34.56	0.33	45.01	0.39	62.59	0.44
31-08-2025 23:50	7.57	29.39	239.42	-17.28	-17.29	36.69	0.37	52.51	0.44	68.79	0.51
31-08-2025 23:55	7.58	29.41	240.43	-16.65	-15.57	44.42	0.36	53.76	0.41	71.52	0.49
01-09-2025 00:00	7.71	29.41	239.41	-17.13	-16.87	24.42	0.45	34.21	0.49	30.5	0.47
01-09-2025 00:05	7.69	29.36	241.61	-15.52	-12.61	58.88	0.45	54.57	0.48	87.73	0.44
01-09-2025 00:10	7.62	29.44	241.33	-16.23	-14.3	48.64	0.35	53.23	0.4	74.44	0.44
01-09-2025 00:15	7.63	29.4	241.02	-16.6	-15.23	46.93	0.43	54.28	0.41	68.9	0.39
01-09-2025 00:20	7.66	29.43	242.05	-14.99	-10.91	50.33	0.39	53.45	0.37	62.89	0.29
01-09-2025 00:25	7.66	29.43	242.54	-13.73	-7.37	40.96	0.36	44.5	0.38	39.89	0.42
01-09-2025 00:30	7.61	29.38	242.63	-13.92	-7.79	53.08	0.41	60.83	0.42	109.41	0.34
01-09-2025 00:35	7.67	29.36	241.52	-15.85	-13.17	45	0.43	45.43	0.39	350.5	0.17
01-09-2025 00:40	7.72	29.36	242.61	-13.99	-8.04	279.69	0.49	280.96	0.45	283.61	0.15
01-09-2025 00:45	7.66	29.42	242.33	-14.15	-8.48	277.55	0.46	275.3	0.41	297.16	0.22
01-09-2025 00:50	7.69	29.35	241.49	-10.23	2.24	254.17	0.43	248.86	0.41	204.96	0.43
01-09-2025 00:55	7.74	29.36	241.62	-9.65	3.83	271.06	0.45	265.35	0.41	185.21	0.48
01-09-2025 01:00	7.72	29.38	241.52	-9.23	5.01	56.11	0.32	70.47	0.29	161.52	0.33
01-09-2025 01:05	7.76	29.41	241.18	-8.39	7.15	38.33	0.32	35.93	0.38	208.19	0.07
01-09-2025 01:10	7.67	29.38	241.3	-8.64	6.51	44.47	0.17	46.32	0.17	262.41	0.09
01-09-2025 01:15	7.76	29.35	241.34	-8.88	5.92	48.71	0.21	66.11	0.19	144.66	0.22
01-09-2025 01:20	7.74	29.35	241.08	-7.73	9.04	75.03	0.26	70.27	0.25	193.18	0.22
01-09-2025 01:25	7.65	29.34	241.27	-8.06	8.11	91.98	0.35	104.37	0.29		
01-09-2025 01:30	7.68	29.34	241.39	-8.39	7.24	65.14	0.29	67.51	0.29	85.73	0.1
01-09-2025 01:35	7.73	29.31	241.57	-8.78	6.2	49.77	0.27	55.24	0.31	152.38	0.1
01-09-2025 01:40	7.67	29.28	241.57	-8.83	6.05	87.91	0.27	86.05	0.25	137.99	0.25
01-09-2025 01:45	7.83	29.28	241.48	-8.53	6.86	44.33	0.29	46.43	0.29	217.8	0.17
01-09-2025 01:50	7.71	29.26	241.27	-8.09	8.11	61.38	0.23	72.58	0.17	162.97	0.25
01-09-2025 01:55	7.76	29.27	241.05	-7.5	9.75	41.55	0.18	63.24	0.1	247.03	0.18
01-09-2025 02:00	7.69	29.27	241.48	-8.52	6.85	72.02	0.18	78.69	0.17	206.73	0.03
01-09-2025 02:05	7.67	29.29	241.29	-7.95	8.4	101.04	0.14	104.07	0.17	176.15	0.23
01-09-2025 02:10	7.66	29.33	241.25	-7.93	8.51	99.02	0.17	100.78	0.18	73.35	0.26
01-09-2025 02:15	7.7	29.34	241.21	-7.81	8.75	100.53	0.18	101.53	0.18	172.93	0.23
01-09-2025 02:20	7.73	29.34	241.22	-7.77	8.98	75.75	0.23	81.36	0.16	43.12	0.12
01-09-2025 02:25	7.69	29.34	240.97	-7.19	10.59	89.1	0.22	102.66	0.24	57.87	0.2
01-09-2025 02:30	7.63	29.34	241.05	-7.34	10.23	100.23	0.22	109.56	0.21	73	0.17
01-09-2025 02:35	7.79	29.34	241.29	-8.07	8.16	71.43	0.22	61.27	0.21	50.72	0.25
01-09-2025 02:40	7.74	29.34	241.5	-8.64	6.52	84.64	0.23	87.43	0.19	102.22	0.33
01-09-2025 02:45	7.72	29.34	241.37	-8.13	7.94	79.05	0.22	97.13	0.21	96.23	0.16

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
01-09-2025 02:50	7.7	29.34	241.31	-8.05	8.14	70.22	0.17	74.05	0.17	52.55	0.24
01-09-2025 02:55	7.66	29.34	241.46	-8.29	7.45	107.61	0.18	111.97	0.19	44.91	0.28
01-09-2025 03:00	7.62	29.34	241.33	-8.04	8.14	96.4	0.19	116.89	0.19	33.96	0.29
01-09-2025 03:05	7.68	29.34	241.33	-8.1	7.96	90.36	0.17	77.12	0.15	25.61	0.37
01-09-2025 03:10	7.65	29.34	241.36	-8.15	7.87	102.44	0.20	128.3	0.22	43.5	0.27
01-09-2025 03:15	7.66	29.34	241.35	-8.14	7.89	111.49	0.20	123.15	0.24	48.64	0.2
01-09-2025 03:20	7.68	29.34	241.29	-7.95	8.38	107.96	0.22	119.01	0.19	35.52	0.24
01-09-2025 03:25	7.76	29.34	241.65	-8.91	5.81	72.89	0.18	79.58	0.14	22.95	0.28
01-09-2025 03:30	7.67	29.34	241.45	-8.27	7.51	101.89	0.18	118.95	0.21	27.02	0.15
01-09-2025 03:35	7.73	29.34	241.16	-7.73	9.03	101.73	0.15	98.64	0.17	26.55	0.25
01-09-2025 03:40	7.68	29.34	240.88	-7.13	10.78	215.73	0.25	209.6	0.27	292.15	0.28
01-09-2025 03:45	7.65	29.33	241.02	-7.3	10.28	204.53	0.26	187.82	0.29	300.91	0.29
01-09-2025 03:50	7.67	29.33	241.2	-7.8	8.8	228.73	0.22	234.31	0.2	305.68	0.32
01-09-2025 03:55	7.74	29.33	241.24	-8.11	7.92	246.07	0.17	221.67	0.16	319.5	0.35
01-09-2025 04:00	7.71	29.33	241.3	-8.21	7.72	69.12	0.20	70.52	0.15	3.17	0.21
01-09-2025 04:05	7.67	29.33	241.24	-8.19	7.84	79.7	0.11	96.76	0.1	46.63	0.13
01-09-2025 04:10	7.54	29.33	241.04	-7.41	9.98	112.37	0.19	123.2	0.21	31.75	0.16
01-09-2025 04:15	7.59	29.33	241.17	-7.68	9.22	92.45	0.19	109.7	0.21	48.59	0.15
01-09-2025 04:20	7.62	29.32	241.09	-7.55	9.6	73.11	0.13	124.7	0.14	9.99	0.08
01-09-2025 04:25	7.55	29.32	241.07	-7.35	10.14	128.28	0.20	137.4	0.18	19.05	0.16
01-09-2025 04:30	7.66	29.32	241.18	-7.62	9.35	118.84	0.14	130.07	0.14	8.6	0.12
01-09-2025 04:35	7.62	29.33	240.91	-7.14	10.76	132.04	0.16	139.89	0.16	148.37	0.08
01-09-2025 04:40	7.69	29.32	241.17	-7.66	9.28	109.37	0.11	138.47	0.13	122.62	0.15
01-09-2025 04:45	7.61	29.32	240.69	-6.57	12.39	128.19	0.18	132.22	0.2	162.5	0.13
01-09-2025 04:50	7.55	29.32	240.79	-6.77	11.83	145.26	0.24	157.32	0.26	122.88	0.24
01-09-2025 04:55	7.62	29.32	241.12	-7.4	10.01	123.1	0.13	122.28	0.13	34.12	0.18
01-09-2025 05:00	7.51	29.32	241.12	-7.44	9.89	136.6	0.23	138.54	0.24	131.13	0.16
01-09-2025 05:05	7.68	29.32	240.99	-7.29	10.31	113.11	0.14	111.23	0.12	19.63	0.23
01-09-2025 05:10	7.57	29.32	240.92	-7.11	10.85	119.27	0.15	130.59	0.18	52.77	0.44
01-09-2025 05:15	7.62	29.32	241.16	-7.65	9.38	124.24	0.15	138.1	0.12	52.66	0.33
01-09-2025 05:20	7.64	29.32	241.36	-8.18	7.78	67.28	0.12	75.17	0.12	17.57	0.65
01-09-2025 05:25	7.57	29.32	241.3	-7.88	8.55	137.93	0.17	144.19	0.21	40.35	0.25
01-09-2025 05:30	7.54	29.32	241.31	-8.03	8.16	119.67	0.16	127.09	0.11	33.63	0.5
01-09-2025 05:35	7.64	29.32	241.23	-7.81	8.85	91.8	0.08	85.48	0.08	24.26	0.53
01-09-2025 05:40	7.65	29.32	240.99	-7.34	10.2	107.29	0.09	99.9	0.05	32.67	0.54
01-09-2025 05:45	7.57	29.32	241.31	-8.08	8.18	150.4	0.10	147.81	0.16	23.09	0.32
01-09-2025 05:50	7.67	29.32	241.36	-8.16	7.84	89.98	0.05	131.26	0.05	15.7	0.38
01-09-2025 05:55	7.63	29.32	241.05	-7.35	10.17	141.87	0.10	120.64	0.09	40.76	0.46
01-09-2025 06:00	7.5	29.32	240.61	-6.54	12.42	153.43	0.14	184.78	0.08		
01-09-2025 06:05	7.61	29.32	241.13	-7.49	9.73	133.81	0.10	144.13	0.13	42.38	0.34
01-09-2025 06:10	7.53	29.31	241	-7.13	10.77	147.84	0.13	150.22	0.14		
01-09-2025 06:15	7.51	29.31	241.1	-7.4	10	167.5	0.24	166.71	0.29	76.97	0.18
01-09-2025 06:20	7.58	29.31	241.14	-7.58	9.52	172.04	0.13	178.04	0.16	40.08	0.27
01-09-2025 06:25	7.62	29.31	241.19	-7.5	9.71	180.61	0.11	205.49	0.17	33.45	0.1
01-09-2025 06:30	7.59	29.31	241.15	-7.56	9.56	182.87	0.13	180.96	0.12	55.12	0.21
01-09-2025 06:35	7.52	29.31	241.01	-7.28	10.35	165.09	0.20	178.24	0.23	52.06	0.28
01-09-2025 06:40	7.54	29.31	240.94	-7.01	11.15	161.21	0.29	162.38	0.16	299.39	0.3
01-09-2025 06:45	7.5	29.31	241.32	-7.84	8.68	154.72	0.27	162.65	0.27	253.21	0.16
01-09-2025 06:50	7.58	29.3	241.02	-7.36	10.1	141.9	0.15	136.98	0.15	308.99	0.29

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
01-09-2025 06:55	7.56	29.31	240.64	-6.3	13.14	135.66	0.14	146.27	0.18	293.21	0.3
01-09-2025 07:00	7.58	29.3	239.39	-6.39	7.31	171.74	0.07	206.15	0.12		
01-09-2025 07:05	7.61	29.3	237.16	-3.36	8.1	179.75	0.16	199.74	0.15	60.33	0.26
01-09-2025 07:10	7.59	29.3	236.26	-1.65	9.2	201.85	0.15	196.07	0.16	96.58	0.18
01-09-2025 07:15	7.47	29.3	236.38	-0.85	11.39	174.63	0.29	182.84	0.36	100.1	0.39
01-09-2025 07:20	7.57	29.31	236.35	-1.07	10.8	188.58	0.26	189.86	0.26	138.52	0.15
01-09-2025 07:25	7.56	29.3	235.8	0.08	11.45	182.32	0.25	184.86	0.28	134.61	0.32
01-09-2025 07:30	7.61	29.3	234.74	1.35	10.03	196.78	0.31	208.68	0.27	73.02	0.14
01-09-2025 07:35	7.6	29.29	232.22	5.39	8.51	200.7	0.21	189.53	0.22	82.45	0.29
01-09-2025 07:40	7.51	29.29	228.71	11.39	4.31	182.63	0.23	187.26	0.3	116.42	0.21
01-09-2025 07:45	7.52	29.29	228.9	12.57	5.16	190.4	0.31	185.26	0.38	139.54	0.22
01-09-2025 07:50	7.52	29.29	228.59	12.33	4.32	186.64	0.24	203.47	0.27	134.16	0.31
01-09-2025 07:55	7.48	29.29	228.41	12.17	3.85	193.21	0.22	190	0.29	142.52	0.29
01-09-2025 08:00	7.5	29.29	228.39	12.16	3.8	195.02	0.25	192.39	0.24	126.6	0.3
01-09-2025 08:05	7.55	29.27	228.32	12.09	3.66	207.25	0.27	219.05	0.22	122.36	0.36
01-09-2025 08:10	7.51	29.26	228.63	12.38	4.45	215	0.27	203.1	0.3	133.94	0.46
01-09-2025 08:15	7.53	29.25	228.8	12.45	4.65	219.09	0.29	208.04	0.21	121.71	0.31
01-09-2025 08:20	7.55	29.24	229.04	12.69	5.29	207	0.26	211.45	0.22	124.1	0.4
01-09-2025 08:25	7.65	29.23	228.72	12.37	4.44	246.84	0.22	238.03	0.23	134.62	0.26
01-09-2025 08:30	7.64	29.22	228.97	12.57	5.01	239.31	0.18	237.88	0.18	121.44	0.08
01-09-2025 08:35	7.63	29.21	228.43	12.16	3.9	250.87	0.20	250.46	0.19	130.01	0.25
01-09-2025 08:40	7.62	29.21	228.74	12.41	4.59	228.68	0.20	234.3	0.21	116.25	0.3
01-09-2025 08:45	7.61	29.2	229.24	12.83	5.68	224.11	0.19	229.46	0.19	119.33	0.33
01-09-2025 08:50	7.56	29.19	228.87	12.5	4.82	209.75	0.13	214.18	0.17	134.22	0.3
01-09-2025 08:55	7.66	29.18	228.76	12.38	4.49	262.5	0.13	278.92	0.19	107.67	0.12
01-09-2025 09:00	7.57	29.18	229.05	12.65	5.2	216.68	0.15	219.21	0.16	112.87	0.31
01-09-2025 09:05	7.6	29.17	228.49	12.12	3.85	247.8	0.16	219.35	0.08	118.5	0.38
01-09-2025 09:10	7.53	29.16	228.03	11.73	2.84	198.84	0.15	185.78	0.13	105.11	0.4
01-09-2025 09:15	7.61	29.16	228.72	12.35	4.39	257.01	0.17	271.24	0.11	98.53	0.26
01-09-2025 09:20	7.56	29.16	228.86	12.41	4.56	201.69	0.14	208.55	0.12	116.27	0.29
01-09-2025 09:25	7.62	29.16	228.37	11.99	3.52	249.26	0.12	251.22	0.14	116.59	0.29
01-09-2025 09:30	7.7	29.16	227.93	11.61	2.54	270.97	0.19	262.19	0.16	107.65	0.22
01-09-2025 09:35	7.62	29.16	227.96	11.64	2.57	210.06	0.10	231.39	0.12	127.79	0.32
01-09-2025 09:40	7.66	29.16	228.28	11.89	3.23	53.7	0.14	42.18	0.07	188.29	0.5
01-09-2025 09:45	7.56	29.16	228.06	11.76	2.88	140.84	0.12	139.4	0.11	195.85	0.55
01-09-2025 09:50	7.55	29.16	228.42	12.12	3.81	150.71	0.13	196.45	0.11	201.39	0.68
01-09-2025 09:55	7.64	29.15	227.49	11.35	1.89	60.29	0.12	41.73	0.12	216.75	0.31
01-09-2025 10:00	7.67	29.16	227.71	11.49	2.28	290.1	0.08	299.89	0.1	110.58	0.33
01-09-2025 10:05	7.58	29.16	229.14	12.78	5.54	279.38	0.09	254.66	0.02	117.33	0.38
01-09-2025 10:10	7.59	29.15	228.41	12.14	3.92	278.52	0.10	292.03	0.1	103.44	0.28
01-09-2025 10:15	7.51	29.15	228.91	12.56	4.97	196.56	0.08	199.04	0.12	127.72	0.33
01-09-2025 10:20	7.55	29.15	228.22	11.54	3.21	216.88	0.08	198.44	0.09	123.58	0.47
01-09-2025 10:25	7.6	29.15	228.25	11.19	3.03	291	0.08	257.07	0.04	122.97	0.46
01-09-2025 10:30	7.63	29.15	227.58	10.56	1.58	320.34	0.09	326.3	0.09	84.44	0.25
01-09-2025 10:35	7.61	29.14	228.9	8.21	3.16	296.21	0.10	250.28	0.02	120.78	0.52
01-09-2025 10:40	7.68	29.15	228.81	8.15	3.09	339.14	0.10	318.53	0.1	87.43	0.35
01-09-2025 10:45	7.64	29.15	229.25	8.54	4.05	188.83	0.04	322.73	0.07	105.08	0.4
01-09-2025 10:50	7.61	29.15	229.11	8.4	3.69	296.07	0.03	340.07	0.04	108.48	0.43
01-09-2025 10:55	7.58	29.14	229.43	8.63	4.37	162.44	0.05	135.05	0.06		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
01-09-2025 11:00	7.6	29.14	229.62	8.81	4.87	232.49	0.01	228.61	0.03	128.97	0.8
01-09-2025 11:05	7.66	29.13	229	8.23	3.36	344.45	0.15	13.42	0.07	89.88	0.51
01-09-2025 11:10	7.61	29.13	229.02	8	3.32	26.36	0.06	11.1	0.05	118.79	0.7
01-09-2025 11:15	7.67	29.13	229.41	6.94	3.42	344.92	0.08	345.16	0.12		
01-09-2025 11:20	7.58	29.12	229.01	6.17	2.33	48	0.05	48.15	0.05		
01-09-2025 11:25	7.61	29.13	229.82	6.49	4.12	10.82	0.08	23.09	0.1	75.71	0.45
01-09-2025 11:30	7.58	29.13	230.07	5.63	3.7	23.48	0.10	26.88	0.12	91.1	0.55
01-09-2025 11:35	7.64	29.13	229.47	4.6	2.04	333.81	0.11	357.47	0.12		
01-09-2025 11:40	7.6	29.12	230.59	5.15	4.6	333.72	0.10	325.83	0.14	93.45	0.53
01-09-2025 11:45	7.5	29.12	230.98	4.82	5.07	86.05	0.04	92.87	0.08	111.89	0.62
01-09-2025 11:50	7.62	29.11	231.37	4.22	5.14	13.26	0.14	7.11	0.16		
01-09-2025 11:55	7.59	29.12	231.38	4.19	5.16	48.51	0.10	50.77	0.17	104.51	0.49
01-09-2025 12:00	7.6	29.13	231.07	2.89	3.21	44.82	0.17	35.7	0.2	119.14	0.71
01-09-2025 12:05	7.66	29.14	230.98	2.75	3.03	5.55	0.14	13.16	0.23	103.94	0.43
01-09-2025 12:10	7.68	29.15	231.2	2.68	3.24	2.33	0.22	8.93	0.28		
01-09-2025 12:15	7.58	29.16	231.44	2.77	3.91	34.78	0.13	47.1	0.2	118.54	0.6
01-09-2025 12:20	7.63	29.15	231.16	2.25	2.71	12.4	0.18	30.83	0.27	118.1	0.4
01-09-2025 12:25	7.6	29.12	231.88	3.17	5.1	29.51	0.19	41.28	0.23	112.94	0.33
01-09-2025 12:30	7.68	29.11	230.95	2.16	2.53	18.62	0.25	30.1	0.28		
01-09-2025 12:35	7.62	29.11	230.67	1.78	1.5	13.23	0.19	32.97	0.26	131.77	0.67
01-09-2025 12:40	7.64	29.1	230.54	1.59	1.09	311.47	0.27	309.19	0.3	190.76	0.43
01-09-2025 12:45	7.57	29.12	230.97	2.07	2.31	319.95	0.14	278.19	0.16	222.33	0.56
01-09-2025 12:50	7.57	29.14	231.02	2.09	2.48	302.76	0.15	295.98	0.24	168.21	0.7
01-09-2025 12:55	7.58	29.15	230.8	1.9	1.99	290.71	0.23	280.98	0.28	204.13	0.48
01-09-2025 13:00	7.6	29.18	230.95	2.06	2.47	42.3	0.29	46.09	0.31	134.31	0.48
01-09-2025 13:05	7.65	29.18	230.34	0.74	0.11	19.58	0.31	31.02	0.34	123.11	0.43
01-09-2025 13:10	7.61	29.2	230.59	0.05	0.24	22.66	0.26	40.34	0.33	106.42	0.44
01-09-2025 13:15	7.69	29.21	230.5	-0.09	0.04	28.42	0.27	27.29	0.36	122.68	0.51
01-09-2025 13:20	7.59	29.18	230.7	0	0.25	42.7	0.31	50.43	0.34	112.75	0.73
01-09-2025 13:25	7.64	29.17	230.12	-0.54	-1.1	31.1	0.32	42.69	0.3	126.24	0.53
01-09-2025 13:30	7.58	29.2	230.41	-0.42	-0.58	55.12	0.24	63.65	0.29	125.7	0.71
01-09-2025 13:35	7.59	29.21	231.46	0.75	2.46	51.17	0.31	45.2	0.31	75.23	0.34
01-09-2025 13:40	7.62	29.19	231.14	0.51	1.87	36.07	0.33	39.23	0.31	123.93	0.45
01-09-2025 13:45	7.6	29.17	231.83	1.16	3.53	35.31	0.25	39.37	0.35	111.06	0.36
01-09-2025 13:50	7.58	29.15	231.65	0.88	2.9	33.31	0.29	37.58	0.34	110.73	0.25
01-09-2025 13:55	7.57	29.15	230.97	0.02	0.65	38.57	0.27	44.26	0.32	128.26	0.41
01-09-2025 14:00	7.6	29.15	231.12	0.07	0.95	42.71	0.27	37.75	0.35	125.92	0.46
01-09-2025 14:05	7.55	29.17	231.33	0.45	1.92	51.5	0.27	42.08	0.34	124.11	0.57
01-09-2025 14:10	7.55	29.18	231.45	0.53	2.15	35.01	0.29	43.35	0.35	126.58	0.45
01-09-2025 14:15	7.58	29.17	230.73	-0.2	0.32	25.31	0.28	44.48	0.28	116.59	0.46
01-09-2025 14:20	7.55	29.16	231.07	-0.4	0.21	52.91	0.32	60.37	0.32	127.25	0.68
01-09-2025 14:25	7.61	29.14	231.45	-0.11	1.15	40.91	0.37	44.81	0.25	99.47	0.53
01-09-2025 14:30	7.54	29.15	231.99	0.59	2.93	57.91	0.29	80.74	0.19	135.98	0.79
01-09-2025 14:35	7.55	29.14	231.77	0.36	2.35	48.45	0.27	57.28	0.27	104.27	0.58
01-09-2025 14:40	7.56	29.13	228.41	-0.76	-0.68	27.88	0.23	38.91	0.2	127.46	0.73
01-09-2025 14:45	7.57	29.13	231.32	-0.29	0.67	33.8	0.30	43.99	0.31	118.95	0.48
01-09-2025 14:50	7.62	29.13	229.3	-1.29	-2.05	32	0.28	28.49	0.23	111.26	0.33
01-09-2025 14:55	7.59	29.18	231.24	-0.46	0.27	34.49	0.25	31.69	0.19	112.46	0.32
01-09-2025 15:00	7.57	29.18	231.89	0.36	2.41	56.89	0.24	61.43	0.24	107.32	0.54

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
01-09-2025 15:05	7.57	29.14	231.82	0.32	2.26	40.49	0.25	53.2	0.17	123.54	0.68
01-09-2025 15:10	7.58	29.14	231.6	-0.05	1.34	35.11	0.30	39.72	0.26	107.37	0.38
01-09-2025 15:15	7.55	29.13	231.54	-0.15	1.07	33.62	0.23	44.94	0.26	113.59	0.5
01-09-2025 15:20	7.52	29.13	230.49	-0.73	-0.46	41.54	0.20	44.09	0.24	122.03	0.63
01-09-2025 15:25	7.51	29.12	231.84	0.12	1.83	46.1	0.24	59.87	0.27	104.25	0.55
01-09-2025 15:30	7.47	29.13	231.59	-0.2	1.01	54.94	0.25	59.67	0.28	116.48	0.72
01-09-2025 15:35	7.51	29.13	231.77	-0.04	1.66	60.91	0.27	75.78	0.23	135.63	0.7
01-09-2025 15:40	7.51	29.13	231.79	0.01	1.83	264.61	0.22	258.18	0.22	190.02	0.67
01-09-2025 15:45	7.51	29.13	231.44	-0.36	0.87	300.37	0.22	277.16	0.16	178.35	0.55
01-09-2025 15:50	7.56	29.14	231.69	-0.05	1.7	299.85	0.21	311.54	0.12	180.57	0.3
01-09-2025 15:55	7.53	29.18	232.19	0.68	3.53	268.39	0.17	246.59	0.12	188.24	0.59
01-09-2025 16:00	7.46	29.19	232.35	1.02	4.35	67.72	0.21	88.98	0.17	122.83	0.57
01-09-2025 16:05	7.56	29.15	232.69	1.39	5.22	39.24	0.24	44.51	0.17	99.82	0.26
01-09-2025 16:10	7.49	29.12	232.63	1.15	4.64	40.19	0.20	51.12	0.17	84.35	0.39
01-09-2025 16:15	7.45	29.12	231.93	0.16	2.17	42.91	0.22	68.55	0.24	83	0.4
01-09-2025 16:20	7.47	29.12	232.03	0.45	2.91	38.11	0.24	44.81	0.22	59.2	0.38
01-09-2025 16:25	7.49	29.11	231.94	0.36	2.65	32.39	0.22	42.19	0.17	88.63	0.36
01-09-2025 16:30	7.49	29.12	231.98	0.28	2.52	39.21	0.28	41.41	0.23	62.62	0.2
01-09-2025 16:35	7.52	29.12	232.01	0.39	2.79	24.83	0.22	14.77	0.15	28.95	0.3
01-09-2025 16:40	7.52	29.19	231.84	0.31	2.61	47.25	0.22	42.4	0.15	61.26	0.23
01-09-2025 16:45	7.44	29.19	232.1	0.71	3.56	69.94	0.23	86.97	0.19	92.63	0.17
01-09-2025 16:50	7.46	29.16	232.15	0.78	3.75	51.88	0.15	64.38	0.18	108.46	0.2
01-09-2025 16:55	7.47	29.13	232.14	0.73	3.64	41.53	0.18	46.02	0.13	69.7	0.23
01-09-2025 17:00	7.44	29.15	232.38	1	4.29	72.18	0.14	67.19	0.12	73.65	0.26
01-09-2025 17:05	7.42	29.16	232.6	1.22	4.85	59.98	0.16	84.12	0.14	101.27	0.17
01-09-2025 17:10	7.39	29.15	232.72	1.46	5.47	78.84	0.25	91.18	0.17	84.51	0.26
01-09-2025 17:15	7.38	29.13	232.54	1.14	4.64	57.4	0.22	63.6	0.12	43.54	0.28
01-09-2025 17:20	7.47	29.12	232.53	1.06	4.5	35.12	0.19	34.91	0.14	64.99	0.25
01-09-2025 17:25	7.5	29.11	232.68	1.16	4.7	29.5	0.16	15.16	0.1	46.53	0.28
01-09-2025 17:30	7.49	29.12	232.67	1.17	4.7	25.67	0.17	32.56	0.07	90.92	0.3
01-09-2025 17:35	7.35	29.13	232.02	0.22	2.31	112.03	0.10	150.09	0.14	95.15	0.29
01-09-2025 17:40	7.45	29.15	232.31	0.72	3.55	68.28	0.06	92.7	0.06	64.87	0.2
01-09-2025 17:45	7.47	29.15	232.65	1.17	4.7	59.8	0.08	58.94	0.03	66.14	0.19
01-09-2025 17:50	7.39	29.17	232.84	1.54	5.62	122.91	0.13	116.91	0.09	65.86	0.15
01-09-2025 17:55	7.39	29.18	232.89	1.65	5.87	107.95	0.14	116.26	0.1	81.5	0.1
01-09-2025 18:00	7.36	29.18	232.94	1.74	6.06	141.33	0.17	147.75	0.12	58.03	0.23
01-09-2025 18:05	7.41	29.18	232.86	1.54	5.63	123.3	0.13	86.76	0.04	61.59	0.23
01-09-2025 18:10	7.36	29.18	232.91	1.61	5.81	128.45	0.13	142.46	0.12	115.28	0.2
01-09-2025 18:15	7.37	29.18	232.89	1.59	5.7	115.64	0.16	147.5	0.1	21.77	0.25
01-09-2025 18:20	7.4	29.17	232.84	1.44	5.37	90.44	0.09	81.02	0.05	8.83	0.51
01-09-2025 18:25	7.39	29.18	232.94	1.69	5.96	112.13	0.09	132.3	0.1	21.92	0.53
01-09-2025 18:30	7.43	29.18	232.83	1.5	5.47	80.61	0.06	148.83	0.06	9.72	0.61
01-09-2025 18:35	7.47	29.17	232.08	1.04	4.35	97.03	0.05	126.53	0.01	25.1	0.48
01-09-2025 18:40	7.43	29.17	233.4	2.46	8.07	219.32	0.08	193.83	0.03	307.79	0.78
01-09-2025 18:45	7.4	29.17	233.13	2.01	6.84	177.29	0.16	165.23	0.16	298.99	0.77
01-09-2025 18:50	7.38	29.17	233.12	2.05	6.93	173.19	0.27	184.01	0.23		
01-09-2025 18:55	7.41	29.17	233.07	2	6.82	231.75	0.11	220.82	0.14	297.27	0.91
01-09-2025 19:00	7.44	29.17	233.09	2.05	6.96	167.16	0.05	168.43	0.05	39.51	0.67
01-09-2025 19:05	7.41	29.17	233.26	2.32	7.65	153.74	0.16	170.32	0.14	43.69	0.52

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
01-09-2025 19:10	7.43	29.16	233.27	2.33	7.69	154.91	0.12	185.9	0.09	35.22	0.36
01-09-2025 19:15	7.34	29.16	233.31	2.46	8.07	156.38	0.14	167.84	0.16		
01-09-2025 19:20	7.44	29.16	233.28	2.31	7.7	203.62	0.05	260.27	0.02	29.57	0.64
01-09-2025 19:25	7.44	29.15	233.32	2.37	7.81	161.98	0.09	194.79	0.05	24.93	0.4
01-09-2025 19:30	7.42	29.15	233.39	2.53	8.24	170.81	0.17	174.5	0.07	39.15	0.43
01-09-2025 19:35	7.34	29.15	233.29	2.49	8.1	158.66	0.18	174.46	0.16	52.48	0.56
01-09-2025 19:40	7.38	29.14	233.31	2.43	7.93	179.78	0.15	166.17	0.16	57.78	0.54
01-09-2025 19:45	7.36	29.15	233.31	2.39	7.85	171.89	0.25	173.27	0.21	59.71	0.55
01-09-2025 19:50	7.36	29.14	233.45	2.6	8.47	196.72	0.09	182.13	0.11		
01-09-2025 19:55	7.38	29.14	233.53	2.79	8.94	203.01	0.14	180.45	0.18	55.55	0.41
01-09-2025 20:00	7.4	29.15	233.48	2.64	8.55	177.02	0.16	192.08	0.14	46.69	0.6
01-09-2025 20:05	7.44	29.15	233.51	2.75	8.86	196.86	0.16	194.34	0.14	49.44	0.48
01-09-2025 20:10	7.42	29.15	233.71	3.11	9.76	196.81	0.13	198.95	0.13	58.68	0.48
01-09-2025 20:15	7.42	29.15	233.61	2.95	9.36	187.91	0.11	195.71	0.13	46.9	0.68
01-09-2025 20:20	7.43	29.15	233.5	2.76	8.84	212.9	0.12	209.56	0.12	31.55	0.6
01-09-2025 20:25	7.37	29.15	233.67	3.02	9.5	202.95	0.18	199.67	0.18	43.87	0.46
01-09-2025 20:30	7.45	29.14	233.51	2.58	8.38	268.28	0.06	230.46	0.06	42.86	0.65
01-09-2025 20:35	7.37	29.14	233.42	2.55	8.26	188.91	0.21	198.62	0.21		
01-09-2025 20:40	7.43	29.13	233.59	2.81	8.97	223.54	0.11	215.98	0.14	59.32	0.6
01-09-2025 20:45	7.48	29.14	233.54	2.73	8.76	227.4	0.11	260.82	0.09	51.28	0.56
01-09-2025 20:50	7.48	29.13	233.47	2.54	8.29	264.73	0.09	257.75	0.12	54.91	0.62
01-09-2025 20:55	7.45	29.11	233.53	2.77	8.8	217.54	0.13	208.7	0.14	63.3	0.44
01-09-2025 21:00	7.43	29.1	233.49	2.92	8.92	205.01	0.14	197.64	0.11	79.47	0.5
01-09-2025 21:05	7.48	29.1	233.35	2.64	8.21	261.27	0.11	259.9	0.12	71.39	0.47
01-09-2025 21:10	7.51	29.1	233.34	2.57	8.03	254.51	0.08	272.94	0.14	63.22	0.49
01-09-2025 21:15	7.5	29.1	233.26	2.4	7.57	260.17	0.07	277.77	0.06	85.56	0.55
01-09-2025 21:20	7.51	29.09	233.51	2.86	8.84	216.58	0.06	228.29	0.09		
01-09-2025 21:25	7.56	29.09	233.31	2.47	7.77	300.11	0.08	303.97	0.08		
01-09-2025 21:30	7.56	29.09	233.18	2.17	7	311.48	0.08	306.33	0.1		
01-09-2025 21:35	7.45	29.09	233.18	2.17	6.98	188.61	0.10	188.02	0.11	138.86	0.74
01-09-2025 21:40	7.48	29.09	233.13	2.09	6.79	121.18	0.08	115.45	0.09	184.29	0.64
01-09-2025 21:45	7.48	29.09	233.08	2.09	6.77	136.24	0.09	51.49	0.03	215.94	0.72
01-09-2025 21:50	7.48	29.09	233.02	2.05	6.66	73.67	0.06	30.68	0.1		
01-09-2025 21:55	7.43	29.08	233.05	2.13	6.85	98.26	0.01	20.38	0.05	225.48	0.44
01-09-2025 22:00	7.41	29.08	233.3	2.59	8.04	164.68	0.12	183.66	0.08	105.83	0.56
01-09-2025 22:05	7.52	29.08	233.11	2.23	7.11	322.39	0.05	314.09	0.06	103.95	0.48
01-09-2025 22:10	7.46	29.08	233.13	2.2	7.06	168.57	0.04	156.64	0.04	118.54	0.59
01-09-2025 22:15	7.54	29.08	232.88	1.82	6.04	268.07	0.07	292.3	0.1	115.08	0.59
01-09-2025 22:20	7.51	29.1	232.83	1.7	5.73	289.37	0.02	277.16	0.05	109.06	0.57
01-09-2025 22:25	7.54	29.1	233.02	1.93	6.34	323.89	0.19	296.3	0.05	114.68	0.47
01-09-2025 22:30	7.58	29.11	232.74	1.61	5.53	345.69	0.10	349.52	0.14	78.35	0.61
01-09-2025 22:35	7.56	29.08	232.64	1.28	4.7	307.52	0.05	315.51	0.05	106.72	0.8
01-09-2025 22:40	7.53	29.08	232.82	1.64	5.62	104.45	0.00	47.92	0.03	104.97	0.52
01-09-2025 22:45	7.54	29.08	232.76	1.51	5.28	31.61	0.08	29.03	0.08	87.83	0.66
01-09-2025 22:50	7.5	29.07	232.86	1.71	5.72	14.16	0.03	74.45	0.04	117.42	0.68
01-09-2025 22:55	7.47	29.07	233.04	1.93	6.34	146.55	0.11	119.34	0.08	104.09	0.5
01-09-2025 23:00	7.57	29.08	233.11	1.91	6.33	49.12	0.09	15.04	0.09	87.07	0.47
01-09-2025 23:05	7.53	29.08	233.05	1.94	6.36	54.42	0.08	28.7	0.12	85.2	0.57
01-09-2025 23:10	7.48	29.08	232.98	1.88	6.22	79.79	0.10	77.84	0.14	99.77	0.59

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
01-09-2025 23:15	7.57	29.09	232.79	1.48	5.31	37.38	0.16	14.2	0.22	73.98	0.58
01-09-2025 23:20	7.48	29.11	232.94	1.71	5.85	57.46	0.11	61.19	0.12	109.52	0.63
01-09-2025 23:25	7.47	29.12	232.74	1.25	4.73	63.43	0.15	72.1	0.13	94.78	0.54
01-09-2025 23:30	7.54	29.12	232.41	0.62	3.34	43.96	0.23	42.57	0.22	103.33	0.41
01-09-2025 23:35	7.51	29.08	232.35	0.6	3.36	43.03	0.23	37.59	0.23	111.87	0.62
01-09-2025 23:40	7.59	29.06	232.6	0.63	3.82	31.71	0.25	27.78	0.35	88.15	0.52
01-09-2025 23:45	7.48	29.05	233.01	0.48	4.52	36.66	0.18	48.74	0.25	118.05	0.54
01-09-2025 23:50	7.58	29.05	232.7	-1.22	1.68	21.93	0.38	22.05	0.39	75.19	0.7
01-09-2025 23:55	7.52	29.05	232.75	-1.42	1.71	32.42	0.27	40.23	0.34	97.9	0.77
02-09-2025 00:00	7.59	29.04	233.12	-1.05	2.73	29.21	0.28	28.95	0.3	99.75	0.63
02-09-2025 00:05	7.53	29.05	233.13	-0.9	3.14	49.04	0.25	45.87	0.26	101.49	0.63
02-09-2025 00:10	7.58	29.05	233.08	-1.04	2.8	38.05	0.27	50.05	0.28	99.36	0.61
02-09-2025 00:15	7.52	29.04	233.36	-0.57	3.96	50.63	0.26	49.02	0.26	117.77	0.59
02-09-2025 00:20	7.56	29.05	233.31	-0.67	3.72	45.51	0.20	35.65	0.25	103.68	0.59
02-09-2025 00:25	7.57	29.08	233.22	-0.81	3.38	34.1	0.22	30.36	0.27	104.5	0.64
02-09-2025 00:30	7.57	29.07	233.13	-0.96	2.96	29.86	0.29	34.12	0.28	94.14	0.49
02-09-2025 00:35	7.56	29.06	232.9	-1.22	2.31	30.53	0.25	29.94	0.28	81.95	0.56
02-09-2025 00:40	7.54	29.06	232.8	-1.33	1.99	283.12	0.32	278.46	0.35	207.29	0.63
02-09-2025 00:45	7.55	29.03	232.79	-1.35	1.95	280.81	0.38	277.83	0.37	208.59	0.79
02-09-2025 00:50	7.52	29	232.72	-1.46	1.69	279.67	0.37	279.75	0.4	218.44	0.9
02-09-2025 00:55	7.62	29	232.12	-2.23	-0.25	298.47	0.40	299.38	0.36	225.94	0.66
02-09-2025 01:00	7.53	28.92	232.23	-2.05	0.21	45.6	0.33	48.34	0.37	120.38	0.81
02-09-2025 01:05	7.55	28.92	232.13	-2.35	-0.33	43.16	0.33	53.47	0.37	104.2	0.65
02-09-2025 01:10	7.57	28.94	232.56	-1.94	0.84	54.33	0.34	50.31	0.36	106.68	0.45
02-09-2025 01:15	7.53	28.91	233.02	-1.36	2.35	51.56	0.29	48.6	0.29	107.75	0.63
02-09-2025 01:20	7.61	28.96	233.15	-1.24	2.66	30.79	0.26	37.81	0.28	108.56	0.68
02-09-2025 01:25	7.6	29	233.08	-1.32	2.48	38.78	0.31	39.55	0.35	90.77	0.63
02-09-2025 01:30	7.61	28.91	233.08	-1.37	2.37	39.27	0.33	35.37	0.36	88.94	0.5
02-09-2025 01:35	7.57	28.87	232.65	-2.35	0.51	41.83	0.33	44.93	0.36	99.87	0.45
02-09-2025 01:40	7.62	28.86	232.4	-3.63	-1.66	41.43	0.38	40.18	0.39	112.81	0.67
02-09-2025 01:45	7.67	28.85	232.52	-3.44	-1.14	29.05	0.37	31.03	0.4	109.72	0.54
02-09-2025 01:50	7.58	28.91	233.14	-2.67	0.87	39.21	0.37	43.56	0.39	96.96	0.63
02-09-2025 01:55	7.59	28.9	233.06	-2.85	0.42	41.11	0.38	52.45	0.4	106.84	0.7
02-09-2025 02:00	7.58	28.86	233.46	-2.42	1.7	57.13	0.37	57.6	0.39	96.08	0.49
02-09-2025 02:05	7.6	28.88	233.63	-2.11	2.54	49.61	0.34	45.44	0.36	98.22	0.54
02-09-2025 02:10	7.6	28.92	233.67	-2.03	2.72	38.16	0.30	37.09	0.41	99.96	0.59
02-09-2025 02:15	7.62	28.87	233.65	-2	2.81	31.81	0.36	46.87	0.41	114.74	0.58
02-09-2025 02:20	7.66	28.93	233.57	-2.34	2.11	47.82	0.39	53.59	0.41	100.25	0.44
02-09-2025 02:25	7.6	28.89	233.79	-1.98	3.06	70.3	0.39	66.23	0.38	102.7	0.5
02-09-2025 02:30	7.64	28.86	233.86	-1.68	3.75	59.42	0.31	50.31	0.35	96.74	0.5
02-09-2025 02:35	7.61	28.88	233.89	-1.67	3.79	67.12	0.20	61.54	0.24	123	0.36
02-09-2025 02:40	7.61	28.9	233.76	-1.84	3.38	51.12	0.38	48.85	0.37	76.79	0.45
02-09-2025 02:45	7.65	28.8	233.69	-2.01	3.01	40.01	0.38	40.5	0.41	100.83	0.59
02-09-2025 02:50	7.64	28.78	233.78	-1.98	3.14	34.47	0.42	36.72	0.43	109.53	0.51
02-09-2025 02:55	7.64	28.84	233.98	-1.7	3.81	36.84	0.34	37.65	0.38	95.54	0.47
02-09-2025 03:00	7.61	28.82	233.98	-1.74	3.7	57.56	0.31	49.8	0.31	104.16	0.55
02-09-2025 03:05	7.66	28.83	234.05	-1.59	4.09	61.54	0.31	68.53	0.28	113.36	0.53
02-09-2025 03:10	7.63	28.9	234.29	-1.57	4.16	61.4	0.29	67.64	0.28	117.8	0.56
02-09-2025 03:15	7.62	28.8	234.19	-1.79	3.59	56.63	0.19	62.61	0.2	127.81	0.36

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
02-09-2025 03:20	7.61	28.81	234.41	-1.31	4.74	83.5	0.18	108.44	0.19	130.04	0.65
02-09-2025 03:25	7.65	28.84	234.46	-1.35	4.7	66.93	0.18	70.03	0.26	107.25	0.54
02-09-2025 03:30	7.64	28.82	234.36	-1.58	4.08	62.5	0.25	59.03	0.23	98.34	0.41
02-09-2025 03:35	7.68	28.81	234.3	-1.62	4	44.64	0.18	44.65	0.23	126.37	0.58
02-09-2025 03:40	7.67	28.82	234.24	-1.71	3.75	304.93	0.14	300.51	0.19	241.65	0.6
02-09-2025 03:45	7.7	28.82	234.77	-0.68	6.43	249.92	0.23	235.84	0.14	179.22	0.69
02-09-2025 03:50	7.7	28.79	234.49	-1.22	5.07	278.04	0.25	270.91	0.23	249.44	0.49
02-09-2025 03:55	7.67	28.78	234.12	-1.92	3.25	282.97	0.23	280.29	0.24	197.15	0.67
02-09-2025 04:00	7.6	28.77	234.44	-1.26	4.9	95.35	0.17	108.08	0.15	109.53	0.54
02-09-2025 04:05	7.66	28.76	234.24	-1.61	3.99	54.38	0.26	49.38	0.2	105.92	0.49
02-09-2025 04:10	7.67	28.86	234.05	-1.99	3.07	52.58	0.19	53.39	0.18	85.53	0.54
02-09-2025 04:15	7.66	28.77	234.3	-1.56	4.16	62.07	0.07	60.59	0.07	79.13	0.52
02-09-2025 04:20	7.68	28.85	234.8	-0.59	6.66	83.25	0.12	95.8	0.13	100.46	0.27
02-09-2025 04:25	7.67	28.85	234.66	-0.92	5.82	77.72	0.19	79.1	0.16	67.7	0.48
02-09-2025 04:30	7.61	28.83	234.2	-1.71	3.77	76.39	0.20	98.97	0.17	109.55	0.65
02-09-2025 04:35	7.6	28.84	234.15	-1.9	3.27	59.3	0.15	76.32	0.15	89.94	0.36
02-09-2025 04:40	7.6	28.77	234.18	-1.83	3.46	74.23	0.13	89.33	0.17	101.4	0.31
02-09-2025 04:45	7.7	28.81	234.35	-1.54	4.19	47.3	0.14	66.36	0.17		
02-09-2025 04:50	7.69	28.87	234.54	-1.19	5.12	58.18	0.18	62.09	0.17	76.89	0.57
02-09-2025 04:55	7.63	28.9	234.56	-1.08	5.37	69.75	0.13	96.41	0.16	90.49	0.53
02-09-2025 05:00	7.65	28.87	234.6	-1.01	5.59	63.71	0.17	78.52	0.14	97.72	0.45
02-09-2025 05:05	7.66	28.81	234.38	-1.38	4.62	61.29	0.22	65.21	0.17	83.11	0.42
02-09-2025 05:10	7.6	28.77	234.49	-1.19	5.09	62.09	0.17	92.15	0.15	77.03	0.53
02-09-2025 05:15	7.65	28.75	234.38	-1.38	4.59	54.03	0.14	76.31	0.09	83.62	0.46
02-09-2025 05:20	7.55	28.76	234.56	-1.14	5.25	91.97	0.13	119.46	0.16	95.24	0.57
02-09-2025 05:25	7.6	28.77	234.47	-1.32	4.76	73.93	0.18	71.59	0.17	80.93	0.54
02-09-2025 05:30	7.54	28.78	234.57	-1.16	5.18	80.4	0.11	120.66	0.16	104.43	0.55
02-09-2025 05:35	7.59	28.78	233.35	-1.97	2.98	56.64	0.13	60.9	0.11	79.65	0.51
02-09-2025 05:40	7.59	28.8	234.29	-1.64	3.88	73.73	0.12	88.63	0.11	89.47	0.26
02-09-2025 05:45	7.63	28.8	234.31	-1.58	4.09	79.13	0.13	71.01	0.13	69.39	0.36
02-09-2025 05:50	7.56	28.82	234.37	-1.47	4.34	83.56	0.13	108.21	0.16	110.28	0.51
02-09-2025 05:55	7.58	28.81	234.49	-1.29	4.85	90.33	0.15	127.32	0.16	110.38	0.64
02-09-2025 06:00	7.58	28.79	234.49	-1.26	4.91	93.14	0.14	119.77	0.1	110.15	0.59
02-09-2025 06:05	7.55	28.79	234.66	-0.71	6.35	111.49	0.21	115.37	0.18	87.3	0.54
02-09-2025 06:10	7.62	28.83	234.62	-0.87	5.93	93.54	0.13	82.45	0.12	86.89	0.56
02-09-2025 06:15	7.55	28.86	234.72	-0.68	6.41	122.1	0.15	118.99	0.2	93.6	0.61
02-09-2025 06:20	7.52	28.89	234.9	-0.35	7.29	124.35	0.18	111.91	0.19	88.82	0.6
02-09-2025 06:25	7.47	28.9	234.77	-0.53	6.83	138.58	0.19	133.82	0.22	93.68	0.46
02-09-2025 06:30	7.46	28.89	234.85	-0.49	6.93	125.92	0.13	128.03	0.23	102.36	0.53
02-09-2025 06:35	7.5	28.89	234.85	-0.43	7.08	110	0.12	129.61	0.2	113.03	0.47
02-09-2025 06:40	7.51	28.89	234.81	-0.5	6.92	210.96	0.20	195.66	0.21	204.54	0.55
02-09-2025 06:45	7.5	28.88	234.68	-0.61	6.58	194.47	0.23	200.96	0.18	200.07	0.59
02-09-2025 06:50	7.49	28.88	234.68	-0.71	6.35	181.55	0.21	177.14	0.28	181.27	0.39
02-09-2025 06:55	7.52	28.87	234.76	-0.04	8.1	189.71	0.23	193.51	0.19	182.3	0.26
02-09-2025 07:00	7.53	28.86	234.81	-0.27	7.48	135.48	0.15	130.08	0.14	91.14	0.35
02-09-2025 07:05	7.63	28.86	234.91	-0.06	8.02	71.59	0.11	45.94	0.09	73.96	0.31
02-09-2025 07:10	7.49	28.86	234.71	-0.33	7.34	122.94	0.24	139.89	0.27	108.62	0.57
02-09-2025 07:15	7.49	28.86	234.85	-0.16	7.76	130.84	0.19	135.37	0.16	105.72	0.48
02-09-2025 07:20	7.52	28.86	234.91	0.09	8.38	141.33	0.20	148.72	0.14	85.7	0.43

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
02-09-2025 07:25	7.52	28.86	234.82	-0.1	7.87	109.91	0.13	141.61	0.14	68.6	0.36
02-09-2025 07:30	7.5	28.86	235.01	0.44	9.32	130.65	0.21	151.25	0.18	88.28	0.39
02-09-2025 07:35	7.51	28.86	234.97	0.56	9.63	138.68	0.15	134.22	0.15	77.42	0.54
02-09-2025 07:40	7.49	28.86	235.06	0.81	10.31	140.09	0.16	159.16	0.21	114.76	0.36
02-09-2025 07:45	7.54	28.85	234.95	0.29	8.89	144.01	0.21	145.05	0.16	116.81	0.46
02-09-2025 07:50	7.49	28.85	235.08	0.88	10.48	144.64	0.21	152.85	0.26	119.35	0.38
02-09-2025 07:55	7.5	28.85	234.95	0.25	8.84	147.49	0.18	165.48	0.2	118.82	0.36
02-09-2025 08:00	7.56	28.85	234.51	-0.96	5.67	127.78	0.13	163.38	0.14	140.28	0.46
02-09-2025 08:05	7.57	28.84	234.77	-0.47	6.95	141.69	0.07	162.82	0.08	118.05	0.36
02-09-2025 08:10	7.58	28.84	234.8	-0.2	7.63	177.04	0.08	165.97	0.05		
02-09-2025 08:15	7.49	28.84	234.6	-0.25	7.45	158.22	0.23	166.19	0.22	121.29	0.43
02-09-2025 08:20	7.54	28.84	234.99	0.31	8.95	170.9	0.13	175.75	0.13		
02-09-2025 08:25	7.52	28.84	234.87	-0.05	7.99	176.03	0.23	181.79	0.22	153.42	0.57
02-09-2025 08:30	7.48	28.84	234.88	-0.1	7.88	165.45	0.22	169.02	0.26	130.68	0.43
02-09-2025 08:35	7.56	28.83	234.73	-0.39	7.06	172.47	0.15	190.22	0.13	105.67	0.39
02-09-2025 08:40	7.56	28.83	234.28	0.92	7.8	180.35	0.15	191.66	0.17	126.7	0.61
02-09-2025 08:45	7.56	28.83	233.95	1.63	7.96	193.53	0.15	200.91	0.15	91.81	0.24
02-09-2025 08:50	7.51	28.82	230.78	8.23	6.79	171.58	0.19	168	0.24		
02-09-2025 08:55	7.51	28.82	230.22	10.4	6.58	179.83	0.21	197.96	0.15		
02-09-2025 09:00	7.55	28.82	229.56	11.47	5.51	183.61	0.20	182.94	0.18	133.86	0.53
02-09-2025 09:05	7.56	28.82	229.6	13.58	6.09	176.41	0.19	197.26	0.16	142.61	0.32
02-09-2025 09:10	7.59	28.8	229.51	13.52	5.95	191.85	0.19	196.19	0.16	149.38	0.4
02-09-2025 09:15	7.46	28.8	229.57	13.6	5.95	175.77	0.23	174.99	0.31		
02-09-2025 09:20	7.54	28.79	228.73	12.94	4	213.17	0.15	195.93	0.2		
02-09-2025 09:25	7.56	28.79	229.01	13.16	4.56	200.59	0.14	202.1	0.14	140.19	0.53
02-09-2025 09:30	7.56	28.79	229.07	13.21	4.7	188.99	0.16	198.38	0.21		
02-09-2025 09:35	7.58	28.79	228.54	12.88	3.85	197.53	0.14	204.96	0.19	137.16	0.54
02-09-2025 09:40	7.58	28.79	229.09	13.41	5.2	98.78	0.14	104.77	0.18		
02-09-2025 09:45	7.61	28.79	228.81	13.13	4.53	118.7	0.14	108.23	0.18	180.65	0.52
02-09-2025 09:50	7.5	28.79	228.88	13.24	4.73	133.97	0.27	128.46	0.31		
02-09-2025 09:55	7.54	28.78	228.02	13.15	2.91	101.77	0.18	103.87	0.14	191.29	0.64
02-09-2025 10:00	7.5	28.77	228.43	13.52	3.74	192.86	0.13	202.27	0.14	144	0.68
02-09-2025 10:05	7.53	28.77	228.26	13.35	3.32	213.86	0.13	233.44	0.14	140.97	0.31
02-09-2025 10:10	7.56	28.76	227.9	13.08	2.67	267.53	0.07	242.63	0.11		
02-09-2025 10:15	7.5	28.76	228.15	13.24	3.06	209.58	0.13	222.01	0.16	149.2	0.49
02-09-2025 10:20	7.49	28.75	227.93	13.05	2.5	200.13	0.11	195.38	0.12	147.35	0.4
02-09-2025 10:25	7.52	28.75	227.84	13.01	2.32	201.62	0.12	196.66	0.16	146.87	0.56
02-09-2025 10:30	7.52	28.74	227.72	12.9	2.05	235.5	0.09	238.12	0.08	133.07	0.5
02-09-2025 10:35	7.53	28.73	227.74	12.96	2.18	205.06	0.05	209.67	0.1	147.47	0.32
02-09-2025 10:40	7.53	28.72	227.72	12.94	2.13	244.74	0.05	232.99	0.11	150.72	0.29
02-09-2025 10:45	7.5	28.74	227.88	13.08	2.46	179.22	0.13	200.46	0.13	137.78	0.67
02-09-2025 10:50	7.5	28.74	228.13	13.22	2.83	177.34	0.09	195.17	0.12	145.15	0.58
02-09-2025 10:55	7.57	28.73	227.97	13.03	2.41	329.59	0.02	284.59	0.04	139.1	0.47
02-09-2025 11:00	7.5	28.73	228.2	13.28	2.96	186.01	0.11	194.89	0.14	140.38	0.69
02-09-2025 11:05	7.56	28.74	227.73	12.9	2.06	304.08	0.04	294	0.08	147.89	0.38
02-09-2025 11:10	7.52	28.72	228	13.12	2.6	212.96	0.04	301.4	0.02	143.51	0.17
02-09-2025 11:15	7.48	28.72	227.83	12.97	2.23	136.48	0.09	181.48	0.05	148.12	0.39
02-09-2025 11:20	7.52	28.72	228.15	13.21	2.79	130.85	0.03	111.35	0.01	149.67	0.56
02-09-2025 11:25	7.5	28.71	228.16	13.23	2.85	174.73	0.04	213.15	0.07	142.74	0.48

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
02-09-2025 11:30	7.48	28.72	228.33	13.33	3.1	134.29	0.04	202.13	0.04	138.23	0.53
02-09-2025 11:35	7.5	28.71	228.51	13.51	3.52	146.6	0.04	141.9	0.04	127.86	0.35
02-09-2025 11:40	7.51	28.7	228.26	13.3	3.02	100.7	0.02	357.71	0.05	122.79	0.26
02-09-2025 11:45	7.48	28.7	228.11	13.16	2.68	127.1	0.04	159.88	0.06	140.07	0.54
02-09-2025 11:50	7.53	28.7	228.09	13.11	2.55	9.25	0.04	343.6	0.01	126.82	0.4
02-09-2025 11:55	7.57	28.7	228.52	13.47	3.47	331.95	0.07	351.82	0.07	137.88	0.45
02-09-2025 12:00	7.57	28.71	228.1	12.9	2.53	4.92	0.07	79.91	0	147.74	0.28
02-09-2025 12:05	7.55	28.71	228.09	12.92	2.61	95.19	0.06	48.97	0.05	128.12	0.47
02-09-2025 12:10	7.52	28.72	228.25	13.1	3.04	20.66	0.04	337.17	0.05	134.48	0.58
02-09-2025 12:15	7.56	28.73	227.97	12.86	2.42	10.17	0.08	327.14	0.08	141.76	0.42
02-09-2025 12:20	7.45	28.76	228.63	13.36	3.73	109.52	0.10	106.08	0.09	127.44	0.43
02-09-2025 12:25	7.51	28.79	227.46	12.29	1.22	17.88	0.07	0.54	0.07	129.6	0.41
02-09-2025 12:30	7.51	28.8	227.46	12.22	1.2	38.24	0.13	36	0.06	137.7	0.6
02-09-2025 12:35	7.5	28.81	227.81	12.51	1.99	86.14	0.19	40.76	0.08	140.07	0.68
02-09-2025 12:40	7.52	28.84	227.25	11.76	0.89	186.78	0.16	288.17	0.32	190.02	0.71
02-09-2025 12:45	7.48	28.89	227.36	11.75	1.24	249.16	0.17	271.1	0.14		
02-09-2025 12:50	7.52	28.87	227.35	11.67	1.2	300.38	0.20	307.26	0.13	178.05	0.68
02-09-2025 12:55	7.53	28.82	227.92	11.72	2.46	303.63	0.19	309.1	0.2	185.51	0.54
02-09-2025 13:00	7.54	28.78	228.19	11.67	2.95	38.36	0.16	24.23	0.18	130.62	0.74
02-09-2025 13:05	7.51	28.76	228.01	11.33	2.5	28.54	0.17	39.53	0.17	131.57	0.57
02-09-2025 13:10	7.56	28.74	227.71	10.12	1.84	26.85	0.24	28.93	0.24	127.5	0.45
02-09-2025 13:15	7.48	28.73	228.59	8.16	2.54	36.36	0.20	45.58	0.25		
02-09-2025 13:20	7.53	28.73	228.84	7.06	2.33	20.13	0.22	31.42	0.23	137.22	0.68
02-09-2025 13:25	7.58	28.74	228.79	6.83	2.14	11.14	0.24	15.19	0.31	131.28	0.33
02-09-2025 13:30	7.49	28.75	229.33	6.92	3.06	32.61	0.18	37.84	0.21	140.88	0.74
02-09-2025 13:35	7.57	28.74	229.03	5.77	1.76	19.48	0.19	24.68	0.26		
02-09-2025 13:40	7.48	28.74	229.67	5.48	3	39.94	0.18	44.08	0.23	130.66	0.66
02-09-2025 13:45	7.45	28.74	229.87	5.6	3.33	30.54	0.11	52.16	0.2	138.96	0.44
02-09-2025 13:50	7.48	28.73	229.57	5.28	2.52	9.85	0.15	38.13	0.22	129.78	0.48
02-09-2025 13:55	7.49	28.73	229.9	5.33	3.12	27.33	0.24	35.48	0.23	117	0.55
02-09-2025 14:00	7.48	28.74	230.07	4.76	2.95	40.85	0.21	43.75	0.32	136.57	0.74
02-09-2025 14:05	7.53	28.74	229.99	3.82	2.05	21.65	0.25	31.16	0.35	107.9	0.63
02-09-2025 14:10	7.49	28.73	230.16	4.01	2.67	8.16	0.26	33.08	0.32	112.05	0.59
02-09-2025 14:15	7.48	28.73	230.44	3.58	2.75	24.65	0.22	34.31	0.31	105.03	0.49
02-09-2025 14:20	7.55	28.74	230.21	2.77	1.59	22.63	0.29	34.9	0.28	95.51	0.72
02-09-2025 14:25	7.49	28.75	230.62	2.31	1.81	22.8	0.21	43.26	0.29	107.2	0.68
02-09-2025 14:30	7.53	28.75	230.65	0.69	0.58	21.75	0.25	38.97	0.3	120.19	0.76
02-09-2025 14:35	7.53	28.76	231.08	0.12	0.69	31.44	0.23	36.15	0.3	129.03	0.86
02-09-2025 14:40	7.49	28.77	231.63	0.34	1.92	41.82	0.30	49.35	0.35	133.79	0.51
02-09-2025 14:45	7.49	28.78	231.43	-0.21	0.91	49.1	0.26	52.64	0.27	131.14	0.68
02-09-2025 14:50	7.51	28.78	231.54	-0.41	0.9	36.46	0.25	54.89	0.27	147.88	0.77
02-09-2025 14:55	7.55	28.78	231.71	-0.36	1.24	32.33	0.32	43.66	0.25	145	0.63
02-09-2025 15:00	7.44	28.79	232.03	-0.08	2.11	59.36	0.27	69.4	0.26	132.79	0.82
02-09-2025 15:05	7.53	28.79	231.95	-0.22	1.92	30.25	0.28	36.39	0.27	137.43	0.5
02-09-2025 15:10	7.55	28.78	231.91	-0.18	1.97	24.99	0.24	37.77	0.31	166.85	0.44
02-09-2025 15:15	7.54	28.77	232.08	0.02	2.56	33.38	0.28	45.61	0.26	158.57	0.47
02-09-2025 15:20	7.52	28.76	231.8	-0.33	1.6	45.95	0.31	68.49	0.23	126.99	0.44
02-09-2025 15:25	7.52	28.78	231.22	-0.92	0.06	48.83	0.26	70.17	0.17	138.06	0.49
02-09-2025 15:30	7.58	28.82	231.85	-0.42	1.44	40.18	0.20	48.34	0.14	148.54	0.35

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
02-09-2025 15:35	7.49	28.81	231.72	-0.43	1.36	60.04	0.18	80.98	0.17	125.26	0.68
02-09-2025 15:40	7.57	28.8	231.67	-0.55	1.05	289.79	0.23	280.22	0.19	203.13	0.71
02-09-2025 15:45	7.45	28.8	232.2	0.22	3.03	234.04	0.26	222.31	0.19	191.74	0.6
02-09-2025 15:50	7.51	28.79	232.16	0.28	3.17	259.75	0.25	238.7	0.16	195.61	0.8
02-09-2025 15:55	7.45	28.79	232.36	0.56	3.81	241.74	0.24	215.47	0.2	205.77	0.85
02-09-2025 16:00	7.52	28.8	232.06	0.15	2.85	52.5	0.18	62.6	0.13	118.67	0.47
02-09-2025 16:05	7.5	28.84	232.39	0.64	3.99	82.43	0.17	91.66	0.17	123.06	0.71
02-09-2025 16:10	7.46	28.86	232.62	1.02	5.01	94.23	0.19	116.68	0.21	152.17	0.86
02-09-2025 16:15	7.52	28.83	232.65	0.96	4.88	70.62	0.17	101.85	0.14	140.75	0.64
02-09-2025 16:20	7.51	28.83	232.54	0.75	4.36	71.73	0.17	68.29	0.15	141.44	0.46
02-09-2025 16:25	7.53	28.84	232.66	0.93	4.84	76.97	0.12	93.66	0.13	153	0.61
02-09-2025 16:30	7.57	28.85	232.74	1	5.03	69.64	0.11	75.02	0.09		
02-09-2025 16:35	7.54	28.95	232.76	1.11	5.23	70.06	0.08	66.22	0.11	153.44	0.34
02-09-2025 16:40	7.43	28.95	232.93	1.38	5.9	119.37	0.17	117.28	0.14	159.09	0.54
02-09-2025 16:45	7.49	28.97	233.07	1.66	6.54	99.19	0.17	121.27	0.12		
02-09-2025 16:50	7.45	29	233.13	1.76	6.84	109.91	0.16	133.47	0.17		
02-09-2025 16:55	7.39	29	233.5	2.44	8.69	127.15	0.22	138.85	0.2	146.98	0.37
02-09-2025 17:00	7.49	29	233.55	2.43	8.64	120.32	0.12	131.71	0.15		
02-09-2025 17:05	7.56	28.99	233.11	1.56	6.35	104.07	0.12	106.98	0.07		
02-09-2025 17:10	7.49	28.94	233.2	1.68	6.59	119.02	0.16	121.31	0.13	103.63	0.3
02-09-2025 17:15	7.44	28.88	233.25	1.91	7.22	124.81	0.20	139.36	0.14	107.66	0.45
02-09-2025 17:20	7.44	28.84	233.2	1.69	6.67	120.68	0.17	144.35	0.14	145.37	0.45
02-09-2025 17:25	7.51	28.83	233.16	1.62	6.47	135.83	0.14	127.29	0.1	117.51	0.38
02-09-2025 17:30	7.51	28.84	233.22	1.76	6.87	103.49	0.09	97.36	0.06	104.81	0.37
02-09-2025 17:35	7.47	28.83	233.43	2.18	7.94	137.71	0.13	158.62	0.14	102.19	0.36
02-09-2025 17:40	7.45	28.82	233.27	1.81	6.95	132	0.24	155.51	0.17	105.51	0.46
02-09-2025 17:45	7.45	28.84	233.37	2.1	7.7	142.77	0.14	152.18	0.15	100.48	0.3
02-09-2025 17:50	7.46	28.83	233.48	2.22	8.05	139.49	0.19	152.39	0.2		
02-09-2025 17:55	7.52	28.84	233.44	2.07	7.7	142.26	0.10	171.12	0.08	69.79	0.12
02-09-2025 18:00	7.47	28.82	233.51	2.23	8.09	149.35	0.16	142.67	0.18	102.68	0.09
02-09-2025 18:05	7.41	28.84	233.62	2.42	8.6	150.91	0.19	169.52	0.19	85.49	0.09
02-09-2025 18:10	7.47	28.83	233.62	2.52	8.91	159.01	0.19	168.28	0.14	104.11	0.08
02-09-2025 18:15	7.43	28.81	233.51	2.38	8.45	145.6	0.22	159.3	0.17	122.71	0.18
02-09-2025 18:20	7.45	28.82	233.77	3.04	10.37	156.89	0.17	173.09	0.13	8.04	0.23
02-09-2025 18:25	7.44	28.82	233.59	2.34	8.37	140.97	0.22	170.36	0.18		
02-09-2025 18:30	7.45	28.81	233.52	2.27	8.25	156.19	0.18	172.51	0.15	352.06	0.29
02-09-2025 18:35	7.44	28.81	233.67	2.51	8.9	147.09	0.17	172.69	0.19	356.4	0.28
02-09-2025 18:40	7.41	28.81	233.42	2.07	7.65	167.88	0.27	155.02	0.27	295.42	0.14
02-09-2025 18:45	7.39	28.81	233.3	1.9	7.18	150.2	0.31	150.62	0.29	280.56	0.19
02-09-2025 18:50	7.44	28.81	233.08	1.44	6	173.31	0.21	154.61	0.27	327.4	0.35
02-09-2025 18:55	7.53	28.81	233.23	1.83	7.14	154.59	0.11	124.98	0.11	336.69	0.38
02-09-2025 19:00	7.4	28.82	233.73	2.89	9.89	171.01	0.27	187.43	0.25		
02-09-2025 19:05	7.46	28.82	233.5	2.51	8.86	168.78	0.23	157.89	0.26	335.5	0.1
02-09-2025 19:10	7.46	28.82	233.4	2.16	7.94	171.57	0.16	173.34	0.16	3.42	0.41
02-09-2025 19:15	7.51	28.82	233.44	2.26	8.23	194.42	0.16	185.18	0.18	335.6	0.24
02-09-2025 19:20	7.35	28.82	233.41	2.03	7.54	176.29	0.29	168.16	0.32		
02-09-2025 19:25	7.54	28.83	233.22	1.79	6.8	215.25	0.14	239.99	0.14	353.5	0.3
02-09-2025 19:30	7.4	28.83	233.37	2.87	8.5	186.28	0.26	176.52	0.28	256.42	0.14
02-09-2025 19:35	7.4	28.83	232.87	4.61	9.37	191.32	0.17	186.26	0.21	299.98	0.03

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
02-09-2025 19:40	7.48	28.83	231.87	5.29	7.59	220.32	0.18	228.88	0.16	312.35	0.38
02-09-2025 19:45	7.41	28.83	232.11	5.67	8.49	196.58	0.22	200.8	0.19	274.15	0.26
02-09-2025 19:50	7.43	28.82	231.79	5.19	7.25	208.01	0.17	208.44	0.15	300.4	0.15
02-09-2025 19:55	7.44	28.82	231.65	4.94	6.57	213.52	0.15	214.88	0.15	322.38	0.12
02-09-2025 20:00	7.44	28.82	231.76	5.13	7	212.32	0.20	220.15	0.2	290.2	0.08
02-09-2025 20:05	7.4	28.83	231.87	5.31	7.45	204.7	0.20	218.95	0.16	305.88	0.22
02-09-2025 20:10	7.46	28.83	231.47	4.85	6.28	207.68	0.19	220.19	0.22	1.75	0.11
02-09-2025 20:15	7.4	28.84	231.54	4.88	6.38	204.36	0.18	210.87	0.21	317.68	0.2
02-09-2025 20:20	7.49	28.85	231.4	4.68	5.88	231.38	0.14	238.98	0.18	317.31	0.4
02-09-2025 20:25	7.42	28.85	231.42	4.71	5.96	207.07	0.20	208.17	0.27	342.55	0.12
02-09-2025 20:30	7.42	28.86	231.28	4.38	5.19	207.51	0.16	200.71	0.2	339.94	0.38
02-09-2025 20:35	7.44	28.87	231.16	4.29	4.94	203.92	0.19	215.87	0.18	339.62	0.33
02-09-2025 20:40	7.41	28.87	231.31	4.5	5.45	201.97	0.22	197.8	0.17		
02-09-2025 20:45	7.46	28.88	231.14	4.24	4.84	223.98	0.14	223.77	0.19	33.61	0.25
02-09-2025 20:50	7.45	28.88	231.3	4.45	5.31	229.01	0.18	225.46	0.16	6.69	0.34
02-09-2025 20:55	7.48	28.89	231.25	4.41	5.21	247.77	0.18	267.75	0.14	7.75	0.26
02-09-2025 21:00	7.42	28.9	231.26	4.38	5.15	212.69	0.17	207.68	0.13	32.57	0.28
02-09-2025 21:05	7.44	28.91	231.25	4.41	5.27	223.2	0.12	231.05	0.09	27.44	0.26
02-09-2025 21:10	7.39	28.91	231.18	4.33	5.06	207	0.16	203.94	0.19	104.68	0.08
02-09-2025 21:15	7.39	28.91	231.13	4.27	4.96	207.41	0.18	205.14	0.18	168.62	0.11
02-09-2025 21:20	7.4	28.91	231.23	4.37	5.18	191.8	0.15	194.12	0.16	78.89	0.37
02-09-2025 21:25	7.4	28.92	231.07	4.15	4.62	207.02	0.16	201.1	0.17	86.42	0.37
02-09-2025 21:30	7.45	28.92	231.21	4.29	4.99	211.64	0.16	216.28	0.16	91	0.29
02-09-2025 21:35	7.46	28.92	231.11	4.19	4.75	229.14	0.14	227.75	0.1	45.41	0.27
02-09-2025 21:40	7.46	28.93	231.18	4.35	5.13	84.36	0.15	120.68	0.17	238.3	0.78
02-09-2025 21:45	7.45	28.94	231.2	4.63	5.57	119.92	0.11	112.94	0.11	254.67	0.6
02-09-2025 21:50	7.43	28.94	231.24	4.87	5.94	103.74	0.09	131.38	0.06	240.8	0.71
02-09-2025 21:55	7.48	28.94	231.15	4.77	5.68	67.41	0.14	79.21	0.17	226.49	0.63
02-09-2025 22:00	7.42	28.94	231.18	4.85	5.9	207.62	0.13	213.05	0.12	88.32	0.66
02-09-2025 22:05	7.42	28.95	230.46	3.88	3.48	209.61	0.14	220.05	0.14	89.97	0.79
02-09-2025 22:10	7.42	28.95	230.46	3.96	3.68	221.44	0.10	201.83	0.09	71.1	0.83
02-09-2025 22:15	7.41	28.94	230.58	4.06	3.93	202.18	0.08	186.99	0.08	94.7	0.74
02-09-2025 22:20	7.4	28.93	230.36	3.9	3.52	237.77	0.07	189.59	0.07	73.74	0.37
02-09-2025 22:25	7.46	28.94	231.16	4.75	5.67	245.87	0.03	233.76	0.09		
02-09-2025 22:30	7.49	28.94	230.9	4.35	4.7	259.85	0.06	242.76	0.07	68.34	0.24
02-09-2025 22:35	7.42	28.94	230.78	4.28	4.51	215.36	0.06	200.35	0.07	80.6	0.6
02-09-2025 22:40	7.43	28.94	230.96	4.54	5.13	192.02	0.04	200.88	0.07	58.62	0.33
02-09-2025 22:45	7.44	28.94	231.04	4.58	5.25	156.94	0.01	225.31	0.04	61.13	0.75
02-09-2025 22:50	7.51	28.93	230.88	4.38	4.76	309.81	0.12	333.02	0.08	42.59	0.75
02-09-2025 22:55	7.5	28.93	231.03	4.57	5.23	327.22	0.06	317.17	0.08	61.93	0.45
02-09-2025 23:00	7.42	28.93	230.9	4.28	4.55	196.54	0.04	233.44	0.04	62.46	0.7
02-09-2025 23:05	7.47	28.93	231.01	4.59	5.28	141.64	0.00	245.65	0.02	66.37	0.77
02-09-2025 23:10	7.42	28.92	231.2	4.85	5.89	150.66	0.02	171.73	0.04	71.41	0.68
02-09-2025 23:15	7.41	28.92	231.06	4.58	5.28	153.51	0.07	146.56	0.04	77.78	0.51
02-09-2025 23:20	7.43	28.92	230.78	4.21	4.38	12.6	0.01	350.28	0.07	46.27	0.75
02-09-2025 23:25	7.49	28.92	230.79	4.23	4.44	10.44	0.04	340.93	0.06	78.36	0.59
02-09-2025 23:30	7.46	28.92	231.24	4.73	5.62	34.53	0.03	28.02	0.03	70.36	0.41
02-09-2025 23:35	7.43	28.91	230.93	4.36	4.74	56.51	0.02	330.26	0.03	73.03	0.64
02-09-2025 23:40	7.41	28.92	230.99	4.45	4.98	24.26	0.05	63.92	0.02	54.06	0.82

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
02-09-2025 23:45	7.45	28.91	230.91	4.34	4.77	92.58	0.03	31.16	0.06	71.15	0.33
02-09-2025 23:50	7.45	28.9	230.72	3.97	3.98	46.06	0.06	63.72	0.05	59.25	0.61
02-09-2025 23:55	7.44	28.9	230.75	3.96	4.03	46.64	0.06	52.97	0.07	61.9	0.66
03-09-2025 00:00	7.51	28.9	230.6	3.76	3.52	4.67	0.10	6.16	0.14		
03-09-2025 00:05	7.52	28.9	230.33	3.36	2.77	1.05	0.14	0.86	0.13	46.38	0.77
03-09-2025 00:10	7.5	28.9	229.91	2.84	1.86	22.55	0.10	4.59	0.11	39.58	0.73
03-09-2025 00:15	7.52	28.91	230.27	3.12	2.71	356.78	0.15	6	0.1	64.73	0.49
03-09-2025 00:20	7.47	28.92	230.92	3.57	4.06	40.84	0.09	18.63	0.16	42.23	0.78
03-09-2025 00:25	7.52	28.93	231.01	3.55	4.24	350.27	0.17	8.14	0.19	47.14	0.86
03-09-2025 00:30	7.48	28.94	231.02	3.47	4.12	15.63	0.13	29.79	0.2	57.62	0.94
03-09-2025 00:35	7.51	28.92	231.35	2.95	4.27	7.98	0.14	13.74	0.16	89.56	0.64
03-09-2025 00:40	7.49	28.89	231.38	2.53	4.1	301.17	0.24	293.43	0.28	253.97	0.9
03-09-2025 00:45	7.45	28.88	231.43	2.63	4.3	310.24	0.21	287.5	0.19	255.3	0.56
03-09-2025 00:50	7.46	28.88	231.57	2.69	4.77	293.51	0.21	275.02	0.17	251.97	0.74
03-09-2025 00:55	7.44	28.89	231.55	2.42	4.51	278.37	0.20	283.71	0.24	251.26	0.56
03-09-2025 01:00	7.54	28.88	231.09	1.7	2.82	9.22	0.21	23.2	0.29	76.3	0.29
03-09-2025 01:05	7.55	28.89	231.75	1.64	3.9	9.15	0.29	19.41	0.32	59	0.6
03-09-2025 01:10	7.54	28.88	231.94	0.2	2.73	12.62	0.29	21.44	0.32	66.61	0.68
03-09-2025 01:15	7.57	28.89	232.51	-0.5	2.87	356.47	0.31	18.23	0.3	92.86	0.63
03-09-2025 01:20	7.52	28.9	233.74	-0.94	4.65	24.96	0.20	44.07	0.29	107.24	0.56
03-09-2025 01:25	7.51	28.9	233.7	-1.89	3.17	28.56	0.22	40.98	0.26	93.42	0.59
03-09-2025 01:30	7.54	28.91	233.72	-2.07	2.87	19.89	0.23	23.67	0.32	63.22	0.53
03-09-2025 01:35	7.5	28.91	233.4	-2.65	1.56	27.01	0.25	34.55	0.3	94.8	0.52
03-09-2025 01:40	7.59	28.92	232.84	-3.46	-0.14	12.17	0.32	22.06	0.4	57.43	0.48
03-09-2025 01:45	7.54	28.92	233.94	-2.57	2.91	24.32	0.26	33.4	0.31	113.03	0.59
03-09-2025 01:50	7.54	28.92	233.3	-4.22	-0.67	23.02	0.29	35.95	0.26	113.12	0.6
03-09-2025 01:55	7.52	28.9	233.21	-5.57	-2.85	34.46	0.32	40.88	0.39	99.16	0.65
03-09-2025 02:00	7.54	28.87	232.68	-7.37	-6.12	25.83	0.33	37.04	0.4	49.12	0.45
03-09-2025 02:05	7.54	28.86	233.21	-7.32	-5.49	32	0.32	40.13	0.35	80.34	0.49
03-09-2025 02:10	7.57	28.86	232.38	-7.99	-7.14	26.32	0.38	31.51	0.37	86.26	0.5
03-09-2025 02:15	7.53	28.87	233.02	-7.77	-6.34	44.19	0.33	47.92	0.37	91.28	0.61
03-09-2025 02:20	7.54	28.86	231.99	-8.78	-8.67	34.46	0.38	39.71	0.44	65.13	0.66
03-09-2025 02:25	7.54	28.86	230.34	-10.41	-12.12	35.48	0.39	40.73	0.45	60.24	0.42
03-09-2025 02:30	7.64	28.84	231.22	-10.2	-11.28	23.11	0.38	30.13	0.48	37.45	0.52
03-09-2025 02:35	7.56	28.83	231.89	-9.88	-10.42	39.12	0.34	49.87	0.36	78.48	0.58
03-09-2025 02:40	7.64	28.84	231.55	-9.91	-10.5	33.28	0.39	31.78	0.48	37.44	0.57
03-09-2025 02:45	7.59	28.86	233.99	-8.48	-6.37	41.12	0.31	43.43	0.33	88.11	0.54
03-09-2025 02:50	7.56	28.87	233.89	-8.7	-6.76	37.33	0.35	41.35	0.39	66.59	0.43
03-09-2025 02:55	7.63	28.86	232.39	-10.27	-10.28	26.72	0.39	30.67	0.39	54.09	0.37
03-09-2025 03:00	7.56	28.83	234.13	-9.22	-7.3	50.48	0.34	52.59	0.44	57.5	0.46
03-09-2025 03:05	7.64	28.85	233.24	-9.9	-9.2	30.61	0.37	40.67	0.42	65.08	0.52
03-09-2025 03:10	7.6	28.84	232.18	-10.54	-10.86	46.49	0.31	39.28	0.4	67.41	0.47
03-09-2025 03:15	7.62	28.81	233.89	-9.59	-8.16	38.99	0.33	48.34	0.32	78.14	0.44
03-09-2025 03:20	7.66	28.79	236.16	-6.72	-0.13	43.9	0.42	43.17	0.37	48.64	0.61
03-09-2025 03:25	7.62	28.81	236.85	-4.85	4.8	46.48	0.32	52.38	0.32	35.5	0.52
03-09-2025 03:30	7.65	28.82	236.84	-5.09	4.26	55.01	0.31	49.29	0.32	58.4	0.57
03-09-2025 03:35	7.73	28.79	236.76	-5.29	3.83	30.18	0.37	36.08	0.36	38.41	0.74
03-09-2025 03:40	7.64	28.82	236.7	-5.29	3.84	280.08	0.36	266.05	0.34	288.15	0.6
03-09-2025 03:45	7.65	28.81	236.63	-5.2	4.1	274.59	0.31	274.77	0.26	305.43	0.87

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
03-09-2025 03:50	7.7	28.81	236.66	-4.73	5.29	285.47	0.35	292.45	0.35	300.51	0.8
03-09-2025 03:55	7.74	28.77	236.64	-4.82	5.03	290.06	0.38	292.21	0.33	306.55	0.53
03-09-2025 04:00	7.7	28.74	236.72	-4.5	5.83	60.75	0.31	52.2	0.21	38.11	0.68
03-09-2025 04:05	7.7	28.74	236.72	-4.7	5.36	61.25	0.27	73.98	0.28	52.23	0.53
03-09-2025 04:10	7.69	28.76	236.73	-4.57	5.68	63.23	0.29	71.26	0.29	47.98	0.47
03-09-2025 04:15	7.71	28.76	236.77	-4.75	5.19	60.54	0.28	69.93	0.27	50.82	0.53
03-09-2025 04:20	7.75	28.77	236.76	-4.94	4.79	46.13	0.23	48.63	0.21	43.66	0.62
03-09-2025 04:25	7.75	28.78	236.69	-5.55	3.2	55.61	0.26	61.01	0.22		
03-09-2025 04:30	7.71	28.79	236.74	-5.49	3.32	66.71	0.26	66.42	0.23	39.61	0.36
03-09-2025 04:35	7.74	28.76	236.72	-5.47	3.43	45.26	0.28	47.14	0.26	45.34	0.45
03-09-2025 04:40	7.72	28.76	236.62	-5.7	2.78	31.43	0.25	43.49	0.22		
03-09-2025 04:45	7.68	28.76	236.72	-5.49	3.35	43.87	0.17	54.8	0.2		
03-09-2025 04:50	7.72	28.76	236.78	-5.25	3.95	54.45	0.18	53.21	0.21	50.03	0.75
03-09-2025 04:55	7.76	28.77	236.77	-5.02	4.56	53.46	0.31	46.07	0.27	51.9	0.66
03-09-2025 05:00	7.72	28.77	236.71	-5.46	3.36	65.77	0.24	61.25	0.24	75.5	0.62
03-09-2025 05:05	7.78	28.73	236.67	-5.87	2.41	50.52	0.25	57.5	0.27	69.36	0.71
03-09-2025 05:10	7.74	28.73	236.77	-5.18	4.1	65.57	0.23	68.16	0.22	68.28	0.44
03-09-2025 05:15	7.71	28.77	236.74	-5.19	4.08	75.54	0.25	78.9	0.28	87.18	0.38
03-09-2025 05:20	7.68	28.79	236.75	-5.25	3.92	60.89	0.21	74.78	0.19	78.18	0.46
03-09-2025 05:25	7.7	28.78	236.77	-5.05	4.45	65.8	0.25	71.26	0.2		
03-09-2025 05:30	7.63	28.78	236.82	-5.07	4.39	73.22	0.20	94.32	0.25	87.34	0.39
03-09-2025 05:35	7.68	28.77	236.85	-4.88	4.83	80.48	0.19	102.74	0.16	92.82	0.19
03-09-2025 05:40	7.69	28.77	236.9	-4.51	5.77	74.99	0.19	91.48	0.16	57.98	0.2
03-09-2025 05:45	7.69	28.78	236.93	-4.21	6.56	88.49	0.10	112.2	0.17	93.43	0.24
03-09-2025 05:50	7.67	28.8	236.92	-4.3	6.35	99.87	0.19	97.75	0.17	57.7	0.47
03-09-2025 05:55	7.72	28.83	236.9	-4.33	6.26	44.02	0.13	49.94	0.15	21.11	0.5
03-09-2025 06:00	7.68	28.84	237.06	-3.76	7.74	95.69	0.20	87.2	0.19	71.42	0.45
03-09-2025 06:05	7.69	28.84	236.99	-3.07	9.68	91.8	0.21	85.94	0.18	46.68	0.22
03-09-2025 06:10	7.68	28.84	237.18	-3.72	7.88	79.32	0.14	95.69	0.13	58.05	0.44
03-09-2025 06:15	7.62	28.84	237.16	-3.59	8.19	109.15	0.23	129.12	0.19	89.07	0.35
03-09-2025 06:20	7.67	28.84	237.2	-3.3	8.96	109.53	0.18	120.03	0.16	108.83	0.23
03-09-2025 06:25	7.68	28.84	237.18	-3.6	8.17	118.38	0.13	122.46	0.14	64.47	0.39
03-09-2025 06:30	7.65	28.85	237.18	-3.65	8.03	119.53	0.24	134.16	0.21	121.31	0.29
03-09-2025 06:35	7.67	28.84	237.17	-3.16	9.36	124.02	0.14	117.44	0.16	81.57	0.28
03-09-2025 06:40	7.61	28.84	237.13	-3.28	8.95	208.88	0.25	186.04	0.29	211.88	0.27
03-09-2025 06:45	7.69	28.84	237.18	-3.74	7.78	223.83	0.24	182.59	0.32	169.85	0.41
03-09-2025 06:50	7.64	28.83	237.1	-3.6	8.18	202.2	0.31	191.78	0.22	264.14	0.34
03-09-2025 06:55	7.58	28.83	237.09	-3.32	8.89	186.23	0.32	192.29	0.31	274.95	0.22
03-09-2025 07:00	7.72	28.83	236.98	-4.22	6.51	77.04	0.11	79.74	0.08		
03-09-2025 07:05	7.6	28.83	237.05	-3.58	8.23	127.93	0.22	126.67	0.2	66.75	0.33
03-09-2025 07:10	7.61	28.82	237.03	-3.87	7.43	135.31	0.21	144.17	0.25	135.81	0.36
03-09-2025 07:15	7.59	28.82	237.05	-3.76	7.74	133.5	0.22	138.73	0.23	128.23	0.34
03-09-2025 07:20	7.68	28.82	237.03	-4.07	6.91	84.75	0.12	82.59	0.08		
03-09-2025 07:25	7.64	28.82	237.09	-3.68	7.97	107.88	0.14	111.18	0.14	67.19	0.46
03-09-2025 07:30	7.64	28.82	237.02	-3.25	9.08	140.29	0.14	147.16	0.1	64.4	0.41
03-09-2025 07:35	7.61	28.82	237.02	-2.99	9.79	135.35	0.16	130.59	0.18	85.35	0.25
03-09-2025 07:40	7.58	28.82	237.12	-2.93	9.94	115.89	0.14	136.85	0.18	70.96	0.42
03-09-2025 07:45	7.64	28.82	236.99	-3.67	7.96	140.5	0.17	159.58	0.16	92.78	0.41
03-09-2025 07:50	7.59	28.82	237.01	-3.87	7.42	133.52	0.24	151.27	0.22	72.41	0.29

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
03-09-2025 07:55	7.57	28.82	237.11	-3.18	9.27	140.45	0.23	144.76	0.17	68.53	0.5
03-09-2025 08:00	7.56	28.82	237.16	-2.83	10.16	154.84	0.23	154.46	0.21	69.27	0.39
03-09-2025 08:05	7.54	28.82	237.14	-2.75	10.4	151.57	0.27	154.36	0.23	71	0.43
03-09-2025 08:10	7.53	28.81	237.1	-2.97	9.81	156.32	0.23	165.47	0.18	104.51	0.31
03-09-2025 08:15	7.54	28.81	237.08	-2.52	10.98	153.87	0.18	177.51	0.17	63.13	0.28
03-09-2025 08:20	7.62	28.81	237.11	-3.42	8.62	140.16	0.07	145.92	0.07	56.52	0.71
03-09-2025 08:25	7.62	28.81	237.18	-2.92	9.95	178.34	0.11	185.35	0.05		
03-09-2025 08:30	7.58	28.81	237.13	-2.36	11.5	161.98	0.18	160.83	0.17	62.43	0.35
03-09-2025 08:35	7.6	28.81	237.14	-2.91	9.98	154.15	0.12	155.92	0.14	73.71	0.34
03-09-2025 08:40	7.6	28.81	237.18	-2.81	10.25	157.94	0.15	171.88	0.11		
03-09-2025 08:45	7.59	28.81	237.11	-3.05	9.63	175.23	0.17	181.07	0.21	68.64	0.35
03-09-2025 08:50	7.55	28.81	236.95	-1.79	12.43	163.76	0.24	162.74	0.21	100.13	0.26
03-09-2025 08:55	7.57	28.81	236.27	-2.34	8.72	176.98	0.22	170.76	0.14		
03-09-2025 09:00	7.53	28.81	236.44	-1.8	10.06	170.05	0.20	175.17	0.22	73.28	0.45
03-09-2025 09:05	7.55	28.81	236.47	-1.31	11.39	173.05	0.17	172.57	0.22	81.79	0.49
03-09-2025 09:10	7.6	28.81	232.5	2.82	6.98	190.88	0.12	206.6	0.15	85.23	0.35
03-09-2025 09:15	7.59	28.8	232.31	3.8	7.87	188.31	0.14	196.58	0.14		
03-09-2025 09:20	7.49	28.8	232.7	4.31	9.03	167.94	0.17	175.51	0.19		
03-09-2025 09:25	7.53	28.8	231.18	4.44	5.6	166.9	0.19	183.37	0.23	114.97	0.36
03-09-2025 09:30	7.54	28.8	231.15	5.42	6.47	179.95	0.18	191.07	0.16		
03-09-2025 09:35	7.49	28.8	231.36	6.44	7.85	197.5	0.18	191.13	0.18		
03-09-2025 09:40	7.52	28.8	230.98	7.15	7.72	137.55	0.23	145.61	0.32	208.89	0.87
03-09-2025 09:45	7.52	28.8	230.33	9.19	7.37	127.67	0.32	128.87	0.34	208.55	1.03
03-09-2025 09:50	7.49	28.8	228	13.45	3.73	138.38	0.31	132.18	0.31	177.39	0.54
03-09-2025 09:55	7.47	28.8	228.17	13.9	4.26	130	0.37	134.49	0.3	193.48	0.59
03-09-2025 10:00	7.53	28.8	228.57	14.88	5.09	204.17	0.25	200.76	0.25	139.79	0.56
03-09-2025 10:05	7.54	28.8	228.18	14.54	4.2	207.24	0.21	193.39	0.18	135.34	0.52
03-09-2025 10:10	7.55	28.8	228.16	14.49	4.07	204.5	0.18	208.71	0.17	127.51	0.46
03-09-2025 10:15	7.38	28.8	229.12	15.25	6.05	174.29	0.32	166.57	0.35	131.83	0.63
03-09-2025 10:20	7.49	28.8	228.58	14.83	4.98	200.08	0.18	194.73	0.21	133.22	0.6
03-09-2025 10:25	7.55	28.8	228.73	15.09	5.29	209.21	0.12	188.11	0.16	129.56	0.54
03-09-2025 10:30	7.44	28.8	228.45	14.85	4.61	195	0.23	193.54	0.2	138.33	0.62
03-09-2025 10:35	7.5	28.81	227.46	14.02	2.57	200.05	0.20	197.58	0.19	139.48	0.46
03-09-2025 10:40	7.54	28.81	227.61	14.12	2.83	232.34	0.15	215.64	0.11	131.43	0.48
03-09-2025 10:45	7.4	28.81	228.04	14.5	3.72	181.74	0.27	176.46	0.24	129.91	0.48
03-09-2025 10:50	7.5	28.81	227.66	14.13	2.82	226.12	0.15	228.13	0.13	127.64	0.29
03-09-2025 10:55	7.5	28.81	228.09	14.47	3.66	233.7	0.14	231.41	0.13	131.92	0.47
03-09-2025 11:00	7.49	28.81	228.34	14.69	4.2	204.3	0.17	189.85	0.15	135.64	0.42
03-09-2025 11:05	7.56	28.81	227.82	14.3	3.2	239.94	0.14	239.42	0.14	125.81	0.21
03-09-2025 11:10	7.45	28.81	228.23	14.61	4.05	197.24	0.20	200.73	0.17	129.73	0.46
03-09-2025 11:15	7.45	28.81	228.63	14.94	4.9	216.53	0.13	160.9	0.08	118.14	0.27
03-09-2025 11:20	7.47	28.82	228.17	14.54	3.86	212.89	0.11	208.38	0.16	134.2	0.24
03-09-2025 11:25	7.48	28.82	227.88	14.29	3.24	223.59	0.10	219.55	0.06	129.99	0.33
03-09-2025 11:30	7.45	28.82	228.46	14.77	4.44	207.76	0.10	193.93	0.17		
03-09-2025 11:35	7.44	28.82	228.13	14.5	3.76	199.04	0.11	189.04	0.14	135.83	0.63
03-09-2025 11:40	7.52	28.82	227.84	14.22	3.11	223.24	0.07	308.74	0.08	128.21	0.49
03-09-2025 11:45	7.43	28.82	227.92	14.35	3.39	188.61	0.09	201.47	0.13	136.27	0.69
03-09-2025 11:50	7.47	28.81	227.9	14.31	3.29	226.25	0.09	208.11	0.13	143	0.52
03-09-2025 11:55	7.5	28.81	227.83	14.23	3.12	255.34	0.05	298.76	0.08	133.72	0.38

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
03-09-2025 12:00	7.45	28.81	227.82	14.22	3.07	213.28	0.11	201.35	0.11	131.77	0.58
03-09-2025 12:05	7.45	28.81	227.76	14.19	2.99	198.48	0.08	185.37	0.13		
03-09-2025 12:10	7.46	28.81	227.29	13.78	2	167.96	0.08	194.93	0.04	137.29	0.67
03-09-2025 12:15	7.49	28.81	226.66	13.33	0.83	194.13	0.04	213.54	0.07	134.16	0.64
03-09-2025 12:20	7.43	28.81	227.29	13.77	1.95	193.35	0.16	181.11	0.13	135.82	0.73
03-09-2025 12:25	7.53	28.81	227.43	13.83	2.15	302.6	0.12	279.03	0.11	129.5	0.52
03-09-2025 12:30	7.45	28.81	227.36	13.82	2.11	213.18	0.08	204.76	0.08	132.89	0.73
03-09-2025 12:35	7.45	28.81	226.83	13.45	1.16	234.32	0.04	190.03	0.06	134.99	0.51
03-09-2025 12:40	7.44	28.81	226.98	13.6	1.56	135.54	0.07	187.75	0.13	183.36	1.13
03-09-2025 12:45	7.43	28.81	227.12	13.74	1.88	106.92	0.07	107.36	0.12	162.06	0.81
03-09-2025 12:50	7.4	28.81	227.46	14.04	2.63	157.88	0.08	168.98	0.04	172.16	0.74
03-09-2025 12:55	7.44	28.81	227.04	13.68	1.75	128.75	0.04	205.63	0.05	179.39	0.68
03-09-2025 13:00	7.48	28.81	226.88	13.57	1.48	333.63	0.07	322.7	0.09	133.29	0.75
03-09-2025 13:05	7.47	28.81	226.81	13.5	1.31	42.65	0.04	302.95	0.01	139	0.57
03-09-2025 13:10	7.46	28.81	226.75	13.48	1.24	317.93	0.01	283.13	0.02	133.07	0.57
03-09-2025 13:15	7.45	28.81	226.74	13.46	1.22	107.69	0.04	138.35	0.03	133.56	0.56
03-09-2025 13:20	7.48	28.81	226.84	13.51	1.35	41.08	0.01	315.95	0.05	129.46	0.38
03-09-2025 13:25	7.5	28.81	227.24	13.82	2.08	324.73	0.04	312.62	0.08	136.31	0.54
03-09-2025 13:30	7.43	28.81	226.43	13.18	0.47	4.8	0.03	116.85	0.04	137.13	0.71
03-09-2025 13:35	7.51	28.81	226.47	13.25	0.66	316.29	0.09	323.8	0.09	133.87	0.45
03-09-2025 13:40	7.49	28.81	226.96	13.58	1.5	332.51	0.17	3.72	0.08	114.6	0.37
03-09-2025 13:45	7.53	28.81	226.84	13.52	1.38	353.84	0.13	358.6	0.15	125.08	0.55
03-09-2025 13:50	7.45	28.81	226.98	13.62	1.65	93.15	0.02	79.71	0.11	125.8	0.57
03-09-2025 13:55	7.44	28.8	227.09	13.59	1.66	72.73	0.06	70.71	0.15	130.2	0.64
03-09-2025 14:00	7.44	28.81	227.1	13.54	1.65	70.25	0.05	84.04	0.07	132.36	0.63
03-09-2025 14:05	7.5	28.82	227	13.46	1.53	354.26	0.05	19	0.13	132.89	0.68
03-09-2025 14:10	7.49	28.83	226.8	13.28	1.2	342.3	0.07	38.71	0.09	130.93	0.55
03-09-2025 14:15	7.47	28.85	226.71	12.98	1.19	1.88	0.09	25.47	0.12	129.83	0.56
03-09-2025 14:20	7.46	28.87	226.9	12.99	1.34	9.85	0.07	29.42	0.16	114.53	0.54
03-09-2025 14:25	7.47	28.87	226.69	12.47	0.86	16.46	0.09	30.29	0.18	123.59	0.69
03-09-2025 14:30	7.43	28.89	227.22	12.07	1.77	83.12	0.07	74.84	0.15	115.57	0.57
03-09-2025 14:35	7.53	28.9	226.84	10.56	0.79	350.45	0.19	10.84	0.21	70.37	0.32
03-09-2025 14:40	7.42	28.9	227.86	9.43	2.56	45.55	0.12	45.26	0.18	82.62	0.61
03-09-2025 14:45	7.51	28.9	227.99	8.31	2.31	13.35	0.18	16.98	0.24	82.21	0.45
03-09-2025 14:50	7.44	28.89	228.71	7.73	3.41	29.18	0.15	49.61	0.24	84.75	0.7
03-09-2025 14:55	7.56	28.89	229.05	6.5	3.26	4.69	0.20	5.15	0.2		
03-09-2025 15:00	7.56	28.89	229.35	6.07	3.48	17.74	0.17	25.9	0.22		
03-09-2025 15:05	7.61	28.89	228.76	5.28	2.4	351.25	0.24	357.21	0.25		
03-09-2025 15:10	7.45	28.89	229.96	6.14	4.88	37.12	0.08	46.79	0.17	93.1	0.72
03-09-2025 15:15	7.51	28.89	229.46	5.26	3.26	4.39	0.16	28.67	0.18	88.11	0.5
03-09-2025 15:20	7.49	28.88	229.38	5.11	2.99	356.31	0.13	31.4	0.18	82.64	0.41
03-09-2025 15:25	7.46	28.88	229.46	4.94	2.99	44.28	0.14	53.09	0.23	71.92	0.53
03-09-2025 15:30	7.53	28.88	229.54	4.44	2.7	22.1	0.16	30.86	0.22	48.91	0.49
03-09-2025 15:35	7.54	28.88	230.05	4.05	3.29	18.13	0.21	34.29	0.27		
03-09-2025 15:40	7.52	28.88	230	4.07	3.33	276.95	0.22	278.19	0.2	272.05	0.66
03-09-2025 15:45	7.52	28.88	230.09	4.19	3.65	280.85	0.24	274.86	0.27	262.85	0.73
03-09-2025 15:50	7.55	28.88	229.9	3.73	2.93	295.73	0.25	284.82	0.3	269.46	0.66
03-09-2025 15:55	7.55	28.88	229.9	3.08	2.53	289.23	0.18	271.19	0.28	259.25	0.82
03-09-2025 16:00	7.54	28.88	230.46	3.58	4	21.75	0.10	42.42	0.18	66.87	0.52

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
03-09-2025 16:05	7.52	28.88	230.3	3.43	3.6	54.58	0.12	56.89	0.19	95.7	0.56
03-09-2025 16:10	7.59	28.89	230.19	3.15	3.05	19.88	0.20	32.6	0.23	59.86	0.76
03-09-2025 16:15	7.63	28.88	229.93	2.97	2.61	9.69	0.25	23.18	0.25	41.3	0.82
03-09-2025 16:20	7.57	28.88	230.42	3.43	3.88	29.25	0.17	42.27	0.18	78.54	0.4
03-09-2025 16:25	7.56	28.89	230.62	3.46	4.19	31.43	0.20	45.21	0.18	75.84	0.52
03-09-2025 16:30	7.53	28.89	230.23	2.78	2.87	43.56	0.14	57.03	0.2	60.32	0.62
03-09-2025 16:35	7.53	28.9	230.47	2.76	3.24	28.3	0.17	43.89	0.22	55.3	0.7
03-09-2025 16:40	7.58	28.9	230.56	2.95	3.66	16.02	0.17	34.01	0.18	60.08	0.61
03-09-2025 16:45	7.55	28.91	230.46	2.77	3.25	22.71	0.15	65.76	0.12	77.69	0.68
03-09-2025 16:50	7.57	28.91	230.29	2.85	3.35	10.85	0.21	40.94	0.19	70.05	0.6
03-09-2025 16:55	7.58	28.92	230.72	3.03	3.87	49.89	0.20	43.7	0.14	84.28	0.64
03-09-2025 17:00	7.5	28.94	230.82	3.21	4.29	95.43	0.13	75.57	0.09	87.43	0.71
03-09-2025 17:05	7.53	28.93	231.23	3.76	5.61	63.46	0.16	76.39	0.12		
03-09-2025 17:10	7.57	28.92	230.95	3.48	4.97	55	0.16	36.93	0.13	65.49	0.7
03-09-2025 17:15	7.55	28.92	231.57	4.42	7.28	39.83	0.09	22.84	0.11		
03-09-2025 17:20	7.61	28.92	231.22	3.83	5.88	12.56	0.18	7.09	0.18	69.73	0.38
03-09-2025 17:25	7.6	28.92	231.02	3.47	4.97	32.8	0.14	24.64	0.16	77.18	0.6
03-09-2025 17:30	7.55	28.93	231.12	3.6	5.25	66.86	0.10	50.64	0.12	85.09	0.81
03-09-2025 17:35	7.46	28.93	231	3.45	4.91	113.66	0.14	129.33	0.15	93.05	0.6
03-09-2025 17:40	7.54	28.92	230.78	3.18	4.23	35.63	0.10	39.4	0.1	73.45	0.59
03-09-2025 17:45	7.57	28.92	230.87	3.22	4.34	24.45	0.09	19.33	0.07	74.1	0.66
03-09-2025 17:50	7.53	28.91	230.74	3.13	4.13	108.12	0.09	80.04	0.07	81.98	0.69
03-09-2025 17:55	7.55	28.9	230.77	3.14	4.13	88.17	0.10	43.34	0.08	72.2	0.73
03-09-2025 18:00	7.62	28.9	230.75	2.99	3.82	42.83	0.07	2.82	0.04	69.49	0.63
03-09-2025 18:05	7.58	28.9	230.65	2.95	3.69	93.68	0.10	58.96	0.04	73.26	0.72
03-09-2025 18:10	7.49	28.9	231.01	3.44	4.85	134.47	0.11	148.08	0.07	70.74	0.55
03-09-2025 18:15	7.57	28.9	231.51	4.14	6.57	67.2	0.08	92.67	0.05	78.19	0.63
03-09-2025 18:20	7.55	28.91	231.57	4.28	6.92	18.8	0.01	162.44	0.07	77.23	0.57
03-09-2025 18:25	7.55	28.9	231.37	4	6.27	147.27	0.10	119	0.07		
03-09-2025 18:30	7.53	28.9	231.44	4.1	6.52	191.18	0.08	174.13	0.08	86.48	0.47
03-09-2025 18:35	7.52	28.9	231.43	4.08	6.48	129.13	0.12	133.4	0.07	76.67	0.62
03-09-2025 18:40	7.55	28.9	231.15	3.72	5.54	73.52	0.04	33.59	0.05		
03-09-2025 18:45	7.49	28.91	231.28	3.97	6.18	154.77	0.16	171.37	0.13	225.63	0.86
03-09-2025 18:50	7.51	28.91	231.18	4.04	6.43	119.2	0.18	120.32	0.19	247.44	0.57
03-09-2025 18:55	7.5	28.91	231.23	4.03	6.33	123.91	0.17	120.28	0.32	207.13	0.61
03-09-2025 19:00	7.54	28.91	231.3	4.07	6.48	195.02	0.13	186.6	0.11	78.67	0.37
03-09-2025 19:05	7.55	28.91	231.17	3.88	5.98	220.09	0.05	214.71	0.14	83.25	0.22
03-09-2025 19:10	7.49	28.91	231.35	4.14	6.53	220.5	0.11	214.91	0.11	79.24	0.32
03-09-2025 19:15	7.46	28.91	231.61	4.59	7.64	185	0.12	175.48	0.15		
03-09-2025 19:20	7.48	28.91	231.5	4.41	7.21	207.75	0.12	191.83	0.18	64.51	0.36
03-09-2025 19:25	7.6	28.9	231.34	4.1	6.46	300.21	0.16	287.55	0.14	50.46	0.28
03-09-2025 19:30	7.5	28.88	231.08	3.77	5.6	218.52	0.10	208.6	0.09	77.35	0.42
03-09-2025 19:35	7.5	28.88	230.94	3.61	5.27	217	0.12	221.01	0.16	85.51	0.37
03-09-2025 19:40	7.51	28.88	230.79	3.41	4.82	181.54	0.11	203.2	0.15	65.44	0.25
03-09-2025 19:45	7.55	28.89	231.09	3.82	5.78	259.21	0.10	234.45	0.11		
03-09-2025 19:50	7.54	28.89	231.26	3.98	6.15	219.84	0.13	203.52	0.17	8.69	0.32
03-09-2025 19:55	7.5	28.9	231.12	3.75	5.63	210.76	0.15	199.56	0.2	7.78	0.31
03-09-2025 20:00	7.54	28.9	231	3.56	5.16	251.34	0.08	211.76	0.1	26.19	0.29
03-09-2025 20:05	7.48	28.91	230.86	3.37	4.67	220.3	0.18	215.23	0.18	35.23	0.22

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
03-09-2025 20:10	7.49	28.91	230.96	3.46	4.96	214.74	0.13	209.95	0.11	36.3	0.23
03-09-2025 20:15	7.49	28.91	231.13	3.73	5.54	213.07	0.11	213.3	0.1	48.56	0.27
03-09-2025 20:20	7.47	28.91	231.45	4.25	6.88	213.8	0.16	239.87	0.2	66.75	0.35
03-09-2025 20:25	7.49	28.91	231.25	3.94	6.07	229.69	0.16	236.25	0.1	54.63	0.3
03-09-2025 20:30	7.41	28.91	231.34	3.96	6.23	214.31	0.22	238.68	0.19		
03-09-2025 20:35	7.5	28.91	231.04	3.58	5.22	235.5	0.18	223.48	0.15	38.12	0.2
03-09-2025 20:40	7.55	28.91	231.17	3.75	5.68	246.42	0.15	257.47	0.17	52.1	0.38
03-09-2025 20:45	7.5	28.91	231.24	3.98	6.25	222.04	0.20	209.41	0.19	21.7	0.44
03-09-2025 20:50	7.47	28.91	231.41	4.08	6.5	206.19	0.17	205.74	0.11	76.57	0.68
03-09-2025 20:55	7.52	28.91	231.46	4.17	6.73	231.62	0.14	253.16	0.14	48.97	0.6
03-09-2025 21:00	7.47	28.91	231.58	4.3	7.08	203.4	0.17	196.47	0.19		
03-09-2025 21:05	7.51	28.9	231.35	3.94	6.12	223.47	0.18	178.8	0.08		
03-09-2025 21:10	7.54	28.89	231.33	4.01	6.27	272.5	0.14	261.04	0.05		
03-09-2025 21:15	7.45	28.88	231.67	4.63	7.83	218.23	0.17	217.67	0.1		
03-09-2025 21:20	7.41	28.87	231.78	4.72	8.03	210.16	0.24	183.6	0.22	107.88	0.64
03-09-2025 21:25	7.39	28.88	231.88	4.83	8.36	197.2	0.23	190.16	0.26		
03-09-2025 21:30	7.42	28.88	231.82	4.73	8.14	207.51	0.19	186.93	0.13	68.95	0.78
03-09-2025 21:35	7.39	28.88	231.32	3.87	5.99	205.65	0.17	184.56	0.16		
03-09-2025 21:40	7.41	28.88	231.48	4.22	6.84	103.87	0.16	108.6	0.11	237.56	0.58
03-09-2025 21:45	7.43	28.88	231.63	2.85	5.8	100.01	0.22	96.19	0.18	240.19	0.62
03-09-2025 21:50	7.46	28.89	232.14	3.07	7.25	119.65	0.14	78.61	0.07		
03-09-2025 21:55	7.44	28.88	231.81	2.58	6	94.12	0.09	33.16	0.08	286.04	1.17
03-09-2025 22:00	7.41	28.89	231.98	2.64	6.42	198.16	0.15	193.48	0.1	72.74	0.86
03-09-2025 22:05	7.47	28.89	232.12	2.21	6.23	235.81	0.08	248.03	0.06		
03-09-2025 22:10	7.44	28.9	232.04	1.87	5.66	205.55	0.08	218.78	0.11	77.69	0.75
03-09-2025 22:15	7.4	28.9	232.28	2.1	6.34	195.95	0.12	193.16	0.07		
03-09-2025 22:20	7.46	28.91	232.35	1.79	6.05	247.43	0.08	298.01	0.11	40.12	0.77
03-09-2025 22:25	7.39	28.91	232.72	1.61	6.89	195.32	0.09	190.82	0.14	104.94	0.49
03-09-2025 22:30	7.46	28.91	233.05	0.81	6.28	300.64	0.09	325.09	0.11		
03-09-2025 22:35	7.42	28.91	233.28	0.56	6.42	199.58	0.03	23.03	0.05	55.18	1
03-09-2025 22:40	7.39	28.91	233.38	0.1	6.15	198.01	0.10	209.3	0.09		
03-09-2025 22:45	7.42	28.91	233.55	-0.06	6.27	227.42	0.07	270.52	0.04	70.38	0.79
03-09-2025 22:50	7.35	28.91	233.88	-0.27	6.81	181.05	0.11	152.3	0.07	66.52	0.8
03-09-2025 22:55	7.39	28.92	234.14	-0.88	6.56	248.99	0.07	235.45	0.06	63.62	0.78
03-09-2025 23:00	7.42	28.92	234.72	-1.15	7.6	225.8	0.09	221.9	0.08	67.13	0.77
03-09-2025 23:05	7.42	28.92	234.77	-1.51	6.85	319.53	0.04	312.83	0.04		
03-09-2025 23:10	7.33	28.92	234.81	-1.41	7.09	191.63	0.11	193.11	0.13		
03-09-2025 23:15	7.38	28.92	234.79	-1.75	6.43	227.16	0.04	245.38	0.08	60.85	0.7
03-09-2025 23:20	7.43	28.92	234.96	-1.89	6.68	288.81	0.10	269.73	0.11		
03-09-2025 23:25	7.32	28.92	235.19	-1.39	8.38	162.88	0.11	164.1	0.12		
03-09-2025 23:30	7.39	28.91	235.51	-2.03	7.63	341.09	0.08	1.2	0.09	63.13	0.85
03-09-2025 23:35	7.43	28.9	235.5	-3.09	5.55	340.53	0.11	349.67	0.16	39.36	0.99
03-09-2025 23:40	7.38	28.9	235.51	-3.04	5.82	12.2	0.07	6.89	0.06		
03-09-2025 23:45	7.37	28.9	235.73	-2.24	7.94	334.47	0.06	313.82	0.08	52.34	0.58
03-09-2025 23:50	7.4	28.9	235.39	-3.6	4.55	343.85	0.12	344.07	0.23	56.8	0.8
03-09-2025 23:55	7.39	28.91	235.83	-1.85	8.94	3.76	0.03	21.46	0.04		
04-09-2025 00:00	7.42	28.89	235.74	-2.3	7.83	17.49	0.12	354.97	0.12		
04-09-2025 00:05	7.46	28.88	235.77	-2.15	8.13	8.47	0.18	359.56	0.14	62.4	0.58
04-09-2025 00:10	7.43	28.88	235.68	-2.49	7.32	7.22	0.22	359.97	0.21		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
04-09-2025 00:15	7.35	28.89	235.56	-2.98	6.09	15.74	0.07	82.02	0.06	70.98	0.72
04-09-2025 00:20	7.38	28.92	235.42	-3.22	5.53	13.59	0.12	17.3	0.1	57.67	0.6
04-09-2025 00:25	7.45	28.92	235.17	-4.35	2.77	2.66	0.21	1.79	0.2	81.82	0.51
04-09-2025 00:30	7.42	28.94	235.25	-4.59	3.16	37.21	0.21	30.31	0.27	72.25	0.7
04-09-2025 00:35	7.47	28.86	235.86	-3.8	5.53	7.09	0.31	14.62	0.37		
04-09-2025 00:40	7.4	28.89	235.8	-3.86	5.43	303.15	0.32	296.12	0.35		
04-09-2025 00:45	7.42	28.93	234.02	-7.15	-3.05	302.07	0.38	304.72	0.46		
04-09-2025 00:50	7.34	28.82	233.42	-8.54	-6.31	283.08	0.34	276.44	0.37		
04-09-2025 00:55	7.35	28.88	234.12	-8.04	-4.81	274.58	0.37	272.62	0.31	229.72	0.77
04-09-2025 01:00	7.36	28.91	233.96	-8.87	-6.32	39.86	0.26	47.74	0.27	116.55	0.64
04-09-2025 01:05	7.45	28.87	234.67	-7.8	-3.14	32.86	0.34	35.38	0.35		
04-09-2025 01:10	7.45	28.92	234.57	-8.51	-4.89	23.33	0.28	23.84	0.32		
04-09-2025 01:15	7.5	28.93	234.37	-8.73	-5.54	16.6	0.37	27.48	0.44	88.64	0.52
04-09-2025 01:20	7.43	28.93	233.83	-9.25	-7.11	41.32	0.30	39.03	0.36	62.31	0.43
04-09-2025 01:25	7.41	28.93	234.37	-8.42	-4.76	45.37	0.31	54.23	0.3	100.12	0.62
04-09-2025 01:30	7.47	28.92	236.48	-4.47	5.92	23.18	0.30	31.17	0.39	76.13	0.85
04-09-2025 01:35	7.47	28.92	236.42	-5.13	4.29	29.35	0.36	31.35	0.44		
04-09-2025 01:40	7.5	28.89	236.6	-5.22	4.61	34.38	0.31	37.5	0.36		
04-09-2025 01:45	7.49	28.89	236.96	-4.66	6.62	48.02	0.31	51.87	0.34		
04-09-2025 01:50	7.61	28.86	236.92	-5.1	5.53	20.45	0.49	20.9	0.53		
04-09-2025 01:55	7.46	28.82	237.03	-5.47	4.91	39.55	0.36	49.46	0.38	61.96	0.74
04-09-2025 02:00	7.51	28.8	237.07	-5.73	4.32	32.46	0.34	37.64	0.39		
04-09-2025 02:05	7.46	28.85	237.41	-5.35	6.1	46.84	0.34	52.99	0.33	83.93	0.58
04-09-2025 02:10	7.47	28.79	237.86	-5.88	6.02	43.04	0.35	50.01	0.37	76.16	0.44
04-09-2025 02:15	7.51	28.76	237.85	-6.96	3.4	49.87	0.43	42.13	0.48		
04-09-2025 02:20	7.6	28.79	237.93	-6.3	5.15	28.73	0.34	32.93	0.38		
04-09-2025 02:25	7.51	28.8	238.18	-6.04	6.36	45.37	0.36	47.25	0.35	68.89	0.68
04-09-2025 02:30	7.54	28.75	238.25	-7.42	2.82	52.62	0.44	53.69	0.46	65.15	0.53
04-09-2025 02:35	7.52	28.76	238.38	-7.6	2.58	53.12	0.33	52.48	0.35		
04-09-2025 02:40	7.55	28.79	238.59	-7.76	2.58	46.27	0.34	51.89	0.45	65.23	0.56
04-09-2025 02:45	7.56	28.79	238.88	-8.12	2.25	54.85	0.37	53.33	0.4		
04-09-2025 02:50	7.59	28.75	239.02	-7.85	3.21	34.09	0.44	42.6	0.41		
04-09-2025 02:55	7.56	28.74	239.26	-7.54	4.47	56.72	0.41	64.47	0.33	65.48	0.53
04-09-2025 03:00	7.59	28.69	239.48	-8.42	2.63	55.98	0.36	56.77	0.32		
04-09-2025 03:05	7.63	28.71	239.38	-7.98	3.75	62.57	0.34	62.12	0.3	95.89	0.28
04-09-2025 03:10	7.63	28.7	239.37	-7.62	4.73	53.81	0.42	56.45	0.38	52.26	0.58
04-09-2025 03:15	7.64	28.78	239.52	-7.36	5.66	30.88	0.34	38.91	0.33	72.14	0.35
04-09-2025 03:20	7.51	28.74	239.57	-7.3	5.85	68.58	0.31	79.25	0.31	86.05	0.57
04-09-2025 03:25	7.64	28.7	239.6	-8.47	2.79	41.58	0.28	48.99	0.28	86.29	0.41
04-09-2025 03:30	7.69	28.69	239.62	-8.04	3.87	41.46	0.29	45.44	0.26		
04-09-2025 03:35	7.68	28.69	239.56	-7.97	4.11	48.03	0.34	40.11	0.29		
04-09-2025 03:40	7.66	28.7	239.46	-7.39	5.67	280.62	0.32	274.56	0.35		
04-09-2025 03:45	7.66	28.7	239.47	-7.35	5.77	263.43	0.31	267.98	0.3		
04-09-2025 03:50	7.69	28.69	239.55	-8.29	3.26	248.46	0.31	252.55	0.27		
04-09-2025 03:55	7.71	28.68	239.55	-8.26	3.33	273.81	0.35	285.61	0.28	297.76	0.25
04-09-2025 04:00	7.65	28.68	239.44	-7.48	5.41	71.65	0.21	83.37	0.2	52.6	0.25
04-09-2025 04:05	7.72	28.69	239.47	-7.34	5.8	56.91	0.26	52.92	0.23	39.22	0.55
04-09-2025 04:10	7.74	28.7	239.46	-7.59	5.15	62.35	0.26	75.12	0.26		
04-09-2025 04:15	7.69	28.67	239.43	-7.43	5.57	69.35	0.25	75.49	0.23	64.53	0.53

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
04-09-2025 04:20	7.69	28.68	239.44	-7.27	5.99	80.47	0.23	88.16	0.28	85.1	0.46
04-09-2025 04:25	7.69	28.63	239.42	-7.45	5.52	81.02	0.25	104.96	0.24	111.41	0.43
04-09-2025 04:30	7.71	28.64	239.39	-6.87	7.1	81.14	0.27	87.77	0.25	73.85	0.41
04-09-2025 04:35	7.68	28.69	239.35	-6.9	6.99	80.79	0.23	99.59	0.2	115.05	0.3
04-09-2025 04:40	7.89	28.63	239.46	-7.53	5.32	43.73	0.30	45.04	0.26	18.83	0.34
04-09-2025 04:45	7.79	28.68	239.48	-7.16	6.3	73.48	0.25	76.74	0.2	110.85	0.27
04-09-2025 04:50	7.76	28.67	239.42	-7.05	6.64	74.09	0.24	85.91	0.21	68.35	0.16
04-09-2025 04:55	7.8	28.67	239.43	-7.06	6.6	59.22	0.24	66.2	0.21	156.85	0.2
04-09-2025 05:00	7.72	28.61	239.51	-7.38	5.71	70.32	0.22	93.19	0.2	105.3	0.14
04-09-2025 05:05	7.69	28.63	239.39	-6.81	7.26	98.19	0.25	98.13	0.23	110.22	0.41
04-09-2025 05:10	7.83	28.68	239.46	-7.3	5.96	62.42	0.20	70.77	0.23	97.5	0.45
04-09-2025 05:15	7.95	28.73	239.33	-7.73	4.78	22.55	0.24	29.61	0.25	20.72	0.49
04-09-2025 05:20	7.83	28.77	239.45	-7.16	6.35	71.46	0.19	44.55	0.22	54.5	0.24
04-09-2025 05:25	7.76	28.79	239.36	-6.44	8.28	83.48	0.17	77.64	0.18	129.99	0.21
04-09-2025 05:30	7.81	28.79	239.3	-6.38	8.44	88.58	0.16	67	0.15	79.21	0.28
04-09-2025 05:35	7.72	28.79	239.21	-5.67	10.31	103.33	0.19	115.43	0.2	133.11	0.23
04-09-2025 05:40	7.78	28.79	239.35	-6.62	7.81	101.46	0.20	101.54	0.18	78.74	0.16
04-09-2025 05:45	7.82	28.78	239.33	-6.67	7.65	93.11	0.15	94.49	0.13	114.49	0.19
04-09-2025 05:50	7.83	28.78	239.4	-6.85	7.18	65.07	0.16	95.39	0.1	153.47	0.15
04-09-2025 05:55	7.91	28.78	239.48	-7.28	6.03	72.49	0.16	54.51	0.11	132.36	0.25
04-09-2025 06:00	7.77	28.78	239.38	-6.7	7.59	117.66	0.27	124.07	0.16	140.97	0.22
04-09-2025 06:05	7.8	28.78	239.4	-7.03	6.7	103.43	0.21	118.25	0.14	146.43	0.32
04-09-2025 06:10	7.79	28.78	239.12	-5.88	9.82	111.21	0.19	125.82	0.16	149.65	0.18
04-09-2025 06:15	7.9	28.78	239.24	-6.19	9	58.8	0.21	74.54	0.12	85.41	0.18
04-09-2025 06:20	7.8	28.78	239.03	-5.2	11.61	113.24	0.20	121.36	0.17	91.86	0.27
04-09-2025 06:25	7.81	28.78	239.08	-5.45	10.93	106.32	0.12	134.56	0.14	126.56	0.19
04-09-2025 06:30	7.78	28.78	239.17	-6.01	9.45	136.36	0.18	155.12	0.15	120.82	0.19
04-09-2025 06:35	7.77	28.77	239.12	-5.56	10.64	133.34	0.24	151.71	0.19	117.78	0.23
04-09-2025 06:40	7.82	28.76	239.19	-5.96	9.6	194.85	0.13	152.74	0.19	312.12	0.03
04-09-2025 06:45	7.83	28.75	239.13	-5.94	9.65	194.34	0.20	185.04	0.18	207.13	0.21
04-09-2025 06:50	7.84	28.74	239.05	-5.52	10.78	191.77	0.16	153.88	0.16	297.05	0.3
04-09-2025 06:55	7.85	28.72	239.13	-6.07	9.33	211.31	0.07	261.71	0.07	291.83	0.34
04-09-2025 07:00	7.85	28.72	239.06	-5.54	10.7	160.89	0.11	167.9	0.12	75.91	0.22
04-09-2025 07:05	7.88	28.71	239.08	-6.7	7.63	136	0.06	173.63	0.09		
04-09-2025 07:10	7.79	28.71	238.94	-5.32	11.34	150.9	0.15	154.79	0.14	55.42	0.35
04-09-2025 07:15	7.81	28.7	238.86	-5	12.12	135.49	0.14	146	0.12	80.15	0.24
04-09-2025 07:20	7.88	28.7	238.98	-5.26	11.43	169.38	0.09	133.78	0.13	61.05	0.17
04-09-2025 07:25	7.86	28.7	239	-5.34	11.26	195.82	0.09	172.14	0.13	65.88	0.29
04-09-2025 07:30	7.79	28.7	239.1	-5.47	10.99	161.03	0.20	163.39	0.18	97.26	0.2
04-09-2025 07:35	7.76	28.7	238.75	-4.42	13.75	166.03	0.16	172.05	0.18	90.1	0.07
04-09-2025 07:40	7.8	28.71	239.18	-5.99	9.56	171.7	0.14	194	0.22	163.41	0.13
04-09-2025 07:45	7.82	28.7	239.11	-5.83	9.96	177.46	0.19	190.77	0.21	152.6	0.1
04-09-2025 07:50	7.73	28.69	238.9	-5	12.2	167.16	0.34	171.42	0.34	175.59	0.37
04-09-2025 07:55	7.81	28.69	239.01	-5.29	11.46	179.56	0.14	182.03	0.14	224.86	0.3
04-09-2025 08:00	7.77	28.69	239.23	-6	9.49	178.56	0.17	191.42	0.24	193.33	0.36
04-09-2025 08:05	7.81	28.69	239.05	-5.28	11.38	197.27	0.17	193.41	0.12	179.06	0.19
04-09-2025 08:10	7.72	28.69	238.7	-4.54	12.64	183.68	0.20	188.94	0.24	198.29	0.26
04-09-2025 08:15	7.7	28.69	238.66	-4.4	12.98	186.37	0.20	183.65	0.24	177.88	0.24
04-09-2025 08:20	7.78	28.68	237.7	-3.36	11.76	203.97	0.15	204.63	0.13	119.17	0.15

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
04-09-2025 08:25	7.78	28.67	232.7	2.64	7.81	205.86	0.18	201.48	0.21		
04-09-2025 08:30	7.67	28.67	232.52	4.97	10.24	183.45	0.23	178.55	0.28		
04-09-2025 08:35	7.7	28.67	232.19	5.41	9.93	192.44	0.22	190.72	0.24		
04-09-2025 08:40	7.74	28.67	231.68	6.07	8.96	194.03	0.26	194.13	0.23		
04-09-2025 08:45	7.66	28.67	230.68	6.34	6.84	194.82	0.23	190.11	0.24	130.84	0.27
04-09-2025 08:50	7.74	28.68	229.43	7.12	4.49	211.85	0.19	213.65	0.18	131.59	0.39
04-09-2025 08:55	7.72	28.68	229.87	7.58	5.7	226.95	0.11	220.18	0.18		
04-09-2025 09:00	7.64	28.69	229.53	7.37	5.1	207.65	0.13	193.49	0.2	99.23	0.3
04-09-2025 09:05	7.65	28.7	229.44	7.25	4.78	204.77	0.16	204.13	0.16		
04-09-2025 09:10	7.69	28.7	229.29	7.15	4.51	240.19	0.11	217.7	0.11	101.1	0.32
04-09-2025 09:15	7.66	28.71	229.14	6.94	4.05	210.37	0.17	216.55	0.19		
04-09-2025 09:20	7.59	28.72	229.24	7.01	4.23	199.56	0.19	205.39	0.22	132.88	0.55
04-09-2025 09:25	7.55	28.72	229.33	7.08	4.37	184.55	0.17	193.26	0.22	118.35	0.57
04-09-2025 09:30	7.63	28.72	228.73	6.59	3.09	222.01	0.12	220.04	0.14	118.51	0.33
04-09-2025 09:35	7.56	28.73	228.81	6.63	3.21	193.02	0.13	188.18	0.15	127.6	0.65
04-09-2025 09:40	7.67	28.74	228.78	6.62	3.22	37.49	0.16	25.52	0.17	242.81	0.15
04-09-2025 09:45	7.61	28.75	228.9	6.88	3.85	99.39	0.07	108.39	0.09	203.18	0.63
04-09-2025 09:50	7.64	28.75	228.91	6.83	3.72	40.86	0.09	49	0.18	191.03	0.34
04-09-2025 09:55	7.56	28.75	228.31	6.33	2.48	121.33	0.02	123.22	0.1	188.15	0.7
04-09-2025 10:00	7.61	28.76	228.75	6.78	3.64	263.37	0.11	262.85	0.11	116.87	0.46
04-09-2025 10:05	7.49	28.76	229	7.03	4.27	169.85	0.09	195.07	0.06	124.93	0.53
04-09-2025 10:10	7.59	28.77	228.42	6.41	2.7	232.55	0.06	291.87	0.11	111.54	0.42
04-09-2025 10:15	7.6	28.76	228.56	6.62	3.22	288.48	0.06	303.82	0.13	115.45	0.34
04-09-2025 10:20	7.6	28.75	228.96	6.96	4.11	302.82	0.06	299.07	0.12	127.18	0.29
04-09-2025 10:25	7.47	28.77	229.28	7.28	4.9	175.38	0.11	185.86	0.08	130.42	0.56
04-09-2025 10:30	7.53	28.76	229.22	7.16	4.66	252.48	0.05	242.59	0.08	156.39	0.52
04-09-2025 10:35	7.5	28.77	229.1	7.11	4.46	198.38	0.11	201.64	0.08	153.95	0.69
04-09-2025 10:40	7.44	28.76	229.19	7.28	4.92	166.84	0.10	197.59	0.17	144.6	0.72
04-09-2025 10:45	7.53	28.77	229.2	7.15	4.62	342.63	0.08	315.81	0.09		
04-09-2025 10:50	7.42	28.76	229.53	7.44	5.34	194.94	0.07	181.05	0.1	154.34	0.45
04-09-2025 10:55	7.44	28.77	229.37	7.34	5.09	198.5	0.05	194.82	0.15	160.29	0.61
04-09-2025 11:00	7.45	28.77	229	6.94	4.05	326.76	0.03	264.71	0.08	151.11	0.48
04-09-2025 11:05	7.44	28.77	229.13	7.08	4.42	220.67	0.04	230.57	0.04	140.8	0.55
04-09-2025 11:10	7.47	28.77	228.68	6.62	3.23	311.18	0.04	302.17	0.05	134.64	0.42
04-09-2025 11:15	7.41	28.78	228.6	7.7	4.19	209.99	0.10	157.88	0.16		
04-09-2025 11:20	7.42	28.8	228.68	8.13	4.17	244.82	0.04	130.9	0.09	131.08	0.56
04-09-2025 11:25	7.39	28.82	228.69	8.02	3.98	198.03	0.06	148.59	0.07	134.45	0.74
04-09-2025 11:30	7.49	28.82	228.01	7.37	2.46	288.01	0.09	320.39	0.06		
04-09-2025 11:35	7.49	28.83	229.05	7.58	4.62	314.47	0.27	316.69	0.02	107.61	0.63
04-09-2025 11:40	7.43	28.8	229.01	5.97	3.55	289.75	0.04	85.32	0.05	100.53	0.81
04-09-2025 11:45	7.4	28.78	230.35	6.01	6.19	288.41	0.01	142.17	0.02		
04-09-2025 11:50	7.49	28.79	230.9	4.9	6.44	337.11	0.13	337.68	0.21	76.52	0.6
04-09-2025 11:55	7.48	28.78	231.24	1	4.17	338.77	0.06	327.15	0.1		
04-09-2025 12:00	7.36	28.77	232.15	0.9	4.7	104	0.06	118.18	0.05	83.04	0.78
04-09-2025 12:05	7.43	28.77	232.35	0.85	5.11	317.21	0.08	2.49	0.09	102.16	0.88
04-09-2025 12:10	7.36	28.77	232.74	0.88	5.98	61.9	0.07	91.75	0.04	104.78	0.56
04-09-2025 12:15	7.44	28.8	232.58	0.4	5.02	29.92	0.10	2.47	0.14	100.32	0.57
04-09-2025 12:20	7.42	28.82	232.79	-0.5	4.3	14.67	0.10	54.36	0.09	67.21	0.75
04-09-2025 12:25	7.44	28.83	232.92	-0.85	4.1	25.55	0.11	39.03	0.14	106.29	0.68

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
04-09-2025 12:30	7.4	28.85	233.65	-0.37	6.2	47.23	0.15	42.56	0.16	113.21	0.58
04-09-2025 12:35	7.3	28.87	233.97	-0.9	6.14	98.38	0.09	81.68	0.16		
04-09-2025 12:40	7.37	28.89	234.15	-1.97	5.02	262.51	0.14	292.15	0.24		
04-09-2025 12:45	7.42	28.9	234.71	-2.55	5.23	346.79	0.17	306.83	0.28		
04-09-2025 12:50	7.38	28.9	234.79	-3.17	4.62	317.34	0.23	308.6	0.22	211.16	0.58
04-09-2025 12:55	7.32	28.89	235.01	-3.36	4.76	302.99	0.15	271.83	0.23	236.96	0.76
04-09-2025 13:00	7.41	28.89	235.13	-3.91	3.96	21.57	0.20	23.22	0.22	72.09	0.74
04-09-2025 13:05	7.37	28.89	235.12	-4.47	3.05	15.11	0.22	24.11	0.24	79.41	0.63
04-09-2025 13:10	7.36	28.88	235.44	-3.88	4.59	27.83	0.20	38.84	0.31		
04-09-2025 13:15	7.36	28.87	235.42	-3.87	4.61	17.01	0.17	33.32	0.22	126	0.45
04-09-2025 13:20	7.28	28.86	235.37	-3.76	4.89	66.52	0.09	79.34	0.14	135.06	0.71
04-09-2025 13:25	7.38	28.84	235.32	-4.01	4.23	14.94	0.14	43.45	0.26	118.41	0.72
04-09-2025 13:30	7.36	28.84	235.27	-4.29	3.55	18.88	0.21	38.2	0.29		
04-09-2025 13:35	7.3	28.83	235.41	-4.04	4.39	59.35	0.17	66.99	0.25		
04-09-2025 13:40	7.39	28.83	235.7	-3.29	6.43	25.25	0.24	38.85	0.38	100.58	0.56
04-09-2025 13:45	7.42	28.83	234.51	-5.8	-0.12	28.32	0.26	48.1	0.31	89.59	0.41
04-09-2025 13:50	7.43	28.83	234.95	-5.35	1.16	17.83	0.36	24	0.36	63.72	0.19
04-09-2025 13:55	7.42	28.83	234.46	-5.99	-0.58	22.14	0.29	35.53	0.31	141.87	0.48
04-09-2025 14:00	7.37	28.83	234.63	-6.03	-0.54	34.89	0.25	41.65	0.33	154.75	0.52
04-09-2025 14:05	7.36	28.84	234.65	-6.57	-1.52	26.16	0.32	40.13	0.38	134.14	0.3
04-09-2025 14:10	7.38	28.84	234.4	-6.74	-2.02	25.28	0.31	41.03	0.43	128.7	0.48
04-09-2025 14:15	7.38	28.84	233.89	-7.56	-4.1	17.84	0.30	35.77	0.39		
04-09-2025 14:20	7.43	28.85	234.1	-7.82	-4.33	16.82	0.32	31.56	0.36		
04-09-2025 14:25	7.39	28.86	234.31	-7.62	-3.71	35.27	0.38	39.71	0.4	138.93	0.46
04-09-2025 14:30	7.51	28.87	234.02	-7.95	-4.63	20.4	0.45	29.05	0.5	88.92	0.52
04-09-2025 14:35	7.47	28.88	233.73	-8.24	-5.36	17.11	0.42	30.13	0.45	90.27	0.47
04-09-2025 14:40	7.33	28.89	234	-7.98	-4.59	50.38	0.28	69.14	0.37		
04-09-2025 14:45	7.4	28.9	233.97	-8.07	-4.82	46.57	0.32	51.62	0.36		
04-09-2025 14:50	7.42	28.9	233.85	-8.11	-4.93	32.28	0.32	48.82	0.35	125.33	0.79
04-09-2025 14:55	7.44	28.89	234.36	-7.69	-3.61	25.73	0.27	44.05	0.32	122.25	0.61
04-09-2025 15:00	7.4	28.88	235.5	-5.72	2.01	40.17	0.29	57.27	0.35	128.03	0.67
04-09-2025 15:05	7.45	28.87	236.07	-4.72	4.76	25.2	0.31	36.17	0.43	76.65	0.3
04-09-2025 15:10	7.52	28.88	236.2	-4.9	4.77	21.83	0.39	29.24	0.43		
04-09-2025 15:15	7.41	28.9	236.46	-5.27	4.31	48.67	0.36	61.97	0.34	141.85	0.62
04-09-2025 15:20	7.43	28.91	236.47	-5.18	4.56	44.12	0.27	62.96	0.29	156.92	0.75
04-09-2025 15:25	7.42	28.9	236.47	-5.1	4.81	50.85	0.31	55.45	0.35	137.18	0.65
04-09-2025 15:30	7.42	28.89	236.5	-4.93	5.21	35.3	0.31	48.65	0.36	150.47	0.48
04-09-2025 15:35	7.45	28.9	236.54	-4.85	5.4	53.13	0.34	54.54	0.39	127.49	0.58
04-09-2025 15:40	7.55	28.91	236.46	-4.89	5.34	286.26	0.43	285.22	0.5		
04-09-2025 15:45	7.44	28.9	236.32	-5.04	4.97	275.61	0.31	253.49	0.36		
04-09-2025 15:50	7.5	28.91	236.35	-4.86	5.36	278.79	0.30	271.25	0.29	150.67	0.59
04-09-2025 15:55	7.5	28.92	236.29	-5.13	4.74	277.21	0.36	263.38	0.25	155.62	0.93
04-09-2025 16:00	7.49	28.92	236.35	-4.98	5.12	55.59	0.33	60.01	0.29	163.52	0.55
04-09-2025 16:05	7.54	28.92	236.37	-5.04	4.97	40.27	0.26	53.21	0.28	160.51	0.7
04-09-2025 16:10	7.44	28.91	236.29	-5.62	3.56	62.51	0.24	78.34	0.26	148.12	0.81
04-09-2025 16:15	7.52	28.91	235.97	-6.4	1.52	39.92	0.29	55.02	0.28	151.04	0.67
04-09-2025 16:20	7.56	28.91	236.07	-6.2	2.07	39.97	0.29	44.34	0.27		
04-09-2025 16:25	7.51	28.93	236.02	-6.38	1.62	62.16	0.23	75.9	0.23	148.45	0.52
04-09-2025 16:30	7.54	29.04	236.22	-5.81	3.12	64.55	0.28	73.54	0.18	144.79	0.54

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
04-09-2025 16:35	7.59	29.01	236.32	-5.24	4.47	53.79	0.25	51.15	0.18	60.38	0.31
04-09-2025 16:40	7.51	28.95	236.49	-4.72	5.81	51.69	0.29	53.44	0.17	8.34	0.23
04-09-2025 16:45	7.62	28.94	236.27	-5.67	3.4	33.07	0.25	28.57	0.16		
04-09-2025 16:50	7.58	29	236.37	-5.63	3.54	59.63	0.19	55.2	0.16		
04-09-2025 16:55	7.63	29.1	236.4	-5.37	4.16	43.83	0.15	27.9	0.07		
04-09-2025 17:00	7.64	29.12	236.47	-4.88	5.4	42.45	0.19	43.98	0.19		
04-09-2025 17:05	7.63	29.06	236.49	-4.61	6.09	76.24	0.16	64.67	0.15	357.02	0.41
04-09-2025 17:10	7.5	29.02	236.63	-3.49	9.03	108.51	0.22	106.2	0.2	48.89	0.2
04-09-2025 17:15	7.6	29.01	236.56	-4.28	6.96	107.48	0.18	102.29	0.15		
04-09-2025 17:20	7.7	28.99	236.65	-3.78	8.33	73.31	0.14	46.15	0.15		
04-09-2025 17:25	7.71	28.98	236.61	-3.73	8.41	61.02	0.14	31.73	0.17	359.07	0.47
04-09-2025 17:30	7.68	28.96	236.59	-4.45	6.5	78.92	0.13	46.33	0.19		
04-09-2025 17:35	7.64	28.96	236.51	-4.53	6.31	73.44	0.14	75.39	0.07		
04-09-2025 17:40	7.65	28.95	236.58	-4.43	6.58	75.29	0.17	66.29	0.15		
04-09-2025 17:45	7.64	28.95	236.58	-4.24	7.1	89.08	0.18	82.7	0.17		
04-09-2025 17:50	7.63	28.94	236.64	-4.1	7.47	92.79	0.14	95.4	0.11	358.59	0.33
04-09-2025 17:55	7.64	28.94	236.56	-3.97	7.86	107.2	0.17	110.08	0.15		
04-09-2025 18:00	7.66	28.93	236.66	-3.99	7.7	99.14	0.16	123.27	0.12		
04-09-2025 18:05	7.72	28.92	236.63	-4.18	7.26	85.26	0.11	70.05	0.09		
04-09-2025 18:10	7.74	28.92	236.59	-4.55	6.29	85.54	0.17	78.73	0.12	24.74	0.47
04-09-2025 18:15	7.7	28.92	236.63	-3.43	9.23	171.81	0.05	106.23	0.08		
04-09-2025 18:20	7.63	28.92	236.68	-3.78	8.3	135.48	0.20	127.28	0.17	54.28	0.49
04-09-2025 18:25	7.69	28.92	236.7	-3.76	8.33	129.61	0.18	119.24	0.19		
04-09-2025 18:30	7.66	28.92	236.69	-3.8	8.24	150.77	0.10	144.63	0.14		
04-09-2025 18:35	7.71	28.92	236.65	-2.97	10.49	128.94	0.07	141.36	0.17	41.01	0.28
04-09-2025 18:40	7.65	28.92	236.6	-3.9	7.98	162.06	0.12	200.22	0.16	300.28	0.69
04-09-2025 18:45	7.64	28.92	236.6	-3.2	9.78	185.81	0.19	170.82	0.26		
04-09-2025 18:50	7.64	28.92	236.6	-3.6	8.77	189.8	0.09	206.92	0.14		
04-09-2025 18:55	7.72	28.92	236.6	-4.13	7.31	161.13	0.19	197.99	0.08		
04-09-2025 19:00	7.64	28.92	236.6	-3.93	7.83	157.47	0.20	159.37	0.29	130.9	0.34
04-09-2025 19:05	7.65	28.92	236.55	-4.01	7.63	181.24	0.12	150.28	0.09	30	0.23
04-09-2025 19:10	7.66	28.93	236.59	-3.53	8.88	195.45	0.13	177.88	0.17	99.72	0.3
04-09-2025 19:15	7.65	28.93	236.53	-4	7.67	182.37	0.13	174.55	0.19		
04-09-2025 19:20	7.72	28.93	236.51	-4	7.68	215.56	0.09	242.38	0.07	335.51	0.26
04-09-2025 19:25	7.67	28.92	236.21	-3.02	8.94	218.58	0.07	183.41	0.1	62.74	0.4
04-09-2025 19:30	7.58	28.92	235.71	-2.01	9.68	176.97	0.24	176.79	0.26		
04-09-2025 19:35	7.6	28.9	233.58	0.9	8.76	179.9	0.20	151.25	0.16	38.67	0.39
04-09-2025 19:40	7.62	28.9	233.39	1.73	9.41	187.64	0.21	190.09	0.26	135.07	0.16
04-09-2025 19:45	7.72	28.88	232.19	3.07	8.19	243.39	0.16	257.33	0.17	341.28	0.39
04-09-2025 19:50	7.62	28.88	231.67	3.01	6.91	204.07	0.17	206.51	0.15	10.87	0.37
04-09-2025 19:55	7.69	28.86	231.26	2.29	5.12	226.69	0.11	264.86	0.09		
04-09-2025 20:00	7.67	28.85	231.64	2.74	6.29	256.37	0.15	245.71	0.09		
04-09-2025 20:05	7.63	28.84	231.58	3.01	6.51	208.3	0.11	214.5	0.12	337.79	0.11
04-09-2025 20:10	7.62	28.84	231.64	3.45	7.14	206.3	0.13	200.95	0.13	102.12	0.26
04-09-2025 20:15	7.65	28.83	230.78	2.26	4.13	230.68	0.18	222.25	0.16	321.52	0.45
04-09-2025 20:20	7.56	28.83	229.53	7.68	5.38	199.22	0.16	181.38	0.22	281.83	0.17
04-09-2025 20:25	7.56	28.83	227.72	11.13	3.98	180.51	0.22	193.59	0.25	157.74	0.12
04-09-2025 20:30	7.73	28.83	227.21	10.64	2.79	270.54	0.15	272.92	0.1		
04-09-2025 20:35	7.64	28.83	227.69	11.15	3.94	230.91	0.14	215.28	0.06		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
04-09-2025 20:40	7.58	28.83	227.86	11.43	4.63	212.64	0.12	197.8	0.22		
04-09-2025 20:45	7.63	28.83	227.9	11.41	4.65	231.86	0.10	210.02	0.14		
04-09-2025 20:50	7.64	28.84	227.67	11.19	4.07	234.84	0.16	191.09	0.1	169.64	0.35
04-09-2025 20:55	7.59	28.84	228.23	11.65	5.17	224.68	0.13	229.49	0.17	268.28	0.31
04-09-2025 21:00	7.58	28.85	227.98	11.39	4.58	205.29	0.18	191.1	0.16		
04-09-2025 21:05	7.52	28.85	228.41	11.84	5.7	200.83	0.21	172.87	0.16	126.6	0.22
04-09-2025 21:10	7.6	28.86	227.79	11.23	4.22	254.62	0.09	285.28	0.08		
04-09-2025 21:15	7.52	28.86	229.49	8.52	6.62	199.28	0.14	158.56	0.1		
04-09-2025 21:20	7.57	28.87	231.02	5.96	8.58	213.33	0.14	185.88	0.09	37.15	0.25
04-09-2025 21:25	7.51	28.87	230.87	5.67	7.73	185.08	0.14	199.57	0.05	76.47	0.23
04-09-2025 21:30	7.48	28.87	230.63	5.35	6.86	182.09	0.19	158.33	0.18	68.43	0.38
04-09-2025 21:35	7.42	28.88	230.69	5.59	7.24	186.65	0.17	132.27	0.13		
04-09-2025 21:40	7.43	28.89	230.56	5.68	7.37	131.25	0.27	166.85	0.12	274.67	0.59
04-09-2025 21:45	7.52	28.9	229.6	4.57	4.49	99.24	0.12	307.29	0.12		
04-09-2025 21:50	7.44	28.91	230.58	5.94	7.93	157.21	0.13	213.01	0.12		
04-09-2025 21:55	7.52	28.92	229.86	4.86	5.1	79.03	0.17	55.66	0.19	300.26	0.91
04-09-2025 22:00	7.48	28.93	230.16	5.28	6.19	229.5	0.08	35.69	0.06	19.69	0.8
04-09-2025 22:05	7.48	28.94	230	5.05	5.57	194.06	0.07	150.63	0.07	72.16	0.57
04-09-2025 22:10	7.48	28.95	229.99	5.15	5.83	206.04	0.08	347.12	0.05	48.13	0.39
04-09-2025 22:15	7.4	28.95	230.06	5.35	6.06	170.18	0.09	143.98	0.06	41.1	0.56
04-09-2025 22:20	7.49	28.96	230.04	5.21	5.83	133.53	0.05	143.38	0.03	26.27	0.41
04-09-2025 22:25	7.42	28.97	229.81	3.89	4.23	191.37	0.12	133.78	0.14	85.03	0.67
04-09-2025 22:30	7.47	28.97	230.98	1.9	4.47	282.66	0.06	34.3	0.1		
04-09-2025 22:35	7.43	28.97	232.65	0.91	6.92	185.28	0.06	76.83	0.07	48.37	0.47
04-09-2025 22:40	7.38	28.98	233.25	0.63	7.97	207.29	0.14	150.68	0.14	48.51	0.7
04-09-2025 22:45	7.38	28.98	233.56	-0.62	6.88	197.05	0.11	119.34	0.05	45.63	0.75
04-09-2025 22:50	7.41	28.98	233.82	-1.28	6.29	304.07	0.06	287.38	0.03	44.62	0.68
04-09-2025 22:55	7.43	28.99	234	-1.94	5.55	321	0.04	355.61	0.03	37.13	0.7
04-09-2025 23:00	7.32	28.99	234.24	-2.24	5.5	195.63	0.05	126.58	0.07	53.79	0.58
04-09-2025 23:05	7.32	28.99	234.56	-1.45	7.85	204.44	0.04	90.27	0.06	50.6	0.71
04-09-2025 23:10	7.41	28.99	234.26	-2.87	4.55	290.31	0.05	29.74	0.09	48.7	1.08
04-09-2025 23:15	7.33	28.99	234.54	-2.14	6.45	187.35	0.06	165.56	0.13		
04-09-2025 23:20	7.35	28.99	234.86	-1.42	8.74	332.55	0.03	59.68	0.06		
04-09-2025 23:25	7.32	28.99	234.92	-1.8	8.05	308.6	0.03	57.33	0.04		
04-09-2025 23:30	7.34	28.99	235.01	-2.1	7.59	12.58	0.08	354.21	0.08	38.53	0.96
04-09-2025 23:35	7.35	28.98	235.11	-2.38	7.24	302.24	0.06	358.83	0.08	48.03	0.52
04-09-2025 23:40	7.36	28.98	235.13	-2.33	7.52	332.9	0.06	258.48	0.08	90.02	0.34
04-09-2025 23:45	7.38	28.94	235	-2.93	6.05	2.39	0.13	5.81	0.2		
04-09-2025 23:50	7.28	28.89	235.18	-2.59	7.01	67.35	0.04	108.89	0.08		
04-09-2025 23:55	7.3	28.88	235.13	-2.74	6.6	30.92	0.14	8.04	0.09		
05-09-2025 00:00	7.41	28.84	235	-2.98	6.04	28.26	0.26	28.81	0.22		
05-09-2025 00:05	7.41	28.85	234.95	-3.25	5.32	37.79	0.29	41.63	0.36	59.58	0.75
05-09-2025 00:10	7.33	28.86	234.95	-3.51	4.76	35.39	0.17	45.34	0.24	49.64	0.4
05-09-2025 00:15	7.3	28.87	234.99	-3.53	4.88	27.01	0.23	41.61	0.33	32.63	0.83
05-09-2025 00:20	7.28	28.86	234.98	-3.55	4.78	43.35	0.17	51.58	0.24		
05-09-2025 00:25	7.34	28.85	234.85	-3.98	3.68	28.15	0.25	20.21	0.37	28.87	1.01
05-09-2025 00:30	7.31	28.85	234.87	-4.08	3.48	36.87	0.25	46.89	0.31		
05-09-2025 00:35	7.31	28.82	234.76	-4.32	2.84	46.61	0.37	49.13	0.38		
05-09-2025 00:40	7.37	28.82	234.72	-4.24	3.02	294.42	0.49	284.61	0.45	252.38	0.47

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
05-09-2025 00:45	7.34	28.84	234.86	-3.87	4.05	287.25	0.44	283.83	0.53	278.74	0.95
05-09-2025 00:50	7.31	28.84	234.76	-4.21	3.2	289.34	0.44	287.49	0.46	281.59	1.12
05-09-2025 00:55	7.33	28.83	234.79	-4.1	3.54	281.8	0.41	284.73	0.51	292.53	0.98
05-09-2025 01:00	7.36	28.84	234.87	-4.09	3.67	32.51	0.38	32.46	0.44	39.93	0.74
05-09-2025 01:05	7.31	28.84	234.95	-4.08	3.8	31.09	0.40	42.14	0.4	46.8	0.77
05-09-2025 01:10	7.35	28.84	234.86	-4.22	3.53	42.93	0.45	47.16	0.39	58.69	0.78
05-09-2025 01:15	7.31	28.84	234.88	-4.38	3.23	31.24	0.40	37.59	0.39	40.85	0.75
05-09-2025 01:20	7.31	28.84	235.02	-4.64	2.95	47.65	0.43	51.52	0.42		
05-09-2025 01:25	7.35	28.81	234.87	-4.95	2.13	50.11	0.35	53.1	0.4	41.94	0.49
05-09-2025 01:30	7.31	28.83	235.06	-5.05	2.07	42.08	0.38	54.3	0.44		
05-09-2025 01:35	7.4	28.8	234.98	-5.18	1.88	38.51	0.43	37.98	0.48	37.25	0.65
05-09-2025 01:40	7.35	28.83	234.99	-4.92	2.43	48.72	0.39	41.67	0.44	66.53	0.82
05-09-2025 01:45	7.43	28.84	235.1	-4.72	3.1	24.46	0.45	37.14	0.54	66.52	0.53
05-09-2025 01:50	7.37	28.82	234.93	-5.25	1.87	42.48	0.44	49.67	0.5	55.81	1.02
05-09-2025 01:55	7.33	28.85	234.95	-5.11	2.22	46.89	0.41	47.07	0.51	41.67	1.13
05-09-2025 02:00	7.44	28.86	235.13	-4.81	2.93	31.55	0.51	35.41	0.55	60.39	0.62
05-09-2025 02:05	7.34	28.82	234.94	-5.26	1.87	51.45	0.45	54.37	0.48	47.81	0.57
05-09-2025 02:10	7.41	28.79	234.95	-5.13	2.19	34.64	0.45	43.55	0.4	74.04	0.7
05-09-2025 02:15	7.48	28.75	234.81	-5.4	1.51	41.52	0.55	40.09	0.48		
05-09-2025 02:20	7.39	28.8	234.5	-5.97	0.04	60.39	0.42	61.41	0.5	69.2	0.71
05-09-2025 02:25	7.38	28.81	234.97	-5.12	2.18	42.77	0.47	56.96	0.43		
05-09-2025 02:30	7.48	28.78	235.43	-4.62	4.02	52.49	0.47	47.41	0.34	60.81	0.36
05-09-2025 02:35	7.47	28.79	235.86	-5.08	4.05	43.33	0.31	46.51	0.47	51.88	0.92
05-09-2025 02:40	7.54	28.83	235.68	-5.88	2.11	38.96	0.47	41.08	0.46		
05-09-2025 02:45	7.44	28.76	235.87	-5.23	3.72	59.01	0.44	56.91	0.44	57.36	0.89
05-09-2025 02:50	7.57	28.71	236.09	-4.85	5.08	38.39	0.54	38.2	0.49		
05-09-2025 02:55	7.55	28.77	236.19	-5.12	4.65	28.01	0.31	27.71	0.4	43.33	0.54
05-09-2025 03:00	7.48	28.75	236.34	-4.12	7.16	77.07	0.32	85.77	0.32	89.18	0.87
05-09-2025 03:05	7.43	28.77	236.43	-4.9	5.67	70.44	0.35	88.25	0.3	94.32	0.99
05-09-2025 03:10	7.47	28.75	236.44	-4.94	5.63	70.35	0.30	69.8	0.28		
05-09-2025 03:15	7.48	28.73	236.76	-4.22	7.92	52.54	0.33	55.12	0.34		
05-09-2025 03:20	7.55	28.78	236.87	-4.88	6.62	53.42	0.18	54.85	0.19		
05-09-2025 03:25	7.48	28.76	236.92	-5.23	5.89	77.04	0.34	83.24	0.3	87.35	0.55
05-09-2025 03:30	7.5	28.73	237.08	-5.36	5.89	57.82	0.31	47.58	0.38	59.12	0.78
05-09-2025 03:35	7.59	28.71	237.07	-5.81	4.87	51.69	0.22	57.79	0.2		
05-09-2025 03:40	7.66	28.71	237.04	-5.69	5.36	288.21	0.43	290.96	0.34		
05-09-2025 03:45	7.65	28.7	236.92	-6	4.53	272.3	0.40	267.77	0.35		
05-09-2025 03:50	7.62	28.73	236.82	-6.47	3.34	278.76	0.38	262.16	0.37		
05-09-2025 03:55	7.69	28.74	237.13	-5.64	5.75	282.5	0.22	259.75	0.19	285.6	0.41
05-09-2025 04:00	7.7	28.7	237.15	-5.51	6.1	61.95	0.30	55.98	0.28		
05-09-2025 04:05	7.8	28.7	237.08	-6.19	4.43	31.66	0.34	37.97	0.33		
05-09-2025 04:10	7.76	28.66	237.1	-5.69	5.62	51.73	0.21	67.39	0.23	62.66	0.37
05-09-2025 04:15	7.77	28.66	237.19	-5.06	7.29	43.68	0.26	46.11	0.18	66.19	0.19
05-09-2025 04:20	7.72	28.68	237.21	-5.25	6.71	75.15	0.27	72.31	0.21	52.96	0.59
05-09-2025 04:25	7.67	28.67	237.21	-5.45	6.2	77.03	0.25	71.02	0.24		
05-09-2025 04:30	7.63	28.72	237.26	-5.32	6.53	77.1	0.30	78.16	0.29	40.79	0.57
05-09-2025 04:35	7.77	28.71	237.2	-5.67	5.64	48.69	0.29	61.18	0.21	16.38	0.48
05-09-2025 04:40	7.69	28.68	237.21	-5.82	5.22	91.45	0.24	105.39	0.24		
05-09-2025 04:45	7.77	28.7	237.19	-5.21	6.79	60.39	0.15	63.28	0.16	77.47	0.38

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
05-09-2025 04:50	7.74	28.72	237.2	-5.14	6.95	99.92	0.21	110.03	0.22	92.27	0.37
05-09-2025 04:55	7.78	28.72	237.2	-4.89	7.63	83	0.19	97.94	0.17	50.05	0.58
05-09-2025 05:00	7.77	28.77	237.2	-4.74	7.91	107.68	0.20	124.91	0.21	56.58	0.51
05-09-2025 05:05	7.85	28.82	237.17	-5.08	7.11	69.71	0.17	65.11	0.08	40.45	0.39
05-09-2025 05:10	7.91	28.82	237.16	-4.91	7.51	68.52	0.18	83.83	0.15	45.66	0.55
05-09-2025 05:15	7.8	28.83	237.15	-4.85	7.66	103.42	0.25	110.13	0.23	56.18	0.52
05-09-2025 05:20	7.82	28.83	237.17	-4.96	7.4	81.53	0.16	79.77	0.13	37.3	0.42
05-09-2025 05:25	7.8	28.82	237.15	-4.86	7.59	96.09	0.17	112.53	0.18	61	0.38
05-09-2025 05:30	7.79	28.83	237.15	-4.55	8.5	122.67	0.23	141.89	0.24	94.8	0.38
05-09-2025 05:35	7.89	28.82	237.2	-4.02	9.88	87.96	0.20	94.6	0.12	69.36	0.26
05-09-2025 05:40	7.88	28.82	237.18	-3.82	10.5	96.68	0.21	90.44	0.11	59.34	0.32
05-09-2025 05:45	7.85	28.82	237.13	-4.07	9.81	124.45	0.16	126.49	0.16	68.13	0.47
05-09-2025 05:50	7.98	28.82	237.26	-4.91	7.56	69.52	0.04	80.52	0.04	95.7	0.12
05-09-2025 05:55	7.88	28.81	237.23	-3.95	10.09	126.89	0.19	139.55	0.18	40.51	0.4
05-09-2025 06:00	7.96	28.81	237.18	-3.75	10.63	100.91	0.14	126.76	0.14	46.84	0.44
05-09-2025 06:05	7.92	28.81	237.26	-4.47	8.71	94.88	0.14	106.93	0.07	13.43	0.44
05-09-2025 06:10	7.93	28.8	237.22	-4.51	8.5	140.73	0.10	127.13	0.11	96.46	0.28
05-09-2025 06:15	7.9	28.8	237.2	-4.34	8.98	151.23	0.19	175.62	0.2	124.08	0.25
05-09-2025 06:20	7.99	28.79	237.21	-4.47	8.59	138.16	0.05	142.75	0.04	69.78	0.21
05-09-2025 06:25	7.98	28.78	237.17	-4.19	9.35	172.07	0.09	169.4	0.09	54.93	0.28
05-09-2025 06:30	8.01	28.77	237.09	-4.06	9.77	148.51	0.09	155.8	0.07	34.28	0.37
05-09-2025 06:35	8.08	28.76	237.26	-4.38	8.86	144.23	0.08	280.03	0.05	358.83	0.33
05-09-2025 06:40	7.96	28.76	237.16	-3.83	10.34	165.59	0.27	174.66	0.2		
05-09-2025 06:45	7.95	28.75	237.08	-3.38	11.53	168.86	0.21	150.77	0.26		
05-09-2025 06:50	7.92	28.75	237.14	-3.73	10.58	159.02	0.18	154.9	0.24		
05-09-2025 06:55	7.97	28.75	237.06	-3.78	10.27	144.36	0.14	159.84	0.07		
05-09-2025 07:00	7.91	28.76	236.83	-3.25	10.94	202.11	0.20	180.27	0.18		
05-09-2025 07:05	7.98	28.73	231.71	4.85	9.47	186.75	0.23	195.66	0.19		
05-09-2025 07:10	8.02	28.71	230.05	5.8	6.7	236.11	0.17	228.71	0.14	112.75	0.08
05-09-2025 07:15	7.97	28.7	230.19	7.01	7.64	220.18	0.17	216.88	0.17	114.86	0.06
05-09-2025 07:20	7.97	28.71	230.37	7.24	8.26	211.94	0.22	196.27	0.22	57.52	0.13
05-09-2025 07:25	7.88	28.72	229.96	6.68	6.77	198.77	0.20	191.55	0.19	78.44	0.39
05-09-2025 07:30	7.98	28.73	229.47	6.2	5.51	240.94	0.16	222.64	0.19	97.52	0.27
05-09-2025 07:35	8	28.71	229.62	6.3	5.78	244.79	0.10	238.58	0.12	32.12	0.28
05-09-2025 07:40	8	28.7	229.34	6.04	5.09	207.06	0.18	220.15	0.16	110.2	0.25
05-09-2025 07:45	8.04	28.67	229.57	6.25	5.63	234.82	0.17	249.94	0.24	57.38	0.16
05-09-2025 07:50	7.99	28.65	229.85	6.6	6.53	218.67	0.18	229.48	0.17	98.18	0.04
05-09-2025 07:55	7.85	28.66	229.88	6.59	6.49	192.68	0.26	189.14	0.28	91.7	0.48
05-09-2025 08:00	7.95	28.68	230.04	6.73	6.87	233.77	0.20	221.3	0.24	350.47	0.28
05-09-2025 08:05	7.94	28.68	229.92	6.56	6.4	240.07	0.13	226.65	0.2	78.48	0.36
05-09-2025 08:10	7.9	28.69	229.84	6.56	6.41	214.83	0.16	216.11	0.15	81.24	0.32
05-09-2025 08:15	7.79	28.69	230.3	7.22	8.17	201.39	0.18	194.34	0.23	92.31	0.42
05-09-2025 08:20	7.86	28.71	230.03	6.68	6.74	232.11	0.14	226.06	0.21	70.39	0.3
05-09-2025 08:25	7.94	28.74	229.67	6.34	5.83	238.64	0.22	241.8	0.21	78.15	0.29
05-09-2025 08:30	7.86	28.76	230.16	6.9	7.26	208.65	0.21	217.94	0.18	83.66	0.33
05-09-2025 08:35	7.88	28.76	230.12	6.9	7.26	217.31	0.20	196.35	0.19	106.62	0.23
05-09-2025 08:40	7.87	28.77	230.2	7.01	7.56	204.78	0.18	220.07	0.19	92.03	0.21
05-09-2025 08:45	7.86	28.76	229.93	6.7	6.75	212.43	0.20	217.12	0.14	108.82	0.35
05-09-2025 08:50	7.83	28.76	229.88	6.63	6.55	211.74	0.20	219.18	0.14	107.55	0.43

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
05-09-2025 08:55	7.86	28.76	230.22	7.1	7.82	196.07	0.16	218.34	0.15	106.22	0.41
05-09-2025 09:00	7.8	28.76	230.12	6.89	7.23	193.24	0.23	181.47	0.24	112.53	0.41
05-09-2025 09:05	7.92	28.76	229.17	5.78	4.35	235.16	0.14	283.13	0.08	105.47	0.16
05-09-2025 09:10	7.85	28.76	229.67	6.42	6.03	228.76	0.12	220.21	0.12	121.88	0.37
05-09-2025 09:15	7.7	28.76	230.13	7.01	7.46	165.31	0.17	177.32	0.22	127.17	0.53
05-09-2025 09:20	7.77	28.76	229.48	6.2	5.4	217.35	0.14	195.63	0.16	114.76	0.46
05-09-2025 09:25	7.8	28.76	228.9	5.74	3.86	272.99	0.07	252.72	0.07	165.35	0.22
05-09-2025 09:30	7.79	28.75	229.08	6.57	4.81	257.75	0.11	240.87	0.13		
05-09-2025 09:35	7.74	28.76	228.82	6.46	4.3	203.35	0.13	230.54	0.16		
05-09-2025 09:40	7.74	28.76	228.44	6.46	3.93	31.31	0.17	45.37	0.16	207.84	0.29
05-09-2025 09:45	7.71	28.76	228.84	6.83	4.93	90.45	0.12	102.99	0.14	199.24	0.56
05-09-2025 09:50	7.67	28.76	229.02	7.16	5.67	136.7	0.05	141.55	0.11	197.98	0.42
05-09-2025 09:55	7.65	28.76	228.71	6.76	4.65	116.44	0.17	119.43	0.19	153.9	0.64
05-09-2025 10:00	7.66	28.76	229.02	7.15	5.53	187.5	0.12	186.77	0.11	147.13	0.4
05-09-2025 10:05	7.66	28.76	228.67	7.18	4.9	197.41	0.11	204.67	0.15	155.39	0.8
05-09-2025 10:10	7.64	28.76	227.98	8.91	4.42	173.9	0.08	166.02	0.1		
05-09-2025 10:15	7.72	28.76	227.73	9.35	4.11	251.82	0.07	216.41	0.12	158.54	0.45
05-09-2025 10:20	7.58	28.76	228.19	9.83	5.24	176.59	0.21	173.37	0.23		
05-09-2025 10:25	7.66	28.76	227.73	9.54	4.1	264.13	0.08	210.99	0.08	151.43	0.43
05-09-2025 10:30	7.63	28.76	227.95	9.88	4.58	196.68	0.10	197.96	0.13	140.41	0.58
05-09-2025 10:35	7.59	28.76	228	9.99	4.89	198.46	0.15	171.02	0.16	151.37	0.47
05-09-2025 10:40	7.67	28.76	227.12	9.86	3.19	266.94	0.09	268.47	0.1		
05-09-2025 10:45	7.61	28.76	227.17	10.75	3.43	240.9	0.04	247.43	0.06		
05-09-2025 10:50	7.6	28.76	227.02	10.63	3.15	234.71	0.02	277.3	0.03	145.14	0.43
05-09-2025 10:55	7.55	28.76	227.09	10.67	3.24	248.91	0.04	277.81	0.07	142.5	0.41
05-09-2025 11:00	7.55	28.77	226.97	10.61	3.07	254.07	0.02	234.42	0.07		
05-09-2025 11:05	7.51	28.77	227.52	11.11	4.27	150.94	0.09	184.22	0.07	122.93	0.28
05-09-2025 11:10	7.48	28.77	227.37	10.98	3.96	167.93	0.10	195.82	0.09	145.08	0.42
05-09-2025 11:15	7.54	28.77	225.31	10.03	1.01	289.16	0.07	285.84	0.09	142.48	0.37
05-09-2025 11:20	7.5	28.77	226.95	11.12	3.22	164.03	0.11	172.17	0.08	140.97	0.52
05-09-2025 11:25	7.48	28.77	227.14	11.22	3.49	182.88	0.02	199.71	0.01	126.79	0.4
05-09-2025 11:30	7.44	28.77	227.58	11.61	4.42	131.12	0.10	145.29	0.1	134.62	0.32
05-09-2025 11:35	7.43	28.77	227.13	11.19	3.41	113.17	0.10	165.92	0.11	138.94	0.36
05-09-2025 11:40	7.41	28.77	226.94	11.04	3.04	149.91	0.02	278.39	0.04	143.93	0.22
05-09-2025 11:45	7.42	28.77	227.25	11.32	3.72	132.29	0.07	185.42	0.09	164.99	0.27
05-09-2025 11:50	7.47	28.77	227.02	11.1	3.19	1.49	0.04	16.65	0.02		
05-09-2025 11:55	7.46	28.77	226.74	10.77	2.39	353.49	0.06	341.54	0.08		
05-09-2025 12:00	7.46	28.77	227.02	11.01	2.95	69.49	0.10	77.22	0.11		
05-09-2025 12:05	7.3	28.77	227.69	11.68	4.57	154.53	0.13	148.5	0.18		
05-09-2025 12:10	7.42	28.77	226.84	10.93	2.69	268.84	0.03	269.27	0.11	324.35	0.47
05-09-2025 12:15	7.32	28.79	227.52	11.55	4.24	138.44	0.05	80.58	0.11	333.18	0.44
05-09-2025 12:20	7.36	28.78	227.32	11.34	3.75	55.43	0.01	58.54	0.07		
05-09-2025 12:25	7.3	28.78	227.14	11.14	3.3	131.25	0.07	130.54	0.09	316.25	0.38
05-09-2025 12:30	7.33	28.77	227.16	11.13	3.3	79.05	0.04	52.3	0.08		
05-09-2025 12:35	7.35	28.77	227.33	11.08	3.65	17.12	0.03	24.21	0.07	331.85	0.37
05-09-2025 12:40	7.36	28.78	226.77	10.57	2.53	348.29	0.05	18.35	0.08	27.86	0.48
05-09-2025 12:45	7.29	28.78	226.99	9.98	2.92	112.68	0.05	152.37	0.08	10.03	0.5
05-09-2025 12:50	7.28	28.79	227.56	7.55	3.16	285.43	0.07	248.49	0.15		
05-09-2025 12:55	7.29	28.82	228.39	6.29	3.9	358.18	0.09	260.8	0.1		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
05-09-2025 13:00	7.25	28.84	229.18	5.6	5.65	93.33	0.11	120.58	0.24		
05-09-2025 13:05	7.39	28.83	230.46	3.6	5.77	0.7	0.19	14.16	0.22		
05-09-2025 13:10	7.34	28.8	230.28	2.8	4.64	27.07	0.13	47.96	0.19	355.75	0.81
05-09-2025 13:15	7.47	28.79	229.55	1.4	2.08	5.66	0.25	7.93	0.35	353.51	0.94
05-09-2025 13:20	7.37	28.82	230.28	1.36	3.25	27.06	0.19	30.76	0.25	358.31	0.91
05-09-2025 13:25	7.32	28.8	231.42	-0.06	3.56	33.52	0.25	39.84	0.32	7.9	0.82
05-09-2025 13:30	7.4	28.79	231.83	-1.9	2.27	15.71	0.34	29.68	0.39	4.31	0.76
05-09-2025 13:35	7.32	28.84	232.88	-1.89	3.91	36.86	0.30	41.22	0.28	345.31	0.43
05-09-2025 13:40	7.33	28.99	233.02	-2.9	2.59	22.15	0.33	39.72	0.3	349.84	0.75
05-09-2025 13:45	7.36	28.91	232.87	-7.01	-3.47	28.45	0.36	35.53	0.36	16.5	0.6
05-09-2025 13:50	7.28	29.22	234.72	-4.66	3.52	46.1	0.25	29.68	0.36		
05-09-2025 13:55	7.29	29.11	235.35	-3.9	5.95	54.67	0.27	47.97	0.36		
05-09-2025 14:00	7.27	29	235.71	-3.65	7.35	54.4	0.27	66.18	0.23		
05-09-2025 14:05	7.33	29.33	236.17	-5.79	4.02	39.51	0.38	40.76	0.39		
05-09-2025 14:10	7.33	29.3	237.7	-5.68	8.26	33.23	0.33	33.8	0.41	26.54	0.89
05-09-2025 14:15	7.33	29.33	237.78	-5.81	8.2	39.34	0.39	44.36	0.45		
05-09-2025 14:20	7.41	29.31	237.83	-6.49	6.56	36.67	0.42	46.99	0.34		
05-09-2025 14:25	7.31	29.4	237.79	-6.72	6.02	56.13	0.34	65.19	0.28		
05-09-2025 14:30	7.35	29.21	237.77	-6.74	5.96	69.99	0.29	65.37	0.36	23.62	0.45
05-09-2025 14:35	7.4	29.22	237.73	-6.81	5.74	47.63	0.36	55.21	0.38	31.04	0.66
05-09-2025 14:40	7.46	29.27	237.76	-7.77	3.32	41.61	0.35	35.63	0.47		
05-09-2025 14:45	7.34	29.31	238.87	-9	2.56	44.2	0.42	60.66	0.45	20.54	0.67
05-09-2025 14:50	7.44	29.29	240.16	-10.01	2.62	35.89	0.43	44.26	0.48		
05-09-2025 14:55	7.47	29.32	241.21	-10.88	2.34	32.88	0.45	41.41	0.48		
05-09-2025 15:00	7.41	29.32	241.27	-11.08	1.83	51.78	0.41	51.76	0.37	24.59	0.68
05-09-2025 15:05	7.39	29.21	241.26	-11.04	1.91	51.38	0.33	53.66	0.39	14.54	0.74
05-09-2025 15:10	7.56	29.29	241.49	-11.06	2.45	28.22	0.51	35.11	0.5	6.03	0.62
05-09-2025 15:15	7.45	29.25	241.75	-11.2	2.68	49.43	0.39	52.7	0.45	8.38	0.87
05-09-2025 15:20	7.42	29.27	241.7	-11	3.21	53.92	0.35	59.98	0.39		
05-09-2025 15:25	7.45	29.31	241.83	-11.42	2.07	53.36	0.37	62.2	0.35	15.23	0.54
05-09-2025 15:30	7.49	29.3	241.86	-11.37	2.19	55.07	0.30	57.09	0.36	7.82	0.53
05-09-2025 15:35	7.6	29.07	241.76	-11.3	2.29	52	0.29	53.02	0.34	60.21	0.36
05-09-2025 15:40	7.47	28.9	240.91	-9.23	7.82	265.08	0.33	260.95	0.39	304.76	0.73
05-09-2025 15:45	7.53	29.01	241	-9.62	6.83	291.32	0.43	277.59	0.52	299.56	0.69
05-09-2025 15:50	7.5	29.28	241.38	-10.08	5.58	264.86	0.29	265.27	0.39	319.66	0.79
05-09-2025 15:55	7.56	29.33	241.82	-11.29	2.38	282.45	0.30	270.19	0.36	300.13	0.36
05-09-2025 16:00	7.58	29.4	241.57	-10.64	4.06	48.43	0.34	45.45	0.46	45.4	0.53
05-09-2025 16:05	7.52	29.55	241.72	-11.22	2.51	57.83	0.30	65.59	0.33	28.04	0.28
05-09-2025 16:10	7.66	29.52	241.62	-10.97	3.22	30.89	0.39	32.37	0.41	7.72	0.56
05-09-2025 16:15	7.65	29.53	241.59	-10.64	4.48	31.39	0.27	27.49	0.37		
05-09-2025 16:20	7.66	29.54	241.64	-10.62	4.92	26.99	0.38	28	0.4	8.41	0.65
05-09-2025 16:25	7.65	29.39	241.79	-10.93	4.08	42.11	0.26	39.79	0.32		
05-09-2025 16:30	7.69	29.2	241.7	-10.79	4.42	51.44	0.19	46.17	0.27	18.16	0.46
05-09-2025 16:35	7.64	29.05	241.55	-10.26	5.82	70.81	0.14	59.55	0.25	32.24	0.38
05-09-2025 16:40	7.6	28.95	241.18	-9.43	8.07	109.4	0.15	84.87	0.22	16.99	0.71
05-09-2025 16:45	7.65	28.92	240.8	-8.61	10.34	76.17	0.16	53.19	0.24	27.84	0.64
05-09-2025 16:50	7.67	28.91	241.12	-9.21	8.61						
05-09-2025 16:55	7.7	28.92	241.29	-9.41	8.08	78.83	0.15	78.99	0.16	63.53	0.28
05-09-2025 17:00	7.74	28.91	241.13	-8.96	9.32	74.89	0.16	52.28	0.21	49.22	0.44

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
05-09-2025 17:05	7.71	28.92	240.93	-8.59	10.41	42.43	0.12	51.17	0.15	19.61	0.28
05-09-2025 17:10	7.81	28.92	241.25	-9.65	7.53	75.8	0.10	73.52	0.12	29.51	0.31
05-09-2025 17:15	7.83	28.93	241.14	-9.32	8.45	10.53	0.09	9.85	0.17	19.96	0.46
05-09-2025 17:20	7.74	28.94	241.17	-9.13	8.85	20.36	0.22	27.63	0.28	16.41	0.33
05-09-2025 17:25	7.75	28.95	241.09	-8.89	9.52	88.88	0.13	46.05	0.17	56.53	0.34
05-09-2025 17:30	7.87	28.95	241.08	-8.93	9.45	64.14	0.16	39.95	0.18	29.04	0.6
05-09-2025 17:35	7.83	28.97	241.33	-9.36	8.21	29.09	0.11	29.81	0.16	18.71	0.46
05-09-2025 17:40	7.82	28.99	241.31	-9.32	8.32	81.56	0.11	27.11	0.1	341.95	0.31
05-09-2025 17:45	7.82	28.99	241.32	-9.41	8.09	82.3	0.08	43.77	0.14	7.29	0.74
05-09-2025 17:50	7.82	29.01	241.33	-9.4	8.12	83.51	0.12	78.51	0.21	49.05	0.36
05-09-2025 17:55	7.75	29.03	241.22	-9.24	8.53	52.93	0.06	84.48	0.11	43.74	0.14
05-09-2025 18:00	7.8	29.04	241.19	-9.05	9.1	134.96	0.07	140.18	0.13	191.06	0.21
05-09-2025 18:05	7.8	29.07	241.11	-8.89	9.54	75.36	0.06	82.99	0.1	159.07	0.14
05-09-2025 18:10	7.82	29.08	241.37	-9.39	8.17	51.69	0.05	105.55	0.11	154.07	0.22
05-09-2025 18:15	7.89	29.09	241.14	-8.93	9.43	75.25	0.06	77.93	0.09	12.45	0.04
05-09-2025 18:20	7.9	29.09	240.82	-8.44	10.77	274.24	0.07	302.94	0.05	213.58	0.02
05-09-2025 18:25	7.77	29.08	240.67	-8.17	11.54	352.46	0.07	346.07	0.1	23.42	0.29
05-09-2025 18:30	7.86	29.05	241.1	-8.81	9.76	173.42	0.08	182.36	0.06	35.56	0.28
05-09-2025 18:35	7.86	29.04	241.44	-9.67	7.37	217.15	0.06	214.65	0.06	30.27	0.17
05-09-2025 18:40	7.88	29.03	241.05	-8.92	9.46	298.69	0.09	269.45	0.05	356.66	0.17
05-09-2025 18:45	7.89	29.02	241.08	-9.07	9.03	146.84	0.07	91.99	0.11	330.13	0.27
05-09-2025 18:50	7.9	28.97	241.11	-9.11	8.96	41.72	0.12	12.99	0.11	306.66	0.52
05-09-2025 18:55	7.8	28.93	241.2	-9.2	8.68	69.22	0.14	64.16	0.16	335.74	0.35
05-09-2025 19:00	7.92	28.94	241.33	-9.42	8.07	103.08	0.21	118.23	0.15	312.45	0.39
05-09-2025 19:05	7.95	28.97	241.28	-9.39	8.12	291.55	0.09	280.85	0.06	16.48	0.66
05-09-2025 19:10	7.82	28.96	241.14	-9.04	9.1	280.16	0.11	297.79	0.11	354.95	0.33
05-09-2025 19:15	7.94	28.94	240.94	-8.69	10.12	216.24	0.16	202.97	0.17	33.81	0.38
05-09-2025 19:20	7.84	28.94	240.86	-8.45	10.74	235.78	0.17	267.75	0.11	23.98	0.43
05-09-2025 19:25	7.86	28.95	240.93	-8.61	10.3	227.5	0.20	232.59	0.17	43	0.23
05-09-2025 19:30	7.86	28.97	240.8	-8.26	11.25	209.56	0.24	227.6	0.14	30.13	0.45
05-09-2025 19:35	7.93	28.98	240.93	-8.54	10.48	232.32	0.22	238.28	0.16	31.19	0.31
05-09-2025 19:40	7.91	28.99	240.83	-8.28	11.21	249.27	0.21	266.03	0.16	359.77	0.21
05-09-2025 19:45	7.87	29	240.7	-8.09	11.76	244.98	0.21	261.89	0.14	44.65	0.3
05-09-2025 19:50	7.9	29.01	240.58	-7.94	12.19	213.77	0.23	201.41	0.2	324.56	0.08
05-09-2025 19:55	7.98	29.03	240.78	-8.27	11.32	218.42	0.21	211.51	0.16	24.73	0.32
05-09-2025 20:00	7.86	29.05	240.82	-8.29	11.19	253.97	0.15	270.23	0.16	22.51	0.54
05-09-2025 20:05	7.9	29.06	241.13	-9	9.22	229.33	0.19	244.82	0.13	29.77	0.35
05-09-2025 20:10	7.91	29.07	241.16	-9.01	9.17	227.44	0.17	231.26	0.1	53.14	0.3
05-09-2025 20:15	7.94	29.08	241.23	-9.29	8.4	242.64	0.17	270.9	0.09	13.65	0.68
05-09-2025 20:20	7.79	29.1	240.86	-8.49	10.6	258.4	0.17	244.74	0.13	6.27	0.27
05-09-2025 20:25	7.83	29.11	240.9	-8.57	10.42	204.76	0.21	208.52	0.24	337.14	0.17
05-09-2025 20:30	7.8	29.12	241.08	-8.86	9.61	221.54	0.20	211.08	0.17	16.61	0.19
05-09-2025 20:35	7.83	29.14	241.06	-8.92	9.43	215.43	0.19	219.45	0.16	2.24	0.09
05-09-2025 20:40	7.87	29.15	241.06	-8.95	9.34	229.69	0.16	234.24	0.1	11.03	0.37
05-09-2025 20:45	7.86	29.16	240.92	-8.74	9.94	232.4	0.16	257.12	0.12	24.98	0.45
05-09-2025 20:50	7.85	29.16	240.65	-8.3	11.1	238.42	0.14	265.16	0.13	9.17	0.29
05-09-2025 20:55	7.81	29.17	240.8	-8.51	10.53	286.28	0.17	294.9	0.12	16.37	0.42
05-09-2025 21:00	7.69	29.19	240.72	-8.33	11.02	220.78	0.17	229.55	0.14	30.35	0.15
05-09-2025 21:05	7.8	29.2	240.99	-8.89	9.46	195.54	0.26	203.83	0.25	47.97	0.24

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
05-09-2025 21:10	7.79	29.21	240.9	-8.73	9.91	219.08	0.08	227.71	0.11	24.29	0.6
05-09-2025 21:15	7.73	29.22	240.64	-8.32	11.03	214.96	0.10	231.73	0.11	355.64	0.32
05-09-2025 21:20	7.68	29.22	240.86	-8.77	9.62	191.98	0.17	182.24	0.18	33.65	0.33
05-09-2025 21:25	7.73	29.23	240.09	-8.41	7.91	192.08	0.09	175.97	0.16	138.4	0.14
05-09-2025 21:30	7.69	29.24	239.08	-7.26	8.61	210.79	0.05	228.91	0.07		
05-09-2025 21:35	7.68	29.24	235.9	-3.06	9.97	195.65	0.19	193.27	0.19		
05-09-2025 21:40	7.73	29.26	234.22	-2.76	6.09	194.39	0.05	200.08	0.13		
05-09-2025 21:45	7.6	29.27	233.54	-0.82	8.07	9.05	0.05	11.53	0.09	311.07	0.35
05-09-2025 21:50	7.61	29.3	233.27	-0.37	8.19	142.95	0.15	139.51	0.22		
05-09-2025 21:55	7.74	29.3	232.67	-0.75	6.3	150.15	0.21	157.03	0.16	243.38	0.49
05-09-2025 22:00	7.59	29.3	233.02	-0.07	8.05	75.6	0.07	15.67	0.07		
05-09-2025 22:05	7.68	29.31	232.67	-0.76	6.27	150.64	0.12	157.63	0.13	130.43	0.36
05-09-2025 22:10	7.55	29.31	232.96	-0.06	8.08	282.77	0.06	336.12	0.07		
05-09-2025 22:15	7.62	29.31	232.64	-0.75	6.28	163.22	0.12	157.18	0.15	63.48	0.74
05-09-2025 22:20	7.45	29.32	232.54	-0.7	6.38	144.71	0.06	32.47	0.01		
05-09-2025 22:25	7.52	29.31	232.76	-0.54	6.81	162.8	0.22	168.33	0.25	75.67	0.35
05-09-2025 22:30	7.59	29.33	232.57	-0.98	5.68	149.71	0.08	130.75	0.07	33.03	0.61
05-09-2025 22:35	7.51	29.32	232.49	-1	5.56	237.54	0.01	342.25	0.05	43.74	0.6
05-09-2025 22:40	7.46	29.32	232.5	-1	5.57	121.57	0.09	129.04	0.06	60.79	0.49
05-09-2025 22:45	7.55	29.33	232.61	-0.73	6.3	154.19	0.10	158.19	0.17	124.93	0.45
05-09-2025 22:50	7.47	29.34	232.71	-0.65	6.56	66.88	0.05	61.73	0.07		
05-09-2025 22:55	7.44	29.34	232.72	-0.66	6.51	54.92	0.03	130.48	0.07	82.79	0.52
05-09-2025 23:00	7.47	29.34	232.48	-1.14	5.25	134.42	0.09	145.88	0.11		
05-09-2025 23:05	7.37	29.34	232.85	-0.4	7.13	7.25	0.06	1.1	0.08		
05-09-2025 23:10	7.41	29.33	232.52	-0.92	5.78	146.61	0.09	105.1	0.13	63.32	0.76
05-09-2025 23:15	7.4	29.24	232.86	-1.26	5.94	207.82	0.04	81.2	0.03	83.94	0.56
05-09-2025 23:20	7.41	29.19	233.23	-1.18	7.04	154.39	0.02	88.54	0.11	40.75	0.55
05-09-2025 23:25	7.48	29.17	233.38	-2.32	5.51	105.89	0.04	78.5	0.11	75.17	0.76
05-09-2025 23:30	7.36	29.17	234.4	-2.31	8.02	359.97	0.07	17.5	0.13	50.69	0.54
05-09-2025 23:35	7.44	29.16	234.86	-2.93	7.88	129.61	0.07	104.09	0.09	59.1	0.57
05-09-2025 23:40	7.35	29.12	234.81	-3.74	6.1	25.23	0.07	28.85	0.16	46.01	1.01
05-09-2025 23:45	7.35	29.1	235.13	-4.36	5.57	11.94	0.09	33.06	0.17		
05-09-2025 23:50	7.35	29.1	235.43	-4.97	4.98	24	0.10	39.17	0.13		
05-09-2025 23:55	7.33	29.08	235.85	-5.15	5.61	355.71	0.11	43.04	0.13	50.68	0.71
06-09-2025 00:00	7.36	29.1	236.21	-6.13	4.5	0.57	0.12	31.77	0.17	48.45	0.79
06-09-2025 00:05	7.35	29.18	237.05	-5.3	8.45	13.33	0.18	24.99	0.21	26.21	0.88
06-09-2025 00:10	7.29	29.31	237.42	-5.96	7.91	7.63	0.12	18.77	0.17	33.14	0.49
06-09-2025 00:15	7.38	29.42	237.45	-6.6	6.29	39.57	0.11	42.55	0.11	58.23	0.39
06-09-2025 00:20	7.34	29.53	237.34	-7.7	3.39	8.77	0.23	16.24	0.27		
06-09-2025 00:25	7.41	29.57	237.32	-8.49	1.56	27.25	0.23	35.16	0.22	66.94	0.59
06-09-2025 00:30	7.36	29.53	237.41	-8.08	2.65	24.18	0.31	25.54	0.23		
06-09-2025 00:35	7.28	29.52	237.44	-5.79	8.7	26.58	0.27	37.1	0.2		
06-09-2025 00:40	7.3	29.55	237.39	-5.74	8.83	60.72	0.28	95.36	0.12		
06-09-2025 00:45	7.31	29.54	237.39	-6.17	7.69	272.28	0.31	262.55	0.21	269.6	0.67
06-09-2025 00:50	7.32	29.44	237.33	-6.09	7.84	274.71	0.37	260.45	0.33		
06-09-2025 00:55	7.33	29.34	237.38	-6.25	7.44	288.25	0.44	279.25	0.48	285.26	0.95
06-09-2025 01:00	7.33	29.34	237.39	-6.54	6.67	293.8	0.52	283.44	0.43		
06-09-2025 01:05	7.24	29.31	237.39	-6.62	6.46	42.26	0.39	53.24	0.34		
06-09-2025 01:10	7.29	29.31	237.29	-7.3	4.52	57.44	0.40	65.2	0.32		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
06-09-2025 01:15	7.26	29.3	237.22	-7.55	3.78	54.59	0.35	62.24	0.32	44.76	0.59
06-09-2025 01:20	7.27	29.26	237.27	-7.26	4.58	51.64	0.41	52.72	0.36		
06-09-2025 01:25	7.27	29.29	237.19	-7.83	2.93	51.25	0.42	57.95	0.43		
06-09-2025 01:30	7.28	29.28	237.16	-7.75	3.09	49.37	0.41	56.1	0.4		
06-09-2025 01:35	7.34	29.25	237.2	-7.17	4.69	47.38	0.43	60.01	0.38		
06-09-2025 01:40	7.37	29.23	237.29	-7.09	5.18	30.84	0.47	34.94	0.4	54.38	0.89
06-09-2025 01:45	7.33	29.24	237.47	-7.03	5.83	34.01	0.39	40.08	0.45		
06-09-2025 01:50	7.38	29.23	237.64	-7.03	6.37	46.23	0.32	52.39	0.35	46.41	0.8
06-09-2025 01:55	7.39	29.23	237.93	-7.07	7.02	22.71	0.35	47.4	0.41		
06-09-2025 02:00	7.36	29.24	237.96	-7.47	6.02	22.5	0.33	33.62	0.41		
06-09-2025 02:05	7.37	29.22	238.04	-7.04	7.35	34.04	0.37	40.45	0.37		
06-09-2025 02:10	7.35	29.2	238.17	-7.09	7.64	32.66	0.32	38.29	0.4	36.6	0.83
06-09-2025 02:15	7.39	29.23	238.19	-7.37	6.91	33.5	0.32	42.05	0.38		
06-09-2025 02:20	7.32	29.24	238.21	-7.33	7.01	24.69	0.37	41.37	0.38		
06-09-2025 02:25	7.37	29.21	238.2	-7.08	7.63	42.07	0.25	56.04	0.34	77.97	0.59
06-09-2025 02:30	7.29	29.22	238.21	-7.04	7.73	40.53	0.25	48.77	0.34	61.29	0.75
06-09-2025 02:35	7.39	29.23	238.31	-7.21	7.47	53.07	0.29	57.5	0.29		
06-09-2025 02:40	7.41	29.26	238.27	-7.17	7.56	32.37	0.36	38.26	0.44		
06-09-2025 02:45	7.37	29.32	238.28	-7.39	6.96	35.35	0.33	45.85	0.43	68.35	0.84
06-09-2025 02:50	7.46	29.38	238.27	-7.5	6.66	40.84	0.35	53.76	0.33		
06-09-2025 02:55	7.45	29.4	238.29	-7.48	6.72	31.33	0.35	48.66	0.43	53.6	0.5
06-09-2025 03:00	7.44	29.39	238.28	-7.47	6.74	42.21	0.34	44.9	0.43		
06-09-2025 03:05	7.44	29.38	238.25	-7.3	7.16	41.33	0.39	51.32	0.38		
06-09-2025 03:10	7.46	29.38	238.27	-7.26	7.3	58.52	0.25	60.68	0.32		
06-09-2025 03:15	7.49	29.45	238.29	-8.06	5.03	54.09	0.35	57.93	0.37	80.69	0.6
06-09-2025 03:20	7.49	29.44	238.31	-8.09	5	51.47	0.37	64.89	0.39	56.82	0.53
06-09-2025 03:25	7.51	29.43	238.31	-7.48	6.64	59.12	0.32	59.55	0.34	86.57	0.35
06-09-2025 03:30	7.62	29.4	238.35	-7.98	5.33	46.5	0.28	68.06	0.3	72.46	0.31
06-09-2025 03:35	7.53	29.46	238.3	-7.38	6.93	53.67	0.37	55.69	0.36	25.87	0.63
06-09-2025 03:40	7.61	29.47	238.33	-7.81	5.78	66.77	0.25	77.69	0.27	52.27	0.38
06-09-2025 03:45	7.56	29.44	238.37	-8.04	5.17	292.14	0.37	281.4	0.41	290.34	0.49
06-09-2025 03:50	7.62	29.42	238.51	-7.71	6.64	275.12	0.43	282.76	0.5		
06-09-2025 03:55	7.64	29.39	238.88	-9.02	3.95	288.77	0.45	289.88	0.5	294.05	0.51
06-09-2025 04:00	7.62	29.4	239.09	-9.54	2.71	284.08	0.48	288.54	0.5	309.12	0.64
06-09-2025 04:05	7.63	29.39	239.05	-9	4.13	64.26	0.32	68.8	0.28	119.12	0.36
06-09-2025 04:10	7.62	29.37	238.84	-8.09	6.56	54.63	0.23	59.16	0.22	29.05	0.44
06-09-2025 04:15	7.73	29.33	238.83	-8.04	6.7	81.15	0.17	89.5	0.2		
06-09-2025 04:20	7.76	29.31	238.82	-7.61	7.87	63.04	0.25	62.74	0.22	55.75	0.36
06-09-2025 04:25	7.71	29.31	238.79	-7.67	7.7	60.65	0.32	73.27	0.22	43.06	0.35
06-09-2025 04:30	7.71	29.39	238.84	-7.75	7.45	64.49	0.21	74.23	0.22	43.76	0.28
06-09-2025 04:35	7.75	29.39	238.75	-7.59	7.91	83.89	0.20	62.8	0.2	28.6	0.59
06-09-2025 04:40	7.83	29.35	238.8	-7.91	6.95	79.08	0.18	71.55	0.2	34.72	0.41
06-09-2025 04:45	7.81	29.38	238.75	-7.65	7.68	50.48	0.23	44.04	0.22	23.56	0.5
06-09-2025 04:50	7.9	29.36	238.74	-7.51	8.16	63.34	0.21	77.95	0.17	32.03	0.14
06-09-2025 04:55	7.73	29.36	238.71	-7.24	8.87	52.65	0.17	60.06	0.14	56.31	0.24
06-09-2025 05:00	7.81	29.41	238.77	-7.36	8.55	82.71	0.22	92.69	0.19	60.9	0.29
06-09-2025 05:05	7.8	29.38	238.67	-7.27	8.81	75.57	0.16	78.43	0.13	50.44	0.24
06-09-2025 05:10	7.92	29.31	238.79	-7.75	7.45	62.77	0.10	85.22	0.13	85.54	0.19
06-09-2025 05:15	7.9	29.3	238.84	-8.05	6.58	20.21	0.13	16.19	0.15	17.8	0.48

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
06-09-2025 05:20	7.94	29.32	238.72	-7.47	8.28	50.36	0.11	39.49	0.1	21.29	0.15
06-09-2025 05:25	7.98	29.34	238.82	-8.03	6.66	41.3	0.16	52.25	0.15	29.5	0.45
06-09-2025 05:30	7.95	29.32	238.81	-7.89	7.03	39.65	0.20	26.96	0.19	4.56	0.44
06-09-2025 05:35	7.97	29.31	238.76	-7.82	7.23	70.18	0.20	78.37	0.1	38.9	0.18
06-09-2025 05:40	7.92	29.3	238.77	-7.59	7.85	42.15	0.16	34.35	0.14	18.26	0.33
06-09-2025 05:45	7.91	29.3	238.79	-7.73	7.53	113.95	0.10	117.61	0.09	61.73	0.28
06-09-2025 05:50	7.91	29.3	238.87	-8.01	6.67	96.21	0.17	100.06	0.14	41.62	0.28
06-09-2025 05:55	8.02	29.3	238.9	-8.06	6.55	95.1	0.12	131.16	0.12	96.96	0.16
06-09-2025 06:00	8.07	29.3	238.95	-8.32	5.91	93.08	0.08	85.65	0.06	33	0.32
06-09-2025 06:05	8.02	29.31	238.92	-8.11	6.43	29.46	0.07	19.64	0.12	24.75	0.29
06-09-2025 06:10	8.06	29.31	238.81	-7.84	7.19	58.95	0.11	30.31	0.09	18.79	0.23
06-09-2025 06:15	8.05	29.31	238.51	-6.72	10.41	61.96	0.14	17.41	0.08	34.1	0.13
06-09-2025 06:20	8.05	29.31	238.63	-7.05	9.44	60.75	0.03	87.51	0.04	91.74	0.27
06-09-2025 06:25	8.16	29.31	238.65	-7.34	8.56	324.81	0.04	348.38	0.08	148.5	0.01
06-09-2025 06:30	8.15	29.31	238.71	-7.42	8.36	11.96	0.14	343.08	0.15	108.89	0.11
06-09-2025 06:35	8.14	29.31	238.68	-7.43	8.33	12.67	0.05	303.11	0.07	94.19	0.08
06-09-2025 06:40	8.12	29.31	238.69	-7.45	8.27	346.73	0.05	329.21	0.05	41.33	0.21
06-09-2025 06:45	8.13	29.31	238.59	-7.22	8.96	118.11	0.07	21.32	0.08	148.12	0.19
06-09-2025 06:50	8.09	29.31	238.57	-7.16	9.14	100.95	0.10	79.6	0.07	137.97	0.2
06-09-2025 06:55	8.16	29.31	238.7	-7.73	7.51	87.1	0.12	52.41	0.1	142.55	0.13
06-09-2025 07:00	8.12	29.3	238.69	-7.53	8.07	44.98	0.08	2.57	0.13	170.21	0.12
06-09-2025 07:05	8.2	29.27	238.67	-7.55	8.09	216	0.06	297.78	0.06	234.89	0.02
06-09-2025 07:10	8.21	29.15	238.73	-7.81	7.3	304.68	0.11	329.11	0.15	11.48	0.24
06-09-2025 07:15	8.14	29.08	238.66	-7.67	7.64	288.41	0.11	310.45	0.08	14.88	0.18
06-09-2025 07:20	8.09	29.04	238.8	-7.89	7.04	308.31	0.04	246.82	0.1	61.38	0.17
06-09-2025 07:25	8.13	29.03	238.81	-7.98	6.79	239.77	0.08	208.71	0.04	38.74	0.14
06-09-2025 07:30	8.13	28.99	238.82	-7.84	7.15	283.83	0.13	263.28	0.07	22.47	0.16
06-09-2025 07:35	8.11	28.98	238.77	-7.59	7.87	291.8	0.17	284.54	0.11	339.93	0.06
06-09-2025 07:40	8.17	28.97	238.78	-7.79	7.31	276.31	0.19	239.57	0.07	108.94	0.12
06-09-2025 07:45	8.19	28.96	238.72	-7.3	8.74	319.51	0.12	302.56	0.11	30.59	0.21
06-09-2025 07:50	8.14	28.97	238.73	-7.22	8.97	304.79	0.14	288.22	0.13	138.76	0.1
06-09-2025 07:55	8.17	28.96	238.77	-7.27	8.84	278.31	0.13	248.13	0.09	57.51	0.14
06-09-2025 08:00	8.14	28.97	238.82	-7.39	8.47	278.93	0.15	277.28	0.15	215.5	0.01
06-09-2025 08:05	8.11	28.97	238.8	-7.27	8.83	279.36	0.10	284.62	0.14	157.27	0.07
06-09-2025 08:10	8.21	28.97	238.82	-7.35	8.6	231.22	0.10	212.27	0.09	184.1	0.17
06-09-2025 08:15	8.1	28.97	238.61	-6.54	10.89	306.01	0.18	320.42	0.16	175.67	0.21
06-09-2025 08:20	8.1	28.98	238.65	-6.69	10.51	228.97	0.03	218.04	0.09	183.87	0.36
06-09-2025 08:25	8.12	28.99	238.63	-6.68	10.54	253.68	0.08	235.53	0.05	178.75	0.11
06-09-2025 08:30	8.08	28.99	238.71	-6.79	10.25	246.58	0.10	274.67	0.07	155.28	0.15
06-09-2025 08:35	8.06	28.99	238.69	-6.8	10.21	267.58	0.12	225.27	0.12	193.19	0.28
06-09-2025 08:40	8.18	28.99	238.85	-7.24	8.91	259.28	0.03	237.01	0.06	197.13	0.18
06-09-2025 08:45	8.06	29	238.82	-7.1	9.33	307.51	0.10	306.24	0.13	206.51	0.09
06-09-2025 08:50	8.04	29	238.77	-6.95	9.75	229.8	0.09	244.7	0.01	188.07	0.27
06-09-2025 08:55	7.99	29.01	238.74	-6.84	10.04	241.81	0.11	238.73	0.11	186.35	0.26
06-09-2025 09:00	8.07	29.01	238.95	-7.37	8.57	180.61	0.05	204.01	0.11	191.64	0.33
06-09-2025 09:05	8.03	29.02	238.85	-7.31	8.71	290.87	0.12	302.15	0.16	205.37	0.17
06-09-2025 09:10	7.94	29.02	238.82	-7.1	9.31	290.46	0.07	254.68	0.09	200.81	0.25
06-09-2025 09:15	8.02	29	238.81	-7.22	8.95	212.03	0.13	201.44	0.09	188.83	0.42
06-09-2025 09:20	7.97	28.98	238.69	-6.5	10.99	242.93	0.09	249.24	0.06	220.63	0.33

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
06-09-2025 09:25	7.89	28.98	238.68	-6.76	10.3	264.41	0.07	227.87	0.06	206.22	0.31
06-09-2025 09:30	7.9	28.97	238.76	-7	9.57	202.02	0.13	190.75	0.21	200.3	0.53
06-09-2025 09:35	7.88	28.97	238.81	-7.2	9.02	193.64	0.20	181.88	0.19	194.35	0.45
06-09-2025 09:40	7.94	28.96	238.83	-7.16	9.12	193.75	0.14	190.9	0.11	197.06	0.33
06-09-2025 09:45	7.86	28.98	238.8	-7.32	8.68	79.46	0.16	156.95	0.05	148.61	0.54
06-09-2025 09:50	7.84	28.97	238.8	-7.42	8.4	127.61	0.08	145.25	0.11	138.87	0.6
06-09-2025 09:55	7.87	28.95	238.85	-7.52	8.09	127.36	0.03	173.05	0.07	165.79	0.41
06-09-2025 10:00	7.85	28.96	238.84	-7.33	8.63	66.43	0.09	28.18	0.07	143.23	0.4
06-09-2025 10:05	7.8	28.95	238.76	-7.33	8.66	245.39	0.05	263.48	0.04	211.69	0.31
06-09-2025 10:10	7.87	28.94	238.79	-7.45	8.33	238.26	0.07	142.98	0.03	170.02	0.27
06-09-2025 10:15	7.76	28.95	238.68	-6.91	9.82	287.34	0.07	320.58	0.07	196.84	0.33
06-09-2025 10:20	7.83	28.95	238.78	-7.07	9.38	204.09	0.11	208.89	0.09	207.06	0.42
06-09-2025 10:25	7.75	28.95	238.81	-7.23	8.91	321.71	0.06	295.06	0.03	214.71	0.3
06-09-2025 10:30	7.78	28.95	238.88	-7.32	8.62	283.21	0.05	228.96	0.04	191.02	0.39
06-09-2025 10:35	7.63	28.95	238.78	-6.86	9.93	240	0.15	249.35	0.05	203.63	0.24
06-09-2025 10:40	7.72	28.94	238.73	-6.89	9.88	204.12	0.11	178.97	0.15	185.3	0.49
06-09-2025 10:45	7.72	28.94	238.72	-6.81	10.12	303.74	0.09	289.63	0.03	198.61	0.25
06-09-2025 10:50	7.7	28.94	238.82	-7.16	9.12	255.03	0.05	14.41	0.07	202.21	0.21
06-09-2025 10:55	7.66	28.94	238.78	-7.06	9.39	206.23	0.03	150.35	0.01	206.2	0.43
06-09-2025 11:00	7.6	28.94	238.83	-7.08	9.34	239.04	0.06	194.19	0.06	208.66	0.5
06-09-2025 11:05	7.55	28.93	238.79	-6.82	10.05	241.66	0.04	210.17	0.02	186.85	0.23
06-09-2025 11:10	7.58	28.93	238.75	-7.06	9.4	207.19	0.08	174.68	0.06	175.11	0.39
06-09-2025 11:15	7.5	28.93	238.8	-7.23	8.87	303.38	0.03	11.48	0.02	199.84	0.26
06-09-2025 11:20	7.55	28.93	238.91	-7.5	8.13	182.81	0.09	171.04	0.09	207.19	0.31
06-09-2025 11:25	7.5	28.93	238.9	-7.39	8.44	259.95	0.05	205.26	0.08		
06-09-2025 11:30	7.46	28.93	238.8	-7.19	9	190.92	0.04	181.59	0.1	167.29	0.41
06-09-2025 11:35	7.51	28.93	238.93	-7.42	8.3	194.42	0.09	206.85	0.19	175.94	0.4
06-09-2025 11:40	7.46	28.93	238.79	-7.11	9.19	251.26	0.05	242.43	0.08	179.12	0.41
06-09-2025 11:45	7.54	28.93	238.84	-7.29	8.72	144.05	0.03	151.03	0.08	194.41	0.28
06-09-2025 11:50	7.45	28.93	238.86	-7.35	8.56	6.26	0.07	0.07	0.08	354.93	0.02
06-09-2025 11:55	7.46	28.93	238.7	-6.79	10.17	209.55	0.05	159.7	0.07	130.62	0.06
06-09-2025 12:00	7.44	28.93	238.71	-6.76	10.24	336	0.07	136.58	0.06	358.82	0.13
06-09-2025 12:05	7.51	28.93	238.76	-6.99	9.58	179.47	0.02	180.75	0.03	56.54	0.25
06-09-2025 12:10	7.38	28.94	238.72	-6.73	10.28	351.63	0.12	333.5	0.07	27.72	0.32
06-09-2025 12:15	7.43	28.93	238.79	-6.87	9.95	82.75	0.03	91.79	0.08		
06-09-2025 12:20	7.43	28.93	238.87	-7.08	9.32	350.06	0.11	21.87	0.13	336.55	0.21
06-09-2025 12:25	7.34	28.93	238.94	-7.39	8.43	1.01	0.10	2.63	0.09		
06-09-2025 12:30	7.38	28.93	239.1	-7.88	7.01	178.49	0.11	125.21	0.11		
06-09-2025 12:35	7.3	28.93	239	-7.59	7.81	93.12	0.03	69.36	0.12	326.7	0.34
06-09-2025 12:40	7.32	28.93	238.99	-7.59	7.82	155.16	0.10	100.87	0.13		
06-09-2025 12:45	7.34	28.94	238.91	-7.36	8.5	178.58	0.09	225.87	0.1		
06-09-2025 12:50	7.39	28.94	238.92	-7.66	7.64	322.04	0.13	293.15	0.17		
06-09-2025 12:55	7.31	28.94	238.86	-7.43	8.3	322.51	0.12	287.52	0.19		
06-09-2025 13:00	7.4	28.93	238.89	-7.59	7.84	237.3	0.01	253.05	0.07	4.53	0.53
06-09-2025 13:05	7.33	28.94	238.94	-7.64	7.67	355.65	0.12	26.55	0.2		
06-09-2025 13:10	7.27	28.93	238.8	-7.39	8.37	357.05	0.05	38.99	0.09		
06-09-2025 13:15	7.28	28.93	238.78	-7.08	9.31	57.82	0.05	73.79	0.1		
06-09-2025 13:20	7.33	28.93	238.89	-7.34	8.56	48.98	0.13	59.56	0.11		
06-09-2025 13:25	7.25	28.93	238.8	-7.09	9.27	9.61	0.11	28.79	0.19		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
06-09-2025 13:30	7.23	28.93	238.89	-7.25	8.8	42.53	0.04	56.23	0.14		
06-09-2025 13:35	7.27	28.94	238.77	-6.76	10.11	44.8	0.06	61.24	0.14		
06-09-2025 13:40	7.22	28.94	238.78	-6.97	9.56	5.37	0.14	35.2	0.2		
06-09-2025 13:45	7.3	28.94	238.53	-6.08	11.99	49.62	0.09	68.66	0.13		
06-09-2025 13:50	7.25	28.94	238.62	-6.23	11.68	25.4	0.19	26.15	0.21		
06-09-2025 13:55	7.27	28.96	238.69	-6.52	10.97	25	0.17	49.88	0.17		
06-09-2025 14:00	7.27	29	238.6	-6.03	12.29	39.66	0.15	55.95	0.19		
06-09-2025 14:05	7.3	29.04	238.54	-6.06	12.2	44	0.15	45.34	0.19		
06-09-2025 14:10	7.26	29.02	238.4	-5.65	13.3	21.48	0.23	37.02	0.24		
06-09-2025 14:15	7.24	28.96	238.36	-5.48	13.86	27.03	0.16	32.22	0.2		
06-09-2025 14:20	7.31	28.94	238.4	-5.5	13.97	44.51	0.23	32.71	0.19		
06-09-2025 14:25	7.28	28.93	238.51	-5.71	13.44	6.63	0.18	27.06	0.19	262.93	0.19
06-09-2025 14:30	7.39	28.93	238.57	-5.85	13.06	51.2	0.09	48.21	0.19		
06-09-2025 14:35	7.29	28.92	238.53	-5.94	12.78	9.98	0.27	7.2	0.24		
06-09-2025 14:40	7.28	28.92	238.55	-5.87	12.97	13.61	0.12	39.98	0.18	339.98	0.1
06-09-2025 14:45	7.29	28.91	238.56	-5.93	12.81	38.86	0.19	43.65	0.24		
06-09-2025 14:50	7.29	28.9	238.58	-5.95	12.78	39.69	0.20	51.24	0.22	43.27	0.11
06-09-2025 14:55	7.31	28.89	238.57	-6	12.66	34.48	0.18	50.08	0.19		
06-09-2025 15:00	7.35	28.89	238.57	-5.96	12.75	40.67	0.18	63.14	0.22		
06-09-2025 15:05	7.34	28.88	238.58	-5.88	12.98	15.38	0.16	39.97	0.22		
06-09-2025 15:10	7.3	28.86	238.62	-6.11	12.33	16.74	0.14	37.9	0.22	23.08	0.24
06-09-2025 15:15	7.42	28.86	238.59	-6	12.64	29.72	0.18	57.81	0.27		
06-09-2025 15:20	7.32	28.86	238.59	-5.93	12.97	22.85	0.29	32.32	0.29		
06-09-2025 15:25	7.35	28.86	238.79	-6.33	12.29	37.05	0.10	79.76	0.16		
06-09-2025 15:30	7.38	28.86	238.79	-6.48	11.93	41.29	0.17	42.19	0.23		
06-09-2025 15:35	7.44	28.86	238.96	-6.91	10.7	48.18	0.20	49.53	0.2	9.84	0.35
06-09-2025 15:40	7.44	28.87	238.97	-7.06	10.28	33.64	0.29	24.5	0.22	3.18	0.49
06-09-2025 15:45	7.43	28.87	238.87	-6.89	10.77	303.78	0.28	276.82	0.26	304.54	0.46
06-09-2025 15:50	7.46	28.87	238.82	-6.74	11.14	293.01	0.25	290.8	0.31	317.09	0.64
06-09-2025 15:55	7.42	28.87	238.76	-6.55	11.7	306.91	0.26	297.39	0.29	318.17	0.86
06-09-2025 16:00	7.48	28.87	238.76	-6.38	12.15	258.78	0.21	280.75	0.23	314.4	0.38
06-09-2025 16:05	7.49	28.87	238.68	-6.16	12.81	29.96	0.17	30.18	0.2	24.26	0.57
06-09-2025 16:10	7.51	28.86	238.58	-5.66	14.42	4.29	0.17	45.63	0.22	36.9	0.52
06-09-2025 16:15	7.54	28.86	238.62	-5.91	13.83	36.83	0.16	11.38	0.15	35.61	0.34
06-09-2025 16:20	7.61	28.86	238.64	-5.9	13.85	2.11	0.23	33.25	0.24	21.05	0.43
06-09-2025 16:25	7.58	28.86	238.57	-5.72	14.35	4.25	0.23	23.91	0.22	32.83	0.49
06-09-2025 16:30	7.53	28.86	238.66	-5.81	14.12	0.32	0.19	28.87	0.19	40.67	0.34
06-09-2025 16:35	7.52	28.87	238.66	-5.78	14.28	52.39	0.10	54.68	0.18	36.67	0.46
06-09-2025 16:40	7.62	28.88	238.67	-5.91	13.98	11.14	0.12	31.71	0.14	28.82	0.31
06-09-2025 16:45	7.53	28.89	238.69	-5.96	13.83	21.96	0.21	39.02	0.23	36.96	0.49
06-09-2025 16:50	7.61	28.9	238.7	-6.01	13.69	69.39	0.12	102.49	0.13	76.9	0.36
06-09-2025 16:55	7.65	28.91	238.86	-6.28	13.07	21.21	0.13	56.26	0.11	51.42	0.22
06-09-2025 17:00	7.62	28.92	238.85	-6.3	13.14	20.06	0.08	151.59	0.02	43.17	0.26
06-09-2025 17:05	7.66	28.93	238.73	-6.02	13.84	82.22	0.03	315.08	0.05		
06-09-2025 17:10	7.69	28.93	238.8	-6.08	13.64	337	0.17	18.9	0.12	58.47	0.47
06-09-2025 17:15	7.67	28.93	238.71	-5.87	14.23	24.59	0.10	35.52	0.13	43.14	0.44
06-09-2025 17:20	7.74	28.92	239.63	-7.24	12.64	335.91	0.03	339.64	0.04	72.62	0.2
06-09-2025 17:25	7.76	28.91	239.93	-7.58	12.71	343.89	0.13	7.93	0.19	27.63	0.5
06-09-2025 17:30	7.78	28.9	239.8	-7.33	13.52	5.78	0.16	46.11	0.09	26.05	0.55

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
06-09-2025 17:35	7.79	28.89	239.86	-7.5	13.04	327.19	0.11	34.68	0.17	47.55	0.53
06-09-2025 17:40	7.8	28.88	239.87	-7.6	12.74	27.53	0.09	26.1	0.21	32.69	0.56
06-09-2025 17:45	7.84	28.87	239.88	-7.66	12.64	10.44	0.17	32.48	0.19	39.3	0.62
06-09-2025 17:50	7.78	28.87	239.79	-7.48	13.13	278.81	0.05	167.64	0.01	39.06	0.47
06-09-2025 17:55	7.89	28.86	240.02	-7.78	12.3	38.78	0.09	56.15	0.12	46.17	0.58
06-09-2025 18:00	7.81	28.86	240.09	-7.79	12.25	353.83	0.19	19.23	0.23	20.58	0.46
06-09-2025 18:05	7.88	28.86	240.18	-8.06	11.45	62.84	0.10	41.24	0.15	49.63	0.4
06-09-2025 18:10	7.87	28.86	240.09	-7.9	11.91	29.53	0.10	41.55	0.16	20.77	0.48
06-09-2025 18:15	7.86	28.86	240.03	-7.81	12.19	348.9	0.12	36.8	0.1	32.14	0.59
06-09-2025 18:20	7.9	28.86	240.13	-7.91	11.86	24.72	0.12	15.61	0.19	41.3	0.63
06-09-2025 18:25	7.88	28.86	240.1	-7.82	12.14	17.37	0.12	5.37	0.22	32.76	0.59
06-09-2025 18:30	7.88	28.87	240.1	-7.79	12.26	13.16	0.10	27.4	0.15	20.43	0.45
06-09-2025 18:35	7.89	28.88	240.2	-7.94	11.81	2.82	0.06	15.06	0.15	22.41	0.51
06-09-2025 18:40	7.93	28.89	239.77	-7.19	14	5.78	0.09	30.06	0.1	32.5	0.36
06-09-2025 18:45	7.95	28.87	239.77	-7.32	13.62	328.82	0.16	325.04	0.12	296.73	0.48
06-09-2025 18:50	8.04	28.86	240.3	-8.33	10.77	339.22	0.11	306.27	0.13	308.15	0.69
06-09-2025 18:55	7.97	28.86	240.71	-9.38	7.87	348.57	0.21	335.05	0.21	325.94	0.83
06-09-2025 19:00	8	28.85	241.23	-10.61	4.57	15.32	0.11	347.28	0.17	327.98	0.67
06-09-2025 19:05	7.95	28.84	241.46	-11.14	3.13	318.29	0.03	44.34	0.08	5.76	0.43
06-09-2025 19:10	7.98	28.84	241.14	-10.42	5.12	318.46	0.05	36	0.09	343.78	0.22
06-09-2025 19:15	7.98	28.83	240.73	-9.37	7.85	294.89	0.05	35.32	0.08	8.8	0.46
06-09-2025 19:20	7.99	28.83	240.66	-9.14	8.47	335.25	0.06	59.6	0.09	21.72	0.52
06-09-2025 19:25	7.93	28.82	240.51	-8.72	9.64	308.45	0.03	15.77	0.07	21.41	0.52
06-09-2025 19:30	7.99	28.82	240.68	-9.21	8.29	263.07	0.07	45.37	0.03	21.05	0.57
06-09-2025 19:35	7.99	28.81	240.61	-9	8.89	279.96	0.08	12.21	0.07	17.94	0.28
06-09-2025 19:40	8.02	28.81	240.58	-8.91	9.15	214.54	0.08	328.92	0.04	12.18	0.21
06-09-2025 19:45	7.92	28.81	240.4	-8.59	10.02	314.99	0.06	8.81	0.16	10.73	0.83
06-09-2025 19:50	7.97	28.81	240.38	-8.56	10.13	211.23	0.08	149.14	0.07	35.37	0.48
06-09-2025 19:55	7.97	28.81	240.43	-8.54	10.17	212.7	0.08	319.44	0.05	28.22	0.47
06-09-2025 20:00	7.98	28.81	240.45	-8.55	10.13	212.54	0.17	195.38	0.09	34.84	0.52
06-09-2025 20:05	7.99	28.81	240.52	-8.66	9.87	242.38	0.26	294.95	0.07	26.33	0.59
06-09-2025 20:10	8.04	28.81	240.48	-8.75	9.59	312.22	0.35	183.39	0.1	33.62	0.36
06-09-2025 20:15	8.07	28.81	240.55	-8.87	9.25	217.11	0.04	286.48	0.01	20.7	0.58
06-09-2025 20:20	8.11	28.82	240.53	-8.85	9.31	274.14	0.07	323.3	0.09	25.3	0.57
06-09-2025 20:25	8.02	28.82	240.6	-8.92	9.09	270.06	0.07	327.56	0.11	19.39	0.68
06-09-2025 20:30	7.93	28.82	240.98	-9.75	6.84	257.82	0.09	308.46	0.09	5.47	0.49
06-09-2025 20:35	8	28.82	240.54	-8.76	9.55	204.06	0.14	228.61	0.1	15.1	0.21
06-09-2025 20:40	7.97	28.82	240.4	-8.55	10.1	266.71	0.12	328.12	0.07	18.23	0.47
06-09-2025 20:45	7.98	28.83	240.41	-8.56	10.12	232.7	0.12	325.77	0.04	16.88	0.33
06-09-2025 20:50	7.9	28.83	240.41	-8.54	10.15	229.35	0.12	192.26	0.09	66.76	0.15
06-09-2025 20:55	7.91	28.83	240.52	-8.78	9.48	208.17	0.12	283.32	0.03	16.16	0.31
06-09-2025 21:00	7.99	28.84	240.59	-8.8	9.45	208.01	0.19	169.89	0.12	73.83	0.19
06-09-2025 21:05	7.94	28.84	240.56	-8.84	9.33	247.89	0.10	325.3	0.05	24.4	0.47
06-09-2025 21:10	7.93	28.84	240.53	-8.96	9	208.31	0.11	242.78	0.07	25.56	0.4
06-09-2025 21:15	7.9	28.84	240.41	-8.58	10.02	227.03	0.10	230.81	0.12	11.91	0.3
06-09-2025 21:20	7.93	28.85	240.56	-8.85	9.31	186.65	0.15	207.56	0.08	13.29	0.31
06-09-2025 21:25	7.86	28.86	240.47	-8.74	9.61	215.95	0.05	313.9	0.07	8.92	0.56
06-09-2025 21:30	7.87	28.86	240.52	-8.73	9.61	172.33	0.12	164.74	0.09	54.39	0.24
06-09-2025 21:35	7.91	28.88	240.67	-9.12	8.56	107.96	0.03	105.36	0.06	41.68	0.49

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
06-09-2025 21:40	7.93	28.89	240.36	-8.54	10.15	278.27	0.05	27.16	0.07	24.56	0.5
06-09-2025 21:45	7.92	28.89	240.26	-8.36	10.63	20.41	0.09	332.65	0.11	321.17	0.76
06-09-2025 21:50	7.79	28.89	239.91	-7.69	12.56	16.67	0.13	332.42	0.22	310.56	0.85
06-09-2025 21:55	7.78	28.9	240.04	-7.97	11.73	73.6	0.12	154.07	0.03	312.21	0.39
06-09-2025 22:00	7.83	28.9	240.38	-8.74	9.58	93.54	0.12	117.1	0.04	344.54	0.21
06-09-2025 22:05	7.78	28.9	240.31	-8.58	10.04	295.99	0.07	7.43	0.08	18.19	0.38
06-09-2025 22:10	7.76	28.91	240.16	-8.25	10.93	312.96	0.03	58.48	0.04	42.18	0.37
06-09-2025 22:15	7.69	28.93	240.22	-8.43	10.42	296.25	0.03	37.49	0.1	28.55	0.55
06-09-2025 22:20	7.74	28.91	240.37	-8.65	9.81	209.89	0.04	153.57	0.12	58.64	0.22
06-09-2025 22:25	7.68	28.91	240.17	-8.13	11.23	309.26	0.06	219.86	0.01	212.62	0.13
06-09-2025 22:30	7.76	28.91	240.39	-8.72	9.59	144.23	0.06	132.4	0.07	25.48	0.3
06-09-2025 22:35	7.62	28.93	240.43	-8.73	9.57	328.4	0.07	349.48	0.08	4.11	0.35
06-09-2025 22:40	7.61	28.93	240.52	-8.9	9.1	148.12	0.03	168.05	0.13	57.72	0.18
06-09-2025 22:45	7.64	28.93	240.45	-8.9	9.1	179.84	0.08	155.73	0.13	78.83	0.03
06-09-2025 22:50	7.65	28.91	240.62	-9.2	8.24	272.06	0.05	76.85	0.04	2.29	0.42
06-09-2025 22:55	7.6	28.9	240.48	-8.89	9.14	359.35	0.08	33.54	0.12	8.23	0.52
06-09-2025 23:00	7.61	28.89	240.49	-8.86	9.19	39.34	0.06	55.26	0.14	14.46	0.69
06-09-2025 23:05	7.55	28.89	240.62	-9.13	8.44	48.16	0.09	77.65	0.09	30.1	0.27
06-09-2025 23:10	7.56	28.89	240.76	-9.52	7.37	40.3	0.05	71.15	0.06		
06-09-2025 23:15	7.52	28.89	240.67	-9.34	7.88	20.61	0.06	46.99	0.09		
06-09-2025 23:20	7.6	28.89	240.79	-9.58	7.21	31.51	0.03	79.87	0.1	17.72	0.89
06-09-2025 23:25	7.45	28.88	240.79	-9.46	7.53	8.2	0.16	26.92	0.19	23.79	0.53
06-09-2025 23:30	7.51	28.88	240.78	-9.52	7.35	119.97	0.03	123.31	0.17	120.77	0.35
06-09-2025 23:35	7.55	28.88	240.88	-9.79	6.64	52.54	0.09	76.57	0.19	34.11	0.56
06-09-2025 23:40	7.46	28.88	240.82	-9.61	7.14	15.24	0.14	50.73	0.22		
06-09-2025 23:45	7.47	28.89	240.84	-9.65	7.01	353.48	0.06	88.7	0.09		
06-09-2025 23:50	7.44	28.89	240.86	-9.71	6.84	8.27	0.10	38.23	0.17		
06-09-2025 23:55	7.49	28.88	240.85	-9.63	7.06	7.83	0.09	66.73	0.17	82.79	0.37
07-09-2025 00:00	7.46	28.88	240.85	-9.77	6.65	13.42	0.13	31.44	0.16		
07-09-2025 00:05	7.39	28.89	240.91	-9.66	6.96	17.08	0.10	55.77	0.21		
07-09-2025 00:10	7.38	28.89	240.92	-9.88	6.44	39.5	0.08	85.1	0.17		
07-09-2025 00:15	7.38	28.89	240.79	-9.7	6.88	39.67	0.13	90.66	0.21		
07-09-2025 00:20	7.32	28.88	240.83	-9.51	7.4	351.4	0.10	82.43	0.17	111.81	0.24
07-09-2025 00:25	7.37	28.88	240.76	-9.42	7.62	82.68	0.09	115.51	0.24		
07-09-2025 00:30	7.37	28.85	240.59	-9.08	8.54	17.69	0.06	76.84	0.09	136.47	0.26
07-09-2025 00:35	7.33	28.85	240.6	-9.04	8.66	26.19	0.21	38.11	0.3		
07-09-2025 00:40	7.33	28.87	240.45	-8.92	9	50.22	0.18	57.96	0.24	127.07	0.39
07-09-2025 00:45	7.36	28.89	240.45	-8.81	9.34	296.43	0.26	285.92	0.3	194.17	0.4
07-09-2025 00:50	7.31	28.9	240.39	-8.64	9.82	292.44	0.19	274.89	0.29	168.65	0.59
07-09-2025 00:55	7.29	28.88	240.3	-8.59	9.93	305.98	0.19	267.51	0.22	175.87	0.29
07-09-2025 01:00	7.31	28.85	240.21	-8.44	10.35	311.29	0.12	263.42	0.25		
07-09-2025 01:05	7.31	28.83	240.19	-8.43	10.38	12.35	0.14	37.85	0.17		
07-09-2025 01:10	7.32	28.82	240.16	-8.42	10.38	7.69	0.15	58.83	0.19	172.5	0.31
07-09-2025 01:15	7.31	28.81	240.15	-8.31	10.71	27.32	0.17	40.57	0.23		
07-09-2025 01:20	7.36	28.81	240	-7.99	11.57	19.55	0.13	55.47	0.22		
07-09-2025 01:25	7.37	28.82	240.03	-8.09	11.27	6.71	0.18	35.1	0.28		
07-09-2025 01:30	7.36	28.81	240.06	-8.04	11.42	345.26	0.19	26.76	0.25	136.4	0.21
07-09-2025 01:35	7.3	28.82	240.06	-8.12	11.18	17.48	0.17	34.79	0.23	51.75	0.2
07-09-2025 01:40	7.33	28.81	240.17	-8.32	10.68	31.1	0.18	48.59	0.25		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
07-09-2025 01:45	7.34	28.82	240.13	-8.26	10.84	23.71	0.22	38.69	0.27	40.44	0.51
07-09-2025 01:50	7.25	28.83	240.16	-8.3	10.69	5.79	0.24	19.73	0.29		
07-09-2025 01:55	7.31	28.81	240.09	-8.13	11.16	67.92	0.06	106.59	0.2		
07-09-2025 02:00	7.38	28.79	240.18	-8.22	10.93	8.92	0.17	42.59	0.26	52.3	0.52
07-09-2025 02:05	7.31	28.8	240.11	-8.09	11.29	16.13	0.24	36.9	0.25	46.08	0.3
07-09-2025 02:10	7.28	28.79	240.11	-8.1	11.3	18.68	0.13	47.29	0.19	59.19	0.4
07-09-2025 02:15	7.29	28.78	240.03	-7.96	11.66	24.21	0.12	73.87	0.2		
07-09-2025 02:20	7.39	28.83	240.1	-8.1	11.26	33.31	0.12	46.54	0.24	58.78	0.31
07-09-2025 02:25	7.37	28.78	240.07	-8	11.53	358.07	0.18	33.82	0.26	65.75	0.2
07-09-2025 02:30	7.36	28.78	240.12	-8.09	11.32	22.71	0.19	54.9	0.21	90.58	0.21
07-09-2025 02:35	7.38	28.79	240.13	-8.14	11.15	22.42	0.21	42.03	0.23	51.32	0.23
07-09-2025 02:40	7.36	28.78	240.14	-8.13	11.17	21.77	0.22	36.5	0.24	128.51	0.12
07-09-2025 02:45	7.36	28.8	240.02	-7.97	11.66	11.4	0.25	29.92	0.32	48.29	0.26
07-09-2025 02:50	7.43	28.8	240.05	-7.97	11.62	26.61	0.19	43.99	0.26	63.28	0.29
07-09-2025 02:55	7.4	28.8	240.06	-8	11.55	4.17	0.24	33.78	0.28	74.81	0.13
07-09-2025 03:00	7.37	28.83	240.12	-8.02	11.47	24.41	0.23	47.5	0.27	75.5	0.13
07-09-2025 03:05	7.39	28.86	240.07	-7.98	11.61	13.25	0.22	39.35	0.23	58.29	0.23
07-09-2025 03:10	7.41	28.82	240.13	-8.15	11.09	35.22	0.12	65.13	0.21	89.39	0.33
07-09-2025 03:15	7.47	28.84	240.11	-8.15	11.13	17.6	0.14	47.22	0.19	64.97	0.29
07-09-2025 03:20	7.41	28.86	240.22	-8.33	10.62	21.46	0.23	37.25	0.25	59.46	0.34
07-09-2025 03:25	7.47	28.84	240.15	-8.23	10.89	23.13	0.12	53.93	0.23	61.87	0.55
07-09-2025 03:30	7.44	28.84	240.17	-8.22	10.9	20.57	0.18	42.81	0.25	53.42	0.46
07-09-2025 03:35	7.39	28.84	240.18	-8.23	10.91	18.37	0.19	41.5	0.24	49.29	0.47
07-09-2025 03:40	7.44	28.84	240.14	-8.25	10.84	68.51	0.13	79.55	0.21		
07-09-2025 03:45	7.5	28.84	240.15	-8.21	10.96	295.12	0.17	253.31	0.23	247.79	0.42
07-09-2025 03:50	7.5	28.85	240.1	-8.22	10.91	312.19	0.21	281.19	0.27	269.12	0.31
07-09-2025 03:55	7.63	28.85	240.05	-8.11	11.23	298.89	0.18	285.14	0.23	262.93	0.3
07-09-2025 04:00	7.6	28.86	240.07	-8.16	11.04	331.99	0.27	318.09	0.29	297.28	0.24
07-09-2025 04:05	7.63	28.87	240.02	-8.1	11.28	2.68	0.19	31.37	0.28	64.04	0.13
07-09-2025 04:10	7.68	28.87	239.98	-8.08	11.32	2.86	0.16	32.65	0.21	72.26	0.15
07-09-2025 04:15	7.64	28.84	239.98	-8	11.53	348.43	0.17	11.45	0.23	91.21	0.11
07-09-2025 04:20	7.64	28.82	240.02	-8.11	11.21	12.23	0.16	29.42	0.2	105.63	0.12
07-09-2025 04:25	7.64	28.82	240.05	-8.17	11.06	14.98	0.14	38.38	0.2	133.1	0.1
07-09-2025 04:30	7.68	28.81	239.97	-7.93	11.71	27.82	0.10	55.83	0.17	108.58	0.18
07-09-2025 04:35	7.71	28.79	239.96	-8	11.54	6.47	0.19	37.21	0.2	77.12	0.16
07-09-2025 04:40	7.67	28.77	239.93	-7.89	11.86	3.33	0.10	51.83	0.15	105.36	0.27
07-09-2025 04:45	7.72	28.76	239.86	-7.78	12.17	0.19	0.12	33.18	0.16	73.05	0.09
07-09-2025 04:50	7.8	28.76	239.86	-7.76	12.24	342.4	0.13	28.47	0.23	51.88	0.18
07-09-2025 04:55	7.73	28.76	239.97	-8	11.52	0.21	0.17	14.45	0.23	18.05	0.26
07-09-2025 05:00	7.78	28.76	240.16	-8.34	10.61	19.57	0.11	31.03	0.17	83.7	0.15
07-09-2025 05:05	7.8	28.76	240.32	-8.75	9.47	7.51	0.12	29.11	0.19	50.63	0.24
07-09-2025 05:10	7.84	28.77	240.45	-9.02	8.71	5.49	0.13	28.26	0.16	91.13	0.13
07-09-2025 05:15	7.85	28.74	240.36	-8.83	9.27	347.34	0.11	19.93	0.13	47.4	0.17
07-09-2025 05:20	7.86	28.73	240.48	-9.11	8.47	334	0.05	11.49	0.07	79.86	0.17
07-09-2025 05:25	7.88	28.74	240.54	-9.13	8.41	350.74	0.11	27.18	0.06	104.12	0.19
07-09-2025 05:30	7.89	28.74	240.52	-9.09	8.53	343.3	0.02	66.73	0.09	75.98	0.3
07-09-2025 05:35	8.01	28.73	240.58	-9.34	7.82	302.33	0.02	79.44	0.04	80.04	0.22
07-09-2025 05:40	7.95	28.73	240.83	-9.83	6.49	336.47	0.19	7.09	0.21	23.68	0.41
07-09-2025 05:45	8.02	28.73	240.79	-9.77	6.66	335.27	0.07	4.58	0.11	43.68	0.25

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
07-09-2025 05:50	7.92	28.73	240.68	-9.47	7.46	347.82	0.14	2.84	0.12	61.37	0.27
07-09-2025 05:55	7.99	28.73	240.57	-9.3	7.93	47.71	0.07	59.11	0.11	49.11	0.37
07-09-2025 06:00	8	28.74	240.58	-9.32	7.89	20.98	0.06	44.37	0.07	51.72	0.24
07-09-2025 06:05	7.98	28.68	240.46	-9.13	8.42	286	0.08	24.9	0.05	101.25	0.2
07-09-2025 06:10	8.08	28.63	240.53	-9.16	8.31	245.59	0.07	237.03	0.03	129.78	0.15
07-09-2025 06:15	8.08	28.61	240.45	-9.09	8.5	299.66	0.08	335.08	0.09	65.08	0.15
07-09-2025 06:20	8.07	28.6	240.49	-9.11	8.46	252.82	0.09	304.26	0.1	30.29	0.05
07-09-2025 06:25	8.04	28.6	240.43	-8.92	9.01	205.98	0.10	105.42	0	41.87	0.21
07-09-2025 06:30	8.12	28.62	240.55	-9.1	8.51	228.37	0.06	266.2	0.03	121.71	0.16
07-09-2025 06:35	8.17	28.63	240.52	-9.17	8.31	274.66	0.10	319.64	0.07	131.02	0.11
07-09-2025 06:40	8.15	28.64	240.5	-9.06	8.58	311.58	0.10	338.61	0.08	40.19	0.1
07-09-2025 06:45	8.14	28.65	240.42	-9.02	8.72	58.94	0.08	12.6	0.03	243.32	0.07
07-09-2025 06:50	8.17	28.64	240.4	-9.02	8.73	99.54	0.13	105.86	0.05	256.83	0.04
07-09-2025 06:55	8.18	28.65	240.37	-8.94	8.93	74.78	0.11	43.64	0.06	183.1	0.21
07-09-2025 07:00	8.17	28.64	240.29	-8.85	9.19	121.2	0.10	355.22	0.08	197.67	0.14
07-09-2025 07:05	8.15	28.63	240.35	-8.82	9.23	240.33	0.15	250.07	0.1	156.59	0.16
07-09-2025 07:10	8.17	28.63	240.34	-8.91	9.01	228.44	0.15	261.36	0.04	73.21	0.19
07-09-2025 07:15	8.17	28.64	240.26	-8.71	9.58	242.14	0.12	241.36	0.06	77.33	0.22
07-09-2025 07:20	8.21	28.65	240.12	-8.32	10.66	239.69	0.19	244.01	0.11	104.39	0.14
07-09-2025 07:25	8.2	28.65	239.92	-7.94	11.69	241.45	0.10	276.49	0.09	193.41	0.12
07-09-2025 07:30	8.22	28.65	239.93	-7.94	11.69	224.88	0.14	262.33	0.03	135.61	0.12
07-09-2025 07:35	8.28	28.65	239.9	-7.93	11.71	239.39	0.15	283.36	0.06	44.78	0.1
07-09-2025 07:40	8.22	28.64	239.76	-7.52	12.96	272.96	0.10	307.26	0.09	124.29	0.06
07-09-2025 07:45	8.25	28.64	240.26	-8.61	9.85	203.84	0.13	183.05	0.05	158.42	0.07
07-09-2025 07:50	8.24	28.64	240.09	-8.17	11	268.24	0.09	306.13	0.09	142.78	0.14
07-09-2025 07:55	8.22	28.64	240.02	-8.1	11.2	227.01	0.13	190.88	0.08	164.51	0.23
07-09-2025 08:00	8.21	28.65	240.04	-8.17	11.02	232.6	0.11	233.09	0.09	216.63	0.19
07-09-2025 08:05	8.25	28.65	240.12	-8.31	10.62	240.69	0.09	272.98	0.05	191.57	0.11
07-09-2025 08:10	8.21	28.65	240.05	-8.1	11.23	255.73	0.09	265.88	0.1	166.54	0.16
07-09-2025 08:15	8.17	28.65	240.01	-8.05	11.36	224.34	0.12	233.42	0.09	185.84	0.27
07-09-2025 08:20	8.31	28.65	240.01	-8.01	11.5	197.51	0.17	212.79	0.12	190.51	0.3
07-09-2025 08:25	8.21	28.65	239.87	-7.77	12.19	250.16	0.10	269.93	0.1	190.86	0.26
07-09-2025 08:30	8.25	28.66	239.9	-7.84	11.97	223.27	0.19	190.9	0.12	183.78	0.24
07-09-2025 08:35	8.3	28.66	240.03	-8.11	11.19	208.25	0.16	256.02	0.13	183.51	0.2
07-09-2025 08:40	8.26	28.66	240	-8.08	11.24	193.23	0.13	297.13	0.08	190.8	0.24
07-09-2025 08:45	8.2	28.67	239.99	-8.07	11.3	228.4	0.09	255.85	0.09	138.26	0.05
07-09-2025 08:50	8.25	28.67	239.96	-8.01	11.48	232.39	0.16	234.48	0.1	142.99	0.18
07-09-2025 08:55	8.17	28.68	239.9	-7.81	12.09	279.8	0.10	272.87	0.11	189.62	0.04
07-09-2025 09:00	8.18	28.68	239.91	-7.86	11.9	222	0.14	231.84	0.13	169.97	0.09
07-09-2025 09:05	8.19	28.68	239.95	-7.99	11.53	256.54	0.11	235.53	0.09	158.63	0.2
07-09-2025 09:10	8.15	28.69	239.96	-7.96	11.58	236.13	0.11	245.49	0.09	114.69	0.05
07-09-2025 09:15	8.11	28.69	239.85	-7.84	11.93	198.09	0.08	238.71	0.08	161.02	0.11
07-09-2025 09:20	8.15	28.69	239.97	-8.02	11.44	225.81	0.12	222.93	0.12	148.39	0.15
07-09-2025 09:25	8.13	28.7	239.98	-8.06	11.28	213.67	0.08	216.37	0.15	169.36	0.24
07-09-2025 09:30	8.1	28.7	239.76	-7.51	12.99	214.21	0.07	254.94	0.1	196.35	0.21
07-09-2025 09:35	8.16	28.7	239.85	-7.79	12.16	221.02	0.12	198.24	0.12	194.89	0.25
07-09-2025 09:40	8.1	28.71	239.86	-7.77	12.17	231.12	0.11	239.57	0.09	206.03	0.26
07-09-2025 09:45	8.1	28.71	239.84	-7.87	11.84	83.43	0.08	85.71	0.15	134.71	0.48
07-09-2025 09:50	8.09	28.72	239.85	-7.95	11.57	95.26	0.07	68.8	0.09	121.54	0.38

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
07-09-2025 09:55	7.98	28.73	239.9	-8.02	11.34	108.3	0.13	87.45	0.04	135.99	0.47
07-09-2025 10:00	7.98	28.73	239.92	-8.05	11.29	82.54	0.11	141.53	0.1	150.08	0.58
07-09-2025 10:05	8	28.74	240.02	-8.3	10.61	216.09	0.13	185.66	0.1	198.59	0.24
07-09-2025 10:10	7.98	28.75	240.17	-8.62	9.74	203.9	0.12	201.46	0.14	201.12	0.4
07-09-2025 10:15	7.96	28.75	240.18	-8.6	9.78	223.06	0.11	218.18	0.12	204.66	0.51
07-09-2025 10:20	7.93	28.76	240.25	-8.75	9.34	208.2	0.11	227.41	0.11	199.95	0.41
07-09-2025 10:25	7.88	28.76	239.72	-7.7	12.33	221.49	0.12	219.32	0.11	192	0.52
07-09-2025 10:30	7.87	28.76	239.7	-7.61	12.5	226.53	0.12	222.26	0.06	209.41	0.36
07-09-2025 10:35	7.82	28.75	239.75	-7.81	11.86	231.57	0.12	215.6	0.12	211.33	0.55
07-09-2025 10:40	7.89	28.75	239.8	-7.92	11.52	200.38	0.03	186.37	0.1	201.52	0.54
07-09-2025 10:45	7.87	28.75	240.18	-8.62	9.65	216.95	0.07	255.31	0.07	207.92	0.36
07-09-2025 10:50	7.8	28.76	240.14	-8.56	9.8	259.19	0.02	257.85	0.08	192.97	0.42
07-09-2025 10:55	7.83	28.76	240.23	-8.83	9.02	228.79	0.04	224.73	0.16	208.08	0.71
07-09-2025 11:00	7.69	28.77	240.13	-8.52	9.84	232.21	0.14	234.84	0.13	199.07	0.64
07-09-2025 11:05	7.76	28.78	240.15	-8.71	9.37	187.14	0.07	171.02	0.18	191.24	0.61
07-09-2025 11:10	7.73	28.78	240.17	-8.69	9.43	142.07	0.09	246.35	0.09	182.14	0.49
07-09-2025 11:15	7.8	28.78	240.25	-8.86	8.94	224.85	0.14	211.22	0.11	191.57	0.61
07-09-2025 11:20	7.68	28.79	240.15	-8.62	9.62	313.55	0.07	291.9	0.08	193.78	0.38
07-09-2025 11:25	7.62	28.79	240.15	-8.58	9.73	168.98	0.07	219.18	0.12	194.14	0.6
07-09-2025 11:30	7.62	28.8	240.19	-8.63	9.59	202.19	0.08	185.32	0.09	185.61	0.47
07-09-2025 11:35	7.63	28.8	240.19	-8.77	9.18	207.08	0.07	221.96	0.12	196.86	0.61
07-09-2025 11:40	7.57	28.8	240.25	-8.77	9.17	224.19	0.06	264.74	0.05	200.96	0.39
07-09-2025 11:45	7.63	28.8	240.22	-8.88	8.86	211.15	0.08	196.08	0.15	196.12	0.61
07-09-2025 11:50	7.56	28.8	240.22	-8.82	9.05	241.24	0.06	265.62	0.09	207.8	0.43
07-09-2025 11:55	7.57	28.81	240.25	-8.85	8.97	196.37	0.01	224.69	0.09	213.04	0.39
07-09-2025 12:00	7.57	28.81	240.32	-8.87	8.89	214.97	0.11	221.79	0.14	198.63	0.54
07-09-2025 12:05	7.56	28.81	240.21	-8.85	8.96	251.35	0.07	252.85	0.07	199.18	0.49
07-09-2025 12:10	7.53	28.81	240.25	-8.86	8.94	307.56	0.06	240.03	0.08	199.24	0.53
07-09-2025 12:15	7.54	28.82	240.2	-8.74	9.22	165.92	0.02	223.06	0.03	192.99	0.41
07-09-2025 12:20	7.48	28.82	240.22	-8.83	9	240.01	0.10	275.47	0.09	195.94	0.42
07-09-2025 12:25	7.42	28.82	240.23	-8.76	9.23	221.72	0.09	227.72	0.06	194.8	0.49
07-09-2025 12:30	7.38	28.83	240.23	-8.7	9.38	191.22	0.08	192.76	0.13	191.77	0.49
07-09-2025 12:35	7.36	28.83	240.12	-8.62	9.59	169.99	0.08	182.16	0.14	191.68	0.66
07-09-2025 12:40	7.48	28.84	240.2	-8.65	9.52	172.8	0.13	183.16	0.37		
07-09-2025 12:45	7.33	28.84	240.13	-8.64	9.52	55.86	0.00	38.95	0.07	122.74	0.5
07-09-2025 12:50	7.39	28.85	240.15	-8.74	9.25	165.22	0.15	153.78	0.21	143.83	0.7
07-09-2025 12:55	7.36	28.85	240.14	-8.75	9.19	32.54	0.04	135.81	0.13	145.87	0.72
07-09-2025 13:00	7.38	28.86	240.15	-8.82	9.01	166.51	0.11	122.95	0.1		
07-09-2025 13:05	7.34	28.86	240.12	-8.69	9.39	194.93	0.06	245.29	0.07	201.84	0.33
07-09-2025 13:10	7.32	28.86	240.1	-8.8	9.1	177.6	0.08	189.49	0.08	224.83	0.56
07-09-2025 13:15	7.32	28.87	240.13	-8.77	9.18	261.4	0.03	279.31	0.04		
07-09-2025 13:20	7.27	28.87	240.08	-8.74	9.26	155.07	0.02	236.14	0.06		
07-09-2025 13:25	7.3	28.87	240.1	-8.73	9.3	188.57	0.05	190.71	0.09		
07-09-2025 13:30	7.38	28.88	240.2	-8.94	8.7	232.74	0.10	240.85	0.11		
07-09-2025 13:35	7.26	28.89	240.1	-8.65	9.52	332.85	0.08	341.5	0.19		
07-09-2025 13:40	7.36	28.89	240.07	-8.65	9.52	164.67	0.11	171.36	0.06		
07-09-2025 13:45	7.32	28.89	240.04	-8.64	9.55	33.89	0.03	298.6	0.08		
07-09-2025 13:50	7.28	28.9	240.08	-8.67	9.43	113.81	0.02	330.23	0.05	303.31	0.07
07-09-2025 13:55	7.26	28.9	240.04	-8.6	9.64	241.47	0.01	300.33	0.03		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
07-09-2025 14:00	7.24	28.9	240.03	-8.63	9.57	139.27	0.08	147.57	0.04		
07-09-2025 14:05	7.31	28.91	240.09	-8.8	9.11	153	0.02	161.38	0.07		
07-09-2025 14:10	7.27	28.9	240	-8.67	9.46	245.07	0.07	262.19	0.08	333.81	0.23
07-09-2025 14:15	7.25	28.91	240.01	-8.65	9.51	219.94	0.10	221.86	0.05		
07-09-2025 14:20	7.26	28.91	240.02	-8.73	9.28	147.04	0.17	113.31	0.11		
07-09-2025 14:25	7.3	28.92	240.12	-8.84	8.97	47.56	0.03	214.89	0.07		
07-09-2025 14:30	7.22	28.92	240.04	-8.67	9.46	173.4	0.02	277.95	0.08		
07-09-2025 14:35	7.27	28.92	240.02	-8.73	9.31	3.19	0.43	39.48	0.24		
07-09-2025 14:40	7.32	28.94	240	-8.73	9.31	340.1	0.07	345.14	0.14		
07-09-2025 14:45	7.32	29	240.06	-8.78	9.16	352.93	0.05	5.42	0.08	271.31	0.13
07-09-2025 14:50	7.24	28.95	239.93	-8.46	10.02	283.05	0.06	316.65	0.08		
07-09-2025 14:55	7.28	28.99	239.76	-8.08	11.06	203.87	0.18	198.51	0.08		
07-09-2025 15:00	7.33	28.98	239.85	-8.29	10.48	179.44	0.07	32.39	0.02		
07-09-2025 15:05	7.27	28.95	239.78	-8.24	10.63	207.9	0.06	323.05	0.05	5.45	0.21
07-09-2025 15:10	7.36	28.97	239.84	-8.4	10.19	183.31	0.09	231.25	0.02		
07-09-2025 15:15	7.28	28.96	239.83	-8.27	10.51	341.9	0.07	349.97	0.15	37.6	0.31
07-09-2025 15:20	7.37	28.95	239.89	-8.45	10.05	220.32	0.04	181.86	0.04		
07-09-2025 15:25	7.35	28.95	239.88	-8.39	10.22	343.7	0.10	328.18	0.11		
07-09-2025 15:30	7.35	28.95	239.85	-8.35	10.3	218.13	0.03	238.58	0.05	60.61	0.15
07-09-2025 15:35	7.38	28.95	239.86	-8.43	10.08	156.53	0.03	248.62	0.03	37.55	0.23
07-09-2025 15:40	7.37	28.95	239.86	-8.45	10.07	34.5	0.04	0.37	0.02	31.03	0.39
07-09-2025 15:45	7.44	28.95	239.87	-8.4	10.23	113.97	0.09	19.36	0.05	321.89	0.25
07-09-2025 15:50	7.46	28.95	239.94	-8.65	9.54	31.82	0.06	7.31	0.09	348.97	0.18
07-09-2025 15:55	7.42	28.94	239.84	-8.52	9.87	35.21	0.13	50.86	0.08		
07-09-2025 16:00	7.41	28.94	239.79	-8.44	10.06	127.19	0.05	74.6	0.05	138.27	0.52
07-09-2025 16:05	7.45	28.94	239.88	-8.55	9.79	160.68	0.11	166.88	0.05		
07-09-2025 16:10	7.49	28.94	239.85	-8.5	9.92	339.09	0.02	330.52	0.04		
07-09-2025 16:15	7.47	28.94	239.82	-8.5	9.9	316.52	0.04	326.65	0.05		
07-09-2025 16:20	7.51	28.94	239.86	-8.59	9.67	187.36	0.04	207.14	0.04		
07-09-2025 16:25	7.47	28.94	239.86	-8.58	9.7	276.32	0.02	295.36	0.04	234.54	0.42
07-09-2025 16:30	7.54	28.94	239.87	-8.44	10.1	170.11	0.06	208.74	0.03		
07-09-2025 16:35	7.55	28.94	239.86	-8.44	10.09	250.6	0.06	243.42	0.04	240.45	0.37
07-09-2025 16:40	7.56	28.94	239.9	-8.54	9.81	95.9	0.01	281.03	0.03	229.22	0.22
07-09-2025 16:45	7.59	28.94	239.96	-8.74	9.25	214.03	0.04	69.46	0.02	224.23	0.25
07-09-2025 16:50	7.64	28.94	239.96	-8.7	9.34	227.54	0.05	294.89	0.03	245.75	0.25
07-09-2025 16:55	7.62	28.94	239.9	-8.6	9.65	241.05	0.06	325.62	0.08		
07-09-2025 17:00	7.56	28.94	239.87	-8.46	10.01	111.83	0.02	239.31	0.01	285.94	0.08
07-09-2025 17:05	7.66	28.94	239.83	-8.56	9.73	156.31	0.09	170.78	0.08	350.74	0.08
07-09-2025 17:10	7.7	28.94	239.87	-8.57	9.78	252.64	0.07	320.49	0.15	299.21	0.12
07-09-2025 17:15	7.76	28.94	239.95	-8.7	9.38	288.89	0.08	46.27	0.05	341.73	0.09
07-09-2025 17:20	7.75	28.94	239.98	-8.86	8.91	180.67	0.04	269.74	0.05	353.86	0.1
07-09-2025 17:25	7.78	28.95	240.03	-8.92	8.75	26.27	0.02	303.76	0.06	343.3	0.22
07-09-2025 17:30	7.85	28.95	240.07	-8.84	8.97	329.23	0.05	287.85	0.07	328.96	0.28
07-09-2025 17:35	7.83	28.95	239.99	-8.79	9.13	307.94	0.10	318.83	0.1	356.93	0.24
07-09-2025 17:40	7.82	28.95	239.98	-8.85	8.92	259.47	0.04	229.9	0.08	3.75	0.25
07-09-2025 17:45	7.78	28.95	239.98	-8.79	9.09	257.57	0.06	225.78	0.09	359.57	0.3
07-09-2025 17:50	7.81	28.95	239.97	-8.81	9.03	296.18	0.06	213.4	0.09	16.78	0.11
07-09-2025 17:55	7.9	28.96	240.04	-8.93	8.73	228.63	0.09	242.42	0.13	32.35	0.22
07-09-2025 18:00	7.93	28.96	240.05	-8.97	8.63	246.25	0.09	289.77	0.05	8.22	0.36

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
07-09-2025 18:05	7.92	28.96	239.98	-8.89	8.81	308.58	0.09	296.82	0.09	33.51	0.17
07-09-2025 18:10	7.92	28.95	239.96	-8.85	8.93	325.67	0.03	234.97	0.05	35.34	0.13
07-09-2025 18:15	7.87	28.95	239.94	-8.76	9.19	242.75	0.06	261.45	0.11	30.99	0.15
07-09-2025 18:20	7.96	28.95	239.97	-8.86	8.93	173.33	0.08	190.13	0.11	61.85	0.12
07-09-2025 18:25	7.98	28.95	240	-8.9	8.82	209.86	0.10	230.83	0.09	29.68	0.18
07-09-2025 18:30	7.95	28.96	240.01	-8.8	9.08	189.25	0.02	293.49	0.09	25.98	0.24
07-09-2025 18:35	7.99	28.96	239.96	-8.83	9	201.16	0.10	201.97	0.16	27.89	0.16
07-09-2025 18:40	7.97	28.96	240.03	-8.92	8.75	205.53	0.10	229.65	0.11	61.72	0.18
07-09-2025 18:45	7.98	28.95	239.99	-8.89	8.81	129.12	0.20	114.33	0.22	43.2	0.06
07-09-2025 18:50	8.04	28.95	240	-8.89	8.83	117.52	0.23	117.97	0.24	138.15	0.09
07-09-2025 18:55	8.08	28.95	239.96	-8.9	8.78	74.02	0.14	81.22	0.12	332.61	0.24
07-09-2025 19:00	8.11	28.95	239.93	-8.89	8.82	106.53	0.17	104.16	0.16	330.11	0.27
07-09-2025 19:05	8.08	28.95	239.98	-8.95	8.66	248.28	0.14	247.17	0.11	25.43	0.29
07-09-2025 19:10	8.09	28.95	239.99	-8.93	8.72	228.58	0.13	239.28	0.09	19.32	0.35
07-09-2025 19:15	8.03	28.95	239.86	-8.69	9.43	227.82	0.13	231.39	0.14	27.12	0.25
07-09-2025 19:20	8.05	28.95	239.82	-8.58	9.71	196.75	0.17	201.07	0.19	49.66	0.19
07-09-2025 19:25	8.14	28.95	239.85	-8.73	9.3	210.89	0.21	197.37	0.19	50.16	0.21
07-09-2025 19:30	8.03	28.95	239.83	-8.59	9.65	235.2	0.12	266.35	0.16	26.71	0.23
07-09-2025 19:35	8.11	28.95	239.9	-8.72	9.33	174.52	0.20	189.24	0.23	97.09	0.08
07-09-2025 19:40	8.21	28.96	239.91	-8.77	9.18	229.07	0.12	219.15	0.12	14.5	0.26
07-09-2025 19:45	8.11	28.96	239.81	-8.61	9.62	240.13	0.21	262.28	0.23	7.65	0.45
07-09-2025 19:50	8.18	28.97	239.85	-8.76	9.22	222.8	0.14	228.04	0.16	30.78	0.16
07-09-2025 19:55	8.18	28.97	239.9	-8.72	9.31	233.47	0.14	247.03	0.1	23.05	0.34
07-09-2025 20:00	8.19	28.97	239.94	-8.79	9.13	247.03	0.08	243.13	0.15	3.11	0.2
07-09-2025 20:05	8.14	28.97	239.91	-8.76	9.2	222.71	0.11	248.66	0.1	11.27	0.37
07-09-2025 20:10	8.18	28.97	239.95	-8.83	9.01	217.79	0.17	223.83	0.13	37.68	0.33
07-09-2025 20:15	8.14	28.97	239.91	-8.81	9.06	219.76	0.10	243.29	0.11	2.68	0.32
07-09-2025 20:20	8.2	28.97	239.95	-8.89	8.85	217.54	0.13	222.88	0.12	12.37	0.3
07-09-2025 20:25	8.17	28.97	239.96	-8.87	8.9	217.44	0.17	248.22	0.16	17.11	0.17
07-09-2025 20:30	8.15	28.97	239.99	-8.94	8.69	213.42	0.18	220.58	0.21	1.94	0.16
07-09-2025 20:35	8.15	28.98	239.96	-8.82	9.04	228.3	0.14	236.3	0.2	10.6	0.17
07-09-2025 20:40	8.21	28.98	239.97	-8.83	8.99	234.11	0.20	217.67	0.21	116.4	0.03
07-09-2025 20:45	8.15	28.98	239.89	-8.79	9.12	243.84	0.13	256.43	0.17	19.37	0.17
07-09-2025 20:50	8.17	28.98	239.93	-8.87	8.88	230.7	0.16	225.07	0.21	356.54	0.06
07-09-2025 20:55	8.14	28.98	239.95	-8.91	8.77	222.99	0.14	231.95	0.18	263.56	0.03
07-09-2025 21:00	8.04	28.99	240.03	-8.93	8.71	243.55	0.10	221	0.17	357.72	0.16
07-09-2025 21:05	8.13	28.99	240.02	-8.98	8.57	211.96	0.21	210.48	0.27	182.95	0.13
07-09-2025 21:10	8.17	28.99	239.98	-8.98	8.62	247.56	0.13	224.07	0.15	162.12	0.07
07-09-2025 21:15	8.12	28.99	239.9	-8.82	9.02	226.93	0.12	228.86	0.14	201.21	0.05
07-09-2025 21:20	8.11	28.99	239.97	-8.94	8.69	204.64	0.19	209.57	0.17	213.47	0.07
07-09-2025 21:25	8.15	28.99	239.95	-8.87	8.91	215.59	0.08	216.83	0.13	195.99	0.15
07-09-2025 21:30	8.1	29	239.99	-8.91	8.77	237.27	0.12	244.71	0.11	340.85	0.06
07-09-2025 21:35	8.11	29	239.95	-8.86	8.94	211.9	0.17	230.02	0.14	280.13	0.04
07-09-2025 21:40	8.08	29	239.93	-8.85	8.97	224.84	0.17	238.08	0.15	338.99	0.11
07-09-2025 21:45	8.05	29	239.88	-8.82	9.04	237.78	0.19	103.57	0.22	358.98	0.33
07-09-2025 21:50	8.06	29.01	239.86	-8.89	8.83	110.29	0.18	117.24	0.23	354.56	0.24
07-09-2025 21:55	8.05	29.01	239.86	-8.85	8.98	91.51	0.17	92.7	0.19	345.29	0.35
07-09-2025 22:00	8	29.01	239.72	-8.8	9.11	113.27	0.18	105.73	0.17	336.24	0.2
07-09-2025 22:05	8	29.02	239.83	-8.73	9.28	213.1	0.13	226.06	0.18	201.61	0.1

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
07-09-2025 22:10	7.96	29.02	239.8	-8.71	9.33	218.84	0.19	205.94	0.2	207.17	0.08
07-09-2025 22:15	8.06	29.02	239.76	-8.63	9.6	194.38	0.17	227	0.2	12.74	0.09
07-09-2025 22:20	7.98	29.02	239.7	-8.53	9.87	227.63	0.11	229.49	0.11	323.17	0.05
07-09-2025 22:25	7.92	29.03	239.19	-8.05	9.8	214.14	0.14	209.57	0.14	97.44	0.08
07-09-2025 22:30	7.99	29.03	238.96	-7.84	9.43	189.98	0.17	197.45	0.13	159.72	0.04
07-09-2025 22:35	7.86	29.03	238.83	-7.61	10.09	222.98	0.16	226	0.13	109.18	0.13
07-09-2025 22:40	7.86	29.03	238.83	-7.67	9.92	198.01	0.18	200.33	0.19	80.9	0.04
07-09-2025 22:45	7.82	29.04	238.78	-7.54	10.29	218.22	0.09	220.74	0.12	42.5	0.1
07-09-2025 22:50	7.84	29.04	238.82	-7.57	10.23	207.97	0.16	225.36	0.16	18.68	0.05
07-09-2025 22:55	7.8	29.04	238.85	-7.7	9.85	217.94	0.16	201.94	0.14	100.87	0.03
07-09-2025 23:00	7.79	29.04	238.83	-7.5	10.43	199.59	0.12	204.27	0.13	99.18	0.14
07-09-2025 23:05	7.79	29.05	238.77	-7.34	10.91	193.83	0.09	198.39	0.12	83.27	0.16
07-09-2025 23:10	7.71	29.05	238.74	-7.4	10.67	206.93	0.13	209.3	0.16	157.74	0.08
07-09-2025 23:15	7.79	29.05	238.66	-7.22	11.18	188.93	0.21	191.92	0.22	165.41	0.27
07-09-2025 23:20	7.7	29.05	238.78	-7.59	10.11	243.85	0.07	231.61	0.1	34.62	0.18
07-09-2025 23:25	7.72	29.05	238.84	-7.7	9.81	200.83	0.16	213.87	0.16	114.91	0.07
07-09-2025 23:30	7.63	29.06	238.72	-7.44	10.25	209.3	0.08	212.98	0.14	45.15	0.16
07-09-2025 23:35	7.64	29.06	238.66	-7.5	9.81	200.11	0.15	201.85	0.18	136.14	0.13
07-09-2025 23:40	7.65	29.07	238.7	-7.61	9.44	183.91	0.12	192.46	0.13	83.8	0.11
07-09-2025 23:45	7.61	29.07	238.69	-7.73	9.08	234.57	0.09	220.44	0.15	55.95	0.2
07-09-2025 23:50	7.53	29.07	238.62	-7.44	9.96	229.34	0.08	238.08	0.1	66.34	0.11
07-09-2025 23:55	7.55	29.07	238.66	-7.56	9.64	171.33	0.15	181.14	0.15	133.4	0.18
08-09-2025 00:00	7.47	29.08	238.67	-7.56	9.59	199.46	0.09	199.25	0.12	164.15	0.13
08-09-2025 00:05	7.55	29.08	238.67	-7.64	9.37	180.58	0.12	183.55	0.15	137.02	0.21
08-09-2025 00:10	7.45	29.08	238.68	-7.6	9.46	208.92	0.08	207.53	0.06	166.87	0.12
08-09-2025 00:15	7.53	29.08	238.63	-7.61	9.44	192.43	0.12	197.86	0.15	112	0.17
08-09-2025 00:20	7.5	29.08	238.63	-7.55	9.58	187.11	0.07	216.63	0.05	174.8	0.13
08-09-2025 00:25	7.45	29.08	238.63	-7.51	9.69	200.43	0.05	225.39	0.08	208.07	0.17
08-09-2025 00:30	7.48	29.08	238.64	-7.59	9.43	212.03	0.05	186.34	0.15	169.87	0.34
08-09-2025 00:35	7.47	29.08	238.6	-7.25	10.42	210.56	0.05	232.48	0.09	185.26	0.3
08-09-2025 00:40	7.39	29.08	238.6	-7.4	10.02	226.37	0.05	206.17	0.06	197.73	0.34
08-09-2025 00:45	7.47	29.08	238.65	-7.61	9.42	153.84	0.11	140.76	0.17	141.76	0.81
08-09-2025 00:50	7.47	29.09	238.61	-7.65	9.29	47.3	0.04	72.45	0.07		
08-09-2025 00:55	7.41	29.09	238.6	-7.6	9.44	14.03	0.04	5.23	0.05		
08-09-2025 01:00	7.39	29.09	238.54	-7.64	9.3	125	0.06	69.35	0.07		
08-09-2025 01:05	7.36	29.09	238.58	-7.59	9.42	40.57	0.02	20.56	0.02	205.67	0.49
08-09-2025 01:10	7.31	29.09	238.53	-7.58	9.47	136.72	0.00	203.04	0.05		
08-09-2025 01:15	7.31	29.09	238.53	-7.64	9.29	184.31	0.07	170.39	0.11		
08-09-2025 01:20	7.34	29.09	238.51	-7.61	9.35	215.74	0.03	231.03	0.03		
08-09-2025 01:25	7.32	29.09	238.52	-7.61	9.39	18.57	0.01	221.05	0.05		
08-09-2025 01:30	7.38	29.1	238.6	-7.73	9	220.69	0.10	187.3	0.08	189.81	0.5
08-09-2025 01:35	7.34	29.1	238.55	-7.69	9.13	340.09	0.05	316.61	0.07	201.27	0.29
08-09-2025 01:40	7.34	29.1	238.55	-7.72	9.03	248.12	0.00	223.4	0.02	196.32	0.27
08-09-2025 01:45	7.32	29.1	238.54	-7.74	8.99	70.41	0.02	132.73	0.02		
08-09-2025 01:50	7.37	29.1	238.56	-7.83	8.68	103.07	0.01	166.1	0.02		
08-09-2025 01:55	7.26	29.1	238.55	-7.66	9.18	339.48	0.09	327.58	0.07		
08-09-2025 02:00	7.25	29.24	238.56	-7.7	9.1	139.14	0.10	109.53	0.06		
08-09-2025 02:05	7.22	29.3	238.53	-7.66	9.24	179.56	0.03	112.16	0.06		
08-09-2025 02:10	7.24	29.17	238.52	-7.65	9.24	156.78	0.07	121.55	0.08		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
08-09-2025 02:15	7.28	29.11	238.5	-7.68	9.13	106.96	0.05	81.48	0.1		
08-09-2025 02:20	7.33	29.1	238.53	-7.75	8.91	284.04	0.04	61.46	0.05		
08-09-2025 02:25	7.29	29.09	238.54	-7.71	9.04	296.18	0.06	110.4	0.03	172.81	0.14
08-09-2025 02:30	7.32	29.09	238.59	-7.78	8.8	245.58	0.07	111.94	0.09	136.81	0.37
08-09-2025 02:35	7.42	29.09	238.63	-7.97	8.27	306.62	0.05	348.89	0.05	159.32	0.28
08-09-2025 02:40	7.22	29.08	238.53	-7.73	8.95	328.96	0.14	321.19	0.17		
08-09-2025 02:45	7.21	29.08	238.57	-7.76	8.86	155.83	0.07	156.33	0.19		
08-09-2025 02:50	7.22	29.08	238.55	-7.8	8.75	147.95	0.04	209.41	0.07		
08-09-2025 02:55	7.26	29.09	238.58	-7.86	8.57	204.45	0.02	180.77	0.07		
08-09-2025 03:00	7.25	29.1	238.65	-7.89	8.46	353.49	0.05	154.86	0.02		
08-09-2025 03:05	7.3	29.1	238.63	-8.02	8.13	349.67	0.06	201.5	0.06		
08-09-2025 03:10	7.32	29.09	238.62	-7.86	8.54	325.55	0.13	275.42	0.07		
08-09-2025 03:15	7.35	29.09	238.57	-7.91	8.41	326.1	0.11	285.74	0.05		
08-09-2025 03:20	7.41	29.08	238.57	-7.9	8.41	343.45	0.11	236.09	0.08		
08-09-2025 03:25	7.34	29.08	238.57	-7.85	8.58	329.28	0.13	303.88	0.09	187.33	0.22
08-09-2025 03:30	7.45	29.07	238.69	-8.09	7.93	302.45	0.07	226.37	0.09		
08-09-2025 03:35	7.37	29.07	238.64	-7.87	8.55	347.06	0.17	311.1	0.09	169.12	0.28
08-09-2025 03:40	7.45	29.07	238.63	-7.99	8.23	304.51	0.04	226.9	0.09	166.26	0.4
08-09-2025 03:45	7.45	29.07	238.58	-7.97	8.26	349.14	0.13	50.86	0.08	153.93	0.5
08-09-2025 03:50	7.52	29.07	238.61	-8.13	7.82	327.94	0.06	115.99	0.09	158.29	0.5
08-09-2025 03:55	7.43	29.06	238.71	-8.5	6.86	339.59	0.15	23.76	0.05	157.11	0.27
08-09-2025 04:00	7.51	29.04	238.79	-8.85	5.98	258.12	0.11	203.73	0.08	178.89	0.22
08-09-2025 04:05	7.47	29.03	238.71	-8.48	6.92	7.11	0.08	339.59	0.03	182.61	0.11
08-09-2025 04:10	7.5	29.03	238.75	-8.55	6.75	94.79	0.06	173.96	0.1		
08-09-2025 04:15	7.46	29.03	238.7	-8.44	7.03	37	0.08	44.61	0.02	123.15	0.13
08-09-2025 04:20	7.51	29.03	238.69	-8.37	7.2	4.01	0.14	189.51	0.07	109.47	0.17
08-09-2025 04:25	7.53	29.03	238.71	-8.36	7.22	16.5	0.10	258.85	0.05	14.01	0.14
08-09-2025 04:30	7.58	29.03	238.75	-8.47	6.98	76.23	0.04	324.26	0.05		
08-09-2025 04:35	7.54	29.03	238.7	-8.32	7.3	14.85	0.10	296.5	0.12		
08-09-2025 04:40	7.65	29.03	238.74	-8.47	6.96	20.07	0.03	233.2	0.08	125.73	0.05
08-09-2025 04:45	7.66	29.03	238.67	-8.27	7.45	55.07	0.04	310.55	0.09	1.48	0.17
08-09-2025 04:50	7.71	29.02	238.66	-8.26	7.51	34.88	0.11	304.64	0.08		
08-09-2025 04:55	7.72	29.02	238.69	-8.32	7.33	23.34	0.09	297.04	0.04	53.51	0.11
08-09-2025 05:00	7.71	29.01	238.7	-8.24	7.54	44.15	0.08	319.45	0.11		
08-09-2025 05:05	7.78	29.01	238.68	-8.35	7.25	26.63	0.08	310.63	0.04	347.23	0.08
08-09-2025 05:10	7.8	29.01	238.7	-8.31	7.35	37.23	0.09	354.32	0.06	1.6	0.17
08-09-2025 05:15	7.8	29	238.65	-8.28	7.44	16.01	0.10	335.9	0.09	4.57	0.18
08-09-2025 05:20	7.76	29	238.65	-8.3	7.4	6.83	0.17	340.87	0.11	8.69	0.15
08-09-2025 05:25	7.79	28.99	238.66	-8.41	7.12	31.76	0.05	255.7	0.04	346.09	0.12
08-09-2025 05:30	7.79	28.99	238.72	-8.31	7.36	346.64	0.14	292.91	0.14	342.16	0.2
08-09-2025 05:35	7.8	28.99	238.7	-8.27	7.49	60.54	0.05	280.91	0.08	345.31	0.11
08-09-2025 05:40	7.84	28.98	238.71	-8.35	7.26	50.35	0.02	252.37	0.04	16.5	0.14
08-09-2025 05:45	7.87	28.98	238.71	-8.34	7.31	28.44	0.05	261.28	0.08	21.38	0.1
08-09-2025 05:50	7.91	28.98	238.71	-8.22	7.62	351.6	0.06	304.6	0.1	23.41	0.18
08-09-2025 05:55	7.94	28.97	238.68	-8.23	7.58	61.01	0.06	136.01	0.03	71.28	0.21
08-09-2025 06:00	8.01	28.97	238.78	-8.37	7.2	43.57	0.02	209.05	0.08	55.96	0.03
08-09-2025 06:05	8.02	28.97	238.82	-8.51	6.88	350.55	0.06	277.96	0.08	4.88	0.22
08-09-2025 06:10	8.05	28.97	238.78	-8.35	7.24	12.81	0.04	252.05	0.05	11.31	0.15
08-09-2025 06:15	8	28.97	238.71	-8.26	7.52	15.88	0.08	313.47	0.05	52.64	0.23

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
08-09-2025 06:20	8	28.97	238.7	-8.22	7.58	305.87	0.01	265.89	0.06	76.51	0.08
08-09-2025 06:25	8.07	28.97	238.69	-8.27	7.48	32.24	0.04	257.18	0.06	80.43	0.1
08-09-2025 06:30	8.09	28.97	238.7	-8.11	7.9	353.82	0.05	281.95	0.06	29.68	0.22
08-09-2025 06:35	8.06	28.97	238.67	-8.17	7.71	141.38	0.03	232.85	0.08	57.33	0.2
08-09-2025 06:40	8.09	28.98	238.68	-8.33	7.32	171.38	0.04	209.62	0.07	61.53	0.17
08-09-2025 06:45	8.14	28.98	238.69	-8.38	7.18	320.66	0.11	34.87	0.06	173.33	0.19
08-09-2025 06:50	8.1	28.98	238.67	-8.27	7.49	9.41	0.14	28.48	0.14	248.86	0.09
08-09-2025 06:55	8.16	28.98	238.66	-8.3	7.4	88.78	0.03	52.36	0.03	341.67	0.56
08-09-2025 07:00	8.24	28.98	238.63	-8.34	7.3	127.38	0.08	17.5	0.07	200.4	0.12
08-09-2025 07:05	8.16	28.98	238.58	-8.16	7.75	307.59	0.11	298.51	0.1	89.2	0.25
08-09-2025 07:10	8.19	28.98	238.58	-8.2	7.66	217.02	0.05	215.91	0.1	148.21	0.13
08-09-2025 07:15	8.21	28.98	238.58	-8.25	7.5	274.87	0.04	257.32	0.07	140.72	0.19
08-09-2025 07:20	8.22	28.98	238.56	-8.17	7.72	307.67	0.04	265.62	0.08	120.9	0.16
08-09-2025 07:25	8.22	28.98	238.55	-8.2	7.64	26.11	0.03	253.11	0.08	133.45	0.17
08-09-2025 07:30	8.26	28.98	238.62	-8.13	7.87	54.22	0.07	261.36	0.07	47.3	0.11
08-09-2025 07:35	8.25	28.98	238.57	-8.14	7.81	72.67	0.03	298.82	0.08	66.62	0.1
08-09-2025 07:40	8.29	28.99	238.6	-8.13	7.9	302.02	0.08	282.81	0.11	31.57	0.2
08-09-2025 07:45	8.2	28.98	238.55	-8.03	8.08	359.49	0.05	293.23	0.11	97.01	0.26
08-09-2025 07:50	8.26	28.99	238.55	-8.07	8	137.93	0.07	191.83	0.07	52.83	0.09
08-09-2025 07:55	8.26	28.99	238.57	-8.07	7.98	252.48	0.08	311.62	0.11	28.14	0.26
08-09-2025 08:00	8.27	28.99	238.63	-7.97	8.25	271.89	0.07	259.07	0.12	353.65	0.06
08-09-2025 08:05	8.33	28.99	238.6	-8.13	7.85	231.07	0.09	230.1	0.11	145.86	0.13
08-09-2025 08:10	8.36	29	238.62	-8.26	7.49	309.1	0.01	272.59	0.07	17.5	0.11
08-09-2025 08:15	8.28	29.01	238.51	-7.93	8.39	314.63	0.12	307.03	0.13	8.89	0.16
08-09-2025 08:20	8.33	29	238.58	-8.09	7.94	182.48	0.11	239.05	0.1	95.81	0.23
08-09-2025 08:25	8.31	29	238.58	-8.11	7.9	355.05	0.05	294.05	0.08	22.2	0.02
08-09-2025 08:30	8.28	29.01	238.57	-7.92	8.45	239	0.10	255.08	0.1	325.88	0.11
08-09-2025 08:35	8.3	29.01	238.55	-7.89	8.48	227.02	0.09	227.39	0.09	334.49	0.03
08-09-2025 08:40	8.37	29.01	238.57	-8.04	8.08	191.66	0.09	241.81	0.08	219.76	0.15
08-09-2025 08:45	8.35	29.01	238.52	-7.91	8.41	301.76	0.08	301.35	0.08	117.97	0.16
08-09-2025 08:50	8.19	29.01	238.43	-7.65	9.19	276	0.05	282.7	0.09	112.54	0.12
08-09-2025 08:55	8.25	29.01	238.5	-7.76	8.86	197.11	0.14	195.47	0.19	165.1	0.24
08-09-2025 09:00	8.34	29.01	238.54	-7.87	8.56	227.78	0.09	205.73	0.11	160.97	0.2
08-09-2025 09:05	8.18	29.02	238.51	-7.81	8.73	253.16	0.08	273.06	0.09	158.94	0.08
08-09-2025 09:10	8.23	29.03	238.54	-7.98	8.23	209.75	0.15	194.99	0.14	158.56	0.31
08-09-2025 09:15	8.17	29.04	238.47	-7.85	8.61	216.49	0.14	242.5	0.11	213.39	0.12
08-09-2025 09:20	8.22	29.05	238.49	-7.9	8.46	175.23	0.15	169.26	0.13	154.06	0.17
08-09-2025 09:25	8.29	29.05	238.51	-7.9	8.43	221.1	0.08	236.48	0.08	153.45	0.12
08-09-2025 09:30	8.12	29.06	238.49	-7.78	8.83	266.34	0.09	256.44	0.09	152.74	0.21
08-09-2025 09:35	8.18	29.07	238.63	-8.26	7.46	190.91	0.10	211.73	0.12	170.08	0.1
08-09-2025 09:40	8.25	29.08	238.64	-8.52	6.88	219.95	0.12	217.68	0.06	121.01	0.09
08-09-2025 09:45	8.1	29.08	238.51	-8.13	7.85	49.66	0.09	15.16	0.14	115.92	0.11
08-09-2025 09:50	8.13	29.08	238.53	-8.23	7.59	148.98	0.25	126.73	0.15	161.52	0.2
08-09-2025 09:55	8.17	29.08	238.49	-8.16	7.76	100.29	0.07	105.13	0.11	182.21	0.11
08-09-2025 10:00	8.12	29.09	238.46	-8.03	8.08	90.1	0.09	59.42	0.11	343.42	0.15
08-09-2025 10:05	8.18	29.09	238.47	-8.19	7.67	202.48	0.13	188.49	0.14	102.5	0.16
08-09-2025 10:10	8.13	29.1	238.4	-7.98	8.24	247.8	0.09	273.61	0.09	6.88	0.26
08-09-2025 10:15	8.12	29.1	238.37	-8.01	8.15	221.08	0.05	252.48	0.08	357.87	0.26
08-09-2025 10:20	8.08	29.11	238.35	-7.85	8.65	236.16	0.09	256.9	0.05	8.66	0.34

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
08-09-2025 10:25	8.02	29.12	238.37	-7.82	8.7	239.74	0.09	268.58	0.08	18.89	0.18
08-09-2025 10:30	8.04	29.12	238.4	-7.89	8.53	220.12	0.03	206.98	0.03	64.67	0.15
08-09-2025 10:35	8.05	29.14	238.39	-7.74	8.99	230.24	0.10	256.45	0.05	42.55	0.22
08-09-2025 10:40	7.95	29.15	238.4	-7.79	8.87	296.01	0.11	282.71	0.13	28.62	0.15
08-09-2025 10:45	7.92	29.15	238.31	-7.53	9.66	181.44	0.13	174.7	0.1	34.53	0.14
08-09-2025 10:50	7.95	29.16	238.35	-7.64	9.29	143.38	0.09	179.86	0.12	44.69	0.23
08-09-2025 10:55	7.99	29.16	238.39	-7.8	8.87	257.25	0.07	192.19	0.05	32.11	0.33
08-09-2025 11:00	7.95	29.16	238.39	-7.62	9.43	320.89	0.04	291.91	0.08	25.67	0.37
08-09-2025 11:05	7.82	29.17	238.27	-7.37	10.11	272.21	0.07	261.44	0.09	21.17	0.33
08-09-2025 11:10	7.85	29.18	238.36	-7.56	9.6	202.3	0.18	191.13	0.16	108.8	0.17
08-09-2025 11:15	7.89	29.18	238.31	-7.52	9.69	218.4	0.08	202.12	0.07	42.02	0.18
08-09-2025 11:20	7.89	29.19	238.32	-7.54	9.64	240.06	0.05	251.37	0.01	67.24	0.2
08-09-2025 11:25	7.79	29.19	238.34	-7.54	9.62	265.06	0.05	295.11	0.08	22.57	0.17
08-09-2025 11:30	7.76	29.2	238.36	-7.57	9.55	250.7	0.08	232.1	0.09	12.96	0.07
08-09-2025 11:35	7.73	29.19	238.31	-7.51	9.68	202.41	0.06	179.78	0.05	87.82	0.19
08-09-2025 11:40	7.77	29.19	238.54	-8.34	7.34	198.72	0.09	207.4	0.07	91.09	0.07
08-09-2025 11:45	7.71	29.19	238.44	-8.01	8.23	277.84	0.04	291.28	0.08	76.71	0.15
08-09-2025 11:50	7.66	29.19	238.44	-7.85	8.63	193.92	0.11	250.82	0.09	131.76	0.13
08-09-2025 11:55	7.59	29.2	238.39	-7.88	8.56	199.32	0.04	174.42	0.06	146.56	0.18
08-09-2025 12:00	7.53	29.2	238.42	-7.83	8.74	184.44	0.08	194.64	0.08	173.62	0.14
08-09-2025 12:05	7.55	29.2	238.45	-7.96	8.36	177.81	0.16	170.93	0.16		
08-09-2025 12:10	7.63	29.21	238.49	-8.12	7.91	222.63	0.08	190.15	0.11	132.71	0.12
08-09-2025 12:15	7.59	29.21	238.49	-8.11	7.94	292.95	0.03	334.3	0.02	46.23	0.09
08-09-2025 12:20	7.48	29.21	238.4	-7.87	8.63	316.23	0.03	299.74	0.07	120.71	0.12
08-09-2025 12:25	7.51	29.21	238.41	-7.78	8.88	182.2	0.12	181.37	0.11		
08-09-2025 12:30	7.55	29.22	238.43	-7.73	9.07	215.93	0.06	234.56	0.08	206.61	0.15
08-09-2025 12:35	7.44	29.22	238.35	-7.58	9.54	299.44	0.10	278.93	0.1		
08-09-2025 12:40	7.5	29.22	238.35	-7.7	9.16	198.47	0.06	206.62	0.08	173.13	0.33
08-09-2025 12:45	7.48	29.23	238.36	-7.74	8.99	117.47	0.06	68.21	0.09	168.98	0.22
08-09-2025 12:50	7.4	29.24	238.3	-7.65	9.31	131.18	0.08	58.64	0.1	156.04	0.53
08-09-2025 12:55	7.43	29.23	238.2	-7.7	8.88	120.69	0.15	111.65	0.13	163.48	0.55
08-09-2025 13:00	7.5	29.23	238.24	-7.86	8.4	39.33	0.09	85.77	0.06	172.31	0.22
08-09-2025 13:05	7.47	29.23	237.6	-7.36	8.05	296.74	0.04	313.67	0.04	15.73	0.12
08-09-2025 13:10	7.35	29.25	236.94	-6.37	9.08	236.83	0.06	260.54	0.09	55.82	0.09
08-09-2025 13:15	7.34	29.25	236.97	-6.53	8.69	179.45	0.09	190.02	0.09	76.18	0.23
08-09-2025 13:20	7.33	29.26	236.95	-6.59	8.51	230.69	0.11	219.62	0.08	66.22	0.21
08-09-2025 13:25	7.25	29.26	236.92	-6.47	8.83	211.85	0.10	215.1	0.07	82.27	0.05
08-09-2025 13:30	7.27	29.26	236.98	-6.45	8.85	209.64	0.13	191.08	0.12		
08-09-2025 13:35	7.28	29.26	236.95	-6.45	8.89	218.48	0.10	203.24	0.1		
08-09-2025 13:40	7.32	29.27	236.93	-6.6	8.49	220.46	0.12	190.63	0.09		
08-09-2025 13:45	7.31	29.27	236.91	-6.48	8.77	260.56	0.10	254.46	0.06		
08-09-2025 13:50	7.31	29.28	236.96	-6.43	8.98	249.15	0.08	256.31	0.08		
08-09-2025 13:55	7.31	29.28	236.99	-6.61	8.47	258.02	0.08	228.92	0.09	156.24	0.31
08-09-2025 14:00	7.26	29.28	236.96	-6.57	8.54	296.08	0.10	271.84	0.08	160.88	0.15
08-09-2025 14:05	7.29	29.28	237.01	-6.63	8.41	248.73	0.11	330.94	0.07		
08-09-2025 14:10	7.26	29.28	236.99	-6.65	8.34	236.98	0.15	233.99	0.14		
08-09-2025 14:15	7.22	29.28	236.97	-6.56	8.56	255.78	0.10	213.57	0.07		
08-09-2025 14:20	7.21	29.27	236.94	-6.48	8.83	216.63	0.10	186.39	0.12		
08-09-2025 14:25	7.15	29.27	236.9	-6	10.09	210.98	0.11	188.55	0.15		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
08-09-2025 14:30	7.27	29.27	237	-6.22	9.52	205.13	0.14	193.25	0.19		
08-09-2025 14:35	7.28	29.27	236.99	-6.38	9.12	226.63	0.07	239.35	0.03		
08-09-2025 14:40	7.25	29.28	236.96	-6.45	8.93	246.22	0.10	217.06	0.09	9.57	0.32
08-09-2025 14:45	7.3	29.28	236.95	-6.42	9.01	227.99	0.09	199.09	0.1		
08-09-2025 14:50	7.24	29.28	236.99	-6.23	9.48	233.05	0.07	272.67	0.07		
08-09-2025 14:55	7.15	29.29	237	-6.07	9.93	185.73	0.17	187.56	0.14		
08-09-2025 15:00	7.24	29.29	237.1	-6.24	9.47	170.22	0.24	171.72	0.11		
08-09-2025 15:05	7.21	29.29	237.06	-6.32	9.25	231.5	0.07	232.21	0.04		
08-09-2025 15:10	7.31	29.29	237.02	-6.68	8.29	292.78	0.10	204.55	0.13		
08-09-2025 15:15	7.29	29.29	237.03	-6.65	8.34	312.58	0.16	296.75	0.12		
08-09-2025 15:20	7.29	29.29	236.99	-6.66	8.32	219.77	0.11	243.8	0.09		
08-09-2025 15:25	7.27	29.29	236.88	-6.48	8.83	254.62	0.08	241.99	0.06		
08-09-2025 15:30	7.34	29.3	236.93	-6.56	8.61	289.47	0.05	210.02	0.06		
08-09-2025 15:35	7.31	29.3	236.95	-6.7	8.25	329.4	0.60	290.75	0.08		
08-09-2025 15:40	7.28	29.3	236.74	-5.99	10.12	319.33	0.15	242.85	0.11		
08-09-2025 15:45	7.32	29.31	236.72	-5.89	10.4	118.5	0.21	115.37	0.24		
08-09-2025 15:50	7.39	29.31	236.85	-6.49	8.83	101.94	0.13	83.17	0.1		
08-09-2025 15:55	7.31	29.31	236.8	-6.43	8.96	85.38	0.05	18.93	0.11	305.61	0.7
08-09-2025 16:00	7.44	29.31	236.83	-6.64	8.38	100.01	0.14	106.99	0.17		
08-09-2025 16:05	7.33	29.32	236.79	-6.52	8.73	323.45	0.06	293.68	0.13		
08-09-2025 16:10	7.29	29.32	236.78	-6.36	9.16	182.86	0.09	207.95	0.1		
08-09-2025 16:15	7.35	29.32	236.8	-6.6	8.48	184.8	0.13	181.14	0.13		
08-09-2025 16:20	7.47	29.33	236.8	-6.85	7.79	180.13	0.10	198.12	0.11		
08-09-2025 16:25	7.46	29.32	236.75	-6.76	8.07	175.46	0.07	281.17	0.09		
08-09-2025 16:30	7.49	29.32	236.84	-6.68	8.31	273.37	0.12	262.33	0.12	25.62	0.44
08-09-2025 16:35	7.48	29.33	236.82	-6.67	8.34	173.63	0.13	293.42	0.12		
08-09-2025 16:40	7.49	29.33	236.78	-6.77	8.02	73.89	0.14	270.97	0.07	11.41	0.41
08-09-2025 16:45	7.6	29.33	236.81	-6.74	8.15	25.85	0.15	314.78	0.05	358.96	0.42
08-09-2025 16:50	7.52	29.33	236.78	-6.68	8.3	125.59	0.16	313.23	0.14	7.45	0.51
08-09-2025 16:55	7.54	29.33	236.8	-6.49	8.81	291.3	0.06	236.84	0.07	18.01	0.43
08-09-2025 17:00	7.51	29.33	236.88	-6.57	8.61	308.19	0.09	238.08	0.12	354.42	0.31
08-09-2025 17:05	7.55	29.33	236.79	-6.64	8.41	208.54	0.03	217.06	0.13	5.42	0.28
08-09-2025 17:10	7.63	29.33	236.78	-6.69	8.29	54.19	0.05	234.64	0.05	24.52	0.41
08-09-2025 17:15	7.61	29.32	236.76	-6.59	8.56	291	0.12	287.14	0.07	6.59	0.33
08-09-2025 17:20	7.67	29.32	236.78	-6.68	8.33	175.97	0.10	199.74	0.13	24.39	0.26
08-09-2025 17:25	7.62	29.33	236.76	-6.59	8.57	60.94	0.08	273.37	0.08	2.27	0.26
08-09-2025 17:30	7.67	29.33	236.78	-6.49	8.82	54.09	0.06	251.14	0.08	23.43	0.4
08-09-2025 17:35	7.67	29.33	236.79	-6.49	8.83	234.14	0.03	246.04	0.14	13.11	0.37
08-09-2025 17:40	7.75	29.32	236.76	-6.56	8.67	190.7	0.07	184.36	0.11	12.11	0.39
08-09-2025 17:45	7.8	29.32	236.71	-6.49	8.84	229.7	0.06	276.96	0.08	8.11	0.34
08-09-2025 17:50	7.75	29.32	236.73	-6.28	9.4	292.97	0.12	287.65	0.13	22.78	0.41
08-09-2025 17:55	7.83	29.31	236.78	-6.44	8.99	210.07	0.14	222.82	0.08	29.59	0.34
08-09-2025 18:00	7.83	29.31	236.87	-6.52	8.76	127.17	0.16	248.8	0.08	26.25	0.36
08-09-2025 18:05	7.88	29.31	236.87	-6.57	8.6	215.16	0.08	271.94	0.1	14.91	0.45
08-09-2025 18:10	7.84	29.3	236.92	-6.5	8.83	206.23	0.10	245.12	0.12	24.94	0.29
08-09-2025 18:15	7.92	29.3	236.9	-6.62	8.5	197.3	0.12	217.25	0.15	18.42	0.36
08-09-2025 18:20	7.9	29.3	236.93	-6.53	8.73	96.98	0.06	260.28	0.07	15	0.43
08-09-2025 18:25	7.94	29.29	236.94	-6.21	9.59	3.34	0.10	242.02	0.13	33.31	0.5
08-09-2025 18:30	7.88	29.3	236.85	-6	10.12	195.72	0.16	238.69	0.21	30.1	0.5

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
08-09-2025 18:35	7.94	29.29	236.87	-6.11	9.85	188.63	0.17	224.71	0.13	26.29	0.45
08-09-2025 18:40	7.97	29.29	236.86	-6.24	9.52	199.51	0.14	240.02	0.14	34.69	0.44
08-09-2025 18:45	7.95	29.29	236.77	-6.02	10.11	79.14	0.08	97.64	0.12	313.32	0.72
08-09-2025 18:50	7.98	29.29	236.79	-5.96	10.24	147.06	0.12	125.37	0.2	321.17	0.33
08-09-2025 18:55	8.01	29.29	236.81	-6.05	10.01	109.39	0.16	103.34	0.1	293.62	0.45
08-09-2025 19:00	8.02	29.29	236.76	-5.72	10.89	86.86	0.08	75.11	0.15	315.25	0.54
08-09-2025 19:05	8.07	29.29	236.84	-5.76	10.78	214.12	0.16	224.2	0.14	36.21	0.5
08-09-2025 19:10	8.06	29.28	236.8	-5.82	10.63	241.4	0.11	236.33	0.1	32.61	0.53
08-09-2025 19:15	8.07	29.28	236.7	-5.89	10.46	227.26	0.12	220.12	0.1	33.36	0.47
08-09-2025 19:20	8.07	29.28	236.67	-5.91	10.38	216.77	0.17	211.1	0.16	17.53	0.34
08-09-2025 19:25	8.2	29.28	236.77	-6.3	9.36	206.48	0.15	203.29	0.14	33.76	0.25
08-09-2025 19:30	8.14	29.28	236.73	-6.49	8.84	244.66	0.04	304.87	0.13	20.47	0.34
08-09-2025 19:35	8.13	29.28	236.7	-6.06	10.01	256.66	0.09	270.05	0.12	18.82	0.35
08-09-2025 19:40	8.12	29.28	236.64	-6.1	9.9	195.03	0.19	214.58	0.13	25.12	0.33
08-09-2025 19:45	8.11	29.28	236.71	-6.04	10.08	214.26	0.14	211.4	0.13	38.56	0.18
08-09-2025 19:50	8.19	29.28	236.81	-6.22	9.6	219.33	0.17	226.65	0.18	36.65	0.34
08-09-2025 19:55	8.14	29.28	236.75	-6.2	9.66	208.03	0.11	234.72	0.15	33.05	0.54
08-09-2025 20:00	8.15	29.28	236.82	-6.07	9.98	216.76	0.11	210.53	0.12	21.5	0.26
08-09-2025 20:05	8.09	29.27	236.82	-5.84	10.58	222.26	0.15	212.93	0.17	33.09	0.29
08-09-2025 20:10	8.26	29.27	236.92	-6.24	9.57	188.03	0.19	195.22	0.18	41.74	0.26
08-09-2025 20:15	8.32	29.27	236.91	-6.21	9.61	263.36	0.07	294.39	0.1		
08-09-2025 20:20	8.26	29.27	236.88	-6.23	9.58	281.84	0.08	306.2	0.09		
08-09-2025 20:25	8.25	29.27	236.9	-6.11	9.91	238.05	0.08	258.51	0.06		
08-09-2025 20:30	8.22	29.27	236.8	-6.01	10.17	261.1	0.11	235.96	0.06		
08-09-2025 20:35	8.2	29.28	236.84	-5.96	10.3	172.86	0.06	196.35	0.07		
08-09-2025 20:40	8.21	29.28	236.86	-6.08	9.96	203.03	0.09	202.26	0.08		
08-09-2025 20:45	8.19	29.27	236.74	-5.84	10.58	217.91	0.15	209.35	0.11	43.75	0.11
08-09-2025 20:50	8.16	29.28	236.81	-6.07	10.02	197.06	0.17	195.82	0.13	46.83	0.38
08-09-2025 20:55	8.28	29.27	236.84	-6.23	9.61	191.99	0.12	189.93	0.13	37.6	0.31
08-09-2025 21:00	8.2	29.28	236.77	-6.05	10.06	242.79	0.08	274.19	0.1		
08-09-2025 21:05	8.24	29.28	236.82	-6.28	9.48	184.56	0.11	212.87	0.08		
08-09-2025 21:10	8.23	29.28	236.83	-6.35	9.24	222.78	0.09	271.93	0.07		
08-09-2025 21:15	8.22	29.28	236.81	-6.4	9.17	200.1	0.09	239.07	0.04	340.59	0.32
08-09-2025 21:20	8.22	29.28	236.85	-6.41	9.14	221.85	0.10	231.01	0.06	353.05	0.53
08-09-2025 21:25	8.26	29.28	236.88	-6.47	8.99	221.72	0.07	222.51	0.07	17.55	0.51
08-09-2025 21:30	8.18	29.28	236.84	-6.32	9.37	212.95	0.07	275.45	0.01		
08-09-2025 21:35	8.28	29.28	236.9	-6.53	8.8	177.36	0.19	201.36	0.12	22.34	0.45
08-09-2025 21:40	8.19	29.28	236.88	-6.26	9.55	276.41	0.11	313.43	0.07	357.64	0.54
08-09-2025 21:45	8.22	29.28	236.92	-6.46	9.01	136.27	0.12	131.41	0.1	317.1	0.43
08-09-2025 21:50	8.24	29.28	236.83	-6.24	9.61	101.23	0.06	26.54	0.09		
08-09-2025 21:55	8.12	29.28	236.78	-6.12	9.92	80.4	0.12	25.06	0.1		
08-09-2025 22:00	8.11	29.28	236.79	-6.14	9.86	120.24	0.12	148.29	0.06	305.4	0.72
08-09-2025 22:05	8.19	29.28	236.77	-6.28	9.48	207.97	0.14	175.04	0.1	33.69	0.19
08-09-2025 22:10	8.25	29.28	236.8	-6.55	8.75	231	0.08	278.58	0.03	61	0.17
08-09-2025 22:15	8.11	29.28	236.82	-6.41	9.15	295.68	0.12	324.75	0.15		
08-09-2025 22:20	8.1	29.28	236.87	-6.47	9	226.94	0.08	320.04	0.02	21.59	0.44
08-09-2025 22:25	8.11	29.29	236.86	-6.51	8.89	257.08	0.10	225.71	0.01	7.2	0.41
08-09-2025 22:30	8.04	29.29	236.87	-6.36	9.3	287.61	0.07	304.6	0.02	14.12	0.21
08-09-2025 22:35	7.99	29.3	236.85	-6.31	9.42	227.76	0.06	160.21	0.07	33.12	0.18

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
08-09-2025 22:40	8.01	29.3	236.83	-6.27	9.54	155.46	0.08	150.18	0.04	41.02	0.4
08-09-2025 22:45	8.05	29.3	236.88	-6.33	9.38	205.32	0.12	70.95	0.03	33.76	0.36
08-09-2025 22:50	8.06	29.31	236.85	-6.39	9.18	253.05	0.05	0.34	0.07	20.83	0.53
08-09-2025 22:55	8.01	29.32	236.91	-6.39	9.23	290.42	0.02	348.53	0.08	20.17	0.37
08-09-2025 23:00	7.9	29.32	236.91	-6.2	9.7	268.81	0.06	352.97	0.07	17.37	0.53
08-09-2025 23:05	7.91	29.32	236.91	-6.29	9.46	162.31	0.09	138.89	0.04	26.86	0.31
08-09-2025 23:10	7.94	29.33	236.9	-6.38	9.25	151.97	0.08	113.35	0.04	20.07	0.38
08-09-2025 23:15	7.81	29.33	236.91	-6.3	9.47	161.53	0.06	322.95	0.01	8.41	0.32
08-09-2025 23:20	7.86	29.34	236.93	-6.5	8.9	160.08	0.12	148.08	0.1	20.16	0.37
08-09-2025 23:25	7.78	29.34	236.86	-6.34	9.34	146.57	0.02	21.03	0.07	33.85	0.32
08-09-2025 23:30	7.86	29.35	236.91	-6.54	8.8	160.19	0.09	119.16	0.12	35.28	0.36
08-09-2025 23:35	7.82	29.35	236.94	-6.54	8.79	177.15	0.03	6.7	0.08	15.66	0.47
08-09-2025 23:40	7.75	29.36	236.89	-6.47	8.99	100.27	0.07	8.46	0.03	16.78	0.42
08-09-2025 23:45	7.82	29.4	236.91	-6.86	7.92	118.51	0.10	121.72	0.1	31.66	0.36
08-09-2025 23:50	7.79	29.44	236.9	-6.85	7.9	329.86	0.05	16.13	0.09	352.82	0.46
08-09-2025 23:55	7.72	29.45	236.85	-6.83	7.98	33.38	0.14	54.77	0.1	12.85	0.44
09-09-2025 00:00	7.69	29.47	236.86	-6.87	7.85	76.72	0.06	36.61	0.07	28.4	0.4
09-09-2025 00:05	7.69	29.48	236.85	-6.87	7.84	49.1	0.08	66.02	0.13	27.48	0.41
09-09-2025 00:10	7.64	29.49	236.81	-6.84	7.94	39.03	0.10	52.81	0.2	30.39	0.49
09-09-2025 00:15	7.64	29.51	236.77	-6.83	7.99	70.11	0.10	54.1	0.17	36.02	0.47
09-09-2025 00:20	7.63	29.52	236.76	-6.8	8.1	60	0.14	77.01	0.2		
09-09-2025 00:25	7.6	29.52	236.75	-6.87	7.87	25.05	0.14	50.22	0.15	28.64	0.44
09-09-2025 00:30	7.58	29.54	236.81	-7.02	7.46	30.21	0.20	49.59	0.19	27.53	0.65
09-09-2025 00:35	7.57	29.55	236.81	-7.33	6.65	41.73	0.17	62.82	0.14	20.52	0.35
09-09-2025 00:40	7.56	29.54	236.75	-7.15	7.14	61.19	0.19	60.73	0.16	28.21	0.54
09-09-2025 00:45	7.63	29.54	236.77	-7.29	6.74	280.82	0.15	262.82	0.13		
09-09-2025 00:50	7.51	29.54	236.72	-7.08	7.31	304.13	0.25	311.15	0.26	319.64	1.07
09-09-2025 00:55	7.48	29.52	236.69	-7.03	7.47	262.13	0.13	276.63	0.17		
09-09-2025 01:00	7.5	29.51	236.65	-7.12	7.21	237.79	0.19	243.39	0.13	317.43	0.62
09-09-2025 01:05	7.48	29.5	236.62	-7.12	7.2	58.51	0.10	64.8	0.11		
09-09-2025 01:10	7.52	29.47	236.58	-7.15	7.12	69.44	0.09	64.19	0.14		
09-09-2025 01:15	7.38	29.44	236.55	-6.85	7.93	43.61	0.12	42.65	0.18		
09-09-2025 01:20	7.47	29.48	236.58	-7.02	7.47	103.81	0.15	103.53	0.15	41.17	0.33
09-09-2025 01:25	7.42	29.46	236.56	-6.94	7.67	52.69	0.13	68.14	0.14		
09-09-2025 01:30	7.37	29.43	236.6	-6.77	8.13	57.15	0.13	69.76	0.13		
09-09-2025 01:35	7.36	29.41	236.57	-6.83	7.99	115.33	0.19	113.48	0.23	77.04	0.62
09-09-2025 01:40	7.36	29.4	236.61	-6.81	8.06	125.82	0.15	109.21	0.17	76.34	0.53
09-09-2025 01:45	7.35	29.39	236.57	-6.8	8.04	112.81	0.16	100.11	0.22	67.29	0.51
09-09-2025 01:50	7.33	29.39	236.58	-6.74	8.2	105.86	0.11	102.23	0.17	66.7	0.36
09-09-2025 01:55	7.41	29.38	236.59	-6.95	7.64	113.7	0.12	102.45	0.16	61.6	0.38
09-09-2025 02:00	7.35	29.38	236.68	-6.91	7.74	30.53	0.06	45.3	0.12	55.37	0.54
09-09-2025 02:05	7.37	29.38	236.63	-7	7.53	133.38	0.08	76.27	0.09	52.45	0.5
09-09-2025 02:10	7.38	29.38	236.64	-7.03	7.45	51.78	0.04	56.49	0.08	37.66	0.69
09-09-2025 02:15	7.34	29.38	236.63	-6.95	7.63	52.59	0.10	55.82	0.15	33.09	0.56
09-09-2025 02:20	7.3	29.38	236.6	-6.85	7.91	126.56	0.07	73.43	0.04	49.24	0.41
09-09-2025 02:25	7.35	29.39	236.65	-6.77	8.15	96.53	0.06	88.02	0.08	75.97	0.48
09-09-2025 02:30	7.29	29.39	236.63	-6.69	8.37	59.66	0.07	33.94	0.06		
09-09-2025 02:35	7.32	29.39	236.62	-6.83	7.97	56.84	0.08	73.75	0.07		
09-09-2025 02:40	7.3	29.41	236.62	-6.79	8.11	51.15	0.09	41.77	0.12		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
09-09-2025 02:45	7.28	29.44	236.62	-6.71	8.33	46.96	0.11	56.47	0.11		
09-09-2025 02:50	7.3	29.48	236.6	-6.68	8.41	94.58	0.06	52.57	0.11		
09-09-2025 02:55	7.39	29.54	236.61	-6.9	7.8	60.23	0.09	40.2	0.09		
09-09-2025 03:00	7.34	29.62	236.67	-6.76	8.18	358.83	0.15	0.25	0.19	50	0.3
09-09-2025 03:05	7.32	29.66	236.58	-6.84	7.97	10.71	0.12	40.87	0.13	102.67	0.24
09-09-2025 03:10	7.28	29.66	236.57	-6.84	7.92	29.45	0.08	39.15	0.13	118.32	0.29
09-09-2025 03:15	7.31	29.66	236.54	-6.79	8.09	32.45	0.11	57.53	0.14		
09-09-2025 03:20	7.36	29.65	236.58	-6.89	7.83	8.56	0.07	49.43	0.09	73.94	0.32
09-09-2025 03:25	7.4	29.64	236.59	-6.98	7.57	29.7	0.12	19.21	0.18	44.51	0.5
09-09-2025 03:30	7.35	29.62	236.58	-6.92	7.73	15.02	0.17	5.36	0.18	38.46	0.43
09-09-2025 03:35	7.4	29.59	236.52	-6.89	7.82	333.23	0.05	18.59	0.13	61.77	0.64
09-09-2025 03:40	7.36	29.59	236.5	-6.85	7.92	357.7	0.12	6.36	0.15	49.57	0.44
09-09-2025 03:45	7.37	29.56	236.49	-6.97	7.61	294.91	0.15	294.77	0.16	255.24	0.74
09-09-2025 03:50	7.35	29.44	236.52	-6.91	7.79	284.76	0.18	270.85	0.14	266.73	0.5
09-09-2025 03:55	7.43	29.43	236.5	-7.09	7.28	256.73	0.16	211.12	0.15	180	0.3
09-09-2025 04:00	7.47	29.44	236.5	-7.13	7.17	276.13	0.19	292.83	0.16	271.1	0.12
09-09-2025 04:05	7.52	29.48	236.49	-7.27	6.81	28.23	0.19	39.47	0.13	106.45	0.23
09-09-2025 04:10	7.47	29.53	236.49	-7.37	6.55	7.59	0.19	21.25	0.2		
09-09-2025 04:15	7.5	29.56	236.49	-7.22	6.92	36.76	0.15	20.85	0.15		
09-09-2025 04:20	7.47	29.56	236.48	-7.21	6.96	32.3	0.16	35.32	0.21		
09-09-2025 04:25	7.48	29.55	236.49	-7.22	6.96	33.46	0.17	41.7	0.22		
09-09-2025 04:30	7.45	29.53	236.5	-7.27	6.8	30.67	0.14	45.43	0.18		
09-09-2025 04:35	7.52	29.51	236.51	-7.33	6.65	50.05	0.14	71.18	0.12		
09-09-2025 04:40	7.55	29.54	236.48	-7.41	6.46	42.68	0.18	40.87	0.14		
09-09-2025 04:45	7.56	29.55	236.46	-7.39	6.51	64.41	0.19	52.63	0.14		
09-09-2025 04:50	7.54	29.54	236.45	-7.17	7.07	22.9	0.17	34.78	0.1		
09-09-2025 04:55	7.59	29.5	236.46	-7.15	7.12	76.52	0.20	77.23	0.12		
09-09-2025 05:00	7.6	29.53	236.52	-7.18	7.04	69.84	0.18	63.89	0.18		
09-09-2025 05:05	7.62	29.52	236.52	-7.19	7.01	64.94	0.17	59.06	0.18		
09-09-2025 05:10	7.62	29.49	236.52	-7.21	6.96	43.12	0.18	45.82	0.19		
09-09-2025 05:15	7.66	29.47	236.49	-7.23	6.92	45.57	0.14	38.96	0.19		
09-09-2025 05:20	7.67	29.46	236.5	-7.52	6.17	39.99	0.18	55.56	0.19	150.98	0.26
09-09-2025 05:25	7.7	29.48	236.5	-7.56	6.02	56.72	0.20	81.38	0.21	108.3	0.25
09-09-2025 05:30	7.73	29.5	236.54	-7.34	6.63	61.59	0.19	43.76	0.13	99.1	0.25
09-09-2025 05:35	7.81	29.52	236.52	-7.45	6.35	85.34	0.19	44.67	0.16	91.38	0.22
09-09-2025 05:40	7.79	29.51	236.5	-7.21	7	54.54	0.14	29.47	0.13	80.98	0.08
09-09-2025 05:45	7.81	29.49	236.47	-7.25	6.87	62.9	0.15	87.07	0.11	71.3	0.08
09-09-2025 05:50	7.83	29.46	236.51	-7.21	7.01	67.22	0.15	63.94	0.12	70.24	0.17
09-09-2025 05:55	7.8	29.46	236.48	-7.22	6.95	76	0.16	82.33	0.09	57.13	0.18
09-09-2025 06:00	7.85	29.45	236.51	-7.06	7.4	88.4	0.16	104.27	0.15	67.79	0.27
09-09-2025 06:05	7.87	29.45	236.54	-7.13	7.21	43.72	0.18	81.8	0.12	69.06	0.21
09-09-2025 06:10	7.93	29.45	236.5	-7.21	6.97	54.57	0.14	69.43	0.08	61.76	0.2
09-09-2025 06:15	7.94	29.45	236.53	-7.11	7.27	51.09	0.16	42.21	0.16	49.57	0.16
09-09-2025 06:20	8	29.46	236.49	-7.13	7.22	46.44	0.14	61.51	0.13	70.14	0.13
09-09-2025 06:25	8.05	29.46	236.49	-7.18	7.05	35.69	0.16	36.5	0.12	58.03	0.11
09-09-2025 06:30	8	29.47	236.52	-7.09	7.3	36.9	0.15	34.48	0.16	44.28	0.25
09-09-2025 06:35	8.09	29.47	236.53	-7.26	6.87	25.11	0.13	48.61	0.11	108.41	0.1
09-09-2025 06:40	8.01	29.47	236.48	-7.04	7.47	3.74	0.21	15.37	0.2	67.3	0.16
09-09-2025 06:45	8.05	29.48	236.46	-7.08	7.34	265.74	0.17	263.7	0.16	187.01	0.23

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
09-09-2025 06:50	8.09	29.49	236.46	-7.19	7.08	297.96	0.06	278.77	0.17	214.63	0.18
09-09-2025 06:55	8.06	29.49	236.39	-7.18	7.09	274.3	0.07	283.95	0.11	190.53	0.2
09-09-2025 07:00	8.16	29.49	236.39	-7.16	7.15	290.46	0.10	288.35	0.15	280.32	0.16
09-09-2025 07:05	8.14	29.48	236.37	-7.1	7.27	347.85	0.09	32.97	0.09	68.1	0.24
09-09-2025 07:10	8.22	29.47	236.38	-7.35	6.65	73.45	0.08	37.98	0.11	79.14	0.18
09-09-2025 07:15	8.16	29.46	236.36	-7.14	7.2	13.53	0.07	12.07	0.19	59.09	0.12
09-09-2025 07:20	8.16	29.46	236.38	-7.13	7.25	54.18	0.06	38.17	0.13	76.12	0.22
09-09-2025 07:25	8.2	29.46	236.38	-7.25	6.9	21.59	0.05	38.04	0.14	40.69	0.09
09-09-2025 07:30	8.2	29.46	236.43	-7.12	7.25	18.39	0.10	9.81	0.13	117.02	0.13
09-09-2025 07:35	8.17	29.46	236.42	-6.93	7.79	16.98	0.03	38.99	0.1	77.22	0.2
09-09-2025 07:40	8.25	29.44	236.35	-7.05	7.43	152.52	0.07	73.45	0.1	97.62	0.26
09-09-2025 07:45	8.22	29.4	236.38	-7.01	7.53	22.37	0.01	13.53	0.05	131.55	0.23
09-09-2025 07:50	8.27	29.38	236.4	-7.07	7.37	71.94	0.06	54.18	0.07	136.94	0.22
09-09-2025 07:55	8.28	29.38	236.42	-7.18	7.13	7.78	0.09	21.59	0.13	161.87	0.13
09-09-2025 08:00	8.37	29.38	236.48	-7.14	7.22	323.43	0.15	18.39	0.14	163.56	0.11
09-09-2025 08:05	8.24	29.38	236.42	-6.95	7.73	344.27	0.13	20.65	0.11		
09-09-2025 08:10	8.25	29.38	236.44	-7.02	7.54	162.7	0.03	99.26	0.05	138.64	0.28
09-09-2025 08:15	8.29	29.38	236.46	-7.04	7.47	18.87	0.07	66.87	0.11	120.49	0.22
09-09-2025 08:20	8.33	29.38	236.4	-7.06	7.42	328.06	0.07	42.97	0.11	137.15	0.17
09-09-2025 08:25	8.33	29.38	236.43	-7.18	7.11	325.39	0.13	17.23	0.15	100.74	0.08
09-09-2025 08:30	8.35	29.38	236.47	-6.75	8.25	353.05	0.07	37.77	0.12	121.21	0.21
09-09-2025 08:35	8.31	29.38	236.45	-6.92	7.8	336.95	0.08	31.92	0.1	108.33	0.12
09-09-2025 08:40	8.38	29.38	236.46	-6.93	7.79	330.46	0.09	26.01	0.13	112.06	0.17
09-09-2025 08:45	8.32	29.38	236.45	-7.11	7.29	323.97	0.10	41.6	0.11	145.85	0.24
09-09-2025 08:50	8.39	29.38	236.49	-7.11	7.31	17.82	0.08	23.88	0.12	126.63	0.17
09-09-2025 08:55	8.37	29.37	236.47	-7.08	7.38	358.14	0.10	13.13	0.14	155.77	0.1
09-09-2025 09:00	8.32	29.37	236.49	-6.98	7.66	344.88	0.10	12.96	0.13	154.71	0.23
09-09-2025 09:05	8.32	29.37	236.51	-7.07	7.4	62.4	0.04	81.52	0.11	122.54	0.22
09-09-2025 09:10	8.34	29.37	236.51	-6.99	7.64	295.39	0.04	26.82	0.09	58.08	0.11
09-09-2025 09:15	8.3	29.37	236.5	-7.06	7.46	99.5	0.09	52.22	0.11	67.1	0.11
09-09-2025 09:20	8.3	29.37	236.52	-7.13	7.27	256.39	0.14	32.83	0.09	155.46	0.07
09-09-2025 09:25	8.39	29.37	236.54	-7.13	7.29	268	0.12	20.98	0.15	30.87	0.15
09-09-2025 09:30	8.29	29.36	236.55	-6.94	7.76	347.27	0.25	10.82	0.2	2.93	0.17
09-09-2025 09:35	8.26	29.35	236.54	-7	7.59	246.48	0.02	73.05	0.13	73.22	0.11
09-09-2025 09:40	8.3	29.35	236.52	-7.11	7.3	189.61	0.07	57.27	0.13	55.79	0.08
09-09-2025 09:45	8.25	29.35	236.48	-6.85	8.02	356.51	0.16	306.85	0.14	293.48	0.11
09-09-2025 09:50	8.21	29.35	236.48	-6.73	8.39	335.52	0.01	270.79	0.09	226.51	0.06
09-09-2025 09:55	8.27	29.34	236.43	-6.96	7.69	231.76	0.05	215.78	0.18	193.72	0.21
09-09-2025 10:00	8.29	29.34	236.47	-6.89	7.9	359.84	0.07	320.41	0.11	237.85	0.1
09-09-2025 10:05	8.32	29.34	236.49	-7	7.61	323.18	0.04	24.35	0.1	30.42	0.1
09-09-2025 10:10	8.22	29.34	236.41	-6.81	8.14	336.68	0.09	1.37	0.12	0.78	0.12
09-09-2025 10:15	8.2	29.34	236.47	-6.96	7.72	280.66	0.09	31.19	0.13	47.66	0.11
09-09-2025 10:20	8.24	29.34	236.46	-7.05	7.48	345	0.01	44.99	0.13	62.02	0.13
09-09-2025 10:25	8.15	29.34	236.47	-6.96	7.72	355.34	0.13	28.4	0.19	31.86	0.13
09-09-2025 10:30	8.19	29.34	236.52	-7.09	7.37	33.35	0.04	43.94	0.1	26.28	0.23
09-09-2025 10:35	8.15	29.33	236.51	-7.11	7.33	343.22	0.08	26.21	0.22	18.39	0.37
09-09-2025 10:40	8.13	29.33	236.51	-7.07	7.43	234	0.09	34.58	0.11	36.06	0.25
09-09-2025 10:45	8.16	29.33	236.55	-6.95	7.74	312	0.12	24.81	0.15	19.5	0.44
09-09-2025 10:50	8.14	29.33	236.56	-7.05	7.48	224	0.13	11.89	0.17	10.82	0.53

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
09-09-2025 10:55	8.08	29.33	236.6	-7.05	7.47	350.86	0.13	2.95	0.16	7.35	0.47
09-09-2025 11:00	8.06	29.32	236.59	-7.18	7.11	350	0.19	10.81	0.15	11.87	0.51
09-09-2025 11:05	8.07	29.32	236.63	-7.12	7.3	36.19	0.05	51.38	0.09	31.16	0.41
09-09-2025 11:10	8.05	29.32	236.62	-7.1	7.34	358.21	0.10	36.39	0.05	22.71	0.33
09-09-2025 11:15	8.03	29.33	236.59	-7.17	7.15	15.99	0.13	22.68	0.14	25.29	0.46
09-09-2025 11:20	8.01	29.34	236.53	-7.08	7.38	17.25	0.10	15.85	0.06	15.06	0.42
09-09-2025 11:25	7.91	29.36	236.55	-7.03	7.57	26.42	0.14	54.34	0.13	27.09	0.47
09-09-2025 11:30	7.88	29.37	236.57	-7.1	7.35	99.56	0.03	96.05	0.07	38.05	0.19
09-09-2025 11:35	7.86	29.41	236.61	-6.95	7.75	41.12	0.06	68.34	0.1	32.13	0.4
09-09-2025 11:40	7.9	29.43	236.54	-6.86	8.01	54.01	0.10	69.17	0.15	38.08	0.46
09-09-2025 11:45	7.85	29.46	236.5	-7.24	6.99	3.68	0.11	37.24	0.15	13.29	0.5
09-09-2025 11:50	7.81	29.49	236.48	-7.1	7.36	17.56	0.14	40.58	0.17	22.5	0.53
09-09-2025 11:55	7.81	29.49	236.49	-7.18	7.16	28.56	0.07	58.95	0.2	27.4	0.5
09-09-2025 12:00	7.8	29.5	236.51	-7.24	6.99	35	0.13	43.58	0.22	23.32	0.53
09-09-2025 12:05	7.71	29.53	236.48	-7.08	7.42	25.77	0.19	39.83	0.24	20.18	0.39
09-09-2025 12:10	7.71	29.58	236.45	-7.03	7.56	66.28	0.16	77.41	0.16	38.47	0.35
09-09-2025 12:15	7.75	29.57	236.5	-7.14	7.26	80.04	0.13	63.15	0.13	37.27	0.44
09-09-2025 12:20	7.7	29.58	236.49	-7.08	7.45	34.18	0.20	29.87	0.19	16.22	0.52
09-09-2025 12:25	7.61	29.56	236.43	-7.01	7.61	56.47	0.11	55.63	0.19	28.72	0.46
09-09-2025 12:30	7.65	29.55	236.52	-7.03	7.53	76.1	0.15	99.73	0.14		
09-09-2025 12:35	7.64	29.54	236.49	-7.1	7.37	78.92	0.11	81.5	0.18	30.36	0.42
09-09-2025 12:40	7.58	29.52	236.45	-7	7.64	87.24	0.10	91.67	0.19	19.3	0.51
09-09-2025 12:45	7.53	29.51	236.43	-6.99	7.64	226.47	0.18	242.26	0.26	306.24	0.53
09-09-2025 12:50	7.52	29.49	236.44	-6.94	7.78	257.32	0.27	257.68	0.21	314.98	0.69
09-09-2025 12:55	7.51	29.49	236.42	-6.96	7.75	231.46	0.18	251.31	0.25	312.53	0.72
09-09-2025 13:00	7.49	29.49	236.36	-6.95	7.77	242.64	0.13	258.41	0.17	314.25	0.58
09-09-2025 13:05	7.51	29.46	236.32	-7.03	7.58	53.29	0.09	78.11	0.1	9.76	0.44
09-09-2025 13:10	7.48	29.43	236.35	-7.06	7.47	87.66	0.09	55.5	0.14	23.82	0.58
09-09-2025 13:15	7.39	29.42	236.33	-6.86	8	95.49	0.07	63.66	0.1	19.44	0.58
09-09-2025 13:20	7.4	29.4	236.33	-6.9	7.92	150.63	0.14	121.69	0.15	35.5	0.48
09-09-2025 13:25	7.33	29.38	236.37	-6.63	8.7	120.28	0.06	90.76	0.11	30.33	0.4
09-09-2025 13:30	7.39	29.36	236.41	-6.79	8.22	153.72	0.19	119.24	0.17	34.08	0.34
09-09-2025 13:35	7.43	29.34	236.44	-6.86	8.02	126.57	0.10	82.36	0.12	20.56	0.54
09-09-2025 13:40	7.35	29.34	236.43	-7.11	7.35	45.84	0.07	46.59	0.11		
09-09-2025 13:45	7.31	29.33	236.43	-6.83	8.12	78.27	0.09	77.77	0.14	27.12	0.48
09-09-2025 13:50	7.35	29.31	236.43	-7	7.64	134.3	0.10	94.5	0.14		
09-09-2025 13:55	7.35	29.3	236.5	-7.02	7.61	57.38	0.08	77.93	0.09	15.4	0.37
09-09-2025 14:00	7.3	29.3	236.51	-6.91	7.88	48.81	0.06	46.21	0.14	8.4	0.53
09-09-2025 14:05	7.31	29.3	236.5	-7	7.63	214.32	0.05	63.75	0.15	22.93	0.46
09-09-2025 14:10	7.28	29.3	236.44	-6.89	7.92	78.16	0.06	49.44	0.11	21.81	0.36
09-09-2025 14:15	7.29	29.3	236.47	-6.96	7.73	47.18	0.06	74.96	0.08	17.14	0.32
09-09-2025 14:20	7.24	29.3	236.43	-6.86	8.01	21.12	0.05	52.29	0.14		
09-09-2025 14:25	7.25	29.3	236.45	-6.88	7.93	118.89	0.06	54.53	0.08	16.47	0.42
09-09-2025 14:30	7.29	29.3	236.52	-6.9	7.9	0.71	0.04	40.8	0.13		
09-09-2025 14:35	7.17	29.3	236.5	-6.73	8.39	51.28	0.03	37.86	0.11	356.76	0.53
09-09-2025 14:40	7.24	29.3	236.48	-6.77	8.27	89.44	0.16	99.17	0.1		
09-09-2025 14:45	7.23	29.29	236.46	-6.85	8.05	77.72	0.05	59.94	0.1		
09-09-2025 14:50	7.22	29.29	236.46	-6.81	8.15	87.04	0.05	51.5	0.11		
09-09-2025 14:55	7.19	29.29	236.49	-6.7	8.49	62.05	0.03	41.43	0.13		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
09-09-2025 15:00	7.18	29.29	236.5	-6.75	8.32	132.05	0.11	74.36	0.1		
09-09-2025 15:05	7.21	29.29	236.49	-6.77	8.29	118.38	0.08	80.15	0.16		
09-09-2025 15:10	7.18	29.29	236.49	-6.67	8.61	115.32	0.03	62.13	0.09		
09-09-2025 15:15	7.17	29.29	236.5	-6.73	8.42	121.74	0.10	64.65	0.13		
09-09-2025 15:20	7.19	29.3	236.53	-6.71	8.47	126.61	0.09	69.16	0.13		
09-09-2025 15:25	7.25	29.3	236.58	-6.9	7.92	147.41	0.06	83.12	0.12		
09-09-2025 15:30	7.21	29.3	236.65	-6.82	8.16	55.83	0.09	33.7	0.15		
09-09-2025 15:35	7.23	29.3	236.63	-6.77	8.3	84.4	0.05	44.02	0.25		
09-09-2025 15:40	7.21	29.31	236.59	-6.8	8.19	110.52	0.06	35.78	0.14		
09-09-2025 15:45	7.28	29.3	236.48	-6.93	7.86	148.77	0.08	253.9	0.16		
09-09-2025 15:50	7.24	29.31	236.34	-6.74	8.39	323.4	0.11	310.8	0.2	337.54	0.66
09-09-2025 15:55	7.25	29.31	236.33	-6.8	8.21	234.44	0.08	277.13	0.25		
09-09-2025 16:00	7.21	29.31	236.34	-6.77	8.31	222.78	0.12	272.67	0.15		
09-09-2025 16:05	7.26	29.31	236.37	-6.81	8.18	122.83	0.05	73.53	0.11		
09-09-2025 16:10	7.26	29.31	236.37	-6.82	8.19	81.87	0.05	45.4	0.12		
09-09-2025 16:15	7.23	29.31	236.32	-6.7	8.52	64.59	0.05	40.38	0.12		
09-09-2025 16:20	7.3	29.31	236.35	-6.87	8.05	155.96	0.07	68.28	0.09		
09-09-2025 16:25	7.27	29.31	236.4	-6.83	8.16	10.27	0.03	33.5	0.12		
09-09-2025 16:30	7.34	29.31	236.41	-7.13	7.32	321.92	0.03	57.03	0.15		
09-09-2025 16:35	7.33	29.31	236.39	-7.05	7.54	33.42	0.05	23.99	0.13		
09-09-2025 16:40	7.32	29.31	236.39	-6.93	7.86	329.55	0.02	47.47	0.12		
09-09-2025 16:45	7.37	29.31	236.38	-7.01	7.64	108.47	0.05	56.69	0.16		
09-09-2025 16:50	7.32	29.32	236.35	-6.91	7.95	134.78	0.05	32.69	0.13		
09-09-2025 16:55	7.44	29.32	236.38	-7.01	7.66	161.09	0.05	68.77	0.15		
09-09-2025 17:00	7.41	29.31	236.47	-6.76	8.37	75.42	0.06	48.01	0.19	343.57	0.55
09-09-2025 17:05	7.43	29.32	236.44	-6.74	8.39	84.8	0.09	47.55	0.2	18.72	0.48
09-09-2025 17:10	7.46	29.32	236.39	-6.77	8.33	72.38	0.08	48.97	0.18	34.2	0.55
09-09-2025 17:15	7.49	29.31	236.35	-6.76	8.37	28.83	0.05	40.38	0.18	14.36	0.26
09-09-2025 17:20	7.48	29.32	236.35	-6.77	8.31	50.52	0.07	44.3	0.25	17.06	0.51
09-09-2025 17:25	7.56	29.32	236.39	-6.9	7.95	114.72	0.09	47.33	0.24	18.47	0.56
09-09-2025 17:30	7.53	29.32	236.49	-6.91	7.92	45.29	0.09	26.03	0.29	26.17	0.63
09-09-2025 17:35	7.55	29.32	236.48	-6.89	7.95	37.95	0.04	33.47	0.23	22.26	0.59
09-09-2025 17:40	7.57	29.32	236.46	-6.71	8.51	25.39	0.11	40.39	0.2	25.47	0.31
09-09-2025 17:45	7.61	29.33	236.53	-6.84	8.16	94.92	0.04	64.57	0.16	36.83	0.47
09-09-2025 17:50	7.62	29.33	236.61	-6.82	8.19	33.63	0.04	21.26	0.19	15.45	0.63
09-09-2025 17:55	7.65	29.33	236.61	-6.78	8.29	352.67	0.04	46.09	0.17	27.36	0.54
09-09-2025 18:00	7.65	29.34	236.63	-6.77	8.33	344.85	0.06	31.53	0.2	15.42	0.54
09-09-2025 18:05	7.68	29.36	236.58	-6.75	8.38	16.97	0.05	33.62	0.19	16.94	0.5
09-09-2025 18:10	7.7	29.35	236.51	-6.77	8.33	37.49	0.10	45.02	0.16	26.12	0.57
09-09-2025 18:15	7.77	29.39	236.6	-6.9	7.99	30.29	0.08	35.18	0.19	33.63	0.58
09-09-2025 18:20	7.78	29.41	236.61	-6.84	8.13	357.72	0.08	34.61	0.19	27.54	0.53
09-09-2025 18:25	7.78	29.42	236.61	-6.73	8.47	23.33	0.15	30.44	0.19	30.09	0.62
09-09-2025 18:30	7.82	29.51	236.6	-6.69	8.57	16.88	0.11	37.26	0.2	38.55	0.52
09-09-2025 18:35	7.88	29.61	236.57	-6.78	8.32	40.26	0.14	43.89	0.25	32.86	0.57
09-09-2025 18:40	7.89	29.75	236.53	-6.89	8	11.6	0.20	18.97	0.25	18.6	0.65
09-09-2025 18:45	7.94	29.83	236.51	-6.39	9.77	308.75	0.23	303.79	0.34	314.36	0.8
09-09-2025 18:50	7.84	29.85	236.43	-5.94	11.05	316.79	0.24	295.34	0.23	306.34	0.7
09-09-2025 18:55	7.96	29.84	236.43	-5.98	10.93	282.45	0.17	280.63	0.24	302.91	0.74
09-09-2025 19:00	7.87	29.83	236.45	-6.05	10.76	310.39	0.24	299.76	0.21	304.62	0.45

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
09-09-2025 19:05	7.96	29.82	236.46	-6.05	10.74	42.6	0.11	50.98	0.16	51.4	0.58
09-09-2025 19:10	7.95	29.81	236.45	-6.06	10.75	26.57	0.19	32.88	0.23	40.72	0.53
09-09-2025 19:15	7.9	29.8	236.35	-6.06	10.74	16.72	0.16	37.1	0.2	37.89	0.53
09-09-2025 19:20	7.99	29.8	236.4	-6.1	10.64	34.61	0.18	44.73	0.23	30.3	0.66
09-09-2025 19:25	8.01	29.8	236.37	-5.93	11.14	21.37	0.20	36.8	0.24	34.12	0.71
09-09-2025 19:30	8.02	29.79	236.42	-6.06	10.78	28.56	0.21	42.38	0.21	40.52	0.41
09-09-2025 19:35	8.12	29.79	236.36	-6.05	10.78	35.24	0.24	36.38	0.26	32.03	0.73
09-09-2025 19:40	8.07	29.78	236.32	-6.05	10.78	3.61	0.30	17.66	0.3	33.58	0.81
09-09-2025 19:45	8.12	29.78	236.35	-6.15	10.55	19.16	0.19	40.14	0.24	41.22	0.44
09-09-2025 19:50	8.09	29.77	236.35	-6.1	10.68	25.05	0.19	23.53	0.32	32.24	0.69
09-09-2025 19:55	8.09	29.76	236.39	-6.15	10.56	19.64	0.21	24.96	0.23	26.37	0.47
09-09-2025 20:00	8.08	29.76	236.38	-6.09	10.7	29.57	0.16	37.28	0.25	15.58	0.53
09-09-2025 20:05	8.12	29.75	236.34	-6.02	10.92	39.6	0.17	50.45	0.24	36.74	0.58
09-09-2025 20:10	8.09	29.76	236.51	-5.96	11.72	19.07	0.25	31.21	0.23	35.4	0.59
09-09-2025 20:15	8.1	29.75	236.52	-5.9	12.16	27.42	0.25	34.78	0.29	39.2	0.53
09-09-2025 20:20	8.18	29.74	236.52	-5.96	12.07	39.08	0.25	49.7	0.28	39.38	0.43
09-09-2025 20:25	8.14	29.73	236.61	-5.87	12.55	24.08	0.27	19.28	0.33		
09-09-2025 20:30	8.16	29.72	236.71	-5.84	13	18.78	0.29	33.98	0.32		
09-09-2025 20:35	8.22	29.73	236.78	-5.94	12.95	16.35	0.30	26.2	0.35	30.86	0.71
09-09-2025 20:40	8.23	29.73	236.83	-6.11	12.69	12.31	0.32	26.2	0.34		
09-09-2025 20:45	8.17	29.72	236.88	-6.25	12.45	17.84	0.28	27.52	0.32		
09-09-2025 20:50	8.31	29.72	236.93	-6.24	12.57	42.36	0.24	50.16	0.28	44.35	0.79
09-09-2025 20:55	8.22	29.71	236.89	-6.26	12.62	11.18	0.32	18.54	0.36	22.39	0.39
09-09-2025 21:00	8.16	29.71	237.06	-6.54	12.07	33.48	0.27	40.72	0.33		
09-09-2025 21:05	8.21	29.71	237.08	-6.48	12.4	26.21	0.24	45.8	0.3		
09-09-2025 21:10	8.22	29.71	237.09	-6.42	12.61	20.44	0.27	35.67	0.3	33.34	0.68
09-09-2025 21:15	8.17	29.71	237.06	-6.29	12.94	31.53	0.23	40.06	0.27	39.97	0.53
09-09-2025 21:20	8.23	29.71	237.01	-6.3	12.96	27.96	0.27	47.25	0.29		
09-09-2025 21:25	8.28	29.71	237.07	-6.41	12.84	19.23	0.26	33.38	0.36		
09-09-2025 21:30	8.25	29.71	237.13	-6.61	12.29	26.31	0.32	29.16	0.4		
09-09-2025 21:35	8.32	29.71	237.09	-6.5	12.6	26.74	0.28	37.31	0.29		
09-09-2025 21:40	8.24	29.73	237.19	-6.91	11.41	18.11	0.31	31.04	0.36		
09-09-2025 21:45	8.27	29.74	237.21	-7.16	10.68	291.77	0.37	283.48	0.38		
09-09-2025 21:50	8.28	29.75	237.23	-7.2	10.57	294.47	0.40	282.59	0.38	310.56	0.73
09-09-2025 21:55	8.22	29.76	237.21	-7.16	10.66	297.46	0.42	300.3	0.44		
09-09-2025 22:00	8.24	29.75	237.18	-6.91	11.34	296.34	0.37	292.55	0.37	287.75	0.42
09-09-2025 22:05	8.25	29.76	237.11	-6.92	11.34	25.54	0.29	31.31	0.4	29.16	0.69
09-09-2025 22:10	8.24	29.82	237.28	-7.98	8.27	28.78	0.36	30.74	0.37	36.04	0.76
09-09-2025 22:15	8.21	29.8	237.32	-7.96	8.33	47.5	0.27	58.11	0.25	47.87	0.41
09-09-2025 22:20	8.24	29.8	237.29	-7.84	8.64	47.77	0.20	44.12	0.26	21.68	0.6
09-09-2025 22:25	8.22	29.78	237.28	-7.8	8.78	31.84	0.26	35.32	0.29	34.07	0.58
09-09-2025 22:30	8.19	29.76	237.35	-8	8.16	67.94	0.23	56.89	0.23	62.98	0.32
09-09-2025 22:35	8.18	29.76	237.34	-8.17	7.8	59.71	0.19	54.49	0.24	31.09	0.4
09-09-2025 22:40	8.18	29.77	237.32	-8.15	7.82	53.38	0.23	52.42	0.22	29.8	0.58
09-09-2025 22:45	8.18	29.77	237.34	-8.34	7.29	46.58	0.23	64.79	0.21	33.56	0.39
09-09-2025 22:50	8.14	29.77	237.29	-8.16	7.78	68.02	0.23	67.17	0.25	37.43	0.54
09-09-2025 22:55	8.09	29.77	237.3	-8.19	7.65	57.74	0.18	56.46	0.18	34.74	0.51
09-09-2025 23:00	8.1	29.77	237.41	-8.41	7.09	74.9	0.19	83.4	0.19	19.86	0.35
09-09-2025 23:05	8.14	29.76	237.43	-8.75	6.22	69.31	0.22	90.6	0.2	32.43	0.46

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
09-09-2025 23:10	8.06	29.76	237.39	-8.45	6.98	63.5	0.23	49.57	0.23	29.16	0.56
09-09-2025 23:15	8.05	29.76	237.34	-8.48	6.91	68.34	0.19	89.09	0.25	36.89	0.4
09-09-2025 23:20	7.95	29.75	237.31	-8.09	7.92	59.44	0.16	81.93	0.15	26.54	0.34
09-09-2025 23:25	8	29.75	237.29	-8.03	8.06	102.07	0.22	111.28	0.26	74.19	0.36
09-09-2025 23:30	7.97	29.75	237.33	-8.08	7.93	103.47	0.18	109.69	0.21	53.56	0.45
09-09-2025 23:35	7.95	29.74	237.33	-7.94	8.33	91.24	0.19	95.97	0.24	25.86	0.54
09-09-2025 23:40	7.93	29.74	237.32	-8.07	7.94	107.6	0.21	116.06	0.21	57.86	0.24
09-09-2025 23:45	7.88	29.7	237.29	-7.94	8.37	111.89	0.21	118.01	0.24	84.68	0.37
09-09-2025 23:50	7.91	29.68	237.31	-7.96	8.23	104.05	0.20	108.56	0.22	106.43	0.32
09-09-2025 23:55	7.87	29.64	237.29	-7.93	8.33	83	0.20	85.53	0.24	35.29	0.46
10-09-2025 00:00	7.86	29.62	237.36	-7.88	8.48	89.63	0.18	78.18	0.13	29.03	0.62
10-09-2025 00:05	7.85	29.63	237.32	-7.94	8.31	104.77	0.09	69.17	0.08	35.23	0.26
10-09-2025 00:10	7.81	29.65	237.28	-7.9	8.43	69.61	0.10	51.39	0.15	22.88	0.29
10-09-2025 00:15	7.8	29.69	237.33	-8.04	8.03	94.92	0.11	76.08	0.17	25.31	0.27
10-09-2025 00:20	7.82	29.69	237.3	-8.03	8.08	64.22	0.14	73.53	0.16	30.17	0.43
10-09-2025 00:25	7.77	29.71	237.3	-7.85	8.56	70.4	0.19	61.86	0.27	19.15	0.76
10-09-2025 00:30	7.78	29.8	237.37	-8.11	7.88	75.56	0.17	95.43	0.26	66.99	0.2
10-09-2025 00:35	7.68	29.87	237.35	-8.18	7.69	58.72	0.22	58.44	0.22	34.03	0.33
10-09-2025 00:40	7.66	29.84	237.33	-8.24	7.49	69.36	0.18	88.76	0.22	39.08	0.36
10-09-2025 00:45	7.67	29.8	237.32	-8.12	7.82	259.88	0.28	251.12	0.3	293.66	0.55
10-09-2025 00:50	7.6	29.76	237.29	-8.23	7.5	240.91	0.20	240.52	0.24	325.01	0.14
10-09-2025 00:55	7.65	29.66	237.24	-8.35	7.23	253.28	0.27	255.6	0.32	322.02	0.71
10-09-2025 01:00	7.63	29.66	237.27	-7.82	8.66	268.58	0.37	269.07	0.33	313.75	0.77
10-09-2025 01:05	7.57	29.66	237.21	-7.84	8.59	87.71	0.24	83.02	0.27	37.04	0.51
10-09-2025 01:10	7.58	29.65	237.2	-7.79	8.78	93.72	0.18	85.19	0.23		
10-09-2025 01:15	7.54	29.67	237.11	-7.26	10.34	76.16	0.20	74.95	0.19	31.76	0.6
10-09-2025 01:20	7.53	29.66	237.15	-7.6	9.33	100.79	0.23	102.44	0.22	73.2	0.39
10-09-2025 01:25	7.52	29.65	237.17	-7.73	8.87	95.62	0.15	83.37	0.2	48.86	0.49
10-09-2025 01:30	7.53	29.65	237.21	-7.71	8.99	72.45	0.17	80.63	0.25	55.22	0.41
10-09-2025 01:35	7.52	29.74	237.2	-7.7	9.01	67.69	0.11	55.3	0.2	53.47	0.48
10-09-2025 01:40	7.48	29.81	237.17	-7.69	9.05	57.89	0.14	67.29	0.19	46.25	0.27
10-09-2025 01:45	7.5	29.81	237.15	-7.79	8.75	76.81	0.18	91.58	0.2	43.51	0.5
10-09-2025 01:50	7.51	29.78	237.22	-7.99	8.16	43.42	0.15	62.2	0.18	29.76	0.38
10-09-2025 01:55	7.48	29.65	237.21	-7.88	8.5	46.43	0.23	44	0.24	36.23	0.6
10-09-2025 02:00	7.42	29.63	237.25	-7.83	8.65	69.06	0.20	70.01	0.23	46.59	0.42
10-09-2025 02:05	7.41	29.64	237.23	-7.8	8.7	94.7	0.23	88.91	0.24	44.76	0.51
10-09-2025 02:10	7.37	29.67	237.18	-7.63	9.2	77.21	0.19	78.54	0.2	41.16	0.47
10-09-2025 02:15	7.39	29.68	237.2	-7.73	8.9	109.65	0.19	98.71	0.22	43.27	0.48
10-09-2025 02:20	7.36	29.68	237.21	-7.78	8.75	99.43	0.14	93.78	0.16	48.7	0.6
10-09-2025 02:25	7.35	29.68	237.29	-7.91	8.36	105.01	0.13	86.61	0.18		
10-09-2025 02:30	7.37	29.68	237.28	-7.86	8.53	100.08	0.12	84.2	0.14	52.2	0.42
10-09-2025 02:35	7.36	29.68	237.27	-7.85	8.56	81.28	0.14	71.13	0.11	42.16	0.35
10-09-2025 02:40	7.4	29.69	237.3	-8.28	7.38	95.31	0.05	63.1	0.13		
10-09-2025 02:45	7.39	29.68	237.31	-8.33	7.26	57.03	0.11	29.79	0.16	31.33	0.39
10-09-2025 02:50	7.39	29.68	237.29	-7.99	8.19	29.53	0.08	42.42	0.13	12.81	0.58
10-09-2025 02:55	7.37	29.69	237.24	-7.82	8.63	54.44	0.09	49.21	0.04		
10-09-2025 03:00	7.37	29.68	237.28	-7.8	8.72	153.82	0.04	60.22	0.06		
10-09-2025 03:05	7.35	29.68	237.25	-7.88	8.49	67.77	0.13	48.52	0.15		
10-09-2025 03:10	7.33	29.68	237.24	-7.86	8.52	62.27	0.08	43.35	0.13	9.36	0.62

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
10-09-2025 03:15	7.32	29.68	237.23	-7.89	8.49	54.2	0.02	84.25	0.05		
10-09-2025 03:20	7.34	29.69	237.26	-7.95	8.29	129.73	0.11	125.84	0.1		
10-09-2025 03:25	7.37	29.71	237.27	-8.13	7.83	70.29	0.09	61.13	0.12		
10-09-2025 03:30	7.34	29.72	237.31	-8.16	7.77	27.4	0.11	16.69	0.14		
10-09-2025 03:35	7.3	29.75	237.23	-7.79	8.76	15.29	0.11	70.49	0.06		
10-09-2025 03:40	7.37	29.75	237.24	-8.12	7.84	50.67	0.12	50.26	0.11	32.87	0.72
10-09-2025 03:45	7.34	29.77	237.14	-7.63	9.25	314.93	0.12	298.89	0.15	306.08	0.84
10-09-2025 03:50	7.31	29.77	237.18	-7.84	8.71	180.52	0.07	274.14	0.11	249.69	0.53
10-09-2025 03:55	7.35	29.77	237.1	-7.63	9.25	242.7	0.05	196.44	0.12		
10-09-2025 04:00	7.42	29.74	237.14	-7.9	8.46	134.05	0.02	203.21	0.06	262.66	0.57
10-09-2025 04:05	7.41	29.72	237.15	-7.86	8.56	300.81	0.05	19.1	0.08	58.11	0.34
10-09-2025 04:10	7.37	29.69	237.11	-7.79	8.74	263.42	0.02	149.59	0.02	66.16	0.4
10-09-2025 04:15	7.39	29.68	237.02	-7.51	9.52	207.98	0.08	145.47	0.03		
10-09-2025 04:20	7.4	29.68	237.08	-7.62	9.28	176.06	0.06	74.76	0.09	41.59	0.63
10-09-2025 04:25	7.37	29.68	237.09	-7.54	9.51	149.5	0.04	45.67	0.05	48.03	0.62
10-09-2025 04:30	7.33	29.68	237.12	-7.55	9.52	142.25	0.10	175.98	0.05	80.73	0.29
10-09-2025 04:35	7.33	29.68	237.13	-7.69	9.04	163.54	0.11	152.6	0.11	56.33	0.31
10-09-2025 04:40	7.37	29.69	237.09	-7.64	9.2	174.78	0.05	165.44	0.11	61.24	0.34
10-09-2025 04:45	7.41	29.69	237.13	-7.78	8.79	128.11	0.08	118.26	0.06	55.75	0.47
10-09-2025 04:50	7.42	29.69	237.15	-7.86	8.55	198.86	0.07	280.79	0.01	57.05	0.41
10-09-2025 04:55	7.43	29.69	237.23	-8.02	8.1	150.54	0.26	24.03	0.05	27.78	0.31
10-09-2025 05:00	7.42	29.69	237.22	-7.86	8.53	116.68	0.04	102.4	0.06		
10-09-2025 05:05	7.38	29.69	237.16	-7.81	8.68	103.1	0.04	148.97	0.12		
10-09-2025 05:10	7.52	29.71	237.22	-8.12	7.82	164.5	0.09	175.85	0.1	90.16	0.3
10-09-2025 05:15	7.47	29.74	237.17	-7.88	8.5	2.83	0.07	52.7	0.05		
10-09-2025 05:20	7.58	29.72	237.19	-8.13	7.81	24.03	0.04	129.89	0.02	87.81	0.22
10-09-2025 05:25	7.58	29.69	237.17	-8	8.2	24.27	0.13	16	0.16	28.89	0.3
10-09-2025 05:30	7.59	29.68	237.18	-7.98	8.21	356.57	0.14	11.95	0.13	37.03	0.4
10-09-2025 05:35	7.54	29.68	237.19	-7.93	8.35	335.99	0.09	24.03	0.06	62.48	0.28
10-09-2025 05:40	7.59	29.68	237.15	-8	8.17	147.49	0.04	106.08	0.06	125.25	0.1
10-09-2025 05:45	7.6	29.68	237.13	-7.79	8.78	243.8	0.02	216.65	0.01	60.36	0.24
10-09-2025 05:50	7.67	29.68	237.18	-7.96	8.26	17	0.10	90.67	0.05	64.84	0.22
10-09-2025 05:55	7.66	29.68	237.15	-7.69	9.04	15.12	0.06	24.56	0.04	20.59	0.29
10-09-2025 06:00	7.64	29.69	237.14	-7.71	8.99	135.13	0.09	49.48	0.04	38.89	0.4
10-09-2025 06:05	7.65	29.7	237.19	-7.83	8.66	167.7	0.10	164.94	0.11	49.82	0.22
10-09-2025 06:10	7.82	29.71	237.15	-7.91	8.45	111.16	0.10	115.63	0.11	47.89	0.29
10-09-2025 06:15	7.71	29.69	237.12	-7.53	9.58	19.46	0.13	4.44	0.12	30.26	0.16
10-09-2025 06:20	7.73	29.68	237.09	-7.72	8.94	109.99	0.10	92.79	0.07	18.39	0.32
10-09-2025 06:25	7.89	29.68	237.18	-8	8.16	100.31	0.13	111.47	0.1	43.61	0.21
10-09-2025 06:30	7.89	29.7	237.24	-8.04	8.04	23.31	0.15	28.3	0.16	34.36	0.36
10-09-2025 06:35	7.79	29.7	237.18	-7.83	8.66	355.75	0.16	23.02	0.11	29.46	0.3
10-09-2025 06:40	7.91	29.69	237.13	-8.06	8	78.4	0.09	98.82	0.09	109.27	0.15
10-09-2025 06:45	7.83	29.69	237.13	-7.92	8.38	304.72	0.20	295.12	0.17	273.56	0.21
10-09-2025 06:50	7.93	29.67	237.08	-8.55	6.69	248.61	0.09	240.34	0.1	211.67	0.18
10-09-2025 06:55	7.88	29.66	237.25	-8.82	6.01	299.91	0.13	299.21	0.14	254.08	0.14
10-09-2025 07:00	7.95	29.65	237.2	-8.87	5.88	301.51	0.09	247.95	0.09	186.04	0.21
10-09-2025 07:05	7.99	29.65	237.19	-8.76	6.17	29.97	0.15	33.26	0.16	57.5	0.26
10-09-2025 07:10	7.93	29.64	237.12	-8.6	6.58	0.02	0.13	10.15	0.19	27.02	0.27
10-09-2025 07:15	7.88	29.65	237.13	-8.54	6.76	29.2	0.13	29.45	0.16	35.48	0.26

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
10-09-2025 07:20	7.99	29.65	237.07	-8.85	5.9	99.81	0.08	73.57	0.1	38.37	0.27
10-09-2025 07:25	8	29.65	237.22	-8.74	6.25	36.78	0.13	52.35	0.11	83.88	0.22
10-09-2025 07:30	7.95	29.63	237.21	-8.57	6.67	12.69	0.11	31.24	0.13	36.17	0.3
10-09-2025 07:35	8.05	29.59	237.25	-8.74	6.22	96.88	0.07	79.23	0.12	46.66	0.3
10-09-2025 07:40	8.03	29.57	237.19	-8.68	6.39	33.89	0.14	35.78	0.18	18.99	0.56
10-09-2025 07:45	8.07	29.57	237.2	-8.86	5.94	20.83	0.16	14.88	0.15	31	0.25
10-09-2025 07:50	8.1	29.58	237.21	-8.65	6.49	13.37	0.16	26.61	0.16	37.04	0.39
10-09-2025 07:55	8.05	29.58	237.2	-8.54	6.75	12.16	0.22	22.74	0.19	21.3	0.41
10-09-2025 08:00	8.16	29.59	237.28	-9.26	4.86	52.66	0.15	48.89	0.18	34.06	0.24
10-09-2025 08:05	8.09	29.64	237.32	-8.95	5.71	7.48	0.21	28.48	0.21	12.7	0.37
10-09-2025 08:10	8.14	29.66	237.28	-8.95	5.7	65.79	0.17	69.85	0.2	39.92	0.35
10-09-2025 08:15	8.09	29.67	237.25	-9.04	5.47	44.24	0.14	42.74	0.16	60.35	0.19
10-09-2025 08:20	8.19	29.67	237.1	-8.66	6.44	68.38	0.16	69.18	0.17	20.05	0.46
10-09-2025 08:25	8.23	29.65	237.11	-8.04	8.08	36.4	0.18	32.44	0.14	34.29	0.29
10-09-2025 08:30	8.19	29.67	237.16	-8.02	8.14	37.55	0.20	34.21	0.21	31.58	0.5
10-09-2025 08:35	8.22	29.67	237.15	-8.06	8.05	53.46	0.21	52.23	0.2	38.65	0.43
10-09-2025 08:40	8.27	29.68	237.16	-8.28	7.49	42.59	0.17	53.37	0.2	49.61	0.34
10-09-2025 08:45	8.19	29.69	237.09	-7.83	8.66	46.57	0.18	35.29	0.19	20.63	0.38
10-09-2025 08:50	8.26	29.68	237.14	-8.19	7.68	86.43	0.19	80.77	0.13	44.79	0.26
10-09-2025 08:55	8.19	29.66	237.07	-7.67	9.16	37.52	0.22	41.76	0.21	24.38	0.33
10-09-2025 09:00	8.24	29.63	237.21	-8.42	7.03	44.39	0.16	51.61	0.13	17.72	0.28
10-09-2025 09:05	8.3	29.62	237.21	-8.53	6.82	47.67	0.15	33.37	0.18	37.46	0.25
10-09-2025 09:10	8.21	29.59	237.22	-8.63	6.52	359.99	0.18	20.09	0.15	357.99	0.41
10-09-2025 09:15	8.26	29.59	237.22	-8.52	6.81	55.91	0.12	71.16	0.13	87.55	0.26
10-09-2025 09:20	8.22	29.64	237.17	-8.26	7.51	49.69	0.14	51.22	0.14	33.18	0.23
10-09-2025 09:25	8.22	29.65	237.17	-8.2	7.62	68.06	0.20	78.05	0.14	30.06	0.13
10-09-2025 09:30	8.26	29.65	237.29	-8.63	6.55	58.24	0.13	72.98	0.09	38.12	0.44
10-09-2025 09:35	8.25	29.65	237.21	-8.4	7.12	50.5	0.19	78.29	0.09	54.74	0.23
10-09-2025 09:40	8.22	29.65	237.11	-7.91	8.44	73.51	0.15	75.29	0.1	20.5	0.26
10-09-2025 09:45	8.18	29.67	237.07	-7.87	8.54	230.64	0.10	219.91	0.15	243.52	0.09
10-09-2025 09:50	8.27	29.71	237.1	-8	8.23	232.15	0.29	238.83	0.26	296.53	0.42
10-09-2025 09:55	8.22	29.74	237	-7.81	8.71	279.65	0.20	251.73	0.17	331.33	0.55
10-09-2025 10:00	8.2	29.76	236.95	-7.44	9.85	249.06	0.17	258.06	0.23	291.22	0.27
10-09-2025 10:05	8.31	29.73	236.93	-7.34	10.15	78.22	0.16	43.86	0.14	36.65	0.44
10-09-2025 10:10	8.34	29.7	237.04	-7.79	8.8	35.98	0.15	22.37	0.14		
10-09-2025 10:15	8.26	29.65	237.06	-8.19	7.73	345.42	0.20	351.58	0.2	21.32	0.34
10-09-2025 10:20	8.26	29.59	237.07	-8.33	7.34	20.73	0.10	20.25	0.19	14.94	0.45
10-09-2025 10:25	8.27	29.57	237.18	-8.94	5.76	7.95	0.10	29.85	0.12	47.17	0.11
10-09-2025 10:30	8.25	29.57	237.2	-8.63	6.51	4.23	0.12	14.86	0.16	18.33	0.25
10-09-2025 10:35	8.13	29.58	237.17	-8.49	6.89	12.39	0.10	28.41	0.14	130.09	0.56
10-09-2025 10:40	8.26	29.59	237.15	-8.58	6.63	81.53	0.09	116.17	0.11	35.21	0.22
10-09-2025 10:45	8.13	29.61	237.08	-8.15	7.8	17.92	0.17	12.96	0.15	24.05	0.46
10-09-2025 10:50	8.05	29.62	237.07	-7.94	8.36	86.9	0.10	123.41	0.09	19.92	0.12
10-09-2025 10:55	8.14	29.67	237.12	-8.26	7.5	101.45	0.16	110.03	0.15	45.71	0.26
10-09-2025 11:00	8.11	29.69	237.11	-7.95	8.35	31.02	0.14	39.37	0.1	31.29	0.41
10-09-2025 11:05	8.04	29.68	237.14	-8.18	7.64	67.57	0.15	105.87	0.09	79.35	0.2
10-09-2025 11:10	8.08	29.67	237.11	-8.3	7.38	93.44	0.16	116.3	0.14	41.51	0.3
10-09-2025 11:15	8.04	29.67	237.1	-8.12	7.83	57.84	0.11	93.75	0.11	23.72	0.35
10-09-2025 11:20	8.11	29.67	237.07	-7.93	8.45	102.85	0.14	101.4	0.14	42.36	0.31

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
10-09-2025 11:25	8.04	29.68	236.88	-7.89	8.6	43.98	0.13	51.6	0.11	12.53	0.3
10-09-2025 11:30	7.94	29.68	237.17	-8.33	7.27	42.09	0.09	53.96	0.11	51.72	0.21
10-09-2025 11:35	8.06	29.67	237.02	-7.59	9.48	129.38	0.05	119.99	0.1	12.76	0.37
10-09-2025 11:40	7.91	29.67	237	-7.42	9.92	34.81	0.11	5.17	0.12	25.38	0.43
10-09-2025 11:45	7.95	29.67	237.05	-7.68	9.14	129.42	0.15	138.21	0.14	34.67	0.33
10-09-2025 11:50	7.97	29.66	237.08	-8.05	8.09	74.95	0.11	60.61	0.12	33.46	0.6
10-09-2025 11:55	7.8	29.66	237.13	-8.03	8.04	45.47	0.12	36.38	0.12	19.23	0.5
10-09-2025 12:00	7.81	29.66	237.29	-8.78	6.12	127.37	0.16	124.63	0.21	60.55	0.28
10-09-2025 12:05	7.87	29.66	237.24	-8.9	5.78	110.6	0.15	130.64	0.17	68.97	0.31
10-09-2025 12:10	7.84	29.66	237.21	-8.84	5.98	41.47	0.07	69.92	0.1	13.71	0.47
10-09-2025 12:15	7.77	29.67	237.2	-8.81	6.02	49.17	0.07	50.32	0.12	31.78	0.32
10-09-2025 12:20	7.8	29.68	237.03	-8.01	8.23	71.76	0.08	66.99	0.13	29.24	0.55
10-09-2025 12:25	7.8	29.69	237.21	-8.64	6.52	42.45	0.09	47.88	0.15	29.24	0.42
10-09-2025 12:30	7.66	29.7	237.12	-7.94	8.33	63.81	0.11	57.31	0.13	31.13	0.33
10-09-2025 12:35	7.7	29.69	237.22	-8.48	6.87	117.26	0.12	108.42	0.21	45.16	0.37
10-09-2025 12:40	7.7	29.7	237.16	-8.55	6.71	64.38	0.12	60.86	0.13	37.3	0.26
10-09-2025 12:45	7.57	29.7	237.11	-8.38	7.16	293.31	0.17	273.41	0.23	320.71	0.7
10-09-2025 12:50	7.65	29.7	237.19	-8.62	6.56	250.38	0.18	226.34	0.29	306.25	0.51
10-09-2025 12:55	7.6	29.71	237.21	-8.89	5.82	308.39	0.13	259.81	0.22	314.67	0.63
10-09-2025 13:00	7.54	29.73	237.19	-8.31	7.34	267	0.09	234.34	0.16		
10-09-2025 13:05	7.64	29.77	237.11	-8.25	7.52	91.87	0.15	93.73	0.18		
10-09-2025 13:10	7.49	29.79	236.96	-8.21	7.67	29.48	0.14	49.79	0.23	9.9	0.5
10-09-2025 13:15	7.54	29.84	236.95	-7.82	8.79	69.54	0.16	95.51	0.21	35	0.3
10-09-2025 13:20	7.48	29.84	237.08	-7.89	8.47	87.42	0.13	83.41	0.17	43.34	0.51
10-09-2025 13:25	7.55	29.84	237.13	-7.92	8.39	97.15	0.15	103.78	0.16		
10-09-2025 13:30	7.54	29.83	237.2	-8	8.17	33.63	0.09	39.75	0.07	5.99	0.45
10-09-2025 13:35	7.44	29.81	237.16	-7.88	8.49	41.92	0.10	31.58	0.11	3.38	0.55
10-09-2025 13:40	7.44	29.76	237.18	-8.36	7.23	123.32	0.09	92.98	0.11	18.64	0.41
10-09-2025 13:45	7.45	29.69	237.15	-8.28	7.43	86.5	0.03	79.76	0.11		
10-09-2025 13:50	7.36	29.67	236.83	-7.35	10.06	60.66	0.02	59.84	0.09		
10-09-2025 13:55	7.37	29.67	236.71	-6.83	11.59	159.65	0.13	108.16	0.15	37.69	0.48
10-09-2025 14:00	7.36	29.67	236.72	-7.09	10.83	129.11	0.08	84.37	0.06	44.72	0.65
10-09-2025 14:05	7.38	29.67	236.86	-7.34	10.13	81.33	0.09	77.83	0.16		
10-09-2025 14:10	7.39	29.67	236.96	-7.53	9.61	43.02	0.05	55.15	0.12	27.86	0.31
10-09-2025 14:15	7.29	29.67	236.93	-7.72	9	12.75	0.08	20.45	0.1		
10-09-2025 14:20	7.33	29.68	237.06	-7.86	8.55	99	0.03	75.11	0.08		
10-09-2025 14:25	7.18	29.68	237.06	-7.61	9.34	20.94	0.04	44.22	0.08		
10-09-2025 14:30	7.21	29.68	237.04	-7.64	9.25	127.4	0.09	94.76	0.11		
10-09-2025 14:35	7.25	29.68	237.12	-7.86	8.63	167.5	0.05	69.49	0.09		
10-09-2025 14:40	7.22	29.68	237.05	-7.7	9	11.52	0.02	58.02	0.07		
10-09-2025 14:45	7.2	29.67	236.99	-7.75	8.9	94.49	0.06	90.11	0.1		
10-09-2025 14:50	7.2	29.67	236.96	-7.92	8.4	143.1	0.02	70.06	0.13		
10-09-2025 14:55	7.28	29.67	237.12	-8.09	7.93	1.85	0.07	50.46	0.18		
10-09-2025 15:00	7.13	29.68	237.07	-7.65	9.17	347.88	0.11	22.3	0.18		
10-09-2025 15:05	7.15	29.67	237.05	-7.72	8.97	125.83	0.12	66.42	0.15		
10-09-2025 15:10	7.18	29.68	237.2	-8.88	5.86	103.94	0.11	76.38	0.12		
10-09-2025 15:15	7.11	29.68	237.09	-8.03	8.06	47.73	0.06	54.8	0.23		
10-09-2025 15:20	7.24	29.7	237.06	-8.56	6.72	88.85	0.10	95.23	0.18		
10-09-2025 15:25	7.23	29.69	237.03	-8.3	7.38	354.89	0.12	19.65	0.29		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
10-09-2025 15:30	7.12	29.73	236.89	-7.92	8.46	354.9	0.08	39.72	0.23		
10-09-2025 15:35	7.12	29.74	236.98	-8.21	7.63	101.32	0.01	83.42	0.22		
10-09-2025 15:40	7.11	29.79	236.99	-7.94	8.4	71.82	0.06	38	0.2		
10-09-2025 15:45	7.26	29.84	236.85	-7.69	9.15	42.32	0.11	247.07	0.33		
10-09-2025 15:50	7.12	29.9	237.11	-8.53	6.75	304.75	0.15	292.36	0.37		
10-09-2025 15:55	7.19	29.96	237.01	-8.41	7.11	273.61	0.15	256.41	0.22		
10-09-2025 16:00	7.3	30.01	236.99	-9.02	5.52	298.87	0.21	272.15	0.21		
10-09-2025 16:05	7.21	30.09	236.95	-8.47	6.97	19.51	0.22	26.02	0.27		
10-09-2025 16:10	7.14	30.12	236.73	-7.12	10.76	24.73	0.18	43.39	0.24		
10-09-2025 16:15	7.21	30.13	236.86	-7.72	9	55.69	0.18	59.44	0.2		
10-09-2025 16:20	7.23	30.14	236.79	-7.73	8.99	37.93	0.23	51.36	0.3		
10-09-2025 16:25	7.23	30.16	236.84	-7.71	9.07	27.71	0.27	34.31	0.28		
10-09-2025 16:30	7.23	30.18	236.95	-7.8	8.8	31.01	0.29	38.81	0.28		
10-09-2025 16:35	7.19	30.17	236.88	-7.49	9.73	33.25	0.30	34.47	0.31		
10-09-2025 16:40	7.18	30.17	236.9	-7.37	10.06	45.25	0.25	50.01	0.35		
10-09-2025 16:45	7.17	30.15	236.88	-7.5	9.67	45.84	0.29	55.38	0.31		
10-09-2025 16:50	7.23	30.16	236.87	-7.7	9.06	52.78	0.27	80.12	0.29		
10-09-2025 16:55	7.22	30.14	236.84	-7.75	8.93	39.3	0.28	44.21	0.32		
10-09-2025 17:00	7.26	30.12	236.81	-7.48	9.75	50.89	0.24	66.6	0.29		
10-09-2025 17:05	7.3	30.1	236.81	-7.47	9.76	33.75	0.25	41.97	0.28		
10-09-2025 17:10	7.26	30.07	236.82	-7.43	9.95	25.43	0.29	37.39	0.28		
10-09-2025 17:15	7.32	30.06	236.74	-7.41	9.97	43.28	0.23	56.03	0.28		
10-09-2025 17:20	7.32	30.06	236.78	-7.63	9.29	31.83	0.30	35.16	0.31		
10-09-2025 17:25	7.33	30.06	236.77	-7.79	8.82	30.27	0.31	48.15	0.35	36.4	0.69
10-09-2025 17:30	7.41	30.04	236.77	-7.82	8.73	38.74	0.24	51.61	0.25		
10-09-2025 17:35	7.36	30.03	236.69	-7.67	9.16	34.01	0.24	40.13	0.32	24.77	0.89
10-09-2025 17:40	7.39	30.09	236.75	-8.88	5.9	40.55	0.27	54.3	0.28	46.54	0.49
10-09-2025 17:45	7.42	30.06	236.73	-8.87	5.93	61.91	0.27	65.43	0.28		
10-09-2025 17:50	7.45	29.97	236.75	-8.78	6.14	43.53	0.26	44.33	0.28		
10-09-2025 17:55	7.4	29.96	236.7	-8.36	7.23	41.88	0.18	47.52	0.26		
10-09-2025 18:00	7.36	30	236.7	-8.1	7.88	27	0.17	39.21	0.26	36.77	0.62
10-09-2025 18:05	7.45	30	236.66	-7.68	9.1	57.1	0.19	67.98	0.25	69.26	0.51
10-09-2025 18:10	7.46	30.02	236.69	-7.79	8.81	25.28	0.23	31.22	0.26	77.34	0.31
10-09-2025 18:15	7.5	30.04	236.67	-8.03	8.08	41.56	0.32	35.51	0.38	40.88	0.61
10-09-2025 18:20	7.51	30.02	236.64	-8.11	7.91	41.71	0.32	38.85	0.37	44.6	0.63
10-09-2025 18:25	7.51	30	236.75	-8.4	7.15	56.02	0.27	92.18	0.18	139.41	0.35
10-09-2025 18:30	7.59	29.93	236.73	-8.24	7.55	67.05	0.26	66.42	0.22	49.69	0.21
10-09-2025 18:35	7.61	29.88	236.77	-8.35	7.25	50.03	0.27	51.94	0.23	6.03	0.3
10-09-2025 18:40	7.64	29.86	236.79	-8.68	6.44	46.68	0.26	65.86	0.22	82.68	0.24
10-09-2025 18:45	7.68	29.86	236.8	-8.8	6.11	240.09	0.32	254.57	0.28	289.19	0.21
10-09-2025 18:50	7.62	29.87	236.82	-8.71	6.35	285.64	0.39	280.59	0.45	311.56	0.67
10-09-2025 18:55	7.7	29.91	236.76	-8.39	7.14	269.64	0.26	245.84	0.33	321.84	0.5
10-09-2025 19:00	7.7	29.94	236.75	-8.06	7.96	292.75	0.38	277.73	0.33	305.1	0.46
10-09-2025 19:05	7.72	29.93	236.65	-7.88	8.54	57.6	0.26	60.95	0.21	358.95	0.33
10-09-2025 19:10	7.69	29.91	236.61	-7.71	9	40.02	0.29	50.97	0.27	39.73	0.28
10-09-2025 19:15	7.83	29.89	236.64	-7.54	9.59	43.2	0.23	60.48	0.24	45.57	0.43
10-09-2025 19:20	7.78	29.95	236.68	-8.03	8.18	24.69	0.28	40.63	0.28	17.06	0.32
10-09-2025 19:25	7.77	29.93	236.72	-8.05	8.05	65.45	0.23	53.85	0.24	23.46	0.65
10-09-2025 19:30	7.8	29.86	236.8	-8.16	7.74	58.28	0.25	68.45	0.22	20.52	0.53

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
10-09-2025 19:35	7.9	29.87	236.81	-8.18	7.74	70.79	0.24	74.88	0.24	57.41	0.31
10-09-2025 19:40	7.89	29.93	236.79	-8.04	8.08	34.96	0.24	39.69	0.19	10.8	0.29
10-09-2025 19:45	7.94	29.95	236.76	-7.99	8.23	54.16	0.25	40.54	0.26	34.02	0.37
10-09-2025 19:50	8	29.82	236.58	-8.18	7.81	47.79	0.16	58.08	0.22	35.8	0.24
10-09-2025 19:55	7.97	29.82	236.66	-7.59	9.41	51.46	0.17	43.33	0.23	52.42	0.28
10-09-2025 20:00	7.97	29.83	236.81	-8.12	8.01	79.47	0.26	67.06	0.29	26.62	0.52
10-09-2025 20:05	7.9	29.85	236.88	-8.16	7.74	68.08	0.22	70.91	0.2	79.88	0.24
10-09-2025 20:10	7.95	29.85	236.85	-8.5	6.88	80.91	0.18	94.18	0.25	59.75	0.22
10-09-2025 20:15	7.95	29.84	236.84	-8.23	7.6	70.21	0.20	73.94	0.24	50.79	0.32
10-09-2025 20:20	7.96	29.88	236.77	-7.69	9.1	70	0.16	69.29	0.18	26.78	0.24
10-09-2025 20:25	8.04	29.87	236.82	-7.83	8.71	73.32	0.21	53.18	0.24	65.78	0.21
10-09-2025 20:30	8.01	29.92	236.87	-8.05	8.11	30.21	0.24	42.17	0.2	41.45	0.27
10-09-2025 20:35	8.09	29.93	236.88	-8.33	7.37	65.13	0.22	63.29	0.21	58.37	0.25
10-09-2025 20:40	8.07	29.92	236.57	-8.77	6.24	28.69	0.18	38.41	0.17	84.2	0.21
10-09-2025 20:45	8.08	29.92	236.11	-8.48	7	65.42	0.18	67.05	0.21	81.69	0.23
10-09-2025 20:50	8.08	29.9	236.77	-8.11	7.98	52.84	0.15	47.32	0.21	40.78	0.35
10-09-2025 20:55	8.1	29.9	236.77	-7.85	8.68	57.79	0.16	65.91	0.11	113.41	0.14
10-09-2025 21:00	8.11	29.88	236.77	-8.82	5.97	84.96	0.14	96.77	0.13	160.04	0.19
10-09-2025 21:05	8.13	29.88	236.78	-8.63	6.52	92.06	0.15	96.56	0.13	142.96	0.05
10-09-2025 21:10	8.16	29.88	236.85	-8.84	6	108.91	0.17	61.92	0.14	139.13	0.15
10-09-2025 21:15	8.09	29.88	236.78	-8.05	8.13	62.94	0.11	66.79	0.16	96.6	0.17
10-09-2025 21:20	8.11	29.88	236.8	-8.23	7.57	80.01	0.15	94.75	0.19	89.97	0.28
10-09-2025 21:25	8.12	29.9	236.85	-8.25	7.54	90.2	0.17	83.7	0.16	145.75	0.31
10-09-2025 21:30	8.26	29.92	236.88	-8.35	7.3	72.58	0.20	73.27	0.18	145.49	0.3
10-09-2025 21:35	8.07	29.91	236.82	-8.68	6.45	22.54	0.24	30.93	0.18	70.67	0.2
10-09-2025 21:40	8.21	29.91	236.72	-8.01	8.23	103.69	0.16	132.35	0.19	156.58	0.44
10-09-2025 21:45	8.15	29.92	236.79	-8.29	7.45	261.29	0.17	243.59	0.15	202.26	0.22
10-09-2025 21:50	8.14	29.92	236.68	-8.07	8.03	254	0.14	219	0.15	187.18	0.29
10-09-2025 21:55	8.19	29.91	236.7	-8.16	7.83	236.47	0.17	225.64	0.14	318.93	0.1
10-09-2025 22:00	8.27	29.91	236.75	-8.46	7.04	229.76	0.12	227.06	0.08	169.14	0.43
10-09-2025 22:05	8.24	29.91	236.62	-8.68	6.44	75.54	0.13	76.69	0.08	106.38	0.34
10-09-2025 22:10	8.13	29.92	236.61	-8.28	7.44	104.85	0.13	77.51	0.09	51.5	0.16
10-09-2025 22:15	8.15	29.92	236.75	-8.4	7.14	107.96	0.20	117.25	0.19	121.84	0.13
10-09-2025 22:20	8.14	29.94	236.65	-8.24	7.54	91.11	0.11	68.65	0.1	58.36	0.35
10-09-2025 22:25	8.16	29.96	236.71	-8.47	6.95	102.83	0.13	105.13	0.16	106.4	0.28
10-09-2025 22:30	8.25	29.95	236.77	-8.79	6.13	66.35	0.12	87.55	0.13	51.52	0.24
10-09-2025 22:35	8.16	29.92	236.69	-8.13	7.91	31.42	0.16	38.88	0.12	47.26	0.24
10-09-2025 22:40	8.17	29.88	236.58	-7.62	9.37	100.48	0.09	105.19	0.14	89.95	0.26
10-09-2025 22:45	8.2	29.87	236.68	-8.2	7.7	92.09	0.12	106.84	0.12	75.18	0.23
10-09-2025 22:50	8.11	29.86	236.67	-7.72	9.03	89.61	0.12	79.44	0.14	91.42	0.22
10-09-2025 22:55	8.14	29.86	236.68	-7.83	8.71	72.08	0.13	90.95	0.1	124.17	0.12
10-09-2025 23:00	8.16	29.86	236.74	-7.95	8.37	94.25	0.12	112.72	0.11	135.27	0.16
10-09-2025 23:05	8.1	29.85	236.7	-7.81	8.75	90.52	0.12	101.49	0.14	120.38	0.26
10-09-2025 23:10	8.1	29.85	236.67	-8.35	7.32	112.47	0.15	115.12	0.21	133.12	0.14
10-09-2025 23:15	8.12	29.85	236.73	-8.4	7.15	110.25	0.19	110.73	0.15	67.06	0.2
10-09-2025 23:20	8.12	29.85	236.68	-8.24	7.63	106.83	0.17	129.83	0.09	113.3	0.21
10-09-2025 23:25	8.1	29.85	236.69	-8.16	7.85	79.47	0.15	79.58	0.1	59.64	0.22
10-09-2025 23:30	8.04	29.85	236.6	-7.11	10.82	97.03	0.10	126.21	0.11	122.68	0.22
10-09-2025 23:35	8.21	29.85	236.6	-9.22	5.08	129.14	0.18	127.7	0.15	119.77	0.38

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
10-09-2025 23:40	8.08	29.85	236.18	-6.63	12.18	100.26	0.08	31.28	0.1	76.48	0.05
10-09-2025 23:45	8.08	29.85	236.56	-7.13	10.81	136.45	0.18	123.89	0.18	60.59	0.12
10-09-2025 23:50	8.08	29.85	236.8	-7.94	8.35	114.7	0.14	111.57	0.1	135.2	0.18
10-09-2025 23:55	7.99	29.84	236.41	-6.57	12.26	126.53	0.10	114.81	0.07	67.41	0.16
11-09-2025 00:00	7.92	29.84	236.47	-6.51	12.44	128.24	0.18	128.63	0.16	64.46	0.32
11-09-2025 00:05	7.97	29.83	236.55	-7.01	11.08	142.27	0.22	143.51	0.22	140.89	0.38
11-09-2025 00:10	8.03	29.83	236.43	-6.77	11.64	129.65	0.15	146.59	0.18	145.84	0.14
11-09-2025 00:15	7.98	29.82	236.38	-6.64	12.03	47.9	0.04	86.92	0.06	166.17	0.13
11-09-2025 00:20	7.99	29.82	236.41	-6.94	11.18	166.4	0.09	125.3	0.08	192.4	0.26
11-09-2025 00:25	7.94	29.82	236.41	-6.46	12.52	128.23	0.16	104.49	0.11	142.97	0.17
11-09-2025 00:30	7.9	29.82	236.66	-7.65	9.17	111.92	0.12	109.04	0.08	165.46	0.09
11-09-2025 00:35	7.89	29.81	236.19	-6.22	13.1	108.53	0.11	152.25	0.12	196.9	0.23
11-09-2025 00:40	7.86	29.81	236.45	-6.56	12.14	115.34	0.22	141.69	0.15	239.95	0.13
11-09-2025 00:45	7.79	29.8	236	-5.75	14.39	222.58	0.13	170.37	0.2	140.86	0.7
11-09-2025 00:50	7.73	29.8	235.89	-5.6	14.81	182.44	0.31	174.33	0.33	133.86	0.71
11-09-2025 00:55	7.9	29.79	236.37	-6.82	11.38	181.54	0.35	173.95	0.32	127.14	0.48
11-09-2025 01:00	7.81	29.79	236.48	-7.52	9.43	210.94	0.17	219.91	0.16	162.28	0.18
11-09-2025 01:05	7.77	29.78	236.55	-7.58	9.23	131.26	0.18	133.54	0.14	143.8	0.2
11-09-2025 01:10	7.74	29.77	236.56	-7.52	9.42	138.23	0.17	139.13	0.15	134.02	0.17
11-09-2025 01:15	7.77	29.77	236.58	-7.71	8.83	133.12	0.14	148.66	0.16	104.35	0.09
11-09-2025 01:20	7.66	29.77	236.43	-7.06	10.7	140.75	0.17	148.67	0.15	102.68	0.22
11-09-2025 01:25	7.64	29.76	236.49	-7.12	10.59	138.68	0.21	143.43	0.22	87.72	0.06
11-09-2025 01:30	7.64	29.76	236.59	-7.61	9.12	136.58	0.21	143.88	0.26	106.6	0.22
11-09-2025 01:35	7.66	29.76	236.56	-7.74	8.72	127.4	0.09	155.46	0.12	165.29	0.17
11-09-2025 01:40	7.62	29.76	236.43	-6.93	11.06	135.76	0.14	143.89	0.1		
11-09-2025 01:45	7.57	29.75	236.42	-6.71	11.73	121.4	0.13	142.04	0.14	141.69	0.21
11-09-2025 01:50	7.59	29.75	236.56	-7.62	9.16	139.55	0.17	163.47	0.16		
11-09-2025 01:55	7.59	29.74	236.64	-7.91	8.29	120.63	0.11	116.95	0.11	110.24	0.15
11-09-2025 02:00	7.62	29.74	236.74	-8.21	7.54	104.95	0.13	100.62	0.09		
11-09-2025 02:05	7.53	29.74	236.51	-7.58	9.2	41.86	0.03	313.52	0.03	183.75	0.14
11-09-2025 02:10	7.55	29.73	236.64	-8.05	7.92	124.29	0.11	122.9	0.11	98.91	0.24
11-09-2025 02:15	7.51	29.73	236.59	-7.85	8.53	101.55	0.12	119.69	0.06		
11-09-2025 02:20	7.56	29.72	236.65	-8.2	7.56	149.26	0.10	142.71	0.12	145.19	0.25
11-09-2025 02:25	7.51	29.72	236.59	-7.72	8.83	20.12	0.00	118.98	0.05	59.5	0.16
11-09-2025 02:30	7.46	29.71	236.46	-7.05	10.75	106.19	0.07	129.47	0.09	31.89	0.18
11-09-2025 02:35	7.43	29.71	236.65	-7.42	9.79	129.69	0.12	141.32	0.13	95.95	0.24
11-09-2025 02:40	7.44	29.71	236.66	-7.69	9.05	120.03	0.11	132.17	0.11	98.99	0.16
11-09-2025 02:45	7.45	29.71	236.69	-7.8	8.71	150.3	0.05	120.91	0.07		
11-09-2025 02:50	7.48	29.71	236.69	-8.39	7.16	86.86	0.06	197.17	0.01		
11-09-2025 02:55	7.41	29.7	236.66	-8.06	8	74.06	0.01	67.25	0.04	94.21	0.3
11-09-2025 03:00	7.39	29.7	236.7	-8.26	7.51	115.66	0.11	121.84	0.11		
11-09-2025 03:05	7.45	29.7	236.75	-8.26	7.52	57.88	0.08	97.32	0.09		
11-09-2025 03:10	7.38	29.69	236.79	-8.23	7.56	27.64	0.08	48.67	0.04		
11-09-2025 03:15	7.34	29.69	236.73	-8.06	8.01	162.22	0.05	118.16	0.09		
11-09-2025 03:20	7.35	29.69	236.54	-7.29	10.19	139.64	0.10	149.89	0.08		
11-09-2025 03:25	7.41	29.68	236.74	-8.33	7.37	126.14	0.07	126.06	0.09		
11-09-2025 03:30	7.36	29.69	236.77	-7.74	8.9	111.45	0.08	120.26	0.02		
11-09-2025 03:35	7.4	29.68	236.59	-7.17	10.62	107.17	0.10	92.42	0.1		
11-09-2025 03:40	7.36	29.69	236.54	-6.97	11.13	153.7	0.07	130.41	0.08	89.21	0.25

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
11-09-2025 03:45	7.34	29.69	236.74	-7.74	8.89	170.66	0.12	220.55	0.13	245.57	0.5
11-09-2025 03:50	7.33	29.69	236.73	-7.79	8.84	181.95	0.12	214.66	0.1	204.42	0.49
11-09-2025 03:55	7.35	29.69	236.72	-8.68	6.39	152.22	0.18	182.29	0.15		
11-09-2025 04:00	7.35	29.68	236.78	-8.32	7.36	174.15	0.07	234.73	0.04	183.59	0.49
11-09-2025 04:05	7.33	29.68	236.61	-8.06	8.1	163.29	0.05	104.25	0.04		
11-09-2025 04:10	7.34	29.68	236.68	-7.54	9.63	163.13	0.06	66.87	0.07	124.15	0.23
11-09-2025 04:15	7.41	29.67	236.67	-8.21	7.73	113.3	0.07	127.48	0.05		
11-09-2025 04:20	7.34	29.66	236.65	-7.74	9.02	81.4	0.04	88.7	0.07		
11-09-2025 04:25	7.35	29.66	236.47	-7.14	10.78	143.77	0.12	144.14	0.1		
11-09-2025 04:30	7.4	29.66	236.59	-7.59	9.47	144.81	0.08	114.56	0.06	57.22	0.2
11-09-2025 04:35	7.37	29.66	236.73	-8.13	7.95	216.33	0.00	213.52	0.06	88.39	0.15
11-09-2025 04:40	7.38	29.66	236.75	-8.07	8.12	231.48	0.02	144.06	0.08	112.63	0.44
11-09-2025 04:45	7.5	29.66	236.71	-8.65	6.56	197.57	0.09	164.71	0.08	135.28	0.21
11-09-2025 04:50	7.35	29.66	236.68	-7.75	9.06	313.73	0.10	338.71	0.17	115.57	0.16
11-09-2025 04:55	7.37	29.66	236.77	-8.37	7.29	115.55	0.06	126.03	0.03		
11-09-2025 05:00	7.4	29.66	236.77	-8.17	7.88	39.92	0.04	359.24	0.04	156.48	0.3
11-09-2025 05:05	7.32	29.66	236.69	-7.6	9.49	276.8	0.02	296.1	0.05	180.57	0.24
11-09-2025 05:10	7.34	29.66	236.78	-8.57	6.81	150.45	0.06	110.83	0.03		
11-09-2025 05:15	7.32	29.66	236.67	-7.59	9.51	112.44	0.02	294	0.05	191.32	0.25
11-09-2025 05:20	7.45	29.66	236.73	-8.35	7.49	202.12	0.03	165.2	0.09	173.85	0.26
11-09-2025 05:25	7.43	29.66	236.71	-8.32	7.58	3.19	0.08	266.78	0.04	147.52	0.18
11-09-2025 05:30	7.45	29.66	236.78	-8.27	7.65	210.94	0.06	191.92	0.06	179.59	0.24
11-09-2025 05:35	7.47	29.65	236.84	-8.19	7.84	344.54	0.03	243.5	0.03	167.14	0.2
11-09-2025 05:40	7.51	29.65	236.7	-7.8	9.03	325.51	0.05	273.42	0.05	195.4	0.05
11-09-2025 05:45	7.48	29.62	236.7	-8.05	8.27	333.31	0.10	266.49	0.04	16.63	0.07
11-09-2025 05:50	7.48	29.61	236.76	-8.35	7.45	156	0.05	197.8	0.04	139.12	0.03
11-09-2025 05:55	7.44	29.58	236.84	-8.59	6.8	150.65	0.02	161.72	0.07	141.58	0.12
11-09-2025 06:00	7.46	29.58	236.78	-7.85	8.81	155.15	0.10	159.94	0.08	129.96	0.08
11-09-2025 06:05	7.56	29.58	236.79	-8.36	7.39	119.48	0.07	148.29	0.14	105.12	0.24
11-09-2025 06:10	7.53	29.57	236.76	-8.18	7.9	48.04	0.04	345.77	0.02	49.13	0.11
11-09-2025 06:15	7.61	29.56	236.81	-8.38	7.38	44.3	0.07	348.72	0.06	73.05	0.08
11-09-2025 06:20	7.49	29.53	236.74	-8.2	7.84	321.86	0.08	322.05	0.09	30.2	0.12
11-09-2025 06:25	7.54	29.47	236.9	-8.72	6.48	122.05	0.13	156.29	0.12	123.2	0.09
11-09-2025 06:30	7.63	29.47	236.94	-8.76	6.38	80.49	0.12	90.52	0.08	70.16	0.15
11-09-2025 06:35	7.59	29.45	236.97	-8.51	7.07	23.4	0.13	1.77	0.07	39.17	0.13
11-09-2025 06:40	7.59	29.45	236.79	-7.91	8.7	50.17	0.06	60.78	0.09	54.73	0.16
11-09-2025 06:45	7.75	29.5	236.82	-8.38	7.42	193.89	0.14	184.82	0.11	303.17	0.1
11-09-2025 06:50	7.68	29.52	236.88	-8.67	6.62	328.21	0.18	328.14	0.22	303.94	0.2
11-09-2025 06:55	7.72	29.55	236.86	-8.61	6.77	235.83	0.17	252.41	0.16	285.85	0.14
11-09-2025 07:00	7.77	29.55	236.76	-8.46	7.23	275.13	0.15	298.27	0.11	310.98	0.12
11-09-2025 07:05	7.78	29.55	236.74	-8.27	7.74	15.04	0.17	14.53	0.14	30.68	0.28
11-09-2025 07:10	7.68	29.53	236.71	-7.99	8.47	17.82	0.16	11.75	0.19		
11-09-2025 07:15	7.91	29.53	236.24	-9.27	5.1	55.08	0.13	70.46	0.13	61.99	0.22
11-09-2025 07:20	7.83	29.54	236.66	-8.23	7.88	21.43	0.14	11.6	0.14	63.2	0.15
11-09-2025 07:25	7.85	29.53	236.79	-8.42	7.35	29.55	0.13	16.53	0.14	12.3	0.24
11-09-2025 07:30	7.82	29.53	236.76	-8.13	8.16	9.97	0.11	25.64	0.22	24	0.3
11-09-2025 07:35	7.77	29.53	236.77	-8.3	7.7	2.13	0.17	19.86	0.2	19.31	0.4
11-09-2025 07:40	7.89	29.53	236.83	-8.65	6.83	68.67	0.13	73.71	0.12	47.94	0.31
11-09-2025 07:45	7.85	29.52	236.77	-8.33	7.69	19.5	0.13	39.3	0.21	36.89	0.26

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
11-09-2025 07:50	7.91	29.51	236.87	-8.69	6.68	59.62	0.14	44.59	0.11	26.2	0.29
11-09-2025 07:55	7.86	29.51	236.76	-7.9	8.92	0.18	0.13	17.37	0.18	27.52	0.34
11-09-2025 08:00	7.98	29.51	236.92	-8.55	7.08	8.25	0.07	19.49	0.11	37.51	0.24
11-09-2025 08:05	7.98	29.52	236.76	-8.51	7.3	9.44	0.10	9.24	0.18	36.85	0.24
11-09-2025 08:10	7.88	29.51	236.81	-8.04	8.52	28.23	0.13	24.75	0.17	45.02	0.27
11-09-2025 08:15	8.12	29.51	236.91	-8.9	6.24	83.27	0.08	97.27	0.06	18.42	0.05
11-09-2025 08:20	8	29.51	236.87	-8.6	7.05	334.44	0.20	356.9	0.22	6.78	0.24
11-09-2025 08:25	8.06	29.51	236.9	-8.53	7.25	22.21	0.11	32.43	0.15	53.39	0.15
11-09-2025 08:30	8.08	29.51	236.87	-8.86	6.37	29.12	0.17	8.33	0.18	65.88	0.17
11-09-2025 08:35	7.99	29.5	236.93	-7.96	8.81	337.44	0.07	6.67	0.18	134.55	0.27
11-09-2025 08:40	8.03	29.5	236.97	-8.47	7.43	87.63	0.06	49.87	0.14	123.16	0.14
11-09-2025 08:45	8.06	29.49	236.97	-8.72	6.79	359.55	0.11	26.17	0.11	52.55	0.06
11-09-2025 08:50	8.04	29.49	236.98	-8.66	6.94	359.72	0.07	27.2	0.12	73.7	0.12
11-09-2025 08:55	8.05	29.49	237.04	-9.22	5.5	40.58	0.07	44.63	0.13	85.14	0.08
11-09-2025 09:00	8.07	29.49	237	-8.71	6.85	11.79	0.11	15.19	0.15	25.19	0.13
11-09-2025 09:05	8.08	29.5	236.98	-8.31	8.01	0.56	0.07	16.39	0.13	1.53	0.16
11-09-2025 09:10	8.03	29.5	237	-8.54	7.43	45.38	0.14	21.46	0.14	14.19	0.11
11-09-2025 09:15	8.05	29.5	236.99	-8.6	7.25	176.45	0.01	56.96	0.08	50.69	0.09
11-09-2025 09:20	8.01	29.5	236.95	-8.51	7.47	35.32	0.04	29.33	0.09	45.64	0.06
11-09-2025 09:25	8.09	29.5	236.97	-8.56	7.37	72.11	0.06	60.92	0.09	150.91	0.23
11-09-2025 09:30	8.06	29.51	237.03	-8.89	6.48	87.48	0.10	30.76	0.13	124.13	0.21
11-09-2025 09:35	8.12	29.51	236.97	-8.49	7.58	322.59	0.04	24.78	0.1	141.17	0.25
11-09-2025 09:40	8.05	29.51	236.98	-8.69	7.16	51.93	0.08	49.5	0.13	141.43	0.16
11-09-2025 09:45	8.1	29.51	237.02	-8.43	7.94	288.91	0.16	289.89	0.18	163.1	0.46
11-09-2025 09:50	8.12	29.51	236.92	-9.11	6.17	278.14	0.17	295.87	0.18	166.02	0.49
11-09-2025 09:55	8.13	29.52	236.98	-8.47	7.92	316.29	0.17	320.7	0.19	347.22	0.35
11-09-2025 10:00	8.12	29.53	237.05	-9.07	6.38	317.63	0.16	292.15	0.22	175.86	0.48
11-09-2025 10:05	8.08	29.53	237.04	-8.88	6.93	5.98	0.15	37.23	0.15	108.07	0.25
11-09-2025 10:10	8.09	29.54	237.06	-8.89	6.92	63.25	0.12	44.27	0.16	101.6	0.1
11-09-2025 10:15	8.03	29.55	237.05	-9.27	5.95	25.18	0.13	39.1	0.14	104.92	0.15
11-09-2025 10:20	8.1	29.55	237.01	-8.88	7.07	69.18	0.05	69.55	0.11	133.86	0.23
11-09-2025 10:25	8.1	29.56	237.13	-9.03	6.63	49.29	0.13	33.47	0.17	139.19	0.38
11-09-2025 10:30	8.1	29.56	237.09	-9.1	6.5	23.28	0.15	21.97	0.16	23.02	0.06
11-09-2025 10:35	8.19	29.56	237.2	-9.2	6.28	67.21	0.10	41.82	0.15	104.5	0.1
11-09-2025 10:40	8.15	29.56	236.91	-9.92	4.4	2.35	0.24	11.13	0.24	66.14	0.24
11-09-2025 10:45	8.09	29.56	237.17	-9.47	5.67	12.9	0.21	50.33	0.19	134.67	0.31
11-09-2025 10:50	8.08	29.57	237.29	-9.59	5.43	15.88	0.16	27.67	0.24	25.36	0.5
11-09-2025 10:55	8.02	29.58	237.3	-10.3	3.49	58.56	0.18	55.12	0.23	24.76	0.46
11-09-2025 11:00	8.13	29.59	237.02	-8.44	8.69	44.49	0.16	43.2	0.22	13.32	0.45
11-09-2025 11:05	8.02	29.6	236.95	-7.29	11.79	22.76	0.21	34.99	0.26	25.57	0.52
11-09-2025 11:10	7.97	29.6	237.22	-8.99	7.13	35.92	0.15	50.65	0.16	43.66	0.42
11-09-2025 11:15	8.06	29.6	237.32	-9.74	5.12	38.07	0.18	57.58	0.22	6.48	0.53
11-09-2025 11:20	8	29.6	237.27	-9.46	5.88	19.87	0.19	42.64	0.24	26.42	0.42
11-09-2025 11:25	8.05	29.61	237.34	-9.81	4.97	18.76	0.17	41.16	0.24	16.13	0.51
11-09-2025 11:30	7.96	29.61	237.34	-10.02	4.4	9.41	0.23	28.79	0.25	15.73	0.46
11-09-2025 11:35	8.07	29.61	236.99	-10.59	2.91	52.97	0.17	45.91	0.19	29.11	0.28
11-09-2025 11:40	7.95	29.63	237.34	-9.9	4.72	12.46	0.28	11.53	0.26	3.48	0.4
11-09-2025 11:45	7.96	29.64	237.45	-10.1	4.2	58.83	0.15	53.02	0.13	7.65	0.39
11-09-2025 11:50	7.93	29.61	237.38	-10.08	4.27	48.79	0.17	53.74	0.15	5.62	0.41

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
11-09-2025 11:55	7.95	29.58	237.39	-10.07	4.31	65.55	0.21	75.01	0.16	43.09	0.32
11-09-2025 12:00	7.9	29.59	237.27	-8.91	7.43	61.21	0.19	86.47	0.18	18.38	0.36
11-09-2025 12:05	7.92	29.58	237.29	-8.68	7.99	84.22	0.15	73.86	0.18	20.17	0.39
11-09-2025 12:10	7.93	29.58	237.3	-9.15	6.79	68.46	0.12	69.85	0.17	16.18	0.42
11-09-2025 12:15	7.89	29.59	237.26	-9.06	7.01	63.61	0.18	85.51	0.15	34.01	0.22
11-09-2025 12:20	7.82	29.59	237.04	-8.08	9.69	102.42	0.20	109.88	0.14	33.1	0.33
11-09-2025 12:25	7.84	29.59	237.11	-8.41	8.72	112.05	0.21	120.76	0.21	50.79	0.34
11-09-2025 12:30	7.79	29.59	236.92	-7.76	10.55	117.15	0.24	100.47	0.2	36.1	0.33
11-09-2025 12:35	7.84	29.59	237.36	-9.08	6.9	119.46	0.15	110.12	0.21	46.15	0.41
11-09-2025 12:40	7.82	29.6	237.06	-8.5	8.61	97.06	0.16	108.7	0.15	17.95	0.36
11-09-2025 12:45	7.72	29.6	237.13	-8.06	9.69	205.35	0.13	227.48	0.17	296.68	0.42
11-09-2025 12:50	7.67	29.6	236.83	-7.32	11.85	225.53	0.19	236.49	0.33	302.38	0.65
11-09-2025 12:55	7.7	29.6	236.72	-7.37	11.67	193.02	0.20	226.76	0.19	309.93	0.77
11-09-2025 13:00	7.82	29.59	237.07	-8.29	9.07	198.97	0.13	261.04	0.19	313.13	0.85
11-09-2025 13:05	7.7	29.59	236.98	-8.15	9.5	27.44	0.13	16.18	0.19	19.74	0.53
11-09-2025 13:10	7.64	29.59	237.1	-8.31	9	115.11	0.18	101.07	0.2	32.92	0.45
11-09-2025 13:15	7.73	29.6	237.21	-8.61	8.23	118.37	0.16	99.41	0.17	42.16	0.33
11-09-2025 13:20	7.68	29.6	236.87	-7.5	11.42	87.18	0.06	61.62	0.13	3.13	0.41
11-09-2025 13:25	7.61	29.6	237.05	-7.74	10.68	64.33	0.10	46.74	0.13	15.9	0.44
11-09-2025 13:30	7.64	29.6	237.1	-7.68	10.8	109.59	0.12	69.89	0.13	39.08	0.46
11-09-2025 13:35	7.6	29.6	237.26	-8.61	8.21	59.7	0.08	71.98	0.12	39.22	0.44
11-09-2025 13:40	7.56	29.6	237.11	-8.08	9.77	64.3	0.07	61.12	0.13	19.65	0.34
11-09-2025 13:45	7.46	29.6	236.66	-6.91	13.06	107.25	0.11	89.16	0.11	40.37	0.53
11-09-2025 13:50	7.51	29.6	237.09	-8.19	9.39	146.21	0.11	140.55	0.13	42.3	0.12
11-09-2025 13:55	7.55	29.6	237.05	-8.36	8.99	145.47	0.12	104.58	0.14		
11-09-2025 14:00	7.48	29.61	236.63	-6.9	13.09	91.55	0.08	83.08	0.1		
11-09-2025 14:05	7.49	29.61	236.55	-6.41	14.53	133.24	0.08	95.11	0.11	42.16	0.31
11-09-2025 14:10	7.5	29.61	237.17	-8.73	7.93	138.82	0.08	84.2	0.13	44.59	0.45
11-09-2025 14:15	7.39	29.61	237.15	-8.25	9.2	70.42	0.05	23.08	0.11		
11-09-2025 14:20	7.34	29.61	236.99	-7.76	10.62	144.03	0.09	94.77	0.12	61.28	0.6
11-09-2025 14:25	7.41	29.61	237.17	-8.67	8.12	145.92	0.11	119.73	0.1	47.44	0.4
11-09-2025 14:30	7.4	29.62	236.9	-7.61	11.09	146.01	0.10	84.04	0.06		
11-09-2025 14:35	7.43	29.62	237.16	-8.14	9.54	145.99	0.07	102.88	0.11		
11-09-2025 14:40	7.31	29.62	237.19	-8.34	9	79.9	0.04	91.54	0.12		
11-09-2025 14:45	7.42	29.62	237.22	-8.39	8.86	136.31	0.13	70.67	0.16		
11-09-2025 14:50	7.29	29.62	237.11	-8.38	8.92	79.37	0.05	65.8	0.18	43.9	0.46
11-09-2025 14:55	7.31	29.62	236.81	-7.19	12.35	127.49	0.09	87.59	0.15		
11-09-2025 15:00	7.26	29.62	237.03	-7.87	10.34	147.49	0.08	71.25	0.08		
11-09-2025 15:05	7.26	29.62	236.98	-7.62	11.09	144.27	0.13	75.57	0.19		
11-09-2025 15:10	7.29	29.62	236.89	-7.54	11.31	145.86	0.12	94.21	0.22		
11-09-2025 15:15	7.16	29.62	236.91	-7.64	11.03	120.78	0.05	58.76	0.17		
11-09-2025 15:20	7.2	29.62	236.89	-7.72	10.8	122.79	0.13	104.05	0.15		
11-09-2025 15:25	7.18	29.62	237.08	-8.66	8.15	122.28	0.11	64.28	0.15		
11-09-2025 15:30	7.2	29.63	237.12	-8.67	8.07	143.06	0.11	91.2	0.17		
11-09-2025 15:35	7.26	29.63	237.23	-8.9	7.51	119.33	0.06	73.44	0.14		
11-09-2025 15:40	7.24	29.66	237.2	-9.16	6.8	25.46	0.08	45.98	0.21		
11-09-2025 15:45	7.21	29.66	236.95	-7.93	10.2	330.91	0.11	270.96	0.21		
11-09-2025 15:50	7.22	29.66	236.78	-7.83	10.48	264.11	0.09	257.16	0.24		
11-09-2025 15:55	7.19	29.64	236.9	-7.87	10.36	327.1	0.04	210.87	0.15		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
11-09-2025 16:00	7.28	29.69	237.04	-8.7	8.1	246.7	0.05	256.1	0.12		
11-09-2025 16:05	7.22	29.74	236.9	-8.57	8.41	8.17	0.18	35.05	0.24		
11-09-2025 16:10	7.1	29.71	236.98	-8.44	8.73	12.85	0.16	24.48	0.25		
11-09-2025 16:15	7.18	29.77	237.01	-8.68	8.1	88.17	0.10	86.37	0.28		
11-09-2025 16:20	7.2	29.82	236.92	-8.18	9.48	7.99	0.13	86.45	0.16		
11-09-2025 16:25	7.1	29.85	237.01	-8.52	8.59	13.2	0.12	88.93	0.14		
11-09-2025 16:30	7.19	29.87	237.03	-8.98	7.39	195.05	0.05	83.31	0.19		
11-09-2025 16:35	7.14	29.83	237.06	-9.09	7.1	353.67	0.19	39.29	0.13		
11-09-2025 16:40	7.23	29.82	237.04	-9.16	6.88	45.75	0.11	62.16	0.2		
11-09-2025 16:45	7.24	29.84	236.97	-8.83	7.76	358.97	0.15	28.63	0.18		
11-09-2025 16:50	7.3	29.84	236.93	-8.85	7.75	345.09	0.13	359.66	0.18		
11-09-2025 16:55	7.24	29.82	236.97	-8.69	8.16	353.24	0.26	11.06	0.25		
11-09-2025 17:00	7.2	29.83	237.02	-8.68	8.19	342.07	0.12	16.26	0.21		
11-09-2025 17:05	7.18	29.88	237.07	-8.75	7.96	20.52	0.14	45.83	0.2		
11-09-2025 17:10	7.23	29.91	236.86	-8.54	8.53	59.47	0.07	72.49	0.12		
11-09-2025 17:15	7.22	29.89	236.92	-9.26	6.62	64.18	0.10	67.39	0.19		
11-09-2025 17:20	7.17	29.89	236.99	-8.73	8.01	51.01	0.17	55.48	0.2		
11-09-2025 17:25	7.23	29.87	236.92	-8.42	8.93	100.96	0.09	89.23	0.18		
11-09-2025 17:30	7.23	29.9	237.12	-8.84	7.69	73.09	0.14	73.14	0.2		
11-09-2025 17:35	7.35	29.91	237.15	-9.14	6.97	18.23	0.19	41.84	0.23		
11-09-2025 17:40	7.3	29.98	236.88	-8.83	7.77	3.15	0.14	33.23	0.18		
11-09-2025 17:45	7.32	29.99	236.97	-9.04	7.26	87.31	0.03	62.25	0.11		
11-09-2025 17:50	7.31	30.06	236.92	-8.92	7.58	43.38	0.09	35.54	0.18		
11-09-2025 17:55	7.46	30.08	236.98	-9.72	5.47	69.14	0.12	53.98	0.15		
11-09-2025 18:00	7.36	30.09	236.99	-9.48	6.08	1.4	0.24	14.27	0.33		
11-09-2025 18:05	7.3	30.12	237.05	-9.75	5.34	15.76	0.14	31.37	0.19		
11-09-2025 18:10	7.3	30.1	236.98	-9.74	5.38	36.63	0.14	59.39	0.18		
11-09-2025 18:15	7.38	30.08	236.98	-10.31	3.93	46.27	0.16	66.61	0.16		
11-09-2025 18:20	7.41	30.07	236.86	-10.76	2.74	24.31	0.20	33.89	0.23		
11-09-2025 18:25	7.4	30.07	236.84	-9.2	6.93	6.94	0.29	24.14	0.25		
11-09-2025 18:30	7.44	30.06	236.82	-10.61	3.17	32.56	0.25	42.75	0.29		
11-09-2025 18:35	7.43	30.06	236.7	-11.46	0.8	20.33	0.27	38.33	0.41	31.39	0.53
11-09-2025 18:40	7.44	30.05	236.8	-11.22	1.4	28.37	0.28	51.16	0.23	62.78	0.31
11-09-2025 18:45	7.52	30.04	236.42	-11.91	-0.46	290.75	0.22	261.4	0.32	203.03	0.35
11-09-2025 18:50	7.47	30.04	236.69	-11.19	1.52	299.61	0.41	289.47	0.44	275.81	0.42
11-09-2025 18:55	7.44	30.03	236.74	-10.77	2.71	315.57	0.30	277.91	0.36	231.63	0.45
11-09-2025 19:00	7.56	30.01	236.71	-10.76	2.74	298.76	0.21	255.09	0.35	214.67	0.35
11-09-2025 19:05	7.59	30.02	236.66	-10.75	2.82	9.87	0.26	34.83	0.29	74.19	0.26
11-09-2025 19:10	7.63	30.01	236.49	-9.57	6.17	24.03	0.28	36.03	0.38		
11-09-2025 19:15	7.63	30.01	236.46	-7.38	12.19	27.04	0.29	50.25	0.35	50.74	0.41
11-09-2025 19:20	7.58	30	236.52	-7.35	12.33	14.26	0.30	30.5	0.34	49.57	0.58
11-09-2025 19:25	7.63	30	236.52	-7.24	12.86	31.88	0.27	53.87	0.29	77.5	0.45
11-09-2025 19:30	7.7	29.97	236.64	-7.36	12.54	24.74	0.29	55.06	0.3	130	0.3
11-09-2025 19:35	7.72	29.97	236.58	-7.32	12.68	31.22	0.30	44.82	0.35	121.05	0.19
11-09-2025 19:40	7.68	29.97	236.57	-7.34	12.6	23.15	0.33	31.04	0.36	81.81	0.19
11-09-2025 19:45	7.66	29.96	236.51	-7.15	13.22	28.56	0.22	51.53	0.32	123.18	0.2
11-09-2025 19:50	7.74	29.93	236.51	-7	13.75	26.69	0.24	39.06	0.35	153.65	0.13
11-09-2025 19:55	7.74	29.93	236.55	-6.67	15.41	19.08	0.28	33.51	0.38	82.41	0.08
11-09-2025 20:00	7.77	29.9	236.66	-6.73	15.5	15.81	0.26	24.87	0.39	40.01	0.14

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
11-09-2025 20:05	7.8	29.89	236.74	-6.81	15.53	7.19	0.24	27.1	0.39	51.37	0.16
11-09-2025 20:10	7.81	29.86	236.9	-7.15	14.78	12.28	0.31	31.56	0.41	73.41	0.29
11-09-2025 20:15	7.74	29.8	237.69	-11.04	4.8	10.75	0.32	32.38	0.36	132.78	0.05
11-09-2025 20:20	7.88	29.78	237.15	-7.26	15.8	32.37	0.21	62.05	0.36	133.7	0.3
11-09-2025 20:25	7.92	29.75	237.2	-7.36	15.5	28.76	0.27	37.31	0.34	107.8	0.15
11-09-2025 20:30	7.89	29.78	237.44	-7.78	14.25	15.36	0.39	26.76	0.39	63.66	0.23
11-09-2025 20:35	7.87	29.84	237.59	-8.28	12.8	33.75	0.27	49.4	0.32	102.3	0.26
11-09-2025 20:40	7.88	29.83	237.55	-8.15	13.17	57.96	0.21	53.97	0.33	73.78	0.41
11-09-2025 20:45	7.87	29.81	237.62	-8.28	12.83	41.05	0.22	64.03	0.31	79.79	0.42
11-09-2025 20:50	7.95	29.77	237.58	-8.15	13.2	32.61	0.26	58.8	0.35	61.52	0.5
11-09-2025 20:55	8	29.74	237.47	-7.82	14.13	26.31	0.31	40.87	0.36	55.24	0.3
11-09-2025 21:00	7.93	29.74	237.5	-7.76	14.33	20.13	0.33	34.63	0.45	47.12	0.41
11-09-2025 21:05	7.98	29.74	237.59	-7.98	13.69	28.8	0.34	51.71	0.37	56.83	0.42
11-09-2025 21:10	8.02	29.74	237.47	-7.7	14.52	23.15	0.25	38.6	0.34	36.94	0.4
11-09-2025 21:15	8.01	29.79	237.5	-7.79	14.27	21.32	0.30	36.29	0.38	49.09	0.35
11-09-2025 21:20	7.94	29.81	237.98	-9.03	10.76	8.32	0.38	26.83	0.41	42.9	0.32
11-09-2025 21:25	8.08	29.76	237.98	-8.92	11.07	56.28	0.24	64.28	0.29	79.73	0.29
11-09-2025 21:30	8.07	29.74	237.86	-8.54	12.14	36.02	0.20	44.63	0.26	78.19	0.16
11-09-2025 21:35	8.12	29.74	237.7	-8.06	13.46	15.38	0.23	30.36	0.31	44.33	0.32
11-09-2025 21:40	8.11	29.75	237.93	-8.64	11.85	26.9	0.29	42.24	0.31	62.66	0.3
11-09-2025 21:45	8.06	29.75	237.93	-8.73	11.59	289.82	0.34	279.65	0.36	305.83	0.56
11-09-2025 21:50	8.06	29.74	237.86	-8.54	12.1	277.35	0.26	265.52	0.34	276.92	0.42
11-09-2025 21:55	8.06	29.79	237.94	-8.83	11.31	301.6	0.31	283.72	0.39	282.81	0.42
11-09-2025 22:00	8.08	29.91	238.15	-9.51	9.41	274.36	0.23	271.32	0.3	299.83	0.67
11-09-2025 22:05	8.06	29.91	238.08	-9.38	9.79	44.87	0.26	51.21	0.32	49.68	0.52
11-09-2025 22:10	7.98	29.91	238.12	-9.61	9.11	40.87	0.18	40.71	0.23	45.31	0.47
11-09-2025 22:15	8.05	29.9	238.15	-9.59	9.18	75.75	0.28	74.56	0.32	62.93	0.36
11-09-2025 22:20	8.13	29.91	238.22	-9.74	8.76	54.15	0.20	50.18	0.25	35.1	0.49
11-09-2025 22:25	8.03	29.9	238.16	-9.52	9.39	30.39	0.21	40.06	0.29	23.03	0.47
11-09-2025 22:30	8.1	29.88	238.06	-9.26	10.13	89.12	0.22	76.93	0.25	53.87	0.27
11-09-2025 22:35	8.08	29.86	238.03	-9.26	10.13	53.29	0.21	40.67	0.23	36.86	0.41
11-09-2025 22:40	8.1	29.83	238.1	-9.47	9.53	61.73	0.19	55.67	0.15	48.6	0.31
11-09-2025 22:45	8.08	29.79	238.13	-9.49	9.48	69.57	0.16	57.04	0.22	16.73	0.42
11-09-2025 22:50	8.09	29.78	238.18	-9.53	9.33	72.56	0.29	72.68	0.28	33.21	0.51
11-09-2025 22:55	8.09	29.77	238.2	-9.56	9.3	52.83	0.24	47.23	0.26	29	0.41
11-09-2025 23:00	8.04	29.76	238.14	-9.39	9.77	61.81	0.25	65.58	0.24	25.16	0.41
11-09-2025 23:05	8.06	29.73	238.18	-9.5	9.46	99.42	0.24	96.19	0.24	27.99	0.3
11-09-2025 23:10	8.04	29.72	238.18	-9.54	9.36	73.42	0.20	86.97	0.24	16.64	0.29
11-09-2025 23:15	8.03	29.82	238.31	-9.83	8.52	81.68	0.24	81.1	0.19	42.65	0.3
11-09-2025 23:20	8.09	29.72	238.24	-9.6	9.17	62.39	0.26	63.26	0.27	35.88	0.5
11-09-2025 23:25	8.19	29.7	237.42	-10.03	8.06	72.67	0.23	64.65	0.22	23.62	0.41
11-09-2025 23:30	8.08	29.68	237.79	-8.5	12.27	41.24	0.19	50.79	0.23	3.43	0.41
11-09-2025 23:35	8.12	29.65	237.93	-9.07	10.7	93.48	0.22	97.14	0.14	66.43	0.26
11-09-2025 23:40	8.04	29.63	237.98	-9.03	10.79	65.13	0.10	45.48	0.17	33.76	0.31
11-09-2025 23:45	8.04	29.62	238.01	-9.08	10.66	93.27	0.19	77.26	0.13	50.31	0.18
11-09-2025 23:50	8.01	29.61	238.5	-10.23	7.41	88.07	0.14	86.98	0.12	27.55	0.07
11-09-2025 23:55	8.03	29.6	238.4	-10.11	7.78	100.83	0.20	98.35	0.18	30.77	0.29
12-09-2025 00:00	7.98	29.59	238.29	-9.47	9.52	87.15	0.16	61.43	0.13	16.1	0.3
12-09-2025 00:05	8	29.59	238.26	-9.55	9.27	116.04	0.26	116.63	0.24	59.28	0.24

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
12-09-2025 00:10	8.01	29.59	238.24	-9.47	9.53	90.07	0.18	116.1	0.18	46.59	0.32
12-09-2025 00:15	8	29.58	238.32	-9.67	8.98	106.71	0.20	103.1	0.18	33.45	0.3
12-09-2025 00:20	7.99	29.58	238.38	-9.89	8.4	104.96	0.22	96.33	0.2	57.07	0.19
12-09-2025 00:25	7.93	29.58	238.24	-9.39	9.78	100.01	0.13	101.36	0.12	40.91	0.2
12-09-2025 00:30	7.93	29.58	238.41	-9.76	8.76	105.81	0.17	126.35	0.24	102.47	0.2
12-09-2025 00:35	7.93	29.57	238.34	-9.78	8.71	108.93	0.17	118.95	0.17	95.94	0.19
12-09-2025 00:40	7.93	29.57	238.32	-9.69	8.92	113.9	0.20	107.08	0.18	48.65	0.21
12-09-2025 00:45	7.99	29.57	238.24	-9.33	10.04	222.13	0.22	234.25	0.18	290.34	0.17
12-09-2025 00:50	7.9	29.56	238.15	-9.31	10	223.18	0.15	218.49	0.16	263.08	0.04
12-09-2025 00:55	7.88	29.55	237.93	-8.75	11.6	212.77	0.23	202.4	0.29	176.59	0.29
12-09-2025 01:00	7.91	29.55	238.22	-9.51	9.41	212.11	0.24	198.76	0.22	195.28	0.04
12-09-2025 01:05	7.97	29.55	238.27	-9.51	9.47	122.53	0.21	104.95	0.16	60.12	0.16
12-09-2025 01:10	7.86	29.53	237.39	-7.66	14.78	86.57	0.12	98.43	0.13	61.07	0.16
12-09-2025 01:15	7.83	29.53	238.07	-8.96	10.97	125.67	0.21	128.42	0.24	151.92	0.11
12-09-2025 01:20	7.81	29.53	238.11	-9.02	10.77	129.98	0.23	122.12	0.24	151.66	0.25
12-09-2025 01:25	7.81	29.53	237.96	-8.84	11.3	132.54	0.25	127.48	0.21	152.35	0.3
12-09-2025 01:30	7.72	29.53	237.91	-8.57	12.09	125.43	0.15	98.99	0.19	107.27	0.13
12-09-2025 01:35	7.7	29.53	238.04	-8.76	11.53	134.57	0.19	124.46	0.2	158.75	0.24
12-09-2025 01:40	7.72	29.52	237.73	-8.25	13.04	122.73	0.18	113.35	0.14	134.77	0.25
12-09-2025 01:45	7.83	29.52	238.29	-9.48	9.52	130.07	0.15	117.88	0.2	148.6	0.2
12-09-2025 01:50	7.71	29.52	238.31	-9.52	9.38	69.7	0.11	56.63	0.16	52.14	0.2
12-09-2025 01:55	7.73	29.52	238	-8.81	11.42	110.33	0.20	93.32	0.18	104.79	0.26
12-09-2025 02:00	7.7	29.52	237.81	-8.3	12.84	108.45	0.13	86.31	0.12	155.44	0.23
12-09-2025 02:05	7.61	29.53	237.93	-8.66	11.84	104.66	0.15	81.2	0.12	84.54	0.19
12-09-2025 02:10	7.6	29.52	238.08	-8.95	11.04	140.34	0.21	124.79	0.2	138.76	0.26
12-09-2025 02:15	7.66	29.51	238.08	-8.95	11.07	133.08	0.11	93.09	0.09	104.35	0.17
12-09-2025 02:20	7.58	29.51	238.16	-9.15	10.49	111.42	0.09	76.53	0.1	82.01	0.19
12-09-2025 02:25	7.66	29.51	238.33	-9.51	9.47	100.67	0.13	63.79	0.14	84.03	0.19
12-09-2025 02:30	7.58	29.5	238.35	-9.47	9.62	67.02	0.06	32.35	0.13	53.22	0.22
12-09-2025 02:35	7.54	29.5	238.29	-9.28	10.13	107.7	0.07	74.29	0.1	87.31	0.22
12-09-2025 02:40	7.48	29.49	238.25	-9.1	10.66	139.26	0.13	99.66	0.11	135.8	0.29
12-09-2025 02:45	7.52	29.49	237.82	-8.5	12.37	140.38	0.15	128.93	0.16	139.81	0.26
12-09-2025 02:50	7.57	29.49	238.05	-8.89	11.25	115.29	0.10	85.96	0.1	143.61	0.22
12-09-2025 02:55	7.51	29.49	238.15	-9.14	10.54	112.63	0.06	75.92	0.09	72.87	0.19
12-09-2025 03:00	7.46	29.49	238.14	-9.17	10.47	83.55	0.04	50.88	0.11	71.29	0.17
12-09-2025 03:05	7.37	29.49	238.1	-8.98	11	120.49	0.12	79.59	0.07	90.84	0.16
12-09-2025 03:10	7.4	29.48	238.4	-9.81	8.63	142.88	0.16	122.19	0.19	96.21	0.25
12-09-2025 03:15	7.53	29.48	237.93	-9.78	8.89	136.61	0.14	114.23	0.15	116.24	0.2
12-09-2025 03:20	7.46	29.48	238.29	-9.5	9.55	313.59	0.02	17.51	0.04	127.68	0.17
12-09-2025 03:25	7.44	29.48	238.31	-9.45	9.68	189.31	0.08	87.15	0.03	76.08	0.05
12-09-2025 03:30	7.37	29.48	238.35	-9.32	10.11	161.79	0.08	125.31	0.05	148.6	0.25
12-09-2025 03:35	7.44	29.48	238.37	-9.6	9.29	159.22	0.15	133.95	0.12	145.48	0.3
12-09-2025 03:40	7.45	29.48	238.32	-9.49	9.62	188.32	0.02	38.34	0.04	160.33	0.12
12-09-2025 03:45	7.41	29.48	238.26	-9.42	9.81	181.26	0.04	267.11	0.05	184.46	0.16
12-09-2025 03:50	7.51	29.48	238.35	-9.74	8.94	158.24	0.09	204.99	0.06	171.63	0.23
12-09-2025 03:55	7.35	29.47	238.24	-9.21	10.42	310.81	0.07	317.21	0.24	223.38	0.06
12-09-2025 04:00	7.35	29.47	238.33	-9.6	9.3	186.36	0.10	222.01	0.07	171.38	0.38
12-09-2025 04:05	7.41	29.47	238.41	-9.69	9	167.22	0.14	146.13	0.09	185.14	0.19
12-09-2025 04:10	7.29	29.47	238.31	-9.43	9.78	14.78	0.01	92.41	0.03	157.82	0.3

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
12-09-2025 04:15	7.3	29.47	238.3	-9.55	9.42	164.18	0.16	163.56	0.11		
12-09-2025 04:20	7.39	29.46	238.42	-9.77	8.8	155.44	0.11	139.96	0.13	152.61	0.28
12-09-2025 04:25	7.37	29.46	238.6	-10.17	7.69	124.32	0.04	9.38	0.08	151.38	0.13
12-09-2025 04:30	7.39	29.46	238.56	-10.03	8.1	108.24	0.04	51.12	0.05	157.02	0.31
12-09-2025 04:35	7.3	29.47	238.08	-8.84	11.48	26.12	0.04	28.82	0.09	132.22	0.25
12-09-2025 04:40	7.27	29.47	238.37	-9.52	9.59	144.28	0.08	125.4	0.1		
12-09-2025 04:45	7.32	29.47	238.37	-9.66	9.15	164.59	0.15	143.36	0.16		
12-09-2025 04:50	7.33	29.46	238.37	-9.66	9.14	192.69	0.07	134.66	0.04		
12-09-2025 04:55	7.34	29.46	238.29	-9.26	10.32	184.54	0.03	32.82	0.03		
12-09-2025 05:00	7.3	29.46	238.32	-9.29	10.21	192.33	0.04	129.18	0.02		
12-09-2025 05:05	7.37	29.46	238.46	-9.63	9.27	151.7	0.08	128.54	0.06		
12-09-2025 05:10	7.34	29.46	237.84	-8.36	12.86	338.4	0.05	11.96	0.08		
12-09-2025 05:15	7.38	29.46	238.05	-8.92	11.27	170.04	0.03	56.1	0.07	149.5	0.12
12-09-2025 05:20	7.27	29.46	238.26	-9.29	10.25	34.33	0.02	15.12	0.08	191.68	0.08
12-09-2025 05:25	7.33	29.46	238.58	-10.19	7.73	169.85	0.16	148.62	0.13		
12-09-2025 05:30	7.32	29.46	238.76	-10.92	5.76	114.46	0.07	70.84	0.03	151.28	0.25
12-09-2025 05:35	7.38	29.46	238.48	-9.8	8.79	140.64	0.14	44.55	0.06	123.24	0.24
12-09-2025 05:40	7.39	29.46	238.5	-10.01	8.26	327.18	0.06	33.01	0.11	111.69	0.12
12-09-2025 05:45	7.31	29.46	238.38	-9.6	9.35	258.67	0.02	4.87	0.05		
12-09-2025 05:50	7.38	29.46	238.55	-10.04	8.18	174.36	0.11	140.47	0.07		
12-09-2025 05:55	7.46	29.46	238.55	-10.05	8.11	130.14	0.05	69.2	0.05	132.57	0.22
12-09-2025 06:00	7.44	29.46	238.12	-8.88	11.39	271.41	0.03	354.04	0.11	138.52	0.17
12-09-2025 06:05	7.44	29.46	238.33	-9.49	9.6	206.36	0.03	302.65	0.02	188.21	0.12
12-09-2025 06:10	7.3	29.46	238.27	-9.59	9.35	204.34	0.05	169.89	0.07	165.68	0.32
12-09-2025 06:15	7.53	29.45	238.27	-9.37	10.04	157.57	0.15	149.77	0.18		
12-09-2025 06:20	7.4	29.46	238.33	-9.39	9.95	339.73	0.09	1.07	0.18	38.57	0.1
12-09-2025 06:25	7.42	29.46	238.35	-9.55	9.48	189.11	0.11	178.24	0.12	160.45	0.26
12-09-2025 06:30	7.43	29.45	238.33	-9.4	9.88	164.5	0.05	68.06	0.04	149.74	0.15
12-09-2025 06:35	7.47	29.46	238.42	-9.67	9.13	140.61	0.08	171.07	0.07	147.27	0.15
12-09-2025 06:40	7.43	29.46	238.44	-9.69	9.09	115.44	0.05	0.26	0.04	107.65	0.12
12-09-2025 06:45	7.49	29.46	238.39	-9.74	8.97	159.23	0.09	175.89	0.12	167.71	0.37
12-09-2025 06:50	7.49	29.45	238.56	-10.09	8	291.03	0.07	295.62	0.18	209.29	0.16
12-09-2025 06:55	7.62	29.45	238.62	-10.36	7.3	179.12	0.03	302.83	0.05	186.48	0.24
12-09-2025 07:00	7.52	29.45	238.51	-10.14	7.84	343.89	0.17	329.15	0.28	214.31	0.15
12-09-2025 07:05	7.55	29.45	238.14	-9.48	9.8	302	0.12	4.83	0.03	156.72	0.12
12-09-2025 07:10	7.59	29.45	238.24	-9.43	9.9	305.24	0.07	24.27	0.02	89.02	0.1
12-09-2025 07:15	7.64	29.45	238.26	-9.6	9.39	24.37	0.04	27.3	0.09	59.57	0.13
12-09-2025 07:20	7.63	29.45	238.44	-10.03	8.16	16.53	0.12	46.16	0.09	47.47	0.14
12-09-2025 07:25	7.65	29.45	238.46	-9.97	8.33	349.67	0.07	350.52	0.06	45.99	0.19
12-09-2025 07:30	7.58	29.45	238.28	-9.65	9.2	31.46	0.03	36.23	0.07	55.6	0.22
12-09-2025 07:35	7.64	29.45	238.38	-9.8	8.8	128.95	0.10	96.03	0.12	74.28	0.2
12-09-2025 07:40	7.71	29.45	238.47	-9.98	8.34	24.58	0.06	24.46	0.13	54.22	0.19
12-09-2025 07:45	7.56	29.46	238.04	-9.02	11.05	359.89	0.04	356.57	0.06	38.8	0.15
12-09-2025 07:50	7.77	29.47	238.36	-9.71	9.11	147.36	0.09	126.55	0.11	139.41	0.16
12-09-2025 07:55	7.81	29.46	238.39	-9.76	8.98	9.62	0.10	350.71	0.13	52.02	0.13
12-09-2025 08:00	7.76	29.46	238.41	-9.76	8.98	19.02	0.10	22.8	0.12	54.89	0.14
12-09-2025 08:05	7.77	29.46	238.41	-9.76	8.95	350.19	0.05	4.48	0.11	85.65	0.07
12-09-2025 08:10	7.77	29.46	238.38	-9.83	8.73	3.18	0.10	0.87	0.12	47.11	0.15
12-09-2025 08:15	7.74	29.46	238.52	-10.09	8.12	351.67	0.07	356.75	0.04	50.85	0.07

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
12-09-2025 08:20	7.87	29.46	238.65	-10.52	6.93	308.6	0.02	143.74	0.01	134.17	0.07
12-09-2025 08:25	7.82	29.46	238.55	-10.19	7.81	353.99	0.18	356.64	0.2	23.16	0.2
12-09-2025 08:30	7.77	29.46	238.17	-9.09	10.88	13.4	0.10	0.47	0.16	58.5	0.1
12-09-2025 08:35	7.85	29.45	238.35	-9.66	9.31	67.17	0.12	89.24	0.11	71.06	0.1
12-09-2025 08:40	7.84	29.44	238.46	-9.86	8.62	46.02	0.13	44.91	0.12	44.01	0.16
12-09-2025 08:45	7.82	29.44	238.46	-9.98	8.39	21.11	0.10	44.98	0.17	97.42	0.12
12-09-2025 08:50	7.86	29.44	238.48	-9.96	8.45	48.86	0.09	44.53	0.13	54.66	0.1
12-09-2025 08:55	7.81	29.44	238.5	-10.14	7.98	103.51	0.15	51.9	0.12	69.58	0.12
12-09-2025 09:00	7.84	29.44	238.61	-10.47	7.1	44.02	0.07	83.35	0.15	111.18	0.21
12-09-2025 09:05	7.99	29.44	238.45	-10.04	8.2	32.67	0.10	51.7	0.14	19.12	0.08
12-09-2025 09:10	7.83	29.44	238.43	-10.02	8.3	17.68	0.14	26.29	0.23	60.82	0.31
12-09-2025 09:15	7.91	29.44	238.59	-10.48	7.05	16.24	0.10	48.49	0.14	58.41	0.18
12-09-2025 09:20	7.92	29.44	238.57	-10.44	7.13	1.86	0.13	18.92	0.14	109.49	0.19
12-09-2025 09:25	7.97	29.43	238.63	-10.65	6.62	45.77	0.09	49.01	0.11	137.43	0.48
12-09-2025 09:30	7.9	29.44	238.67	-10.39	7.31	22.25	0.17	24.31	0.21	64.95	0.13
12-09-2025 09:35	7.91	29.44	238.59	-10.34	7.47	36.31	0.07	41.14	0.16	80.25	0.17
12-09-2025 09:40	7.92	29.44	238.36	-9.93	8.52	11.75	0.14	22.36	0.19	69.26	0.18
12-09-2025 09:45	7.95	29.45	238.45	-10.2	7.86	312.28	0.13	279.71	0.19	172.28	0.61
12-09-2025 09:50	7.96	29.45	238.5	-10.41	7.31	275.98	0.07	291.77	0.14	235.59	0.15
12-09-2025 09:55	7.94	29.45	238.5	-10.4	7.34	327.04	0.24	310	0.24	253.52	0.09
12-09-2025 10:00	8.02	29.45	238.55	-10.53	6.97	358.1	0.41	295.6	0.22	223.42	0.15
12-09-2025 10:05	7.92	29.45	238.33	-9.81	8.92	356.8	0.24	20.81	0.22	76.32	0.07
12-09-2025 10:10	7.87	29.45	238.54	-10.43	7.18	57.31	0.11	65.15	0.16	115.99	0.28
12-09-2025 10:15	7.92	29.45	238.36	-9.98	8.46	256	0.12	95.34	0.16	147.56	0.38
12-09-2025 10:20	8.01	29.45	238.43	-10.16	7.97	352	0.12	58.47	0.15	96.78	0.19
12-09-2025 10:25	7.98	29.45	238.55	-10.43	7.24	345.69	0.16	26.23	0.17	81.11	0.11
12-09-2025 10:30	7.96	29.45	238.5	-10.34	7.5	20.19	0.23	15.71	0.19	129.07	0.01
12-09-2025 10:35	7.93	29.45	238.51	-10.47	7.09	14.83	0.21	36.79	0.23	155.49	0.11
12-09-2025 10:40	8.01	29.45	238.57	-10.52	7.06	39.68	0.13	59.2	0.09	163.66	0.23
12-09-2025 10:45	7.94	29.45	238.55	-10.5	7.08	14.16	0.19	24.71	0.15	151.48	0.35
12-09-2025 10:50	7.97	29.45	238.49	-10.17	8	27.42	0.11	48.12	0.19	140.36	0.22
12-09-2025 10:55	8.01	29.45	238.61	-10.59	6.85	355.8	0.09	27.89	0.18	160.47	0.33
12-09-2025 11:00	7.89	29.45	238.66	-10.49	7.13	355.18	0.16	20.96	0.16	186.03	0.15
12-09-2025 11:05	7.9	29.44	238.69	-10.78	6.35	51.13	0.04	47.5	0.14	150.67	0.2
12-09-2025 11:10	8.07	29.44	238.77	-10.85	6.2	32.84	0.14	59.26	0.17	151.43	0.26
12-09-2025 11:15	7.98	29.44	238.62	-10.41	7.4	348.34	0.19	6.53	0.26	91.05	0.05
12-09-2025 11:20	7.94	29.44	238.59	-10.41	7.35	35.79	0.07	45.25	0.16	125.94	0.14
12-09-2025 11:25	7.92	29.43	238.53	-10.43	7.33	46.16	0.11	38.48	0.11	151.66	0.13
12-09-2025 11:30	7.98	29.43	238.64	-10.57	7.01	85.79	0.03	117.97	0.09	167.9	0.15
12-09-2025 11:35	7.97	29.43	238.68	-10.69	6.64	2.48	0.11	16.41	0.2	107.47	0.09
12-09-2025 11:40	7.87	29.43	238.81	-10.95	5.9	13.1	0.10	33.57	0.17	133.58	0.13
12-09-2025 11:45	7.9	29.43	238.73	-10.98	5.84	66.28	0.07	29.02	0.16	151.76	0.36
12-09-2025 11:50	8.02	29.43	238.87	-11.4	4.75	54.43	0.13	38.87	0.16	145.62	0.16
12-09-2025 11:55	7.86	29.43	238.59	-10.45	7.29	351.18	0.20	6.31	0.23	153.67	0.2
12-09-2025 12:00	7.92	29.43	238.7	-10.52	7.16	40.68	0.08	65.22	0.1	166.36	0.34
12-09-2025 12:05	7.95	29.43	238.7	-10.56	7	27.38	0.10	29.4	0.19	183.29	0.17
12-09-2025 12:10	7.85	29.43	238.67	-10.33	7.64	6.6	0.13	26.17	0.12	14.65	0.14
12-09-2025 12:15	7.9	29.43	238.68	-10.45	7.34	5.14	0.09	39.46	0.15	146.46	0.05
12-09-2025 12:20	7.87	29.39	238.75	-10.56	7.01	31.36	0.17	40.27	0.18	52.62	0.1

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
12-09-2025 12:25	7.86	29.35	238.95	-10.98	5.83	49.32	0.16	68.03	0.17	86.82	0.23
12-09-2025 12:30	7.95	29.33	239.02	-11.09	5.6	15.23	0.07	67.69	0.17	26.48	0.21
12-09-2025 12:35	7.89	29.32	239.02	-11	5.86	350.66	0.21	0.31	0.23	2.68	0.32
12-09-2025 12:40	7.81	29.32	238.79	-10.65	6.82	353.74	0.18	10.21	0.21	359.45	0.56
12-09-2025 12:45	7.8	29.32	238.92	-10.81	6.36	325.91	0.13	298.36	0.17	321.62	0.44
12-09-2025 12:50	7.83	29.31	238.97	-10.84	6.33	276.46	0.07	284.27	0.12	326.43	0.52
12-09-2025 12:55	7.75	29.31	238.8	-10.45	7.32	331.01	0.11	313.64	0.09	336.5	0.42
12-09-2025 13:00	7.74	29.31	237.83	-9.36	10.56	15.91	0.11	43.72	0.04	336.04	0.45
12-09-2025 13:05	7.67	29.31	238.29	-9.05	11.26	351.14	0.09	42.37	0.09	20.61	0.47
12-09-2025 13:10	7.73	29.31	238.54	-9.58	9.77	113.7	0.05	117.49	0.08	28.63	0.37
12-09-2025 13:15	7.74	29.3	238.64	-9.92	8.79	237.21	0.04	251.03	0.02	31.77	0.27
12-09-2025 13:20	7.57	29.31	238.57	-9.92	8.72	331.18	0.09	6.91	0.07	4.26	0.48
12-09-2025 13:25	7.56	29.3	238.39	-9.54	9.84	190.37	0.07	168.61	0.11	355.7	0.26
12-09-2025 13:30	7.71	29.31	238.77	-10.69	6.79	179.17	0.13	188.97	0.13	3.6	0.19
12-09-2025 13:35	7.55	29.3	238.71	-10.16	8.18	292.75	0.09	22.31	0.04	350.71	0.5
12-09-2025 13:40	7.57	29.29	238.77	-10.35	7.64	183.67	0.13	162.18	0.12	16.17	0.19
12-09-2025 13:45	7.67	29.28	238.63	-9.85	9.02	204.58	0.12	144.41	0.06	20	0.25
12-09-2025 13:50	7.6	29.28	238.76	-10.32	7.71	265.94	0.05	7.64	0.02	1.06	0.53
12-09-2025 13:55	7.68	29.27	238.81	-10.31	7.78	278.18	0.03	228.06	0.06	349.71	0.27
12-09-2025 14:00	7.7	29.27	238.9	-10.63	6.94	296.31	0.05	310.52	0.08	3.7	0.33
12-09-2025 14:05	7.62	29.27	238.8	-10.24	7.94	320.8	0.21	333.07	0.13	0.73	0.47
12-09-2025 14:10	7.59	29.27	238.84	-10.26	7.88	304.73	0.10	331.13	0.05	345.3	0.43
12-09-2025 14:15	7.55	29.27	238.45	-9.29	10.62	267.75	0.05	308.36	0.05	9.39	0.45
12-09-2025 14:20	7.57	29.27	238.67	-9.77	9.24	251.91	0.12	222.39	0.09	24.59	0.34
12-09-2025 14:25	7.58	29.27	238.73	-9.88	8.96	209.03	0.13	252.98	0.06	36.35	0.28
12-09-2025 14:30	7.6	29.27	238.82	-9.9	8.84	285.99	0.11	252.37	0.05	15.11	0.3
12-09-2025 14:35	7.5	29.27	238.75	-9.81	9.11	305.75	0.11	292.01	0.09	354.77	0.3
12-09-2025 14:40	7.48	29.27	238.76	-10	8.57	263.87	0.10	284.69	0.1	8.27	0.29
12-09-2025 14:45	7.43	29.27	238.6	-9.62	9.63	294.43	0.04	234.28	0.04	28.69	0.2
12-09-2025 14:50	7.43	29.27	238.68	-9.8	9.19	209.8	0.07	176.55	0.05	13.12	0.31
12-09-2025 14:55	7.37	29.27	238.49	-9.76	9.22	316.95	0.04	262.81	0.04		
12-09-2025 15:00	7.48	29.27	238.86	-10.63	6.96	202.93	0.19	198.59	0.18	43.86	0.21
12-09-2025 15:05	7.4	29.27	238.76	-10.38	7.6	302.69	0.05	343.96	0.05	11.68	0.24
12-09-2025 15:10	7.32	29.27	238.53	-9.76	9.31	252.01	0.06	204.7	0.05		
12-09-2025 15:15	7.28	29.26	237.92	-8.41	13.09	178.09	0.09	183.92	0.11		
12-09-2025 15:20	7.42	29.27	238.46	-9.43	10.25	175.43	0.18	172.82	0.19		
12-09-2025 15:25	7.28	29.27	238.65	-9.79	9.16	267.42	0.11	231.96	0.04	35.56	0.28
12-09-2025 15:30	7.32	29.27	238.72	-10.02	8.65	184.31	0.11	161.02	0.16		
12-09-2025 15:35	7.36	29.28	238.63	-9.81	9.2	215.92	0.14	191.36	0.13		
12-09-2025 15:40	7.35	29.28	238.77	-10.07	8.45	233.28	0.08	161.77	0.16		
12-09-2025 15:45	7.31	29.28	238.78	-10.05	8.5	61.76	0.08	54.82	0.07	335.44	0.66
12-09-2025 15:50	7.21	29.29	238.65	-10.03	8.55	139.34	0.11	191.17	0.06		
12-09-2025 15:55	7.3	29.29	238.7	-10.92	6.16	154.74	0.16	164.51	0.17		
12-09-2025 16:00	7.3	29.29	238.52	-9.97	8.71	76.06	0.10	113.51	0.16		
12-09-2025 16:05	7.35	29.29	238.69	-10.44	7.46	261.56	0.07	208.49	0.08		
12-09-2025 16:10	7.22	29.3	238.4	-9.8	9.23	308.81	0.14	305.48	0.11		
12-09-2025 16:15	7.33	29.3	238.56	-10.2	8.15	179.84	0.08	169.17	0.1		
12-09-2025 16:20	7.18	29.29	238.47	-9.83	9.11	324.79	0.04	330.69	0.09		
12-09-2025 16:25	7.16	29.28	238.54	-9.88	8.96	187.03	0.09	182.34	0.15		

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
12-09-2025 16:30	7.29	29.29	238.73	-10.26	8	173.65	0.08	178.84	0.18		
12-09-2025 16:35	7.29	29.29	238.89	-10.67	6.89	335.56	0.11	295.34	0.08		
12-09-2025 16:40	7.14	29.29	237.94	-8.81	12.05	187.12	0.08	275.89	0.1		
12-09-2025 16:45	7.22	29.29	238.38	-9.53	10.02	191.16	0.17	172.86	0.46		
12-09-2025 16:50	7.28	29.29	238.33	-9.49	10.15	224.86	0.05	263.6	0.01		
12-09-2025 16:55	7.24	29.29	238.61	-10	8.69	272.74	0.07	282.92	0.11		
12-09-2025 17:00	7.3	29.29	238.78	-10.3	7.92	240.63	0.05	251.95	0.06		
12-09-2025 17:05	7.24	29.29	238.6	-9.96	8.83	313.51	0.10	320.07	0.08		
12-09-2025 17:10	7.2	29.29	239.11	-10.93	6.11	153.67	0.05	176.63	0.06		
12-09-2025 17:15	7.19	29.29	238.82	-9.92	8.9	184.27	0.05	207.08	0.09		
12-09-2025 17:20	7.19	29.29	238.76	-9.71	9.5	207.39	0.09	198.26	0.13		
12-09-2025 17:25	7.23	29.29	238.71	-9.65	9.7	182.29	0.09	177.85	0.12		
12-09-2025 17:30	7.29	29.29	239.05	-10.38	7.7	216.47	0.04	220.76	0.08		
12-09-2025 17:35	7.24	29.29	239.11	-10.49	7.37	323.59	0.12	279.33	0.05		
12-09-2025 17:40	7.22	29.29	238.74	-9.52	10.09	188.79	0.05	194.46	0.07		
12-09-2025 17:45	7.31	29.29	238.89	-10	8.74	240.45	0.10	207.98	0.1		
12-09-2025 17:50	7.3	29.28	238.9	-10.06	8.56	354.83	0.04	314.22	0.06	358.31	0.48
12-09-2025 17:55	7.35	29.28	239.11	-10.56	7.27	302.81	0.09	301.47	0.11		
12-09-2025 18:00	7.27	29.27	239.04	-10.13	8.37	317.25	0.09	310.52	0.1		
12-09-2025 18:05	7.31	29.27	239.08	-10.37	7.76	262.72	0.08	224.2	0.07		
12-09-2025 18:10	7.33	29.26	239.09	-10.43	7.56	12.61	0.00	322.04	0.07	7.44	0.6
12-09-2025 18:15	7.38	29.25	239.21	-10.72	6.83	353.16	0.02	312.44	0.02	4.46	0.52
12-09-2025 18:20	7.32	29.25	239.12	-10.51	7.33	318.93	0.09	319.07	0.1		
12-09-2025 18:25	7.34	29.25	239.12	-10.65	6.97	39.87	0.03	33.32	0.02		
12-09-2025 18:30	7.34	29.25	239.09	-10.43	7.59	219.4	0.03	247.49	0.03		
12-09-2025 18:35	7.33	29.25	239.23	-10.75	6.74	191.52	0.05	196.75	0.07	13.19	0.27
12-09-2025 18:40	7.31	29.25	239.07	-10.56	7.26	101.23	0.03	118.36	0.02		
12-09-2025 18:45	7.33	29.25	238.9	-10.25	8.12	157.89	0.05	174.56	0.09	332.9	0.39
12-09-2025 18:50	7.34	29.25	238.77	-10.02	8.78	132.96	0.04	102.23	0.02		
12-09-2025 18:55	7.41	29.24	238.88	-10.22	8.22	193.77	0.06	246.39	0.05	349.22	0.87
12-09-2025 19:00	7.44	29.24	239.02	-10.37	7.83	335.23	0.12	346.93	0.07	331.31	0.89
12-09-2025 19:05	7.48	29.24	238.9	-10.51	7.5	343.42	0.07	339.29	0.08	3.49	0.5
12-09-2025 19:10	7.29	29.24	238.79	-9.95	8.97	333.79	0.08	3.99	0.09	2.9	0.49
12-09-2025 19:15	7.46	29.24	238.89	-10.21	8.29	161.22	0.13	152.83	0.18		
12-09-2025 19:20	7.45	29.24	238.98	-10.36	7.87	316.96	0.04	324.11	0.03	16.28	0.49
12-09-2025 19:25	7.56	29.24	239.1	-11.36	5.21	329.2	0.07	281.5	0.02	17.63	0.33
12-09-2025 19:30	7.54	29.24	239.08	-10.48	7.56	332.64	0.14	6.54	0.19	10.33	0.52
12-09-2025 19:35	7.51	29.24	238.84	-10.02	8.79	333.11	0.08	7.71	0.09	15.49	0.7
12-09-2025 19:40	7.55	29.24	239.04	-10.64	7.12	68.98	0.04	65.2	0.08	25.13	0.4
12-09-2025 19:45	7.54	29.24	239	-10.3	8.02	332.22	0.08	23.89	0.08	13.53	0.46
12-09-2025 19:50	7.53	29.24	238.98	-10.28	8.09	337.76	0.05	41.9	0.06	22.5	0.52
12-09-2025 19:55	7.62	29.24	239.12	-10.62	7.19	293.08	0.02	29.12	0.02	8.39	0.56
12-09-2025 20:00	7.64	29.23	239.11	-10.56	7.35	336.65	0.10	356.89	0.14	1.15	0.53
12-09-2025 20:05	7.6	29.23	239.28	-11	6.19	345.08	0.13	0.73	0.15	13.18	0.53
12-09-2025 20:10	7.53	29.23	239.11	-10.57	7.3	338.98	0.11	19.93	0.06	14.71	0.45
12-09-2025 20:15	7.68	29.23	239.17	-10.92	6.38	132.24	0.04	102.09	0.04	10.55	0.39
12-09-2025 20:20	7.7	29.23	239.08	-10.67	7.02	326.98	0.17	342.86	0.17	0.47	0.49
12-09-2025 20:25	7.69	29.23	239.15	-10.81	6.67	342.59	0.14	7.21	0.12	27.26	0.3
12-09-2025 20:30	7.72	29.23	239.1	-10.56	7.33	340.71	0.09	359.1	0.1	87.42	0.17

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
12-09-2025 20:35	7.66	29.22	239.01	-10.62	7.17	333.51	0.10	358.63	0.12	47.73	0.25
12-09-2025 20:40	7.66	29.23	239.03	-10.53	7.39	291.27	0.14	2.08	0.1	26.05	0.18
12-09-2025 20:45	7.82	29.23	238.98	-10.52	7.47	321.38	0.05	330.97	0.07	57.18	0.12
12-09-2025 20:50	7.7	29.22	238.93	-10.17	8.39	328.29	0.18	346.47	0.19	22.87	0.29
12-09-2025 20:55	7.78	29.22	239.01	-10.35	7.9	16.39	0.03	99.34	0.08	96.82	0.22
12-09-2025 21:00	7.89	29.22	239.14	-10.71	6.95	338.05	0.08	8.58	0.12	40.23	0.18
12-09-2025 21:05	7.75	29.22	239.07	-10.55	7.38	327.74	0.20	349.73	0.19	19.22	0.3
12-09-2025 21:10	7.82	29.22	239.14	-10.9	6.42	320.95	0.09	339.35	0.06	41.45	0.18
12-09-2025 21:15	7.86	29.22	239.1	-10.68	7	342.62	0.11	356.01	0.12	58.01	0.34
12-09-2025 21:20	7.79	29.22	239.03	-10.32	7.93	342.59	0.16	354.19	0.15	47.07	0.34
12-09-2025 21:25	7.84	29.22	239.03	-10.41	7.7	345.83	0.06	6.3	0.07	44.32	0.26
12-09-2025 21:30	7.92	29.22	239.14	-10.66	7.04	333.88	0.12	340.63	0.11	89.46	0.17
12-09-2025 21:35	7.8	29.22	239.15	-10.7	6.88	332.34	0.14	18.19	0.17	127.38	0.2
12-09-2025 21:40	7.86	29.22	239.05	-10.58	7.24	288.31	0.06	23.68	0.03	135.38	0.21
12-09-2025 21:45	7.77	29.22	238.94	-10.45	7.56	10.28	0.12	303.17	0.02	181.69	0.37
12-09-2025 21:50	7.96	29.22	239.03	-10.59	7.22	65.41	0.04	289.39	0.08	180	0.45
12-09-2025 21:55	7.9	29.22	238.87	-10.34	7.87	345.58	0.18	334.82	0.17	185.26	0.33
12-09-2025 22:00	7.89	29.21	238.9	-10.29	8	28.01	0.03	292.01	0.07	165.96	0.7
12-09-2025 22:05	7.95	29.21	238.97	-10.55	7.34	227.97	0.01	116.54	0.07	168.08	0.36
12-09-2025 22:10	7.82	29.22	238.86	-10.35	7.85	323.18	0.15	342.31	0.12	161.75	0.26
12-09-2025 22:15	7.95	29.21	238.96	-10.48	7.52	174.33	0.05	153.56	0.05	167.19	0.41
12-09-2025 22:20	7.85	29.21	238.89	-10.2	8.26	339.92	0.11	342.43	0.15	178.97	0.15
12-09-2025 22:25	8.03	29.21	239.15	-10.75	6.76	67.64	0.01	135.39	0.09	162.35	0.26
12-09-2025 22:30	7.99	29.21	239.04	-10.38	7.77	330.97	0.14	337.19	0.2	262.74	0.09
12-09-2025 22:35	8	29.21	238.91	-10.2	8.32	318.06	0.10	352.72	0.11	202.38	0.04
12-09-2025 22:40	7.9	29.21	238.73	-9.74	9.57	325.59	0.11	359.02	0.18	21	0.06
12-09-2025 22:45	7.97	29.21	238.84	-10	8.81	125.87	0.03	25.26	0.05	24.33	0.12
12-09-2025 22:50	7.88	29.21	238.77	-9.73	9.52	312.19	0.04	2.92	0.09	26.76	0.28
12-09-2025 22:55	8.06	29.21	238.9	-10.03	8.71	144.9	0.05	145.41	0.05	30.23	0.29
12-09-2025 23:00	8.03	29.21	238.71	-9.61	9.89	321.22	0.12	353.85	0.12	16.77	0.51
12-09-2025 23:05	8.02	29.21	238.77	-9.54	10.1	343.79	0.12	9.73	0.1	18.65	0.43
12-09-2025 23:10	8.05	29.21	239.34	-11.07	5.83	326.79	0.04	4.23	0.05	22.4	0.5
12-09-2025 23:15	7.98	29.21	238.89	-10.03	8.74	305.15	0.03	352.95	0.07	24.9	0.45
12-09-2025 23:20	8	29.21	238.88	-9.8	9.33	15	0.06	107.64	0.06	17.31	0.35
12-09-2025 23:25	8.09	29.21	239.03	-10.22	8.21	229.46	0.04	59.03	0.01	33.82	0.29
12-09-2025 23:30	8.02	29.21	238.84	-9.79	9.36	354.16	0.12	349.55	0.11	359.46	0.54
12-09-2025 23:35	8.06	29.21	238.82	-9.68	9.69	166.17	0.04	131.19	0.12	19.88	0.45
12-09-2025 23:40	8.05	29.21	238.99	-10.08	8.56	289.34	0.06	346.53	0.07	18.15	0.44
12-09-2025 23:45	8	29.21	238.97	-10.07	8.57	316.94	0.03	330.18	0.08	16.78	0.49
12-09-2025 23:50	8.06	29.21	239.04	-10.27	8.05	69.81	0.03	321.42	0.05	2.06	0.34
12-09-2025 23:55	8.03	29.21	239.05	-10.33	7.89	327.28	0.13	347.82	0.12	18.36	0.5
13-09-2025 00:00	8.05	29.21	239.12	-10.42	7.63	299.09	0.08	343.81	0.09	11.82	0.48
13-09-2025 00:05	8.09	29.21	239.17	-10.58	7.2	341.48	0.12	7.2	0.07	358.66	0.52
13-09-2025 00:10	8.05	29.21	239.09	-10.46	7.53	345.45	0.10	347.73	0.12	1.26	0.44
13-09-2025 00:15	7.94	29.2	238.52	-9.2	11.04	320.71	0.09	337.72	0.07	17.76	0.34
13-09-2025 00:20	8.04	29.2	238.95	-10.1	8.55	248.63	0.05	341	0.04	16.26	0.35
13-09-2025 00:25	8.02	29.2	238.74	-9.64	9.76	340.06	0.11	355.53	0.07	12.61	0.48
13-09-2025 00:30	7.92	29.2	238.88	-9.9	9.03	347.86	0.07	4.75	0.07	23.19	0.36
13-09-2025 00:35	8.04	29.2	239.09	-10.37	7.79	194.94	0.09	148.16	0.08	45.4	0.28

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
13-09-2025 00:40	7.96	29.21	238.71	-9.46	10.22	341.27	0.11	341.73	0.15	13.59	0.35
13-09-2025 00:45	8.02	29.2	239.11	-10.59	7.16	171.88	0.05	185.73	0.05	324.17	0.26
13-09-2025 00:50	7.99	29.2	238.92	-10.36	7.76	152.34	0.04	29.49	0.02	344.86	0.51
13-09-2025 00:55	7.84	29.2	238.66	-9.66	9.65	340.27	0.11	8.76	0.06	343.41	0.59
13-09-2025 01:00	7.97	29.2	238.99	-10.26	8.02	152.3	0.16	167.24	0.18	3.75	0.08
13-09-2025 01:05	8.01	29.2	238.69	-10.28	8.02	102.17	0.02	50.07	0.06	19.61	0.22
13-09-2025 01:10	7.95	29.2	238.51	-9.52	10.08	333.33	0.12	339.53	0.16	357.89	0.15
13-09-2025 01:15	7.88	29.19	238.65	-9.64	9.75	47.94	0.03	101.43	0.08	146.13	0.07
13-09-2025 01:20	7.94	29.19	238.74	-9.79	9.31	69.56	0.01	106.82	0.06	161.63	0.23
13-09-2025 01:25	7.97	29.19	238.76	-9.8	9.29	76.9	0.01	123.25	0.03	155.92	0.29
13-09-2025 01:30	7.91	29.19	239.1	-10.66	6.96	32.22	0.03	31.23	0.07	154.24	0.27
13-09-2025 01:35	7.84	29.19	238.49	-9.19	10.95	119.74	0.01	357.81	0.05	128.98	0.22
13-09-2025 01:40	7.87	29.19	238.9	-10.08	8.42	129.41	0.09	147.71	0.08	169.36	0.27
13-09-2025 01:45	7.91	29.18	239	-10.46	7.42	7.29	0.03	68.03	0.03	115.78	0.22
13-09-2025 01:50	7.88	29.19	238.56	-9.57	9.91	20.53	0.09	27.73	0.1	115.39	0.15
13-09-2025 01:55	7.84	29.19	239.07	-10.67	6.85	8.84	0.13	1.22	0.15	153.89	0.12
13-09-2025 02:00	7.93	29.18	239.11	-10.59	7.11	58.73	0.12	82.63	0.06	131.79	0.18
13-09-2025 02:05	7.73	29.18	239.12	-10.64	6.92	6.02	0.16	9.14	0.15	69.48	0.1
13-09-2025 02:10	7.75	29.18	239.04	-10.58	7.06	75	0.05	66.3	0.05		
13-09-2025 02:15	7.68	29.18	238.87	-10.07	8.49	78.26	0.16	63.48	0.23	76.23	0.25
13-09-2025 02:20	7.75	29.18	238.92	-10.24	8.03	130.94	0.17	122.68	0.18	100.77	0.29
13-09-2025 02:25	7.75	29.17	238.68	-9.63	9.75	117.4	0.08	90.59	0.09	56.33	0.21
13-09-2025 02:30	7.71	29.18	238.99	-10.26	8	324.8	0.03	345.56	0.09	66.85	0.11
13-09-2025 02:35	7.77	29.18	238.83	-10.04	8.61	336.11	0.08	99.95	0.06	93.47	0.22
13-09-2025 02:40	7.78	29.17	239.02	-10.45	7.47	355.49	0.10	30.74	0.12	49.95	0.21
13-09-2025 02:45	7.75	29.17	239.04	-10.42	7.56	348.55	0.11	35.94	0.13	29.81	0.2
13-09-2025 02:50	7.74	29.17	239.01	-10.25	8.03	351.85	0.11	30.2	0.13	29.21	0.3
13-09-2025 02:55	7.6	29.17	238.95	-10.03	8.61	19.29	0.11	44.85	0.13	43.73	0.32
13-09-2025 03:00	7.62	29.17	239.01	-10.23	8.06	66.21	0.03	80.07	0.08	27.21	0.32
13-09-2025 03:05	7.68	29.17	239.14	-10.69	6.86	41.5	0.07	77.67	0.13	41.82	0.28
13-09-2025 03:10	7.67	29.17	239	-10.48	7.36	7.83	0.13	27.93	0.14	50.61	0.26
13-09-2025 03:15	7.61	29.17	238.89	-10.06	8.54	2.29	0.14	43.38	0.12	35.06	0.26
13-09-2025 03:20	7.54	29.18	238.78	-9.69	9.55	16.55	0.09	45.94	0.14	48.84	0.2
13-09-2025 03:25	7.64	29.17	239.17	-10.63	6.97	61.5	0.03	93.58	0.1	107.84	0.23
13-09-2025 03:30	7.6	29.17	238.88	-10.07	8.5	1.49	0.14	26.25	0.14	57.47	0.22
13-09-2025 03:35	7.5	29.18	238.99	-10.33	7.8	0.33	0.13	58.52	0.08	80.45	0.18
13-09-2025 03:40	7.56	29.18	239.07	-10.57	7.12	69.74	0.08	77.37	0.09	72.78	0.29
13-09-2025 03:45	7.6	29.18	239.11	-10.73	6.71	299.44	0.10	281.49	0.11	288.94	0.12
13-09-2025 03:50	7.54	29.17	239.02	-10.53	7.24	317.9	0.13	310.64	0.16	317.44	0.27
13-09-2025 03:55	7.6	29.17	239.03	-10.52	7.31	301.55	0.19	288.51	0.25	300.2	0.45
13-09-2025 04:00	7.57	29.17	238.42	-9	11.54	314.41	0.11	269.23	0.14	317.11	0.52
13-09-2025 04:05	7.58	29.17	238.69	-9.77	9.39	28.29	0.10	31.16	0.19	48.6	0.42
13-09-2025 04:10	7.59	29.17	238.95	-10.76	6.69	7.87	0.21	11.3	0.24	29.46	0.5
13-09-2025 04:15	7.54	29.17	238.85	-9.93	8.89	5.8	0.20	31.1	0.16	69.27	0.26
13-09-2025 04:20	7.52	29.17	238.96	-10.13	8.38	10.4	0.20	22.55	0.21	145.44	0.17
13-09-2025 04:25	7.48	29.18	239.08	-10.61	7.05	19.58	0.13	29.78	0.17		
13-09-2025 04:30	7.43	29.18	238.82	-9.99	8.69	21.06	0.20	32.82	0.14	158.45	0.4
13-09-2025 04:35	7.4	29.18	238.89	-10	8.66	51.07	0.07	62.84	0.09	166.51	0.26
13-09-2025 04:40	7.36	29.18	239.05	-10.56	7.12	91.55	0.10	88.34	0.17	154.47	0.43

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
13-09-2025 04:45	7.53	29.18	239.09	-10.59	7.1	92.51	0.06	84.33	0.11	163.56	0.54
13-09-2025 04:50	7.41	29.18	238.77	-9.83	9.13	9.47	0.21	11.4	0.23	145.76	0.2
13-09-2025 04:55	7.46	29.18	238.82	-9.92	8.91	65.79	0.12	67.81	0.13	146.37	0.31
13-09-2025 05:00	7.46	29.18	239.2	-10.76	6.63	33.1	0.12	50.77	0.25	125	0.14
13-09-2025 05:05	7.47	29.19	239.27	-11.01	6.01	17.9	0.17	23.77	0.25	109.23	0.1
13-09-2025 05:10	7.46	29.19	239.27	-10.91	6.26	10.56	0.19	30.39	0.21	168.36	0.3
13-09-2025 05:15	7.41	29.19	239.07	-10.42	7.57	25.09	0.12	7.02	0.16	188.32	0.23
13-09-2025 05:20	7.42	29.19	239.24	-10.93	6.16	26.84	0.15	38.29	0.17	168.67	0.19
13-09-2025 05:25	7.43	29.19	239.1	-10.48	7.39	12.68	0.18	52.94	0.14	171.71	0.44
13-09-2025 05:30	7.47	29.18	239.17	-10.62	7	29.25	0.07	33.24	0.11	157.42	0.33
13-09-2025 05:35	7.5	29.19	239.13	-10.49	7.38	7.2	0.15	45.09	0.17	166.78	0.46
13-09-2025 05:40	7.32	29.2	239.17	-10.71	6.81	13.05	0.18	31.75	0.22	149.04	0.26
13-09-2025 05:45	7.37	29.2	239.38	-11.34	5.11	65.18	0.12	78.48	0.22		
13-09-2025 05:50	7.46	29.2	239.34	-11.22	5.42	77.17	0.09	58.04	0.17	148.78	0.11
13-09-2025 05:55	7.33	29.2	239.1	-10.6	7.08	5.58	0.21	35.18	0.23	45.65	0.07
13-09-2025 06:00	7.49	29.21	239.28	-10.95	6.16	84.6	0.10	86.16	0.19	67.52	0.06
13-09-2025 06:05	7.4	29.21	239.2	-10.7	6.83	4.22	0.21	15.27	0.29	352.39	0.44
13-09-2025 06:10	7.41	29.21	239.26	-11.07	5.83	37.52	0.12	47.21	0.21	16.81	0.26
13-09-2025 06:15	7.4	29.21	239.3	-11.17	5.54	4.97	0.11	42.38	0.21	15.46	0.36
13-09-2025 06:20	7.4	29.21	239.27	-11.06	5.84	7.93	0.12	45.16	0.13	52.73	0.12
13-09-2025 06:25	7.43	29.23	239.27	-11.05	5.89	46.56	0.12	57.67	0.2	34.37	0.24
13-09-2025 06:30	7.36	29.23	239.06	-10.44	7.54	18.95	0.13	45.5	0.22	16.2	0.33
13-09-2025 06:35	7.41	29.24	238.87	-9.85	9.1	76.73	0.08	62.94	0.14		
13-09-2025 06:40	7.48	29.24	238.99	-10.42	7.6	45.8	0.12	48.54	0.14	14.77	0.46
13-09-2025 06:45	7.48	29.24	238.78	-9.85	9.11	325.43	0.21	313.07	0.26	343.87	0.6
13-09-2025 06:50	7.49	29.25	238.72	-9.86	9.09	316.58	0.19	308.29	0.27	332.84	0.55
13-09-2025 06:55	7.48	29.25	238.79	-10.02	8.65	316.49	0.21	310.76	0.3	322.56	0.56
13-09-2025 07:00	7.45	29.25	239.09	-10.76	6.68	316.32	0.20	303.05	0.22	321.3	0.42
13-09-2025 07:05	7.5	29.25	239.08	-10.74	6.73	40.81	0.15	46.47	0.19	41.69	0.36
13-09-2025 07:10	7.46	29.25	238.54	-9.52	10.12	10.94	0.13	25.2	0.17	28.42	0.26
13-09-2025 07:15	7.48	29.26	238.69	-9.8	9.33	25.46	0.14	51.25	0.13	38.35	0.32
13-09-2025 07:20	7.52	29.27	238.96	-10.56	7.22	45.15	0.13	62.29	0.24	29.42	0.45
13-09-2025 07:25	7.56	29.27	239.01	-10.64	6.99	43.11	0.20	32.35	0.26	24.17	0.45
13-09-2025 07:30	7.54	29.27	239.13	-11.03	5.96	28.97	0.15	26.98	0.23	17.43	0.54
13-09-2025 07:35	7.55	29.26	239.16	-10.75	6.68	12.94	0.16	21.87	0.23	26.04	0.27
13-09-2025 07:40	7.55	29.27	239.15	-10.84	6.45	30.2	0.12	29.95	0.19	356.47	0.23
13-09-2025 07:45	7.56	29.27	239.07	-10.78	6.61	25	0.16	27.62	0.2	2.43	0.32
13-09-2025 07:50	7.53	29.26	239.13	-10.88	6.35	47.1	0.17	36.75	0.29	17.87	0.53
13-09-2025 07:55	7.63	29.27	239.05	-11.26	5.37	61.57	0.18	47.6	0.21	58.48	0.29
13-09-2025 08:00	7.58	29.28	239.17	-11.03	5.89	7.95	0.19	11.77	0.2	359.71	0.3
13-09-2025 08:05	7.56	29.3	238.89	-10.38	7.69	14.45	0.17	20.52	0.17	0.53	0.28
13-09-2025 08:10	7.56	29.29	238.87	-10.3	7.93	14.23	0.09	37.34	0.1	37.04	0.23
13-09-2025 08:15	7.57	29.3	238.81	-10.13	8.37	354.23	0.04	37.45	0.11	13.86	0.33
13-09-2025 08:20	7.67	29.3	239.03	-10.68	6.92	52.26	0.10	43.44	0.16	7.21	0.42
13-09-2025 08:25	7.67	29.3	239.1	-10.89	6.34	21.55	0.20	20.46	0.2	13.06	0.5
13-09-2025 08:30	7.64	29.3	238.99	-10.59	7.14	39.54	0.13	27.06	0.15	12.85	0.32
13-09-2025 08:35	7.59	29.3	239.02	-10.59	7.15	30.68	0.15	31.16	0.15	11.64	0.44
13-09-2025 08:40	7.65	29.29	238.82	-10.13	8.38	74.57	0.09	71.11	0.15	10.38	0.19
13-09-2025 08:45	7.65	29.28	238.85	-10.22	8.14	21.31	0.12	41.97	0.17	16.03	0.18

CURRENT MEASUREMENT DATA

Date	Depth (m)	Temp. (deg)	Heading (deg)	Pitch (deg)	Roll (deg)	Bottom Layer		Middle Layer		Surface Layer	
						Dir (deg)	Speed (m)	Dir (deg)	Speed (m)	Dir (deg)	Speed (m)
13-09-2025 08:50	7.67	29.26	238.95	-10.43	7.58	7.46	0.12	28.93	0.19	27.81	0.27
13-09-2025 08:55	7.67	29.26	238.82	-10.15	8.32	43.73	0.18	40.4	0.25	32.02	0.41
13-09-2025 09:00	7.74	29.27	238.9	-10.33	7.85	65.05	0.15	73.07	0.16	52.99	0.35
13-09-2025 09:05	7.65	29.24	238.84	-10.26	8.04	22.73	0.14	44.35	0.22	39.97	0.3
13-09-2025 09:10	7.64	29.23	238.96	-10.55	7.25	338.65	0.06	34.48	0.08	57.5	0.13
13-09-2025 09:15	7.79	29.24	239.2	-11.32	5.21	68.17	0.07	79.21	0.11	98.55	0.11
13-09-2025 09:20	7.7	29.23	238.97	-10.68	6.89	356.3	0.19	4.38	0.27	8.75	0.58
13-09-2025 09:25	7.75	29.21	238.92	-10.47	7.46	30.9	0.17	35.31	0.17	19.33	0.37
13-09-2025 09:30	7.64	29.2	239.13	-10.96	6.14	9.94	0.18	36.24	0.2	26.84	0.28
13-09-2025 09:35	7.75	29.19	239.17	-11.25	5.41	43.14	0.09	82.35	0.13	36.71	0.23
13-09-2025 09:40	7.73	29.18	239.11	-10.92	6.26	14.4	0.13	32.41	0.13	9.59	0.45
13-09-2025 09:45	7.85	29.18	239.22	-11.17	5.59	288.27	0.19	275.81	0.25	299.47	0.39
13-09-2025 09:50	7.71	29.18	239.1	-10.94	6.19	322.15	0.26	309.2	0.2	320.3	0.29
13-09-2025 09:55	7.78	29.18	239.16	-11.35	5.07	276.17	0.21	278.39	0.24	303.96	0.44
13-09-2025 10:00	7.82	29.18	239.22	-11.25	5.32	305.69	0.18	298.72	0.22	302.47	0.24
13-09-2025 10:05	7.89	29.17	239.04	-10.77	6.67	351.62	0.17	26.98	0.18	45.31	0.3
13-09-2025 10:10	7.8	29.17	239	-10.59	7.16	12.41	0.16	30.18	0.16	53.79	0.31
13-09-2025 10:15	7.88	29.17	239.36	-12.01	3.25	9.31	0.14	32.55	0.09	116.92	0.11
13-09-2025 10:20	7.87	29.17	239.18	-11.47	4.77	348.34	0.19	13.1	0.22	15.08	0.26
13-09-2025 10:25	7.78	29.17	239	-10.74	6.7	18.67	0.20	18.39	0.21	20.72	0.26
13-09-2025 10:30	7.86	29.17	239.16	-10.91	6.29	45.97	0.11	62.65	0.12	104.48	0.26
13-09-2025 10:35	7.83	29.17	238.93	-10.52	7.34	24.02	0.13	23.41	0.14	60.12	0.23
13-09-2025 10:40	7.85	29.17	239.03	-10.74	6.73	32.35	0.08	28.28	0.15	85.06	0.08
13-09-2025 10:45	7.91	29.17	238.93	-10.51	7.42	350.46	0.17	11.24	0.21	10.55	0.23
13-09-2025 10:50	7.86	29.16	239.06	-10.77	6.67	357.95	0.16	19.4	0.2	20.14	0.25
13-09-2025 10:55	7.81	29.16	238.95	-10.44	7.55	355.03	0.18	16.75	0.15	62.89	0.2
13-09-2025 11:00	7.92	29.16	239.15	-10.73	6.77	358.1	0.11	29.23	0.09	105.5	0.18
13-09-2025 11:05	7.88	29.16	238.98	-10.39	7.67	0.18	0.20	8.17	0.19	36.3	0.17
13-09-2025 11:10	7.8	29.16	238.85	-10.4	7.65	10.81	0.14	29.77	0.17	64.41	0.16
13-09-2025 11:15	7.94	29.16	239.28	-11.25	5.35	74.13	0.11	83.2	0.14	121.73	0.2
13-09-2025 11:20	7.85	29.17	239.18	-11.07	5.84	4.61	0.24	18.09	0.26	41.16	0.22
13-09-2025 11:25	7.95	29.16	239.15	-10.98	6.11	351.35	0.14	15.55	0.12	14.59	0.06
13-09-2025 11:30	7.88	29.16	239.18	-11.01	6.04	16.04	0.20	22.97	0.19	27.34	0.18
13-09-2025 11:35	7.83	29.16	239.02	-10.69	6.89	8.09	0.21	7.48	0.13	113.5	0.13
13-09-2025 11:40	7.86	29.16	238.75	-11.06	5.73	66.64	0.10	80.79	0.1	145.53	0.25
13-09-2025 11:45	7.88	29.16	250.64	-10.1	2.73	13.28	0.15	22.57	0.1	181.04	0.2

WAVE MEASUREMENT DATA

Time	Dir (deg)	Tp (s)	Hs (m)	Tp Mean (s)
30-08-2025 12:40	166.03	10.01	0.94	4.96
30-08-2025 13:40	164.06	10.39	0.90	5.13
30-08-2025 14:40	161.80	10.46	0.88	5.06
30-08-2025 15:40	159.65	10.30	0.88	4.83
30-08-2025 15:40	159.65	10.30	0.88	4.83
30-08-2025 16:40	156.74	9.79	0.88	4.24
30-08-2025 17:40	156.30	9.50	0.91	4.02
30-08-2025 18:40	157.98	9.40	0.96	4.07
30-08-2025 18:40	157.98	9.40	0.96	4.07
30-08-2025 19:40	160.20	9.45	1.07	4.53
30-08-2025 20:40	165.25	9.59	1.09	4.82
30-08-2025 21:40	172.04	9.77	1.06	4.97
30-08-2025 21:40	172.04	9.77	1.06	4.97
30-08-2025 22:40	182.68	10.07	0.93	4.86
30-08-2025 23:40	189.05	10.24	0.85	4.91
31-08-2025 00:40	191.99	10.28	0.82	5.05
31-08-2025 00:40	191.99	10.28	0.82	5.05
31-08-2025 01:40	189.96	10.22	0.84	5.56
31-08-2025 02:40	188.99	10.13	0.85	5.63
31-08-2025 03:40	188.50	10.01	0.84	5.41
31-08-2025 03:40	188.50	10.01	0.84	5.41
31-08-2025 04:40	188.99	9.83	0.81	4.62
31-08-2025 05:40	187.47	9.75	0.79	4.29
31-08-2025 06:40	183.99	9.74	0.76	4.31
31-08-2025 06:40	183.99	9.74	0.76	4.31
31-08-2025 07:40	183.04	9.74	0.74	4.72
31-08-2025 08:40	174.97	9.84	0.71	5.10
31-08-2025 09:40	162.51	10.00	0.69	5.43
31-08-2025 09:40	162.51	10.00	0.69	5.43
31-08-2025 10:40	138.48	10.42	0.66	5.74
31-08-2025 11:40	127.34	10.50	0.65	5.91
31-08-2025 12:40	125.87	10.35	0.65	5.95
31-08-2025 12:40	125.87	10.35	0.65	5.95
31-08-2025 13:40	138.30	9.73	0.66	5.98
31-08-2025 14:40	145.03	9.50	0.67	5.78
31-08-2025 15:40	147.31	9.56	0.68	5.43
31-08-2025 15:40	147.31	9.56	0.68	5.43
31-08-2025 16:40	146.32	9.99	0.69	4.77
31-08-2025 17:40	143.47	10.31	0.70	4.39
31-08-2025 18:40	139.95	10.54	0.71	4.24
31-08-2025 18:40	139.95	10.54	0.71	4.24
31-08-2025 19:40	131.35	10.65	0.70	4.39
31-08-2025 20:40	131.27	10.72	0.71	4.48
31-08-2025 21:40	137.54	10.73	0.74	4.53
31-08-2025 21:40	137.54	10.73	0.74	4.53
31-08-2025 22:40	150.49	10.83	0.79	4.44
31-08-2025 23:40	162.44	10.69	0.83	4.49
01-09-2025 00:40	172.72	10.40	0.85	4.64
01-09-2025 00:40	172.72	10.40	0.85	4.64
01-09-2025 01:40	185.54	9.84	0.88	5.03
01-09-2025 02:40	189.49	9.51	0.88	5.19

WAVE MEASUREMENT DATA

Time	Dir (deg)	Tp (s)	Hs (m)	Tp Mean (s)
01-09-2025 03:40	186.83	9.37	0.84	5.19
01-09-2025 03:40	186.83	9.37	0.84	5.19
01-09-2025 04:40	173.68	9.37	0.75	4.92
01-09-2025 05:40	165.81	9.53	0.70	4.83
01-09-2025 06:40	161.80	9.79	0.68	4.87
01-09-2025 06:40	161.80	9.79	0.68	4.87
01-09-2025 07:40	164.81	10.23	0.72	5.12
01-09-2025 08:40	163.32	10.52	0.73	5.30
01-09-2025 09:40	158.66	10.71	0.72	5.44
01-09-2025 09:40	158.66	10.71	0.72	5.44
01-09-2025 10:40	147.33	10.81	0.68	5.33
01-09-2025 11:40	141.28	10.83	0.66	5.52
01-09-2025 12:40	138.94	10.79	0.65	5.90
01-09-2025 12:40	138.94	10.79	0.65	5.90
01-09-2025 13:40	145.65	10.61	0.67	6.73
01-09-2025 14:40	144.64	10.56	0.66	7.06
01-09-2025 15:40	138.48	10.60	0.64	6.99
01-09-2025 15:40	138.48	10.60	0.64	6.99
01-09-2025 16:40	121.50	10.84	0.59	6.56
01-09-2025 17:40	114.42	10.89	0.55	6.07
01-09-2025 18:40	114.85	10.81	0.53	5.56
01-09-2025 18:40	114.85	10.81	0.53	5.56
01-09-2025 19:40	125.93	10.47	0.53	4.84
01-09-2025 20:40	133.17	10.31	0.53	4.56
01-09-2025 21:40	137.50	10.29	0.52	4.63
01-09-2025 21:40	137.50	10.29	0.52	4.63
01-09-2025 22:40	136.56	10.47	0.48	5.02
01-09-2025 23:40	138.49	10.55	0.49	5.46
02-09-2025 00:40	142.26	10.53	0.52	5.92
02-09-2025 00:40	142.26	10.53	0.52	5.92
02-09-2025 01:40	150.37	10.44	0.61	6.51
02-09-2025 02:40	153.95	10.31	0.66	6.79
02-09-2025 03:40	154.09	10.18	0.67	6.83
02-09-2025 03:40	154.09	10.18	0.67	6.83
02-09-2025 04:40	149.59	9.98	0.64	6.70
02-09-2025 05:40	146.57	9.89	0.62	6.39
02-09-2025 06:40	144.74	9.86	0.61	5.98
02-09-2025 06:40	144.74	9.86	0.61	5.98
02-09-2025 07:40	143.91	9.91	0.60	5.32
02-09-2025 08:40	143.63	9.95	0.60	4.96
02-09-2025 09:40	143.65	9.98	0.59	4.82
02-09-2025 09:40	143.65	9.98	0.59	4.82
02-09-2025 10:40	145.62	10.04	0.58	4.92
02-09-2025 11:40	145.21	10.00	0.58	5.08
02-09-2025 12:40	143.31	9.90	0.58	5.27
02-09-2025 12:40	143.31	9.90	0.58	5.27
02-09-2025 13:40	136.61	9.74	0.59	5.49
02-09-2025 14:40	135.24	9.59	0.60	5.70
02-09-2025 15:40	137.58	9.47	0.60	5.87
02-09-2025 15:40	137.58	9.47	0.60	5.87
02-09-2025 16:40	146.81	9.26	0.61	6.01

WAVE MEASUREMENT DATA

Time	Dir (deg)	Tp (s)	Hs (m)	Tp Mean (s)
02-09-2025 17:40	150.69	9.27	0.60	6.09
02-09-2025 18:40	150.48	9.41	0.59	6.10
02-09-2025 18:40	150.48	9.41	0.59	6.10
02-09-2025 19:40	146.46	9.81	0.55	6.23
02-09-2025 20:40	142.04	10.01	0.55	6.05
02-09-2025 21:40	137.88	10.05	0.56	5.66
02-09-2025 21:40	137.88	10.05	0.56	5.66
02-09-2025 22:40	131.91	9.95	0.60	4.81
02-09-2025 23:40	130.88	9.80	0.63	4.41
03-09-2025 00:40	133.81	9.63	0.66	4.34
03-09-2025 00:40	133.81	9.63	0.66	4.34
03-09-2025 01:40	137.96	9.31	0.69	4.73
03-09-2025 02:40	146.24	9.20	0.70	4.94
03-09-2025 03:40	156.61	9.25	0.71	5.01
03-09-2025 03:40	156.61	9.25	0.71	5.01
03-09-2025 04:40	175.17	9.61	0.71	4.92
03-09-2025 05:40	181.97	9.72	0.71	4.81
03-09-2025 06:40	179.85	9.63	0.69	4.69
03-09-2025 06:40	179.85	9.63	0.69	4.69
03-09-2025 07:40	164.08	9.23	0.67	4.62
03-09-2025 08:40	154.19	9.03	0.64	4.49
03-09-2025 09:40	148.46	8.98	0.61	4.35
03-09-2025 09:40	148.46	8.98	0.61	4.35
03-09-2025 10:40	152.60	9.10	0.57	4.00
03-09-2025 11:40	148.61	9.20	0.55	4.00
03-09-2025 12:40	139.23	9.27	0.53	4.26
03-09-2025 12:40	139.23	9.27	0.53	4.26
03-09-2025 13:40	118.53	9.35	0.52	4.84
03-09-2025 14:40	108.30	9.34	0.52	5.27
03-09-2025 15:40	106.08	9.27	0.54	5.54
03-09-2025 15:40	106.08	9.27	0.54	5.54
03-09-2025 16:40	115.92	9.09	0.57	5.81
03-09-2025 17:40	121.02	8.97	0.60	5.76
03-09-2025 18:40	122.82	8.88	0.63	5.49
03-09-2025 18:40	122.82	8.88	0.63	5.49
03-09-2025 19:40	119.71	8.88	0.65	4.85
03-09-2025 20:40	119.87	8.81	0.68	4.45
03-09-2025 21:40	122.89	8.68	0.73	4.25
03-09-2025 21:40	122.89	8.68	0.73	4.25
03-09-2025 22:40	126.14	8.41	0.80	4.26
03-09-2025 23:40	134.18	8.30	0.84	4.30
04-09-2025 00:40	145.29	8.28	0.85	4.35
04-09-2025 00:40	145.29	8.28	0.85	4.35
04-09-2025 01:40	159.57	8.49	0.84	4.50
04-09-2025 02:40	171.19	8.52	0.82	4.52
04-09-2025 03:40	179.52	8.42	0.78	4.45
04-09-2025 03:40	179.52	8.42	0.78	4.45
04-09-2025 04:40	192.94	8.09	0.72	4.15
04-09-2025 05:40	191.01	7.94	0.69	4.09
04-09-2025 06:40	178.52	7.92	0.67	4.21
04-09-2025 06:40	178.52	7.92	0.67	4.21

WAVE MEASUREMENT DATA

Time	Dir (deg)	Tp (s)	Hs (m)	Tp Mean (s)
04-09-2025 07:40	146.80	8.04	0.69	4.65
04-09-2025 08:40	130.19	8.16	0.69	4.86
04-09-2025 09:40	125.41	8.26	0.67	4.92
04-09-2025 09:40	125.41	8.26	0.67	4.92
04-09-2025 10:40	134.84	8.35	0.62	4.65
04-09-2025 11:40	142.71	8.39	0.60	4.61
04-09-2025 12:40	149.14	8.38	0.60	4.71
04-09-2025 12:40	149.14	8.38	0.60	4.71
04-09-2025 13:40	154.22	8.12	0.62	5.14
04-09-2025 14:40	158.10	8.04	0.64	5.26
04-09-2025 15:40	160.88	8.00	0.66	5.15
04-09-2025 15:40	160.88	8.00	0.66	5.15
04-09-2025 16:40	162.45	8.98	0.66	4.74
04-09-2025 17:40	163.39	8.46	0.68	4.42
04-09-2025 18:40	163.68	6.97	0.73	4.17
04-09-2025 18:40	163.68	6.97	0.73	4.17
04-09-2025 19:40	165.66	3.21	0.82	4.00
04-09-2025 20:40	164.09	1.74	0.86	3.88
04-09-2025 21:40	160.37	1.99	0.87	3.81
04-09-2025 21:40	160.37	1.99	0.87	3.81
04-09-2025 22:40	149.62	4.58	0.83	3.74
04-09-2025 23:40	147.02	6.36	0.79	3.78
05-09-2025 00:40	150.21	7.46	0.77	3.90
05-09-2025 00:40	150.21	7.46	0.77	3.90
05-09-2025 01:40	160.55	7.82	0.76	4.18
05-09-2025 02:40	167.46	8.04	0.74	4.32
05-09-2025 03:40	170.81	8.13	0.73	4.36
05-09-2025 03:40	170.81	8.13	0.73	4.36
05-09-2025 04:40	180.97	8.20	0.72	4.22
05-09-2025 05:40	174.71	8.06	0.71	4.20
05-09-2025 06:40	158.19	7.77	0.70	4.27
05-09-2025 06:40	158.19	7.77	0.70	4.27
05-09-2025 07:40	113.91	7.18	0.70	4.43
05-09-2025 08:40	100.15	6.85	0.69	4.57
05-09-2025 09:40	108.88	6.72	0.68	4.69
05-09-2025 09:40	108.88	6.72	0.68	4.69
05-09-2025 10:40	149.55	6.88	0.65	4.85
05-09-2025 11:40	175.65	6.92	0.66	4.87
05-09-2025 12:40	189.64	6.88	0.68	4.78
05-09-2025 12:40	189.64	6.88	0.68	4.78
05-09-2025 13:40	192.70	6.78	0.75	4.56
05-09-2025 14:40	190.08	6.64	0.78	4.37
05-09-2025 15:40	183.46	6.49	0.78	4.22
05-09-2025 15:40	183.46	6.49	0.78	4.22
05-09-2025 16:40	171.06	6.26	0.74	4.13
05-09-2025 17:40	162.25	6.17	0.73	4.02
05-09-2025 18:40	156.63	6.21	0.73	3.92
05-09-2025 18:40	156.63	6.21	0.73	3.92
05-09-2025 19:40	153.12	6.32	0.76	3.74
05-09-2025 20:40	152.84	6.52	0.78	3.72
05-09-2025 21:40	154.98	6.77	0.79	3.82

WAVE MEASUREMENT DATA

Time	Dir (deg)	Tp (s)	Hs (m)	Tp Mean (s)
05-09-2025 21:40	154.98	6.77	0.79	3.82
05-09-2025 22:40	159.38	7.18	0.80	4.08
05-09-2025 23:40	163.80	7.37	0.79	4.27
06-09-2025 00:40	167.81	7.40	0.77	4.42
06-09-2025 00:40	167.81	7.40	0.77	4.42
06-09-2025 01:40	175.79	7.28	0.73	4.54
06-09-2025 02:40	176.77	7.15	0.70	4.59
06-09-2025 03:40	173.20	7.02	0.67	4.58
06-09-2025 03:40	173.20	7.02	0.67	4.58
06-09-2025 04:40	156.82	6.77	0.65	4.46
06-09-2025 05:40	153.65	6.78	0.63	4.41
06-09-2025 06:40	159.72	6.98	0.62	4.40
06-09-2025 06:40	159.72	6.98	0.62	4.40
06-09-2025 07:40	182.79	7.44	0.62	4.45
06-09-2025 08:40	193.05	7.79	0.61	4.46
06-09-2025 09:40	193.56	8.06	0.59	4.42
06-09-2025 09:40	193.56	8.06	0.59	4.42
06-09-2025 10:40	180.15	8.21	0.58	4.38
06-09-2025 11:40	171.82	8.35	0.56	4.25
06-09-2025 12:40	167.28	8.48	0.54	4.05
06-09-2025 12:40	167.28	8.48	0.54	4.05
06-09-2025 13:40	170.34	8.63	0.50	3.82
06-09-2025 14:40	168.56	8.69	0.50	3.56
06-09-2025 15:40	163.71	8.67	0.53	3.29
06-09-2025 15:40	163.71	8.67	0.53	3.29
06-09-2025 16:40	150.80	8.56	0.60	2.92
06-09-2025 17:40	146.47	8.46	0.65	2.77
06-09-2025 18:40	148.44	8.39	0.69	2.79
06-09-2025 18:40	148.44	8.39	0.69	2.79
06-09-2025 19:40	160.85	8.28	0.72	3.01
06-09-2025 20:40	167.24	8.25	0.72	3.21
06-09-2025 21:40	169.19	8.26	0.70	3.39
06-09-2025 21:40	169.19	8.26	0.70	3.39
06-09-2025 22:40	162.80	8.50	0.65	3.51
06-09-2025 23:40	161.66	8.46	0.61	3.65
07-09-2025 00:40	164.06	8.24	0.58	3.79
07-09-2025 00:40	164.06	8.24	0.58	3.79
07-09-2025 01:40	176.92	7.60	0.55	4.00
07-09-2025 02:40	179.58	7.38	0.53	4.07
07-09-2025 03:40	175.49	7.48	0.52	4.02
07-09-2025 03:40	175.49	7.48	0.52	4.02
07-09-2025 04:40	154.81	7.98	0.52	3.88
07-09-2025 05:40	150.33	8.39	0.52	3.72
07-09-2025 06:40	157.53	8.72	0.52	3.58
07-09-2025 06:40	157.53	8.72	0.52	3.58
07-09-2025 07:40	181.83	9.00	0.53	3.31
07-09-2025 08:40	196.82	9.16	0.53	3.29
07-09-2025 09:40	203.96	9.22	0.52	3.46
07-09-2025 09:40	203.96	9.22	0.52	3.46
07-09-2025 10:40	204.51	9.23	0.51	3.89
07-09-2025 11:40	200.30	9.17	0.50	4.18

WAVE MEASUREMENT DATA

Time	Dir (deg)	Tp (s)	Hs (m)	Tp Mean (s)
07-09-2025 12:40	192.69	9.07	0.49	4.34
07-09-2025 12:40	192.69	9.07	0.49	4.34
07-09-2025 13:40	179.21	8.72	0.48	4.41
07-09-2025 14:40	169.56	8.69	0.47	4.37
07-09-2025 15:40	162.81	8.88	0.47	4.25
07-09-2025 15:40	162.81	8.88	0.47	4.25
07-09-2025 16:40	163.94	9.67	0.46	4.10
07-09-2025 17:40	158.98	9.85	0.47	3.90
07-09-2025 18:40	150.56	9.62	0.48	3.70
07-09-2025 18:40	150.56	9.62	0.48	3.70
07-09-2025 19:40	130.43	8.43	0.51	3.32
07-09-2025 20:40	125.09	8.09	0.51	3.26
07-09-2025 21:40	130.64	8.34	0.51	3.43
07-09-2025 21:40	130.64	8.34	0.51	3.43
07-09-2025 22:40	149.83	9.74	0.49	3.95
07-09-2025 23:40	164.13	10.30	0.47	4.28
08-09-2025 00:40	173.62	10.24	0.46	4.44
08-09-2025 00:40	173.62	10.24	0.46	4.44
08-09-2025 01:40	184.01	9.11	0.44	4.47
08-09-2025 02:40	183.05	8.67	0.44	4.42
08-09-2025 03:40	174.18	8.75	0.44	4.32
08-09-2025 03:40	174.18	8.75	0.44	4.32
08-09-2025 04:40	152.40	9.57	0.44	4.08
08-09-2025 05:40	139.81	10.03	0.46	4.01
08-09-2025 06:40	134.79	10.22	0.48	4.07
08-09-2025 06:40	134.79	10.22	0.48	4.07
08-09-2025 07:40	135.65	10.15	0.52	4.23
08-09-2025 08:40	140.91	9.95	0.54	4.42
08-09-2025 09:40	148.89	9.68	0.53	4.61
08-09-2025 09:40	148.89	9.68	0.53	4.61
08-09-2025 10:40	159.94	9.34	0.50	4.91
08-09-2025 11:40	168.02	9.03	0.48	4.97
08-09-2025 12:40	172.67	8.78	0.46	4.85
08-09-2025 12:40	172.67	8.78	0.46	4.85
08-09-2025 13:40	183.42	8.41	0.43	4.53
08-09-2025 14:40	177.83	8.38	0.43	4.23
08-09-2025 15:40	161.41	8.58	0.44	3.97
08-09-2025 15:40	161.41	8.58	0.44	3.97
08-09-2025 16:40	123.44	9.19	0.47	3.66
08-09-2025 17:40	105.27	9.52	0.50	3.52
08-09-2025 18:40	102.66	9.62	0.52	3.49
08-09-2025 18:40	102.66	9.62	0.52	3.49
08-09-2025 19:40	116.41	9.48	0.55	3.67
08-09-2025 20:40	131.26	9.34	0.55	3.73
08-09-2025 21:40	145.97	9.19	0.54	3.71
08-09-2025 21:40	145.97	9.19	0.54	3.71
08-09-2025 22:40	164.71	9.02	0.51	3.57
08-09-2025 23:40	174.45	8.94	0.48	3.51
09-09-2025 00:40	177.20	8.95	0.47	3.53
09-09-2025 00:40	177.20	8.95	0.47	3.53
09-09-2025 01:40	171.02	8.96	0.47	3.53

WAVE MEASUREMENT DATA

Time	Dir (deg)	Tp (s)	Hs (m)	Tp Mean (s)
09-09-2025 02:40	166.59	9.12	0.47	3.71
09-09-2025 03:40	163.54	9.37	0.47	4.01
09-09-2025 03:40	163.54	9.37	0.47	4.01
09-09-2025 04:40	163.02	9.86	0.47	4.51
09-09-2025 05:40	161.38	10.09	0.48	4.84
09-09-2025 06:40	159.15	10.12	0.49	5.02
09-09-2025 06:40	159.15	10.12	0.49	5.02
09-09-2025 07:40	154.46	9.92	0.52	5.07
09-09-2025 08:40	153.19	9.77	0.53	5.04
09-09-2025 09:40	154.44	9.66	0.52	4.96
09-09-2025 09:40	154.44	9.66	0.52	4.96
09-09-2025 10:40	158.71	9.50	0.48	4.79
09-09-2025 11:40	161.95	9.53	0.46	4.65
09-09-2025 12:40	164.12	9.70	0.44	4.52
09-09-2025 12:40	164.12	9.70	0.44	4.52
09-09-2025 13:40	167.23	10.08	0.43	4.47
09-09-2025 14:40	166.64	10.31	0.43	4.33
09-09-2025 15:40	163.53	10.41	0.45	4.14
09-09-2025 15:40	163.53	10.41	0.45	4.14
09-09-2025 16:40	157.34	10.50	0.48	3.83
09-09-2025 17:40	153.12	10.39	0.51	3.64
09-09-2025 18:40	151.01	10.16	0.55	3.55
09-09-2025 18:40	151.01	10.16	0.55	3.55
09-09-2025 19:40	144.75	9.48	0.61	3.65
09-09-2025 20:40	148.52	9.34	0.63	3.63
09-09-2025 21:40	158.63	9.58	0.63	3.55
09-09-2025 21:40	158.63	9.58	0.63	3.55
09-09-2025 22:40	186.29	10.56	0.59	3.30
09-09-2025 23:40	194.99	10.94	0.57	3.24
10-09-2025 00:40	190.00	10.87	0.58	3.33
10-09-2025 00:40	190.00	10.87	0.58	3.33
10-09-2025 01:40	161.68	10.21	0.62	3.59
10-09-2025 02:40	148.00	9.76	0.64	3.83
10-09-2025 03:40	145.29	9.51	0.65	4.06
10-09-2025 03:40	145.29	9.51	0.65	4.06
10-09-2025 04:40	159.13	9.36	0.63	4.32
10-09-2025 05:40	165.46	9.43	0.63	4.47
10-09-2025 06:40	166.17	9.66	0.62	4.52
10-09-2025 06:40	166.17	9.66	0.62	4.52
10-09-2025 07:40	158.44	10.11	0.63	4.39
10-09-2025 08:40	154.48	10.44	0.63	4.39
10-09-2025 09:40	153.35	10.69	0.61	4.46
10-09-2025 09:40	153.35	10.69	0.61	4.46
10-09-2025 10:40	157.61	10.79	0.56	4.71
10-09-2025 11:40	158.66	10.90	0.55	4.79
10-09-2025 12:40	157.64	11.00	0.57	4.75
10-09-2025 12:40	157.64	11.00	0.57	4.75
10-09-2025 13:40	150.37	11.25	0.62	4.58
10-09-2025 14:40	149.77	11.21	0.66	4.43
10-09-2025 15:40	153.79	10.96	0.69	4.31
10-09-2025 15:40	153.79	10.96	0.69	4.31

WAVE MEASUREMENT DATA

Time	Dir (deg)	Tp (s)	Hs (m)	Tp Mean (s)
10-09-2025 16:40	170.89	10.31	0.71	4.15
10-09-2025 17:40	175.88	9.98	0.73	4.15
10-09-2025 18:40	173.03	9.89	0.74	4.28
10-09-2025 18:40	173.03	9.89	0.74	4.28
10-09-2025 19:40	146.15	10.13	0.74	4.57
10-09-2025 20:40	144.46	10.24	0.75	4.81
10-09-2025 21:40	159.94	10.24	0.75	5.01
10-09-2025 21:40	159.94	10.24	0.75	5.01
10-09-2025 22:40	210.44	10.15	0.77	5.28
10-09-2025 23:40	231.09	10.00	0.76	5.38
11-09-2025 00:40	229.41	9.80	0.73	5.36
11-09-2025 00:40	229.41	9.80	0.73	5.36
11-09-2025 01:40	196.41	9.58	0.64	4.87
11-09-2025 02:40	175.83	9.37	0.61	4.93
11-09-2025 03:40	165.28	9.18	0.63	5.33
11-09-2025 03:40	165.28	9.18	0.63	5.33
11-09-2025 04:40	164.10	8.85	0.74	6.58
11-09-2025 05:40	166.12	8.82	0.78	6.98
11-09-2025 06:40	169.97	8.99	0.78	6.77
11-09-2025 06:40	169.97	8.99	0.78	6.77
11-09-2025 07:40	179.93	9.62	0.70	5.55
11-09-2025 08:40	182.27	9.84	0.66	4.88
11-09-2025 09:40	179.02	9.76	0.65	4.63
11-09-2025 09:40	179.02	9.76	0.65	4.63
11-09-2025 10:40	167.99	9.22	0.69	5.05
11-09-2025 11:40	160.43	8.93	0.71	5.11
11-09-2025 12:40	155.86	8.84	0.71	4.92
11-09-2025 12:40	155.86	8.84	0.71	4.92
11-09-2025 13:40	153.69	9.01	0.68	4.41
11-09-2025 14:40	153.59	9.11	0.66	4.02
11-09-2025 15:40	155.01	9.16	0.66	3.77
11-09-2025 15:40	155.01	9.16	0.66	3.77
11-09-2025 16:40	160.28	9.17	0.68	3.49
11-09-2025 17:40	162.54	9.15	0.69	3.54
11-09-2025 18:40	162.98	9.11	0.69	3.82
11-09-2025 18:40	162.98	9.11	0.69	3.82
11-09-2025 19:40	156.93	9.02	0.67	4.48
11-09-2025 20:40	158.39	8.98	0.66	4.89
11-09-2025 21:40	165.03	8.98	0.67	5.12
11-09-2025 21:40	165.03	8.98	0.67	5.12
11-09-2025 22:40	181.66	9.06	0.71	5.15
11-09-2025 23:40	190.25	9.07	0.72	5.13
12-09-2025 00:40	192.76	9.03	0.70	5.07
12-09-2025 00:40	192.76	9.03	0.70	5.07
12-09-2025 01:40	186.21	8.90	0.65	4.92
12-09-2025 02:40	183.38	8.82	0.61	4.85
12-09-2025 03:40	183.27	8.79	0.59	4.85
12-09-2025 03:40	183.27	8.79	0.59	4.85
12-09-2025 04:40	186.44	8.76	0.58	5.05
12-09-2025 05:40	188.43	8.79	0.58	5.03
12-09-2025 06:40	189.19	8.84	0.58	4.88

WAVE MEASUREMENT DATA

Time	Dir (deg)	Tp (s)	Hs (m)	Tp Mean (s)
12-09-2025 06:40	189.19	8.84	0.58	4.88
12-09-2025 07:40	190.07	9.06	0.57	4.36
12-09-2025 08:40	187.89	9.04	0.58	4.21
12-09-2025 09:40	183.44	8.85	0.61	4.31
12-09-2025 09:40	183.44	8.85	0.61	4.31
12-09-2025 10:40	176.04	8.36	0.67	4.89
12-09-2025 11:40	169.73	8.09	0.70	5.12
12-09-2025 12:40	164.43	7.99	0.71	5.08
12-09-2025 12:40	164.43	7.99	0.71	5.08
12-09-2025 13:40	161.51	8.10	0.70	4.62
12-09-2025 14:40	157.65	8.18	0.68	4.39
12-09-2025 15:40	153.65	8.23	0.67	4.31
12-09-2025 15:40	153.65	8.23	0.67	4.31
12-09-2025 16:40	146.23	8.31	0.66	4.54
12-09-2025 17:40	145.13	8.28	0.65	4.59
12-09-2025 18:40	148.72	8.20	0.65	4.52
12-09-2025 18:40	148.72	8.20	0.65	4.52
12-09-2025 19:40	158.53	7.92	0.64	4.15
12-09-2025 20:40	165.88	7.85	0.65	4.09
12-09-2025 21:40	171.01	7.94	0.66	4.25
12-09-2025 21:40	171.01	7.94	0.66	4.25
12-09-2025 22:40	175.51	8.34	0.69	4.79
12-09-2025 23:40	176.78	8.48	0.70	5.08
13-09-2025 00:40	175.87	8.44	0.70	5.20
13-09-2025 00:40	175.87	8.44	0.70	5.20
13-09-2025 01:40	169.52	8.09	0.68	5.01
13-09-2025 02:40	168.26	7.92	0.66	4.96
13-09-2025 03:40	170.56	7.90	0.64	4.99
13-09-2025 03:40	170.56	7.90	0.64	4.99
13-09-2025 04:40	179.52	8.06	0.62	5.28
13-09-2025 05:40	183.39	8.17	0.61	5.29
13-09-2025 06:40	183.44	8.25	0.62	5.08

Appendix E
Flora and Fauna

Check list of Flora

List of Trees

S.No	Scientificname	Common Name	Order	Family	IUCN	Core	Buffer	Vernacular Name (Tamil)
1.	*Vachellia nilotica (L.) P.J.H.Hurter & Mabb.*	Gum arabic tree	Fabales	Fabaceae	LC	*	*	Karuvelam
2.	*Vachellia farnesiana (L.) Wight & Arn.*	Needle bush,	Fabales	Fabaceae	LC		*	Peevel
3.	*Acacia melanoxylon R.Br.*	black wood	Fabales	Fabaceae	LC		*	Acaciamelonoxylon
4.	*Aegle marmelos (L.) Corrêa*	Bengal quince	Sapindales	Rutaceae	LC	*	*	Vilvam
5.	*Anacardium occidentale L.*	Cashew	Sapindales	Anacardiaceae	LC		*	Munthirimaram
6.	*Artocarpus heterophyllus Lam.*	Jack fruittree	Rosales	Moraceae	LC		*	Palamaram
7.	*Avicennia marina (Forssk.) Vierh.*	Grey mangrove	Lamiales	Acanthaceae	LC		*	Kanna
8.	*Avicennia officinalis L*	Indian mangrove	Lamiales	Acanthaceae	LC		*	Madaipattai
9.	*Azadirachta indica A.Juss.*	Neem	Sapindales	Meliaceae	LC	*	*	Vembu
10.	*Arringtonia acutangula (L.) Gaertn.*	mango-pine	Ericales	Lecythidaceae	LC		*	Samudrapazham
11.	*Bombax ceiba L.*	Cotton tree	Malvales	Malvaceae	LC		*	Ilavu
12.	*Borassus flabellifer L.*	Palmyra palm	Arecales	Arecaceae	LC	*	*	Panaimaram
13.	*Butea monosperma (Lam.) Kuntze*	Flame of the Forest	Fabales	Fabaceae	LC	*	*	Purasu
14.	*Calophyllum inophyllum L.*	Beauty leaf	Malpighiales	Calophyllaceae	LC		*	Punnai
15.	*Carica papaya L.*	Papaya	Brassicales	Caricaceae	LC		*	Pappali
16.	*Cassia fistula L.*	Goldenshowertree	Fabales	Fabaceae	LC		*	Sarakondrai
17.	Casuarina glauca Sieber ex Spreng.	swamp she-oak	Fagales	Casuarinaceae	LC		*	Savukku
18.	*Citrus × limon (L.) Osbeck*	Lemon	Sapindales	Rutaceae	LC		*	Elumichaimaram
19.	*Cocos nucifera L*	Coconut tree	Arecales	Arecaceae	LC		*	Thennaimaram
20.	*Cordia dichotoma G.Forst*	Glue berry tree	Boraginales	Boraginaceae	LC	*	*	Mukuchalipazham
21.	*Couroupita guianensis Aubl.*	cannonball tree	Ericales	Lecythidaceae	LC		*	Nagalingam

S.No	Scientificname	Common Name	Order	Family	IUCN	Core	Buffer	Vernacular Name (Tamil)
22.	*Delonix regia (Bojer ex Hook.) Raf.*	Flame of the forest	Fabales	Fabaceae	LC	*	*	Gulmohar
23.	Phyllanthus emblica L.	Indian goose berry	Malpighiales	Phyllanthaceae	LC	*	*	Nelli
24.	*Samanea saman (Jacq.) Merr.*	Rain tree	Fabales	Fabaceae	LC	*	*	Mazhaimaram
25.	*Eucalyptus globulus Labill.*	southern blue gum	Myrtales	Myrtaceae	LC		*	Eucalyptus
26.	*Eucalyptus camaldulensis Dehnh.*	River red gum	Myrtales	Myrtaceae	NT		*	Eucalyptus
27.	*Ficus benghalensis L.*	Banyan	Rosales	Moraceae	LC		*	Alamaram
28.	*Ficus religiosa L.*	Peepal	Rosales	Moraceae	LC	*	*	Arasanmaram
29.	*Lannea coromandelica (Houtt.) Merr.*	Indian ash tree	Sapindales	Anacardiaceae	LC		*	Oti
30.	*Lepisanthes tetraphylla (Vahl) Radlk*	Kurpa	Sapindales	Sapindaceae	LC		*	Karadipongan
31.	*Leucaena leucocephala (Lam.) de Wit*	White lead tree	Fabales	Fabaceae	LC		*	Periyathakarai
32.	*Limonia acidissima L.*	Wood apple	Sapindales	Rutaceae	LC		*	VilamPalam
33.	Mangifera indica L.	Mango	Sapindales	Anacardiaceae	LC	*	*	Maamaram
34.	*Morinda pubescens Sm.*	Indian mulberry	Gentianales	Rubiaceae	LC	*	*	Mannanunai
35.	*Moringa oleifera Lam.*	Drum stick	Brassicales	Moringaceae	LC		*	MurungaiMaram
36.	*Musa × paradisiaca L.*	Banana	Zingiberales	Musaceae	LC		*	Vazhaimaram
37.	*Neltuma juliflora (Sw.) Raf.*		Fabales	Fabaceae	LC	*	*	
38.	*Peltophorum pterocarpum (DC.) Backer ex K.Heyne*	Copperpod	Fabales	Fabaceae	LC		*	Vakai
39.	*Pongamia pinnata (L.) Pierre*	Indian beech	Fabales	Fabaceae	LC		*	Pungam
40.	*Prosopis cineraria (L.) Druce*	Persian mesquite	Fabales	Fabaceae	LC		*	Vanni
41.	*Psidium guajava L.*	Gauva	Myrtales	Myrtaceae	LC		*	Koiya
42.	*Rhizophora mucronata Poir.*	Redmangrove	Malpighiales	Rhizophoraceae	LC		*	Surapunnai
43.	*Saraca asoca (Roxb.) W.J.de Wilde*	Ashoka tree	Fabales	Fabaceae	Vu		*	Asokamaram
44.	*Sesbania grandiflora (L.) Poir.*	Humming bird tree	Fabales	Fabaceae	LC		*	Agati

S.No	Scientificname	Common Name	Order	Family	IUCN	Core	Buffer	Vernacular Name (Tamil)
45.	*Syzygium cumini (L.) Skeels*	Indian black plum	Myrtales	Myrtaceae	LC		*	Nagai
46.	*Tamarindus indica L.*	Tamarind	Fabales	Fabaceae	LC		*	Puliyamaram
47.	*Tectona grandis L.f.*	Teak	Lamiales	Lamiaceae	LC	*	*	Theku
48.	*Thespesia populnea (L.) Sol. ex Corrêa*	Indian tulip tree	Malvales	Malvaceae	LC	*	*	Pooarasanmaram
49.	*Ziziphus mauritiana Lam.*	Indianplum	Rosales	Rhamnaceae	LC	*	*	Ezhandapazham

List of Shrubs

S.No	Scientificname	Common Name	Order	Family	IUCN	Core	Buffer	Vernacular Name (Tamil)
1.	*Abutilon indicum (L.) Sweet*	Country mallow	Malvales	Malvaceae	LC		*	Paniyaratutti
2.	*Calamus rotang L.*	Common *rattan*	Arecales	Arecaceae	LC		*	Pirambu
3.	*Calotropis procera (Aiton) W.T.Aiton*	Sodom apple	Gentianales	Apocynaceae	LC	*	*	Erukan
4.	*Calotropis gigantea (L.) W.T.Aiton*	Crown flower	Gentianales	Apocynaceae	LC	*	*	
5.	*Canthium coromandelicum (Burm.f.) Alston*	Karai	Gentianales	Rubiaceae	LC		*	Nallakkarai
6.	*Carissa spinarum L.*	conkerberry	Gentianales	Apocynaceae	LC	*	*	Chirukila
7.	*Dichrostachys cinerea (L.) Wight & Arn.*	Sicklebush	Fabales	Fabaceae	LC		*	Vedutalam
8.	*Hibiscus × rosa-sinensis L.*	China rose	Malvales	Malvaceae	LC		*	Chembarithi
9.	*Ixora coccinea L.*	FlameoftheWoods,	Gentianales	Rubiaceae	LC		*	Idlipoo
10.	*Jatropha curcas L.*	Purigingnut	Malpighiales	Euphorbiaceae	LC	*	*	Kattamanakku
11.	*Lantana camara L.*	Lantana	Lamiales	Verbenaceae	LC	*	*	Unnichedi
12.	*Lawsonia inermis L.*	Henna	Myrtales	Lythraceae	LC		*	Maruthani
13.	*Nerium oleander L.*	oleander	Gentianales	Apocynaceae	LC		*	Alari
14.	*Phoenix pusilla Gaertn.*	Ceylon Date Palm	Arecales	Arecaceae	LC		*	Tharaiichan
15.	*Ricinus communis L.*	Castoroil plant	Malpighiales	Euphorbiaceae	LC	*	*	Amanangu

S.No	Scientificname	Common Name	Order	Family	IUCN	Core	Buffer	Vernacular Name (Tamil)
16.	*Flueggea leucopyrus Willd.*	Indian snowberry	Malpighiales	Phyllanthaceae	LC		*	Mulluppulatti
17.	*Solanum torvum Sw.*	Night shade plant	Solanales	Solanaceae	LC	*	*	Sundaikai
18.	*Tarenna asiatica (L.) Kuntze ex K.Schum.*	Asiaticteranna	Gentianales	Rubiaceae	LC		*	Tharani
19.	*Cissus quadrangularis L.*	winged treebine	Vitales	Vitaceae	LC		*	Perandai
20.	*Vitex negundo L.*	Fiveleaf chastera	Lamiales	Lamiaceae	LC		*	Nochi

List of Climbers

S.No	Scientificname	Common Name	Order	Family	IUCN	Core	Buffer	Vernacular Name (Tamil)
1.	Cardiospermum halicacabum L.	Balloon vine	Sapindales	Sapindaceae	LC		*	Kottavan
2.	*Clitoria ternatea L.*	butterfly-pea	Fabales	Fabaceae	LC		*	Sangupoo
3.	*Coccinia grandis (L.) Voigt*	Coccinia	Cucurbitales	Cucurbitaceae	LC	*	*	
4.	*Combretum albidum G.Don*	Piluki	Myrtales	Combretaceae	LC		*	Odaikodi
5.	*Ipomoea pes-caprae (L.) R.Br.*	Beach Morning Glory	Solanales	Convolvulaceae	LC	*	*	Adapukodi
6.	*Jasminum angustifolium (L.) Willd.*	Wild jasmine	Lamiales	Oleaceae	LC		*	Malli
7.	*Cucumis maderaspatanus L.*	Madras peapumpkin	Cucurbitales	Cucurbitaceae	LC		*	Musumusukkai
8.	*Reissantia indica (Willd.) N.Hallé*	Mopane paddle pod	Celastrales	Celastraceae	LC		*	Odangod
9.	*Solanum trilobatum L.*	Purple fruited peaeggplant	Solanales	Solanaceae	LC	*	*	Thuthuvelai
10.	*Gloriosa superba L.*	Glorylily	Liliales	Colchicaceae	LC		*	Kalappaikilangu

List of Herbs

S.No	Scientificname	Common Name	Order	Family	IUCN	Core	Buffer	Vernacular Name (Tamil)
1.	*Acalypha indica L.*	*Indian acalyph*	*Malpighiales*	*Euphorbiaceae*	*LC*		*	*Kuppameni*
2.	*Achyranthes aspera L.*	Prickly chaff flower	Caryophyllales	Amaranthaceae	LC		*	Nayuruvi
3.	*Justicia adhatoda L.*	Malabar nut	Lamiales	Acanthaceae	LC		*	Adotodai
4.	*Aloe vera (L.) Burm.f.*	Aloe	Asparagales	Asphodelaceae	LC	*	*	Sothukathalai
5.	*Canna indica L.*	Indian shot	Zingiberales	Cannaceae	LC		*	
6.	*Catharanthus roseus (L.) G.Don*	Peri winkle	Gentianales	Apocynaceae	LC		*	Nithyakalyani
7.	*Centella asiatica (L.) Urb.*	Indian pennywort.	Apiales	Apiaceae	LC		*	Vallarai
8.	*Cleome viscosa L.*	Asian spiderflower	Brassicales	Cleomaceae	LC	*	*	
9.	*Commelina benghalensis L.*	Benghal dayflower	Commelinales	Commelinaceae	LC		*	Kanamvazhai
10.	*Commelina communis L.*	Asiatic dayflower	Commelinales	Commelinaceae	LC		*	Kamilina
11.	*Cyanotis cristata (L.) D.Don*	Nabhali	Commelinales	Commelinaceae	LC		*	Kuthiraikulambadi
12.	*Datura metel L.*	Indian thornapple	Solanales	Solanaceae	LC	*	*	Madulam
13.	*Eclipta prostrata (L.) L.*	False daisy	Asterales	Asteraceae	LC		*	Karisilanganni
14.	*Euphorbia hirta L.*	Asthma-plant	Malpighiales	Euphorbiaceae	LC	*	*	
15.	*Ocimum tenuiflorum L.*	Sacredbasil	Lamiales	Lamiaceae	LC		*	Tulsi
16.	*Perotis indica (L.) Kuntze*	Indiancornetgrass	Poales	Poaceae	LC	*	*	Kudhiraivalpullu
17.	*Phyllanthus amarus Schumach. & Thonn.*	Carryme seed	Malpighiales	Phyllanthaceae	LC		*	Kilanelli
18.	*Tephrosia purpurea (L.) Pers.*	Wildindigo	Fabales	Fabaceae	LC		*	Kattukolunchi
19.	*Triumfetta rhomboidea Jacq.*	Burrbush	Malvales	Malvaceae	LC		*	Otupullu
20.	*Tridax procumbens L.*	coatbuttons	Asterales	Asteraceae	LC	*	*	
21.	*Tribulus terrestris L.*		Zygophyllales	Zygophyllaceae	LC	*	*	
22.	*Sida acuta Burm.f*	common wireweed	Malvales	Malvaceae	LC	*	*	
23.	*Sida cordifolia L.*	Flannel weed	Malvales	Malvaceae	LC	*	*	
24.	*Solanum nigrum L.*	Black nightshade	Solanaceae	Solanum	LC	*	*	Manthakali
25.	*Cyperus compressus L.*	Annual sedge	Poales	Cyperaceae	LC	*	*	Kunnakorai

S.No	Scientificname	Common Name	Order	Family	IUCN	Core	Buffer	Vernacular Name (Tamil)
26.	*Cyperus mindorensis (Steud.) Huygh*	Whitewater sedge	Poales	Cyperaceae	LC	*	*	Veluthanirbasi
27.	*Cyperus rotundus L.*	Nut grass	Poales	Cyperaceae	LC	*	*	Korai
28.	*Bambusabambo*	Bamboo			LC		*	Moonghil

Check list of Fauna

Sl.No	Scientific Name	Common Name	Order	Family	IUCN	IWPA	Vernacular Name(Tamil)
Mammales							
1.	*Felis chaus*	Jungle cat	Carnivora	Felidae	LC	II	Kattupoonai
2.	*Funambulus palmarum*	Three-striped palm squirrel	Rodentia	Sciuridae	LC		Ramaranil
3.	*Urva auropunctata*	Small Indian mongoose	Carnivora	Herpestidae	LC	II	Keeripullai
4.	*Hystrix indica*	Indian crested porcupine	Rodentia	Hystricidae	LC	I	Mullamandri
5.	*Lepus nigricollis*	Indian hare	Lagomorpha	Leporidae	LC	II	Muyal
7.	*Rattus rattus*	Common rat	Rodentia	Muridae	LC		Eli
Birds							
1.	*Phalacrocorax fuscicollis*	Indian Cormorant	Suliformes	Phalacrocoracidae	LC	II	Kondai Neer Kagam
2.	*Egretta garzetta*	Little Egret	Pelecaniformes	Ardeidae		II	ChinnaKokku
3.	*Pelecanus philippensis*	Spot-billed Pelican	Pelecaniformes	Pelecanidae	NT	II	Kuzhai Kada
4.	*Egretta gularis*	Western reef heron	Pelecaniformes	Ardeidae	LC		KaraiKokku
5.	*Ardea cinerea*	Grey heron	Pelecaniformes	Ardeidae	LC	II	Sambal Narai
6.	*Ardea alba*	Great egret	Pelecaniformes	Ardeidae	LC	II	PeriaKokku

Sl.No	Scientific Name	Common Name	Order	Family	IUCN	IWPA	Vernacular Name(Tamil)
7.	*Ardea intermedia*	Intermediate Egret	Pelecaniformes	Ardeidae	LC	II	VellaiKokku
8.	*Bubulcus ibis*	Cattle Egret	Pelecaniformes	Ardeidae	LC	II	UnniKokku
9.	*Ardeola grayii*	Indian Pond Heron	Pelecaniformes	Ardeidae	LC	II	KuruttuKokku
10.	*Ortygornis pondicerianus*	Grey Francolin	Galliformes	Phasianidae	LC	II	Kowdhari
11.	*Coturnix coturnix*	Common Quail	Galliformes	Phasianidae	LC	II	Kaadai
12.	*Porphyrio porphyrio*	Western swamphen	Gruiformes	Rallidae	LC		NeelaThazhaiKozhi
13.	*Gallinula chloropus*	Common Moorhen	Gruiformes	Rallidae	LC	II	ThaazhaiKozhi
14.	*Spilopelia senegalensis*	Laughing dove	Columbiformes	Columbidae	LC	II	ChinnaThavittuPura
15.	*Spilopelia chinensis*	Spotted dove	Columbiformes	Columbidae	LC	II	PulliPura
16.	*Streptopelia tranquebarica*	Red Collared-Dove	Columbiformes	Columbidae	LC	II	ThavittuPura
17.	*Columba livia*	Blue Rock Pigeon	Columbiformes	Columbidae	LC	II	MadaPura
18.	*Psittacula eupatria*	Alexandrine Parakeet	Psittaciformes	Psittaculidae	LC	II	PeriaPachaiKili
19.	*Psittacula krameri*	Rose-ringed Parakeet	Psittaciformes	Psittaculidae	LC	II	SenthaarPynkili
20.	*Cuculus micropterus*	Indian cuckoo	Cuculiformes	Cuculidae	LC	II	Kuyil
21.	*Merops orientalis*	GreenBee-eater	Coraciiformes	Meropidae	LC		PachaiPanchuruttan
22.	*Dinopium benghalense*	Lesser Golden backed Woodpecker	Piciformes	Picidae	LC		Merkathia
23.	*Pycnonotus jocosus*	Red-whiskered Bulbul	Passeriformes	Pycnonotidae	LC	II	SivappuMeesai Chinnaan

Sl.No	Scientific Name	Common Name	Order	Family	IUCN	IWPA	Vernacular Name(Tamil)
24.	*Pycnonotuscafer*	Red-vented Bulbul	Passeriformes	Pycnonotidae	LC	II	Chinnaan
25.	*Argya affinis*	Yellow-billed Babbler	Passeriformes	Leiothrichidae	LC	II	VenthalaiSilamban
26.	*Dicrurus macrocercus*	Black Drongo	Passeriformes	Dicruridae	LC	II	KarungKarichaan
27.	*Corvus splendens*	House Crow	Passeriformes	Corvidae	LC		Kakkai
28.	*Passer domesticus*	House Sparrow	Passeriformes	Passeridae	LC	II	Chittu
29.	*Petroniaxanthocollis*	Yellow-throated Sparrow	Passeriformes	Passeridae	LC		ManjalThondaiChittu
Amphibians							
1.	*Euphlyctis cyanophlyctis*	Skipper frog	Anura	Dicroglossidae	LC		*Thavalai*
2.	*Euphlyctis hexadactylus*	Indian green frog	Anura	Dicroglossidae	LC		Pachaithavali
3.	*Minervarya kudremukhensis*	Cricket frog	Anura	Dicroglossidae	LC		-
4.	*Hoplobatrachus crassus*	Jerdon's bullfrog	Anura	Dicroglossidae	LC		-
5.	*Rana temporaria*	Common frog	Anura	Dicroglossidae	LC		Thavalai
6.	*Sphaerotheca breviceps*	Indian burrowing frog	Anura	Ranidae	LC		-
Reptiles							
7	*Calotes versicolor*	*Common garden lizard*	*Squamata*	*Gekkonidae*	LC		*Onan*
8	*Ptyas mucosa*	*Common rat snake*	*Squamata*	*Colubridae*	LC	*II*	*Sarai pambu*
9	*Varanus bengalensis*	*Common Indian monitor*	*Squamata*	*Varanidae*	*NT*	*I*	*Udumbu*
10	*Eutropis carinata*	Brahminy skink	Squamata	Scincidae	LC		*Kattu Aranai*
11	*Hemidactylus flaviviridis*	House Gecko	Squamata	Gekkonidae	LC		*Palli*

Sl.No	Scientific Name	Common Name	Order	Family	IUCN	IWPA	Vernacular Name(Tamil)
12	*Hemidactylus brookii*	Spotted Indian House Gecko	Squamata	Gekkonidae	LC		*Mara Palli*
13	*Sitana ponticeriana*	Fan-Throated Lizard	Squamata	Agamidae	LC		*Visir i thonta i onan*
14	*Mabuya carinatus*	Common skink	Squamata	Scincidae	LC		*Aranai*
15	*Ahaetulla mycterizans*	Common Green Whip Snake	Squamata	Colubridae	LC		*Pachai pambu*
16	*Chamaeleo zeylanicus*	Indian Chameleon	Squamata	Chamaeleonidae	LC		*Pachondhi*
17	*Bungarus caeruleus*	Common Indian Krait	Squamata	Elapidae	LC	I	*Kattu vir iyan*

Appendix F
IS 10500 2012 - Drinking Water Standards

भारतीय मानक

पीने का पानी — विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

DRINKING WATER — SPECIFICATION

(Second Revision)

ICS 13.060.20

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 2012 **Price Group 6**

AMENDMENT NO. 1 JUNE 2015
TO
IS 10500 : 2012 DRINKING WATER — SPECIFICATION

(Second Revision)

[*Page* 2, *Table* 2, *Sl No.* xii), *col* 3] — Substitute '1.0' *for* '0.3'.

[*Page* 3, *Table* 3, *Sl No.* x) , *col* 4] — Substitute 'No relaxation' *for* '0.05'.

(FAD 14)

Publication Unit, BIS, New Delhi, India

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Drinking Water Sectional Committee had been approved by the Food and Agriculture Division Council.

This standard was originally published in 1983. A report prepared by the World Health Organization in cooperation with the World Bank showed that in 1975, some 1 230 million people were without safe water supplies. These appalling facts were central to the United Nations decision to declare an International Drinking Water Supply and Sanitation decade, beginning in 1981. Further, the VI Five-Year Plan of India had made a special provision for availability of safe drinking water for the masses. Therefore, the standard was formulated with the objective of assessing the quality of water resources, and to check the effectiveness of water treatment and supply by the concerned authorities.

The first revision was undertaken to take into account the up-to-date information available about the nature and effect of various contaminants as also the new techniques for identifying and determining their concentration. Based on experience gained additional requirements for alkalinity; aluminium and boron were incorporated and the permissible limits for dissolved solids, nitrate and pesticides residues modified.

As per the eleventh five year plan document of India (2007-12), there are about 2.17 lakh quality affected habitations in the country with more than half affected with excess iron, followed by fluoride, salinity, nitrate and arsenic in that order. Further, approximately, 10 million cases of diarrhoea, more than 7.2 lakh typhoid cases and 1.5 lakh viral hepatitis cases occur every year a majority of which are contributed by unclean water supply and poor sanitation. The eleventh five year plan document of India (2007-2012) recognizes dealing with the issue of water quality as a major challenge and aims at addressing water quality problems in all quality affected habitations with emphasis on community participation and awareness campaigns as well as on top most priority to water quality surveillance and monitoring by setting up of water quality testing laboratories strengthened with qualified manpower, equipments and chemicals.

The second revision was undertaken to upgrade the requirements of the standard and align with the internationally available specifications on drinking water. In this revision assistance has been derived from the following:

a) EU Directives relating to the quality of water intended for human consumption (80/778/EEC) and Council Directive 98/83/EC.

b) USEPA standard — National Primary Drinking Water Standard. EPA 816-F-02-013 dated July, 2002.

c) WHO Guidelines for Drinking Water Quality. 3rd Edition Vol. 1 Recommendations, 2008.

d) Manual on Water Supply and Treatment, third edition — revised and updated May 1999, Ministry of Urban Development, New Delhi.

This standard specifies the acceptable limits and the permissible limits in the absence of alternate source. It is recommended that the acceptable limit is to be implemented as values in excess of those mentioned under 'Acceptable' render the water not suitable. Such a value may, however, be tolerated in the absence of an alternative source. However, if the value exceeds the limits indicated under 'permissible limit in the absence of alternate source' in col 4 of Tables 1 to 4, the sources will have to be rejected.

Pesticide residues limits and test methods given in Table 5 are based on consumption pattern, persistence and available manufacturing data. The limits have been specified based on WHO guidelines, wherever available. In cases where WHO guidelines are not available, the standards available from other countries have been examined and incorporated, taking in view the Indian conditions.

In this revision, additional requirements for ammonia, chloramines, barium, molybdenum, silver, sulphide, nickel, polychlorinated biphenyls and trihalomethanes have been incorporated while the requirements for colour, turbidity, total hardness, free residual chlorine, iron, magnesium, mineral oil, boron, cadmium, total arsenic, lead, polynuclear aromatic hydrocarbons, pesticides and bacteriological requirements have been modified.

In this revision, requirement and test method for virological examination have been included. Further, requirements and test methods for cryptosporidium and giardia have also been specified.

Routine surveillance of drinking water supplies should be carried out by the relevant authorities to understand the risk of specific pathogens and to define proper control procedures. The WHO Guidelines for Drinking Water Quality, 3rd Edition, Vol. 1 may be referred for specific recommendations on using a water safety approach incorporating risk identification. Precautions/Care should be taken to prevent contamination of drinking water from chlorine resistant parasites such as cryptosporidium species and giardia.

Indian Standard

DRINKING WATER — SPECIFICATION

(Second Revision)

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for drinking water.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard the following definition shall apply.

3.1 Drinking Water — Drinking water is water intended for human consumption for drinking and cooking purposes from any source. It includes water (treated or untreated) supplied by any means for human consumption.

4 REQUIREMENTS

Drinking water shall comply with the requirements given in Tables 1 to 4. The analysis of pesticide residues given in Table 3 shall be conducted by a recognized laboratory using internationally established test method meeting the residue limits as given in Table 5.

Drinking water shall also comply with bacteriological requirements (*see* **4.1**), virological requirements (*see* **4.2**) and biological requirements (*see* **4.3**).

4.1 Bacteriological Requirements

4.1.1 *Water in Distribution System*

Ideally, all samples taken from the distribution system including consumers' premises, should be free from coliform organisms and the following bacteriological quality of drinking water collected in the distribution system, as given in Table 6 is, therefore specified when tested in accordance with IS 1622.

4.2 Virological Requirements

4.2.1 Ideally, all samples taken from the distribution

Table 1 Organoleptic and Physical Parameters
(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 3025	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Colour, Hazen units, *Max*	5	15	Part 4	Extended to 15 only, if toxic substances are not suspected in absence of alternate sources
ii)	Odour	Agreeable	Agreeable	Part 5	a) Test cold and when heated b) Test at several dilutions
iii)	*p*H value	6.5-8.5	No relaxation	Part 11	—
iv)	Taste	Agreeable	Agreeable	Parts 7 and 8	Test to be conducted only after safety has been established
v)	Turbidity, NTU, *Max*	1	5	Part 10	—
vi)	Total dissolved solids, mg/l, *Max*	500	2 000	Part 16	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 2 General Parameters Concerning Substances Undesirable in Excessive Amounts

(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Aluminium (as Al), mg/l, *Max*	0.03	0.2	IS 3025 (Part 55)	—
ii)	Ammonia (as total ammonia-N), mg/l, *Max*	0.5	No relaxation	IS 3025 (Part 34)	—
iii)	Anionic detergents (as MBAS) mg/l, *Max*	0.2	1.0	Annex K of IS 13428	—
iv)	Barium (as Ba), mg/l, *Max*	0.7	No relaxation	Annex F of IS 13428* or IS 15302	—
v)	Boron (as B), mg/l, *Max*	0.5	1.0	IS 3025 (Part 57)	—
vi)	Calcium (as Ca), mg/l, *Max*	75	200	IS 3025 (Part 40)	—
vii)	Chloramines (as Cl_2), mg/l, *Max*	4.0	No relaxation	IS 3025 (Part 26)* or APHA 4500-Cl G	—
viii)	Chloride (as Cl), mg/l, *Max*	250	1 000	IS 3025 (Part 32)	—
ix)	Copper (as Cu), mg/l, *Max*	0.05	1.5	IS 3025 (Part 42)	—
x)	Fluoride (as F) mg/l, *Max*	1.0	1.5	IS 3025 (Part 60)	—
xi)	Free residual chlorine, mg/l, *Min*	0.2	1	IS 3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be minimum 0.5 mg/l
xii)	Iron (as Fe), mg/l, *Max*	0.3	No relaxation	IS 3025 (Part 53)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xiii)	Magnesium (as Mg), mg/l, *Max*	30	100	IS 3025 (Part 46)	—
xiv)	Manganese (as Mn), mg/l, *Max*	0.1	0.3	IS 3025 (Part 59)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xv)	Mineral oil, mg/l, *Max*	0.5	No relaxation	Clause **6** of IS 3025 (Part 39) Infrared partition method	—
xvi)	Nitrate (as NO_3), mg/l, *Max*	45	No relaxation	IS 3025 (Part 34)	—
xvii)	Phenolic compounds (as C_6H_5OH), mg/l, *Max*	0.001	0.002	IS 3025 (Part 43)	—
xviii)	Selenium (as Se), mg/l, *Max*	0.01	No relaxation	IS 3025 (Part 56) or IS 15303*	—
xix)	Silver (as Ag), mg/l, *Max*	0.1	No relaxation	Annex J of IS 13428	—
xx)	Sulphate (as SO_4) mg/l, *Max*	200	400	IS 3025 (Part 24)	May be extended to 400 provided that Magnesium does not exceed 30
xxi)	Sulphide (as H_2S), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 29)	—
xxii)	Total alkalinity as calcium carbonate, mg/l, *Max*	200	600	IS 3025 (Part 23)	—
xxiii)	Total hardness (as $CaCO_3$), mg/l, *Max*	200	600	IS 3025 (Part 21)	—
xxiv)	Zinc (as Zn), mg/l, *Max*	5	15	IS 3025 (Part 49)	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under ‘acceptable’ render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under ‘permissible limit in the absence of alternate source’ in col 4, above which the sources will have to be rejected.

Table 3 Parameters Concerning Toxic Substances

(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Cadmium (as Cd), mg/l, *Max*	0.003	No relaxation	IS 3025 (Part 41)	—
ii)	Cyanide (as CN), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 27)	—
iii)	Lead (as Pb), mg/l, *Max*	0.01	No relaxation	IS 3025 (Part 47)	—
iv)	Mercury (as Hg), mg/l, *Max*	0.001	No relaxation	IS 3025 (Part 48)/ Mercury analyser	—
v)	Molybdenum (as Mo), mg/l, *Max*	0.07	No relaxation	IS 3025 (Part 2)	—
vi)	Nickel (as Ni), mg/l, *Max*	0.02	No relaxation	IS 3025 (Part 54)	—
vii)	Pesticides, µg/l, *Max*	See Table 5	No relaxation	See Table 5	—
viii)	Polychlorinated biphenyls, mg/l, *Max*	0.000 5	No relaxation	ASTM 5175*	— or APHA 6630
ix)	Polynuclear aromatic hydro-carbons (as PAH), mg/l, *Max*	0.000 1	No relaxation	APHA 6440	—
x)	Total arsenic (as As), mg/l, *Max*	0.01	0.05	IS 3025 (Part 37)	—
xi)	Total chromium (as Cr), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 52)	—
xii)	Trihalomethanes:				
	a) Bromoform, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
	b) Dibromochloromethane, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
	c) Bromodichloromethane, mg/l, *Max*	0.06	No relaxation	ASTM D 3973-85* or APHA 6232	—
	d) Chloroform, mg/l, *Max*	0.2	No relaxation	ASTM D 3973-85* or APHA 6232	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under ‘acceptable’ render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source’ in col 4, above which the sources will have to be rejected.

Table 4 Parameters Concerning Radioactive Substances

(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 14194	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Radioactive materials:				
	a) Alpha emitters Bq/l, *Max*	0.1	No relaxation	Part 2	—
	b) Beta emitters Bq/l, *Max*	1.0	No relaxation	Part 1	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under ‘acceptable’ render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under ‘permissible limit in the absence of alternate source’ in col 4, above which the sources will have to be rejected.

Table 5 Pesticide Residues Limits and Test Method

(*Foreword* and *Table* 3)

Sl No.	Pesticide	Limit µg/l	Method of Test, Ref to	
			USEPA	AOAC/ ISO
(1)	(2)	(3)	(4)	(5)
i)	Alachlor	20	525.2, 507	—
ii)	Atrazine	2	525.2, 8141 A	—
iii)	Aldrin/ Dieldrin	0.03	508	—
iv)	Alpha HCH	0.01	508	—
v)	Beta HCH	0.04	508	—
vi)	Butachlor	125	525.2, 8141 A	—
vii)	Chlorpyriphos	30	525.2, 8141 A	—
viii)	Delta HCH	0.04	508	—
ix)	2,4- Dichlorophenoxyacetic acid	30	515.1	—
x)	DDT (*o, p* and *p, p* – Isomers of DDT, DDE and DDD)	1	508	AOAC 990.06
xi)	Endosulfan (alpha, beta, and sulphate)	0.4	508	AOAC 990.06
xii)	Ethion	3	1657 A	—
xiii)	Gamma — HCH (Lindane)	2	508	AOAC 990.06
xiv)	Isoproturon	9	532	—
xv)	Malathion	190	8141 A	—
xvi)	Methyl parathion	0.3	8141 A	ISO 10695
xvii)	Monocrotophos	1	8141 A	—
xviii)	Phorate	2	8141 A	—

NOTE — Test methods are for guidance and reference for testing laboratory. In case of two methods, USEPA method shall be the reference method.

Table 6 Bacteriological Quality of Drinking Water[1)]

(*Clause* 4.1.1)

Sl No.	Organisms	Requirements
(1)	(2)	(3)
i)	*All water intended for drinking*:	
	a) *E. coli* or thermotolerant coliform bacteria[2), 3)]	Shall not be detectable in any 100 ml sample
ii)	*Treated water entering the distribution system*:	
	a) *E. coli* or thermotolerant coliform bacteria[2)]	Shall not be detectable in any 100 ml sample
	b) Total coliform bacteria	Shall not be detectable in any 100 ml sample
iii)	*Treated water in the distribution system*:	
	a) *E. coli* or thermotolerant coliform bacteria	Shall not be detectable in any 100 ml sample
	b) Total coliform bacteria	Shall not be detectable in any 100 ml sample

[1)]Immediate investigative action shall be taken if either *E.coli* or total coliform bacteria are detected. The minimum action in the case of total coliform bacteria is repeat sampling; if these bacteria are detected in the repeat sample, the cause shall be determined by immediate further investigation.

[2)]Although, *E. coli* is the more precise indicator of faecal pollution, the count of thermotolerant coliform bacteria is an acceptable alternative. If necessary, proper confirmatory tests shall be carried out. Total coliform bacteria are not acceptable indicators of the sanitary quality of rural water supplies, particularly in tropical areas where many bacteria of no sanitary significance occur in almost all untreated supplies.

[3)]It is recognized that, in the great majority of rural water supplies in developing countries, faecal contamination is widespread. Under these conditions, the national surveillance agency should set medium-term targets for progressive improvement of water supplies.

system including consumers' premises, should be free from virus.

4.2.2 None of the generally accepted sewage treatment methods yield virus-free effluent. Although a number of investigators have found activated sludge treatment to be superior to trickling filters from this point of view, it seems possible that chemical precipitation methods will prove to be the most effective.

4.2.3 Virus can be isolated from raw water and from springs, enterovirus, reovirus, and adenovirus have been found in water, the first named being the most resistant to chlorination. If enterovirus are absent from chlorinated water, it can be assumed that the water is safe to drink. Some uncertainty still remains about the virus of infectious hepatitis, since it has not so far been isolated but in view of the morphology and resistance of enterovirus it is likely that, if they have been inactivated hepatitis virus will have been inactivated also.

4.2.4 An exponential relationship exists between the rate of virus inactivation and the redox potential. A redox potential of 650 mV (measured between platinum and calomel electrodes) will cause almost instantaneous inactivation of even high concentrations of virus. Such a potential can be obtained with even a low concentration of free chlorine, but only with an extremely high concentration of combined chlorine. This oxidative inactivation may be achieved with a number of other oxidants also, for example, iodine, ozone and potassium permanganate, but the effect of the oxidants will always be counteracted, if reducing components, which are mainly organic, are present. As a consequence, the sensitivity of virus towards disinfectants will depend on the *milieu* just as much as on the particular disinfectant used.

4.2.5 Viruses are generally resistant to disinfectants as well as get protected on account of presence of particulate and organic matter in water. Because the difference between the resistance of coliform organisms and of virus to disinfection by oxidants increases with increasing concentration of reducing components, for example, organic matter, it cannot be assumed that the absence of available coliform organisms implies freedom from active virus under circumstances where a free chlorine residual cannot be maintained. Sedimentation and slow sand filtration in themselves may contribute to the removal of virus from water.

4.2.6 In practice, >0.5 mg/l of free chlorine for 1 h is sufficient to inactivate virus, even in water that was originally polluted provided the water is free from particulates and organic matter.

4.2.7 MS2 phage are indicator of viral contamination in drinking water. MS2 phage shall be absent in 1 litre of water when tested in accordance with USEPA method 1602. If MS2 phage are detected in the drinking water, virological examination shall be done by the Polymerase Chain Reaction (PCR) method for virological examination as given in Annex B. USEPA method in Manual of Method for Virology Chapter 16, June 2001 shall be the alternate method. If viruses are detected, the cause shall be determined by immediate further investigation.

4.3 Biological Requirements

4.3.1 Ideally, all samples taken including consumers premises should be free from biological organisms. Biological examination is of value in determining the causes of objectionable tastes and odours in water and controlling remedial treatments, in helping to interpret the results of various chemical analysis, and in explaining the causes of clogging in distribution pipes and filters. In some instances, it may be of use in demonstrating that water from one source has been mixed with that from another.

4.3.2 The biological qualities of water are of greater importance when the supply has not undergone the conventional flocculation and filtration processes, since increased growth of methane-utilizing bacteria on biological slimes in pipes may then be expected, and the development of bryozoal growths such as *Plumatella* may cause operational difficulties.

4.3.3 Some of the animalcules found in water mains may be free-living in the water, but others such as *Dreissena* and *Asellus* are more or less firmly attached to the inside of the mains. Although these animalcules are not themselves pathogenic, they may harbour pathogenic organisms or virus in their intestines, thus protecting these pathogens from destruction by chlorine.

4.3.4 Chlorination, at the dosages normally employed in waterworks, is ineffective against certain parasites, including amoebic cysts; they can be excluded only by effective filtration or by higher chlorine doses than can be tolerated without subsequent dechlorination. *Amoebiasis* can be conveyed by water completely free from enteric bacteria; microscopic examination after concentration is, therefore, the only safe method of identification.

4.3.5 Strict precautions against back-syphonage and cross-connections are required, if amoebic cysts are found in a distribution system containing tested water.

4.3.6 The *cercariae of schistosomiasis* can be detected by similar microscopic examination, but there is, in

any case, no evidence to suggest that this disease is normally spread through piped water supplies.

4.3.7 The cyclops vector of the embryos of *Dracunculus medinensis* which causes dracontiasis or Guinea-worm disease can be found in open wells in a number of tropical areas. They are identifiable by microscopic examination. Such well supplies are frequently used untreated, but the parasite can be relatively easily excluded by simple physical improvements in the form of curbs, drainage, and apron surrounds and other measures which prevent physical contact with the water source.

4.3.8 Cryptosporidium shall be absent in 10 liter of water when tested in accordance with USEPA method 1622 or USEPA method 1623* or ISO 15553 : 2006.

4.3.9 Giardia shall be absent in 10 liter of water when tested in accordance with USEPA method 1623* or ISO 15553 : 2006.

4.3.10 The drinking water shall be free from microscopic organisms such as algae, zooplanktons, flagellates, parasites and toxin producing organisms. An illustrative (and not exhaustive) list is given in Annex C for guidance.

NOTE — In case of dispute, the method indicated by '*' in **4.3.8** and **4.3.9** shall be referee method.

5 SAMPLING

Representative samples of water shall be drawn as prescribed in IS 1622 and IS 3025 (Part 1).

ANNEX A
(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
1622 : 1981	Methods of sampling and microbiological examination of water (*first revision*)
3025	Methods of sampling and test (physical and chemical) for water and waste water:
(Part 1) : 1987	Sampling (*first revision*)
(Part 2) : 2002	Determination of 33 elements by inductively coupled plasma atomic emission spectroscopy
(Part 4) : 1983	Colour (*first revision*)
(Part 5) : 1983	Odour (*first revision*)
(Part 7) : 1984	Taste threshold (*first revision*)
(Part 8) : 1984	Tasting rate (*first revision*)
(Part 10) : 1984	Turbidity (*first revision*)
(Part 11) : 1983	*p*H value (*first revision*)
(Part 16) : 1984	Filterable residue (total dissolved solids) (*first revision*)
(Part 21) : 1983	Total hardness (*first revision*)
(Part 23) : 1983	Alkalinity (*first revision*)
(Part 24) : 1986	Sulphates (*first revision*)
(Part 26) : 1986	Chlorine residual (*first revision*)
(Part 27) : 1986	Cyanide (*first revision*)
(Part 29) : 1986	Sulphide (*first revision*)
(Part 32) : 1988	Chloride (*first revision*)
(Part 34) : 1988	Nitrogen (*first revision*)
(Part 37) : 1988	Arsenic (*first revision*)
(Part 39) : 1989	Oil and grease
(Part 40) : 1991	Calcium
(Part 41) : 1992	Cadmium (*first revision*)
(Part 42) : 1992	Copper (*first revision*)
(Part 43) : 1992	Phenols (*first revision*)
(Part 46) : 1994	Magnesium
(Part 47) : 1994	Lead
(Part 48) : 1994	Mercury
(Part 49) : 1994	Zinc
(Part 52) : 2003	Chromium
(Part 53) : 2003	Iron
(Part 54) : 2003	Nickel
(Part 55) : 2003	Aluminium
(Part 56) : 2003	Selenium
(Part 57) : 2005	Boron
(Part 59) : 2006	Manganese
(Part 60) : 2008	Fluoride
13428 : 2003	Packaged natural mineral water — Specification (*first revision*)
14194	Radionuclides in environmental samples — Method of estimation:
(Part 1) : 1994	Gross beta activity measurement
(Part 2) : 1994	Gross alpha activity measurement
15302 : 2002	Determination of aluminium and barium in water by direct nitrous oxide-acetylene flame atomic absorption spectrometry
15303 : 2002	Determination of antimony, iron and selenium in water by electrothermal atomic absorption spectrometry

ANNEX B

(*Clause* 4.2.7)

POLYMERASE CHAIN REACTION (PCR) METHOD

B-1 GENERAL

The method involves the concentration of viruses from 100 litre of drinking water to 1 ml by membrane filter technique. The concentrate is subjected to amplification using polymerase chain reaction (PCR) and primers based on highly conserved regions of viral genomes. This method can detect as low as 10 genome copies. Stringent precautions are needed to avoid contamination with amplified DNA products leading to false positive reactions. Detection of hepatitis A virus (HAV) RNA and enterovirus (EV) RNA is considered as an indication of presence of viruses in water. Steps involved include concentration of water, RNA extraction, complementary DNA (cDNA) synthesis and PCR.

B-2 CONCENTRATION OF DRINKING WATER

B-2.1 Apparatus

B-2.1.1 *Pressure Pump*

B-2.1.2 *Membrane Filter Assembly with 144 mm Diameter with Tripod Stand*

B-2.1.3 *Pressure Vessel (50 litre capacity) with Pressure Gauge*

B-2.1.4 *Inter-connecting Pressure Tubes*

B-2.2 Reagents

Autoclaved double distilled water shall be used for the preparation of reagents/buffers in this study.

B-2.2.1 *Aluminium Chloride*

B-2.2.2 *HCl/NaOH Urea (Extra Pure)*

B-2.2.3 *Disodium Hydrogen Phosphate* ($Na_2HPO_4.2H_2O$) — 0.2 M, filter sterilized.

B-2.2.4 *Sodium Dihydrogen Phosphate* ($NaH_2PO_4.2H_2O$) — 0.2 M, filter sterilized.

B-2.2.5 *Citric Acid* — 0.1 M, filter sterilized.

B-2.2.6 *L-Arginine* — 0.5 M, filter sterilized.

B-2.2.7 *Urea-Arginine Phosphate Buffer* (*U-APB*) — Mix 4.5 g of urea with 2 ml of 0.2 M NaH_2PO_4 and 2 ml of 0.5 M L - Arginine and make up the volume to 50 ml with sterile distilled water. The *p*H of the eluent shall be 9.0.

B-2.2.8 *Magnesium Chloride* ($MgCl_2$) — 1 M.

B-2.2.9 *McII Vaines Buffer* (*p*H *5.0*) — Mix 9.7 ml of 0.1 M citric acid with 10.3 ml of 0.2 M $Na_2HPO_4.2H_2O$ under sterile conditions.

B-2.3 Procedure

Filter 100 litre of drinking water sample through membrane filter assembly using either positively charged membrane of 144 mm diameter or 0.22 micron diameter pore size nitrocellulose membrane. For positively charged membrane the test water *p*H need not be adjusted. But for the 0.22 micron nitrocellulose membrane adjust the *p*H to 3.5 after adding the aluminium chloride as a coagulant to a final concentration of 0.000 5 M.

At lower *p*H pass the water through the membrane. The flow rate shall be 40 litre/h approximately. After the completion of the filtration, elute the adsorbed particles using 100 ml of urea-arginine phosphate buffer (U-APB). Precipitate the suspended particles using 1 ml of magnesium chloride (1 M). Dissolve the resultant precipitate centrifuged out of the sample in 800-1.0 ml of McII vaines buffer. The processed sample can be stored at refrigerator until required.

B-3 RNA EXTRACTION

B-3.1 Apparatus

B-3.1.1 *Cooling Centrifuge*

B-3.1.2 *Deep Freezer (–20°C)*

B-3.1.3 *Vortex Mixer*

B-3.1.4 *Pipette Man*

B-3.2 Reagents

B-3.2.1 *Cetyl Trimethyl Ammonium Bromide (CTAB) Buffer*

CTAB	:	1 percent
Sodium Dodecyl Sulphate (SDS)	:	1 percent
EDTA	:	20 mM
Sodium Chloride	:	1 M

B-3.2.2 *Phenol, Chloroform and Isoamylalcohol in the ratio of 25:24:1 (PCI)*

B-3.2.3 *Ethanol*

B-3.2.4 *TE Buffer (p*H *8.0)*

Tris base	:	1 M
EDTA	:	0.5 M

B-3.2.5 *Sodium Acetate* — 3 M.

B-3.3 Procedure

Treat 300 µl of concentrated water sample with equal volume of CTAB and 1/10th volume of PCI. Vortex and centrifuge at 5 000 × g for 30 min at 4°C. Add 1/10th volume of 3 M sodium acetate and double the volume of cold ethanol to the aqueous layer. Keep the mixture at either at –20°C for overnight or in liquid nitrogen for 2-5 min. Centrifuge at 10 000 × g, for 30 min at 4°C. Discard the supernatant and air dry the pellet and dissolve it in 20 µl TE buffer.

B-4 COMPLEMENTARY DNA (c DNA) SYNTHESIS

B-4.1 Apparatus

B-4.1.1 *PCR Machine*

B-4.1.2 *Deep Freezer (–20°C)*

B-4.2 Reagents

B-4.2.1 *cDNA Synthesis Kit*

B-4.3 Procedure

Suspend the extracted RNA in 20 µl of cDNA reaction mixture, which consists of 4 µl of 5X reverse transcriptase reaction buffer [250 mM TRIS–HCl (*p*H 8.5), 40 mM KCl, 150 mM $MgCl_2$, 5 mM dithiothreitol (DTT)], 0.5 µl of 10 mM deoxynucleotide phosphate (dNTP), 2 µl of hexa nucleotide mixture, 1 µl of 25 U of Maloney Murine Leukaemia Virus (M-MuLV) reverse transcriptase, 0.5 µl of 20 U of human placental RNase inhibitor. Heat the reaction mixture to 95°C for 5 min and rapidly chill on ice, this is followed by the addition of 1 µl (25 U/µl) of M-MuLV reverse transcriptase. Incubate the reaction mixture as given by the manufacturer of the kit and quickly chill the reaction tube on ice.

B-5 PCR AMPLIFICATION

B-5.1 Apparatus

B-5.1.1 *PCR Machine*

B-5.1.2 *Deep Freezer (–20°C)*

B-5.1.3 *Micropippette*

B-5.2 Reagents

B-5.2.1 *Primers for EV and HAV*

EV sense primer, 5' — TCC TCC GGC CCC TGA ATG CG — 3'

antisense primer, 5' — ATT GTC ACC ATA AGC AGC CA — 3'

HAV sense primer, 5' — GTTTT GCTCC TCTTT ATCAT GCTAT G-3'

antisense primer, 5' — GGAAA TGTCT CAGGT ACTTT CTTTG-3'

B-5.2.2 *PCR Master Mix*

B-5.2.3 *Mineral Oil*

B-5.3 Procedure

B-5.3.1 *PCR Amplification for Hepatitis A Virus (HAV)*

In 5 µl of cDNA, add 95 µl of a PCR Master Mix (10 mM TRIS–HCl (*p*H 8.3), 50 mM KCl, 2.5 mM $MgCl_2$, 0.01 percent gelatin (1× PCR buffer), 200 µM of each dNTP, 1.5 U of *Thermus aquaticus* polymerase). Add 25 pico moles of sense and antisense oligonucleotide primers of HAV and overlay with mineral oil. Appropriate positive and negative controls shall be included with each run. Set the following reaction at thermo cycler:

Denaturation at 94°C for 2 min

Denaturation for	1.0 min	at 94°C	} 35 cycles
Annealing for	1.0 min	at 57°C	
Extension for	1.3 min	at 72°C	

Final extension at 72°C for 7 min.

B-5.3.2 *PCR Amplification for Enterovirus (EV)*

In 5 µl of cDNA, add 95 µl of a PCR Master Mix (10 mM TRIS–HCl (*p*H 8.3), 50 mM KCl, 2.5 mM $MgCl_2$, 0.01 percent gelatin (1X PCR buffer), 200 µM of each dNTP, 1.5 U of *Thermus aquaticus* polymerase). Add 25 pico moles of sense and antisense oligonucleotide primers of EV and overlay with mineral oil. Appropriate positive and negative controls shall be included with each run. Set the following reaction at thermo cycler:

Denaturation at 94°C for 2 min

Denaturation for	1.0 min	at 94°C	} 35 cycles
Annealing for	1.0 min	at 42°C	
Extension for	2.0 min	at 72°C	

Final extension at 72°C for 7 min.

B-6 AGAROSE GEL ELECTROPHORESIS

B-6.1 Apparatus

B-6.1.1 *Micropippette*

B-6.1.2 *Electrophoresis Apparatus*

B-6.1.3 *Gel Documentation System*

B-6.2 Reagents

B-6.2.1 *Running Buffer* — 50X TAE buffer

Tris base/Tris buffer : 121.00 g

Glacial acetic acid	:	28.55 ml
0.5 M EDTA	:	50 .00 ml
Distilled water (autoclaved)	:	300.45 ml

Make the final volume upto 1 000 ml with deionised distilled water, sterilize and store at 4°C. The final concentration for the preparation of agarose gel and to run the gel shall be 1X.

B-6.2.2 *Tracking Dye* — 6X bromophenol blue.

B-6.2.3 *Ethidium Bromide* — 0.5 µg/ml.

B-6.3 Procedure

Run the PCR amplified product of EV and HAV on 1.5 percent agarose gel using 1X TAE buffer. Load 10 µl of amplified product after mixing it with 1 µl 10X loading dye. Run the molecular weight marker along with the samples. Run the electrophoresis at 100 V for 30 min. Stain the gel with ethidium bromide (0.5 µl/ml) for 20 min. Wash it with distilled water and view under UV transilluminator and photograph the gel to analyse the band pattern. EV gives the band as 155 base pair and the HAV gives band as 225 base pair.

ANNEX C

(*Clause* 4.3.10)

ILLUSTRATIVE LIST OF MICROSCOPIC ORGANISMS PRESENT IN WATER

Sl No. (1)	*Classification of Microscopic Organism* (2)	*Group and Name of the Organism* (3)	*Habitat* (4)	*Effect of the Organisms and Significance* (5)
i)	Algae	a) Chlorophyceae:		
		1) *Species of* Coelastrum, Gomphospherium, Micractinium, Mougeotia, Oocystis, Euastrum, Scenedesmus, Actinastrum, Gonium, Eudorina Pandorina, Pediastrum, Zygnema, Chlamydomonas, Careteria, Chlorella, Chroococcus, Spirogyra, Tetraedron, Chlorogonium, Stigeoclonium	Polluted water, impounded sources	Impart colouration
		2) *Species of* Pandorina, Volvox, Gomphospherium, Staurastrum, Hydrodictyon, Nitella	Polluted waters	Produce taste and odour
		3) *Species of* Rhizoclonium, Cladothrix, Ankistrodesmus, Ulothrix, Micrasterias, Chromulina	Clean water	Indicate clean condition
		4) *Species of* Chlorella, Tribonema, Clostrium, Spirogyra, Palmella	Polluted waters, impounded sources	Clog filters and create impounded difficulties
		b) Cyanophyceae:		
		1) *Species of* Anacystis and Cylindrospermum	Polluted waters	Cause water bloom and impart colour
		2) *Species of* Anabena, Phormidium, Lyngbya, Arthrospira, Oscillatona	Polluted waters	Impart colour
		3) *Species of* Anabena, Anacystis, Aphanizomenon	Polluted waters, impounded sources	Produce taste and odour
		4) *Species of* Anacystis, Anabena, Coelospherium, Cleotrichina, Aphanizomenon	Polluted waters	Toxin producing
		5) *Species of* Anacystis, Rivularia, Oscillatoria, Anabena	Polluted waters	Clog filters

Sl No. (1)	*Classification of Microscopic Organism* (2)	*Group and Name of the Organism* (3)	*Habitat* (4)	*Effect of the Organisms and Significance* (5)
		6) *Species of* Rivularia	Calcareous waters and also rocks	Bores rocks and calcareous strata and causes matted growth
		7) *Species of* Agmenellum, Microcoleus, Lemanea	Clean waters	Indicators of purification
		c) Diatoms (Bacillareophyceae):		
		1) *Species of* Fragillaria, Stephanodiscus, Stauroneis	—	Cause discoloration
		2) *Species of* Asterionella, Tabellaria	Hill streams high altitude, torrential and temperate waters	Taste and odour producing clog filters
		3) *Species of* Synedra and Fragillavia	Polluted waters	Taste and odour producing
		4) *Species of* Nitzchia, Gomphonema	Moderately polluted waters	Cause discoloration
		5) *Species of* Cymbela, Synedra, Melosira, Navicula, Cyclotella, Fragillaria, Diatoma, Pleurogsigma	Rivers and streams impounded sources	Clog filters and cause operational difficulties
		6) *Species of* Pinmularia, Surinella, Cyclotella, Meridion, Cocconeis	Clean waters	Indicators of purification
		d) Xanthophyceae:		
		Species of Botryococcus	Hill streams, high altitude and temperate waters	Produces coloration
ii)	Zooplankton	a) Protozoa:		
		1) Amoeba, Giardia Lamblia Arcella, Difflugia, Actinophrys	Polluted waters	Pollution indicators
		2) Endamoeba, Histolytica	Sewage and activated sludge	Parasitic and pathogenic
		b) Ciliates:		
		Paramoecium, Vorticella, Carchesium, Stentor, Colpidium, Coleps, Euplotes, Colopoda, Bodo	Highly polluted waters, sewage and activated sludge	Bacteria eaters
		c) Crustacea:		
		1) Bosmina, Daphnia	Stagnant polluted waters	Indicators of pollution
		2) Cyclops	Step wells in tropical climate	Carrier host of guinea worm
iii)	Rotifers	a) Rotifers:		
		Anurea, Rotaria, Philodina	Polluted and Algae laden waters	Feed on algae
		b) Flagellates:		
		1) Ceratium, Glenodinium, Peridinium Dinobryon	Rocky strata, iron bearing and acidic waters	Impart colour and fishy taste
		2) Euglena, Phacus	Polluted waters	Impart colour

Sl No.	*Classification of Microscopic Organism*	*Group and Name of the Organism*	*Habitat*	*Effect of the Organisms and Significance*
(1)	(2)	(3)	(4)	(5)
iv)	Miscellaneous Organisms	a) Sponges, Hydra	Fresh water	Clog filters and affect purification systems
		b) Tubifex, Eristalls, Chironomids	Highly polluted waters, sewage and activated sludge and bottom deposits	Clog filters and render water unaesthetic
		c) Plumatella	Polluted waters	Produces biological slimes and causes filter operational difficulties
		c) Dreissena, Asellus	Polluted waters	Harbour pathogenic organisms

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Appendix G
ISI-IS 2296-1982 Surface Water Standards

Tolerance and Classification

As per ISI-IS: 2296-1982, the tolerance limits of parameters are specified as per classified use of water (Table 1,2,3,4,5 below) depending on various uses of water. The following classifications have been adopted in India.

Class of Water

Classification	Type of use
Class A	Drinking water source without conventional treatment but after disinfection
Class B	Outdoor bathing
Class C	Drinking water source with conventional treatment followed by disinfection.
Class D	Fish culture and wild life propagation
Class E	Irrigation, industrial cooling or controlled waste disposal

TOLERANCE LIMITS

TABLE-1: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – A

S. No.	Characteristic	Tolerance
(1)	(2)	(3)
(i)	pH	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/l,	6.0
(iii)	Bio-chemical Oxygen Demand	2.0
(iv)	Total Coliform Organisms, MPN/100 ml, Max	50
(v)	Colour, Hazen units, Max	10
(vi)	Odour	unobjectionable
(vii)	Taste	Agreeable taste
(viii)	Total Dissolved Solids, mg/l, Max	500
(ix)	Total Hardness (as $CaCO_3$), mg/l ,Max	300
(x)	Calcium Hardness (as $CaCO_3$), mg/l, Max	200
(xi)	Magnesium (as $CaCO_3$), mg/1,Max	100
(xii)	Copper (as Cu), mg/l, Max	1.5
(xiii)	Iron (as Fe), mg/l,Max	0.3
(xiv)	Manganese (as Mn), mg/1,Max	0.5
(xv)	Chlorides (as Cl), mg/l,Max	250
(xvi)	Sulphate (as SO_4), mg/l ,Max	400
(xvii)	Nitrates (as NO_2), mg/1,Max	20
(xviii)	Fluorides (as F,) mg/l,Max	1.5
(xix)	Phenolic compounds(as C_6H_5OH), mg/l,Max	0.002
(xx)	Mercury (as Hg), mg/l ,Max	0.001
(xxi)	Cadmium (as Cd), mg/1,Max	0.01
(xxii)	Selenium (as Se), mg/l ,Max	0.01
(xxiii)	Arsenic (as As), mg/1,Max	0.05
(xxiv)	Cyanides (as CN), mg/l, Max	0.05
(xxv)	Lead (as Pb), mg/l, Max	0.1
(xxvi)	Zinc (as Zn), mg/l, Max	15
(xxvii)	Chromium (asCr^{6+}), mg/l,Max	0.05
(xxviii)	Anionic detergents, (as MBAS), mg/l ,Max .	0.2
(xxix)	Poly-nuclear aromatic hydrocarbons (PAH),	0.2
(xxx)	Mineral oil, mg/l ,Max	0.01
(xxxi)	Barium (as Ba), mg/l ,Max	1.0
(xxxii)	Silver (as Ag), mg/l Max	0.05
(xxxiii)	Pesticides	Absent
(xxxiv)	Alpha emitters, µc/ml, Max	10^{-9}
(xxxv)	Beta emitters, µc/ml, Max	10^{-8}

TABLE- 2: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – B

S. No.	Characteristic	Tolerance Limit
(1)	(2)	(3)
(i)	pH Value	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/1,Max	5.0
(iii)	Biochemical Oxygen Demand (5 days at 20 °C), Max	3.0
(iv)	Total Coliform Organisms, MPN/100 ml, Max	500
(v)	Fluorides (as F)<mg/l, Max	1.5
(vi)	Colour, Hazen units, Max	300
(vii)	Cyanides (as CN), mg/l, Max	0.05
(viii)	Arsenic (as As), mg/l, Max	0.2
(ix)	Phenolic Compounds (as C_6H_5OH) mg/l, Max	0.005
(x)	Chromium (as Cr^{6+}), mg/l, Max	1.0
(xi)	Anionic detergents (as MBAS), mg/l, Max	1.0
(xii)	Alpha emitters, µc/ml, Max	10^{-8}

TABLE - 3: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – C

S.No.	Characteristic	Tolerance Limit
(1)	(2)	(3)
(i)	pH Value	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/l Minimum	4.0
(iii)	Biochemical Oxygen Demand	3.0
(iv)	Total coliform organisms, MPN/100 ml, Max	5000
(v)	Colour, Hazen units, Max	300
(vi)	Fluorides (as F), mg/l ,Max	1.5
(vii)	Cadmium (as Cd), mg/l, Max	0.01
(viii)	Chlorides (as Cl), mg/l, Max	600
(ix)	Chromium (as Cr^{6+}), mg/l, Max	0.05
(x)	Cyanides (as CN), mg/l, Max	0.05
(xi)	Total Dissolved Solids, mg/l, Max	1500
(xii)	Selenium (as Se), mg/l, Max	0.05
(xiii)	Sulphates (as SO_4), mg/l, Max	400
(xiv)	Lead (as Pb), mg/l, Max	0.1
(xv)	Copper (as Cu),mg/l,Max	1.5
(xvi)	Arsenic (as As), mg/l, Max	0.2
(xvii)	Iron (as Fe), mg/l, Max	50
(xviii)	Phenolic compounds (as C_6H_5OH), mg/l, Max	0.005
(xix)	Zinc (as Zn), mg/l, Max	15
(xx)	Insecticides, mg/l, Max	Absent
(xxi)	Anionic detergents (as MBAS), mg/l, Max	1.0
(xxii)	Oils and grease, mg/l, Max	0.1
(xxiii)	Nitrates (as NO_3), mg/1,Max	50
(xxiv)	Alpha emititers, µc/mg, Max	10^{-9}
(xxv)	Beta emitters, µc/ml, Max	10^{-8}

TABLE- 4: TEOLERANCE LIMITS FOR INLAND SURFACE WATERS, CALSS – D

S.No.	Characteristic	Tolerance Limit
(1)	**(2)**	**(3)**
(i)	pH value	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/l, Min.	4.0
(iii)	Free Ammonia (as N), mg/l, Max.	1.2
(iv)	Electrical Conductance at 25 °C, µS, Max	1000
(v)	Free Carbon Dioxide (as $C0_2$),mg/1, Max	6.0
(vi)	Oils and Grease, mg/l, Max	0.1
(vii)	Alpha emitters, µc/ml, Max	10^{-9}
(viii)	Beta emitters, µc/ml, Max	10^{-8}

TABLE- 5: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – E

S.No.	Characteristic	Tolerance Limit
(1)	**(2)**	**(3)**
(i)	pH value	6.0 to 8.5
(ii)	Electrical Conductance at 25°C, µS, Max	2250
(iii)	Sodium Adsorption Ratio, Max	26
(iv)	Boron (as B), mg/l, Max	2.0
(v)	Total Dissolved Solids, (inorganic), mg/l, Max	2100
(vi)	Sulphates (as SO_4), mg/l, Max	1000
(vii)	Chlorides (as Cl), Mg/l, Max	600
(viii)	Sodium Percentage, Max	60
(ix)	Alpha emitters, µc/ml, Max	10^{-9}
(x)	Beta emitters, µc/ml, Max	10^{-8}

Appendix H
National Ambient Air Quality Standards (NAAQS)

THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000

(The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.)

Whereas the increasing ambient noise levels in public places from various sources, inter-alia, industrial activity, construction activity, fire crackers, sound producing instruments, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices have deleterious effects on human health and the psychological well being of the people; it is considered necessary to regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise;

Whereas a draft of Noise Pollution (Control and Regulation) Rules, 1999 was published under the notification of the Government of India in the Ministry of Environment and Forests vide number S.O. 528 (E), dated the 28th June, 1999 inviting objections and suggestions from all the persons likely to be affected thereby, before the expiry of the period of sixty days from the date on which the copies of the Gazette containing the said notification are made available to the public;

And whereas copies of the said Gazette were made available to the public on the 1st day of July, 1999;

And whereas the objections and suggestions received from the public in respect of the said draft rules have been duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by clause (ii) of sub-section (2) of section 3, sub-section (1) and clause (b) of sub-section (2) of section 6 and section 25 of the Environment (Protection) Act, 1986 (29 of 1986) read with rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following rules for the regulation and control of noise producing and generating sources, namely:-

The Noise Pollution (Regulation and Control) Rules, 2000

1. Short-title and commencement.-

(1) These rules may be called the 'Noise Pollution (Regulation and Control) Rules, 2000.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. **Definitions-** In these rules, unless the context otherwise requires,-

(a) "Act" means the Environment (Protection) Act, 1986 (29 of 1986);

(b) "area / zone" means all areas which fall in either of the four categories given in the Schedule annexed to these rules;

(c) "authority" means and includes any authority or officer authorized by the Central Government, or as the case may be, the State Government in accordance with the laws in force and includes a District Magistrate, Police Commissioner, or any other officer not below the rank of the Deputy Superintendent of Police designated for the maintenance of the ambient air quality standards in respect of noise under any law for the time being in force;

(d) "court" means a governmental body consisting of one or more judges who sit to adjudicate disputes and administer justice and includes any court of law presided over by a judge, judges or a magistrate and acting as a tribunal in civil, taxation and criminal cases;

(e) "educational institution" means a school, seminary, college, university, professional academies, training institutes or other educational establishment, not necessarily a chartered institution and includes not only buildings, but also all grounds necessary for the accomplishment of the full scope of educational instruction, including those things essential to mental, moral and physical development;

(f) "hospital" means an institution for the reception and care of sick, wounded, infirm or aged persons, and includes government or private hospitals, nursing homes and clinics;

(g) "person" shall include any company or association or body of individuals, whether incorporated or not;

(h) "State Government" in relation to a Union territory means the Administrator thereof appointed under article 239 of the Constitution.

(i) "public place" means any place to which the public have access, whether as of right or not, and includes auditorium, hotels, public waiting rooms, convention centres, public offices, shopping malls, cinema halls, educational institutions, libraries, open grounds and the like which are visited by general public; and

(j) "night time" means the period between 10.00 p.m. and 6.00 a.m.

3. Ambient air quality standards in respect of noise for different areas/zones.-

(1) The ambient air quality standards in respect of noise for different areas / zones shall be such as specified in the Schedule annexed to these rules.

(2) The State Government shall categorize the areas into industrial, commercial, residential or silence areas / zones for the purpose of implementation of noise standards for different areas.

(3) The State Government shall take measures for abatement of noise including noise emanating from vehicular movements, blowing of horns, bursting of sound emitting firecrackers, use of loud speakers or public address system and sound producing instruments and ensure that the existing noise levels do not exceed the ambient air quality standards specified under these rules.

(4) All development authorities, local bodies and other concerned authorities while planning developmental activity or carrying out functions relating to town and country planning shall take into consideration all aspects of noise pollution as a parameter of quality of life to avoid noise menace and to achieve the objective of maintaining the ambient air quality standards in respect of noise.

(5) An area comprising not less than 100 metres around hospitals, educational institutions and courts may be declared as silence area / zone for the purpose of these rules.

4. Responsibility as to enforcement of noise pollution control measures.-

(1) The noise levels in any area / zone shall not exceed the ambient air quality standards in respect of noise as specified in the Schedule.

(2) The authority shall be responsible for the enforcement of noise pollution control measures and the due compliance of the ambient air quality standards in respect of noise.

(3) The respective State Pollution Control Boards or Pollution Control Committees in consultation with the Central Pollution Control Board shall collect, compile and publish technical and statistical data relating to noise pollution and measures devised for its effective prevention, control and abatement.

5. <u>Restrictions on the use of loud speakers / public address system and sound producing instruments.-</u>

(1) A loud speaker or a public address system shall not be used except after obtaining written permission from the authority.

(2) A loud speaker or a public address system or any sound producing instrument or a musical instrument or a sound amplifier shall not be used at night time except in closed premises for communication within, like auditoria, conference rooms, community halls, banquet halls or during a public emergency.

(3) Notwithstanding any thing contained in sub-rule (2), the State Government may subject to such terms and conditions as are necessary to reduce noise pollution, permit use of loud speakers or public address system and the like during night hours (between 10.00 p.m. to 12.00 midnight) on or during any cultural or religious festive occasion of a limited duration not exceeding fifteen days in all during a calendar year. The concerned State Government shall generally specify in advance, the number and particulars of the days on which such exemption would be operative.

(4) The noise level at the boundary of the public place, where loudspeaker or public address system or any other noise source is being used shall not exceed 10 dB (A) above the ambient noise standards for the area or 75 dB (A) whichever is lower;

(5) The peripheral noise level of a privately owned sound system or a sound producing instrument shall not, at the boundary of the private place, exceed by more than 5 dB (A) the ambient noise standards specified for the area in which it is used.

5A. <u>Restrictions on the use of horns, sound emitting construction equipments and bursting of fire crackers</u>:-

(1**)** No horn shall be used in silence zones or during night time in residential areas except during a public emergency**.**

(2) Sound emitting fire crackers shall not be burst in silence zone or during night time.

(3) Sound emitting construction equipments shall not be used or operated during night time in residential areas and silence zones.

6. Consequences of any violation in silence zone / area.-

Whoever, in any place covered under the silence zone / area commits any of the following offence, he shall be liable for penalty under the provisions of the Act:-

(i) whoever, plays any music or uses any sound amplifiers,

(ii) whoever, beats a drum or tom-tom or blows a horn either musical or pressure, or trumpet or beats or sounds any instrument, or

(iii) whoever, exhibits any mimetic, musical or other performances of a nature to attract crowds.

(iv) whoever, bursts sound emitting fire crackers; or

(v) whoever, uses a loud speaker or a public address system.

7. Complaints to be made to the authority.-

(1) A person may, if the noise level exceeds the ambient noise standards by 10 dB (A) or more given in the corresponding columns against any area / zone or, if there is a violation of any provision of these rules regarding restrictions imposed during night time, make a complaint to the authority.

(2) The authority shall act on the complaint and take action against the violator in accordance with the provisions of these rules and any other law in force.

8 Power to prohibit etc. continuance of music sound or noise.-

(1) If the authority is satisfied from the report of an officer incharge of a police station or other information received by him including from the complainant that it is necessary to do so in order to prevent annoyance, disturbance, discomfort or injury or risk of annoyance, disturbance, discomfort or injury to the public or to any person who dwell or occupy property on the vicinity, he may, by a written order issue such directions as he may consider necessary to any person for preventing, prohibiting, controlling or regulating:-

(a) the incidence or continuance in or upon any premises of-

(i) any vocal or instrumental music,

(ii) sounds caused by playing, beating, clashing, blowing or use in any manner whatsoever of any instrument including loudspeakers, public address systems, horn, construction

equipment, appliance or apparatus or contrivance which is capable of producing or re-producing sound, or

(iii) sound caused by bursting of sound emitting fire crackers, or,

(b) the carrying on in or upon, any premises of any trade, avocation or operation or process resulting in or attended with noise.

(2) The authority empowered under sub-rule (1) may, either on its own motion, or on the application of any person aggrieved by an order made under sub-rule (1), either rescind, modify or alter any such order:

Provided that before any such application is disposed of, the said authority shall afford to the applicant and to the original complainant, as the case may be, an opportunity of appearing before it either in person or by a person representing him and showing cause against the order and shall, if it rejects any such application either wholly or in part, record its reasons for such rejection.

SCHEDULE

(see rule 3(1) and 4(1))

Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note:- 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A “decibel” is a unit in which noise is measured.

“A”, in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

Appendix I
National Ambient Noise Standards

THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000

(The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.)

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Whereas a draft of Noise Pollution (Control and Regulation) Rules, 1999 was published under the notification of the Government of India in the Ministry of Environment and Forests vide number S.O. 528 (E), dated the 28th June, 1999 inviting objections and suggestions from all the persons likely to be affected thereby, before the expiry of the period of sixty days from the date on which the copies of the Gazette containing the said notification are made available to the public;

And whereas copies of the said Gazette were made available to the public on the 1st day of July, 1999;

And whereas the objections and suggestions received from the public in respect of the said draft rules have been duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by clause (ii) of sub-section (2) of section 3, sub-section (1) and clause (b) of sub-section (2) of section 6 and section 25 of the Environment (Protection) Act, 1986 (29 of 1986) read with rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following rules for the regulation and control of noise producing and generating sources, namely:-

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(2) They shall come into force on the date of their publication in the Official Gazette.

2. **Definitions-** In these rules, unless the context otherwise requires,-

(a) "Act" means the Environment (Protection) Act, 1986 (29 of 1986);

(b) "area / zone" means all areas which fall in either of the four categories given in the Schedule annexed to these rules;

(c) "authority" means and includes any authority or officer authorized by the Central Government, or as the case may be, the State Government in accordance with the laws in force and includes a District Magistrate, Police Commissioner, or any other officer not below the rank of the Deputy Superintendent of Police designated for the maintenance of the ambient air quality standards in respect of noise under any law for the time being in force;

(d) "court" means a governmental body consisting of one or more judges who sit to adjudicate disputes and administer justice and includes any court of law presided over by a judge, judges or a magistrate and acting as a tribunal in civil, taxation and criminal cases;

(e) "educational institution" means a school, seminary, college, university, professional academies, training institutes or other educational establishment, not necessarily a chartered institution and includes not only buildings, but also all grounds necessary for the accomplishment of the full scope of educational instruction, including those things essential to mental, moral and physical development;

(f) "hospital" means an institution for the reception and care of sick, wounded, infirm or aged persons, and includes government or private hospitals, nursing homes and clinics;

(g) "person" shall include any company or association or body of individuals, whether incorporated or not;

(h) "State Government" in relation to a Union territory means the Administrator thereof appointed under article 239 of the Constitution.

(i) "public place" means any place to which the public have access, whether as of right or not, and includes auditorium, hotels, public waiting rooms, convention centres, public offices, shopping malls, cinema halls, educational institutions, libraries, open grounds and the like which are visited by general public; and

(j) "night time" means the period between 10.00 p.m. and 6.00 a.m.

3. Ambient air quality standards in respect of noise for different areas/zones.-

(1) The ambient air quality standards in respect of noise for different areas / zones shall be such as specified in the Schedule annexed to these rules.

(2) The State Government shall categorize the areas into industrial, commercial, residential or silence areas / zones for the purpose of implementation of noise standards for different areas.

(3) The State Government shall take measures for abatement of noise including noise emanating from vehicular movements, blowing of horns, bursting of sound emitting firecrackers, use of loud speakers or public address system and sound producing instruments and ensure that the existing noise levels do not exceed the ambient air quality standards specified under these rules.

(4) All development authorities, local bodies and other concerned authorities while planning developmental activity or carrying out functions relating to town and country planning shall take into consideration all aspects of noise pollution as a parameter of quality of life to avoid noise menace and to achieve the objective of maintaining the ambient air quality standards in respect of noise.

(5) An area comprising not less than 100 metres around hospitals, educational institutions and courts may be declared as silence area / zone for the purpose of these rules.

4. Responsibility as to enforcement of noise pollution control measures.-

(1) The noise levels in any area / zone shall not exceed the ambient air quality standards in respect of noise as specified in the Schedule.

(2) The authority shall be responsible for the enforcement of noise pollution control measures and the due compliance of the ambient air quality standards in respect of noise.

(3) The respective State Pollution Control Boards or Pollution Control Committees in consultation with the Central Pollution Control Board shall collect, compile and publish technical and statistical data relating to noise pollution and measures devised for its effective prevention, control and abatement.

5. <u>Restrictions on the use of loud speakers / public address system and sound producing instruments.-</u>

(1) A loud speaker or a public address system shall not be used except after obtaining written permission from the authority.

(2) A loud speaker or a public address system or any sound producing instrument or a musical instrument or a sound amplifier shall not be used at night time except in closed premises for communication within, like auditoria, conference rooms, community halls, banquet halls or during a public emergency.

(3) Notwithstanding any thing contained in sub-rule (2), the State Government may subject to such terms and conditions as are necessary to reduce noise pollution, permit use of loud speakers or public address system and the like during night hours (between 10.00 p.m. to 12.00 midnight) on or during any cultural or religious festive occasion of a limited duration not exceeding fifteen days in all during a calendar year. The concerned State Government shall generally specify in advance, the number and particulars of the days on which such exemption would be operative.

(4) The noise level at the boundary of the public place, where loudspeaker or public address system or any other noise source is being used shall not exceed 10 dB (A) above the ambient noise standards for the area or 75 dB (A) whichever is lower;

(5) The peripheral noise level of a privately owned sound system or a sound producing instrument shall not, at the boundary of the private place, exceed by more than 5 dB (A) the ambient noise standards specified for the area in which it is used.

5A. <u>Restrictions on the use of horns, sound emitting construction equipments and bursting of fire crackers</u>:-

(1**)** No horn shall be used in silence zones or during night time in residential areas except during a public emergency**.**

(2) Sound emitting fire crackers shall not be burst in silence zone or during night time.

(3) Sound emitting construction equipments shall not be used or operated during night time in residential areas and silence zones.

6. Consequences of any violation in silence zone / area.-

Whoever, in any place covered under the silence zone / area commits any of the following offence, he shall be liable for penalty under the provisions of the Act:-

(i) whoever, plays any music or uses any sound amplifiers,

(ii) whoever, beats a drum or tom-tom or blows a horn either musical or pressure, or trumpet or beats or sounds any instrument, or

(iii) whoever, exhibits any mimetic, musical or other performances of a nature to attract crowds.

(iv) whoever, bursts sound emitting fire crackers; or

(v) whoever, uses a loud speaker or a public address system.

7. Complaints to be made to the authority.-

(1) A person may, if the noise level exceeds the ambient noise standards by 10 dB (A) or more given in the corresponding columns against any area / zone or, if there is a violation of any provision of these rules regarding restrictions imposed during night time, make a complaint to the authority.

(2) The authority shall act on the complaint and take action against the violator in accordance with the provisions of these rules and any other law in force.

8 Power to prohibit etc. continuance of music sound or noise.-

(1) If the authority is satisfied from the report of an officer incharge of a police station or other information received by him including from the complainant that it is necessary to do so in order to prevent annoyance, disturbance, discomfort or injury or risk of annoyance, disturbance, discomfort or injury to the public or to any person who dwell or occupy property on the vicinity, he may, by a written order issue such directions as he may consider necessary to any person for preventing, prohibiting, controlling or regulating:-

(a) the incidence or continuance in or upon any premises of-

(i) any vocal or instrumental music,

(ii) sounds caused by playing, beating, clashing, blowing or use in any manner whatsoever of any instrument including loudspeakers, public address systems, horn, construction

equipment, appliance or apparatus or contrivance which is capable of producing or re-producing sound, or

(iii) sound caused by bursting of sound emitting fire crackers, or,

(b) the carrying on in or upon, any premises of any trade, avocation or operation or process resulting in or attended with noise.

(2) The authority empowered under sub-rule (1) may, either on its own motion, or on the application of any person aggrieved by an order made under sub-rule (1), either rescind, modify or alter any such order:

Provided that before any such application is disposed of, the said authority shall afford to the applicant and to the original complainant, as the case may be, an opportunity of appearing before it either in person or by a person representing him and showing cause against the order and shall, if it rejects any such application either wholly or in part, record its reasons for such rejection.

SCHEDULE

(see rule 3(1) and 4(1))

Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note:- 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A “decibel” is a unit in which noise is measured.

“A”, in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

Appendix J

Primary Water Quality Standards for Harbour Water

Primary Water Quality Criteria for Class SW-IV Waters (For Harbor waters)			
S.No	Parameter	Standards	Rationale/Remarks
1	pH range	6.0-9.0	To minimize corrosive and scaling effect
2	Dissolved oxygen	3.0mg/l or 40% saturation value whichever is higher	Considering the biodegradation of oil and inhibition tooxygen production through photosynthesis
3	Colour and odour	No visible colour or offensive odour	None from reactive chemicals which corrode paints/metallic surfaces
4	Floating materials,	10mg/l oil, grease and scum (including petroleum products)	Floating matter should be free from excessive living organisms which may clog or coat operative parts of marine vessels/equipment
5	Fecal coliform	500/100 ml (MPN)	Not exceeding 1000/100ml in 20% of samples in the year and in 3 consecutive samples in monsoon months
6	Biochemical oxygen demand (BOD) (3 days at 27°C)	5mg/l decomposable wastes	To maintain water reactively free from pollution caused by sewage and other

Appendix K
STP outlet standards

REGD. NO. D. L.-33004/99

भारत का राजपत्र
The Gazette of India

EXTRAORDINARY
II— — (i)
PART II—Section 3—Sub-section (i)

PUBLISHED BY AUTHORITY

843]
No. 843] NEW DELHI, FRIDAY, OCTOBER 13, 2017/ASVINA 21, 1939

पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

अधिसूचना

नई दिल्ली, 13 , 2017

सा.का.नि. 1265(अ).—केन्द्रीय सरकार, पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 6 और धारा 25 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, पर्यावरण (संरक्षण) नियम, 1986 का और संशोधन करने के लिए निम्नलिखित नियम बनाती है, अर्थात् : —

1. **संक्षिप्त नाम और प्रारम्भ :—**(1) इन नियमों का संक्षिप्त नाम पर्यावरण (संरक्षण) संशोधन नियम, 2017 है ।

(2) ये राजपत्र में उनके प्रकाशन की तारीख को प्रवृत्त होंगे ।

2. पर्यावरण (संरक्षण) नियम, 1986 की अनुसूची-1 में, क्रम संख्यांक 104 और उससे सम्बन्धित प्रविष्टियों के पश्चात्, निम्नलिखित क्रम संख्यांक और प्रविष्टियां अन्तःस्थापित की जाएगी, अर्थात् :—

क्र. सं.	उद्योग	मानदंड	मानक	
1	2	3	4	
		बहिर्स्राव निस्सारण मानक (निपटान के सभी ढंगों को लागू)		
"105	मल उपचार संयंत्र (एसटीपी)		अवस्थान	सांद्र का निम्नलिखित से अधिक न होना
			(क)	(ख)
		पीएच	देश में कहीं भी	6.5-9.0
		जैव-रासायनिक ऑक्सीजन मांग (बीओडी)	महानगर* अरूणाचल प्रदेश, असम, मणिपुर, मेघालय, मिजोरम, नागालैण्ड, त्रिपुरा, सिक्किम, हिमाचल प्रदेश, उत्तराखंड, जम्मू-कश्मीर राज्यों और	

			अंदमान और निकोबार द्वीप, दादरा और नागर हवेली, दमण और दीव और लक्षद्वीप के सिवाय, सभी राज्यों की राजधानी ।	
			ऊपर उल्लिखित से भिन्न क्षेत्र/प्रदेश	30
		कुल निलंबित ठोस पदार्थ (टीएसएस)	महानगर* अरूणाचल प्रदेश, असम, मणिपुर, मेघालय, मिजोरम, नागालैण्ड, त्रिपुरा, सिक्किम, हिमाचल प्रदेश, उत्तराखंड, जम्मू-कश्मीर राज्यों और अंदमान और निकोबार द्वीप, दादरा और नागर हवेली, दमण और दीव और लक्षद्वीप के सिवाय, सभी राज्यों की राजधानी ।	<50
			ऊपर उल्लिखित से भिन्न क्षेत्र/प्रदेश	<100
		फेकल कोलीफॉर्म (एफसी) (अतिसंभाव्य संख्या प्रति 100 मिलीलिटर एमपीएन/100 मिलीलिटर	देश में कहीं भी	<1000

*मुम्बई, दिल्ली, कोलकाता, चेन्नई, बेंगलूरू, हैदराबाद, अहमदाबाद और पुणे महानगर हैं ।

टिप्पण :

(i) पीएच और फैकल कौलीफॉर्म के सिवाय, मिलीग्राम/लिटर में सभी मूल्य ।

(ii) ये, मानक जलाशयों में निस्सारण और भूमि निपटान/अनुप्रयोगों के लिए लागू होंगे ।

(iii) फैकल कौलीफॉर्म के लिए मानक औद्योगिक प्रयोजनों के लिए उपचारित बहिर्स्राव के उपयोग के सम्बन्ध में लागू नहीं होंगे ।

(iv) ये मानक 1 जून, 2019 को या उसके पश्चात् कमीशन किए जाने वाले सभी मल उपचार संयंत्रों (एसटीपी) को लागू होंगे और पुराने/विद्यमान मल उपचार संयंत्र (एसटीपी) राजपत्र में इस अधिसूचना के प्रकाशन की तारीख से पांच वर्ष की अवधि के भीतर इन मानकों को प्राप्त करेंगे ।

(v) समुद्र में उपचारित बहिर्स्राव के निस्सारण के मामले में, इसे उचित समुद्री मुहाने के माध्यम से किया जाएगा और विद्यमान तट निस्सारण को समुद्री मुहानों में संपरिवर्तित किया जाएगा और उन मामलों में, जहां समुद्री मुहाना निस्सारण के बिन्दु पर 150 गुणा न्यूनतम आरम्भिक तनुकरण और निस्सारण बिन्दु से दूर 100 मीटर के किसी बिन्दु पर 1500 गुणा न्यूनतम तनुकरण प्रदान करता है, तब विद्यमान सन्नियम साधारण निस्सारण मानकों में विनिर्दिष्ट किए गए अनुसार लागू होंगे ।

(vi) उपचारित बहिर्स्राव का पुनःउपयोग/पुनःचक्रण तथा उन मामलों में, जहां उपचारित बहिर्स्राव के भाग का पुनःउपयोग और पुनःचक्रण किया जाता है जिसमें मानवीय सम्पर्क की सम्भावना अन्तर्वलित है, ऊपर यथा विनिर्दिष्ट मानक लागू होंगे ।

(vii) केन्द्रीय प्रदूषण नियंत्रण बोर्ड/राज्य प्रदूषण नियंत्रण बोर्ड/प्रदूषण नियंत्रण समितियां, पर्यावरण (संरक्षण) अधिनियम, 1986 की धारा 5 के अधीन स्थानीय परिवेश को ध्यान में रखते हुए, अधिक कठोर सन्नियम जारी कर सकेगा/कर सकेंगी ।

[फा. सं. क्यू-15017/2/2008/-सीपीडब्ल्यू]

अरुण कुमार मेहता, अपर सचिव

टिप्पण : मूल नियम भारत के राजपत्र, असाधारण, भाग II, खंड 3, उप-खंड (i) में का.आ. सं. 844(अ), तारीख 19 नवम्बर, 1986 द्वारा प्रकाशित किए गए थे और तत्पश्चात् उनमें निम्नलिखित अधिसूचनाओं द्वारा संशोधन किए गए थे, अर्थात् :— का.आ. 433(अ), तारीख 18 अप्रैल, 1987; सा.का.नि. 176(अ), तारीख 2 अप्रैल, 1996; सा.का.नि. 97(अ), तारीख 18 फरवरी, 2009; सा.का.नि. 149(अ), तारीख 4 मार्च, 2009; सा.का.नि. 543(अ), तारीख 22 जुलाई, 2009; सा.का.नि. 739(अ), तारीख 9 सितम्बर, 2010; सा.का.नि. 809(अ), तारीख 4 अक्तूबर, 2010; सा.का.नि. 215(अ), तारीख 15 मार्च, 2011; सा.का.नि. 221(अ), तारीख 18 मार्च, 2011; सा.का.नि. 354(अ), तारीख 2 मई, 2011; सा.का.नि. 424(अ), तारीख 1 जून, 2011; सा.का.नि. 446(अ), तारीख 13 जून, 2011; सा.का.नि. 152(अ), तारीख 16 मार्च, 2012; सा.का.नि. 266(अ), तारीख 30 मार्च, 2012; सा.का.नि. 277(अ), तारीख 31 मार्च, 2012; सा.का.नि. 820(अ), तारीख 9 नवम्बर, 2012; सा.का.नि. 176(अ), तारीख 18 मार्च, 2013; सा.का.नि. 535(अ), तारीख 7 अगस्त, 2013; सा.का.नि. 771(अ), तारीख 11 दिसम्बर, 2013; सा.का.नि. 2(अ), तारीख 2 जनवरी, 2014; सा.का.नि. 229(अ), तारीख 28 मार्च, 2014; सा.का.नि. 232(अ), तारीख 31 मार्च, 2014; सा.का.नि. 325(अ), तारीख 7 मई, 2014; सा.का.नि. 612(अ), तारीख 25 अगस्त, 2014; सा.का.नि. 789(अ), तारीख 11 नवम्बर, 2014; का.आ. 3305(अ), तारीख 7 दिसम्बर, 2015; का.आ. 4(अ), तारीख 1 जनवरी, 2016; सा.का.नि. 35(अ), तारीख 14 जनवरी, 2016; सा.का.नि. 281(अ), तारीख 7 मार्च, 2016; सा.का.नि. 496(अ), तारीख 9 मई, 2016; सा.का.नि. 497(अ), तारीख 10 मई, 2016; सा.का.नि. 978(अ), तारीख 10 अक्तूबर, 2016; और अंतिम बार अधिसूचना संख्यांक सा.का.नि. 1016(अ), तारीख 28 अक्तूबर, 2016 द्वारा संशोधित किए गए थे ।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 13th October, 2017

G.S.R. 1265(E).—In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:-

1. **Short title and commencement.**—(1) These rules may be called the Environment (Protection) Amendment Rules, 2017.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986, in Schedule – I, after serial number 104 and the entries relating thereto, the following serial number and entries shall be inserted, namely:—

Sl. No.	Industry	Parameters	Standards	
1	2	3	4	
		Effluent discharge standards (applicable to all mode of disposal)		
"105	Sewage Treatment Plants (STPs)		Location	Concentration not to exceed
			(a)	(b)
		pH	Anywhere in the country	6.5-9.0
		Bio-Chemical Oxygen Demand (BOD)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir, and Union territory of	20

			Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	
			Areas/regions other than mentioned above	30
		Total Suspended Solids (TSS)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir and Union territory of Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	<50
			Areas/regions other than mentioned above	<100
		Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100ml	Anywhere in the country	<1000

*Metro Cities are Mumbai, Delhi, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad and Pune.

Note :

(i) All values in mg/l except for pH and Fecal Coliform.

(ii) These standards shall be applicable for discharge into water bodies as well as for land disposal/applications.

(iii) The standards for Fecal Coliform shall not apply in respect of use of treated effluent for industrial purposes.

(iv) These Standards shall apply to all STPs to be commissioned on or after the 1st June, 2019 and the old/existing STPs shall achieve these standards within a period of five years from date of publication of this notification in the Official Gazette.

(v) In case of discharge of treated effluent into sea, it shall be through proper marine outfall and the existing shore discharge shall be converted to marine outfalls, and in cases where the marine outfall provides a minimum initial dilution of 150 times at the point of discharge and a minimum dilution of 1500 times at a point 100 meters away from discharge point, then, the existing norms shall apply as specified in the general discharge standards.

(vi) Reuse/Recycling of treated effluent shall be encouraged and in cases where part of the treated effluent is reused and recycled involving possibility of human contact, standards as specified above shall apply.

(vii) Central Pollution Control Board/State Pollution Control Boards/Pollution Control Committees may issue more stringent norms taking account to local condition under section 5 of the Environment (Protection) Act, 1986".

[F. No. Q-15017/2/2008-CPW]

ARUN KUMAR MEHTA, Addl. Secy.

Note : The principal rules were published in the Gazette of India, Extraordinary, Part II, Section 3,Sub-section (i) *vide* number S.O. 844 (E), dated the 19th November, 1986 and subsequently amended *vide* the following notifications, namely:—

S.O. 433 (E), dated the 18th April 1987; G.S.R. 176(E) dated the 2nd April, 1996; G.S.R. 97 (E), dated the 18th February, 2009; G.S.R. 149 (E), dated the 4th March , 2009; G.S.R. 543(E), dated the 22nd July,2009; G.S.R. 739 (E), dated the 9th September, 2010; G.S.R. 809(E), dated the 4th October, 2010, G.S.R.

215 (E), dated the 15th March, 2011; G.S.R. 221(E), dated the 18th March, 2011; G.S.R. 354 (E), dated the 2nd May, 2011; G.S.R. 424 (E), dated the 1st June, 2011; G.S.R. 446 (E), dated the 13th June, 2011; G.S.R. 152 (E), dated the 16th March, 2012; G.S.R. 266(E), dated the 30th March, 2012; and G.S.R. 277 (E), dated the 31st March, 2012; and G.S.R. 820(E), dated the 9th November, 2012; G.S.R. 176 (E), dated the 18th March, 2013; G.S.R. 535(E), dated the 7th August, 2013; G.S.R. 771(E), dated the 11th December, 2013; G.S.R. 2(E), dated the 2nd January, 2014; G.S.R. 229 (E), dated the 28th March, 2014; G.S.R. 232(E), dated the 31st March, 2014; G.S.R. 325(E), dated the 7th May, 2014; G.S.R. 612, (E), dated the 25th August 2014; G.S.R. 789(E), dated the 11th November 2014; S.O. 3305(E), dated the 7th December, 2015; S.O.4(E), dated the 1st January 2016; G.S.R. 35(E), dated the 14th January 2016; G.S.R. 281 (E), dated the 7th March, 2016; G.S.R. 496(E), dated the 9th May, 2016; G.S.R.497(E), dated the 10th May, 2016; G.S.R.978(E), dated the 10thOctober, 2016; and lastly amended vide notification G.S.R. 1016(E), dated the 28th October, 2016.

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Appendix L
Request Letters to NHAI & GM (SR) – Indian Railways

Highways and Minor Ports (HV1) Department,
Secretariat, Chennai-600 009.
Phone No: 044 – 2566 5583
Email Id:

Letter No.12028705 /HV1/2025 , dated 31.10.2025

From
Dr. R. Selvaraj, I.A.S.,
Secretary to Government.

To
The Regional Officer,
National Highways Authority of India,
Chennai – 107. (w.e)

Sir,

Sub: Highways – Tamil Nadu Maritime Board- Requested to take up road connectivity (four lane) from Cuddalore port - NH-45A - Chidambaram Road by NHAI – Regarding

Ref: From the Principal Secretary / Vice Chairman and Chief Executive Officer of Tamil Nadu Maritime Board, letter No. 4978/CE/2025 dated 17.10.2025

****

I am directed to invite attention to the reference cited (copy enclosed) wherein, the Principal Secretary / Vice Chairman of Tamil Nadu Maritime Board has stated that

(i) Tamil Nadu Maritime Board has developed Cuddalore Port under the Sagarmala / Coastal Berth Scheme of the Government of India at a cost of Rs.135.00 crore, with 50% Grant-in-Aid from the Government of India.

(ii) The four-laning of the road from Cuddalore Port to NH-45A is listed in the PM Gati Shakti portal under Project ID No. 4209, with an estimated cost of Rs.76.29 crore. The implementing agency is the National Highways Authority of India (NHAI).

2. Further, the Vice Chairman and Chief Executive Officer, Tamil Nadu Maritime Board has proposed that the following components to be taken up under the Port Connectivity Scheme of the Government of India.

(i) Four-laning of the Port Office Road (erstwhile Salt Office Road) from the Port main gate to NH-45A (1 km), including land acquisition (to be taken on priority basis).

(ii) Four-laning of NH-45A (Cuddlore to Chidambaram Road) from the junction with the Port Office Road to the proposed New East Coast Road (ECR) joining.

(iii) Construction of a four-lane spur road from the Port Office Road junction with NH-45A to the New ECR via the shortest possible route.

3. In view of the above, I am to forward the proposal of the Vice Chairman and Chief Executive Officer, Tamil Nadu Maritime Board for information and necessary action (particularly para No.2(i) above) and request you to send the action taken in this regard to the Government early.

Yours faithfully,

E. Rajkumar 31.10.25

for Secretary to Government.

31/10/2025.

12028705

23/10/25

TAMILNADU MARITIME BOARD
GOVERNMENT OF TAMILNADU

No.171, South Kesavaperumalpuram,
Off Greenways Road,
Raja Annamalaipuram,
Chennai - 600 028.

Telephone : 24641232
24934481
Fax : 24951632
Email : tnmb@tn.gov.in

Thiru.T.N.Venkatesh, I.A.S.,
Principal Secretary / Vice Chairman and Chief Executive Officer

Letter No.4978/CE/2025 dated:17.10.2025

To

The Secretary to Government,
Highways & Minor Ports Department,
Secretariat,
Chennai – 600 009.

Sir,

Sub: Tamil Nadu Maritime Board - Providing Road connectivity (Four lane) from Cuddalore Port NH 45 A to National Highways connective of Chidambaram road (approx 8 Km) - Requesting to take up the project for four lane road - Reg.

Ref: 1. General Manager (Tech), National Highways Authority of India, New Delhi Letter No.NHAI/11011/PC/Minor Ports, Dated: 05.07.2021
2. Deputy Secretary to Government, Highways and Minor Ports (HM1) Department, Chennai Letter No. 8064/HM1/2021-1, dated:16.07.2021.
3. This Office Letter No.5351/CE/2017, dated: 26.10.2021.

******

With reference to the letters cited, it is informed that the Tamil Nadu Maritime Board has developed Cuddalore Port under the Sagarmala / Coastal Berth Scheme of the Government of India. The following infrastructure has been developed at a cost of Rs. 135.00 crore, with 50% Grant-in-Aid from the Government of India:

1. Extension of North and South Breakwaters.
2. Construction of Berths (Berth 1 & 2) – 240 meters in length each.
3. Capital dredging of the Channel, Turning Circle, and Berth Pocket to a depth of (-) 9 meters.

Further, developmental and allied works are currently ongoing at Cuddalore Port, and cargo operations are expected to commence shortly. The major types of cargo expected to be handled at the port include coal, fertilizers, cement, agro products, containers, construction materials, miscellaneous general cargo, etc. The maximum cargo volume projected to be handled at Cuddalore Port is approximately **3.0 million metric tonnes per annum**.

Road Connectivity:

The port's main entrance is located approximately 1 km from NH-45A. The area on the left-hand side of the port entrance falls under the jurisdiction of the Village Panchayat, while the right-hand side falls under the Corporation limits. The road needs to be developed into a **four-lane carriageway** to support the movement of heavy trucks and container traffic.

At present, there is no rail connectivity to the port, and it relies entirely on road transport.

The nearest domestic airport is located in Puducherry, approximately 27 km from the port, while the nearest international airport is Chennai International Airport, about 180 km away.

Therefore, for efficient cargo evacuation, it is essential to establish robust road connectivity between Cuddalore Port and NH-45A. The **four-laning of the road** from Cuddalore Port to NH-45A is listed in the **PM Gati Shakti portal** under **Project ID No. 4209**, with an estimated cost of **Rs. 76.29 crore**. The implementing agency is the **National Highways Authority of India (NHAI)**.

It is proposed that the following components be taken up under the Port Connectivity Scheme of the Government of India:

1. Four-laning of the Port Office Road (erstwhile Salt Office Road) from the Port main gate to NH-45A (1 km), including land acquisition,
2. Four-laning of NH-45A (Cuddalore to Chidambaram Road) from the junction with the Port Office Road to the proposed New East Coast Road (ECR) joining with NH-45A (approximately 8 km).
3. Construction of a four-lane spur road from the Port Office Road junction with NH-45A to the New ECR via the shortest possible route.

Hence, it is requested that National Highways Authority of India shall take up the above proposal, particularly Sl.No.1 on priority basis and provide Road Connectivity (Four Laning) to Cuddalore Port from NH 45A as the operation of the Cuddalore Port will provide employment opportunities to the local people and will also enhance the Socio-Economic development in this region.

Yours faithfully,

Sd/- T.N.Venkatesh,

Principal Secretary / Vice Chairman

and Chief Executive Officer

/Forwarded/

17/10/13

Chief Accounts Officer

TAMIL NADU MARITIME BOARD

GOVERNMENT OF TAMILNADU

T. N. VENKATESH, I.A.S.
Principal Secretary / Vice Chairman
& Chief Executive Officer

D.O. Letter No. 4770/S1/2022, dated: 17.02.2026

Dear Shri Singh,

Sub: Tamil Nadu Maritime Board - Request for restoration and execution of railway connectivity to Cuddalore Port – Reg.

Ref: 1. DRM, Tiruchirappalli Letter No: T/T.563/CUPJ, dated.03.02.2026.
2.CTPM (SR), lr.no: T.143/A/Cuddalore Port/26/01.dated: 29.01.26 addressed to the DRM with copy marked to TNMB
3. This office letter no:4770/S1/2025, dated. 05.11.2025.
4. Minutes of meeting held under the Chairmanship of DRM, Trichy on 06.02.2026.
5. This office letter no:4770/S1/2022, dated:11.02.2026.

****

I wish to draw your kind attention to the urgent need for restoration and execution of railway connectivity to Cuddalore Port.

Tamil Nadu Maritime Board have been in discussion with the Divisional Railway Manager, Trichy, restoration of rail connectivity to Cuddalore Port is of strategic importance not only for the operational efficiency of the Port but also for unlocking the vast freight potential available in the hinterland of Cuddalore and adjoining districts. The revised Demand Assessment Report prepared by ITCOT and the updated Feasibility Study submitted by MGR Infra Techno Economic Services clearly establish the technical and commercial viability of the project.

In this context, I wish to inform that the Port development works have already commenced in Cuddalore Port and operations are scheduled to begin within 12 months, and full operational capacity is expected within 24 months. This necessitates

timely execution of the connecting railway line which is of critical significance to ensure seamless transportation of cargo from the very inception of port operations.

I would also like to reiterate that the proposed railway connectivity will serve as a Common User Facility and will eventually cater to both the existing Cuddalore Port and the proposed Greenfield Port project planned over more than 1000 acres. The proposed Greenfield development will significantly augment cargo volumes and is expected to generate additional traffic of at least 5 million tonnes per annum to Southern Railway within three years of full-fledged port operations.

Considering the larger public interest and the long-term freight benefits to the Railways, I request your kind intervention to facilitate early approval and execution of the 1.65 km connecting railway line on Railway land. Given that Tamil Nadu Maritime Board does not have provision under the GCT policy to undertake the development on Railway land, a realistic and mutually beneficial solution may kindly be evolved at the earliest.

I am assured that with the proactive support of Southern Railway and your valued guidance; this important infrastructure project can be taken forward expeditiously.

With regards

Yours faithfully,

Th Venkatesh 17/2/26

(T.N.VENKATESH)

To
Shri. R.N. Singh, IRSE
General Manager,
1st floor NGO Main Building
Southern Railway
Park Town, Chennai - 600003.

Appendix M
NABET Certificate of Falcon Resilient Infra Consultants (FRICS)

भारतीय गुणवत्ता परिषद्
QUALITY COUNCIL® OF INDIA
QCI Creating an Ecosystem for Quality

NABET

National Accreditation Board for Education and Training

Certificate of Accreditation

Falcon Resilient Infra Consultants

501A, Sudheer Tapani Towers, Old MLA Quarters Road, Opp. Telugu Academy, Himayatnagar, Hyderabad- 500029, Telangana

The organization is accredited as ***Category-A*** *under the QCI-NABET* ***Scheme for Accreditation of EIA Consultant Organization, Version 3****: for preparing EIA/EMP reports in the following Sectors-*

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1.	River Valley projects	3	1 (c)	A
2.	Thermal power plants	4	1 (d)	A
3.	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	21	5 (f)	A
4.	Airports	29	7 (a)	B
5.	Industrial estates/ parks/ complexes/areas, export processing Zones(EPZs), Special Eco-nomic Zones (SEZs), Biotech Parks, Leather Complexes	31	7 (c)	A
6.	Ports, harbours, break waters and dredging	33	7 (e)	A
7.	Highways	34	7 (f)	A
8.	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)	B
9.	Building and construction projects	38	8 (a)	B
10.	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in SAAC minutes dated March 11, 2025, posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no QCI/NABET/ENV/ACO/25/3562 dated March 18, 2025. The accreditation needs to be renewed before the expiry date of Falcon Resilient Infra Consultants, Hyderabad, following due process of assessment.

Valid up to
August 16, 2026

Issue Date
March 18, 2025

Certificate No.
NABET/EIA/23-26/SA 0236

Prof (Dr) Varinder S Kanwar
CEO - NABET

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

Appendix N
NABEL Certificate of Enviro care India Private limited

National Accreditation Board for Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

ENVIRO CARE INDIA PRIVATE LIMITED

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

NO.43, HARVEY NAGAR, SECOND STREET, MADURAI, TAMIL NADU, INDIA

in the field of

TESTING

Certificate Number: TC-6226

Issue Date: 29/11/2025 Valid Until: 28/11/2029

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.

(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Entity: ENVIRO CARE INDIA PRIVATE LIMITED

Signed for and on behalf of NABL

Anuja Anand
Director

Dr. Ramanand N. Shukla
Chief Executive Officer

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Appendix O
Annamalai University Letter -Cuddalore Port

ANNAMALAI UNIVERSITY
CAS in Marine Biology,
Faculty of Marine Sciences,
Parangipettai – 608 502, Tamil Nadu, India

Dr. A. SUNDARAMANICKAM,
Associate Professor

Tel: (O) 04144-243070, 243071,243223
Mobile: 9486456460
E-mail: fish_lar@yahoo.com

To,
Falcon Resilient Infra Consultants (FRICS)

501 A, Sudheer Tapani Towers, opposite Telugu Academy,
Old MLA quarters road, Himayat Nagar,
500029, Hyderabad,
Telangana

Kind attention: Mrs. Susruta Mamidanna, Technical Director.

Subject: **Submission of Marine Environmental monitoring reports of July to October, 2025 for Cuddalore Port, Cuddalore district, Tamil Nadu -Reg.**

Reference: Work order No: 003-C25014-MDS-L- Annamalai WO, dated September 26, 2025

Dear Madam,

Hereby submitting the Marine Environmental monitoring reports of July to October, 2025 for Cuddalore Port, Cuddalore district, Tamil Nadu.

The following Terms of Reference (ToR) conditions from MoEFFCC, have been addressed in the Marine Environmental Monitoring and Biodiversity Management Plan Report.

S. No	Terms of Reference (ToR) conditions
ESZ, CRZ, International Boundary And Acts	
3.7	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 required mitigation plan be submitted.
Water Environment/quality Analysis/ Hydrology And Water Bodies	
6.4	Specific study on effects of construction activity and pile driving on marine life.

Thanking you.

Yours faithfully,

(A. SUNDARAMANICKAM)

FALCON RESILIENT
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