Vizhinjam International Seaport
Thiruvananthapuram

Development of Vizhinjam International Deepwater Multipurpose Seaport

Environmental Clearance F. No. 11-122/2011-IA.III dated 3rd January 2014

Half Yearly Compliance Report (HYCR) for the Period April 2023 to September 2023

Project Concessionaire

Adani Vizhinjam Port Private Ltd. (AVPPL)

Project Authority

Government of Kerala (GoK)

Implementing Agency on behalf of GoK

Vizhinjam International Seaport Limited (VISL)
(A GoK Undertaking)

November 2023

Vizhinjam International Seaport Limited
(A Government of Kerala Undertaking)

VISL/ 53/2021-GM1 (E) /817

25th Nov 2023

To

Additional Principal Chief Conservator of Forests (C),
Ministry of Environment Forest and Climate Change (MoEF&CC),
Regional Office (SZ), Kendriya Sadan,
4th Floor, E&F Wings, 17th Main Road,
Koramangala II Block, Bangalore-560034 (Karnataka)
rosz.bng-mefcc@nic.in; Ph: 080-25635901

Sub: Half Yearly Compliance Report (HYCR) of Environmental and CRZ Clearance (EC) for Vizhinjam International Multipurpose Deep water Seaport for the period of April 2023 to September 2023 – Reg.

Ref: 1) File No. 11-122/2011-IA.III dated 3rd January 2014
2) Letter No. 1285/A3/13/KCZMA/S&TD dated 24th August 2013
3) File No: EP/12.1/7/2013-14/Ker 829 dated 20th August 2019
4) F.No.11-122/2011-IA.III Proposal No. IA/KL/MIS/178082/2020 dated 29th December 2020

Dear Sir,

This has reference to the Environmental & CRZ Clearance (EC) issued on 3rd January 2014 (vide reference 1st) by the Ministry of Environment, Forest & Climate Change (MoEF&CC) for the proposed Vizhinjam International Multipurpose Deepwater Seaport at Vizhinjam in Thiruvananthapuram District of Kerala State based on the recommendation of KCZMA (vide reference 2nd). Subsequently, the validity of EC was extended by MoEF&CC dated 29th December 2020 (vide reference 4th). The Half Yearly Compliance Report (HYCR) of the conditions stipulated in the cited references for the period from April 2023 to September 2023 is enclosed herewith for record and reference. As per the MoEF&CC Letter (vide the reference 3rd), wherein submission of HYCRs by email/soft copy is declared acceptable, therefore the HYCR for the period of April 2023 to September 2023 is being submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA via email.

Yours Sincerely
For Vizhinjam International Seaport Ltd. (VISL)

Chief Executive Officer

Encl: As Stated Above
Copy to: MD & CEO Adani Vizhinjam Port Private Ltd. (AVPPL)
01, Port Operation Building, Vizhinjam Seaport, Mulloor P.O, Vizhinjam,
Thiruvananthapuram-695521, Kerala, India

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
11.	**Specific Conditions**	
(i)	"Consent for Establishment" shall be obtained from Kerala State Pollution Control Board under Air and Water Act and a copy shall be submitted to the Ministry before start of any construction work at the site.	**Complied** Consent for Establishment (CTE) had been obtained from Kerala State Pollution Control Board (KSPCB) vide Consent No. PCB/HO/TVM/ICE/08/2015 dated 15.09.2015 valid up to 31.07.2018. The CTE was renewed vide Consent No. PCB/HO/TVM/ICE-R/02/2018 dated 19.07.2018 valid up to 31.07.2023. The CTE was further renewed vide Consent No. KSPCB/TV/ICE/10029484/2023 dated 30.07.2023 valid up to 31.07.2028 (A Copy of the same is enclosed as **Annexure I**).
(ii)	Project Proponent shall carry out intensive monitoring with regulatory reporting six monthly on shoreline changes to the Regional Office, MoEF.	**Being Complied** Based on the Shoreline Monitoring Plan prepared by L&T Infra Engineers Ltd (L&T IEL) under the guidance of National Institute of Ocean Technology (NIOT), Shoreline monitoring is being carried out by agency Shankar Surveys Pvt, Ltd. (SSPL) for a stretch of 40 km (20 km on both sides of the project site) and reports are being regularly submitted to Ministry of Environment and Forests & Climate Change (MoEF&CC) as a part of the HYCRs. Broadly the scope covers: • Wave Observations • Onshore Cross beach profiling • Offshore Cross beach profiling • Littoral Environmental Observations (LEO) • Beach Sampling • Multi-beam Echo Sounder (MBES) survey • River cross section surveys • Grab Sampling • Current & Tide Observations • Weather Observations • Marine Water Sampling Shoreline Monitoring Report by SSPL for the period April 2023 to September 2023 is enclosed as **Annexure II**. L&T IEL had prepared Mathematical Modelling Reports based on available Shoreline Monitoring

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023

<table>
<tr><th>S. No.</th><th>Conditions</th><th>Compliance Status as on 30.09.2023</th></tr>
<tr><td></td><td></td><td>data; which were vetted by NIOT. Five mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC; as detailed below:

<table><tr><th>Data Period</th><th>Submitted with HYCR for the Period</th></tr><tr><td>Feb 2015 to Feb 2017</td><td>Apr 2017 to Sep 2017</td></tr><tr><td>Mar 2017 to Feb 2018</td><td>Apr 2018 to Sep 2018</td></tr><tr><td>Mar 2018 to Feb 2019</td><td>Apr 2019 to Sep 2019</td></tr><tr><td>Mar 2019 to Feb 2020</td><td>Apr 2020 to Sep 2020</td></tr><tr><td>Mar 2020 to Feb 2021</td><td>Apr 2021 to Sep 2021</td></tr><tr><td>Mar 2021 to Sep 2022</td><td>Apr 2022 to Sep 2022</td></tr></table>
Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data for the period October 2022 to September 2023 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. The mathematical modelling report for the period October 2022 to September 2023 vetted by NIOT is given as Annexure III.</td></tr>
<tr><td>(iii)</td><td>The capital dredged material (7.6 Mm^3) shall be utilized for reclamation of berths.</td><td>Being Complied
During the compliance period, 0.065 Mm^3 material has been dredged and a total 3.96 Mm^3 dredged material has been utilized for reclamation of 48.61 Ha area of land.</td></tr>
<tr><td>(iv)</td><td>Additional fish landing centre shall be developed as part of the proposed Vizhinjam port for upliftment of fisheries sector.</td><td>Being Complied
Based on the recommendation of the study carried out by Central Water and Power Research Station (CWPRS), the Harbour Engineering Department (HED) has prepared the preliminary design and estimate for the extension of seaward breakwater of the existing fishing harbour. However, detailed design, including physical model study, is required before its construction. Discussions between Fisheries Department and Ports Department, Government of Kerala (GoK) and consultation with the fishermen community are ongoing. GoK would be soon finalising the plan of action to develop and make available the additional fish landing facilities for the benefit of the local fishermen. (Source: VISL)</td></tr>
</table>

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(v)	The project shall be executed in such a manner that there is minimum disturbance to fishing activity.	**Being Complied** Following is being practiced ensuring minimum disturbance to fishing activity: • Work is planned in such a way that there is only minimal hindrance to the fishermen due to construction activities. • Signboards have been placed for demarcation of construction area and navigational buoys/marker buoys are placed in the marine area for fishing boats to maintain a safe distance from the areas of breakwater construction. • The number of buoys for monitoring in the project area has been optimized, considering the safety of fishermen and ease of movement during construction. • For mutual understanding of the developmental activities with the local fishing community an exclusive CSR team has been assigned. • Using the technological advancements (such as WhatsApp), the dedicated CSR team of AVPPL are in constant touch with the fishermen/fishing community members to facilitate the flow of various project related information/updates. • AVPPL CSR team also provides regular updates to the committee which has been formed by the local church/other representatives adjoining to the port area, who in turn pass on port project execution information to the fishermen. • Marine Water Quality is being monitored regularly and results are submitted as part of the compliance reports. No abnormal results were observed during the compliance period (**Refer Annexure IV**). • Central Marine Fisheries Research Institute (CMFRI) have conducted a study on estimation of marine fish landings data from the potential impact zones of Vizhinjam International Seaport for the period June 2021 to May 2022. The report (included as **Annexure V**) concluded

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		that Fish landings survey recorded an increase of 3.35% compared to the total landings reported in 2011. Seasonal and zonal variations of fish catch analysis depicted the highest catch from the direct footprint zone, implying the insignificant impacts of the development phase of Vizhinjam on the availability of fish resources.
(vi)	Steps would be taken to safeguard the interests of the fisheries sector as detailed in the Resettlement Action Plan (RAP), Corporate Social Responsibility (CSR) and in the Integrated Fishing Community Management (IFCMP), namely a component of Rs.7.1 crores as part of the compensation package for the fisheries sector, as livelihood restoration measures for mussel collectors, shore seine fishermen and others. Rs.41.30 crores as part of CSR activities in the fisheries sector under (i) water supply scheme (7.3crores) (ii) new fishing landing centre (16crores) (iii) adoption of existing fishing harbor (5crores) (iv) sea food park (4crores) (iii) skill development centre (4crores) (iv) environmental sanitation (3crores) and (v) solid waste management (2crores).	**Being Complied** In consultation with the fishermen, enhanced livelihood compensation of Rs. 108.32 Crores was sanctioned by GoK and distributed by VISL to fishermen as livelihood compensation, instead of Rs. 8.55 crores, as suggested earlier in the EIA. Till 30.09.2023 an amount of Rs. 100 Crores have been disbursed for a total number of 2641 Livelihood Affected Persons (LAPs) whose verification was complete in all respects; this includes boat owners to whom kerosene is supplied free of cost during the breakwater construction period. Remaining disbursals would be done as soon as possible. *(Source: VISL)* The status of the Social Welfare activities envisaged in the fisheries sector is as follows: **Water Supply**: Kerala Water Authority (KWA) set up a 3.00 MLD water supply scheme for the project with the source of water being Vellayani Lake which was commissioned in April 2013 by VISL by expending an amount of Rs. 8.10 Crores. The net availability of treated water from this supply scheme is 2.49 MLD of potable water out of which 1.49 MLD of water shall be distributed to the local people as part of social welfare measures of VISL. The balance 1.0 MLD was to be used for port related activities. However, at present, the entire treated water from the scheme is being utilised by the community. For Operation & Maintenance (O&M) of the same, an amount of Rs. 5.38 crores have been spent up to 31.03.2021. From 04.04.2019 onwards, O&M of the scheme is being done by KWA. An additional amount of Rs. 1.74

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		Crores has been sanctioned and deposited by VISL to KWA to extend piped water connections for treated water supply facilities to the community at Kottapuram Village. More than 1000 free domestic water connections have been given to the project affected areas. KWA now have adequate coverage of water supply around the port and project affected areas. VISL is coordinating with local body representatives to identify water shortage areas and taking effort to resolve the same. *(Source: VISL)* **Fish Landing Centre**: The planning work for the fish landing centre (Rs. 16.00 crores) and the fishery breakwater (Rs. 131.12 crores) had been initiated as part of the funded work component of the concession agreement with AVPPL. Based on studies on tranquillity carried out by CWPRS, Pune studies on tranquillity at the proposed new fishing harbour, the landing centre needs to be relocated after construction of an extension of seaward breakwater of the old fishing harbour. GoK is finalising the way forward to build the additional fish landing centre for the benefit of the local fishermen. *(Source: VISL)* **Existing Fishing Harbour**: Tender for modernization of the existing fishing harbour was invited by HED and work awarded. However, the works could not be initiated due to sectoral protests among different fishermen groups. GoK has formed a higher-level committee to prepare a master plan for the old fishing harbour. Government Departments concerned are coordinating to resolve the differences and to arrive at an acceptable plan in consultation with all stakeholders. *(Source: VISL)* **Seafood Park**: Procurement of land for seafood park (Rs. 26.00 crores) by VISL has been completed. Action for development of seafood park is being taken to commission the same along

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		with the completion of the new fishing landing facilities planned. *(Source: VISL)* **Skill Development:** Additional Skill Acquisition Program (ASAP) is a GoK initiative aimed to impart required skills to local youth for improving their employability. ASAP proceeded with the construction of a Community Skill Park (CSP) in an area of 1.5 acres of land at Vizhinjam and the infrastructure is completed. It will operate on a PPP model wherein 25,000 sq. ft. building with facilities for students' hostel are constructed by GoK by ASAP with ADB assistance, whereas the operation of the centre with logistics and other high-end courses are being taken up by Adani Skill Development Centre (ASDC) as per agreement with GoK/ASAP/VISL. The Civil construction work for Community Skill Park (CSP) is completed inside Vizhinjam Port area in association with Additional Skill Acquisition Programme (ASAP) and the internal panelling and other electrical works are progressing. The land handover is by VISL to the ASAP team for construction having 3 storied building as Ground Floor for office space, Seminar Hall Training Rooms, G-1 Floor for IT lab & Other Training room facilities including Library, Meeting room, Faculty room. It is planned to start high end Port related courses according to the anticipated vacancies arising in the port, in other the top organizations as well as abroad. ASAP is planning to handover the building by the end of this year. **Environmental Sanitation/Solid Waste Management:** Material Recovery Facility (MRF): As per the request received from Trivandrum Municipal Corporation it is decided to construct an MRF at harbor ward. Land for the same allotted by Harbour Engineering Department. The operation of the unit will be done by Trivandrum Municipal Corporation under the technical support of Suchithwa Mission

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		and Clean Kerala Company. Socio-Economic Foundation (SEUF) is carrying out the construction works. A Haritha Karma Sena will be formed for the daily collection of waste after the commissioning of the proposed unit. This is carried out as shared activity between VISL, Thiruvananthapuram Corporation, Adani Foundation and AVPPL. Necessary funds have been transferred and civil construction work by SEUF are ongoing. The MRF comprises of: • 3500 sqft building • Shredding Machine • Baling Machine • Dust remover • Conveyor belt • Compound wall • Internal roads An MoU has already been entered into to demystify the role of all the stakeholders. <u>Cleaning Campaign:</u> The cleaning campaign promoted by Adani Foundation is progressing commendably during the period. One of the livelihood groups, promoted under the CSR of AVPPL/Adani Foundation - Karshika Karmasena is coordinating the campaign. Four members who are actively participating in the cleaning campaign are from widow's category as part of the widow's engagement programme. During the period, the campaign included community cleaning, clearing of vegetation and plastic waste collection and the cleaning of public places coordinated by the Group. Activities carried out by AVPPL/Adani Foundation as a part of CSR intervention for fishermen, fishing community and fisheries sector for the period of April 2023 to September 2023 is given in **Annexure VI**.
(vii)	Rail connectivity shall be parallel to the harbour road on elevated	**Will be Complied** Konkan Railway Corporation Limited (KRCL) has been engaged for turnkey execution of the project.

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	structures at +4/5.00 m level without affecting the entry to the existing harbor.	Out of the total rail route length of 10.7 km, 9.0 km is planned to be passing through an underground tunnel to minimize the disturbance to the local population. Detailed Project Report (DPR) has been approved by Southern Railway. Geophysical and geomorphological studies, flood mapping studies and hydrogeological studies have also been completed. EC amendments in this regard had been submitted to MoEF&CC on 17.08.2022 vide Proposal No. IA/KL/NCP/285459/2022 and File No. 11-122/2011-IA.III. The Expert Appraisal Committee (EAC) during their 308th and 322nd meetings held on 15.09.2022 and 21.03.2023, 22.03.2023 respectively apprised the proposal. The additional information and clarification sought on account of vibration impact and subsidence due to underground railway construction by the EAC during the meeting has been prepared by Council of Scientific & Industrial Research (CSIR) – Central Institute of Mining and Fuel Research (CIMFR), Dhanbad and ready for submission to MoEF. *(Source: VISL)*
(viii)	Compensation packages in accordance with the Central/State Government norms shall be given to all the authorized-cum-affected (having valid clearances as applicable) resort owners.	**Being Complied** Resort owners evicted have been compensated for land and not for the structures since they were in violation of CRZ notification. Remaining land of 2.865 Ha is to be acquired by Land Acquisition (LA) process; for which notification has been published and the acquisition is in an advanced stage. *(Source: VISL)*
(ix)	The port shall ensure that all ships under operation follow the MARPOL convention regarding discharge or spillage of any toxic, hazardous or polluting material like ballast water, oily water or sludge, sewage, garbage etc. The emission of NOx & SOx shall remain within permissible limits.	**Will be Complied** Currently project is under construction. This shall be complied during operational phase. All vessels entering the port will comply with DGS Circular No 02 of 2023 for Annex VI of MARPOL. Vizhinjam Port is also registered under Swachh Sagar portal of DG shipping. KSPCB approved vendors for waste collection under Swatch Sagar Portal is also implemented.

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<table>
<tr><th>S. No.</th><th>Conditions</th><th>Compliance Status as on 30.09.2023</th></tr>
<tr><td></td><td></td><td>Summary of the Ambient Air Quality Monitoring (AAQM) during the compliance period April 2023 to September 2023 at 5 monitoring locations is mentioned below:

<table>
<tr><th>Parameter</th><th>Unit</th><th>Max</th><th>Avg.</th><th>Min</th><th>Perm. Limit</th></tr>
<tr><td>PM_{10}</td><td>$\mu g/m^3$</td><td>77.5</td><td>61.7</td><td>48.9</td><td>100</td></tr>
<tr><td>$PM_{2.5}$</td><td>$\mu g/m^3$</td><td>43.1</td><td>31.3</td><td>20.5</td><td>60</td></tr>
<tr><td>SO_2</td><td>$\mu g/m^3$</td><td>5.84</td><td>4.53</td><td>4.00</td><td>80</td></tr>
<tr><td>NO_2</td><td>$\mu g/m^3$</td><td>7.41</td><td>5.55</td><td>4.60</td><td>80</td></tr>
<tr><td>CO</td><td>mg/m^3</td><td>BDL</td><td>BDL</td><td>BDL</td><td>4</td></tr>
<tr><td>HC</td><td>ppm</td><td>BDL</td><td>BDL</td><td>BDL</td><td>--</td></tr>
</table></td></tr>
<tr><td>(x)</td><td>CSR activities shall cover villages within 10 km radius of the project.</td><td>Being Complied
All CSR activities are being activities are being carried out in villages within 10 km radius of the project. CSR activities are being taken up and carried out mainly in the fields of education, community health, sustainable livelihood development, community infrastructure development and general administration; after receiving formal demands from social controlled institutions, government-controlled institutions and recognized platforms. An amount of Rs. 203.81 Lakhs has been spent on CSR activities during the compliance period (April 2023 to September 2023) as shown below:

<table>
<tr><th>S. No.</th><th>Head</th><th>Amount (Rs. Lakhs)</th></tr>
<tr><td>1</td><td>Education</td><td>5.00</td></tr>
<tr><td>2</td><td>Community Health</td><td>18.57</td></tr>
<tr><td>3</td><td>Sustainable Livelihood Development</td><td>28.84</td></tr>
<tr><td>4</td><td>Community Infrastructure Development</td><td>140.80</td></tr>
<tr><td>5</td><td>General Administration</td><td>10.60</td></tr>
<tr><td colspan="2">Total</td><td>203.81</td></tr>
</table>
Details on CSR activities carried out by AVPPL during compliance period (April 2023 to September 2023) are enclosed as Annexure VI.</td></tr>
</table>

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(xi)	Oil Contingency Management Plan shall be put in place.	**Will be Complied** After duly incorporating the comments of Indian Coast Guard (ICG), the final facility Level Oil Spill Disaster Contingency Plan (OSDCP) in line with the National Oil Spill-Disaster Contingency Plan (NOS-DCP) has been submitted to ICG for approval vide letter No. AVPPL/ICG/2020-21/1134 dated 22.05.2020. After final review by PRT (West), ICG has made specific remarks on the compliance of OSDCP prepared in line with NOS-DCP guidelines; directing AVPPL to submit the OSDCP for approval only after pollution response equipment are in place before start of operation. Procurement of pollution response equipment is under progress presently and the final OSDCP will be submitted to ICG for approval prior to commissioning of the port; when the pollution response equipment is in place.
(xii)	All the recommendations /conditions stipulated by Kerala Coastal Zone Management Authority (KCZMA) shall be complied with.	**Being Complied** AVPPL are complying with all the recommendations/conditions of KCZMA. Copies of the HYCRs are also being sent to KCZMA. Compliance to the recommendations/conditions of KCZMA for the period April 2023 to September 2023 is enclosed as **Annexure VII**.
(xiii)	The responses/ commitments made during public hearing shall be complied with in letter and spirit.	**Being Complied** The project proponent is complying with the responses/commitments made during public hearing (as applicable). Status of the same is being submitted regularly with HYCRs to all the authorities concerned. The compliance status of the commitments made during Public Hearing & actions on the same during the compliance period April 2023 to September 2023 is enclosed as **Annexure VIII**.
(xiv)	All the recommendation of the EMP shall be complied with in letter and spirit. All the mitigation measures submitted in the EIA report	**Being Complied** Project is presently in construction stage. Recommendations of the Construction stage EMP are being implemented. Status of construction

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	shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF along with half yearly compliance report to MoEF-RO.	stage EMP in matrix format is enclosed as **Annexure IX**.
(xv)	The project proponent shall bring out a special tourism promotion package for the area in consultation with the State Government and implement the same along with the project.	**Being Complied** Implementation of the Tourism Management Plan is being discussed with tourism department for a way forward. *(Source: VISL)*
(xvi)	The project proponent shall place on its website its response to the Public Hearing, and representations as presented to the EAC in the 128th meeting held on 23rd November 2013, for information of the general public.	**Complied** All the relevant details pertaining to EIA, ToR, EAC meetings, Public Hearing, etc. related to the project have been placed on VISL website http://www.vizhinjamport.in/eia-30-5-13.php
(xvii)	There shall be no withdrawal of groundwater in Coastal Regulation Zone Area, for this project. In case any groundwater is proposed to be withdrawn from outside the CRZ area, specific prior permission from the concerned State/Central Groundwater Board shall be obtained in this regard.	**Noted** There will not be any withdrawal of groundwater in CRZ Area. In case of requirement of groundwater withdrawal outside CRZ area, specific prior permission will be obtained from State/Central Groundwater Board. At present, the water for construction purposes for the port is being sourced from the open market/private suppliers. On an average about 81 KLD water is being consumed for construction related activities, sprinkling, and drinking water during the compliance period (April 2023 to September 2023).
(xviii)	The Hazardous waste generated shall be properly collected and	**Being Complied** The Hazardous Waste at site are being stored according to the Hazardous Waste Rules.

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	handled as per the provision of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.	During the compliance period (April 2023 to September 2023) 1.167 KL of used oil, 22 kg of oily cotton material, 9 nos. battery waste, 19 nos. oil contaminated filters and 22 nos. of discarded containers had been generated and disposed to authorized (CPCB/KSPCB) handlers.
(xix)	No hazardous chemicals shall be stored in the Coastal Regulation Zone area.	**Noted for Compliance** No hazardous chemical is being stored in the CRZ area.
(xx)	The waste water generated from the activity shall be collected, treated and reused properly.	**Noted for Compliance**
(xxi)	Sewage Treatment facility should be provided in accordance with the CRZ Notification.	**Being Complied** A Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner in accordance with the CRZ Notification is being implemented. The order to develop the STP with capacity of 50 KLD has been awarded to M/s. Starcon Infra Projects (I) Pvt. Ltd.
(xxii)	No solid waste will be disposed of in the Coastal Regulation Zone area. The solid waste shall be properly collected, segregated and disposed as per the provision of Solid Waste (Management and Handling) Rules, 2000.	**Noted for Compliance** No solid waste is being disposed in the CRZ area. Bio-degradable waste is being treated in an Organic Waste Converter (OWC) installed at site and the output is being used as manure in greenbelt development within the port project areas. The dry waste is being properly collected, segregated, and disposed of in line with the Solid Waste Management Rules 2016, as amended.
(xxiii)	Installation and operation of DG set if any shall comply with the guidelines of CPCB. Oil spills if any shall be properly collected and disposed as per the Rules. Project proponent shall install necessary oil spill mitigation measures.	**Being Complied** In the compliance period, 17 DG sets were on site of which 3 were on standby. These are compliant to CPCB guidelines. Concrete storage with dyke is constructed for separation and used for containment. If any oil spill occurs, it shall be properly collected and disposed as per the Rules.

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(xxiv)	No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.	**Being Complied** Construction of the project is being carried out as per the approval obtained under CRZ Notification.
(xxv)	The approach channel shall be properly demarcated with lighted buoys for safe navigation and adequate traffic control guidelines shall be framed.	**Complied** AVPPL had given order for manufacturing, supply, and installation of Navigation Aids on 12.08.2023 and the same (7 Nos. of Navigation Buoys and Marine Lanterns) have been delivered to the Vizhinjam Port Site on 29.09.2023 and installed. A layout of the approach channel demarcated with Buoys for safe navigation with navigational aid buoys is attached as **Annexure X**.  **Star Board Side Buoy**

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
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		 **Port Side Buoy**  **South Cardinal Buoy** A Vessel Traffic Management System (VTMS) will be implemented prior start of commercial operation. The berthing tariff and policy structure (BPTS) will be circulated to relevant trade forums which will have port information on traffic guidelines.

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
(xxvi)	The project proponent shall take up development of green belt in the project area, wherever possible. Adequate budget shall be provided in the Environment Management Plan for such development.	**Will be Complied** Greenbelt: A natural greenbelt exists around the port boundary towards the landward side. Greenbelt of adequate width with suitable species as identified in the EIA is being developed in all possible areas in line with the establishment of the project. A greenbelt development plan has been considered in the Master Plan and adequate budgetary provision has been kept for this purpose. Landscape Development: Landscape development work has also been completed at several locations in the port areas.  **Fruit Orchard at GIS Building**  **Landscape Development in the Turning Circle**

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023

S. No.	Conditions	Compliance Status as on 30.09.2023

Landscape Development along Approach Road

Compensatory Afforestation: AVPPL, in collaboration with Forest department, have carried out planting of 40,040 trees in two Phases in adequate land as identified by social Forest Department, for a total area of 29.65 Ha spending Rs. 254.50 Lakhs. This has sufficiently covered the requirement of compensatory afforestation required for the development of Vizhinjam Port. Details of the same are provided below:

Phase	Location	Area (ha)	No. of Trees	Cost (Rs. Lakhs)
1	Sainik School, Kazhakootam	12.05	15,540	80.50
2	Kerala University Campus, Karyavattom	12.60	16,500	174.00
2	STP, Muttathara	5.00	8,000	
Total		**29.65**	**40,040**	**254.50**

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
		 **Progress at Sainik School, Kazhakootam**  **Progress at KU, Karyavattom**  **Progress at STP, Muttathara**

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
(xxvii)	The fund earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes.	**Being Complied** An amount of 40 Crores has been kept solely for EMP implementation as per the commitment in the EIA; and this amount is not diverted for any other purpose. An amount of Rs. 1.057 Crores has been utilized towards EMP implementation measures during compliance period April 2023 to September 2023. Till date, an amount of Rs. 28.64 Crores has been spent on environmental protection measures. The EMP expenditure is enclosed as **Annexure XI**.
(xxviii)	The project proponent shall set up an organizational mechanism/institutional structure for Environment, Health & Safety & CSR under the supervision of a General Manager as outlined in the EIA Report for effective implementation of the stipulated EHS safeguards & CSR activities.	**Complied** During construction phase an officer of VISL has been designated as Head (EHS & CSR) for effective implementation of the stipulated EHS safeguards & CSR activities. AVPPL has also appointed competent and qualified professional for effective implementation of EHS safeguards & CSR activities. In addition to the above, independent environment, health and safety consultants have been appointed as per concession agreement signed between GoK and AVPPL. It is also ensured that contractors executing the work also deploy qualified and competent EHS personnel for effective implementation of EMP measures. Organizational Structure for Environment, Health, and Safety & CSR for construction phase is enclosed as **Annexure XII**.
(xxix)	Staff Colony should be located beyond CRZ area.	**Will be Complied** Port facility planning is done in such a way that staff colony will be located beyond CRZ area.
12.	**General Conditions**	
(i)	Construction of the proposed structures shall be undertaken meticulously conforming to the existing Central/local rules and regulations including Coastal Regulation Zone Notification, 2011 & its	**Complied** All the construction activities are being carried out as per existing Central/local rules. Necessary permissions under CRZ Notification 2011 & its amendments have been obtained. Further, necessary approvals from concerned Statutory Departments/Agencies have been obtained for the construction designs/drawings relating to construction activities as mentioned hereunder:

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
	amendments. All the construction designs/drawings relating to the proposed construction activities must have approvals of the concerned Statutory Departments / Agencies.	• Consent to Establish (CTE) No. PCB/HO/TVM/ICE/08/2015 dated 15.09.2015 valid up to 31.07.2018 was renewed from Kerala State Pollution Control Board (KSPCB) vide Consent No. PCB/HO/TVM/ICE-R/02/2018, dated 19.07.2018 valid up to 31.07.2023 and further renewed vide Consent No. KSPCB/TV/ICE/10029484/2023 dated 30.07.2023 valid up to 31.07.2028 (A Copy of the same is enclosed as **Annexure I**). All other port construction related aligned activities such as paver blocks, batching plants, etc. fall under this CTE taken for the port development. • Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 07.12.2015. • CTE for Temporary Mobile Crusher at Vizhinjam port project site was obtained for the port construction activities vide Consent No. KSPCB/TV/ICE/10023574/2023 dated 15.04.2023 valid up to 14.04.2026 (A Copy of the same is enclosed as **Annexure XIII**). • CTE for Consumer Pump inside the Vizhinjam port premises was obtained on 05.03.2021 (Consent No.: PCB/TVM-DO/NTA/PTP/15/2021) for the period of 5 years valid up to 28.02.2026. • Consent to Operate (CTO) for Explosives Storage at Chappath area was obtained on 20.07.2021 (Consent No.: PCB/TVM-DO/ICO/NTA/HCS/49/2021) valid up to 31.12.2024. • As per the exemption granted by GoK G.O. No. 310/2015/LSGD dated 01.10.2015, AVPPL is not required to obtain any further building permits/permission to construct port related building within the port premises.
(ii)	Adequate provision for infrastructure facilities including water supply, fuel and sanitation must be ensured for construction workers during the construction phase of the project to	**Complied** On an average 1116 Nos. of employees, staff and construction workers were engaged in the port construction activities daily during the compliance period April 2023 to September 2023. There are no labourers residing in the labour camps. It is ensured that construction workers

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
	avoid any damage to the environment.	who are staying outside in the contractor rented houses/apartments are provided with necessary infrastructure facilities.
(iii)	Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.	**Being Complied** Mitigation measures are being followed while undertaking digging activities. Surface and Ground water quality is monitored monthly in line to Environment Monitoring Plan prescribed in EIA and analysis reports are enclosed as **Annexure IV**. There are no significant changes observed in the water quality during the compliance period.
(iv)	Borrow sites for each quarry sites for road construction material and dump sites must be identified keeping in view the following: (a) No excavation or dumping on private property is carried out without written consent of the owner. (b) No excavation or dumping shall be allowed on wetlands, forest areas or other ecologically valuable or sensitive locations. (c) Excavation work shall be done in close consultation with the Soil Conservation and Watershed Development Agencies working in the area, and (d) Construction spoils including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump	**Being Complied** Quarry material is being obtained from approved quarry sites only. • No excavation has been carried out in private property. • No excavation or dumping has been carried out in wetlands, forest area or other ecologically valuable or sensitive locations. • Kerala State Remote Sensing and Environment Centre (KSREC) have studied the impact due to construction of port approach road. Recommendations of KSREC are being implemented and suitable mitigation measures as suggested in the KSREC report are being adopted during construction. • No bituminous or hazardous material has been used.

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
	sites for such materials must be secured so that they shall not leach into the ground water.	
(v)	The construction material shall be obtained only from approved quarries. In case new quarries are to be opened, specific approvals from the competent authority shall be obtained in this regard.	**Being Complied** The construction material was obtained from approved quarries only. As on date, the Concessionnaire have obtained Environmental Clearance (EC) from the State Environmental Impact Assessment Authority (SEIAA) and Consent to Operate (CTO) from KSPCB for the following five granite building stone quarries: • Block No. 29, Re-Survey No. 120/10 in Manickal Village, Nedumangad Taluk, Thiruvananthapuram District, Kerala (Details submitted along with the HYCR for the period October 2019 to March 2020) • Survey No. 555/2, Nagaroor Village (Kadavilla), Chirayinkeezhu Taluk, Thiruvananthapuram District (Details submitted along with the HYCR for the period April 2019 to September 2019) • Block No. 47, Re-Survey Nos. 133/4, 133/16, & 139/6 in Aryanadu Village, Nedumangad Taluk, Thiruvananthapuram District, Kerala (Details submitted along with the HYCR for the period April 2022 to September 2022). • Block No. 30, Re-Survey No. 341/6 in Koodal Village, Konni Taluk, Pathanamthitta District, Kerala (Details submitted along with the HYCR for the period April 2022 to September 2022). • Block No. 37, Re-Survey Nos. 554/1, 554/5 & 554/6 in Nagaroor Village (Kadavilla), Chirayinkeezhu Taluk, Thiruvananthapuram District, Kerala (Details submitted along with the HYCR for the period April 2022 to September 2022). In case of new quarries, necessary approvals will be obtained from the competent authority.

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
		Apart from these, the concessionaire is also sourcing rocks from the following private quarry owners in Kerala: • Vismaya Rocks Pvt. Ltd. Quarry at Kummil Village, Kottarakara Taluk, Kollam District, Kerala • Tasna Mines Quarry at Mancode Village, Kottarakara Taluk, Kollam District, Kerala The concessionaire is also sourcing rocks from several private quarry operators in Tamil Nadu. It is ensured that all private quarry owners have necessary approvals and permits from competent authorities.
(vi)	The project authorities shall make necessary arrangements for disposal of solid wastes and for the treatment of effluents by providing a proper wastewater treatment plant outside the CRZ area. The quality of treated effluents, solid wastes and noise level etc. must conform to the standards laid down by the competent authorities including the Central/State Pollution Control Board and the Union Ministry of Environment and Forests under the Environment (Protection) Act, 1986, whichever are more stringent.	**Being Complied** • No solid waste is being disposed of in the CRZ area. • Solid waste is handled as per the Solid Waste Management Rules, 2016 as amended. • No solid waste is being disposed in the CRZ area. • Bio-degradable waste is being treated in an OWC installed at site and output is being used as manure in greenbelt development. • The dry waste is being properly collected, segregated, and disposed in line to Solid Waste Management Rules 2016, as amended. • A Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner in accordance with the CRZ Notification is being implemented. The order to develop the STP with capacity of 50 KLD has been awarded to M/s. Starcon Infra Projects (I) Pvt. Ltd. • Environment Monitoring is being carried out as per Environment Monitoring Plan prescribed in EIA by NABL accredited agency Standards Environmental & Analytical Laboratories. • Ambient Noise is being monitored as per Noise Pollution (Regulation & Control) Rules, 2000 (Rules 3 (1) and 4(1)) at 5 locations (Residential, commercial & Industrial) twice a month and it is observed that noise readings were within

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
		limits at all locations on all monitoring days during the monitoring months (from April 2023 to September 2023). • Detailed Monitoring Reports for the period April 2023 to September 2023 is attached as **Annexure IV**).
(vii)	The proponent shall obtain the requisite consents for discharge of effluents and emissions under the Water (Prevention and control of Pollution) Act, 1974 and the Air (Prevention and control of Pollution) Act, 1981 from the Kerala State Pollution Control Board before commissioning of the project and a copy of each of these shall be sent to this Ministry.	**Will be Complied** CTO under the Water (Prevention and control of Pollution) Act, 1974 and the Air (Prevention and control of Pollution) Act, 1981 will be obtained from KSPCB before commissioning of the project and copy of the CTO will be sent to Ministry on receipt.
(viii)	Adequate precautions shall be taken during transportation of the construction material so that it does not affect the environment adversely.	**Complied** Following precautionary measures are undertaken during transportation of the construction material as environment safeguard: • Tarpaulin cover is being used during transportation of construction material. • All vehicles coming into the site are under a speed restriction of 20 km/hr. • Regular Water Sprinkling is done on the approach road by water tankers. • It is ensured that all vehicles entering the Port have a valid PUC certification. • The dumpers have speed governors ensuring adherence to speed limit.

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
		 **Water Sprinkling in Progress**  **Tarpaulin Covered Trucks**  Form 53 Pollution Under Control Certificate Date : 31/01/2023 Time : 15:22:58 PM Validity upto : 30/01/2024 Vehicle Photo with Registration plate **PUC Certificate**

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
(ix)	Full support shall be extended to the officers of this Ministry/Regional Office at Bangalore by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.	**Noted** There was no visit by officers of Ministry/Regional Office at Bangalore during the compliance period. All necessary support will be extended to officers of this Ministry/Regional Office during inspection of the project/site visit; whenever planned.
(x)	Ministry of Environment & Forests or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.	**Noted for Compliance**
(xi)	The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied to the satisfaction of the Ministry.	**Noted**
(xii)	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment & Forests.	**Noted and Will be Complied** AVPPL is the concessionaire for implementing the project and operating it for the next 40 years, based on concession agreement signed between the GoK &, AVPPL on 17.08.2015. Vizhinjam International Seaport Limited (VISL) is the nodal agency for development of the port on behalf of GoK. As on date, there is no change in the project profile.
(xiii)	The project proponent shall inform the Regional Office as well as the Ministry, the date of	**Complied** Concession agreement with AVPPL was signed on 17.08.2015. The layout of the port has been approved by GoK by letter No.308799/E1/15/F&PD

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
	financial closure and final approval of the project by the concerned authorities and the date of start of land development work.	dated 30.10.2015 (Submitted along with the Compliance Report for the period October 2015 to March 2016). The preliminary construction activities commenced at site on 16.11.2015 followed by official inauguration on 05.12.2015. Financing agreement forming part of financial closure was submitted by the concessionaire on 13.05.2016.
(xiv)	Kerala State Pollution Control Board shall display a copy of the clearance letter at the Regional Office, District Industries Center and Collector's Office/Tehsildar's office for 30 days.	**Noted** This condition does not pertain to project proponent. However, it is learnt that KSPCB had complied with the same.
13.	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 2006, including the amendments and rules made thereafter.	**Noted for Compliance**
14.	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the	**Complied** All the construction activities are being carried out as per existing Central/local rules. Necessary permissions under CRZ Notification 2011 & its amendments have been obtained. Further, necessary approvals from concerned Statutory Departments / Agencies have been obtained for the construction designs/drawings relating to the proposed construction as mentioned hereunder: • Consent to Establish (CTE) No. PCB/HO/TVM/ICE/08/2015 dated 15.09.2015

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
	respective competent authorities.	valid up to 31.07.2018 was renewed from Kerala State Pollution Control Board (KSPCB) vide Consent No. PCB/HO/TVM/ICE-R/02/2018, dated 19.07.2018 valid up to 31.07.2023 and further renewed T vide Consent No. KSPCB/TV/ICE/10029484/2023 dated 30.07.2023 valid up to 31.07.2028 (A Copy of the same is enclosed as **Annexure I**). • Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 7.12.2015. • CTE for Temporary Mobile Crusher at Vizhinjam port project site was obtained for the port construction activities vide Consent No. KSPCB/TV/ICE/10023574/2023 dated 15.04.2023 valid up to 14.04.2026 (A Copy of the same is enclosed as **Annexure XIII**). • CTE for consumer pump inside the Vizhinjam port premises was obtained on 05.03.2021 (Consent No.: PCB/TVM-DO/NTA/PTP/15/2021) for the period of 5 years valid up to 28.02.2026. • Consent to Operate (CTO) for Explosives Storage at Chappath area was obtained on 20.07.2021 (Consent No.: PCB/TVM-DO/ICO/NTA/HCS/49/2021) valid up to 31.12.2024. • As per the exemption granted by GoK G.O. No. 310/2015/LSGD dated 01.10.2015, AVPPL is not required to obtain any further building permits/permission to construct port related building within the port premises.
15.	The project proponent shall advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Environment Clearance and copies of the clearance letters are available with the Kerala State Pollution Control	**Complied** Details regarding the advertisement that the project had been accorded EC and copies of the clearance letter that were published in local newspapers was intimated (along with copy of advertisement) to the regional office of MoEF&CC, vide letter No. VISL/EC/MoEF/2013 dated 20.01.2014 (Submitted along with the HYCR for the period October 2015 to March 2016). Copy of the EC is available on VISL website at http://www. vizhinjamport.in/eia-30-5-13.php. The same is also uploaded on Adani Ports and Special

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
	Board and may also be seen on the website of the Ministry of Environment & Forest at http://www.envfor.nic.in. The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bangalore.	Economic Zone (APSEZ) website at https://www.adaniports.com/Downloads.
16.	This Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.	**Noted**
17.	Any appeal against this clearance 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.	**Noted** Three appeals challenging the EC granted to the project (two appeals filed at NGT, Southern Regional Bench, Chennai and one at NGT, Principal Bench, Delhi) and one original application (OA-filed at NGT, Principal Bench Delhi) indirectly challenging the CRZ Notification, 2011 were filed as per the NGT Act, 2010. The appeals filed at Chennai bench were later transferred to the Delhi bench. The Delhi Bench of NGT has upheld the EC granted to the project vide its judgment dated 02.09.2016.
18.	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, ZilaParishad/Municipal Corporation, Urban Local Body and the Local NGO, if any from whom suggestions/ representations, if any,	**Complied** The EC was submitted to the concerned Panchayat, Zila Parishad/Municipal Corporation, Urban Local Body and the Local NGOs from whom representations were received vide letter No. VISL/EC/MoEF/2013 dated 29.01.2014. Copy of the EC is available on VISL website at http://www. vizhinjamport.in/eia-30-5-13.php. The

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
	were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	same is also uploaded on APSEZ website at https://www.adaniports.com/Downloads
19.	The proponent shall upload the status of compliance of the stipulated Clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; SPM, RSPM, SO_2, NOx (ambient levels as well as stack emissions) 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.	**Being Complied** The copy of the latest HYCR for the period October 2022 to March 2023 including the results of six monthly monitoring data for the same period has been uploaded on VISL website http://www.vizhinjamport.in and also on APSEZ website https://www.adaniports.com/Downloads. The HYCR for the period October 2022 to March 2023 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA via email dated 30.05.2023 (a copy of the email is enclosed as **Annexure XIV**). Environment Monitoring is being carried out as per Environment Monitoring Plan prescribed in EIA by NABL accredited agency Standards Environmental & Analytical Laboratories. Detailed Monitoring reports (Air, Water, Noise, Marine Water, and Sediment) for the Compliance Period April 2023 to September 2023 are enclosed as **Annexure IV**. Additionally, summary of monthly Environment monitoring results is also uploaded on the APSEZ website https://www.adaniports.com/Downloads.
20.	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated Clearance conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective	**Being Complied** HYCRs on the status of compliance of the stipulated clearance conditions including results of monitored data are regularly submitted to all the concerned agencies. As per the MoEF&CC Notification dated 26.11.2018, wherein submission of HYCRs by email/soft copy is declared acceptable, therefore the HYCR for the period October 2022 to March 2023 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the

Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
	Zonal Office of CPCB and the SPCB.	CPCB (Bangalore), KSPCB & KCZMA via email dated 30.05.2023 (a copy of the email is enclosed as **Annexure XIV**). Additionally, as per the MoEF&CC Office Memorandum dated 14.06.2022, the HYCR for the period October 2022 to March 2023 has been submitted online through newly developed compliance module in the PARIVESH Portal.
21.	The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned Kerala State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986 as amended subsequently, shall also be put on the website of the company along with the status of compliance of Clearance conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.	**Will be Complied** The project is in construction phase. The same shall be complied post commissioning during operational phase.

Enclosures:

Annexure Number	Details of Annexure
Annexure I:	Integrated CTE Renewal for Vizhinjam Port
Annexure II:	Mathematical Modelling Report (October 2022 to September 2023)
Annexure III:	Shoreline Monitoring Report (April 2023 to September 2023)
Annexure IV:	Environment Monitoring Report (April 2023 to September 2023)
Annexure V:	CMFRI Report on Estimation of Marine Fish Landings
Annexure VI:	CSR Activities by AVPPL (April 2023 to September 2023)
Annexure VII:	Compliance to Conditions of KCZMA Recommendation
Annexure VIII:	Compliance of the Commitments made during Public Hearing
Annexure IX:	Status of Environment Management Plan
Annexure X:	Navigational Buoys Layout
Annexure XI:	EMP Expenditure
Annexure XII:	Environment Health, Safety & CSR Organizational Structure
Annexure XIII:	CTE for Temporary Crusher Plant
Annexure XIV:	Email Submission of HYCR for the Period October 2023 to March 2023

Annexure I

Integrated CTE Renewal for Vizhinjam Port

KERALA STATE POLLUTION CONTROL BOARD

FILE NO. : KSPCB/TV/ICE/10029484/2023
Date of issue : 30-07-2023

INTEGRATED CONSENT TO ESTABLISH - RENEWAL

Consent No : KSPCB/TV/ICE/10029484/2023
Valid upto : 31 / 07 / 2028

Ref: Consent No : PCB/HO/TVM/ICE-R/02/2018 dated 19.07.2018 valid upto 31.07.2023

The Integrated Consent to Establish issued as per reference above to M/s. Adani Vizhinjam Port Pvt. Ltd. , Mulloor Post, Vizhinjam is hereby renewed up to 31 / 07 / 2028 and issued to M/s. Adani Vizhinjam Port Pvt Limited Mulloor Post, Vizhinjam .
The consent(s)/ variation order(s) cited under reference are integral part of this renewal order and this order is subject to the conditions stipulated therein and the following modifications/ additions.

GENERAL CONDITIONS

Sl no.	Item	**Description**
1	Validity	31.07.2028
2	Capital Investment	Rs.5552 Crores
3	Annual Fee	Rs.1,11,04,000/-.
4	Fee remitted	Rs. 55520000/-

CONDITIONS

1. This consent is granted subject to the power of the Board to review and make variations in all or any of the conditions as per section 21(6) of the Air (Prevention & Control) of pollution Act 1981 & section 27 of the water (Prevention & control) of pollution Act 1974.
2. This consent is granted on the basis of the affidavit and other documents furnished by the applicant. If the statement furnished in the affidavit/document is found false or in the case of

non-compliance of integrated consent to operate conditions the consent issued will be withdrawn/cancelled.

3. At the end of the validity period if the construction is in progress the same shall be renewed. The date of commissioning shall be intimated, at least one month in advance to the District Office of the Board.
4. The applicant shall comply with the instructions that the Board may issue from time to time regarding prevention and control of air, water, land and sound pollution.
5. Facilities as required under Solid Waste Management Rules, 2016; Plastic Waste Management Rules, 2016 and amendments and Hazardous Waste Management Rules, 2016; E-waste Management Rules, 2016 and Battery Waste Management Rules, 2022 and Construction and Demolition Waste Management Rules 2016 shall be provided.
6. Consent to Operate shall be obtained before commissioning of the project under the Water (Prevention and Control of Pollution) Act, the Air (Prevention and Control of Pollution) Act and the relevant Rules under Environment (Protection) Act. All other conditions of the Integrated Consent to Operate issued as per reference above remain unchanged.

SIGNATURE OF ISSUING AUTHORITY

CHAIRMAN

To

M/s Adani Vizhinjam Port Pvt. Ltd.
Adani Vizhinjam Port Pvt Ltd Mulloor Post, Vizhinjam
E-Mail : hebin.c@adani.com
Contact Number :9099056757,

1.This digitally signed document is legally valid as per the Information Technology Act 2000

2. For verifying this document please go to www.keralapcbonline.com and search using date of issue/name of the unit/Application Number in “Consent Granted Applications” link in the home page of the Board’s Phoenix website.

Annexure II

Mathematical Modelling Report

(October 2022 to March 2023)

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

Client: **Adani Vizhinjam Port Private Limited**
Vizhinjam

Project: Data Analysis & Model Studies for Vizhinjam Port using data collected by AVPPL (Oct 2022 – Sep 2023)	**Project No.:** C1231501	
Title: Data analysis and model study report (October 2022 – September 2023)	**Document No.:** RP003	**Rev.:** 0

File path:
https://adaniltd-my.sharepoint.com/personal/30029671_adani_com/documents/studies/lntiel_shoreline modelling/reports/october 2022 to september 2023/annual report/rp003-r0-sms-data analysis report on model studies-22-23.docx

Notes:

1.

Revision Details:

Rev.	Date	Details	Prepared Init.	Prepared Sign.	Checked Init.	Checked Sign.	Approved Init.	Approved Sign.
0	16/11/2023	First Submission	SMS		PRJ		PRJ	

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Executive Summary

Government of Kerala (GoK) is planning to setup a green field modern deep water multipurpose seaport at Vizhinjam in Thiruvananthapuram District of Kerala. Vizhinjam International Seaport Limited (VISL), which is a fully owned GoK undertaking, has been entrusted with the task of developing the green field seaport. VISL has awarded Adani Vizhinjam Port Private Limited (AVPPL) the job of constructing the port as a concessionaire. As a part of the project requirements, AVPPL must continuously monitor the impact of the port construction on the surrounding environment. A continuous monitoring will help to assess if at all the port construction has any impact on the neighbouring environment.

LNTIEL has been long associated with VISL and had carried out comprehensive marine model studies in August 2013. In 2022, LNTIEL submitted a report based on the data received from February 2021 - August 2022. A report encompassing model studies was also submitted. In a follow up for the project, LNTIEL was awarded the job for carrying out the data analysis and accompanying model study for the data collected from October 2022 to September 2023. LNTIEL was given the task of assessing the impact of port construction on shoreline, beach morphology, water quality and effect of waves on fishing harbour. Parameters in consideration were waves, current, tides, wind, bathymetry, turbidity, beach profile, etc. Physical oceanographic parameters such as waves, current and tides are primary variables. The variation in these parameters will cause changes in the dependent variables such as bathymetry, turbidity, and beach profile. In addition, impact of any major weather change has been evaluated. Since the trends are expected to change owing to the dynamic nature of the parameters, any abnormal changes in them were further investigated.

With this background, LNTIEL has prepared this report by carrying out the analysis of the data received from October 2022 to September 2023 to assess the impact of port development.

Following are the summary of the works carried out by LNTIEL to arrive at the intended scope of the project:-

1) Data Analysis

- The bathymetry analysis has been carried out to check whether any changes occurred in the sea water depth due to the impact of upcoming port. Analysis was carried out by considering 3 transect lines perpendicular to the shore; one on the North of port, one on the South of port and one near the port. Post-monsoon 2022 and pre-monsoon 2023 bathymetric cross sections were compared to post-monsoon 2015 and pre-monsoon 2015.
- An analysis and comparison are made between the observed wave data from October 2022 to September 2023 provided by AVPPL and the observed wave data from October 2020 to March 2022. The majority of the waves that are seen at the project site are between 0.5 and 1.5 metres in height. Additionally, a comparison between the wave data from 2015 and 2023 is made. From these comparisons, the variability of wave heights and directions are within expected ranges. It was also noted that some of the higher events were as a direct result of the moving storms & depressions in the sea and that these events caused a direct impact on the wave heights.
- The current data was provided for the post-monsoon of 2022 at three locations: Vizhinjam, Mulloor and Poovar. Analysis has been carried out to check if there are any changes in the trend of current components from the previous years due to the

construction of breakwater. It can be noticed that the current speed in the region is in the range of 0.1 to 0.4 m/s. However, occasionally maximum current speed observed during all the seasons is in the range of 0.6 to 0.8 m/s.

- LNTIEL extracted (+) 2 m contour from cross shore profile data. The time series plot of (+) 2 m contour over eight years with similar time scale were analysed. From this plot it can be noticed that the beach undergoes seasonal variation of erosion on monsoon season and accretion on other seasons.
- LNTIEL extracted -3m, -4m, -6m, -8m and -10m contours from cross shore profile data and time series plots of respective contours over two-year data are shown at Neerody, Pozhiyoor, Karumkulam, Panathura, Beemapally and Vettucaud locations.
- The near shore profile data obtained from pressure sensor survey were analysed and compared with the corresponding cross shore profiles. From the comparisons, significant variations are noticed between the two datasets at some CSP transects on the seaside where the cross shore and near shore profiles overlap.
- From the LEO data, it can be observed that the movement is towards south during monsoon and from earlier analysis; it was found that erosion on the northern side of the port takes place during the monsoon times. Therefore, the results of this analysis suggest that the erosion in the north during monsoon is not due to the port.

2) Model Studies

a) Assessment of Hydrodynamics

- Earlier in 2013, LNTIEL had comprehensively covered the assessment of hydrodynamics in the port vicinity. To understand the impact of the port construction on the hydrodynamics, LNTIEL carried out the assessment of hydrodynamics with the latest surveyed bathymetries.
- From the assessment of hydrodynamics, it was found that current speeds prevailing near the project location over past years (2013, 2022 and 2023) were identical.
- In addition, the model was also calibrated using the latest data. From the model studies it was found that the tide and current pattern at several locations follow trends set in the previous years. This indicates that the flow field remains the same and the impacts on the siltation and the shoreline will be as expected (concluded in model studies report of 2012)

b) Long shore sediment transport

- Long shore sediment transport refers to the cumulative movement of beach and near shore material parallel to the shore by the combined action of tides, wind, waves and the shore-parallel currents produced by them.
- The study area extends from Edappadu Beach (CS 01) in the South to Thumba (CS 81) in the North over a stretch of approximately 40km. This coast can be distinguished into two subsets depending on the coastal orientation. The shore angle on south side is in the range of 125^0 to 130^0 (True North) and shore angle on north side is in the range of 135^0 to 145^0 (True North). This change in orientation will have effect on long shore sediment transport and its behaviour.
- To compute longshore transport rate, breaking parameters need to be estimated first. The breaking parameters such as breaking wave height, breaking depth and breaking angle (shore normal) were calculated using depth limited criterion. The wave parameters were collected from WRB deployed at 23.2 m water depth and the breaking characteristics of waves were determined by combining wave refraction and shoaling calculations with wave breaking criteria.

- Depending on the coast orientation two average LSTR estimates were calculated based on available 7 years data (Feb 2015 – Feb 2023, Feb-Feb is considered since most beach profiles have built up, even though the scope of this report is Oct 2022-Mar 2023). The northerly and southerly (annual average) long shore sediment movement in south stretch is in the range of 0.17 to 0.19 M m^3/yr (Northwards) and -0.16 to -0.17 M m^3/yr (Southwards). In north stretch, the range is 0.24 to 0.26 M m^3/yr (Northwards) and -0.11 to -0.12 M m^3/yr (Southwards).The net annual average long shore sediment movement in south stretch is in the range of 0.01 to 0.02 M m^3/yr (Northwards) and in north stretch in the range of 0.13 to 0.14 M m^3/yr (Northwards).

c) Impact of breakwater, groynes and seawalls on 10km radius of Vizhinjam port

- The shoreline evolution model study has been carried out for various phase of breakwater development incorporating all the existing coastal features (manmade and natural). The model considers a 10km coastal stretch for the simulation of shoreline evolution on either side of the port. Only three groynes are there within 10km radius and all other groynes are outside 10km radius and the effect of those groynes will be localised.
- From the simulated results it is noticed that the shoreline evolution follows a similar trend as of no breakwater case whilst the introduction of breakwater in the model. The accretion and erosion patterns are as predicted earlier in 2012 report. The maximum accretion of 7m is observed after 10 year, at a rate of 0.7 m/year near the port location. The maximum erosion of 1.4m is observed at a rate of 0.14 m/year at the locations north of port. Shoreline changes are noticed near the groin fields north of the port which were constructed by Government of Kerala. However, the changes around groin fields are localised and the port has no effect on these changes.
- The absence of any adverse effect on the shoreline towards north-west side of the proposed port can be attributed to many factors including the presence of headlands, the low longshore sediment transport rates and relatively high cross-shore sediment transport, and presence of distinct sediment cells.

1 Introduction

Government of Kerala is setting up a green field, modern deep water, multipurpose seaport at Vizhinjam in Thiruvananthapuram District of Kerala. Vizhinjam International Seaport Limited (VISL), which is a fully owned Government of Kerala undertaking, has been entrusted with the task of developing the green field seaport.

In this regard, VISL had appointed Royal Haskoning DHV India (RHI) as their technical consultant in April 2010 and entrusted RHI with the task of preparing the concept port Master Plan. The port layout and the conceptual design were provided by RHI. As an initial study, Ministry of Environment and Forests (MoEF) had suggested VISL to explore the likely impacts on the existing fishing harbour and adjacent coastal regions due to the proposed port. Later, as part of the EIA studies, VISL appointed AECOM India Private Limited (AEIPL) to prepare the Detailed Project Report (DPR) for the Development of Vizhinjam Port. As a part of DPR and EIA studies, the design criterion for the port as well as the impact of the port on the marine environment was studied.

L&T Infrastructure Engineering Limited (LNTIEL) (formerly known as L&T Rambøll Consulting Engineers Limited) has been long associated with VISL. LNTIEL had assisted VISL in preparing a comprehensive model studies report containing details of effects of the port construction on various oceanic parameters such as wave, currents, sedimentation, shoreline changes, etc. LNTIEL had also assisted VISL in NGT hearings and other activities necessary to obtain clearances for development of the port.

With subsequent progress in the project, Adani Vizhinjam Port Private Limited (AVPPL) was appointed as a concessionaire by VISL. During NGT's hearings it was ordered by the honourable court to carry out intense monitoring to assess the impact of the upcoming port on the environment. This included regular collection and assessment of environmental data and assessment of the impacts of the port construction on environment through these data. As a concessionaire, AVPPL was assigned the task to collect environmental data at regular intervals. Considering LNTIEL's long association with this project and the fact that LNTIEL had carried out most of the previous marine related model studies earlier, AVPPL approached LNTIEL with the task of assessing the data collected by AVPPL and to carry out model studies to study the impact on the environment due to the port construction.

In this context, LNTIEL have been carrying out data analysis and the required model studies based on the data collected from February 2015 to September 2022, LNTIEL has produced reports containing analyses for all these years and has drawn out comparisons with the baseline data (2015; pre-project scenario). In continuation, AVPPL has awarded the job to LNTIEL for carrying out the data analysis and accompanying model study for October 2022 to September 2023 period. AVPPL has measured oceanographic data from October 2022 to September 2023 and provided it to LNTIEL for carrying out the data analysis and accompanying model study. This report is a part of the final report and contains the analysis of data and model studies carried out and is named as "Intermediate Model study Report"

1.1 Project location

The deep-water port is being constructed at Vizhinjam in Thiruvananthapuram District of Kerala. A Vizhinjam fishing harbour is located at about 300m north of the port and is a major landmark at this location. The port location is shown in Figure 1-2.

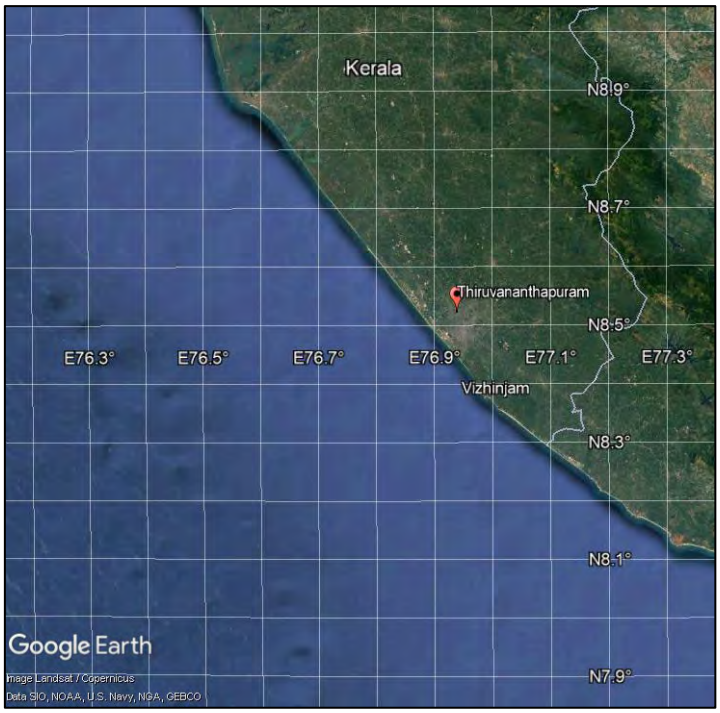


Figure 1-1 Location map of Vizhinjam

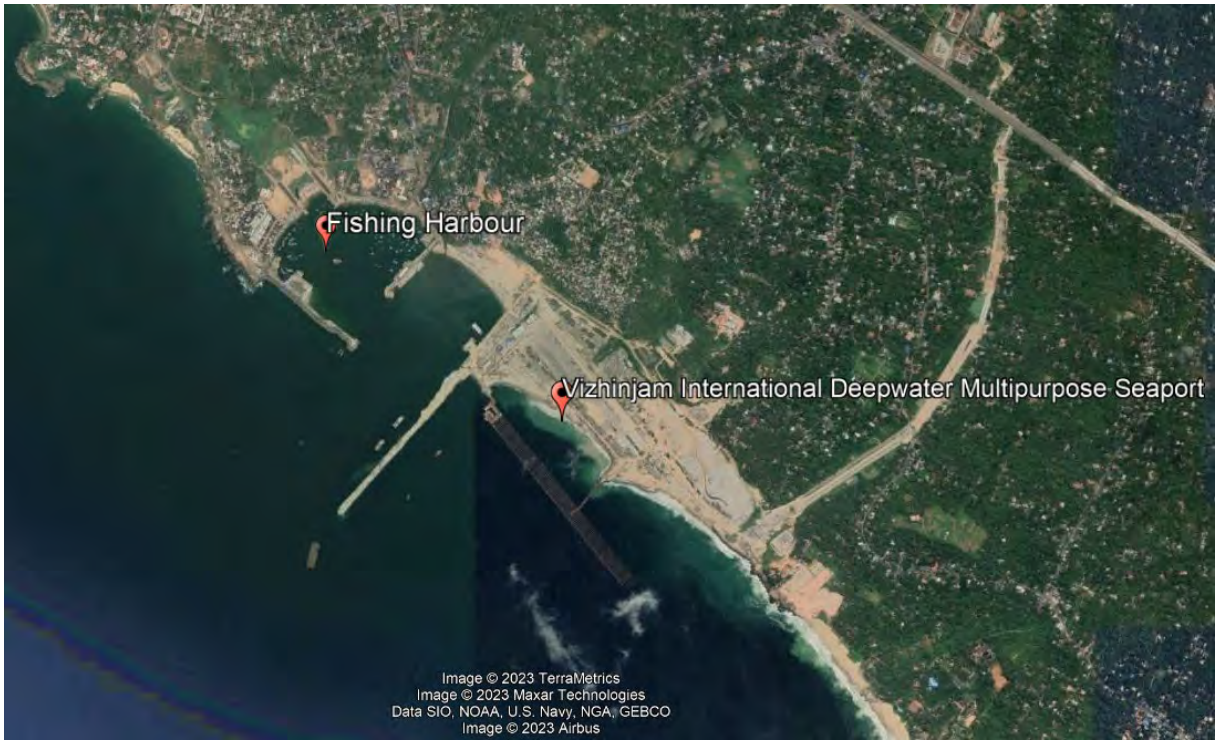


Figure 1-2 Location of the port (zoomed in)

2 Data Analysis

AVPPL has measured oceanographic data from October 2022 to September 2023 and has shared the list of data presented in Table 2-1.

Table 2-1 Data covered in present analysis

S. No	Data covered in present analysis
1	Wave data recorded continuously during the period of October 2022 to September 2023. (Missing Data : April 2023, May 2023, 11th August to 21st September 2023)
2	Long term observation of water level variations for the period October 2022 to September 2023.
3	Measurement of wind speed and direction from October 2022 to September 2023
4	Surveyed bathymetry for Post Monsoon 2022 and Pre monsoon 2023
5	Cross shore beach profiles at 81 locations which cover approximately 40 km along the coastline.
6	Near shore profiles from pressure sensor survey along 7 CSP transects (CSP Nos. 2, 33, 34, 68, 69, 73 and 74)
7	Littoral Environment Observations
8	Monthly photographic documentation at 81 locations

2.1 Waves

Wave data is being recorded continuously off Vizhinjam since early 2015. This section of the report discusses about the wave parameters based on the observed wave data. Wave parameters were measured using WRB (Mulloor) at 08°21' 43.15" N, 76°59'25.86" E (-23.2 m) during the period of 01st October 2022 to 31st September 2023 for this cycle of study. The measured significant wave height, peak wave period and direction are represented in the form of graphs and are presented in Figure 2-1 to Figure 2-3.

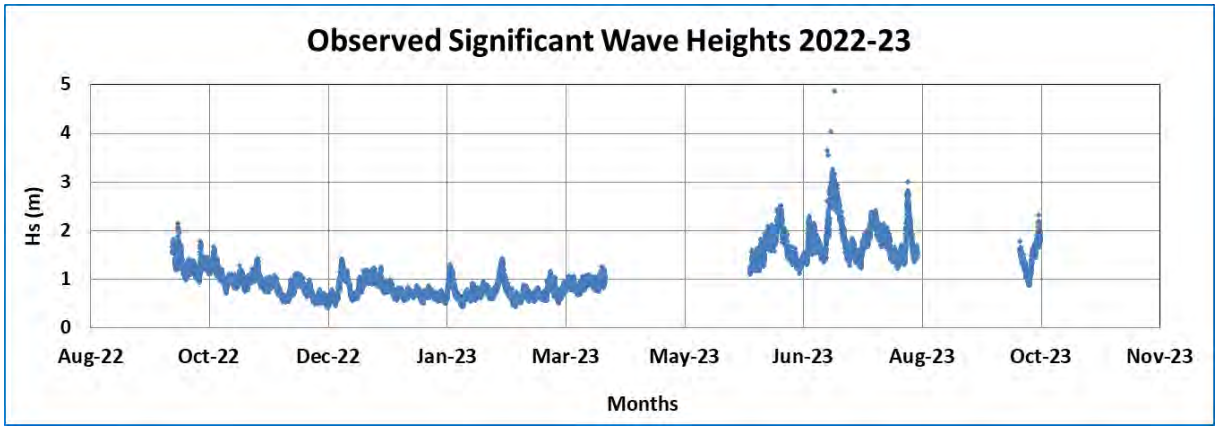


Figure 2-1 Temporal plot of wave height for observed wave data

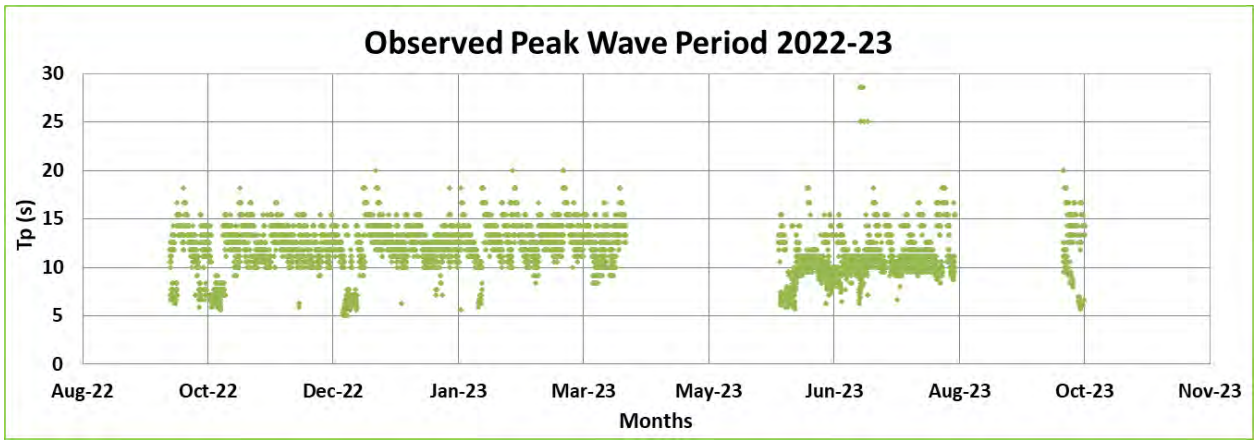


Figure 2-2 Temporal plot of peak wave period for observed wave data

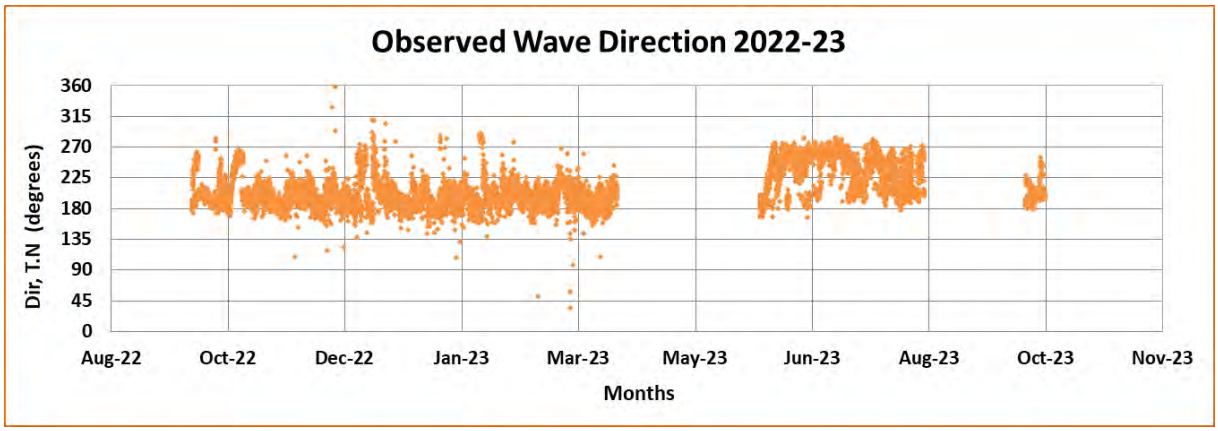


Figure 2-3 Temporal plot of wave direction for observed wave data

From the above graphs, we can observe that the significant wave heights are mostly in the range of 0.5 m – 1.5 m during non-monsoon period and it reaches around 5m during monsoon period.

It can be observed that wave direction throughout the period is mostly between 180^0 – 270^0 (S to W) with respect to true North. The predominant wave direction is observed to be from SSW. During Non-monsoon season the direction is mainly from S to SW.

The following table accounts for the higher wave events that can be noticed in the graph for wave heights. It may be noted that in most of these events, the cause was either a storm or a depression. As a general trend, an increase in wave heights is observed over past few years and at least one strong event per year.

Table 2-2 Significant events observed during Oct 2022 to Mar 2023

S. No.	Date	Reason	Intensity
1	15th to 17th Dec 2022	Low Pressure Area over east-central and adjoining southeast Arabian sea.	-
2	2nd Feb to 7th Feb 2023	Depression over Sri Lanka	Depression

S. No.	Date	Reason	Intensity
3	6th June to 19th June	Extremely Severe Cyclonic Storm Biparjoy	-

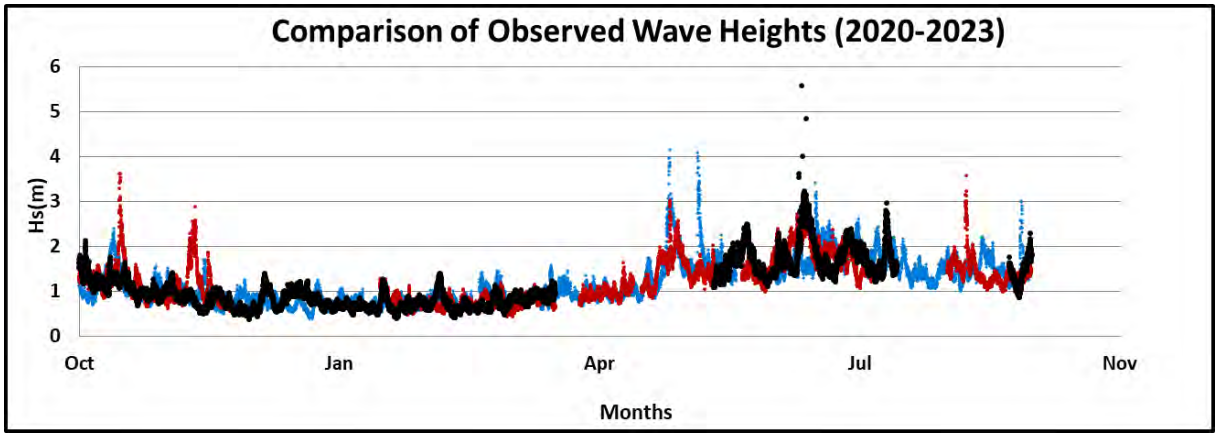


Figure 2-4 Comparison of wave heights for past 3 years (2020 – 2023)

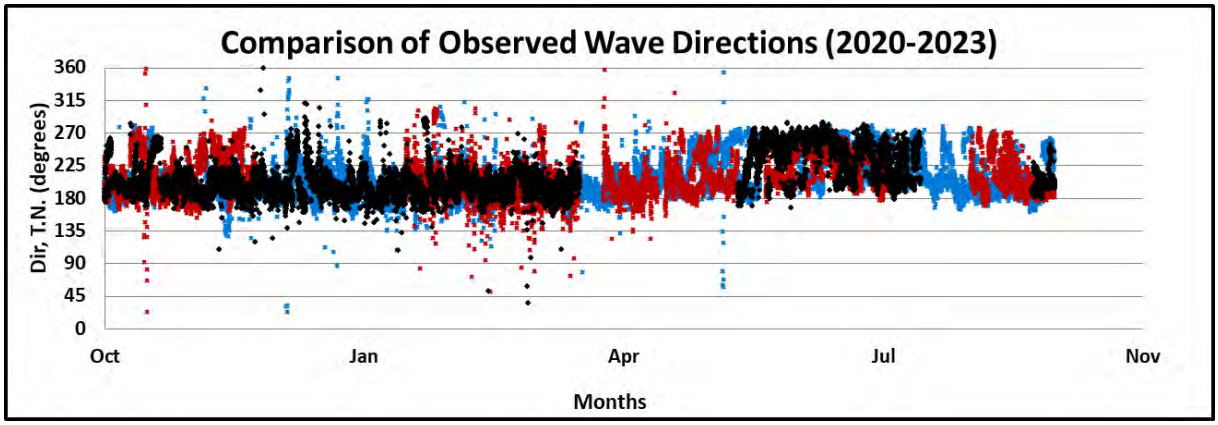
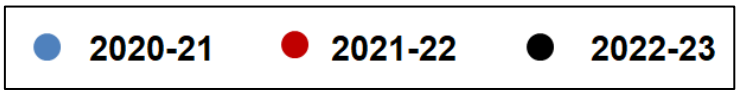


Figure 2-5 Comparison of wave directions for past 3 years (2020 – 2023)



Legend of wave height and wave directions plots (2020 – 2023)

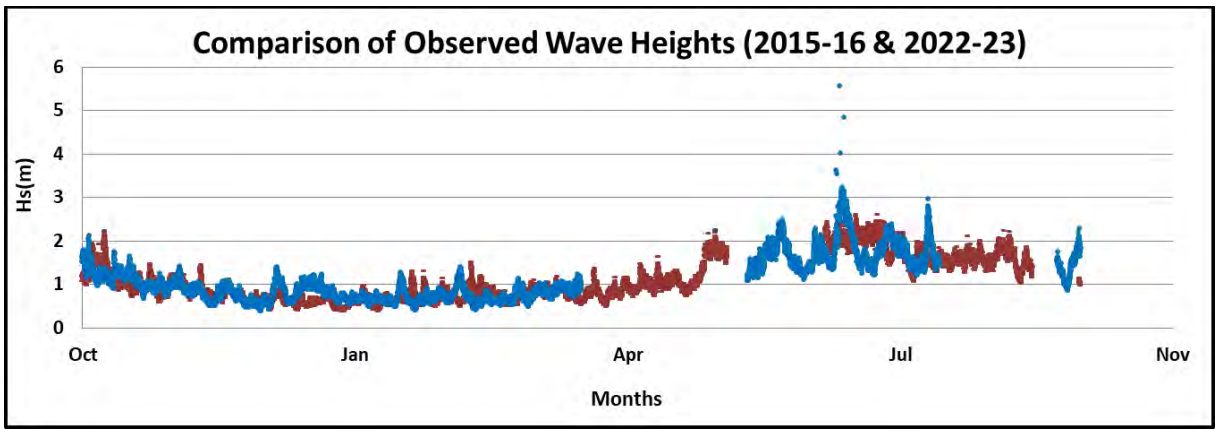


Figure 2-6 Comparison of wave heights (2015-16 & 2022-23)

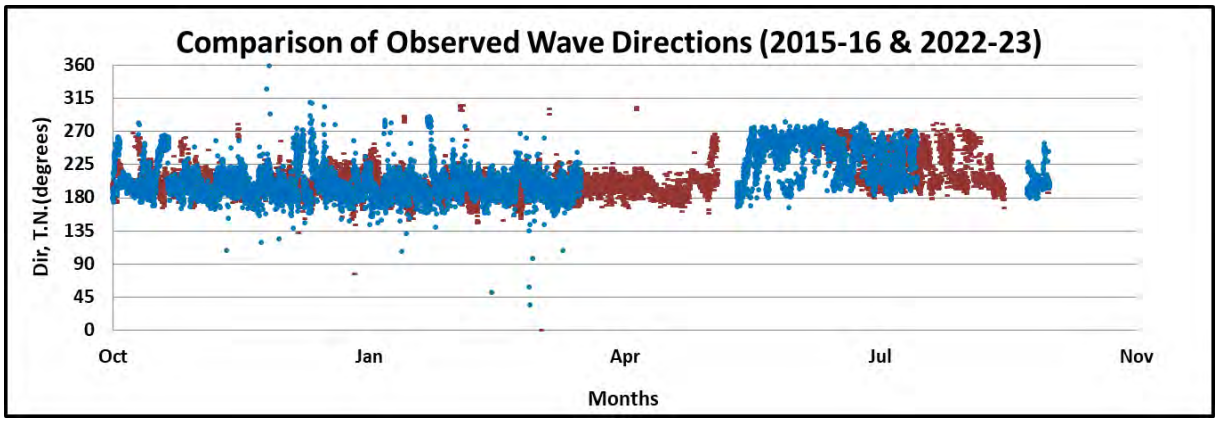


Figure 2-7 Comparison of wave directions (2015-16 & 2022-23)

Legend for wave height comparison plots (2015-16 & 2021-22)

From these comparisons, it can be observed that wave direction remains mostly between 180^0 – 270^0 (S to W) with respect to true North. The predominant wave direction is observed to be from SSW. It was also noted that some of the higher events were as a direct result of the moving storms & depressions in the sea and that these events caused a direct impact on the wave heights.

2.2 Tide

Long term observation of water level variations at a location is useful as it provides the required data for estimating the tidal harmonic constituents, which can be used to arrive at the tidal statistics as well as for the prediction of tidal levels at the location. Long term observation of tidal elevation at Vizhinjam, though intermittent, is available from 1971 to present. In addition to these data, in-situ tide measurements using ATG were also available in earlier reports. Due to the low range, the influence of tide on the coastal currents is expected to be low. AVPPL also provided tide data collected by NIOT for the period from 03rd November 2012 to 7th March 2013, 25th May to 3rd August 2013, 7th February 2015 to 29th February 2016, 01st March 2017 to 28th February 2018 and February 2018 to February 2019. For the period March 2019 to June 2020, Ocean Science collected data at 08° 22' 33.68" N, 76° 59' 16.65" E and at a depth of 3.3 m. Shankar & Co. (SAC) collected data from July 2019 to September 2022. These data were reported in the earlier reports by LNTIEL.

Subsequently, SAC collected data, at the above mentioned location, for the period October 2022 to 30th September 2023. The measured tide is presented in Figure 2-8.

In December 2021 Survey of India (SOI) corrected the datum used for tide measurement and notified vide no 2497/39-C-(Vizhinjam). As per the notification an adjustment of 0.549 m has been applied to all bathymetries and cross shore profile data as required.

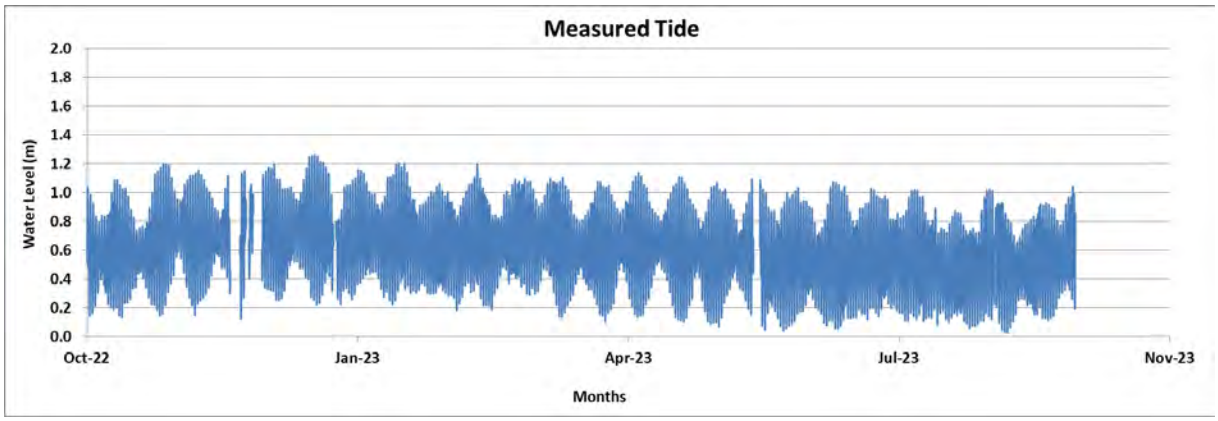


Figure 2-8 Tide data measured during Oct 2022 to 30th Sep 2023

2.3 Currents

Measured current speeds and directions at different depths as given in Table 2-3 at four different locations Pachalloor, Vizhinjam, Mulloor and Poovar as presented in Figure 2-9. AVPPL provided the current data for one month for one season from October 2022 to March 2023 (Post-monsoon). The data collected for Post-Monsoon season are presented in Figure 2-10 to Figure 2-15.

Figure 2-9 Locations from where the current data are collected

Table 2-3 Observed Current Speed and Direction (October 2022 to March 2023)

Location and Depth (CD,m)	Coordinates		Post Monsoon	
	Latitude	Longitude	Current Speed Range (m/s)	Predominant Current Direction
Vizhinjam 21.1	$8^0$21'55.4"	$76^0$58'51.6"	0.1-0.40	SE
Poovar 23.0	$8^0$17'35.8"	$77^0$04'03.5"	0.1-0.40	SE
Pachalloor 21.4	$8^0$24'08.6"	$76^0$56'16.1"	-	-
Mulloor 23.2	$8^0$21'42.3"	$76^0$59'33.9"	0.1-0.50	SE

The current speed and the current direction for different seasons at three different locations are shown Figure 2-10 in to Figure 2-15. The Pachalloor ADCP was lost during the monsoon 2022 campaign; therefore observations were carried out only at 3 locations for post monsoon 2022. Start and end times of observed currents in three seasons is as shown in Table 2-4.

Table 2-4 Current observation timeline (October 2022-March 2023)

Location	Coordinates		Post Monsoon	
	Latitude	Longitude	Start date	End date
Vizhinjam	$8^0$21'55.4"	$76^0$58'51.6"	28/02/23	30/03/23
Poovar	$8^0$17'35.8"	$77^0$04'03.5"	28/02/23	30/03/23
Pachalloor	$8^0$24'08.6"	$76^0$56'16.1"	-	-
Mulloor	$8^0$21'42.3"	$76^0$59'33.9"	28/02/23	30/03/23

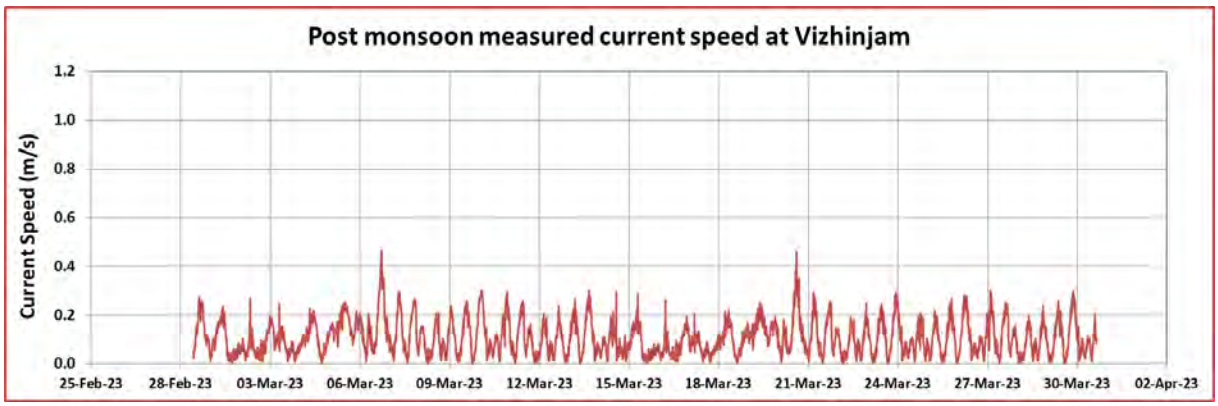


Figure 2-10 Post monsoon measured current speed at Vizhinjam during March 2023

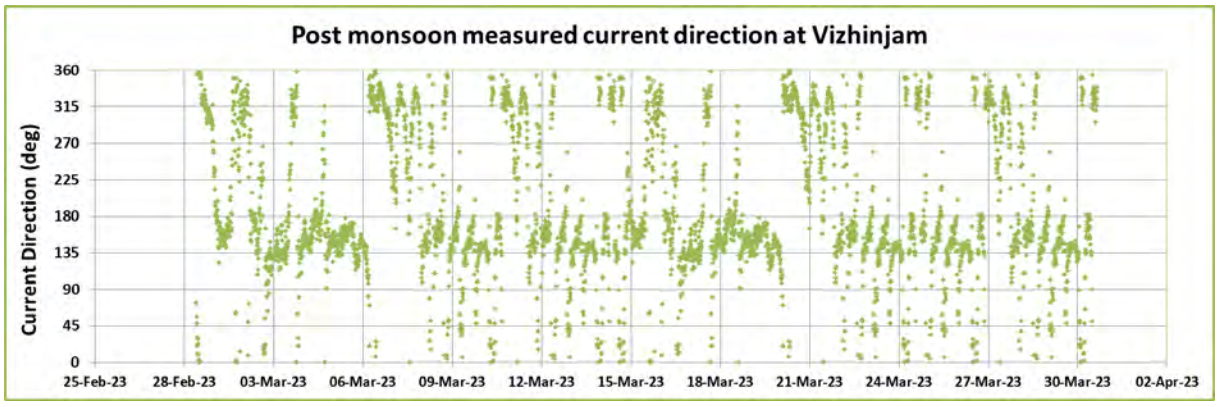


Figure 2-11 Post monsoon measured current direction at Vizhinjam during March 2023

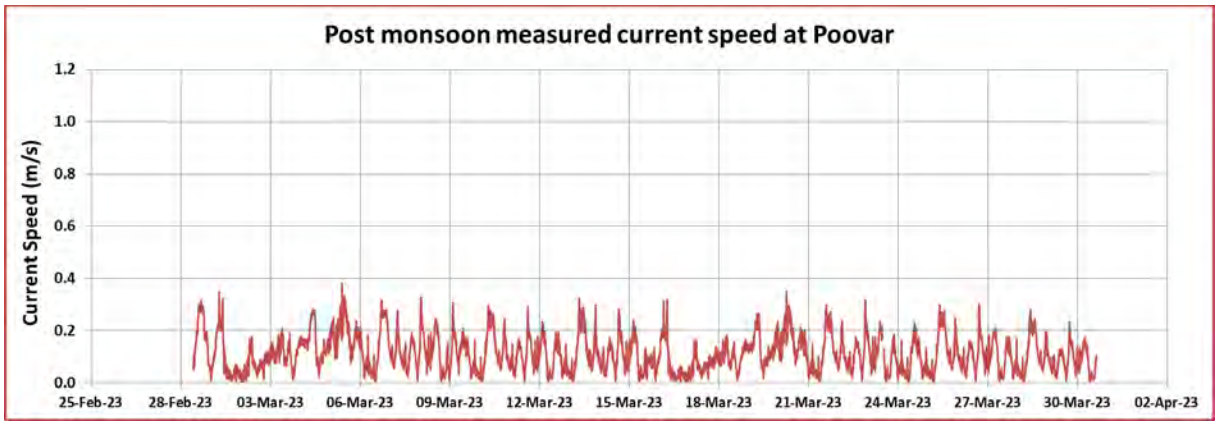


Figure 2-12 Post monsoon measured current speed at Poovar during March 2023

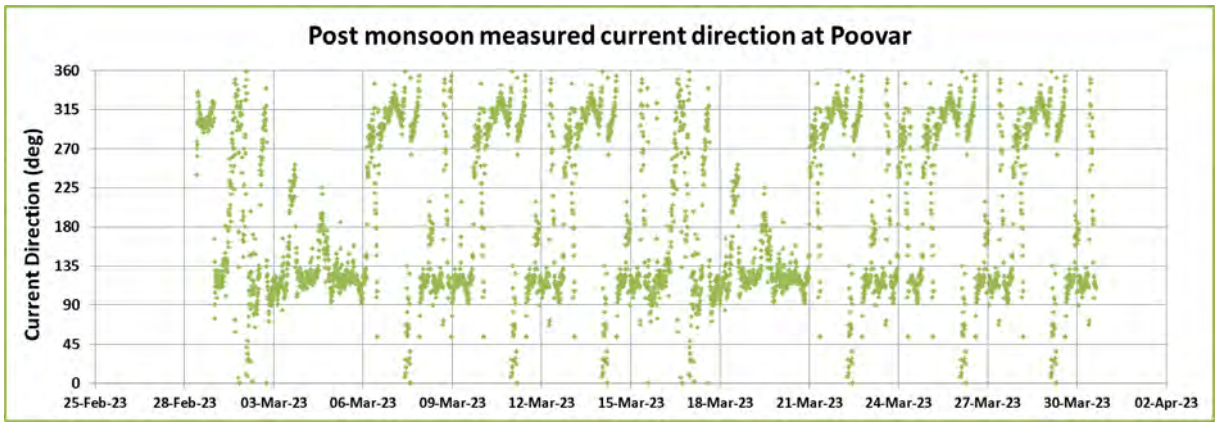


Figure 2-13 Post monsoon measured current direction at Poovar during March 2023

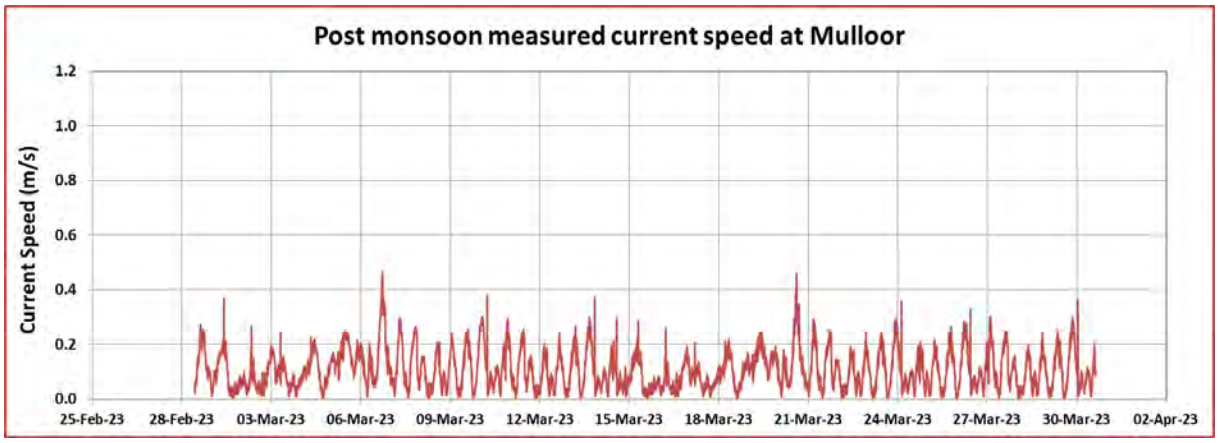


Figure 2-14 Post monsoon measured current speed at Mulloor during March 2023

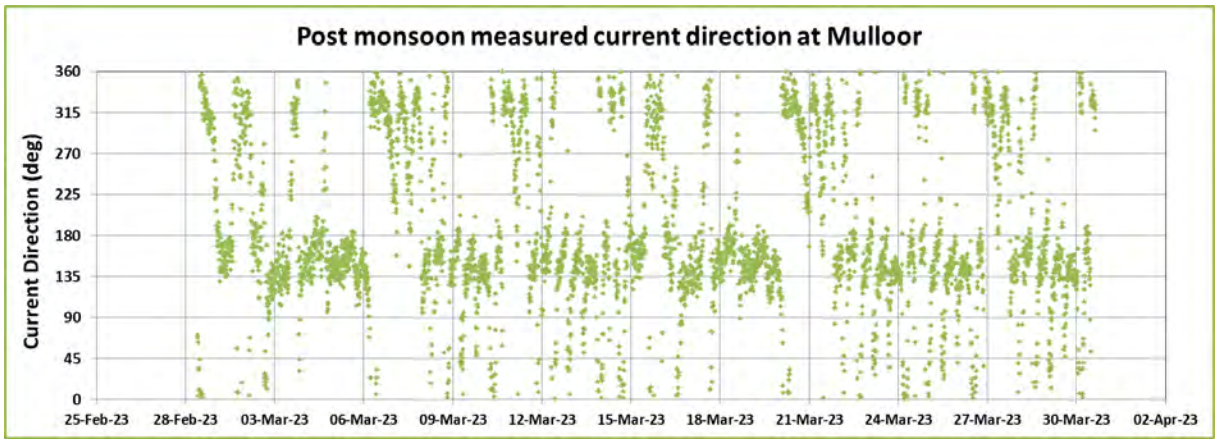


Figure 2-15 Post monsoon measured current direction at Mulloor during March 2023

It can be noticed that the current speed in the region will be in general in the range of 0.1 to 0.4 m/s. However, occasionally maximum current speed observed during all the seasons is in the range of 0.6 to 0.8 m/s.

2.4 Wind

The Automatic Weather Station (AWS) is installed at 08° 22' 22.75"N, 76° 59' 39.62"E (on the terrace of the Port Control Office). The location of AWS is presented in Figure 2-16.

AVPPL provided the measurement of wind speed and direction from 1st October 2022 to 31st September 2023. The wind speed mostly varies from 2 to 7 m/s and the maximum wind speed measured is 14 m/s. The graph showing the variation of wind speed and wind direction, measured at an elevation of 10m with respect to MSL is presented in Figure 2-17 and Figure 2-18.

Figure 2-16 Location of AWS

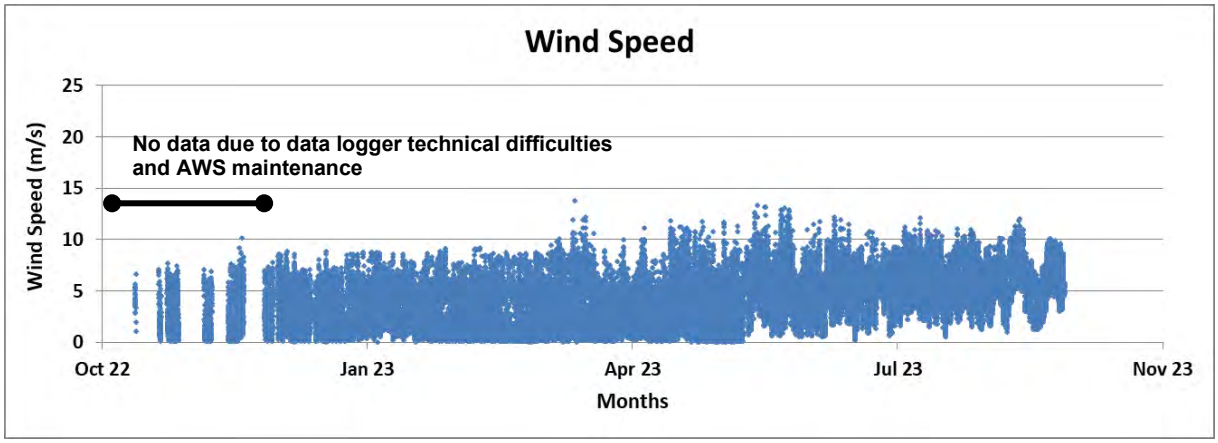


Figure 2-17 Wind speed measured during October 2022 to September 2023

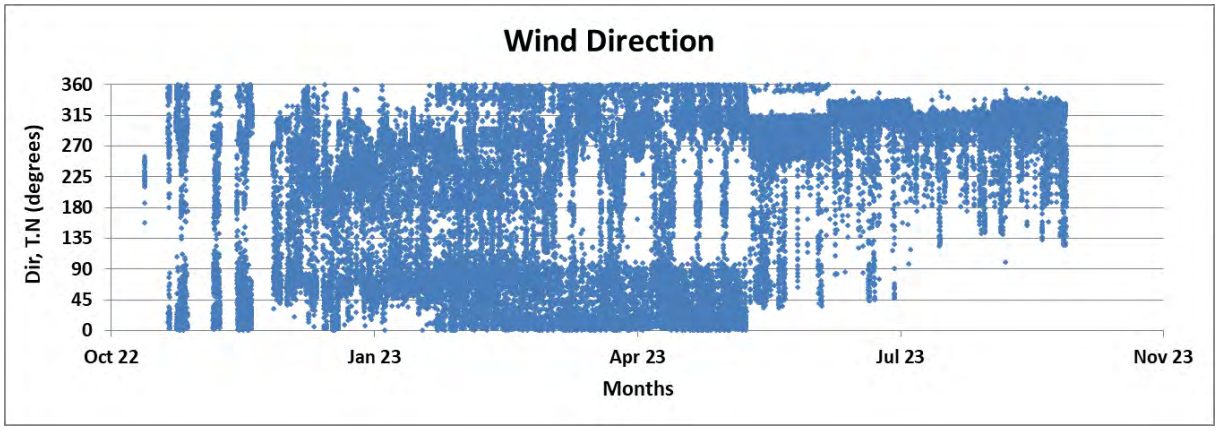


Figure 2-18 Wind direction measured during October 2022 to September 2023

2.5 Bathymetry

A bathymetry survey was done by National Institute of Ocean Technology (NIOT) in April 2003. The survey was carried out in a 1.5 km x 10 km wide corridor along the shore. The bathymetry survey for the proposed project area was done during February to March 2011 by Fugro Survey India Private Limited (FSINPVT). Secondary information on bathymetry from Naval Hydro graphic Chart (NHO – chart no. 2111) and those from ETOPO1 global relief model of NOAA were extracted for the project site. The bathymetry for the model study reports submitted earlier was created by combining the primary data from the surveys by NIOT and FSINPVT with those available from NHO Charts and ETOPO1.

The surveyed bathymetry for Post Monsoon 2022 and Pre Monsoon 2023 are shown in Figure 2-19 and Figure 2-20.

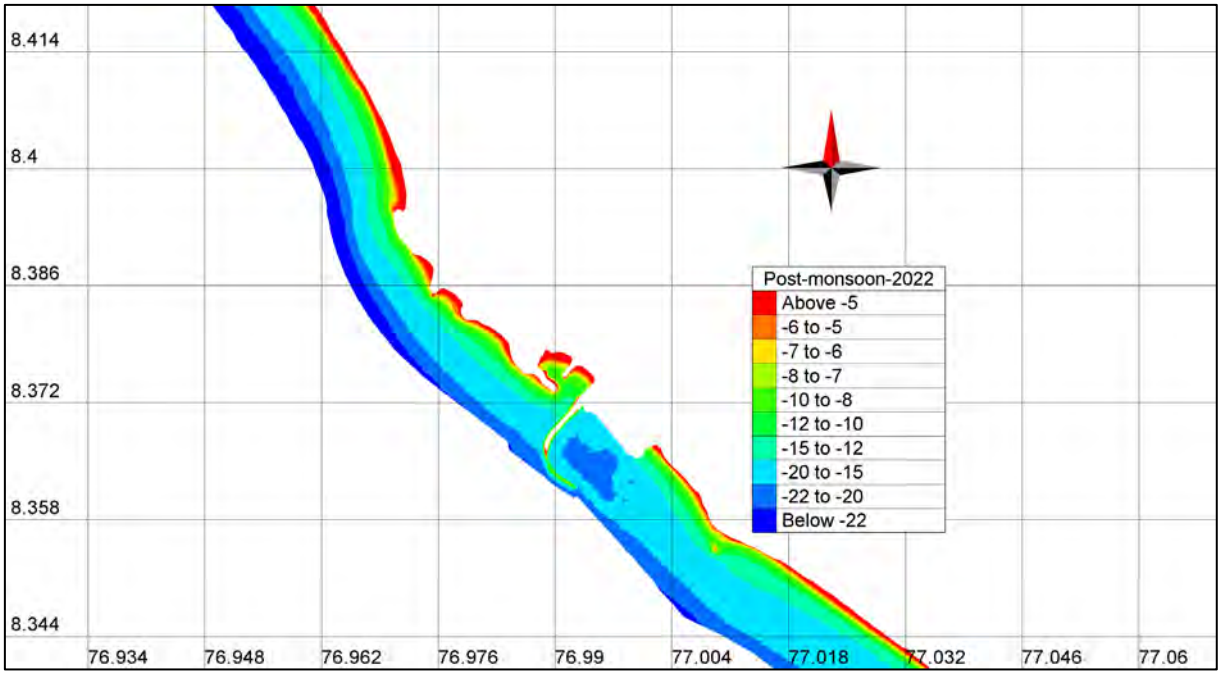


Figure 2-19 Bathymetry survey data using MBES for Post Monsoon 2022

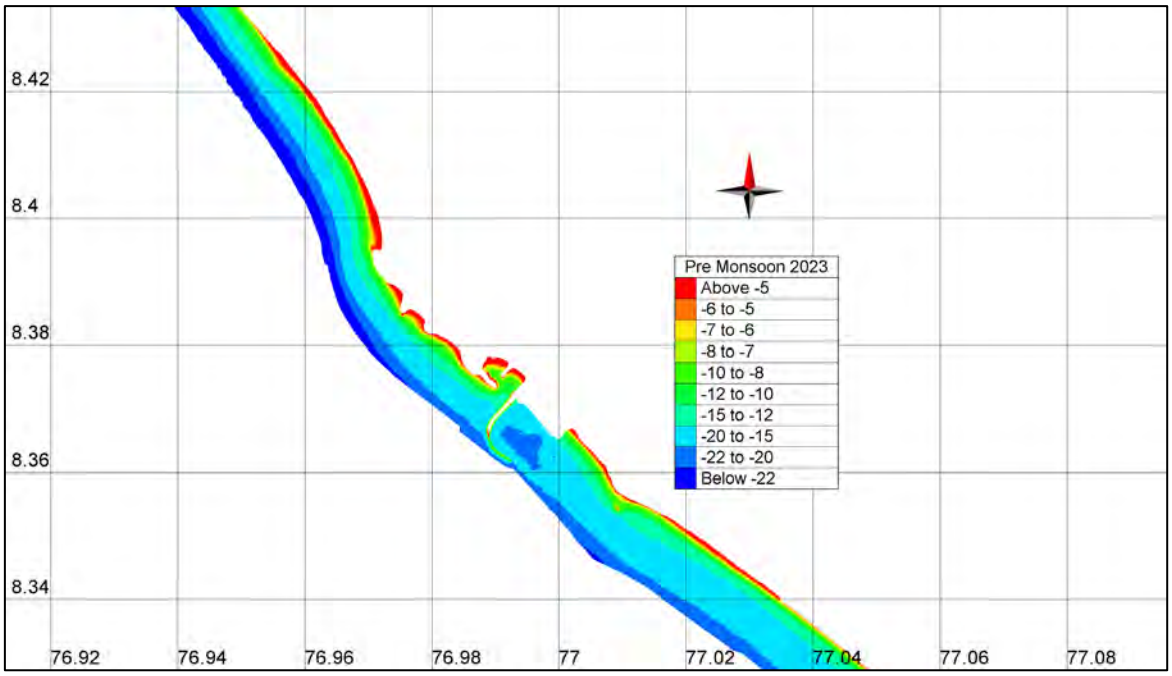


Figure 2-20 Bathymetry survey data using MBES for Pre Monsoon 2023

A comparison was made between Post monsoon 2021 and Post monsoon 2022 MBES data and is shown in Figure 2-21.The comparison of bathymetry data between pre monsoon 2022 and pre monsoon 2023 is shown in Figure 2-22.

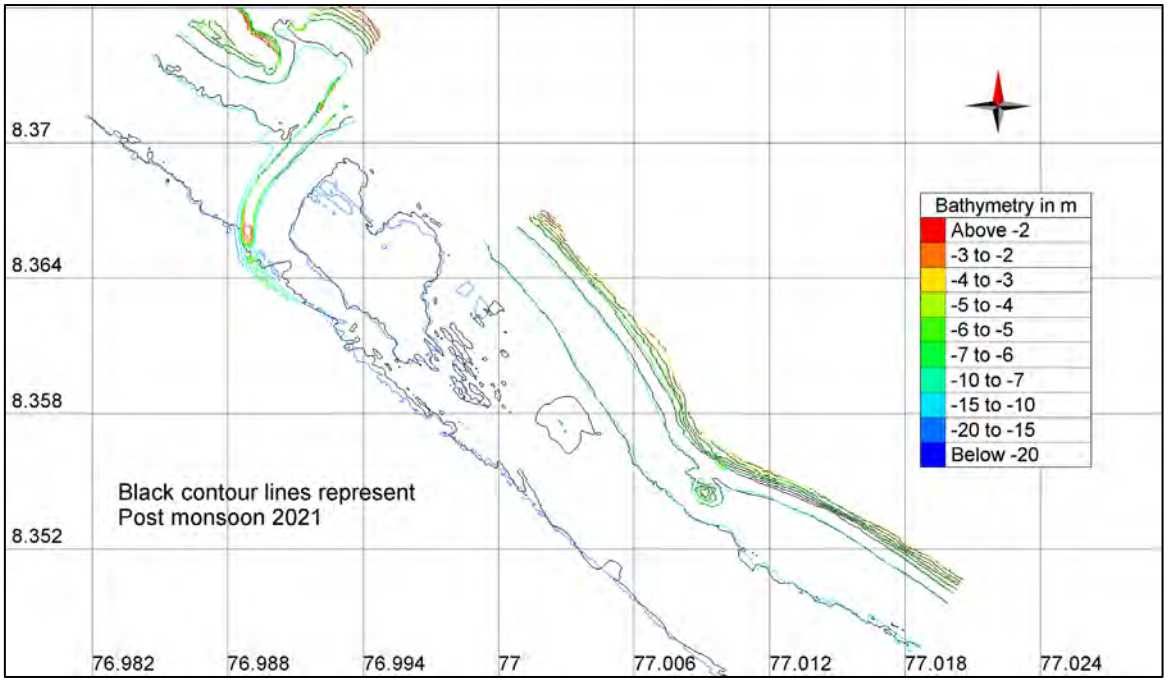


Figure 2-21 Difference in Bathymetry during Post monsoon 2021 and 2022

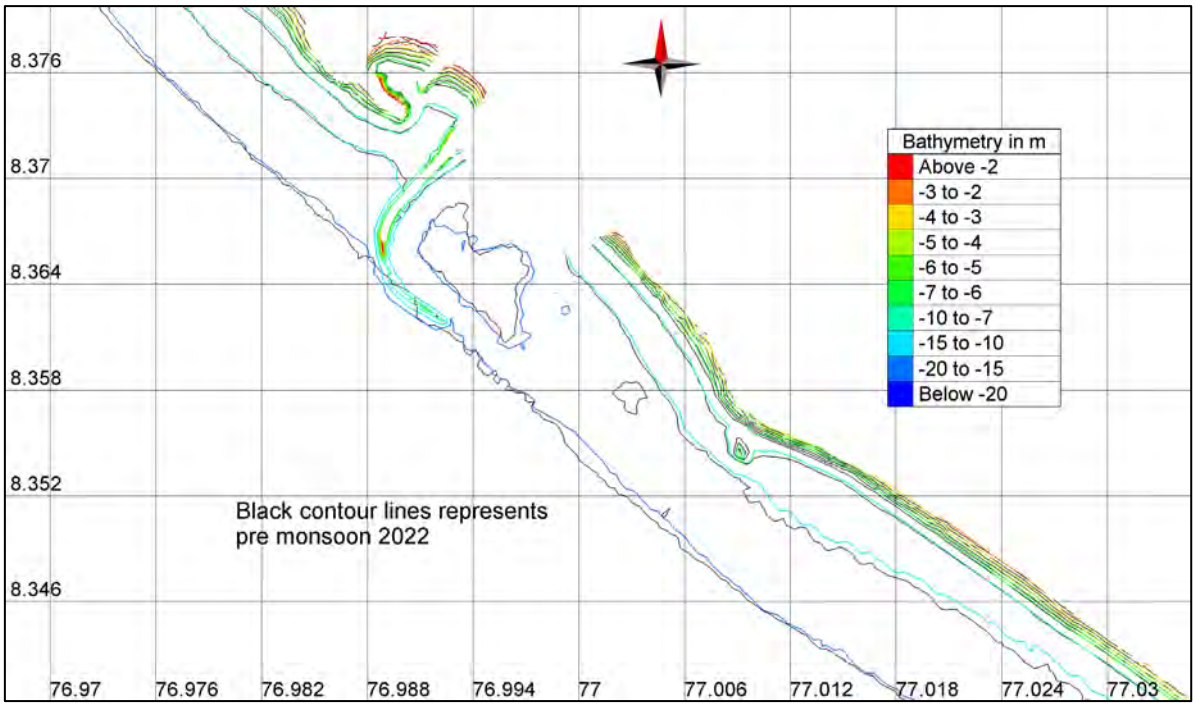


Figure 2-22 Difference in Bathymetry during Pre monsoon 2022 and 2023

In addition to the above-mentioned analysis, seven lines were selected to check the variation in bathymetry profiles for different seasons (Pre monsoon 2015, Post monsoon 2015, Pre monsoon 2016, Post monsoon 2016, Pre monsoon 2017, Post monsoon 2017, Pre monsoon 2018, Post monsoon 2018, Pre monsoon 2019, Post monsoon 2019, Pre monsoon 2020, Post monsoon 2020, Pre monsoon 2021, Post monsoon 2021, Pre monsoon 2022, Post monsoon 2022 and Pre monsoon 2023). The locations of these sections are as shown in Figure 2-23. The aim of this analysis is to identify any significant changes in bathymetry because of dredging and reclamation works carried out as on date near port vicinity.

The Post monsoon 2022 data covers only 6 Km on either side of the port as survey was not possible due to local protests in the areas during the months of August to December 2022. Therefore variation in bathymetry profiles is presented only for three locations (Adimalathura, Port location, and Panathura).

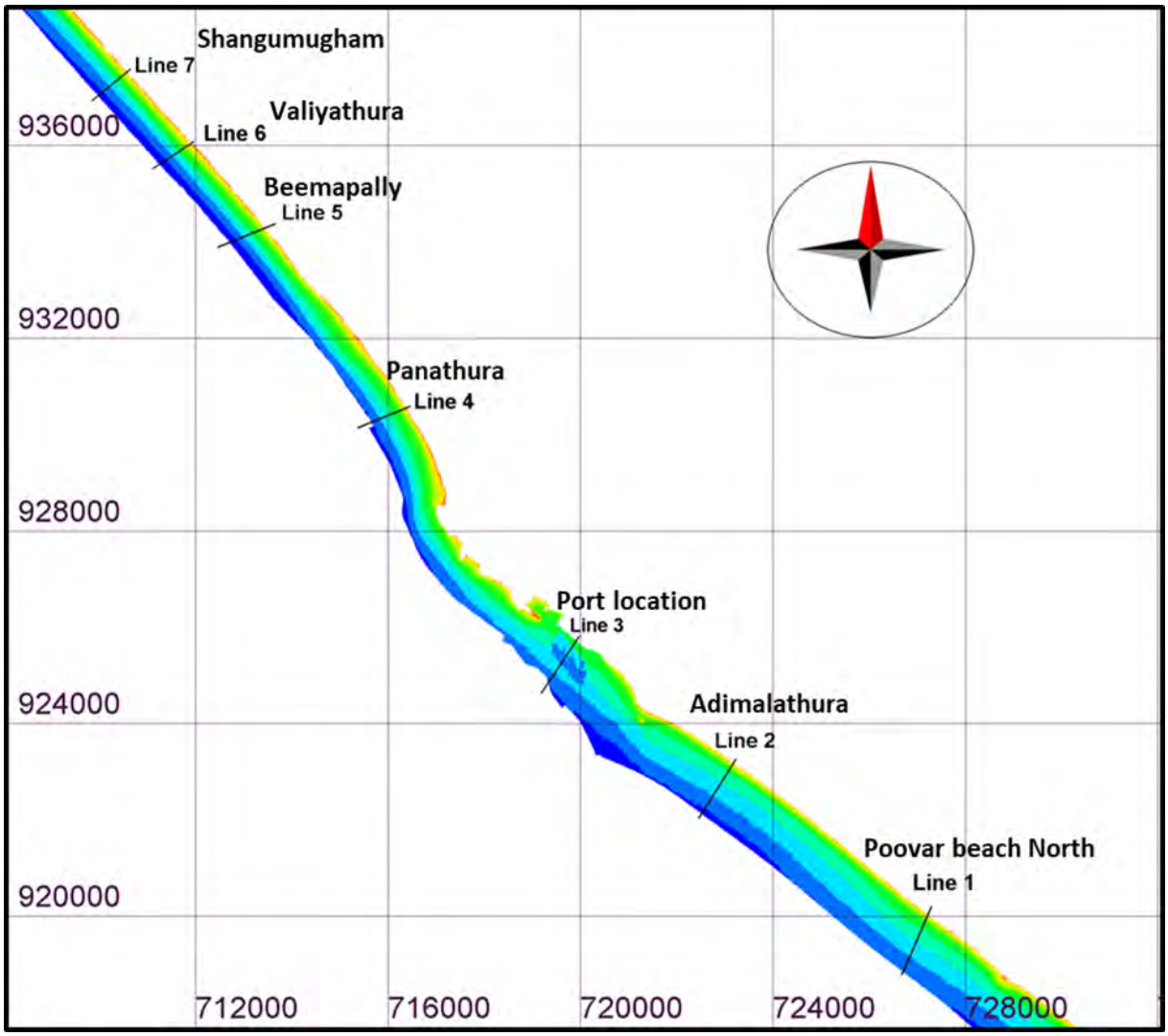


Figure 2-23 Location of the selected transect lines

Figure 2-24 to Figure 2-43 shows the comparison of Pre monsoon and Post monsoon of eight years (2015, 2016, 2017, 2018, 2019, 2020, 2021 & 2022) bathymetry data and Pre monsoon 2023 bathymetry along the selected sections.

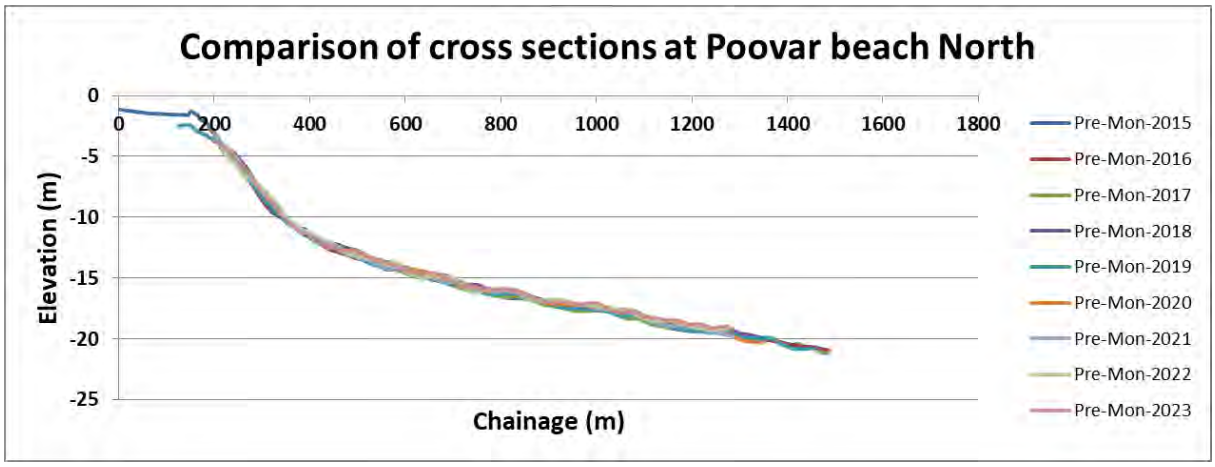


Figure 2-24 Bathymetry – Cross section comparison at Poovar beach North (Pre-monsoon)

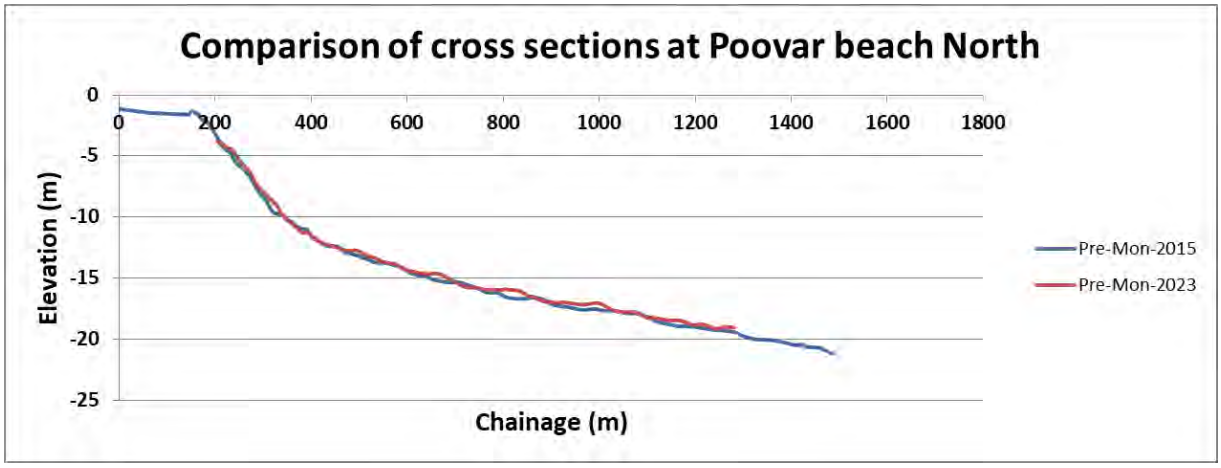


Figure 2-25 Bathymetry – Cross section comparison between 2015 and 2023 at Poovar beach North (Pre-monsoon)

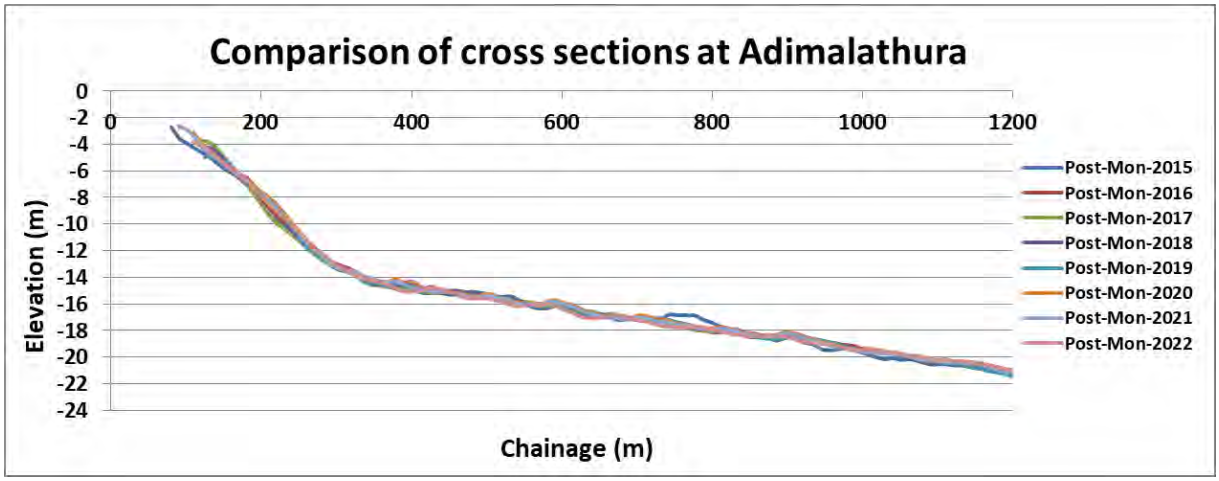


Figure 2-26 Bathymetry – Cross section comparison at Adimalathura (Post-monsoon)

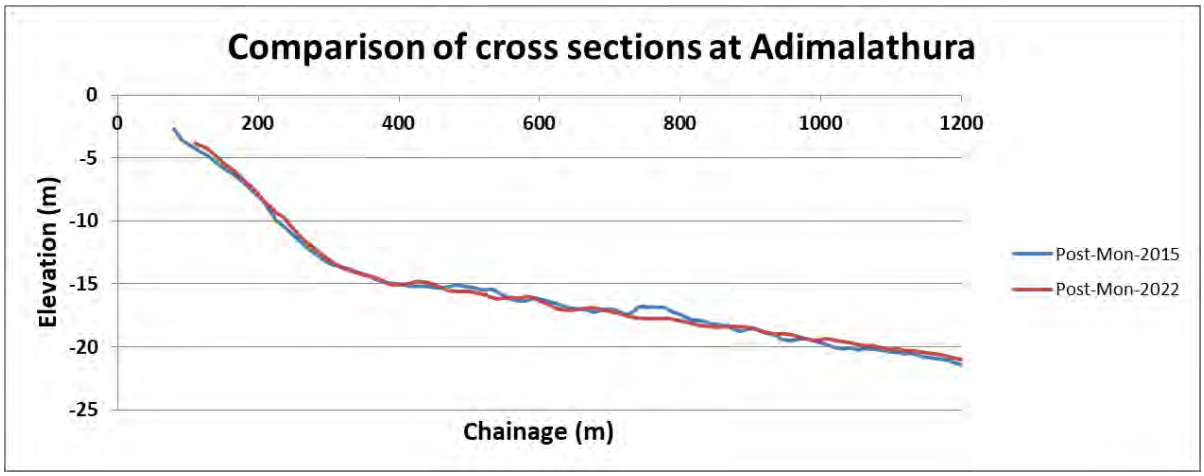


Figure 2-27 Bathymetry – Cross section comparison between 2015 and 2022 at Adimalathura (Post-monsoon)

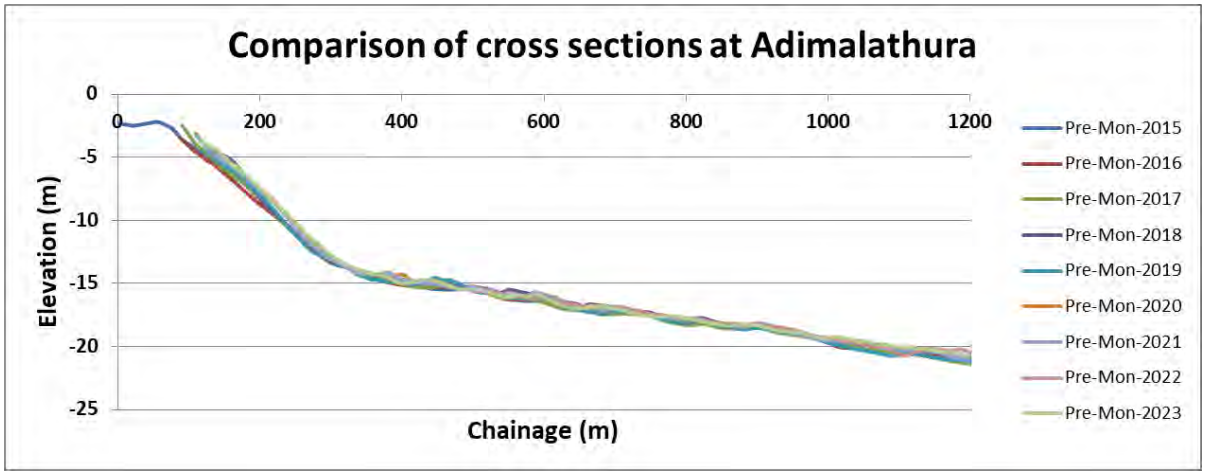


Figure 2-28 Bathymetry – Cross section comparison at Adimalathura (Pre-monsoon)

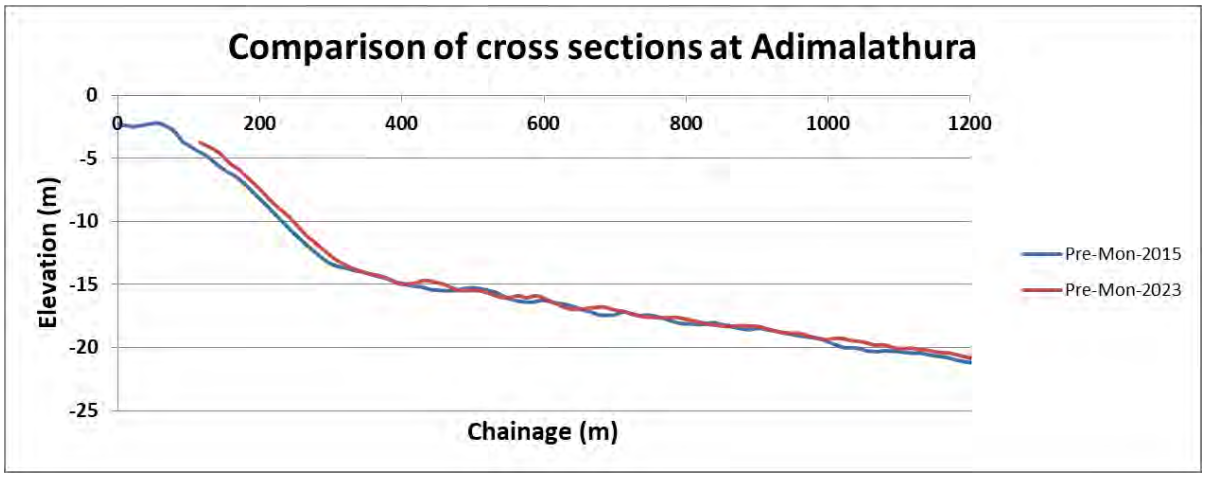


Figure 2-29 Bathymetry – Cross section comparison between 2015 and 2023 at Adimalathura (Pre-monsoon)

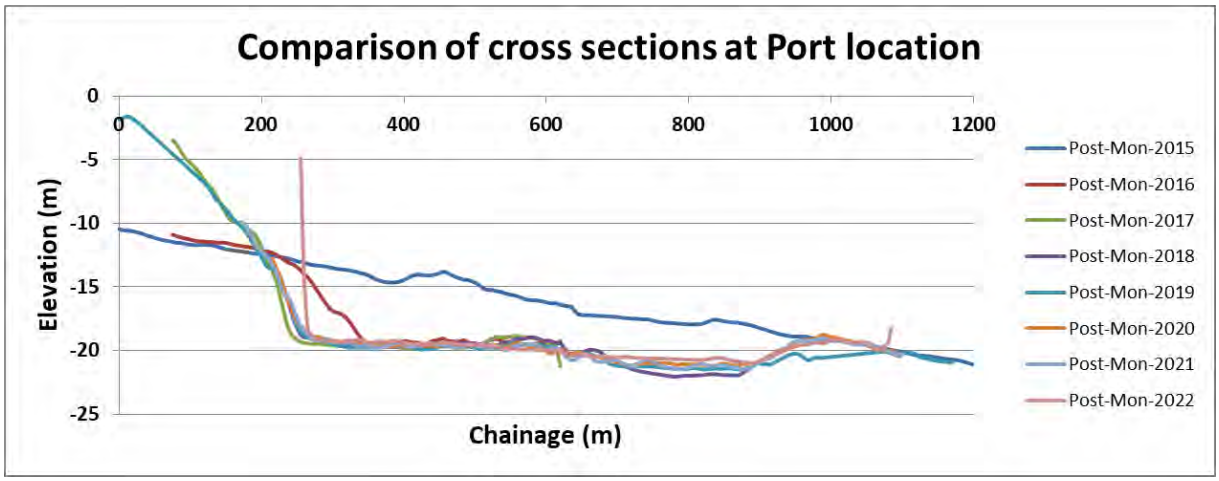


Figure 2-30 Bathymetry – Cross section comparison at Port location (Post-monsoon)

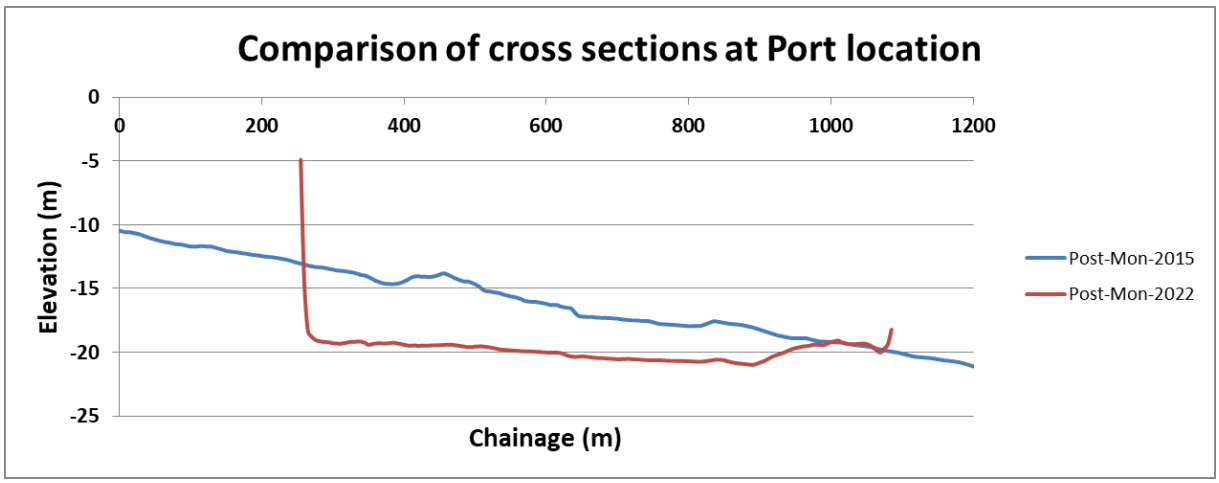


Figure 2-31 Bathymetry – Cross section comparison between 2015 and 2022 at Port location (Post-monsoon)

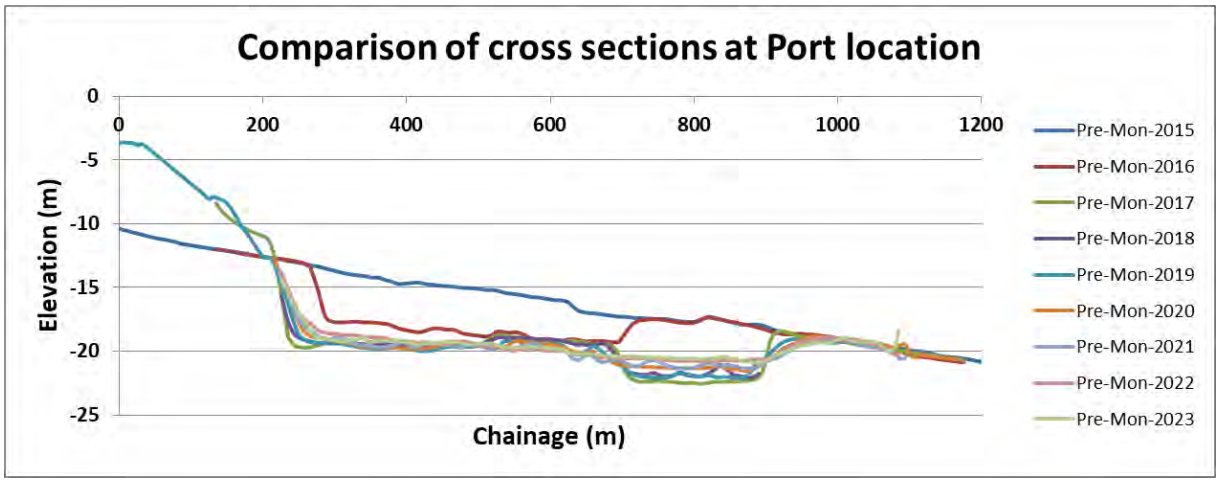


Figure 2-32 Bathymetry – Cross section comparison at Port location (Pre-monsoon)

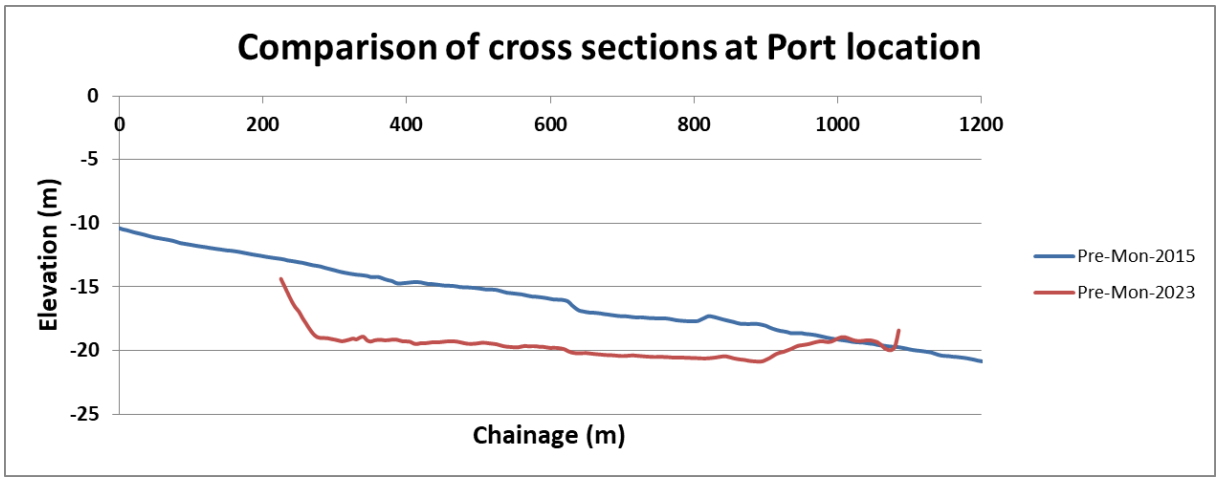


Figure 2-33 Bathymetry – Cross section comparison between 2015 and 2023 at Port location (Pre-monsoon)

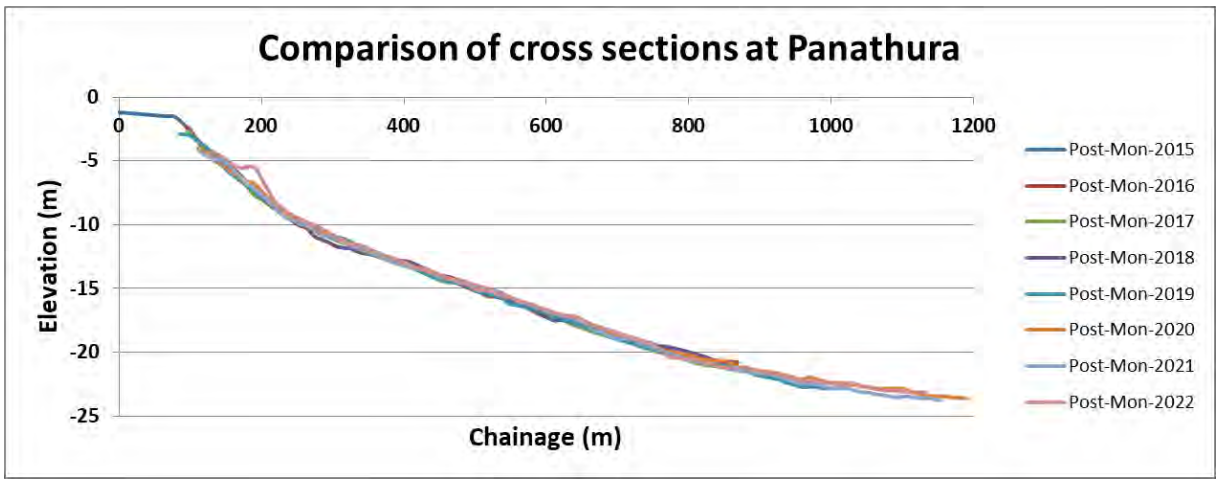


Figure 2-34 Bathymetry – Cross section comparison at Panathura (Post-monsoon)

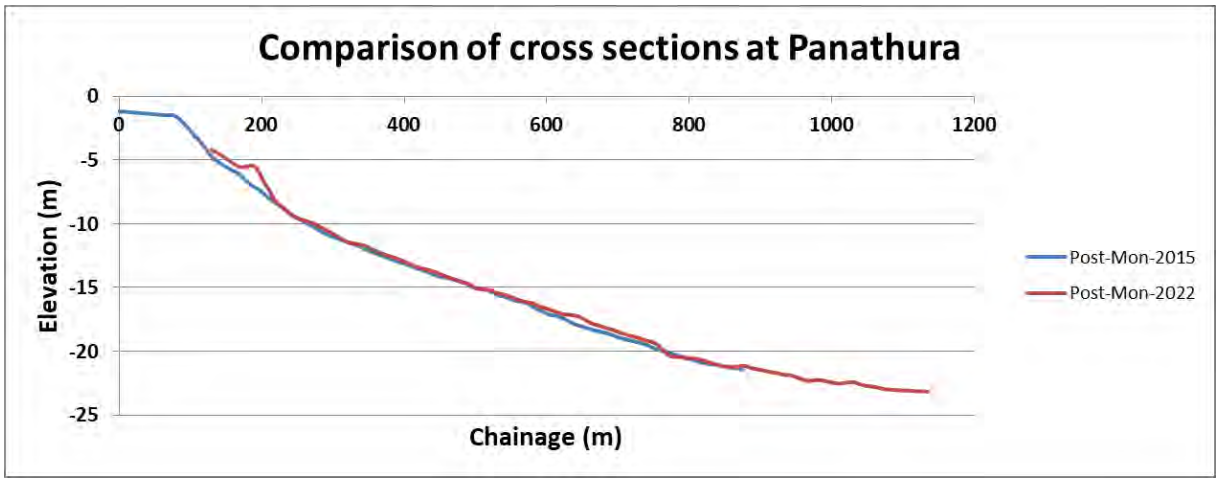


Figure 2-35 Bathymetry – Cross section comparison between 2015 and 2022 at Panathura (Post-monsoon)

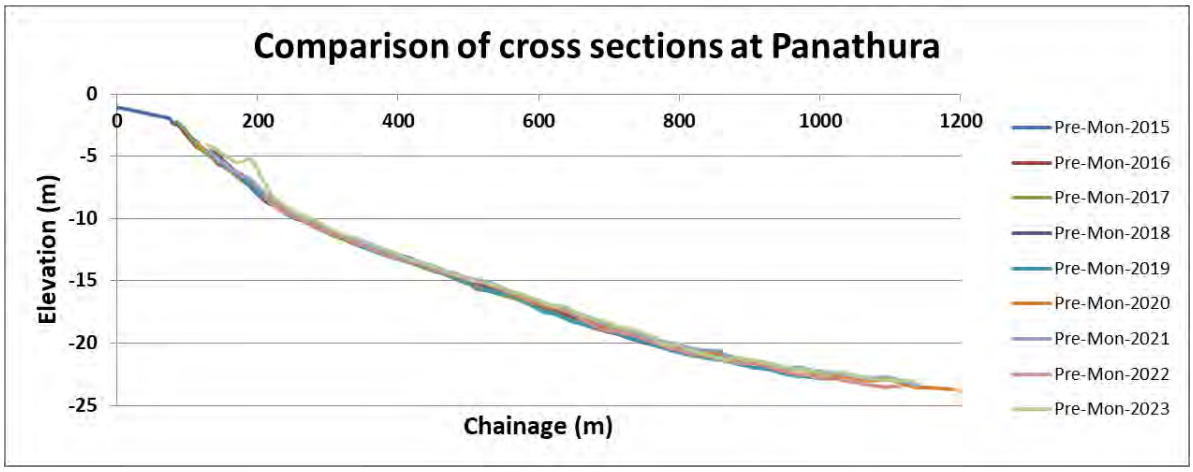


Figure 2-36 Bathymetry – Cross section comparison at Panathura (Pre-monsoon)

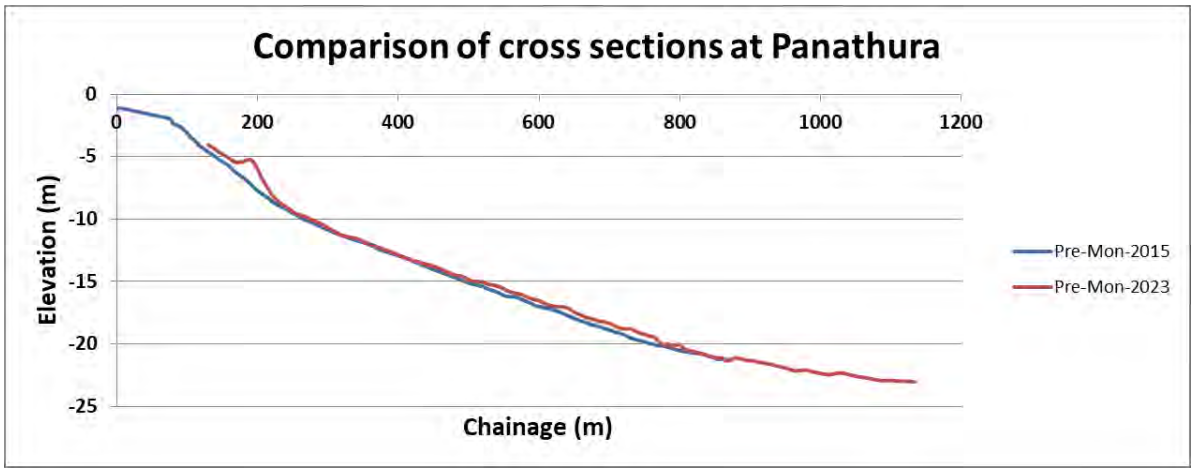


Figure 2-37 Bathymetry – Cross section comparison between 2015 and 2023 at Panathura (Pre-monsoon)

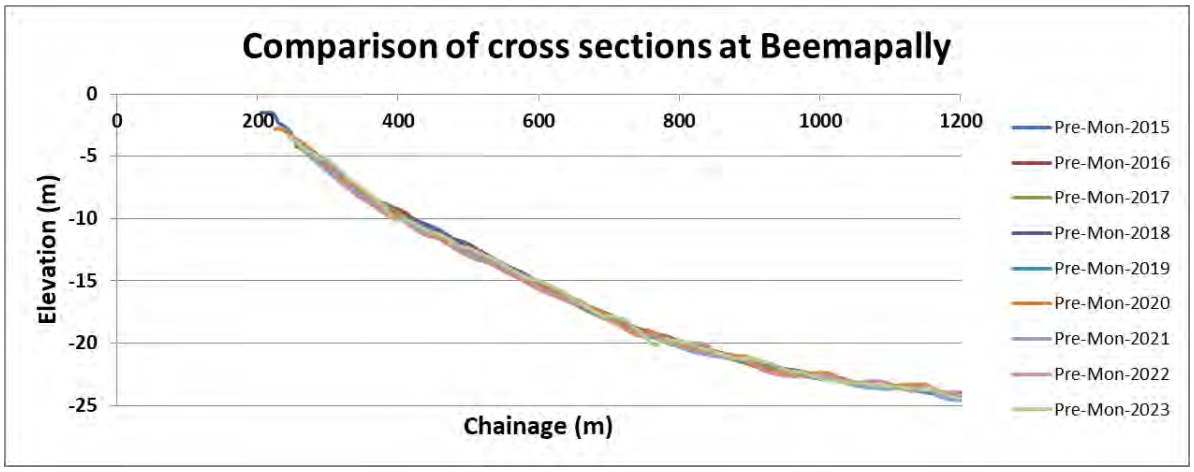


Figure 2-38 Bathymetry – Cross section comparison at Beemapally (Pre-monsoon)

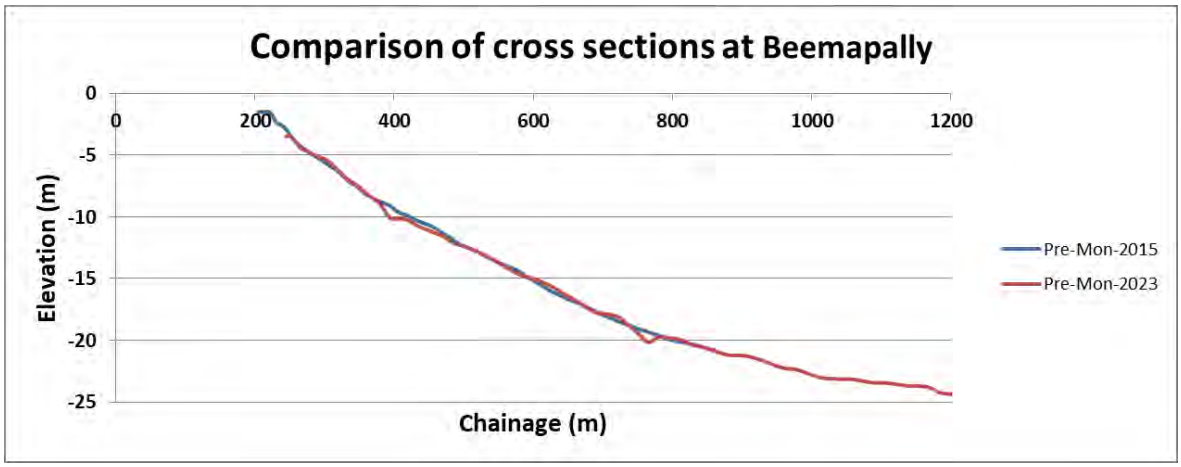


Figure 2-39 Bathymetry – Cross section comparison between 2015 and 2023 at Beemapally (Pre-monsoon)

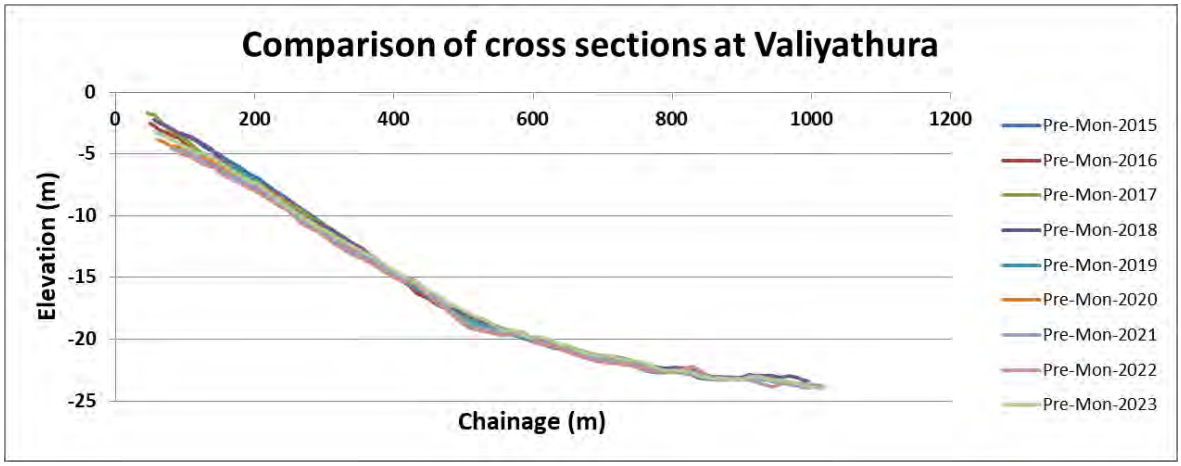


Figure 2-40 Bathymetry – Cross section comparison at Valiyathura (Pre-monsoon)

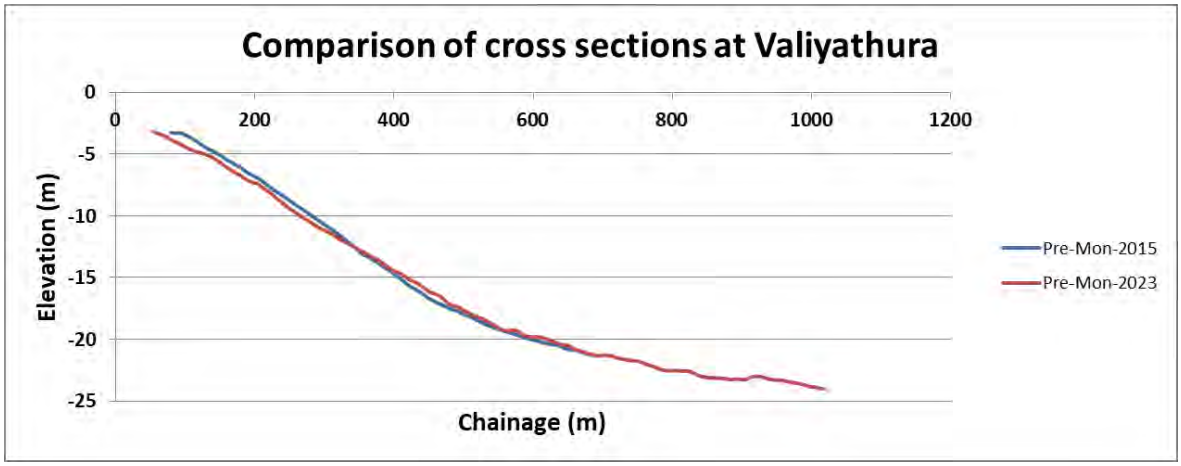


Figure 2-41 Bathymetry – Cross section comparison between 2015 and 2023 at Valiyathura (Pre-monsoon)

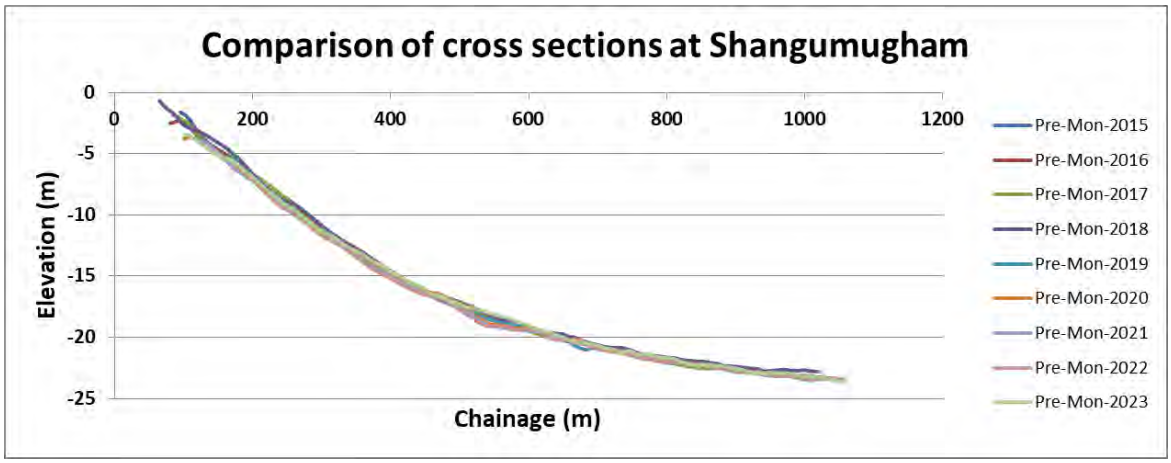


Figure 2-42 Bathymetry – Cross section comparison at Shangumugham (Pre-monsoon)

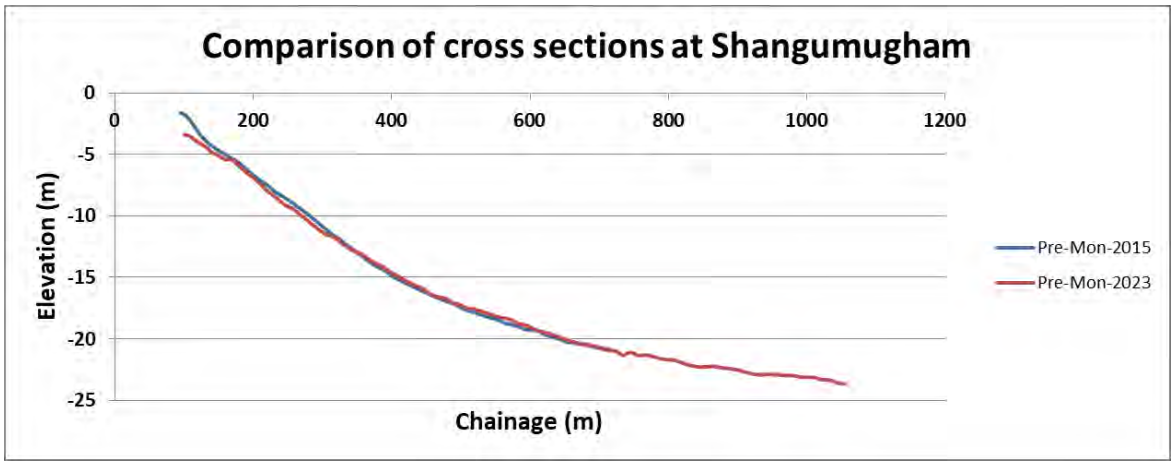


Figure 2-43 Bathymetry – Cross section comparison between 2015 and 2023 at Shangumugham (Pre-monsoon)

The comparison between the pre-monsoon bathymetry for 2023 and 2022 presented in Figure 2-44, shows the horizontal displacement in the -10m contour from a reference line. The difference in horizontal shift between -10m contour is also presented in Figure 2-45.The horizontal shift between -10m contour in year 2023 from 2022 generally varies in the range of -30m to +10m. The bed slope in this region is around 1 in 50. Therefore, an error of 0.3m in bathymetry survey can vary the horizontal shift by 15m. The error of 0.3m in bathymetry survey is within the acceptable limits. To check the general trend, -10m contour in year 2015 and 2016 were also compared.

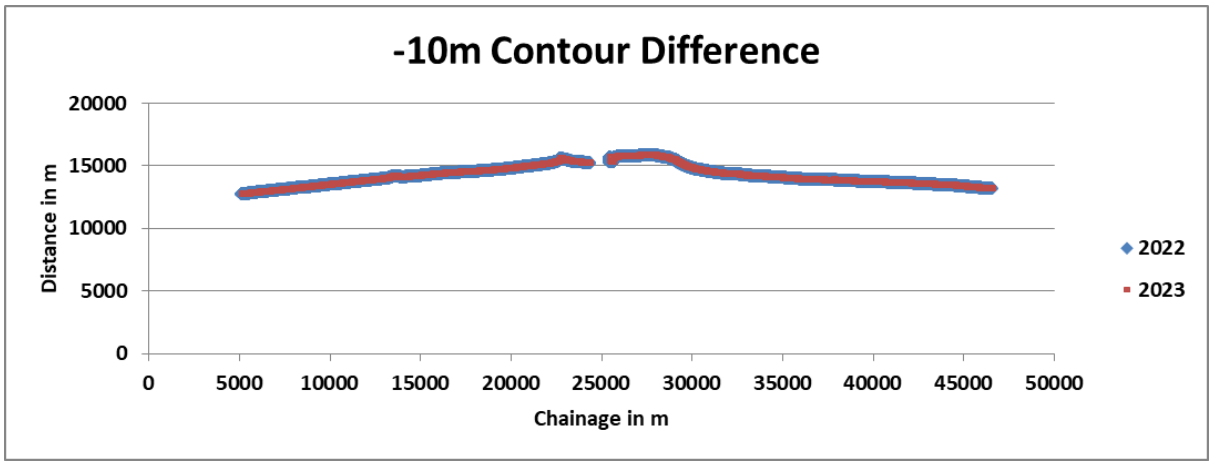


Figure 2-44 -10m contour comparison

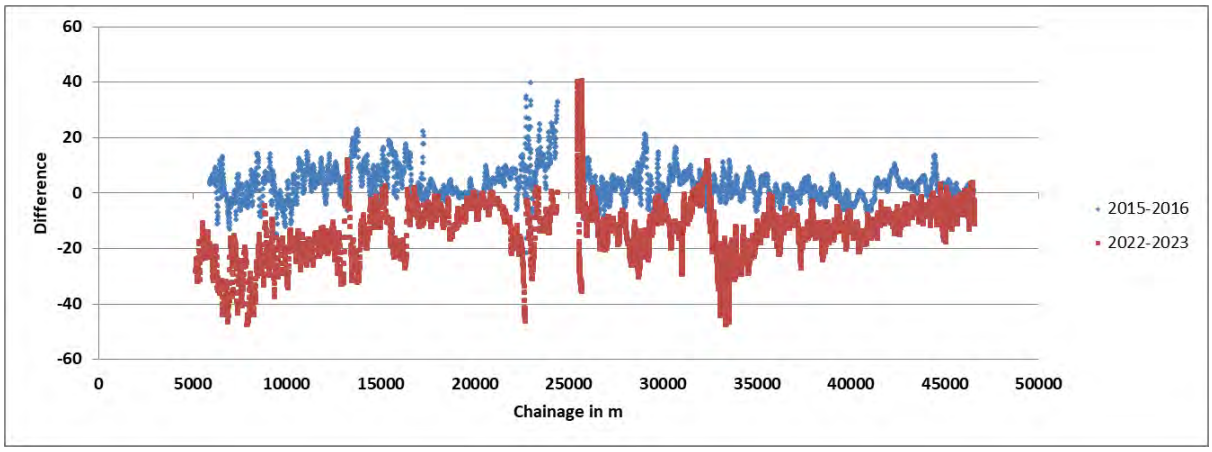
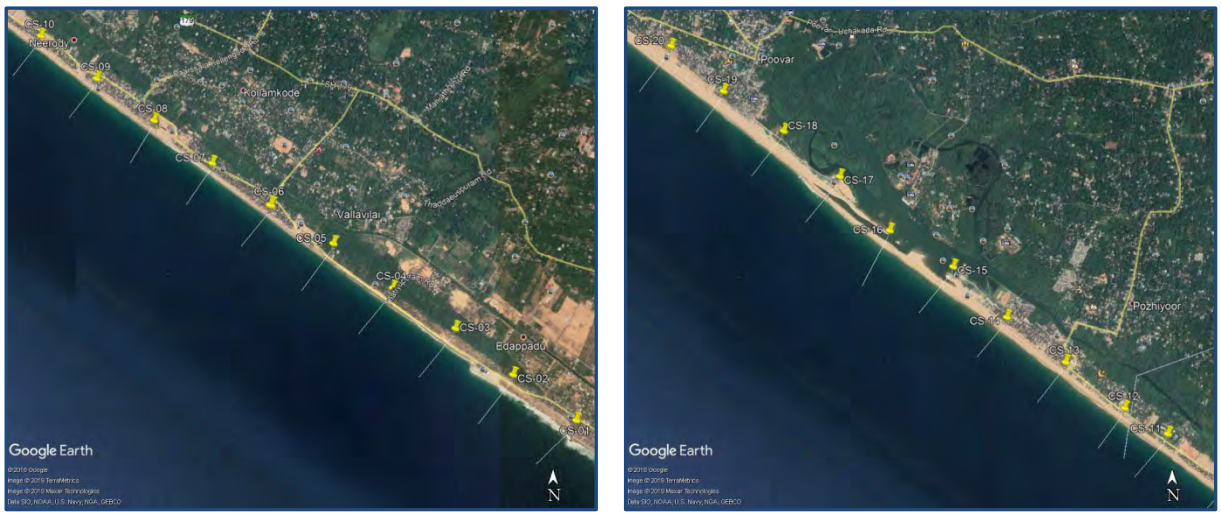


Figure 2-45 Difference in horizontal shift between -10m contour lines

2.6 Cross Shore Profile

Cross shore beach profiles were collected by AVPPL at 81 locations which cover approximately 40 km along the coastline. The spacing between two adjacent cross sections is approximately 0.5 km. Among the 81 locations, 41 are to the north of port, 37 are to the south of port and 3 are at the port location. Survey data from February 2015 to September 2023 is available. The cross-shore profile locations are shown in Figure 2-46.



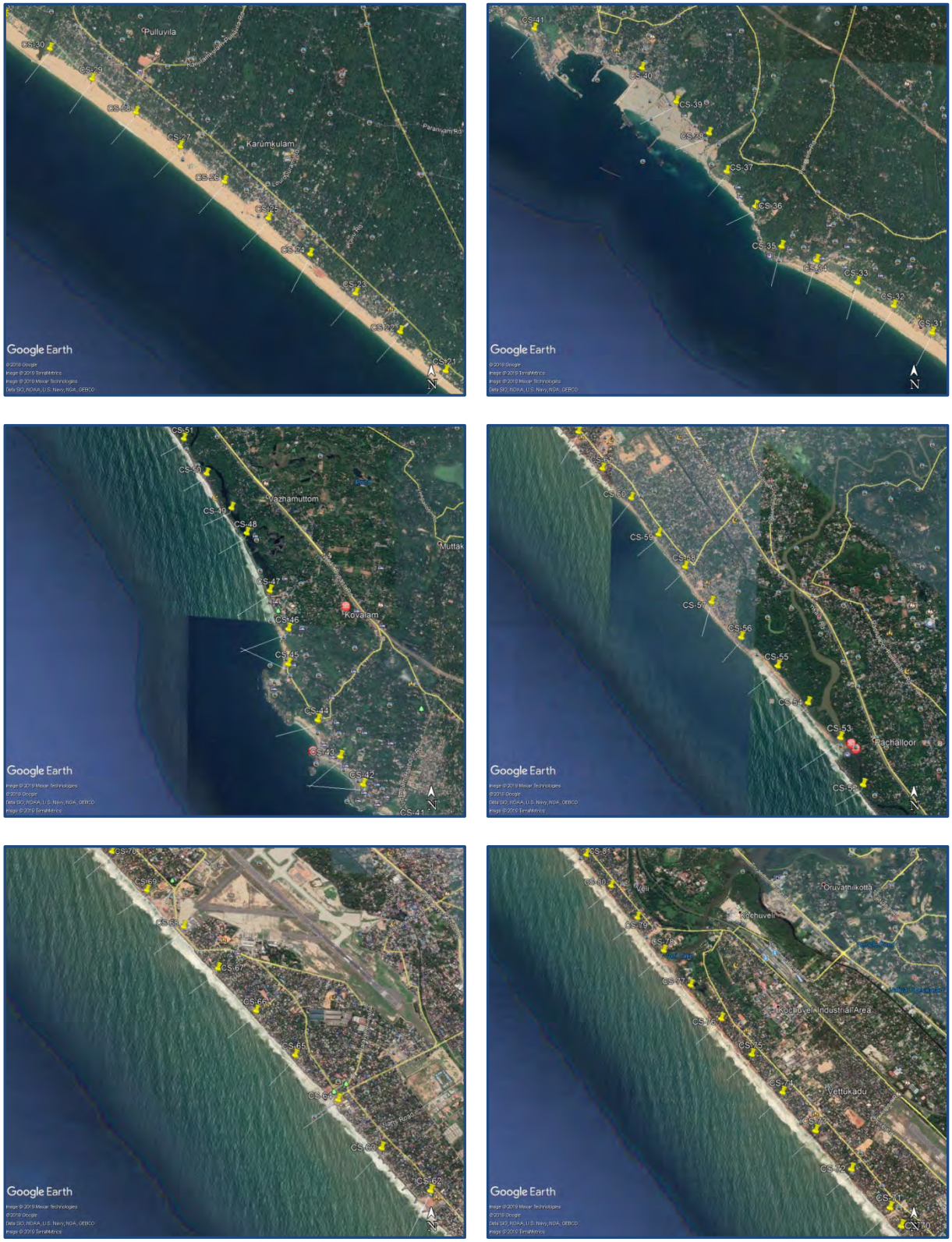


Figure 2-46 Cross Shore Profile Locations

AVPPL provided names of the 81 locations and the respective landmarks for easy identification and discussion. Table 2-5 shows the names of the landmarks and the corresponding CSP numbers.

Table 2-5 CSP Location Details

CSP NO.	Land Mark	Location	Remarks
CSP-01	Catholic Crismatic Prayer Center	Edappadu Beach	Groyne
CSP-02			Beach
CSP-03			Seawall
CSP-04	St.Mary's Church	Vallavilai	Groyne
CSP-05			Groyne
CSP-06			Groyne
CSP-07	St.Nicolas Church	Neerody	Groyne constructed in 2020
CSP-08			Groyne constructed in 2020
CSP-09			Groyne constructed in 2020
CSP-10	Sree Bhadrakali Temple	Pozhiyoor	Groyne constructed in 2020
CSP-11			Seawall
CSP-12			Seawall
CSP-13	St.Mathew's Church	Paruthiyoor	Seawall
CSP-14	Church Of Christ		Seawall
CSP-15	Poovar Island Resort	Poovar Beach South	Beach near Neyyar River Mouth
CSP-16			Beach near Neyyar River Mouth
CSP-17			Beach
CSP-18	Pozhikara Beach	Poovar	Beach
CSP-19			Beach
CSP-20	St.Antony's Chapel	Poovar Beach North	Beach
CSP-21			Beach
CSP-22	St.Antony's Church	Karumkulam	Beach
CSP-23			Beach
CSP-24			Beach
CSP-25			Beach
CSP-26			Beach
CSP-27	Gothambu Road	Pulluvila	Beach

CSP NO.	Land Mark	Location	Remarks
CSP-28			Beach
CSP-29			Beach
CSP-30			Beach
CSP-31	Adimalathura Catholic Church	Adimalathura	Beach
CSP-32			Beach
CSP-33			Beach
CSP-34			Beach
CSP-35	Azhimala Temple	Azhimala	Azhimala Cliff
CSP-36	Nagar Bhagavathy Temple	Mullur	Beach
CSP-37			Mullur Beach View Point
CSP-38	Adani Reclamation Area	Adani Port Office Vizhinjam	Beach Inside AVPPL Port
CSP-39			Inside AVPPL Port
CSP-40			Inside AVPPL Port
CSP-41	Vizhinjam Light House	Kovalam	Beach
CSP-42			Beach
CSP-43			Beach
CSP-44			Beach
CSP-45			Beach
CSP-46			Beach
CSP-47	Samudra Beach Park	Kovalam	Beach
CSP-48	Mosque	Panathura	Seawall
CSP-49			Seawall
CSP-50	Panathura Temple	Panathura	Seawall
CSP-51			Seawall
CSP-52			Seawall
CSP-53	Punthura Fish Market	Punthura	Killi River Mouth
CSP-54			Beach
CSP-55			Beach
CSP-56			Seawall
CSP-57			Seawall
CSP-58	Beemapally	Beemapally	Seawall between Groynes

CSP NO.	Land Mark	Location	Remarks
CSP-59			Seawall
CSP-60			Seawall
CSP-61	Cheriyathura Sports Ground	Cheriyathura	Seawall between Groynes
CSP-62			Beach between Groynes
CSP-63	Valiyathura Bridge	Valiyathura	Groyne
CSP-64			Seawall near Valiyathura Pier
CSP-65			Seawall
CSP-66			Seawall
CSP-67			Seawall
CSP-68	Shangumugham Beach	Shangumugham	Beach
CSP-69			Beach
CSP-70	St.Peters Church	Shangumugham	Beach
CSP-71			Beach
CSP-72	Vettucaud Church	Vettucaud	Beach
CSP-73			Beach
CSP-74			Beach
CSP-75	Veli Childrens Park	Kochuveli	Beach
CSP-76			Beach
CSP-77			Beach
CSP-78	St.Thomas Church	Valiya Veli	Veli Lake Mouth
CSP-79			Beach
CSP-80	Christian Brotheren Church	Thumba	Beach
CSP-81			Beach

2.6.1 Survey Methodology

The survey area was divided into land side and sea side. On the land side, the survey was carried out using Real Time Kinematic (RTK) system up to 100 m from HTL or +2 m of HTL. On the sea side bathymetric survey was carried out using Multi Beam Echo Sounder (MBES) up to a depth of 10m till August 2018 and later on survey was conducted up to a depth of 20m till April 2019 as per the guideline of shoreline committee. Further during the shoreline committee meeting held on 13-03-2019, it was decided that: Only 4 CSP lines needs to be carried out up to a depth of 20 m in the month of January, May, August and October. All other lines, during all months need to be carried up to a depth of 10 m only. Accordingly, two

lines were selected (CSP 2 & CSP 35) to south of the port and two more lines (CSP 64 & CSP 74) to north of the port to carry out the survey up to 20m depth.

The RTK system comprises the following:

- Hemisphere GPS R320 GNSS base station
- Hemisphere GPS R320 rover

The bathymetric survey was carried out using the following systems:

- Geoswath GS+ 250 KHz wide swath bathymetric system for the Multi beam area

Data gaps were observed in the foreshore zone (as shown in Figure 2-47) due to inaccessible depths and due to rough weather condition during survey period (i.e. whenever rough weather occurred in the period October 2022 to September 2023). October 2022, November 2022, June 2023, July 2023, August 2023 and September 2023 data were removed from analysis which did not pass the quality control. The details of data included in analysis were shown in Table 2-6.

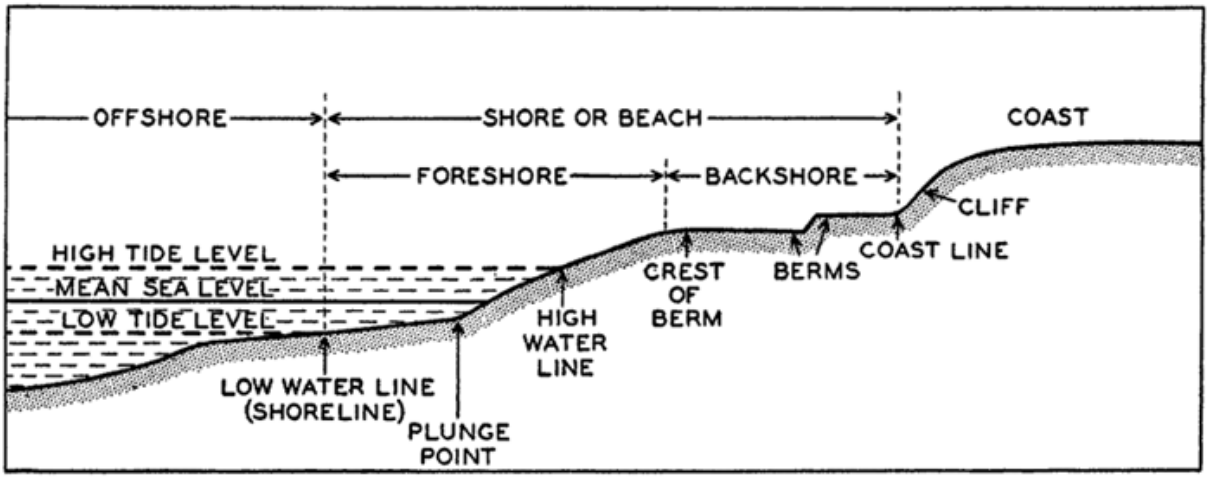


Figure 2-47 Beach profile terminology

Table 2-6 Details of CSP data included in analysis

Status of data received									
	2015	2016	2017	2018	2019	2020	2021	2022	2023
Jan									
Feb									
Mar					Only 52 profiles				
Apr									
May									
Jun								Only 4 profiles	
Jul									
Aug									
Sep									
Oct									
Nov									
Dec									

	Data not collected:		Data omitted due to lack of offshore data
	June - Aug 2019 due to Monsoon and change of contractor		Data included
	July 2020 due to COVID-19 restrictions		
	At certain locations during the period of October 2022 to November 2022 due to locals protest		

2.6.2 Analysis of cross shore profiles

The data received by LNTIEL was analysed by plotting each of the profiles. The aim of this comprehensive exercise was to check the data quality and to compare profiles with surveyed data from different locations which would help to visualise erosion or accretion during different seasons and locations. The assessment of the profiles before/during the construction of the port at Vizhinjam can be compared in future with the profiles collected after the port construction. Any difference, if arising, can be investigated further to understand if the port has any impact on the shoreline evolution.

At first, LNTIEL analysed average profiles for different seasons and location wise. The trends of beach profile were assessed qualitatively. In general, the beach profile variations tend to be daily, monthly, seasonal or annual. However, since the data is collected monthly once, analyses of daily variations are not possible. Even prediction of monthly variation of profiles will be difficult due to data gap near foreshore region. Therefore, the monthly profiles were averaged to obtain seasonal profiles. The months considered for seasonal average was as follows:

Pre-Monsoon – April to May

Monsoon – June to September

Post-Monsoon – October to November

Fair Weather – December to March

The above seasons were adopted as advised in MOM of the shoreline committee meeting held on 13th February 2019.

For example, if we consider October 2022 to September 2023, the seasons will be as follows:

Post-Monsoon 2022 – October 2022 to November 2022

Fair Weather 2022 – December 2022 to March 2023

Pre-Monsoon 2023 – April 2023 to May 2023

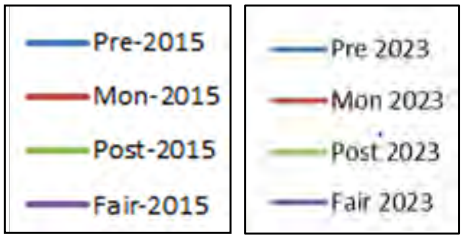
Monsoon 2023 – June 2023 to September 2023

The focus was on comparison of profiles of different seasons over a year (seasonal comparison) and comparison of same seasonal profiles of different years (yearly comparison) at a particular location to thoroughly understand the seasonal variations. As there were many cross-shore profiles over a stretch of 40km, it was not feasible to show all the profiles in the report. Therefore, LNTIEL grouped similar sections into a category and presented one of the sections in each category to report. Thus, LNTIEL selected three sections to South of the Port (CS-07 – Neerody, CS-12 – Pozhiyoor and CS-26 – Karumkulam) and three sections to North of the Port (CS-49 – Panathura, CS-58 – Beemapally and CS-74 – Vettucaud). The plots are shown in Figure 2-48 to Figure 2-136. In Figure 2-48, Abscissa represents the distance in meters from an arbitrary point which is constant for all profiles at a cross section, ordinate represents elevation in meter and legend is self-explanatory. First chart (Figure 2-48) shows comparison of profiles of different seasons in a particular year (Seasonal charts) and second chart (Figure 2-51) shows comparison of profiles of different years of a particular season (Yearly charts).

Legend: CSP – Cross Shore Profile, CS – Cross Section

Table 2-7 Classification of stretches

Stretch	Cross sections		Selected Cross section
	From	To	
1	3	10	7
2	11	14	12
3	18	34	26
4	47	52	49
5	56	65	58,62
6	66	81	74



Legend of seasonal charts

2.6.2.1 Stretch 1

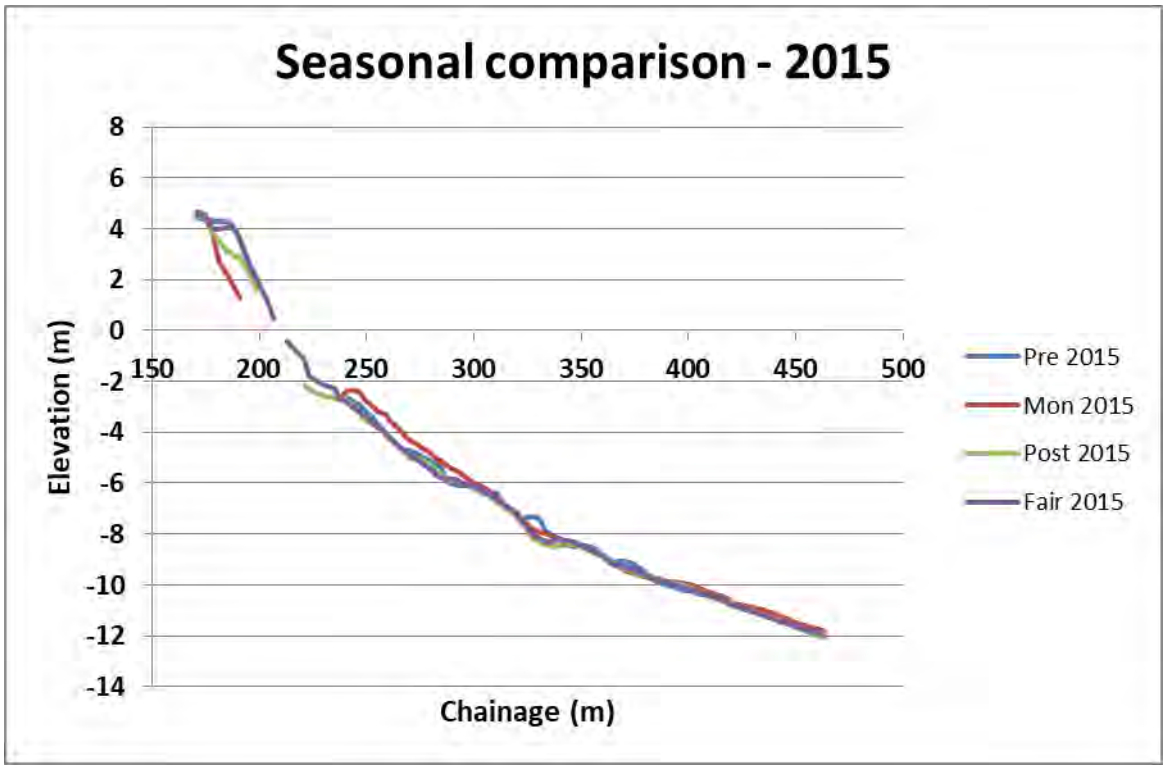


Figure 2-48 Profiles at Neerody (CS 07) – Seasonal comparison (2015)

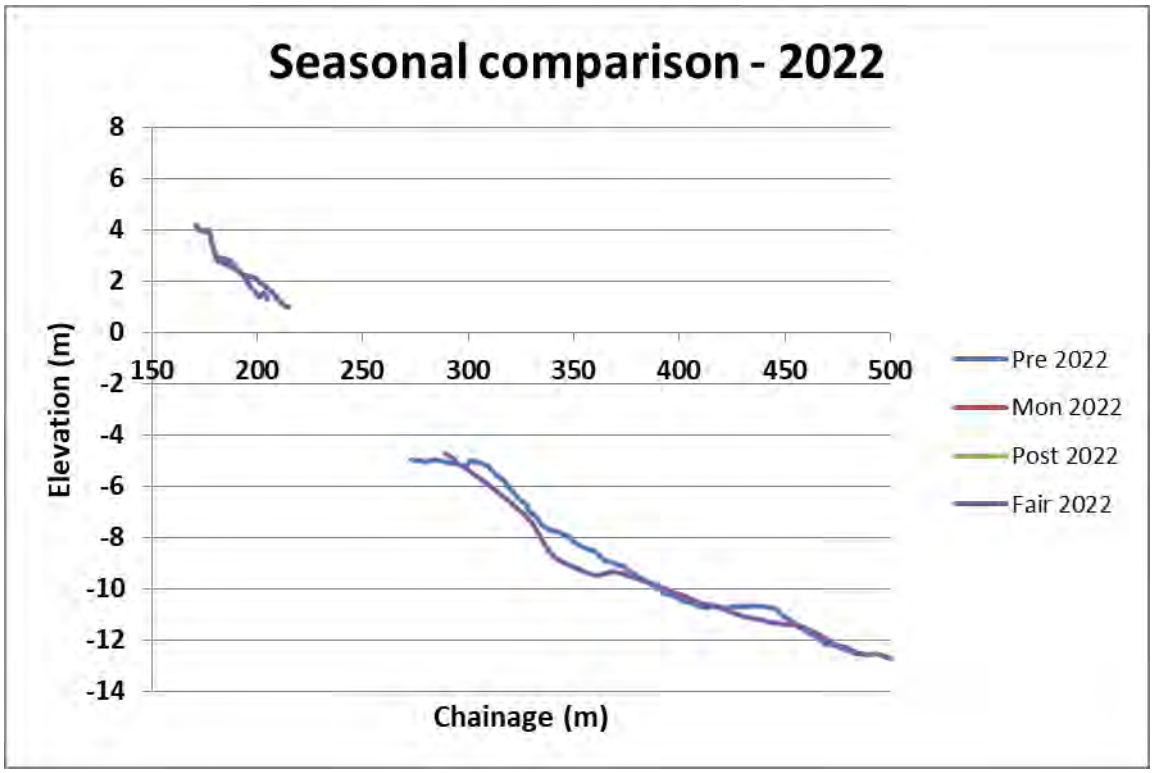


Figure 2-49 Profiles at Neerody (CS 07) – Seasonal comparison (2022)

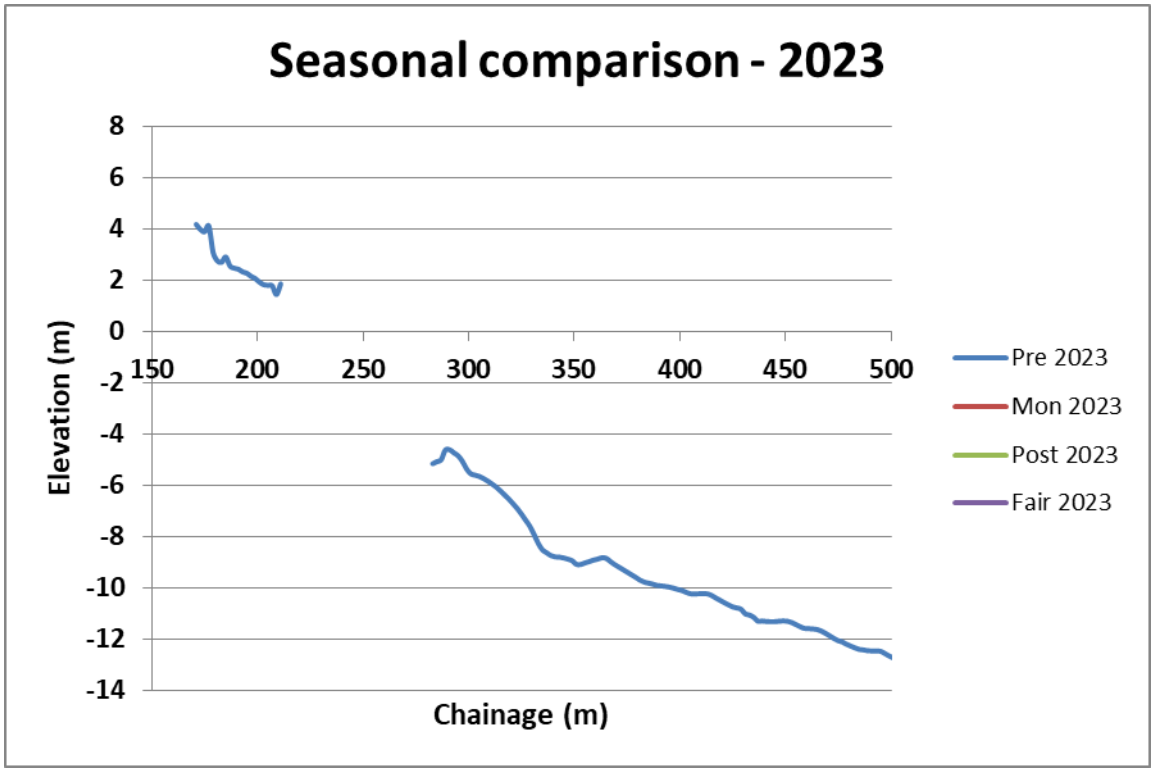


Figure 2-50 Profiles at Neerody (CS 07) – Seasonal comparison (2023)

Seawalls are present in the stretch of CS 3 to CS 10. Among these sections, CS 7 which is at Neerody, in Tamil Nadu, was chose to illustrate the seasonal trends.

From Figure 2-48 to Figure 2-50, it can be noticed that the seasonal variations were very minimal.

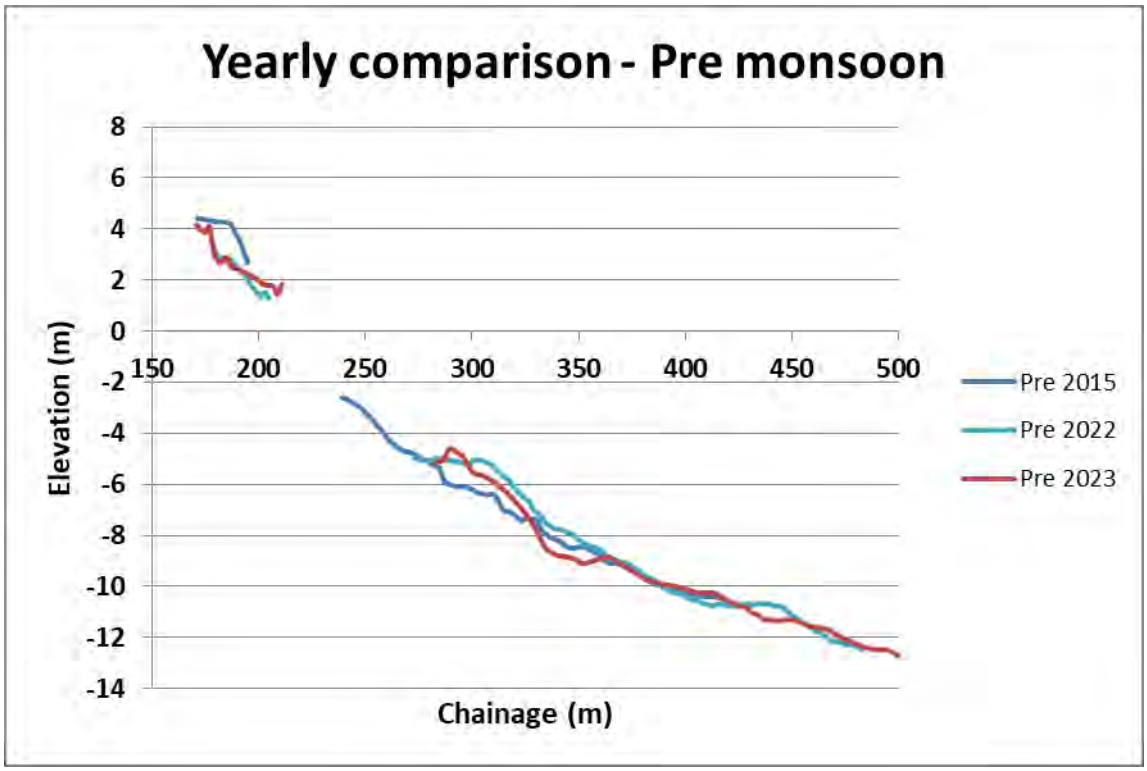


Figure 2-51 Profiles at Neerody (CS 07) – Yearly comparison – Pre monsoon

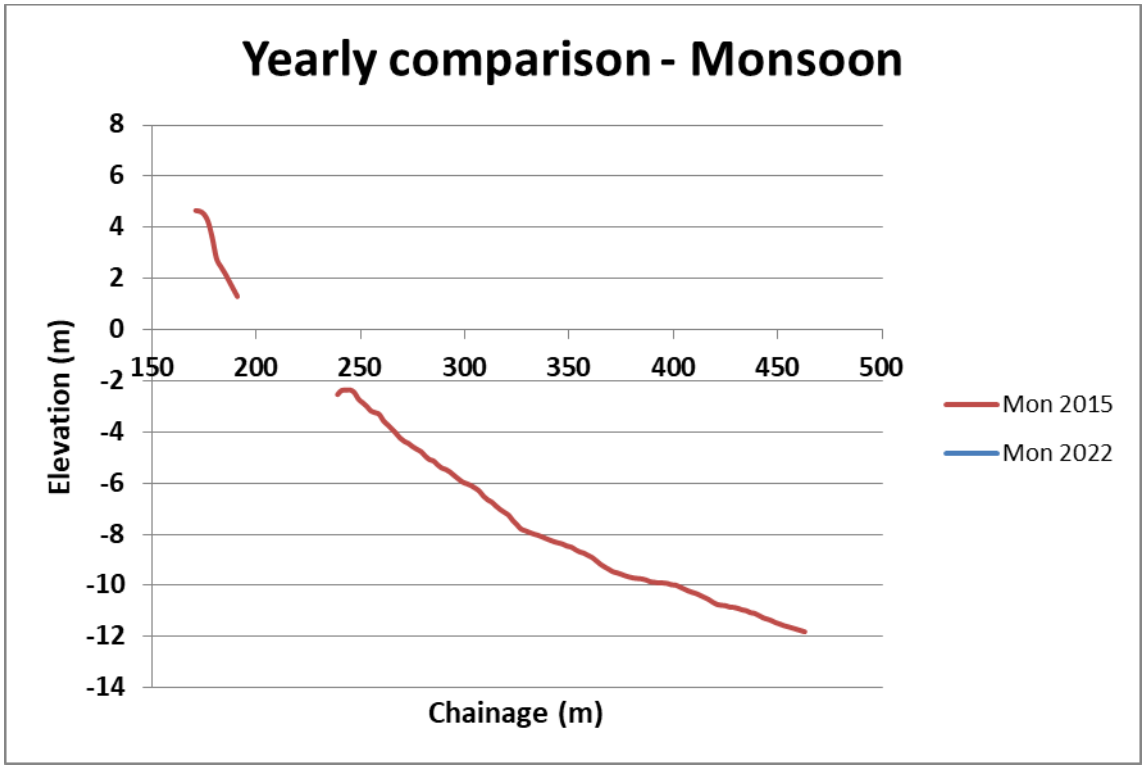


Figure 2-52 Profiles at Neerody (CS 07) – Yearly comparison - Monsoon

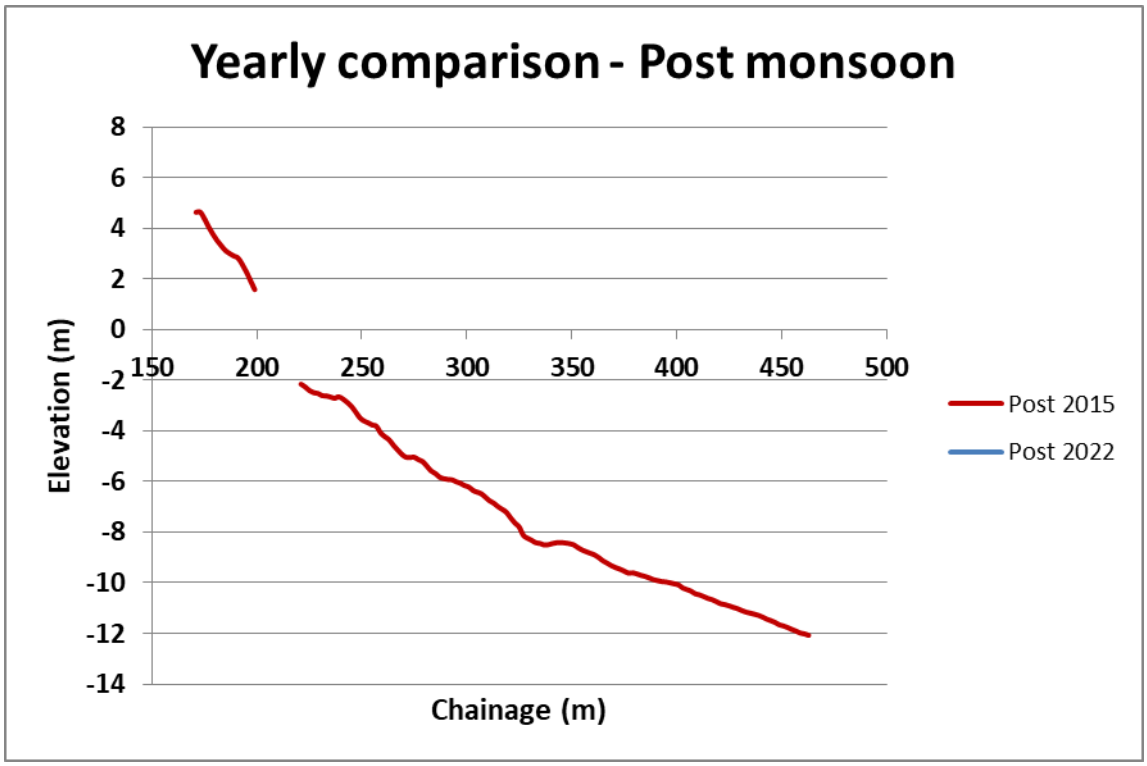


Figure 2-53 Profiles at Neerody (CS 07) – Yearly comparison – Post monsoon

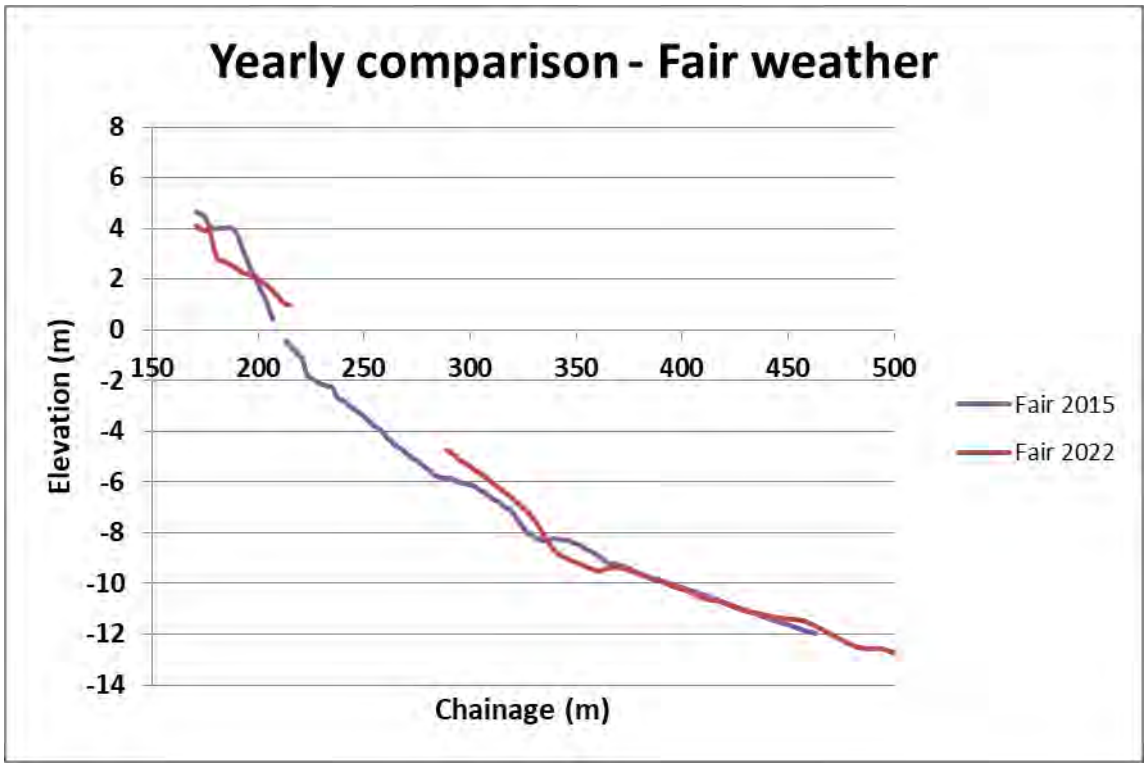


Figure 2-54 Profiles at Neerody (CS 07) – Yearly comparison – Fair weather

LNTIEL extracted +2m (not extracted at the location where seawall is present), -3m, -4m, -6m, -8m and -10m contours from cross shore profile data at Neerody and below plots are time series of respective contours for two years (2015 and 2022). The time scale is similar. The plots represent the contour distances with respect to an arbitrary point which is constant

for all profiles at a cross section and represent the seasonal variations of erosion and accretion in this stretch.

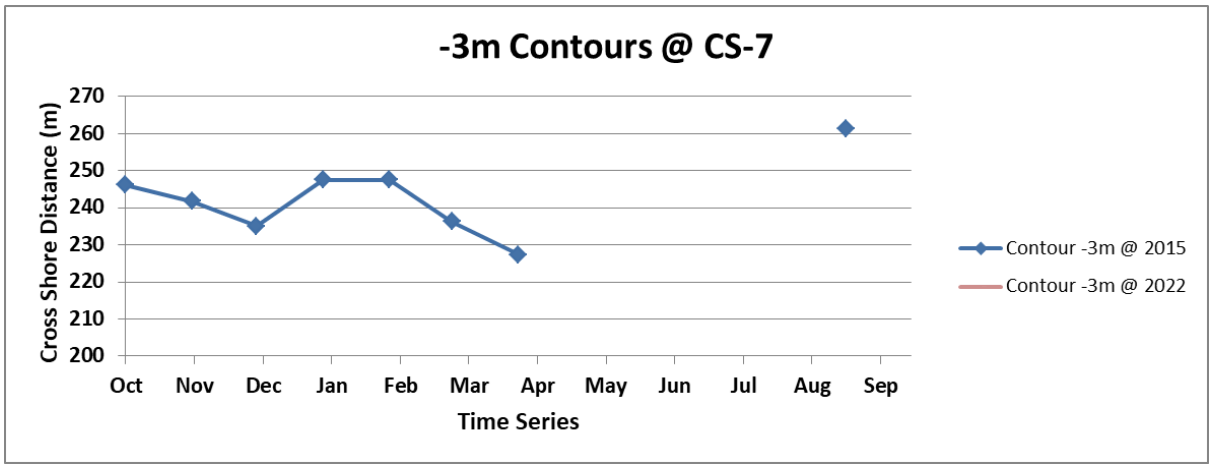


Figure 2-55 Time series of (–) 3 m contour at Neerody (CS 07)

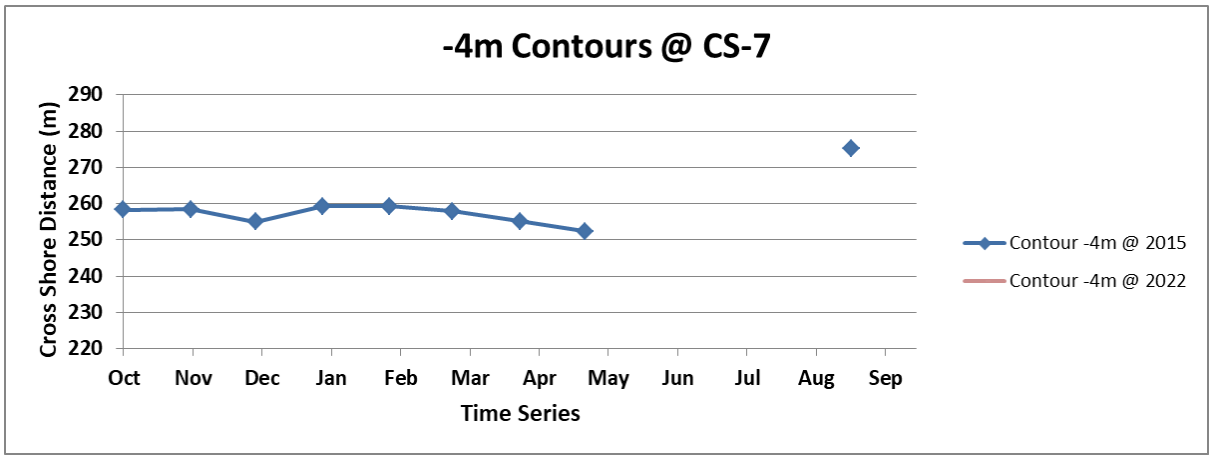


Figure 2-56 Time series of (–) 4 m contour at Neerody (CS 07)

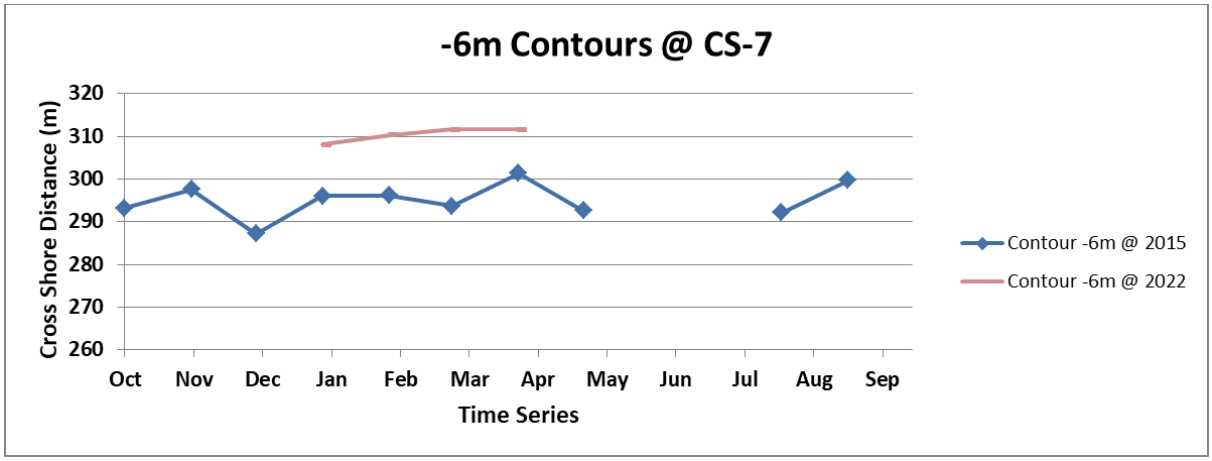


Figure 2-57 Time series of (–) 6 m contour at Neerody (CS 07)

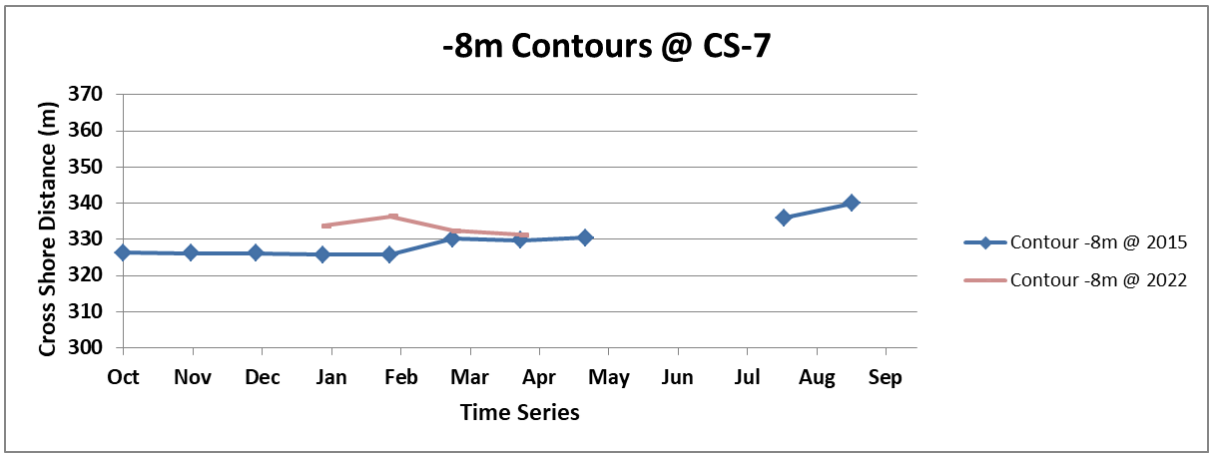


Figure 2-58 Time series of (–) 8 m contour at Neerody (CS 07)

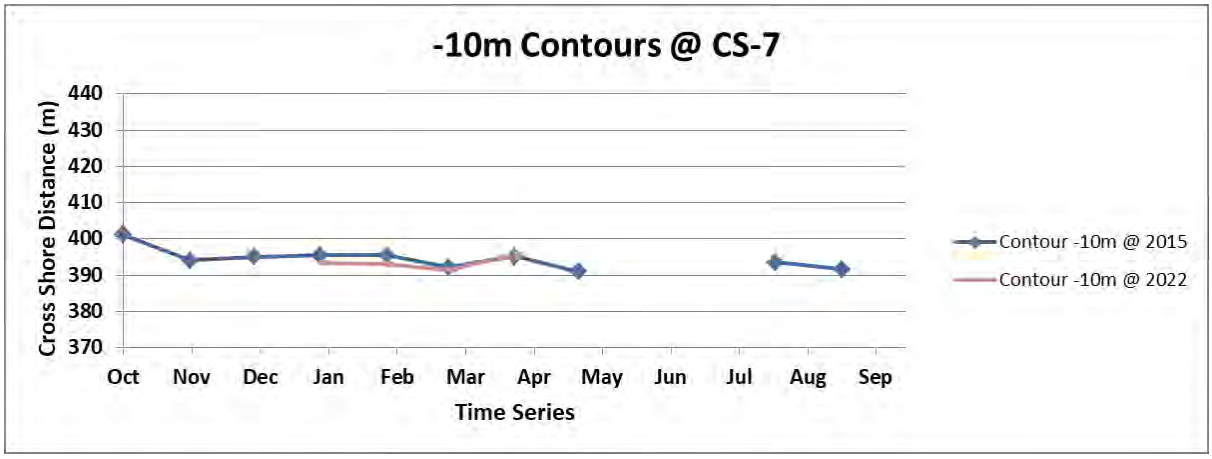


Figure 2-59 Time series of (–) 10 m contour at Neerody (CS 07)

In addition to above, continuous variation of contour distances over 7 years was provided for better clarity as shown in Figure 2-60.

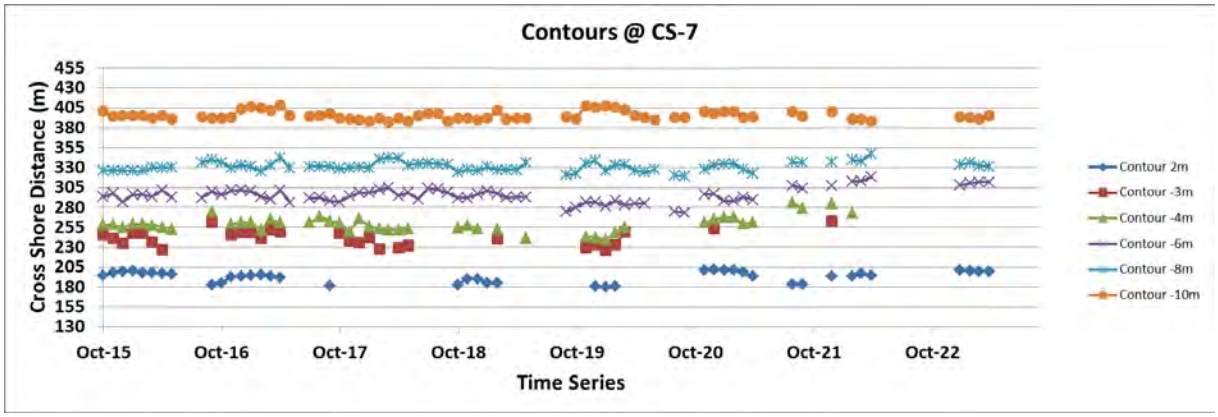


Figure 2-60 Continuous time series of contours at Neerody (CS 07)

2.6.2.2 Stretch 2

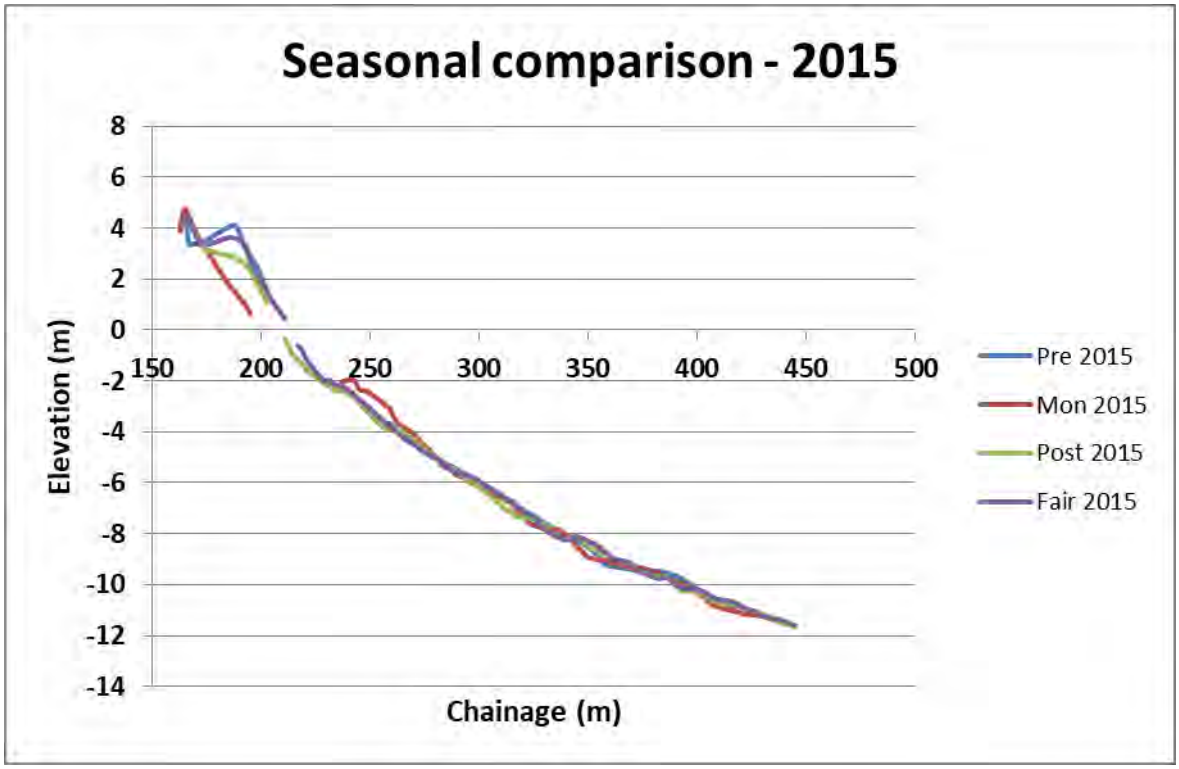


Figure 2-61 Profiles at Pozhiyoor (CS 12) – Seasonal comparison (2015)

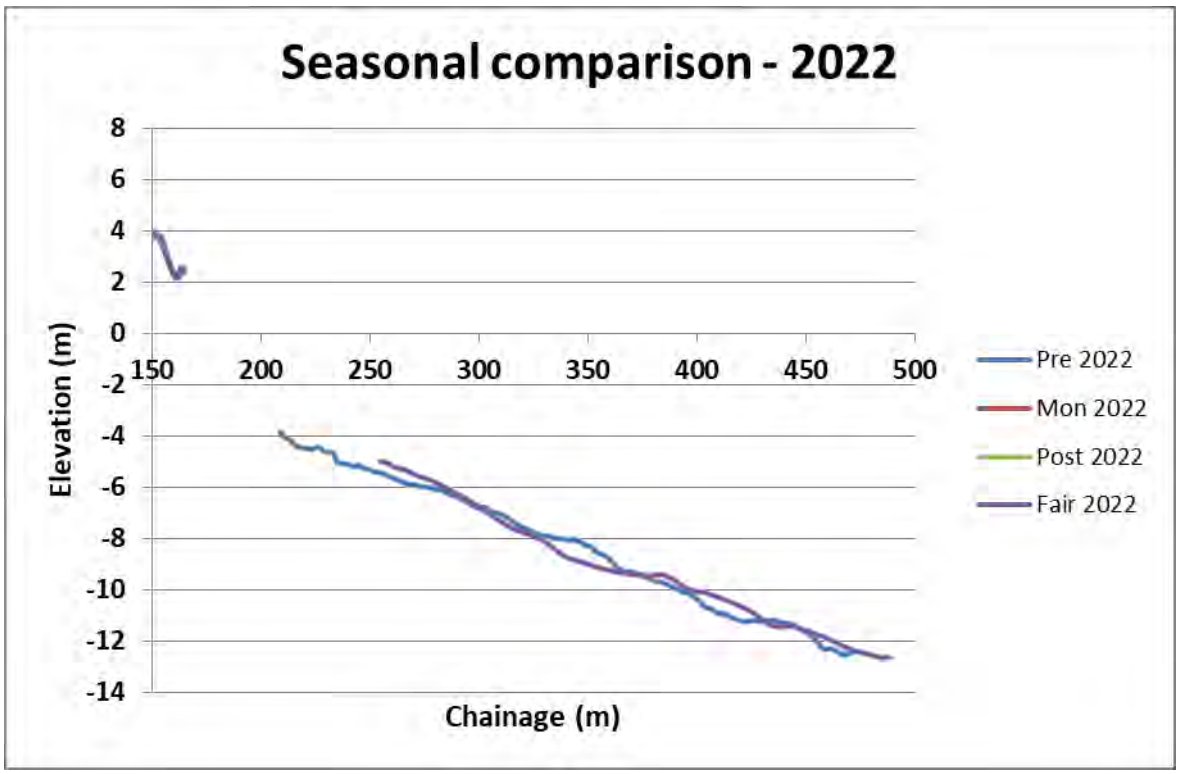


Figure 2-62 Profiles at Pozhiyoor (CS 12) – Seasonal comparison (2022)

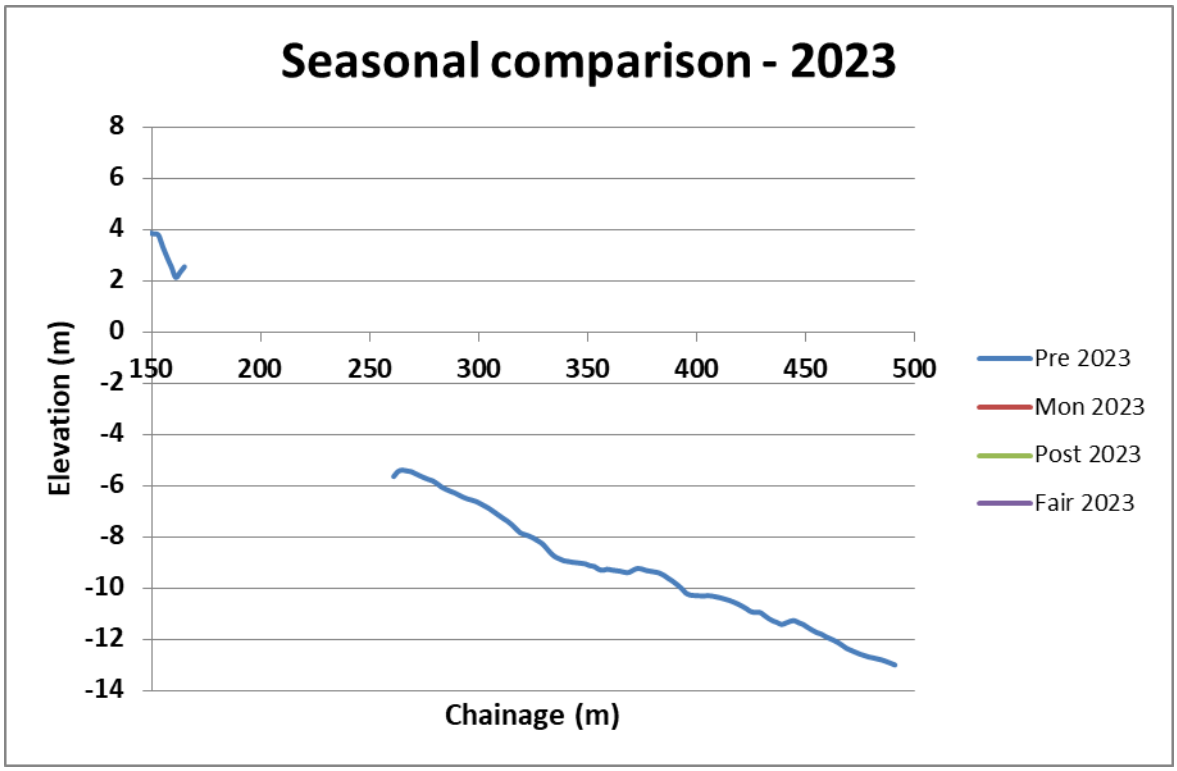


Figure 2-63 Profiles at Pozhiyoor (CS 12) – Seasonal comparison (2023)

From Figure 2-61, it can be noticed that the coast experiences significant seasonal variations over a year. The general trend seems to be that of a stable beach during pre-monsoon seasons, of beach erosion and deposition in offshore region during monsoon seasons and of gradual beach build up during post monsoon & fair-weather seasons. From Figure 2-62, it can be seen that the beach profile remains similar during pre-monsoon 2022 and fair weather 2022.

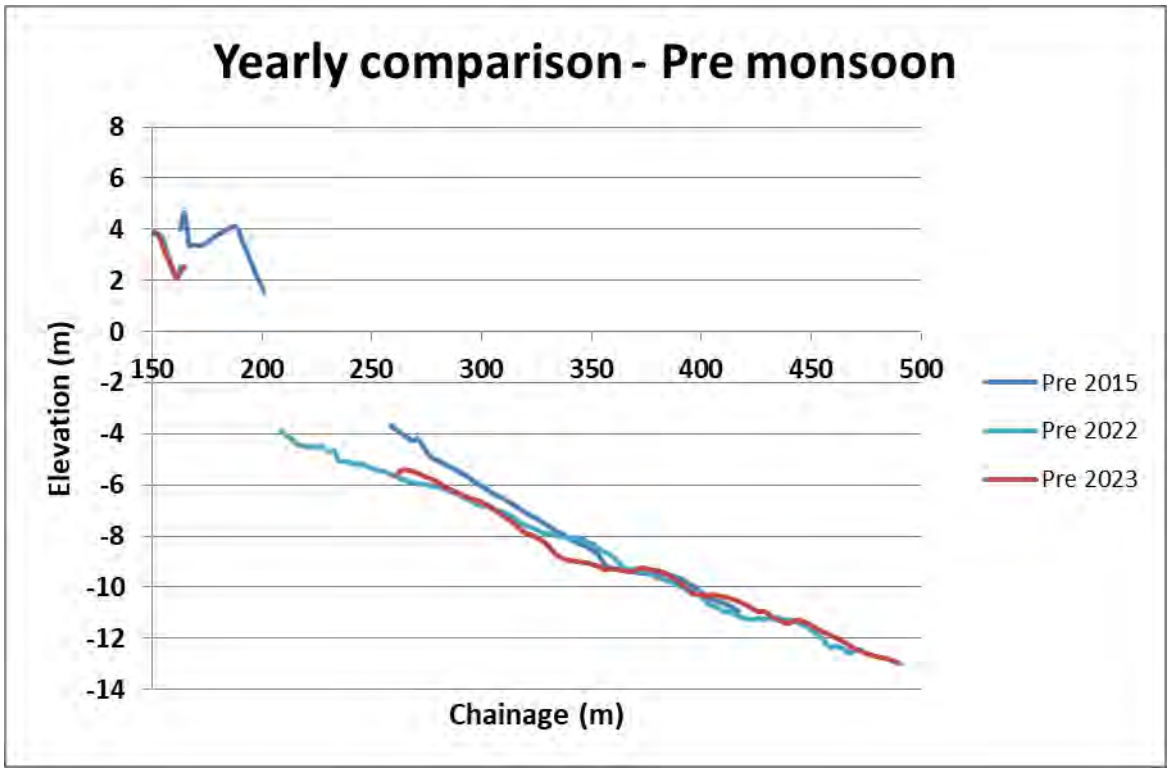


Figure 2-64 Profiles at Pozhiyoor (CS 12) – Yearly comparison – Pre Monsoon

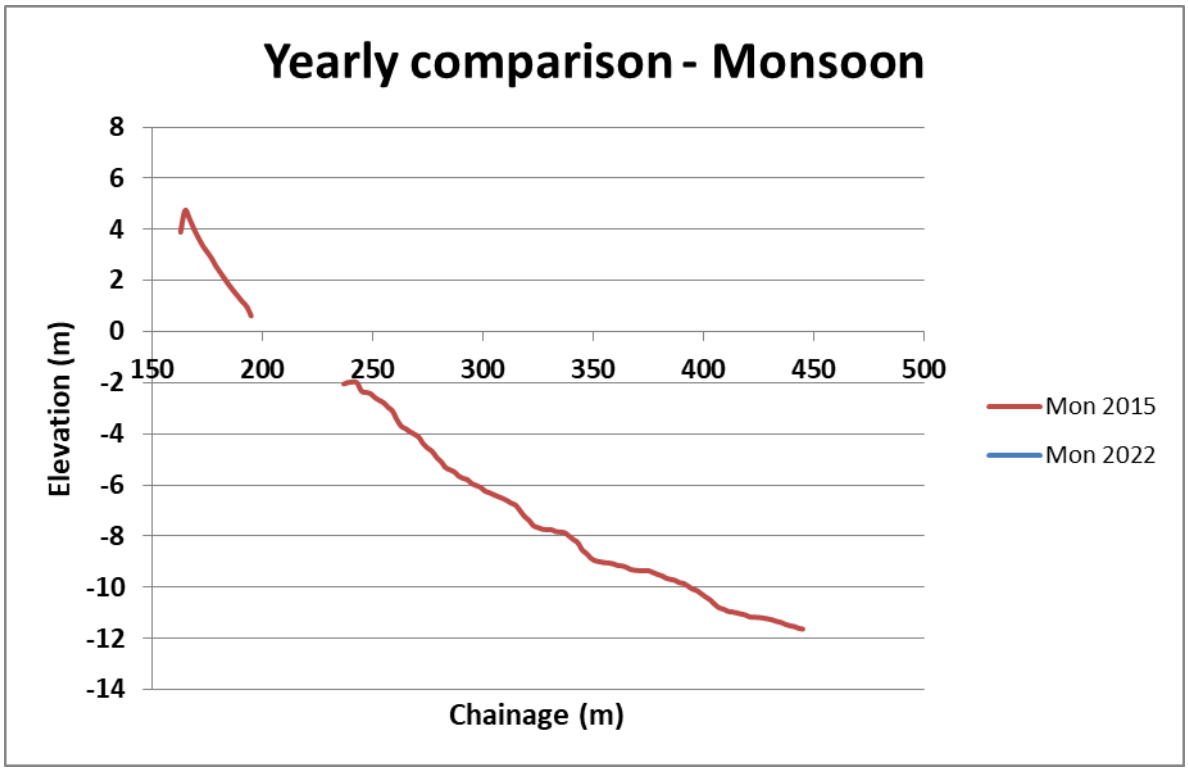


Figure 2-65 Profiles at Pozhiyoor (CS 12) – Yearly comparison – Monsoon

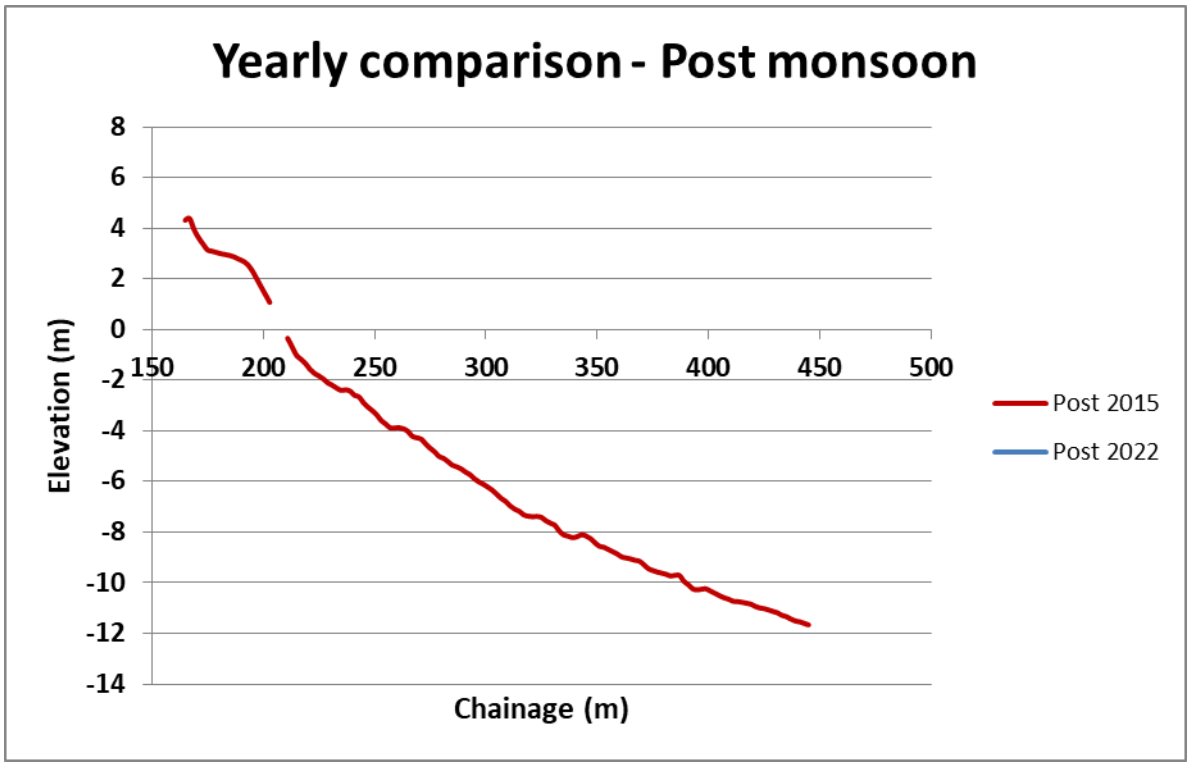


Figure 2-66 Profiles at Pozhiyoor (CS 12) – Yearly comparison – Post Monsoon

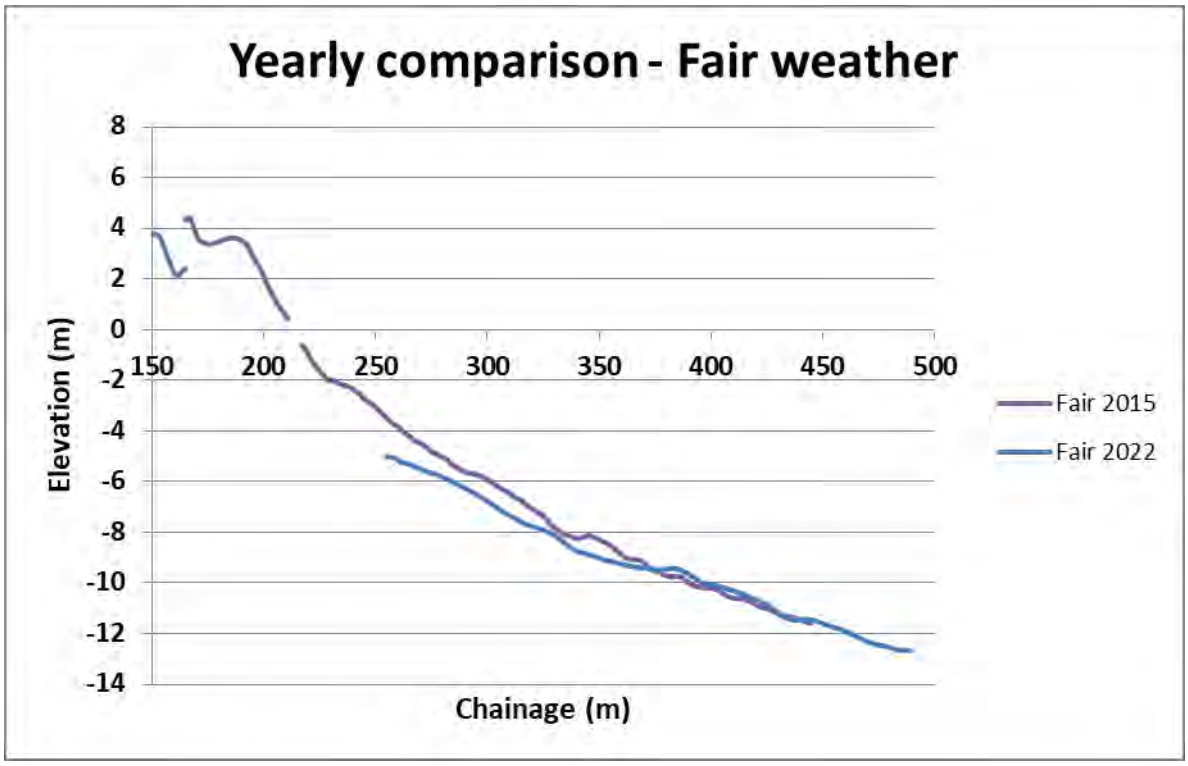
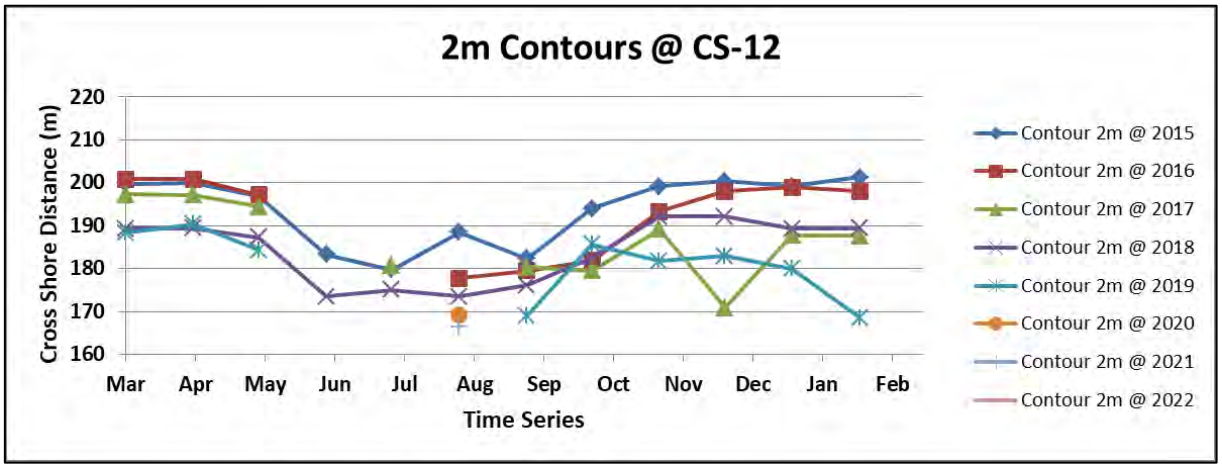


Figure 2-67 Profiles at Pozhiyoor (CS 12) – Yearly comparison – Fair Weather

LNTIEL extracted +2m, -3m, -4m, -6m, -8m and -10m contours from cross shore profile data at Pozhiyoor and below plots are time series of contours for two years (2015 and 2022).



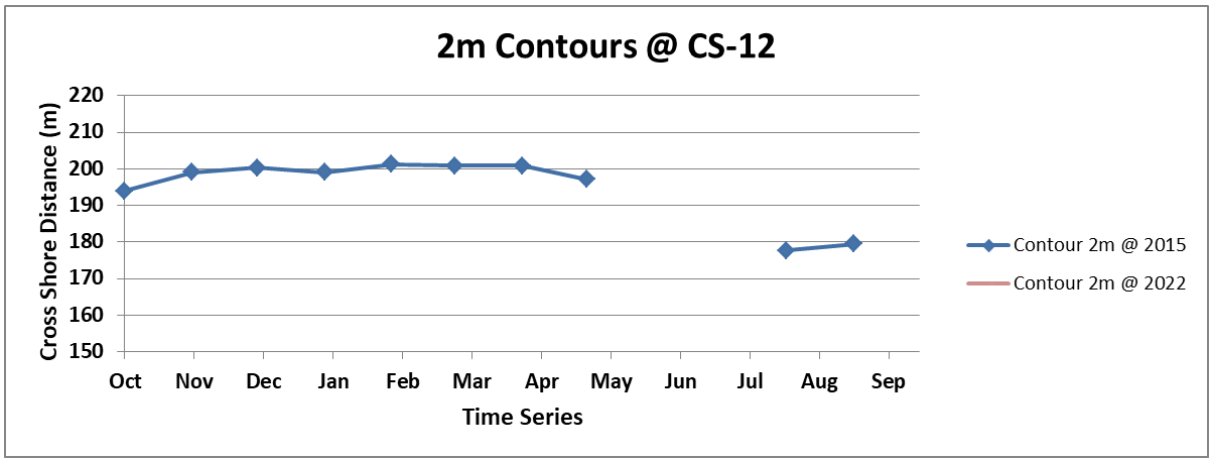


Figure 2-68 Time series of (+) 2 m contour at Pozhiyoor (CS 12)

Figure 2-68 is the time series of (+) 2 m contour data at Pozhiyoor. From this plot it can be noticed that the beach experiences seasonal variations resulting in erosion during monsoon season and accretion during other seasons. During Ockhi the beach was exposed to severe erosion and minimal accretion was noticed during fair weather 2017 and pre-monsoon 2018 in the course of which beach was supposed to build up. In addition, as a result of monsoon 2018 and 2019 the beach further eroded than previous monsoon seasons.

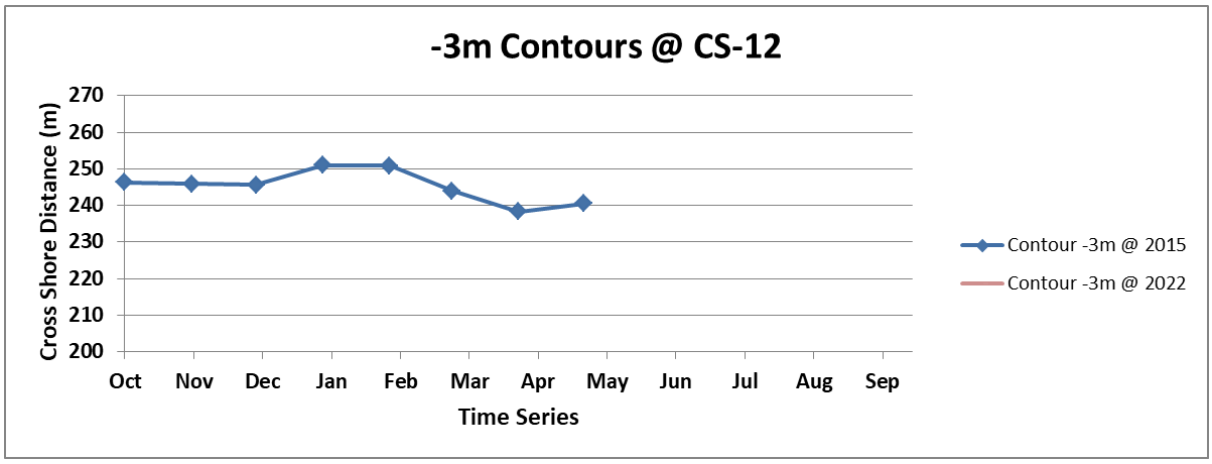


Figure 2-69 Time series of (–) 3 m contour at Pozhiyoor (CS 12)

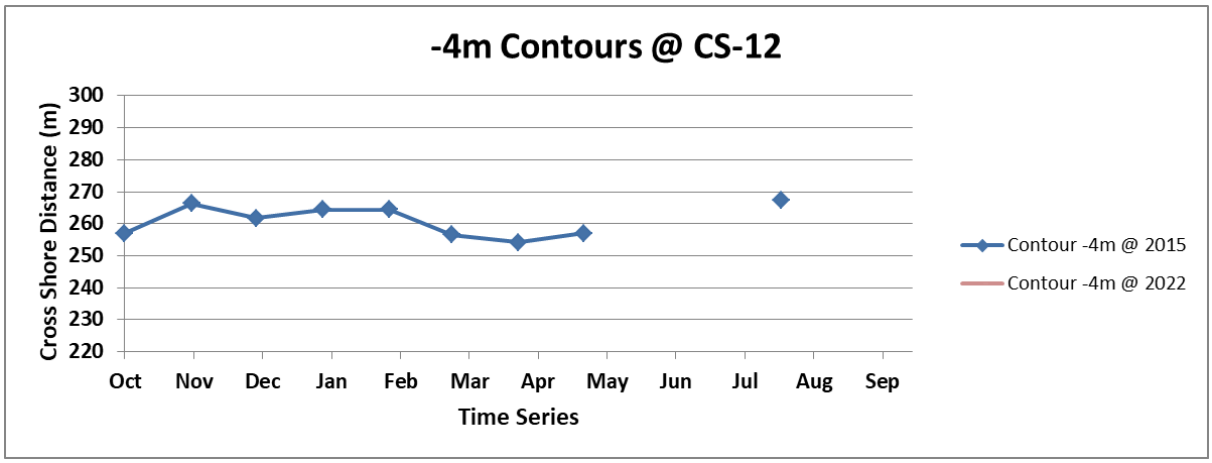


Figure 2-70 Time series of (–) 4 m contour at Pozhiyoor (CS 12)

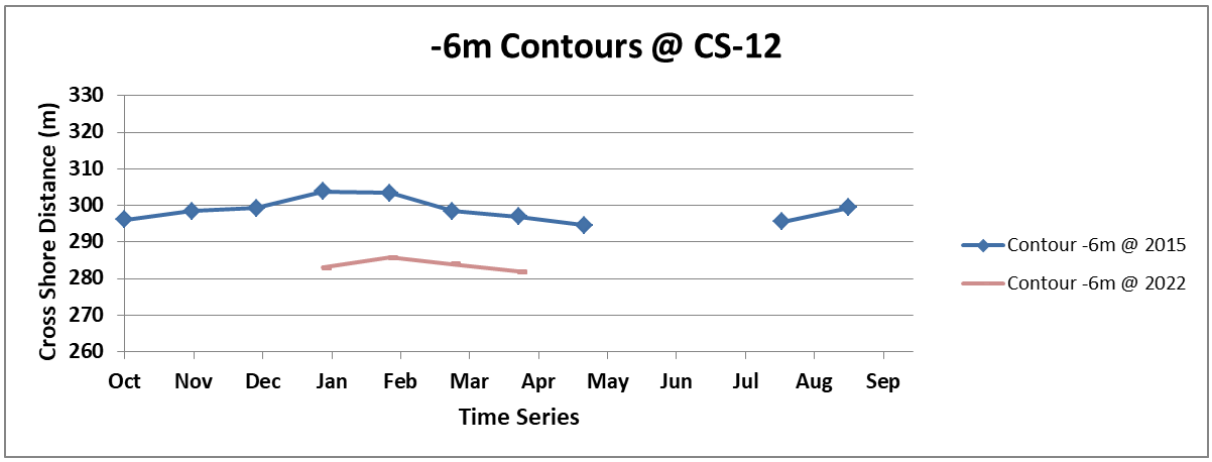


Figure 2-71 Time series of (–) 6 m contour at Pozhiyoor (CS 12)

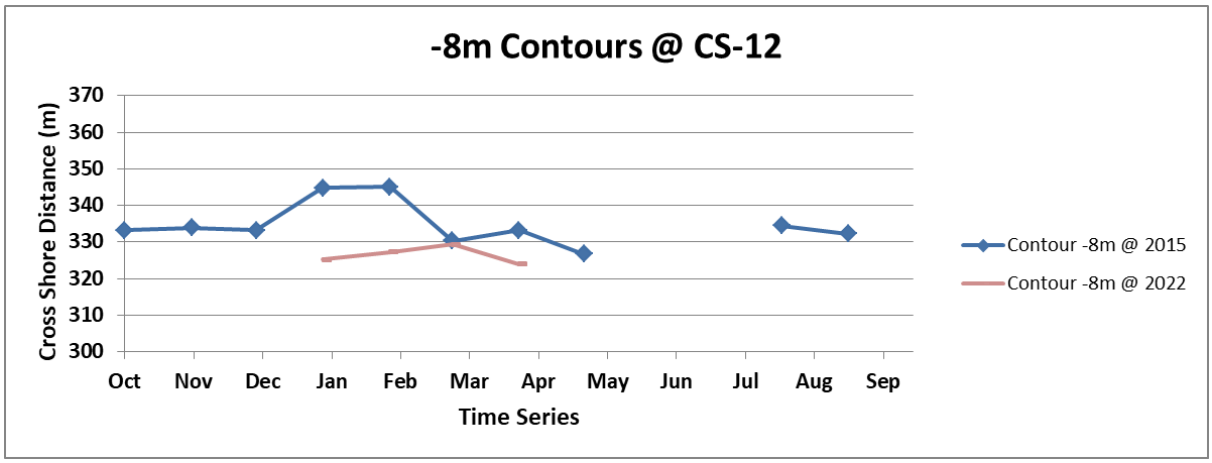


Figure 2-72 Time series of (–) 8 m contour at Pozhiyoor (CS 12)

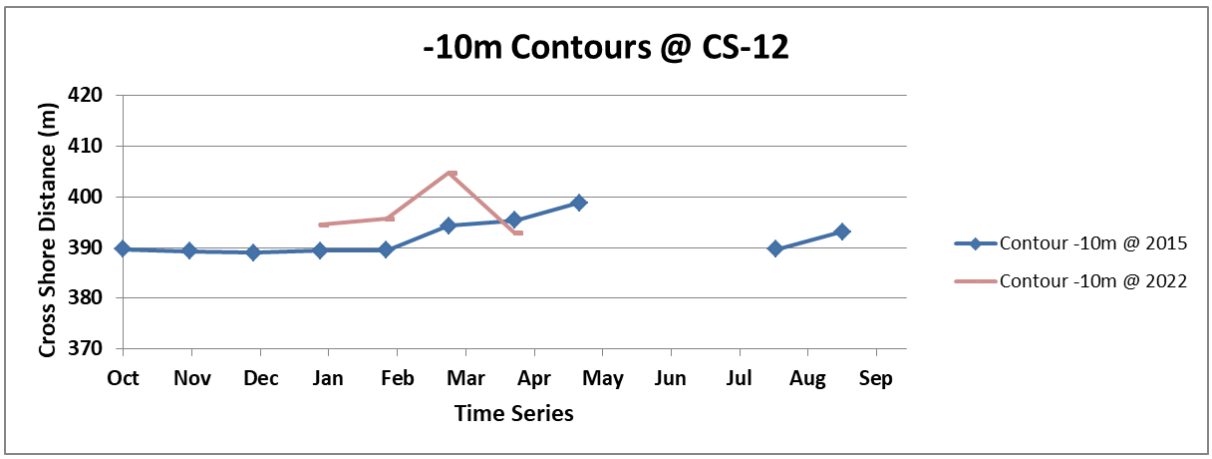


Figure 2-73 Time series of (–) 10 m contour at Pozhiyoor (CS 12)

In addition to above, the +2m, -3m, -4m, -6m, -8m and -10m contours continuous variation of contour distances over 7 years was provided for better clarity as shown in Figure 2-74.

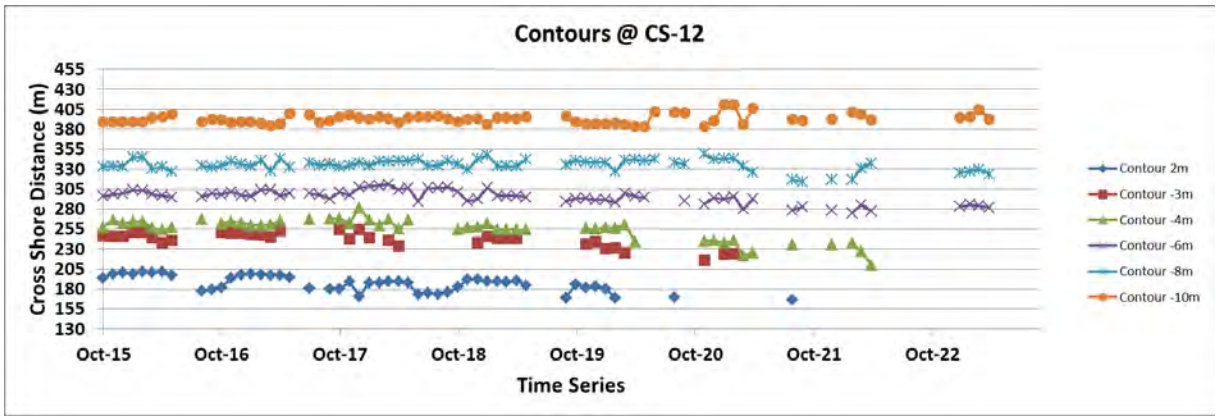


Figure 2-74 Continuous time series of contours at Pozhiyoor (CS 12)

Figure 2-74 shows the variation of contour distances from common arbitrary point on land side. It can be observed that most of the sediment exchange was in between +2m and -3m contours prior to Ockhi i.e. simultaneous erosion on beach side & accretion on sea side and vice versa. Post Ockhi such trend could not be traced due to various reasons such as lack of adequate survey data, construction activities (independent & unrelated to the port) happened to the South of this stretch, and subsequent higher monsoonal events.

2.6.2.3 Stretch 3

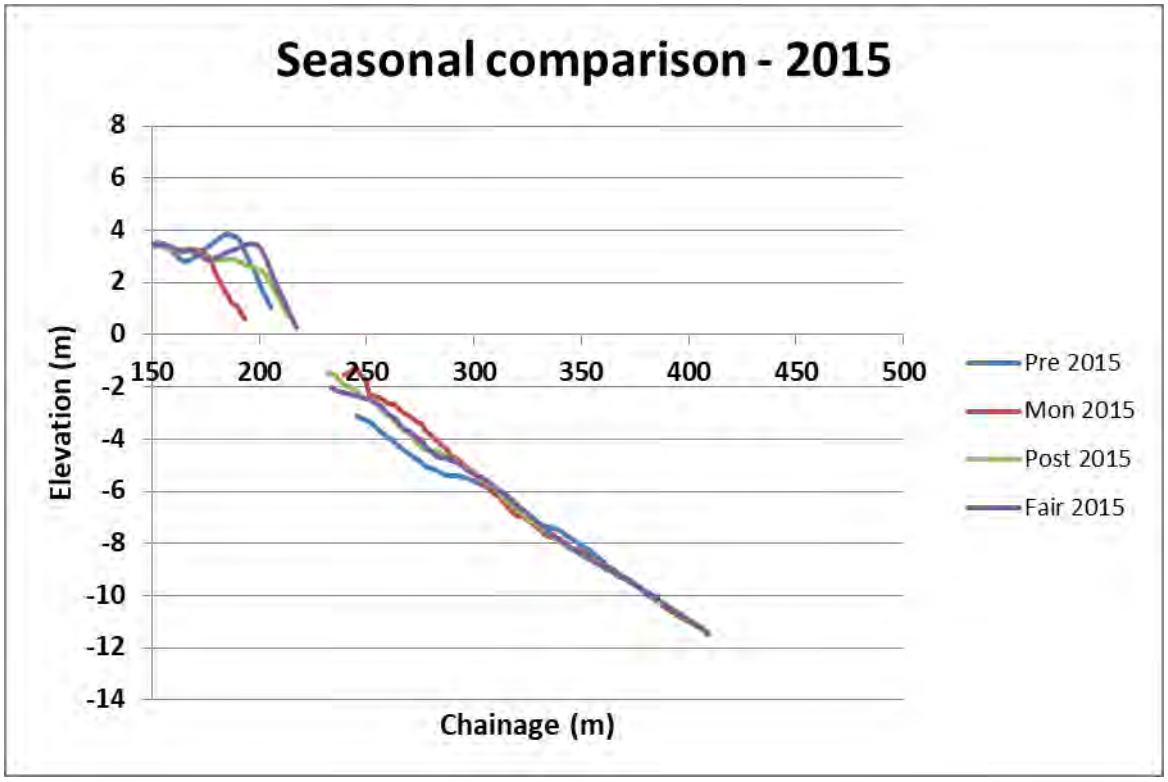


Figure 2-75 Profiles at Karumkulam (CS 26) – Seasonal comparison – (2015)

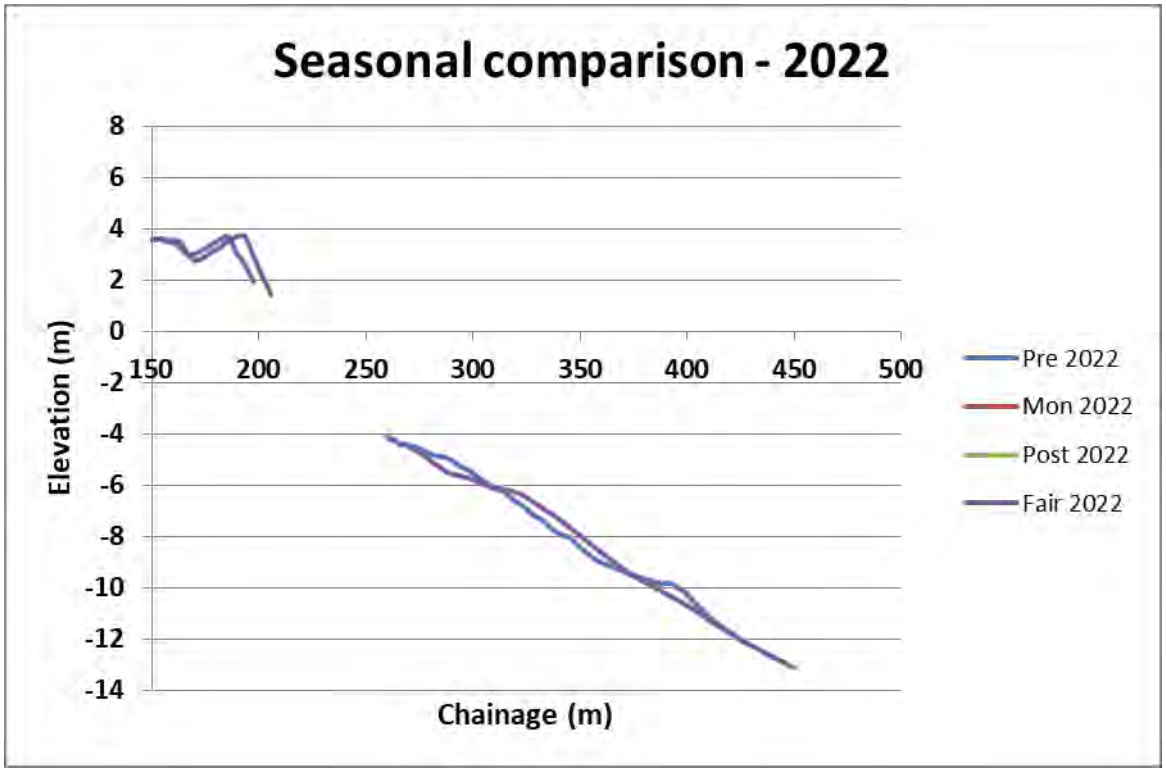


Figure 2-76 Profiles at Karumkulam (CS 26) – Seasonal comparison – (2022)

Beach is present throughout the year in the stretch of CS 18 to CS 34. Among these sections, CS 26 which is at Karumkulam in Thiruvananthapuram district of Kerala was chosen to illustrate the seasonal trends over seven years. From Figure 2-75, it can be

noticed that the coast experience seasonal variations over a year. In general, it seems to have a stable beach during pre-monsoon seasons, beach erosion and deposition in offshore region during monsoon seasons and gradual beach build up during post monsoon & fair weather. Whereas in 2017 the coast experienced a very severe cyclonic storm (IMD Classification) named Ockhi (December 2017) during fair weather season and resulted in severe erosion all along the coast. From Figure 2-76, it can be seen that there was better beach build-up during fair weather 2022 when compared to pre monsoon 2022.

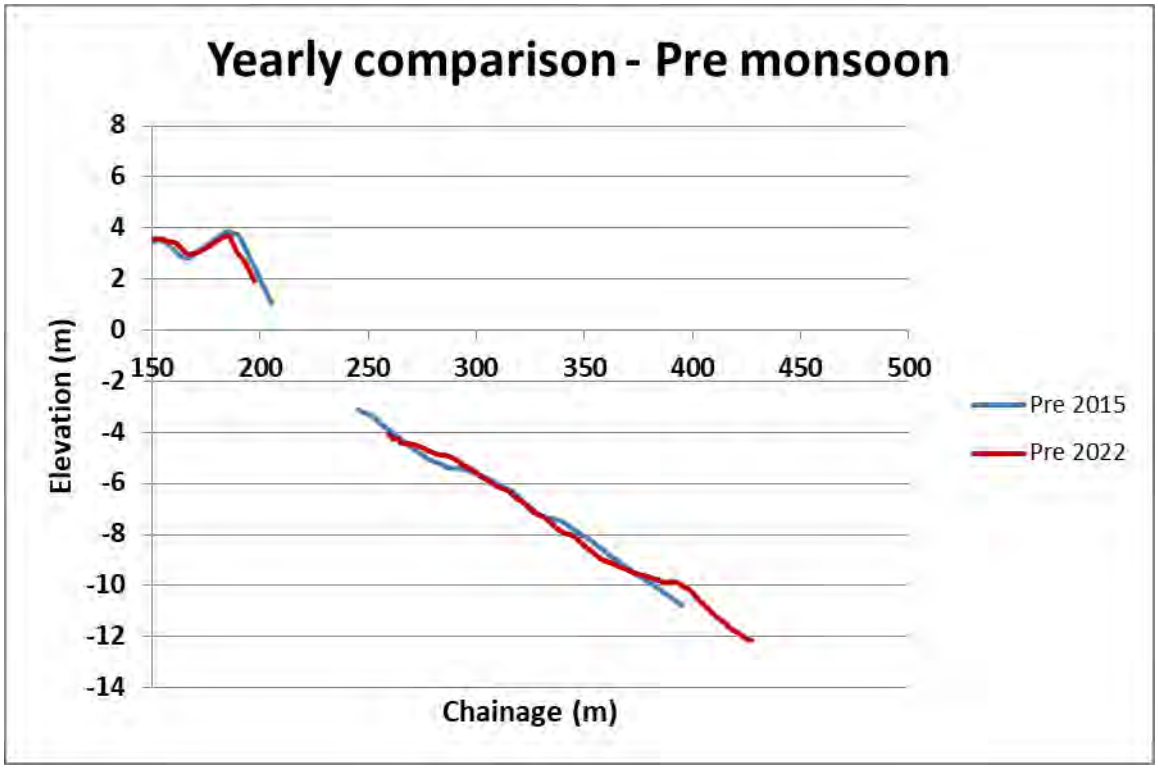


Figure 2-77 Profiles at Karumkulam (CS 26) – Yearly comparison – Pre monsoon

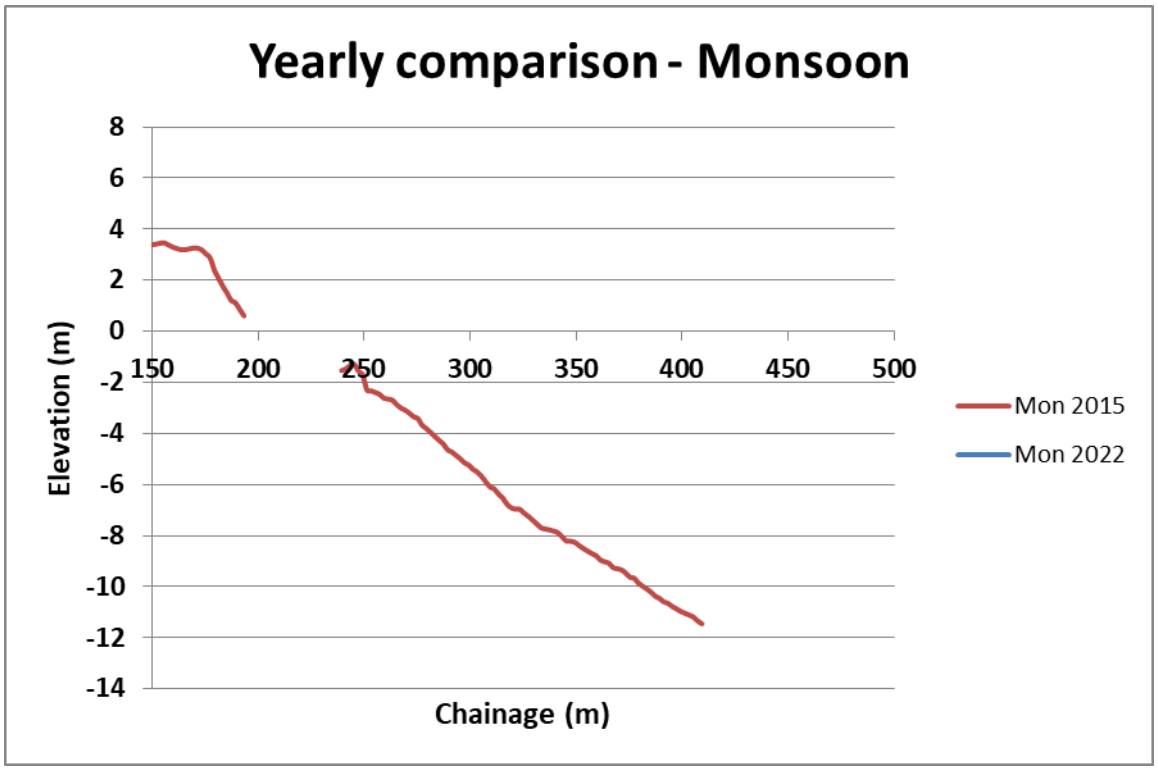


Figure 2-78 Profiles at Karumkulam (CS 26) – Yearly comparison – Monsoon

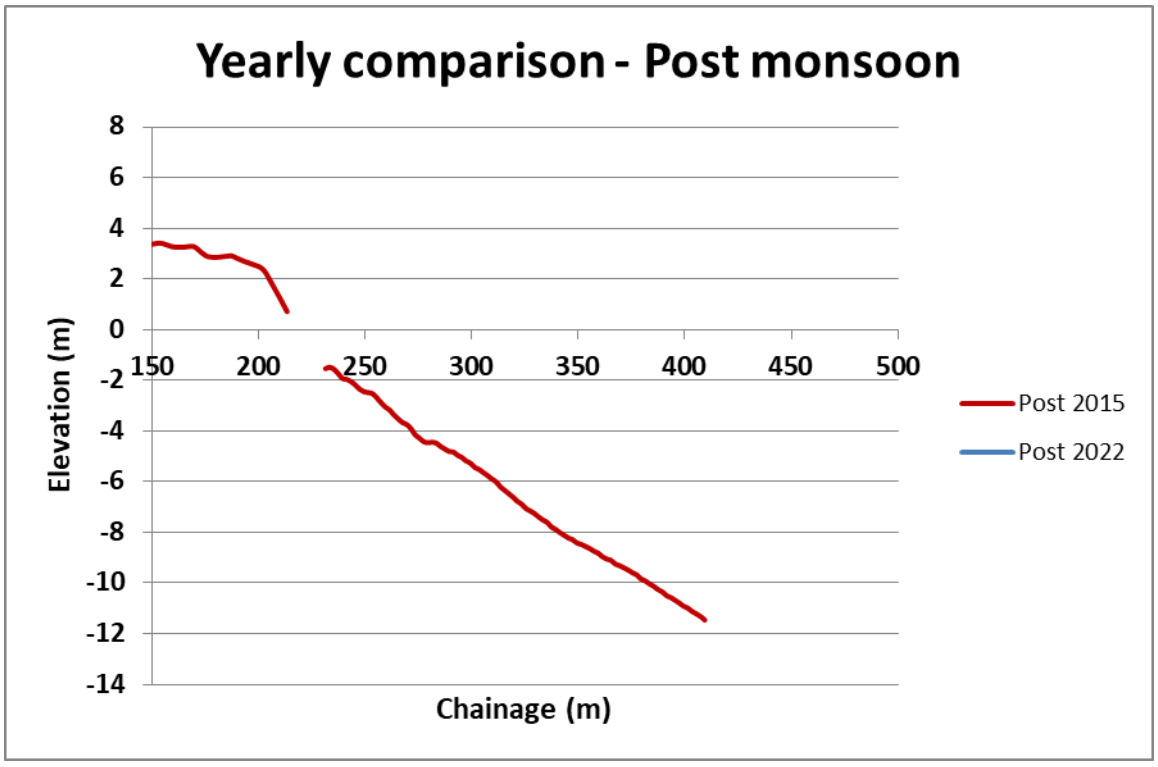


Figure 2-79 Profiles at Karumkulam (CS 26) – Yearly comparison – Post monsoon

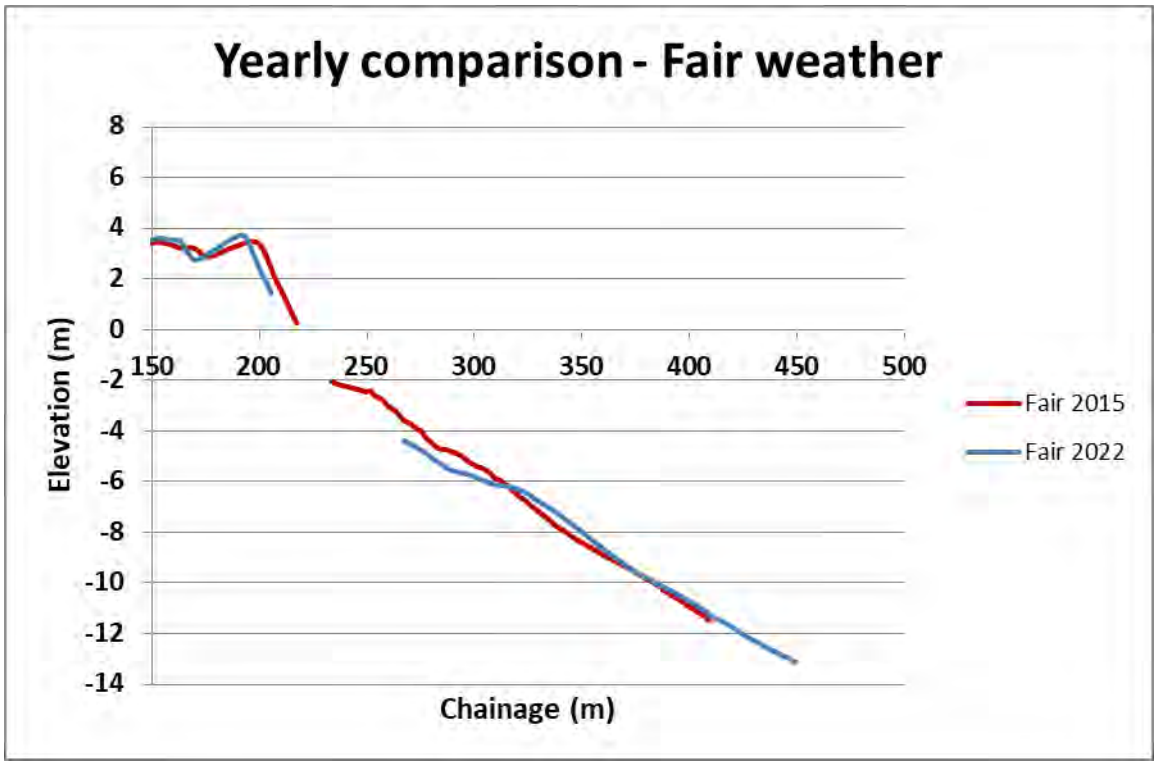
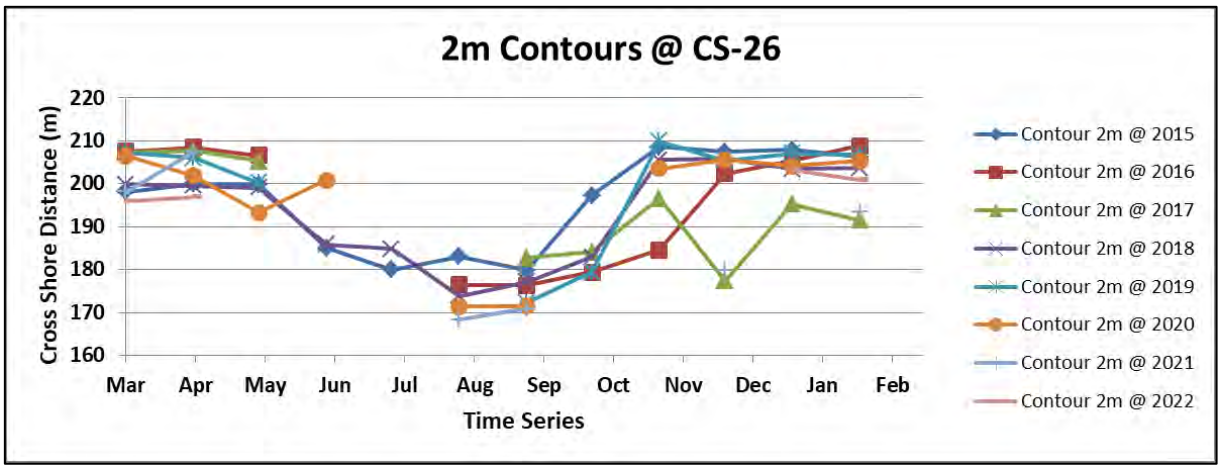


Figure 2-80 Profiles at Karumkulam (CS 26) – Yearly comparison – Fair weather

Figure 2-77 to Figure 2-80 represent comparison of profiles of season for two years (2015 & 2022). The coast is undergoing processes to recover from the Cyclone Ockhi impact, and this can be observed from fair weather seasons comparison plot.

LNTIEL extracted +2m, -3m, -4m, -6m, -8m and -10m contours from cross shore profile data at Karumkulam and below plots were time series of respective contours for two years (2015 and 2022) data with similar time scale. The plots represent the contour distances with respect to an arbitrary point which is constant for all profiles at a cross section and show the monthly variations of erosion (downward drift) and accretion (upward drift) in this stretch.

Figure 2-81 is the time series of (+) 2 m contour at Karumkulam. From this plot it can be noticed that the beach experiences seasonal variation of erosion during monsoon season and accretion during other seasons.



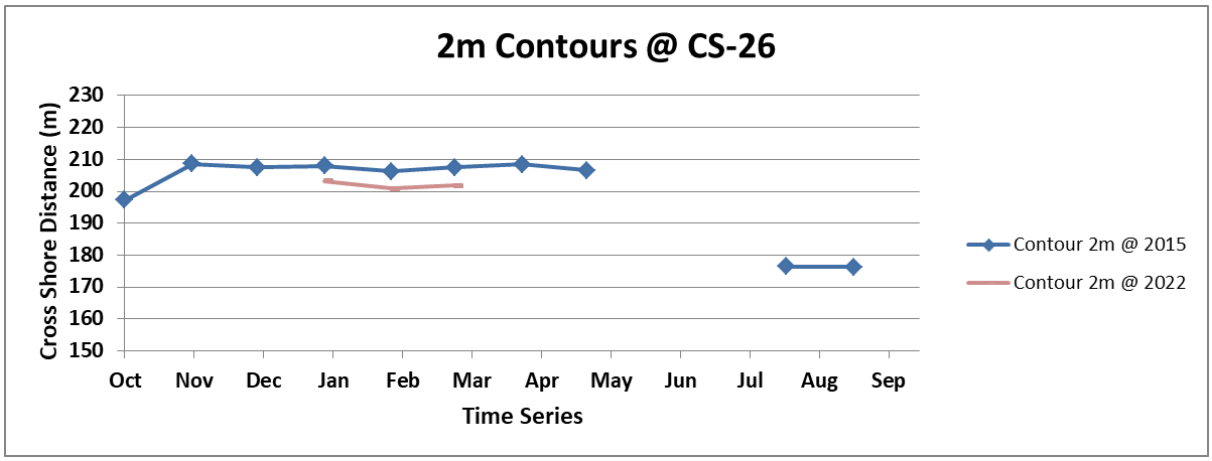


Figure 2-81 Time series of (+) 2 m contour at Karumkulam (CS 26)

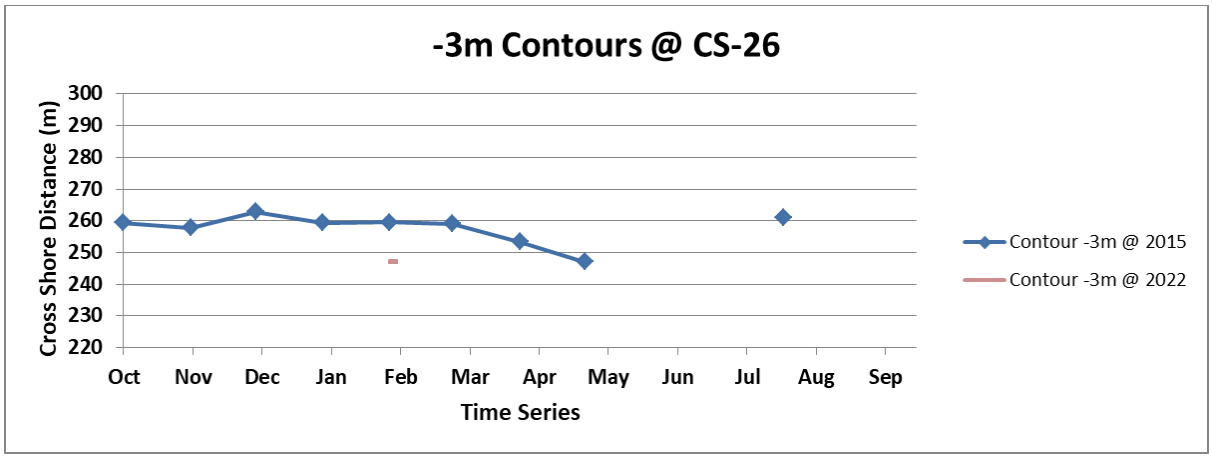


Figure 2-82 Time series of (–) 3 m contour at Karumkulam (CS 26)

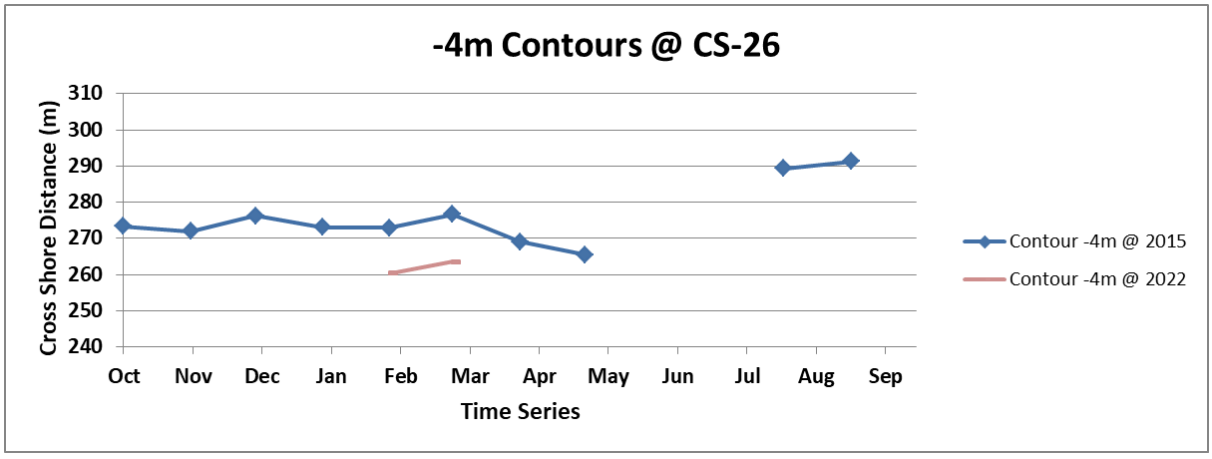


Figure 2-83 Time series of (–) 4 m contour at Karumkulam (CS 26)

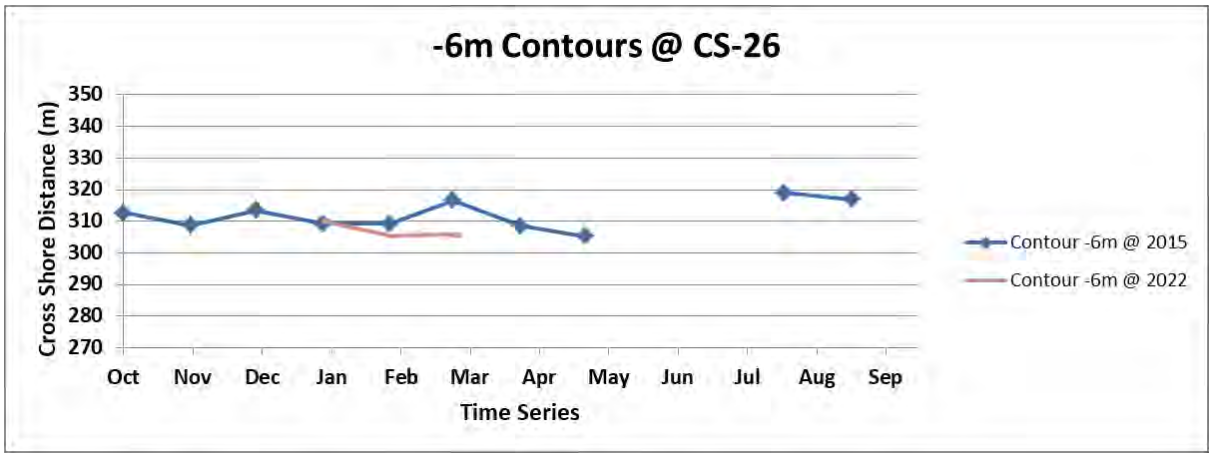


Figure 2-84 Time series of (–) 6 m contour at Karumkulam (CS 26)

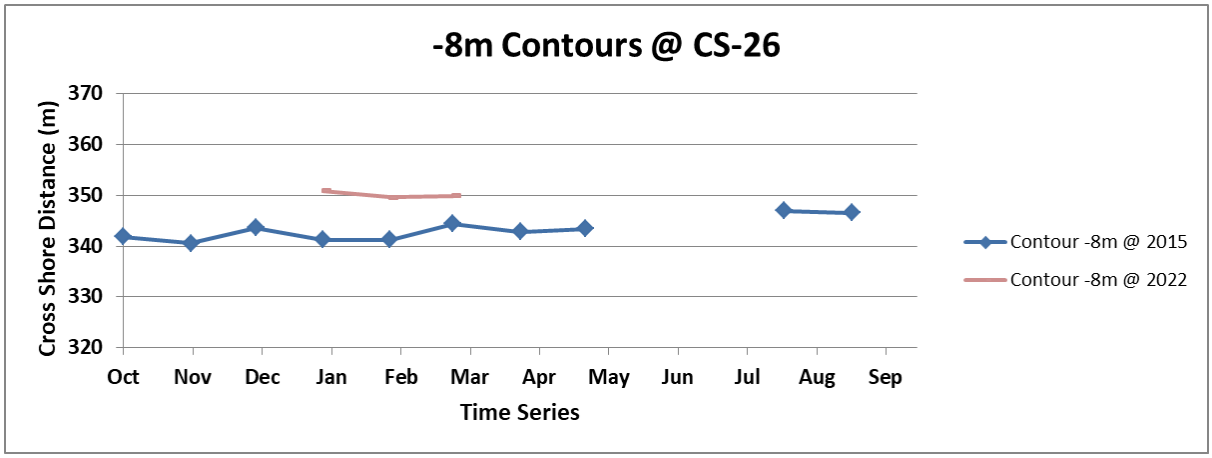


Figure 2-85 Time series of (–) 8 m contour at Karumkulam (CS 26)

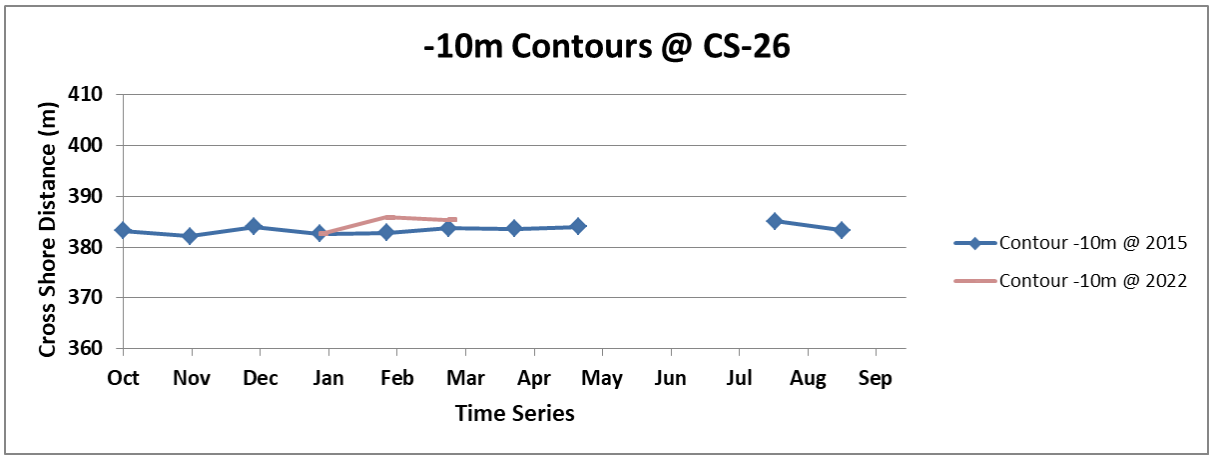


Figure 2-86 Time series of (–) 10 m contour at Karumkulam (CS 26)

In addition to above, the +2m, -3m, -4m, -6m, -8m and -10m contours continuous variation of contour distances over 7 years was provided for better clarity as shown in Figure 2-87.

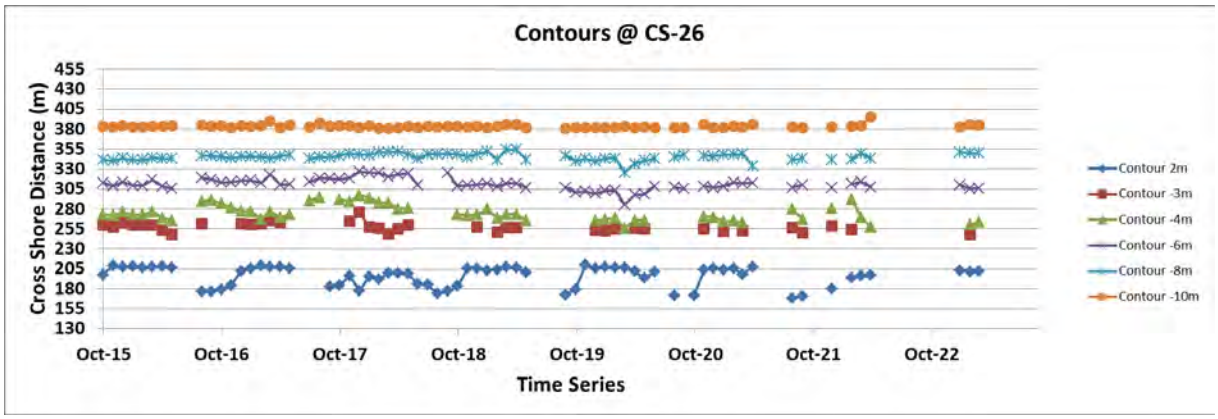


Figure 2-87 Continuous time series of contours at Karumkulam (CS 26)

Figure 2-87 shows the variation of respective contour distances from common arbitrary point on land side. It can be observed that most of the sediment exchange was in between +2m and -3m contours i.e. simultaneous erosion on beach side & accretion on sea side and vice versa. It can be noticed from +2m contour that there was better beach build-up during fair weather 2022.

2.6.2.4 Stretch 4

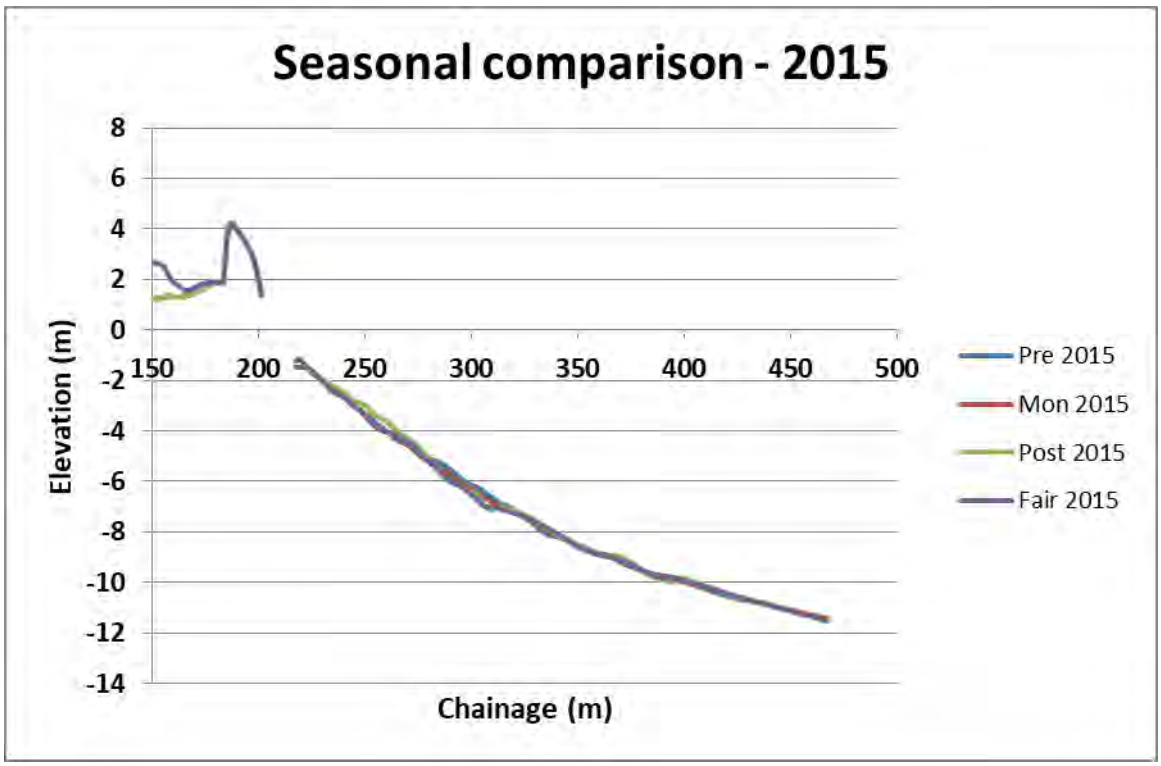


Figure 2-88 Profiles at Panathura (CS 49) – Seasonal comparison (2015)

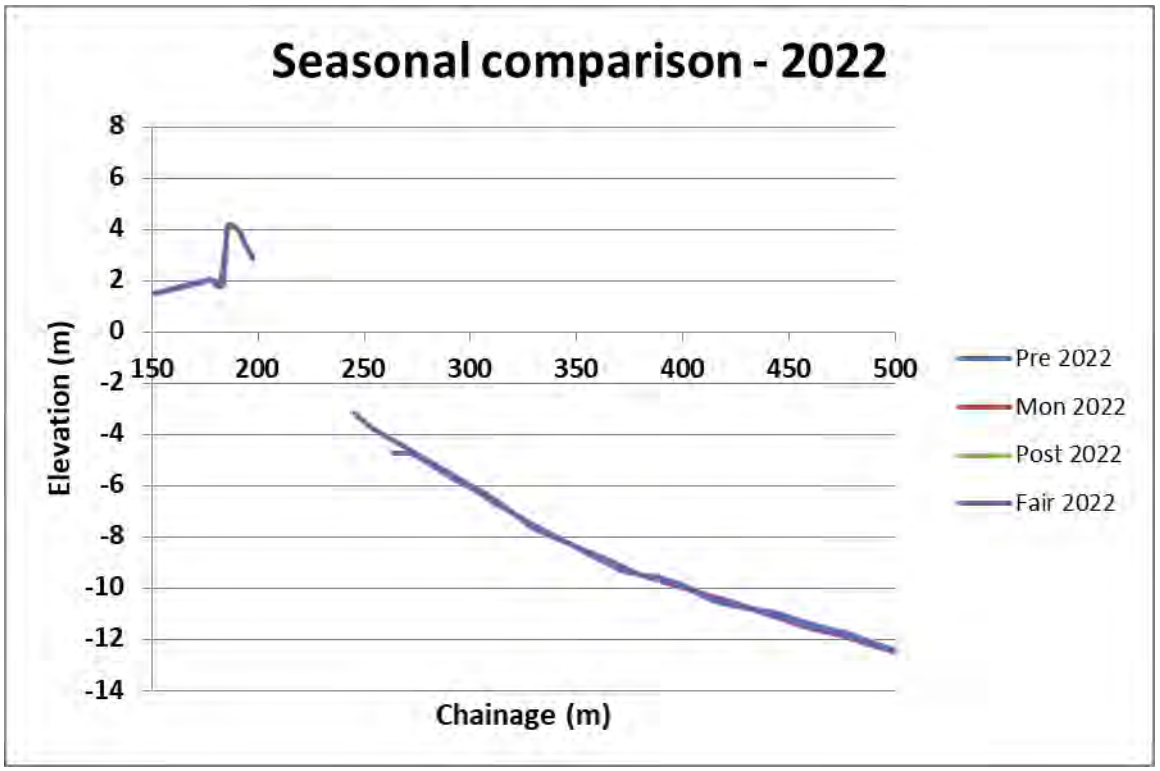


Figure 2-89 Profiles at Panathura (CS 49) – Seasonal comparison (2022)

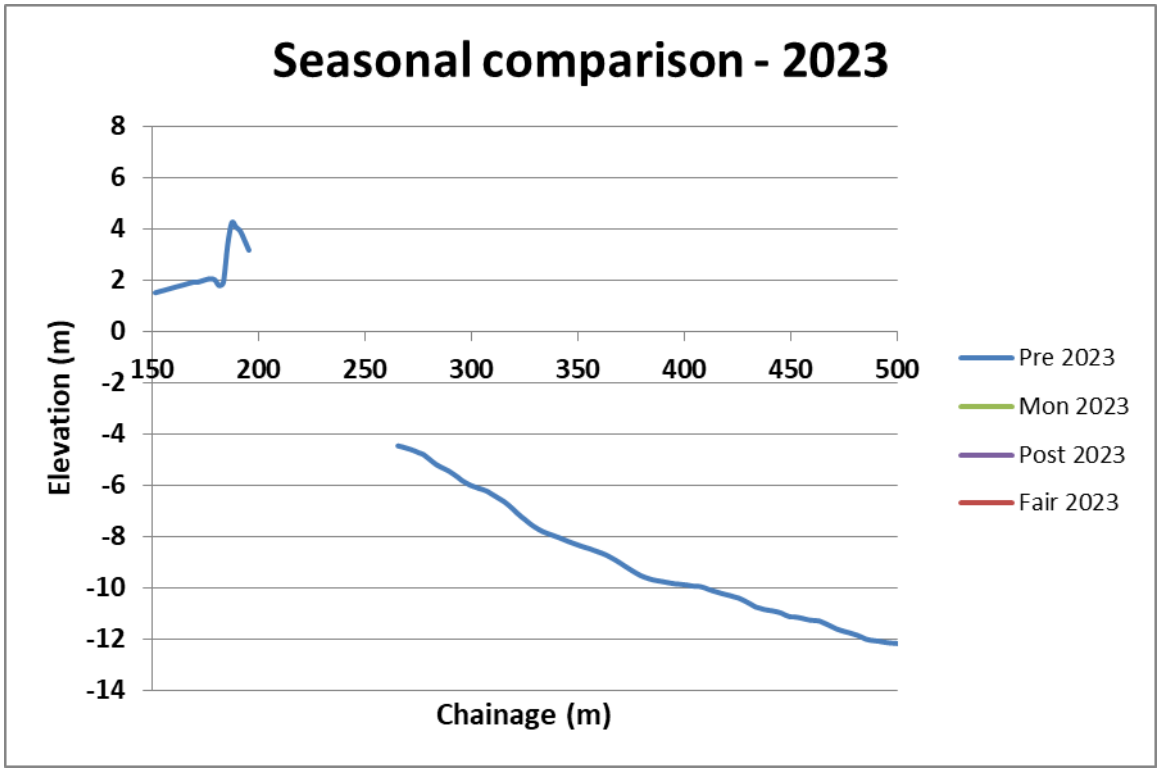


Figure 2-90 Profiles at Panathura (CS 49) – Seasonal comparison (2023)

Seawalls are present in the stretch of CS 47 to CS 52. Among these sections, CS 49 which is at Panathura in Thiruvananthapuram district was chosen to illustrate the seasonal trends over seven years.

From Figure 2-88 and Figure 2-89, it can be noticed that the seasonal variations are very minimal. Figure 2-91 to Figure 2-94 represent comparison of profiles of different seasons for two years (2015 and 2022).

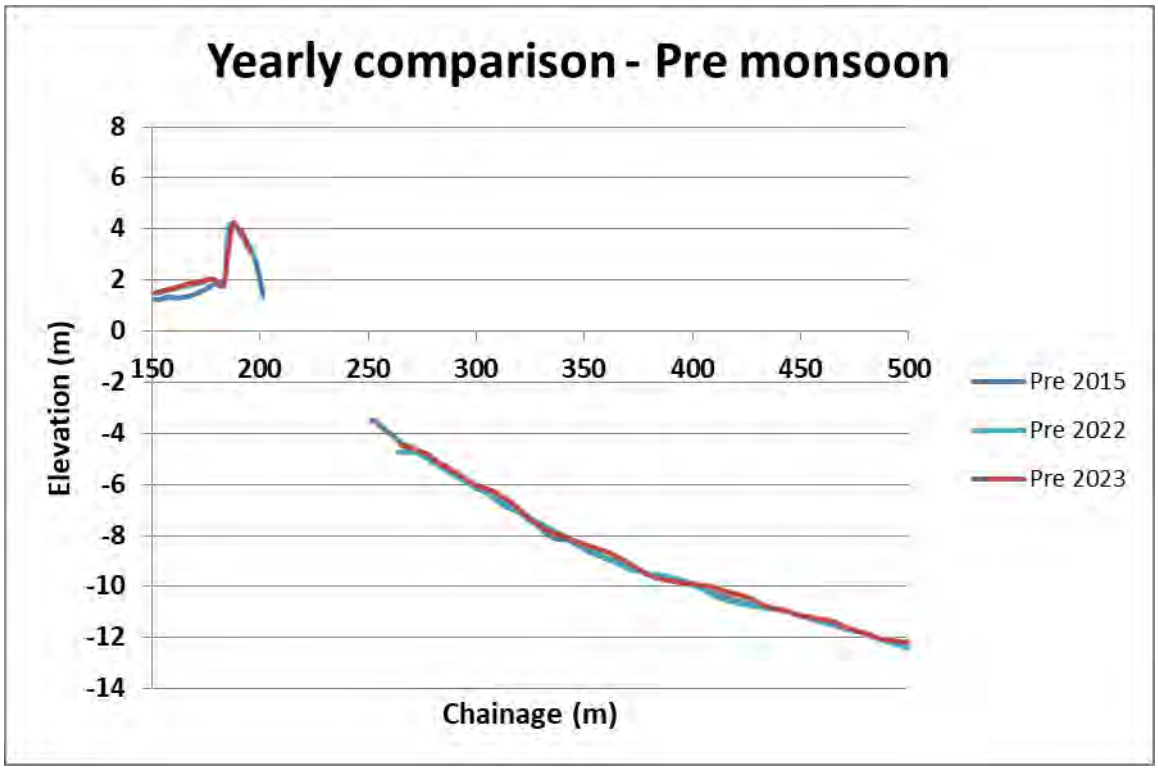


Figure 2-91 Profiles at Panathura (CS 49) – Yearly comparison – Pre monsoon

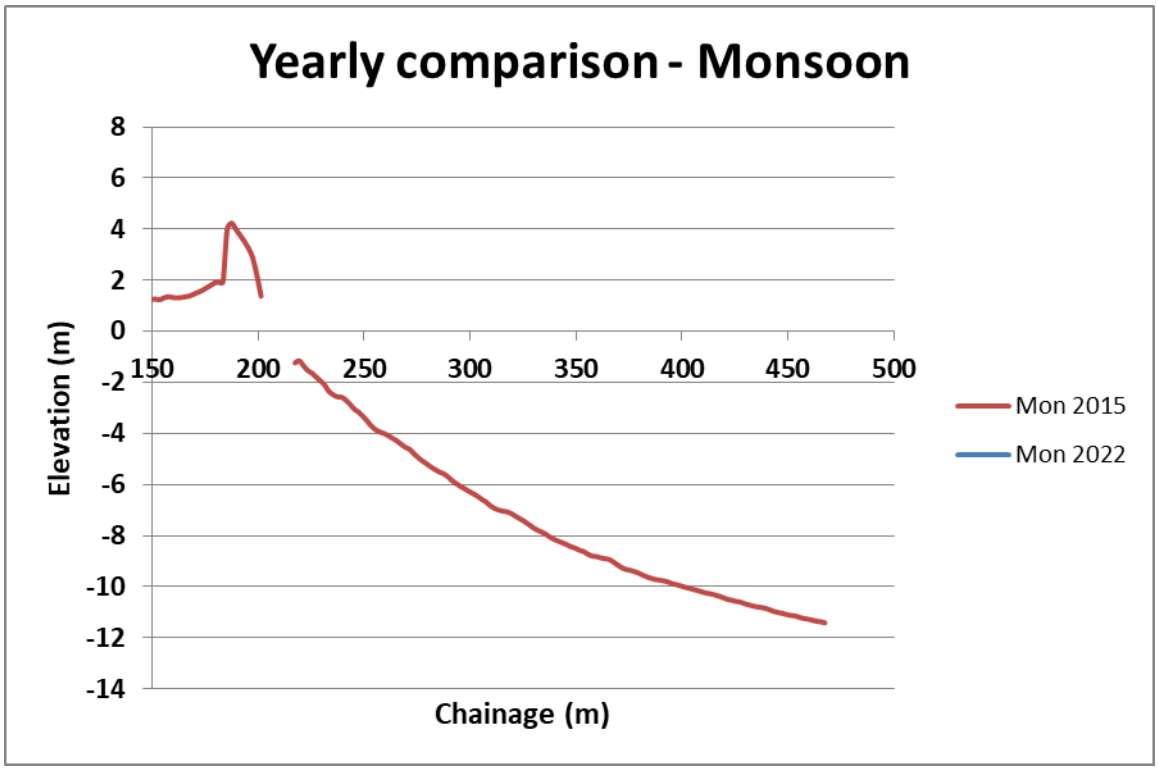


Figure 2-92 Profiles at Panathura (CS 49) – Yearly comparison - Monsoon

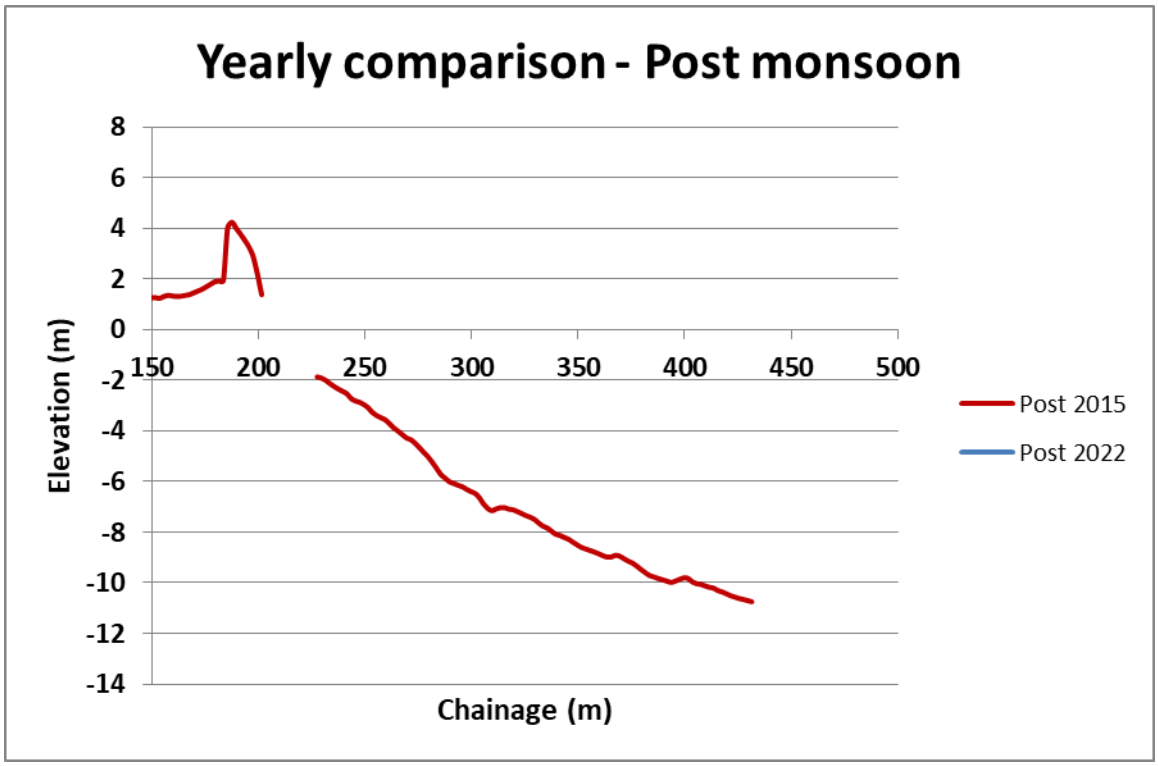


Figure 2-93 Profiles at Panathura (CS 49) – Yearly comparison – Post Monsoon

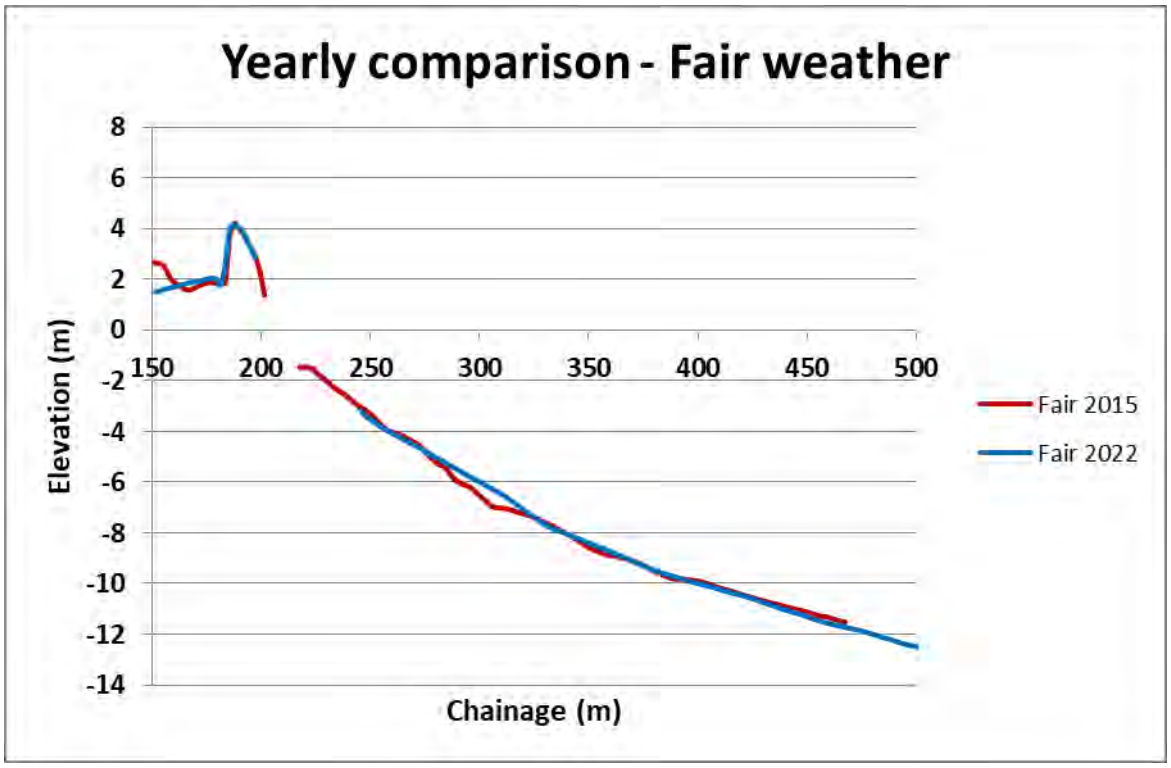


Figure 2-94 Profiles at Panathura (CS 49) – Yearly comparison – Fair weather

LNTIEL extracted +2m (not extracted at the location where seawall is present), -3m, -4m, -6m, -8m and -10m contours from cross shore profile data at Panathura and below plots are time series of respective contours over two years(2015 and 2022). The plots represent the contour distances with respect to an arbitrary point which is constant for all profiles at a cross

section and show the monthly variations of erosion (downward drift) and accretion (upward drift) in this stretch.

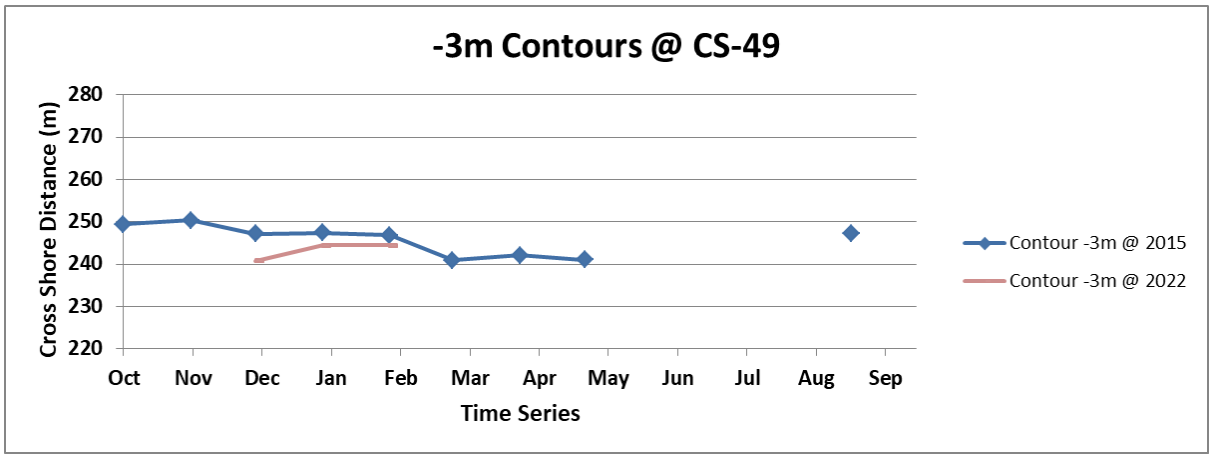


Figure 2-95 Time series of (–) 3 m contour at Panathura (CS 49)

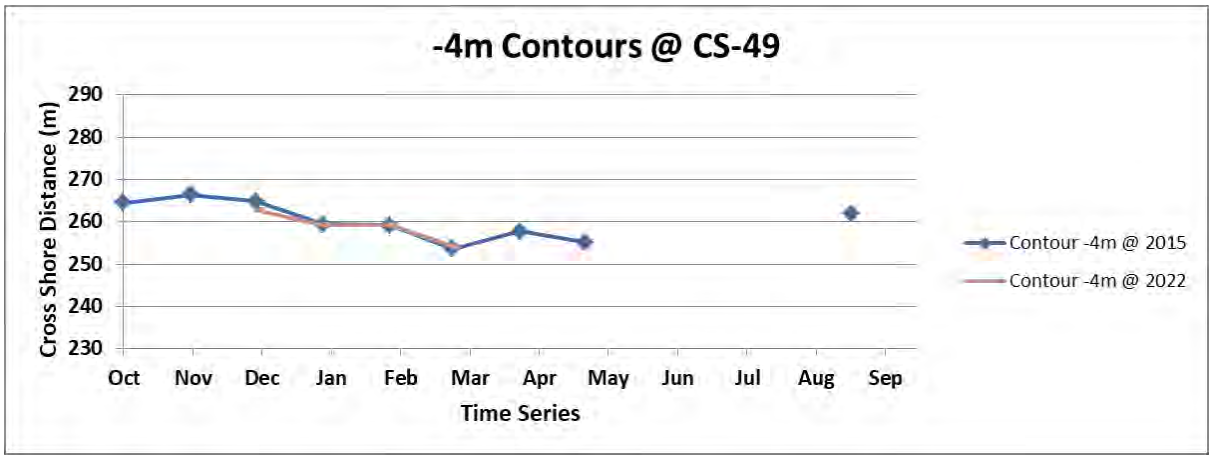


Figure 2-96 Time series of (–) 4 m contour at Panathura (CS 49)

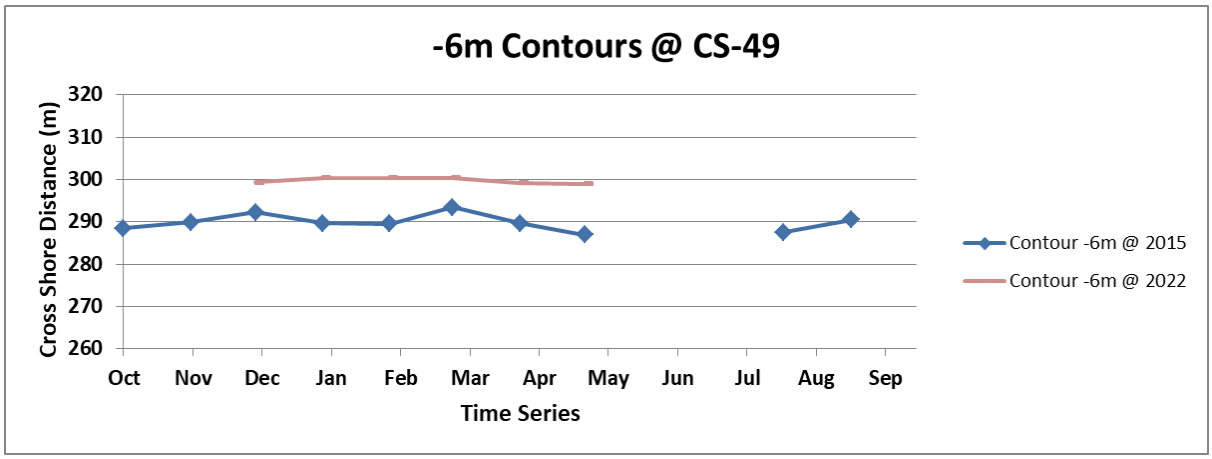


Figure 2-97 Time series of (–) 6 m contour at Panathura (CS 49)

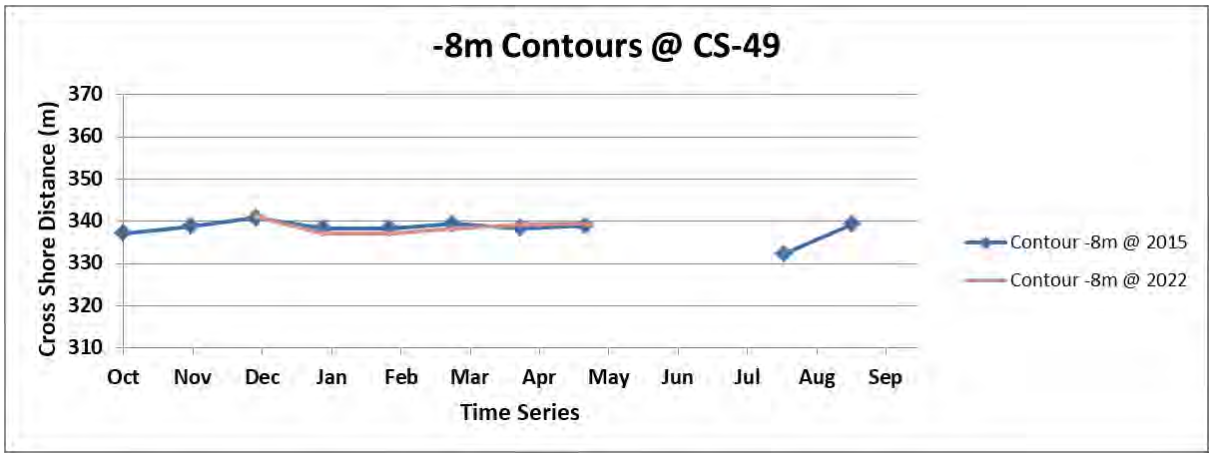


Figure 2-98 Time series of (–) 8 m contour at Panathura (CS 49).

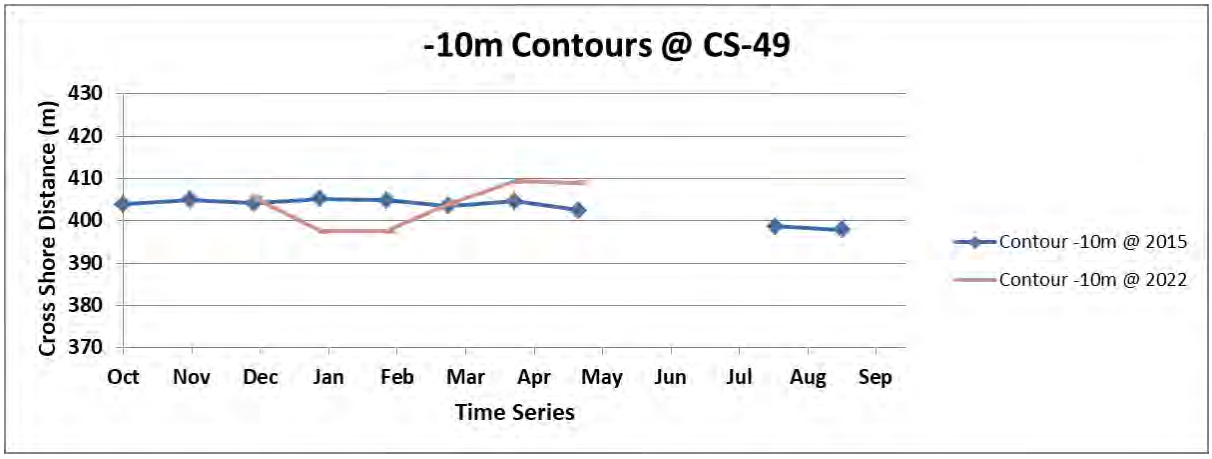


Figure 2-99 Time series of (–) 10 m contour at Panathura (CS 49)

In addition to above, the +2m (not extracted at the location where seawall is present), -3m, -4m, -6m, -8m and -10m contours continuous variation of contour distances over 7 years was provided for better clarity as shown in Figure 2-100.

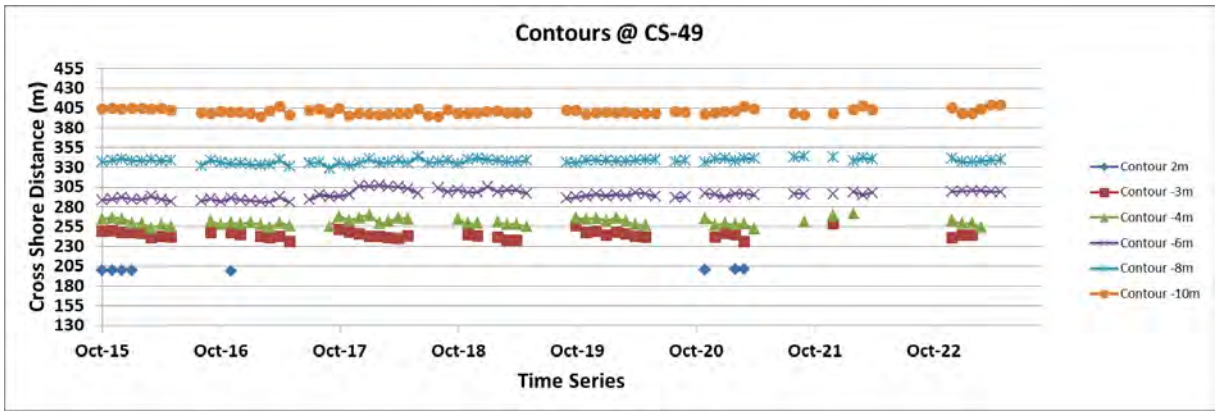


Figure 2-100 Continuous time series of contours at Panathura (CS 49)

2.6.2.5 Stretch 5

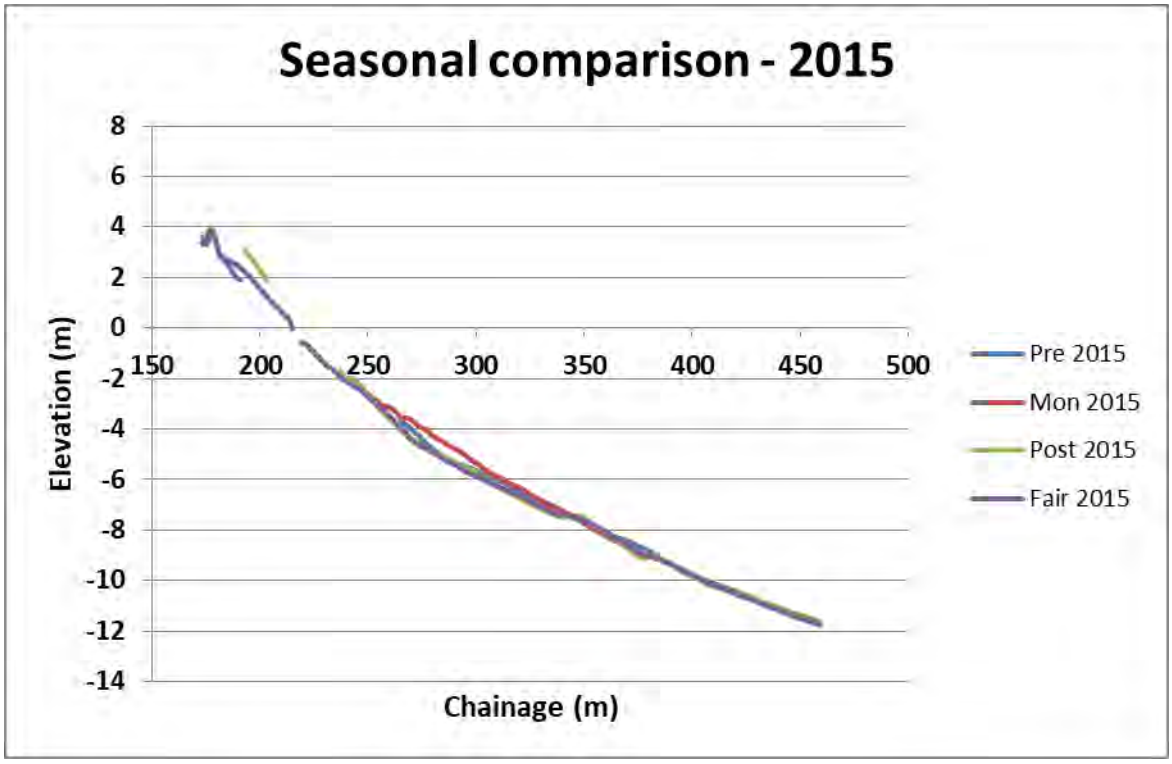


Figure 2-101 Profiles at Beemapally (CS 58) – Seasonal comparison (2015)

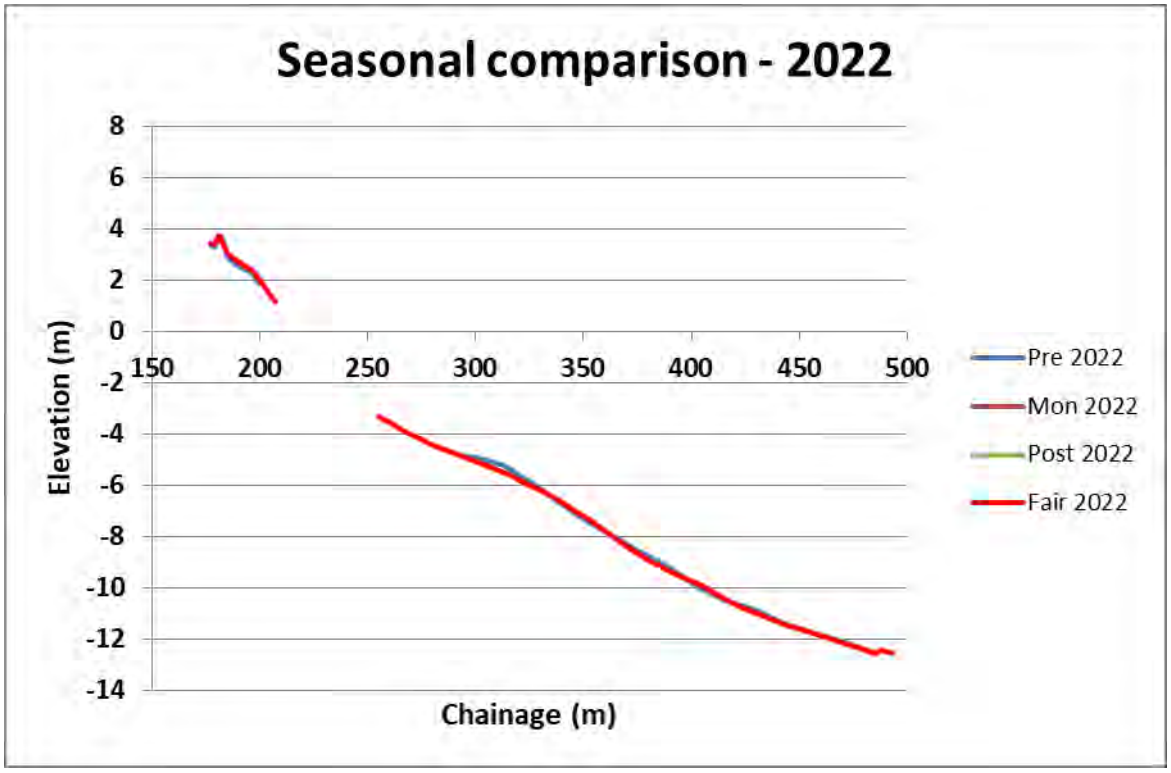


Figure 2-102 Profiles at Beemapally (CS 58) – Seasonal comparison (2022)

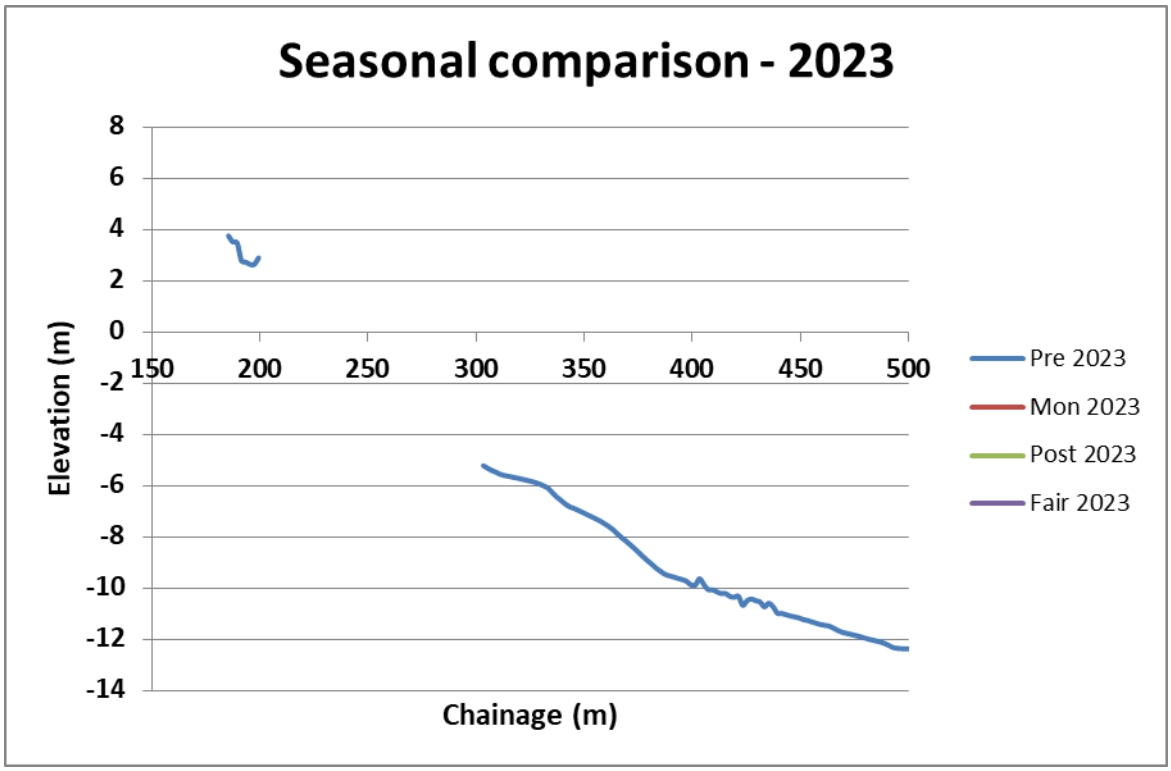


Figure 2-103 Profiles at Beemapally (CS 58) – Seasonal comparison (2023)

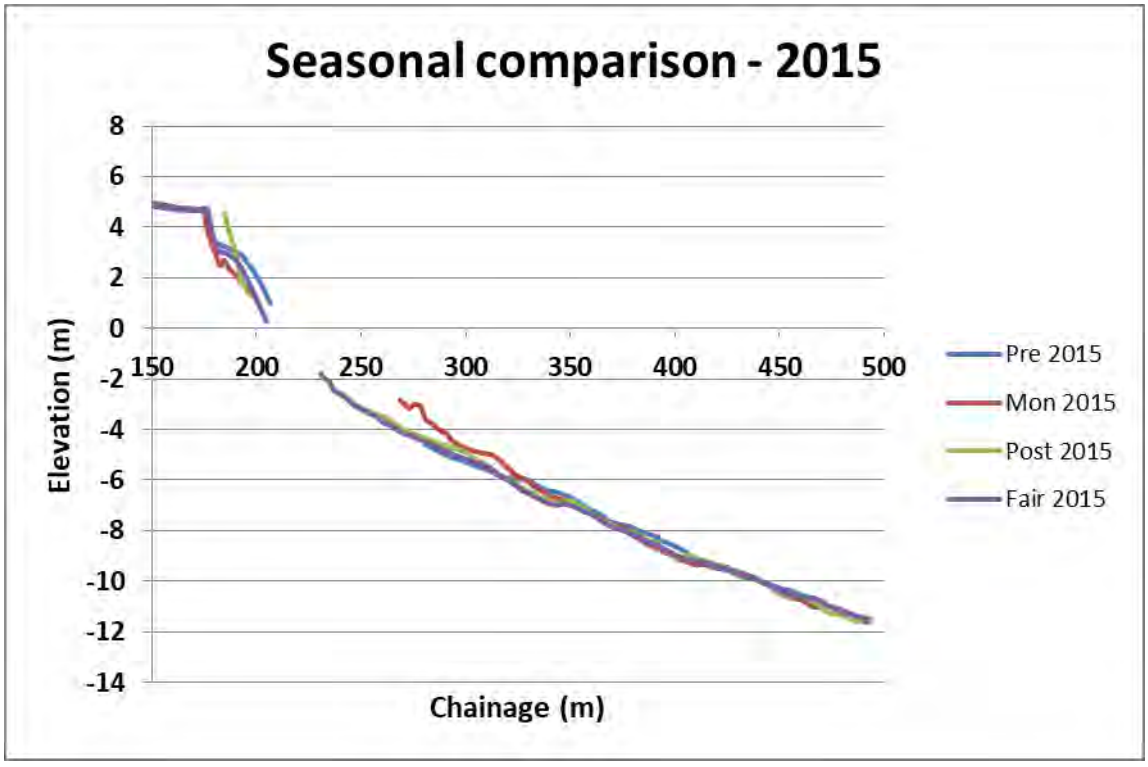


Figure 2-104 Profiles at Cheriyathura (CS 62) – Seasonal comparison (2015)

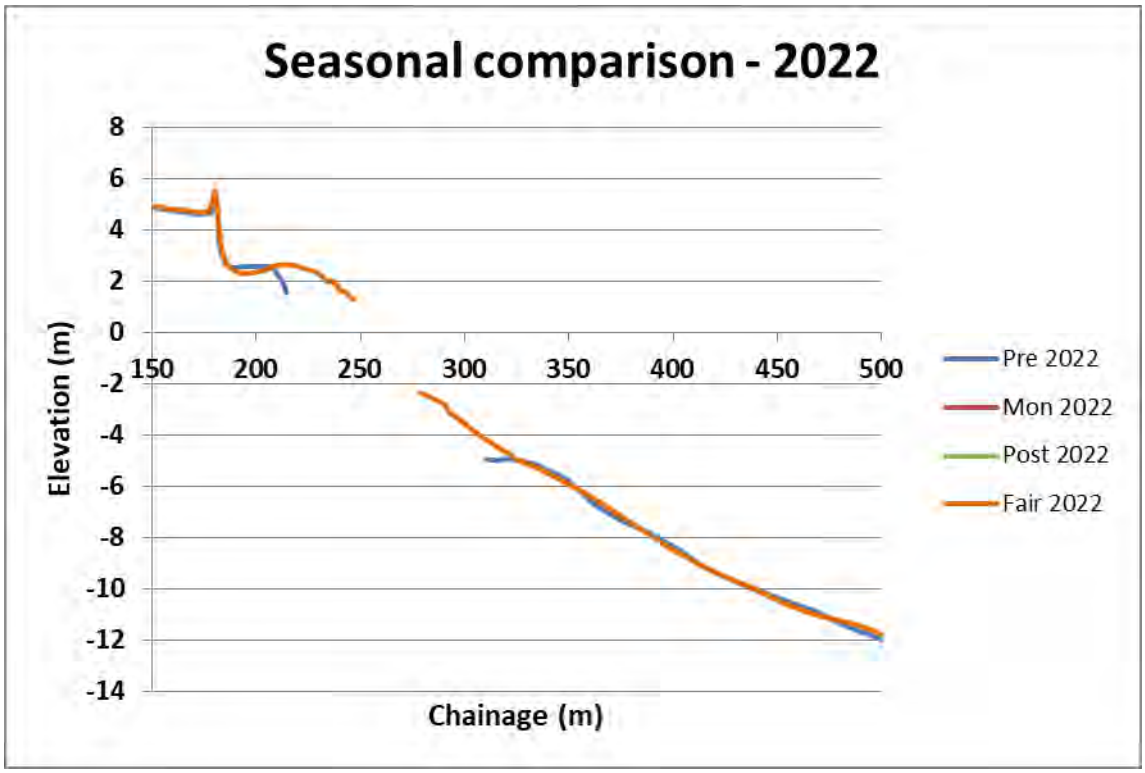


Figure 2-105 Profiles at Cheriyathura (CS 62) – Seasonal comparison (2022)

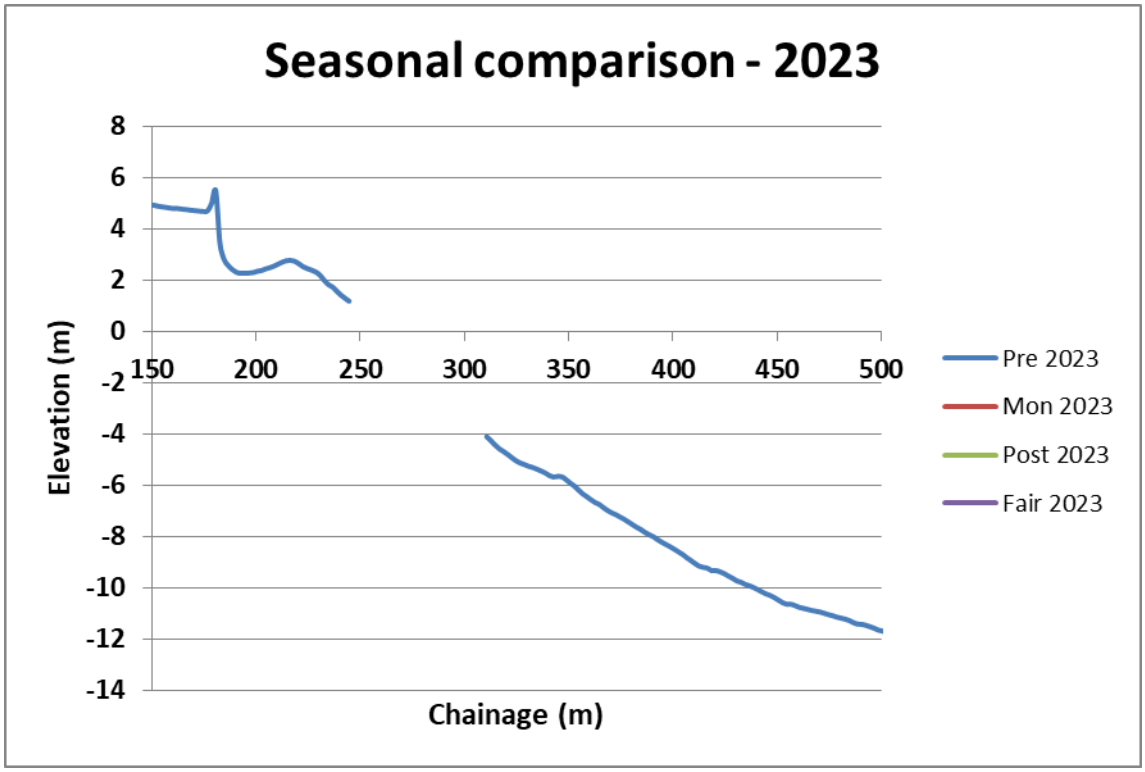


Figure 2-106 Profiles at Cheriyathura (CS 62) – Seasonal comparison (2023)

Seawall along with groynes are present in the stretch of CS 56 to CS 65 out of which CS 56 to CS 59 can be denoted as groyne field 1 (exists from start of survey period) and CS 60 to CS 63 can be denoted as groyne field 2 (since it was constructed after survey commence as shown in Figure 2-107). Among these sections, CS 58 and CS 62 which are at Beemapally and Cheriyathura locations in Thiruvananthapuram district of Kerala state were chosen to

illustrate the seasonal trends over seven years. From Figure 2-101 to Figure 2-106, it can be noticed that the coast experience seasonal variations over a year. The general phenomenon seems to be stable beach during pre-monsoon seasons, beach erosion and deposition in offshore region during monsoon seasons and gradual beach build up during post monsoon & fair weather seasons whereas in 2017 the coast experienced a very severe cyclonic storm (IMD Classification) named Ockhi (December 2017) during fair weather season and resulted in severe erosion all along the coast. After Ockhi the erosion was noticed during fair weather 2017 and pre monsoon 2018 seasons on land side. This has been compounded by the prevalence of the higher events related to storms and construction activities happened in this stretch.

(a) Before construction of groyne field 2 (Source: Google earth – 10/2016)

(b) After construction of groyne field 2 (Source: Google earth – 01/2019)

Figure 2-107 Groyne construction activities after commencement of survey

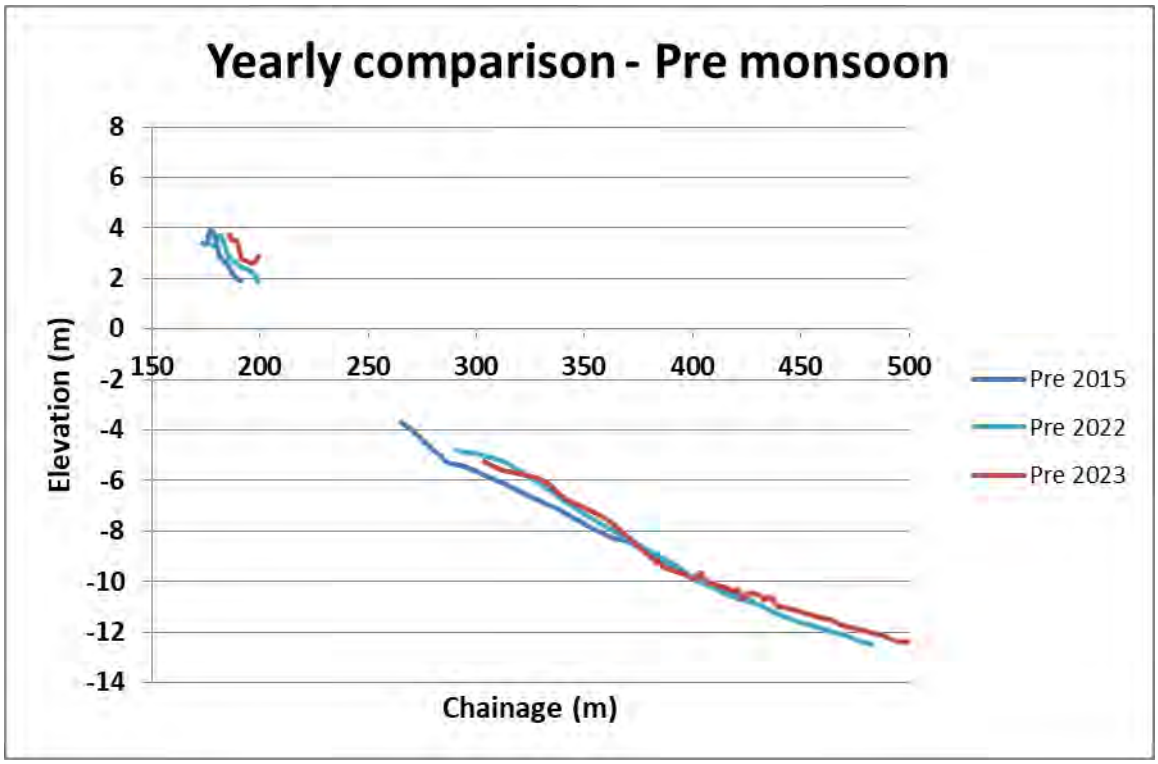


Figure 2-108 Profiles at Beemapally (CS 58) – Yearly comparison – Pre Monsoon

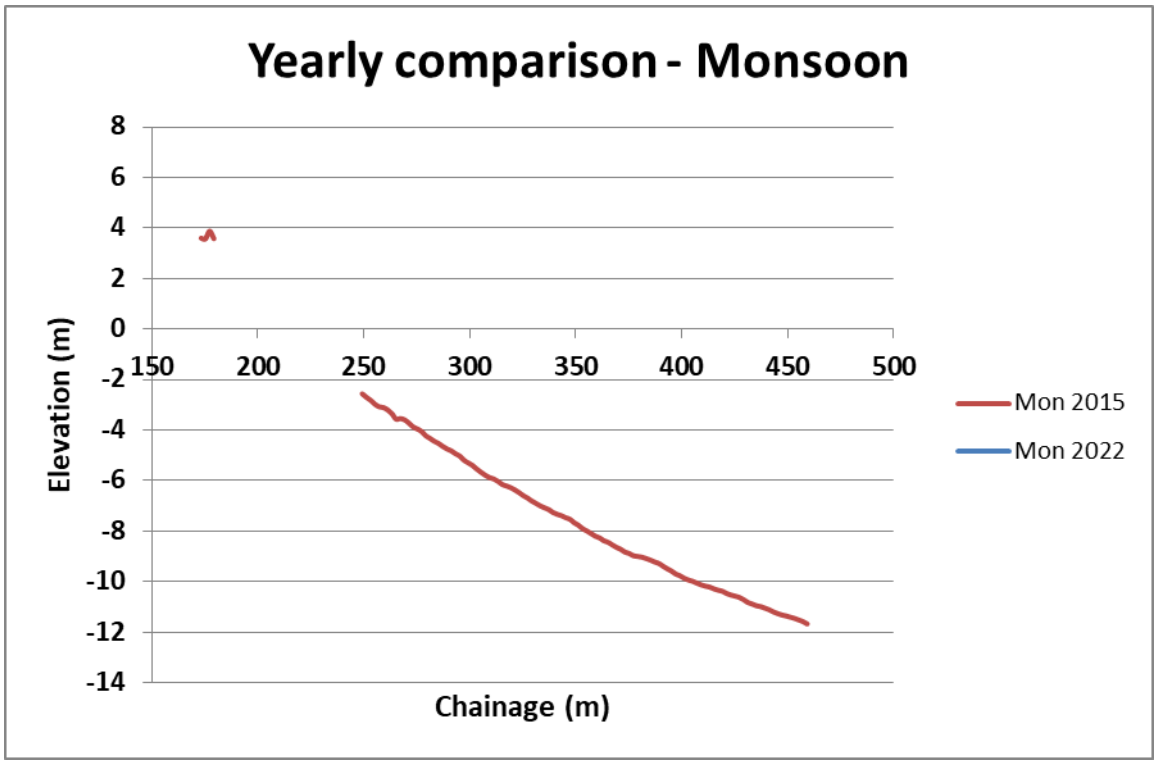


Figure 2-109 Profiles at Beemapally (CS 58) – Yearly comparison - Monsoon

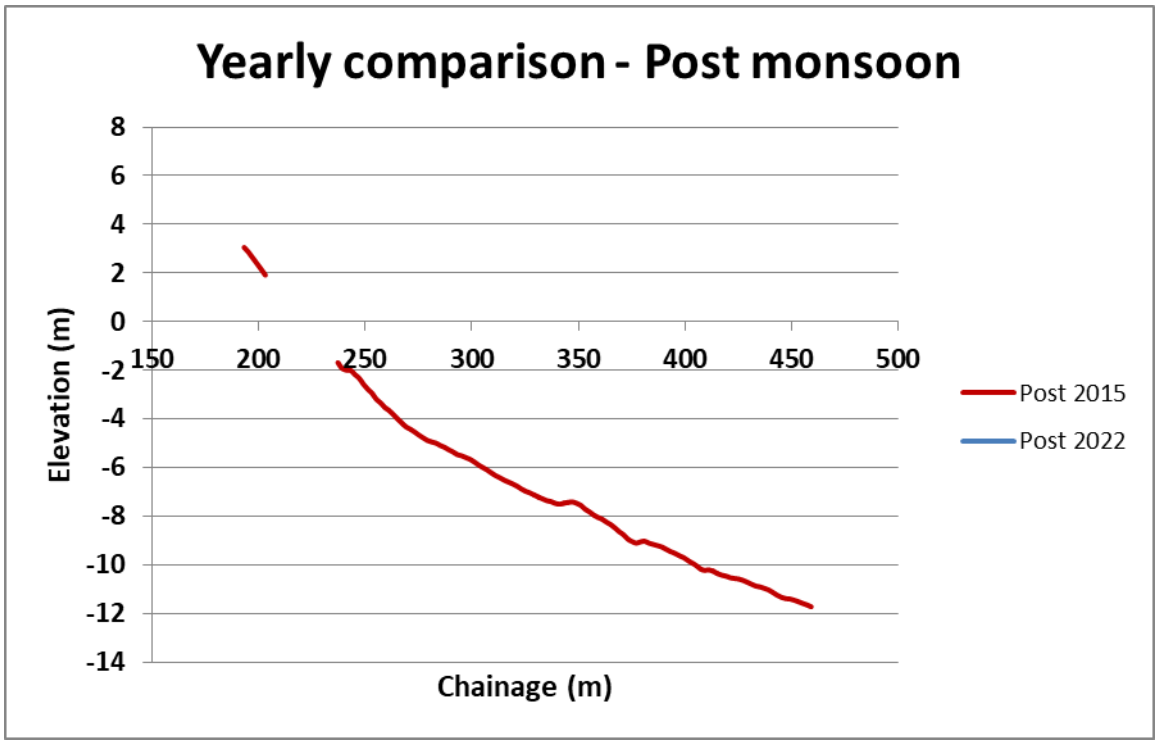


Figure 2-110 Profiles at Beemapally (CS 58) – Yearly comparison – Post Monsoon

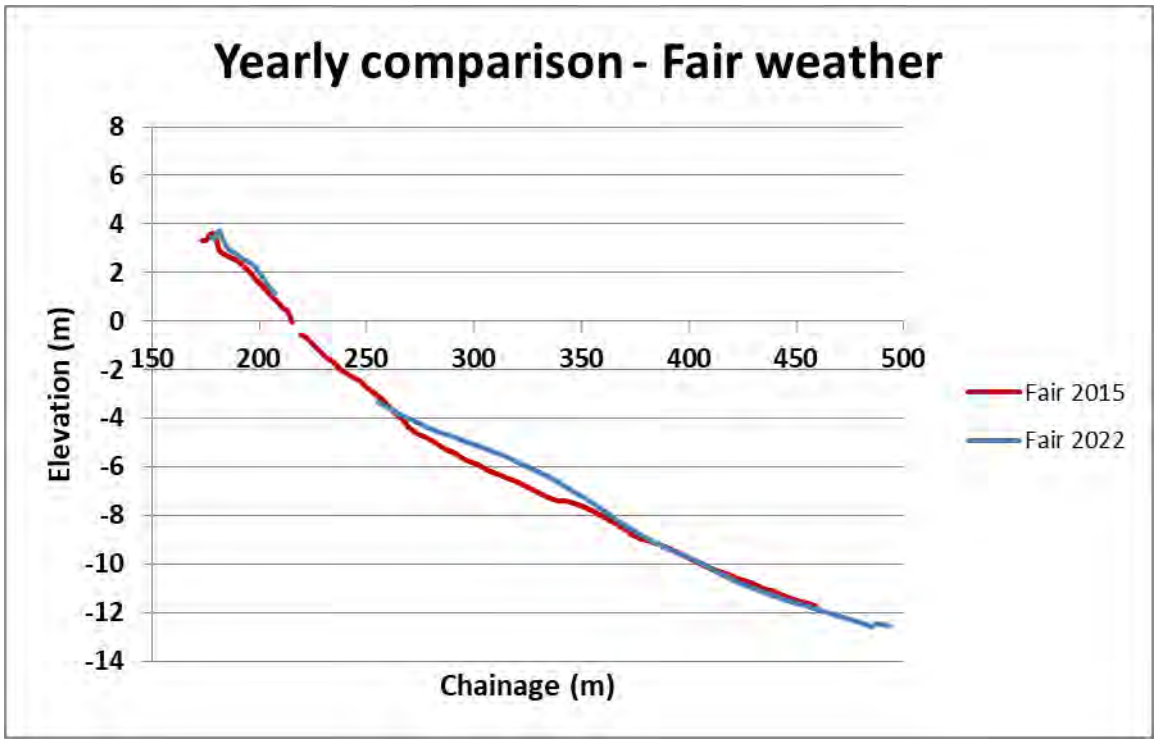


Figure 2-111 Profiles at Beemapally (CS 58) – Yearly comparison – Fair weather

Figure 2-108 to Figure 2-111 plots represent comparison of profiles of a particular season for two years (2015 and 2022).

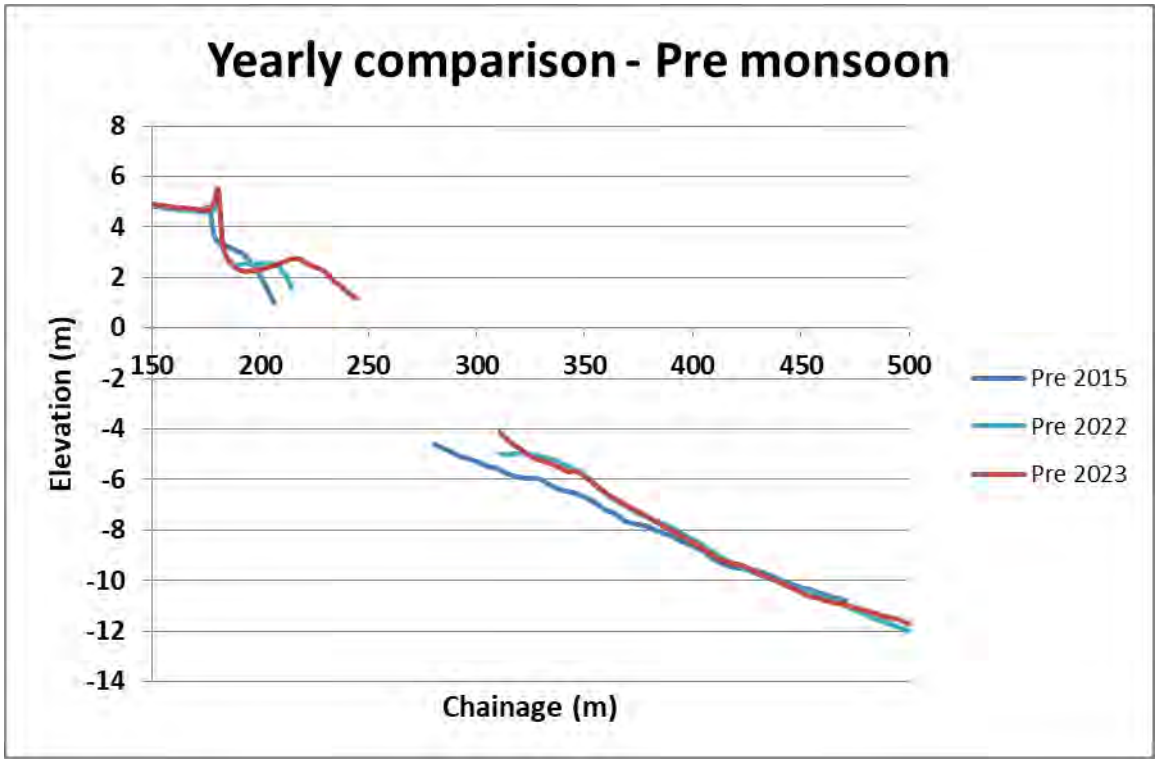


Figure 2-112 Profiles at Cheriyathura (CS 62) – Yearly comparison – Pre monsoon

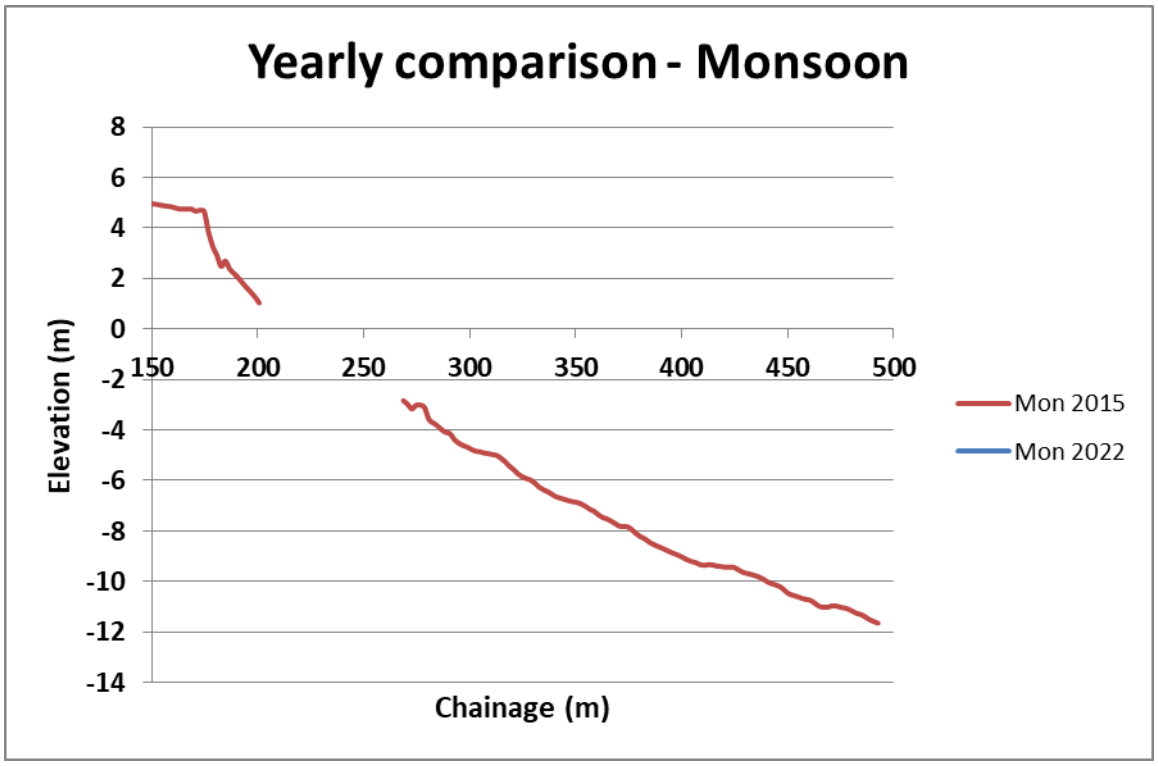


Figure 2-113 Profiles at Cheriyathura (CS 62) – Yearly comparison - Monsoon

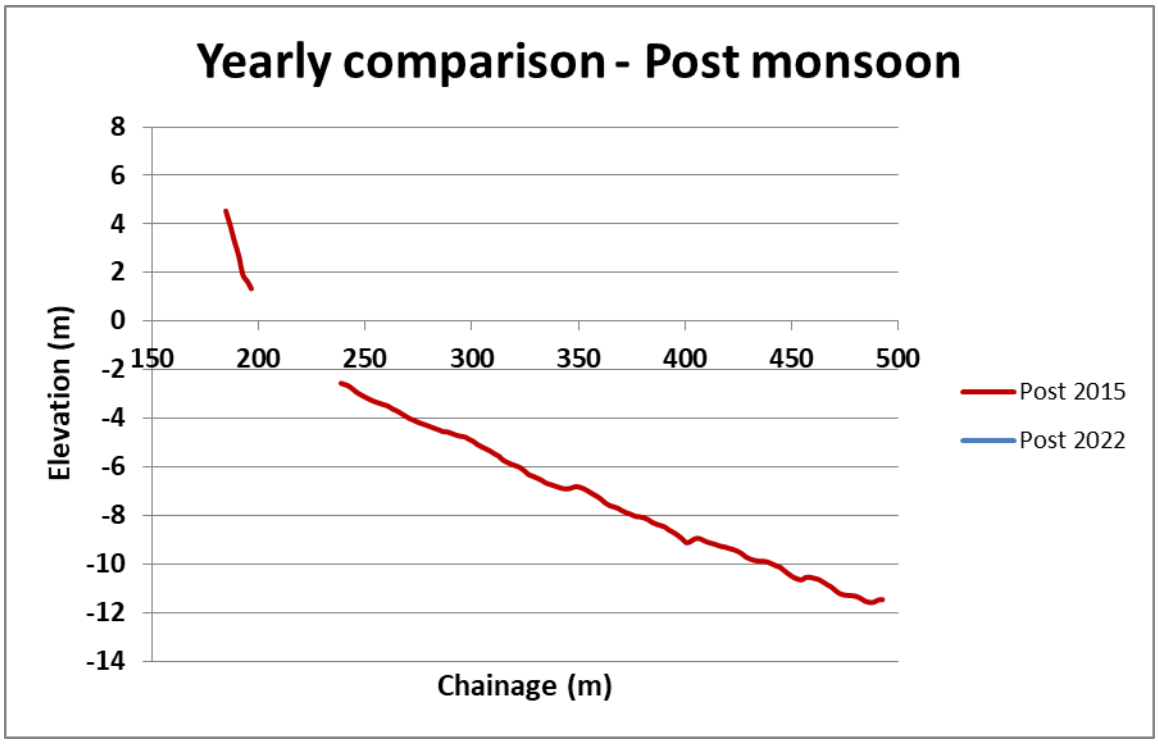


Figure 2-114 Profiles at Cheriyathura (CS 62) – Yearly comparison – Post monsoon

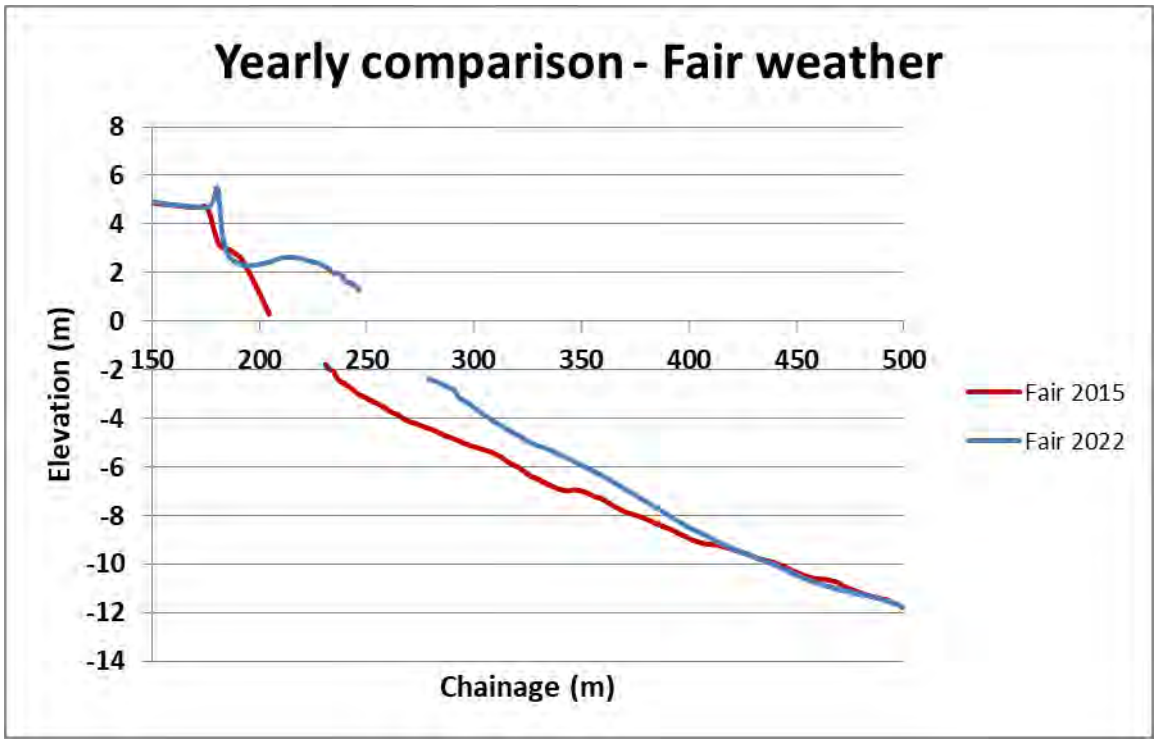
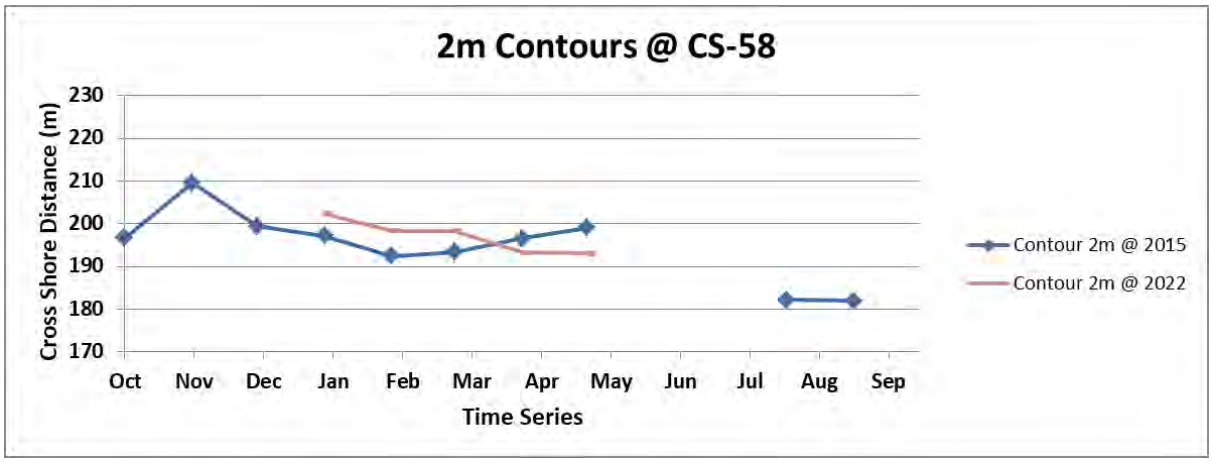


Figure 2-115 Profiles at Cheriyathura (CS 62) – Yearly comparison – Fair weather

Figure 2-112 to Figure 2-115 plots represent comparison of profiles over two years (2015 and 2022). In addition to Ockhi cyclone, some anthropogenic activities such as construction of groyne fields and seawalls by Government of Kerala took place in this stretch. Yearly comparison plots of past years have shown three distinguish set of profiles based on their behaviour after Ockhi and anthropogenic activities compared to initial set.

LNTIEL extracted +2m, -3m, -4m, -6m, -8m and -10m contours from cross shore profile data at Beemapally and Cheriyathura locations. Below plots were time series of respective contours over two year data (2015 and 2022) with similar time scale. The plots represent the contour distances with respect to an arbitrary point which is constant for all profiles at a cross section.



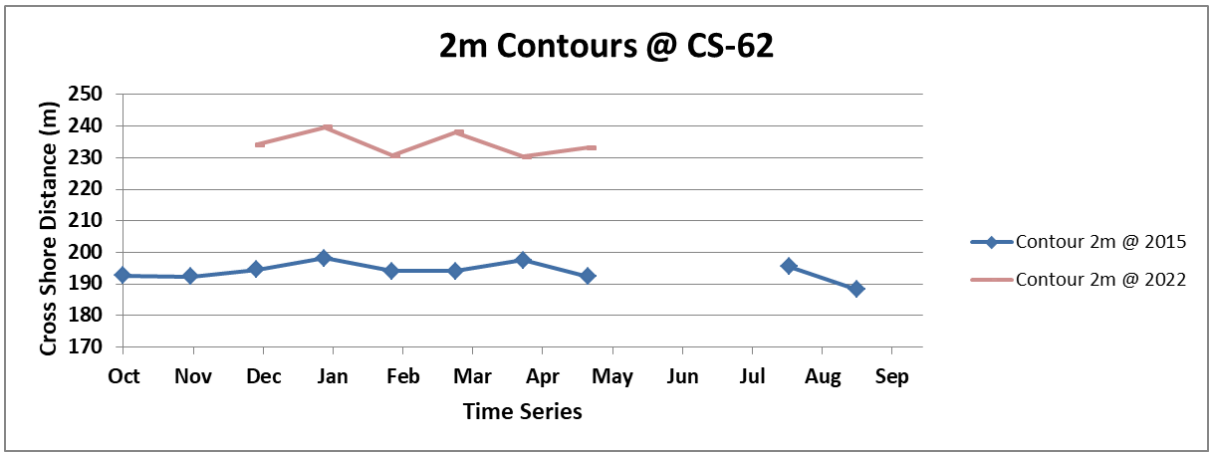
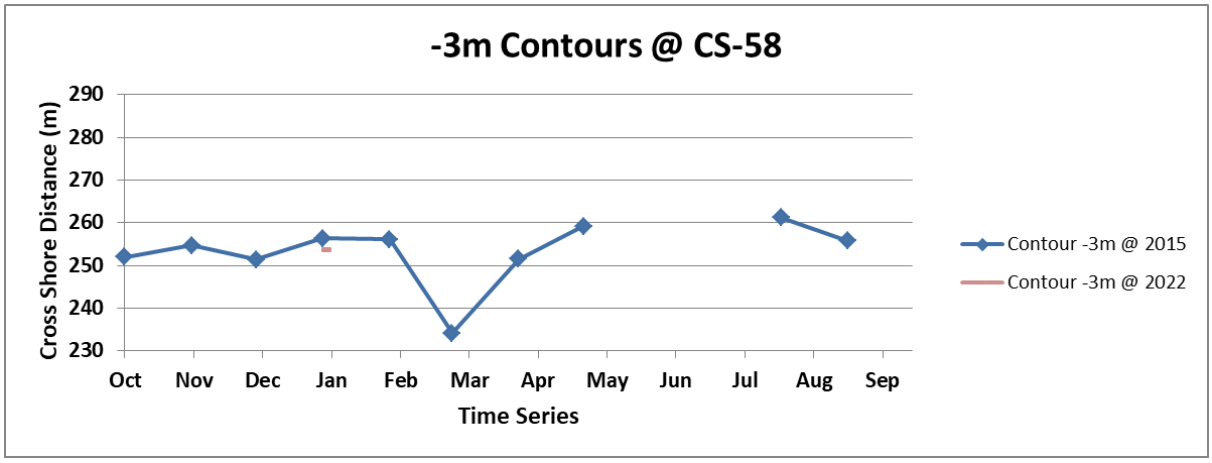


Figure 2-116 Time series of (+) 2 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)



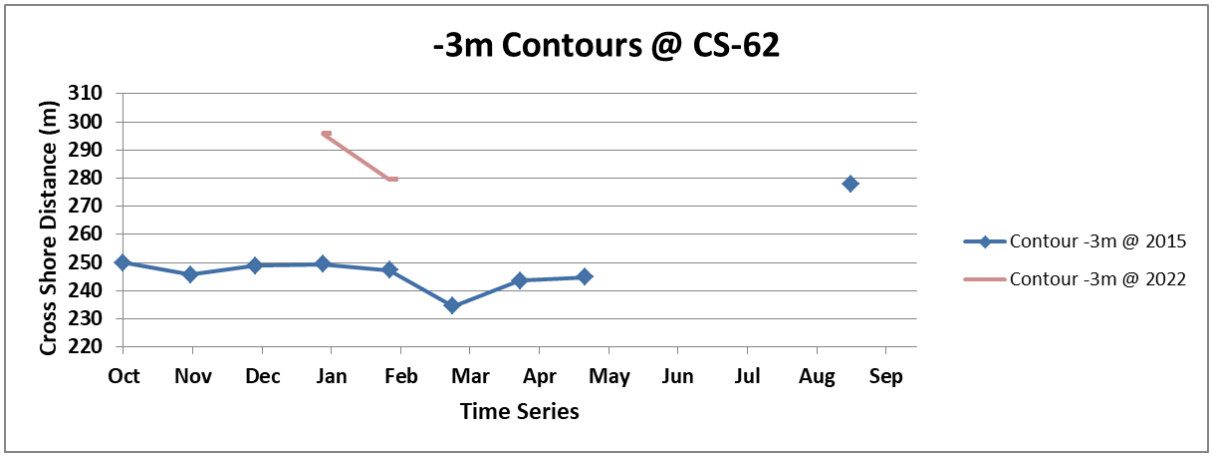


Figure 2-117 Time series of (–) 3 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)

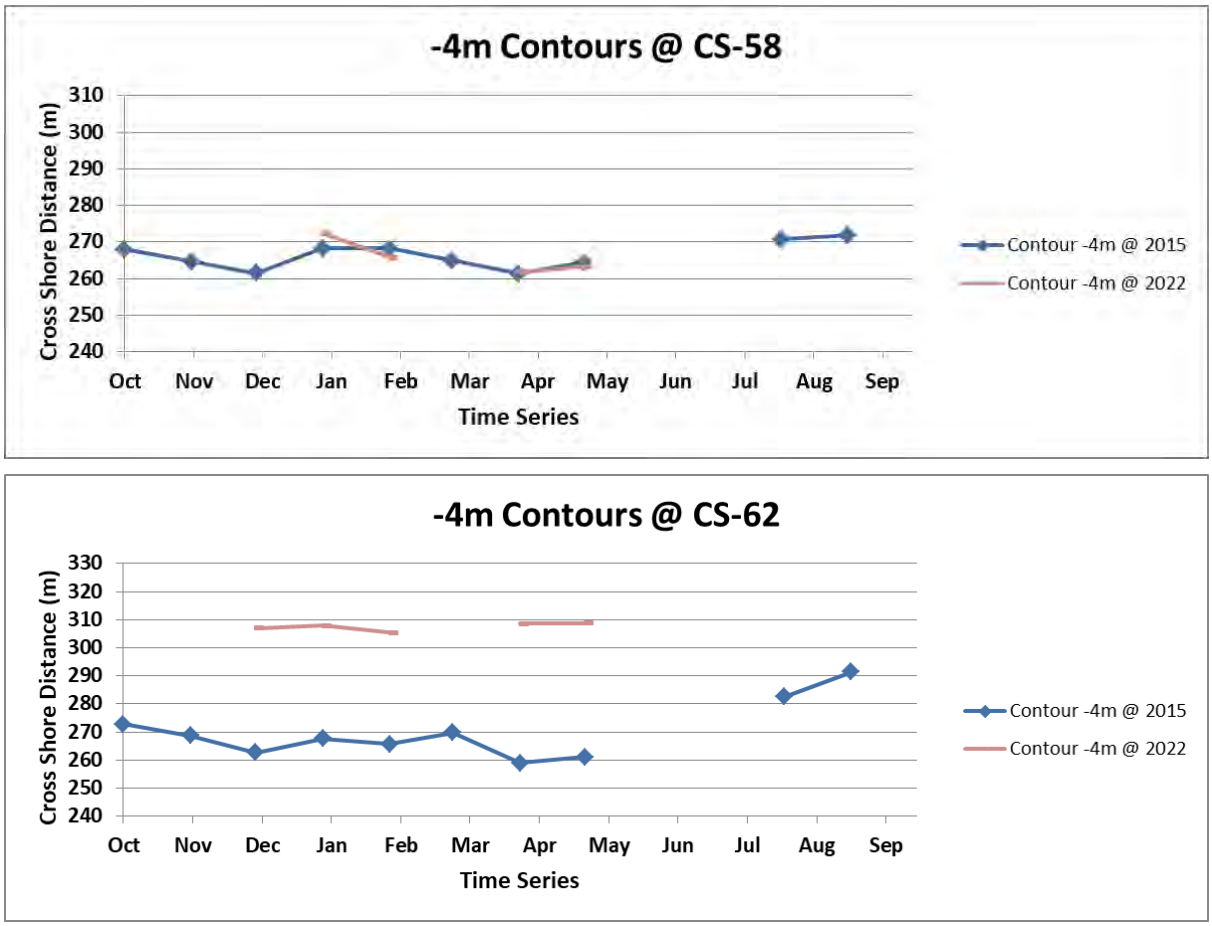
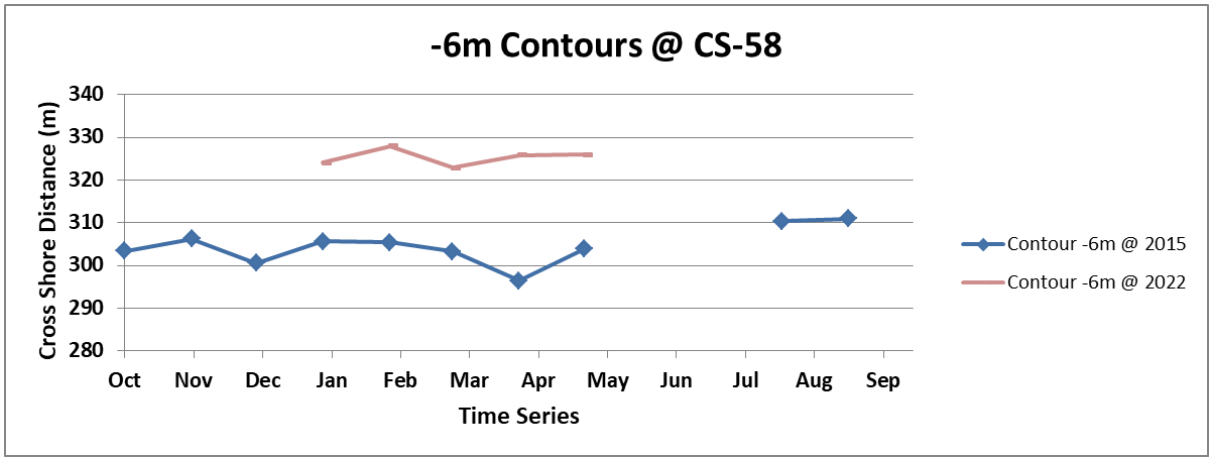


Figure 2-118 Time series of (–) 4 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)



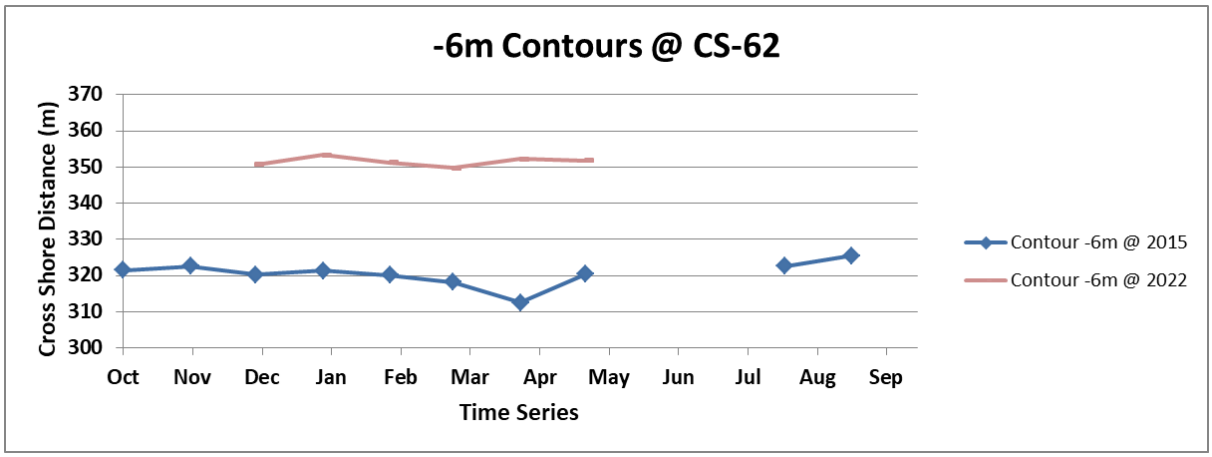
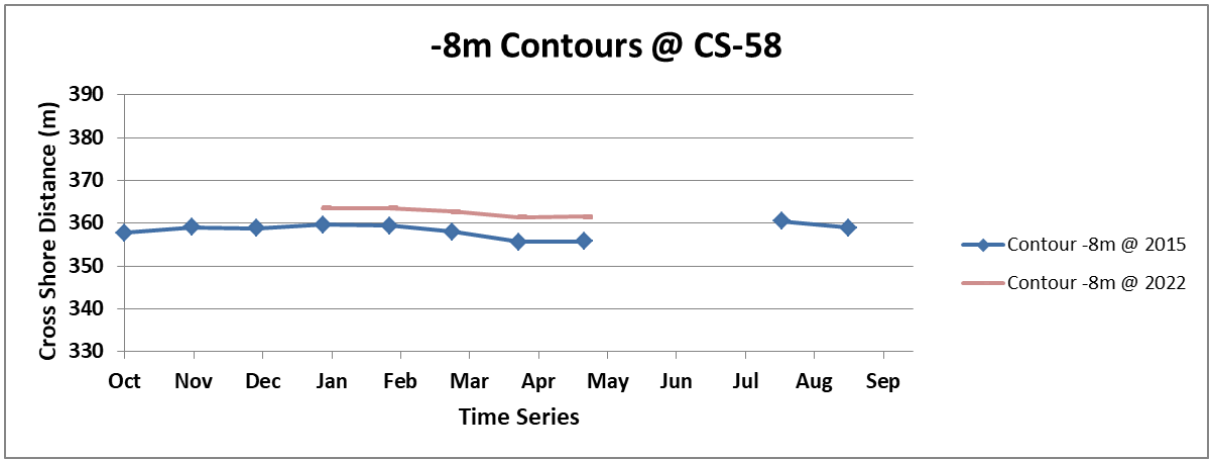


Figure 2-119 Time series of (–) 6 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)



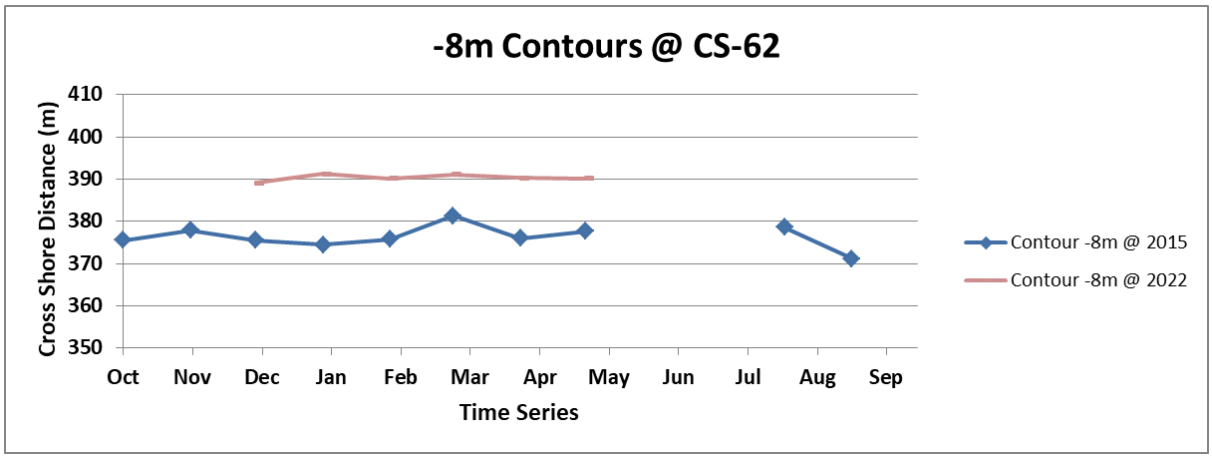


Figure 2-120 Time series of (–) 8 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)

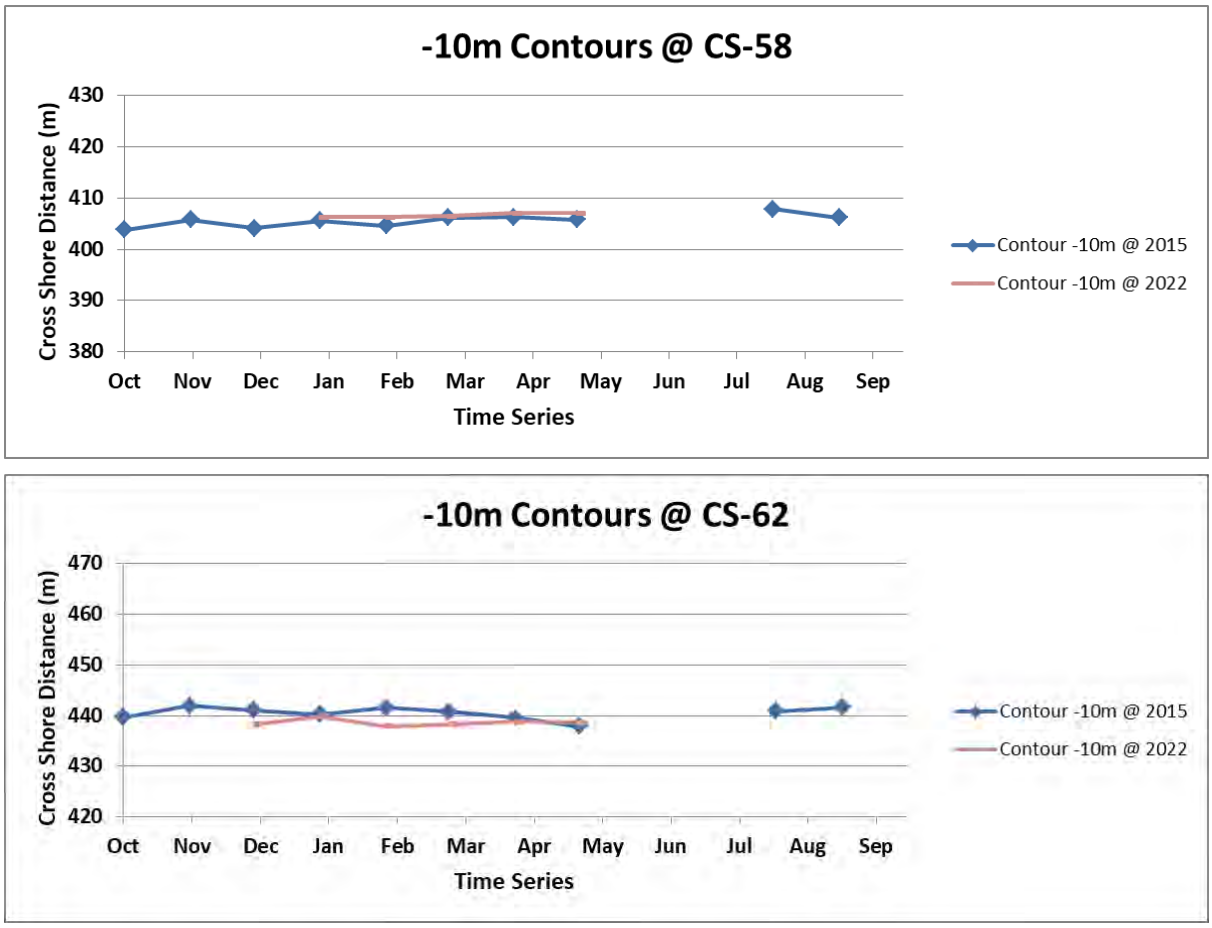
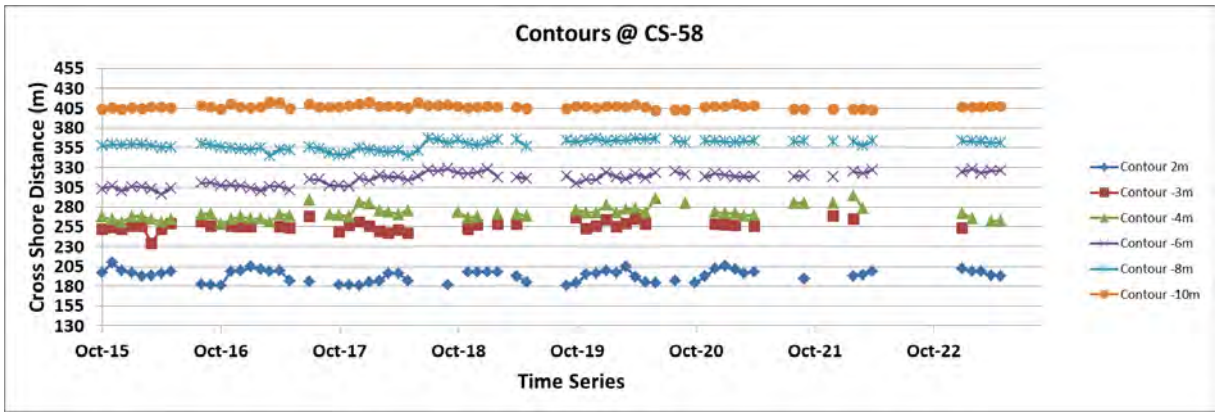


Figure 2-121 Time series of (–) 10 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)

In addition to above, the +2m, -3m, -4m, -6m, -8m and -10m contours continuous variation of contour distances over 7 years was provided for better clarity as shown in Figure 2-122.



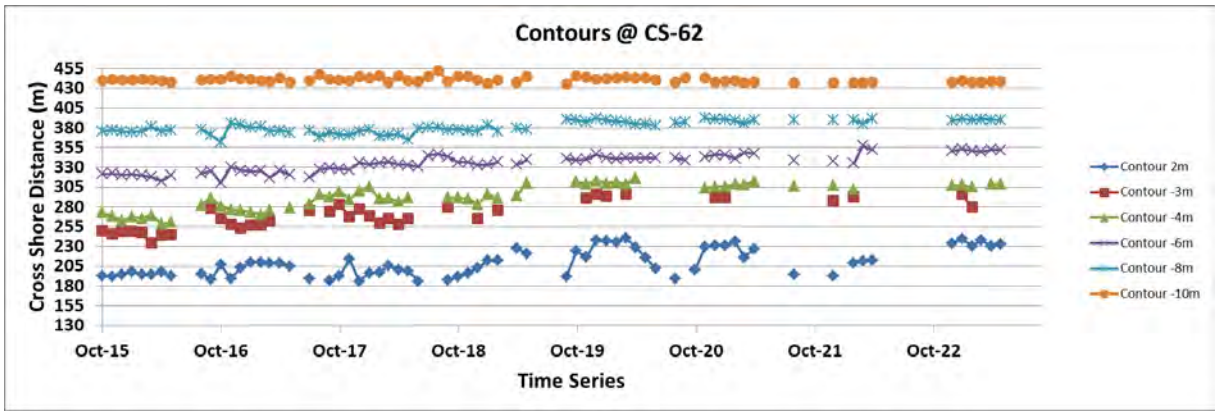


Figure 2-122 Continuous time series of contours at Beemapally and Cheriyathura (CS 58 & CS 62)

2.6.2.6 Stretch 6

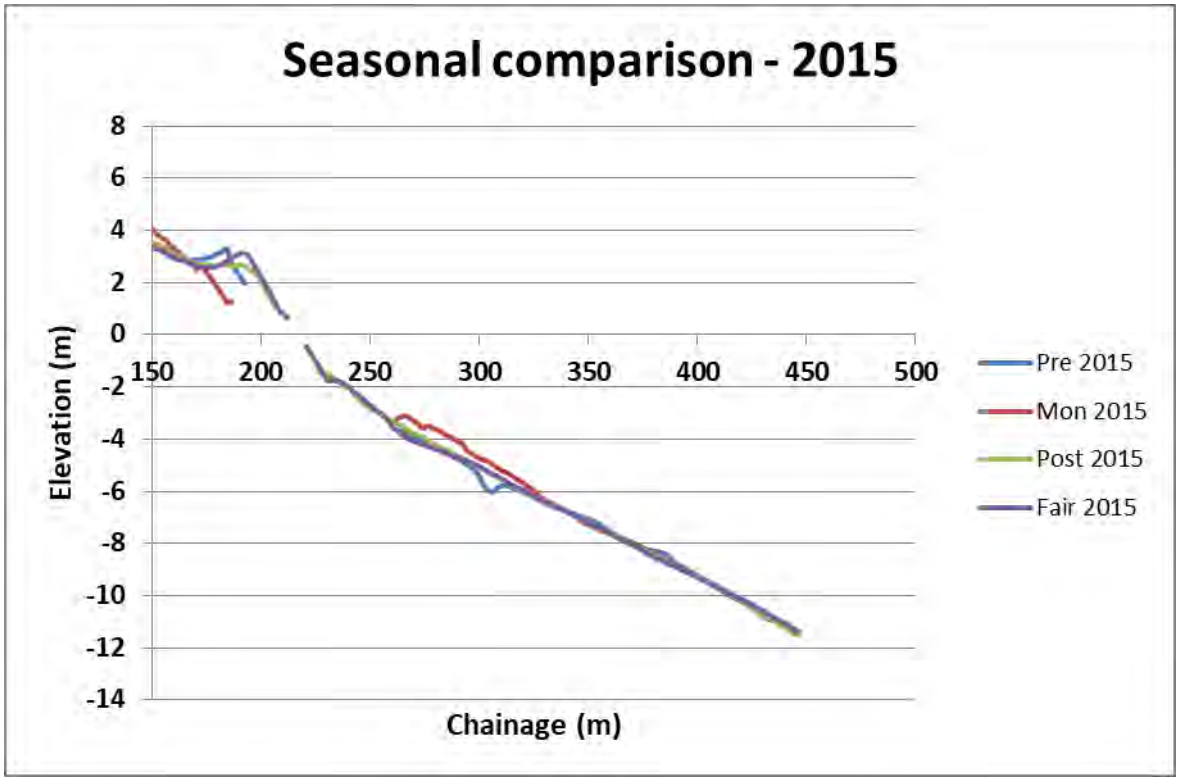


Figure 2-123 Profiles at Vettucaud (CS 74) – Seasonal comparison (2015)

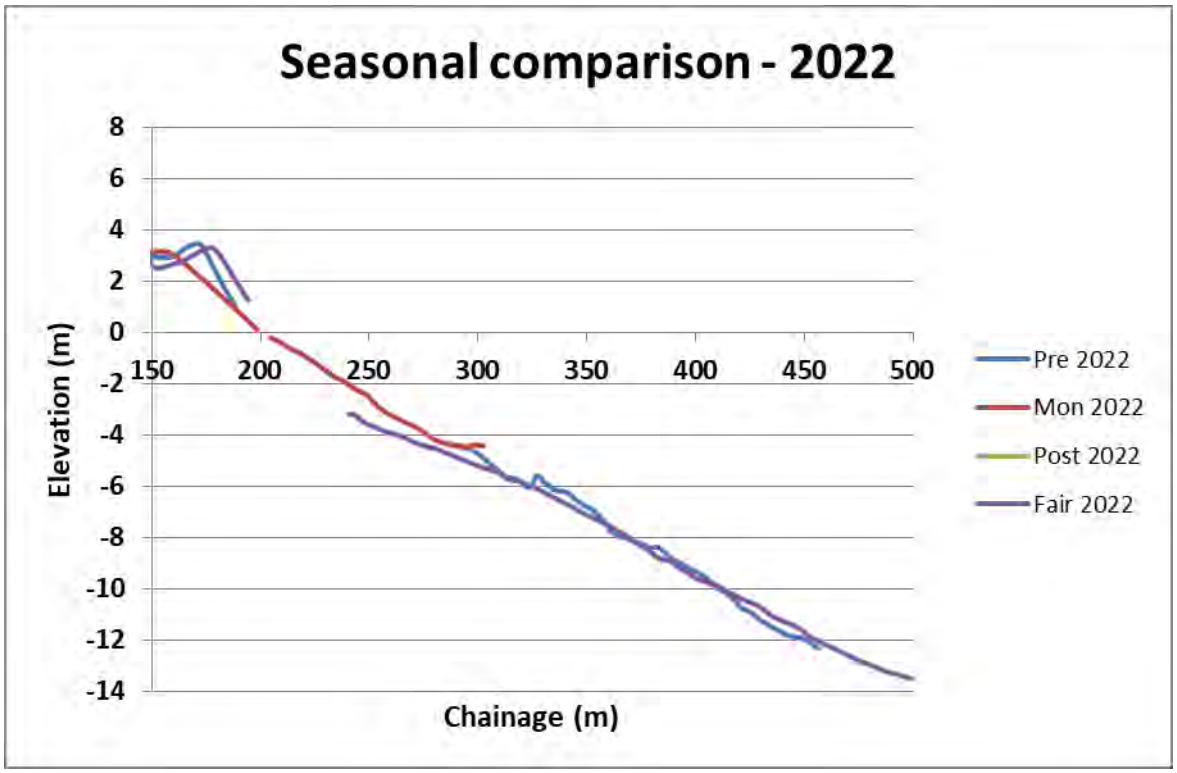


Figure 2-124 Profiles at Vettucaud (CS 74) – Seasonal comparison (2022)

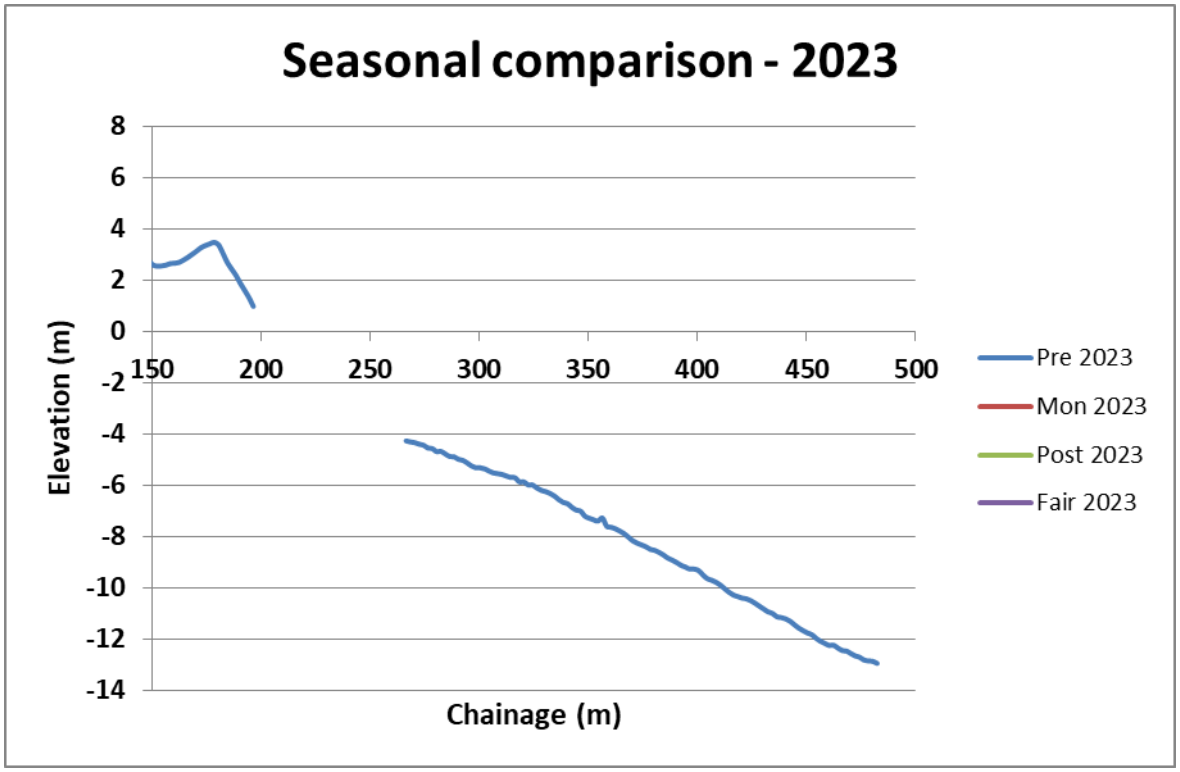


Figure 2-125 Profiles at Vettucaud (CS 74) – Seasonal comparison (2023)

Beach was present throughout the year in the stretch of CS 66 to CS 81. Among these sections, CS 74 which is at Vettucaud in Thiruvananthapuram district was chosen to illustrate the seasonal trends over the years. From Figure 2-123 and Figure 2-124, it can be noticed that the coast experience seasonal variations over a year. The general phenomenon seems to be stable beach during pre-monsoon seasons, beach erosion and deposition in offshore

region during monsoon seasons and gradual beach build up during post monsoon & fair weather seasons. It can be noticed that there was better beach build-up during fair weather 2022 when compared to pre monsoon 2022.

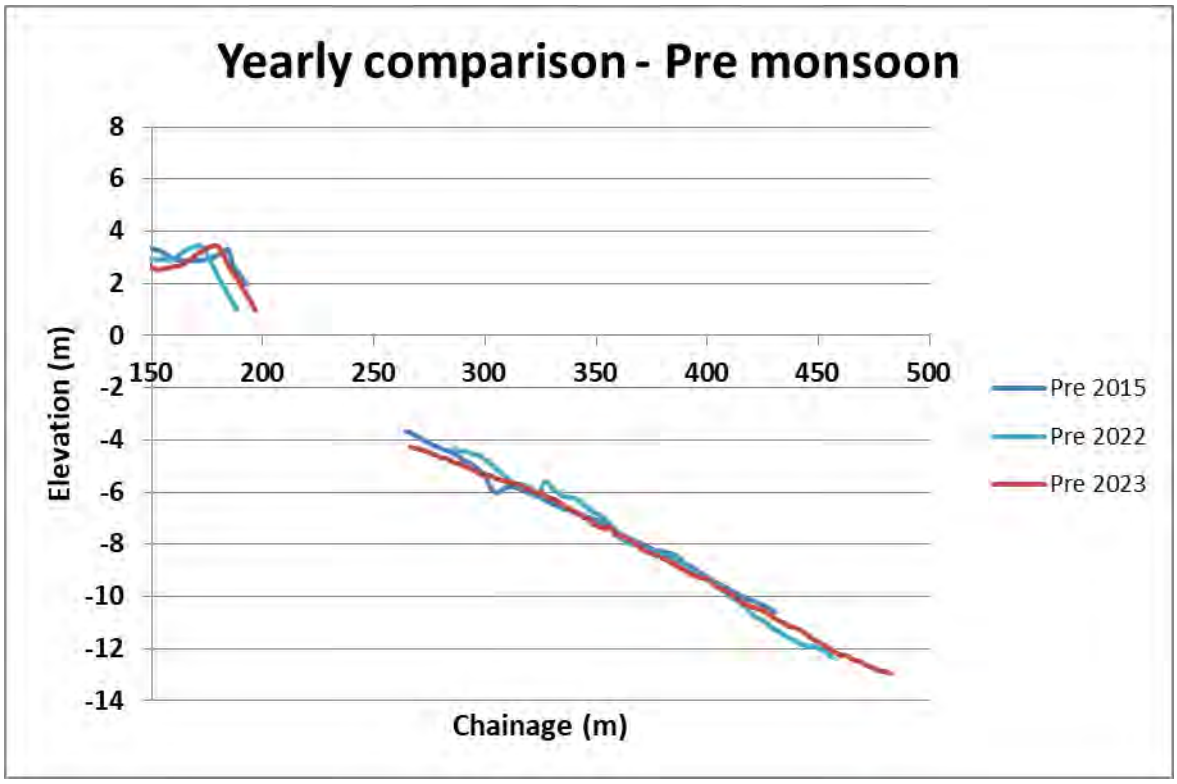


Figure 2-126 Profiles at Vettucaud (CS 74) – Yearly comparison – Pre monsoon

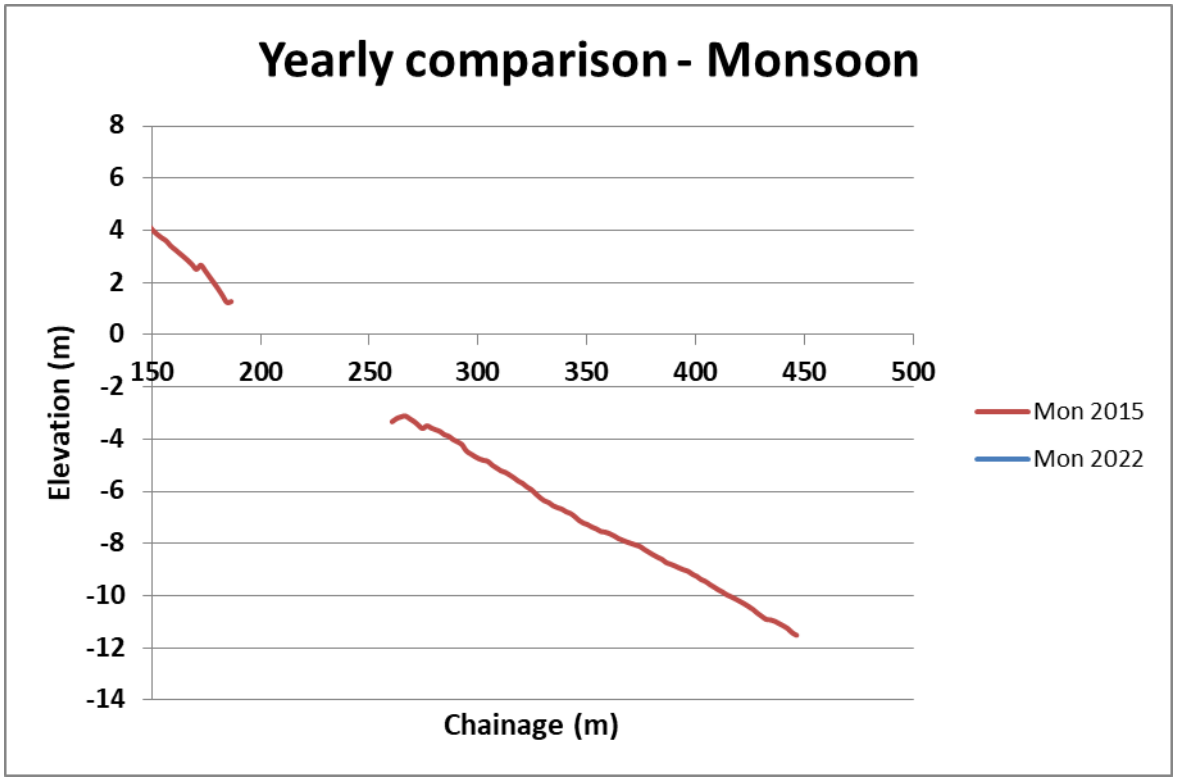


Figure 2-127 Profiles at Vettucaud (CS 74) – Yearly comparison - Monsoon

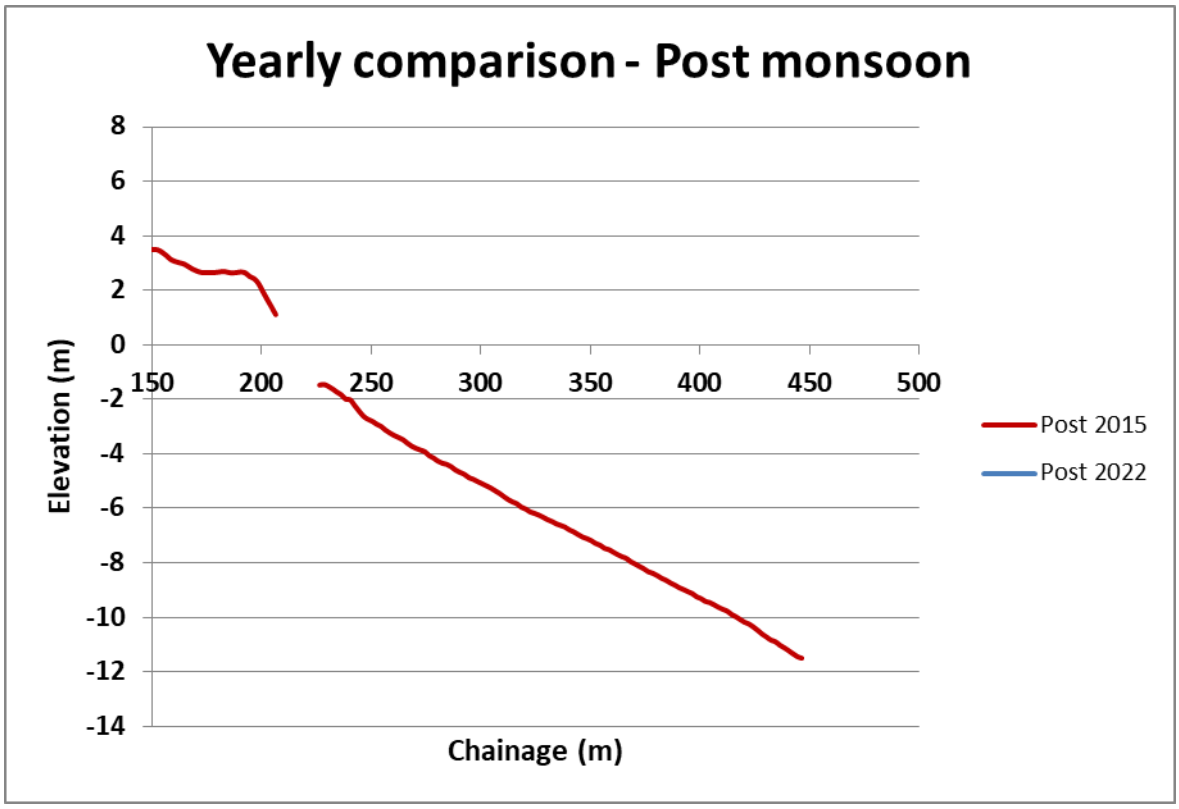


Figure 2-128 Profiles at Vettucaud (CS 74) – Yearly comparison – Post Monsoon

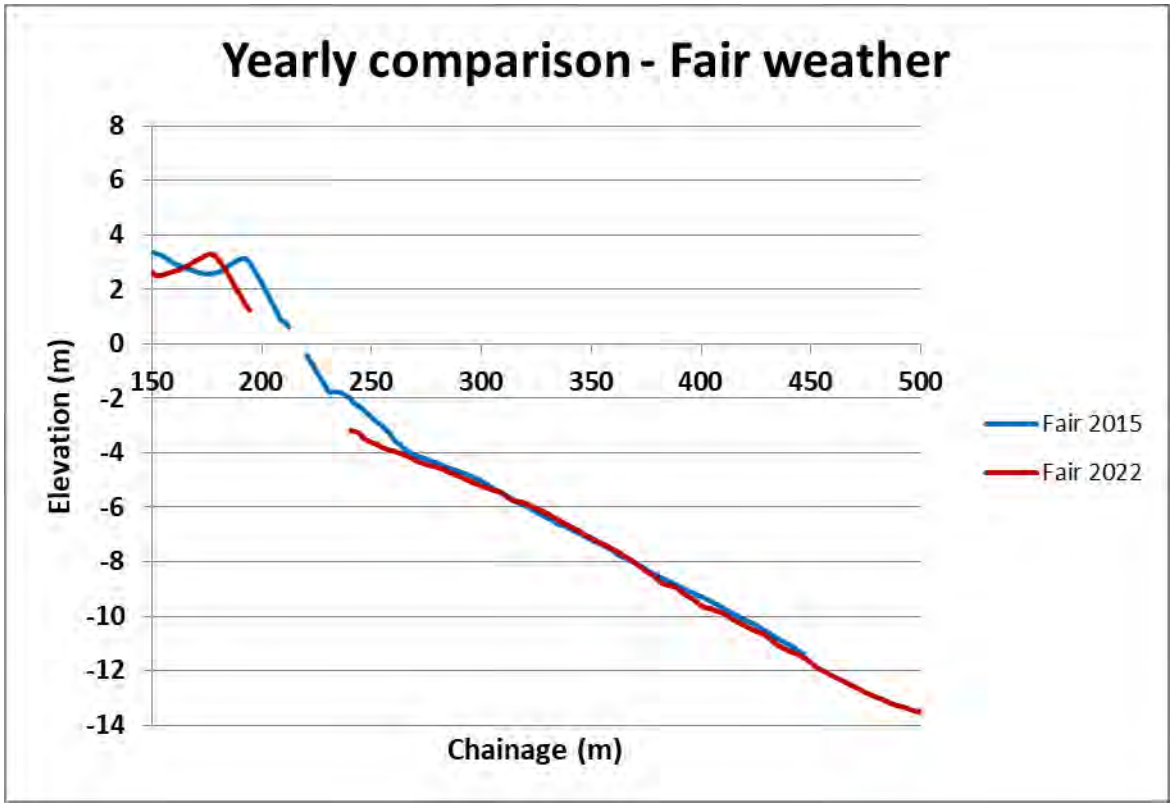


Figure 2-129 Profiles at Vettucaud (CS 74) – Yearly comparison – Fair weather

Figure 2-126 to Figure 2-129 plots represent comparison of profiles of season for two years (2015 and 2022). These plots suggest that the coast is undergoing processes to recover from the Ockhi impact which can be observed from fair weather seasons comparison plot.

LNTIEL extracted +2m, -3m, -4m, -6m, -8m and -10m contours from cross shore profile data at Vettucaud and below plots were time series of respective contours for two years (2015 and 2022) data with similar time scale. The plots represent the contour distances with respect to an arbitrary point which is constant for all profiles at a cross section.

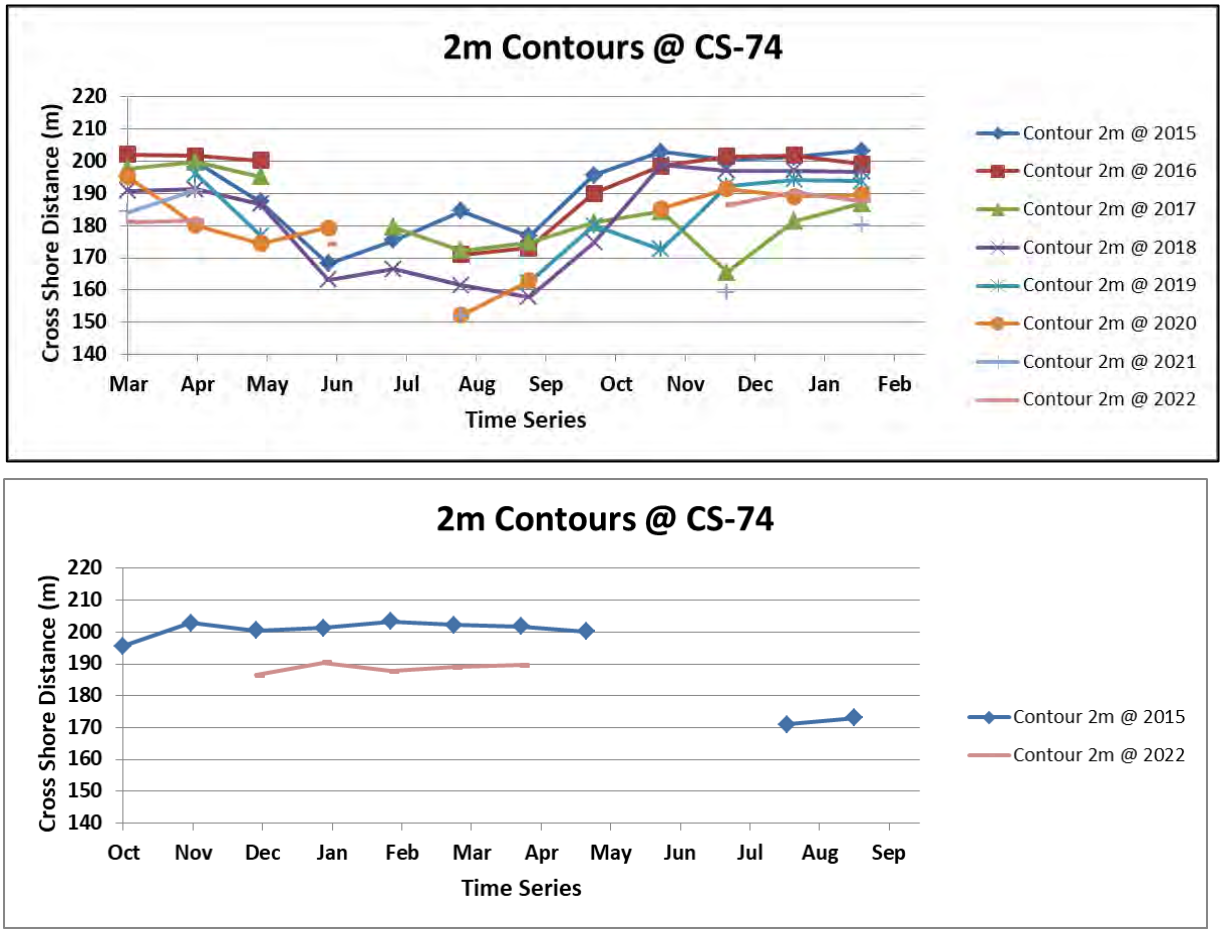


Figure 2-130 Time series of (+) 2 m contour at Vettucaud (CS 74)

Figure 2-130 represents time series of (+) 2 m contour over seven years at Vettucaud with similar time scale. From this plot it can be noticed that the beach experience seasonal variation of erosion during monsoon season and accretion during other seasons. During Ockhi the beach was exposed to severe erosion and minimal accretion was noticed during fair weather 2017 and pre-monsoon 2018 during which beach was supposed to build up. In addition, because of monsoon 2018 and 2019 the beach further eroded than previous monsoon seasons.

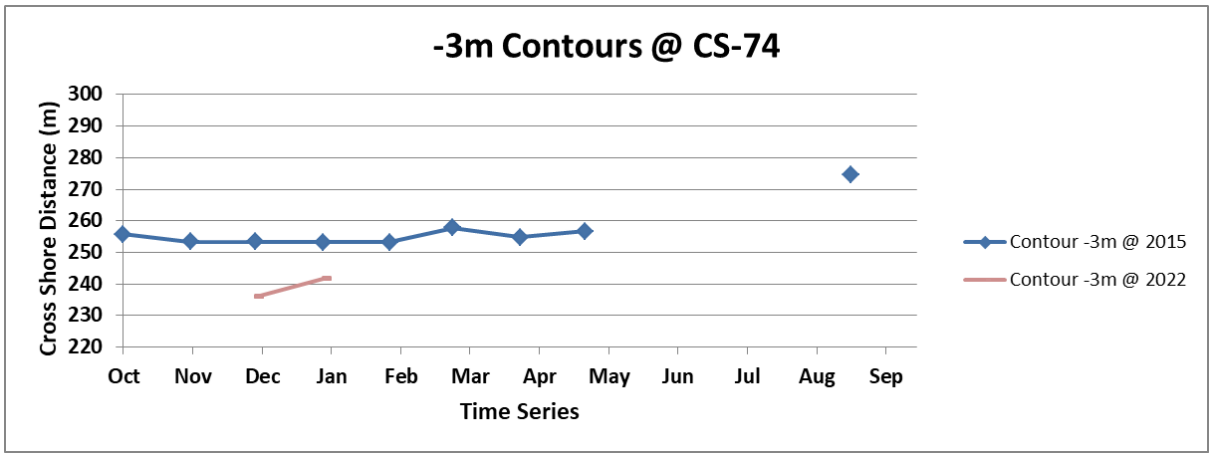


Figure 2-131 Time series of (–) 3 m contour at Vettucaud (CS 74)

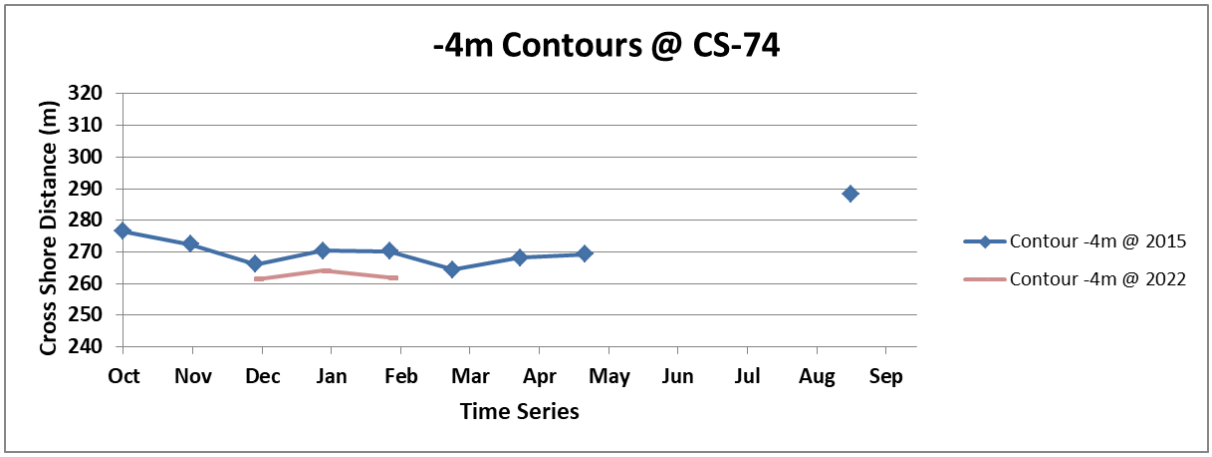


Figure 2-132 Time series of (–) 4 m contour at Vettucaud (CS 74)

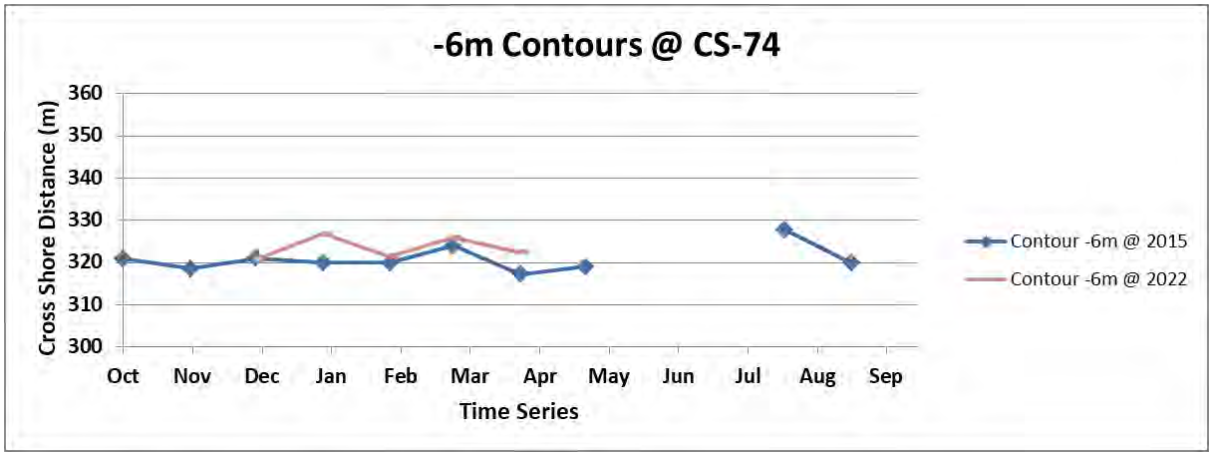


Figure 2-133 Time series of (–) 6 m contour at Vettucaud (CS 74)

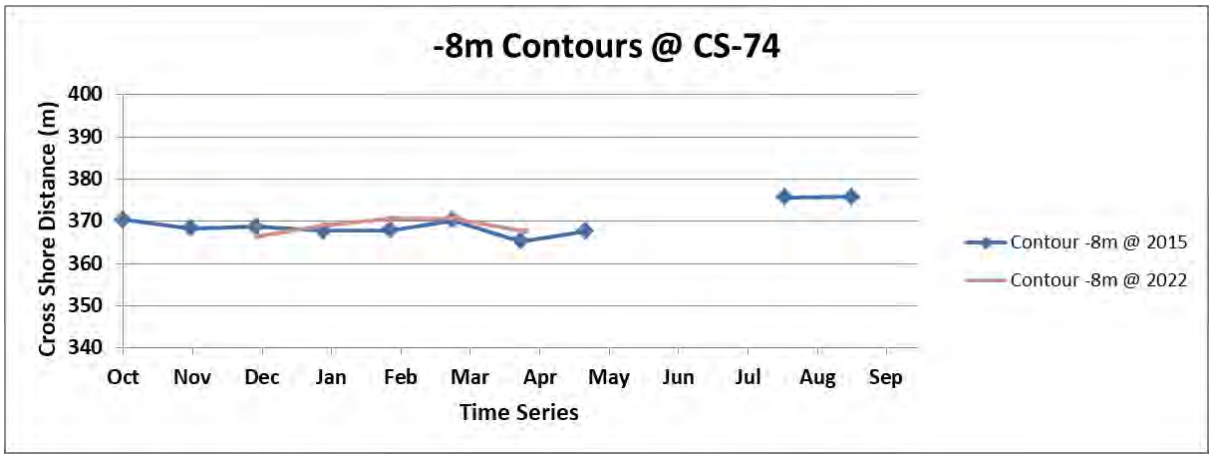


Figure 2-134 Time series of (–) 8 m contour at Vettucaud (CS 74)

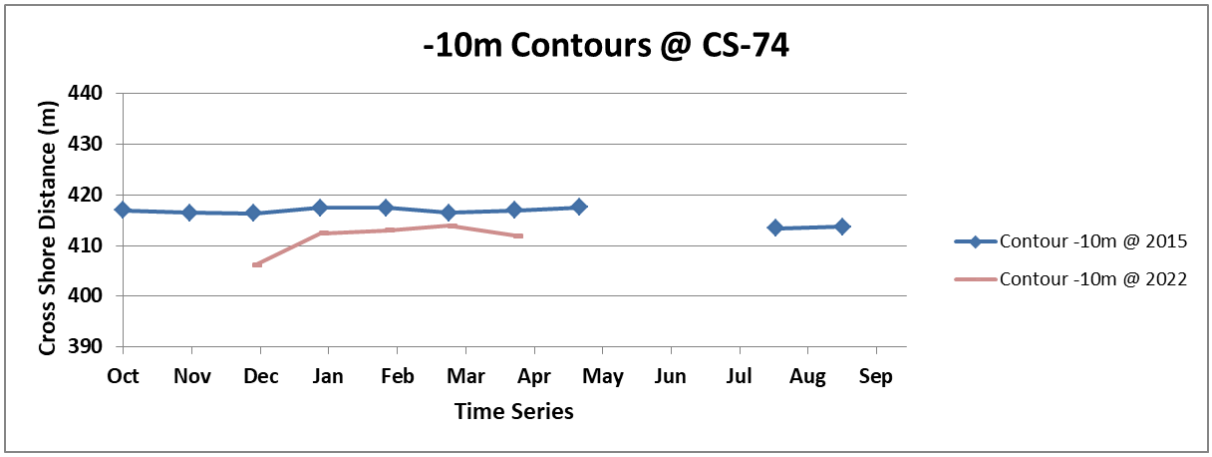


Figure 2-135 Time series of (–) 10 m contour at Vettucaud (CS 74)

In addition to above, the +2m, -3m, -4m, -6m, -8m and -10m contours continuous variation of contour distances over 7 years was provided for better clarity as shown in Figure 2-136.

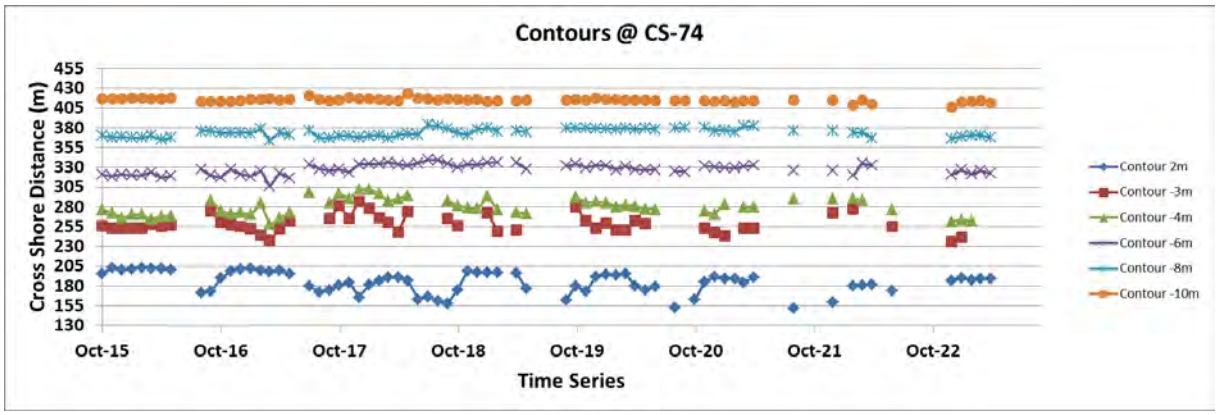


Figure 2-136 Continuous time series of contours at Vettucaud (CS 74)

Figure 2-136 shows the variation of respective contour distances from common arbitrary point on land side. It can be observed that most of the sediment exchange was in between +2m and -3m contours i.e. simultaneous erosion on beach side & accretion on sea side and vice versa.

2.6.3 Analysis of cross shore profiles going up to 20m CD

During the shoreline committee meeting held on 13-03-2019, it was decided that: Only 4 CSP lines needs to be carried out up to a depth of 20 m in the month of January, May, August and October. All other lines, during all months need to be carried up to a depth of 10 m only. Accordingly, two lines were selected (CSP 2 & CSP 35) to south of the port and two more lines (CSP 64 & CSP 74) to north of the port to carry out the survey up to 20m depth.

The data received by LNTIEL was analysed by plotting each of the profiles. The aim of this comprehensive exercise was to check the data quality and to compare profiles with surveyed data from different locations which would help to visualise erosion or accretion during different seasons and locations.

2.6.3.1 Edappadu beach (CS02)

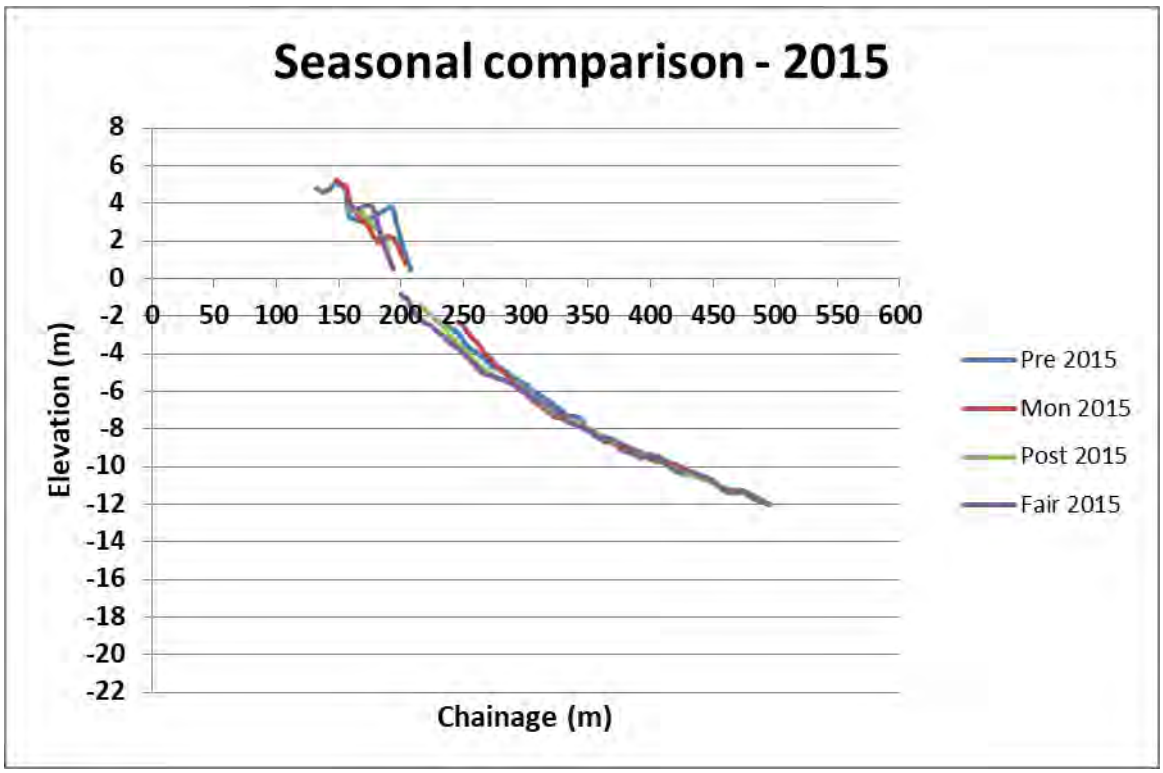


Figure 2-137 Profiles at Edappadu beach (CS 02) – Seasonal comparison – 2015

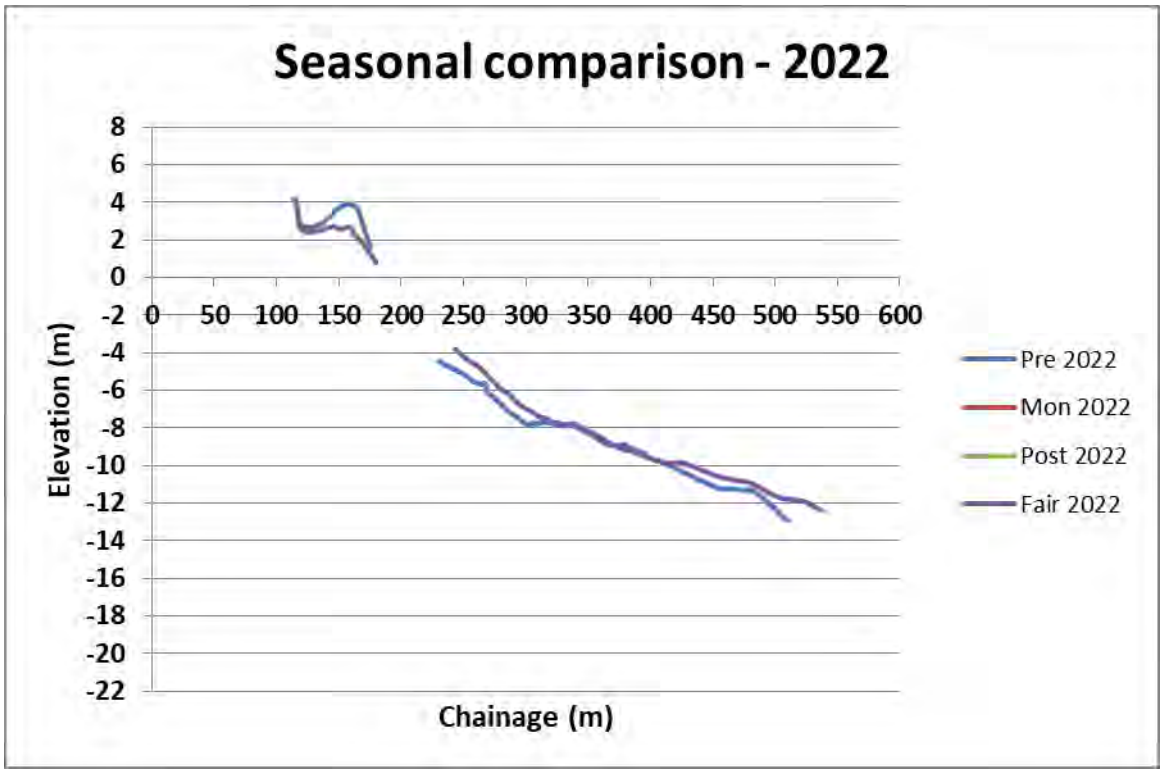


Figure 2-138 Profiles at Edappadu beach (CS 02) – Seasonal comparison – 2022

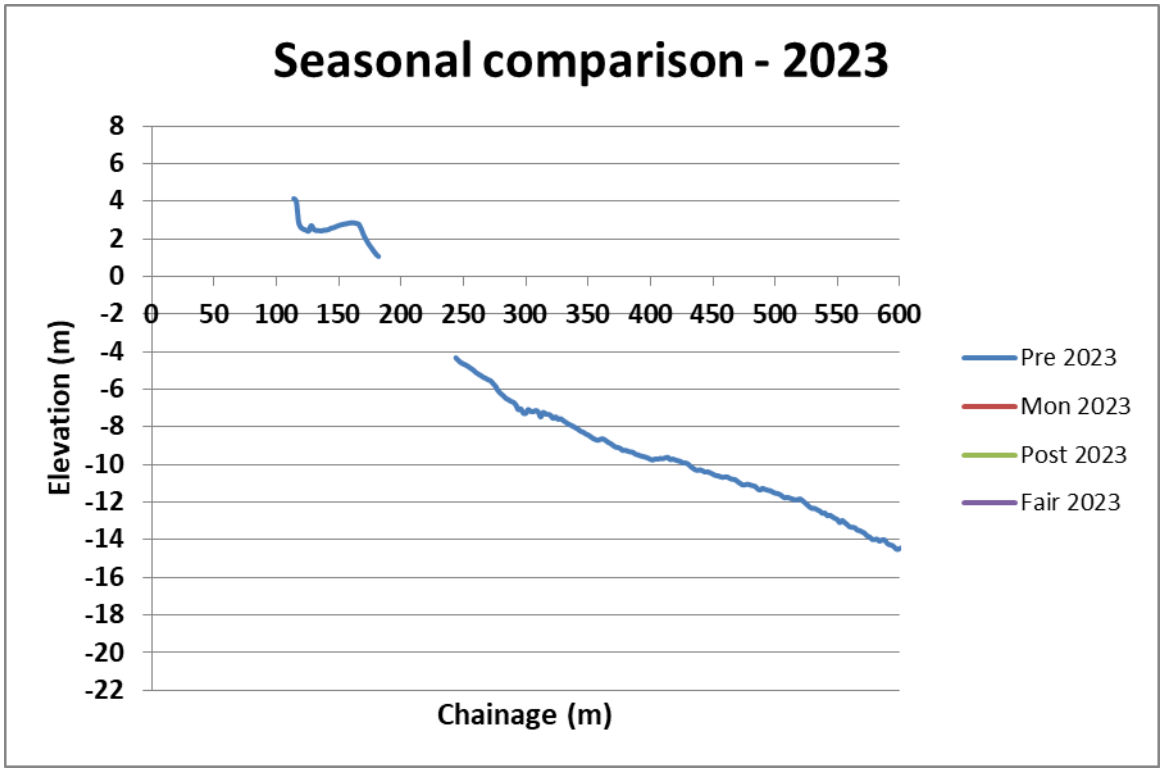


Figure 2-139 Profiles at Edappadu beach (CS 02) – Seasonal comparison – 2023

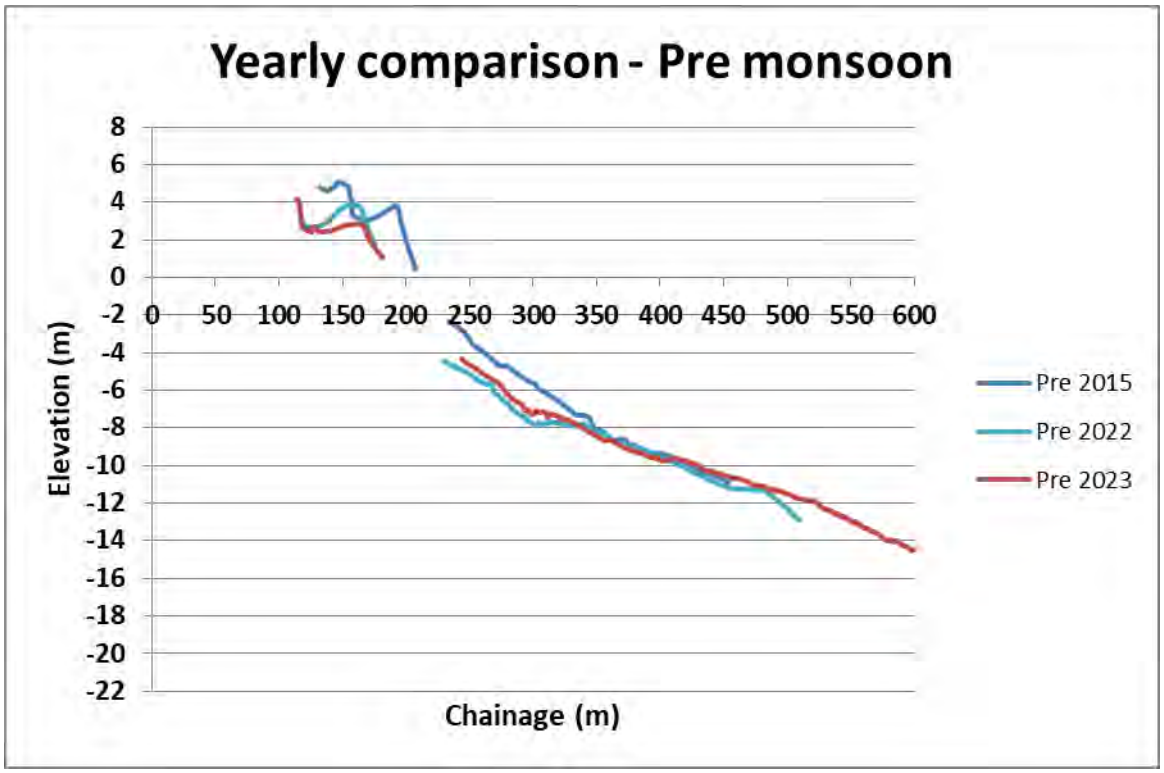


Figure 2-140 Profiles at Edappadu beach (CS 02) – Yearly comparison – Pre Monsoon

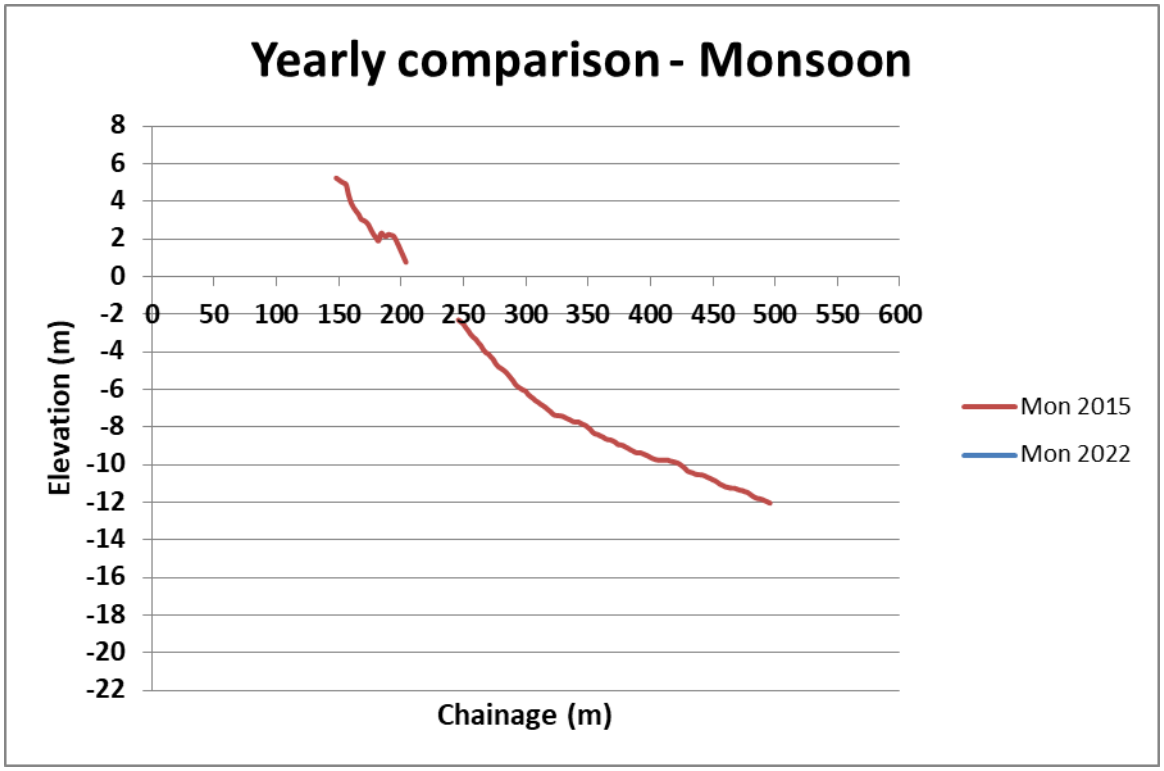


Figure 2-141 Profiles at Edappadu beach (CS 02) – Yearly comparison - Monsoon

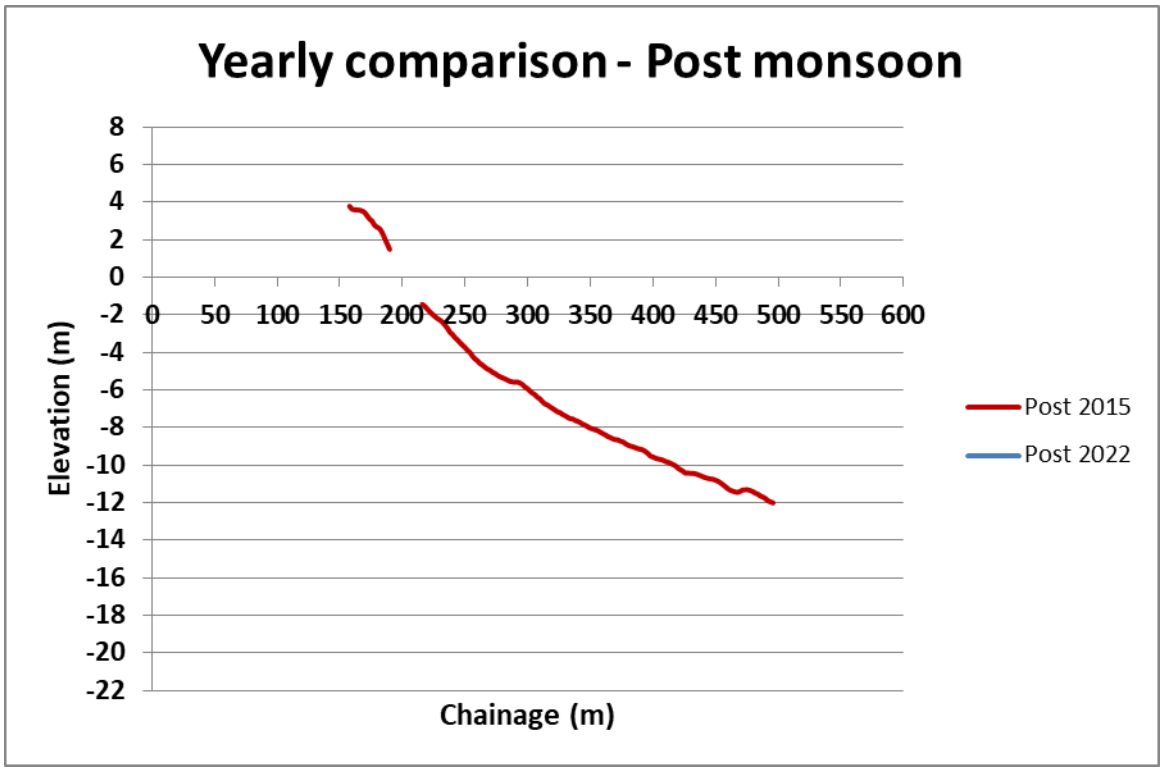


Figure 2-142 Profiles at Edappadu beach (CS 02) – Yearly comparison – Post Monsoon

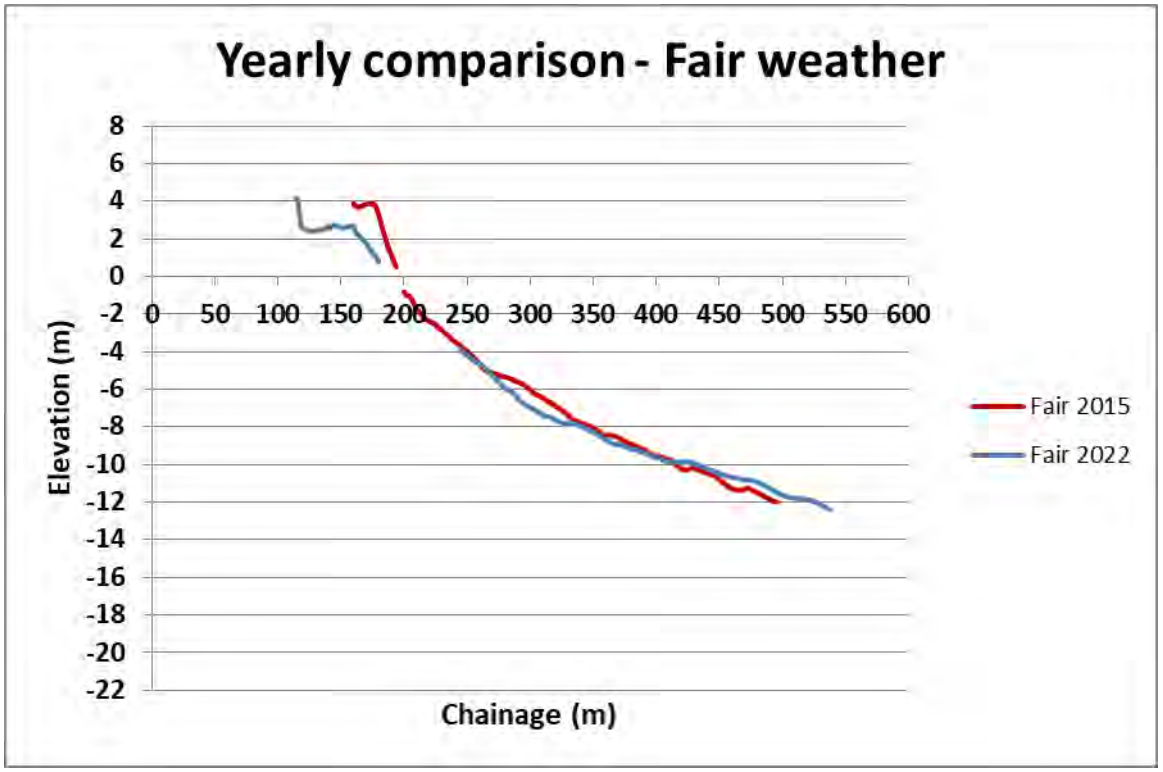


Figure 2-143 Profiles at Edappadu beach (CS 02) – Yearly comparison - Fair Weather

2.6.3.2 Azhimala (CS 35)

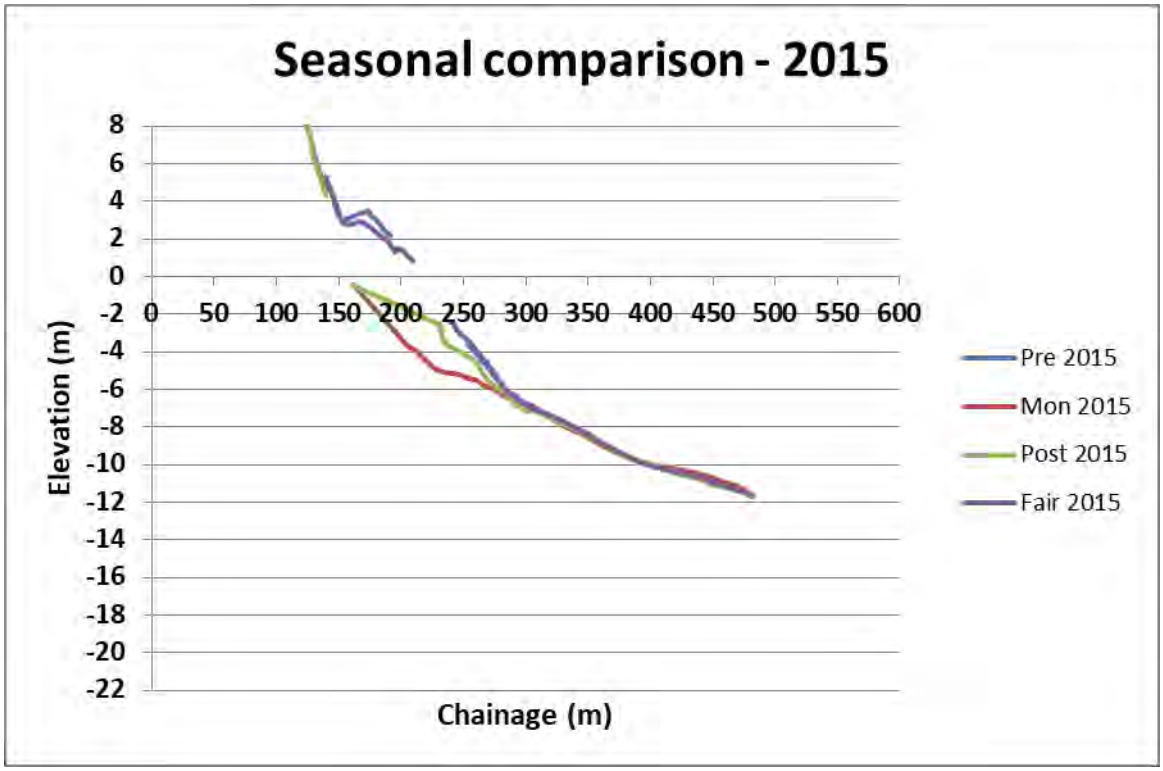


Figure 2-144 Profiles at Azhimala (CS 35) – Seasonal comparison

No data in 2022 at Azhimala (CS 35) to plot seasonal and yearly graphs

2.6.3.3 Valiyathura (CS 64)

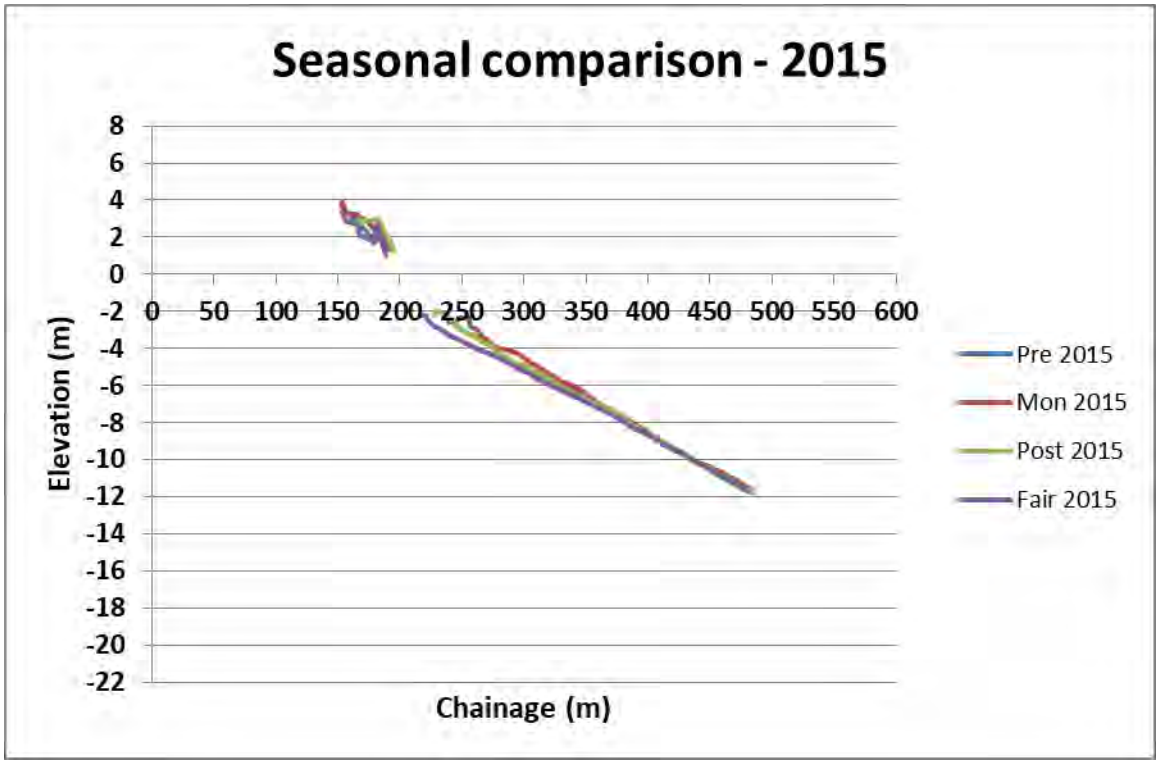


Figure 2-145 Profiles at Valiyathura (CS 64) – Seasonal comparison (2015)

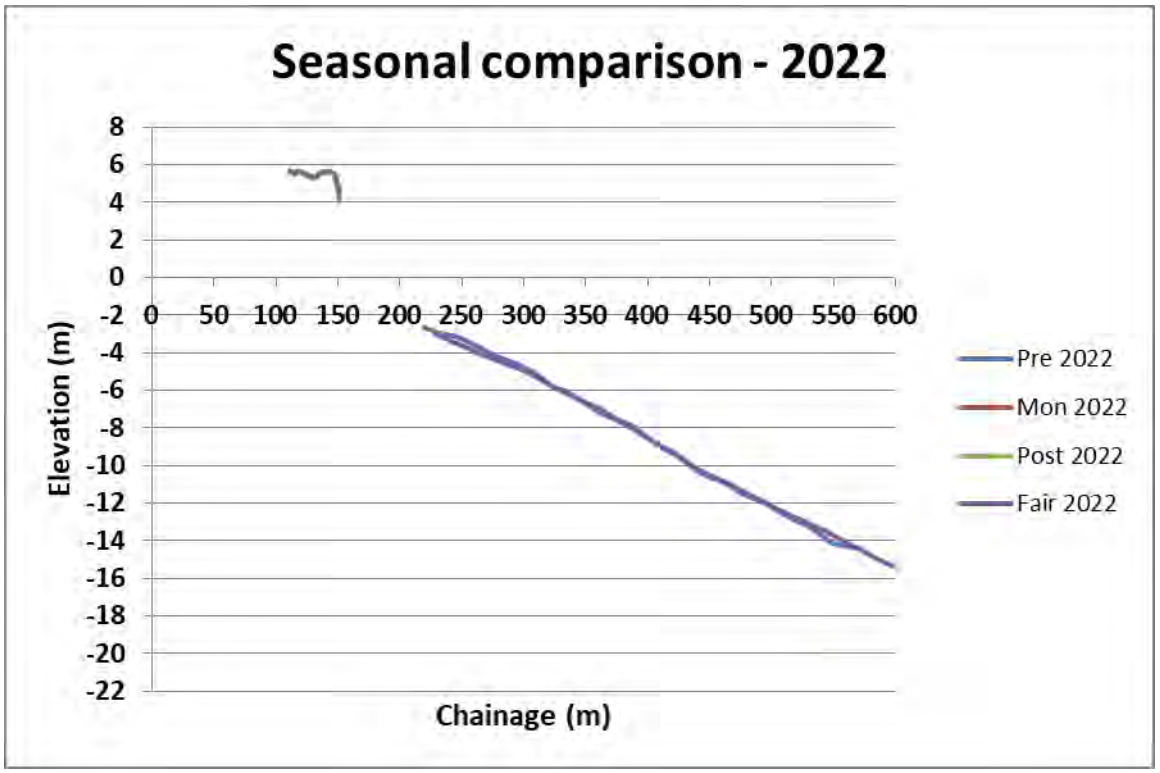


Figure 2-146 Profiles at Valiyathura (CS 64) – Seasonal comparison (2022)

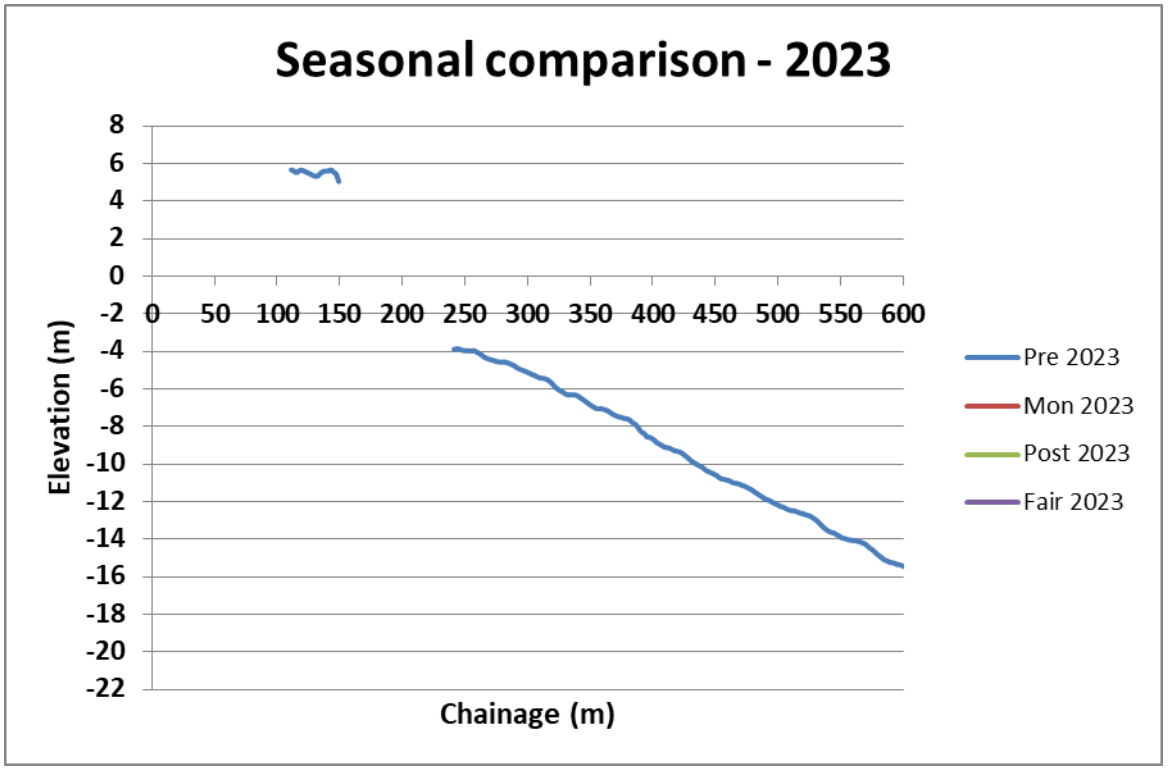


Figure 2-147 Profiles at Valiyathura (CS 64) – Seasonal comparison (2023)

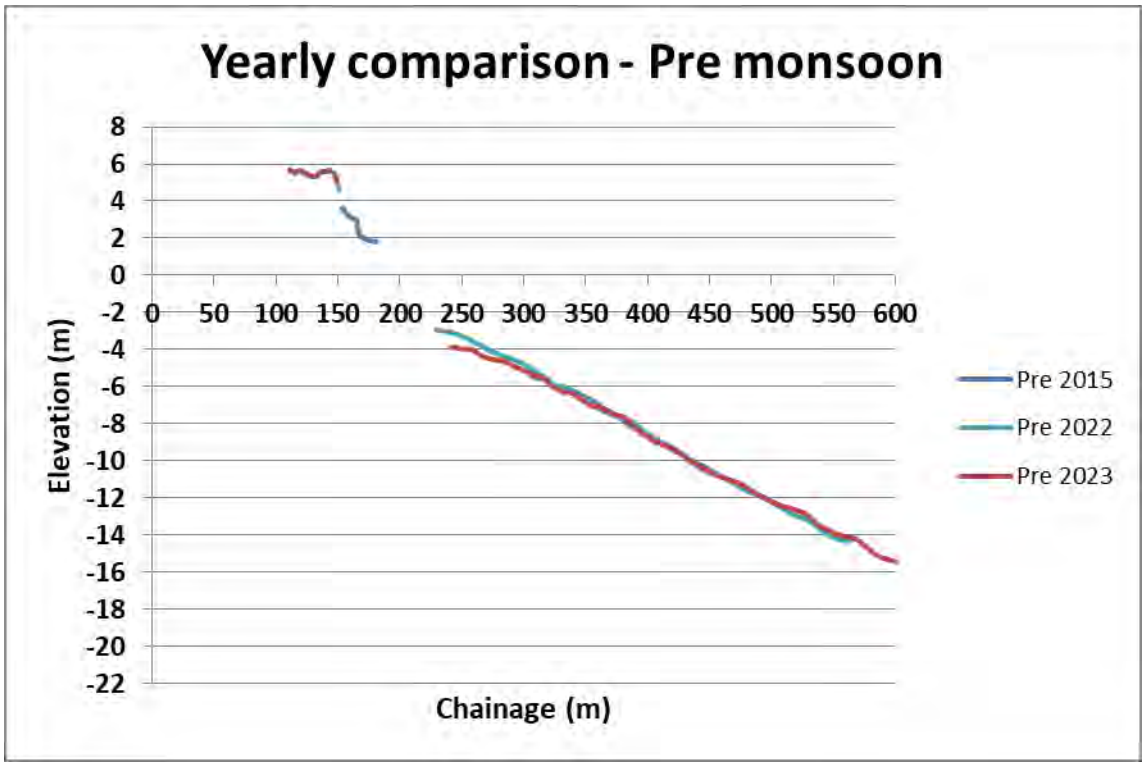


Figure 2-148 Profiles at Valiyathura (CS 64) – Yearly comparison – Pre Monsoon

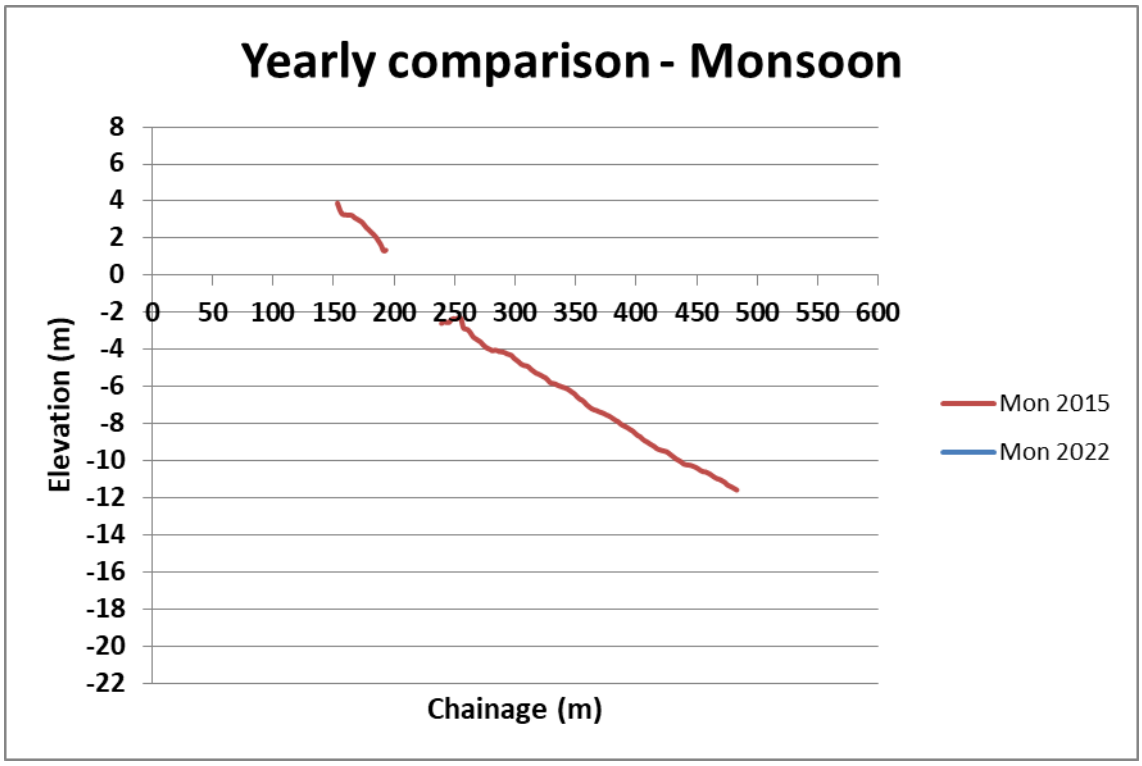


Figure 2-149 Profiles at Valiyathura (CS 64) – Yearly comparison - Monsoon

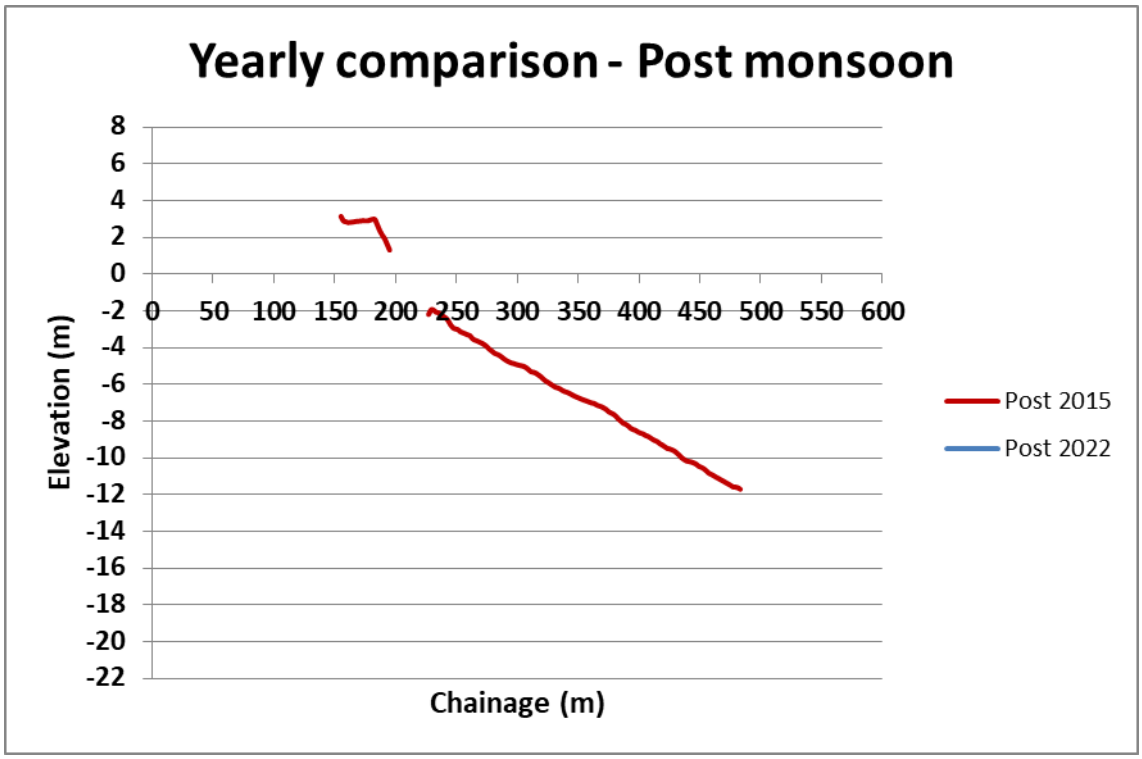


Figure 2-150 Profiles at Valiyathura (CS 64) – Yearly comparison – Post Monsoon

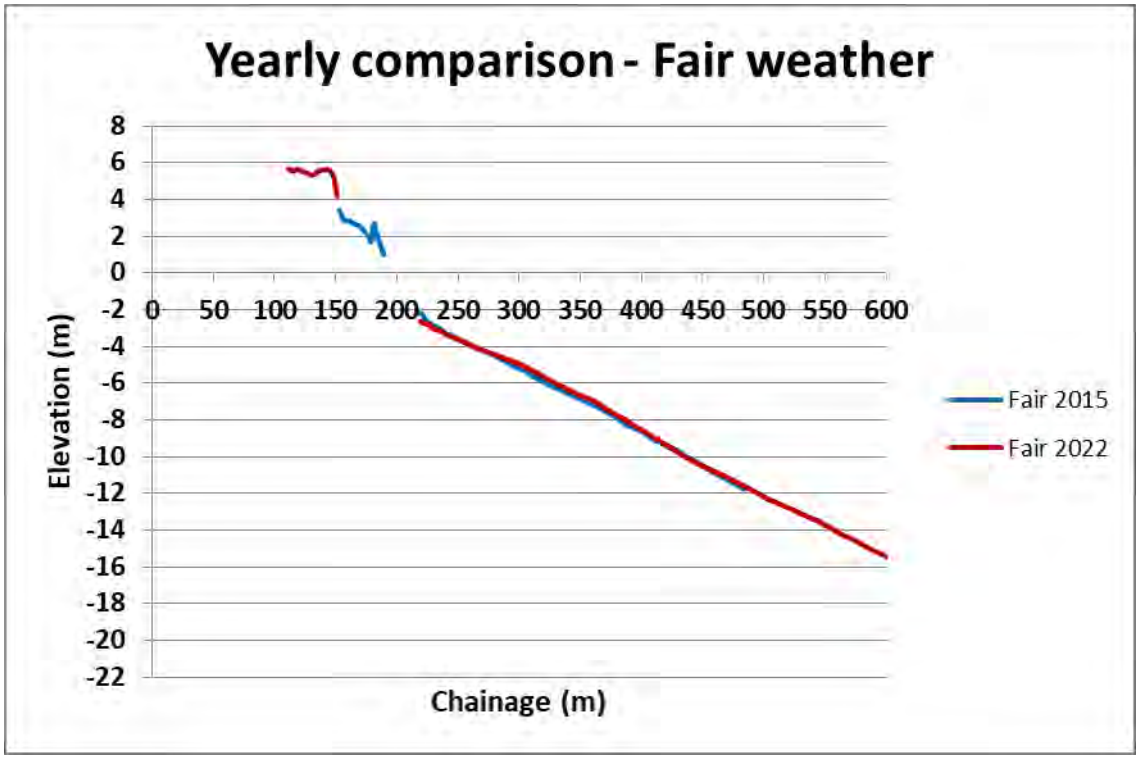


Figure 2-151 Profiles at Valiyathura (CS 64) – Yearly comparison – Fair weather

2.6.3.4 Vettucaud Church (CS 74

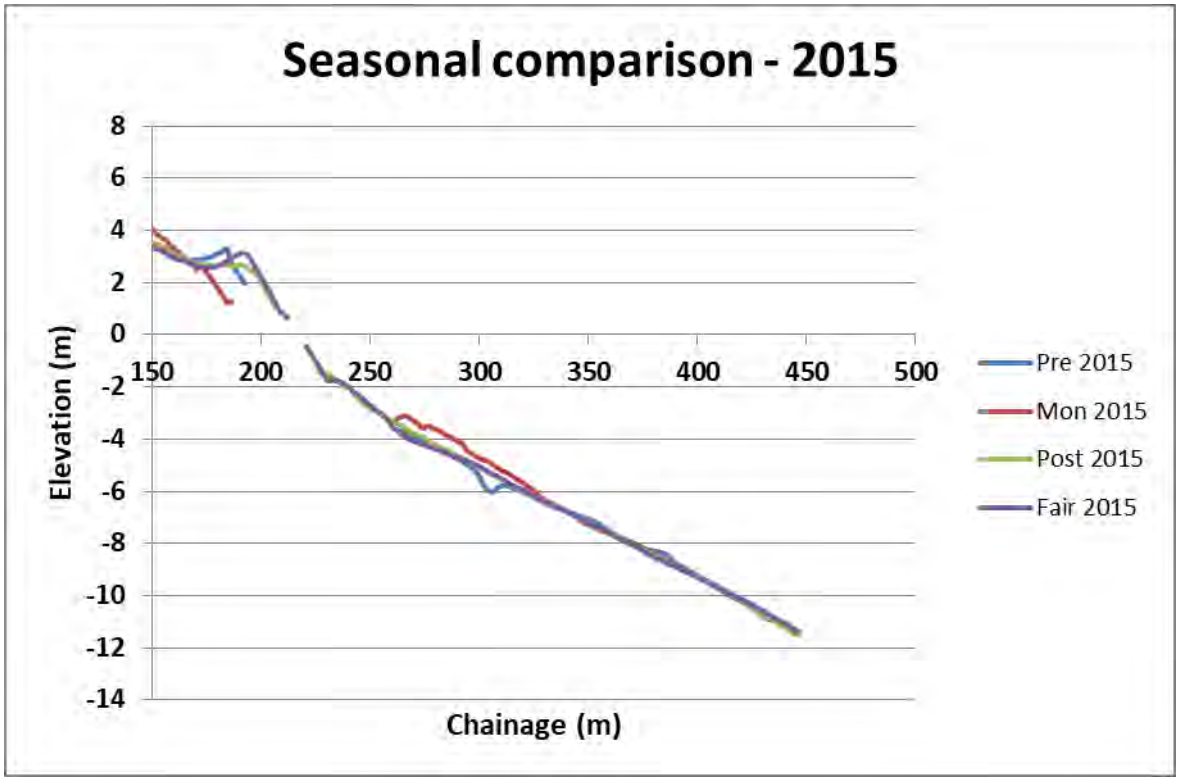


Figure 2-152 Profiles at Vettucaud Church (CS 74) – Seasonal comparison - 2015

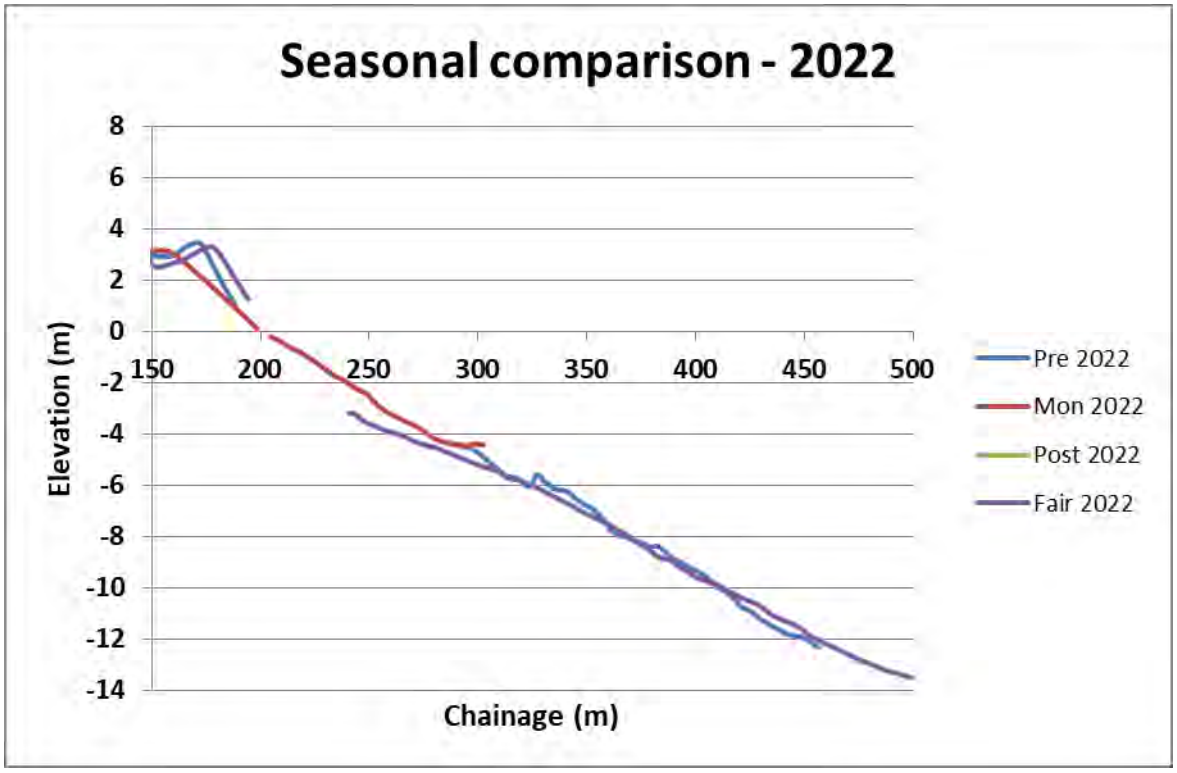


Figure 2-153 Profiles at Vettucaud Church (CS 74) – Seasonal comparison – 2022

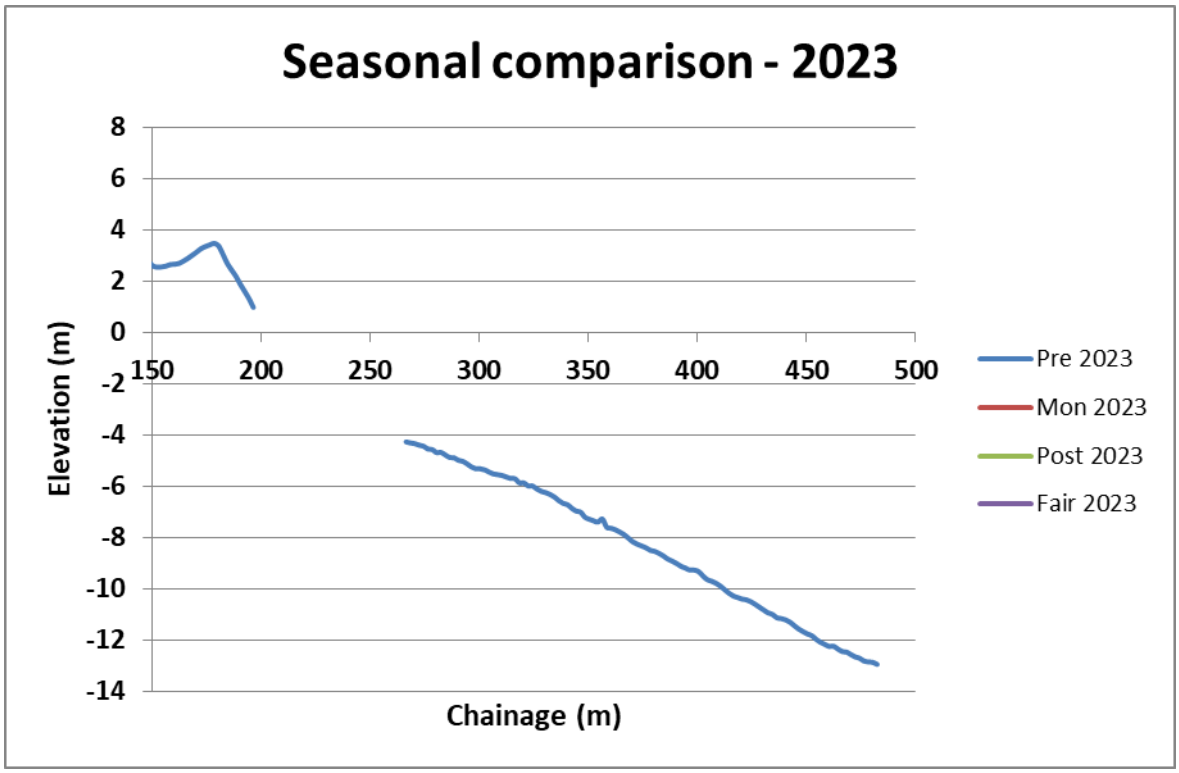


Figure 2-154 Profiles at Vettucaud Church (CS 74) – Seasonal comparison – 2023

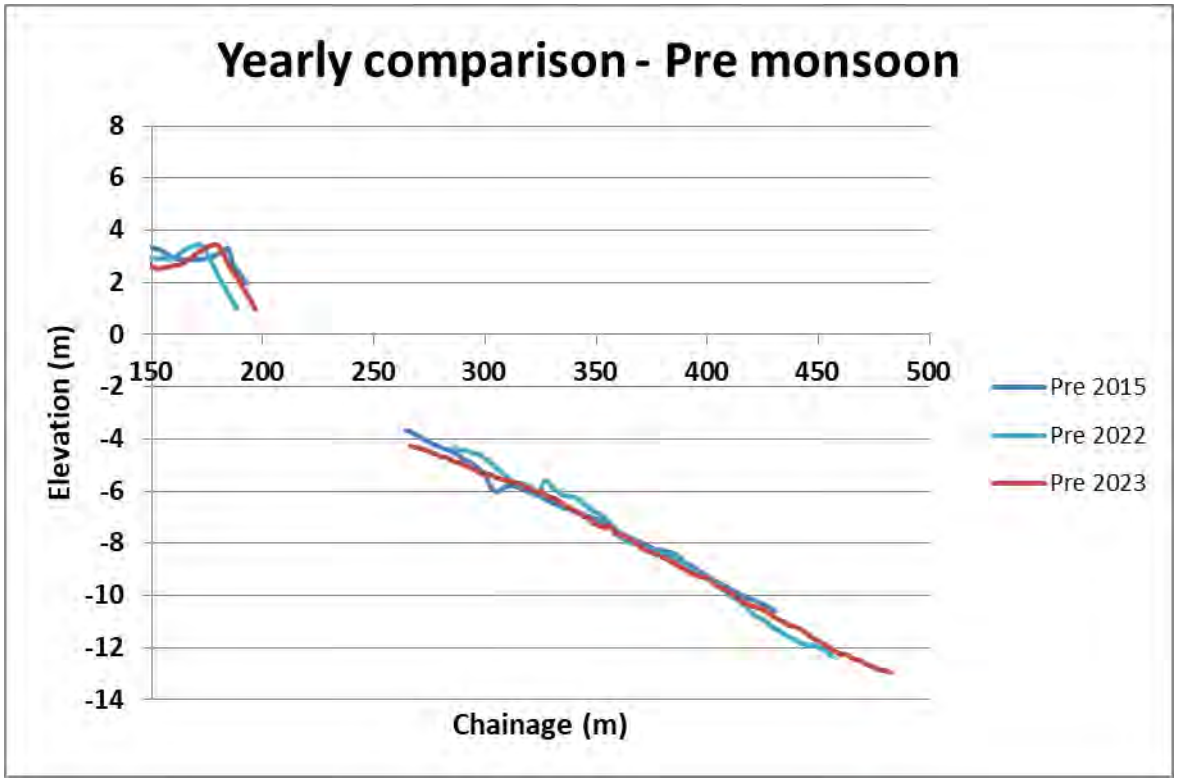


Figure 2-155 Profiles at Vettucaud Church (CS 74) – Yearly comparison – Pre Monsoon

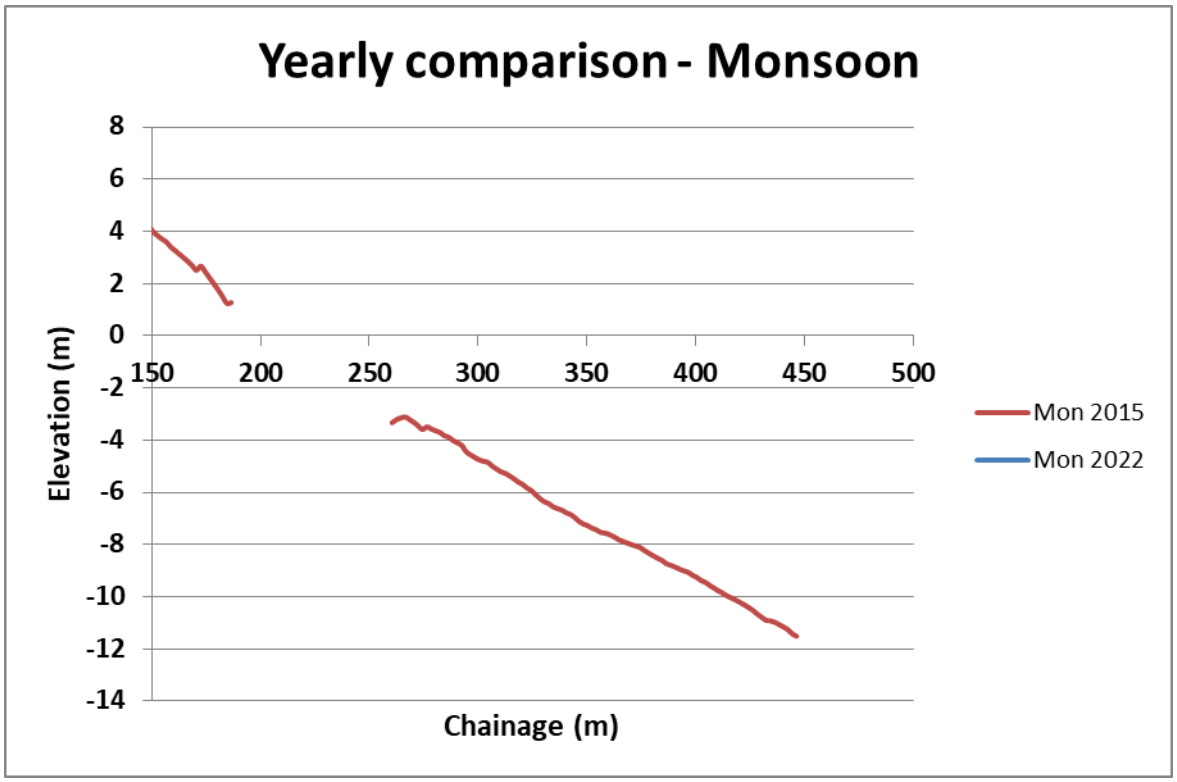


Figure 2-156 Profiles at Vettucaud Church (CS 74) – Yearly comparison – Monsoon

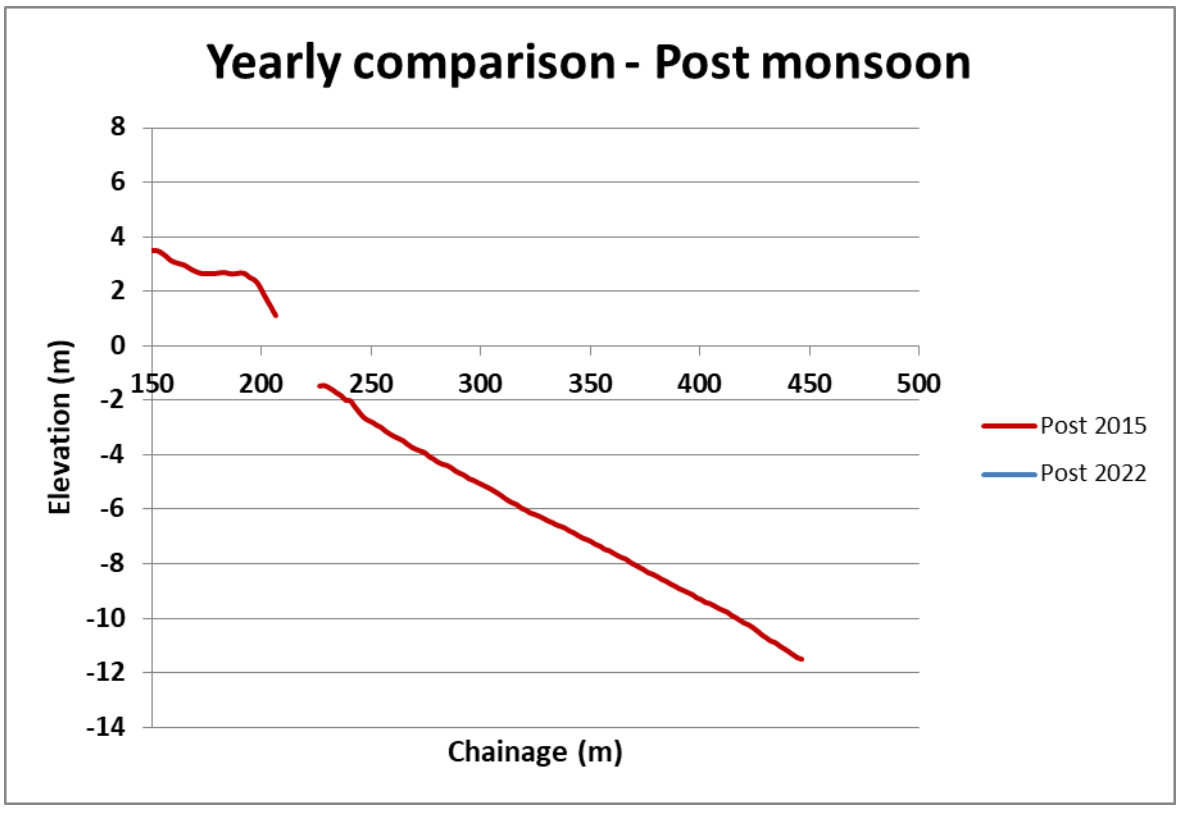


Figure 2-157 Profiles at Vettucaud Church (CS 74) – Yearly comparison – Post Monsoon

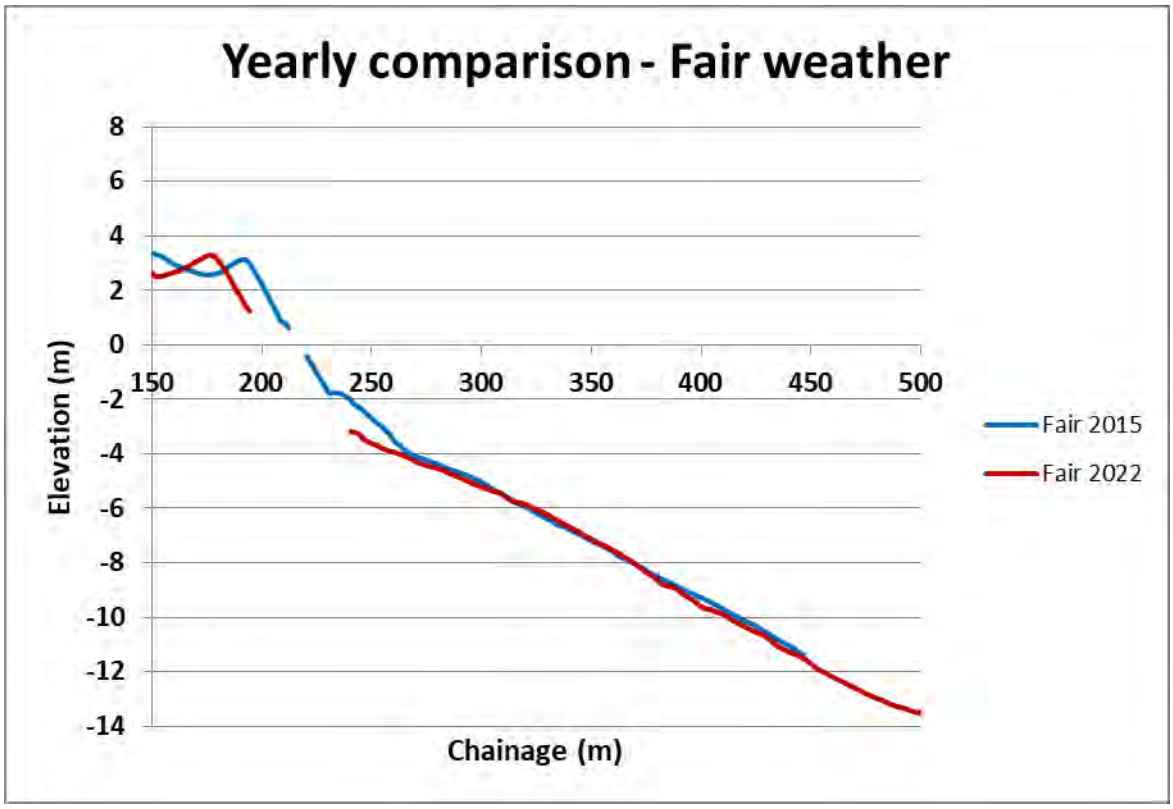
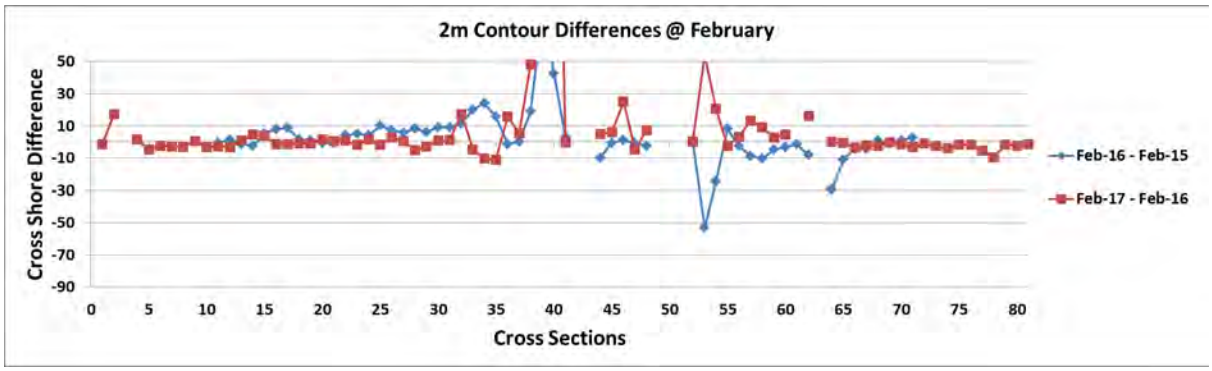


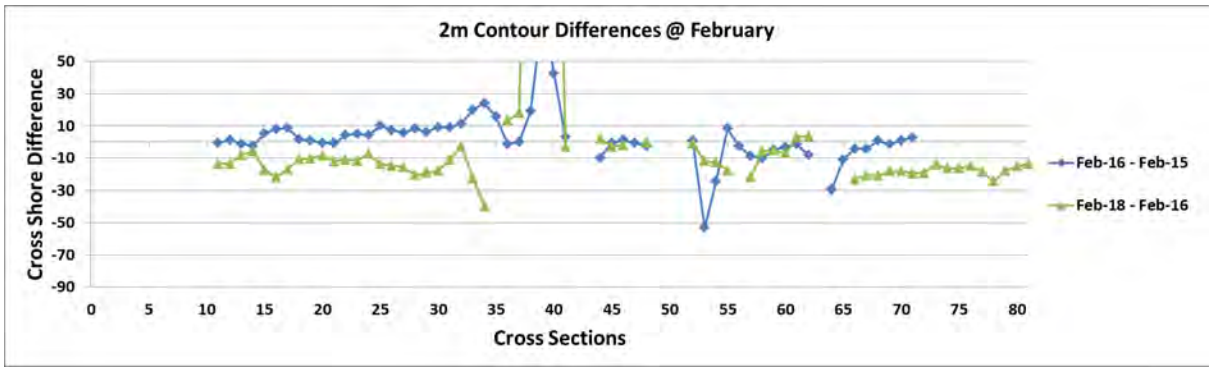
Figure 2-158 Profiles at Vettucaud Church (CS 74) – Yearly comparison – Fair weather

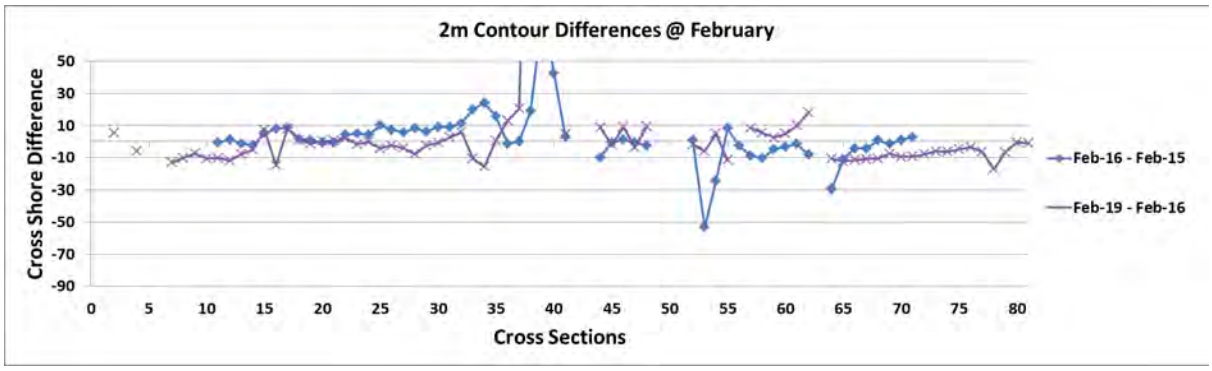
2.6.4 Alongshore comparison of contour differences

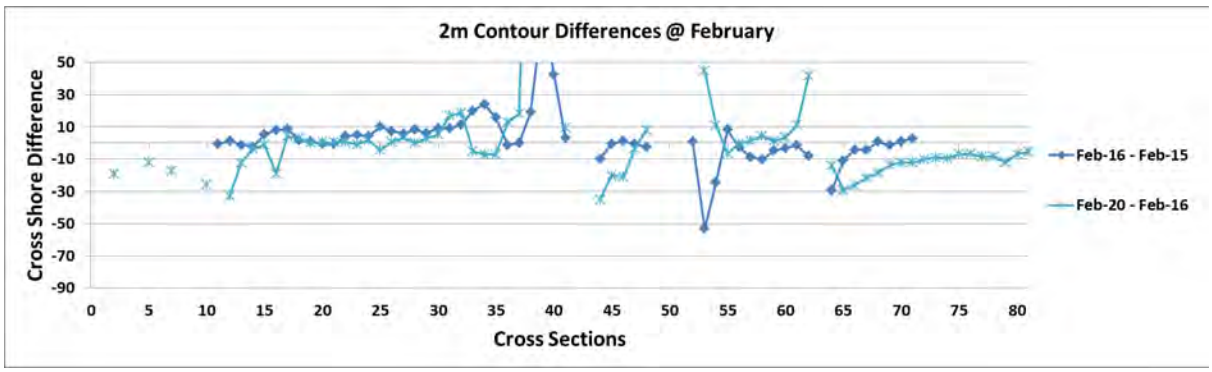
Fair weather season is the best time to compare the coasts as there will not be much cross shore movement and beach will be stable during this period after subjected to seasonal variations. February month of all years was chosen to evaluate the alongshore scenario of the coast.

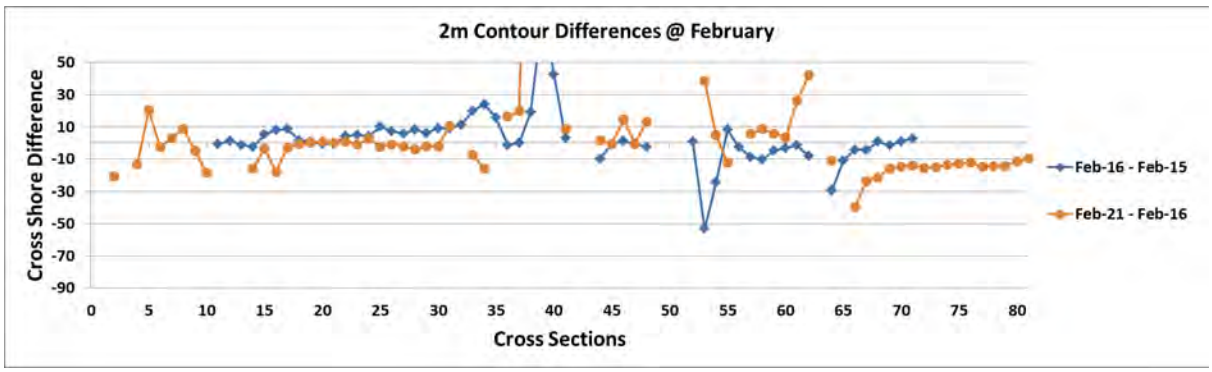
Figure 2-159 to Figure 2-164 show the variation of contours with respect to contours of February 2016. February 2016 was taken as the reference year in this case. Figure 2-165 to Figure 2-170 shows the variation of contours relative to the previous year (yearly rates).




2m Contour Differences @ February
Cross Shore Difference
Cross Sections
Feb-16 - Feb-15
Feb-18 - Feb-16


2m Contour Differences @ February
Cross Shore Difference
Cross Sections
Feb-16 - Feb-15
Feb-19 - Feb-16


2m Contour Differences @ February
Cross Shore Difference
Cross Sections
Feb-16 - Feb-15
Feb-20 - Feb-16


2m Contour Differences @ February
Cross Shore Difference
Cross Sections
Feb-16 - Feb-15
Feb-21 - Feb-16

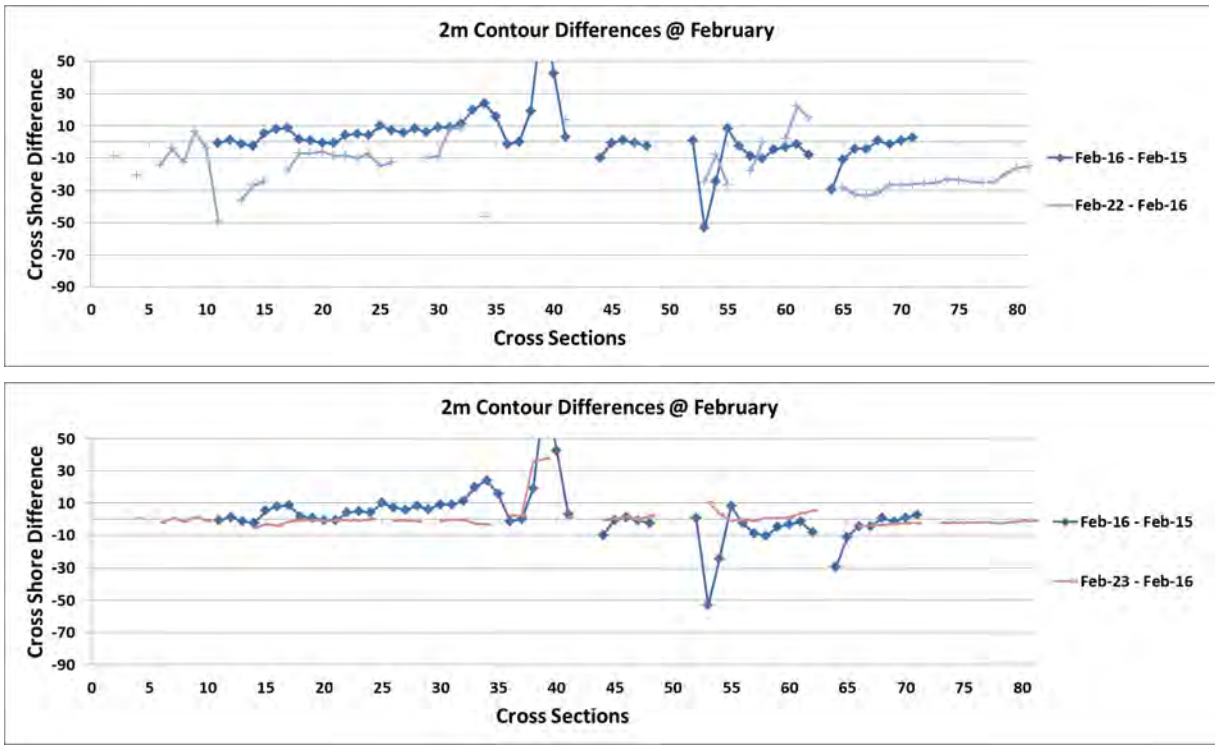


Figure 2-159 Alongshore comparison of (+) 2m contour differences during February

LNTIEL extracted (+) 2m contour from February months of cross shore profile data at 81 locations. It was noticed that (+) 2m contour was not available in survey data at some of the cross sections which could be due to inaccessibility or protest and these values were not interpolated and left as such.

Figure 2-159 shows the comparison of difference of (+) 2m contour of February 2016 with reference to February 2015. As February 2015 data consists of 61 locations and there was minimal variation between February 2016 and February 2015 (Blue line), February 2016 was considered as baseline for this analysis and remaining series are comparison of differences of (+) 2m contour of February months with reference to February 2016. Green line represents the alongshore scenario of coast after Ockhi cyclone. It can be seen from this plot that the coast experienced severe erosion. Violet, Cyan and orange lines represent the alongshore scenario of coast post Ockhi cyclone (subsequent years). Light red line represents the alongshore scenario of coast for February 2023. The stretch south of Poovar River mouth is still in transition and stretch north of Poovar River mouth to Adimalathura seems to be recovered from Ockhi cyclone impact. Near Valiyathura pier there was accretion on south of groyne and erosion on north of groyne which seems to be natural phenomenon due to construction of groyne.

Similarly, -3m, -4m, -6m, -8m and -10m contour differences are shown in Figure 2-160 to Figure 2-164.

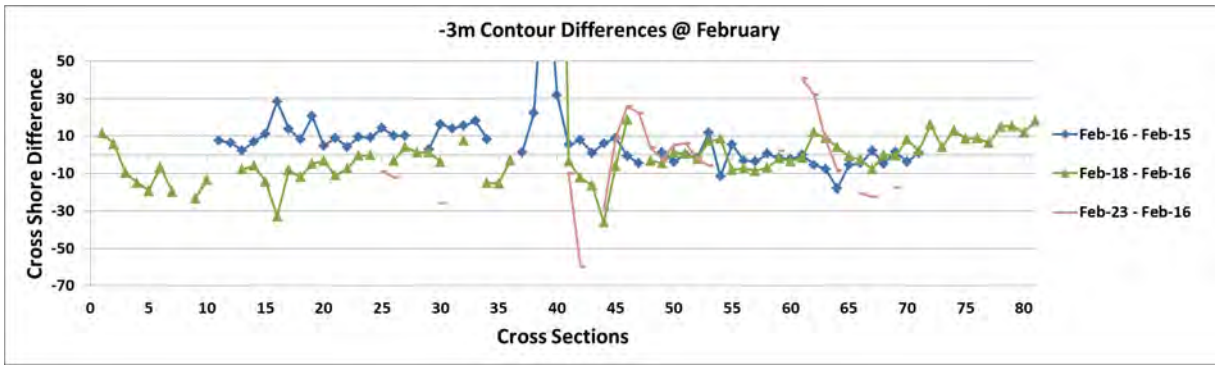


Figure 2-160 Alongshore comparison of (-) 3m contour differences during February

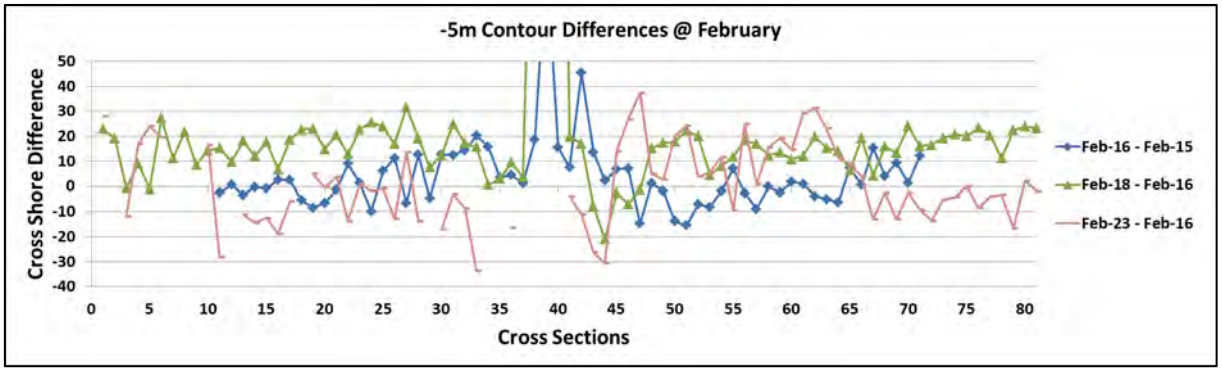


Figure 2-161 Alongshore comparison of (-) 5m contour differences during February

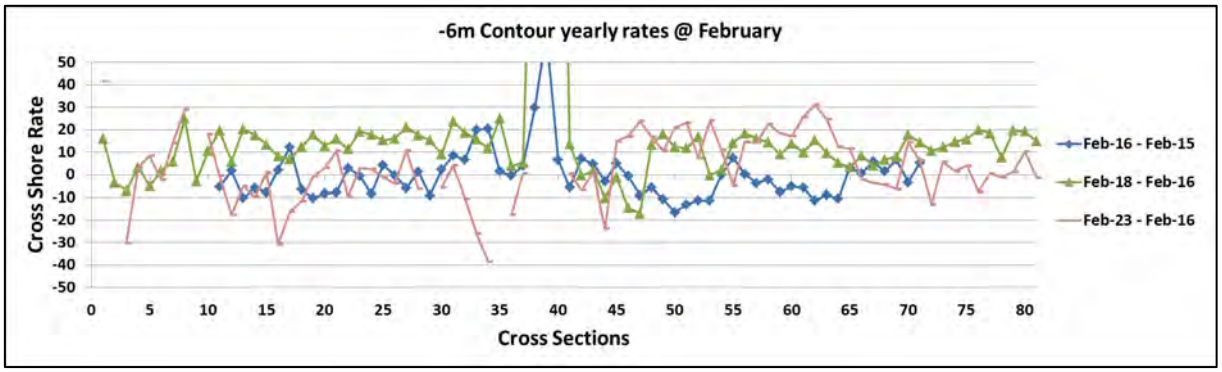


Figure 2-162 Alongshore comparison of (-) 6m contour differences during February

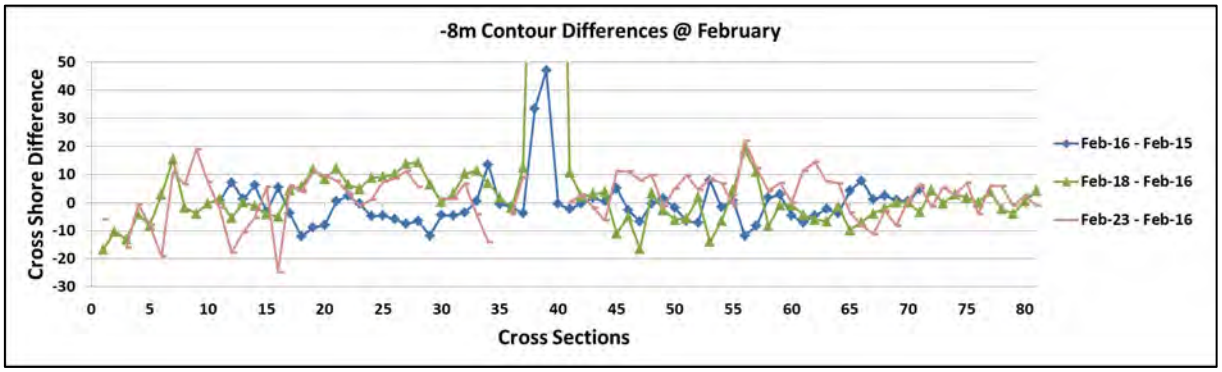


Figure 2-163 Alongshore comparison of (-) 8m contour differences during February

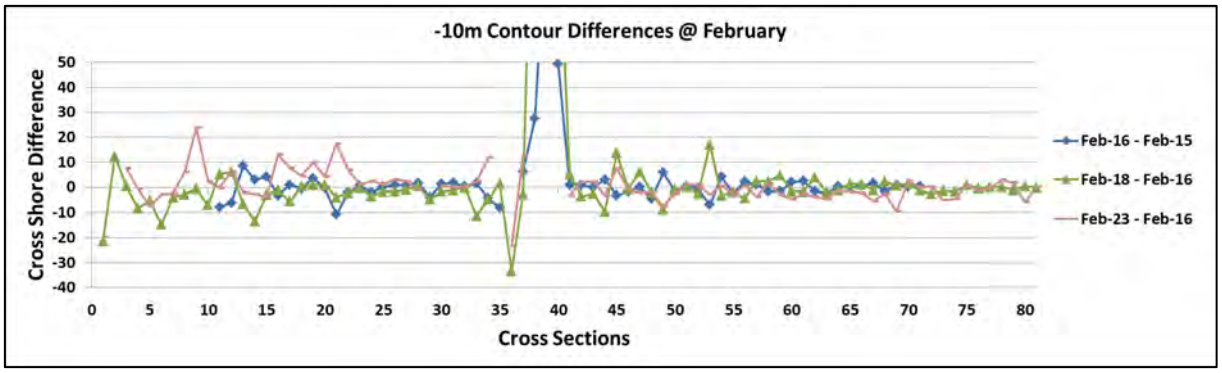


Figure 2-164 Alongshore comparison of (-) 10m contour differences during February

2.6.5 Alongshore comparison of contour yearly rates

LNTIEL analysed the yearly rates during February month. Figure 2-165 shows the comparison of yearly rates of (+) 2m contour of February month with reference to previous year February month. After Ockhi almost entire coast experienced severe erosion which can be noticed from Feb-18 – Feb-17 series (Green). Earlier we observed that the yearly rate of 2018-2019 year was high along the coast compared to previous years probably because the coast was in the process to attain its stable or equilibrium position. In the period of March 2019 to February 2021 the rates were almost similar to pre Ockhi scenario and during the period of 2022 – 2023 (Red) the rates were high.

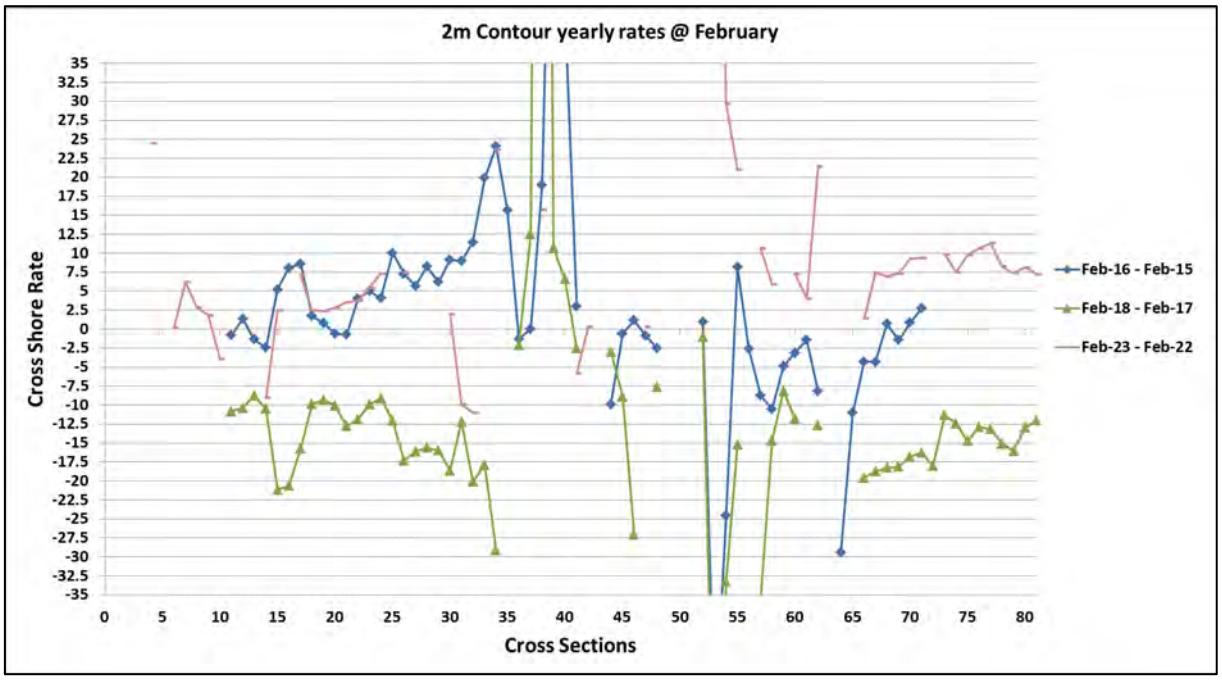


Figure 2-165 Alongshore comparison of (+) 2m contour yearly rates during February

Similarly, -3m, -4m, -6m, -8m and -10m contour differences are shown in Figure 2-166 to Figure 2-170.

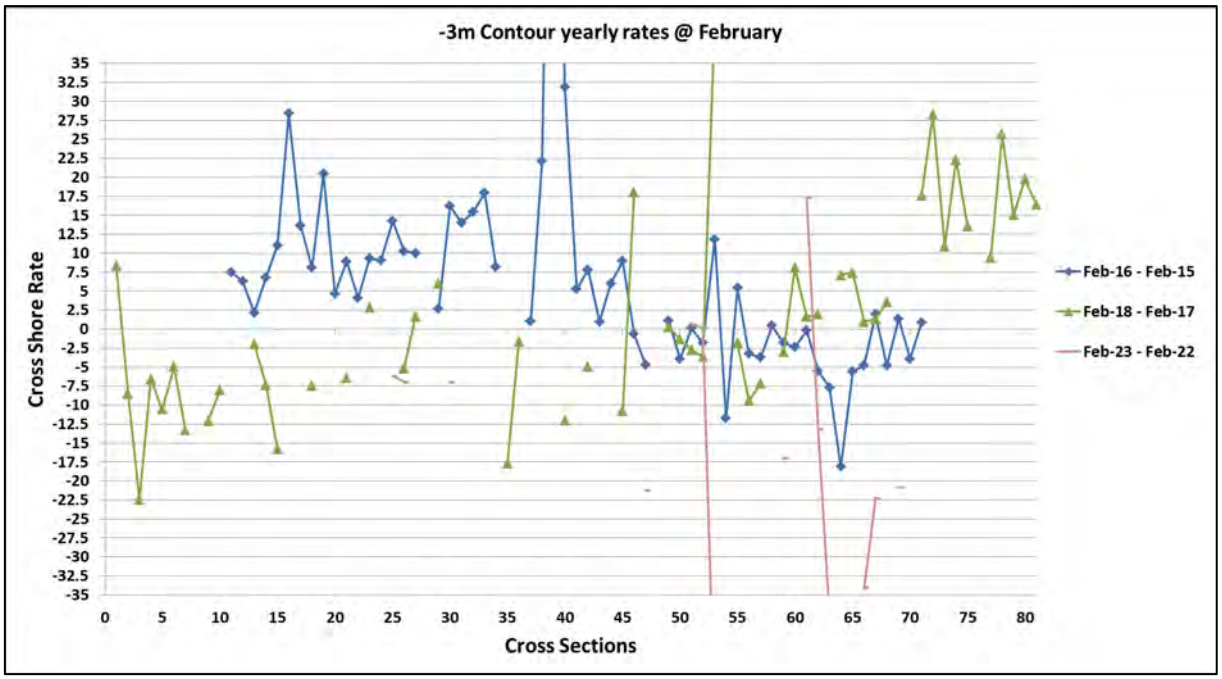


Figure 2-166 Alongshore comparison of (-) 3m contour yearly rates during February

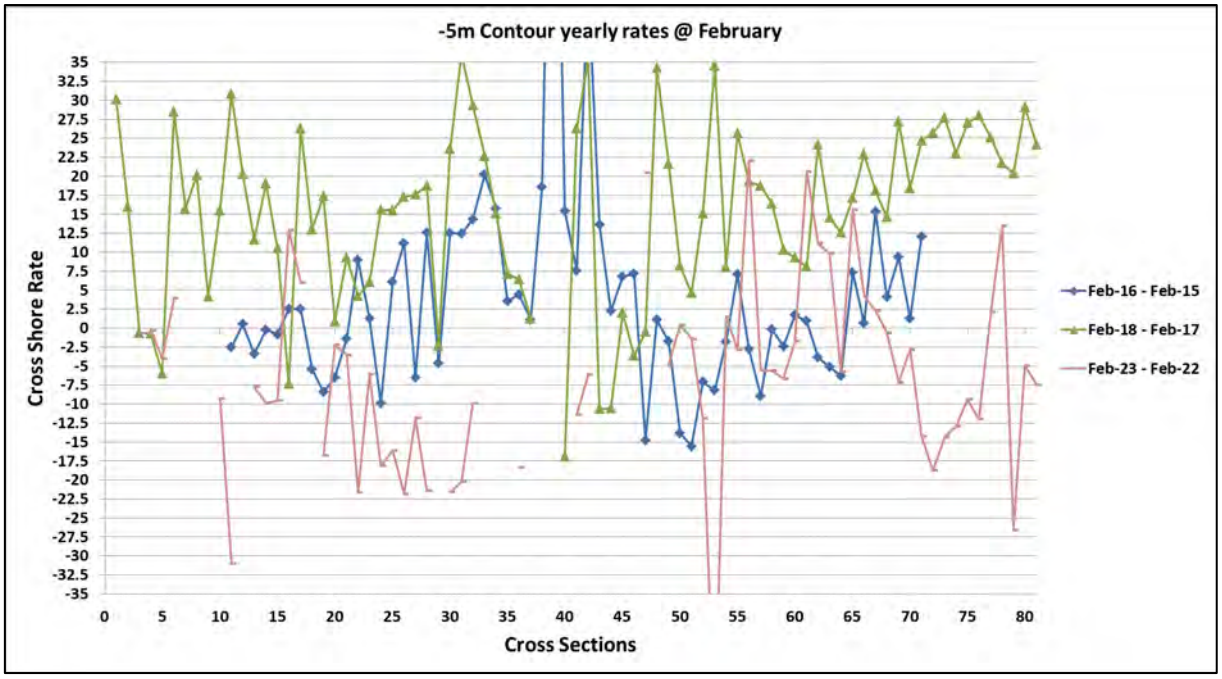


Figure 2-167 Alongshore comparison of (-) 5m contour yearly rates during February

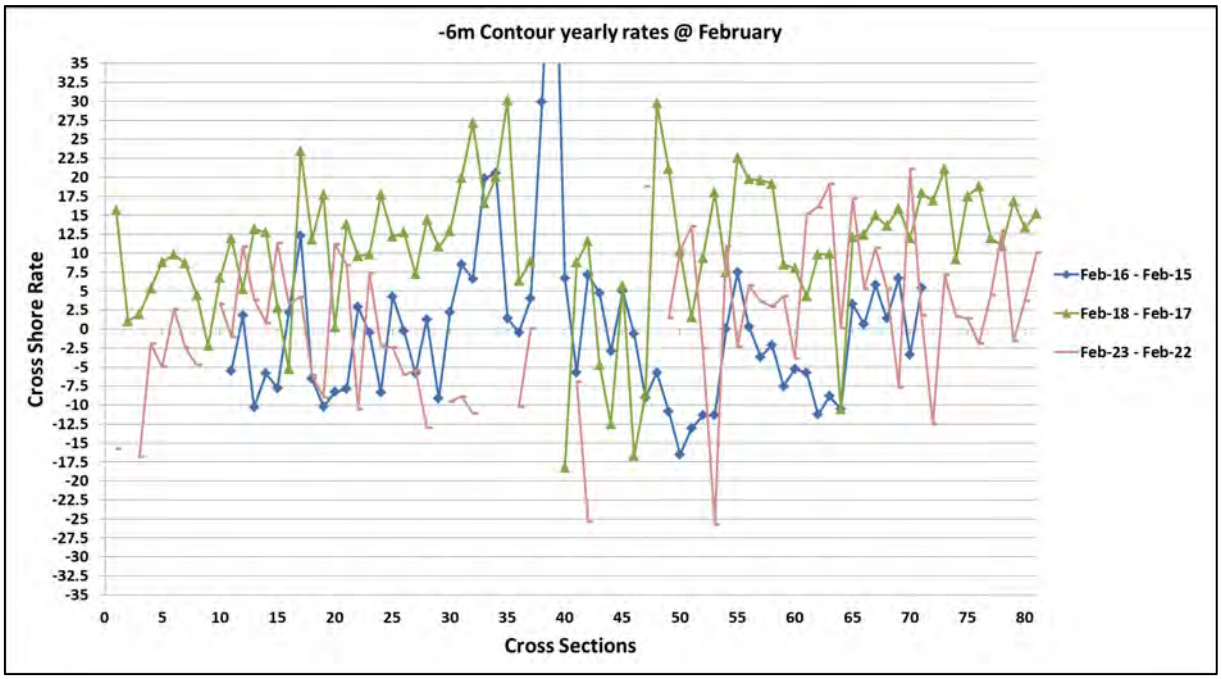


Figure 2-168 Alongshore comparison of (-) 6m contour yearly rates during February

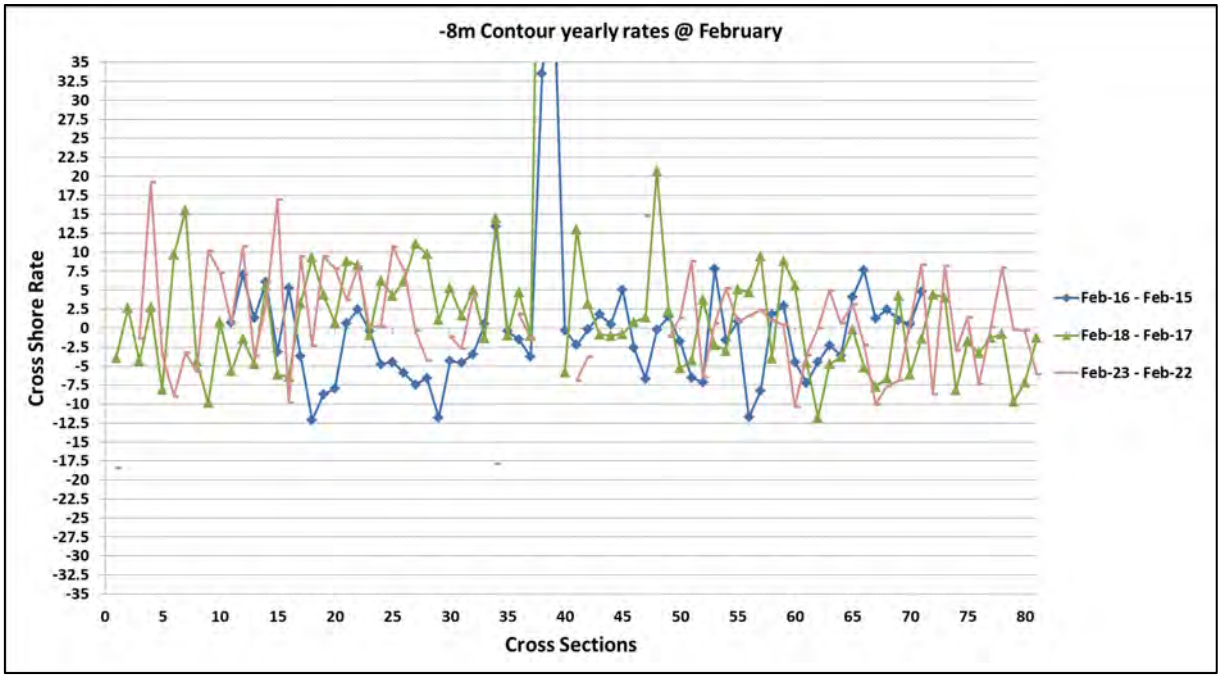


Figure 2-169 Alongshore comparison of (-) 8m contour yearly rates during February

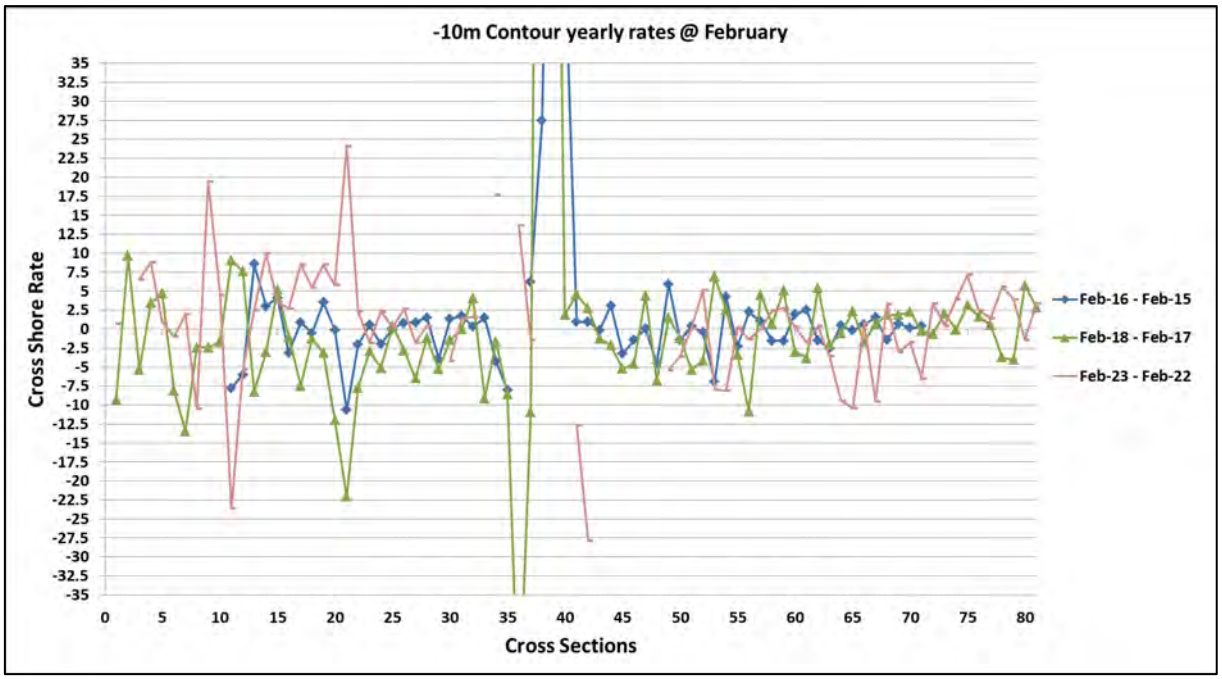


Figure 2-170 Alongshore comparison of (-) 10m contour yearly rates during February

2.6.6 Assessment of depth of closure

The term depth of closure, hereafter DoC, is a fundamental concept used to define the most landward depth of seaward beyond which there is no significant change in bottom elevation and no significant net sediment exchange between nearshore and offshore for a given time interval. The references to this study were taken from publications such as “Morang A., Birkemeier W.A. (2005) Depth of Closure on Sandy Coasts. In: Schwartz M.L. (eds) Encyclopedia of Coastal Science. Encyclopedia of Earth Science Series. Springer, Dordrecht.”

To assess the DoC, the surveyed profiles at a particular location were averaged and standard deviation of profile was derived using statistics. Standard deviation is a measure of the degree of dispersion of points from its mean i.e. lower the dispersion better is the convergence. However, expectation of zero-meter dispersion from its mean may not be realistic approach because there can be chances of survey related errors. Therefore, threshold of 0.3m deviation from its mean was considered as reasonable limit. Another reason for a threshold value of 0.3m is that the survey errors are in the range on 0.3-0.4m and therefore any deviations below this range may confuse between actual change and survey error.

The average profile and the standard deviation of depths were plotted as function of the offshore distance as shown in Figure 2-171 to Figure 2-179. The respective DoCs are shown in plots with dash lines and their intersection points are also shown.

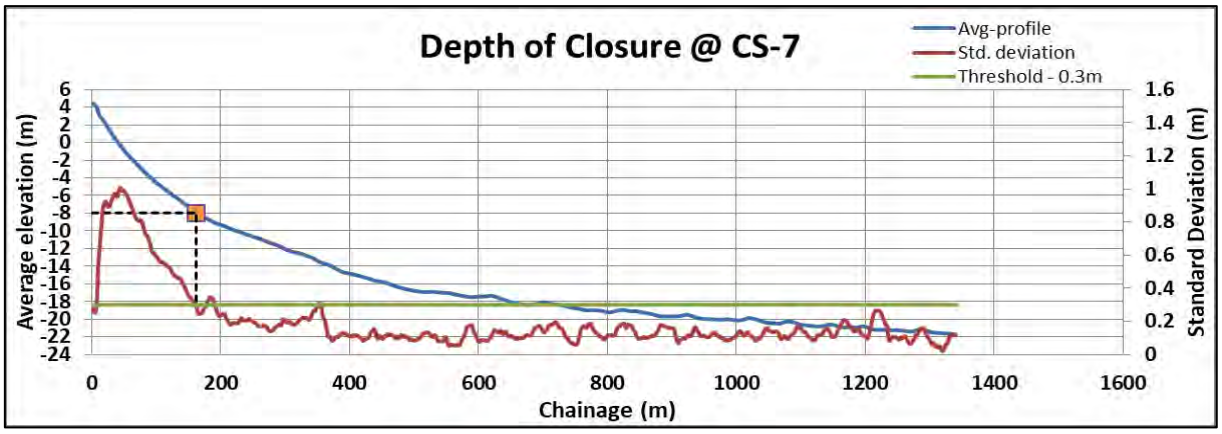


Figure 2-171 Depth of closure at Neerody location (CS 7)

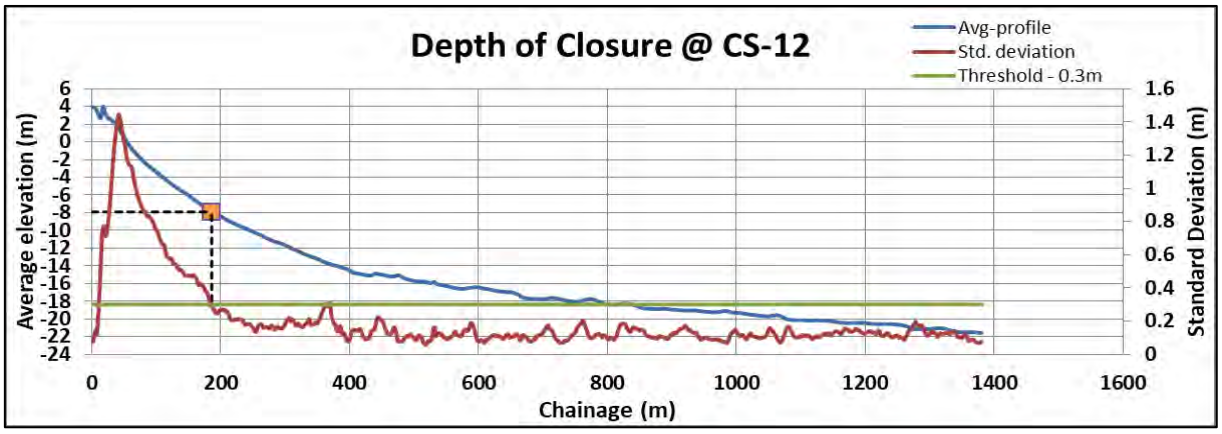


Figure 2-172 Depth of closure at Pozhiyoor location (CS 12)

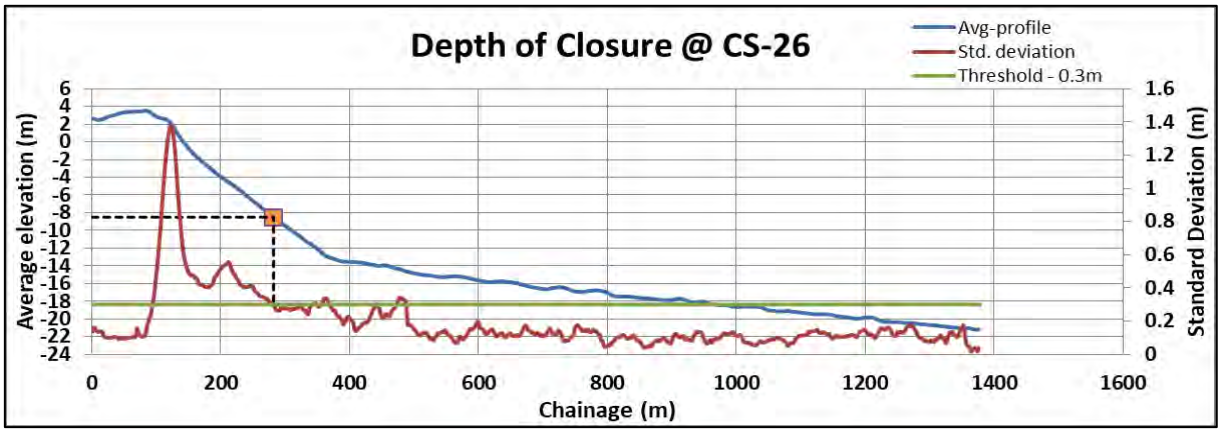


Figure 2-173 Depth of closure at Karumkulam location (CS 26)

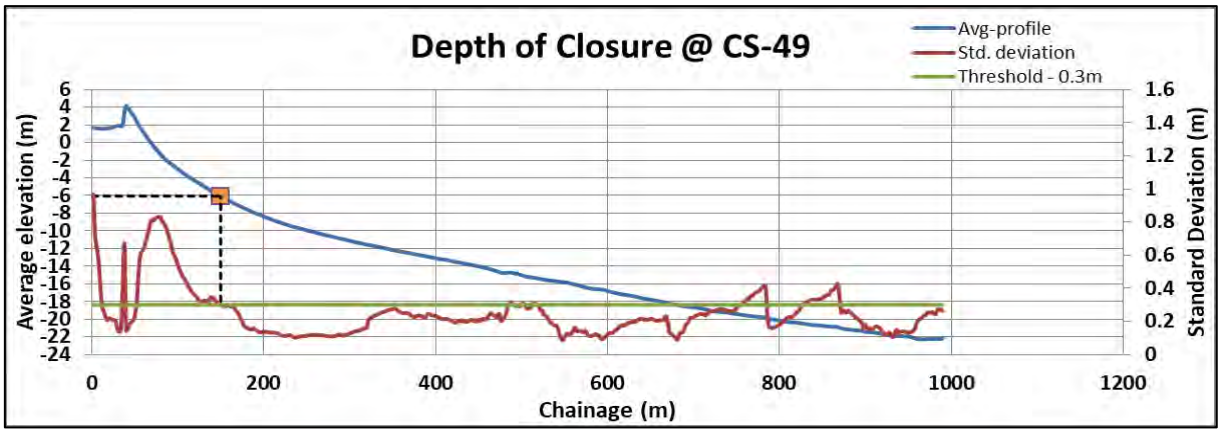


Figure 2-174 Depth of closure at Panathura location (CS 49)

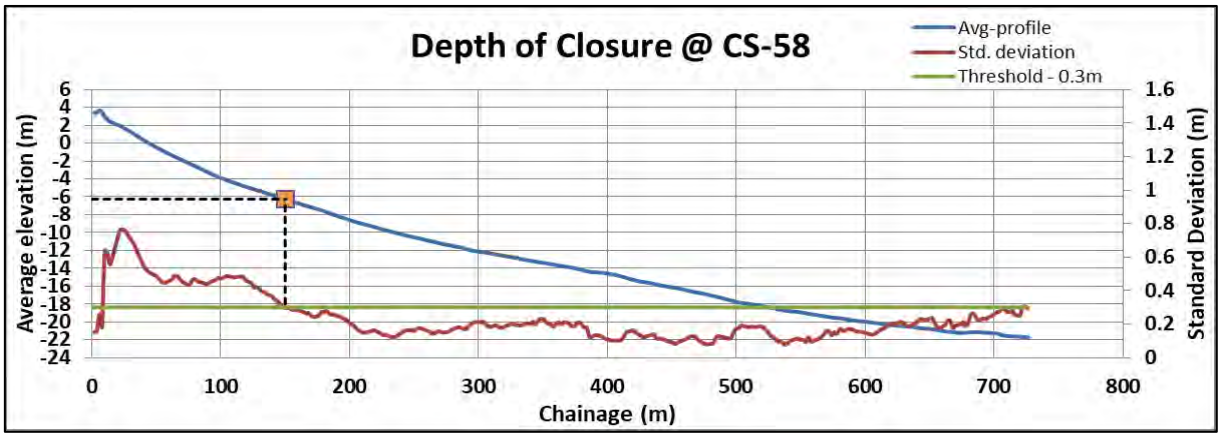


Figure 2-175 Depth of closure at Beemapally location (CS 58)

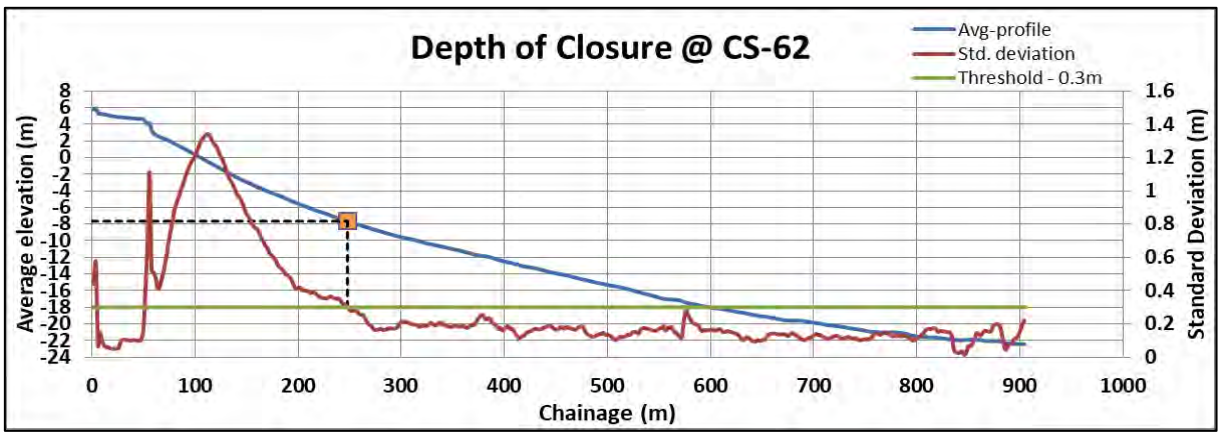


Figure 2-176 Depth of closure at Cheriyathura location (CS 62)

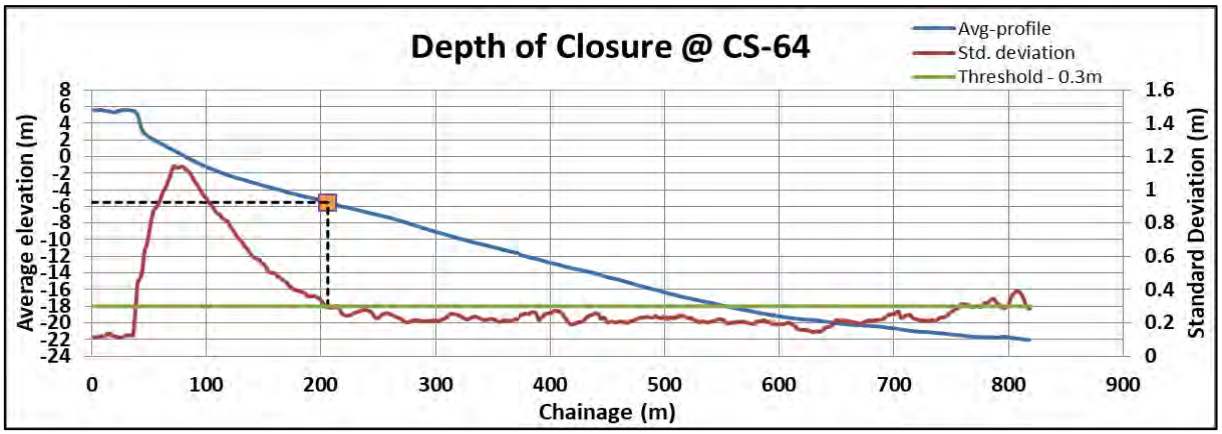


Figure 2-177 Depth of closure at Valiyathura location (CS 64)

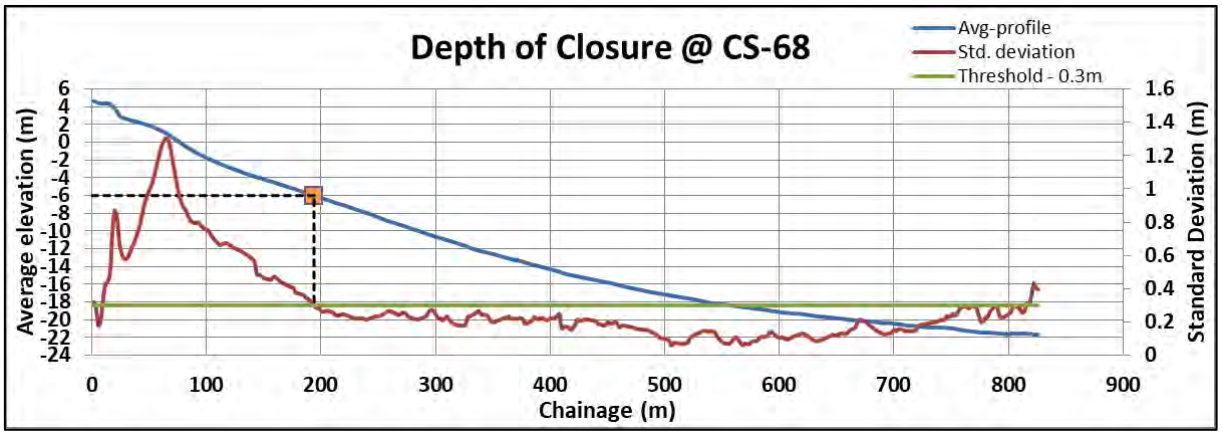


Figure 2-178 Depth of closure at Shangumugham location (CS 68)

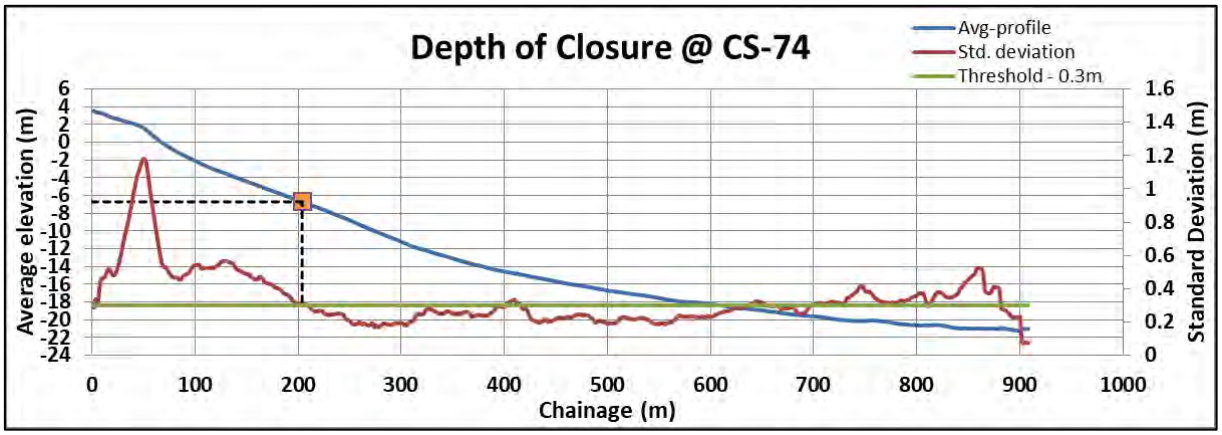


Figure 2-179 Depth of closure at Vettucaud location (CS 74)

2.7 Near shore profiles

LNTIEL analysed the cross shore profiles and presented the seasonal variations in Section 2.6. Further depth of closure was estimated by averaging the surveyed profiles at a particular location and deriving standard deviation of the profile.

A major limitation in cross profiles is the data gap between beach profiles and sea bed profiles near foreshore region where data collection is complex and uncertain. Prediction of seasonal variation in profiles is difficult due to the data gap.

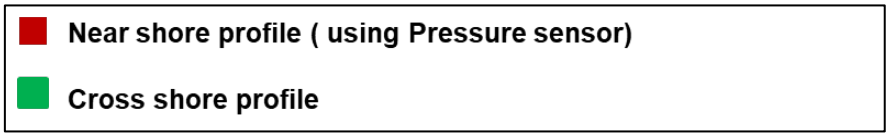
During the shoreline committee meeting held on 19-04-2022, the Shoreline Monitoring Cell advised to carry out near shore survey and use the data to validate the Depth of Closure estimation. It was decided that the near shore survey will be carried out along 7 CSP transects (CSP Nos. 2, 33, 34, 68, 69, 73 and 74) every month. In this regard, SAC has carried out near shore surveys using pressure sensors.

2.7.1 Survey Methodology

The survey in the breaker zone is carried out using a pressure sensor which is secured on a frame and towed at seabed by the divers. The entire setup is carried along the CSP transect up to a depth beyond which bathymetric survey is carried out using Multi Beam Echo Sounder (MBES). The other end of the pressure sensor is connected to a display on the shore. The setup will then be pulled towards the shore by the survey team personnel and the depth was noted with the help of the data logger on the shore side.

2.7.2 Analysis of near shore profiles

The data received by LNTIEL was analysed by plotting each of the near shore profiles and the respective cross shore profiles wherever available. The aim of this exercise was to check the data quality and to study the consistency between the two datasets.



Legend of profile comparison plots

2.7.2.1 Profiles at CSP 2 (Edappadu Beach)

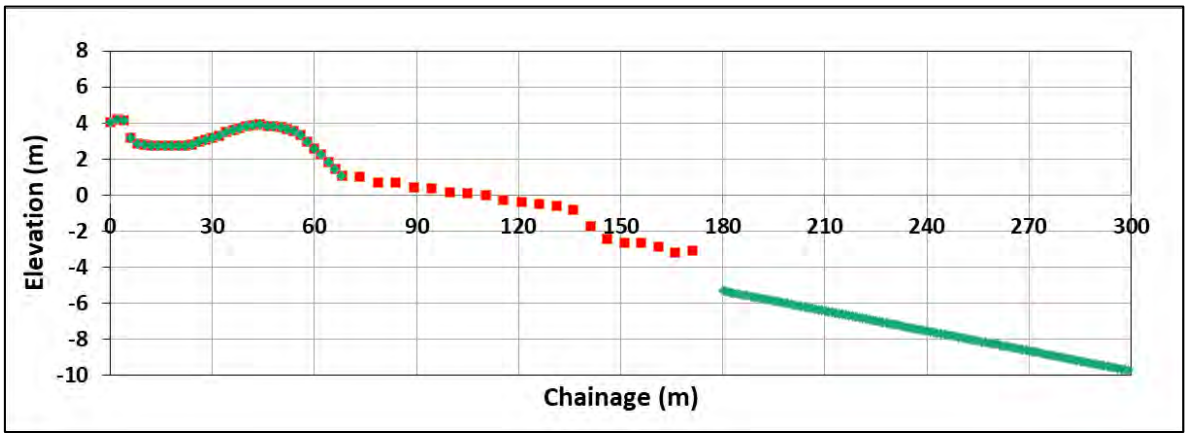


Figure 2-180 Profiles at CSP 2 (Edappadu Beach) from Cross shore and near shore surveys during February 2022

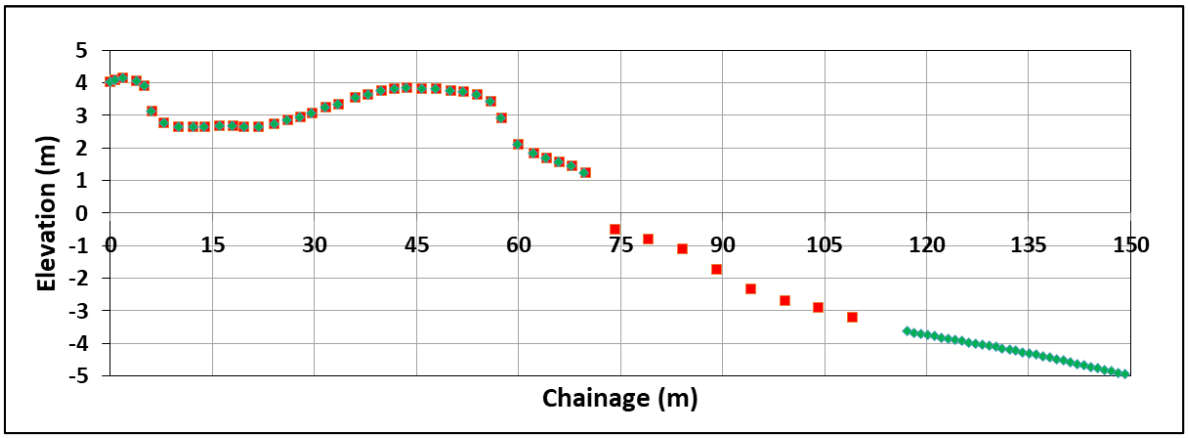


Figure 2-181 Profiles at CSP 2 (Edappadu Beach) from Cross shore and near shore surveys during March 2022

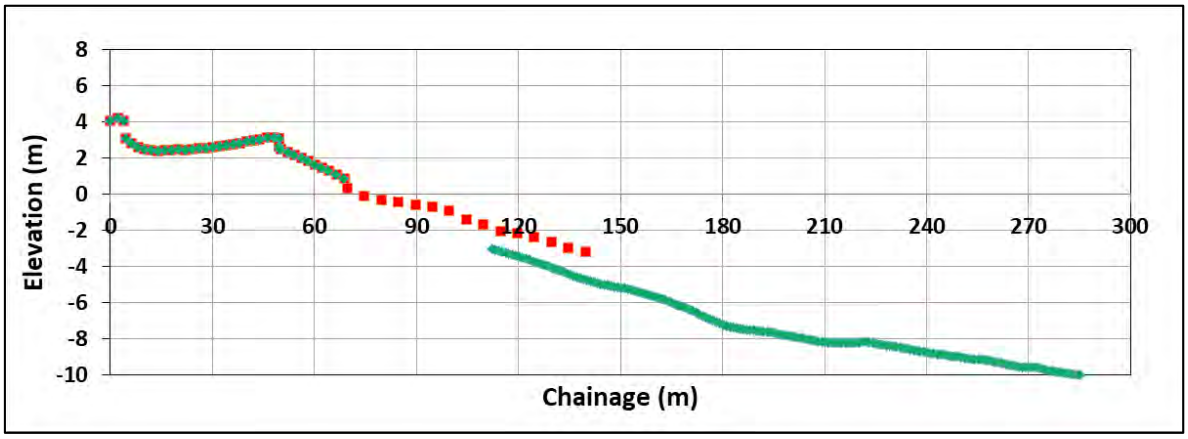
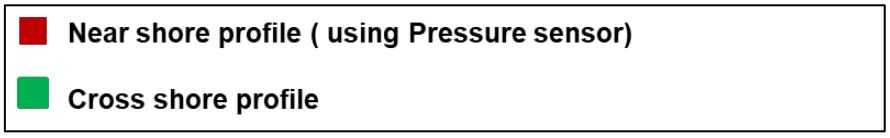


Figure 2-182 Profiles at CSP 2 (Edappadu Beach) from Cross shore and near shore surveys during January 2023



Legend of profile comparison plots

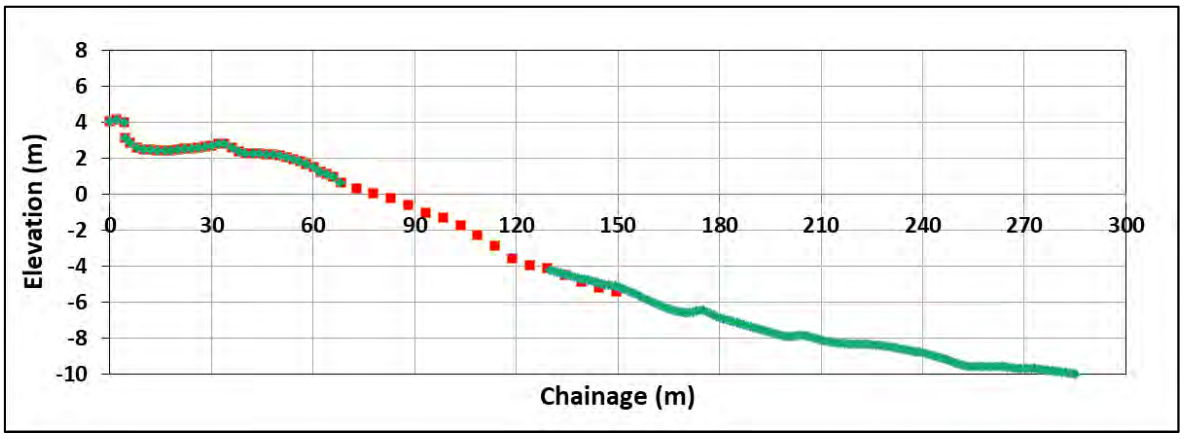


Figure 2-183 Profiles at CSP 2 (Edappadu Beach) from Cross shore and near shore surveys during March 2023

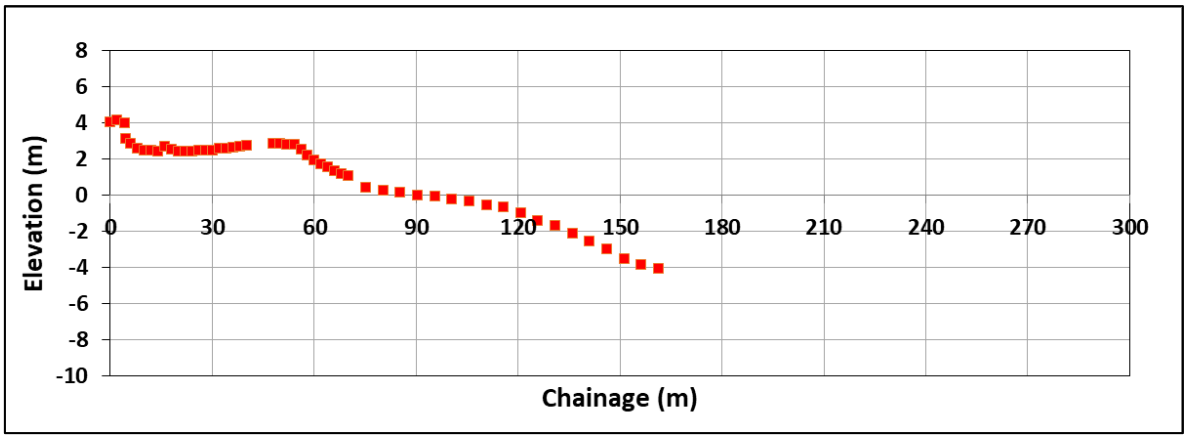


Figure 2-184 Profile at CSP 2 (Edappadu Beach) from near shore survey during April 2023

2.7.2.2 Profiles at CSP 33 (Adimalathura)

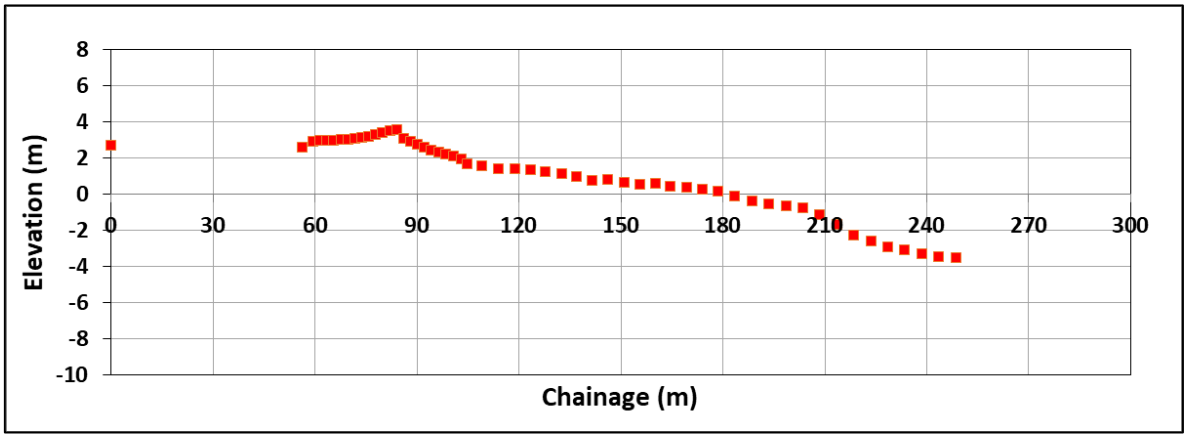
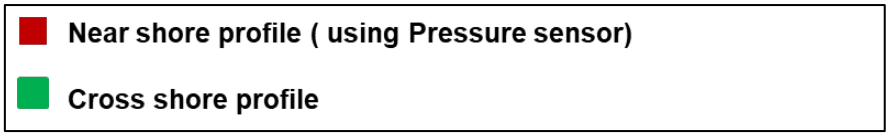


Figure 2-185 Profile at CSP 33 (Adimalathura) from near shore surveys during February 2022



Legend of profile comparison plots

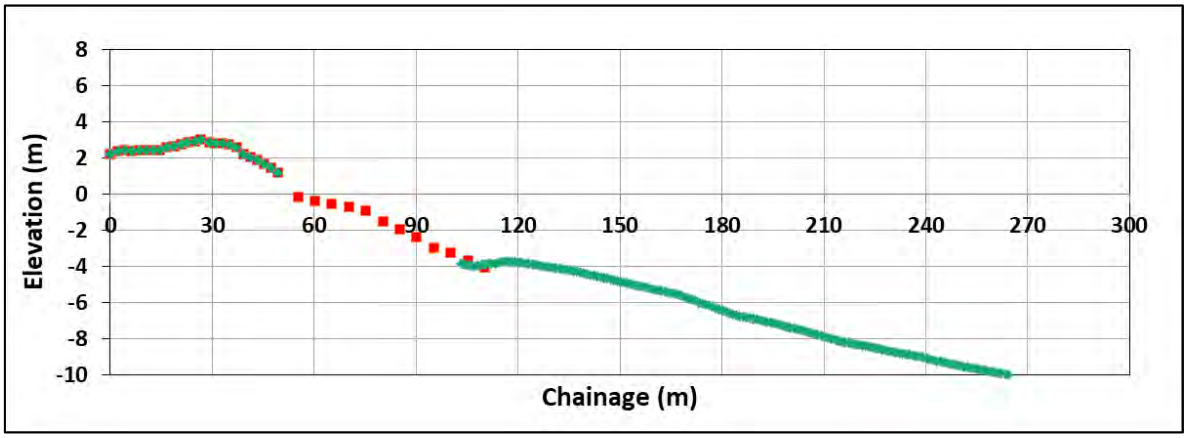


Figure 2-186 Profiles at CSP 33 (Adimalathura) from Cross shore and near shore surveys during March 2022

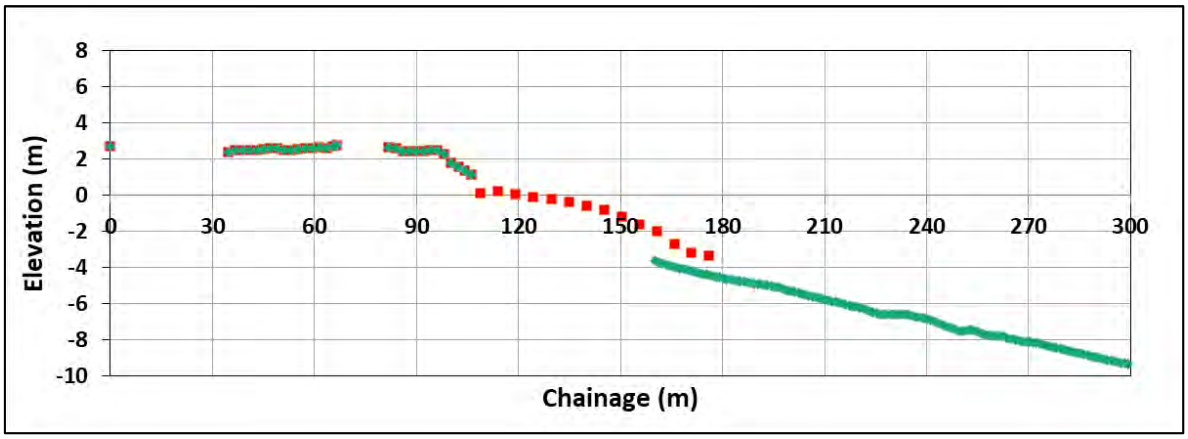


Figure 2-187 Profiles at CSP 33 (Adimalathura) from Cross shore and near shore surveys during January 2023

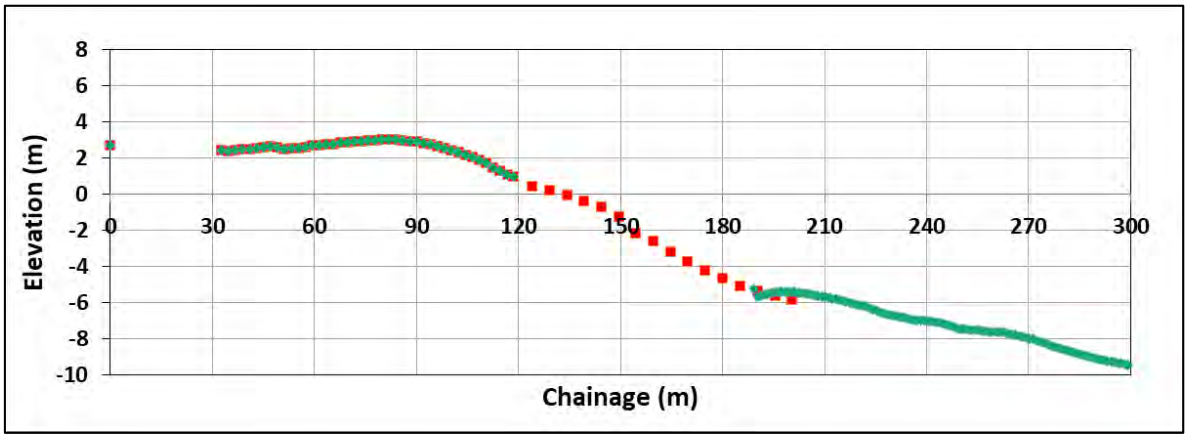
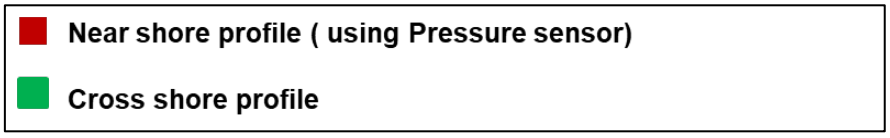


Figure 2-188 Profiles at CSP 33 (Adimalathura) from Cross shore and near shore surveys during March 2023



Legend of profile comparison plots

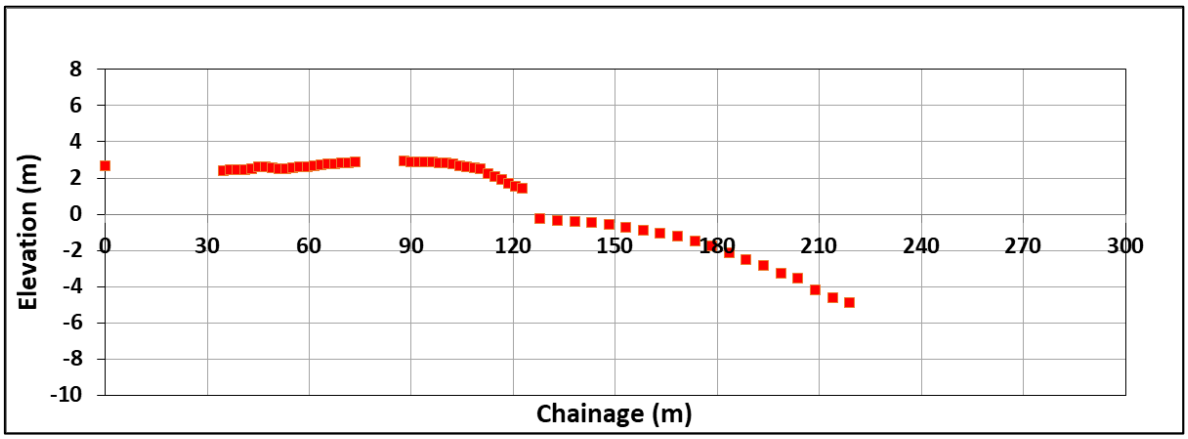


Figure 2-189 Profile at CSP 33 (Adimalathura) from near shore surveys during April 2023

2.7.2.3 Profiles at CSP 34 (Adimalathura)

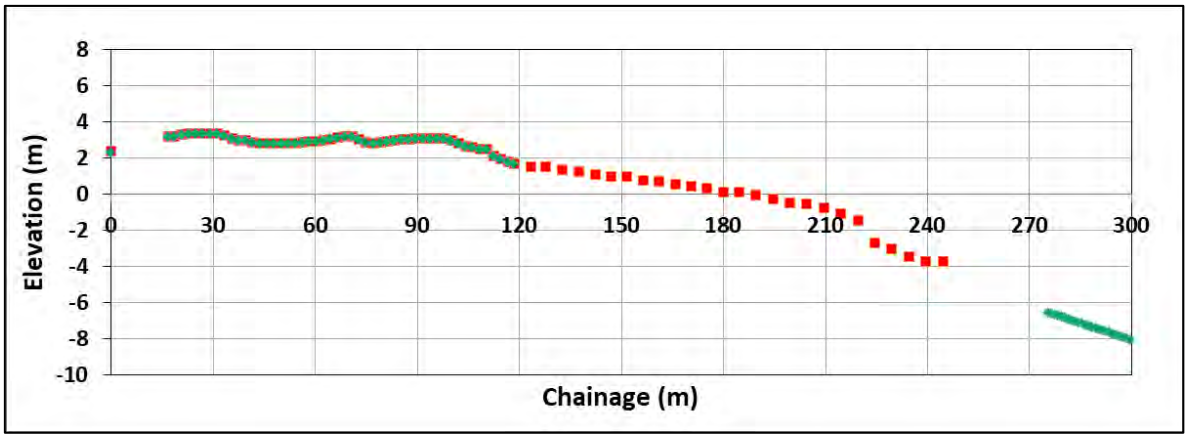


Figure 2-190 Profiles at CSP 34 (Adimalathura) from Cross shore and near shore surveys during February 2022

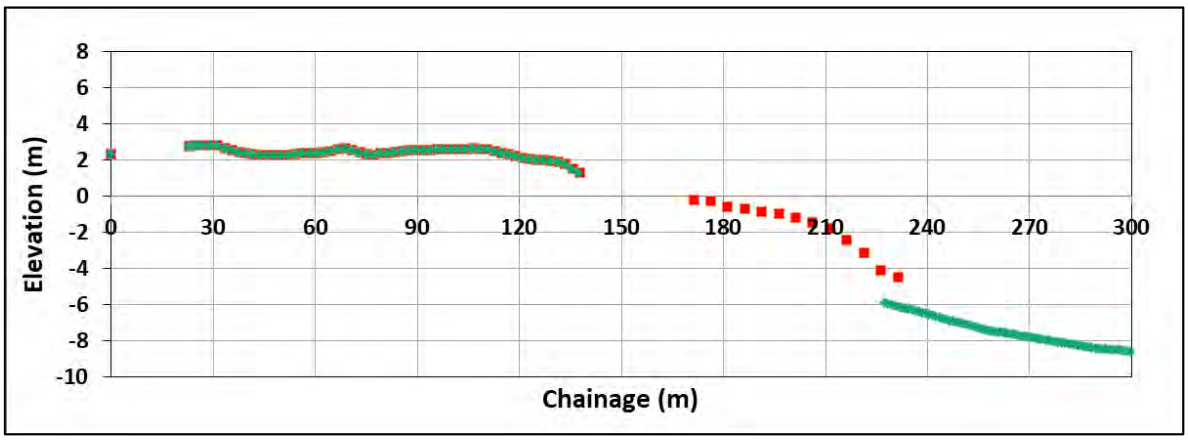
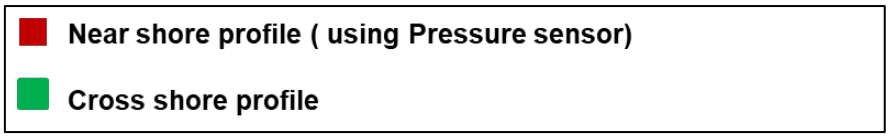


Figure 2-191 Profiles at CSP 34 (Adimalathura) from Cross shore and near shore surveys during March 2022



Legend of profile comparison plots

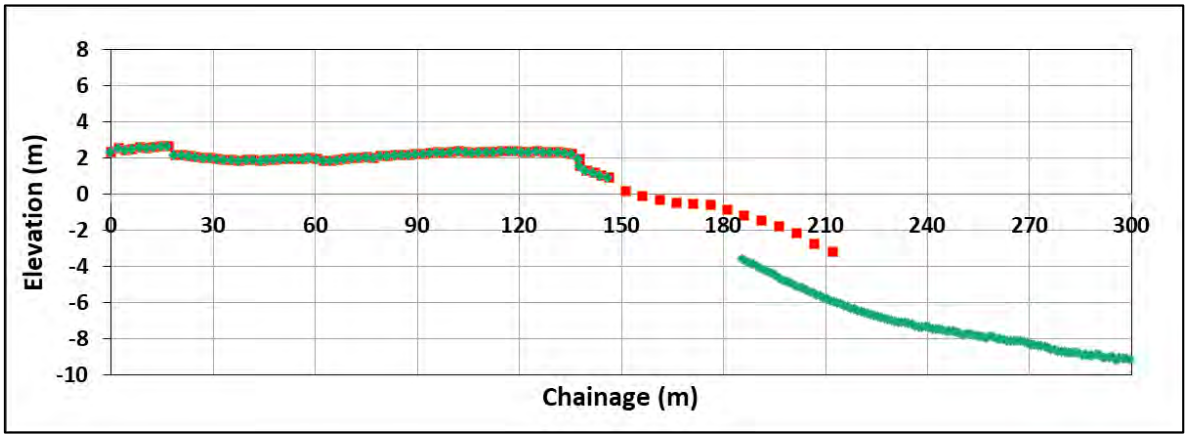


Figure 2-192 Profiles at CSP 34 (Adimalathura) from Cross shore and near shore surveys during January 2023

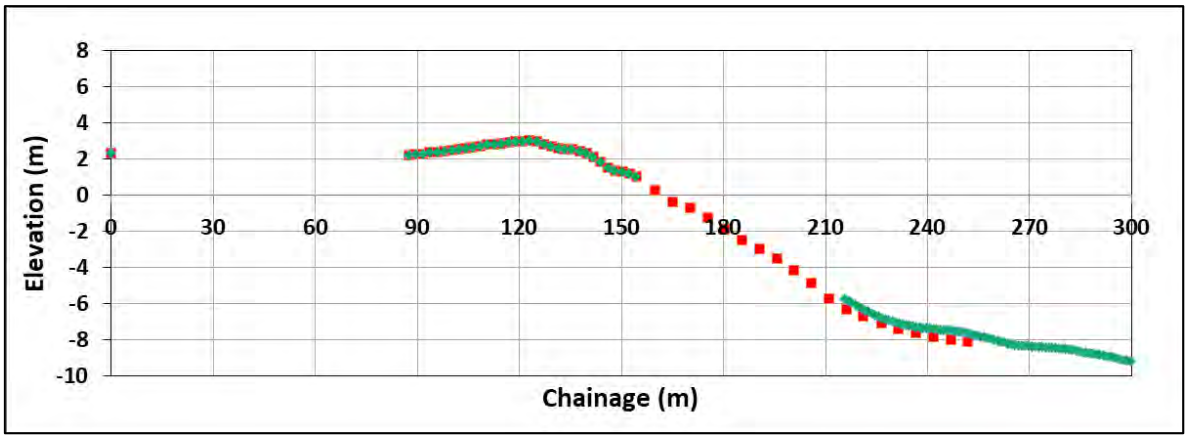


Figure 2-193 Profiles at CSP 34 (Adimalathura) from Cross shore and near shore surveys during March 2023

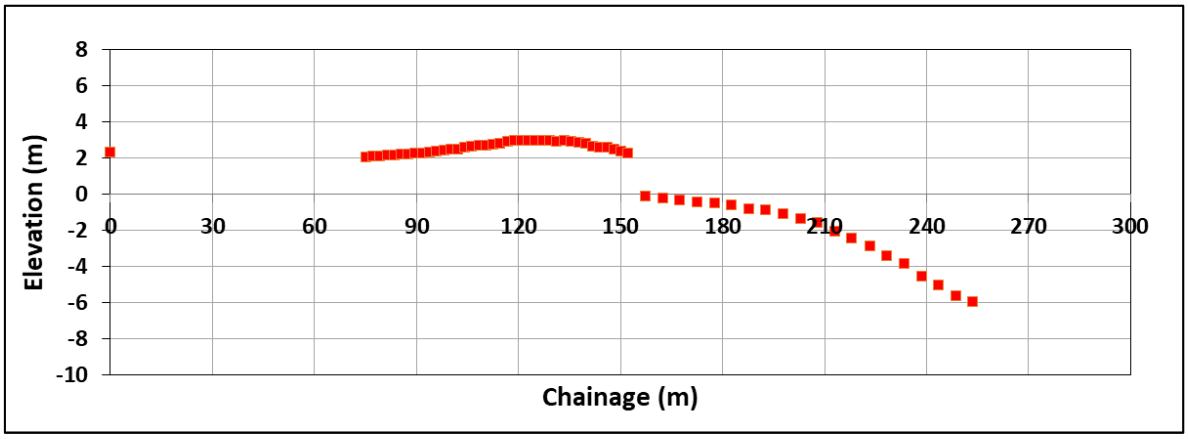
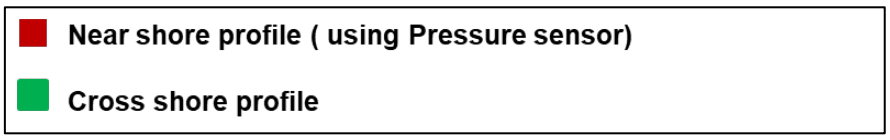


Figure 2-194 Profile at CSP 34 (Adimalathura) from near shore survey during April 2023



Legend of profile comparison plots

2.7.2.4 Profiles at CSP 68 (Shangumugham)

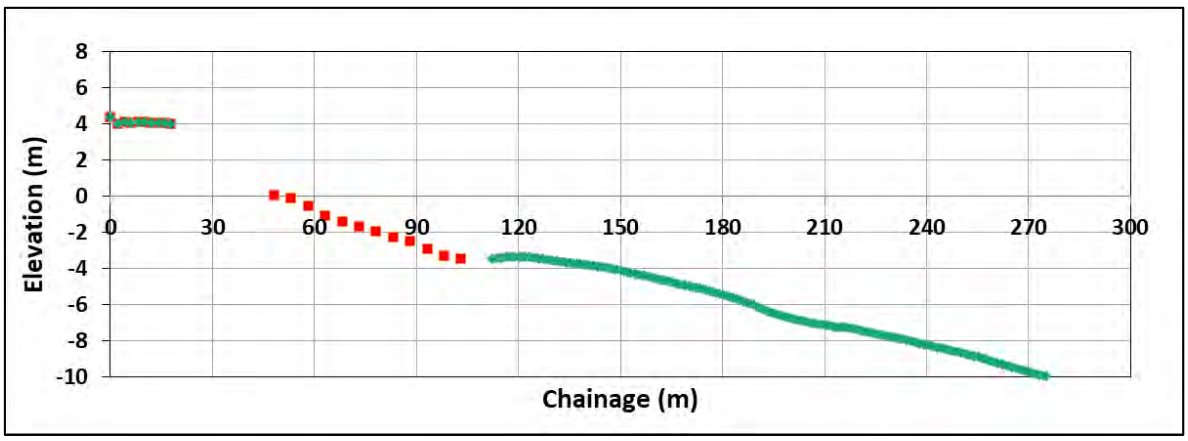


Figure 2-195 Profiles at CSP 68 (Shangumugham) from Cross shore and near shore surveys during March 2022

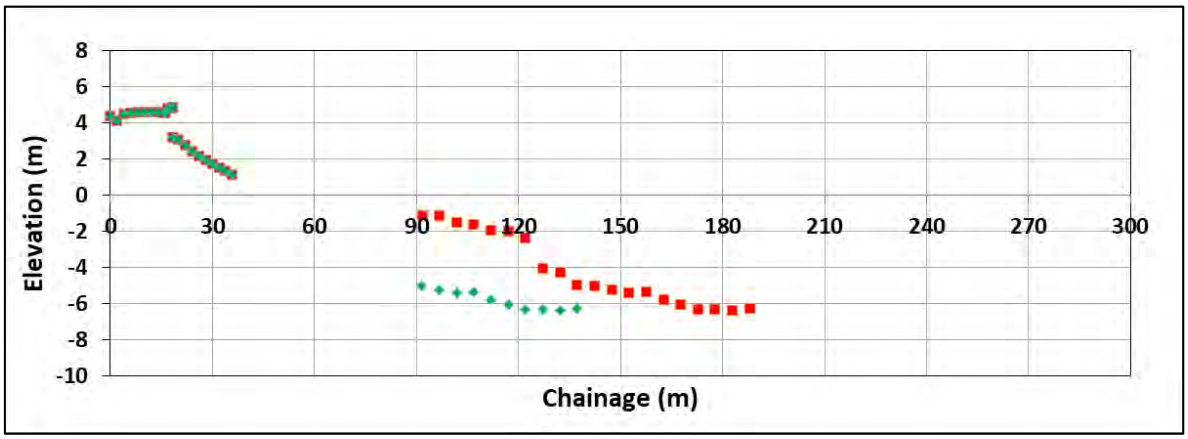


Figure 2-196 Profiles at CSP 68 (Shangumugham) from Cross shore and near shore surveys during June 2022

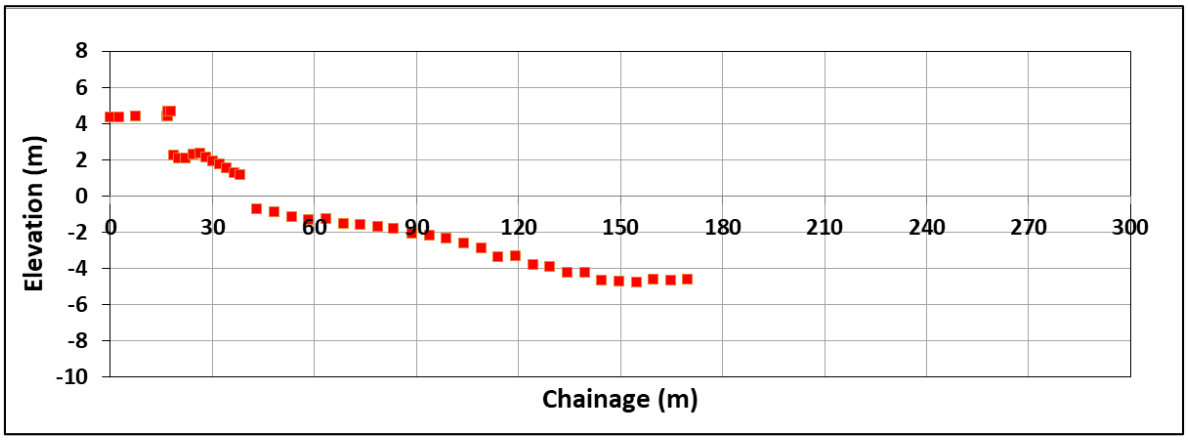
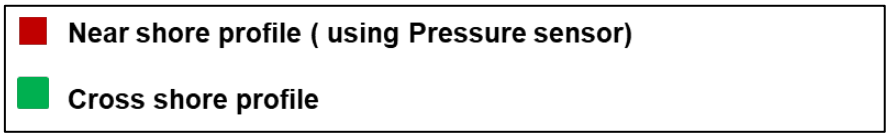


Figure 2-197 Profile at CSP 68 (Shangumugham) from near shore survey during October 2022



Legend of profile comparison plots

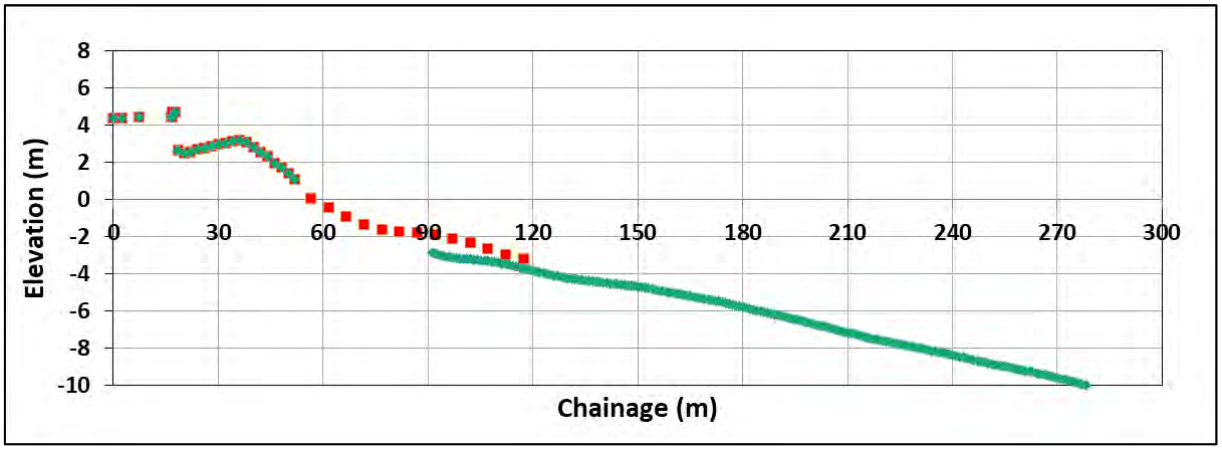


Figure 2-198 Profiles at CSP 68 (Shangumugham) from Cross shore and near shore surveys during December 2022

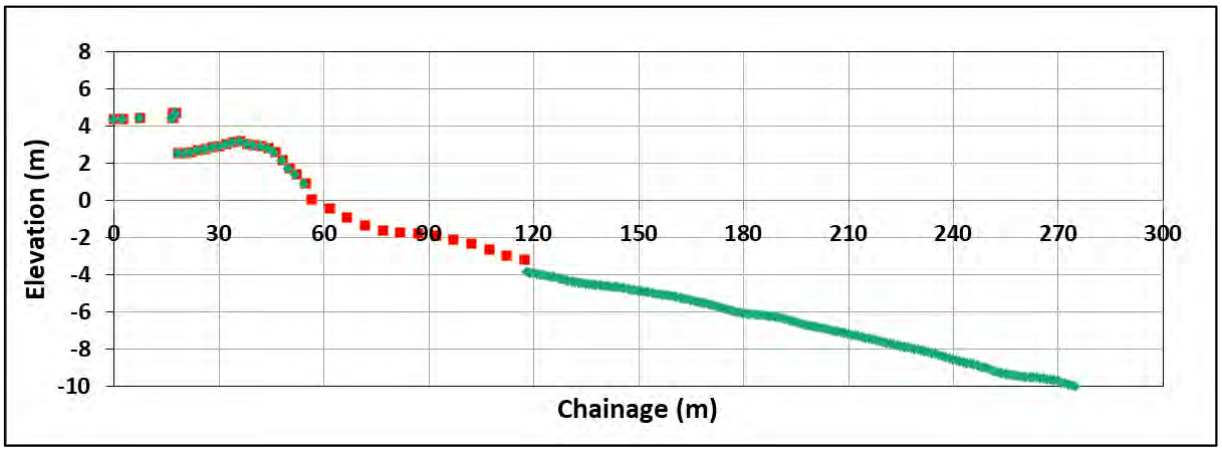


Figure 2-199 Profiles at CSP 68 (Shangumugham) from Cross shore and near shore surveys during January 2023

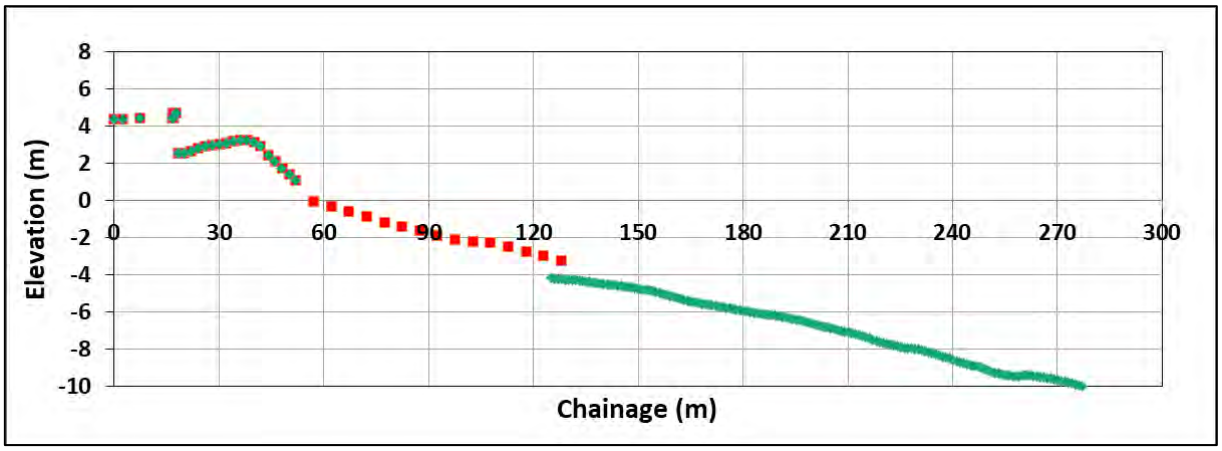
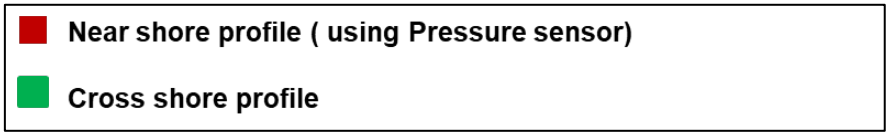


Figure 2-200 Profiles at CSP 68 (Shangumugham) from Cross shore and near shore surveys during February 2023



Legend of profile comparison plots

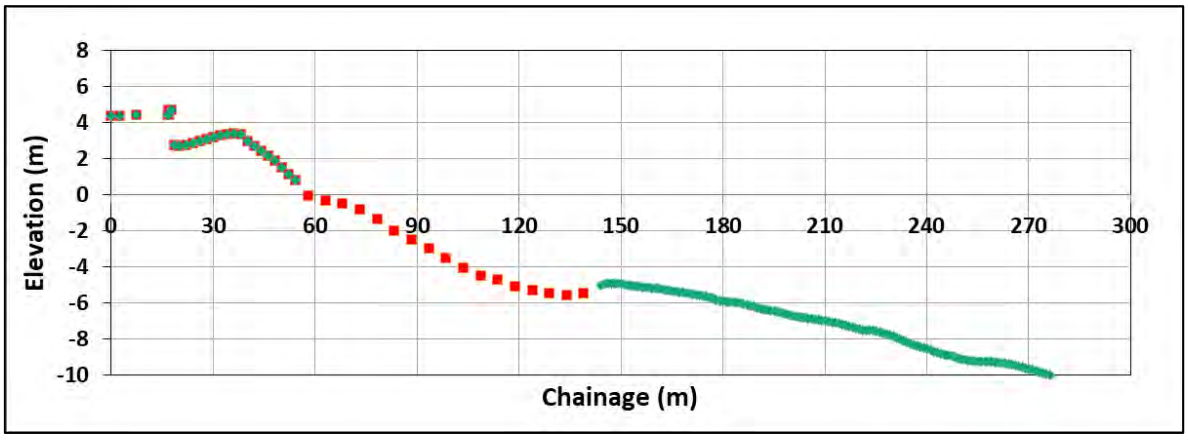


Figure 2-201 Profiles at CSP 68 (Shangumugham) from Cross shore and near shore surveys during March 2023

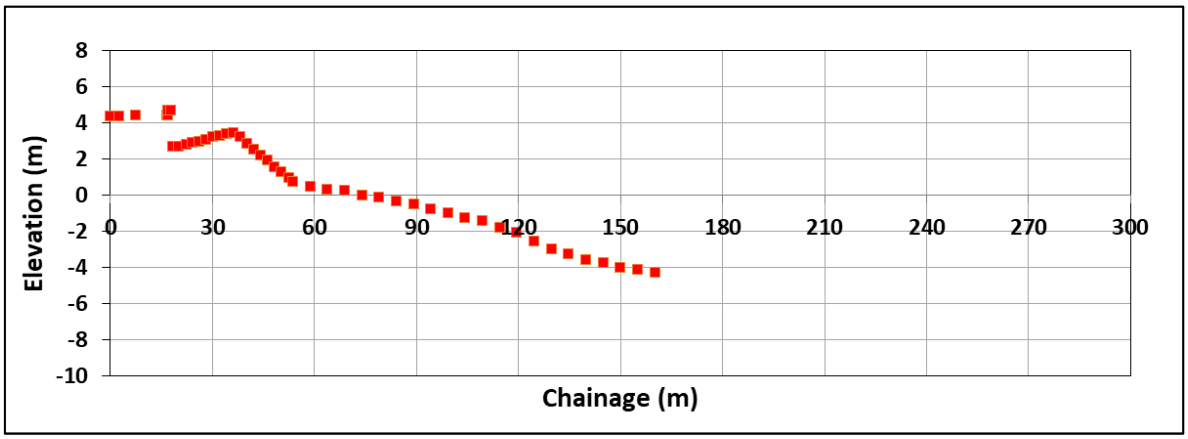


Figure 2-202 Profile at CSP 68 (Shangumugham) from near shore survey during April 2023

2.7.2.5 Profiles at CSP 69 (Shangumugham)

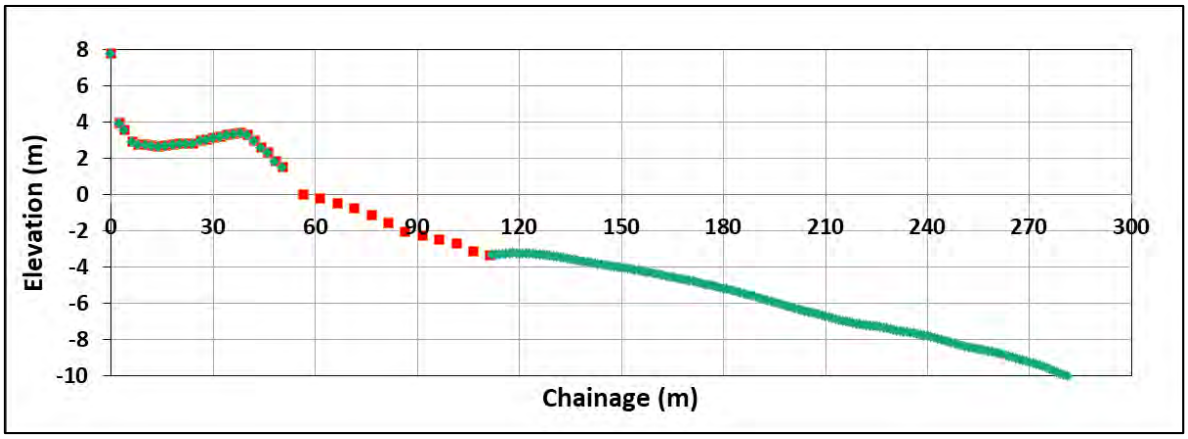
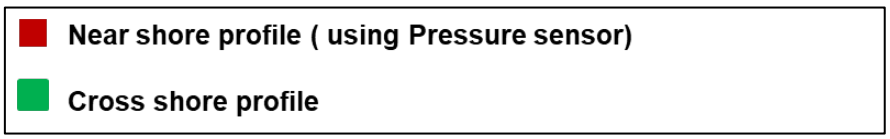


Figure 2-203 Profiles at CSP 69 (Shangumugham) from Cross shore and near shore surveys during March 2022



Legend of profile comparison plots

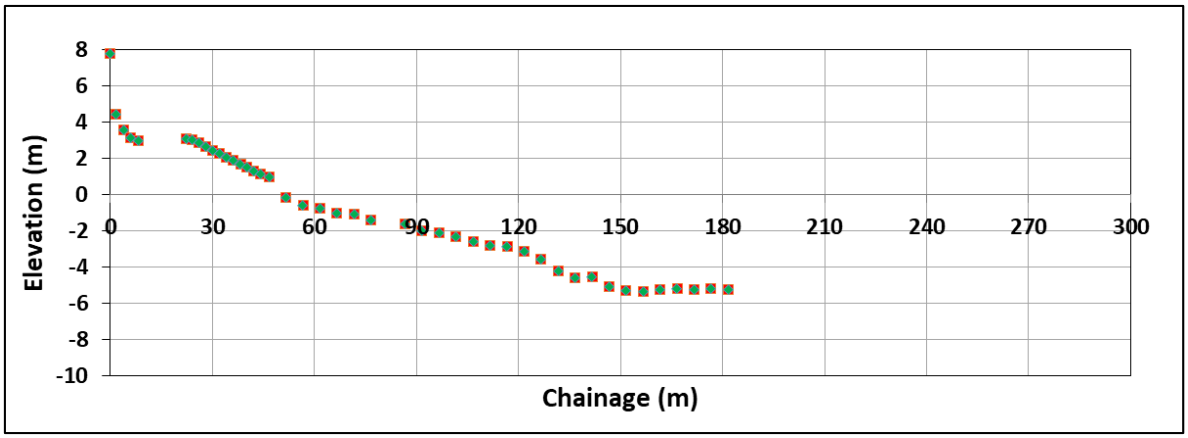


Figure 2-204 Profiles at CSP 69 (Shangumugham) from Cross shore and near shore surveys during June 2022

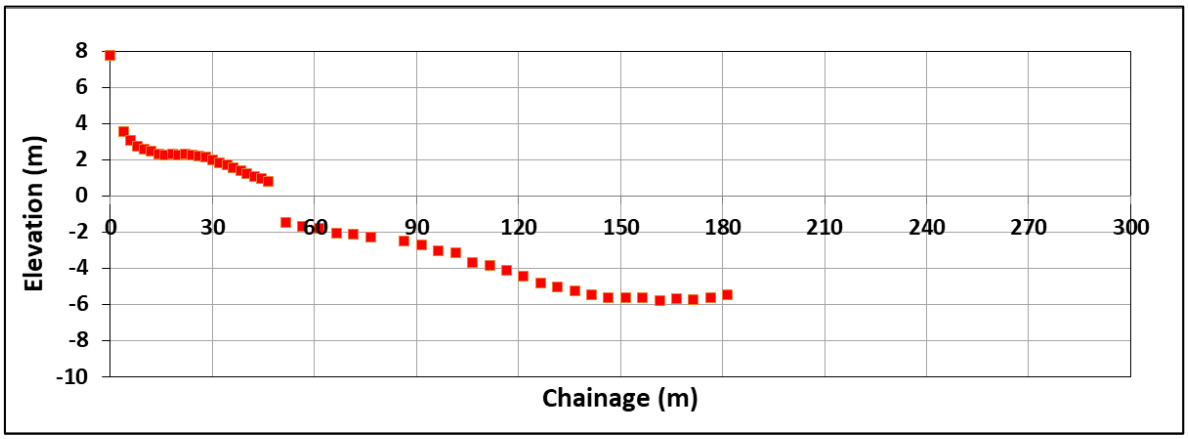


Figure 2-205 Profile at CSP 69 (Shangumugham) from near shore survey during October 2022

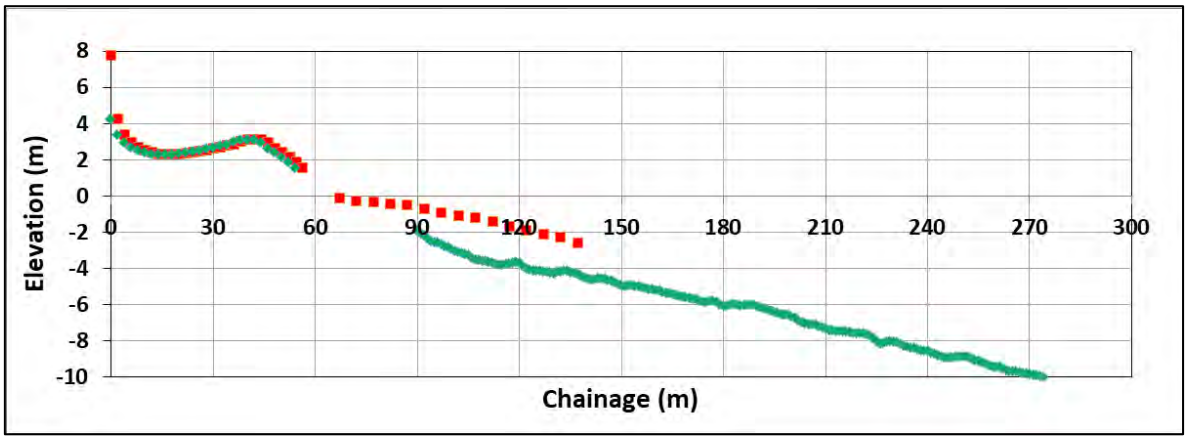
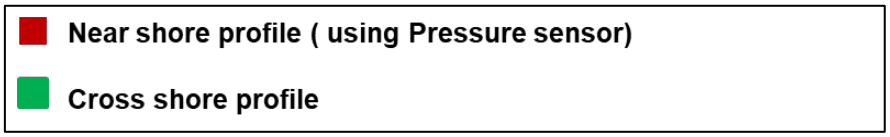


Figure 2-206 Profiles at CSP 69 (Shangumugham) from Cross shore and near shore surveys during December 2022



Legend of profile comparison plots

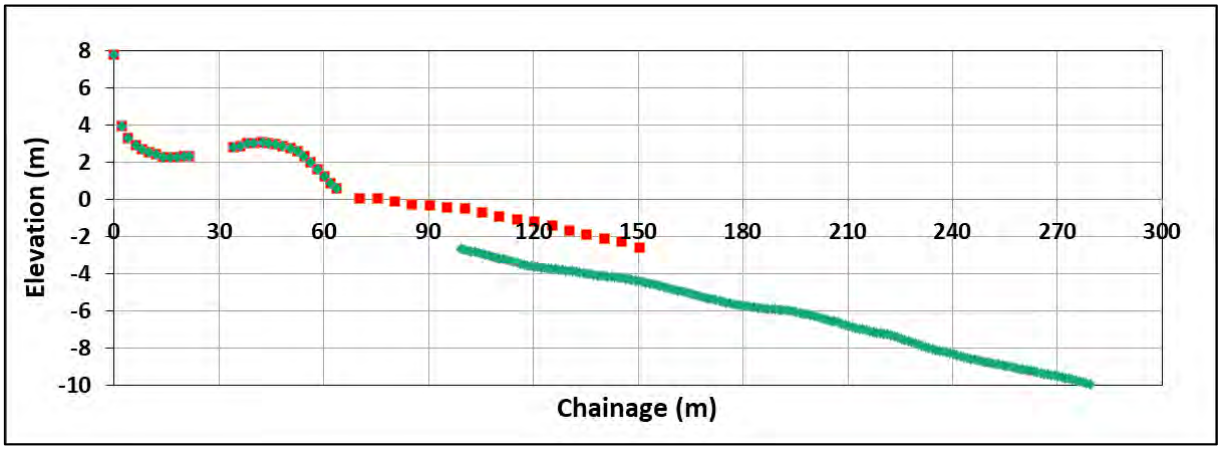


Figure 2-207 Profiles at CSP 69 (Shangumugham) from Cross shore and near shore surveys during January 2023

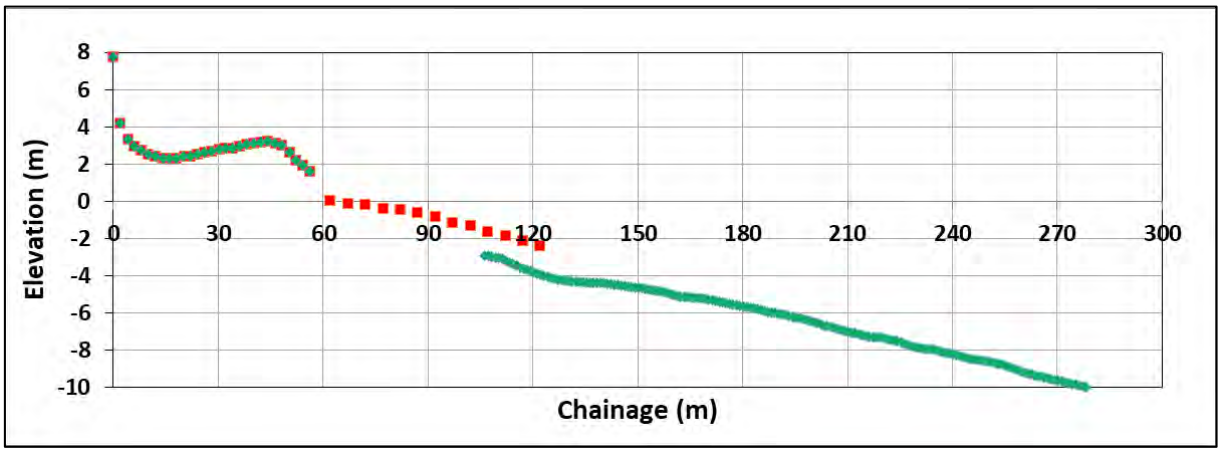


Figure 2-208 Profiles at CSP 69 (Shangumugham) from Cross shore and near shore surveys during February 2023

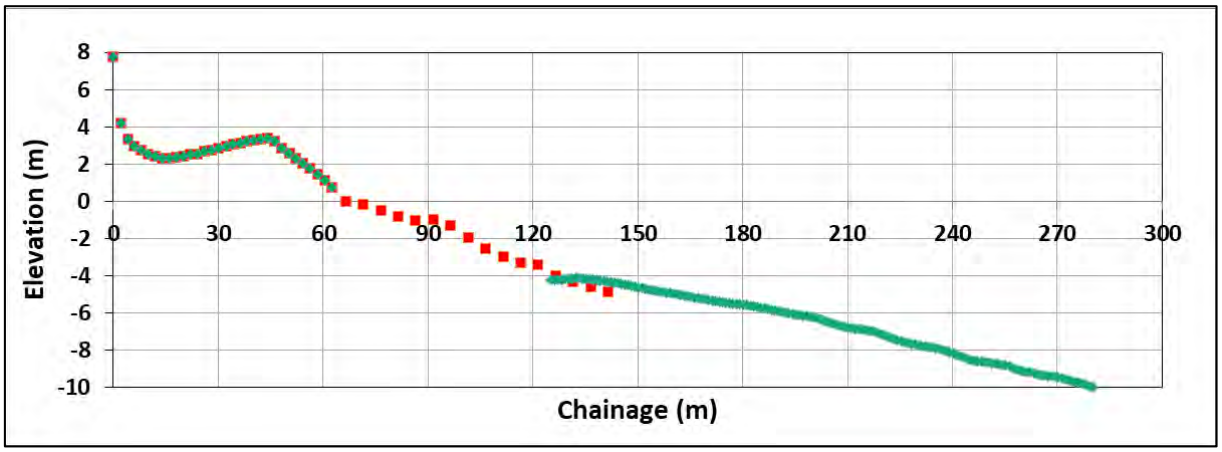
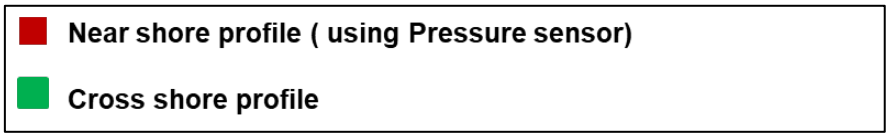


Figure 2-209 Profiles at CSP 69 (Shangumugham) from Cross shore and near shore surveys during March 2023



Legend of profile comparison plots

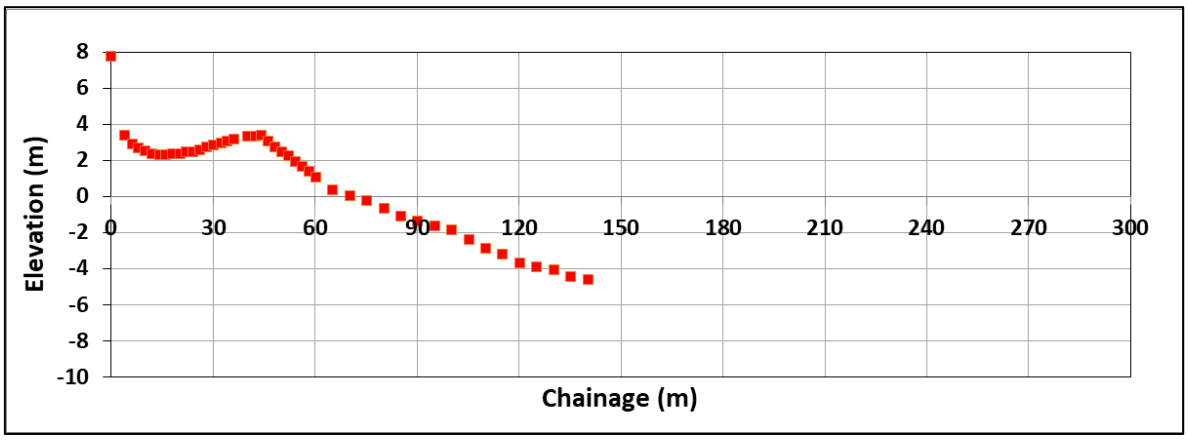


Figure 2-210 Profile at CSP 69 (Shangumugham) from near shore survey during April 2023

2.7.2.6 Profiles at CSP 73 (Vettucaud)

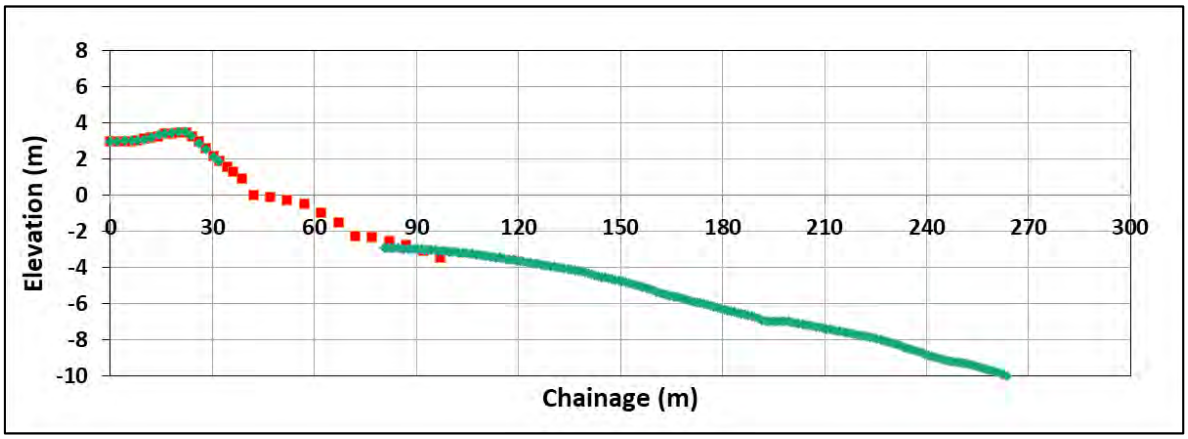


Figure 2-211 Profiles at CSP 73 (Vettucaud) from Cross shore and near shore surveys during March 2022

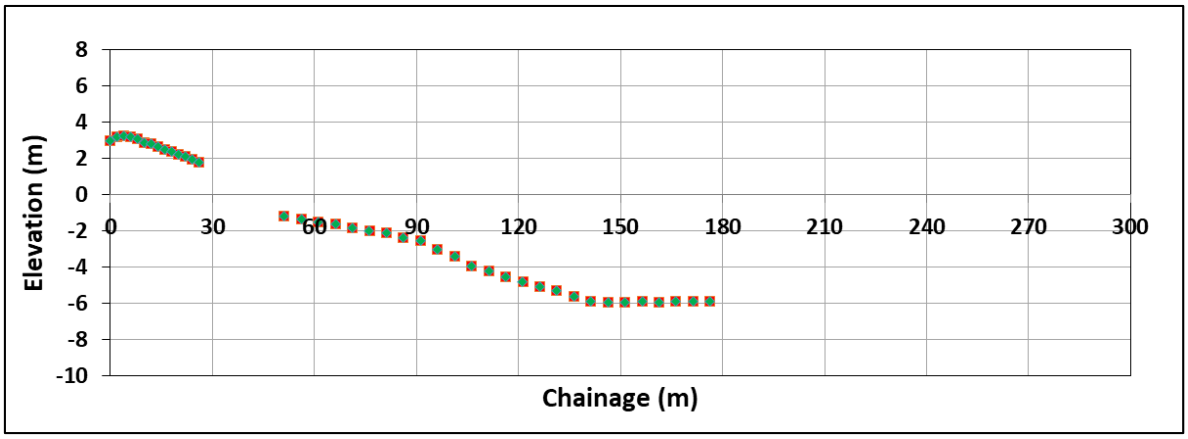
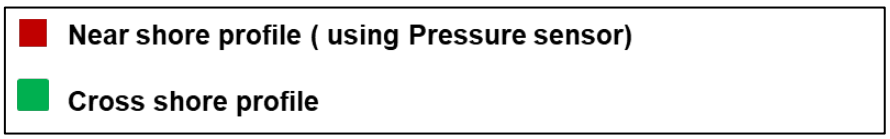


Figure 2-212 Profiles at CSP 73 (Vettucaud) from Cross shore and near shore surveys during June 2022



Legend of profile comparison plots

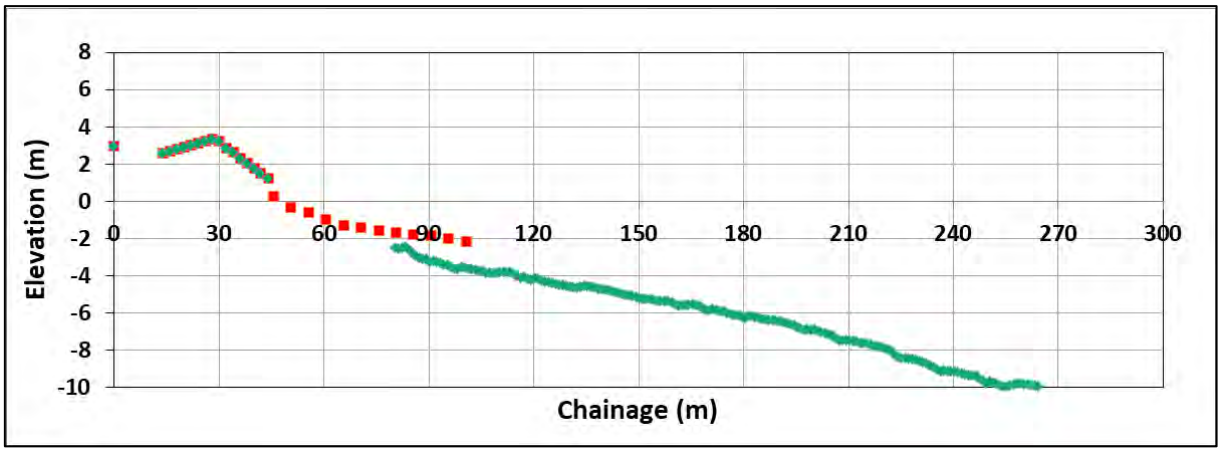


Figure 2-213 Profiles at CSP 73 (Vettucaud) from Cross shore and near shore surveys during December 2022

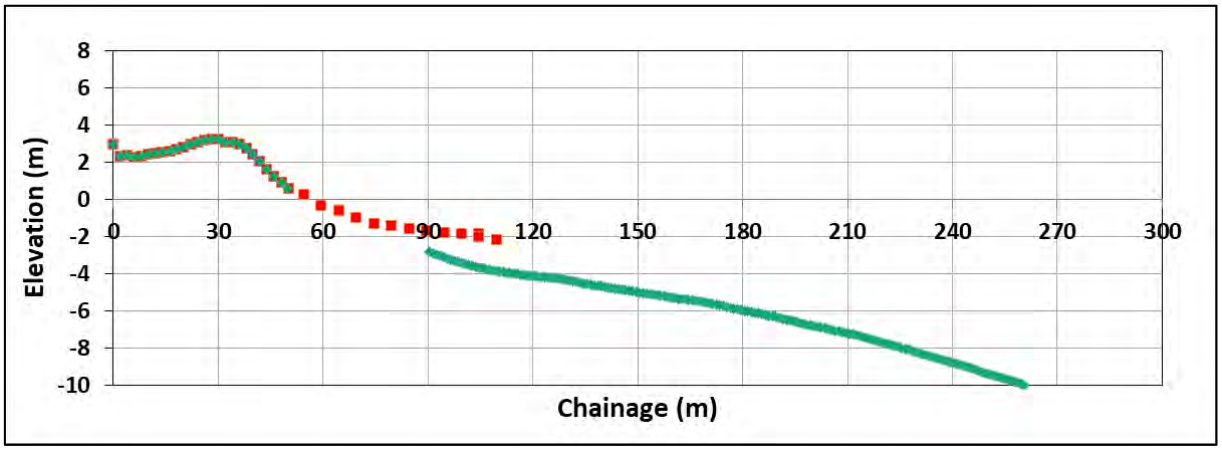


Figure 2-214 Profiles at CSP 73 (Vettucaud) from Cross shore and near shore surveys during January 2023

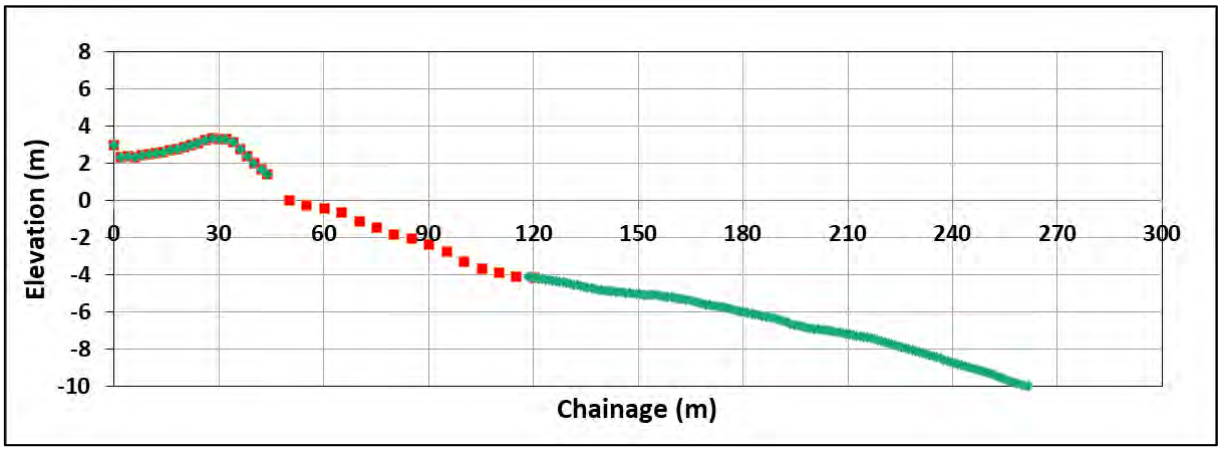
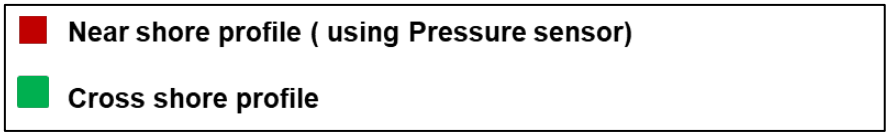


Figure 2-215 Profiles at CSP 73 (Vettucaud) from Cross shore and near shore surveys during February 2023



Legend of profile comparison plots

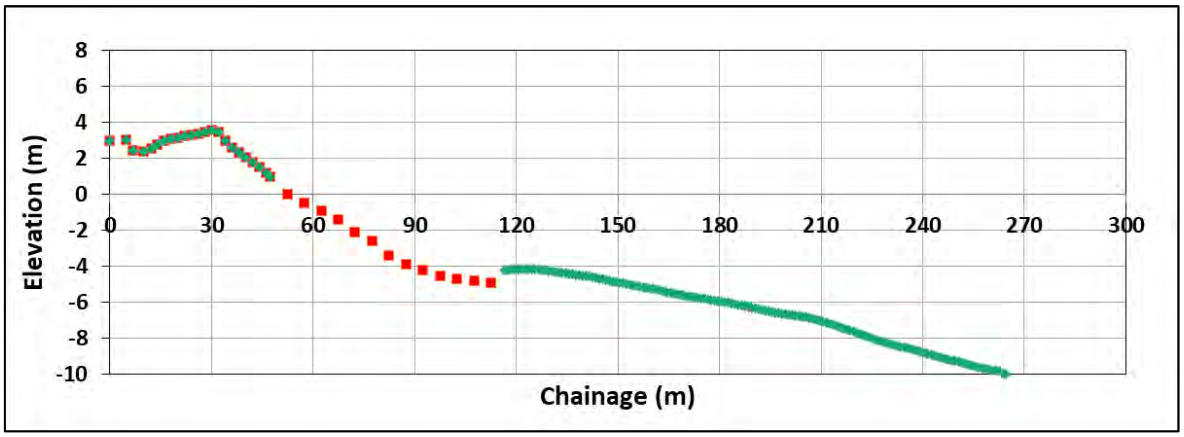


Figure 2-216 Profiles at CSP 73 (Vettucaud) from Cross shore and near shore surveys during March 2023

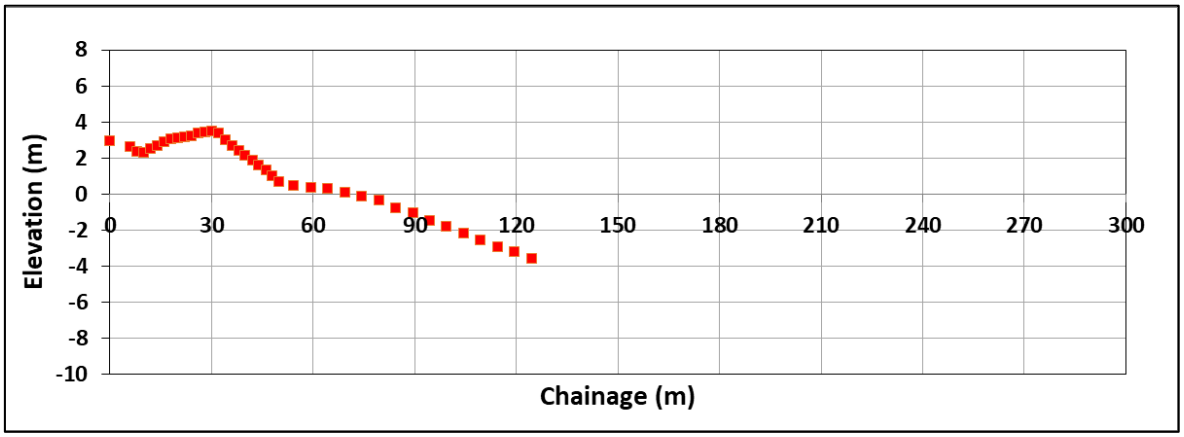


Figure 2-217 Profile at CSP 73 (Vettucaud) from near shore survey during April 2023

2.7.2.7 Profiles at CSP 74 (Vettucaud)

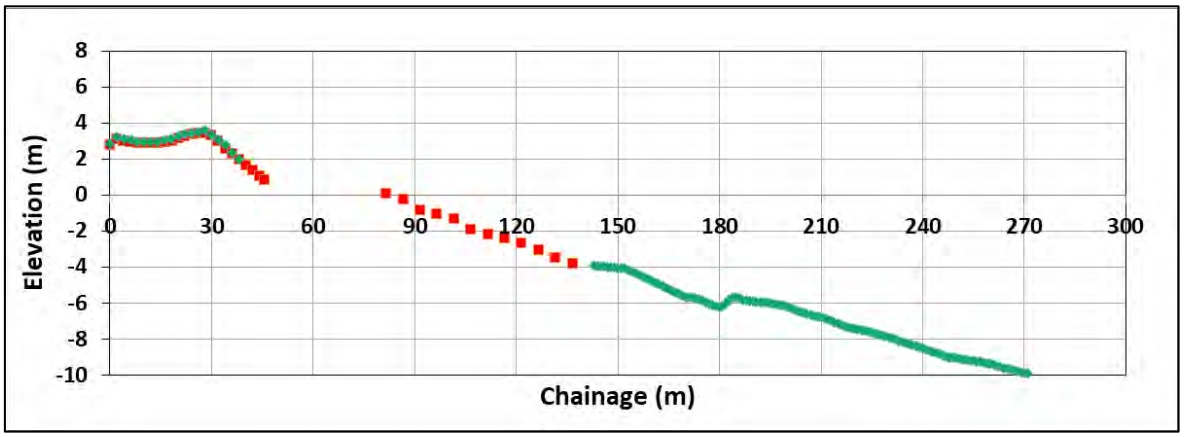
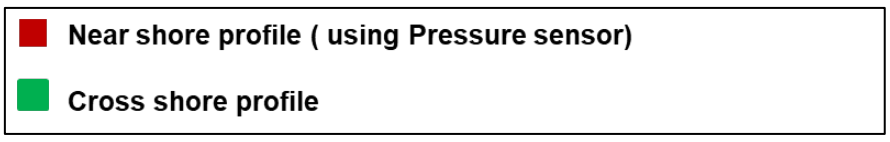


Figure 2-218 Profiles at CSP 74 (Vettucaud) from Cross shore and near shore surveys during March 2022



Legend of profile comparison plots

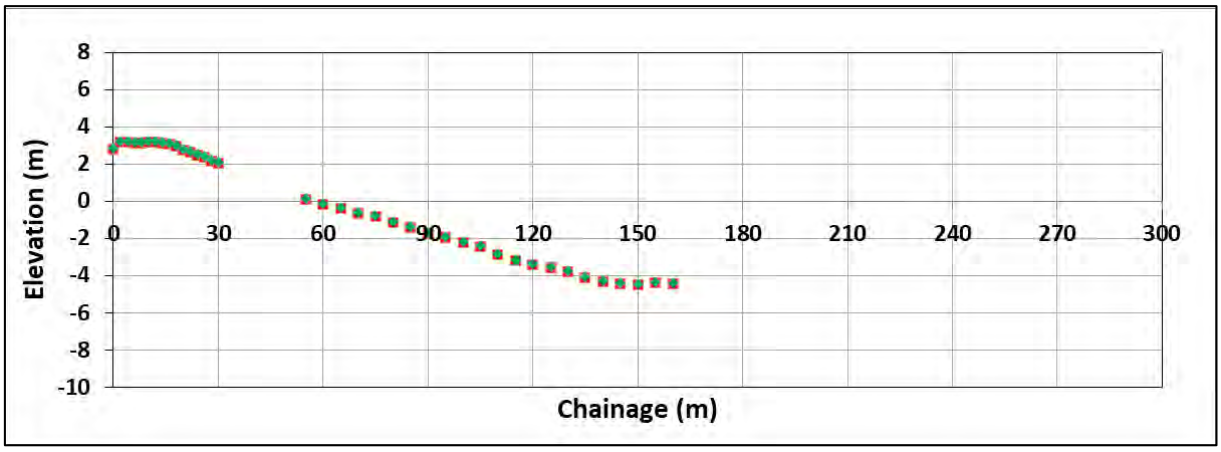


Figure 2-219 Profiles at CSP 74 (Vettucaud) from Cross shore and near shore surveys during June 2022

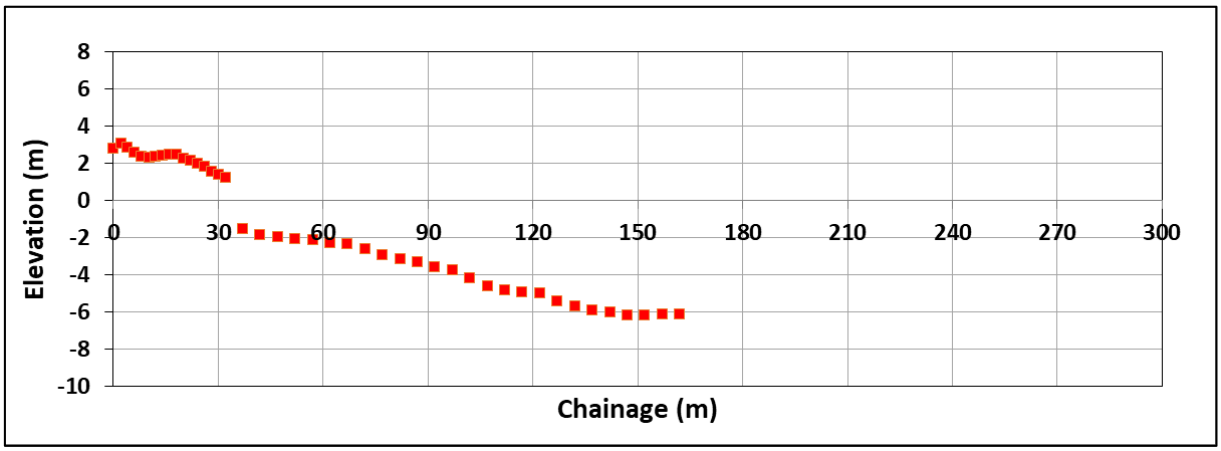


Figure 2-220 Profile at CSP 74 (Vettucaud) from near shore survey during October 2022

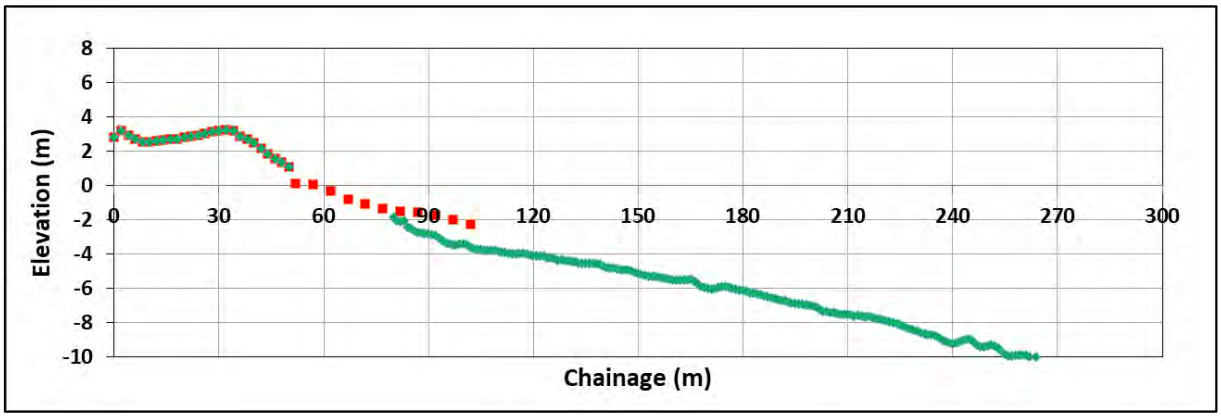
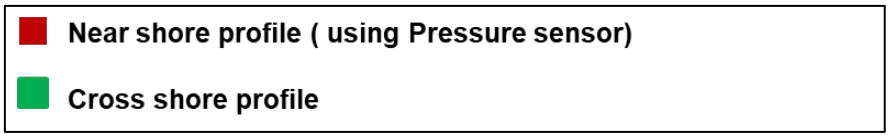


Figure 2-221 Profiles at CSP 74 (Vettucaud) from Cross shore and near shore surveys during December 2022



Legend of profile comparison plots

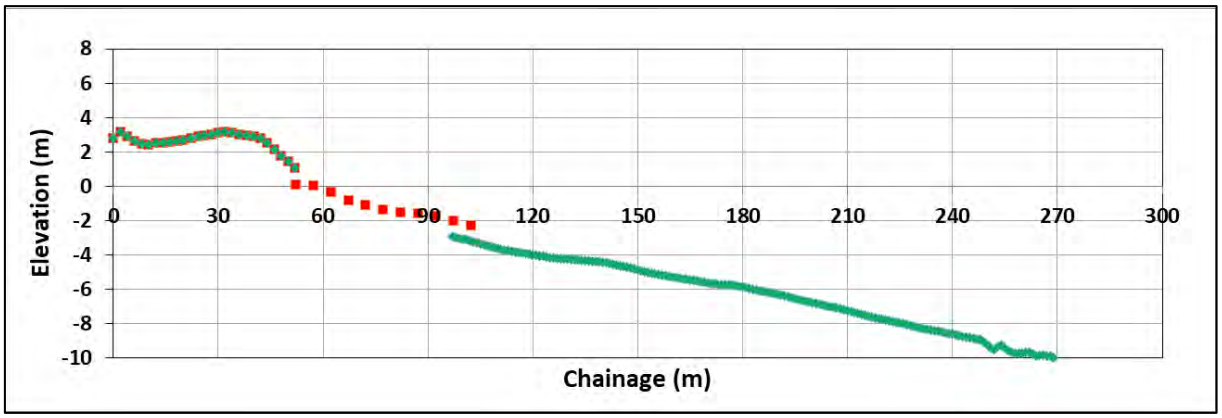


Figure 2-222 Profiles at CSP 74 (Vettucaud) from Cross shore and near shore surveys during January 2023

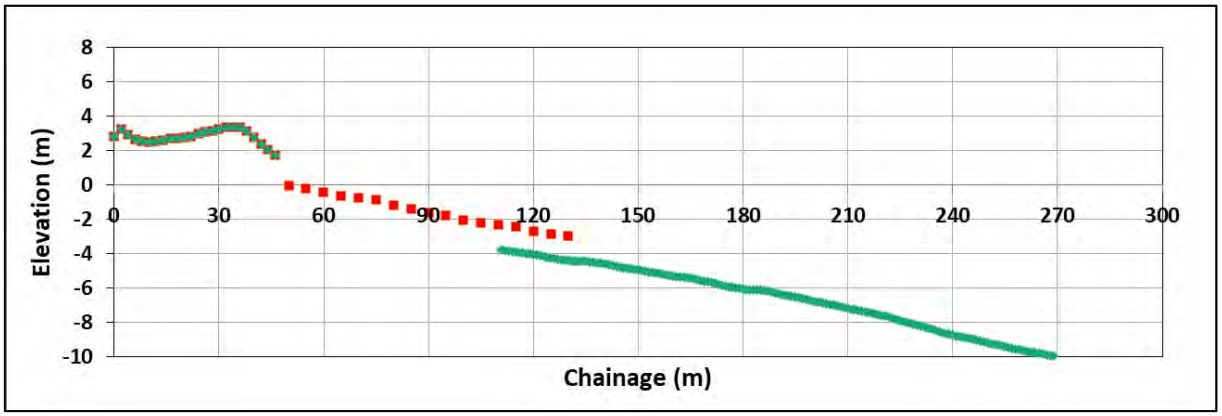


Figure 2-223 Profiles at CSP 74 (Vettucaud) from Cross shore and near shore surveys during February 2023

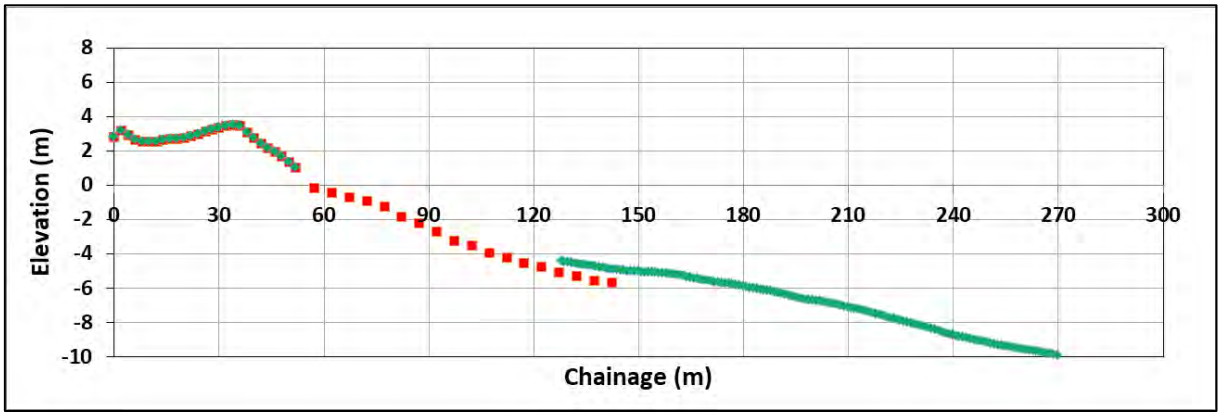
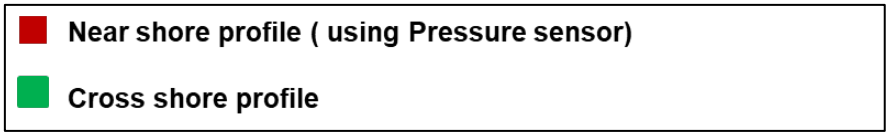


Figure 2-224 Profiles at CSP 74 (Vettucaud) from Cross shore and near shore surveys during March 2023



Legend of profile comparison plots

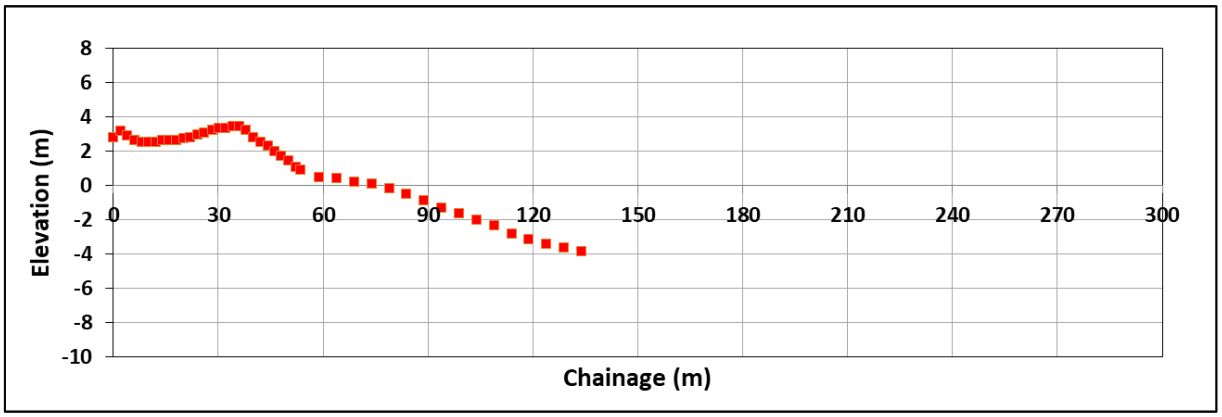
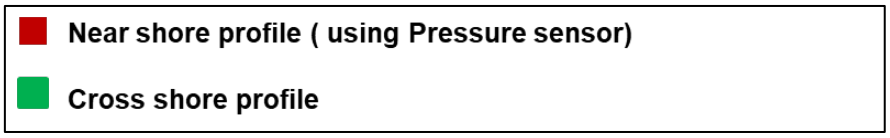


Figure 2-225 Profile at CSP 74 (Vettucaud) from near shore survey during April 2023



Legend of profile comparison plots

From the comparisons, it is noticed that there is significant variations between the two datasets at some CSP transects on the seaside where the cross shore and near shore profiles overlap.

2.8 Littoral environment observation

Littoral environment observation (LEO) data was provided by AVPPL at 81 locations. These locations were same as the cross-shore profile locations. In this type of survey, observers obtain monthly visual observations of coastal variables such as current speed, current direction, breaker angle, wave height, wave period and surf zone width.

Analysis was done for the period of February 2015 to September 2023. The focus was given to alongshore current behaviour over the months. Some of the observations are shown in Figure 2-226 to Figure 2-243.

Legend of Leo observation charts

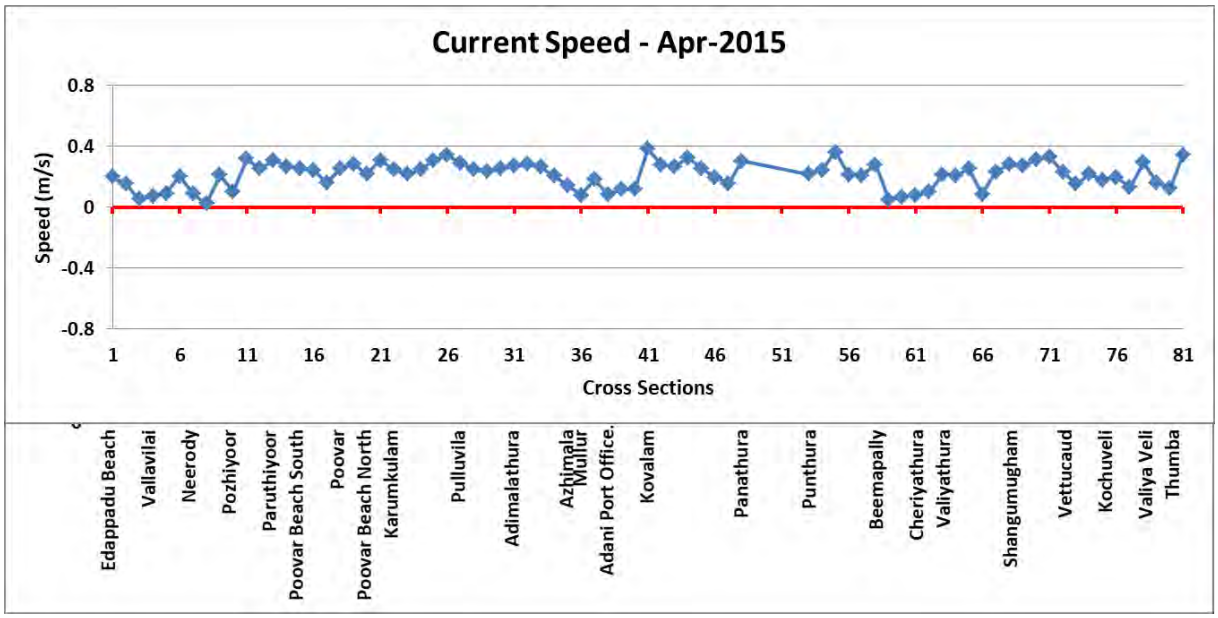


Figure 2-226 Alongshore current speed during April 2015

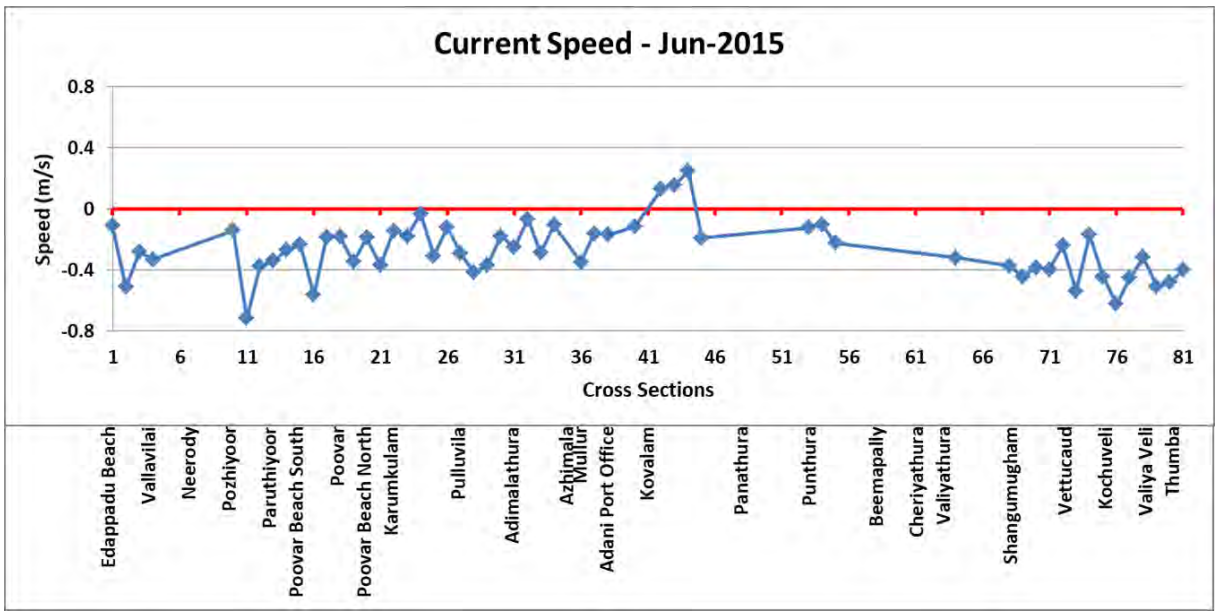


Figure 2-227 Alongshore current speed during June 2015

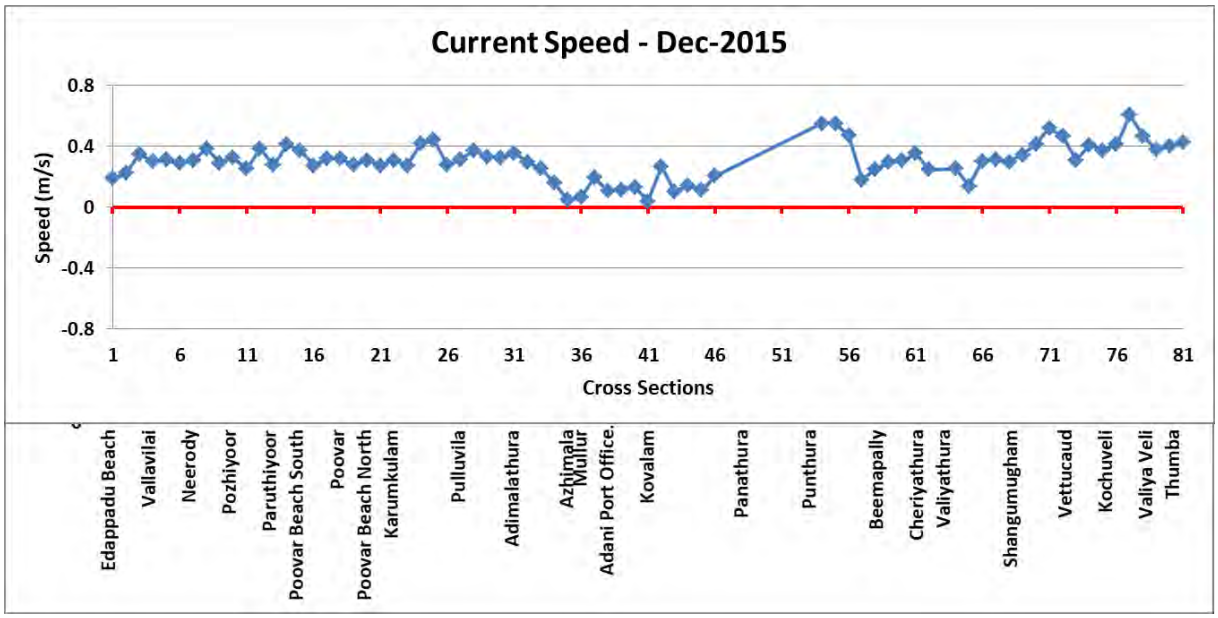


Figure 2-228 Alongshore current speed during December 2015

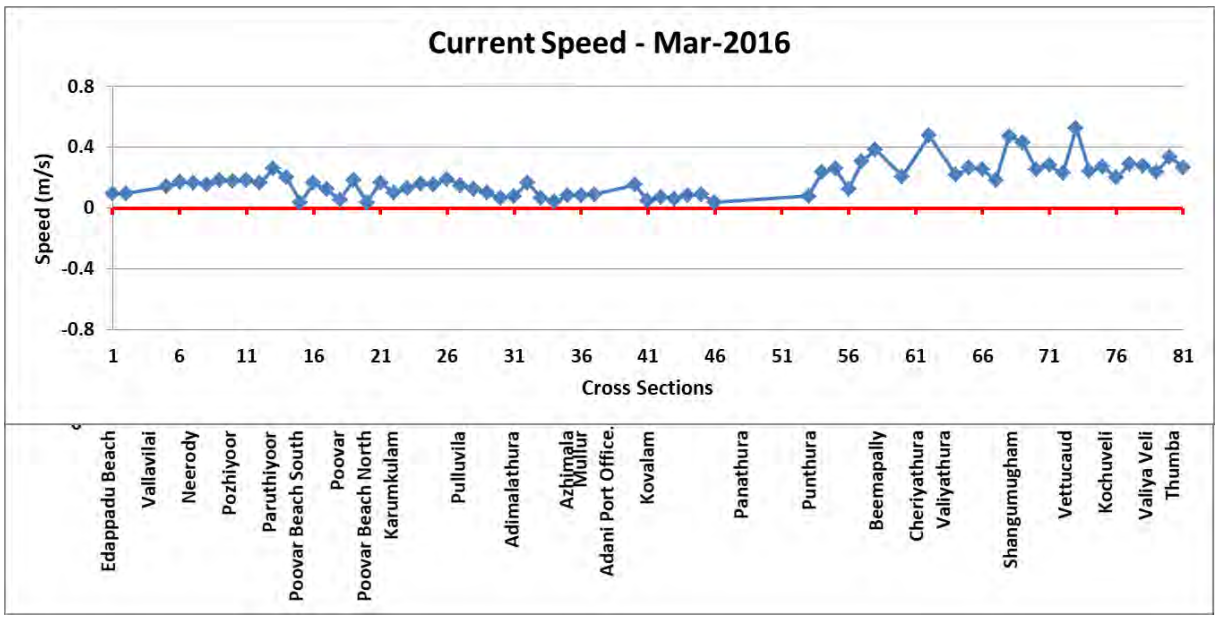


Figure 2-229 Alongshore current speed during March 2016

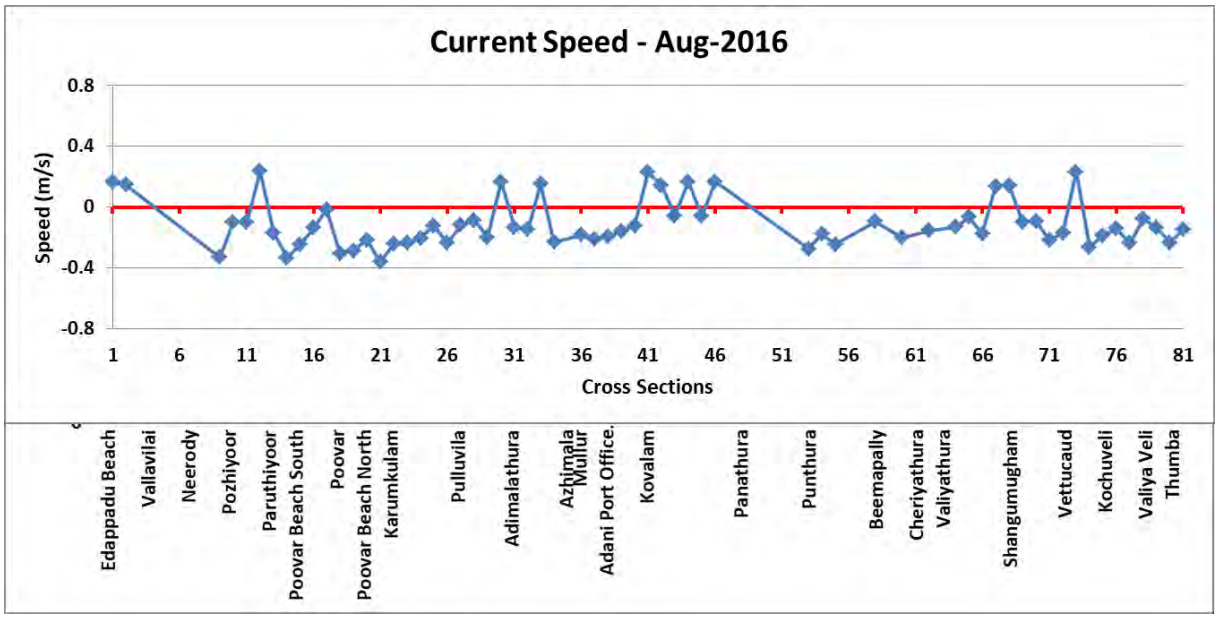


Figure 2-230 Alongshore current speed during August 2016

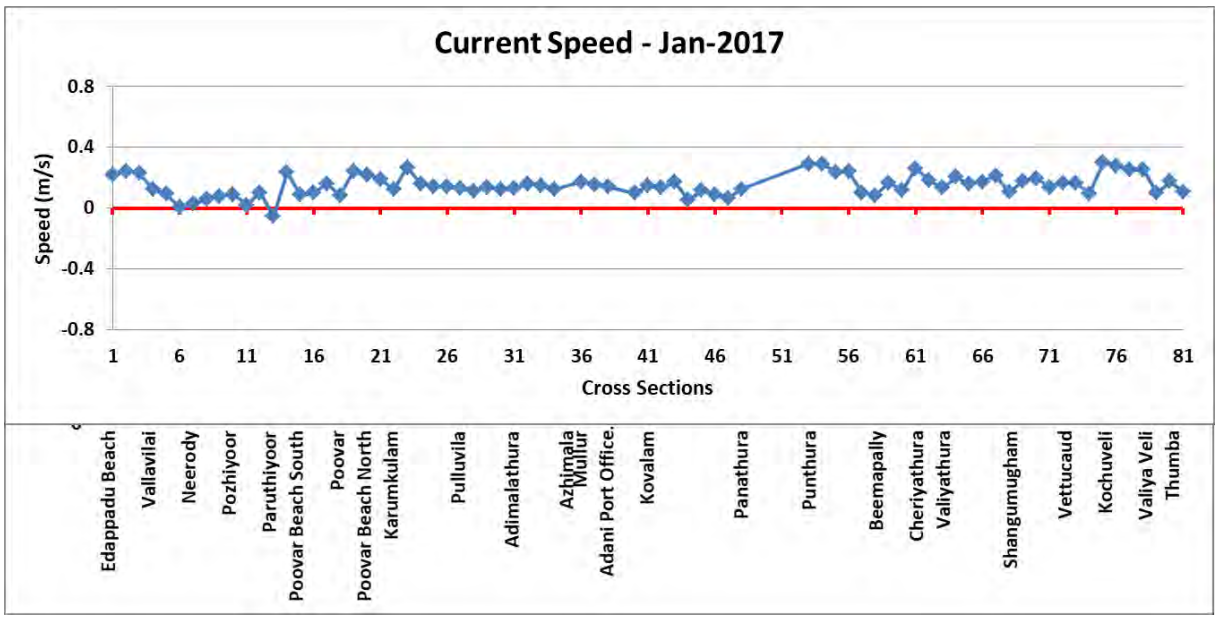


Figure 2-231 Alongshore current speed during January 2017

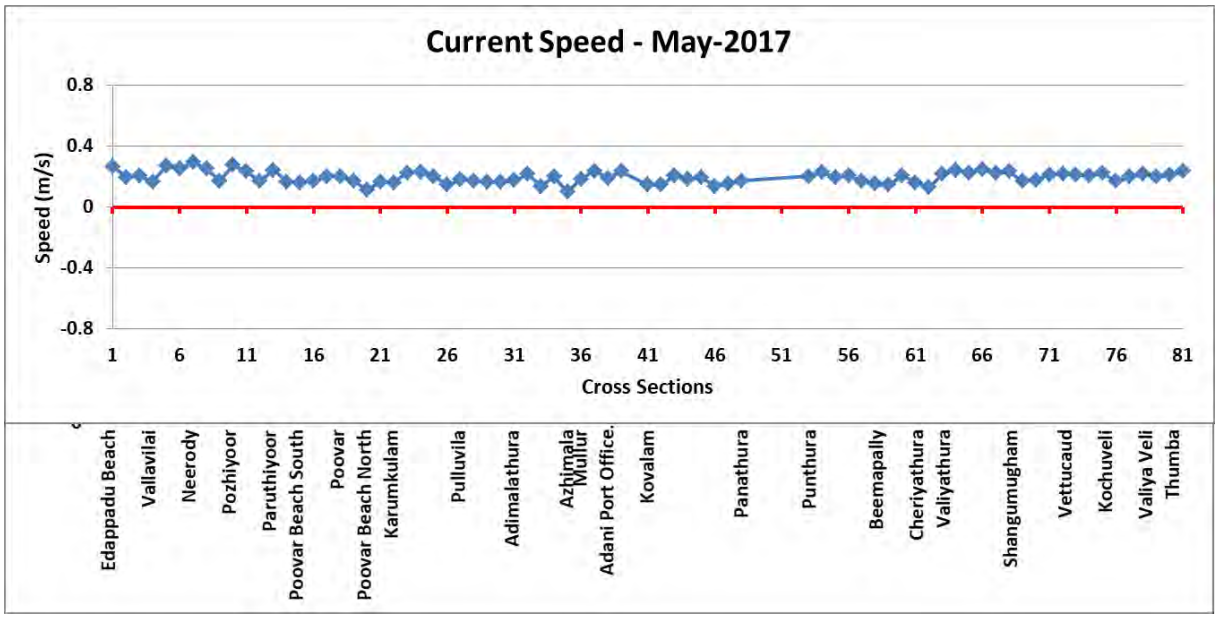


Figure 2-232 Alongshore current speed during May 2017

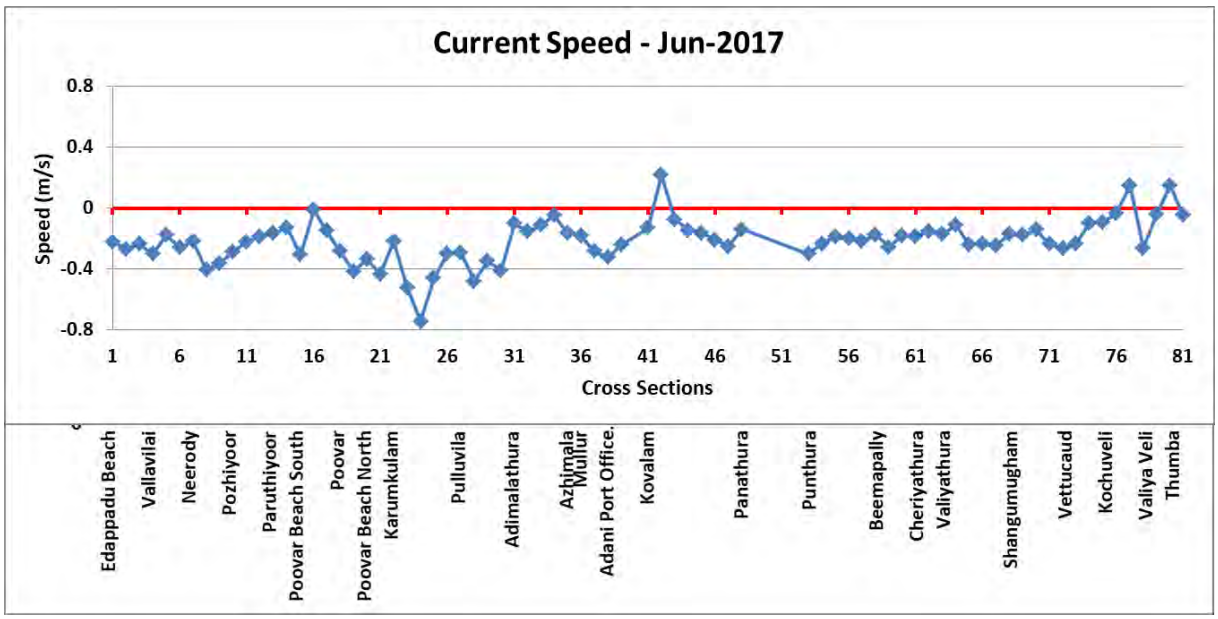


Figure 2-233 Alongshore current speed during June 2017

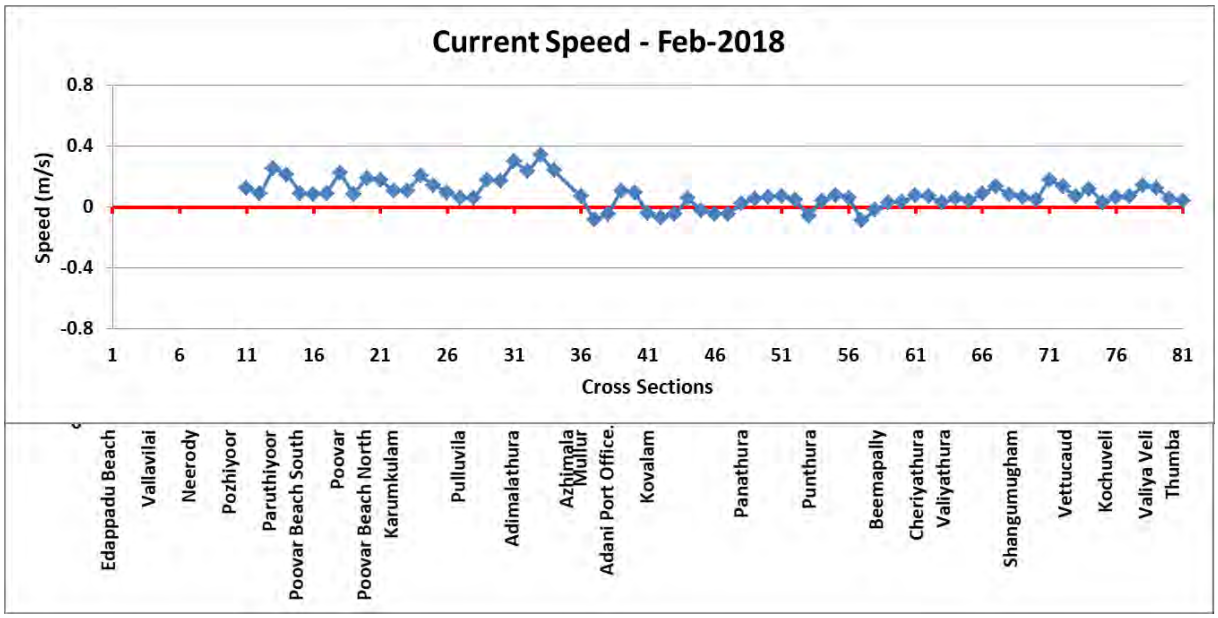


Figure 2-234 Alongshore current speed during February 2018

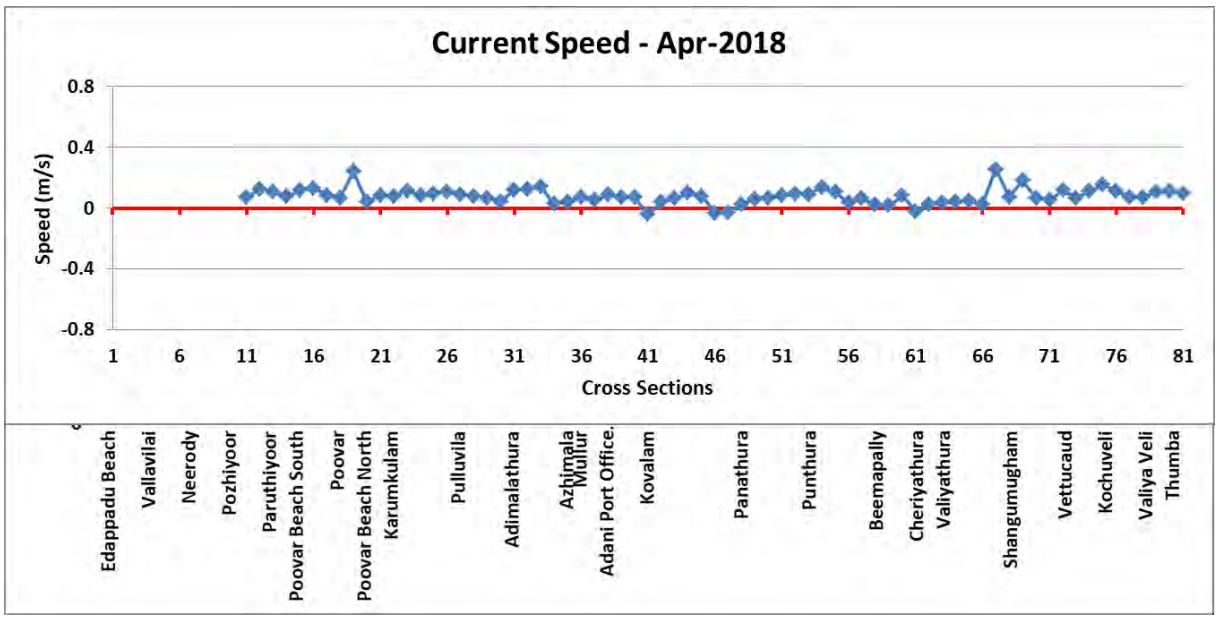


Figure 2-235 Alongshore current speed during April 2018

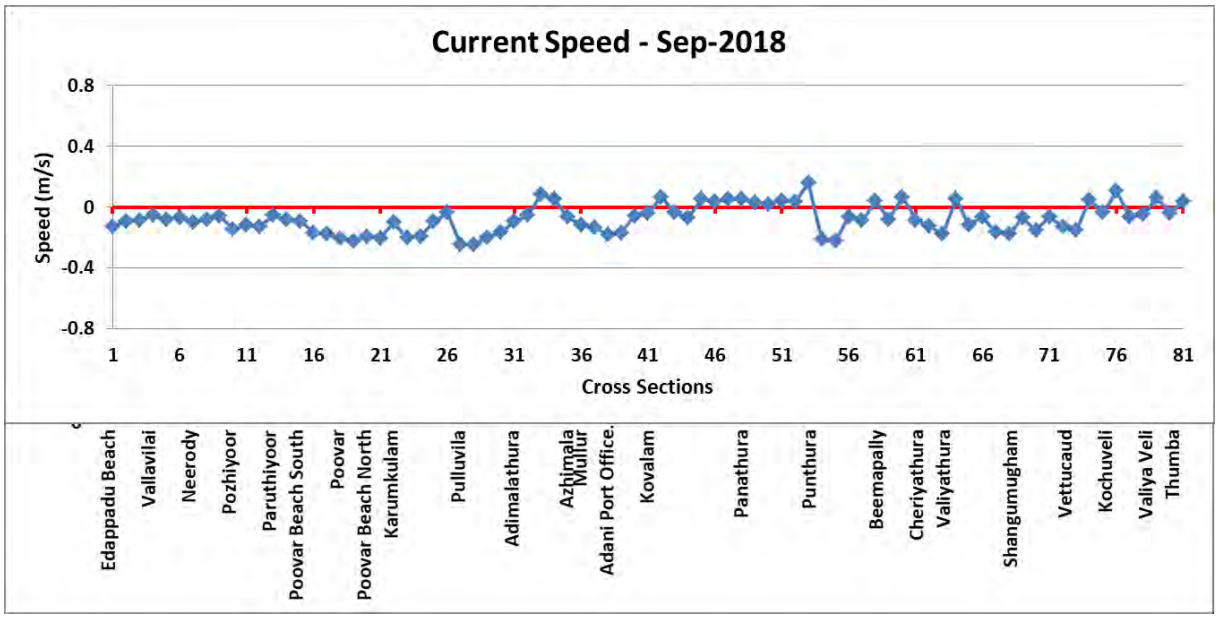


Figure 2-236 Alongshore current speed during September 2018

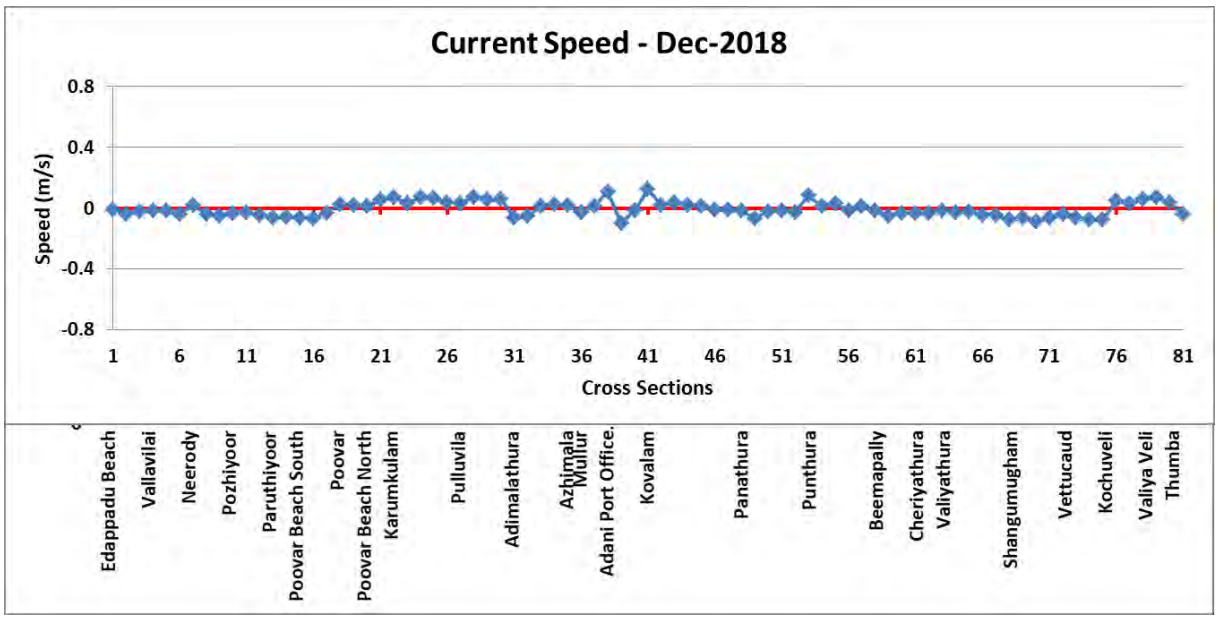


Figure 2-237 Alongshore current speed during December 2018

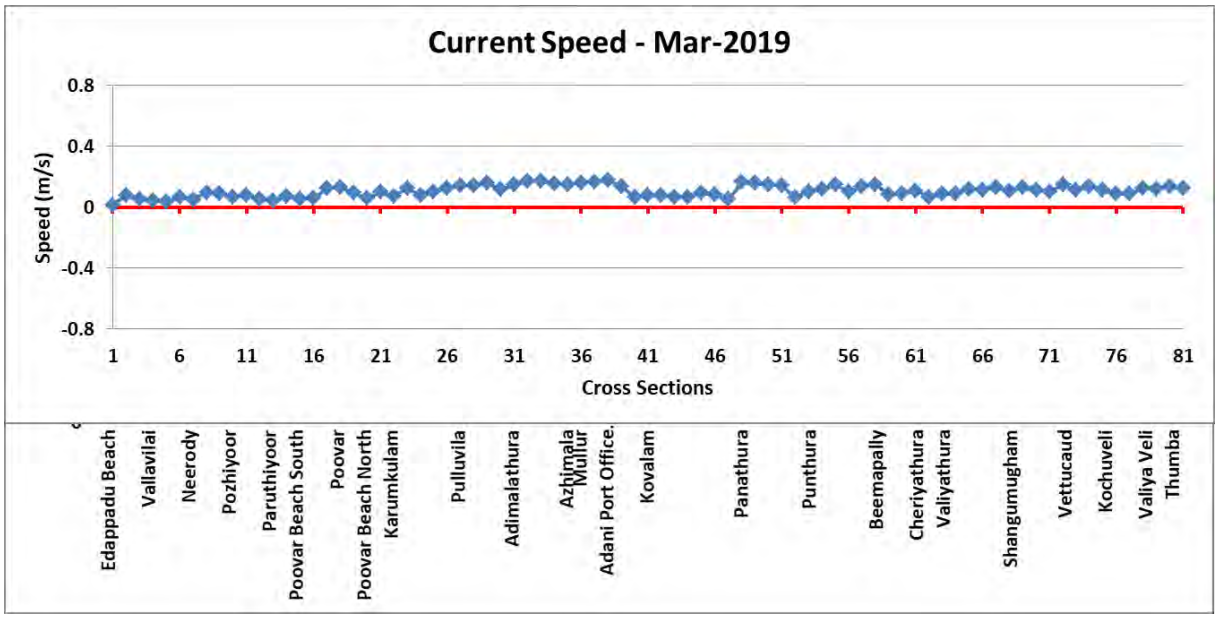


Figure 2-238 Alongshore current speed during March 2019

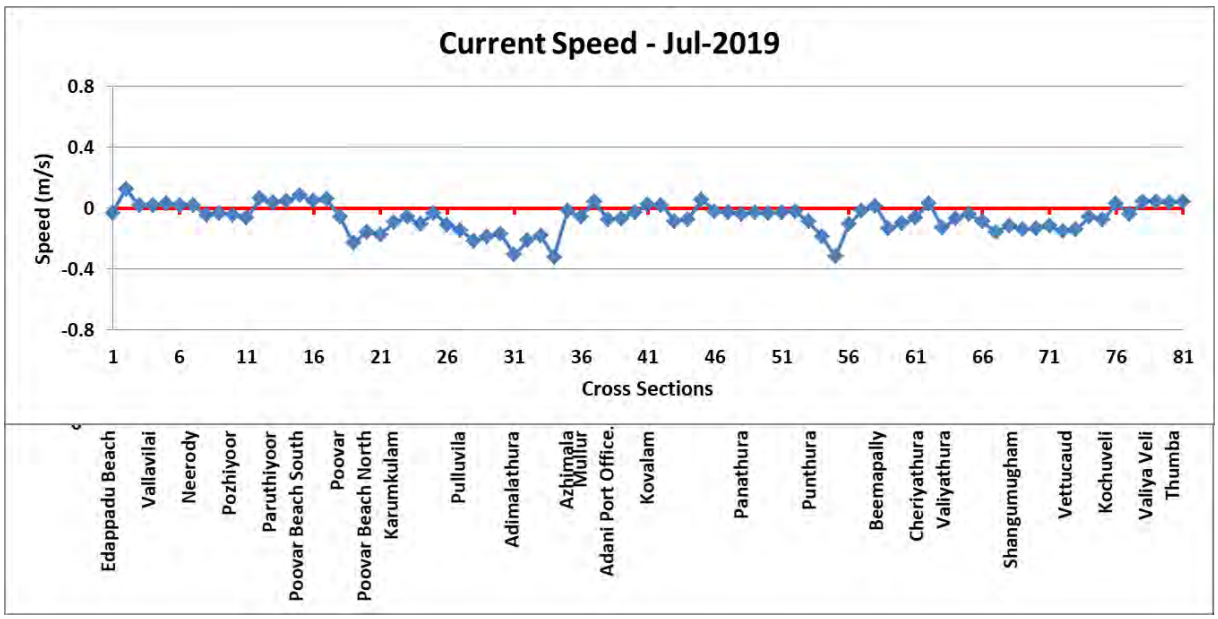


Figure 2-239 Alongshore current speed during July 2019

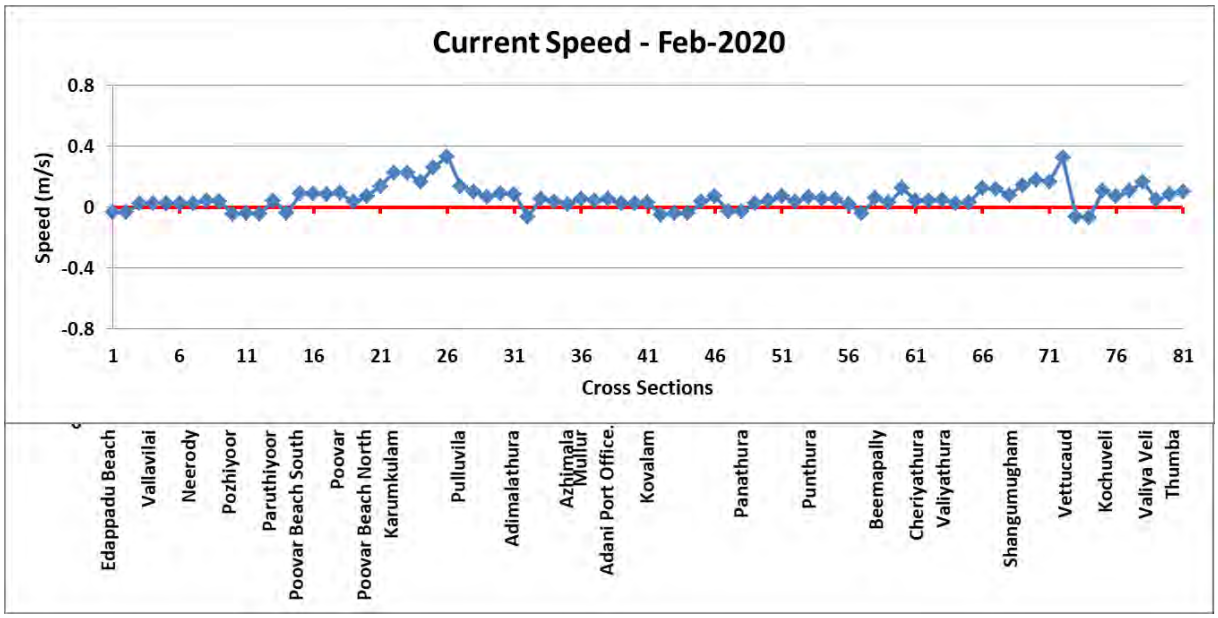


Figure 2-240 Alongshore current speed during February 2020

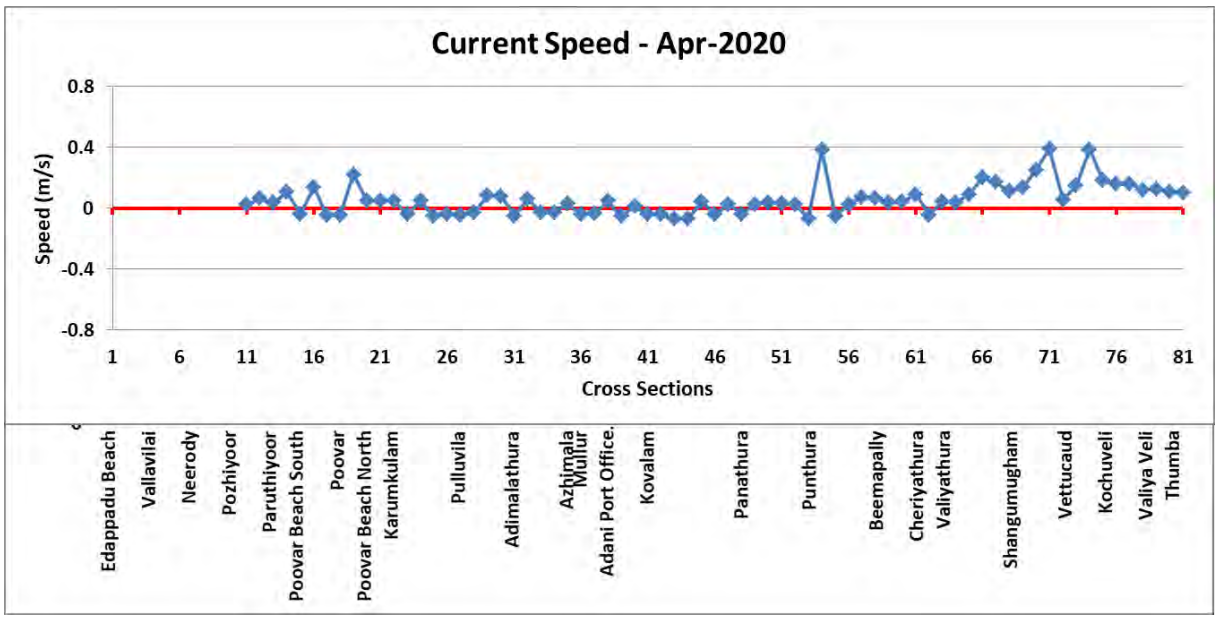


Figure 2-241 Alongshore current speed during April 2020

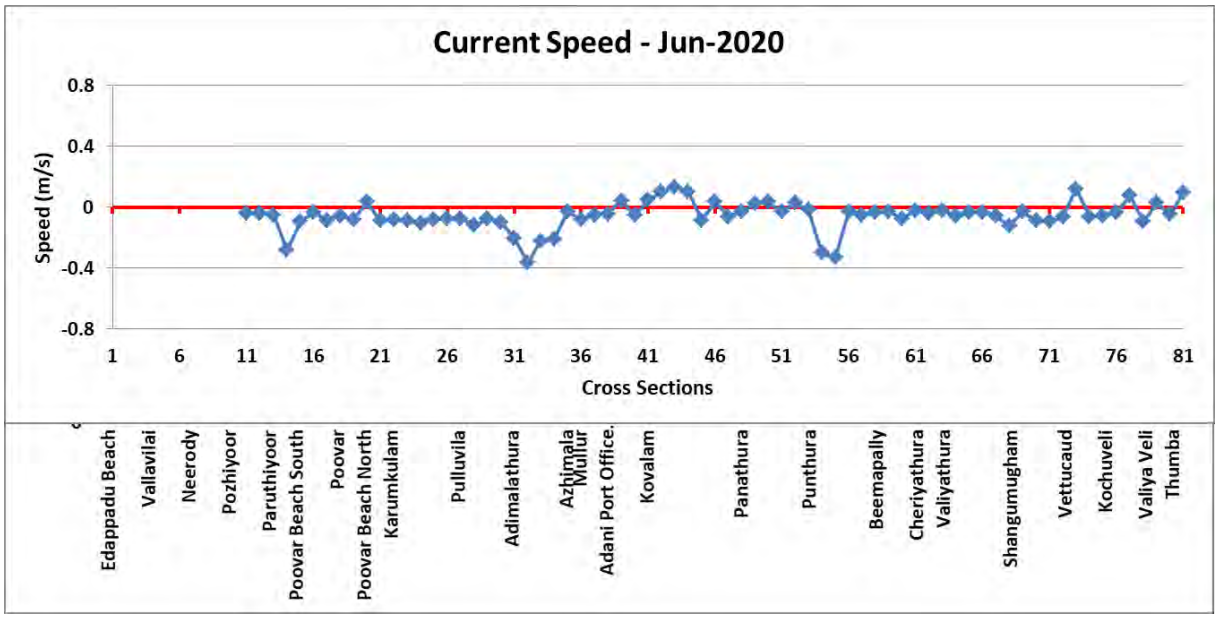


Figure 2-242 Alongshore current speed during June 2020

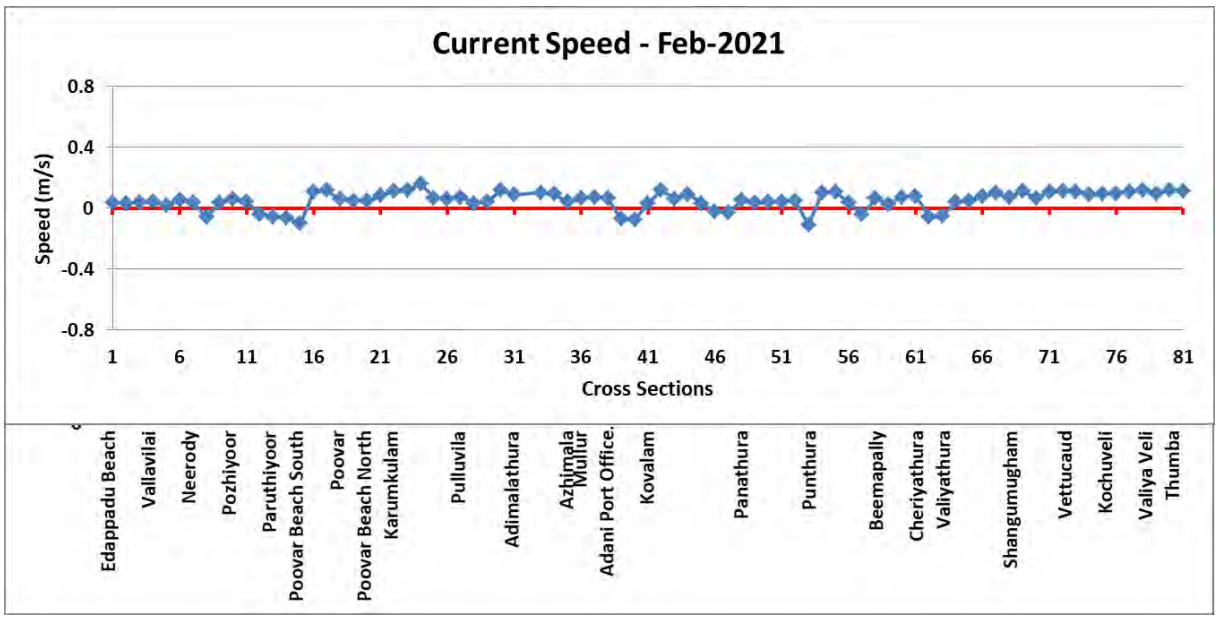


Figure 2-243 Alongshore current speed during February 2021

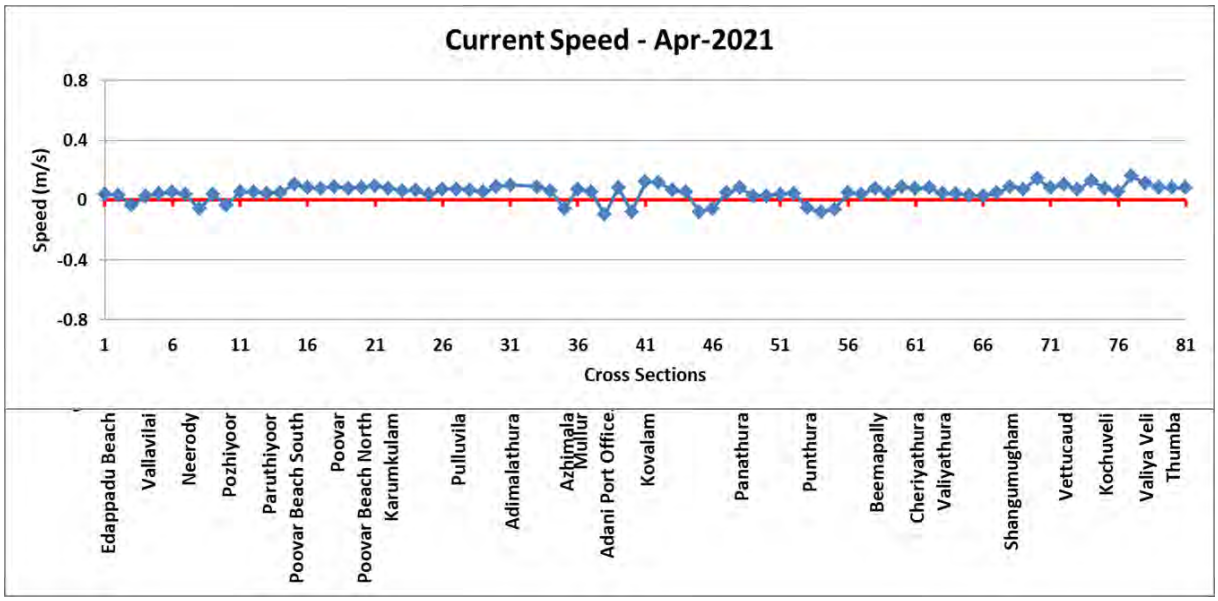


Figure 2-244 Alongshore current speed during April 2021

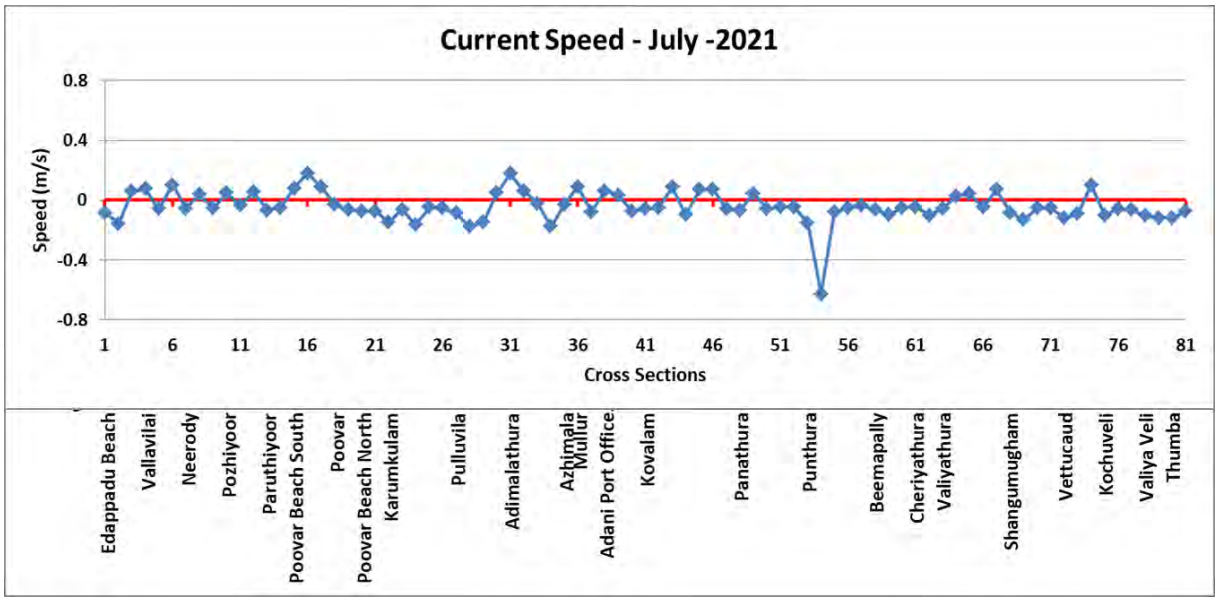


Figure 2-245 Alongshore current speed during July 2021

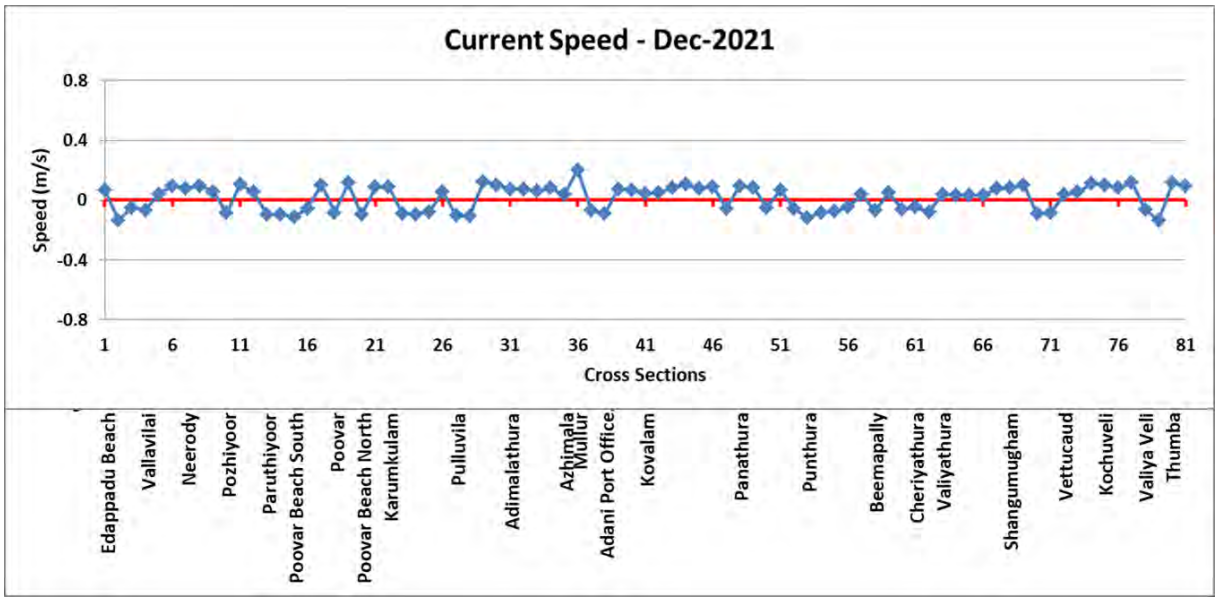


Figure 2-246 Alongshore current speed during December 2021

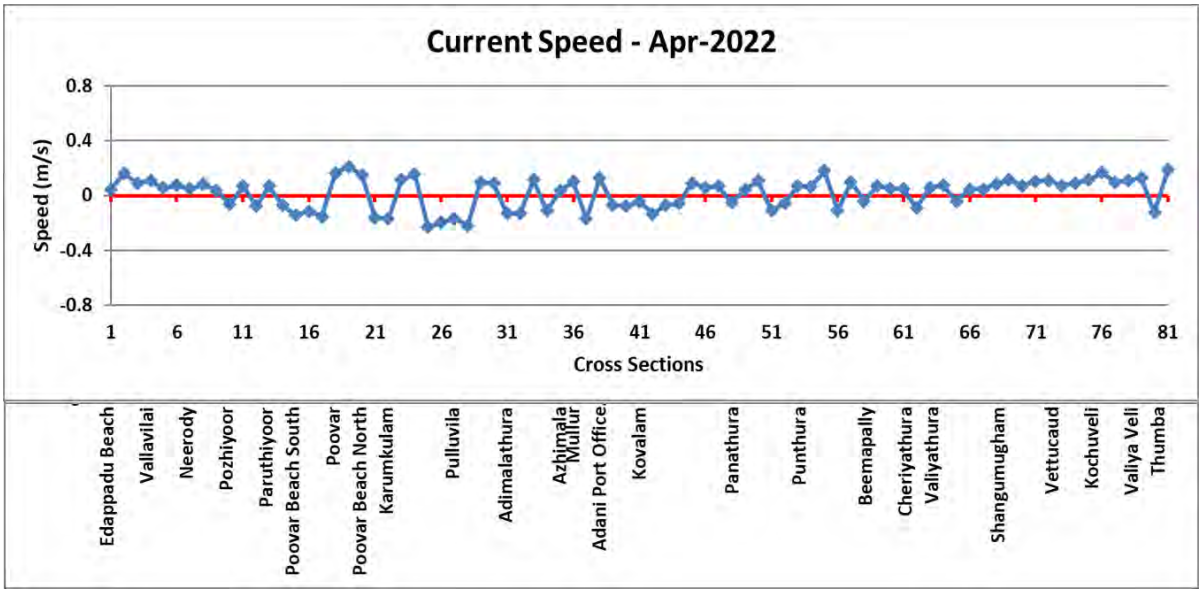


Figure 2-247 Alongshore current speed during April 2022

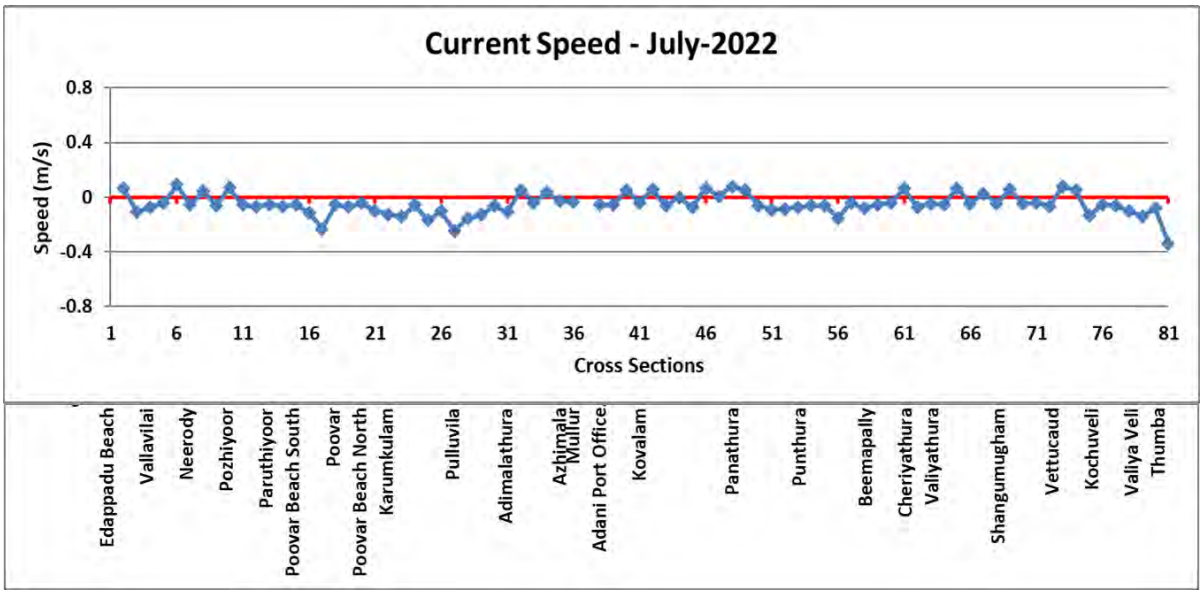


Figure 2-248 Alongshore current speed during July 2022

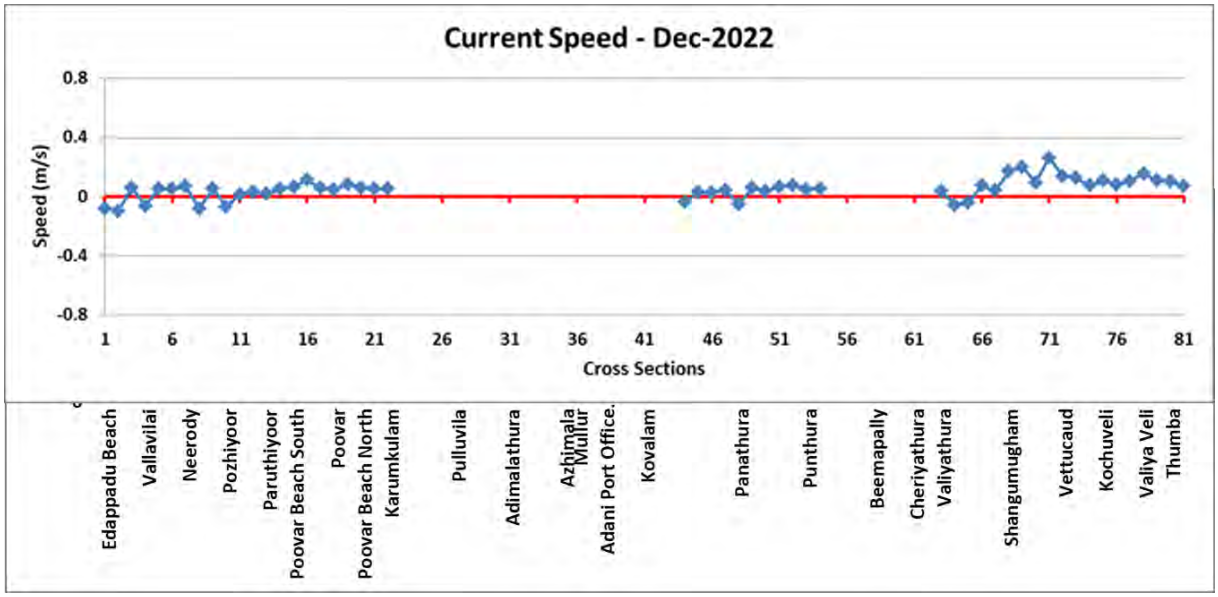


Figure 2-249 Alongshore current speed during December 2022

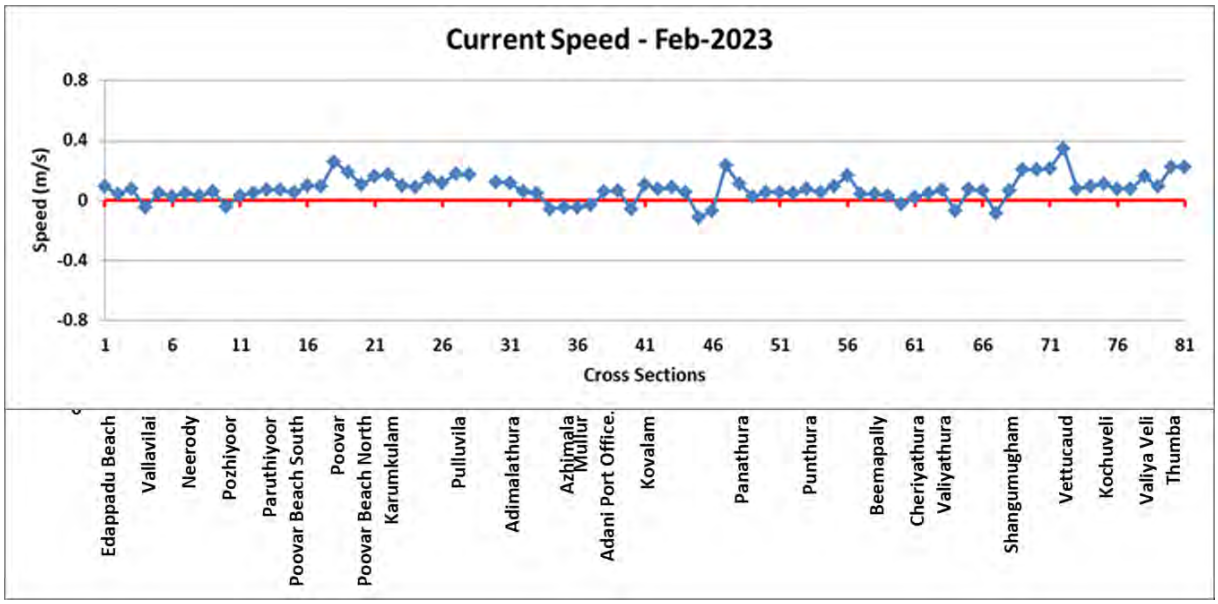


Figure 2-250 Alongshore current speed during February 2023

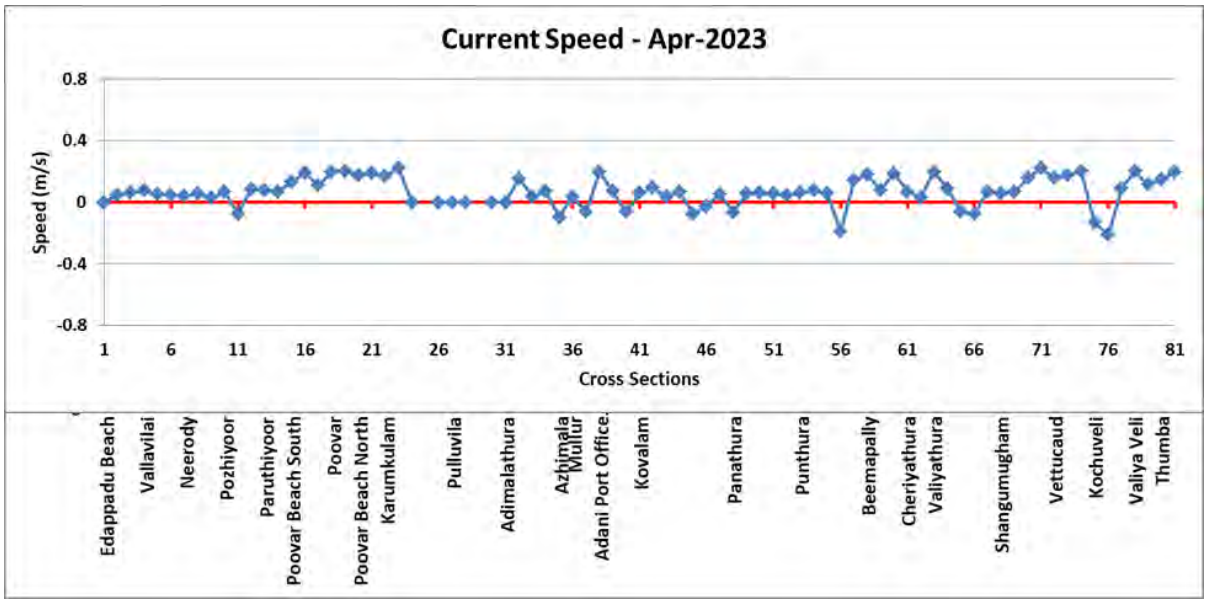


Figure 2-251 Alongshore current speed during April 2023

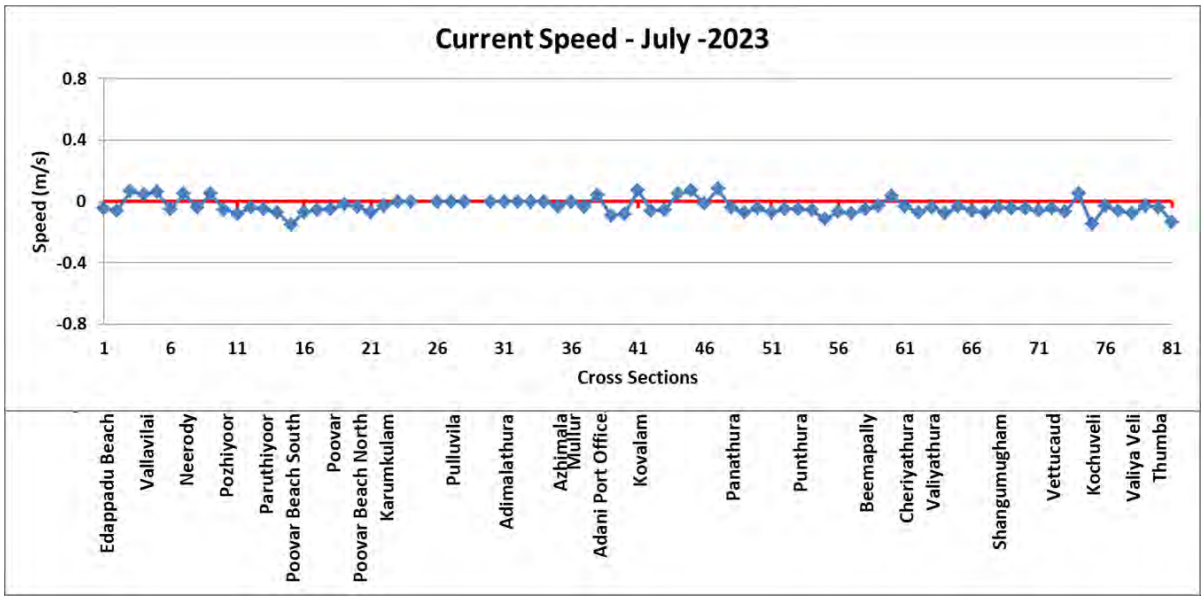


Figure 2-252 Alongshore current speed during July 2023

Figure 2-253 Sign Convention of current speed

The sign convention of current speed is considered positive if an observer stands on the beach facing to sea, notices rightward movement and negative if the movement is leftwards to the same observer. A representation is shown in Figure 2-253.

General trend of current movement towards South is noticed during Monsoon and towards North during other seasons.

The time series for selected sections on North and South side of proposed port are shown from Figure 2-254 to Figure 2-289.

Legend of Leo observation plots at selected CSP

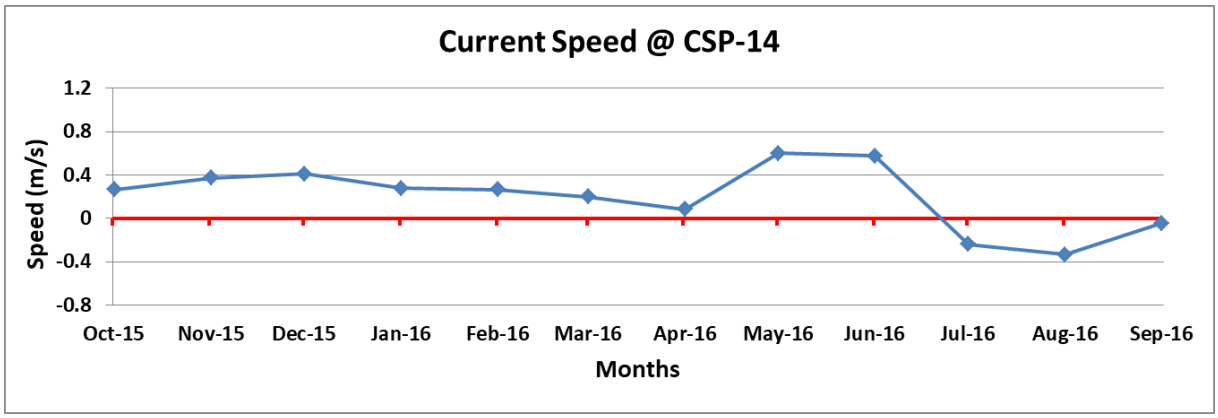


Figure 2-254 Time series of current speed at Paruthiyoor (October 2015 – September 2016)

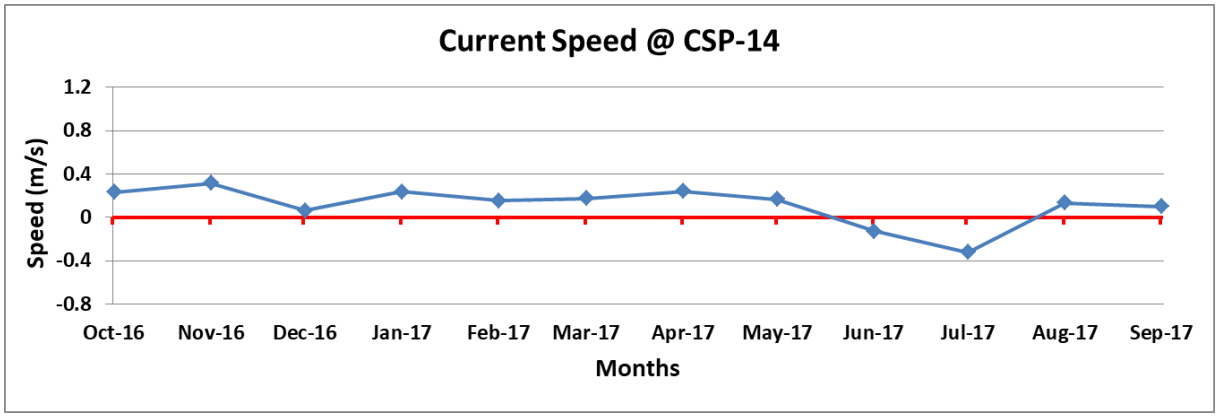


Figure 2-255 Time series of current speed at Paruthiyoor (October 2016 –September 2017)

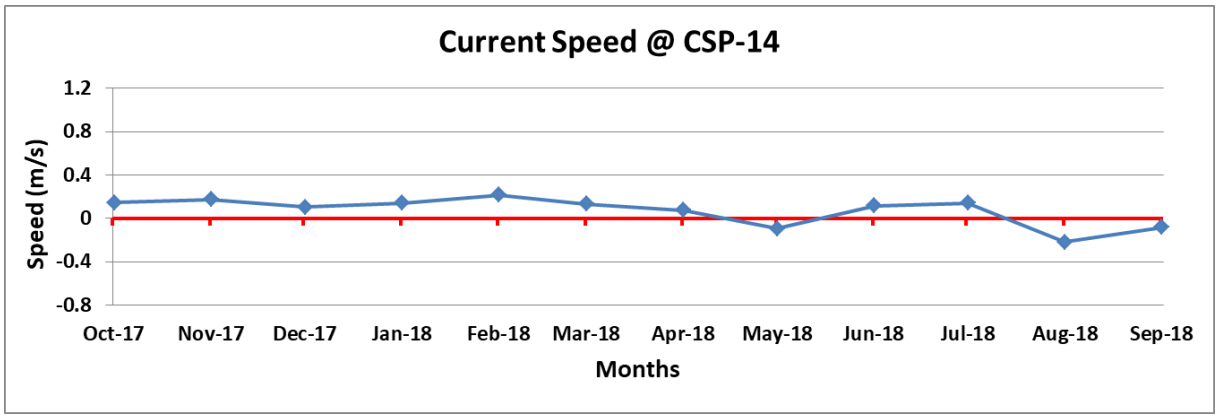


Figure 2-256 Time series of current speed at Paruthiyoor (October 2017 –September 2018)

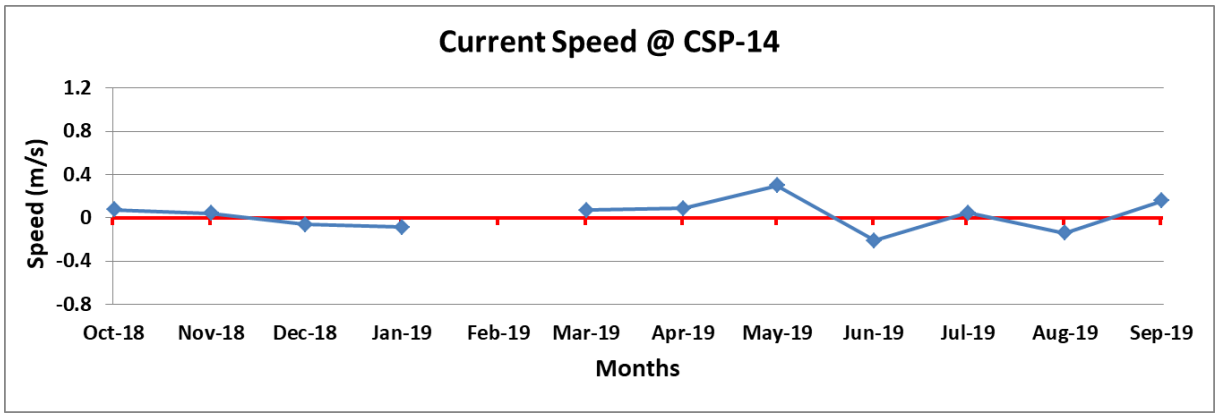


Figure 2-257 Time series of current speed at Paruthiyoor (October 2018 –September 2019)

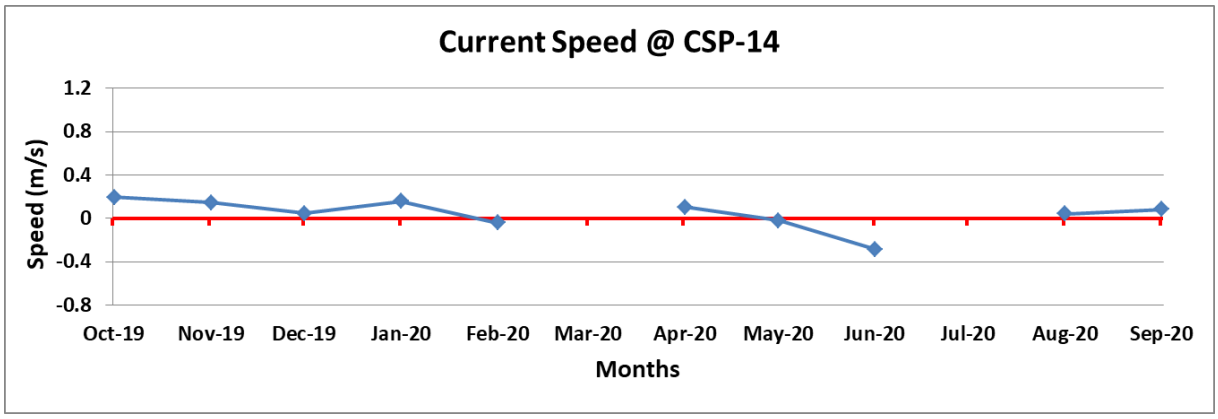


Figure 2-258 Time series of current speed at Paruthiyoor (October 2019 –September 2020)

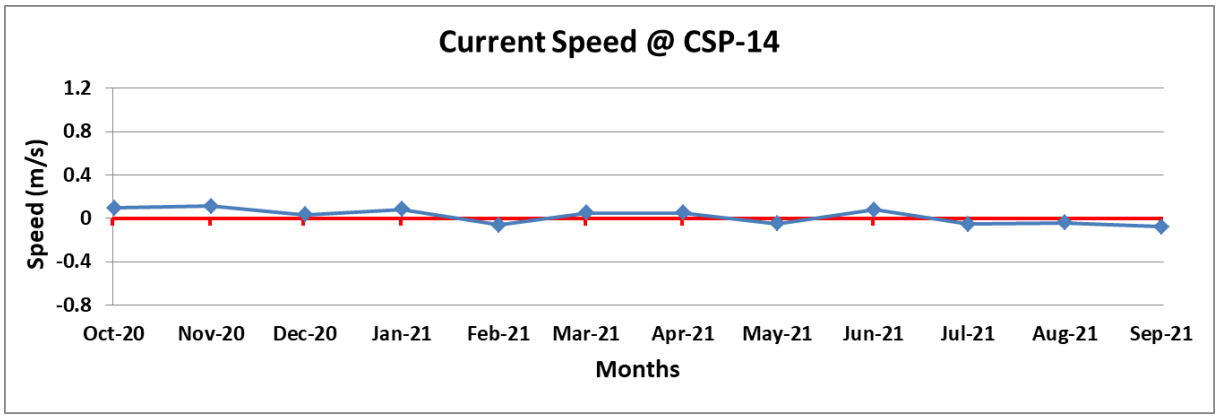


Figure 2-259 Time series of current speed at Paruthiyoor (October 2020 –September 2021)

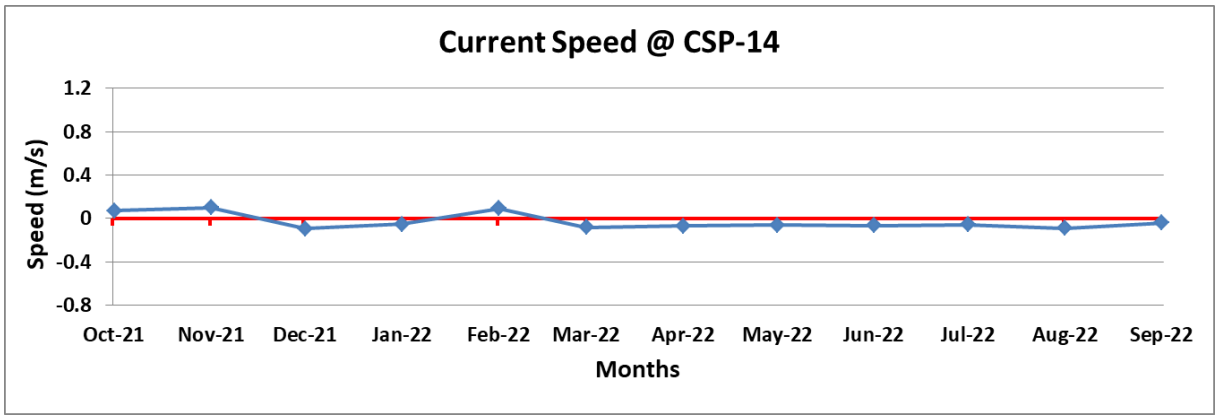


Figure 2-260 Time series of current speed at Paruthiyoor (October 2021 –September 2022)

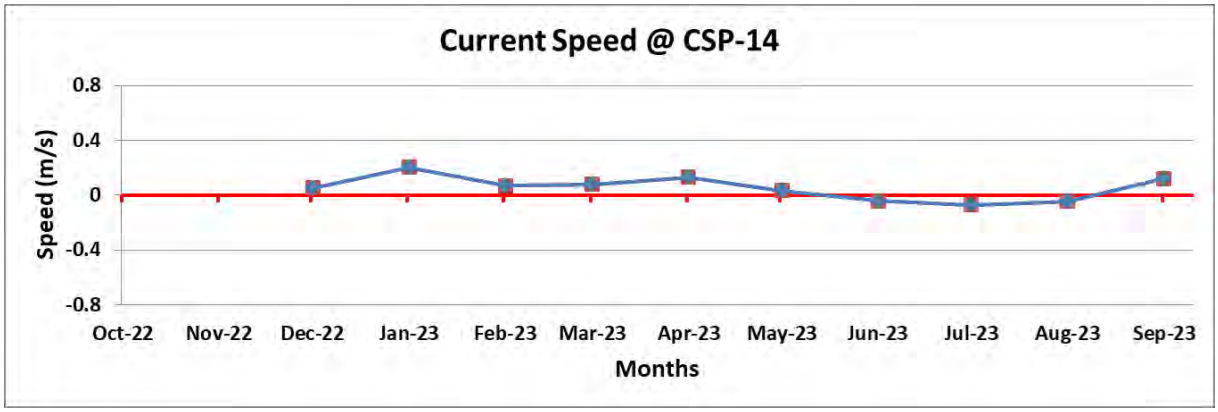


Figure 2-261 Time series of current speed at Paruthiyoor (October 2022 – September 2023)

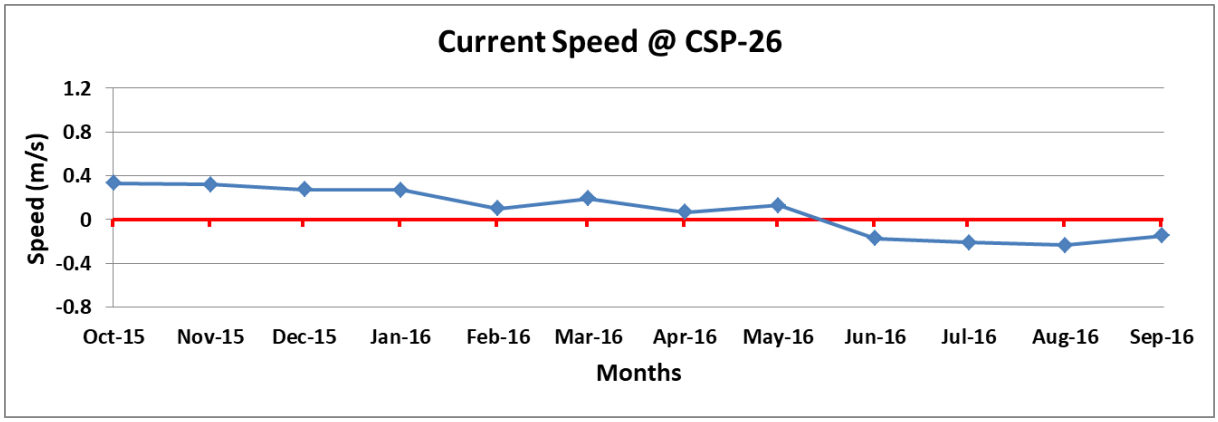


Figure 2-262 Time series of current speed at Karumkulam (October 2015 –September 2016)

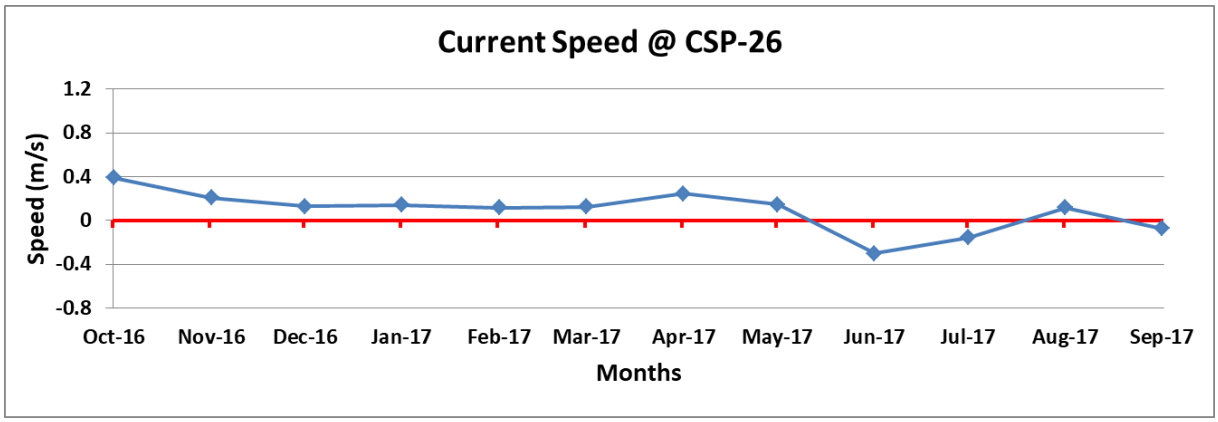


Figure 2-263 Time series of current speed at Karumkulam (October 2016 –September 2017)

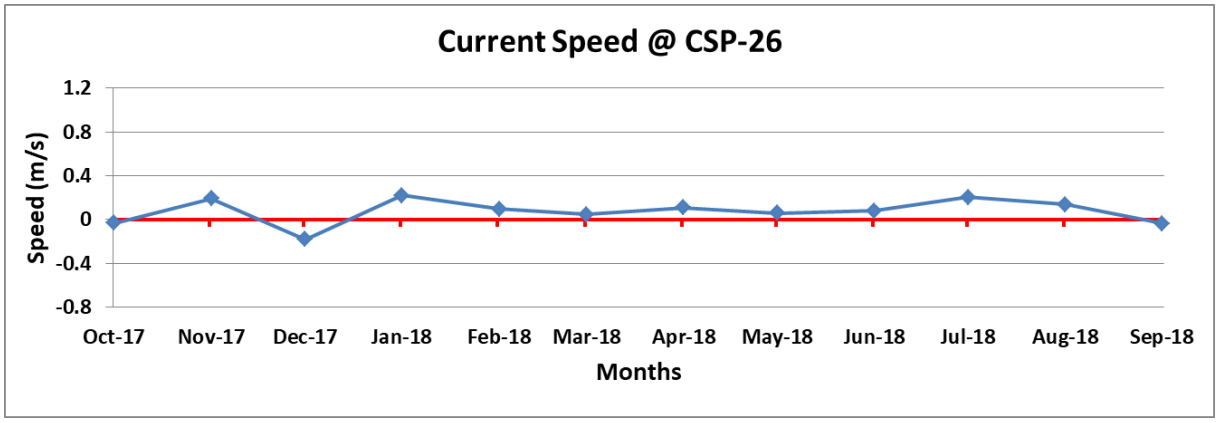


Figure 2-264 Time series of current speed at Karumkulam (October 2017 –September 2018)

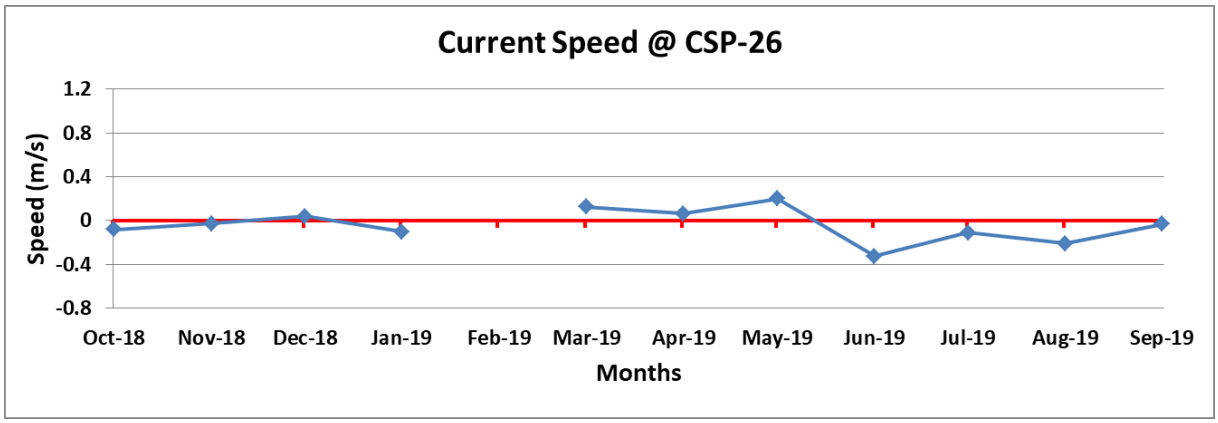


Figure 2-265 Time series of current speed at Karumkulam (October 2018 –September 2019)

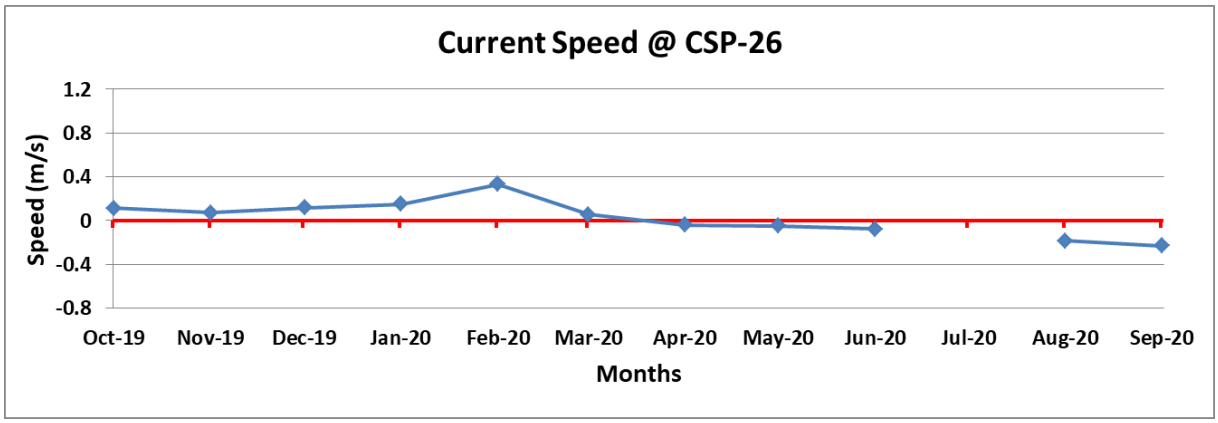


Figure 2-266 Time series of current speed at Karumkulam (October 2019 –September 2020)

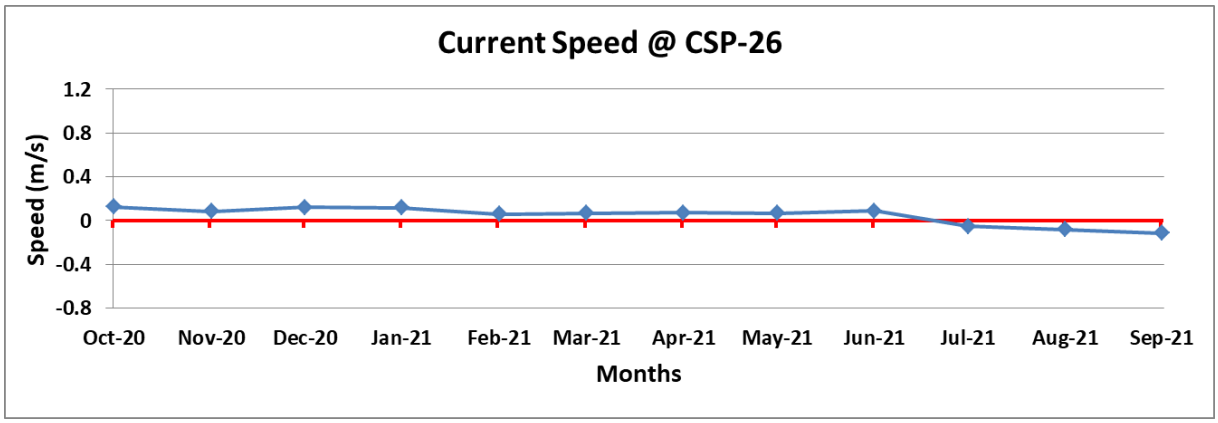


Figure 2-267 Time series of current speed at Karumkulam (October 2020 –September 2021)

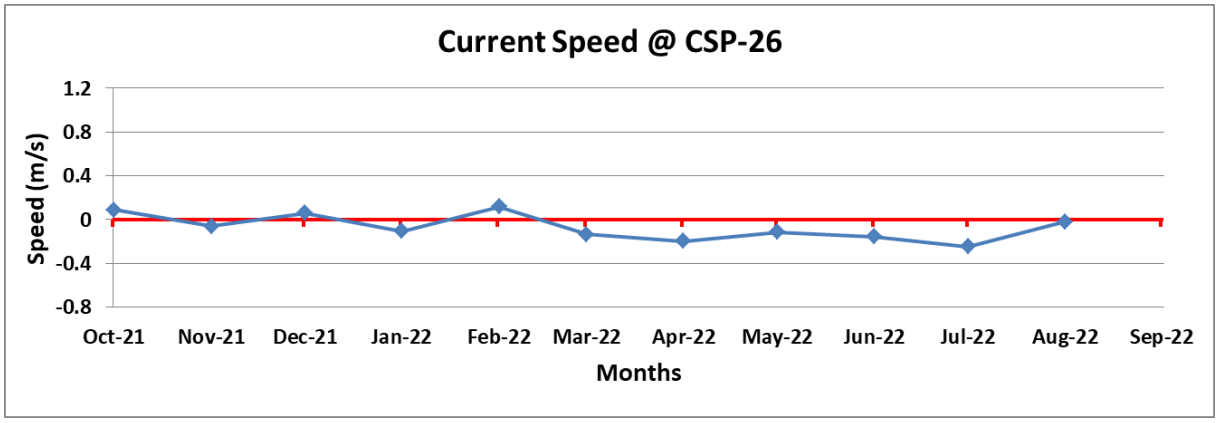


Figure 2-268 Time series of current speed at Karumkulam (October 2021 –September 2022)

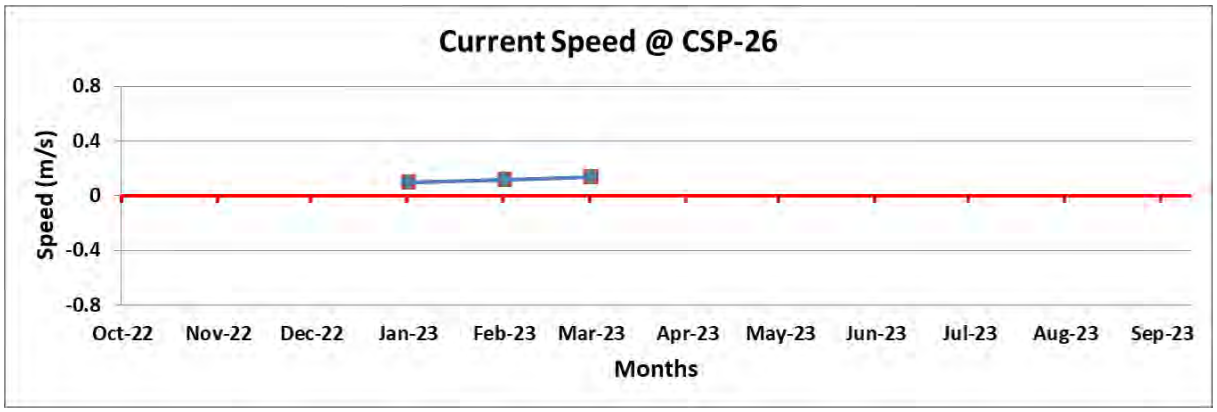


Figure 2-269 Time series of current speed at Karumkulam (October 2022 –March 2023)

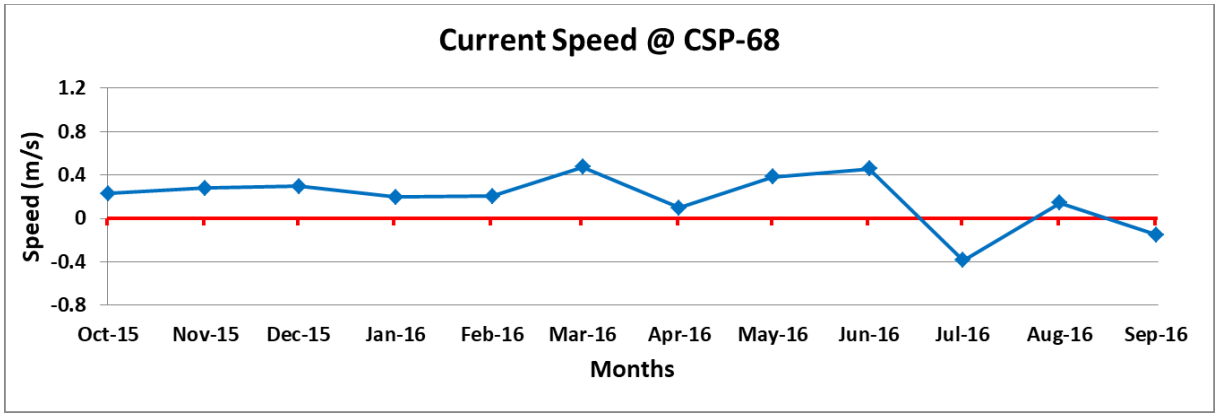


Figure 2-270 Time series of current speed at Shagumugham (October 2015 – September 2016)

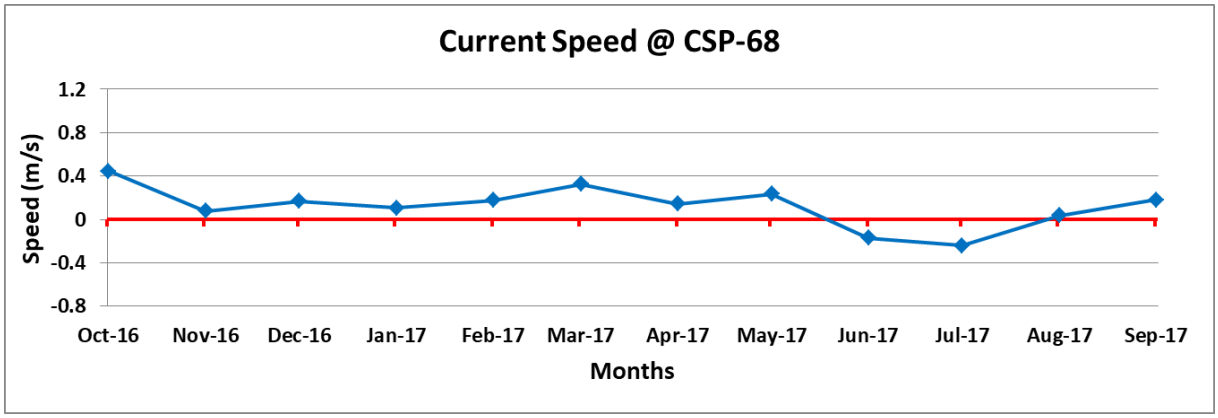


Figure 2-271 Time series of current speed at Shagumugham (October 2016 – September 2017)

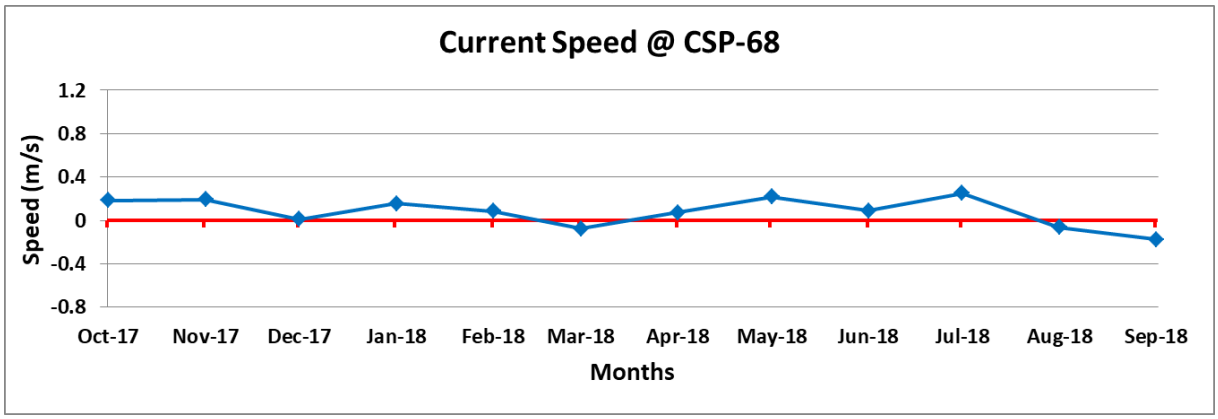


Figure 2-272 Time series of current speed at Shagumugham (October 2017 – September 2018)

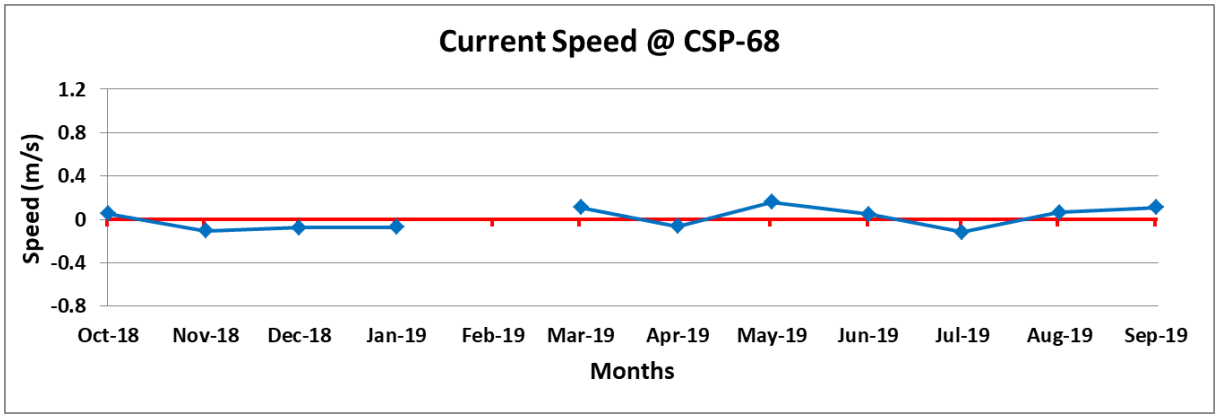


Figure 2-273 Time series of current speed at Shagumugham (October 2018 – September 2019)

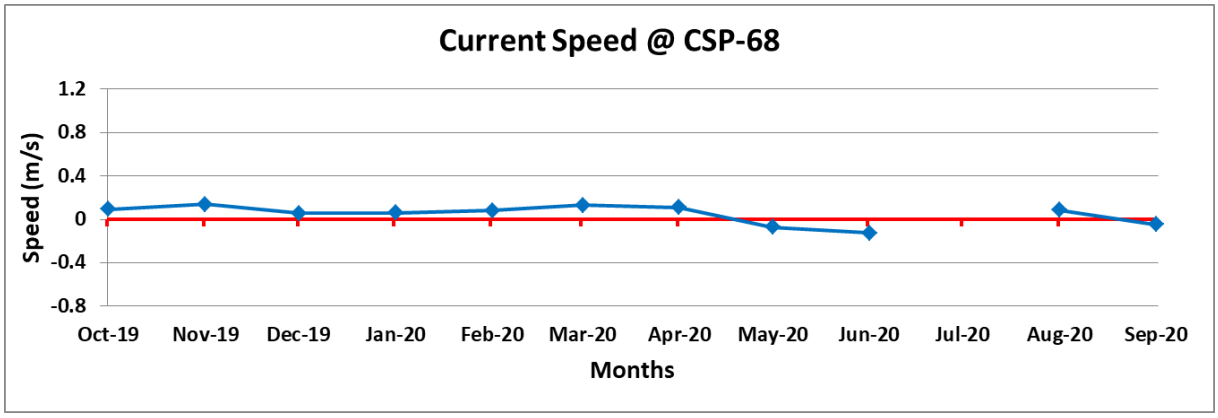


Figure 2-274 Time series of current speed at Shagumugham (October 2019 – September 2020)

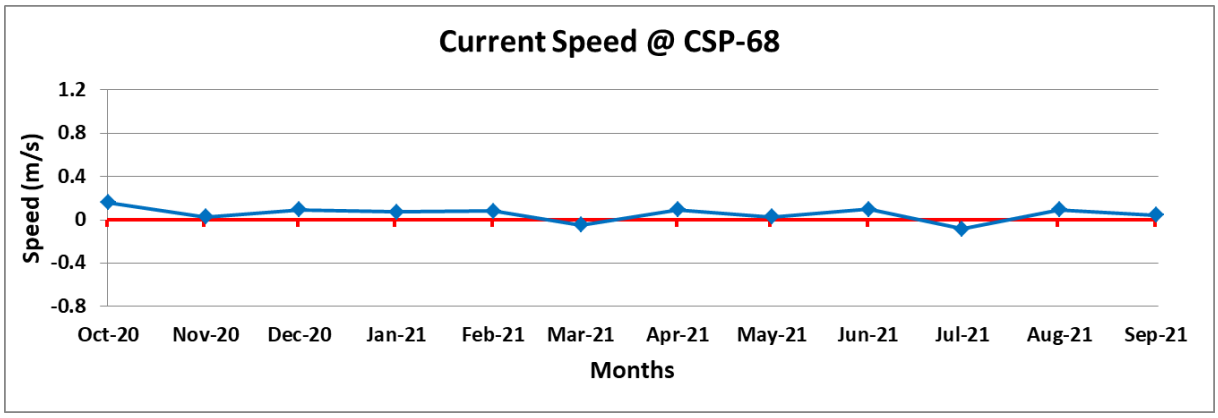


Figure 2-275 Time series of current speed at Shagumugham (October 2020 – September 2021)

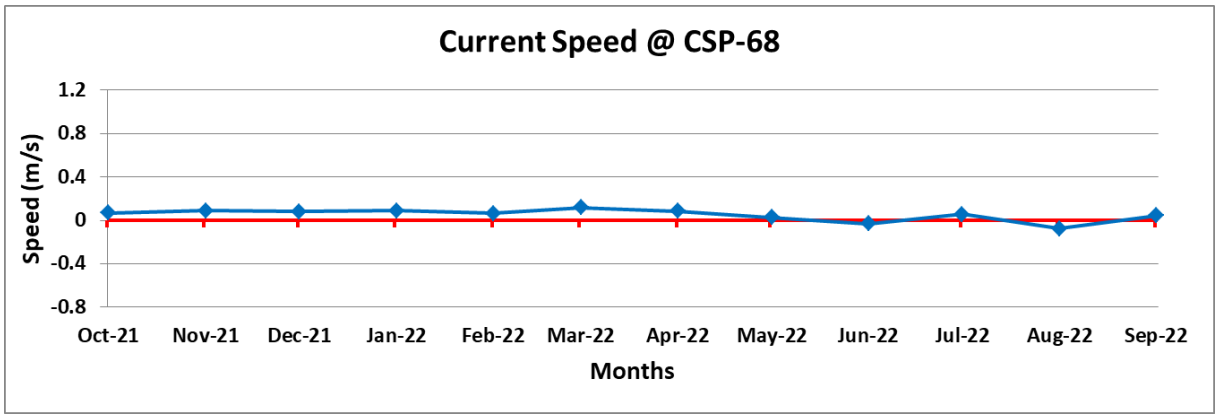


Figure 2-276 Time series of current speed at Shagumugham (October 2021 – September 2022)

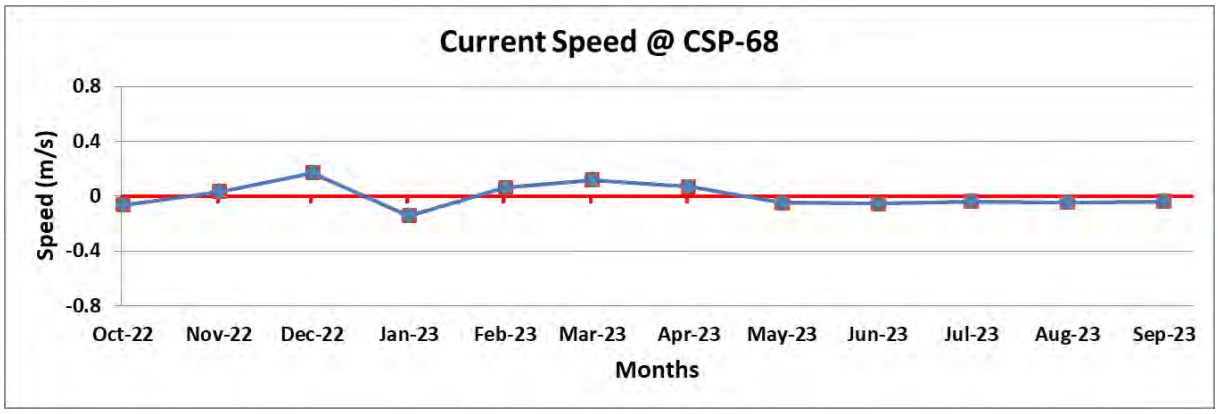


Figure 2-277 Time series of current speed at Shagumugham (October 2022 –March 2023)

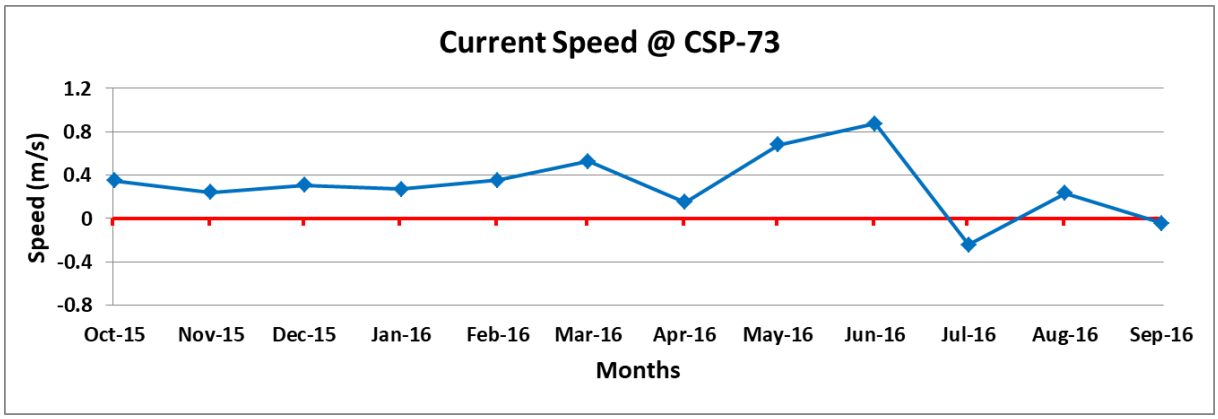


Figure 2-278 Time series of current speed at Vettucaud (October 2015 –September 2016)

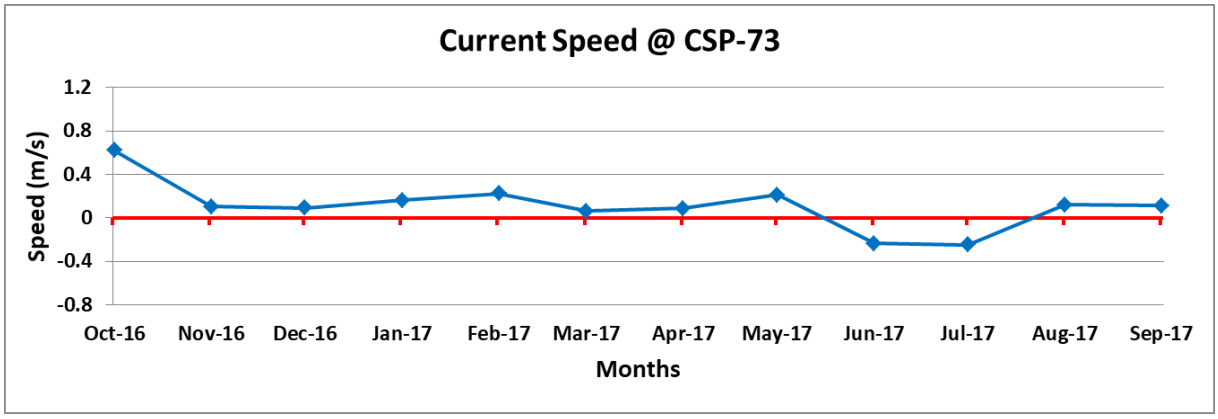


Figure 2-279 Time series of current speed at Vettucaud (October 2016 –September 2017)

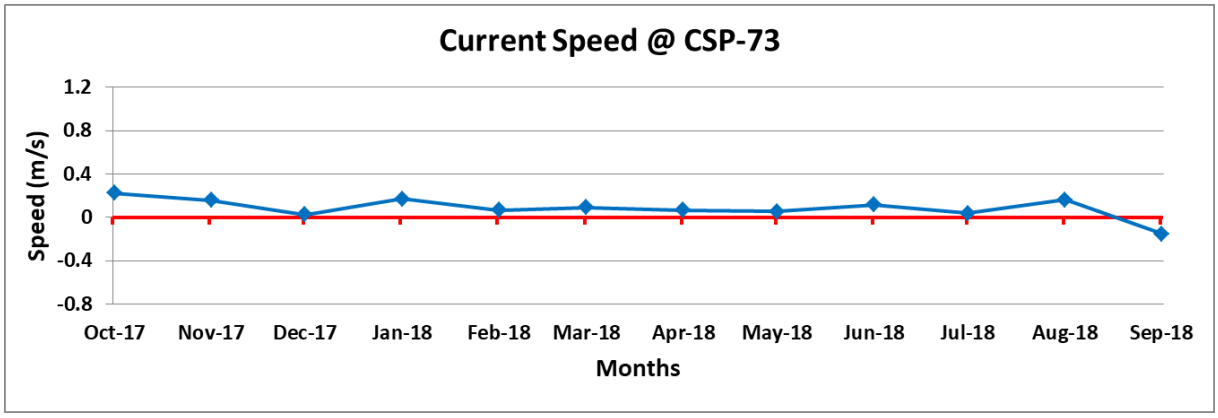


Figure 2-280 Time series of current speed at Vettucaud (October 2017 –September 2018)

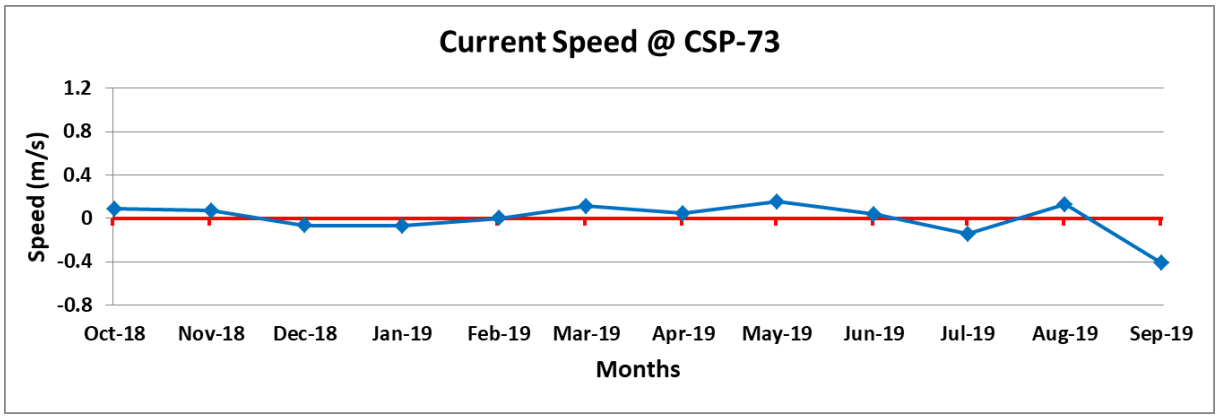


Figure 2-281 Time series of current speed at Vettucaud (October 2018 –September 2019)

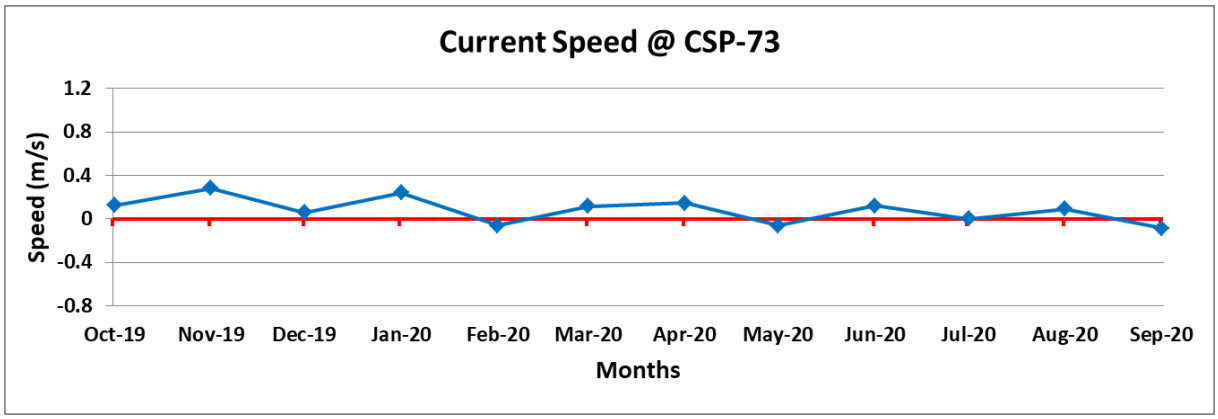


Figure 2-282 Time series of current speed at Vettucaud (October 2019 –September 2020)

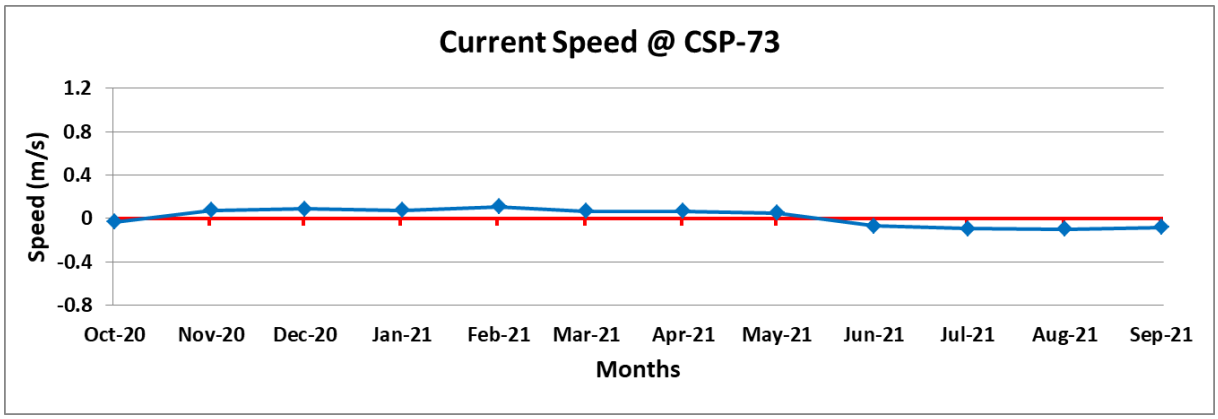


Figure 2-283 Time series of current speed at Vettucaud (October 2020 –September 2021)

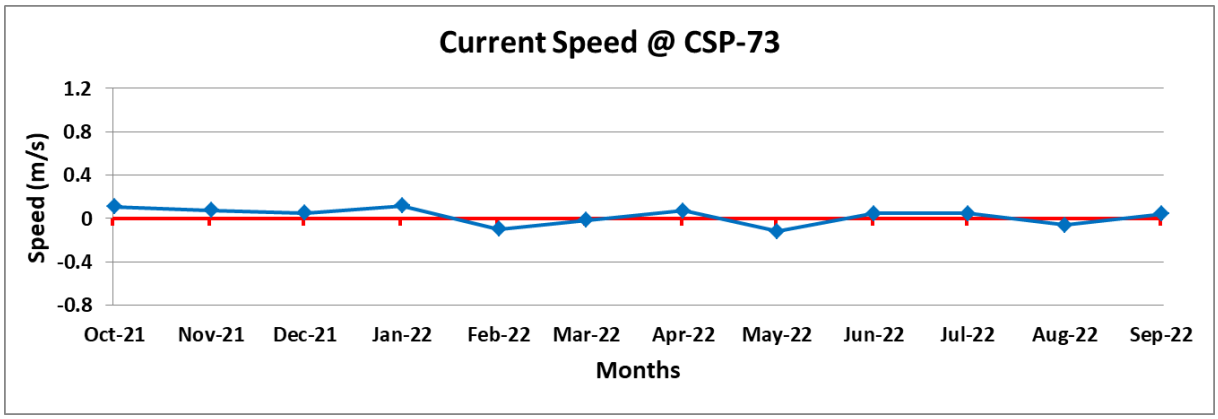


Figure 2-284 Time series of current speed at Vettucaud (October 2021 –September 2022)

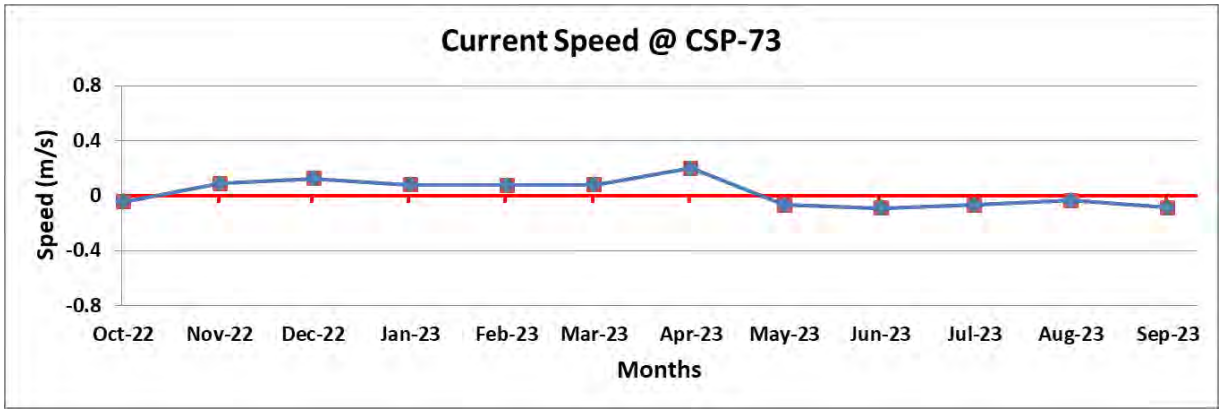
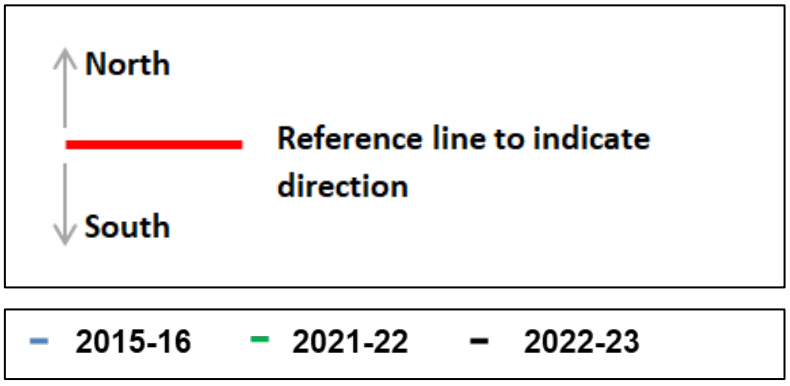


Figure 2-285 Time series of current speed at Vettucaud (October 2022 –March 2023)

Legend of Leo observation charts



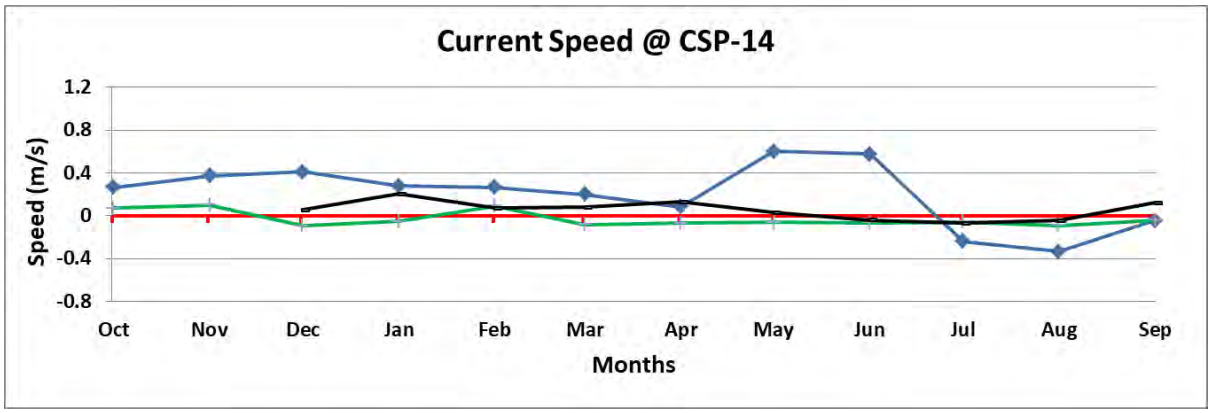


Figure 2-286 Time series of current speed at Paruthiyoor (2015-16, 2021-22 and 2022-23)

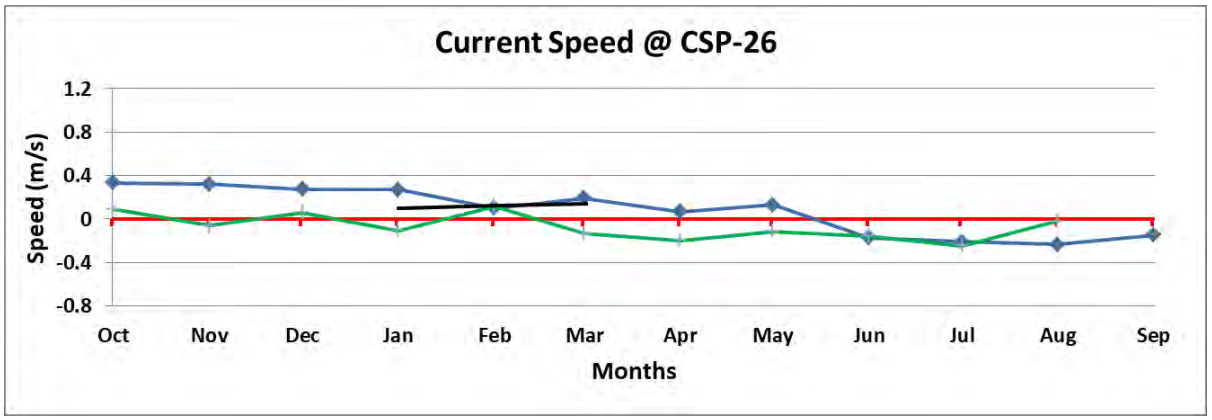


Figure 2-287 Time series of current speed at Karumkulam (2015-16, 2021-22 and 2022-23)

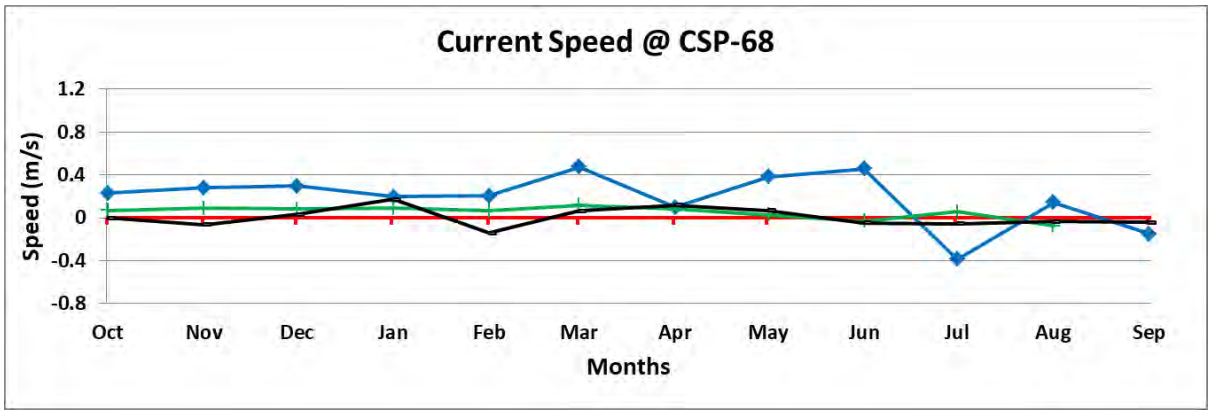


Figure 2-288 Time series of current speed at Shagumugham (2015-16, 2021-22 and 2022-23)

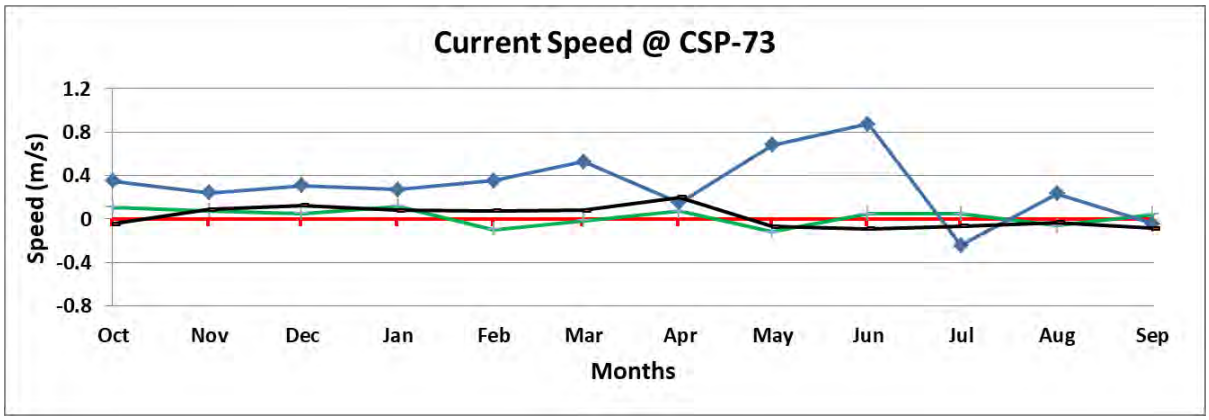


Figure 2-289 Time series of current speed at Vettucaud (2015-16, 2021-22 and 2022-23)

3 Model Studies

3.1 Assessment of hydrodynamics

3.1.1 Introduction

Hydrodynamics is the branch of science which deals with the dynamics of fluid and aims at studying the forces exerted by fluids in motion. For a large water body such as sea, the study becomes very complex owing to vast number of processes going on simultaneously. Processes such as tides, waves and wind interactions cause motion of fluid which in turn has far reaching effects. The motion of fluid, otherwise called as currents can induce a number of phenomena such as erosion and accretion along shoreline, morphological changes and forces on marine structures.

With development in advanced computing methods, numerical modelling has replaced the earlier methods of study. Various numerical modelling software packages have been developed for this purpose. These have the ability to solve complex equations involved in the study of hydrodynamics in efficient and less time-consuming manner.

Earlier in 2013, LNTIEL had comprehensively covered the assessment of hydrodynamics in the port vicinity. To understand the impact of the port construction on the hydrodynamics, LNTIEL carried out the assessment of hydrodynamics with the latest surveyed bathymetries. This chapter of the report covers the assessment of hydrodynamics carried out by LNTIEL.

In this part of the study, the following tasks were identified:

- Comparison of results from the updated hydrodynamic model with the calibrated hydrodynamic model used in 2013.
- Assessment of the impact of change in bathymetry on prevailing water levels and currents by using the hydrodynamic model.

3.1.2 Model setup using TELEMAC-2D

In this study, the model domain is updated as per the latest shoreline. The region of interest is situated along a coastline which is oriented in NW – SE direction and is straight. The model domain used for the study is almost parallel to the coastline. The model domain covers a region of about 50 X 22 km^2. The mesh size near target location was kept low (restricted to 20m) to resolve the proposed schemes and velocities properly. The mesh near

the target location can be viewed in Figure 3-1. The model bathymetry was prepared using the available primary and secondary data and is shown in Figure 3-2. The latest length of breakwater, as on August 2023 is included in the model for hydrodynamic modelling.

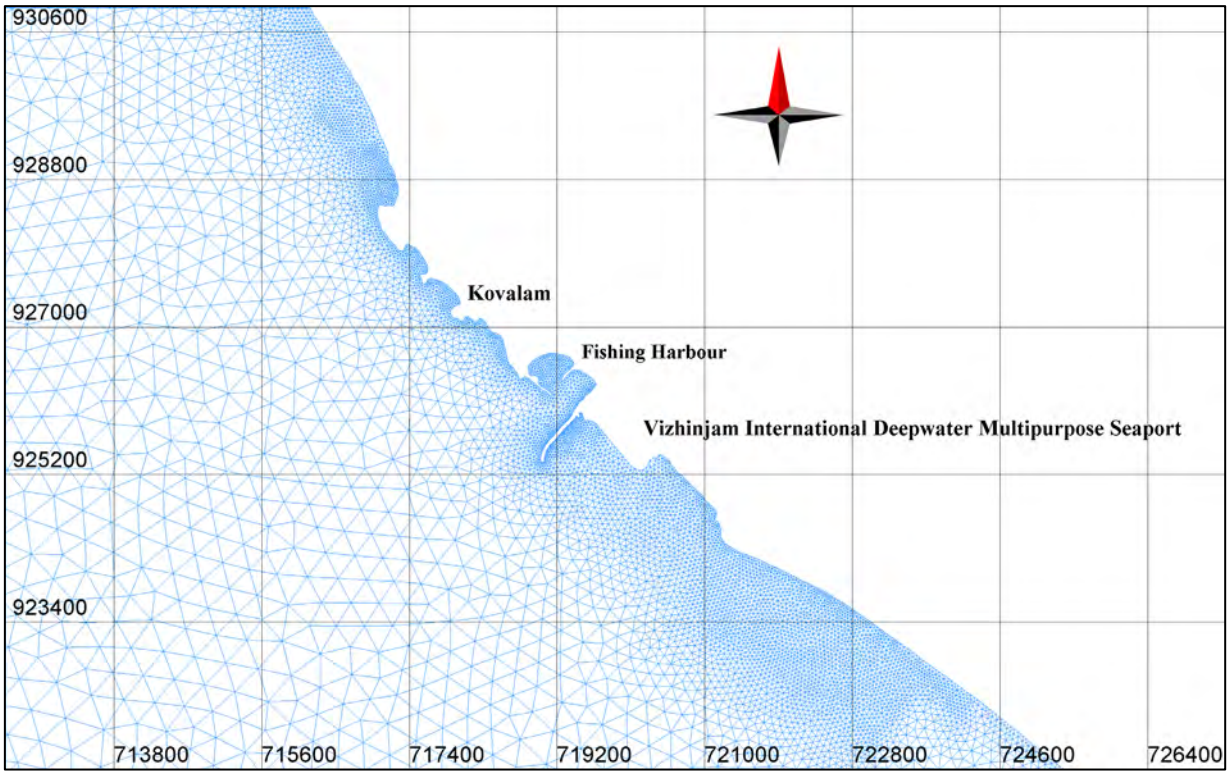


Figure 3-1 Fine mesh near project location

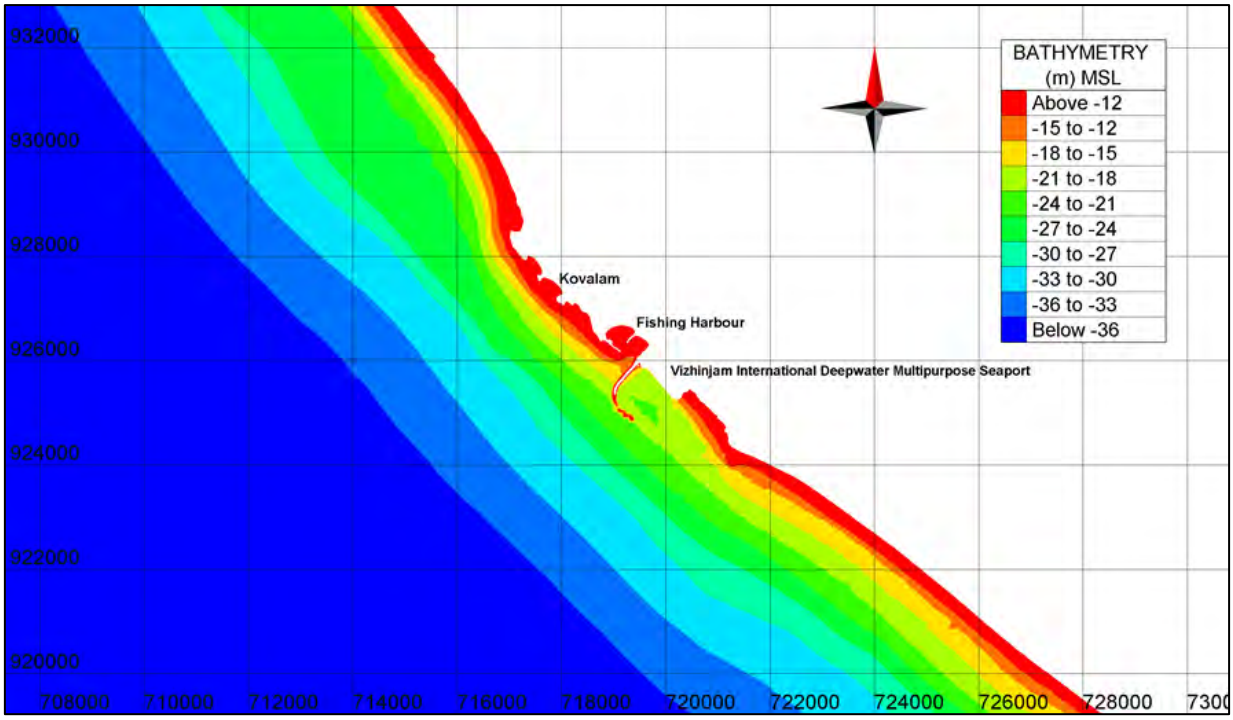


Figure 3-2 Latest bathymetry with respect to MSL

3.1.2.1 Boundary conditions

Tidal levels were applied along the open boundary of the model domain. To set up the model, tidal elevations along the open boundary were predicted using OTPS developed by OSU. The open boundary of the HD model setup is as shown in Figure 3-3.

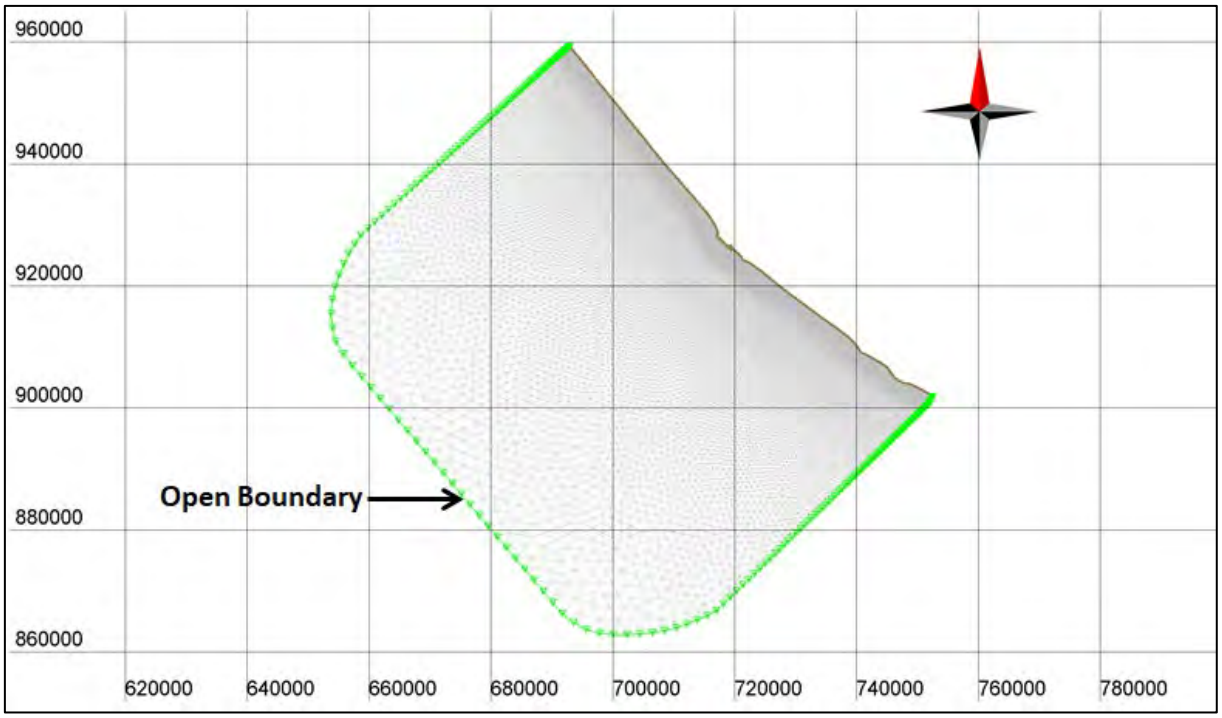


Figure 3-3 Open boundary conditions – HD model

OTPS accomplish 2 tasks:

- Extracting harmonic constants from barotropic tidal solutions in OTIS format at given locations
- Predicting tides at given times and locations

Predictions were based on global and/or regional barotropic inverse tidal solutions obtained with OTIS.

Wind was applied on the model to account for wind driven currents in the model. Time varying wind field was applied for model validation, as the variation in wind speed and direction may lead to change in current speed and direction.

3.1.2.2 Model comparison and validation

The aim of this study is to assess the impact of the change in bathymetry on the hydrodynamics of the region. A calibrated model was achieved and the results from the model were reported in the report of August 2013. In this present study, the model used in 2013 was updated with the pre monsoon bathymetries of 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022 & 2023 and simulations were carried out with the same parameters used in 2013.

Comparison between the tide and currents simulated by the models were done. Figure 3-4 to Figure 3-8 shows the comparison between the modelled tides put on similar time scales. Tide measurement carried out by AVPPL was also put on the scale. From the comparisons it

can be seen that there is a good correlation between all the data which indicates that the change in bathymetry has no effect on the tidal variations.

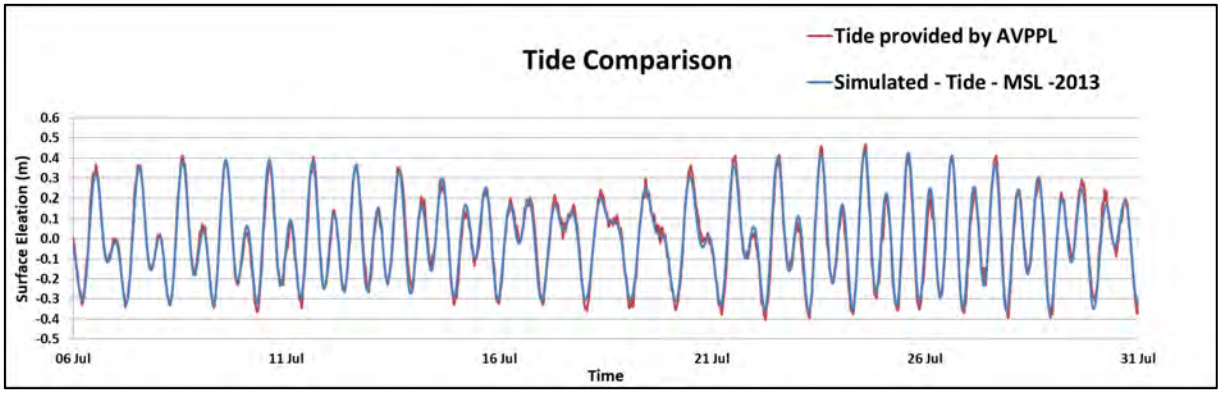


Figure 3-4 Comparison of AVPPL data with simulated tide (2013)(SW Monsoon)

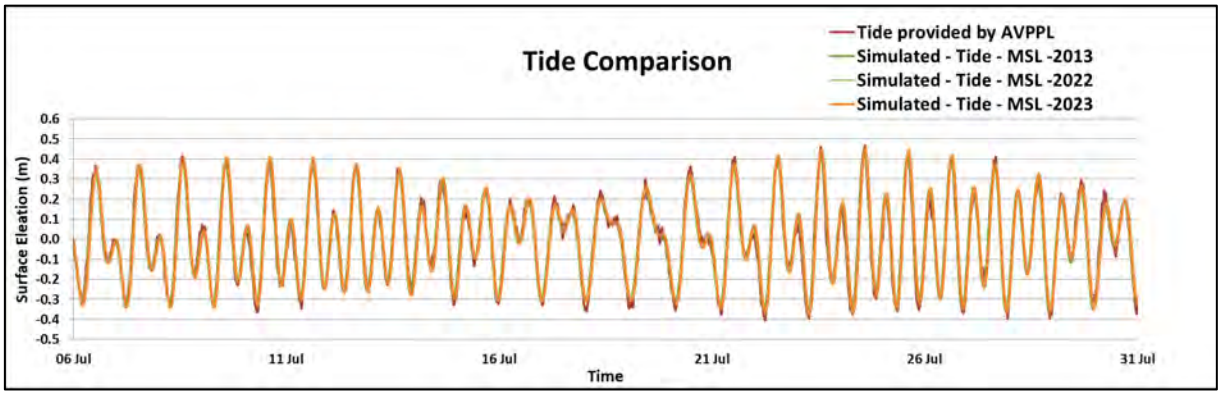
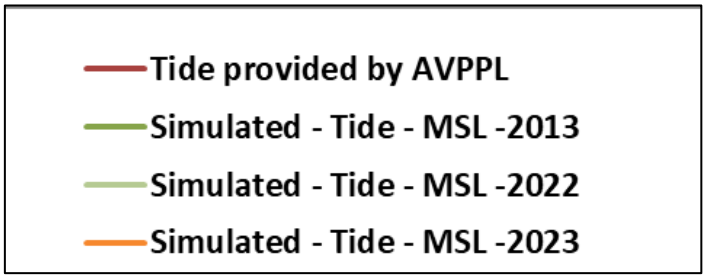


Figure 3-5 Comparison of AVPPL data with simulated tide (SW Monsoon)



Legend of Tide comparison plot

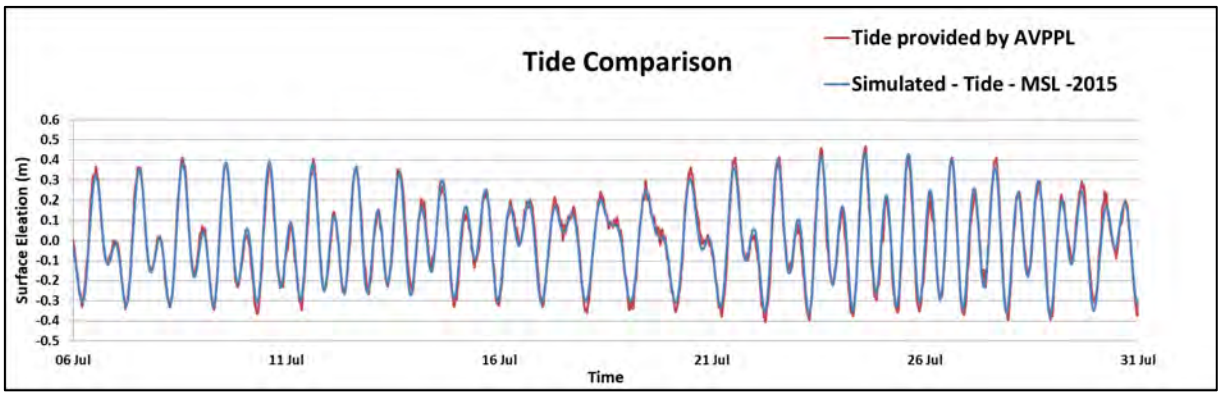


Figure 3-6 Comparison of AVPPL data with simulated tide (2015)(SW Monsoon)

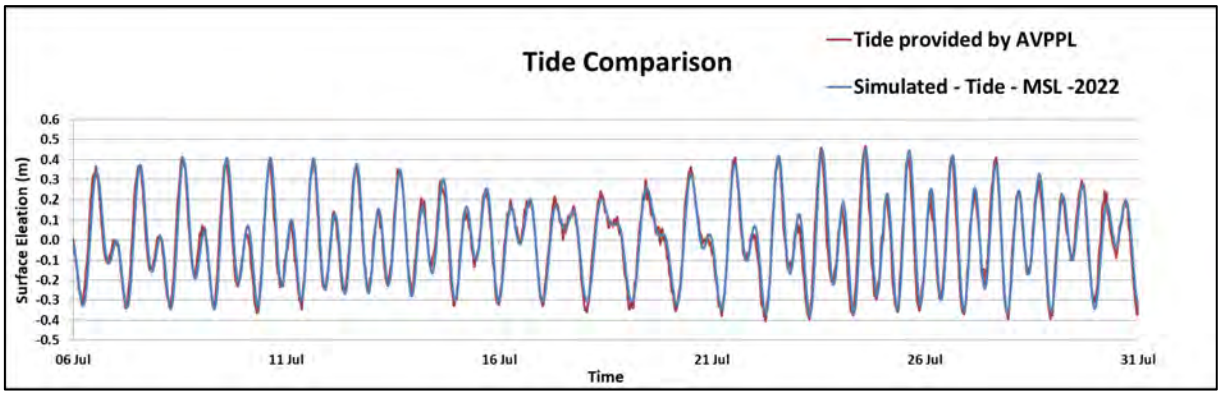


Figure 3-7 Comparison of AVPPL data with simulated tide (2022)(SW Monsoon)

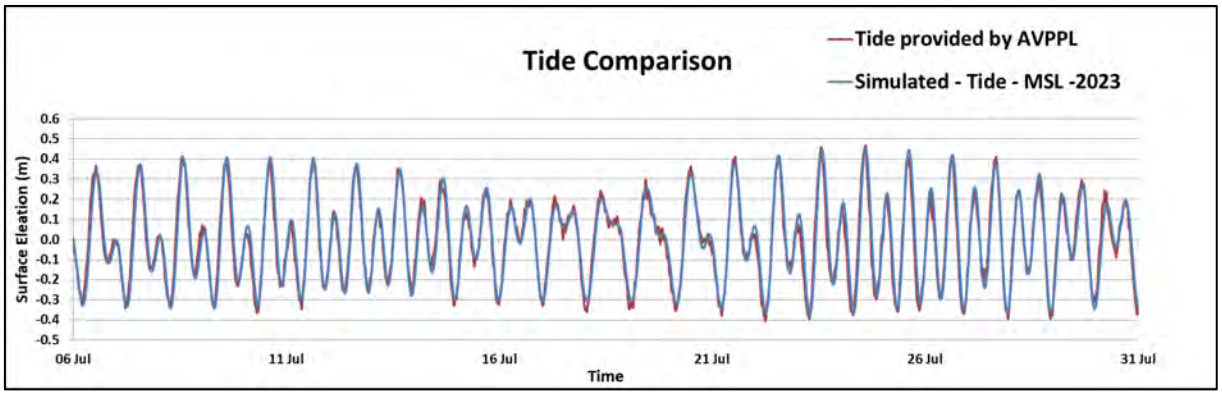


Figure 3-8 Comparison of AVPPL data with simulated tide (2023)(SW Monsoon)

Figure 3-11 to Figure 3-26 shows the comparison of N-S and E-W components of simulated currents at the measurement locations put on a similar time scale.

Simulated currents at CM3 location show good correlation with each other. Since the other locations are shadowed by the progress of breakwater construction (refer Figure 3-10) the current speeds have reduced and it can be noticed from N-S components plots presented below. Since the bathymetry data is not available at CM1 location, comparison has not been carried out at this location. Figure 3-27 and Figure 3-28 shows typical plots from the simulation.

Figure 3-9 Current meter locations (2013)

Figure 3-10 Current meter locations (2013) presented over 2022 Google imagery

Table 3-1 Current meter locations – Mulloor (2013)

Name	Depth – CD (m)	Location	UTM – Zone 43 – WGS84	
CM1	13.0	Mulloor	720043 E	925377 N
CM2	18.0		719621 E	925034 N

Name	Depth – CD (m)	Location	UTM – Zone 43 – WGS84	
CM3	24.0		719013 E	924545 N

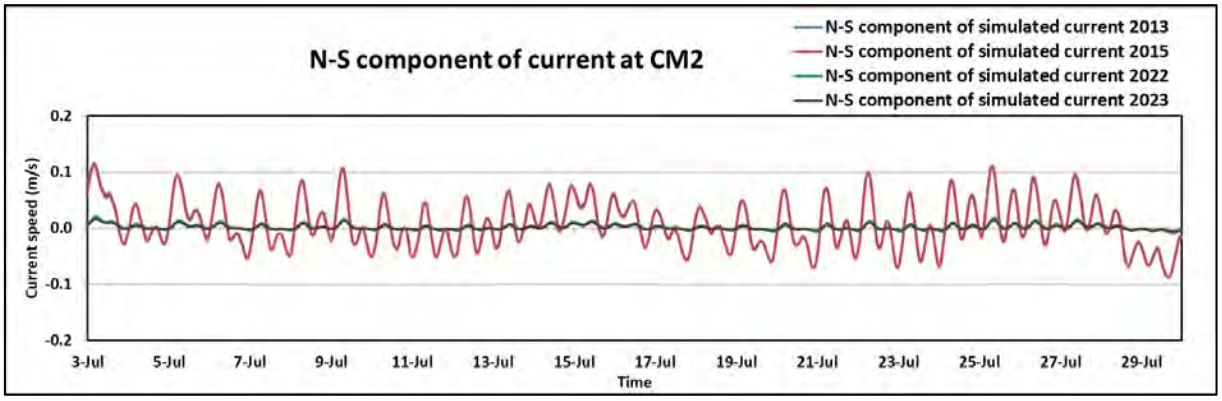


Figure 3-11 Comparison of N-S component of current at CM2

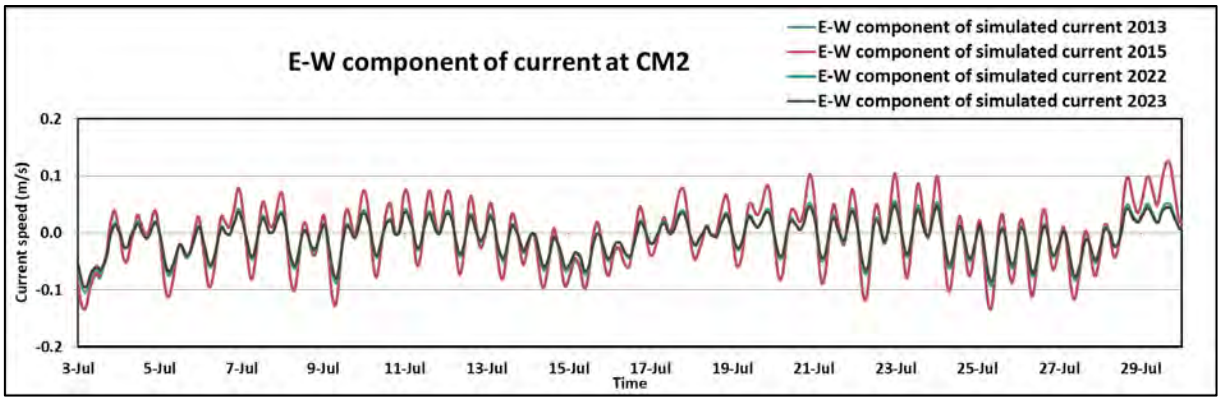


Figure 3-12 Comparison of E-W component of current at CM2

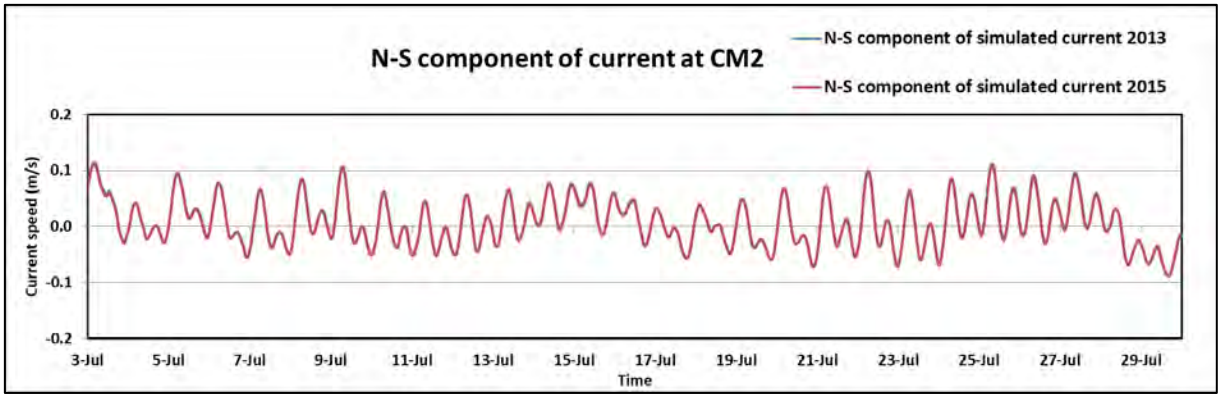


Figure 3-13 Comparison of N-S component of current at CM2 (2013 vs 2015)

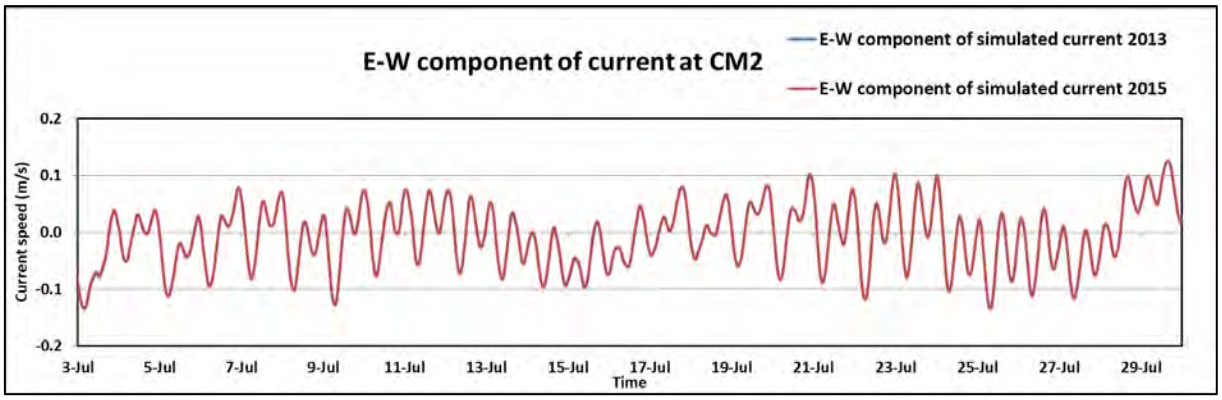


Figure 3-14 Comparison of E-W component of current at CM2 (2013 vs 2015)

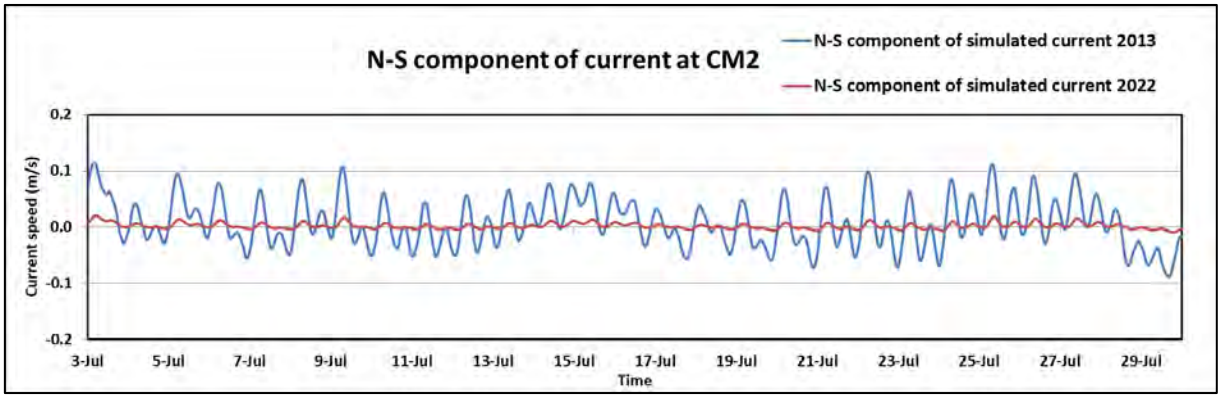


Figure 3-15 Comparison of N-S component of current at CM2 (2013 vs 2022)

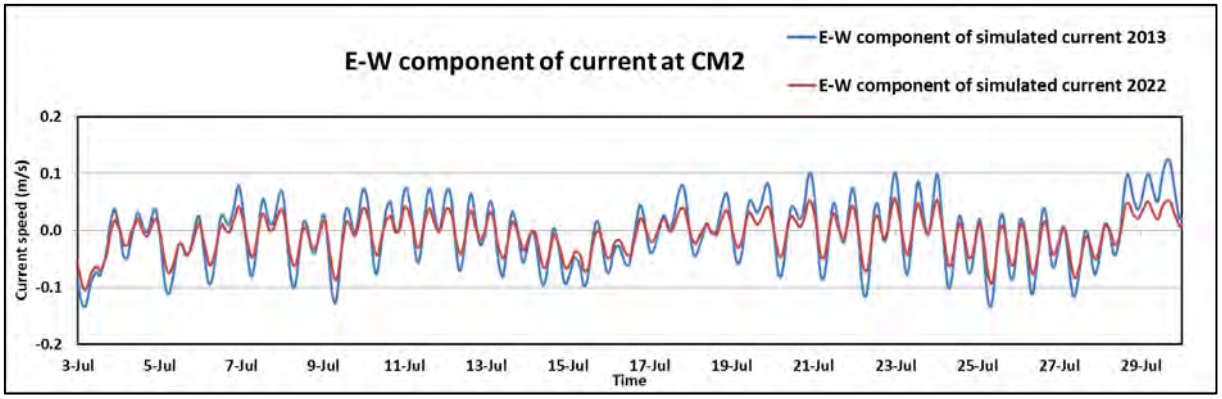


Figure 3-16 Comparison of E-W component of current at CM2 (2013 vs 2022)

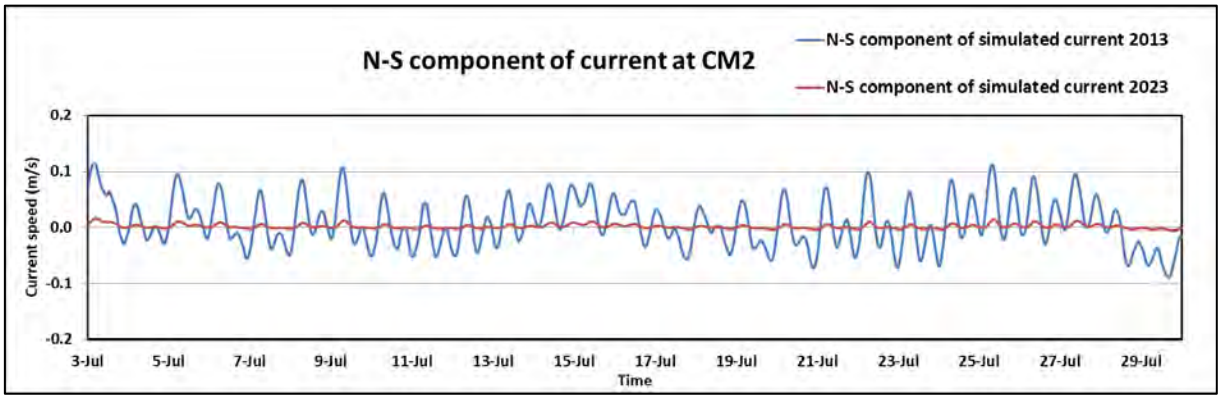


Figure 3-17 Comparison of N-S component of current at CM2 (2013 vs 2023)

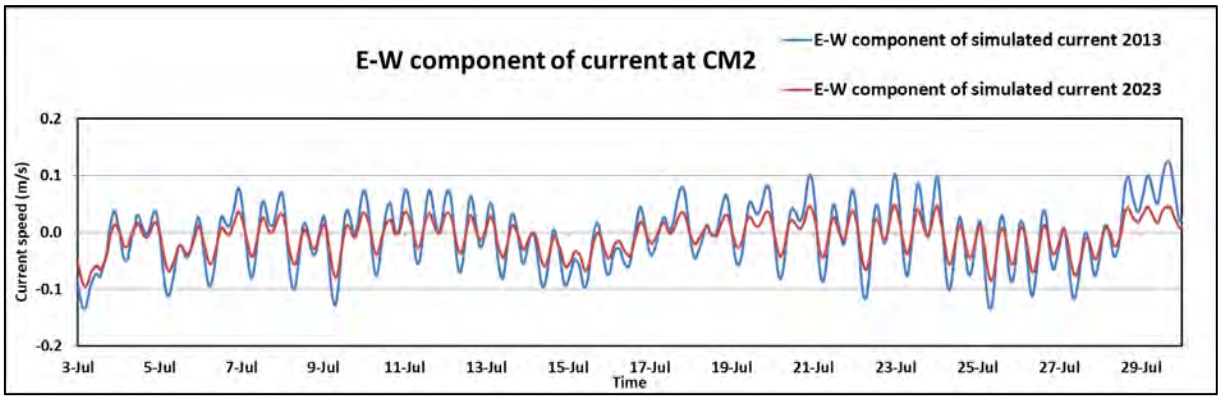


Figure 3-18 Comparison of E-W component of current at CM2 (2013 vs 2023)

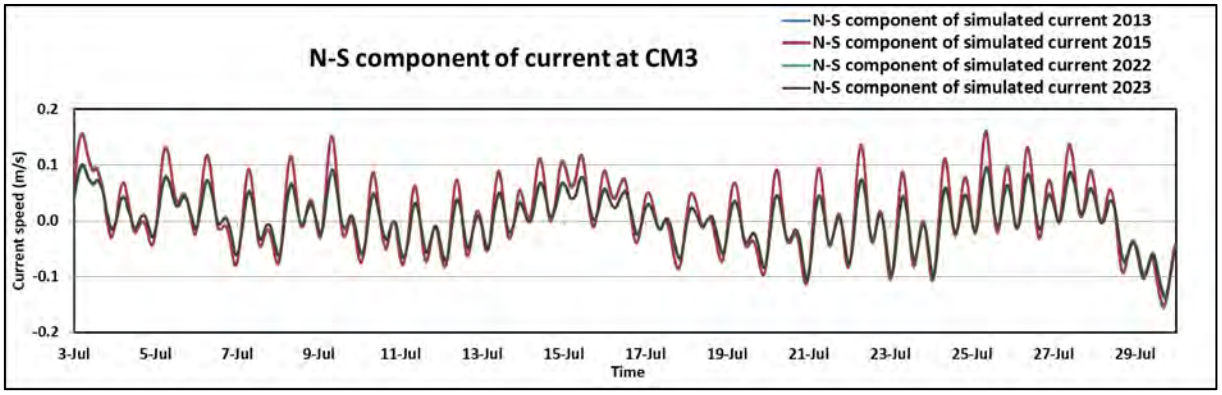


Figure 3-19 Comparison of N-S component of current at CM3

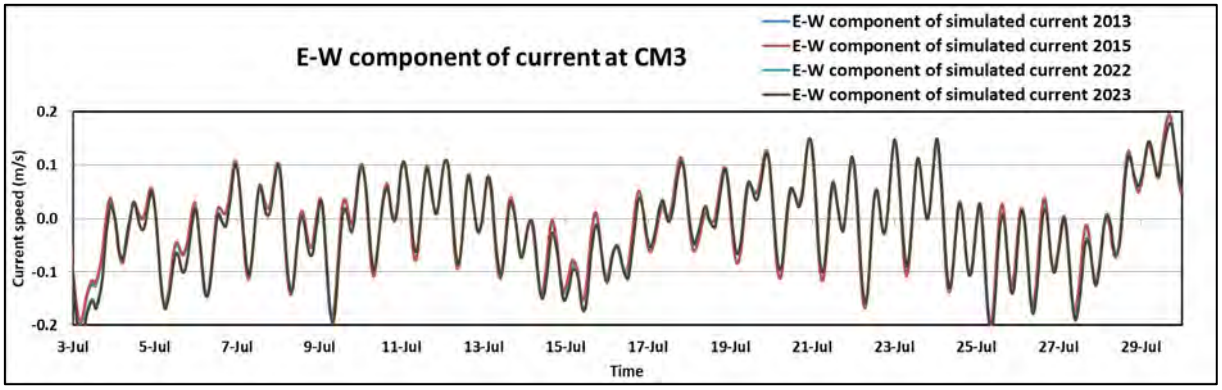


Figure 3-20 Comparison of E-W component of current at CM3

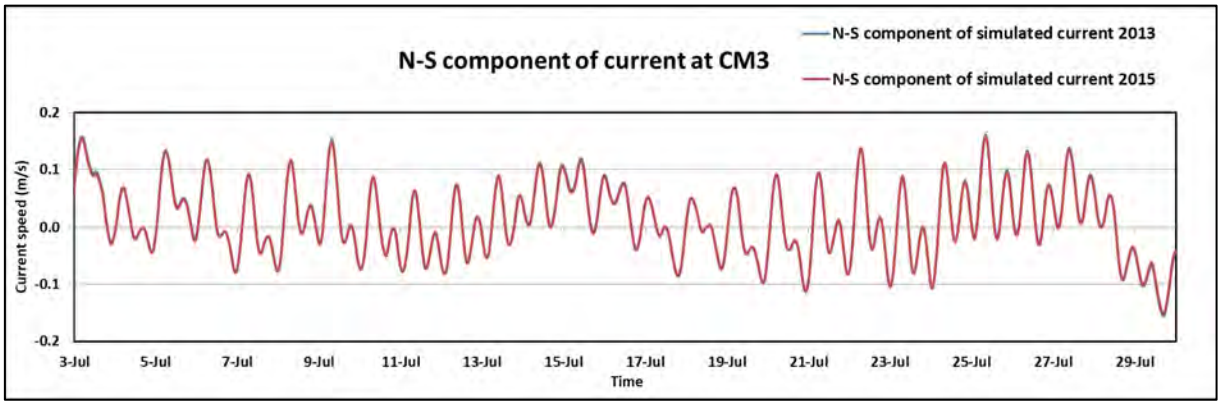


Figure 3-21 Comparison of N-S component of current at CM3 (2013 vs 2015)

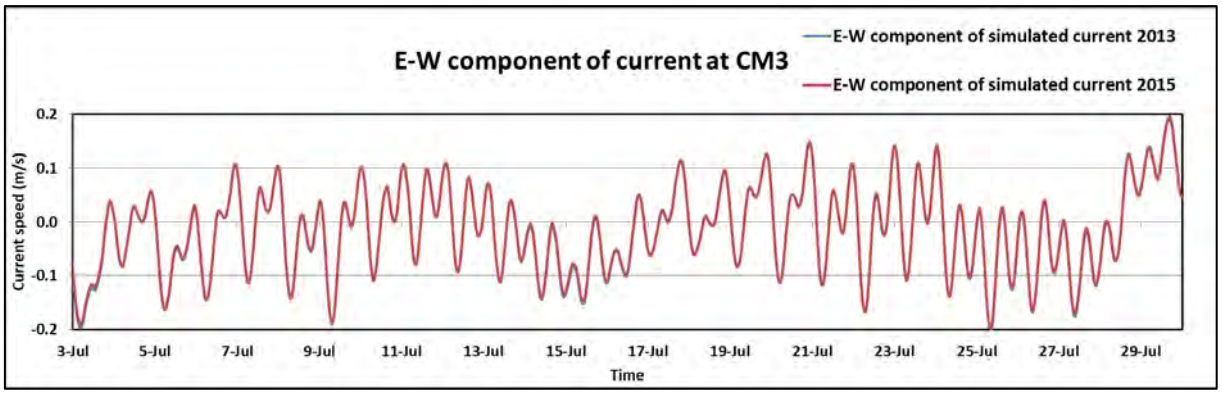


Figure 3-22 Comparison of E-W component of current at CM3 (2013 vs 2015)

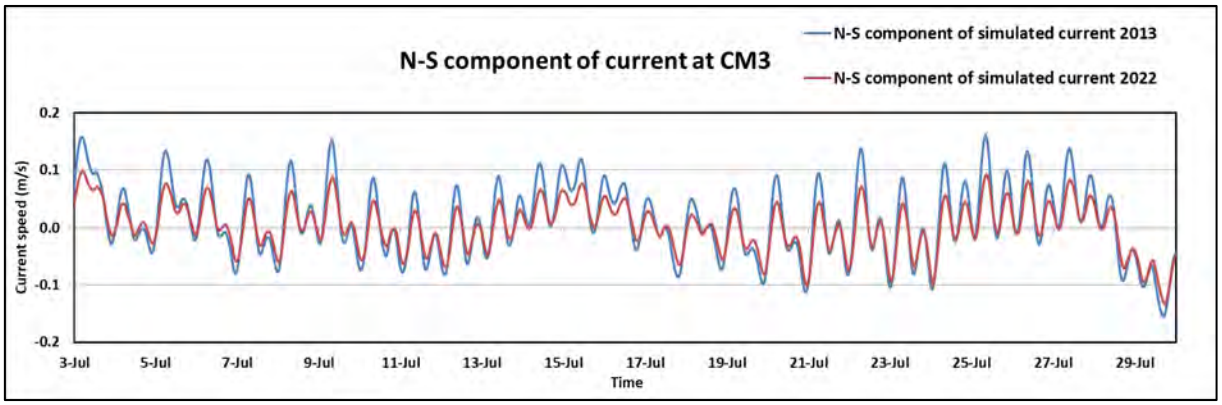


Figure 3-23 Comparison of N-S component of current at CM3 (2013 vs 2022)

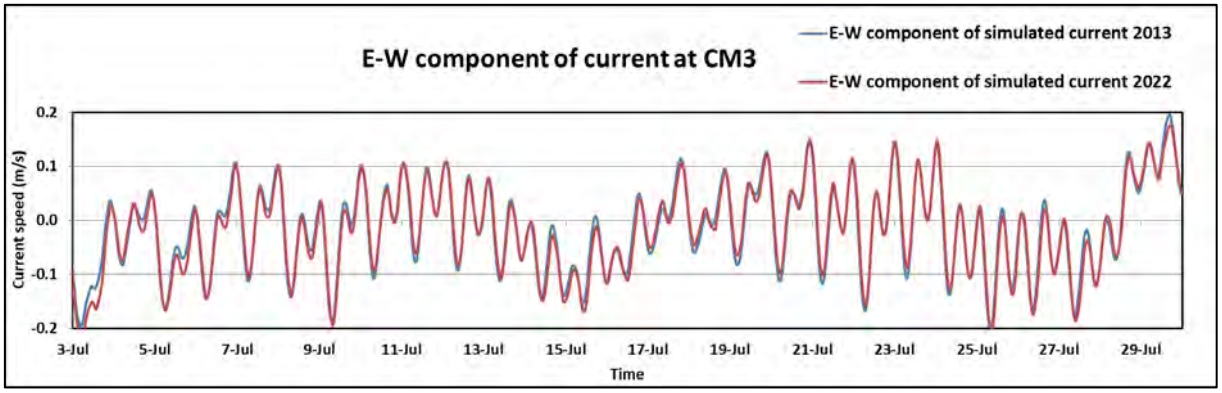


Figure 3-24 Comparison of E-W component of current at CM3 (2013 vs 2022)

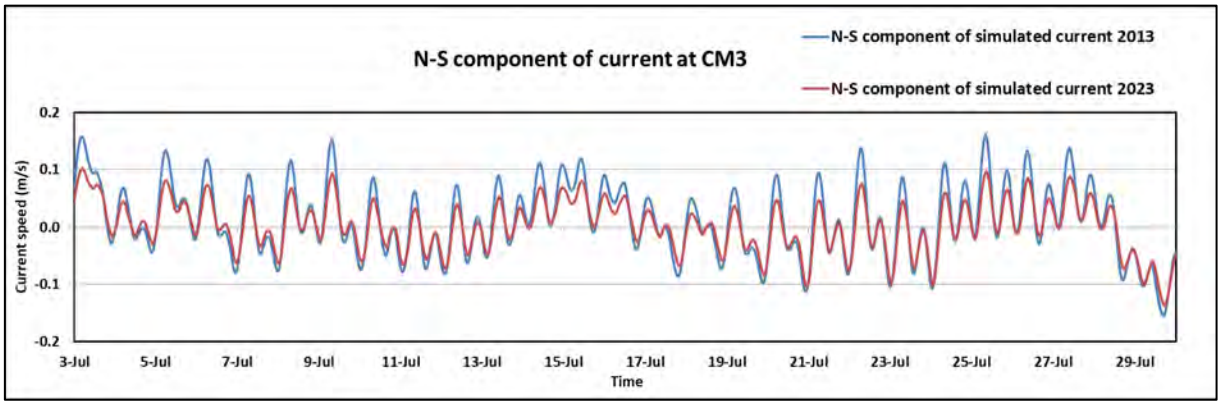


Figure 3-25 Comparison of N-S component of current at CM3 (2013 vs 2023)

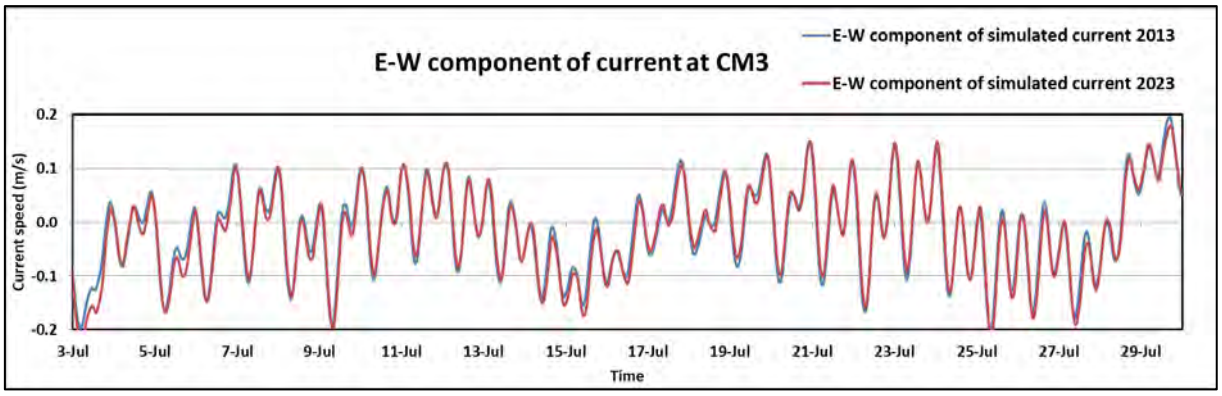


Figure 3-26 Comparison of E-W component of current at CM3 (2013 vs 2023)

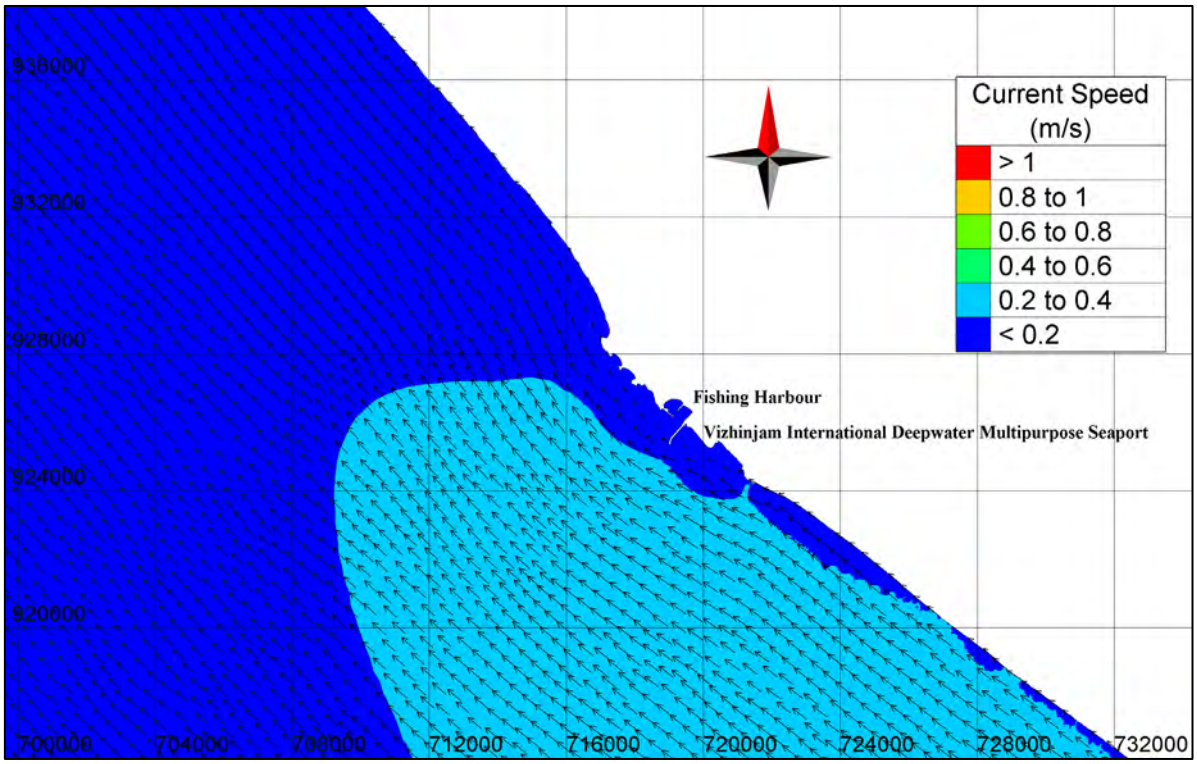


Figure 3-27 Current pattern showing north-westerly flow (typical during monsoon) for pre-monsoon bathymetry

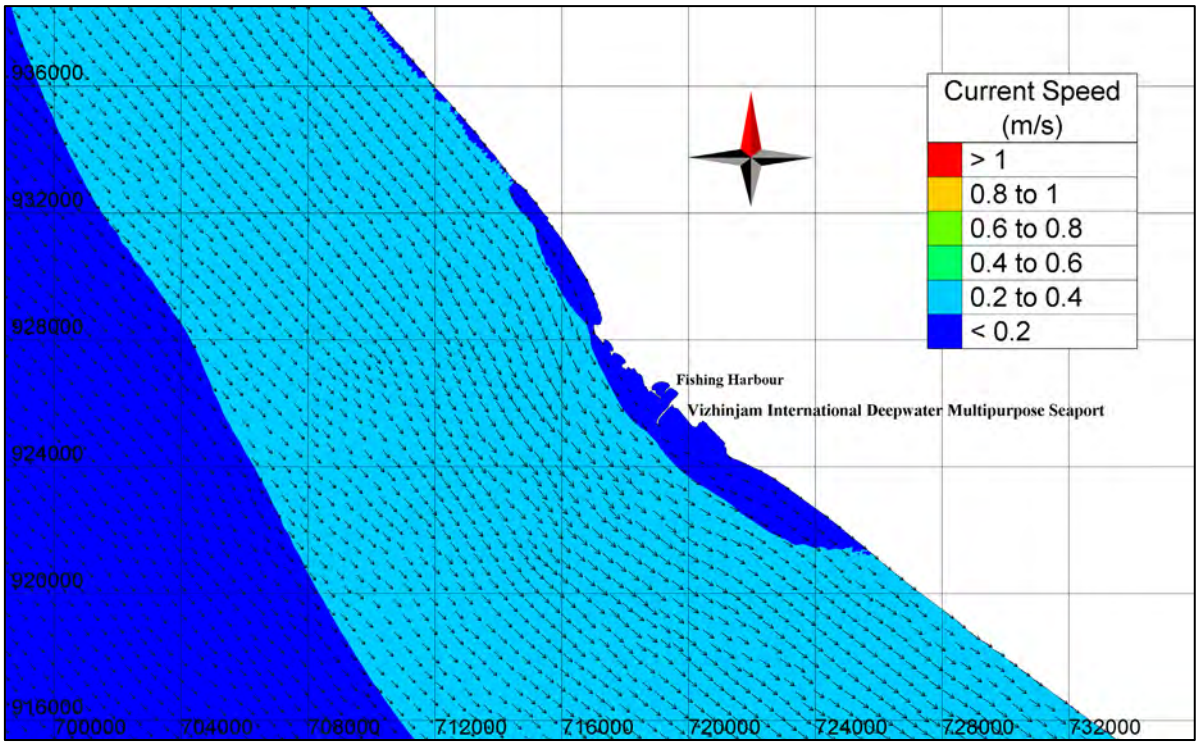


Figure 3-28 Current pattern showing south-easterly flow (typical during monsoon) for pre-monsoon bathymetry

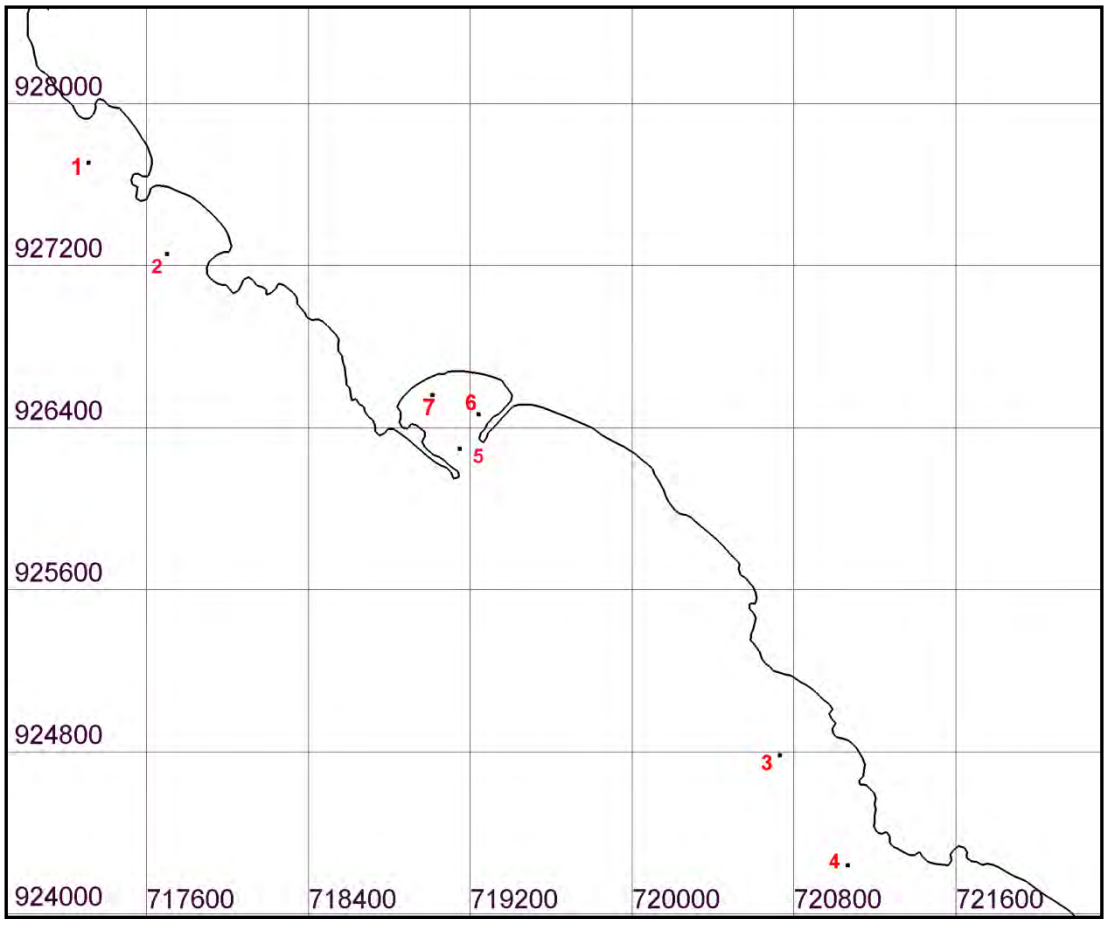


Figure 3-29 Current comparison points location (near shoreline)

Moreover, the current patterns were compared at different locations around the project vicinity at shallow water depth to see if there are any changes in flow pattern. Total 7 points were chosen to cover Fishery harbour, North and South side of proposed port as shown in Figure 3-29. The current comparison plots were shown in Figure 3-30 to Figure 3-57. From these plots it was observed that there was no significant change in current speeds. This indicates that the flow pattern at these locations is not influenced by the construction activity.

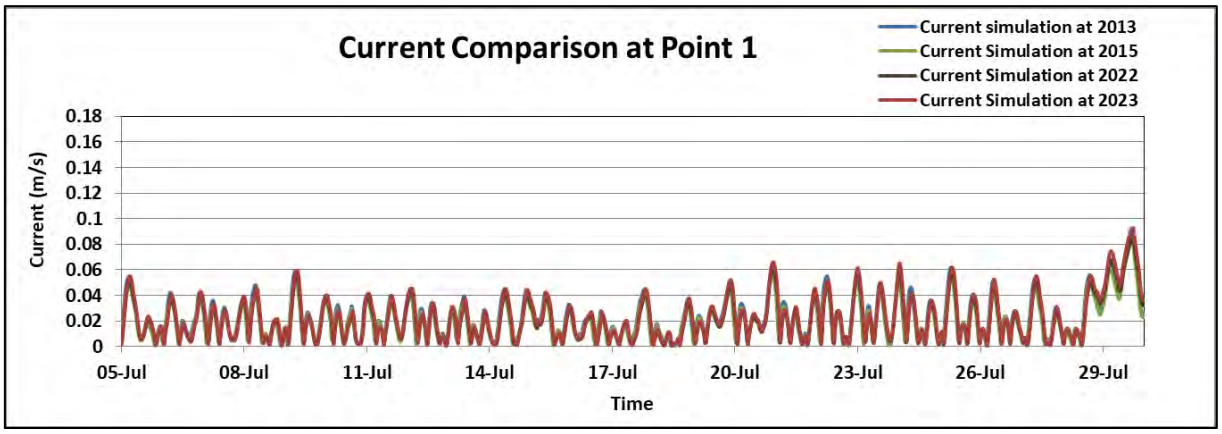


Figure 3-30 Current comparison at point 1

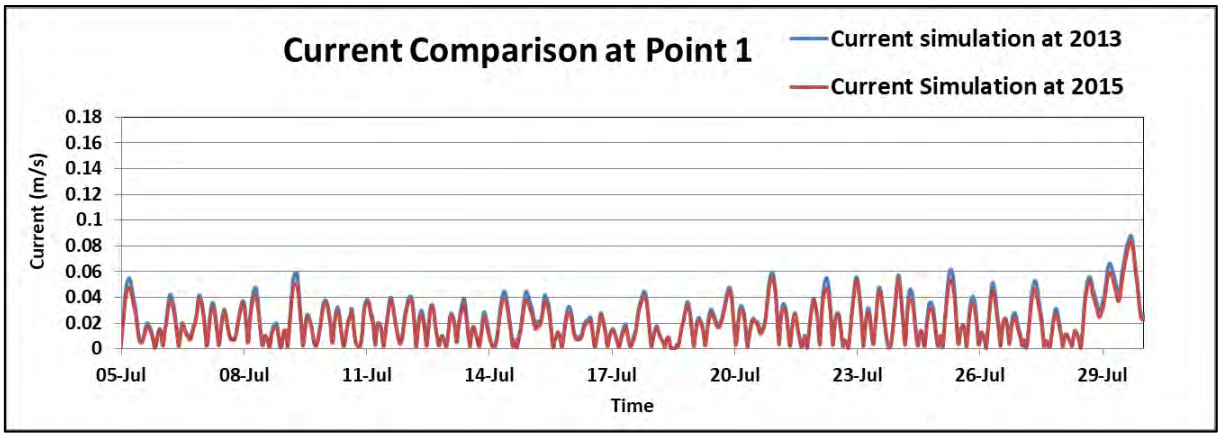


Figure 3-31 Current comparison at point 1 (2013 vs 2015)

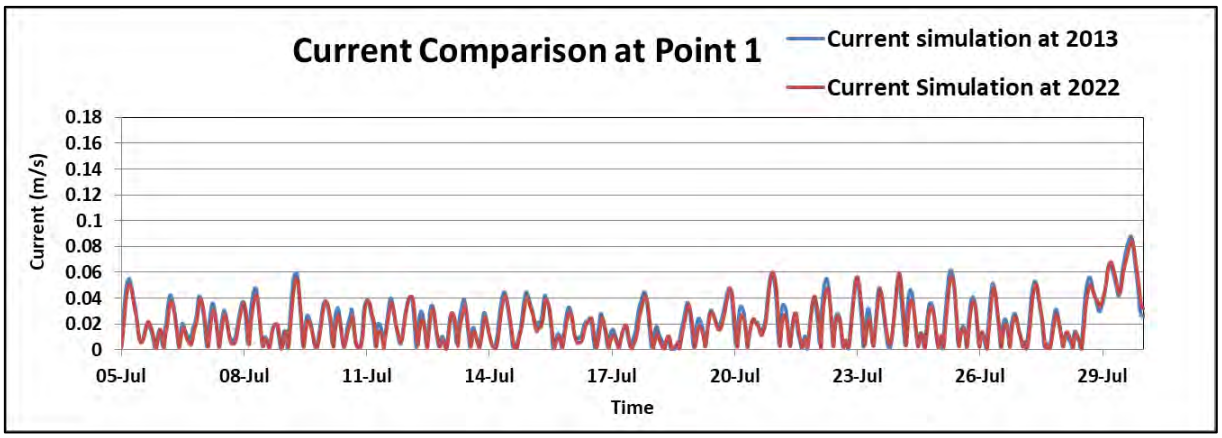


Figure 3-32 Current comparison at point 1 (2013 vs 2022)

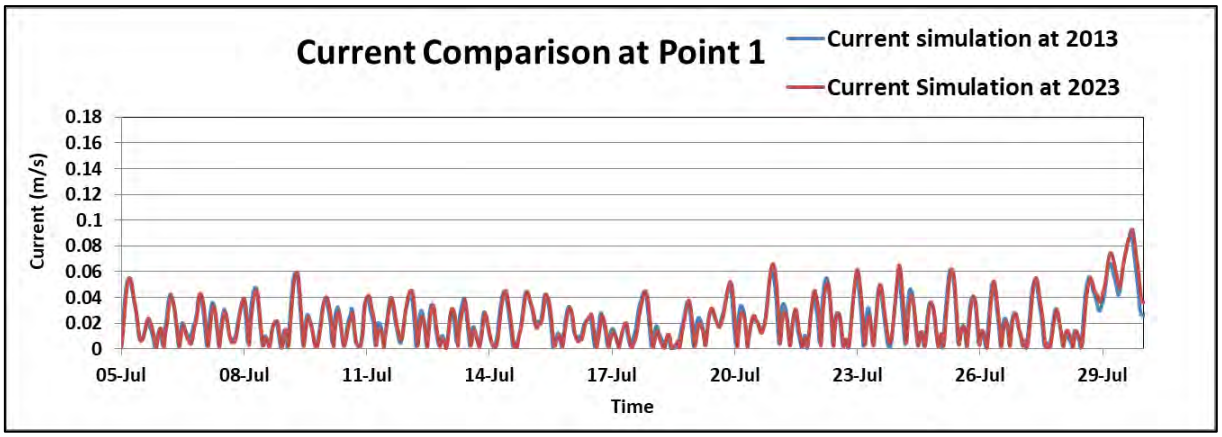


Figure 3-33 Current comparison at point 1 (2013 vs 2023)

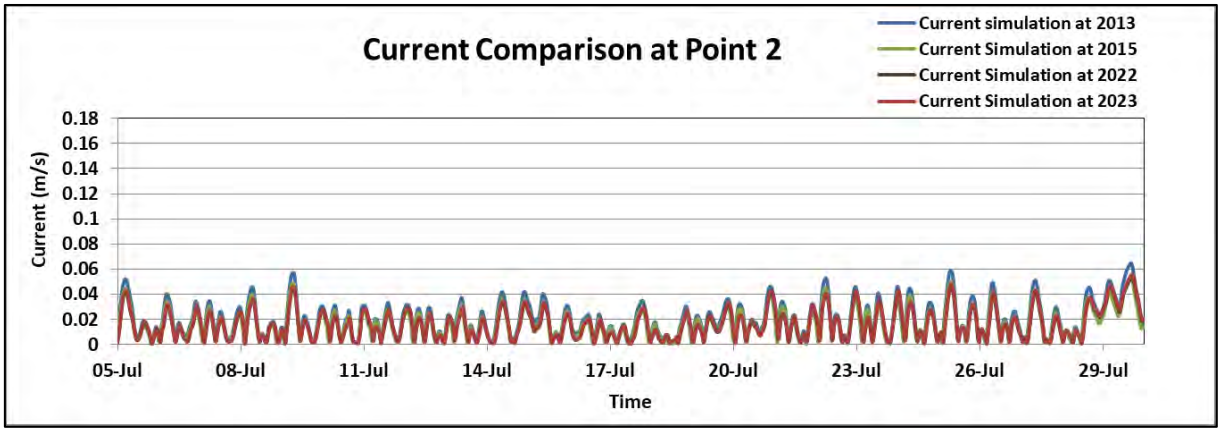


Figure 3-34 Current comparison at point 2

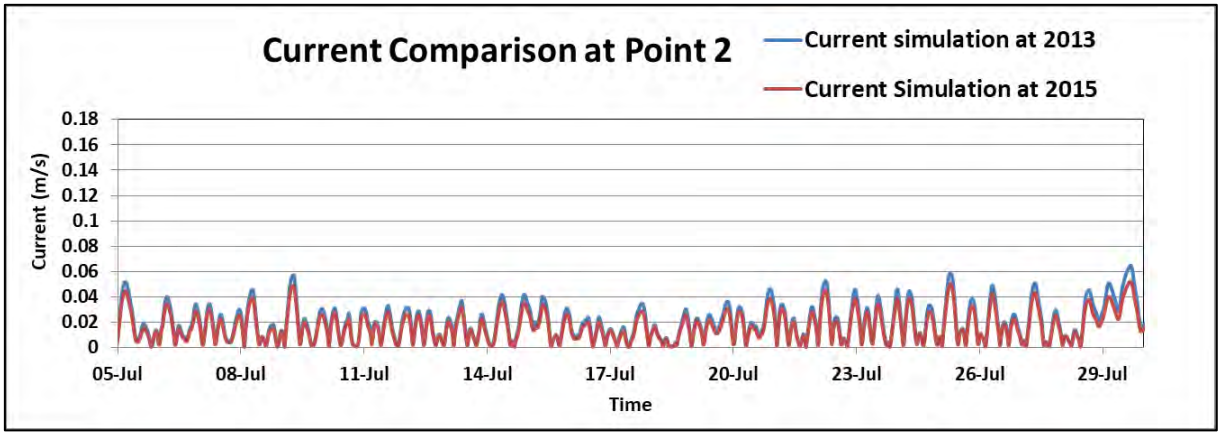


Figure 3-35 Current comparison at point 2 (2013 vs 2015)

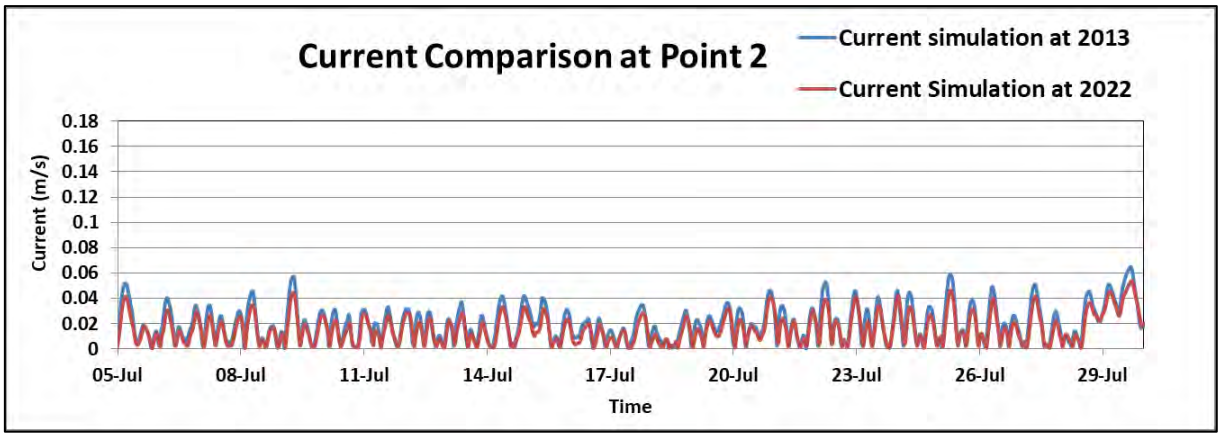


Figure 3-36 Current comparison at point 2 (2013 vs 2022)

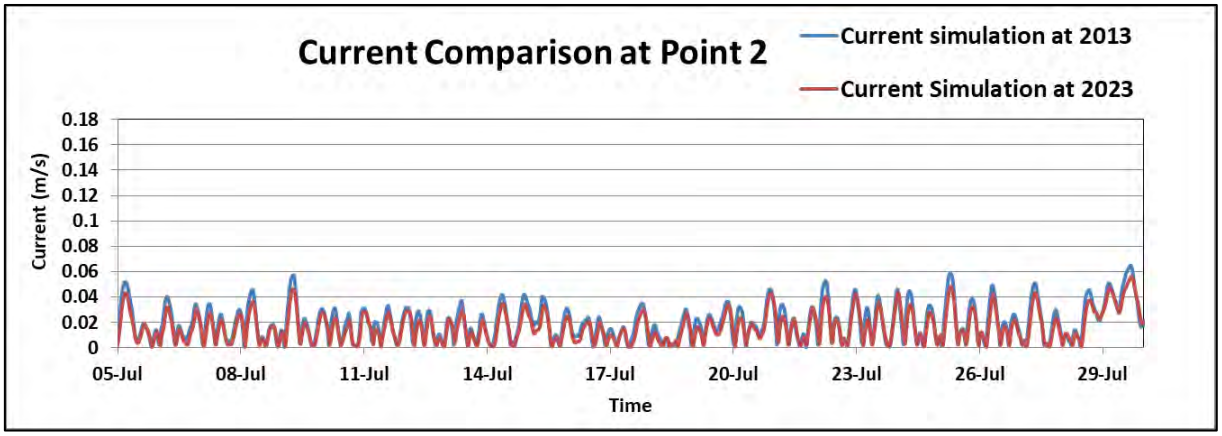


Figure 3-37 Current comparison at point 2 (2013 vs 2023)

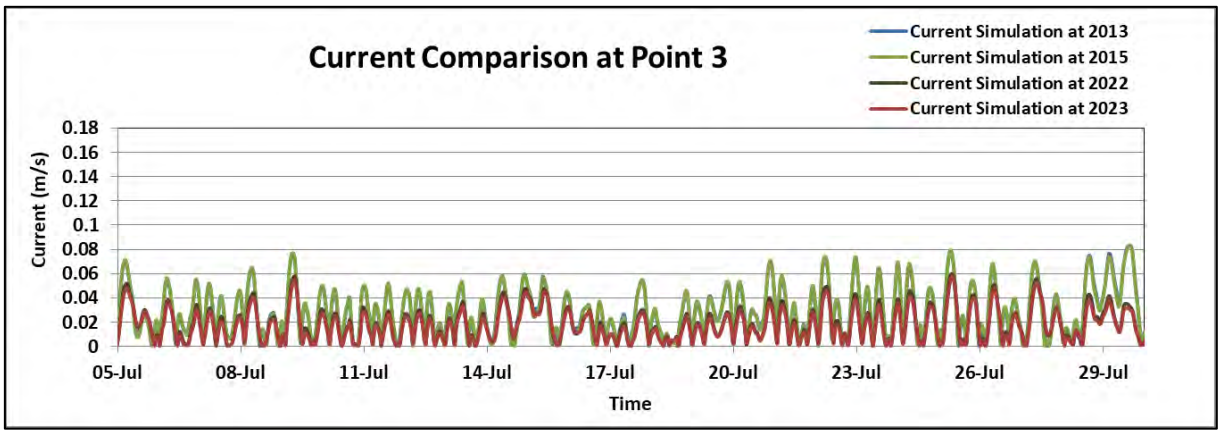


Figure 3-38 Current comparison at point 3

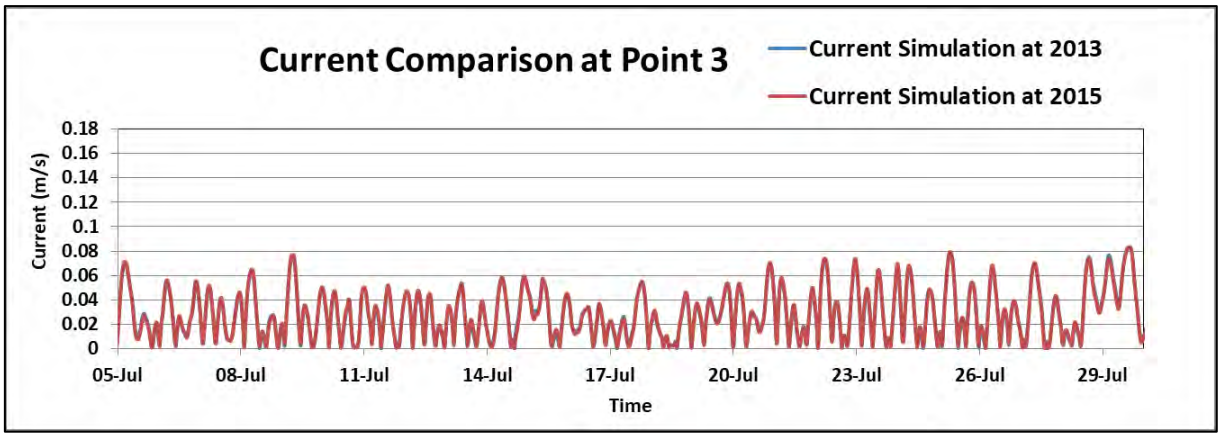


Figure 3-39 Current comparison at point 3 (2013 vs 2015)

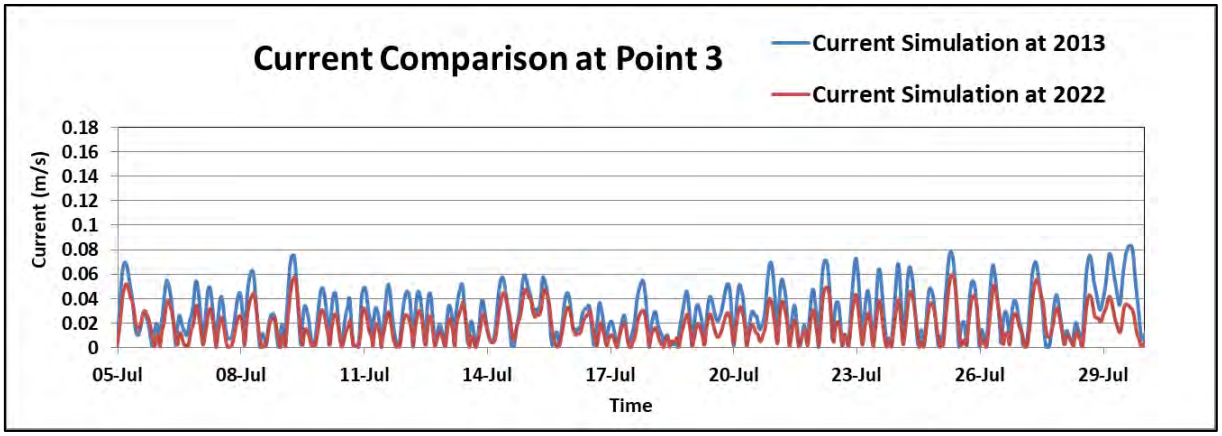


Figure 3-40 Current comparison at point 3 (2013 vs 2022)

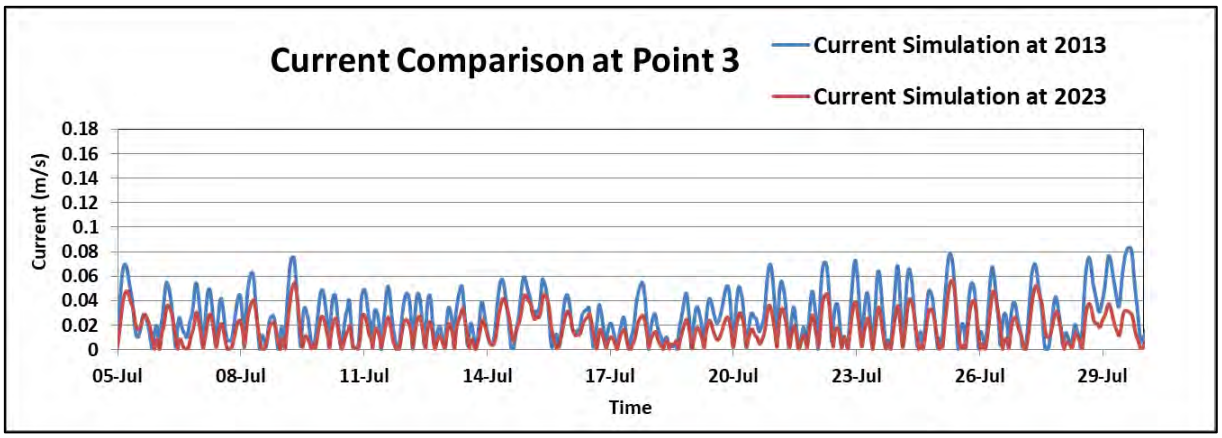


Figure 3-41 Current comparison at point 3 (2013 vs 2023)

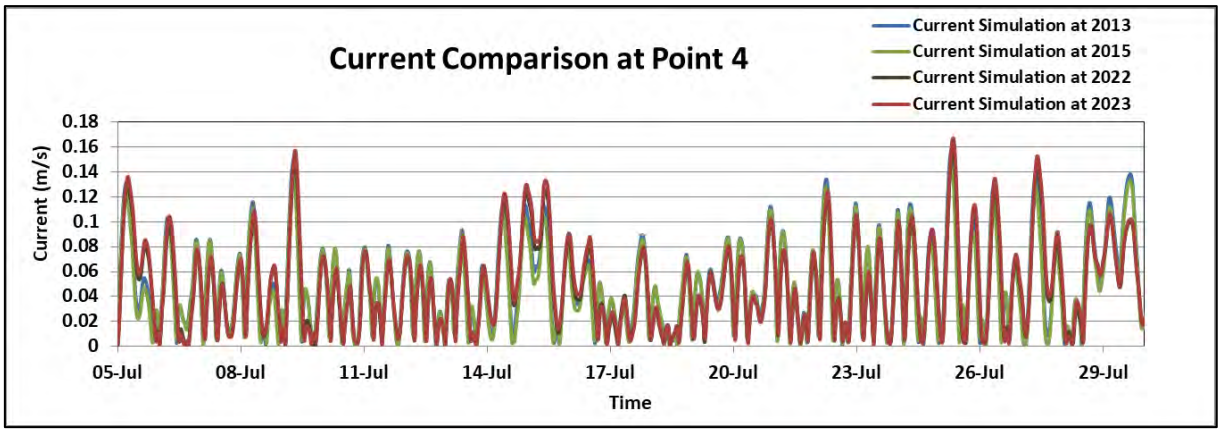


Figure 3-42 Current comparison at point 4

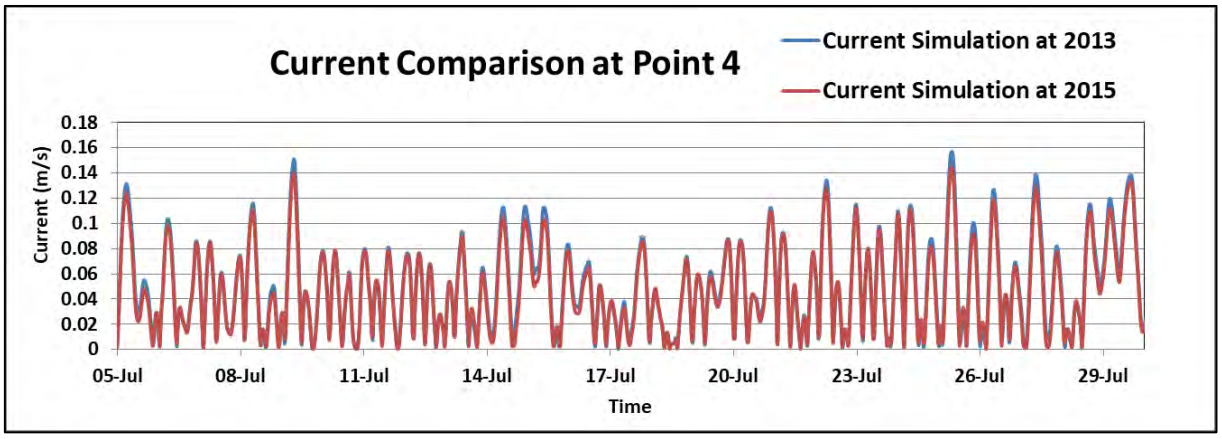


Figure 3-43 Current comparison at point 4 (2013 vs 2015)

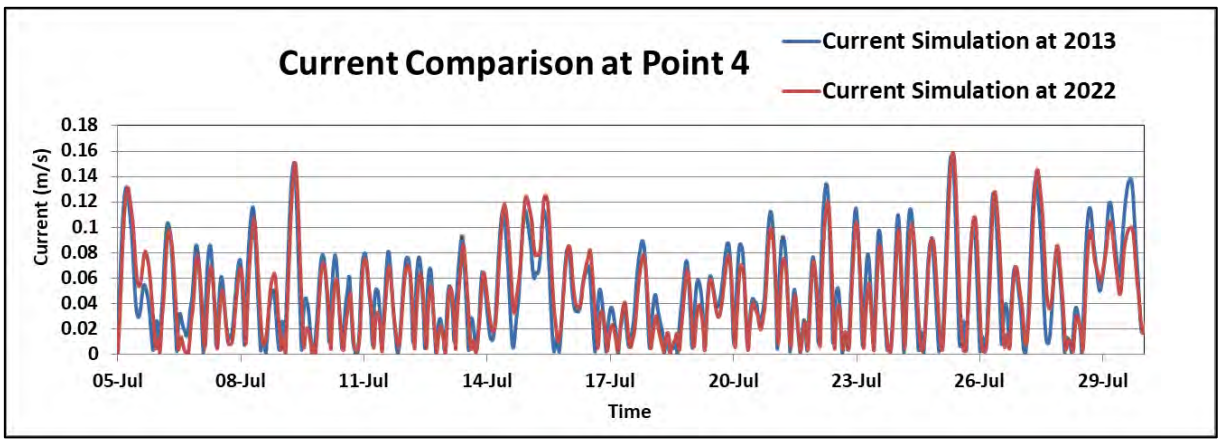


Figure 3-44 Current comparison at point 4 (2013 vs 2022)

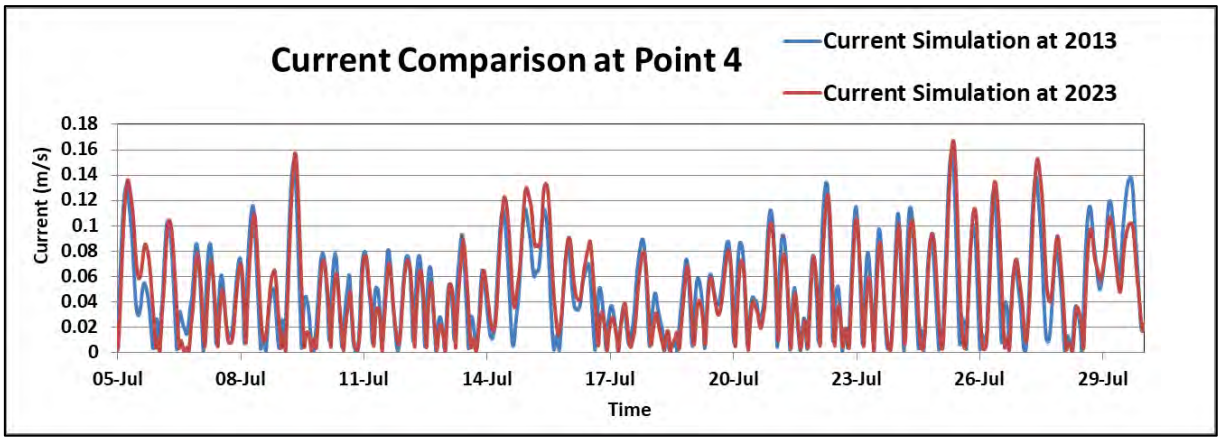


Figure 3-45 Current comparison at point 4 (2013 vs 2023)

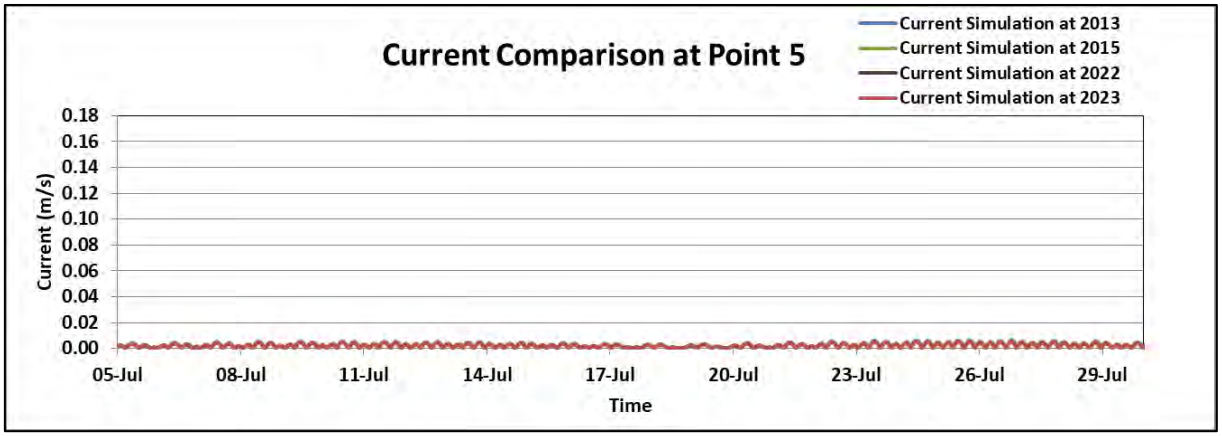


Figure 3-46 Current comparison at point 5

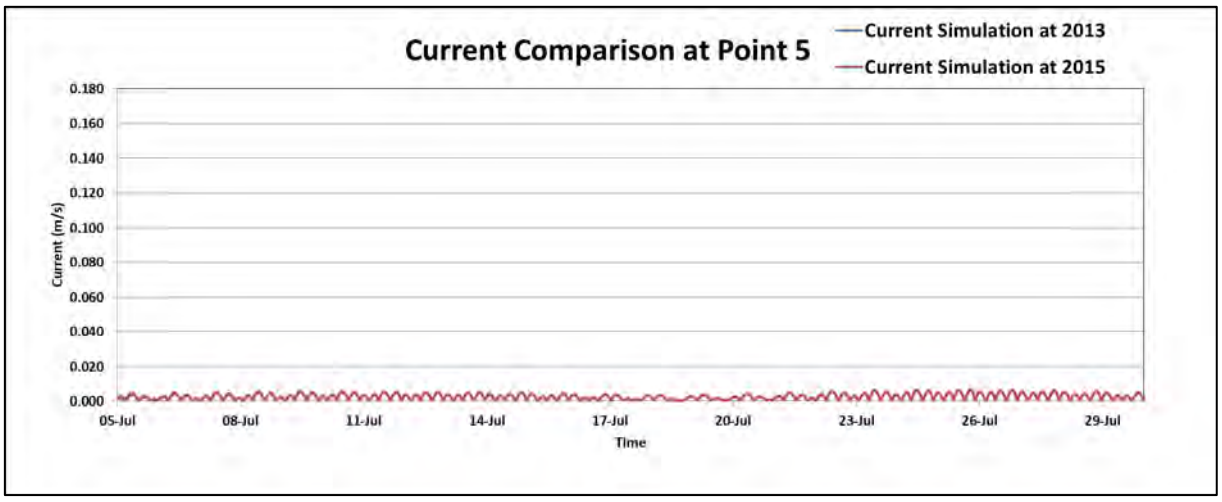


Figure 3-47 Current comparison at point 5 (2013 vs 2015)

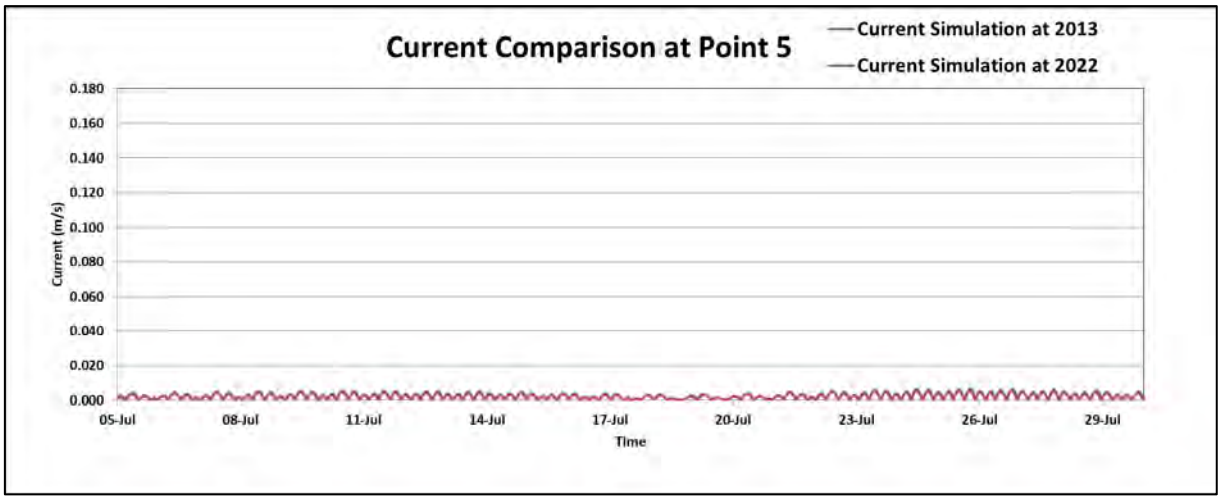


Figure 3-48 Current comparison at point 5 (2013 vs 2022)

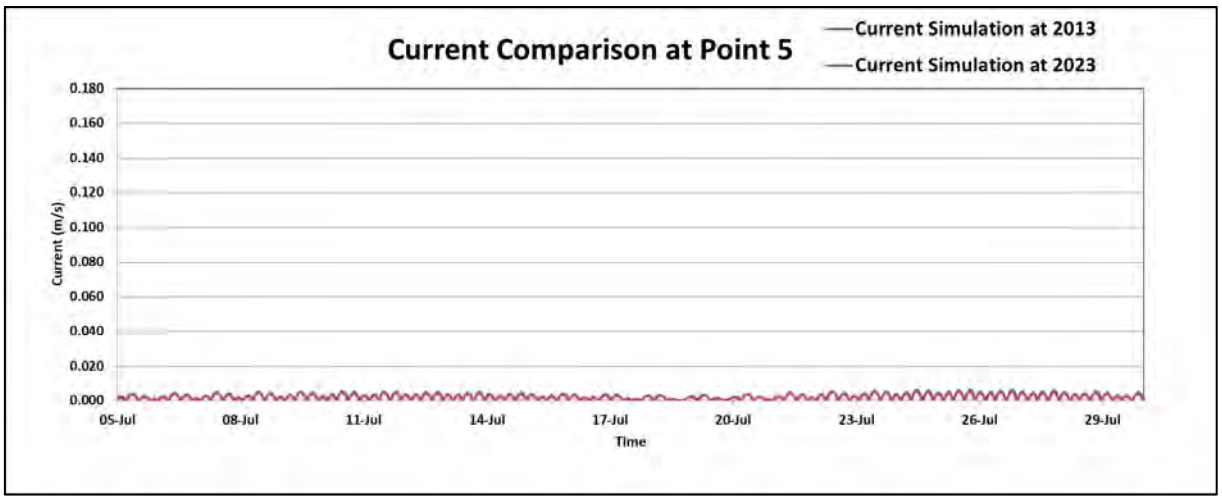


Figure 3-49 Current comparison at point 5 (2013 vs 2023)

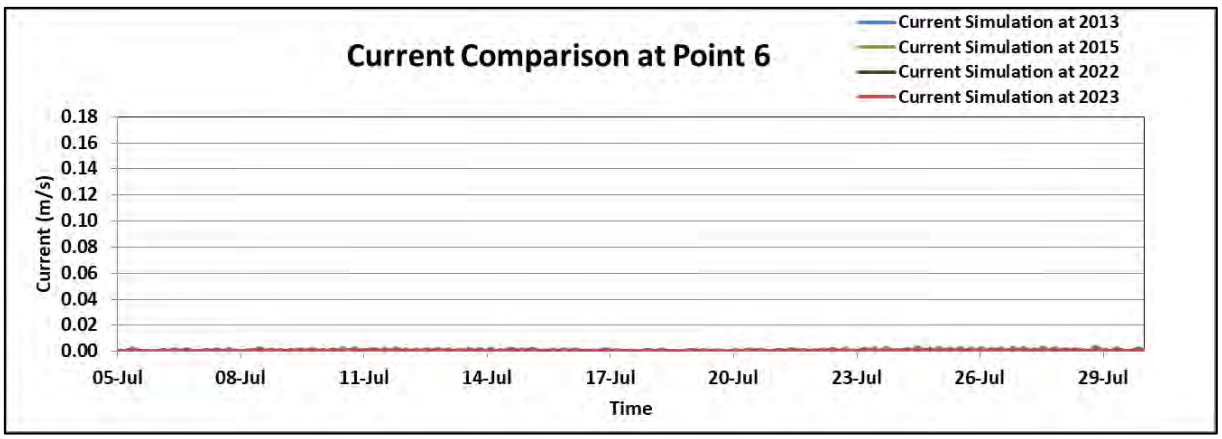


Figure 3-50 Current comparison at point 6

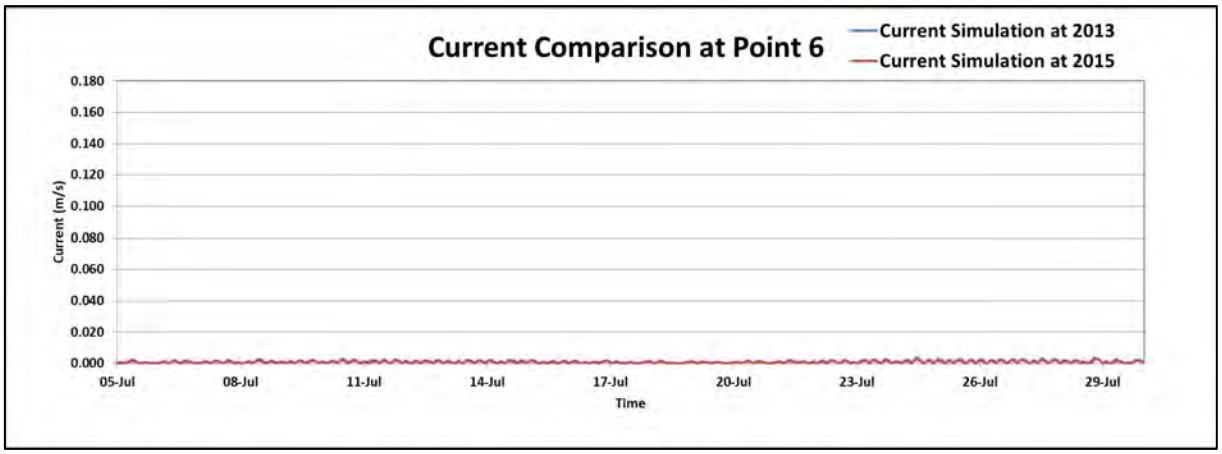


Figure 3-51 Current comparison at point 6 (2013 vs 2015)

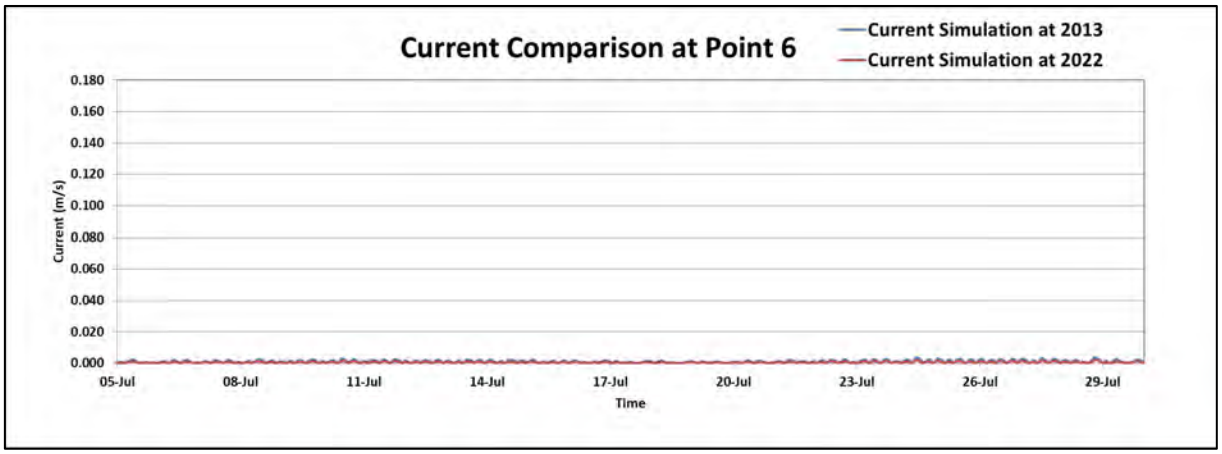


Figure 3-52 Current comparison at point 6 (2013 vs 2022)

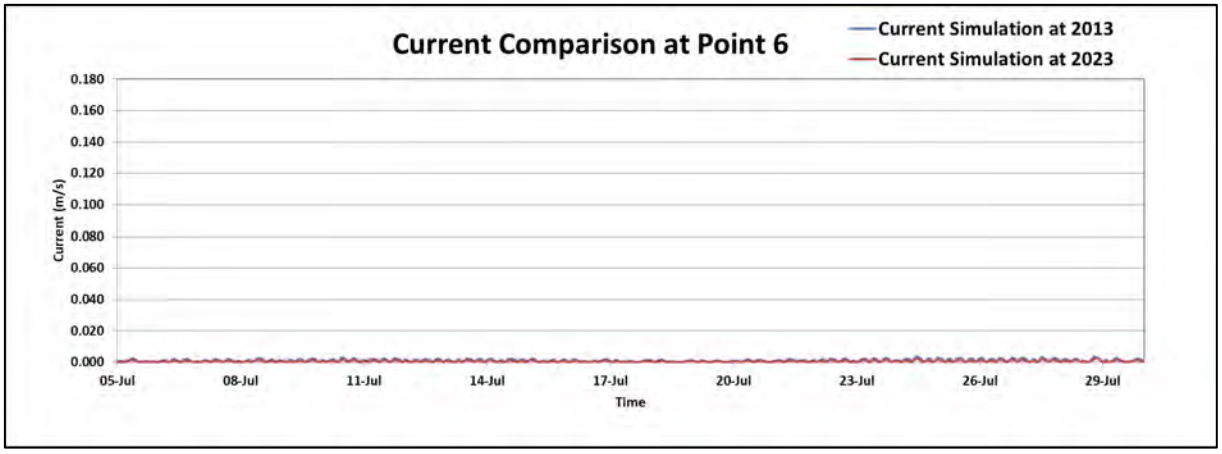


Figure 3-53 Current comparison at point 6 (2013 vs 2023)

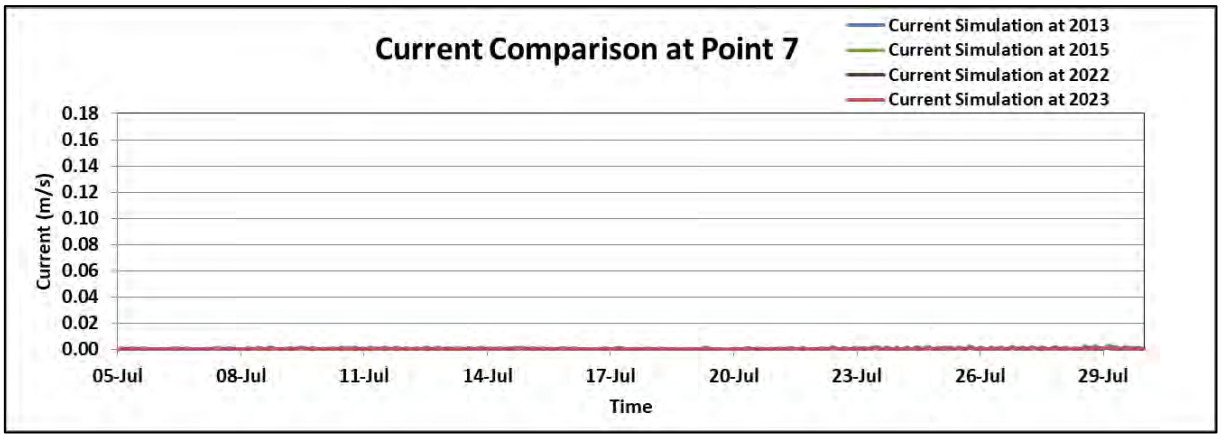


Figure 3-54 Current comparison at point 7

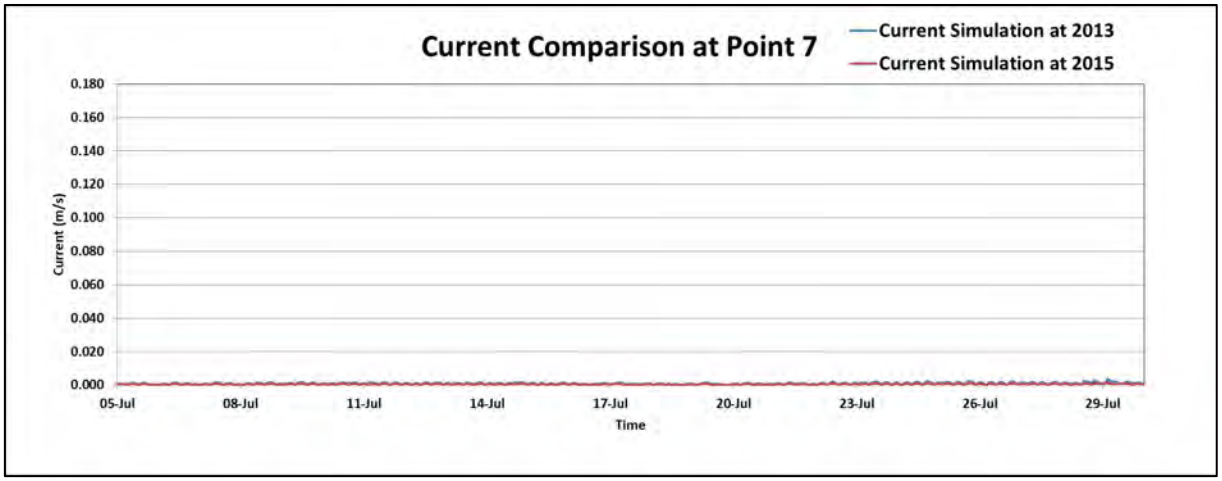


Figure 3-55 Current comparison at point 7 (2013 vs 2015)

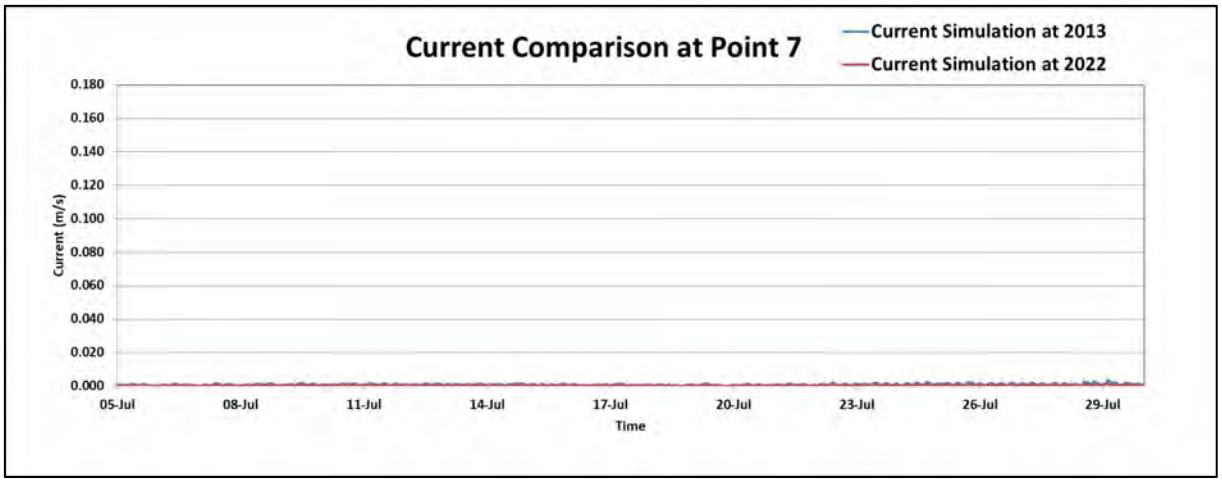


Figure 3-56 Current comparison at point 7 (2013 vs 2022)

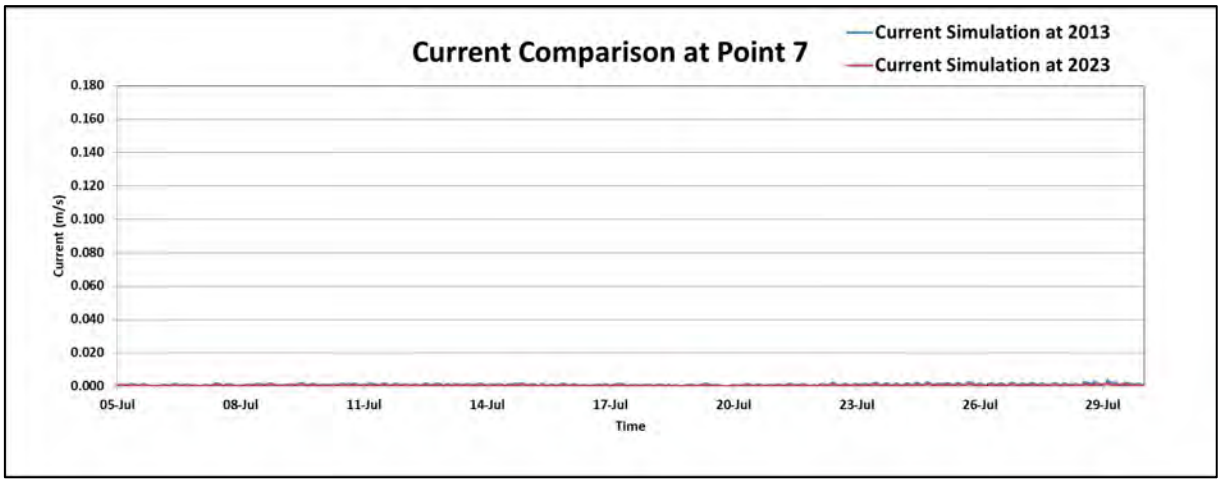


Figure 3-57 Current comparison at point 7 (2013 vs 2023)

Also, model was setup using latest surveyed bathymetry as Pre monsoon 2023. The same calibration parameters and boundary conditions as discussed in earlier sections are used to simulate hydrodynamics. The model bathymetry prepared using the available primary and secondary data is shown in Figure 3-2.

Comparison between the simulated and observed tide and currents were done. Figure 3-58 shows the comparison between the modelled tide and observed tide measured by AVPPL. From the comparisons there is a good correlation between simulated and observed data which indicates that the change in bathymetry has no effect on the tidal variations.

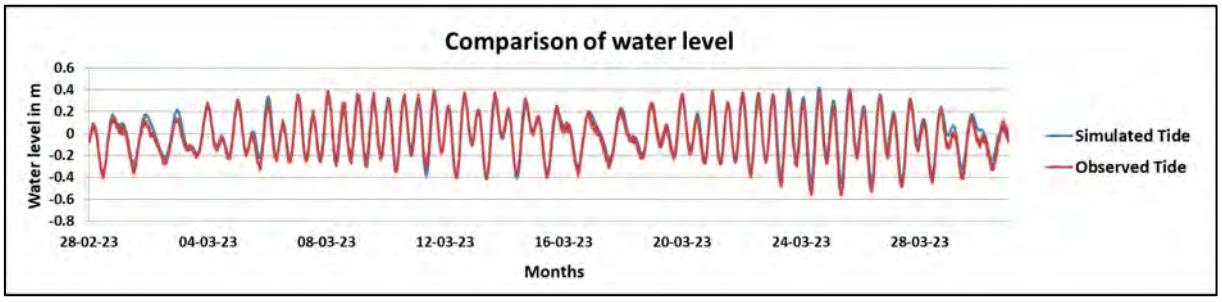


Figure 3-58 Comparison of simulated tide with observed tide (Pre Monsoon 2023)

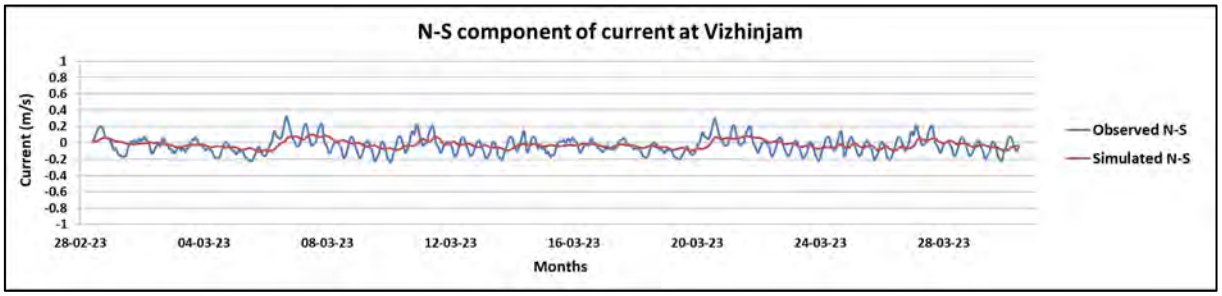


Figure 3-59 Comparison of N-S component of current at Vizhinjam (Pre Monsoon 2023)

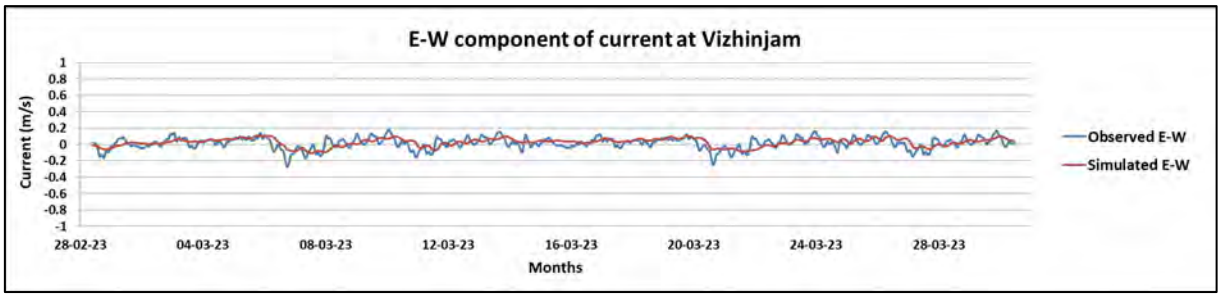


Figure 3-60 Comparison of E-W component of current at Vizhinjam (Pre Monsoon 2023)

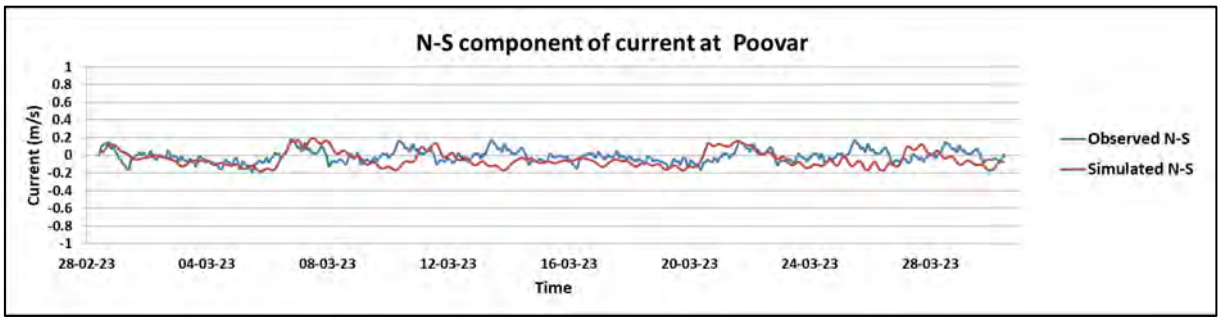


Figure 3-61 Comparison of N-S component of current at Poovar (Pre Monsoon 2023)

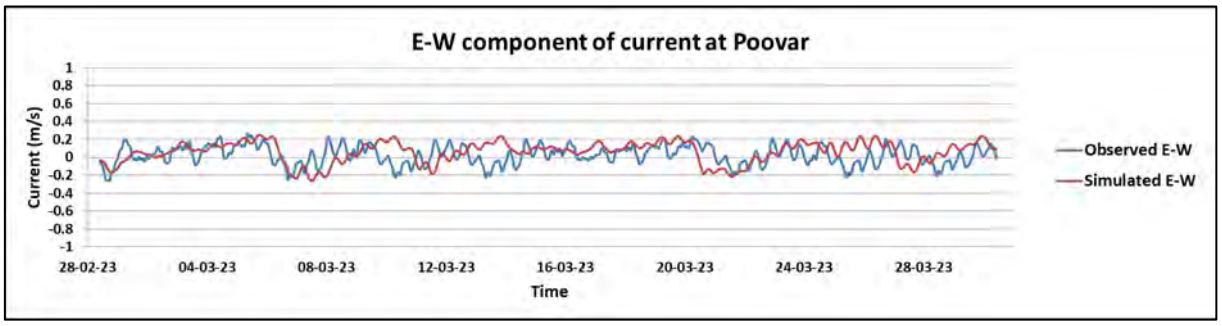


Figure 3-62 Comparison of E-W component of current at Poovar (Pre Monsoon 2023)

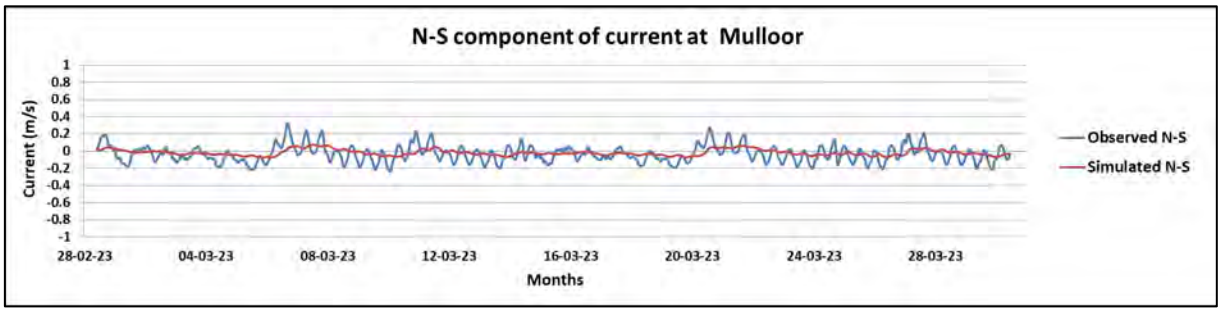


Figure 3-63 Comparison of N-S component of current at Mulloor (Pre Monsoon 2023)

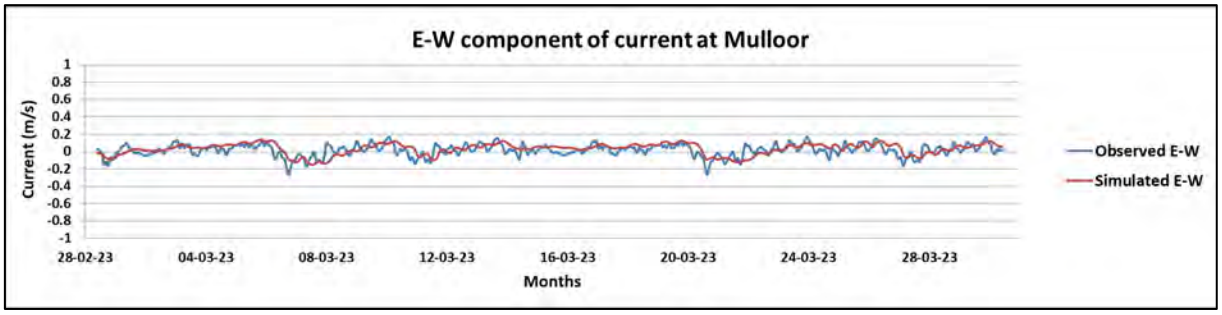


Figure 3-64 Comparison of E-W component of current at Mulloor (Pre Monsoon 2023)

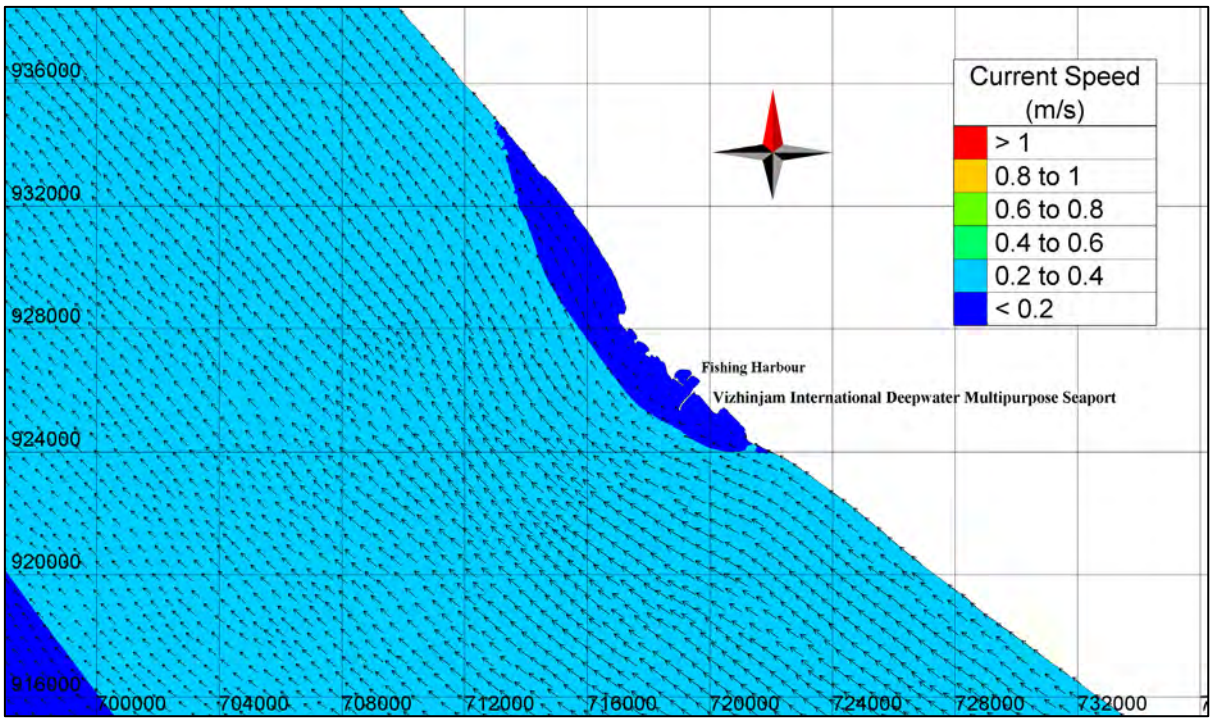


Figure 3-65 Typical plot of current pattern showing north-westerly flow

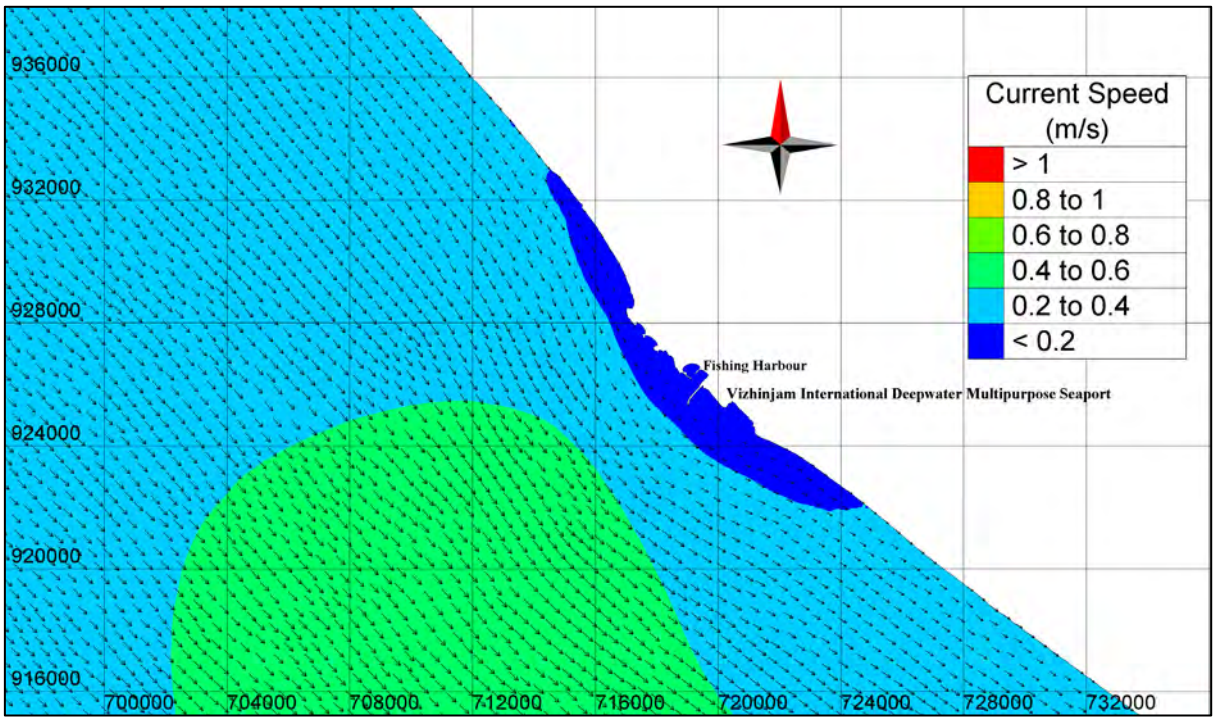


Figure 3-66 Typical plot of current pattern showing south-easterly flow

Figure 3-59 to Figure 3-64 represents the comparison of E-W and N-S components of current during Pre monsoon 2021, Post monsoon 2021 and Pre monsoon 2022 at different locations (Vizhinjam, Pachalloor, Poovar and Mulloor). From the comparison plots it can be noticed that there is a good correlation between simulated and observed current. Figure 3-65 and Figure 3-66 shows typical plots from simulation. This shows that the model can replicate the actual scenario well.

3.2 Longshore sediment transport

Longshore sediment transport refers to the cumulative movement of beach and near shore material parallel to the shore due to wave induced currents in the surf zone. These forces usually result in an almost continuous movement of material either in suspension or in bed load. The movement of water over the sea bed exerts a tractive force upon the surface particles on the bottom. When the force exerted exceeds the resistance of the particle to movement, transport takes place. The characteristics of transport are dependent principally upon the velocity and direction of water movement, sediment characteristics and upon the slope of the sea bed.

In earlier section, the offshore movement of the sediments were studied in the analysis of the cross shore profiles. The seasonal and annual movement of the shoreline was assessed and the various causes attributing to this movement were noted. However, along with the cross shore sediment transport, it is necessary to study the movement of the shoreline along the coast as well. A study on the same is covered in this section.

The study area extends from Edappadu Beach (CS 01) in the South to Thumba (CS 81) in the North over a stretch of approximately 40km as shown in Figure 3-67. This coast can be distinguished into two subsets depending on the coastal orientation. The shore angle on south side is in the range of 125^0 to 130^0 (True North) and shore angle on north side is in the range of 135^0 to 145^0 (True North). These orientations were shown with green and maroon lines in Figure 3-68. This change in orientation will have effect on long shore sediment transport and its behaviour.

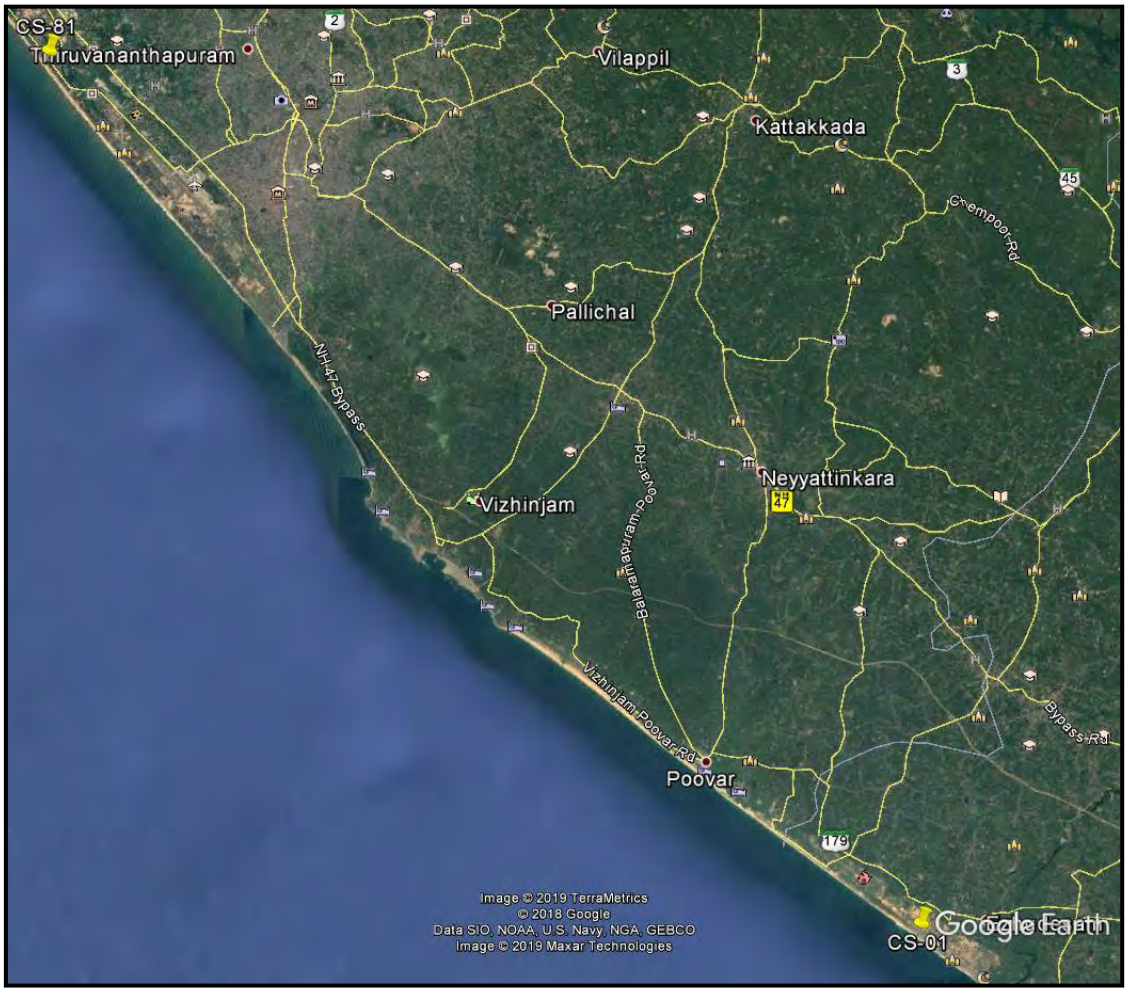
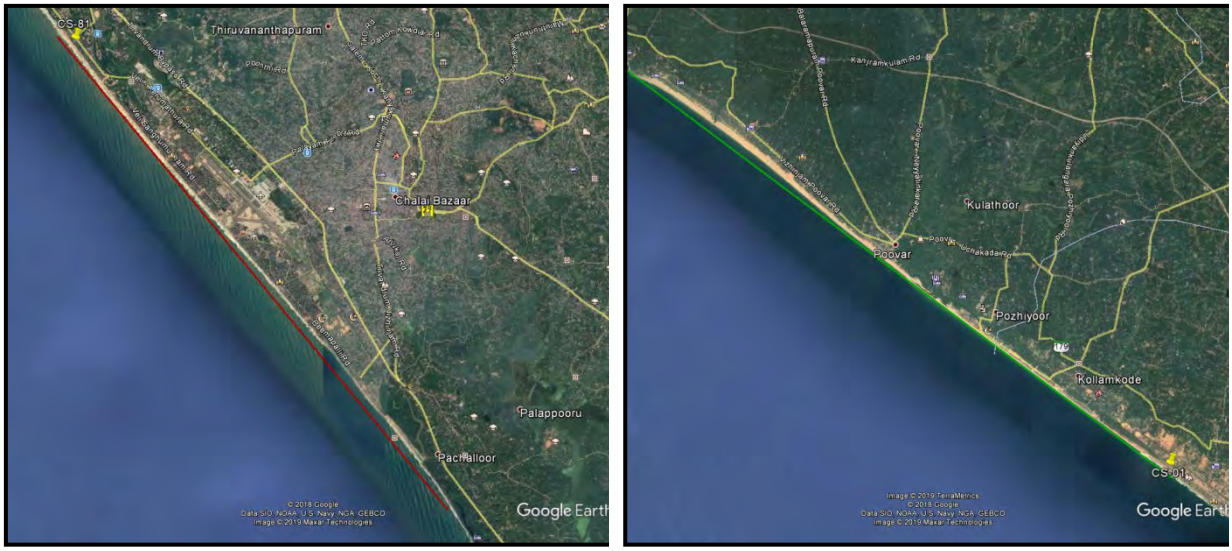


Figure 3-67 Study area



Orientation north of the port **Orientation south of the port**

Figure 3-68 Coast orientations

3.2.1 Longshore sediment transport due to breaking waves

To compute longshore transport rate, breaking parameters need to be estimated first. The breaking parameters such as breaking wave height, breaking depth and breaking angle (shore normal) were calculated using depth limited criterion. This expression includes the influence of beach slope m.

$$\frac{H_{sb}}{d_b} = 0.56\, e^{3.5m}$$

The wave parameters were collected from WRB deployed at 23.2 m water depth and the breaking characteristics of waves were determined by combining wave refraction and shoaling calculations with the above wave breaking criteria.

The dynamic equation of the long shore transport rate (LSTR), Q is

$$Q = (H^2 C_g)_b [a_1 sin2\Theta_{bs} - a_2 cos\Theta_{bs} \frac{\partial H}{\partial x}]_b$$

$$a_1 = \frac{K_1}{16(s-1)(1-p)(1.416)^{5/2}}$$

$$a_2 = \frac{K_2}{8(s-1)(1-p)tan\beta(1.416)^{7/2}}$$

Where H is the breaking wave height, C_g is the breaking wave group velocity, x is the long shore direction, and θ_{bs} is the angle of breaking waves referenced to the shore perpendicular direction, a_1 and a_2 are the non-dimensional parameters, p is porosity of the sand on the bed, s is ratio of density of sand to density of water and *tan* β is the average near shore bottom slope. The first term considers sediment transport generated by the long shore component of the breaking wave energy flux (similar to CERC formula). The second term modifies the transport rate to account for long shore gradients in breaking wave height $\frac{\partial H}{\partial x}$. K_1 and K_2 are

the two dimensionless calibration parameters for controlling the long shore sediment transport and offshore wave breaking.

Following standard convention of longshore transport directed to the right of an observer on the beach facing the sea is positive (Northward transport in this study), and transport toward the left is negative. The long shore transport rates were calculated using dynamic equation at each section and net transport rate was estimated over a year. In LSTR computation, the effect of groins and seawalls was not considered.

As explained earlier, depending on the coast orientation two average LSTR estimates were calculated based on available 5 years data (Feb 2015 – Feb 2022). The northerly and southerly (annual average) longshore sediment movement in south stretch is in the range of 0.17 to 0.19 M m^3/yr (Northwards) and -0.16 to -0.17 M m^3/yr (Southwards). In north stretch, the range is 0.24 to 0.26 M m^3/yr (Northwards) and -0.11 to -0.12 M m^3/yr (Southwards). The net annual average longshore sediment movement in south stretch is in the range of 0.01 to 0.02 M m^3/yr (Northwards) and in north stretch in the range of 0.13 to 0.14 M m^3/yr (Northwards).

4 Impact of breakwater, groynes and seawalls on 10km radius of Vizhinjam port

4.1 Introduction

Shoreline is a fringe of land that represents the dynamic boundary that separates the shoreline from the continual impact of waves, winds, surge, and tides. This boundary evolves over timescales of hours (e.g., changing tides or wave conditions) to decades.

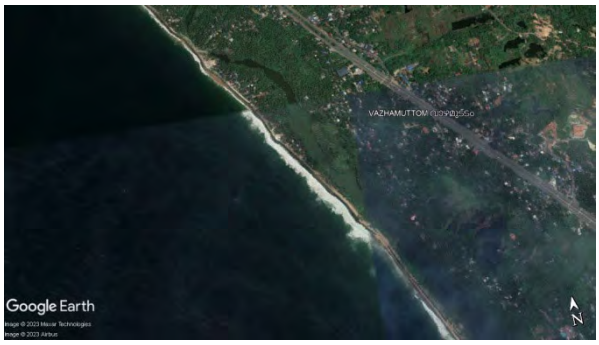
Alongshore sediment transport takes place when waves approach obliquely to the shore and eventually break. The wave breaking releases energy which brings sediment into suspension and alongshore littoral currents transports the sediment. Sediment transport is a cyclic process in which sediments are transported to and from the coast. The cycle of sediment transport by the waves to and from the coast is continuous which has aided in maintaining the equilibrium of the coastline over the geological times. Any change to the sediment transport due to natural and manmade development leads to imbalance in shoreline dynamics leading to accretion/erosion.

The aim of this study is to assess the long-term shoreline behaviour in the area and to assess the shoreline evolution due to the impact of breakwater, groynes and seawalls on 10km radius of Vizhinjam port. The long-term shoreline changes in the study area were studied based on analysis of primary and secondary data. GENESIS shoreline evolution model was setup to study the existing scenario and to study the long-term change due to the proposed port development during different phases of its development.

Coastal structure such as a groyne or a breakwater when introduced into the sea interrupts wave-induced littoral sediment transport in the direction of flow. The obstruction of sediment transport leads to sediment built-up up-drift and erosion down-drift due to deficit in sediment supply due to the obstruction. These aspects are studied individually in the context of proposed developmental activities which is detailed in the following section.

a) 0 - 2 km towards North

b) 2 - 4 km towards North



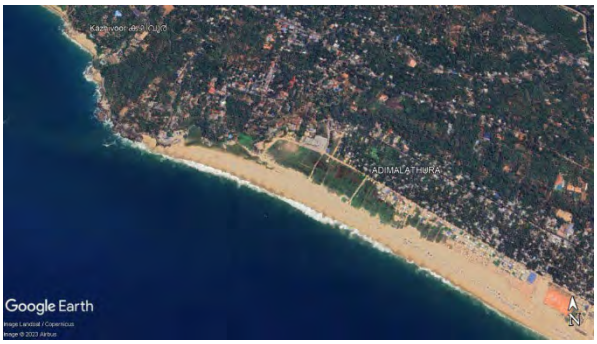
c) 4 - 6 km towards North

d) 6 - 8 km towards North

e) 8 - 10 km towards North

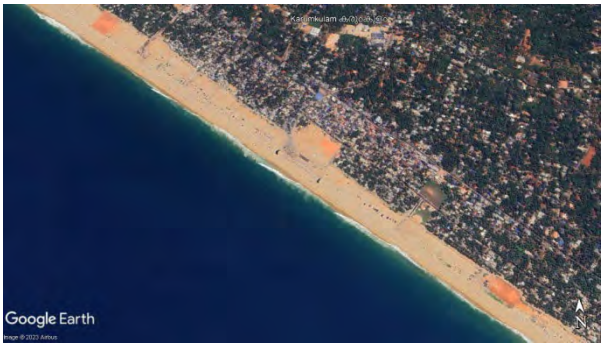
Figure 4-1 Shoreline towards the north of port

a) 0 – 2 km South

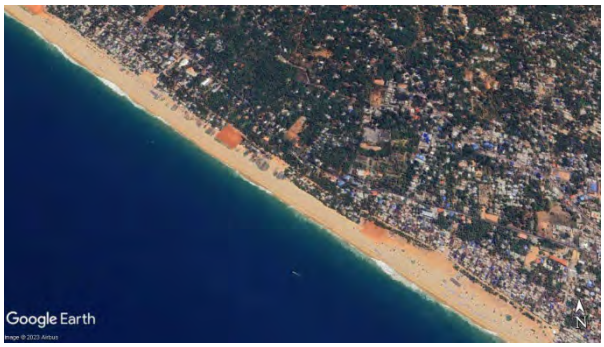


b) 2 – 4 km South

c) 4 – 6 km South



d) 6 – 8 km South



e) 8 – 10 km South

Figure 4-2 Shoreline towards the south of port

Figure 4-3 Groyne fields north of the port

4.2 GENESIS shoreline change model

GENESIS is used to examine long-term shoreline change due to the proposed breakwater. GENESIS is an elaborate one-dimensional numerical model, which simulates changes in shoreline position due to spatial and temporal gradients in longshore sediment transport. The model considers the motion of sediment as uniform over the entire active profile between two well-defined limiting elevations i.e. the top of active berm and the depth of closure (the seaward limit of significant sediment transport). GENESIS can simulate changes in shoreline position due to the presence and combinations of beach fills and nearshore structures such

as groyne, jetties, seawalls, and breakwaters. The model allows for sand bypassing around and through groyne and jetties. The model also accommodates wave diffraction by long groins and offshore breakwaters and wave transmission through breakwaters. Wave conditions, which drive the model, consist of wave height, period and direction and can originate from multiple independent generation sources.

GENESIS shoreline change model is suited for coastal stretches where longshore sediment transport is dominant. The shoreline change produced by cross shore sediment transport such as that associated with storm events cannot be simulated. GENESIS is best suited to situations where there is a systematic trend of long term changes in shoreline position such as shoreline regression and advancement due to the coastal structures like groyne, breakwater, seawalls and detached breakwater. The prediction of the GENESIS model is deterministic, the quality of which depends on the input data and good calibration. The model produces representative values and the accuracy of results is linked to the quality of input data used for calibration.

GENESIS considers longshore sediment transport due to breaking waves. The dynamic equation or the statement of the longshore sand transport rate, Q is

$$Q = (H^2 C_g)_b [a_1 sin2\Theta_{bs} - a_2 cos\Theta_{bs} \frac{\partial H}{\partial x}]_b$$

$$a_1 = \frac{K_1}{16(s-1)(1-p)(1{,}14116)^{5/2}}$$

$$a_2 = \frac{K_2}{8(s-1)(1-p)tan\beta(1{,}14116)^{7/2}}$$

Where H is the breaking wave height, C_g is the breaking wave group velocity, x is the longshore direction, and θ_{bs} is the angle of breaking waves referenced to the shore perpendicular direction, a_1 and a_2 are the non-dimensional parameters, p is porosity of the sand on the bed, s is ratio of density of sand to density of water and *tan* β is the average near shore bottom slope. The first term considers sediment transport generated by the longshore component of the breaking wave energy flux. The second term modifies the transport rate to account for longshore gradients in breaking wave height. K_1 and K_2 are the two dimensionless calibration factor for controlling the longshore sediment transport and offshore wave breaking.

4.2.1 Model inputs

- Bathymetry for the coastal stretch - Bathymetry for the study was prepared using the available primary and secondary data.
- Wave data – The wave data is being recorded continuously off Vizhinjam since early 2015. Wave parameters were measured using WRB (Mulloor) at 08°21' 43.15" N, 76°59'25.86" E (-23.2 m)
- Shoreline data - Initial shoreline position, which is an essential input to simulate shoreline evolution, was extracted from latest Google Earth Imagery of the project site.

4.2.2 Shoreline model simulation

The shoreline evolution model has been set up for existing condition incorporating all the existing coastal features (manmade and natural). A shoreline stretch of 20km evenly

distributed near the vicinity of the proposed port has been studied. A grid resolution of 25m×25m was used for the simulation of shoreline evolution using GENESIS.

4.3 Results and discussion

The shoreline evolution model study has been carried out for various phase of breakwater development incorporating all the existing coastal features (manmade and natural). The model considers a 10km coastal stretch for the simulation of shoreline evolution on either side of the port.

a) 2016

b) 2017

c) 2018

d) 2019

e) 2020

f) 2021

g) 2022 h) 2023

Figure 4-4 Different phases of breakwater construction.

The influence of the port development was simulated by introducing the various phase of proposed breakwater and keeping all other parameters same as those used in the existing condition. The shoreline evolution is presented in Figure 4-5 to Figure 4-7 (scaled up three times for better visualization).

4.3.1 Predicted shoreline evolution accounting different phases of breakwater

The shoreline evolution for different phases of breakwater during the first, fifth and tenth year are presented in Figure 4-5, Figure 4-6, and Figure 4-7 respectively.

From the simulated results it is noticed that the shoreline evolution follows a similar trend as of no breakwater case whilst the introduction of breakwater in the model. The cumulative change per 25m chainage for every 1000m stretch is shown in Table 4-1 to Table 4-4. The accretion and erosion patterns are as predicted earlier in 2012 report. Shoreline changes are noticed near the groin fields north of the port. However, the changes around groin fields are localised and the port has no effect on these changes.

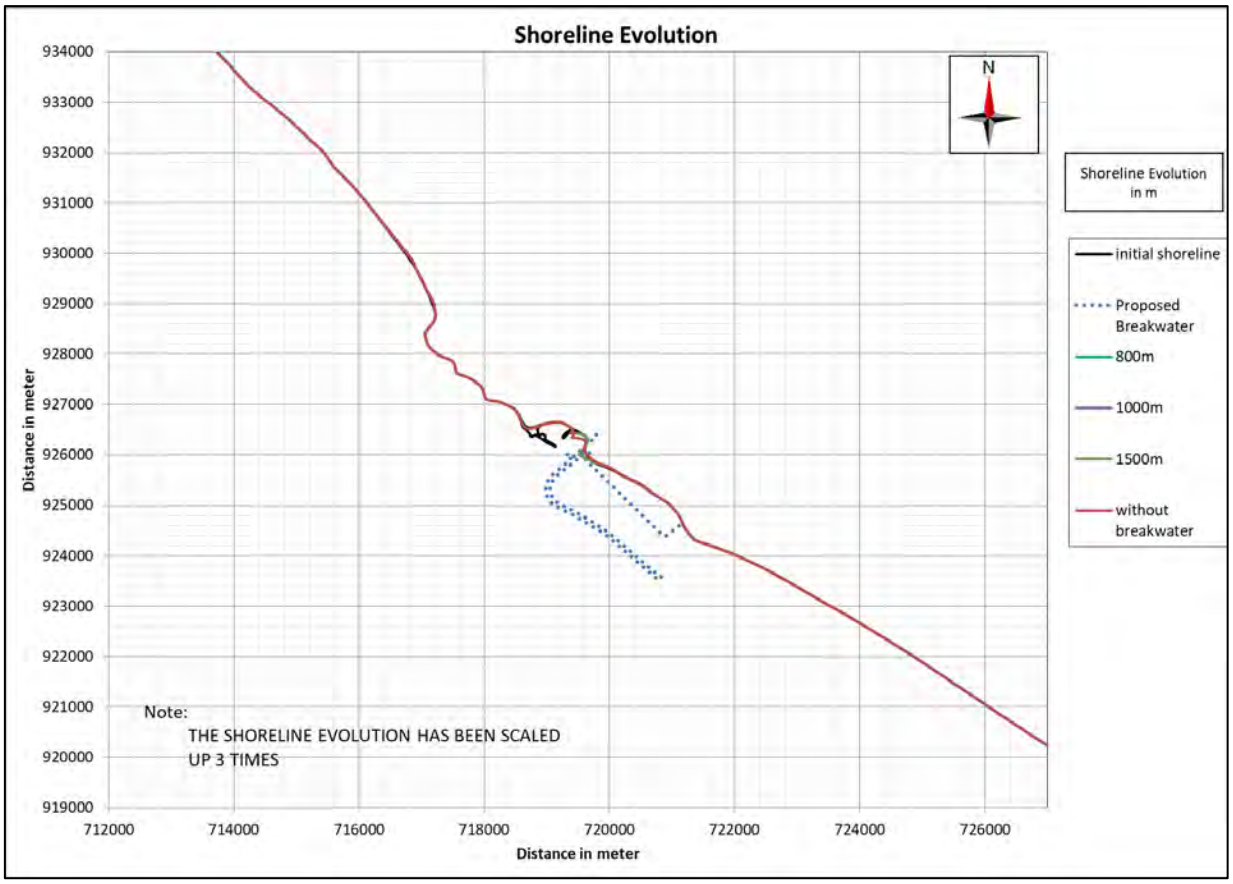


Figure 4-5 Predicted shoreline evolution during 1st year

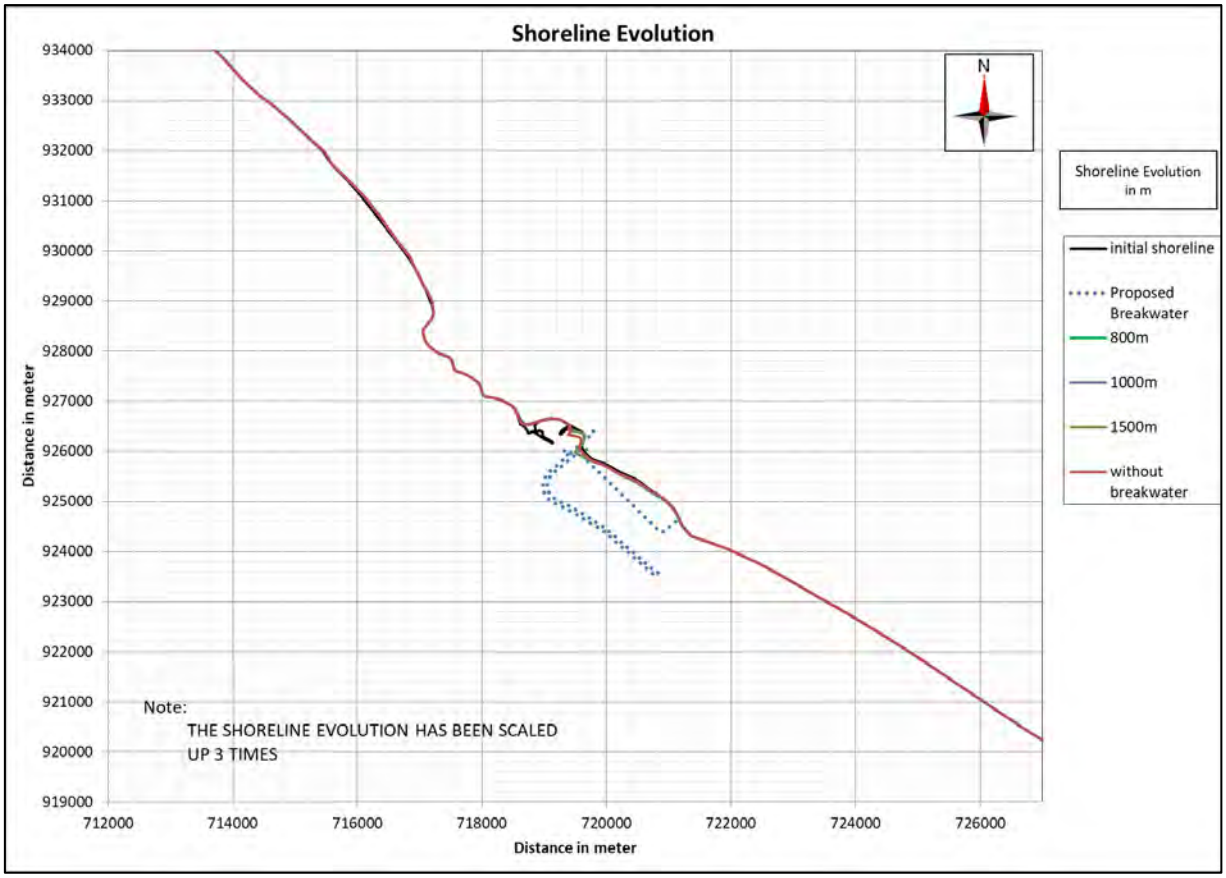


Figure 4-6 Predicted shoreline evolution during 5th year

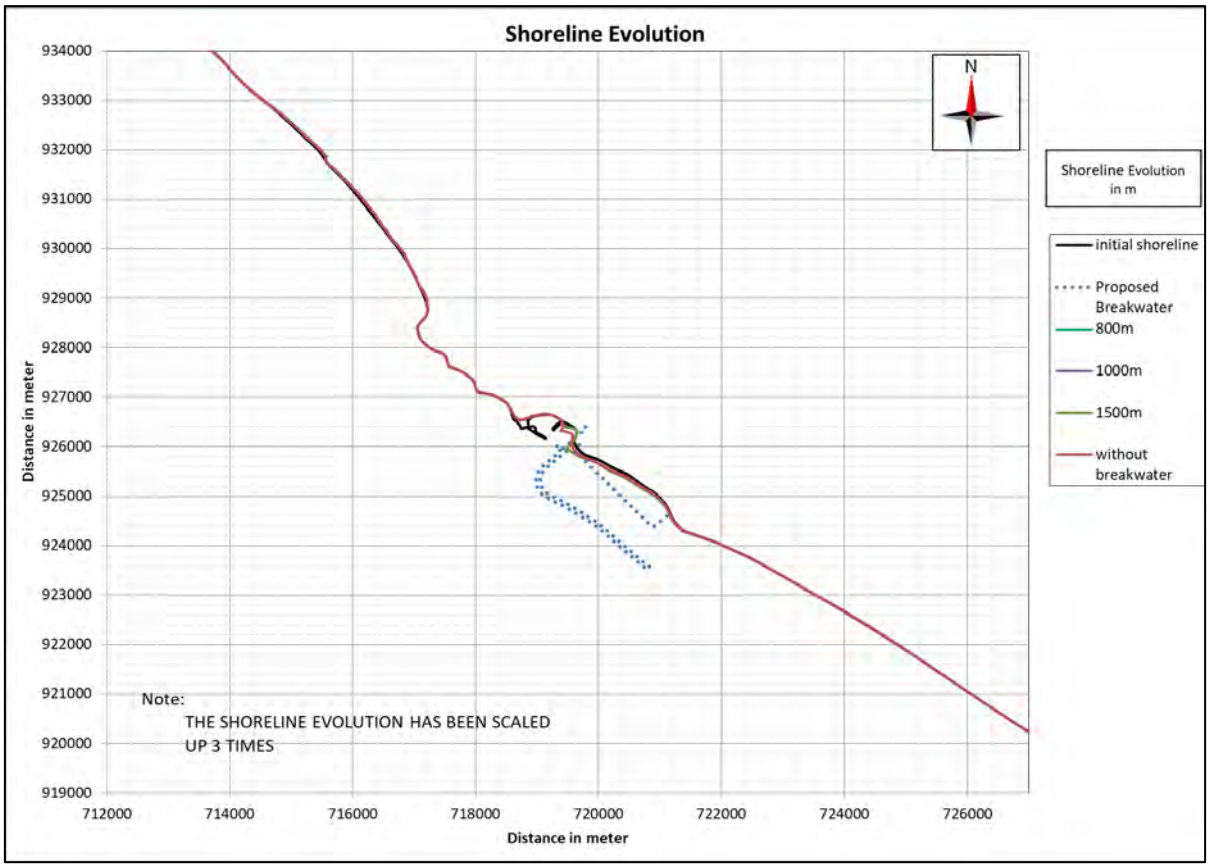


Figure 4-7 Predicted shoreline evolution during 10th year

Table 4-1 Predicted shoreline evolution rate for 800m length breakwater

Chainage in m	Shoreline change										Shoreline change per 25m
	1st yr	2nd yr	3rd yr	4th yr	5th yr	6th yr	7th yr	8th yr	9th yr	10th yr	
0-1000	-1.0	-1.0	-0.8	-0.7	-0.5	-0.4	-0.4	-0.5	-0.5	-0.7	0.0
1000-2000	2.1	2.5	2.8	3.0	3.1	2.9	2.5	2.0	1.3	0.5	0.0
2000-3000	-1.3	-1.4	-1.9	-2.9	-4.4	-6.1	-8.1	-10.3	-12.7	-15.1	-0.4
3000-4000	-0.2	-3.9	-8.6	-13.6	-18.5	-23.5	-28.4	-33.2	-37.9	-42.5	-1.1
4000-5000	-17.8	-30.3	-40.5	-49.5	-57.7	-65.2	-72.3	-79.0	-85.4	-91.4	-2.3
5000-6000	-6.0	-13.7	-21.7	-29.3	-36.7	-43.7	-50.4	-56.6	-62.3	-67.4	-1.7
6000-7000	-2.0	-5.1	-8.8	-12.8	-17.0	-20.7	-23.7	-25.6	-26.2	-25.6	-0.6
7000-8000	-6.6	-7.9	-9.2	-9.2	-6.4	-0.6	8.2	19.5	33.3	49.2	1.2
8000-9000	-1.1	4.5	20.1	44.2	74.9	110.1	148.8	189.8	232.7	276.7	6.9
9000-	78.	15	244.	334.	423.	509.	593.	675.	755.	832.	20.8

10000	9	7.1	6	3	0	5	8	9	5	8	
10000-11000	131.1	261.0	381.6	479.3	564.6	642.2	711.8	776.3	836.9	893.7	22.3
11000-12000	186.8	191.2	177.1	174.5	126.5	86.9	53.6	44.5	42.5	40.7	1.0
12000-13000	-4.1	-4.8	-4.1	-4.3	-5.2	-5.4	-5.4	-27.0	-40.4	-40.4	-1.0
13000-14000	-12.3	-12.4	-12.2	-12.2	-12.4	-12.6	-12.7	-12.8	-25.5	-35.2	-0.9
14000-15000	-93.5	-99.4	-100.7	-102.1	-109.3	-114.8	-120.4	-123.9	-127.2	-142.2	-3.6
15000-16000	-190.9	-228.1	-232.2	-233.7	-239.7	-242.9	-245.4	-246.8	-248.1	-249.7	-6.2
16000-17000	-53.4	-182.4	-306.3	-414.8	-460.8	-471.3	-471.6	-471.7	-471.8	-471.8	-11.8
17000-18000	0.3	-19.3	-71.4	-123.3	-148.8	-189.0	-225.6	-256.1	-283.1	-307.9	-7.7
18000-19000	-1.1	0.6	0.8	-15.4	-49.2	-103.4	-163.8	-223.6	-280.6	-332.4	-8.3
19000-20000	0.2	1.9	5.9	11.3	15.0	14.0	5.9	-8.8	-29.3	-57.4	-1.4
20000-21000	8.6	26.3	44.7	61.7	77.1	90.4	101.5	109.6	114.6	115.7	2.9
21000-22000	60.0	91.0	113.1	128.1	139.8	149.4	157.6	164.5	170.3	174.8	4.4
22000-23000	-53.7	-78.7	-95.9	-107.0	-115.2	-121.6	-126.6	-130.6	-133.9	-136.5	-3.4
23000-24000	-15.2	-38.1	-59.5	-78.0	-93.7	-106.7	-117.6	-126.6	-133.9	-139.9	-3.5
24000-24725	1.0	-1.3	-5.6	-10.2	-14.5	-18.4	-21.6	-24.3	-26.6	-28.4	-0.7

Table 4-2 Predicted shoreline evolution rate for 1000m length breakwater

Chainage in m	Shoreline change										Shoreline change per 25m
	1st yr	2nd yr	3rd yr	4th yr	5th yr	6th yr	7th yr	8th yr	9th yr	10th yr	
0-1000	-1.0	-1.0	-0.8	-0.7	-0.5	-0.4	-0.4	-0.5	-0.5	-0.7	0.0
1000-2000	2.1	2.5	2.8	3.0	3.1	2.9	2.5	2.0	1.3	0.5	0.0
2000-3000	-1.3	-1.4	-1.9	-2.9	-4.4	-6.1	-8.1	-10.3	-12.7	-15.1	-0.4
3000-4000	-0.2	-3.9	-8.6	-13.6	-18.5	-23.5	-28.4	-33.2	-37.9	-42.5	-1.1

4000-5000	-17.8	-30.3	-40.5	-49.5	-57.7	-65.2	-72.3	-79.0	-85.4	-91.4	-2.3
5000-6000	-6.0	-13.7	-21.7	-29.3	-36.7	-43.7	-50.4	-56.6	-62.3	-67.4	-1.7
6000-7000	-2.0	-5.1	-8.8	-12.8	-17.0	-20.7	-23.7	-25.6	-26.2	-25.5	-0.6
7000-8000	-6.6	-7.9	-9.2	-9.2	-6.4	-0.5	8.3	19.7	33.6	49.7	1.2
8000-9000	-1.1	4.5	20.1	44.5	75.3	110.8	149.7	191.1	234.3	278.6	7.0
9000-10000	79.1	157.8	245.9	336.3	425.6	512.8	597.9	680.6	760.9	838.9	21.0
10000-11000	131.6	261.4	381.9	479.5	564.4	641.8	711.1	775.4	835.5	892.0	22.3
11000-12000	186.2	190.1	175.7	172.7	124.3	84.2	50.6	41.6	39.1	37.1	0.9
12000-13000	-4.1	-4.8	-4.1	-4.3	-5.2	-5.4	-5.3	-27.5	-40.4	-40.4	-1.0
13000-14000	-12.3	-12.4	-12.2	-12.2	-12.4	-12.6	-12.7	-12.7	-26.1	-35.2	-0.9
14000-15000	-93.5	-99.4	-100.7	-102.1	-109.3	-114.9	-120.4	-123.9	-127.2	-142.9	-3.6
15000-16000	-190.9	-228.1	-232.2	-233.8	-239.7	-242.9	-245.4	-246.8	-248.1	-249.8	-6.2
16000-17000	-53.4	-182.4	-306.3	-415.0	-460.9	-471.3	-471.7	-471.7	-471.8	-471.8	-11.8
17000-18000	0.3	-19.3	-71.5	-123.3	-148.9	-189.2	-225.9	-256.4	-283.5	-308.4	-7.7
18000-19000	-1.1	0.6	0.8	-15.4	-49.3	-103.7	-164.2	-224.2	-281.3	-333.2	-8.3
19000-20000	0.2	1.9	5.9	11.3	15.0	13.9	5.9	-8.9	-29.5	-57.8	-1.4
20000-21000	8.6	26.3	44.7	61.7	77.1	90.4	101.5	109.6	114.6	115.7	2.9
21000-22000	60.0	91.0	113.1	128.1	139.8	149.4	157.6	164.5	170.3	174.8	4.4
22000-23000	-53.7	-78.7	-95.9	-107.0	-115.2	-121.6	-126.6	-130.6	-133.9	-136.5	-3.4
23000-24000	-15.2	-38.1	-59.5	-78.0	-93.7	-106.7	-117.6	-126.6	-133.9	-139.9	-3.5
24000-24725	1.0	-1.3	-5.6	-10.2	-14.5	-18.4	-21.6	-24.3	-26.6	-28.4	-0.7

Table 4-3 Predicted shoreline evolution rate for 1500m length breakwater

Chainage in m	Shoreline change										Shoreline change per 25m
	1st yr	2nd yr	3rd yr	4th yr	5th yr	6th yr	7th yr	8th yr	9th yr	10th yr	
0-1000	-1.0	-1.0	-0.8	-0.7	-0.5	-0.4	-0.4	-0.5	-0.5	-0.7	0.0
1000-2000	2.1	2.5	2.8	3.0	3.1	2.9	2.5	2.0	1.3	0.5	0.0
2000-3000	-1.3	-1.4	-1.9	-2.9	-4.4	-6.1	-8.1	-10.3	-12.7	-15.1	-0.4
3000-4000	-0.2	-3.9	-8.6	-13.6	-18.5	-23.5	-28.4	-33.2	-37.9	-42.5	-1.1
4000-5000	-17.8	-30.3	-40.5	-49.5	-57.7	-65.2	-72.3	-79.0	-85.4	-91.4	-2.3
5000-6000	-6.0	-13.7	-21.7	-29.3	-36.7	-43.7	-50.4	-56.6	-62.3	-67.4	-1.7
6000-7000	-2.0	-5.1	-8.8	-12.8	-17.0	-20.7	-23.7	-25.6	-26.2	-25.5	-0.6
7000-8000	-6.6	-7.9	-9.2	-9.2	-6.4	-0.5	8.3	19.7	33.6	49.7	1.2
8000-9000	-1.1	4.5	20.1	44.5	75.3	110.8	149.7	191.1	234.3	278.6	7.0
9000-10000	79.1	157.8	245.9	336.3	425.6	512.8	597.9	680.6	760.9	838.9	21.0
10000-11000	131.6	261.4	381.9	479.5	564.4	641.8	711.1	775.4	835.5	892.0	22.3
11000-12000	186.2	190.1	175.7	172.7	124.3	84.2	50.6	41.6	39.1	37.1	0.9
12000-13000	-4.1	-4.8	-4.1	-4.3	-5.2	-5.4	-5.3	-27.5	-40.4	-40.4	-1.0
13000-14000	-12.3	-12.4	-12.2	-12.2	-12.4	-12.6	-12.7	-12.7	-26.1	-35.2	-0.9
14000-15000	-93.5	-99.4	-100.7	-102.1	-109.3	-114.9	-120.4	-123.9	-127.2	-142.9	-3.6
15000-16000	-190.9	-228.1	-232.2	-233.8	-239.7	-242.9	-245.4	-246.8	-248.1	-249.8	-6.2
16000-17000	-53.4	-182.4	-306.3	-415.0	-460.9	-471.3	-471.7	-471.7	-471.8	-471.8	-11.8
17000-18000	0.3	-19.3	-71.5	-123.3	-148.9	-189.2	-225.9	-256.4	-283.5	-308.4	-7.7
18000-19000	-1.1	0.6	0.8	-15.4	-49.3	-103.7	-164.2	-224.2	-281.3	-333.2	-8.3
19000-20000	0.2	1.9	5.9	11.3	15.0	13.9	5.9	-8.9	-29.5	-57.8	-1.4

20000-21000	8.6	26.3	44.7	61.7	77.1	90.4	101.5	109.6	114.6	115.7	2.9
21000-22000	60.0	91.0	113.1	128.1	139.8	149.4	157.6	164.5	170.3	174.8	4.4
22000-23000	-53.7	-78.7	-95.9	-107.0	-115.2	-121.6	-126.6	-130.6	-133.9	-136.5	-3.4
23000-24000	-15.2	-38.1	-59.5	-78.0	-93.7	-106.7	-117.6	-126.6	-133.9	-139.9	-3.5
24000-24725	1.0	-1.3	-5.6	-10.2	-14.5	-18.4	-21.6	-24.3	-26.6	-28.4	-0.7

Table 4-4 Predicted shoreline evolution rate for without breakwater condition

Chainage in m	Shoreline change										Shoreline change per 25m
	1st yr	2nd yr	3rd yr	4th yr	5th yr	6th yr	7th yr	8th yr	9th yr	10th yr	
0-1000	-1.0	-1.0	-0.8	-0.7	-0.5	-0.4	-0.4	-0.5	-0.5	-0.7	0.0
1000-2000	2.1	2.5	2.8	3.0	3.1	2.9	2.5	2.0	1.3	0.5	0.0
2000-3000	-1.3	-1.4	-1.9	-2.9	-4.4	-6.1	-8.1	-10.3	-12.6	-15.1	-0.4
3000-4000	-0.2	-3.9	-8.6	-13.6	-18.5	-23.5	-28.4	-33.2	-37.8	-42.5	-1.1
4000-5000	-17.8	-30.3	-40.5	-49.5	-57.6	-65.2	-72.3	-78.9	-85.3	-91.4	-2.3
5000-6000	-6.0	-13.8	-21.6	-29.3	-36.6	-43.6	-50.3	-56.8	-62.9	-68.8	-1.7
6000-7000	-2.2	-4.8	-8.5	-12.6	-17.0	-21.4	-25.8	-29.9	-33.5	-36.1	-0.9
7000-8000	-4.8	-7.5	-10.1	-11.6	-13.3	-14.5	-13.9	-10.7	-4.9	3.0	0.1
8000-9000	-1.0	-1.7	-2.2	-0.6	10.2	28.2	51.8	79.3	109.6	141.8	3.5
9000-10000	9.1	21.0	71.7	139.9	211.6	284.5	356.2	425.6	492.5	557.0	13.9
10000-11000	96.6	270.1	415.3	530.7	631.9	722.3	803.1	878.1	948.4	1014.2	25.4
11000-12000	285.2	296.7	285.2	279.9	264.0	210.9	176.6	146.8	120.7	119.9	3.0
12000-13000	-4.1	-4.8	-4.2	-4.4	-5.1	-5.7	-6.1	-6.1	-6.4	-28.8	-0.7
13000-14000	-12.3	-12.4	-12.2	-12.2	-12.4	-12.5	-12.6	-12.7	-12.8	-12.8	-0.3
14000-15000	-93.4	-98.8	-99.9	-101.2	-106.0	-110.7	-115.9	-120.4	-123.6	-126.1	-3.2
15000-16000	-18	-226.	-231.	-232.	-237.	-240.	-243.	-245.	-246.	-247.	-6.2

	9.9	5	3	7	2	7	4	4	7	7	
16000-17000	-52.3	-167.9	-279.5	-367.0	-446.7	-468.3	-471.4	-471.6	-471.7	-471.8	-11.8
17000-18000	0.4	-16.6	-59.9	-112.0	-137.4	-160.7	-197.4	-228.1	-254.5	-277.2	-6.9
18000-19000	-1.1	0.5	1.0	-11.7	-33.7	-71.3	-121.2	-174.3	-226.9	-276.0	-6.9
19000-20000	0.2	1.9	5.9	11.3	15.6	17.2	13.7	4.4	-10.2	-29.7	-0.7
20000-21000	8.6	26.3	44.7	61.7	77.0	90.4	101.7	110.6	117.0	120.5	3.0
21000-22000	60.0	91.0	113.1	128.1	139.8	149.4	157.5	164.5	170.3	175.1	4.4
22000-23000	-53.7	-78.7	-95.9	-107.0	-115.2	-121.6	-126.6	-130.6	-133.9	-136.5	-3.4
23000-24000	-15.2	-38.1	-59.5	-78.0	-93.7	-106.7	-117.6	-126.6	-133.9	-139.9	-3.5
24000-24725	1.0	-1.3	-5.6	-10.2	-14.6	-18.4	-21.6	-24.3	-26.6	-28.4	-0.7

The difference in shoreline evolution rate with 800m length breakwater and without breakwater condition is presented in Figure 4-8. The maximum accretion of 7m is observed after 10 year, at a rate of 0.7 m/year near the port location and the maximum erosion of 1.4m is observed at a rate of 0.14 m/year at the locations north of port. The difference in shoreline evolution rate with and without breakwater is presented in Figure 4-9.

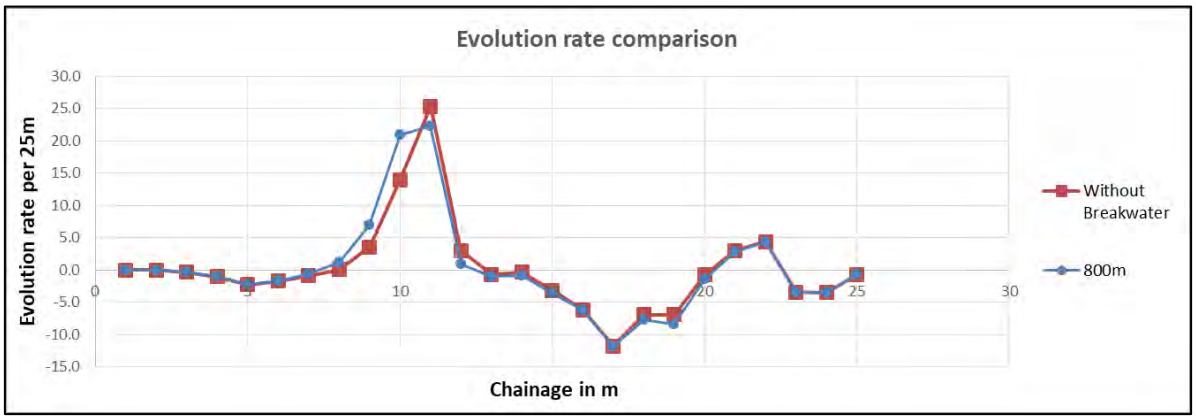


Figure 4-8 Evolution rate comparison

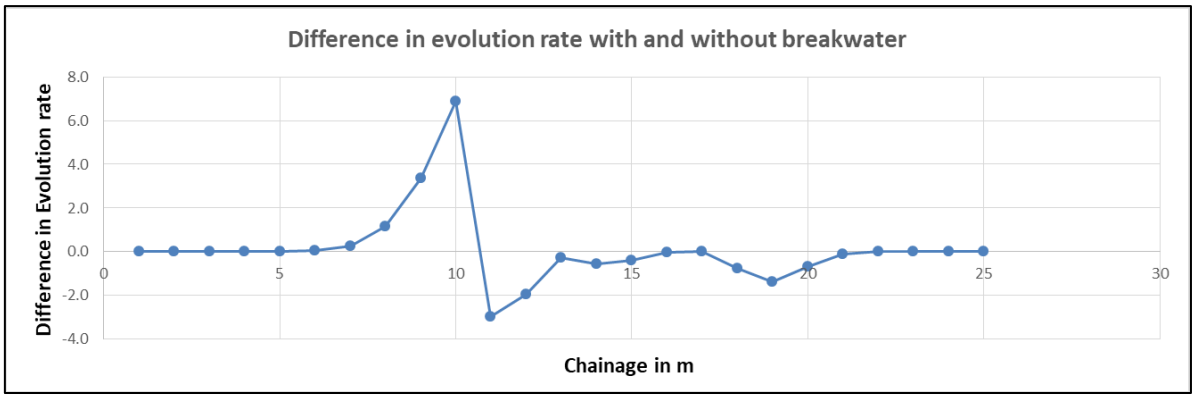


Figure 4-9 Difference in evolution rate with and without breakwater

The absence of any adverse effect on the shoreline towards north-west side of the proposed port can be attributed to many factors including the presence of headlands, the low longshore sediment transport rates and relatively high cross-shore sediment transport, and presence of distinct sediment cells. Various literatures suggests that considerable cross-shore sediment transport and relatively low longshore sediment movement. During the monsoon the accreted sediments are picked up by waves and transported offshore which gets trapped in the offshore bar and gradually returns to the shore during non-monsoon period. The same is also noticed in Cross Shore Profile analysis i.e. sediments from beach are taken to the offshore bar during monsoon months and the beaches rebuild gradually during non-monsoon months. This cycle was hampered during Cyclone Ockhi in December 2017. After Ockhi, erosion was noticed during fair weather 2017 and pre monsoon 2018 seasons in the course of which beach was supposed to build up. In addition, as a result of monsoon 2018 and 2019 the beach further eroded than previous monsoon seasons which are evident at Shangumugham and Valiyathura locations.

As the cross shore sediment transport is perpendicular to the coast, only a shore parallel structure will significantly affect the process in the areas leeward of those structures. The proposed development will not influence the cross-shore sediment transport in the adjoining stretches as it will not alter the wave fields beyond the existing fishing harbour towards north. As stated earlier, the headlands are already blocking the northerly longshore sediment transport and the introduction of proposed breakwater will not have any impact towards north of these headlands.

5 Conclusion

Following are the summary of the work carried out by LNTIEL:

1) Data Analysis

- The bathymetry analysis has been carried out to check whether any changes occurred in the sea water depth due to the impact of upcoming port. Analysis was carried out by considering 3 transect lines perpendicular to the shore; one on the North of port, one on the South of port and one near the port. Post-monsoon 2022 and pre-monsoon 2023 bathymetric cross sections were compared to post-monsoon 2015 and pre-monsoon 2015.
- The observed wave data provided by AVPPL for the period of October 2022 to September 2023 is analysed and compared with the observed wave data for October 2020 to September 2022. Majority of the waves observed at the project location fall in the range of 0.5-1.5 m. From these comparisons, the variability of wave heights and

directions are within expected ranges. It was also noted that some of the higher events were as a direct result of the moving storms & depressions in the sea and that these events caused a direct impact on the wave heights.

- The current data was provided for the post-monsoon of 2022 at three locations: Vizhinjam, Mulloor and Poovar. Analysis has been carried out to check if there are any changes in the trend of current components from the previous years due to the construction of breakwater. It can be noticed that the current speed in the region is in the range of 0.1 to 0.4 m/s. However, occasionally maximum current speed observed during all the seasons is in the range of 0.6 to 0.8 m/s.
- LNTIEL extracted (+) 2 m contour from cross shore profile data. The time series plot of (+) 2 m contour over eight years with similar time scale were analysed. From this plot it can be noticed that the beach undergoes seasonal variation of erosion on monsoon season and accretion on other seasons. During Ockhi the beach was subjected to severe erosion and not much accretion was noticed during fair weather 2017 and pre-monsoon 2018. In addition, because of monsoon 2018 and 2019 the beach got further eroded compared to previous monsoon seasons.
- LNTIEL extracted -3m, -4m, -6m, -8m and -10m contours from cross shore profile data and time series plots of respective contours over two-year data are shown at Neerody, Pozhiyoor, Karumkulam, Panathura, Beemapally and Vettucaud locations.
- The near shore profile data obtained from pressure sensor survey were analysed and compared with the corresponding cross shore profiles. From the comparisons, significant variations are noticed between the two datasets at some CSP transects on the seaside where the cross shore and near shore profiles overlap.
- From the LEO data, it can be observed that the movement is towards south during monsoon and from earlier analysis; it was found that erosion on the northern side of the port takes place during the monsoon times. Therefore, the results of this analysis suggest that the erosion in the north during monsoon is not due to the port.

Model Studies

a) Assessment of Hydrodynamics

- Earlier in 2013, LNTIEL had comprehensively covered the assessment of hydrodynamics in the port vicinity. To understand the impact of the port construction on the hydrodynamics, LNTIEL carried out the assessment of hydrodynamics with the latest surveyed bathymetries.
- From the assessment of hydrodynamics, it was found that current speeds prevailing near the project location over past years (2013, 2022 and 2023) were identical.
- In addition, the model was also calibrated using the latest data. From the model studies it was found that the tide and current pattern at several locations follow trends set in the previous years. This indicates that the flow field remains the same and the impacts on the siltation and the shoreline will be as expected (concluded in model studies report of 2012)

b) Long shore sediment transport

- Long shore sediment transport refers to the cumulative movement of beach and near shore material parallel to the shore by the combined action of tides, wind, waves and the shore-parallel currents produced by them.
- The study area extends from Edappadu Beach (CS 01) in the South to Thumba (CS 81) in the North over a stretch of approximately 40km. This coast can be distinguished into two subsets depending on the coastal orientation. The shore angle

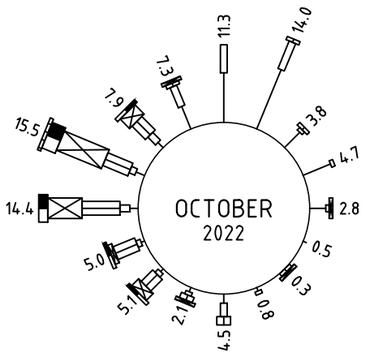
on south side is in the range of 125^0 to 130^0 (True North) and shore angle on north side is in the range of 135^0 to 145^0 (True North). This change in orientation will have effect on long shore sediment transport and its behaviour.

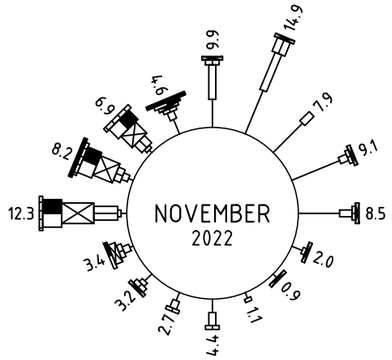
- To compute longshore transport rate, breaking parameters need to be estimated first. The breaking parameters such as breaking wave height, breaking depth and breaking angle (shore normal) were calculated using depth limited criterion. The wave parameters were collected from WRB deployed at 23.2 m water depth and the breaking characteristics of waves were determined by combining wave refraction and shoaling calculations with wave breaking criteria.

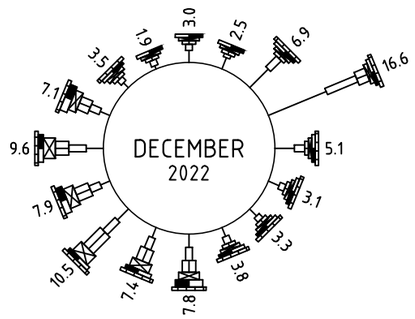
Depending on the coast orientation two average LSTR estimates were calculated based on available 7 years data (Feb 2015 – Feb 2023, Feb-Feb is considered since most beach profiles have built up, even though the scope of this report is Oct 2022- Mar 2023). The northerly and southerly (annual average) long shore sediment movement in south stretch is in the range of 0.17 to 0.19 M m^3/yr (Northwards) and -0.16 to -0.17 M m^3/yr (Southwards). In north stretch, the range is 0.24 to 0.26 M m^3/yr (Northwards) and -0.11 to -0.12 M m^3/yr (Southwards).The net annual average long shore sediment movement in south stretch is in the range of 0.01 to 0.02 M m^3/yr (Northwards) and in north stretch in the range of 0.13 to 0.14 M m^3/yr (Northwards).

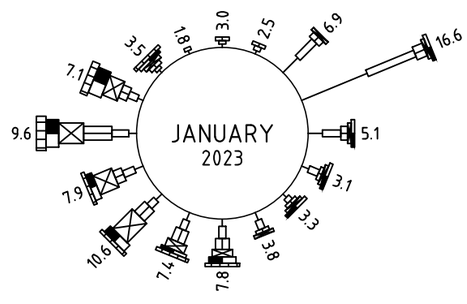
c) Impact of breakwater, groynes and seawalls on 10km radius of Vizhinjam port

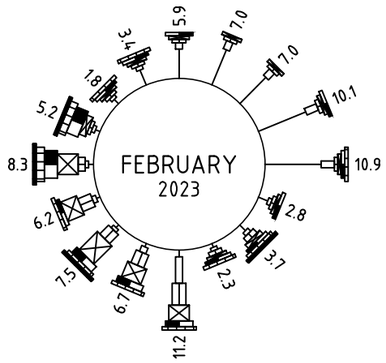
- The shoreline evolution model study has been carried out for various phase of breakwater development incorporating all the existing coastal features (manmade and natural). The model considers a 10km coastal stretch for the simulation of shoreline evolution on either side of the port. Only three groynes are there within 10km radius and all other groynes are outside 10km radius and the effect of those groynes will be localised.
- From the simulated results it is noticed that the shoreline evolution follows a similar trend as of no breakwater case whilst the introduction of breakwater in the model. The accretion and erosion patterns are as predicted earlier in 2012 report. The maximum accretion of 7m is observed after 10 year, at a rate of 0.7 m/year near the port location. The maximum erosion of 1.4m is observed at a rate of 0.14 m/year at the locations north of port. Shoreline changes are noticed near the groin fields north of the port which were constructed by Government of Kerala. However, the changes around groin fields are localised and the port has no effect on these changes.
- The absence of any adverse effect on the shoreline towards north-west side of the proposed port can be attributed to many factors including the presence of headlands, the low longshore sediment transport rates and relatively high cross-shore sediment transport, and presence of distinct sediment cells.

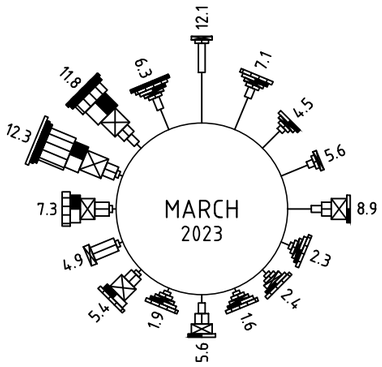


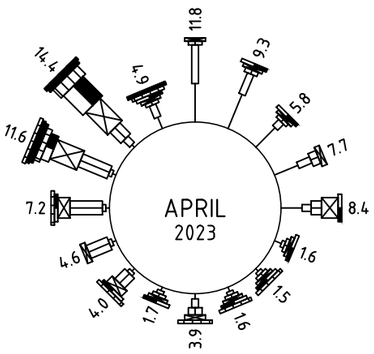


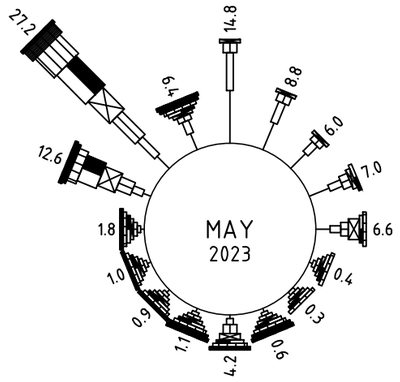


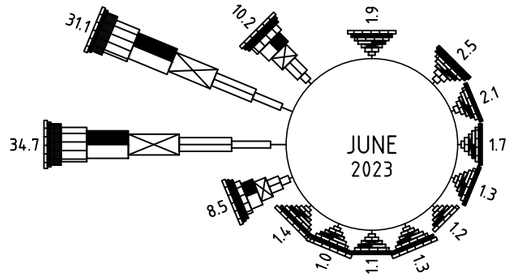


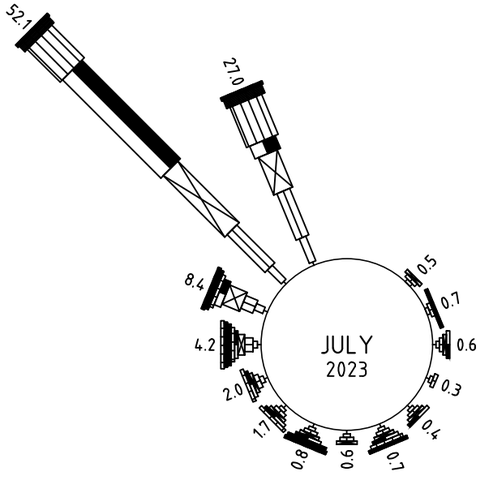


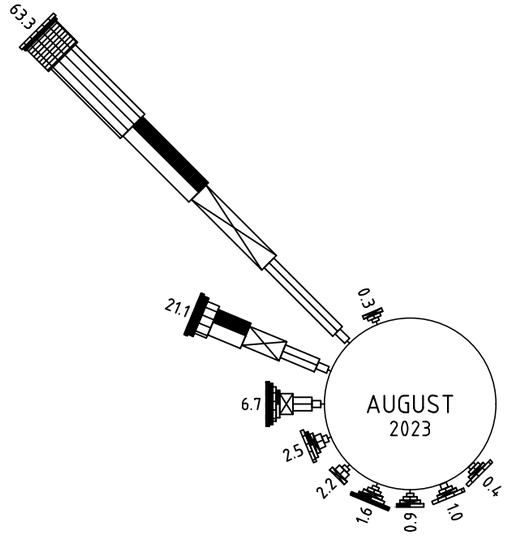


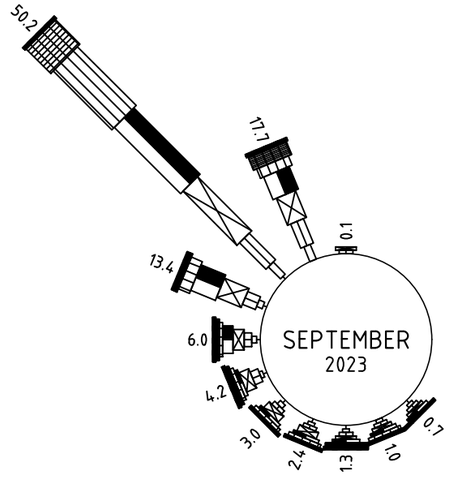


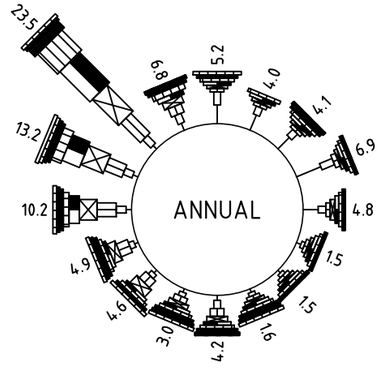












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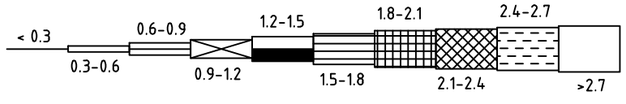

WAVE HEIGHT IN (M)

PATH: REFER BOTTOM LEFT CORNER OF THE DRAWING

SCALE: NTS

REPORT NO: RP003	
PROJECT: DATA ANALYSIS AND MODEL STUDIES FOR VIZHINJAM PORT	PROJECT NO: C1231501
TITLE: ROSE DIAGRAM FOR OBSERVED WIND (OCT 2022- SEP 2023)	DATE: 16/11/23
	MADE: AAJ
L&T Infra Engineering — L&T Infrastructure Engineering Ltd.	FIGURE NO: FD0001 / REV: 0

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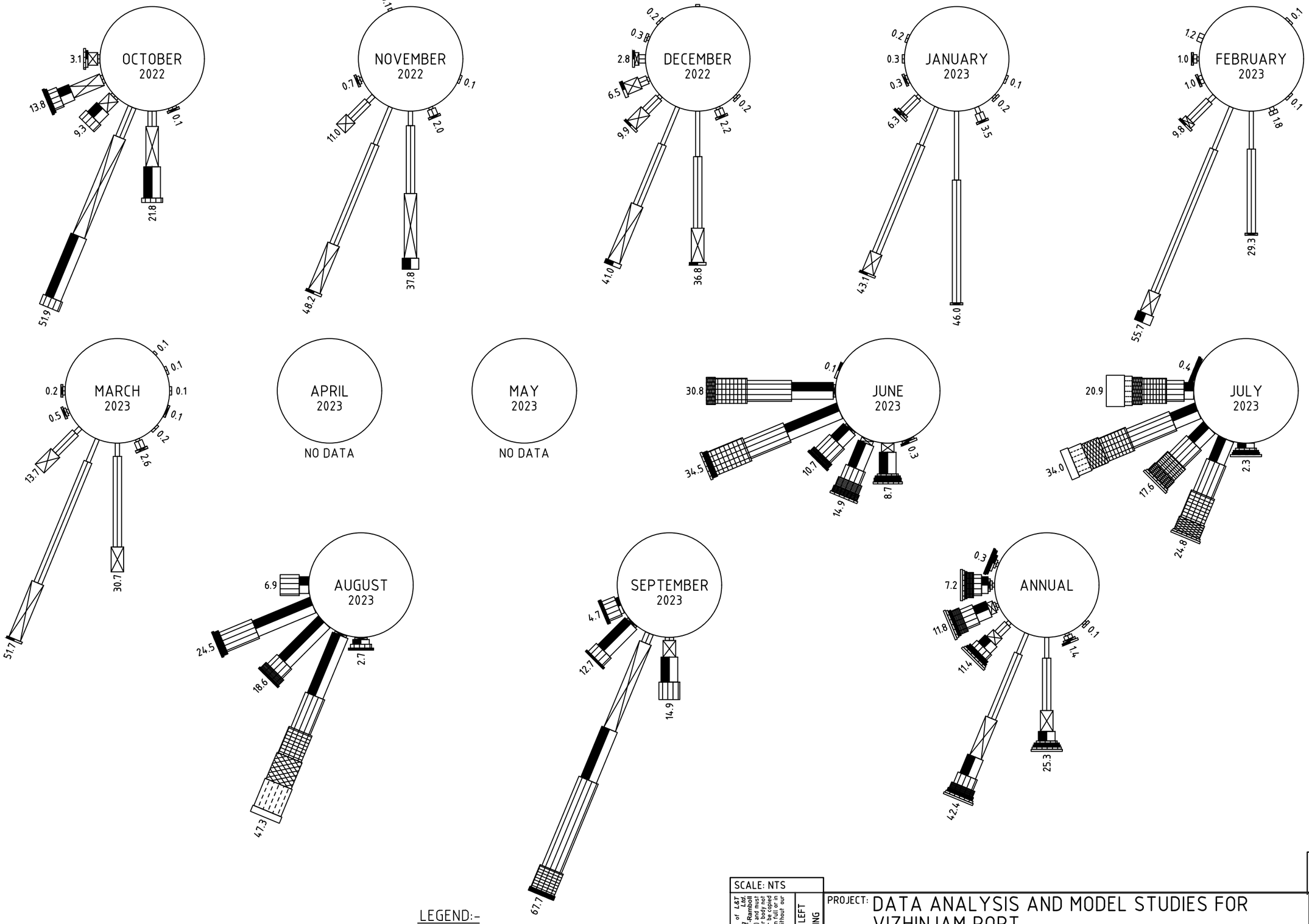
TBA



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TBA

PATH: REFER BOTTOM LEFT CORNER OF THE DRAWING

SCALE: NTS

REPORT NO: RP003

PROJECT: DATA ANALYSIS AND MODEL STUDIES FOR VIZHINJAM PORT

PROJECT NO: C1231501

TITLE: ROSE DIAGRAM FOR OBSERVED WAVE (OCT 2022- SEP 2023)

DATE: 16/11/23

MADE: AAJ

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

FIGURE NO: FD0002

REV: 0

Annexure III

Shoreline Monitoring Report

(April 2023 to September 2023)

SHANKAR SURVEYS

adani

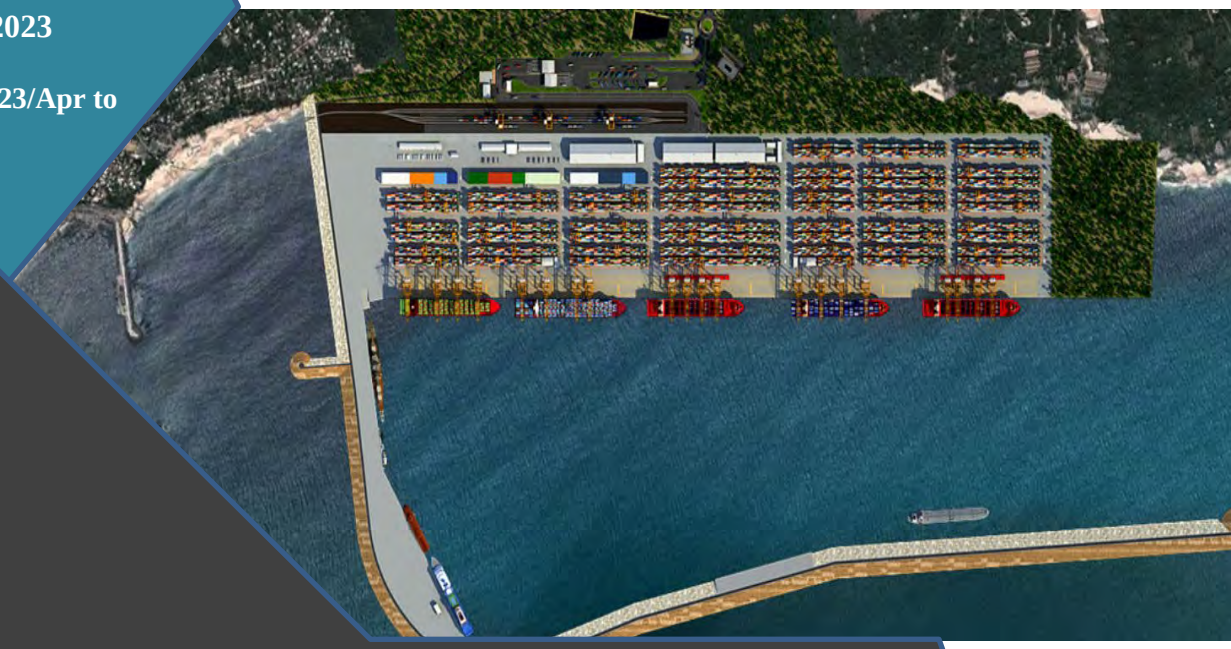
Adani Vizhinjam Port Pvt. Ltd.

OCEANOGRAPHIC AND BATHYMETRIC DATA COLLECTION FOR ASSESSMENT OF SHORELINE CHANGES

Shankar Surveys Pvt. Ltd.
115, Neco Chambers,
CBD Belapur,
Navi Mumbai – 400 614

Date: 25th November 2023

SSPL Ref # SSPL/P034-23/Apr to Sep 2023 Rev 1



HALF YEARLY REPORT
(APRIL TO SEPTEMBER 2023)

"APPROVAL SHEET"

Prepared by:	*Signed*	*Date*
V Chathurala		*22/11/2023*

Checked by:	*Signed*	*Date*
V Mehta		*24/11/2023*

Approved by:	*Signed*	*Date*
S Philip		*25/11/2023*

REVISION CONTROL

Date	Rev	Section / Page No.	Remarks	Comment by
21/10/2023	0		Submitted for approval	
25/11/2023	1	Sec 2, Pg 10	Replaced 'increases progressing' with 'progresses'	AVPPL
		Sec 3.1, Pg 13	Amended AWS height as per schematic plan of AWS installation	
		Sec 3.1, Pg 14	Added water depth column in Table 3-3	NIOT
		Sec 3.2, Pg 14	Mentioned pre-monsoon months in first line of second paragraph.	AVPPL
		Sec 4.3, Pg 20	Changed 'SAC' to 'SSPL' in first sentence	AVPPL
		Sec 5.2, Pg 21	Added date of WRB deployment	AVPPL
		Sec 6, Pg 32	Added 'Atmospheric' before 'Temperature in Table 6-1, CSP location numbers and bathymetric survey added	AVPPL & NIOT
		Sec 6.2, Pg 37 - 40	Changes made as suggested,	AVPPL

			included May 2023 wave data	
		Sec 6.3, Pg 40	Added '2023' in second sentence as suggested	AVPPL
		Sec 6.3, Pg 42	Amended wind speed value for April 2023 from '12.12' to'12.16' as per the data, added '2023' in last sentence as suggested	AVPPL
		Sec 6.3, Pg 45	Added '2023' in last sentence as suggested	AVPPL
		Sec 6.3, Pg 47	Mentioned IMD Pune station for measured rainfall	AVPPL
		Sec 6.3, Pg 48	Added '2023' Figure 6-11 as suggested	AVPPL
		Sec 6.4, Pg 50	Mentioned month names for current direction in Figure 6-12	NIOT
		Sec 6.10, Pg 72	The representative bathymetry charts for the pre-monsoon 2023 period shall be provided in an additional annexure to this report (Annexure III)	NIOT

Table of Contents

List of Tables

List of Figures

List of Annexures

ABBREVIATIONS

ADCP	Acoustic Doppler Current Profiler
APHA	American Public Health Association Guidelines
CES	Coastal Erosion Stone
AVPPL	Adani Vizhinjam Port Pvt. Ltd.
BDL	Below Detectable Level
C.M.	Central Meridian
CD	Chart Datum
cm	Centimetre
COG	Course over ground
dd mm.mmm	Degrees minutes. Decimal minutes
DGPS	Differential Global Positioning System
DTM	Digital Terrain Model
EC	Environmental & CRZ Clearance
EIL	Engineer In Charge
EEZ	Exclusive Economic Zone
GoI	Government of India
GoK	Government of Kerala
GPS	Global Positioning System
HSE	Health, Safety & Environment
HWM	High Water Mark
IHO	International Hydrographic Organization
INCOIS	Indian National Centre for Ocean Information Services
IS 1498	Indian Standard for Classification and Identification of Soils for General Engineering Purposes
IS 3025	Indian Standard or Methods of Sampling and Test for Water and Waste water Part 1 - Sampling
kHz	Kilohertz
Km	Kilometre
kPa	Kilo Pascal
LAT	Lowest Astronomical Tide
Lat	Latitude
LEO	Littoral environmental observation
Long	Longitude
m	Metre
MBES	Multibeam Echo Sounder
Mg/L	Milligram per litre
MoEF	Ministry of Environment & Forests

MoU	Memorandum of Understanding
MSL	Mean Sea Level
MV	Motor Vessel
NA	Not Applicable
NABL	National Accreditation Board for Testing and Calibration Laboratories
NHO	Naval Hydrographic Organization
NIOT	National Institute of Ocean Technology
nm	Nautical mile
NTU	Nephelometric Turbidity Units
PEP	Project Execution Plan
PVD	Progressive vector diagram
PPP	Public Private Partnership
ppt	Parts per Thousand
RTK	Real Time Kinematics
SSPL	Shankar Surveys Private Limited
SBES	Single Beam Echo Sounder
SoI	Survey of India
SOG	Speed over ground
SOW	Scope of Work
TEU	Twenty Foot Equivalent Unit
UNCLOS	United Nations Convention on the Law of the Sea
UTM	Universal Transverse Mercator projection
VISL	Vizhinjam International Seaport Ltd.
w.d.	Water depth
WGS84	World Geodetic System 1984
WMO	World Meteorological Organisation

DEFINITIONS

Project Owner	Vizhinjam International Seaport Ltd (VISL), Thiruvananthapuram
Project Concessionaire	Adani Vizhinjam Port Pvt. Ltd. (AVPPL), Thiruvananthapuram
Advisor to VISL	National Institute of Ocean Technology (NIOT), Chennai
Survey Contractor	Shankar Surveys Private Limited (SSPL), Navi Mumbai
Survey Requirement	Oceanographic & Bathymetric Survey for Shoreline Monitoring
Chart Datum	Chart datum is the level to which soundings on published charts are reduced, and above which tidal predictions and tidal levels are given in the Tide Table. All depths on charts are referred to this datum.
Rip Current	A relatively strong, narrow current flowing outward from the beach through the surf zone
LEO	Littoral Environmental Observations
Wave Peak period (Tp)	The peak period gives the characteristic frequency of the arriving wave energy. This gives the period at which the spectrum has its highest value.
Significant Wave Height (Hs)	Significant wave height is the average peak-to-peak amplitude of the largest one third of the waves in a given field.
Wave direction	The direction **from which** the waves are coming. A westerly wave implies that the waves are moving from west to east.
Wind Speed	The speed at which the air moves with respect to the surface of earth. The speed is denoted in m/s
Wind Direction	Wind direction is an indicator of the direction that the wind is **blowing from**. A northerly wind is coming from the north and blowing towards the south
Atmospheric pressure	It is defined as the force per unit area exerted against a surface by the weight of the air above that surface. Atmospheric pressure is expressed in millibars (mb)
Relative Humidity	Relative humidity is defined as the ratio of the water vapor density (mass per unit volume) to the saturation water vapor density, usually expressed in percent

1 EXECUTIVE SUMMARY

The **Vizhinjam International Deepwater Multipurpose Seaport** is an ambitious project taken up by the Government of Kerala, (GoK). It is designed primarily to cater to container trans-shipment besides multi-purpose and break-bulk cargo. The port is being currently developed in a Public-Private Partnership (PPP) component on a design, build, finance, operate and transfer ("DBFOT") basis. The private partner, the Concessionaire - **M/s Adani Vizhinjam Port Private Limited** (AVPPL) had commenced construction on 5th December 2015.

Vizhinjam International Seaport Ltd (VISL) - a company fully owned by GoK is the implementing agency for the project, will be responsible for all obligations and responsibilities of GoK in respect of the Project and the Concession Agreement.

With its numerous natural advantages and potential, the port will contribute greatly to economic development and will be an asset in terms of infrastructure development in the country.

The project obtained Environmental & CRZ Clearance ("EC") from the Ministry of Environment & Forests (MoEF), Government of India (GoI) on 3rd January 2014, wherein it has been specified to carry out intense monitoring and regulatory reporting of the shoreline changes in the project area. Accordingly, VISL has entered into a memorandum of understanding (MoU) with the National Institute of Ocean Technology (NIOT), Chennai, under the Ministry of Earth Sciences (MoES), for a long-term shoreline monitoring programme including the seasonal bathymetry mapping.
(Source: https://www.vizhinjamport.in/home.html)

Shankar Surveys Private Limited, hereinafter referred to as SSPL, based in Navi Mumbai, has been awarded the contract to carry out Shoreline Monitoring – Oceanographic & Bathymetric Data Collection in the vicinity of the proposed site for the development of the Vizhinjam International Deepwater Multipurpose Seaport.

This report provides the results of the data collected for the half yearly period from April 2023 to September 2023.

All the co-ordinates in the report are referenced to WGS-84, UTM Projection, CM 75° East, Zone 43, Northern Hemisphere.

2 INTRODUCTION

The proposed project is being developed as a PPP project on a DBFOT basis in accordance with the terms and conditions set forth in the concession agreement signed between AVPPL and GoK/VISL. The investment for land, external infrastructure (rail, water and power) and breakwater will be borne by the landlord (VISL/GoK). The investments for other port infrastructure (dredging & reclamation, berths, terminals, superstructure & equipment) will be shared on PPP basis availing Viability Gap Funding (VGF). The PPP concessionaire, AVPPL has been given the right to operate the port for a specified concession period of 40 years. Traffic-linked stage-wise future development of the project with an ultimate berth length of 2000m is also envisaged.

The proposed site is endowed with a natural depth of 23 to 25m (which is by far the best compared to other ports in the world) as close as 2 km from the coast. This will enable berthing of mother vessels of 18000 TEU and higher. Since the port site is located at the southern tip of India, barely 10 nautical miles from the international sea route (Suez – Far East route & Far East – Middle East route), it has the potential to become the future trans-shipment hub of the country.
(Source : https://www.vizhinjamport.in/download/Feasibility-Report.pdf)

The study includes carrying out MetOcean observations (meteorological parameters and tide) at one location, bathymetric survey of up to 20m contour in two seasons, cross-shore profiling (CSP) from 10m CD (4 CSP lines carried out up to a depth of 20m during the months of January, May, August and October) to 100m inland from the high-water line along a stretch of 40 km, water & grab sampling, and littoral environmental observation. All these surveys and field data measurements are to be carried out for a period of 1 year commencing April 2023.

The Google Earth images, showing the Multibeam survey area, locations of the Automatic Tide Gauge (ATG), Wave Rider Buoy (WRB) and Automatic Weather Station (AWS) are given in Figure 2-1 and Figure 2-2.

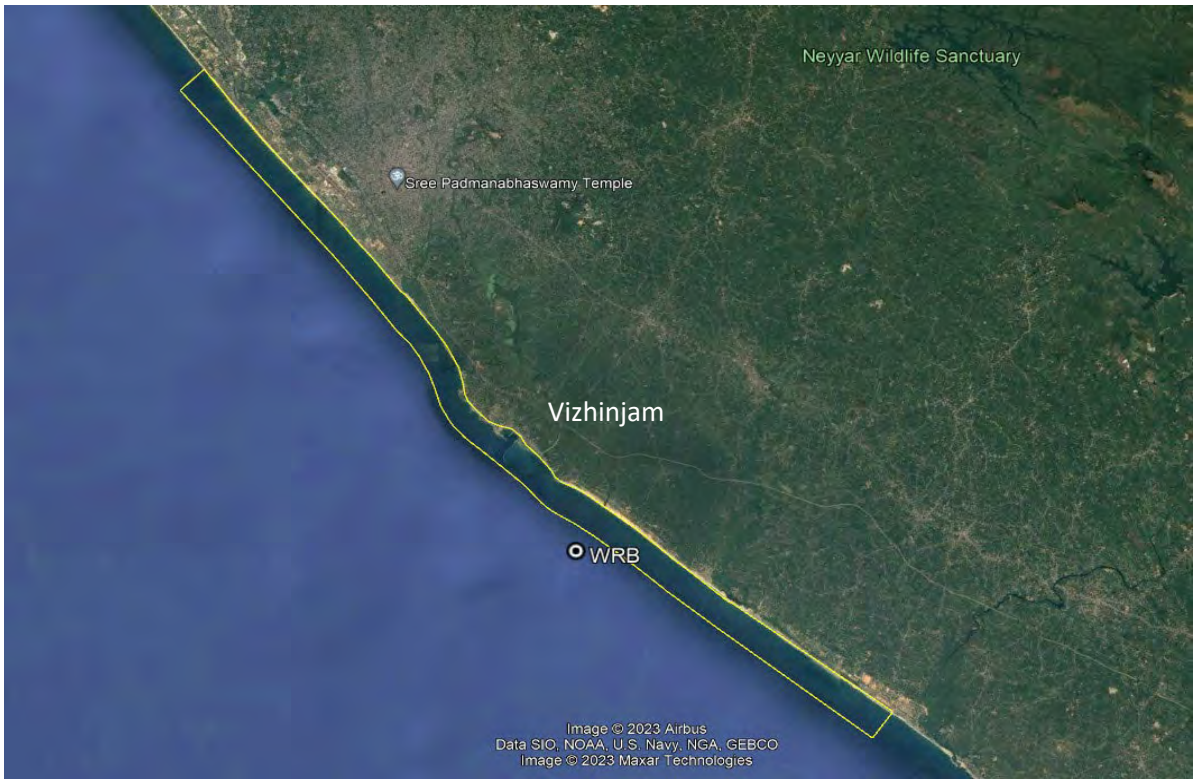


Figure 2-1: Location of Multibeam survey area and WRB

Figure 2-2: Location of ATG and AWS

① The CSP lines, which coincide with the Littoral Environment Observation (LEO), beach sampling and photographic documentation, are indicated in Figure 2-3. The cross-shore profiles are named as CSP-01 to CSP-81. CSP-01 corresponds to the southernmost profile which lies to the south of the existing Vizhinjam Harbour and gradually progresses towards north for the entire 40 km stretch (20 km on either side of the port) with a 500 m interval between each CSP line, CSP-81 being the northernmost profile.

Figure 2-3: CSP, LEO and Photographic Documentation Locations

3 SCOPE OF WORK

The survey scope of work as per the contract includes the following:

- To mobilize a suitable marine spread and a survey boat at site for carrying out the operations.
- To provide requisite personnel and equipment for undertaking of oceanographic measurements and study of shoreline.
- Monthly cross-shore beach profiling perpendicular to the shoreline for a 40 km stretch at intervals of 500m, using RTK or total station landward up to 100m from HTL or +2m of HTL and using shallow draft boats, sled or any other suitable techniques seaward down to 10m CD (4 CSP Lines carried out up to a depth of 20 m in the months of January, May, August and October).
- Monthly monitoring of littoral zone (at the CSP locations) to observe the littoral transport direction and alongshore current speed by means of appropriate drogue observations and visual observations.
- Monthly photographic documentation of geomorphological changes (at the cross-shore beach profiling locations in four directions).
- Seasonal beach sediment sampling and analysis (at the CSP locations).
- Bathymetric survey twice in a year, i.e., just after the monsoon season and just prior to the commencement of the next monsoon to generate 0.5m contours (with bathymetric survey lines spaced at 25 m interval) in areas with depths to 20m CD using multi beam echo sounder.
- Seabed sediment sampling and analysis in 80 sq. km with one sample per sq km.
- Collection and analysis of water samples at specified periods (seasonal) for total suspended solids (TSS) and turbidity from four specified locations.
- Tide measurements using an automatic tide gauge close to the survey area to observe the tidal variations around the clock at 6-minute intervals or as specified to cover one full year. The tide gauge shall be connected to the nearest Survey of India Benchmark.
- Collection of wind speed & direction, atmospheric pressure, humidity, temperature at 1 location specified by the client/EIC (Engineer in Charge) by establishing an automatic weather station (AWS).
- Processing and documentation of monthly wave data provided by INCOIS.
- Processing and documentation of seasonal current data provided by INCOIS.
- Shoreline monitoring survey using RTK in GPS mode is to be carried out along the entire 40 km stretch every month (commenced from November 2021 onwards).
- Sled survey to be carried out for the nearshore areas along 7 CSP transects (CSP Nos. 2, 33, 34, 68, 69, 73 and 74) every month using pressure sensor. This survey

shall be carried out till the minimum depth which can be navigated by the offshore CSP survey boat.

- Analysis and processing of the data and submission of periodic reports in soft & hard copies.

3.1 Location Coordinates

The location co-ordinates of the tide station are provided below:

Table 3-1: Tide station location coordinates

Tide Station Co-ordinates WGS-84 Spheroid, UTM Projection, CM 75 East, Zone 43, North			
Name	**Latitude**	**Longitude**	**Height above CD (m)**
Tide station	08° 22' 33.55"N	76° 59' 16.69"E	2.711

The Gill Metpack Automatic Weather Station (AWS) was installed on the terrace of the Port Control Office. The following table shows the coordinates of the AWS installation.

① Table 3-2: Weather station location coordinates

Weather Station Co-ordinates WGS-84 Spheroid, UTM Projection, CM 75 East, Zone 43, North			
Name	**Latitude**	**Longitude**	**Height above CD (m)**
Weather Station	08° 22' 22.75"N	76° 59' 39.62"E	13.335

Note: The wind sensor was installed at a height of 14.785m above MSL (15.335m above CD). As suggested by NIOT, 7% of the speed was reduced to derive the wind speeds at 10m above MSL as per WMO standards.

The Datawell DWR 4 Wave Rider Buoy (WRB) was deployed by INCOIS and AVPPL on 21st May 2023.

The location co-ordinates of the Wave rider buoy are provided below:

Table 3-3: Wave rider buoy location coordinates

WRB Co-ordinates WGS-84 Spheroid, UTM Projection, CM 75 East, Zone 43, North			
Name	**Latitude**	**Longitude**	**Water Depth (m)**
WRB	08° 19.656918' N	77° 1.078776' E	~25m

3.2 Beach Sampling

A total of 81 beach samples were to be collected per season, as part of the contract. The samples were to be analyzed for grain size distribution as per Wentworth classification.

In the pre-monsoon 2023 period (March 2023 to May 2023), 57 samples could be collected out of 81 The samples which could not be collected due to lack of beach were BS-3, BS-11 to BS-14, BS-35, BS-40, BS-49 to BS-52, BS-59, BS-63 to BS-66. Locations BS-23 to BS-30 could not be collected as a result of the ongoing agitation faced from the locals residing in these areas.

In the monsoon 2023 period (June 2023 to September 2023), 46 samples could be collected out of 81. The samples which could not be collected due to lack of beach were BS-3, BS-11, BS-12, BS-14, BS-41, BS-47 to BS-52, BS-56 to BS-61, BS-63, BS-64 and BS-65 to BS-68. Locations BS-22 to BS-35 could not be collected as a result of the ongoing agitation faced from the locals residing in these areas.

The location coordinates of beach samples are provided in the table below.

Table 3-4: Beach Sampling Locations

BEACH SAMPLING LOCATIONS WGS-84, UTM Projection, CM 75° East, Zone 43, North		
Location	**Latitude**	**Longitude**
BS-1	8° 16.0265' N	77° 7.9532' E
BS-2	8° 16.1775' N	77° 7.7195' E
BS-3	8° 16.3348' N	77° 7.4987' E
BS-4	8° 16.4955' N	77° 7.2778' E
BS-5	8° 16.6565' N	77° 7.0579' E
BS-6	8° 16.8176' N	77° 6.8379' E
BS-7	8° 16.9782' N	77° 6.6187' E
BS-8	8° 17.1382' N	77° 6.3980' E

BEACH SAMPLING LOCATIONS WGS-84, UTM Projection, CM 75° East, Zone 43, North		
BS-9	8° 17.2984' N	77° 6.1765' E
BS-10	8° 17.4586' N	77° 5.9566' E
BS-11	8° 17.6207' N	77° 5.7379' E
BS-12	8° 17.7276' N	77° 5.5946' E
BS-13	8° 17.8899' N	77° 5.3756' E
BS-14	8° 18.0524' N	77° 5.1568' E
BS-15	8° 18.2151' N	77° 4.9388' E
BS-16	8° 18.3603' N	77° 4.7165' E
BS-17	8° 18.5517' N	77° 4.5120' E
BS-18	8° 18.7213' N	77° 4.3003' E
BS-19	8° 18.8852' N	77° 4.0829' E
BS-20	8° 19.0488' N	77° 3.8659' E
BS-21	8° 19.2152' N	77° 3.6499' E
BS-22	8° 19.3848' N	77° 3.4369' E
BS-23	8° 19.5582' N	77° 3.2282' E
BS-24	8° 19.7318' N	77° 3.0196' E
BS-25	8° 19.9075' N	77° 2.8098' E
BS-26	8° 20.0796' N	77° 2.5989' E
BS-27	8° 20.2492' N	77° 2.3841' E
BS-28	8° 20.4130' N	77° 2.1703' E
BS-29	8° 20.5731' N	77° 1.9581' E
BS-30	8° 20.7305' N	77° 1.7499' E
BS-31	8° 20.8951' N	77° 1.5274' E
BS-32	8° 21.0493' N	77° 1.2973' E
BS-33	8° 21.1815' N	77° 1.0911' E
BS-34	8° 21.3210' N	77° 0.8491' E
BS-35	8° 21.3974' N	77° 0.6359' E
BS-36	8° 21.6830' N	77° 0.4829' E
BS-37	8° 21.8799' N	77° 0.2980' E
BS-38	8° 22.1369' N	77° 0.1947' E
BS-39	8° 22.3420' N	76° 59.9895' E
BS-40	8° 22.5417' N	76° 59.7689' E
BS-41	8° 22.8201' N	76° 59.0753' E
BS-42	8° 23.0287' N	76° 58.7934' E

BEACH SAMPLING LOCATIONS		
WGS-84, UTM Projection, CM 75° East, Zone 43, North		
BS-43	8° 23.1727' N	76° 58.6741' E
BS-44	8° 23.3709' N	76° 58.5145' E
BS-45	8° 23.7061' N	76° 58.3743' E
BS-46	8° 23.8974' N	76° 58.3798' E
BS-47	8° 24.1304' N	76° 58.2814' E
BS-48	8° 24.4789' N	76° 58.1346' E
BS-49	8° 24.6320' N	76° 58.0289' E
BS-50	8° 24.8665' N	76° 57.8917' E
BS-51	8° 25.0976' N	76° 57.7474' E
BS-52	8° 25.3176' N	76° 57.5868' E
BS-53	8° 25.5653' N	76° 57.4562' E
BS-54	8° 25.7602' N	76° 57.2767' E
BS-55	8° 25.9643' N	76° 57.0963' E
BS-56	8° 26.1500' N	76° 56.9073' E
BS-57	8° 26.3461' N	76° 56.7308' E
BS-58	8° 26.5741' N	76° 56.5678' E
BS-59	8° 26.7782' N	76° 56.4051' E
BS-60	8° 26.9997' N	76° 56.2272' E
BS-61	8° 27.2030' N	76° 56.0492' E
BS-62	8° 27.4175' N	76° 55.8762' E
BS-63	8° 27.6142' N	76° 55.6937' E
BS-64	8° 27.8102' N	76° 55.5014' E
BS-65	8° 28.0132' N	76° 55.3255' E
BS-66	8° 28.2159' N	76° 55.1437' E
BS-67	8° 28.4224' N	76° 54.9642' E
BS-68	8° 28.6228' N	76° 54.7840' E
BS-69	8° 28.8276' N	76° 54.6048' E
BS-70	8° 29.0316' N	76° 54.4243' E
BS-71	8° 29.1104' N	76° 54.3586' E
BS-72	8° 29.3118' N	76° 54.1755' E
BS-73	8° 29.5150' N	76° 53.9964' E
BS-74	8° 29.7202' N	76° 53.8181' E
BS-75	8° 29.9258' N	76° 53.6393' E
BS-76	8° 30.1345' N	76° 53.4652' E

BEACH SAMPLING LOCATIONS WGS-84, UTM Projection, CM 75° East, Zone 43, North		
BS-77	8° 30.3450' N	76° 53.2940' E
BS-78	8° 30.5558' N	76° 53.1226' E
BS-79	8° 30.7701' N	76° 52.9558' E
BS-80	8° 30.9840' N	76° 52.7867' E
BS-81	8° 31.1988' N	76° 52.6188' E

4 SURVEY CONTROL

4.1 Geodesy

The survey operations were conducted in the WGS 84 Spheroid, Universal Transverse Mercator Projection based on the geodetic parameters presented below. All co-ordinates quoted within this document are with reference to it.

Table 4-1: Geodetic Parameters

GEODETIC PARAMETERS	
Satellite Datum	
Spheroid	WGS-84
Datum	WGS 84
Semi-Major Axis	6378137.000 m
Semi Minor Axis	6356752.314 m
Inverse Flattening	298.2572
Projection Parameters	
Grid Projection	Universal Transverse Mercator
Latitude of Origin of Projection	0° (Equator)
Longitude of Origin of Projection	75° E, Zone 43
Hemisphere	North
False Easting (metres)	500000
False Northing (metres)	0
Scale Factor on CM	0.9996
Units	Metres

4.2 Survey Vessels

The following vessels were utilized for the survey operation:

Figure 4-1: Multibeam survey boat Bismi

4.3 Personnel

① The following survey personnel from SSPL/AVPPL were assigned to the project in the capacities listed in the table below during the period.

Table 4-2: Personnel

Shankar Surveys Pvt. Ltd.		
Name	**Designation**	**Period**
Rajinder Singh Sandhu	Project Manager (Navi Mumbai office)	Duration of Project
Vasil Chathurala	Oceanographer	Duration of Project
Vishnu K.	Party Chief /Survey Engineer	Duration of Project
Vishnu Haridas	Land / Hydrographic Surveyor	Duration of Project
Ajeesh A.S.	Assistant Surveyor	Duration of Project
Amal Deva	Assistant Engineer	Duration of Project
Sanjeevanee Khaire	Data Processor (Navi Mumbai office)	Duration of Project
Adani Vizhinjam Port Pvt. Ltd.		
Name	**Designation**	**Period**
Hebin C	Manager - Environment	Duration of Project
Jesse Fullonton	Assistant Manager - Environment	Duration of Project

5 SURVEY EQUIPMENT DETAILS

5.1 Automatic Tide Gauge

The Valeport Tidemaster Automatic Tide Gauge (ATG) was installed at the Coast Guard jetty, inside the fishing harbour for measuring the tides. The tide gauge is a pressure-sensor based instrument, measuring the water level due to change in pressure on the surface of sensor. The sensor was installed in such a way that the zero of sensor is always in water, irrespective of the phases of tide. This was levelled to the local benchmark, situated on top of the jetty. The tide station was programmed to measure the tide at 6-minute intervals throughout the duration of the project.

A photograph of the tide gauge location is shown below.

Figure 5-1: Automatic Tide Gauge

5.2 Wave Rider Buoy (WRB)

① The Datawell DWR4 Wave Rider Buoy was deployed by INCOIS and AVPPL on 21st May 2023. The WRB was programmed to measure all the wave parameters at half-hourly intervals. The data is collected and sent to SSPL after quality check.

The system has an accuracy of 1 cm + 0.5% of vertical motion; resolution of 1mm and range of ± 20 m at the sampling rate of 5.12 Hz. The directional accuracy and resolution are 0.1° within the range of 0° to 360°.

Figure 5-2: WRB deployed at site

5.3 Automatic Weather Station (AWS)

A Gill Metpack Automatic Weather Station (AWS) was installed on top of the Port Control Office building. The system measures wind speed/direction, atmospheric pressure, temperature, relative humidity and rainfall.

The system consists of the following:

- Sonic anemometer
- Relative humidity & temperature sensor
- Pressure sensor
- Rainfall Gauge
- Datalogger

The data is logged in a datalogger installed at the receiving station at intervals of 10 minutes. The data is also transmitted from the data logger to a cloud-based server for further processing and QC checks.

Some images of the automatic weather station are provided below.

Figure 5-3: AWS on top of Port Control Office building

5.4 Real Time Kinematic (RTK) Survey

An RTK system was mobilized at site to carry out cross-shore profiling on the landward side. The system used was a Geomax Zenith 35 Pro RTK system with base station and rover. A photograph of the system is provided below.

Figure 5-4: RTK System with base and rover

5.5 DGPS Positioning System

Vessel positioning was carried out by the Trimble SPS 461 dual antenna DGPS system which also provided vessel heading. Vessel track and offset positions were recorded digitally in the navigation software. The positioning system was interfaced to the navigation software as well as the digital data acquisition system. DGPS positioning accuracy of the moving vessel was better than ±1m.

The computed position of the vessel from the DGPS receiver was interfaced to the navigation computer system. Hypack navigation and data acquisition software was used to provide track guidance information to the survey crew and also output the position of the vessel to assist the helmsman in maintaining the selected track guidance line. The VDU displays the selected survey line, the position of the vessel in relation to that line and numerical data to assist the helmsman such as the along-line and off-line distances, vessel speed and course made good, gyro heading, distance and bearing to end of line and water depth. The position of each fix, together with other

information such as fix numbers, depths, PDOP and along-line distances were logged to the hard drive.

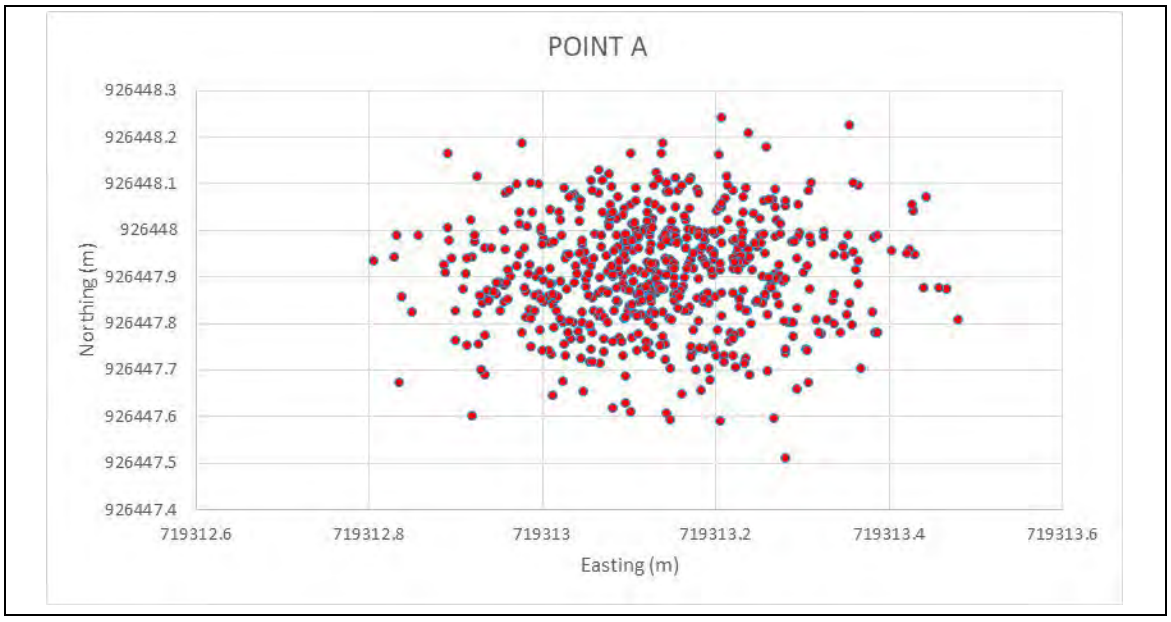
5.5.1 DGPS Consistency Check

In order to determine the integrity and reliability of the positioning system, the system was checked for its consistency during mobilization.

After installing the Trimble DGPS positioning system on board the vessel, two points were marked on the jetty. The DGPS antenna was set up on the jetty at these two points, designated as Point A and Point B.

Time was synchronized between Trimble/Hypack and the observer's watch, for which local time (GMT+5.30) was used. The Trimble SPS 461 DGPS antenna positions were logged in the Hypack navigation software. The logged data was processed to derive the final positions of both the points.

The difference between the calculated distance and measured distance was found to be within the permissible accuracy. The scatter plot of the latest DGPS calibration carried out in the month of September 2023 is shown in the figure below.



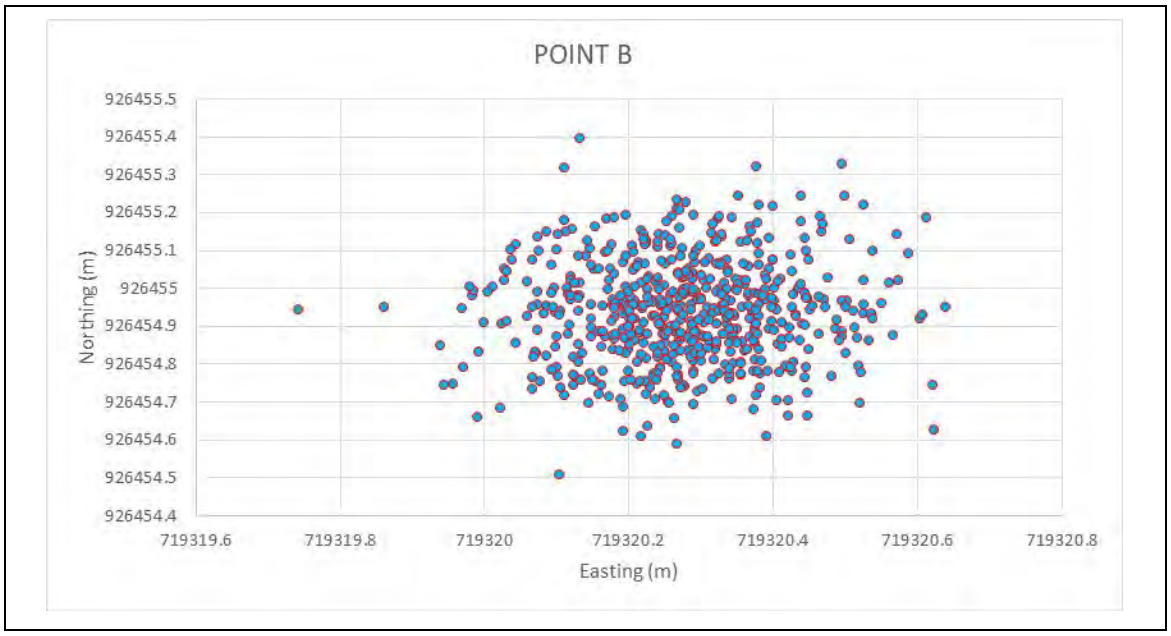


Figure 5-5: Scatter plot of DGPS calibration on board multibeam boat Bismi

Table 5-1: DGPS Calibration results

AVERAGE POSITIONS		
POINT	**EASTING**	**NORTHING**
A	719313.13	926447.91
B	719320.28	926454.94
Distance between points		**10.02 m**
Measured Distance		**10.00 m**
Difference		**0.02 m**

5.5.2 Gyrocompass Calibration

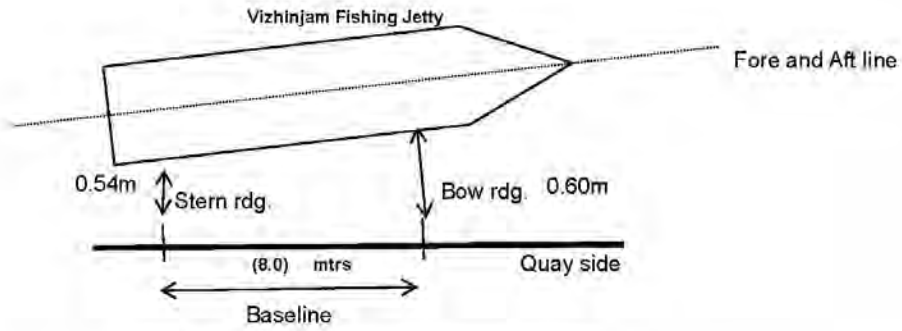
The calculated heading of the vessel was compared with the recorded gyrocompass heading to derive a calculated-observed (C-O) value. A final C-O of 0.02° was obtained, which was entered into the navigation software before commencing the survey. The Gyro Verification table for the month of September 2023 is placed below.

GYRO CALIBRATION
(Quay / Tape Offset Method)

Job	AVPPL Shoreline Monitoring	Job No	P034-23
Client	AVPPL	Vessel	BISMI
Location	Vizhinjam Fishing Jetty	Date	14-Sep-23
Gyro S/N	20872		

Quay heading(T)	Baseline length(m)	Gyro Name : TRIMBLE GA 830	Quayside on:
45.73	8.00	S/No. 12172	Starboard

Observations				Calculations			
Time	Gyro (true)	Bow	Stern	Calc. angle	Calculated Heading	True Quay Hdg	C-O
10:35:00	45.8	0.4	0.5	0.72	45.08	45.73	0.65
10:35:10	45.5	0.7	0.4	-2.15	47.65	45.73	-1.92
10:35:20	45.6	0.9	0.7	-1.43	47.03	45.73	0.72
10:35:30	45.7	0.8	0.3	-3.58	49.28	45.73	-3.55
10:35:40	45.9	0.6	0.9	2.15	43.75	45.73	1.98
10:35:50	45.4	0.5	0.3	-1.43	46.83	45.73	-0.66
10:36:00	45.7	0.3	0.7	2.86	42.84	45.73	2.89
	45.66	**0.60**	**0.54**	**-0.41**	**46.07**	**45.73**	**0.02**



Note: Drawing not on scale only for representaion purpose

Signed			
Designation	Name	Signature	Date
Surveyor	Vishnu Hariads		14-Sep-23
Party Chief	VISHNU K		14-Sep-23

Figure 5-6: Gyrocompass Calibration on board multibeam boat Bismi

5.6 Multibeam Echo Sounder System

An R2Sonic 2020 multibeam echo sounder, operating at a frequency of 220 kHz, was used to delineate the topography of the seabed. The measured sound velocity and observed tide was fed into the system during data processing.

The swath bathymetry system was calibrated according to methods described in the manufacturer's manual. The swath transducer system was aligned with the Motion Reference Unit (MRU). Great care was taken to mount the heads and MRU as accurately as possible and the final calibration was carried out during sea trials by running three reciprocal lines near the survey area. The following calibrations were carried out:

- Alignment of sonar heads
- Roll calibration
- Pitch calibration
- Latency checks

5.6.1 Multibeam Swath Calibration Report

The calibration (or patch test) of the R2Sonic MBES was used to fix the time and angle offsets between the various positioning systems and the transducer head. This was done after mobilization.

The system offsets were entered in the acquisition software prior to surveying and raw data acquisition. Some of these were easily measured and entered and others were corrected through the calibration procedure. The calibration done in the month of March 2023 is provided below.

Offsets:

The directly measured system offsets are:

- Transducer sensor offsets measured as the distance from the COG to the transducer point (X= 0.000 m, Y= 0.00 m, Z = 0.800 m from water line for Bismi).
- Antenna offsets measured as the distance from the COG to the antenna (X= 0.000 m, Y= 0.965 m and Z = -2.667 m from transducer).
- Heave offset measured as the vertical distance from the centre of the transducer to the water surface (X= -0.350 Y= 0.160 m, Z= -1.500 m for Bismi).
- Time offset (latency) introduced by DGPS computer/ navigation computers or during the serial data transfers.

A DMS-05 MRU provided compensation for vessel heave, roll, pitch and yaw. The sound velocity profiles and tide readings were used to get an accurate calibration form the patch test.

The recommended order of calibration is:

- Calibrate for Latency
- Calibrate for Roll
- Calibrate for Pitch
- Calibrate for Yaw

This is called the LRPY sequence. The figure below shows the sensor offsets for the survey vessel Bismi in Hypack software.

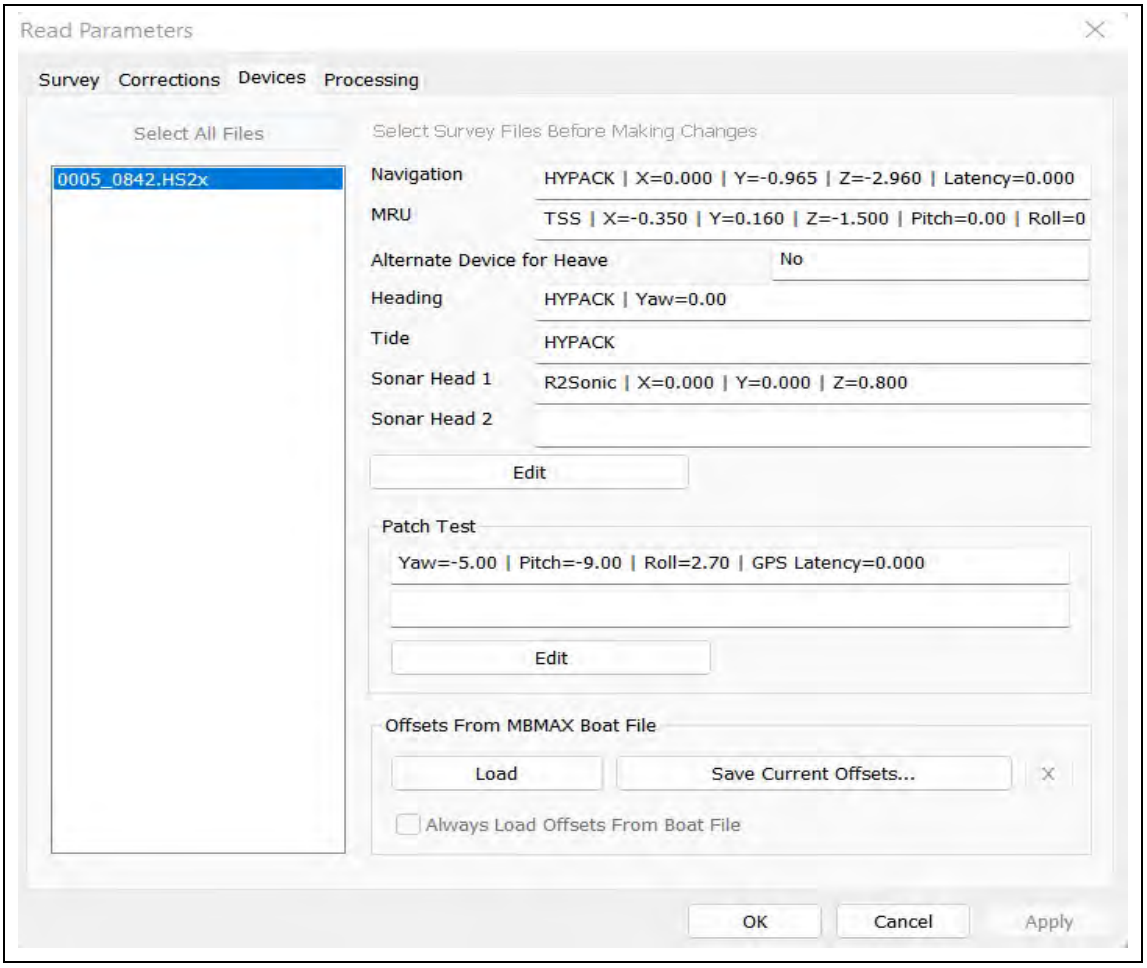


Figure 5-7: Multibeam sensor offsets of MBES boat Bismi

Roll Calibration:

- Three survey lines, were run in opposite directions at 4 knots over flat topography approximately 700 m long with 100% overlap before the start of the survey.
- The sound velocity profile was carried out before running the calibration lines.
- Observed ATG tide of Coast guard jetty at Vizhinjam was applied with respect to Chart Datum correction to the calibration files.

Pitch Bias and Navigation Delay Calibration:

- Unlike the roll offset, these offsets will not cause false depth values, but will assign the measured depth values to wrong positions. Both calibrations are dependent on each other and have to be separated by calculating the offsets in a fixed order.
- Three lines were run in opposite directions for pitch and two lines were run in the same direction at different speeds, over a distinct object or a steep slope perpendicular to the contours.

Yaw Calibration:

Three lines were run in opposite directions for yaw correction on either side of a conspicuous object. This is often the same object that is used calculate the residual pitch bias and navigation time delay.

- The lines length was approximately 4000 m since the seabed feature exhibited a good slope in the area.
- The lines were run at normal survey speed, approximately 4 knots, to obtain a “suitably high resolution”.

The Table below shows the calibration values which were obtained and used for data processing.

Table 5-2: MBES Calibration results

Parameter	Value	Comments
Latency	0.00s	Trimble SPS 461 positioning system
Roll	2.70°	DMS accuracy 0.05° in roll
Pitch	-9.00º	DMS accuracy 0.05° in pitch
Yaw	-5.00º	Accuracy better than 0.2°

The figure below provides the comparison grid (with and without calibration) to show the calibration results.

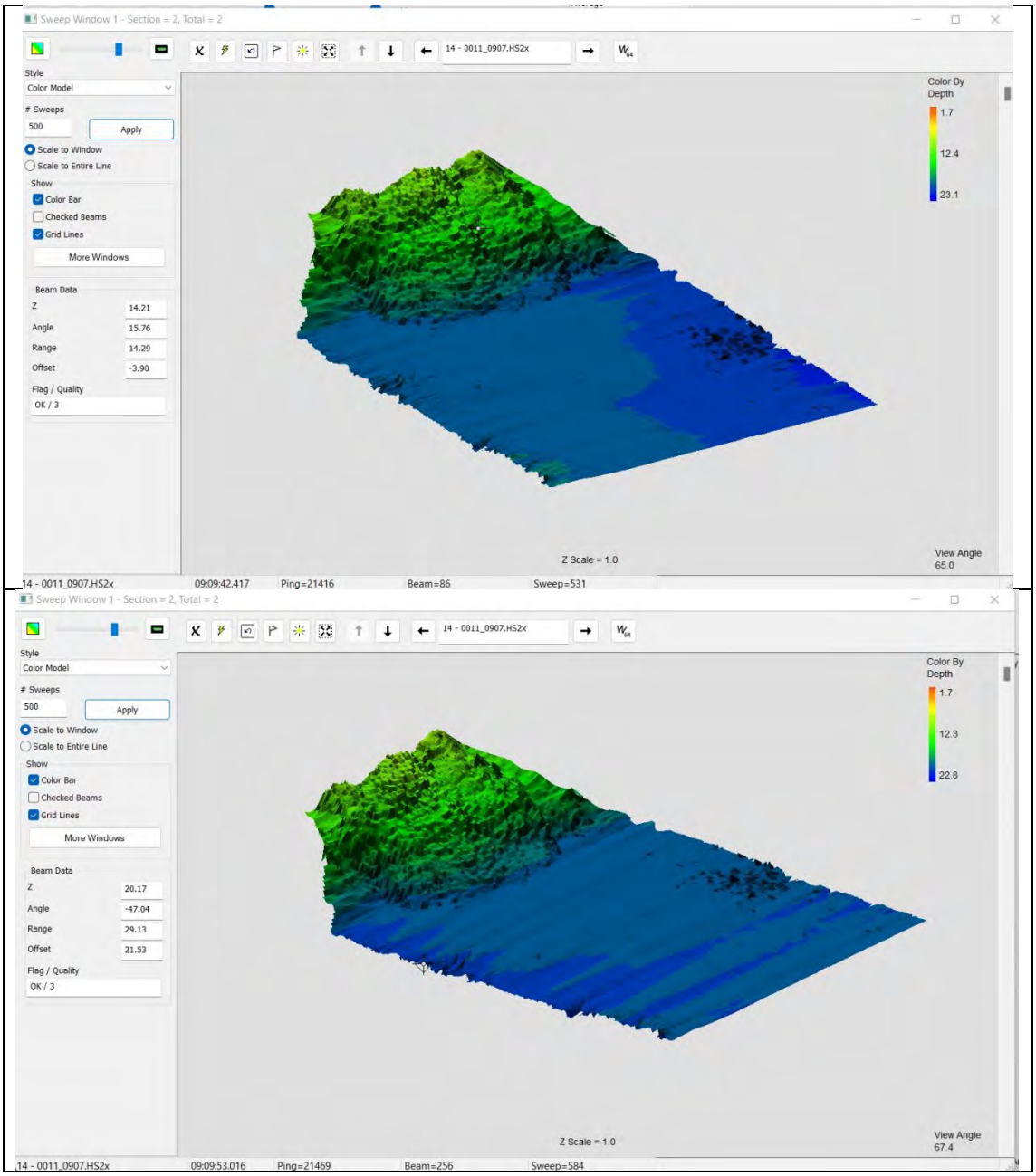


Figure 5-8: Calibration results with cross profiles (Above: without calibration, Below: with calibration)

6 SURVEY RESULTS

The following table illustrates the data collection parameters along with duration and frequency of measurement.

Table 6-1: Summary table of data collection parameters

Parameter	Duration of Measurement	Frequency of Measurement
Tide	1st Apr 2023 - 30th Sept 2023	6 minutes
Wave height and direction	21st May 2023 - 30th Sept 2023	10 minutes
Wind speed and direction	1st Apr 2023 - 30th Sept 2023	10 minutes
Atmospheric Temperature	1st Apr 2023 - 30th Sept 2023	10 minutes
Atmospheric Pressure	1st Apr 2023 - 30th Sept 2023	10 minutes
Relative Humidity	1st Apr 2023 - 30th Sept 2023	10 minutes
	Locations surveyed	**Remarks**
Littoral Environment Observations	417 out of 486	CSP locations 23 to 35 could not be approached due to local protests
Photographic Documentation	417 out of 486	
Cross Shore Profiles	416 out of 486 (Onshore) 126 out of 486 (Onshore)	CSP locations 23 to 35 could not be approached due to local protests. Offshore profiles could not be attempted due to rough weather
Near Shore Survey	7 out of 42	Could not be attempted due to rough weather
Shoreline monitoring survey	216 km out of 246 km	CSP locations 23 to 35 not be approached due to local protests
Collection of beach samples	97 out of 168	As a result of the protests from the locals, BS-23 to BS-30 could not be approached in the pre-monsoon 2023 period and BS-23 to BS-35

		could not be approached in the monsoon 2023 period
Bathymetric Survey (40 km)	1300 line km out of 1300 line km	

6.1 Tidal Measurements

The tides were observed near the Coast Guard jetty. The tide is referenced to the chart datum. On 9th September 2023, maintenance was carried out on the ATG system and the zero of the sensor was lowered to 5.06m below the jetty top. The correction factor remains 2.349m. An image of the jetty top value marked on the wharf to which the tide gauge has been levelled is provided below.

Figure 6-1: Location of TBM

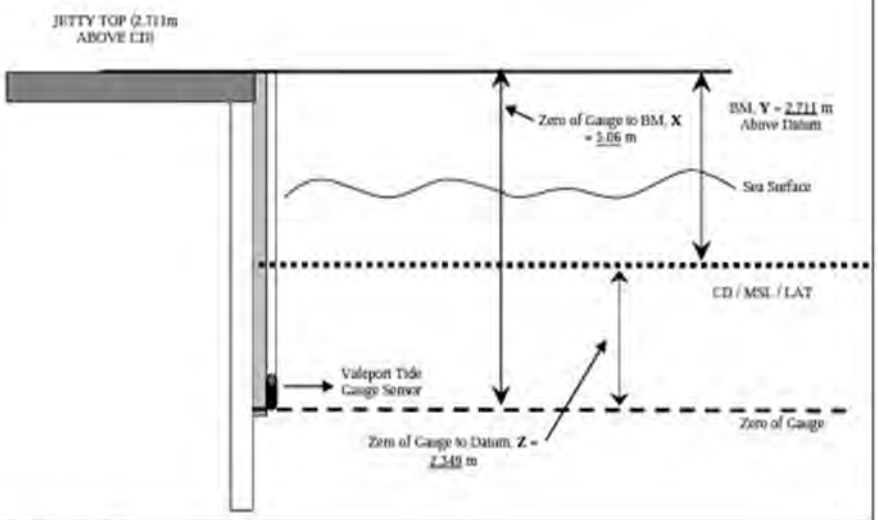
The offset calculation of the Tidemaster tide gauge based on the 'jetty top' value is given in the figure below:

TIDE GAUGE INSTALLATION

Job Number	P034-23	**Project**	Shoreline Monitoring at Vizhinjam
Client	Adani Vizhinjam Port Pvt. Ltd.		
Location	Vizhinjam	**Installation Date**	09/09/2023
Tide Gauge Sr. No.	84143	**Party Chief**	Vishnu K.

Tide Gauge setup refers to:	✓	**CD**		**MSL**	**LAT**

Diagram



Bench Mark details:

Value of Bench Mark	**2.711**	**Meters above the Chart Datum**
Levelled By	**Vishnu K.**	
Date	**28/06/2022**	

Checked the level from zero of the gauge to BM on: 09/09/2023

Calculations:

X, Length from Bench Mark to Zero of Tide Gauge	**5.06 m**
Y, Level of Bench Mark above Datum	**2.711 m**
Z, Tide Correction factor, Z=X - Y	**2.349 m**
Tide height in m above Datum = Raw Tide reading - Z	

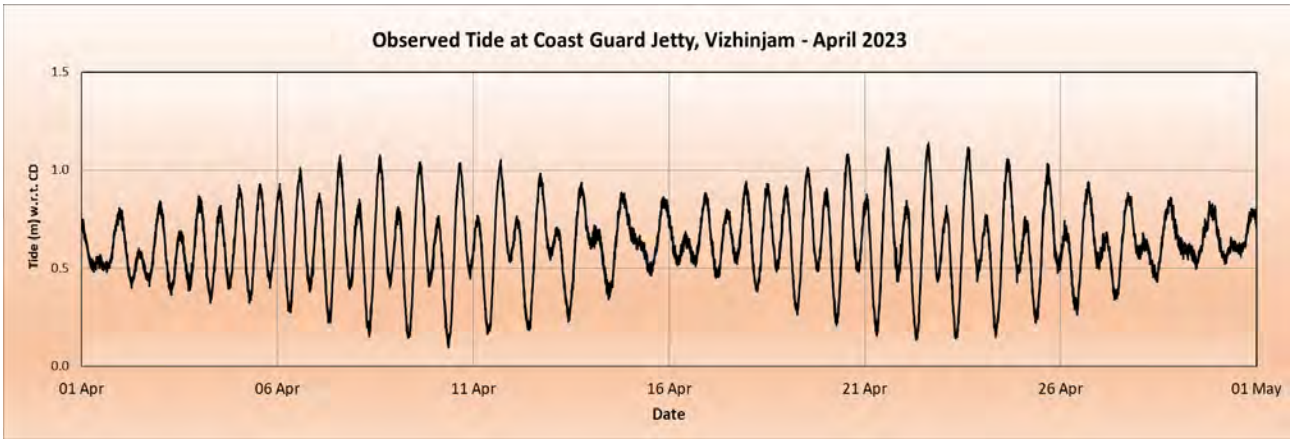
Signature:

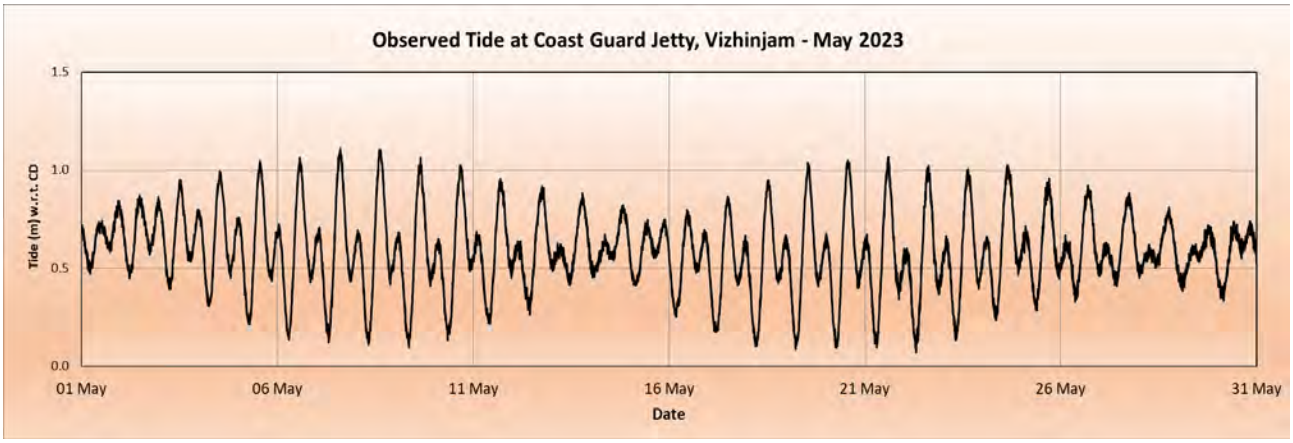
Party Chief	**Vishnu K.**
Surveyor / Engineer	**Vishnu Haridas**

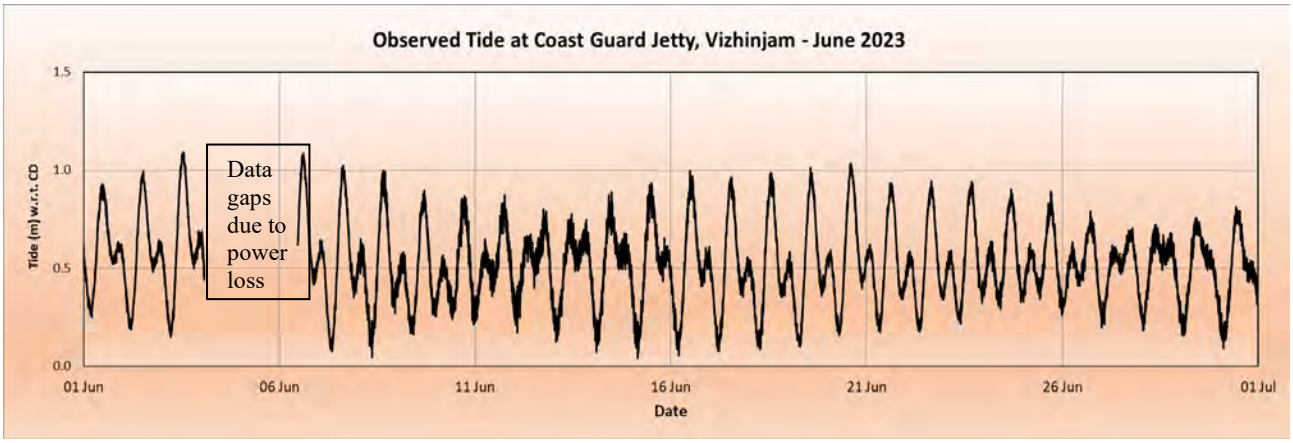
DOC-SSPL Tide Gauge Installation Rev 0

Figure 6-2: Schematic Diagram of Valeport Tidemaster Tide Gauge

The tides observed are mixed semi-diurnal in nature, with the maximum range being observed in the springs. The representation of tide data collected, in the form of graphs is placed below.







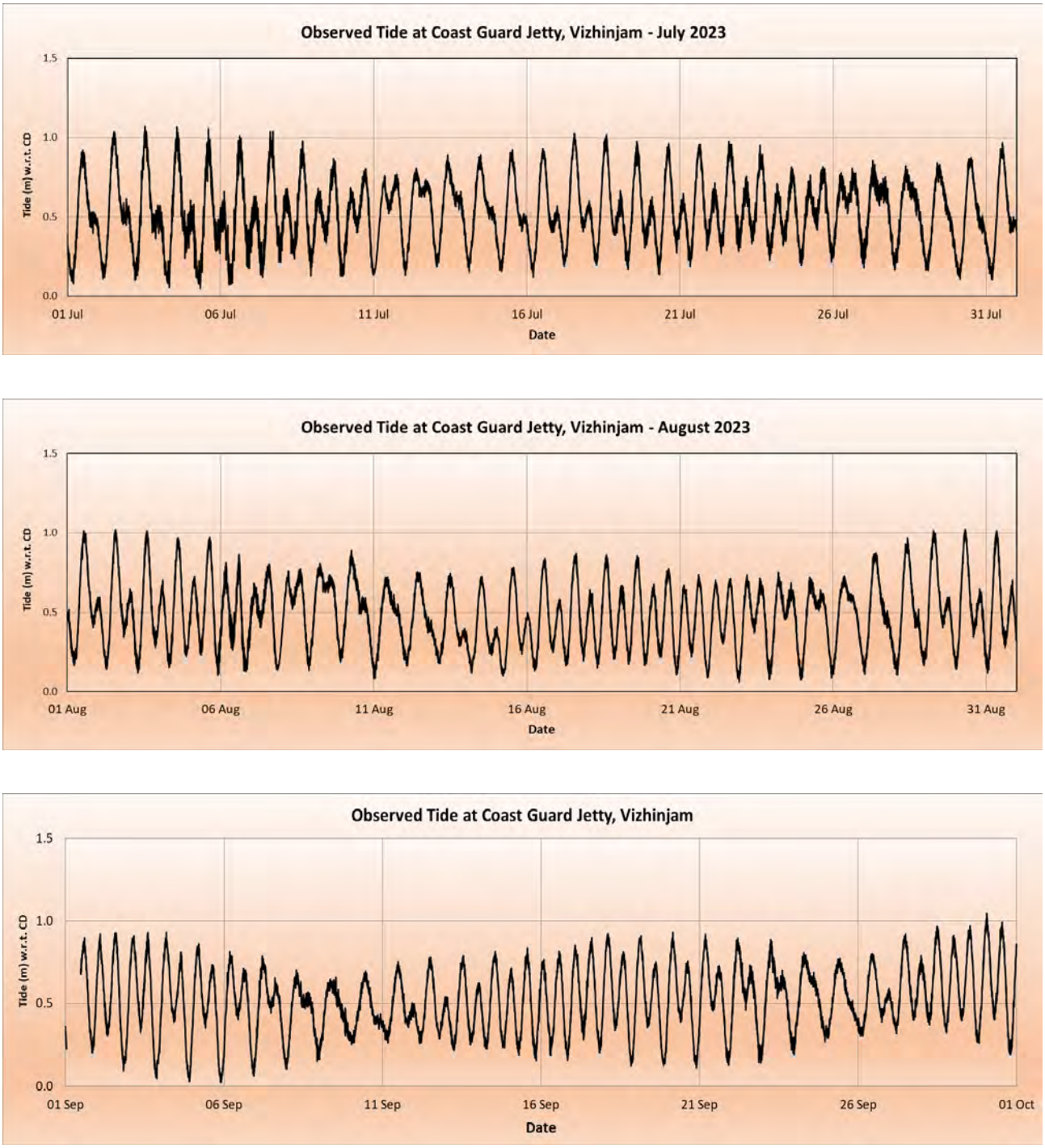


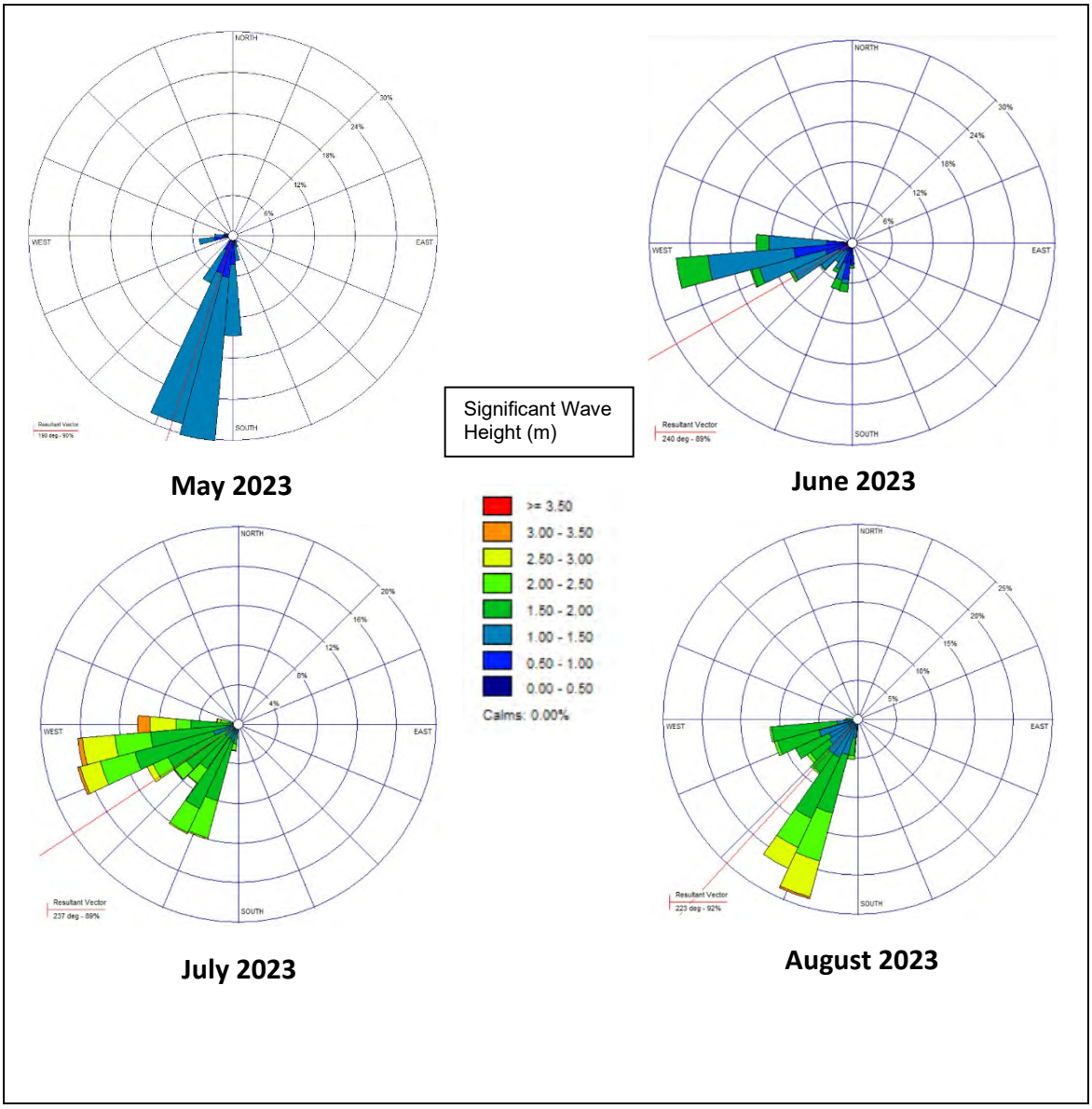
Figure 6-3: Time series of tide

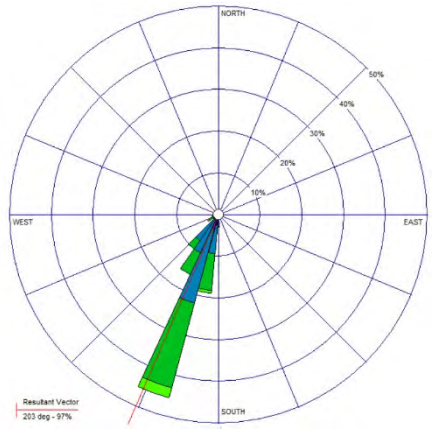
6.2 Wave Measurements

The data from the WRB (provided by INCOIS after processing and quality control) was used to produce the time series and rose diagram, which are provided below:

① The INCOIS WRB was deployed on 21st May 2023. It drifted away from the location on 10th August 2023 and was hence, redeployed by AVPPL on 22nd September 2023.

① Refer to the following rose plots of significant height (Hs) v/s direction for the entire period from May 2023 to September 2023:





September 2023

Figure 6-4: Wave Rose (Hs in metre v/s Direction)

The following table provides the monthly maximum significant wave height (Hs) and wave period (Tp) observed during the period from May 2023 to September 2023.

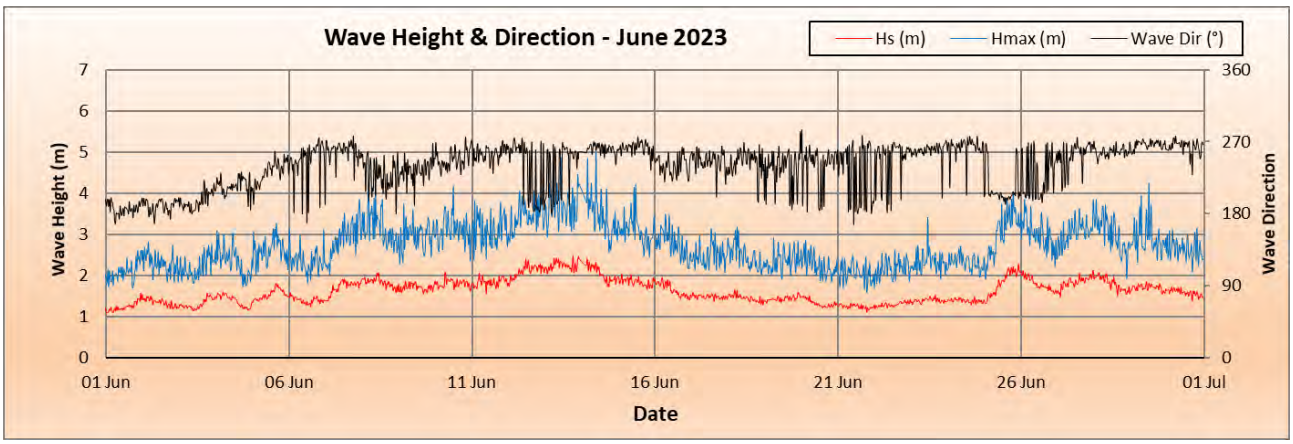
Table 6-2: Monthly maximum Hs, Hmax and Tp

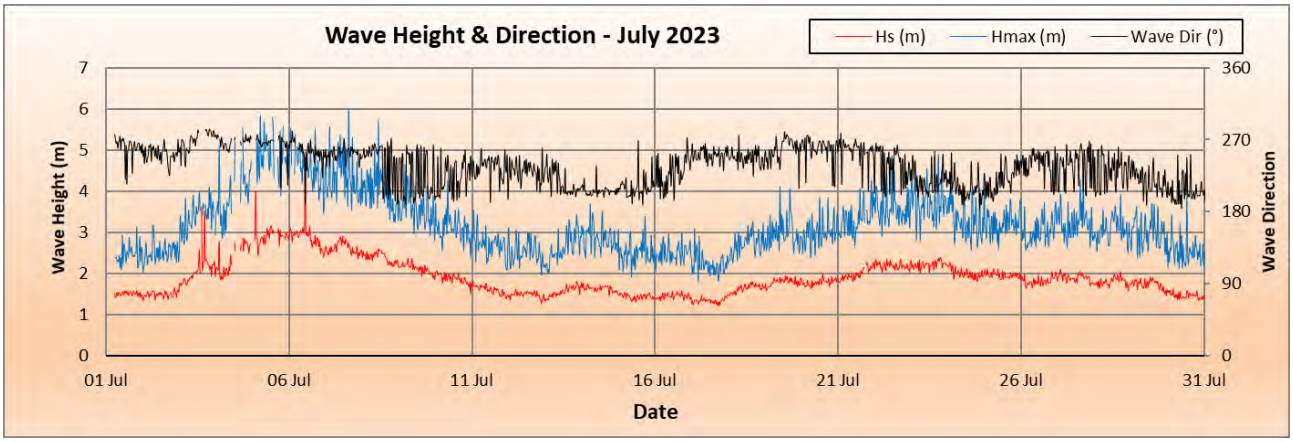
Maximum significant wave height (Hs), Hmax and Maximum wave period (Tp)				
Month	**Hs (m)**	**Predominant Direction (°)**	**Hmax (m)**	**Tp (sec)**
May 2023	1.33	198	2.70	16.70
June 2023	2.49	240	4.98	18.20
July 2023	5.57	192	5.96	28.57
August 2023	2.97	223	5.42	18.18
September 2023	2.29	203	3.03	20.00

The above table indicates that with the onset of monsoon, the wave heights increased.

The time series of wave data from May 2023 to September 2023 is shown below.


Wave Height & Direction - May 2023
Hs (m)
Hmax (m)
Wave Dir (°)
Wave Height (m)
Wave Direction
INCOIS WRB buoy deployed on 21st May 2023
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Date


Wave Height & Direction - June 2023
Hs (m)
Hmax (m)
Wave Dir (°)
Wave Height (m)
Wave Direction
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Date


Wave Height & Direction - July 2023
Hs (m)
Hmax (m)
Wave Dir (°)
Wave Height (m)
Wave Direction
01 Jul
06 Jul
11 Jul
16 Jul
21 Jul
26 Jul
31 Jul
Date

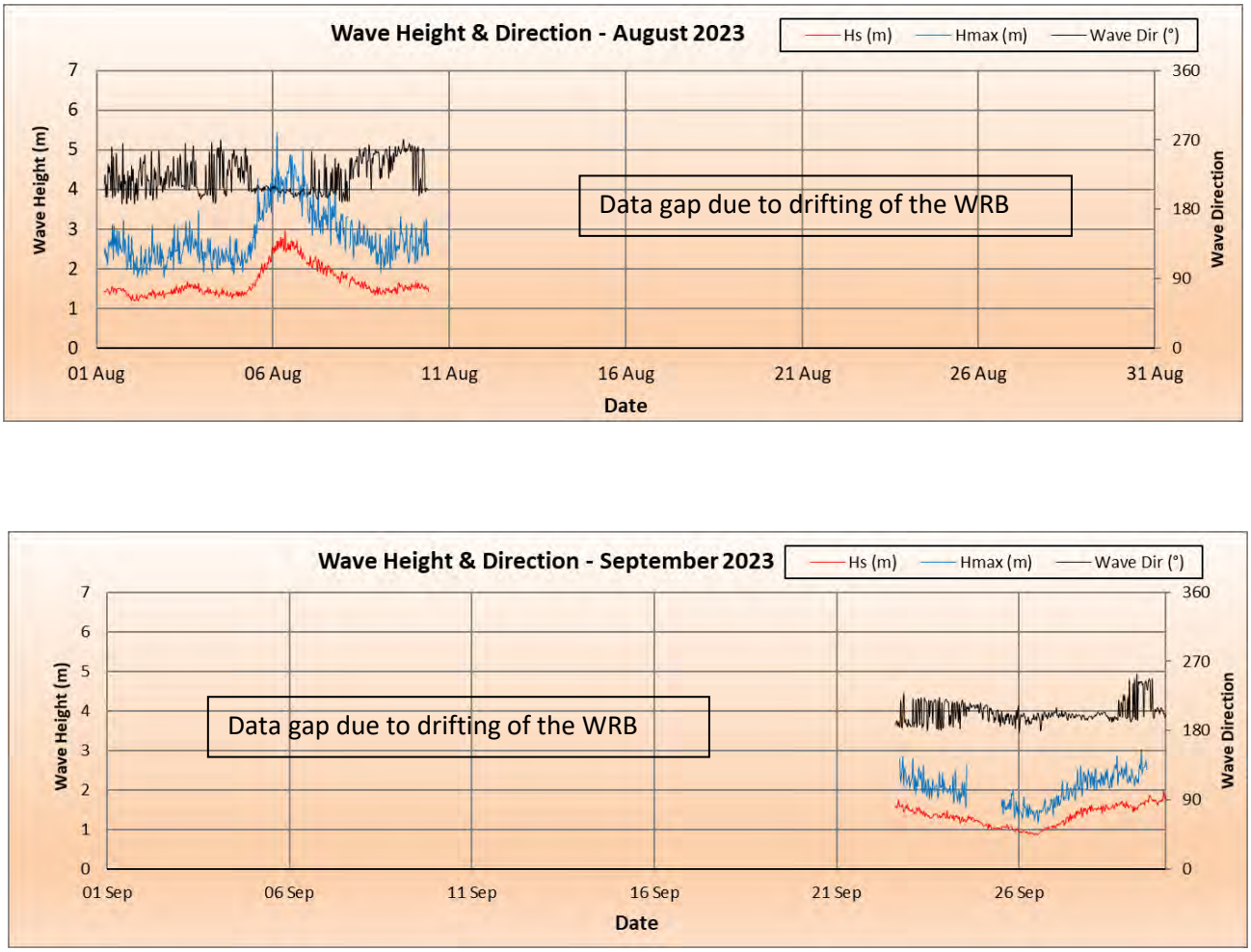


Figure 6-5: Time series of wave parameters

6.3 Measurement of Meteorological Parameters

①

The automatic weather station was installed on the terrace of the Port Control Office building. The wind data from April 2023 to September 2023 is compiled and presented in the form of rose plots below.

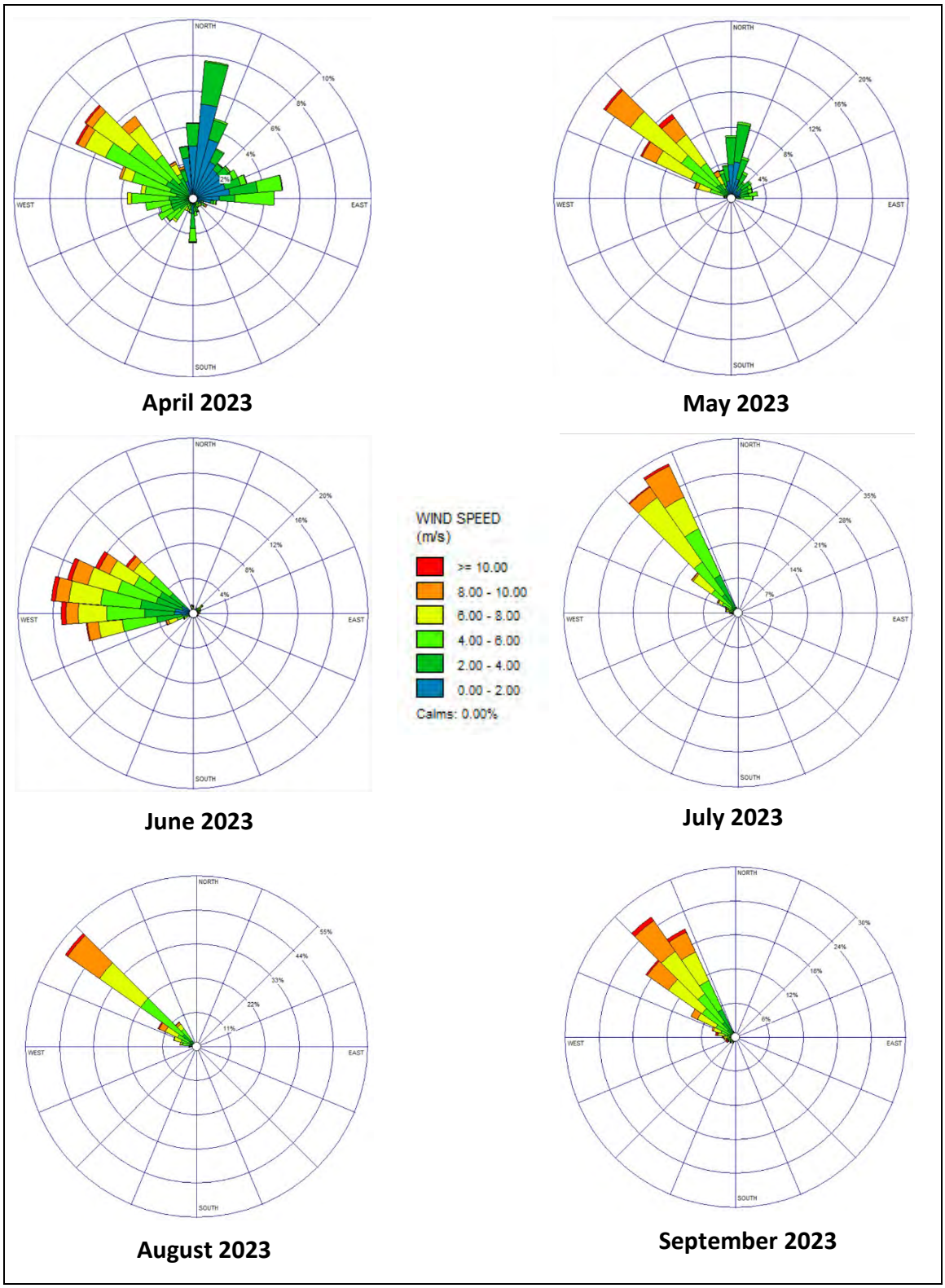


Figure 6-6: Wind rose (Speed in m/s vs direction)

The monthly maximum wind speed and predominant direction are provided in the tables below.

Table 6-3: Monthly maximum landward wind speed

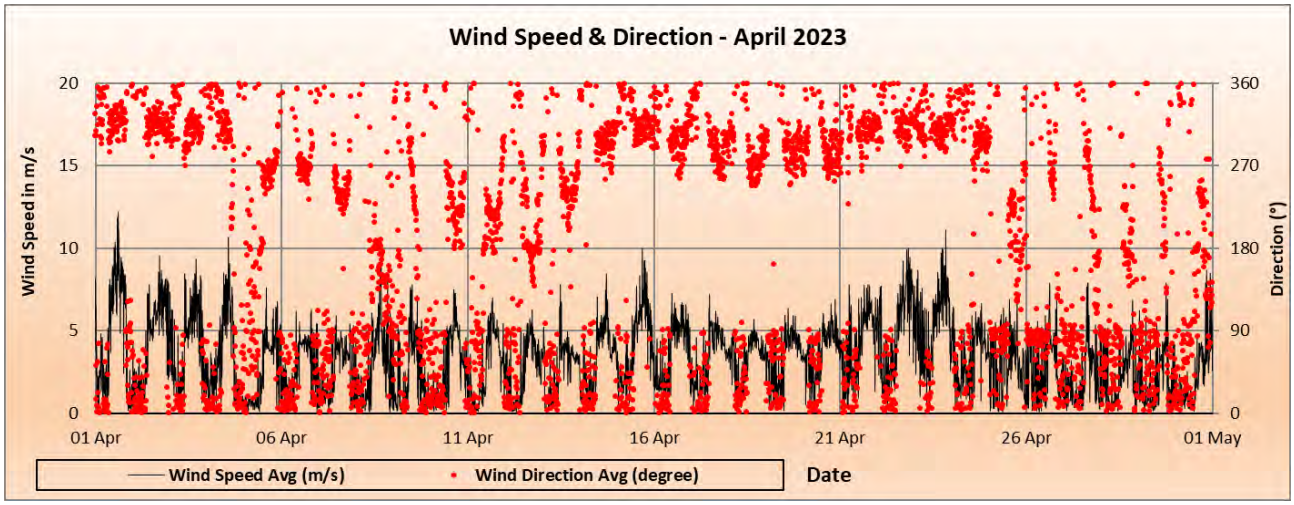
Month	Wind Speed (m/s)	Predominant Direction (°)
April 2023	8.72	56
May 2023	10.74	46
June 2023	13.30	89
July 2023	9.79	97
August 2023	7.93	157
September 2023	9.46	152

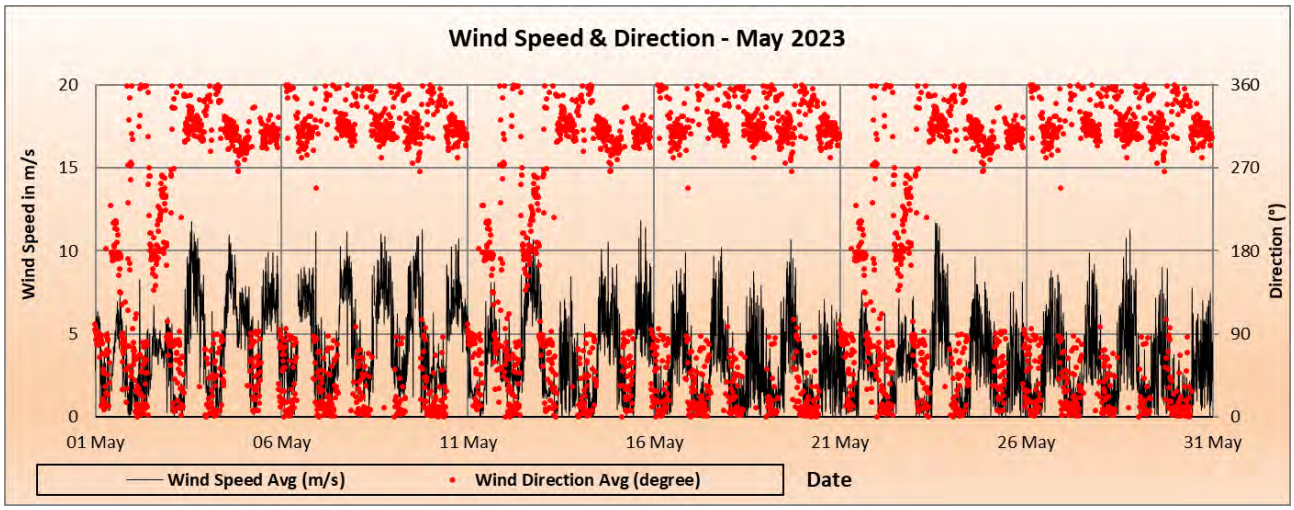
①

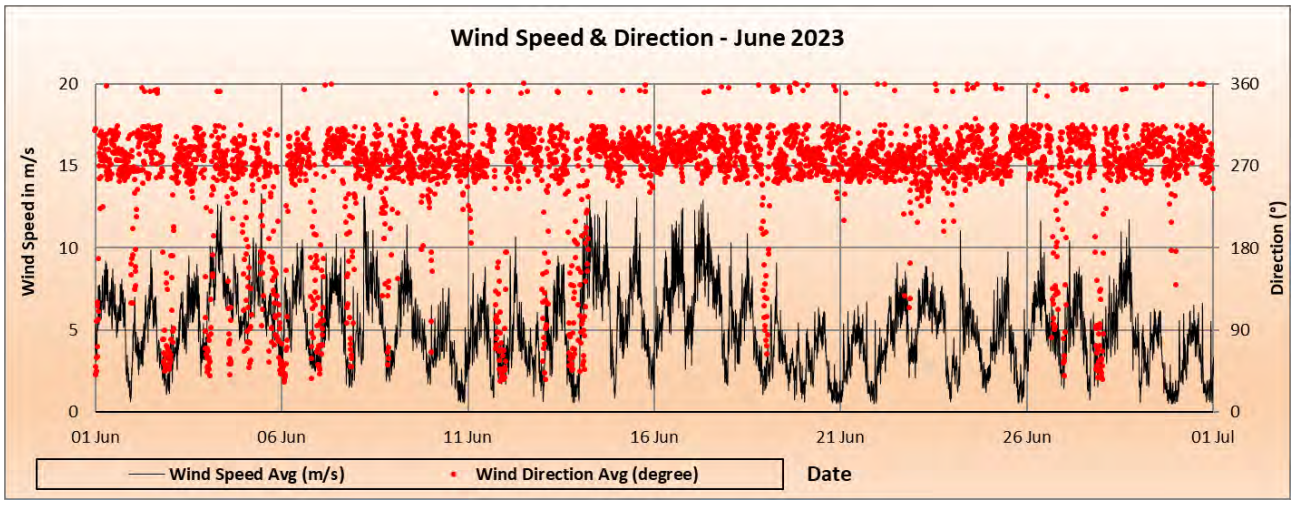
Table 6-4: Monthly maximum seaward wind speed

Month	Wind Speed (m/s)	Predominant Direction (°)
April 2023	12.16	298
May 2023	11.76	310
June 2023	13.10	280
July 2023	12.13	321
August 2023	12.09	308
September 2023	11.98	314

The time series of wind data from April 2023 to September 2023 is shown below.


Wind Speed & Direction - April 2023
Wind Speed in m/s
Direction (°)
20
15
10
5
0
360
270
180
90
0
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Date


Wind Speed & Direction - May 2023
Wind Speed in m/s
Direction (°)
20
15
10
5
0
360
270
180
90
0
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Date


Wind Speed & Direction - June 2023
Wind Speed in m/s
Direction (°)
20
15
10
5
0
360
270
180
90
0
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Date

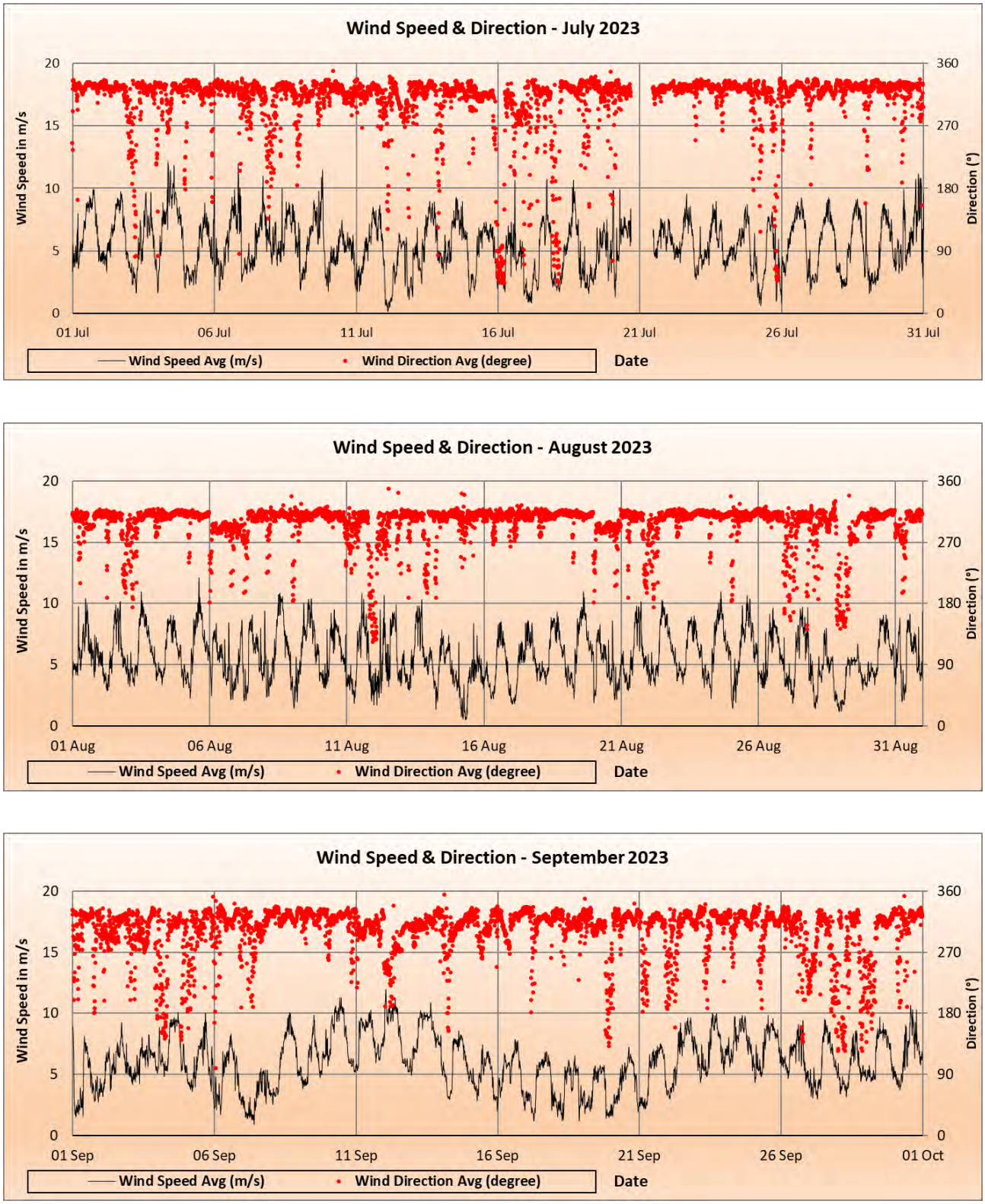


Figure 6-7: Time series of wind data

The percentage occurrence tables for atmospheric pressure, temperature and relative humidity for the period of April 2023 to September 2023 are shown below.

Table 6-5: Frequency distribution of atmospheric pressure

Frequency Distribution	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23
Atm. Pressure (mb)	**Percentage Occurrence**					
<1000	0.00	0.00	0.00	0.00	0.00	0.00
1000-1004	0.00	0.00	0.00	7.08	0.00	0.00
1004-1008	3.24	2.01	11.50	63.70	41.02	20.02
>1008	96.76	97.99	88.50	29.23	58.98	79.98
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 6-6: Frequency distribution of temperature

Frequency Distribution	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23
Temperature (°)	**Percentage Occurrence**					
20-24	0.02	0.00	0.00	0.56	0.96	0.69
24-28	17.06	39.08	54.71	85.82	98.28	94.77
28-32	80.54	60.92	45.29	13.62	0.76	4.54
>32	2.38	0.00	0.00	0.00	0.00	0.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 6-7: Frequency distribution of relative humidity

Frequency Distribution	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23
Rel. Humidity (%)	**Percentage Occurrence**					
50-60	0.00	0.00	0.00	0.00	0.00	0.00
60-70	3.54	5.19	0.12	0.13	0.02	0.23
70-80	59.62	58.97	9.57	15.57	13.73	9.12
>80	36.84	35.84	90.32	84.30	86.25	90.65
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

① The frequency histograms for atmospheric pressure, temperature and relative humidity for the period of April 2023 to September 2023 are shown below.

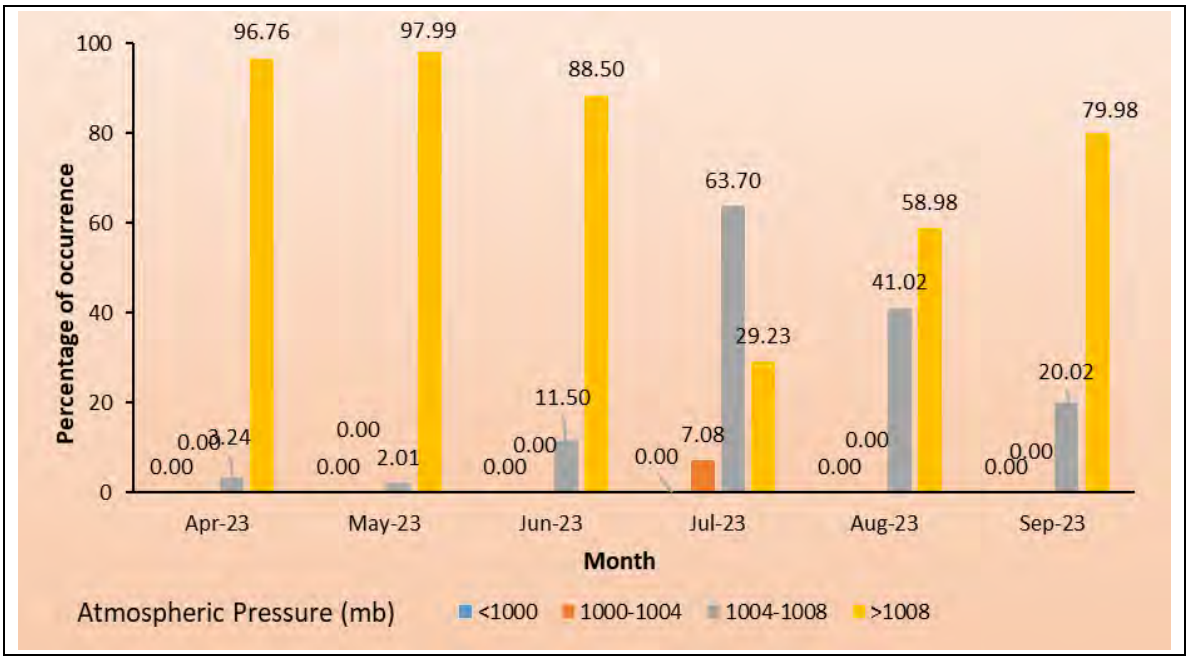


Figure 6-8: Histogram of atmospheric pressure

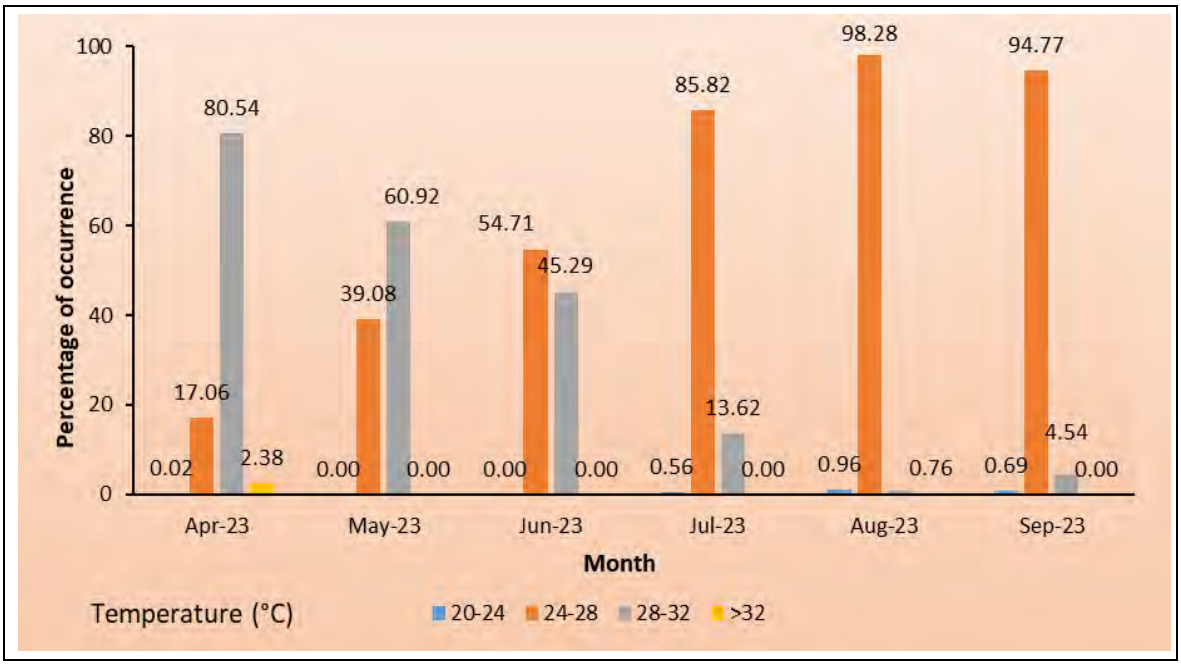


Figure 6-9: Histogram of temperature

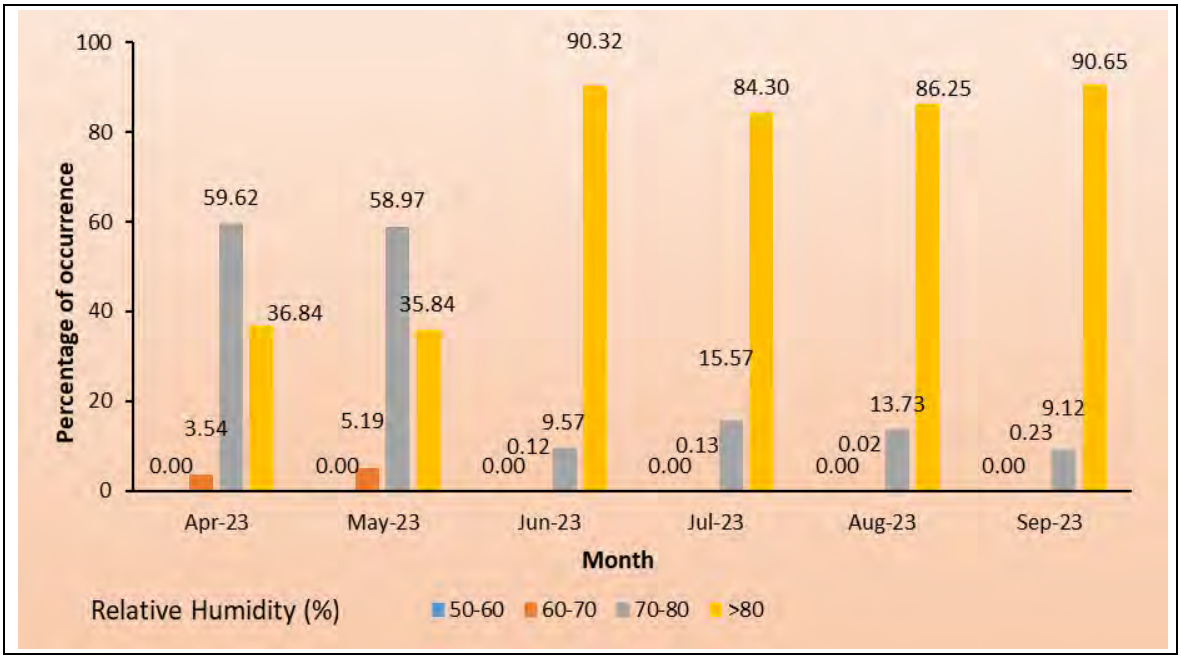


Figure 6-10: Histogram of relative humidity

The data reveals that the temperature decreased from June 2023. The occurrence of relative humidity readings greater than 80% was observed to increase from June to September 2023 as a result of monsoon. During the period of observation, the majority of atmospheric pressure readings were greater than 1008 mb, except for July 2023.

Since the rainfall is not being logged in the AWS system, supplementary rainfall data from IMD (Daily Merged Satellite Gauge Rainfall (GPM) data (0.25 x 0.25 degree Real-time)) is being provided. The target latitude and longitude are 8.5 N and 77 E respectively. The month-wise rainfall received is shown in the table below:

① Table 6-8: Rainfall measured from April 2023 to September 2023 (*Source: IMD Pune*)

Month	Measured Rainfall (mm)
April	91.79
May	138.80
June	144.43
July	183.90
August	66.39
September	485.85
Total rainfall (mm)	**1111.16**

The month-wise histogram of rainfall received is provided in the figures below.

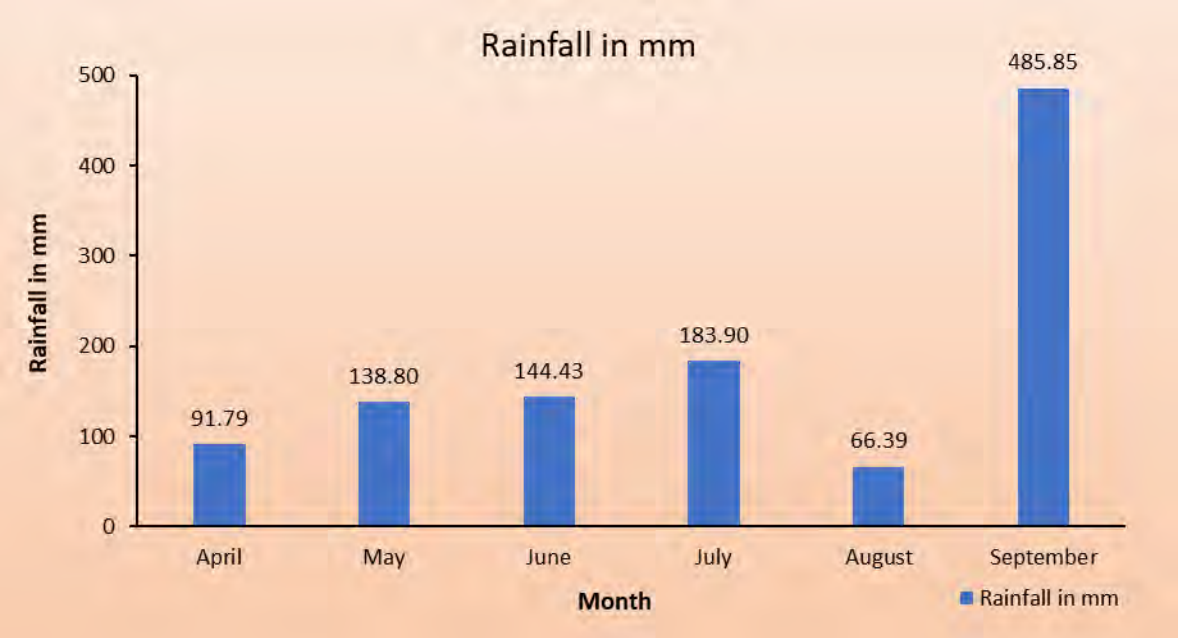


Figure 6-11: Histogram of month-wise rainfall received from April 2023 to September 2023

6.4 Littoral Environment Observations

The LEO was to be carried out at 81 locations from April 2023 to September 2023. In the month of April 2023, 73 locations were covered, 71 locations in May 2023, 69 locations in June 2023, 66 locations in July 2023, 69 locations in August 2023 and 69 locations in September 2023. The locations in which the LEO could not be carried out were primarily due to increased opposition faced from the locals residing in those areas. The LEO plate was deployed at all the locations and the same was tracked for about five to ten minutes, as per the site conditions. The initial and final GPS positions were then used to calculate the SOG and COG. The estimated wave height, angle of wave, period and the stretch of breakers were also noted down in the log.

The along shore current followed a northward trend in the pre-monsoon 2023 period and southward trend in the monsoon 2023 period. The following table shows the maximum along shore current speed recorded in each month.

Table 6-9: Monthly maximum along shore current

Month	Max Speed (cm/s)	Predominant Direction	Line No.	Location
April 2023	22.44	North	CSP 22	Karumkulam
May 2023	27.18	North	CSP 22	Karumkulam
June 2023	21.67	South	CSP 79	Valiyaveli
July 2023	15.27	South	CSP 15	Poovar Beach South
August 2023	11.79	South	CSP 80	Thumba
September 2023	18.14	North	CSP 22	Karumkulam

A pictorial representation of the alongshore current direction during the Pre-Monsoon – Monsoon 2023 period is shown in the Google Earth image below.

①

Figure 6-12: Representation of surface current direction from April 2023 to September 2023

6.5 Photographic Documentation

Photographic documentation was to be carried out for all the 81 locations from April to September 2023, coinciding with the cross-shore profiling. Due to the local agitation, photographic documentation could not be carried in few locations during the period.

The latest photographs for the month of September 2023 are provided in **Annexure I**. As a common reference point, a flag was fixed at each of the cross-shore profiling alignments while taking the photograph. Using the RTK system, this point was staked during the photography.

6.6 Cross Shore Profiles

The cross-shore profiling for the period was carried out using RTK in the onshore region and a wide swath bathymetric system in the offshore region. The offshore profiling could not be carried out for the Monsoon 2023 as a result of bad weather and rough sea conditions. The nearest depth which could be attained was about 4 to 5m due to the presence of waves breaking in the zone. The boat is not able to approach this zone, due to breakers nearshore considering the safety of the personnel and equipment onboard.

The following table provides the identification of CSP vis-à-vis the local name:

Table 6-10: CSP Location names

CSP NO.	LANDMARK	LOCATION	SITE CONDITION
CSP-01	CATHOLIC CHARISMATIC PRAYER CENTER	EDAPPADU BEACH	Seawall, Groyne No. 1
CSP-02			Beach
CSP-03			Seawall
CSP-04	ST. MARY'S CHURCH	VALLAVILAY	Groyne Nos. 2 to 5 in the vicinity, Beach and Seawall
CSP-05			Groyne Nos. 6 to 8 in the vicinity, Beach and Seawall
CSP-06			Groyne Nos. 9 to 13 in the vicinity, Seawall
CSP-07	ST. NICOLAS' CHURCH	NEERODY	Groyne Nos. 14 to 16 in the vicinity, Beach and Seawall
CSP-08			Groyne Nos. 17 to 21 in the vicinity, Beach and Seawall
CSP-09			Groyne Nos. 22 to 24 in the vicinity, Beach and Seawall
CSP-10	SREE BHADRAKALI TEMPLE	POZHIYOOR	Groyne Nos. 25 to 27 in the vicinity, Beach and Seawall
CSP-11			Groyne Nos. 28 and 29 in the vicinity, Seawall
CSP-12			Seawall
CSP-13	ST. MATHEW'S CHURCH	PARUTHIYOOR	Seawall
CSP-14	CHURCH OF CHRIST		Seawall
CSP-15	POOVAR ISLAND RESORT	POOVAR BEACH SOUTH	Beach
CSP-16			Beach
CSP-17			Beach
CSP-18	POZHIKARA BEACH	POOVAR	Beach
CSP-19			Beach
CSP-20	ST. ANTONY'S CHAPEL	POOVAR BEACH NORTH	Beach
CSP-21			Beach
CSP-22	ST. ANTONY'S CHURCH	KARUMKULAM	Beach
CSP-23			Inaccessible due to opposition from locals
CSP-24			Inaccessible due to opposition from locals
CSP-25			Inaccessible due to opposition from locals
CSP-26			Inaccessible due to opposition from locals
CSP-27	GOTHAMBU ROAD	PULLUVILA	Inaccessible due to opposition from locals
CSP-28			Inaccessible due to

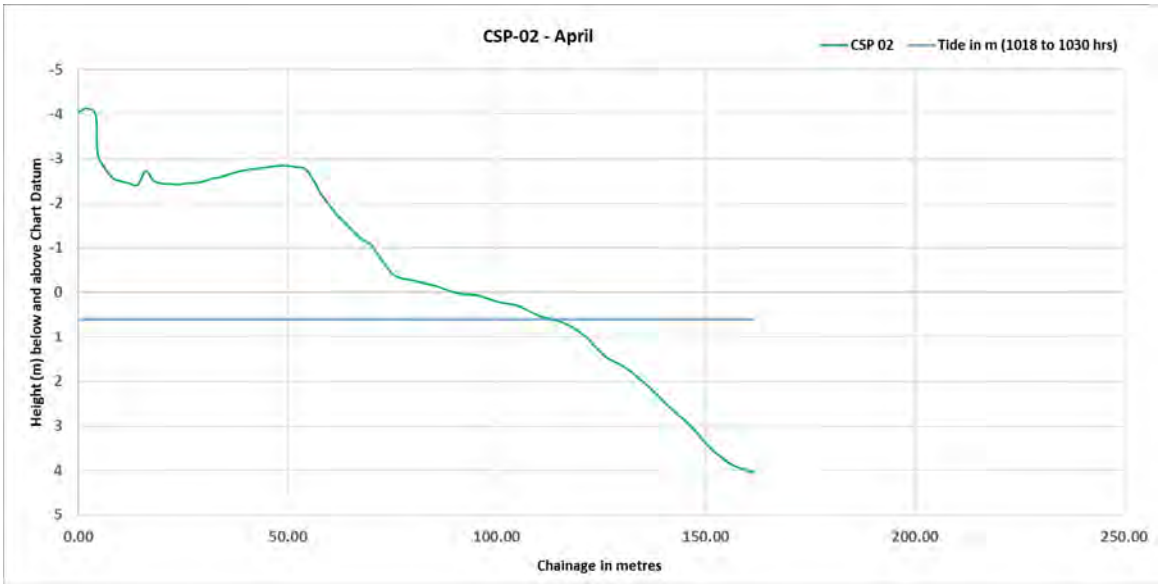
CSP NO.	LANDMARK	LOCATION	SITE CONDITION
			opposition from locals
CSP-29			Inaccessible due to opposition from locals
CSP-30			Inaccessible due to opposition from locals
CSP-31	ADIMALATHURA CATHOLIC CHURCH	ADIMALATHURA	Inaccessible due to opposition from locals
CSP-32			Inaccessible due to opposition from locals
CSP-33			Inaccessible due to opposition from locals
CSP-34			Inaccessible due to opposition from locals
CSP-35	AZHIMALA TEMPLE	AZHIMALA	Inaccessible due to rocky area
CSP-35A	AZHIMALA TEMPLE	AZHIMALA	Inaccessible due to opposition from locals
CSP-36	NAGAR BHAGAVATHY TEMPLE	MULLUR	Beach
CSP-37			Beach and Seawall
CSP-38	ADANI PORT RECLAMATION AREA	ADANI PORT OFFICE VIZHINJAM	Beach and Seawall
CSP-39			Port Construction
CSP-40			Port Construction
CSP-40A			Beach and Seawall
CSP-41	VIZHINJAM LIGHT HOUSE	KOVALAM	Rock and Seawall
CSP-42			Beach and Seawall
CSP-43			Beach and Seawall
CSP-44			Beach and Seawall
CSP-45			Beach and Seawall
CSP-46			Beach and Seawall
CSP-47	SAMUDRA BEACH PARK		Seawall
CSP-48	MOSQUE	PANATHURA	Beach and Seawall
CSP-49			Seawall
CSP-50	PANATHURA TEMPLE		Seawall
CSP-51			Seawall
CSP-52			Groyne No. 30 in the vicinity, Seawall
CSP-53	PUNTHURA FISH MARKET	PUNTHURA	Groyne No. 31 in the vicinity, Beach
CSP-54			Beach
CSP-55			Beach and Seawall
CSP-56			Seawall
CSP-57			Seawall

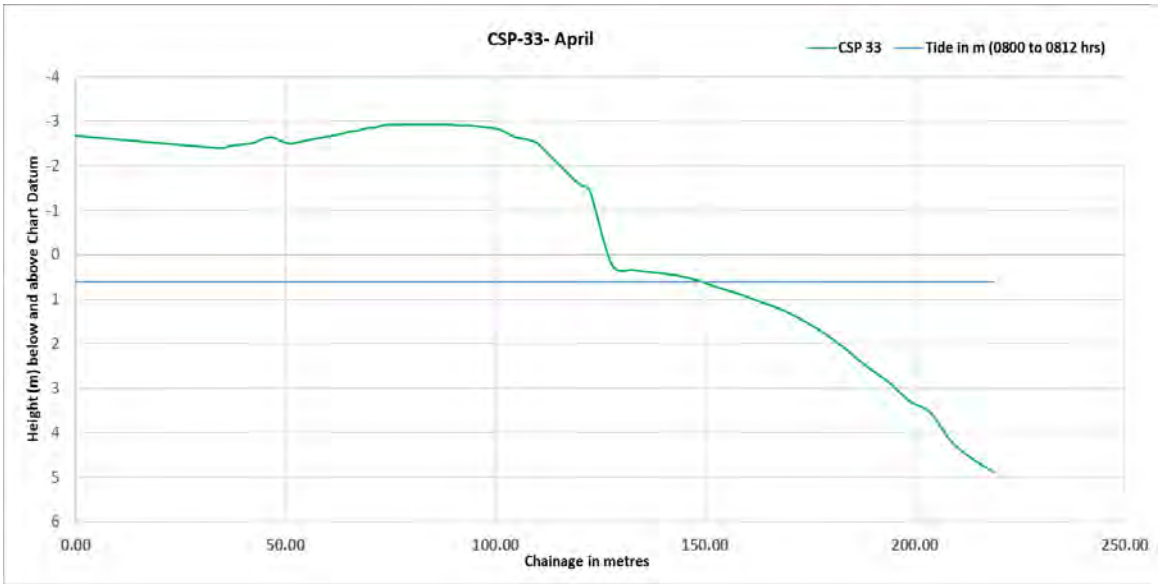
CSP NO.	LANDMARK	LOCATION	SITE CONDITION
CSP-58	BEEMA PALLY	BEEMA PALLY	Seawall
CSP-59			Seawall
CSP-60			Seawall
CSP-61	CHERIYATHURA SPORTS GROUND	CHERIYATHURA	Groyne Nos. 38 to 42 in the vicinity, Seawall
CSP-62			Groyne Nos. 43 to 47 in the vicinity, Beach and Seawall
CSP-63	VALIYATHURA BRIDGE	VALIYATHURA	Groyne Nos. 48 to 51 in the vicinity, Seawall
CSP-64			Seawall, Valiyathura Bridge
CSP-64A			Beach
CSP-65			Seawall
CSP-66			Seawall
CSP-67			Seawall
CSP-68	SHANGUMUGHAM BEACH	SHANGUMUGHAM	Seawall
CSP-69			Beach and Seawall
CSP-70	ST. PETER'S CHURCH		Beach and Seawall
CSP-71			Beach and Seawall
CSP-72	VETTUCAUD CHURCH	VETTUCAUD	Beach
CSP-73			Beach and Seawall
CSP-74			Beach
CSP-75	VELI CHILDREN'S PARK	KOCHUVELI	Beach
CSP-76			Beach
CSP-77			Beach
CSP-78	ST. THOMAS' CHURCH	VALIYAVELI	Beach and Seawall
CSP-79			Beach and Seawall
CSP-80	CHRISTIAN BROTHEREN CHURCH	THUMBA	Beach
CSP-81			Beach

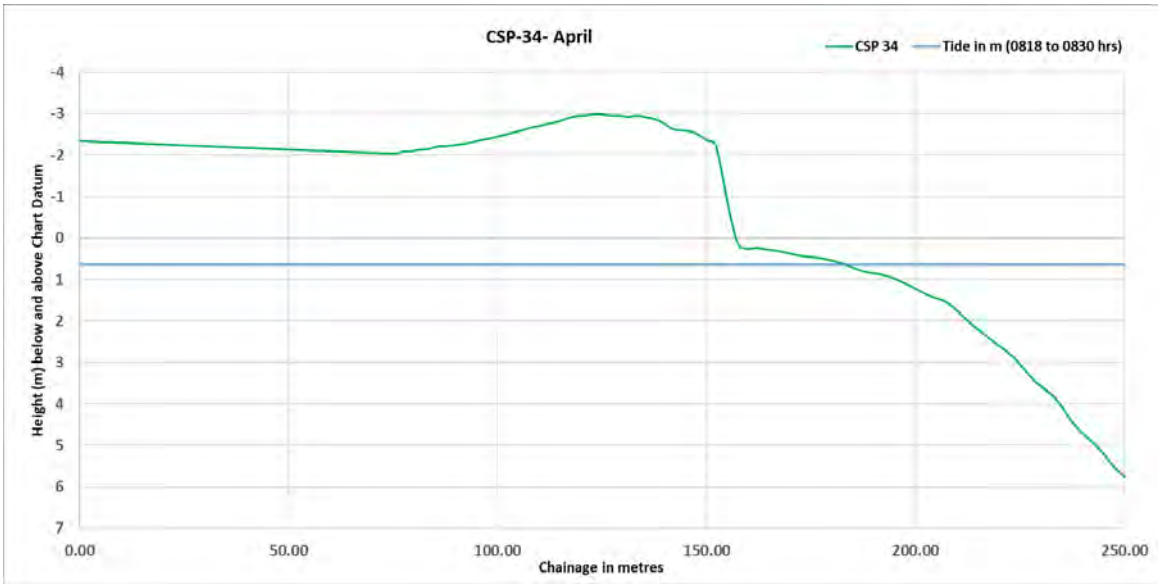
6.7 Near-shore Survey

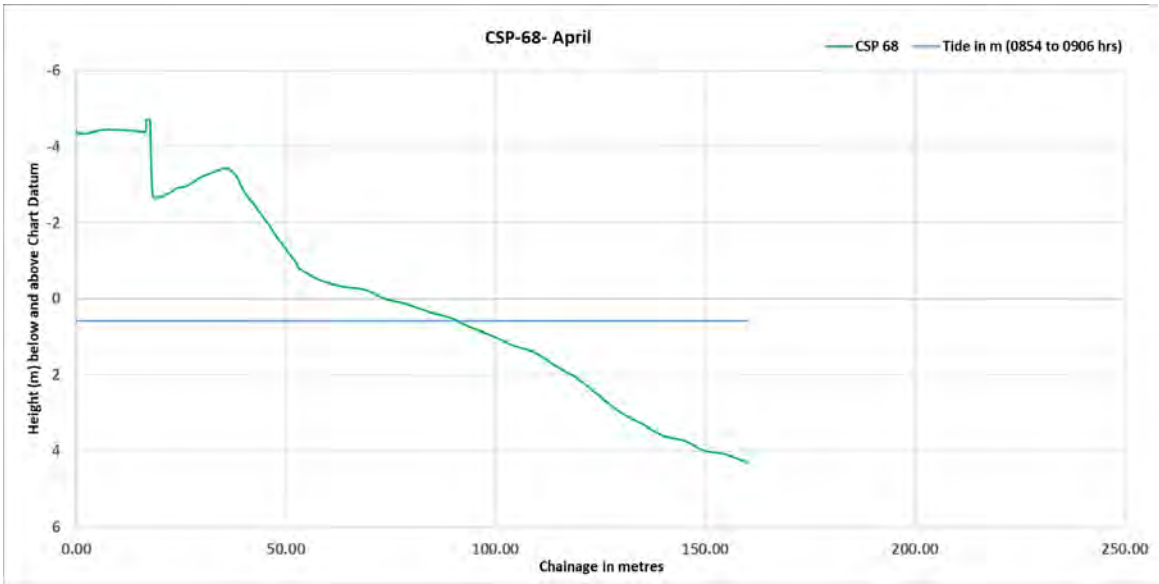
Near-shore survey was carried out along 7 CSP lines namely CSP 2 (Edappadu), 33, 34 (Adimalathura), 68, 69 (Shangumugham), 73 and 74 (Vettucaud) using pressure sensor during April 2023. No near shore survey was carried out for the rest of the period due to rough sea conditions.

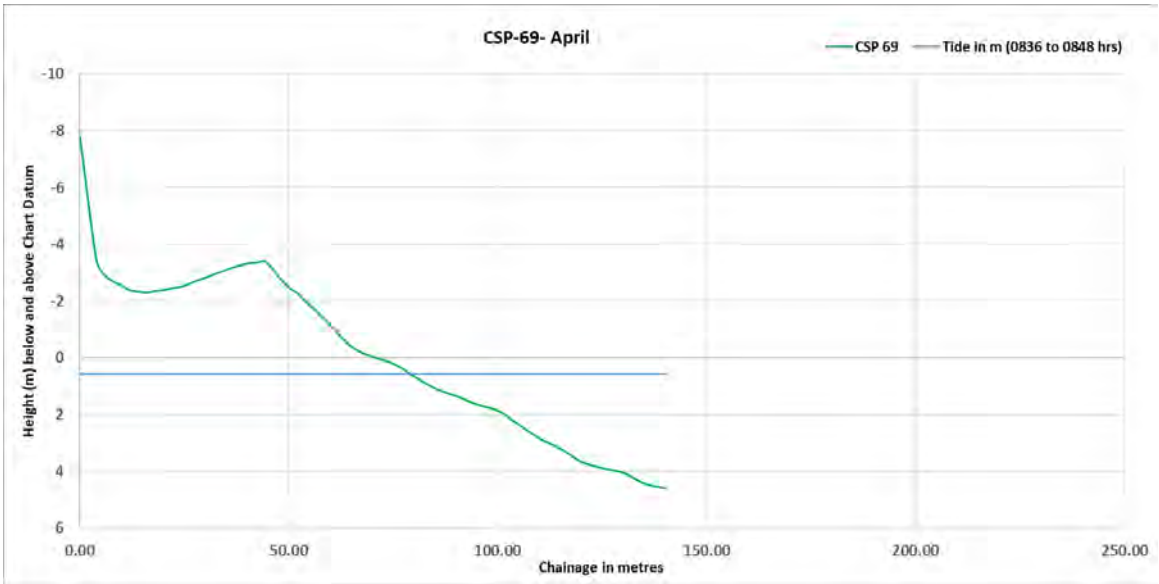
The graphs for the near-shore survey are provided below:

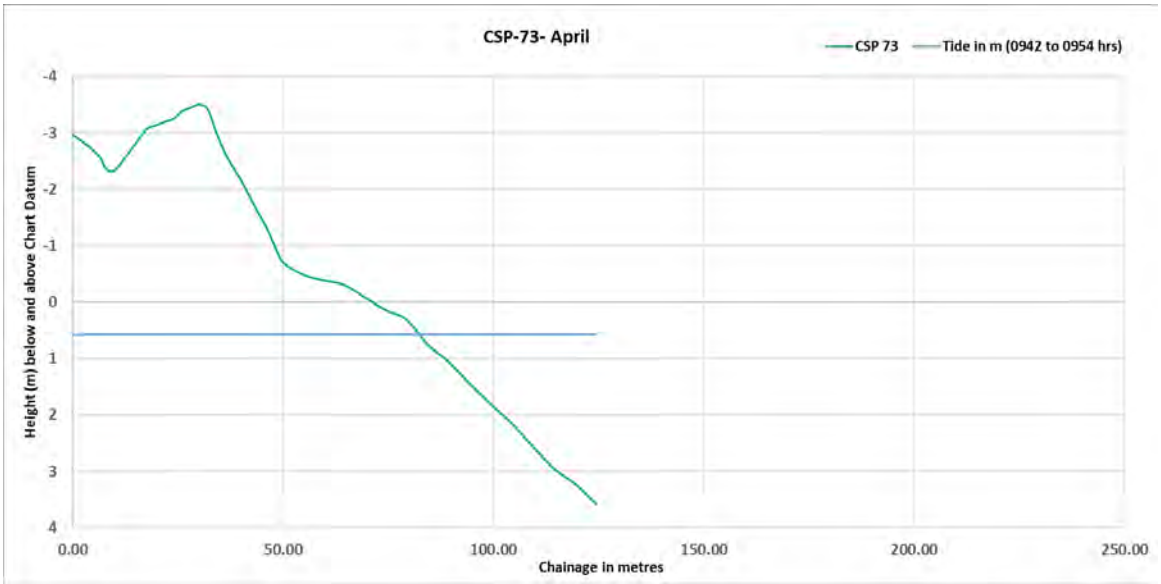

CSP-02 - April
CSP 02
Tide in m (1018 to 1030 hrs)
Height (m) below and above Chart Datum
-5
-4
-3
-2
-1
0
1
2
3
4
5
0.00
50.00
100.00
150.00
200.00
250.00
Chainage in metres


CSP-33- April
CSP 33
Tide in m (0800 to 0812 hrs)
Height (m) below and above Chart Datum
-4
-3
-2
-1
0
1
2
3
4
5
6
0.00
50.00
100.00
150.00
200.00
250.00
Chainage in metres


CSP-34- April
CSP 34
Tide in m (0818 to 0830 hrs)
Height (m) below and above Chart Datum
-4
-3
-2
-1
0
1
2
3
4
5
6
7
0.00
50.00
100.00
150.00
200.00
250.00
Chainage in metres


CSP-68- April
CSP 68
Tide in m (0854 to 0906 hrs)
Height (m) below and above Chart Datum
-6
-4
-2
0
2
4
6
0.00
50.00
100.00
150.00
200.00
250.00
Chainage in metres


CSP-69- April
CSP 69
Tide in m (0836 to 0848 hrs)
Height (m) below and above Chart Datum
-10
-8
-6
-4
-2
0
2
4
6
0.00
50.00
100.00
150.00
200.00
250.00
Chainage in metres


CSP-73- April
CSP 73
Tide in m (0942 to 0954 hrs)
Height (m) below and above Chart Datum
-4
-3
-2
-1
0
1
2
3
4
0.00
50.00
100.00
150.00
200.00
250.00
Chainage in metres

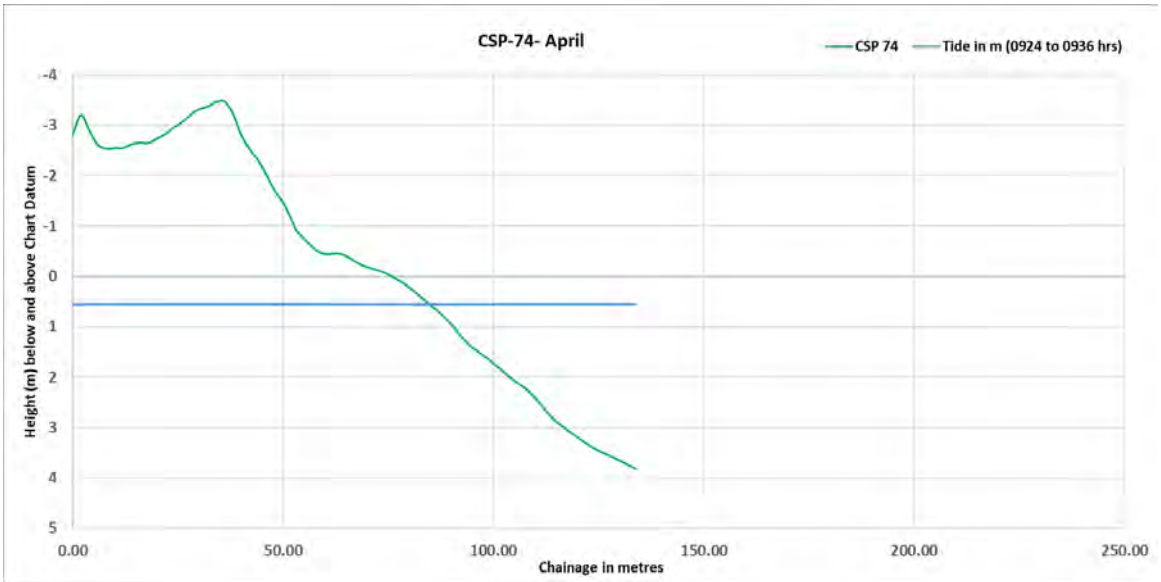


Figure 6-13: Graphs of near shore survey

6.8 Shoreline Monitoring Survey

The entire 41 km of shoreline was surveyed on April 2023. From May to September 2023, CSP locations 22 to 34 could not be approached for due to the agitation and protests. The survey was carried out using RTK system in GPS mode. This stretch extends from CSP-1 in the south (Eddapadu) to CSP-81 in the north (Thumba). A total of 51 groynes have been observed within the survey area. An overlay of month-on-month GPS survey charts is provided in **Annexure II**.

Table 6-11: Area wise number of groynes

Area	Number of Groynes	North / South of the Port Area	Total no. of Groynes North/South of the port
Edappadu Beach	1	South	29 South
Vallavilay	12	South	
Neerody	11	South	
Pozhiyoor	5	South	
Panathura	1	North	22 North
Punthura	2	North	
Beemapally	4	North	
Cheriyathura	10	North	
Valiyathura	5	North	
Total number of groynes			**51**

6.9 Beach Sampling

6.9.1 Pre-Monsoon 2023

Beach samples were collected from 57 out of the 81 locations for the pre-monsoon 2023 period in the month of April 2023. The samples which could not be collected due to lack of beach were BS-3, BS-11 to BS-14, BS-35, BS-40, BS-49 to BS-52, BS-59, BS-63 to BS-66. Locations BS-23 to BS-30 could not be collected as a result of the ongoing agitation faced from the locals residing in these areas.

The following table shows the D50 value (in mm) of the sediments collected along with the soil classification as per Wentworth scale

Table 6-12: Beach sample soil classification (Pre monsoon 2023 period)

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-1	0.00	100.00	0.00	100.00	0.4130	Medium Sand
BS-2	0.00	100.00	0.00	100.00	0.3590	Medium Sand
BS-3	Not collected due to lack of beach					
BS-4	0.00	100.00	0.00	100.00	0.4142	Medium Sand
BS-5	0.00	100.00	0.00	100.00	0.4832	Medium Sand
BS-6	0.00	100.00	0.00	100.00	0.4131	Medium Sand
BS-7	0.00	100.00	0.00	100.00	0.3580	Medium Sand
BS-8	0.00	100.00	0.00	100.00	0.4344	Medium Sand
BS-9	0.00	100.00	0.00	100.00	0.3623	Medium Sand
BS-10	0.00	100.00	0.00	100.00	0.4343	Medium Sand
BS-11	Not collected due to lack of beach					
BS-12	Not collected due to lack of beach					
BS-13	Not collected due to lack of beach					
BS-14	Not collected due to lack of beach					
BS-15	0.00	100.00	0.00	100.00	0.4354	Medium Sand
BS-16	0.00	100.00	0.00	100.00	0.4506	Medium Sand
BS-17	0.00	100.00	0.00	100.00	0.4872	Medium Sand
BS-18	0.00	100.00	0.00	100.00	0.4344	Medium Sand
BS-19	0.00	100.00	0.00	100.00	0.5108	Coarse Sand
BS-20	0.00	100.00	0.00	100.00	0.5966	Coarse Sand
BS-21	0.00	100.00	0.00	100.00	0.3923	Medium Sand
BS-22	0.00	100.00	0.00	100.00	0.4312	Medium Sand
BS-23	Beach samples not collected as a result of the resistance faced from the locals in these areas					
BS-24						
BS-25						
BS-26						
BS-27						
BS-28						
BS-29						
BS-30						

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-31	0.00	100.00	0.00	100.00	0.4341	Medium Sand
BS-32	0.00	100.00	0.00	100.00	0.3817	Medium Sand
BS-33	0.00	100.00	0.00	100.00	0.6902	Coarse Sand
BS-34	0.00	100.00	0.00	100.00	0.5624	Coarse Sand
BS-35	Not collected due to lack of beach					
BS-35A	0.00	100.00	0.00	100.00	0.6232	Coarse Sand
BS-36	0.00	100.00	0.00	100.00	0.4012	Medium Sand
BS-37	0.00	100.00	0.00	100.00	0.4435	Medium Sand
BS-38	0.00	100.00	0.00	100.00	0.4970	Medium Sand
BS-39	0.00	100.00	0.00	100.00	0.5324	Coarse Sand
BS-40	Not collected due to lack of beach					
BS-40A	0.00	100.00	0.00	100.00	0.6367	Coarse Sand
BS-41	0.00	100.00	0.00	100.00	0.5758	Coarse Sand
BS-42	0.00	99.21	0.79	100.00	0.1587	Fine Sand
BS-43	0.00	100.00	0.00	100.00	0.3031	Medium Sand
BS-44	0.00	100.00	0.00	100.00	0.3447	Medium Sand
BS-45	0.00	100.00	0.00	100.00	0.3135	Medium Sand
BS-46	0.00	100.00	0.00	100.00	0.3208	Medium Sand
BS-47	0.00	100.00	0.00	100.00	0.3247	Medium Sand
BS-48	0.00	100.00	0.00	100.00	0.3427	Medium Sand
BS-49	Not collected due to lack of beach					
BS-50	Not collected due to lack of beach					
BS-51	Not collected due to lack of beach					
BS-52	Not collected due to lack of beach					
BS-53	0.00	100.00	0.00	100.00	0.3616	Medium Sand
BS-54	0.00	100.00	0.00	100.00	0.3709	Medium Sand
BS-55	0.00	100.00	0.00	100.00	0.4061	Medium Sand
BS-56	0.00	100.00	0.00	100.00	0.4360	Medium Sand
BS-57	0.00	100.00	0.00	100.00	0.3430	Medium Sand
BS-58	0.00	100.00	0.00	100.00	0.4082	Medium Sand
BS-59	Not collected due to lack of beach					
BS-60	0.00	100.00	0.00	100.00	0.3610	Medium Sand
BS-61	0.00	100.00	0.00	100.00	0.3260	Medium Sand
BS-62	0.00	100.00	0.00	100.00	0.3347	Medium Sand
BS-63	Not collected due to lack of beach					
BS-64	Not collected due to lack of beach					
BS-65	Not collected due to lack of beach					
BS-66	Not collected due to lack of beach					
BS-67	0.00	100.00	0.00	100.00	0.3260	Medium Sand
BS-68	0.00	100.00	0.00	100.00	0.3394	Medium Sand
BS-69	0.00	100.00	0.00	100.00	0.3216	Medium Sand
BS-70	0.00	100.00	0.00	100.00	0.3121	Medium Sand
BS-71	0.00	100.00	0.00	100.00	0.3158	Medium Sand
BS-72	0.00	100.00	0.00	100.00	0.4296	Medium Sand

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-73	0.00	100.00	0.00	100.00	0.3388	Medium Sand
BS-74	0.00	100.00	0.00	100.00	0.3802	Medium Sand
BS-75	0.00	100.00	0.00	100.00	0.3359	Medium Sand
BS-76	0.00	100.00	0.00	100.00	0.3240	Medium Sand
BS-77	0.00	100.00	0.00	100.00	0.3102	Medium Sand
BS-78	0.00	100.00	0.00	100.00	0.3366	Medium Sand
BS-79	0.00	100.00	0.00	100.00	0.5017	Medium Sand
BS-80	0.00	100.00	0.00	100.00	0.3912	Medium Sand
BS-81	0.00	100.00	0.00	100.00	0.3368	Medium Sand

The classification is based on Wentworth scale as provided below:

Very fine Sand – 0.0625 to 0.125 mm
Fine Sand – 0.125 to 0.250 mm
Medium Sand – 0.250 to 0.500 mm
Coarse Sand – 0.500 to 1.000 mm
Very coarse Sand – 1.000 to 2.000 mm

The following graph shows the distribution of D50 value of the sediments collected in each location.

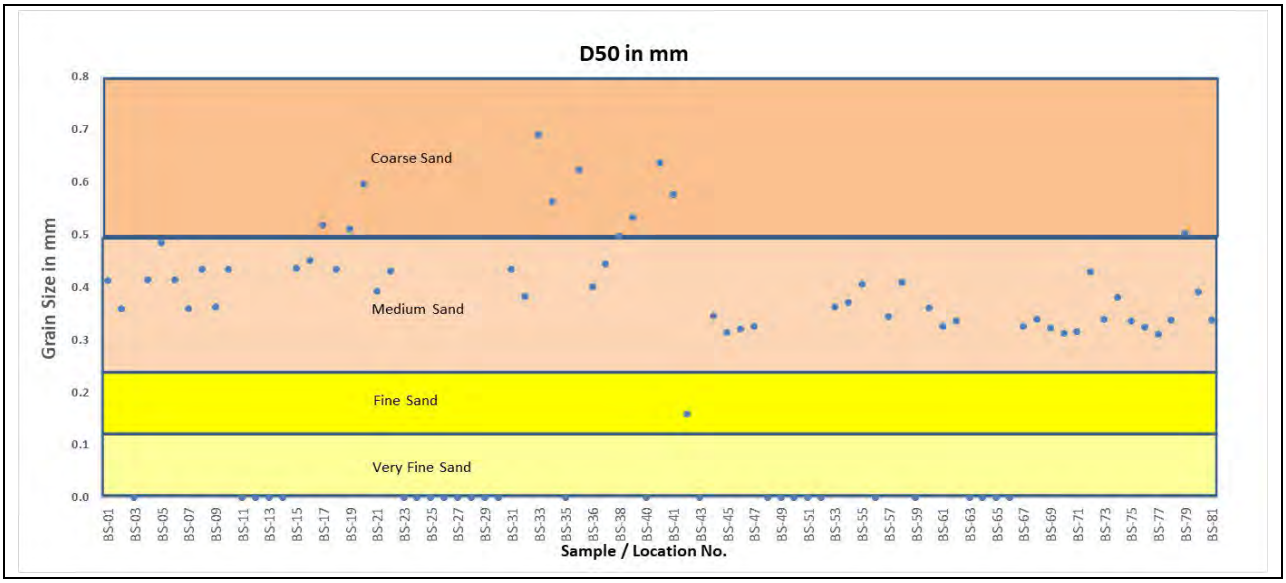
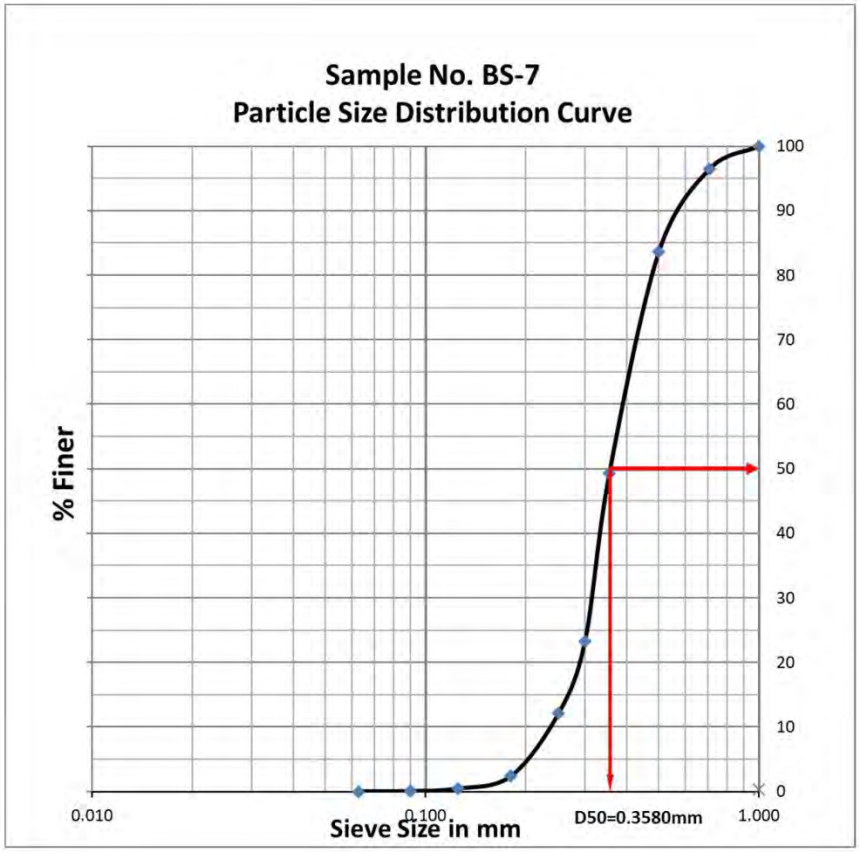


Figure 6-14: Distribution of D50 value of beach samples

The particle size distribution curves for beach samples collected a few locations are placed in the images below.

Standard^{S} Environmental Monitoring

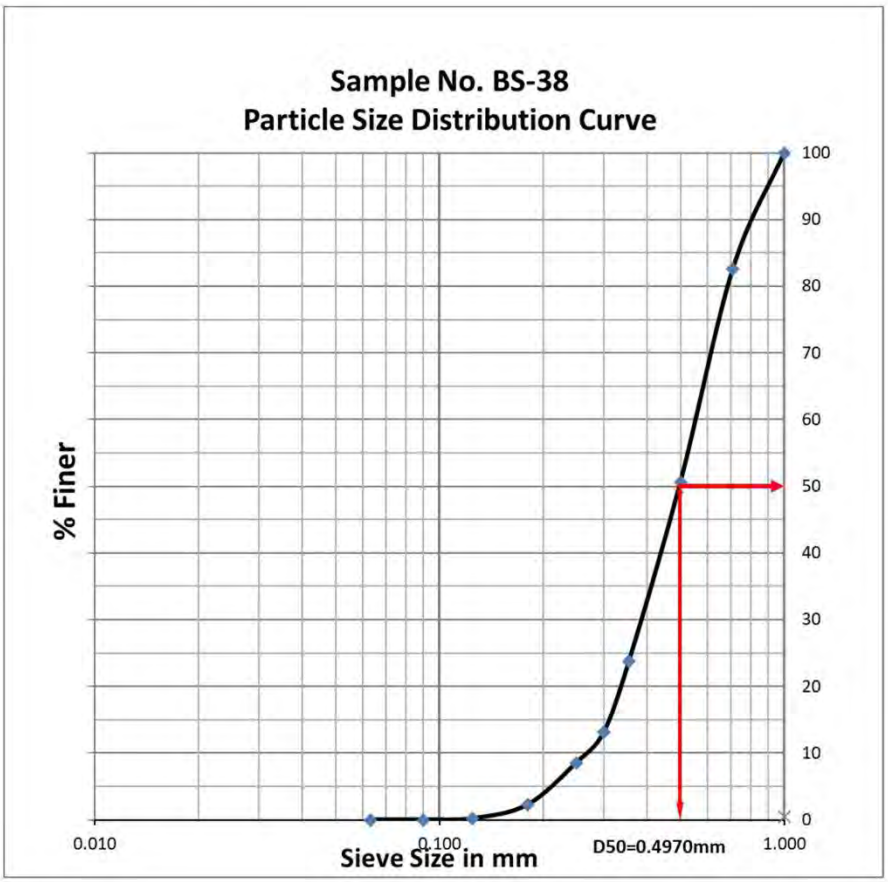


Standard^{S} Environmental & Analytical Laboratories
Approval & Recognition: "A" Grade Laboratory approved by Kerala State Pollution Control Board.
K.J. Tower, Pathalam, Udyogamandal P.O., Ernakulam-683 501, Tel. 0484-2546660, 93 87 27 24 02, 90 74 34 14 43
Web: www.sealabs.in, E-mail: seaalab@gmail.com

Page 1 of 1

Figure 6-15: Grain size distribution curve for BS-7 (Pre-Monsoon 2023)

Standard^S Environmental Monitoring



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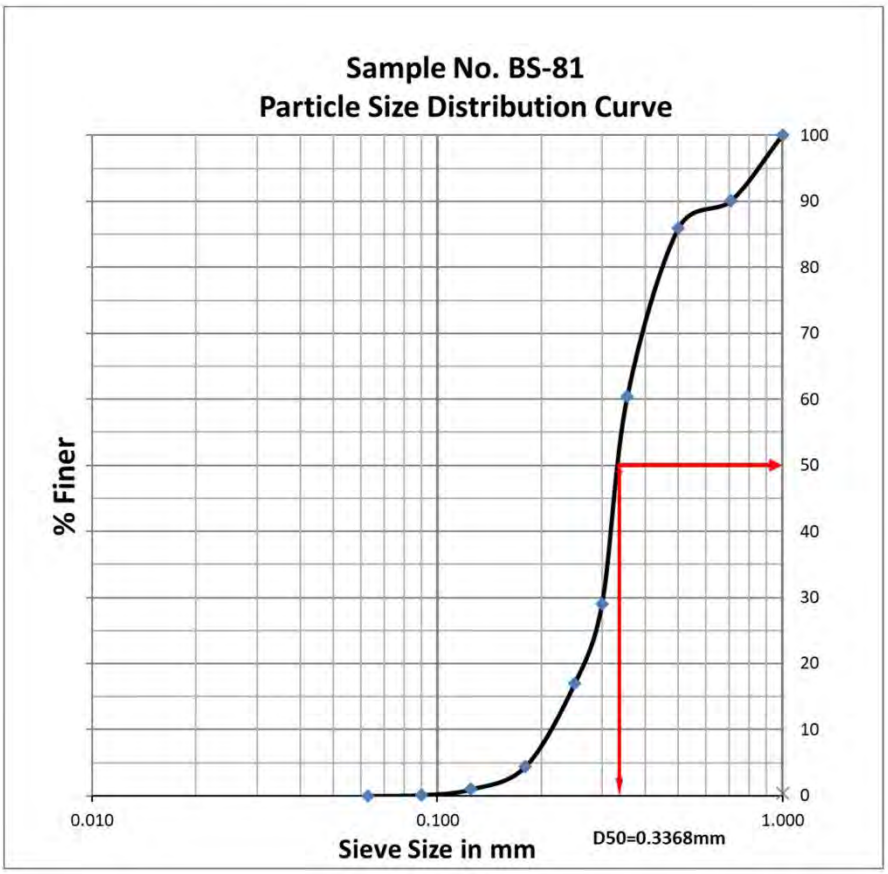
Page 1 of 1

Figure 6-16: Grain size distribution curve for BS-38 (Pre-Monsoon 2023)

Standard^S Environmental Monitoring



Standard^S Environmental & Analytical Laboratories
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Page 1 of 1

Figure 6-17: Grain size distribution curve for BS-81 (Pre-Monsoon 2023)

6.9.2 Monsoon 2023

Beach samples were collected from 46 out of the 81 locations for the monsoon 2023 period in the month of August 2023. The samples which could not be collected due to lack of beach were BS-3, BS-11, BS-12, BS-14, BS-35, BS-40, BS-41, BS-47 to BS-52, BS-56 to BS-61, BS-63, BS-64 and BS-65 to BS-68. Locations BS-23 to BS-30 could not be collected as a result of the ongoing agitation faced from the locals residing in these areas.

The following table shows the D50 value (in mm) of the sediments collected along with the soil classification as per Wentworth scale

Table 6-13: Beach sample soil classification (Monsoon 2023 period)

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-1	0.00	100.00	0.00	100.00	0.3459	Medium Sand
BS-2	0.00	100.00	0.00	100.00	0.3452	Medium Sand
BS-3	Not collected due to non-availability of beach					
BS-4	0.00	100.00	0.00	100.00	0.2315	Fine Sand
BS-5	0.00	100.00	0.00	100.00	0.3999	Medium Sand
BS-6	0.00	100.00	0.00	100.00	0.4748	Medium Sand
BS-7	0.00	100.00	0.00	100.00	0.4743	Medium Sand
BS-8	0.00	100.00	0.00	100.00	0.5134	Coarse Sand
BS-9	0.00	100.00	0.00	100.00	0.4679	Medium Sand
BS-10	0.00	100.00	0.00	100.00	0.5456	Coarse Sand
BS-11	Not collected due to non-availability of beach					
BS-12						
BS-13	0.00	100.00	0.00	100.00	0.4850	Medium Sand
BS-14	Not collected due to non-availability of beach					
BS-15	0.00	100.00	0.00	100.00	0.3372	Medium Sand
BS-16	0.00	100.00	0.00	100.00	0.3312	Medium Sand
BS-17	0.00	100.00	0.00	100.00	0.5767	Coarse Sand
BS-18	0.00	100.00	0.00	100.00	0.4371	Medium Sand
BS-19	0.00	100.00	0.00	100.00	0.4127	Medium Sand
BS-20	0.00	100.00	0.00	100.00	0.3754	Medium Sand
BS-21	0.00	100.00	0.00	100.00	0.3202	Medium Sand
BS-22	0.00	100.00	0.00	100.00	0.3236	Medium Sand
BS-23	Not collected due to protests by locals residing at these locations					
BS-24						
BS-25						
BS-26						
BS-27						
BS-28						
BS-29						
BS-30						
BS-31						

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-32						
BS-33						
BS-34						
BS-35						
BS-35A						
BS-36	0.00	100.00	0.00	100.00	0.5571	Coarse Sand
BS-37	0.00	100.00	0.00	100.00	0.5170	Coarse Sand
BS-38	0.00	100.00	0.00	100.00	0.5546	Coarse Sand
BS-39	0.00	100.00	0.00	100.00	0.5496	Coarse Sand
BS-40	Not collected due to non-availability of beach					
BS-40A	0.00	100.00	0.00	100.00	0.3027	Medium Sand
BS-41	Not collected due to non-availability of beach					
BS-42	0.00	100.00	0.00	100.00	0.2066	Fine Sand
BS-43	0.00	100.00	0.00	100.00	0.5464	Coarse Sand
BS-44	0.00	100.00	0.00	100.00	0.2664	Medium Sand
BS-45	0.00	100.00	0.00	100.00	0.3226	Medium Sand
BS-46	0.00	100.00	0.00	100.00	0.1643	Fine Sand
BS-47	Not collected due to non-availability of beach					
BS-48						
BS-49						
BS-50						
BS-51						
BS-52						
BS-53	0.00	100.00	0.00	100.00	0.2918	Medium Sand
BS-54	0.00	100.00	0.00	100.00	0.2394	Fine Sand
BS-55	0.00	100.00	0.00	100.00	0.2919	Medium Sand
BS-56	Not collected due to non-availability of beach					
BS-57						
BS-58						
BS-59						
BS-60						
BS-61						
BS-62	0.00	100.00	0.00	100.00	0.4181	Medium Sand
BS-63	Not collected due to non-availability of beach					
BS-64						
BS-64A	0.00	100.00	0.00	100.00	0.3884	Medium Sand
BS-65	Not collected due to non-availability of beach					
BS-66						
BS-67						
BS-68						
BS-69	0.00	100.00	0.00	100.00	0.2929	Medium Sand
BS-70	0.00	100.00	0.00	100.00	0.3045	Medium Sand
BS-71	0.00	100.00	0.00	100.00	0.3017	Medium Sand
BS-72	0.00	100.00	0.00	100.00	0.3280	Medium Sand

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-73	0.00	100.00	0.00	100.00	0.3023	Medium Sand
BS-74	0.00	100.00	0.00	100.00	0.3101	Medium Sand
BS-75	0.00	100.00	0.00	100.00	0.3214	Medium Sand
BS-76	0.00	100.00	0.00	100.00	0.3175	Medium Sand
BS-77	0.00	100.00	0.00	100.00	0.2997	Medium Sand
BS-78	0.00	100.00	0.00	100.00	0.3314	Medium Sand
BS-79	0.00	100.00	0.00	100.00	0.3152	Medium Sand
BS-80	0.00	100.00	0.00	100.00	0.3034	Medium Sand
BS-81	0.00	100.00	0.00	100.00	0.3137	Medium Sand

The classification is based on Wentworth scale as provided below:

Very fine Sand – 0.0625 to 0.125 mm
Fine Sand – 0.125 to 0.250 mm
Medium Sand – 0.250 to 0.500 mm
Coarse Sand – 0.500 to 1.000 mm
Very coarse Sand – 1.000 to 2.000 mm

The following graph shows the distribution of D50 value of the sediments collected in each location during the monsoon 2023 period.

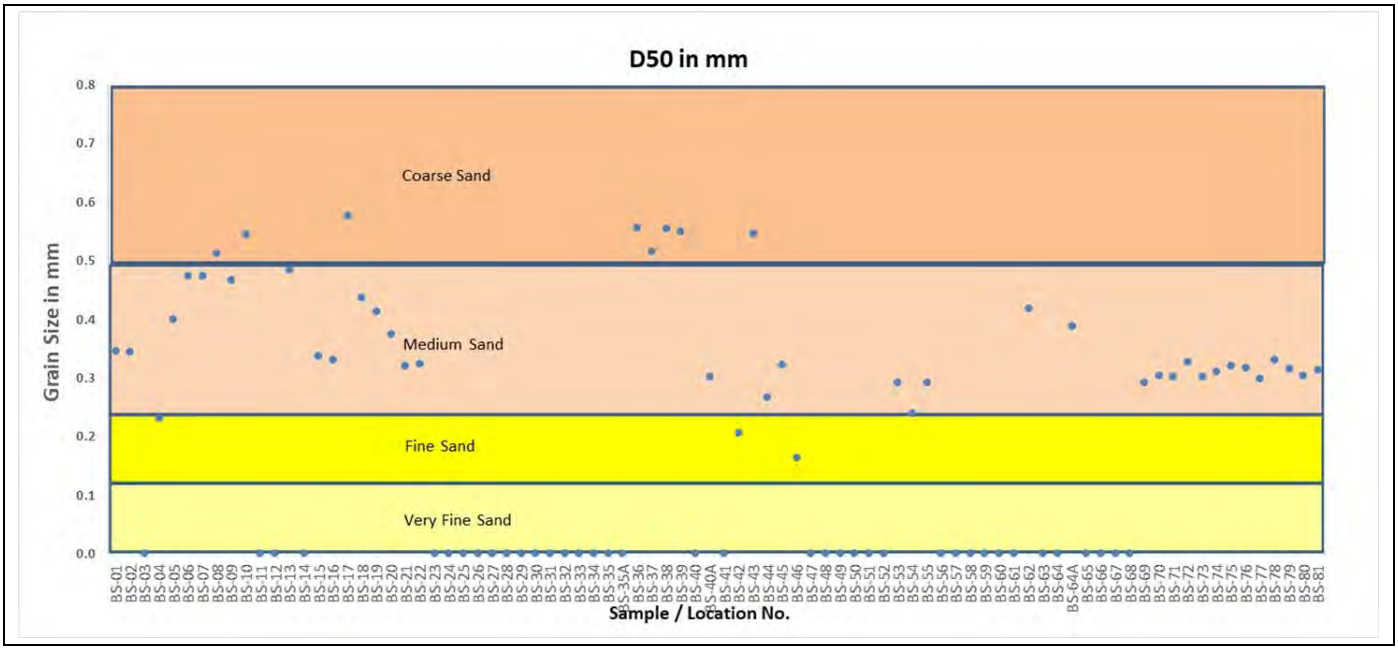
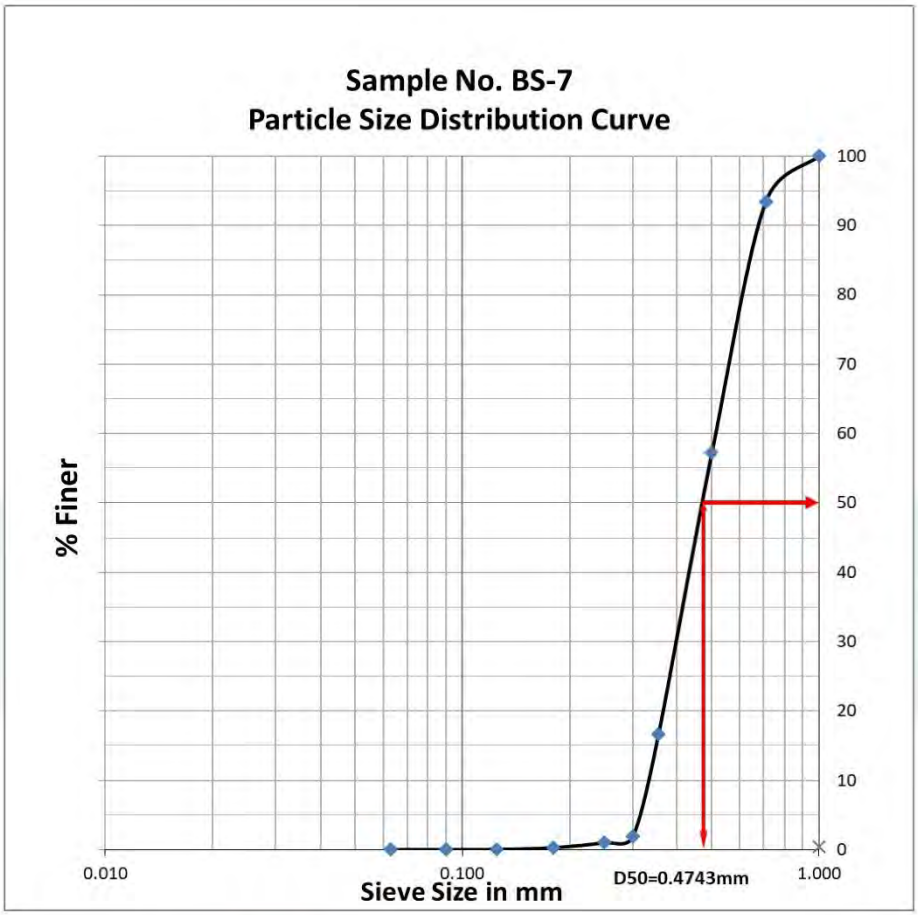


Figure 6-18: Distribution of D50 value of beach samples (Monsoon 2023 period)

The particle size distribution curves for beach samples collected a few locations are placed in the images below.

Standards



The results are related only to the samples submitted for analysis and this test report shall not be reproduced except in full, without the written approval of the laboratory.

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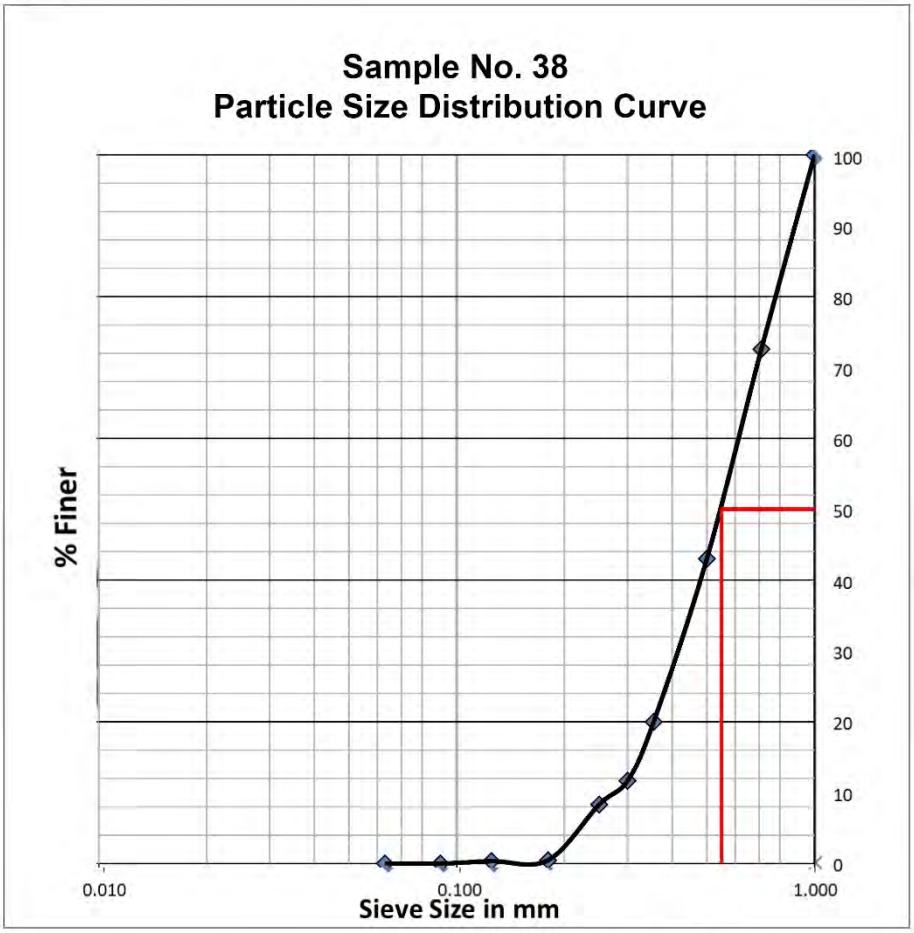
Page 1 of 1

Figure 6-19: Grain size distribution curve for BS-7 (Monsoon 2023)

Standards



D50=0.5496mm

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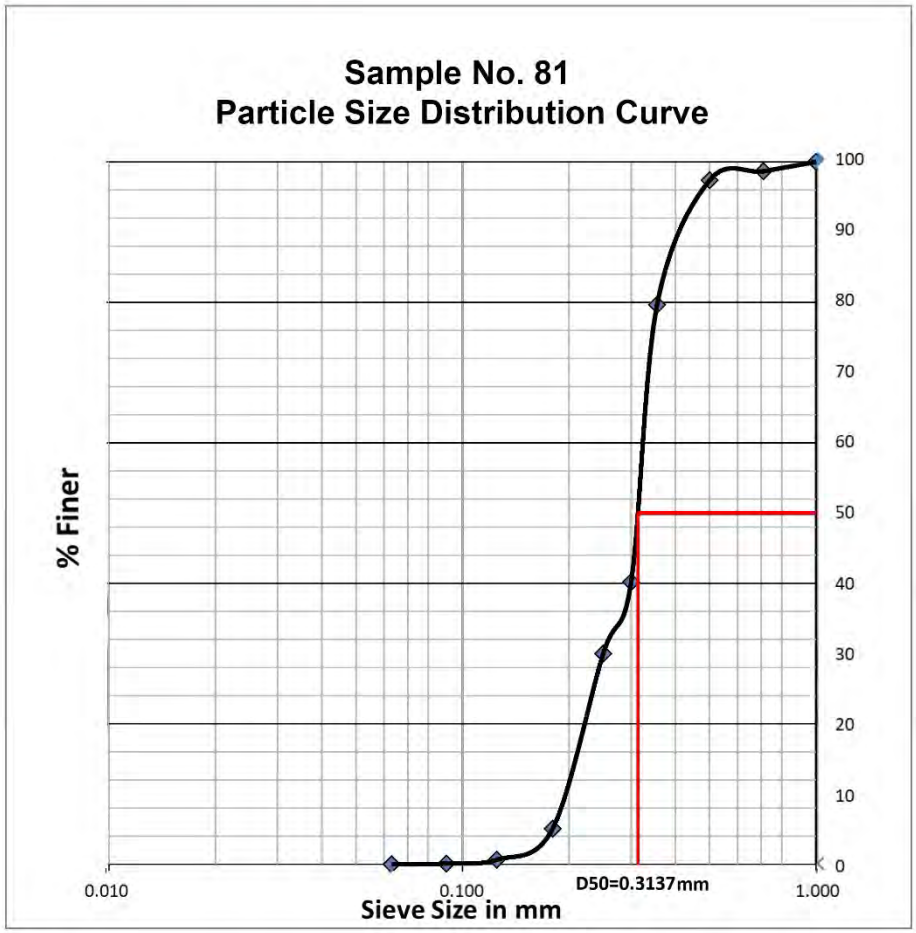
Page 1 of 1

Figure 6-20: Grain size distribution curve for BS-38 (Monsoon 2023)

Standards



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Page 1 of 1

Figure 6-21: Grain size distribution curve for BS-81 (Monsoon 2023)

6.10 Bathymetry

Survey Location

The following image shows the coverage of the area surveyed using R2Sonic 2020 multibeam echo sounder.

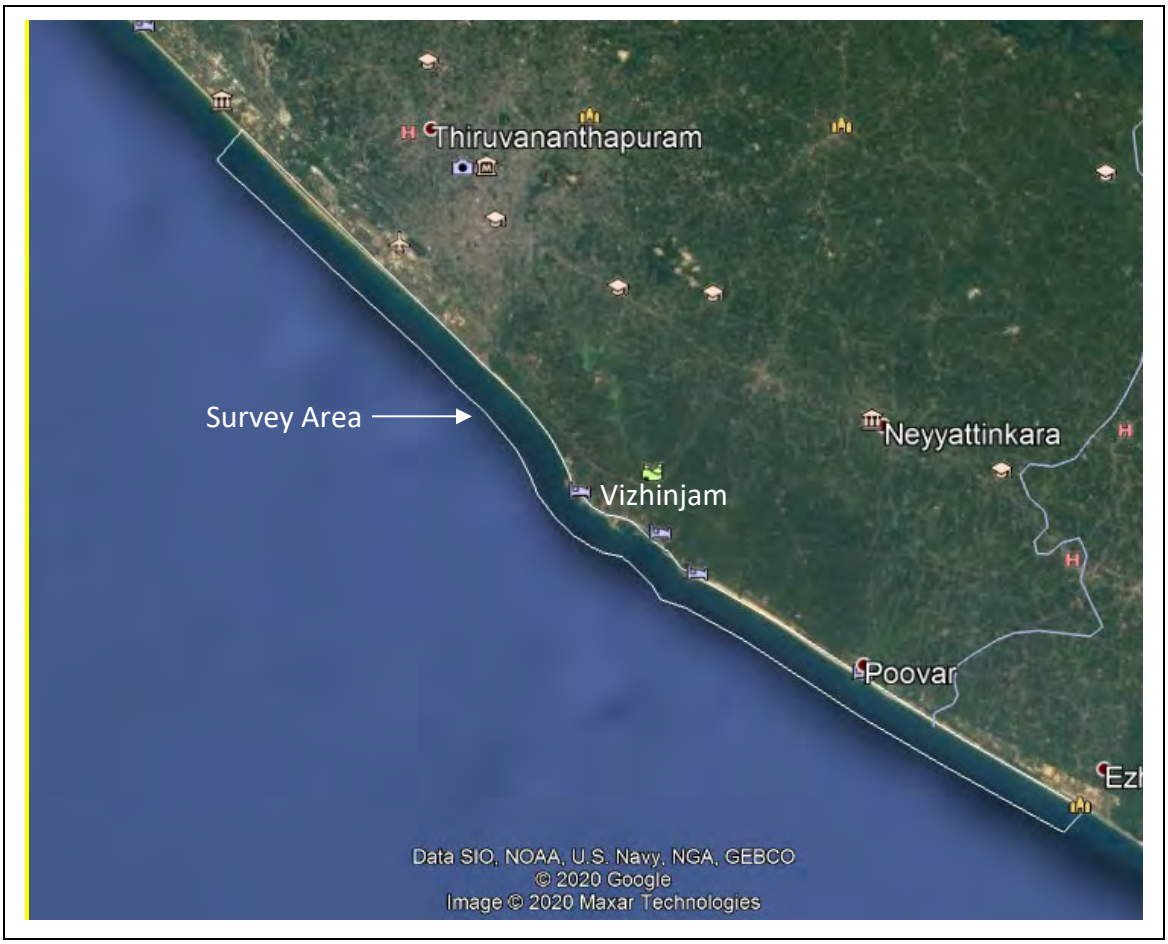


Figure 6-22: Bathymetry area coverage

Line Plan and Survey Methodology

The survey lines were planned at intervals of 25m parallel to the coast up to the depth of 20m. The vessel was positioned using a Trimble DGPS system which also provided the heading. The vessel tracks and offset positions were recorded digitally and the data from the multibeam echo sounder was logged digitally within the Hypack acquisition software.

Prior to commencement of the survey, the DGPS and gyrocompass calibrations were carried out when the survey vessel was berthed at the Vizhinjam Fishing Jetty. The multibeam echo sounder was calibrated by conducting the patch test. The bathymetric

data was reduced to Chart Datum (CD) by using the observed tides from the tide gauge installed at the Coast Guard Jetty. A Valeport Sound Velocity Probe (SVP) was used to measure the speed of sound of in the water column. Motion compensation was achieved by the DMS-05 Motion Reference Unit (MRU). Quality checks were constantly performed at every step of the data processing. Data was processed using Hypack software. Calibration values obtained from the patch test were applied to the acquired data along with the required sound velocity profile and tide data for creation of final xyz file.

Results

The bathymetric survey of the area about 40 km in length, was carried out up to the 20m contour for the pre-monsoon 2023 period using a multibeam echo sounder.

The maximum depth recorded by multibeam echo sounder is 25m below CD in the northern part of the survey area at few locations along the western boundary. The seabed is seen to slope gently towards the southwest.

① Note: As suggested by NIOT, the representative bathymetry charts are being submitted as an annexure to the report (**Annexure III**)

7 WEATHER

During the month of April 2023, the weather was favourable for survey operations. The weather was not conducive to the survey operations for the rest of the period.

8 REFERENCES

The following documents/web sites were referenced during the preparation of the report.

- AVPPL Service order 5702011433 dated 05th June 2023
- Web site https://www.vizhinjamport.in/home.html, and https://www.vizhinjamport.in/download/Feasibility-Report.pdf
- WMO manual, section 5.2.2
- Monthly survey reports from April 2023 to September 2023

9 CONCLUSIONS

The following conclusions were made during this phase of the project:

1. Tide was mixed semi diurnal with a maximum range being observed during spring tide.
2. The significant wave heights increased during the monsoon period. The maximum wind speeds were blowing from the northwesterly direction.
3. The long-shore current speed was recorded in a northward direction in the pre monsoon months and southward in the monsoon period.
4. The beach samples consisted mainly of coarse to medium sand during both the seasons.
5. The seabed is seen to slope gently towards the southwest. The maximum depth recorded by multibeam echo sounder is 25m below CD in the northern part of the survey area at few locations along the western boundary.

10 ACKNOWLEDGEMENTS

During the course of project, the support received from AVPPL staff is highly appreciated and acknowledged. The guidance received throughout the project from NIOT scientists is also hereby appreciated. The boat crew and all others, who had supported us during the project is also acknowledged.

Annexure I

Photo Documentation At CSP Locations - September 2023

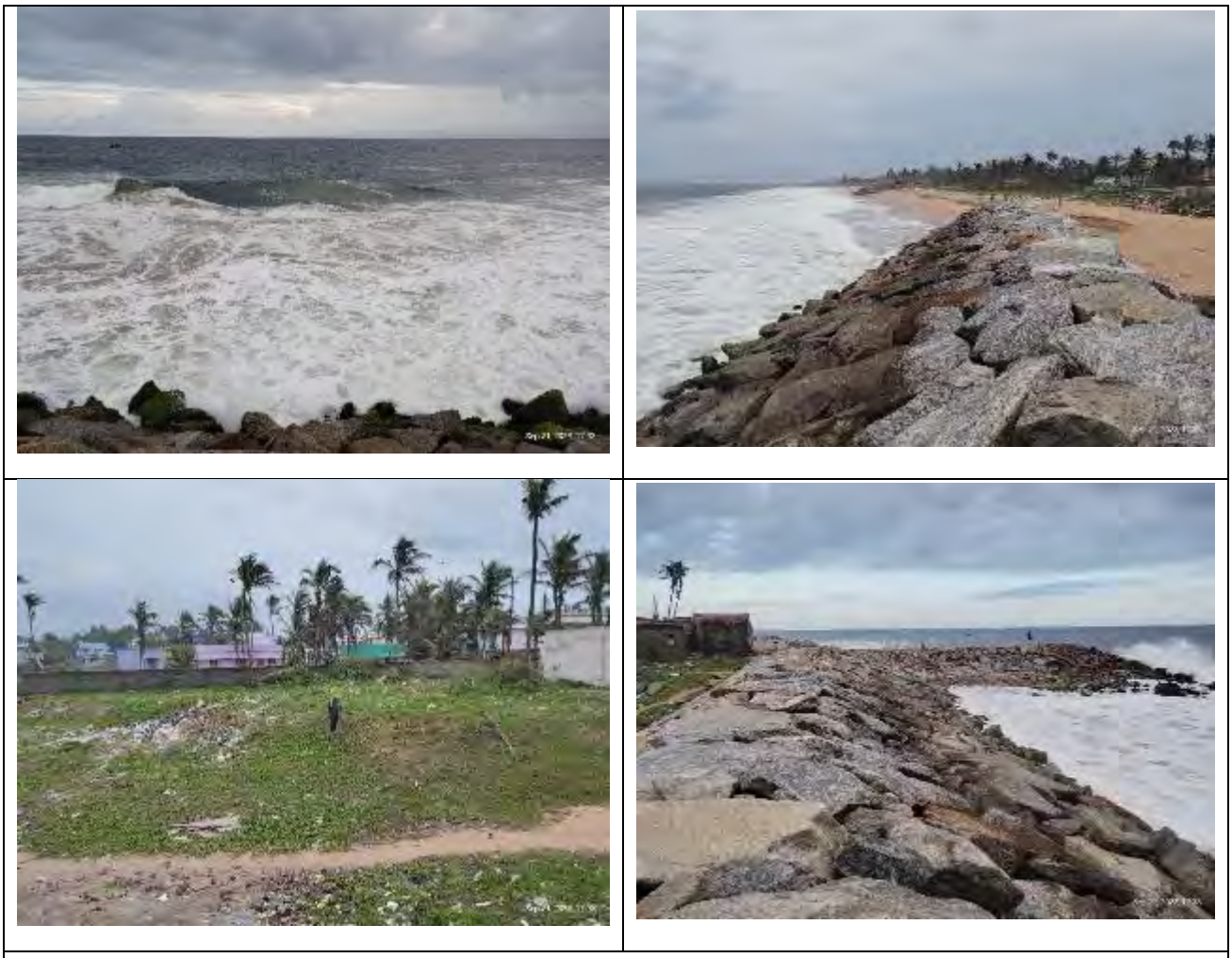


Figure 1- September CSP 01




Figure 2- September CSP 02

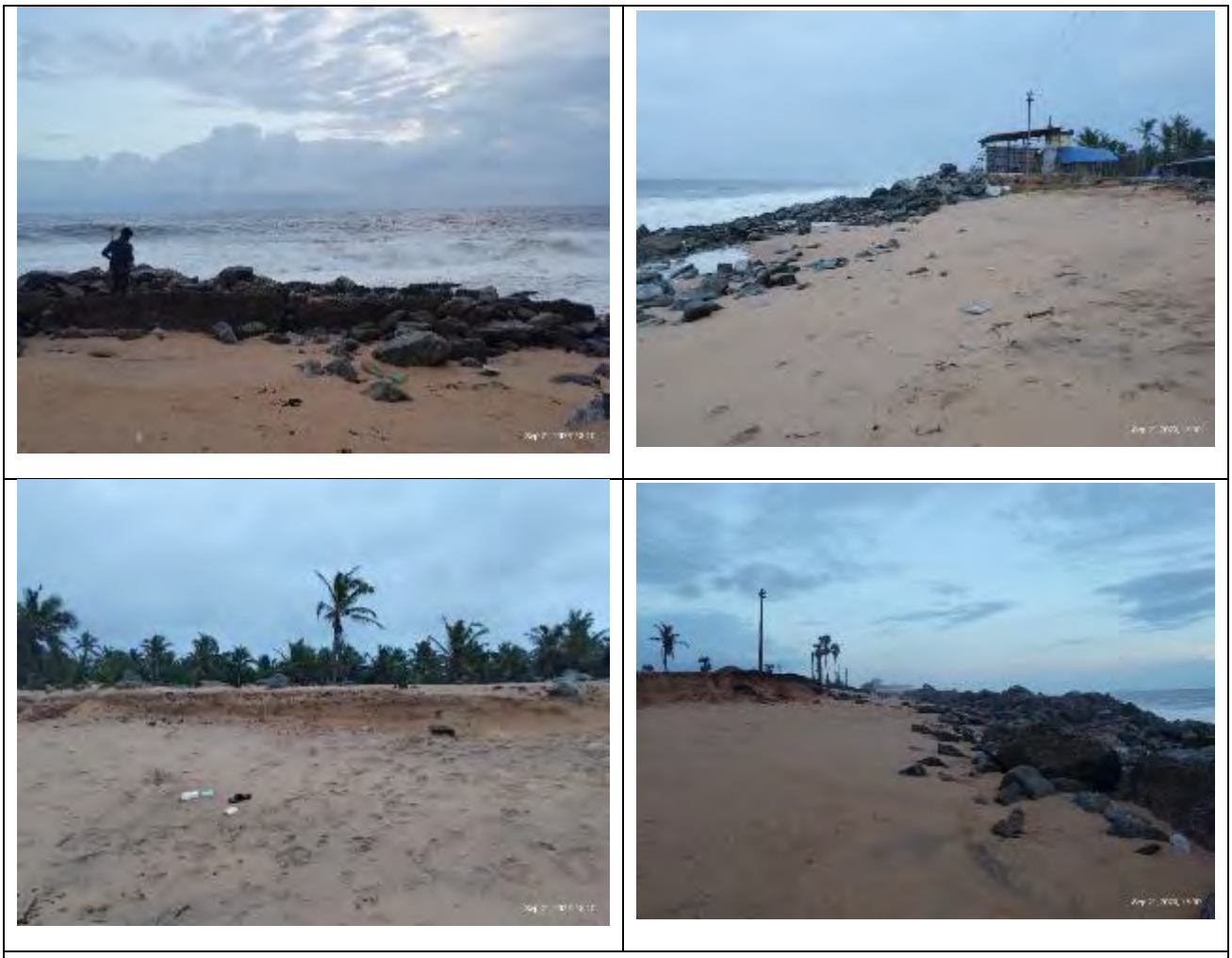


Figure 3- September CSP 03

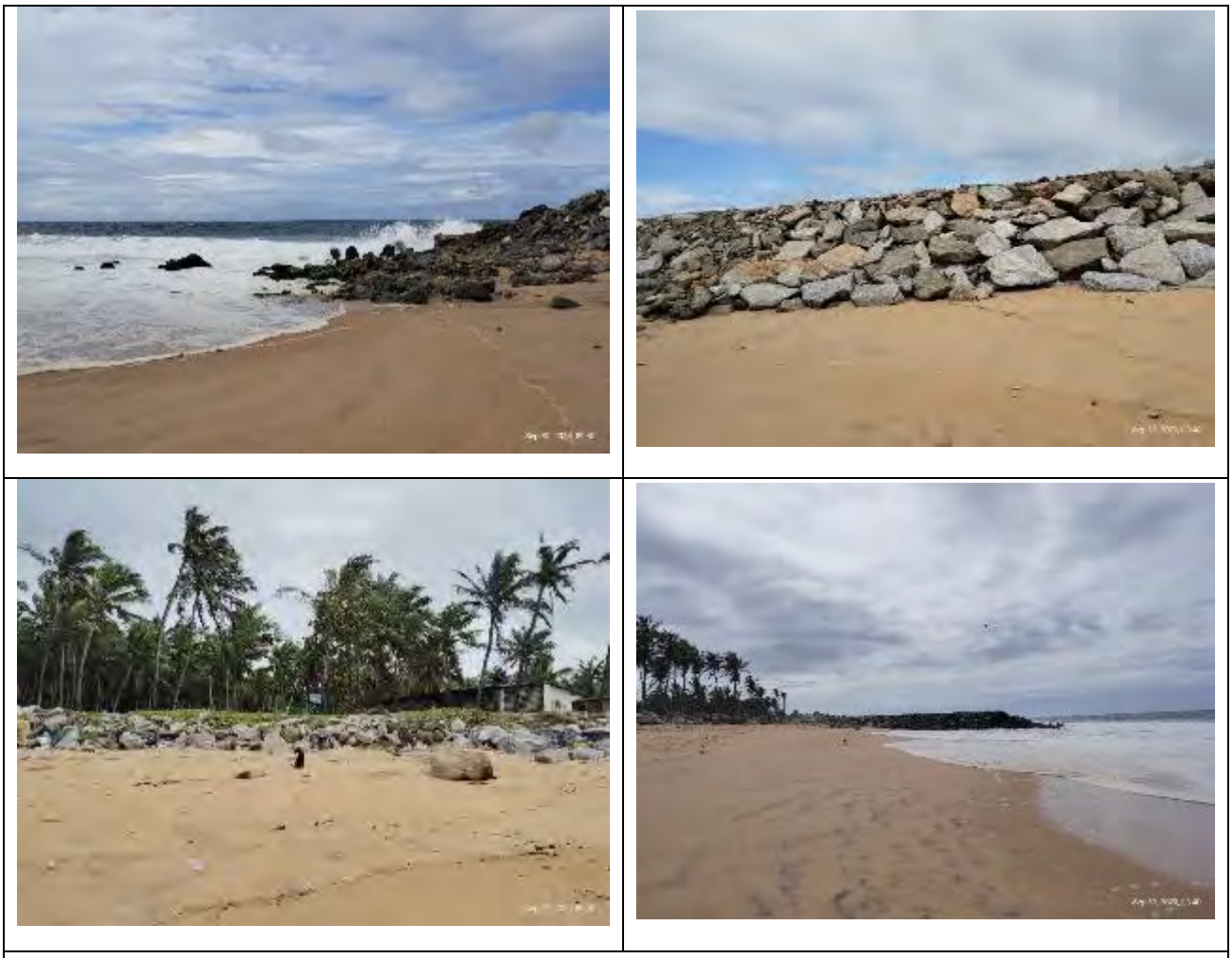


Figure 4- September CSP 04

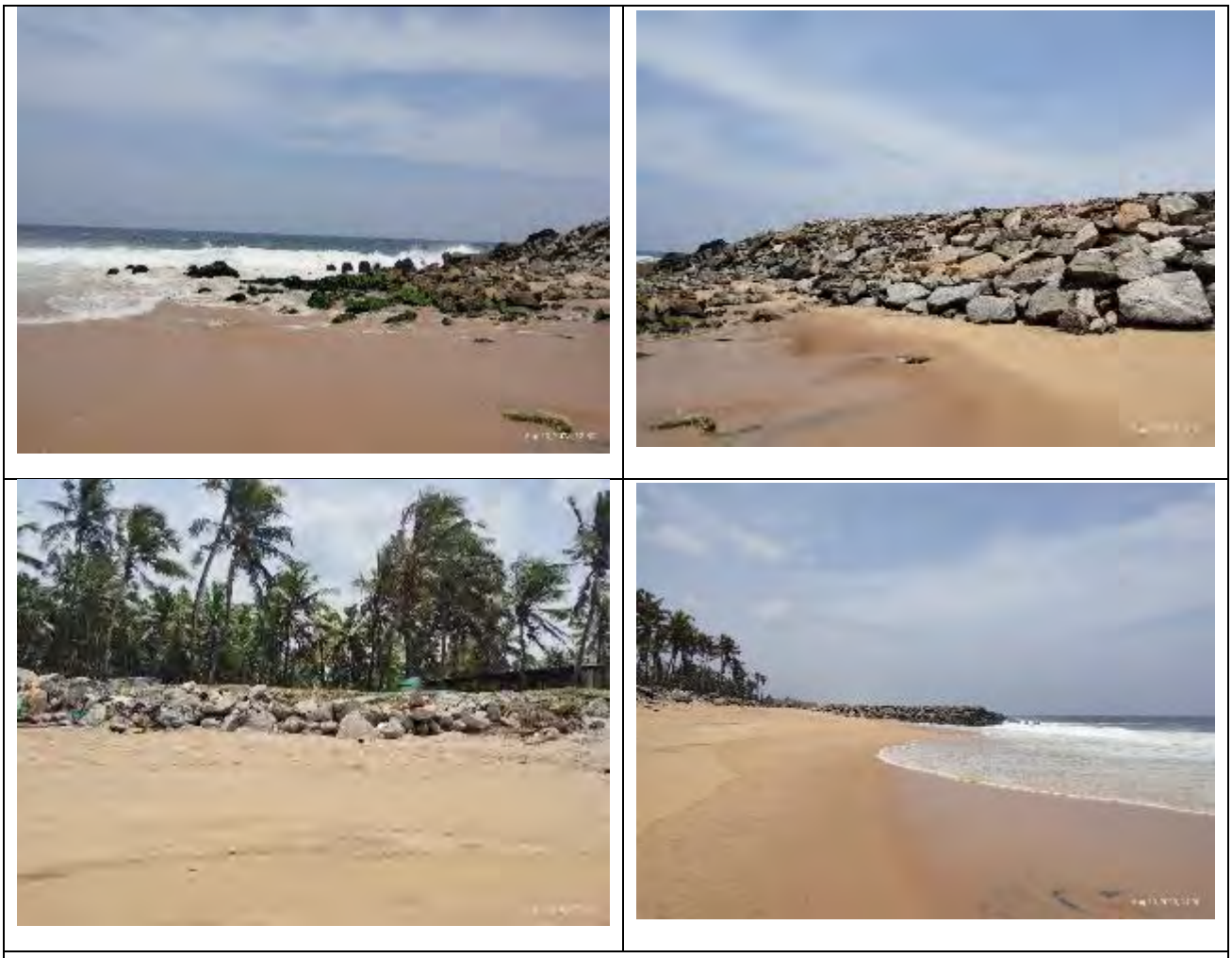


Figure 5- September CSP 05

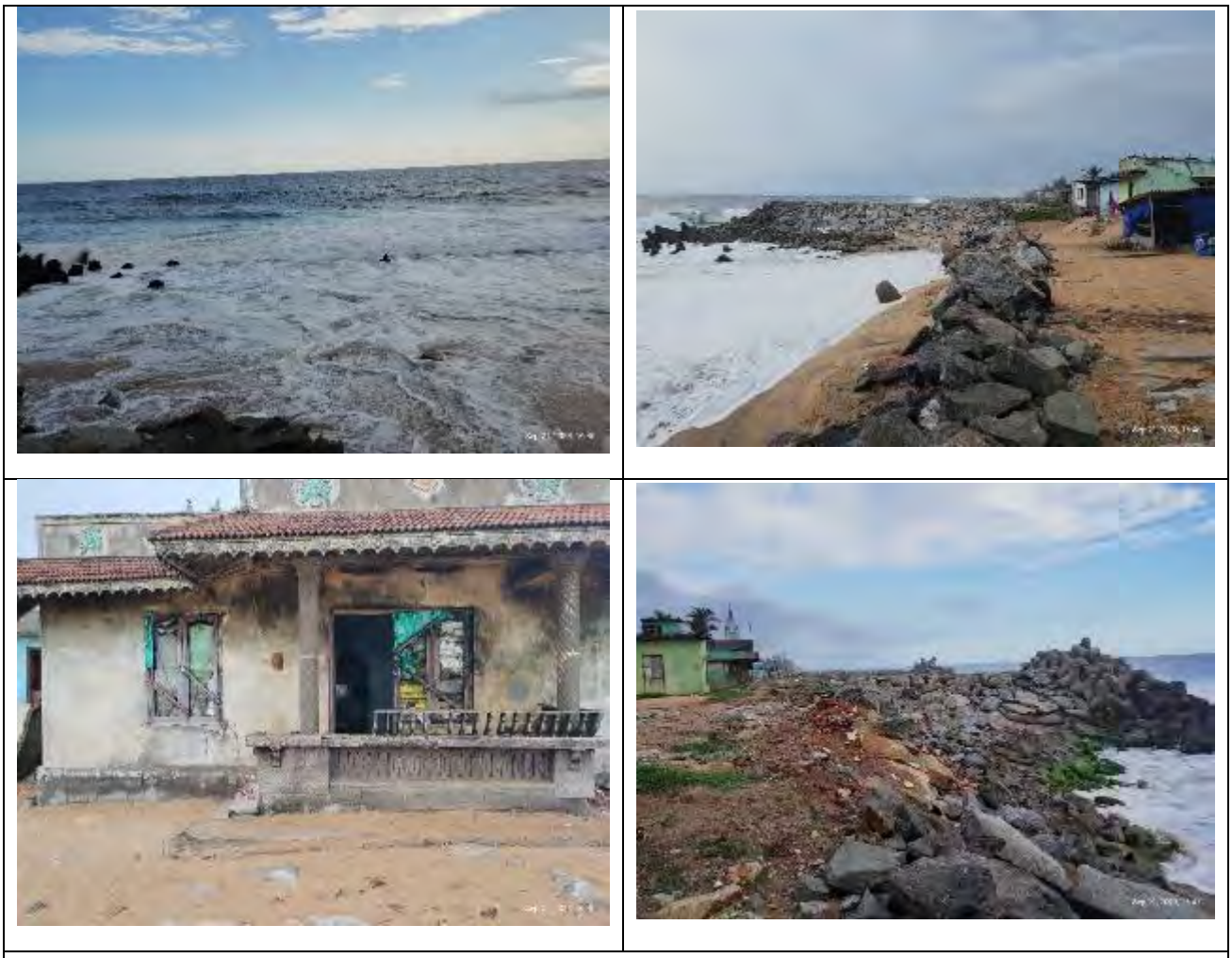


Figure 6- September CSP 06

Figure 7- September CSP 07

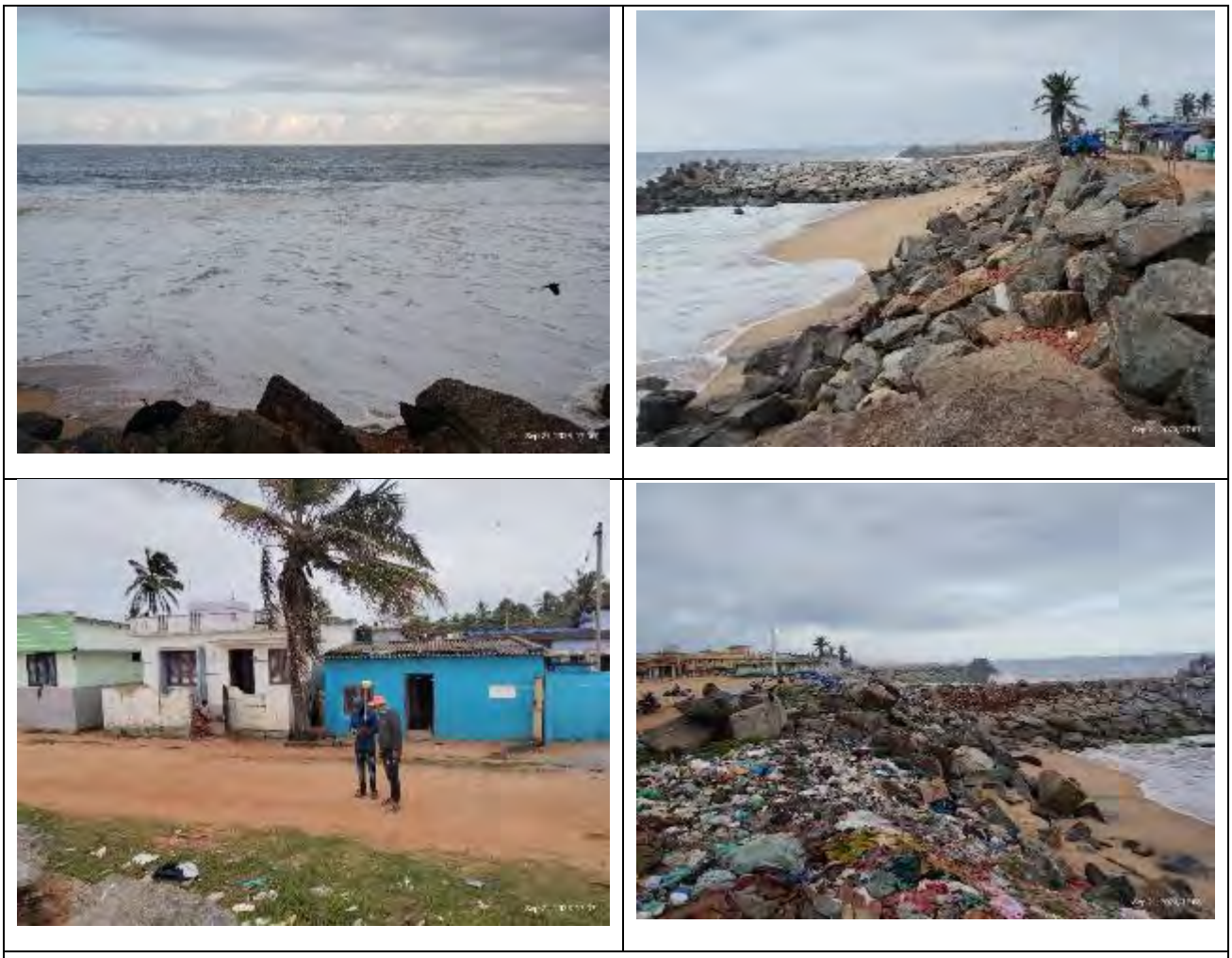


Figure 8- September CSP 08

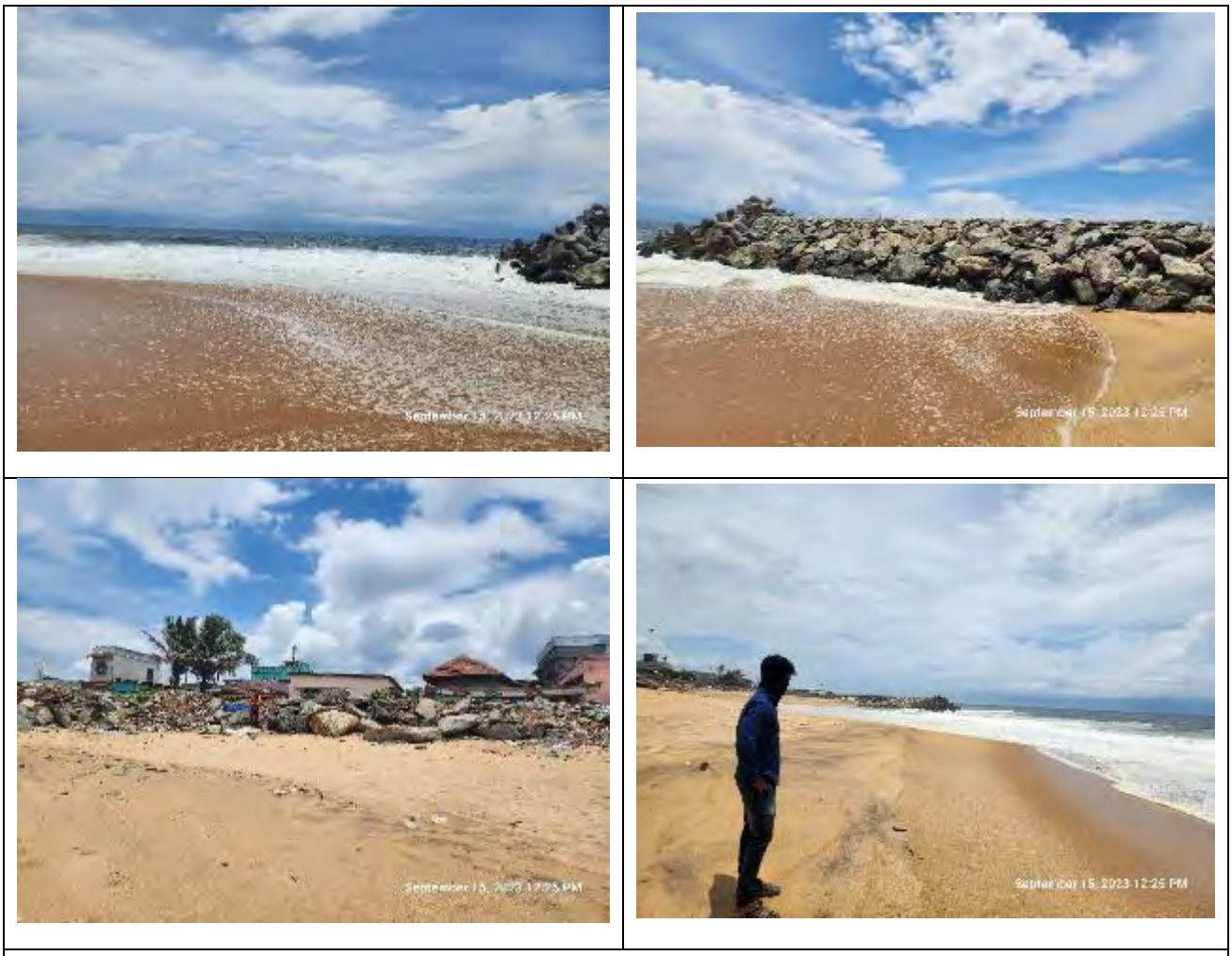


Figure 9- September CSP 09

Figure 10- September CSP 10

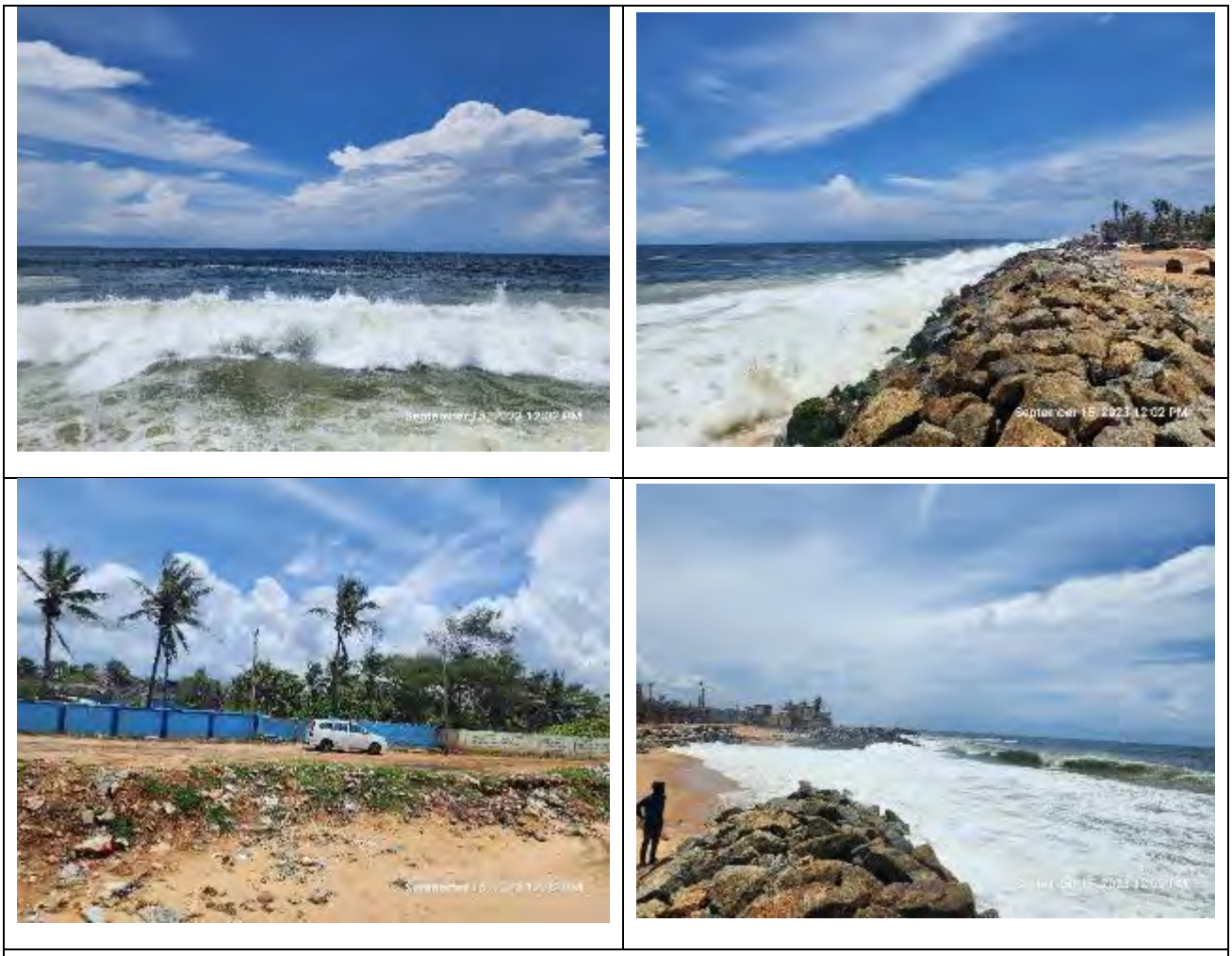


Figure 11- September CSP 11

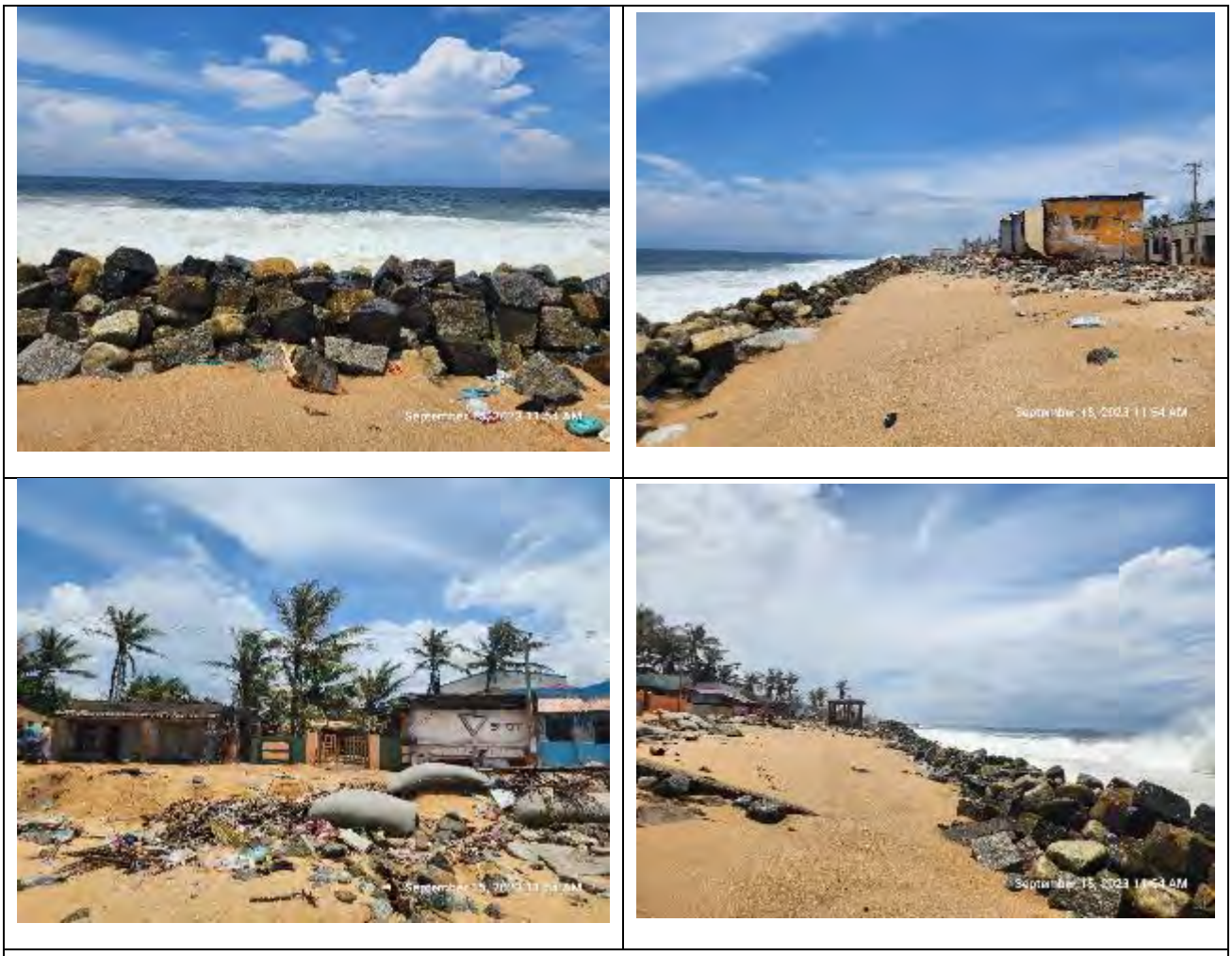


Figure 12- September CSP 12

Figure 13- September CSP 13

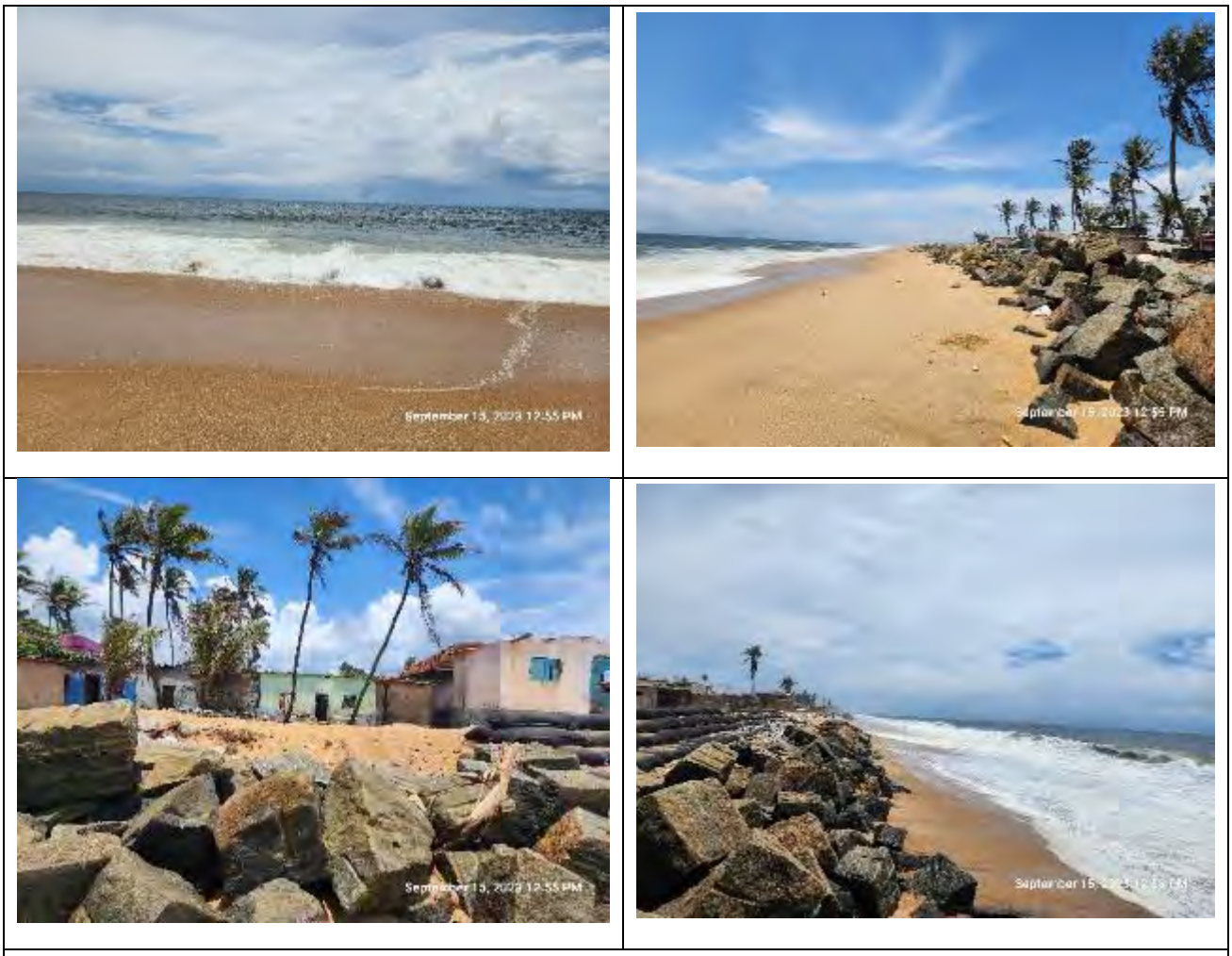


Figure 14- September CSP 14

Figure 15- September CSP 15

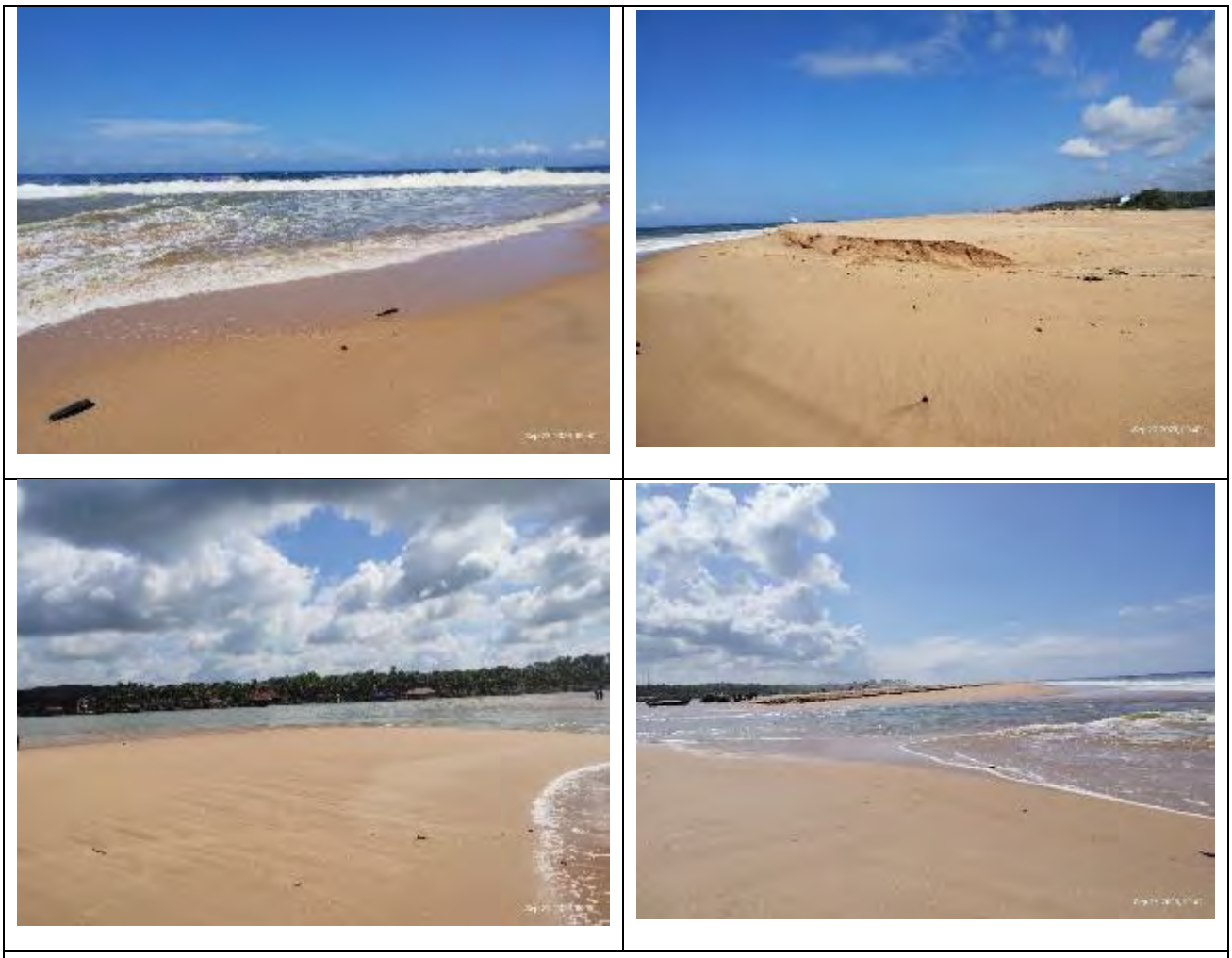


Figure 16- September CSP 16

Figure 17- September CSP 17

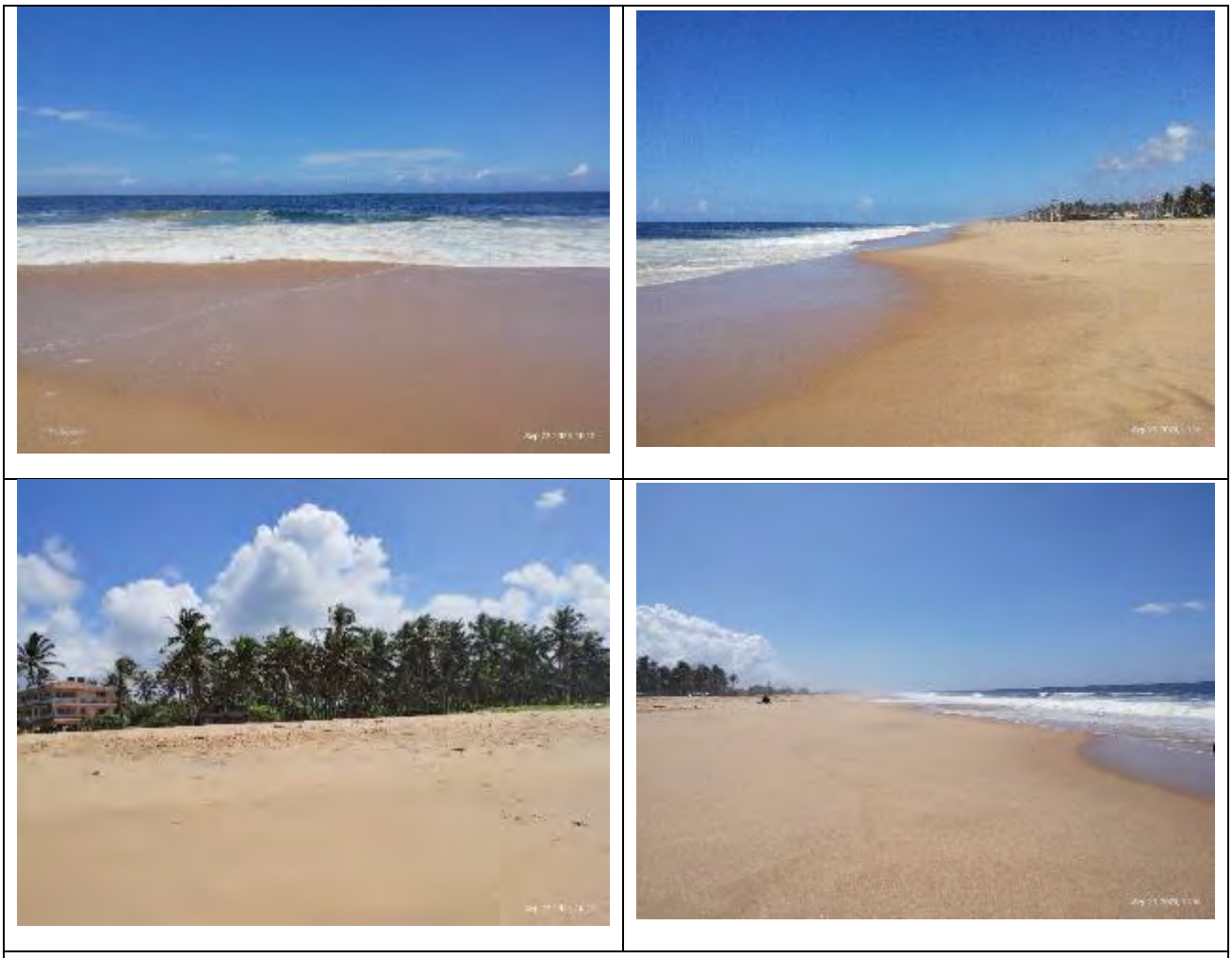


Figure 18- September CSP 18

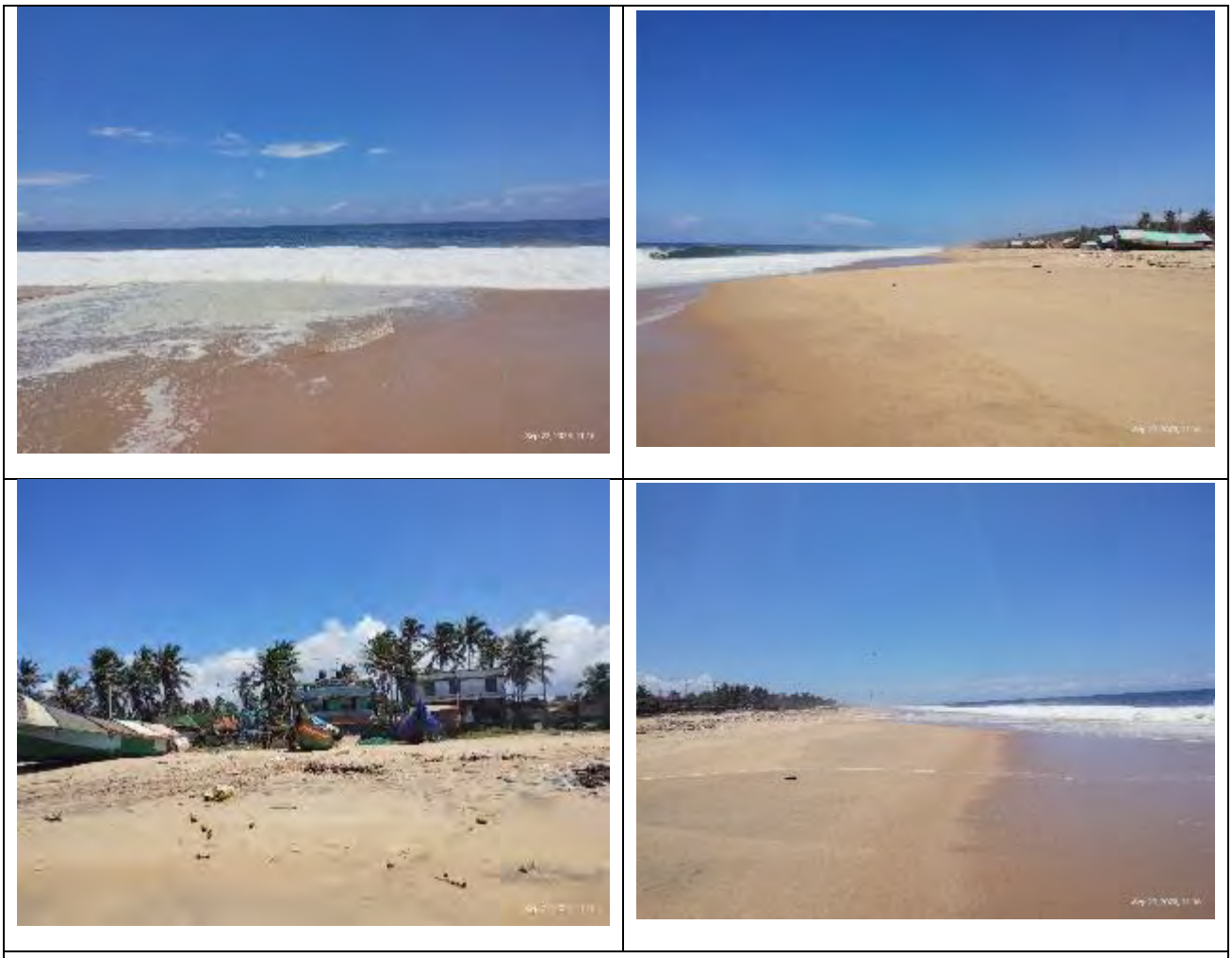


Figure 19- September CSP 19

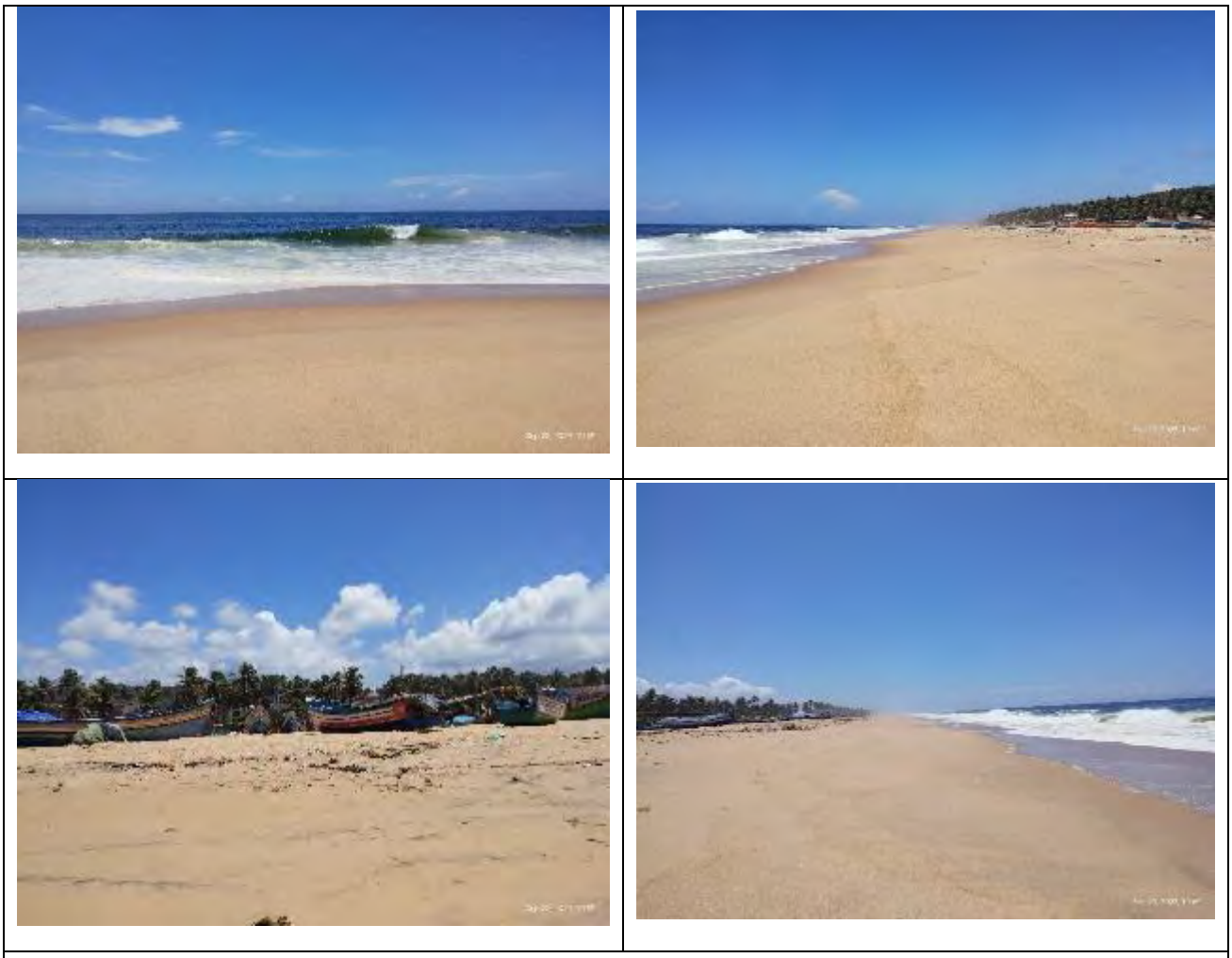


Figure 20- September CSP 20

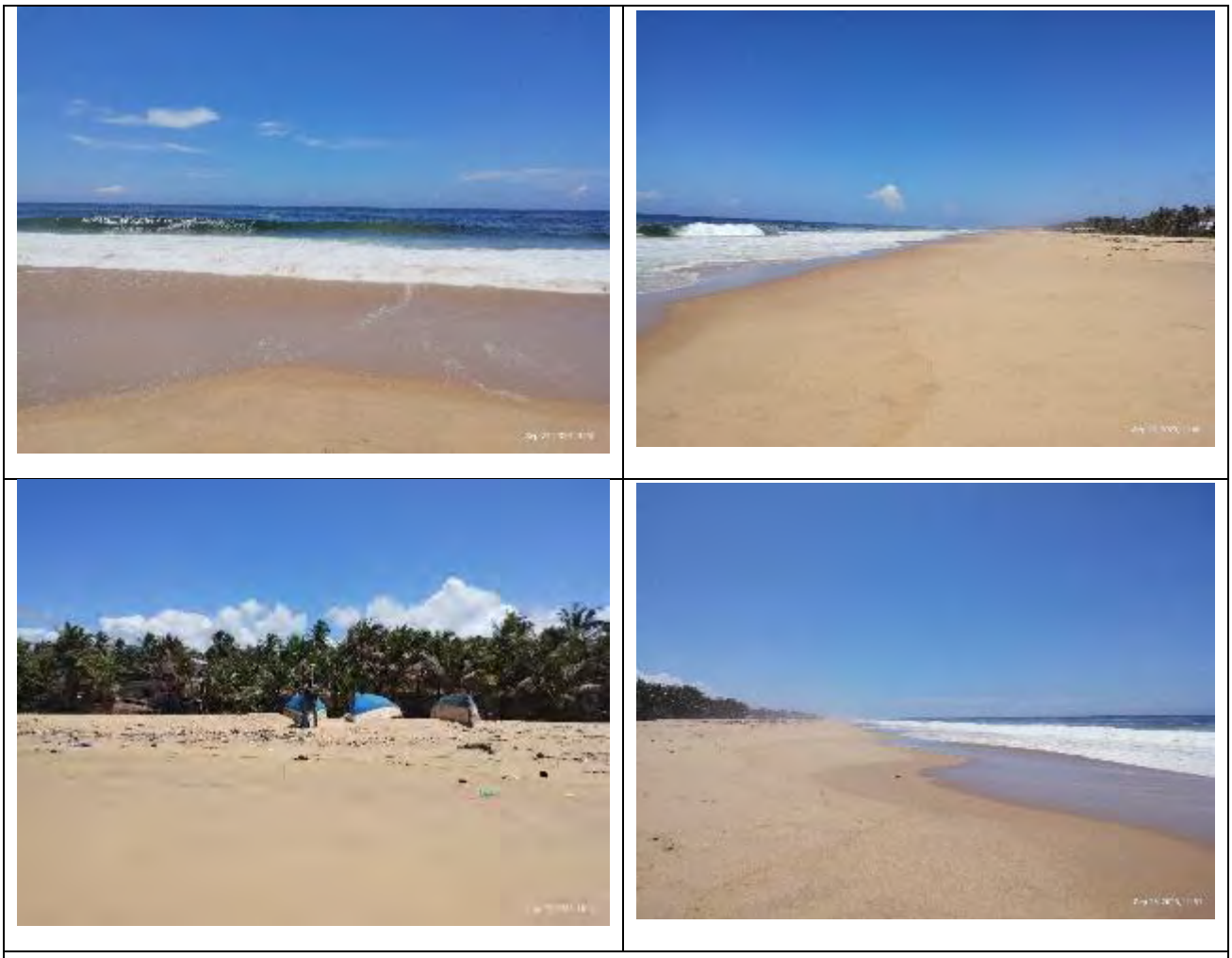


Figure 21- September CSP 21

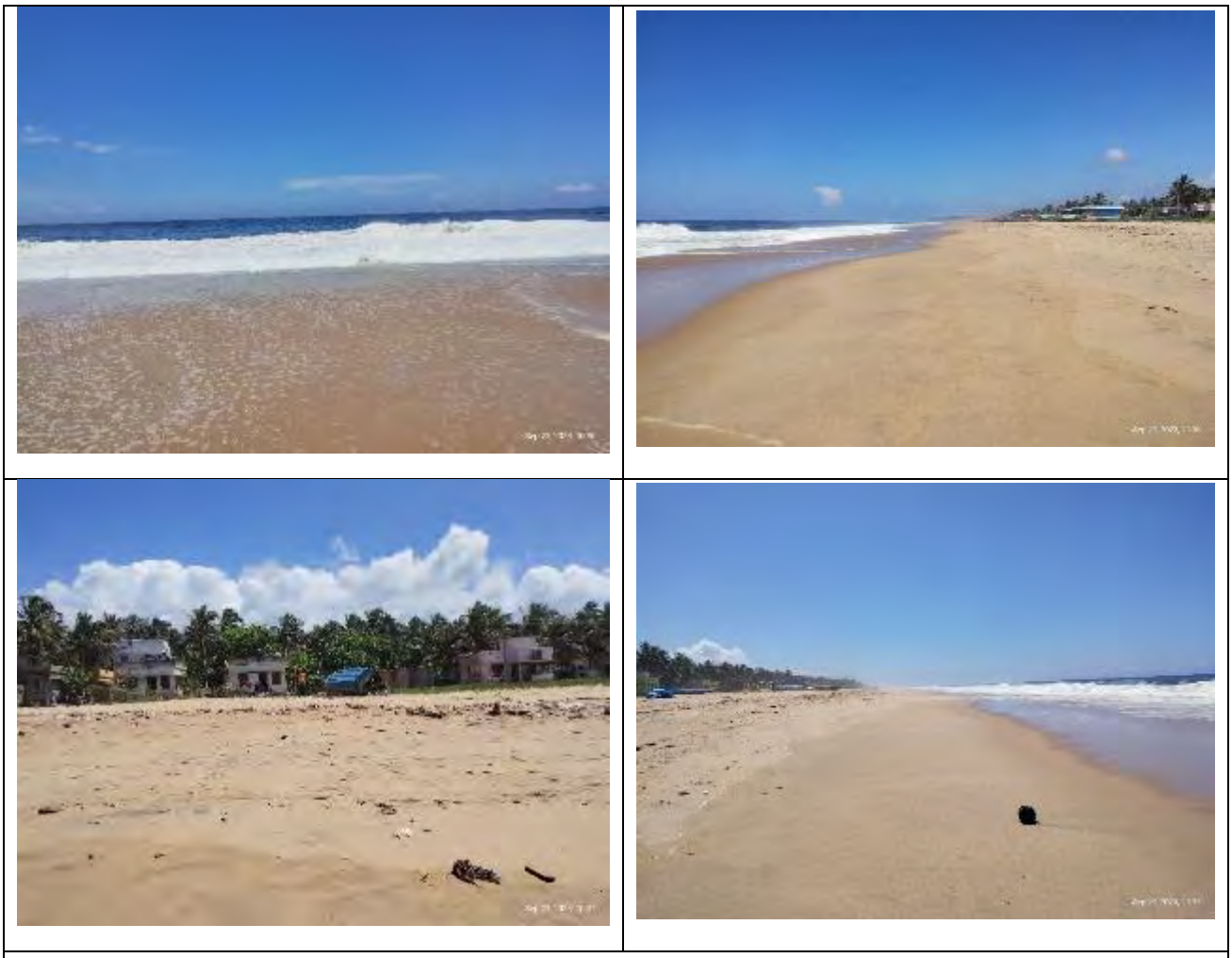


Figure 22- September CSP 22

Figure 23- September CSP 35

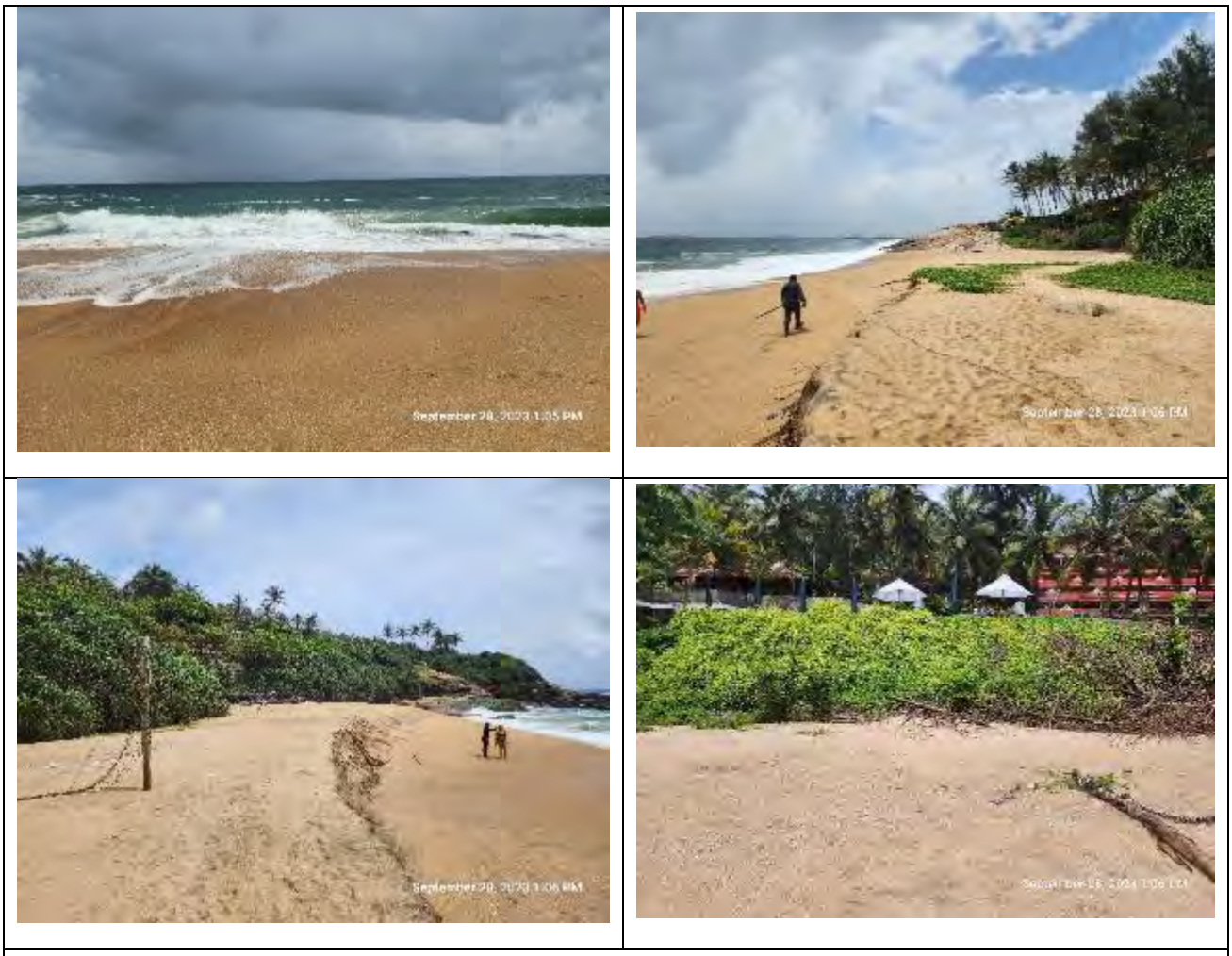


Figure 24- September CSP 36

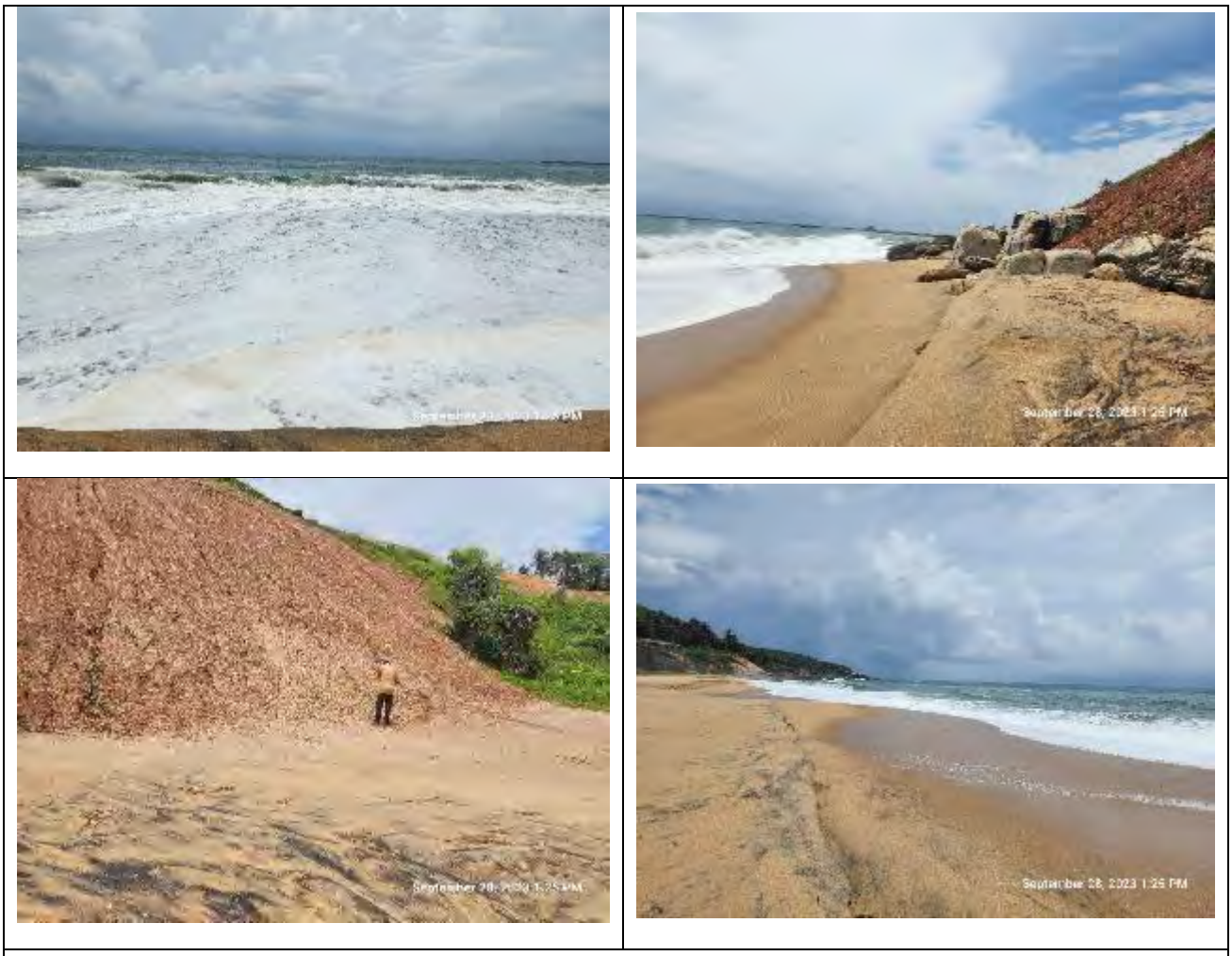


Figure 25- September CSP 37

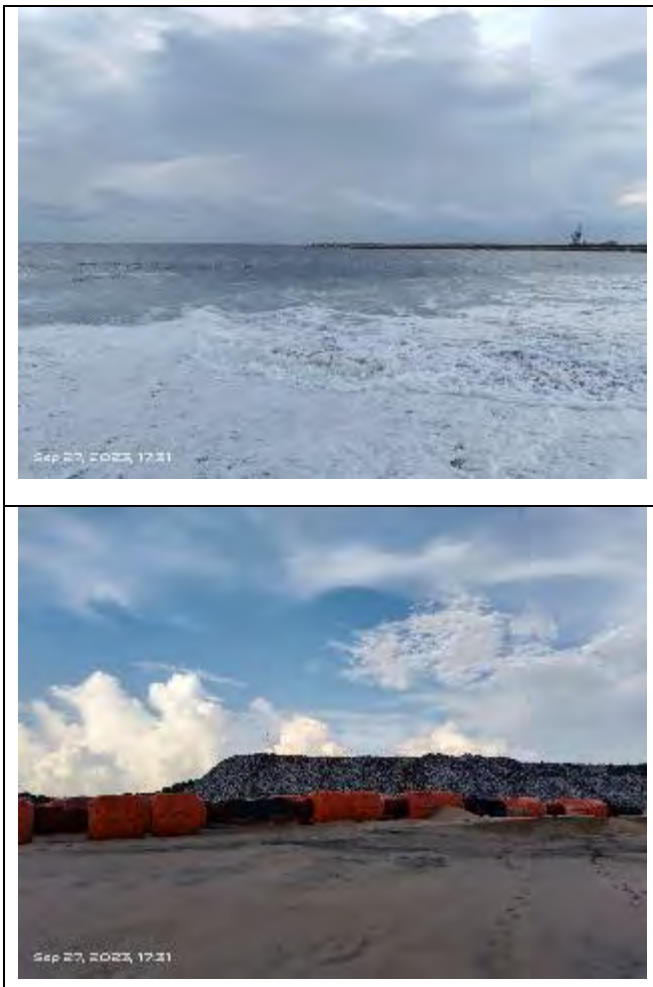


Figure 26- September CSP 38




Figure 27- September CSP 39




Figure 28- September CSP 40

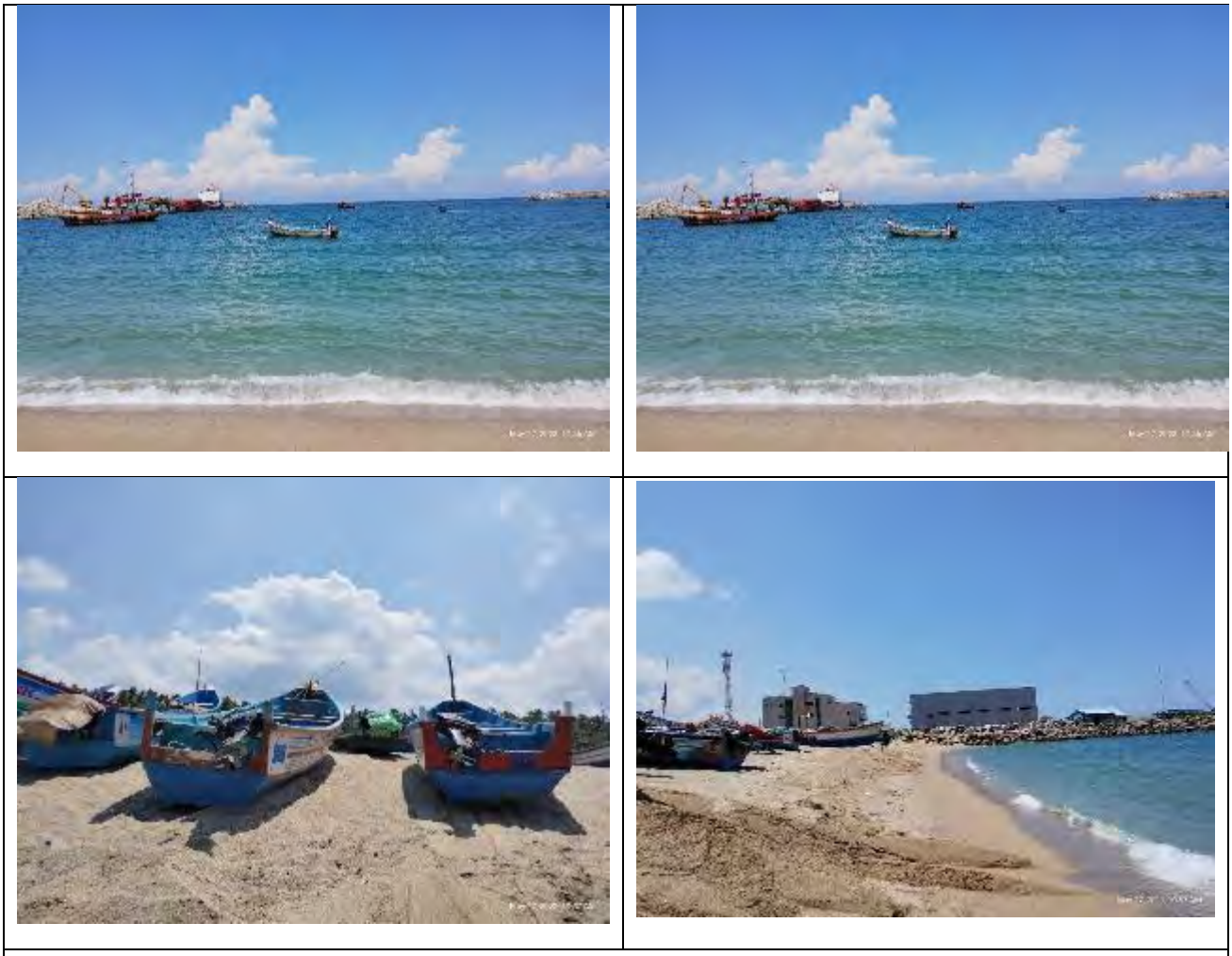


Figure 29- September CSP 40A




Figure 30- September CSP 41

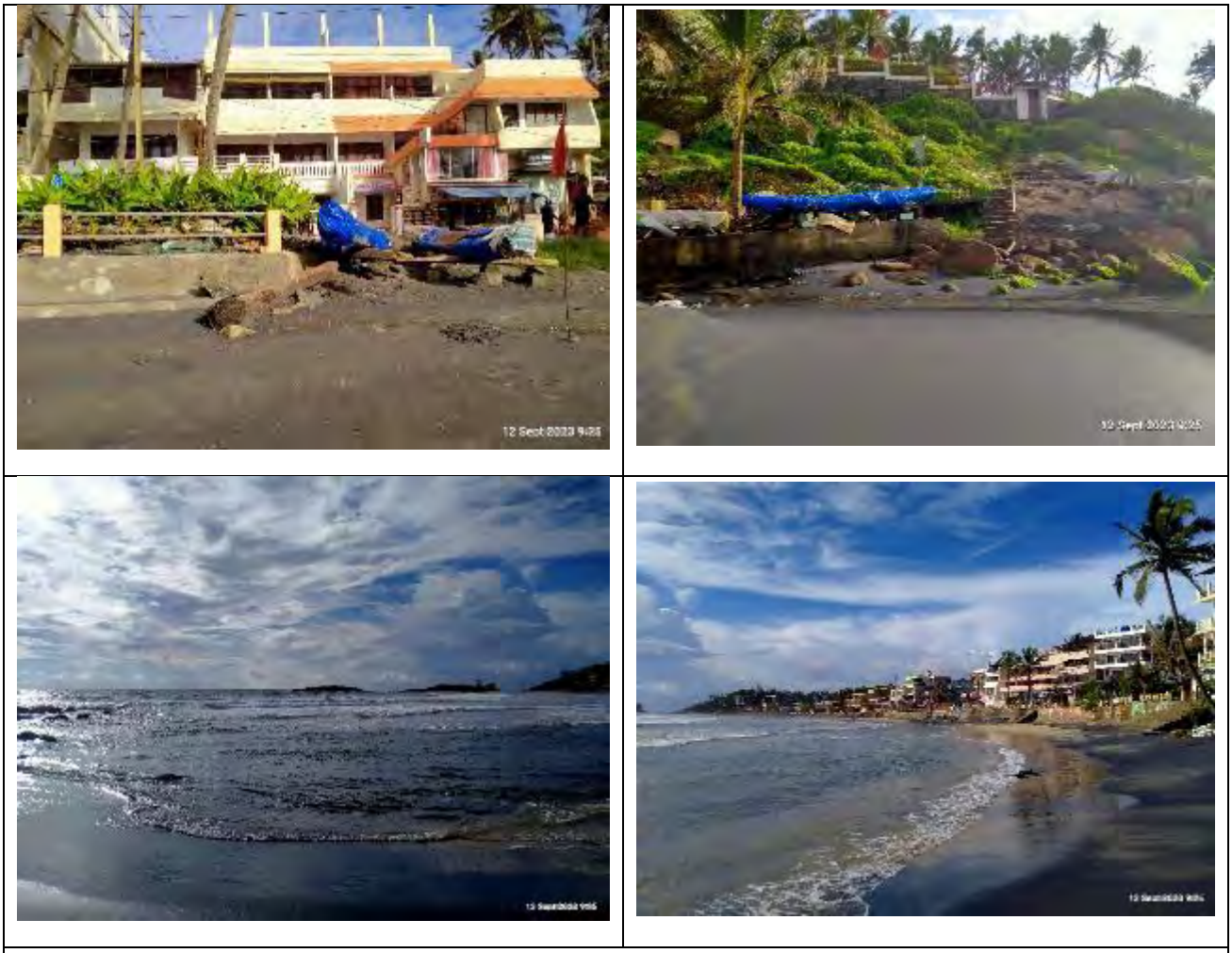


Figure 31- September CSP 42

Figure 32- September CSP 43

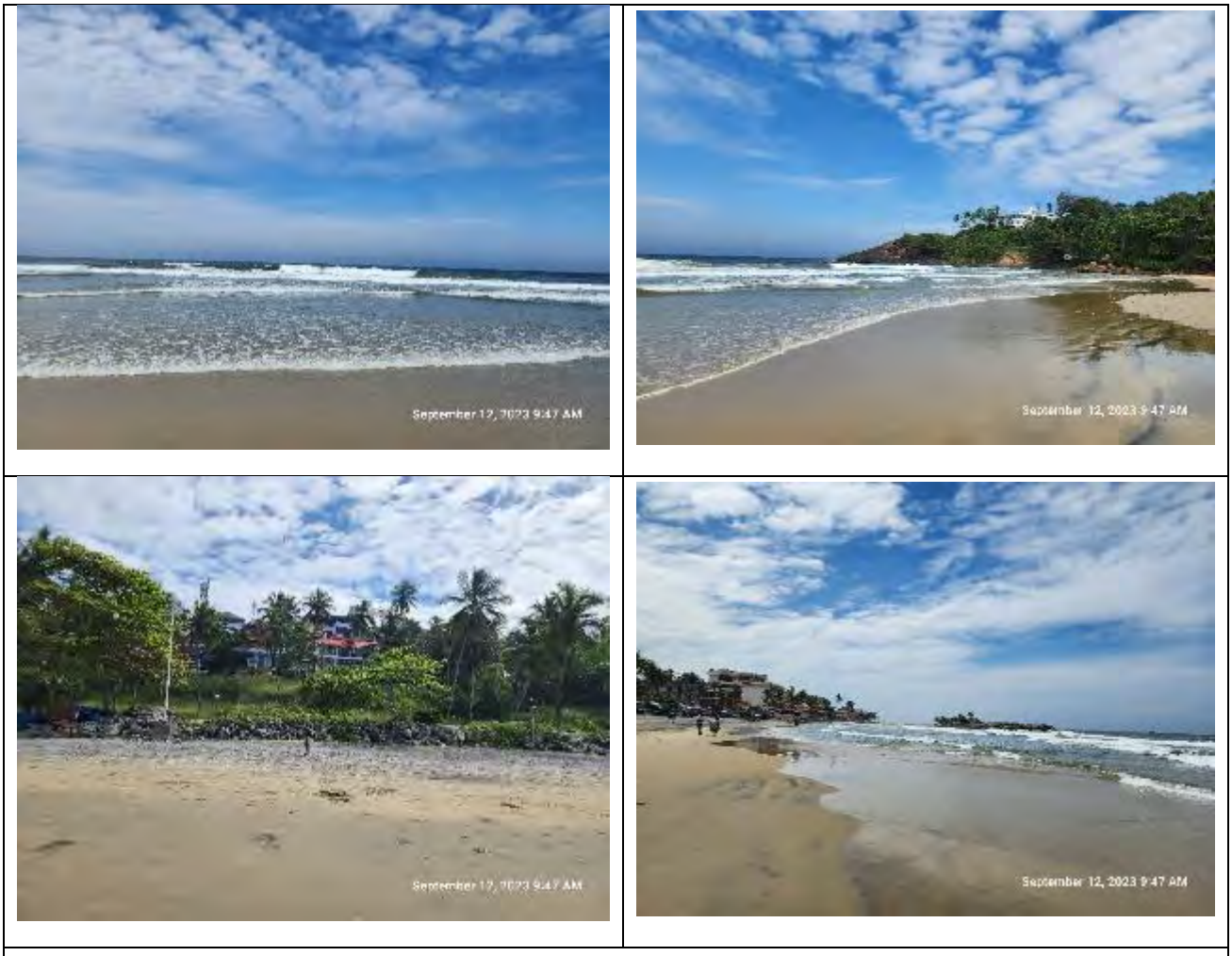


Figure 33- September CSP 44

Figure 34- September CSP 45




Figure 35- September CSP 46

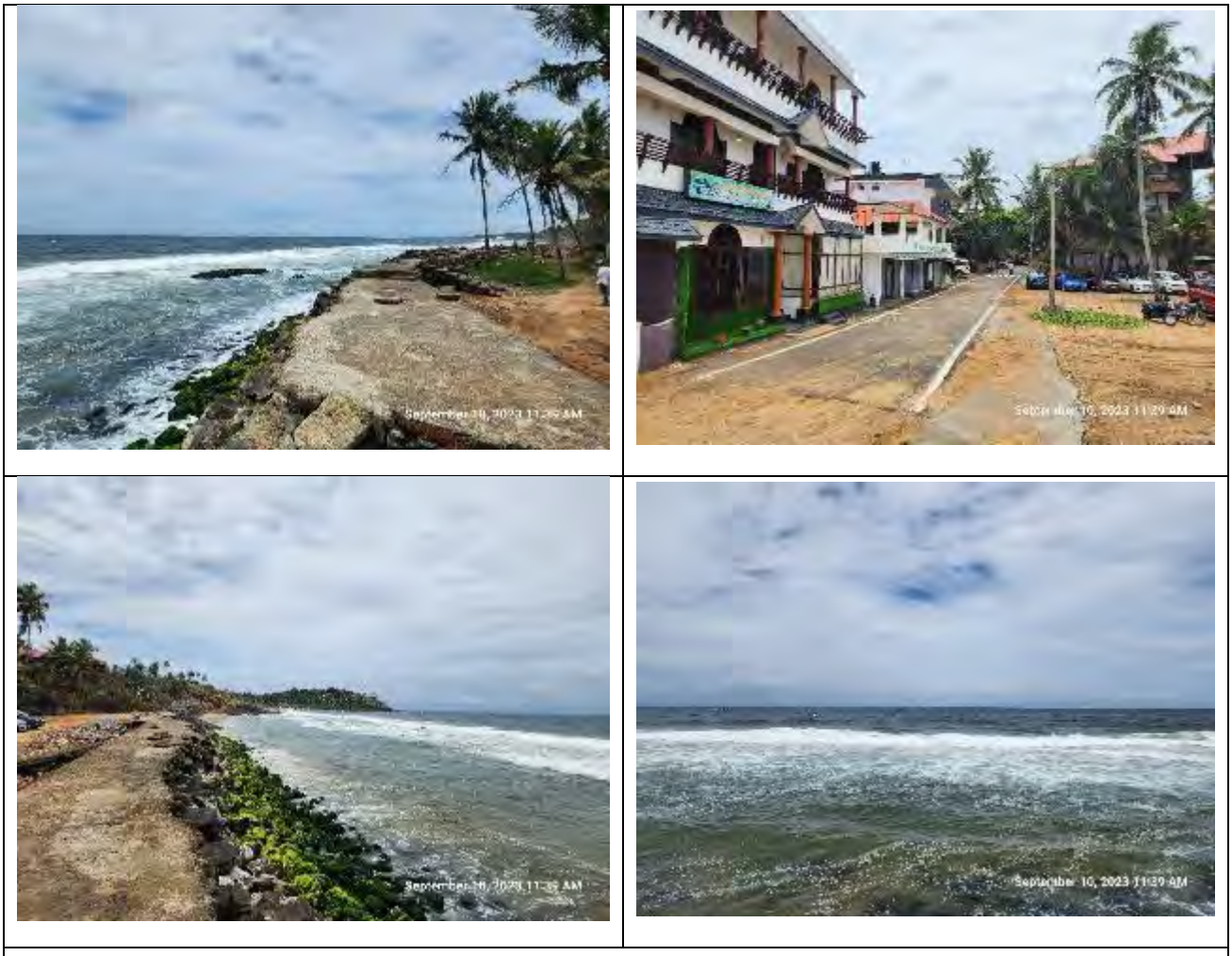


Figure 36- September CSP 47

Figure 37- September CSP 48

Figure 38- September CSP 49

Figure 39- September CSP 50

Figure 40- September CSP 51

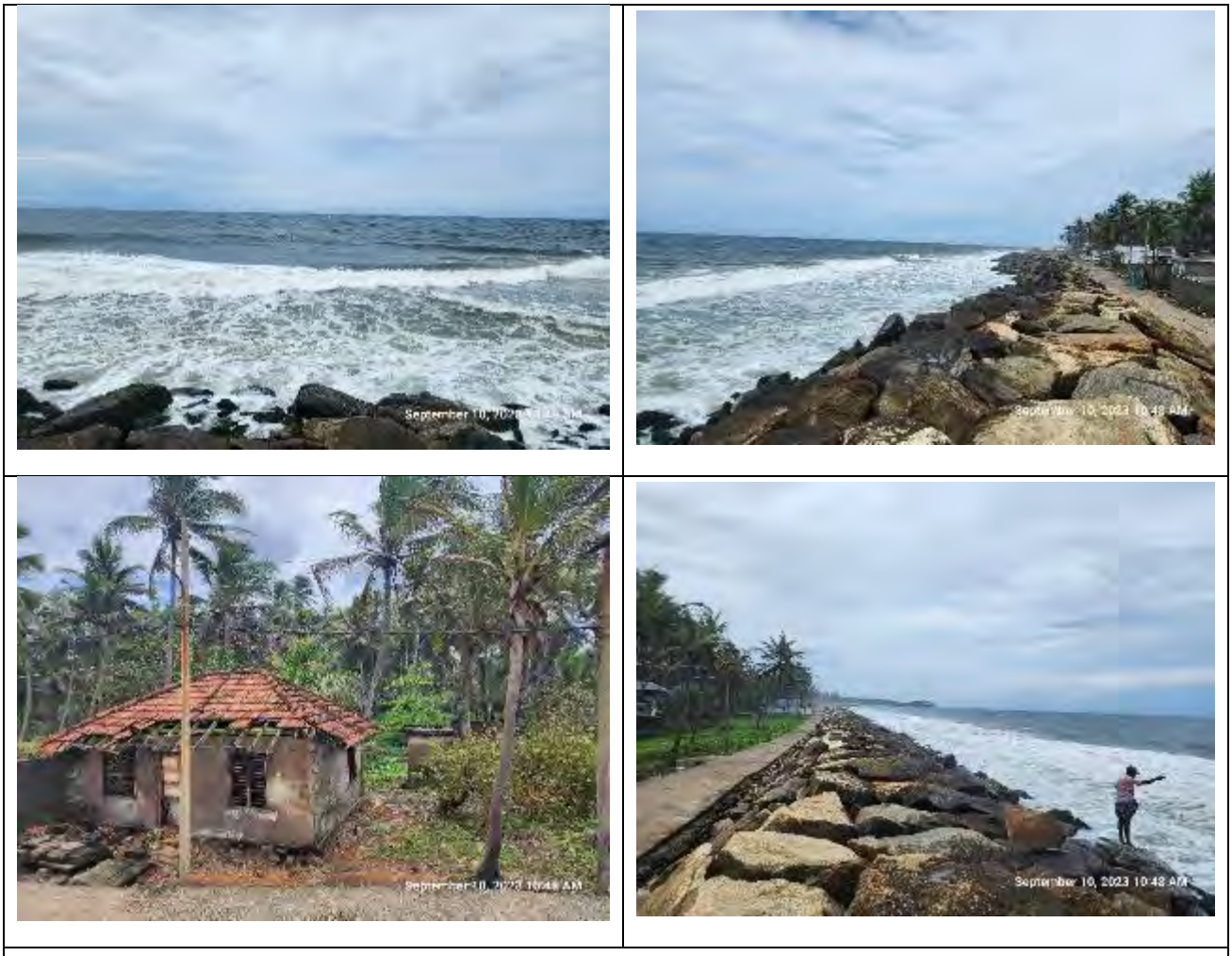


Figure 41- September CSP 52




Figure 42- September CSP 53




Figure 43- September CSP 54




Figure 44- September CSP 55

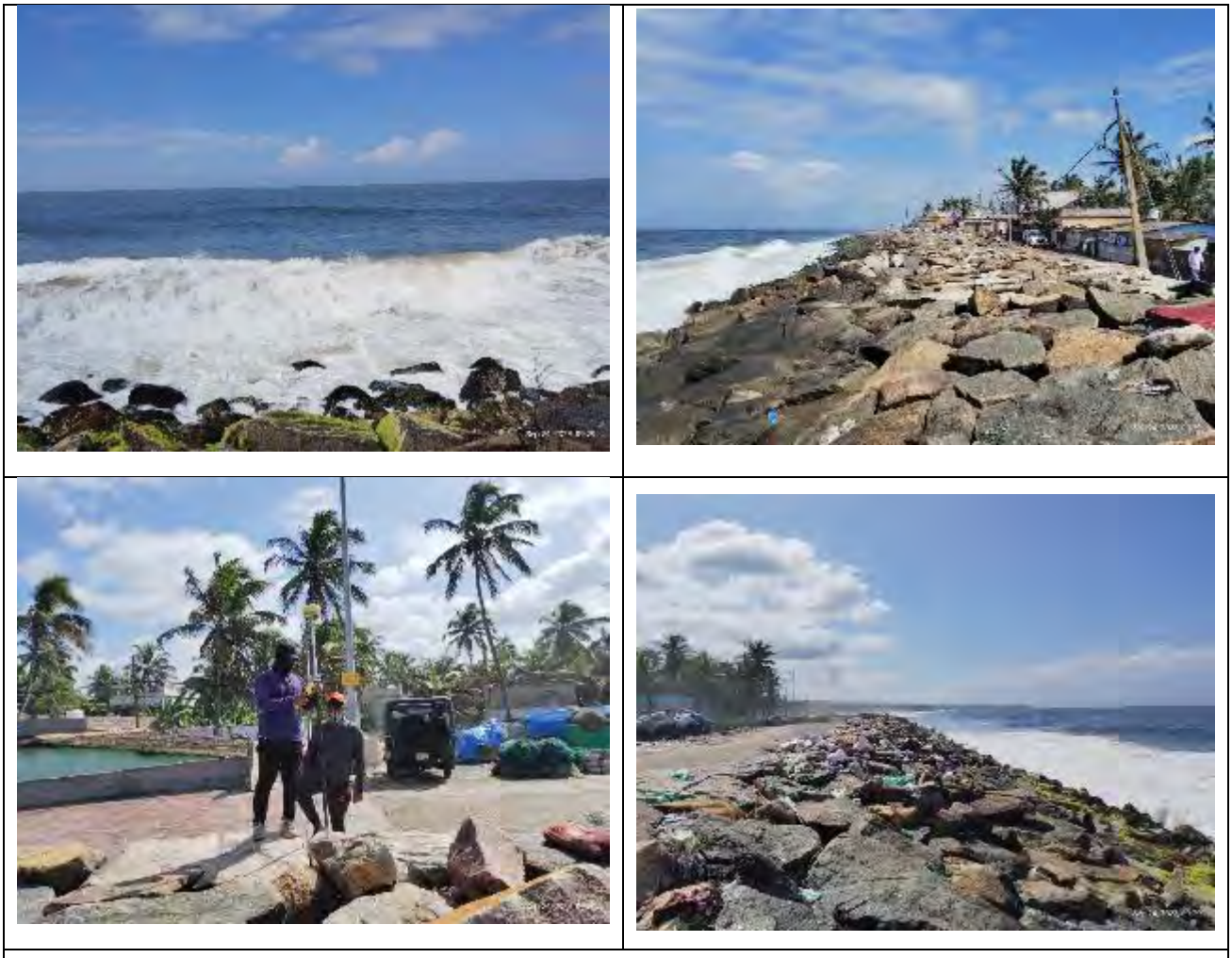


Figure 45- September CSP 56

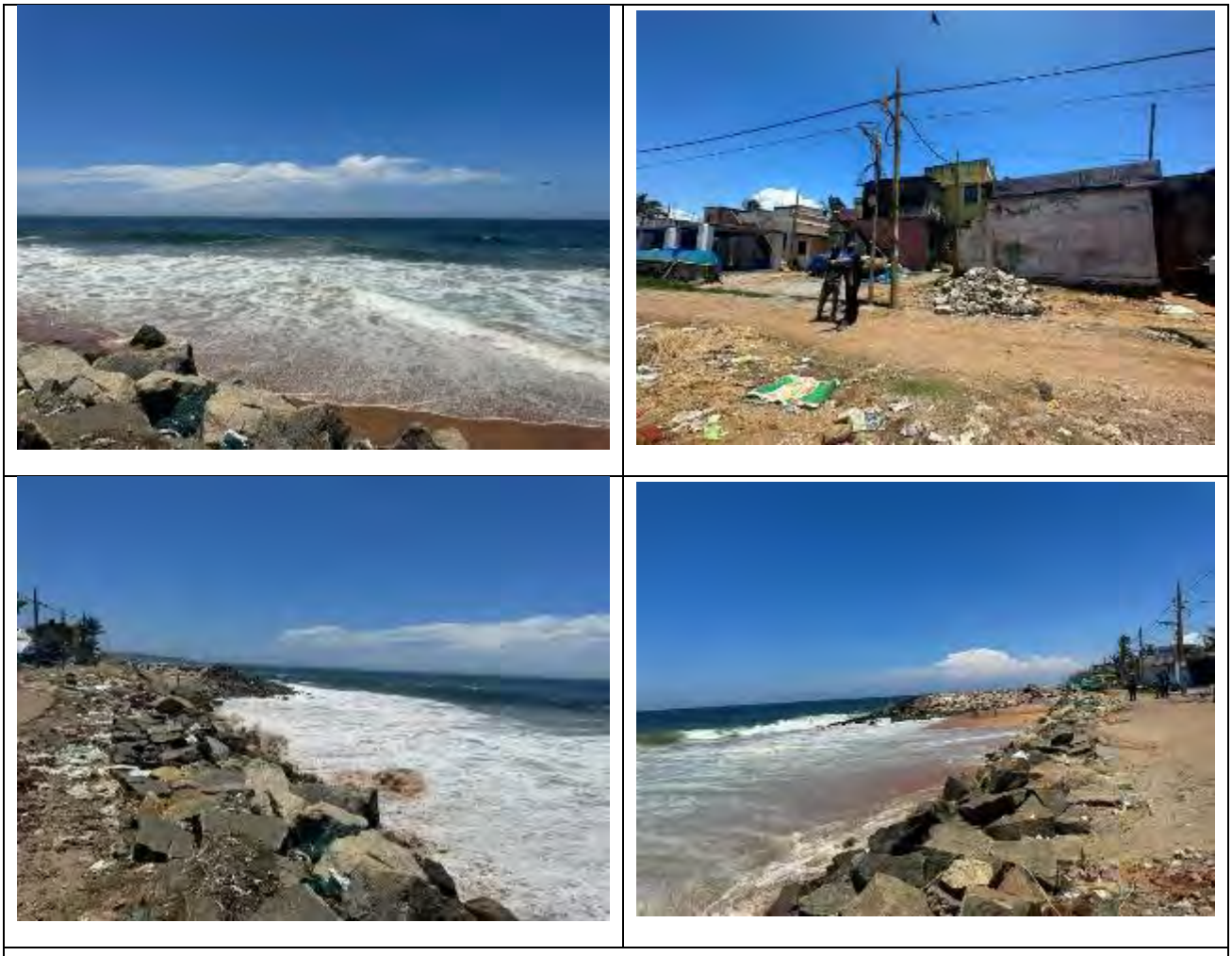


Figure 46- September CSP 57




Figure 47- September CSP 58

Figure 48- September CSP 59




Figure 49- September CSP 60

Figure 50- September CSP 61

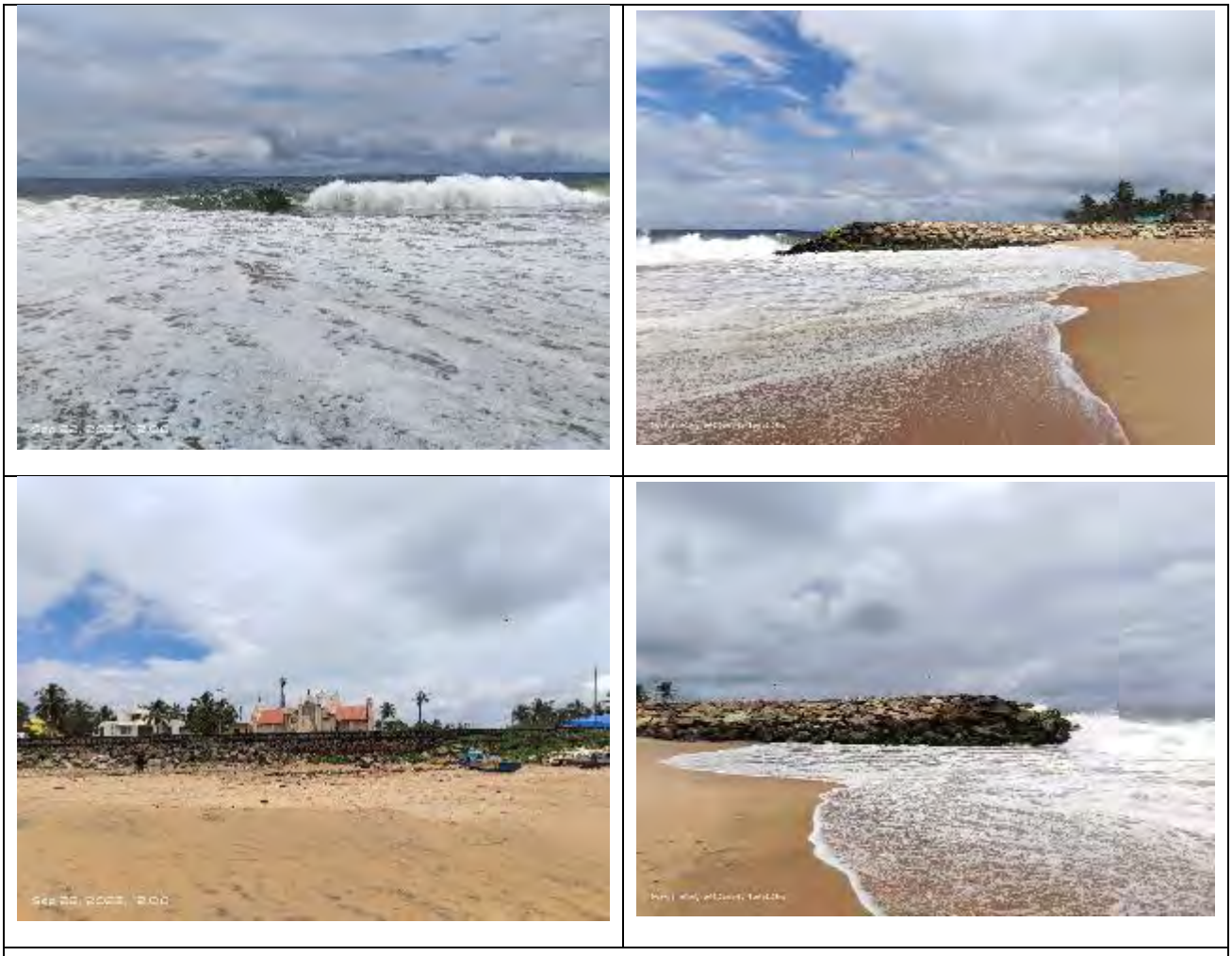


Figure 51- September CSP 62

Figure 52- September CSP 63

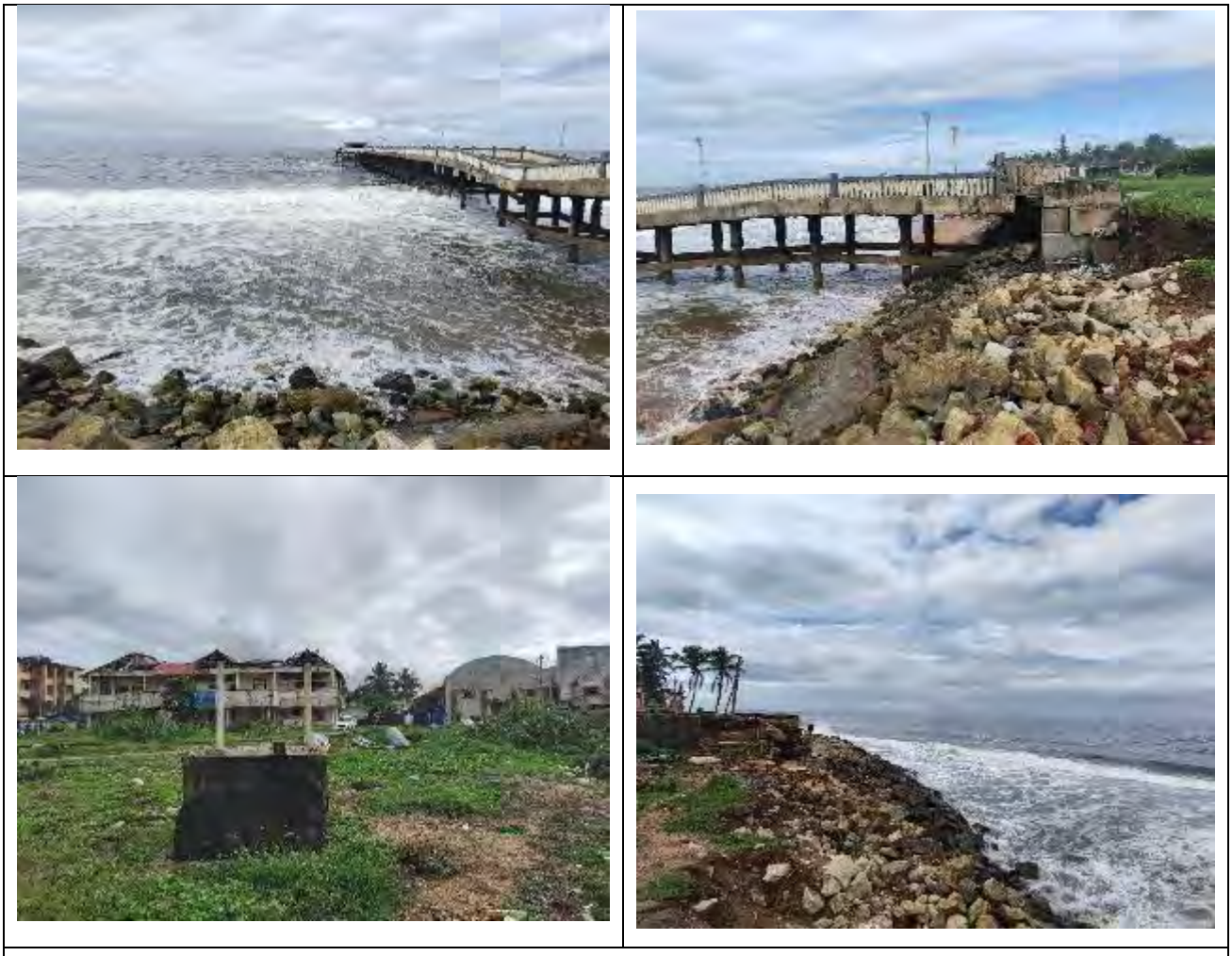


Figure 53- September CSP 64




Figure 54- September CSP 64A

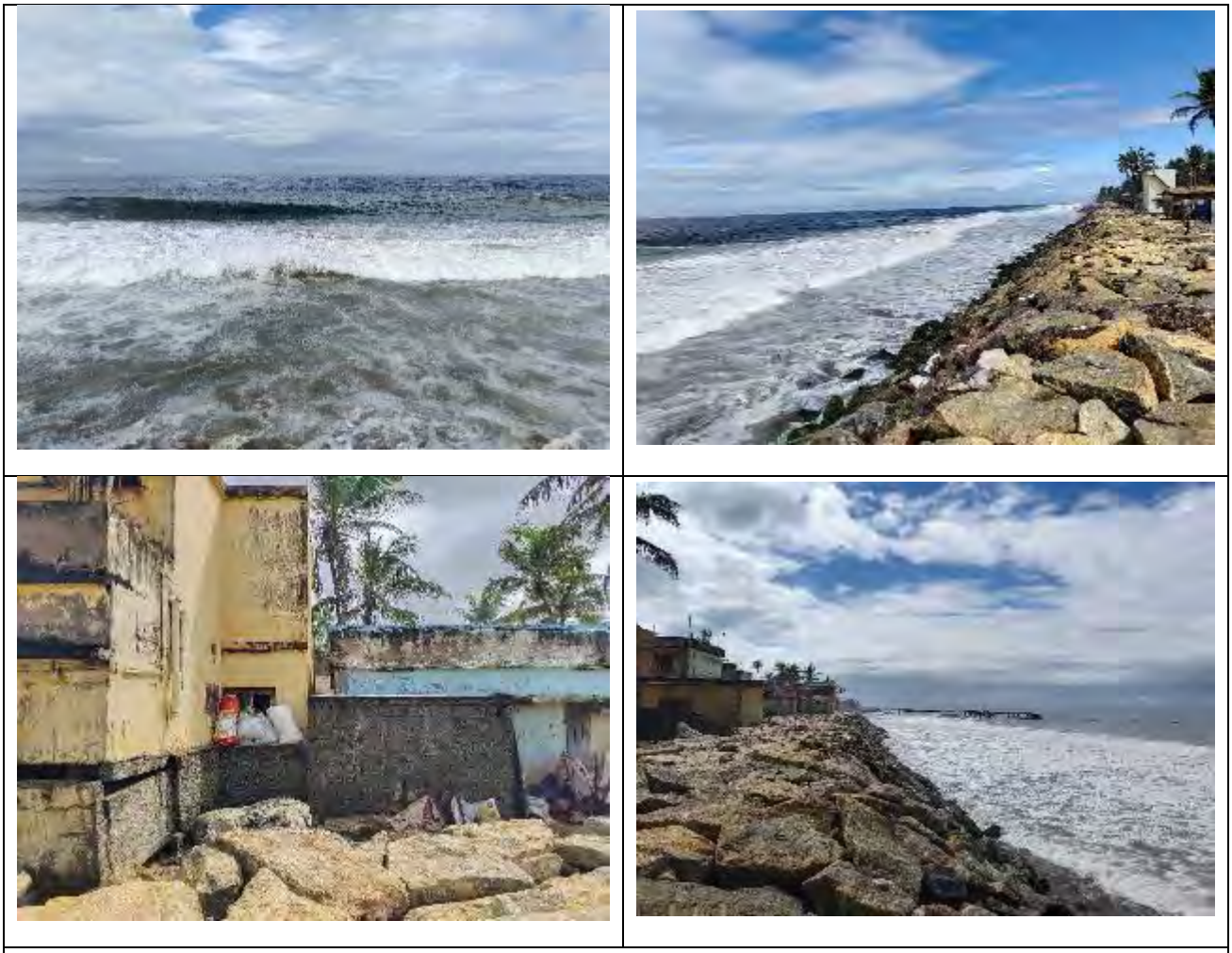


Figure 55- September CSP 65

Figure 56- September CSP 66

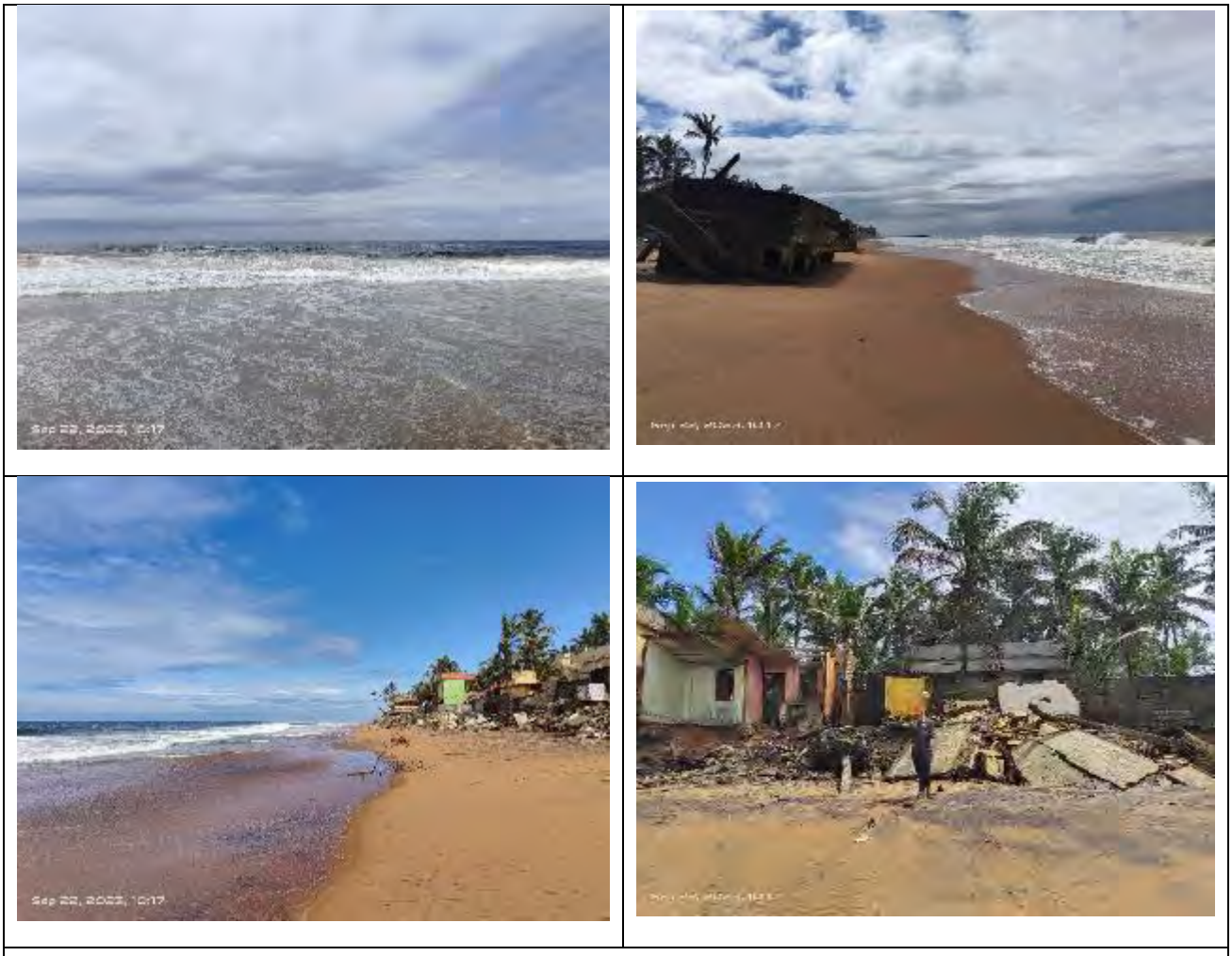


Figure 57- September CSP 67

Figure 58- September CSP 68

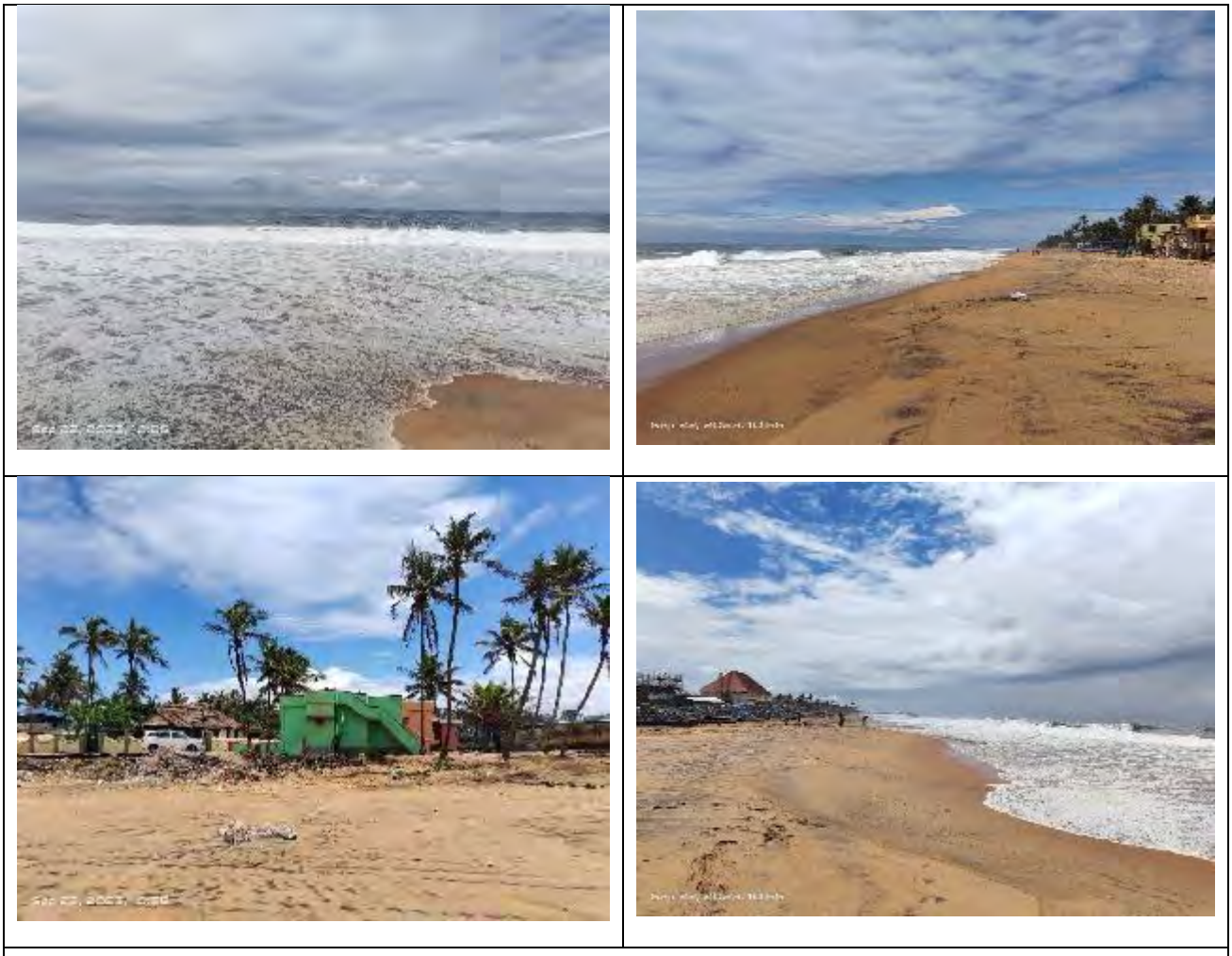


Figure 59- September CSP 69

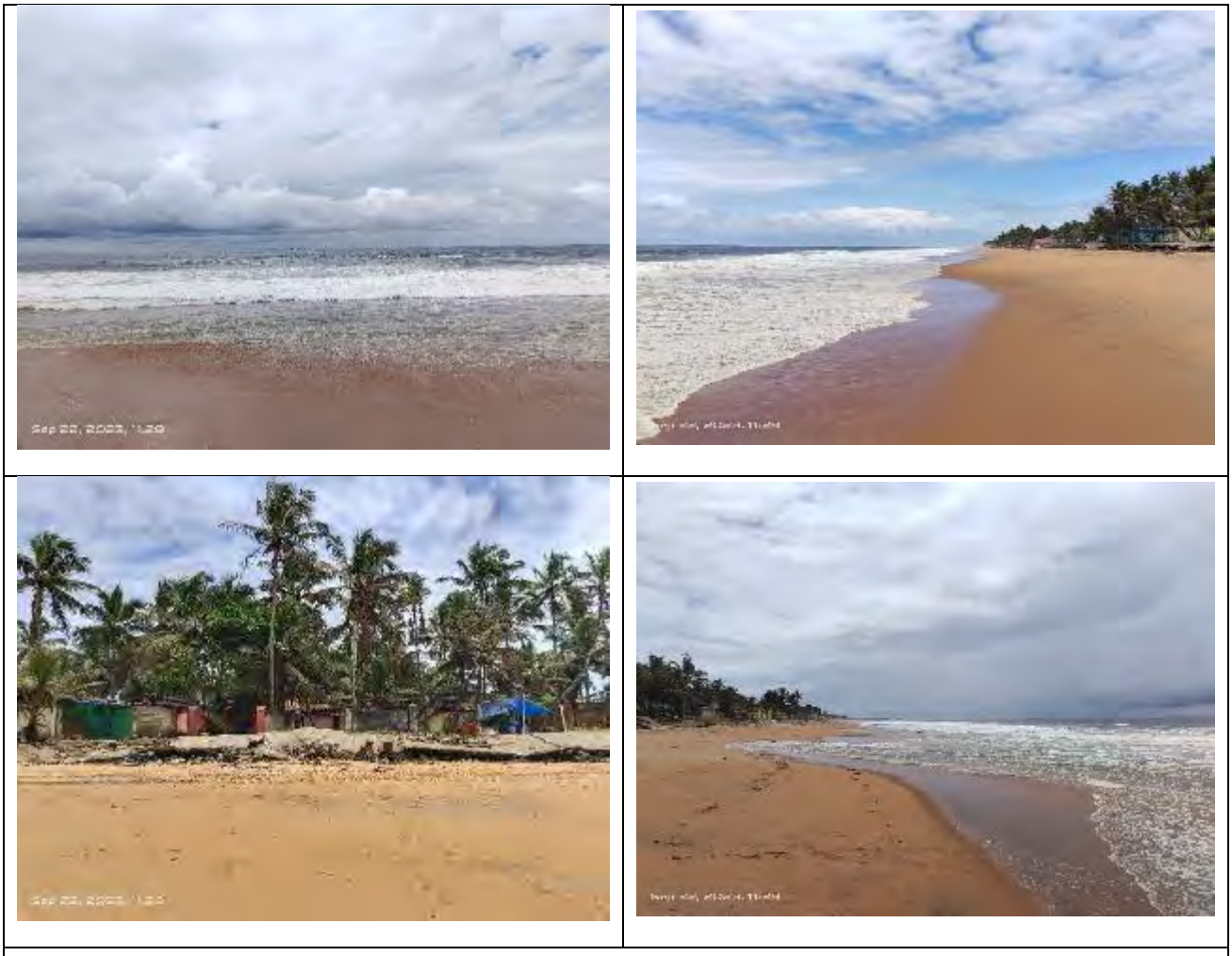


Figure 60- September CSP 70

Figure 61- September CSP 71




Figure 62- September CSP 72

Figure 63- September CSP 73




Figure 64- September CSP 74




Figure 65- September CSP 75




Figure 66- September CSP 76

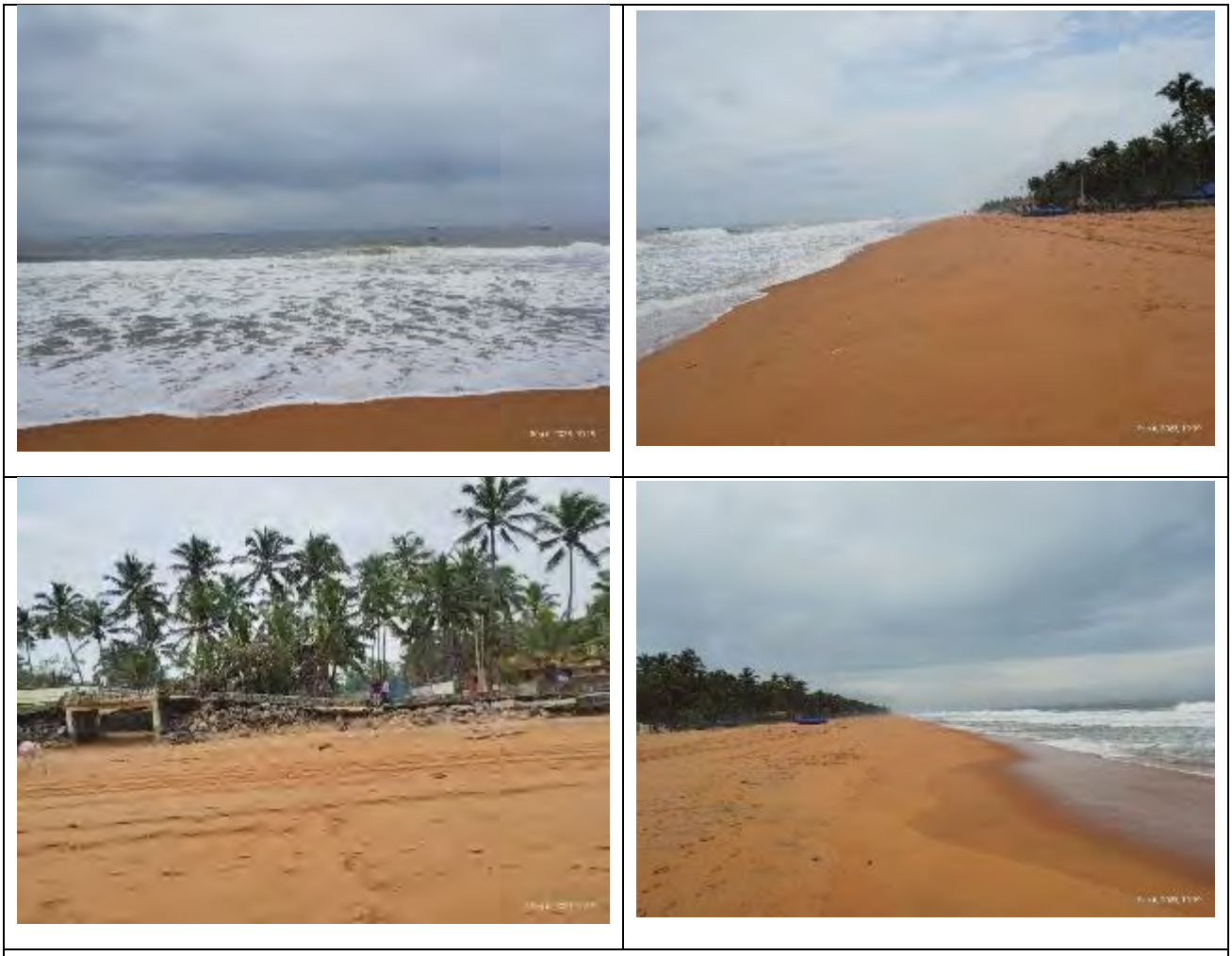


Figure 67- September CSP 77




Figure 68- September CSP 78




Figure 69- September CSP 79



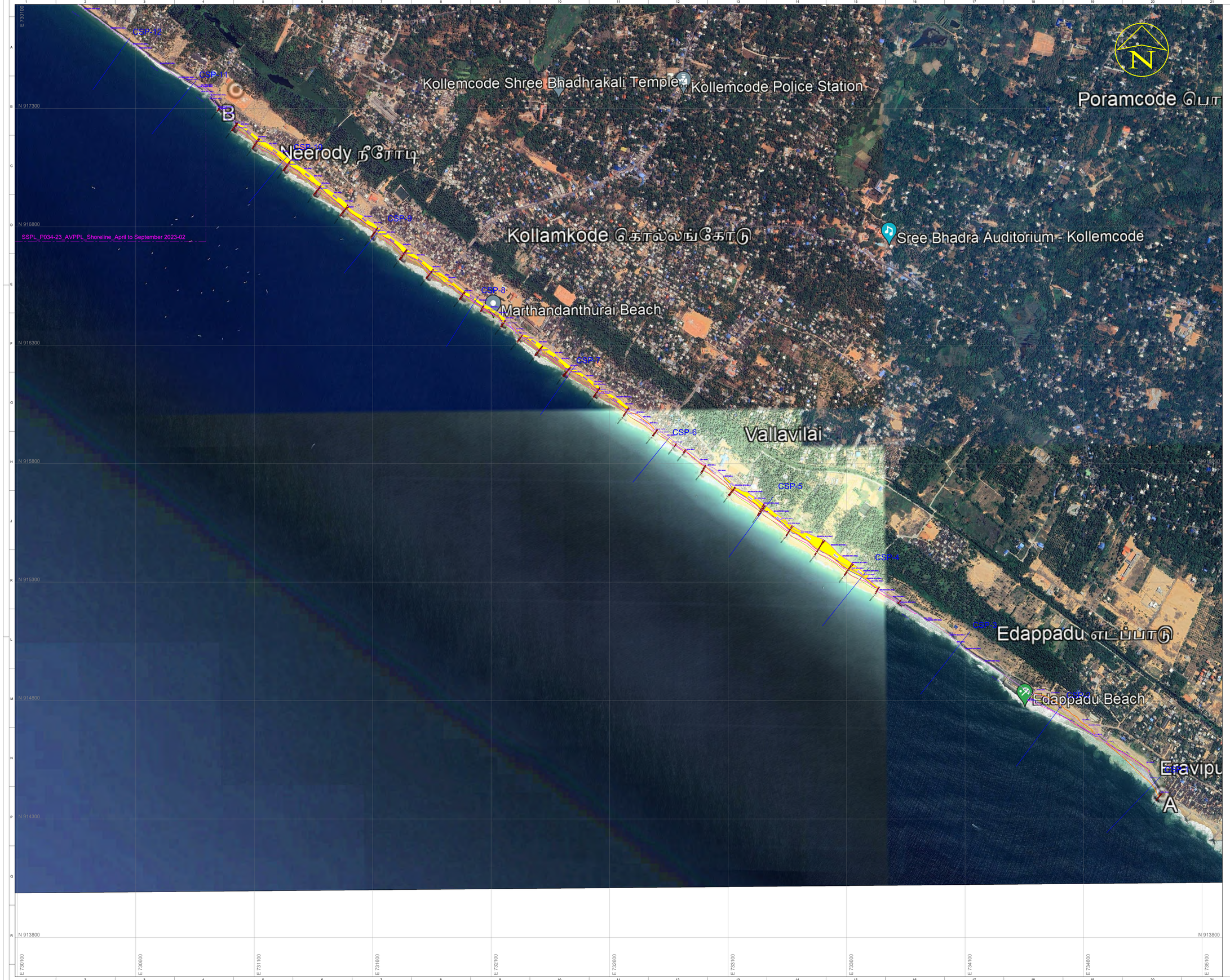

Figure 70- September CSP 80




Figure 71- September CSP 81

Annexure II

Overlay of Month on Month Shoreline Survey Charts



Notes :

1. All coordinates are in WGS 84 datum, UTM grid system, Zone 43 North

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2023
- SHORELINE MAY 2023
- SHORELINE JUNE 2023
- SHORELINE JULY 2023
- SHORELINE AUGUST 2023
- SHORELINE SEPTEMBER 2023

Survey Notes

Surface Positioning : Geomax Zenith (GPS Mode)

Geodetic Parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 5000

100 0 100 200 300 400 500metres

Key Plan

Client

ADANI VIZHINJAM PORT PVT. LTD.
3rD Floor, Aspinwall House,
Kawdiar Road, Kuravankonam,
Thiruvananthapuram - 695003

Survey Contractor

SHANKAR SURVEYS PVT.LTD
115, 1st Floor, Neco Chambers
Sector 11, CBD Belapur, Navi Mumbai
Tele/Fax:- 022 27562900
E-mail : info@shankarsurveys.com

Project

Oceanographic And Bathymetric Data Collection
For Assessment of Shoreline Changes

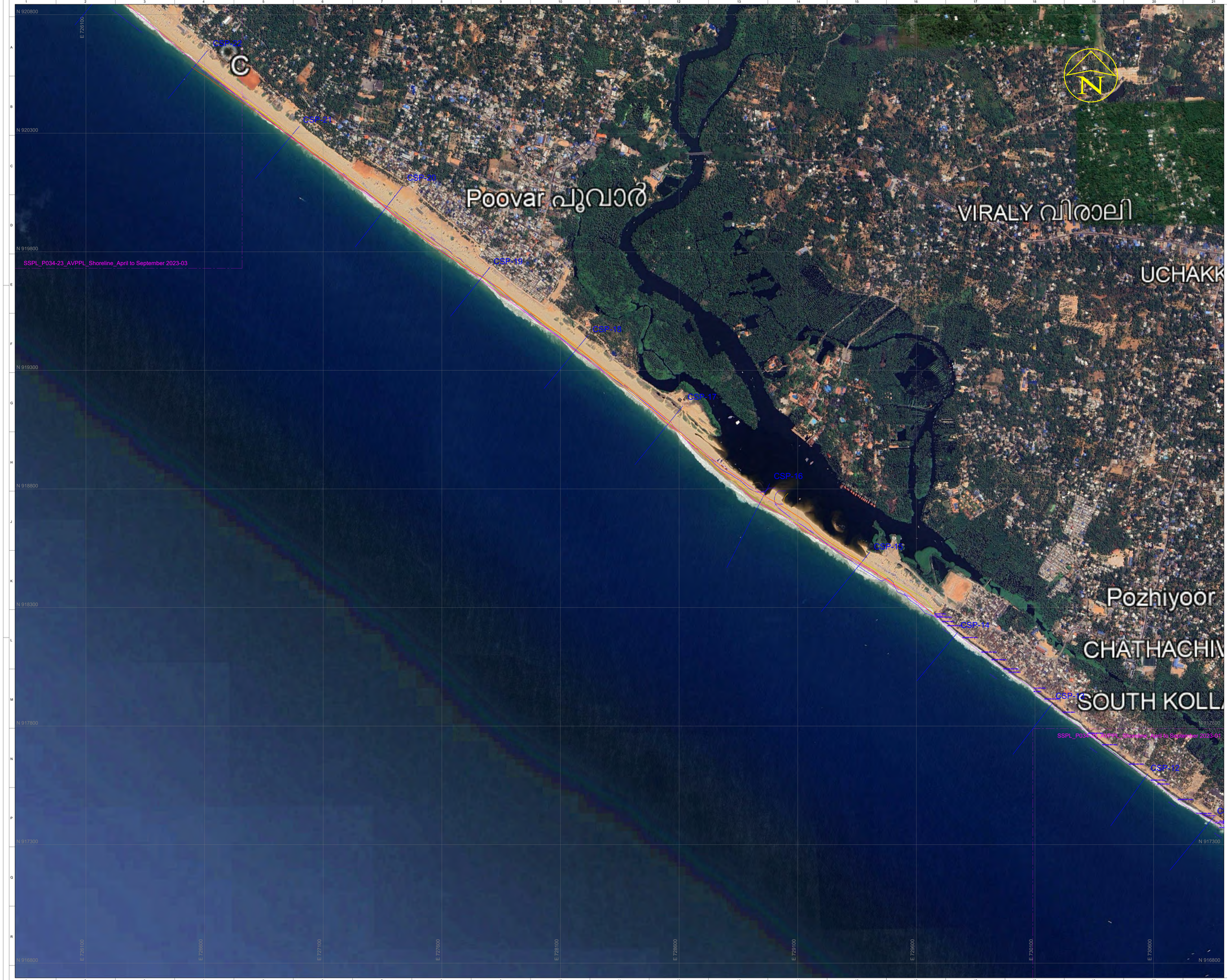
Drawing Title

Shoreline Monitoring Chart

Rev.No.	Description	Date
0	First issue	17.10.2023

Drawn : S. Khaire | Interpreted : Vishnu. R | Checked : V. Mehta

Dwg No. SSPL_P034-23_AVPPL_Shoreline_April to September 2023-01



Notes :

1. All coordinates are in WGS 84 datum, UTM grid system, Zone 43 North

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2023
- SHORELINE MAY 2023
- SHORELINE JUNE 2023
- SHORELINE JULY 2023
- SHORELINE AUGUST 2023
- SHORELINE SEPTEMBER 2023

Survey Notes

Surface Positioning : Geomax Zenith (GPS Mode)

Geodetic Parameters :

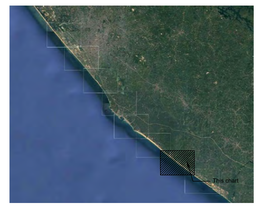
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 5000

100 0 100 200 300 400 500metres

Key Plan



Client

ADANI VIZHINJAM PORT PVT. LTD.
3rD Floor, Aspinwall House,
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Thiruvananthapuram - 695003

Survey Contractor

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Tele/Fax:- 022 27562900
E-mail : info@shankarsurveys.com

Project

Oceanographic And Bathymetric Data Collection
For Assessment of Shoreline Changes

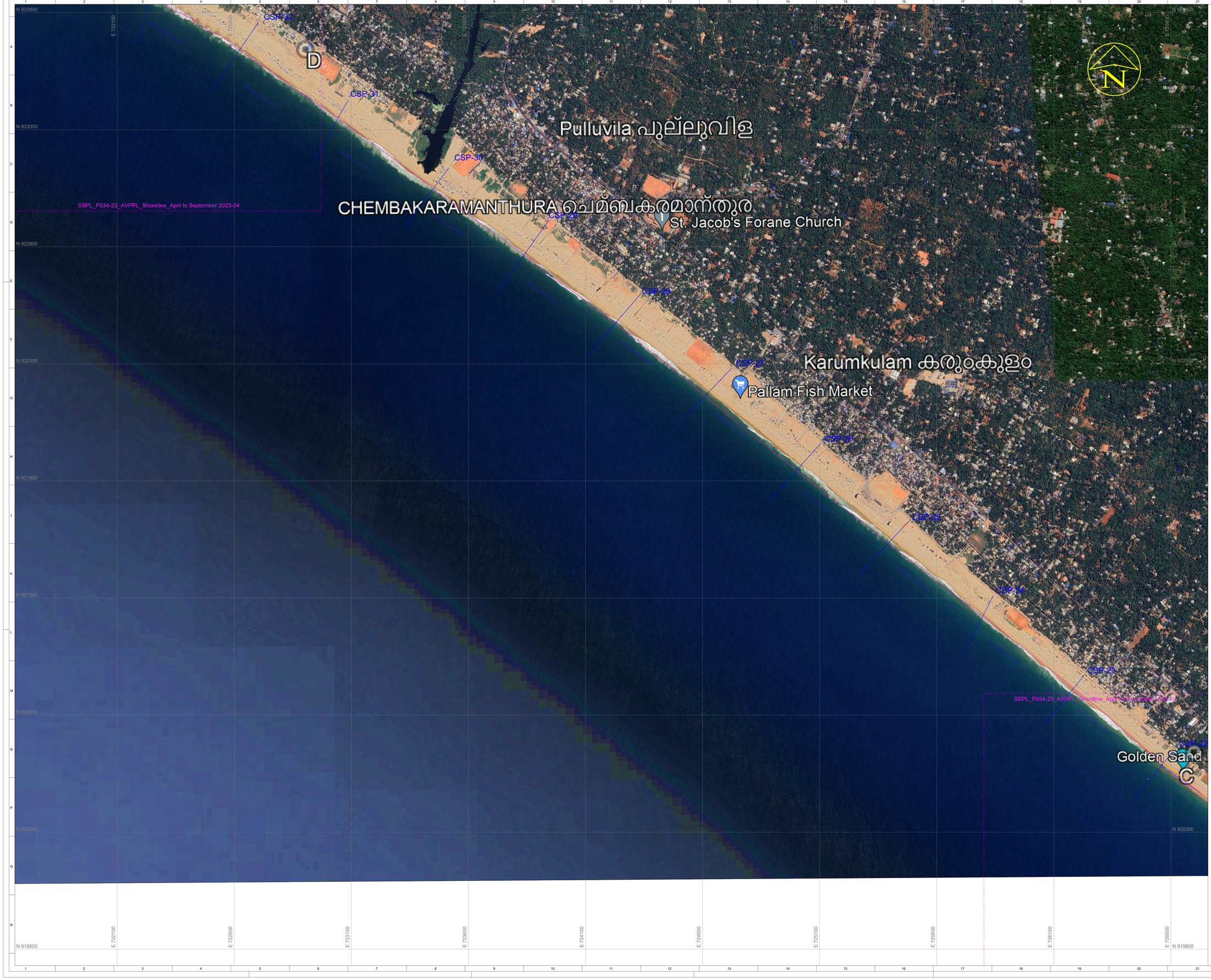
Drawing Title

Shoreline Monitoring Chart

Rev.No.	Description	Date
0	First issue	17.10.2023

Drawn : S. Khaire | Interpreted : Vishnu. R | Checked : V. Mehta

Dwg No. SSPL_P034-23_AVPPL_Shoreline_April to September 2023-02



Notes :

1. All coordinates are in WGS 84 datum, UTM grid system, Zone 43 North

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2023
- SHORELINE MAY 2023
- SHORELINE JUNE 2023
- SHORELINE JULY 2023
- SHORELINE AUGUST 2023
- SHORELINE SEPTEMBER 2023

Survey Notes

Surface Positioning	:	Geomax Zenith (GPS Mode)

Geodetic Parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 5000

100 0 100 200 300 400 500metres

Key Plan

Client

ADANI VIZHINJAM PORT PVT. LTD.
3rD Floor, Aspinwall House,
Kawdiar Road, Kuravankonam,
Thiruvananthapuram - 695003

Survey Contractor

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E-mail : info@shankarsurveys.com

Project

Oceanographic And Bathymetric Data Collection
For Assessment of Shoreline Changes

Drawing Title

Shoreline Monitoring Chart

Rev.No.	Description	Date
0	First issue	17.10.2023

Drawn : S. Khaire | Interpreted : Vishnu. R | Checked : V. Mehta

Dwg No. SSPL_P034-23_AVPPL_Shoreline_April to September 2023-03

Notes :

1. All coordinates are in WGS 84 datum, UTM grid system, Zone 43 North

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2023
- SHORELINE MAY 2023
- SHORELINE JUNE 2023
- SHORELINE JULY 2023
- SHORELINE AUGUST 2023
- SHORELINE SEPTEMBER 2023

Survey Notes

Surface Positioning	:	Geomax Zenith (GPS Mode)

Geodetic Parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.257223563D
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 5000

100 0 100 200 300 400 500metres

Key Plan

Client

ADANI VIZHINJAM PORT PVT. LTD.
3rD Floor, Aspinwall House,
Kawdiar Road, Kuravankonam,
Thiruvananthapuram - 695003

Survey Contractor

SHANKAR SURVEYS PVT.LTD
115, 1st Floor, Neco Chambers
Sector 11, CBD Belapur, Navi Mumbai
Tele/Fax:- 022 27562900
E-mail : info@shankarsurveys.com

Project

Oceanographic And Bathymetric Data Collection
For Assessment of Shoreline Changes

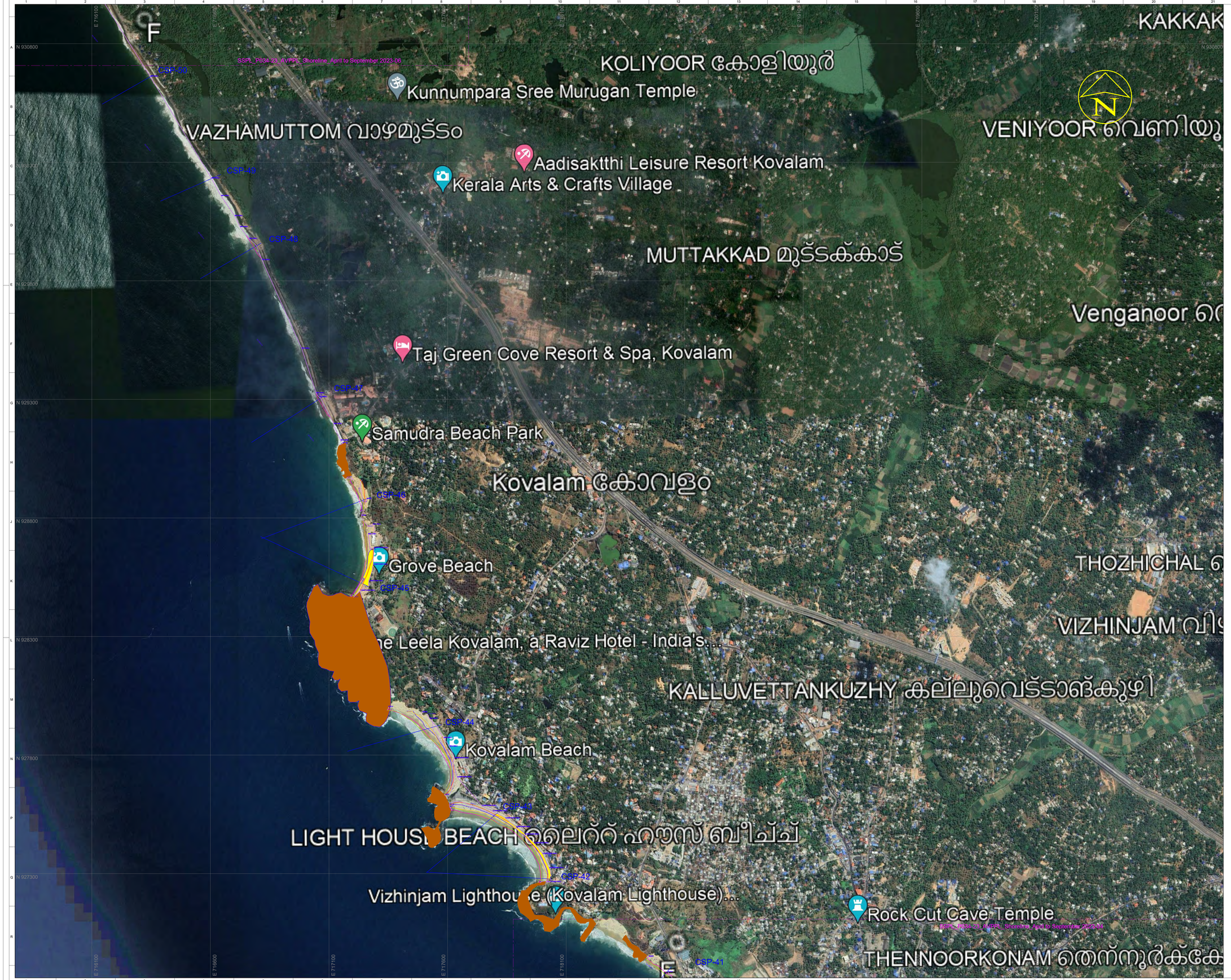
Drawing Title

Shoreline Monitoring Chart

Rev.No.	Description	Date
0	First issue	17.10.2023

Drawn : S. Khaire | Interpreted : Vishnu. R | Checked : V. Mehta

Dwg No. SSPL_P034-23_AVPPL_Shoreline_April to September 2023-04



Notes :

1. All coordinates are in WGS 84 datum, UTM grid system, Zone 43 North

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2023
- SHORELINE MAY 2023
- SHORELINE JUNE 2023
- SHORELINE JULY 2023
- SHORELINE AUGUST 2023
- SHORELINE SEPTEMBER 2023

Survey Notes

Surface Positioning : Geomax Zenith (GPS Mode)

Geodetic Parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 5000

100 0 100 200 300 400 500metres

Key Plan

Client

adani

ADANI VIZHINJAM PORT PVT. LTD.
3rD Floor, Aspinwall House,
Kawdiar Road, Kuravankonam,
Thiruvananthapuram - 695003

Survey Contractor

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115, 1st Floor, Neco Chambers
Sector 11, CBD Belapur, Navi Mumbai
Tele/Fax:- 022 27562900
E-mail : info@shankarsurveys.com

Project

Oceanograohic And Bathymetric Data Collection
For Assessment of Shoreline Changes

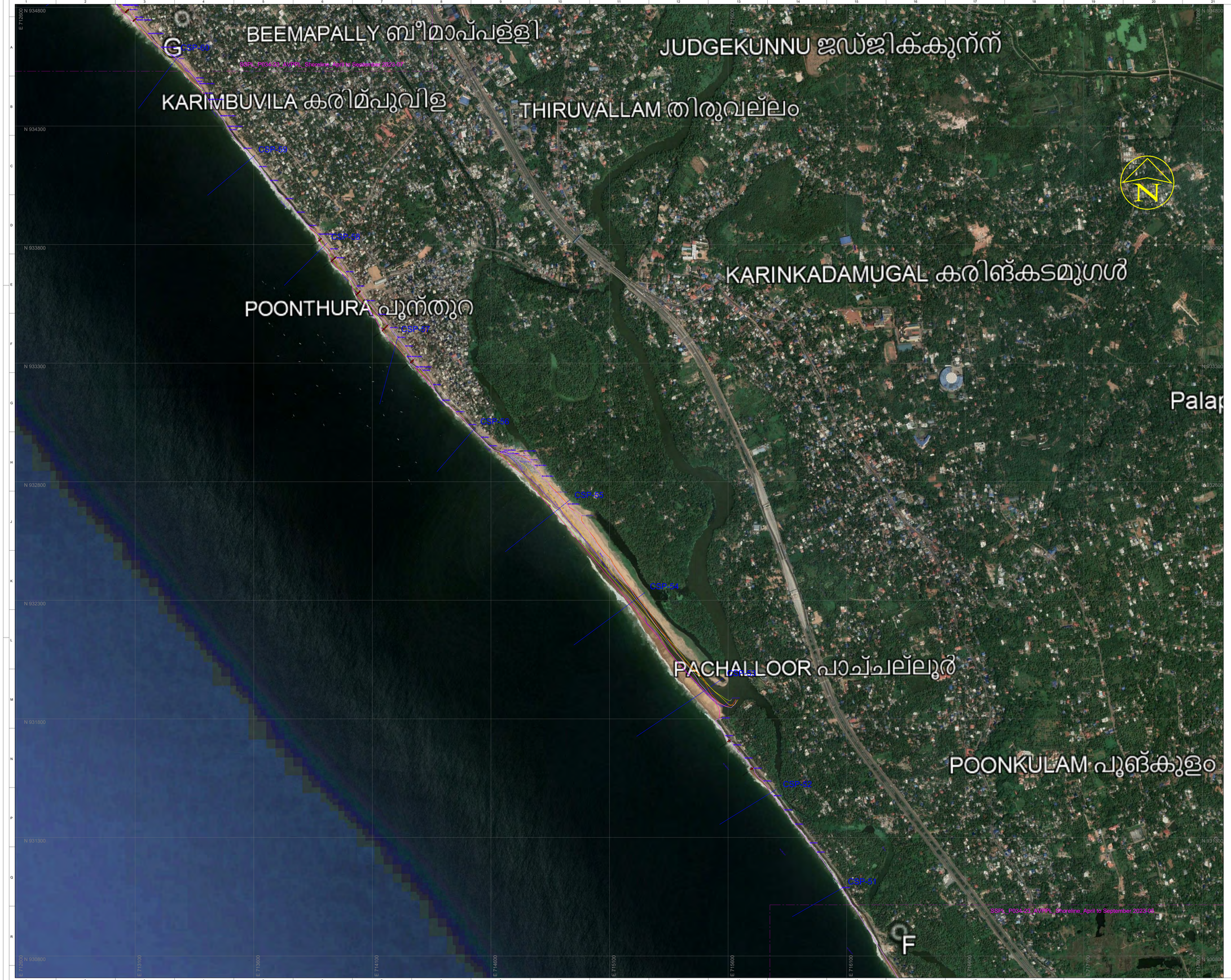
Drawing Title

Shoreline Monitoring Chart

Rev.No.	Description	Date
0	First issue	17.10.2023

Drawn : S. Khaire | Interpreted : Vishnu. R | Checked : V. Mehta

Dwg No. SSPL_P034-23_AVPPL_Shoreline_April to September 2023-05



Notes :

1. All coordinates are in WGS 84 datum, UTM grid system, Zone 43 North

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2023
- SHORELINE MAY 2023
- SHORELINE JUNE 2023
- SHORELINE JULY 2023
- SHORELINE AUGUST 2023
- SHORELINE SEPTEMBER 2023

Survey Notes

Surface Positioning : Geomax Zenith (GPS Mode)

Geodetic Parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 5000

100 0 100 200 300 400 500metres

Key Plan

Client

ADANI VIZHINJAM PORT PVT. LTD.
3rD Floor, Aspinwall House,
Kawdiar Road, Kuravankonam,
Thiruvananthapuram - 695003

Survey Contractor

SHANKAR SURVEYS PVT.LTD
115, 1st Floor, Neco Chambers
Sector 11, CBD Belapur, Navi Mumbai
Tele/Fax:- 022 27562900
E-mail : info@shankarsurveys.com

Project

Oceanographic And Bathymetric Data Collection
For Assessment of Shoreline Changes

Drawing Title

Shoreline Monitoring Chart

Rev.No.	Description	Date
0	First issue	17.10.2023

Drawn : S. Khaire | Interpreted : Vishnu. R | Checked : V. Mehta

Dwg No. SSPL_P034-23_AVPPL_Shoreline_April to September 2023-06

Notes :

1. All coordinates are in WGS 84 datum, UTM grid system, Zone 43 North

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2023
- SHORELINE MAY 2023
- SHORELINE JUNE 2023
- SHORELINE JULY 2023
- SHORELINE AUGUST 2023
- SHORELINE SEPTEMBER 2023

Survey Notes

Surface Positioning : Geomax Zenith (GPS Mode)

Geodetic Parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 5000

100 0 100 200 300 400 500metres

Key Plan

Client

ADANI VIZHINJAM PORT PVT. LTD.
3rD Floor, Aspinwall House,
Kawdiar Road, Kuravankonam,
Thiruvananthapuram - 695003

Survey Contractor

SHANKAR SURVEYS PVT.LTD
115, 1st Floor, Neco Chambers
Sector 11, CBD Belapur, Navi Mumbai
Tele/Fax:- 022 27562900
E-mail : info@shankarsurveys.com

Project

Oceanographic And Bathymetric Data Collection
For Assessment of Shoreline Changes

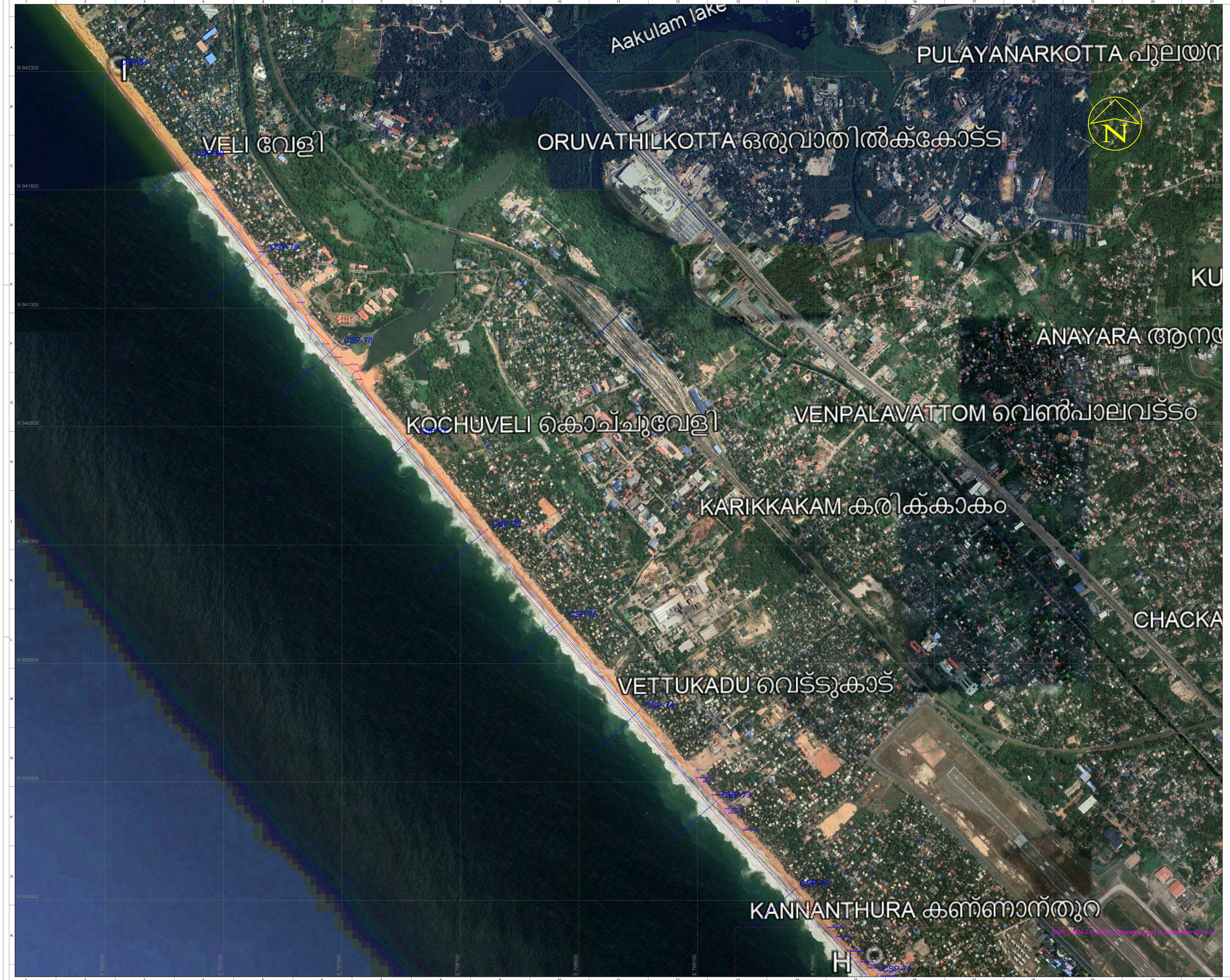
Drawing Title

Shoreline Monitoring Chart

Rev.No.	Description	Date
0	First issue	17.10.2023

Drawn : S. Khaire | Interpreted : Vishnu.R | Checked : V. Mehta

Dwg No. SSPL_P034-23_AVPPL_Shoreline_April to September 2023-07



Notes :

1. All coordinates are in WGS 84 datum, UTM grid system, Zone 43 North

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2023
- SHORELINE MAY 2023
- SHORELINE JUNE 2023
- SHORELINE JULY 2023
- SHORELINE AUGUST 2023
- SHORELINE SEPTEMBER 2023

Survey Notes

Surface Positioning : Geomax Zenith (GPS Mode)

Geodetic Parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 5000

100 0 100 200 300 400 500metres

Key Plan

Client

ADANI VIZHINJAM PORT PVT. LTD.
3rD Floor, Aspinwall House,
Kawdiar Road, Kuravankonam,
Thiruvananthapuram - 695003

Survey Contractor

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Project

Oceanographic And Bathymetric Data Collection
For Assessment of Shoreline Changes

Drawing Title

Shoreline Monitoring Chart

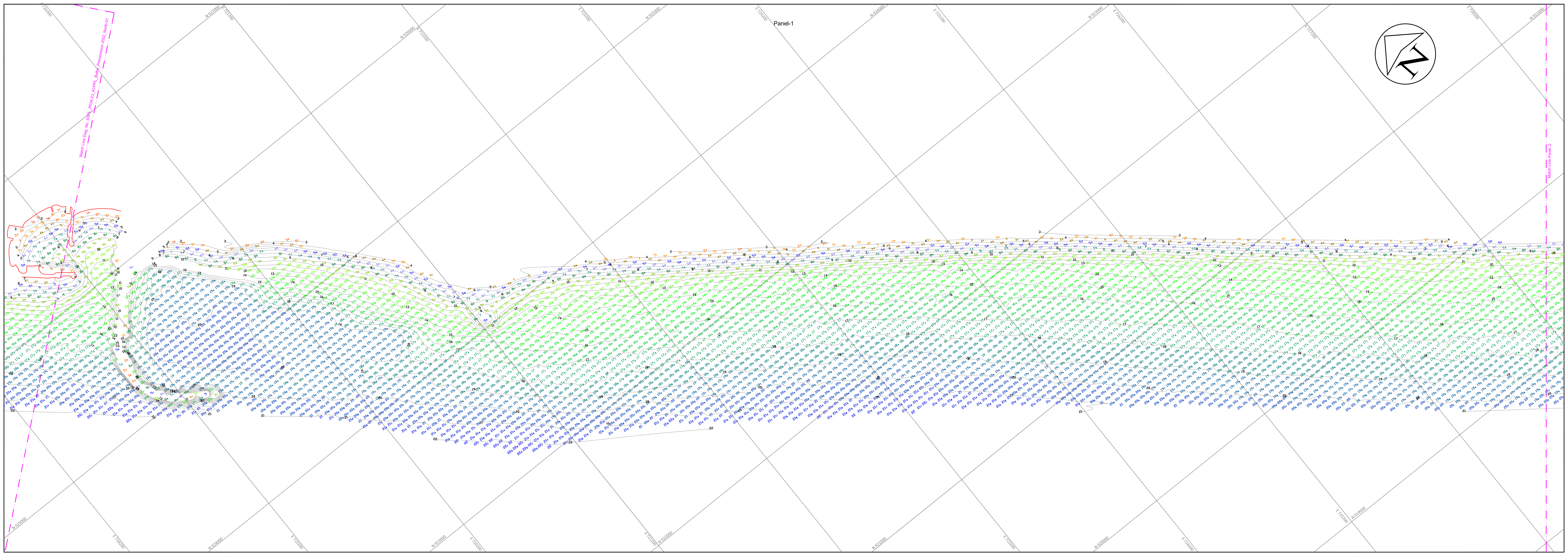
Rev.No.	Description	Date
0	First issue	17.10.2023

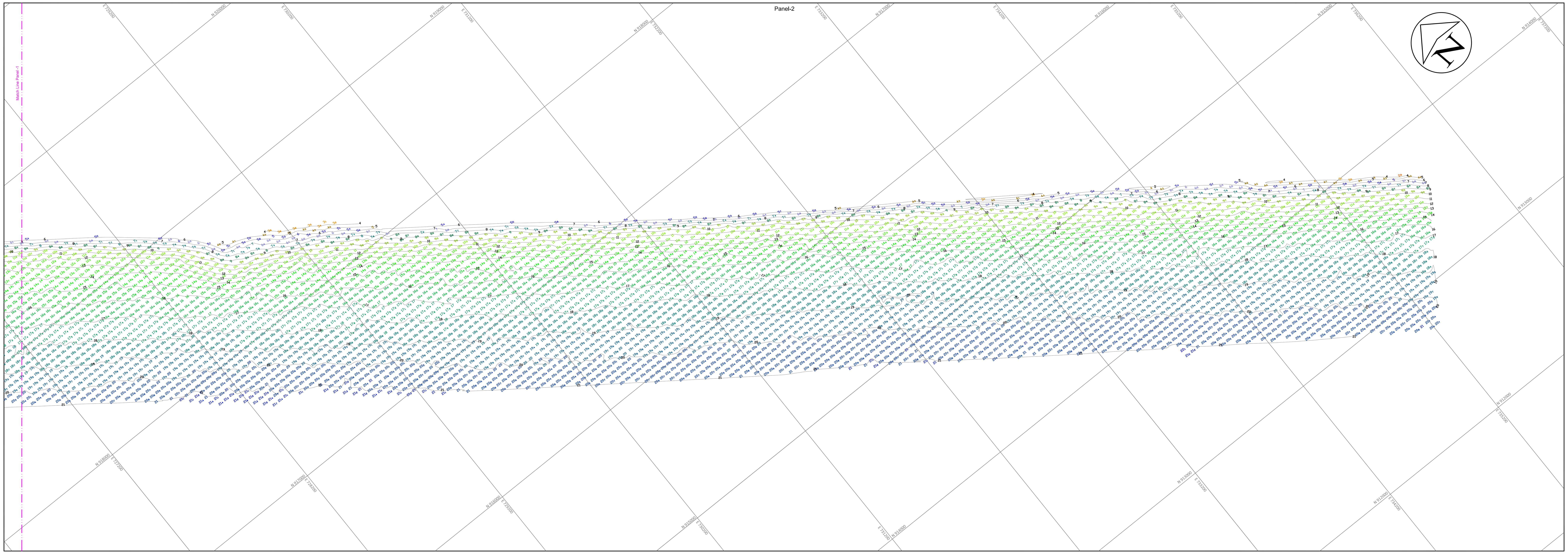
Drawn : S. Khaire | Interpreted : Vishnu.R | Checked : V. Mehta

Dwg No. SSPL_P034-23_AVPPL_Shoreline_April to September 2023-08

Annexure III

Representative Bathymetry Charts (Pre-monsoon 2023)





Notes :

1. The observed tide at Vizhinjam Harbour was used to reduce the raw bathy to Chart Datum.

LEGEND

UTM Grid Line & Text

Water Depth in metres and decimetres

Depth contours in metres below Chart Datum

Survey Notes

Survey Vessel	:	Bismi
Positioning System	:	Trimble SPS 461 DGPS System
Bathymetry acquired using	:	R2Sonic 2020 Multibeam Echo Sounder

Geodetic Parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

This AutoCAD drawing may only be used for the purpose for which it was assigned and in accordance with the terms of engagement for that assignment. Unauthorized use of this drawing in any form whatsoever is undertaken entirely at the users' risk

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan

Client

adani

ADANI VIZHINJAM PORT PVT. LTD.
3rd Floor, Aspinwall House,
Kawdiar Road, Kuravankonam,
Kerala - 695003

Advisor

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY
(MINISTRY OF EARTH SCIENCES, GOVT. OF INDIA)
NIOT Campus, Velachery - Tambaram Main Road,
Pallikaranai, Chennai - 600 100, INDIA
Phone: 6678 3325 / 3322 ; Fax: 91- 44 - 22460645

Survey Contractor

SHANKAR SURVEYS PVT. LTD
115, 1st Floor, Neco Chambers
Sector 11, CBD Belapur, Navi Mumbai
Tele/Fax:- 022 27562900
E-mail : info@shankarsurveys.com

Project

Oceanographic & Bathymetric Data Collection
For Assessment of Shoreline Changes
For
Adani Vizhinjam Port Pvt. Ltd.

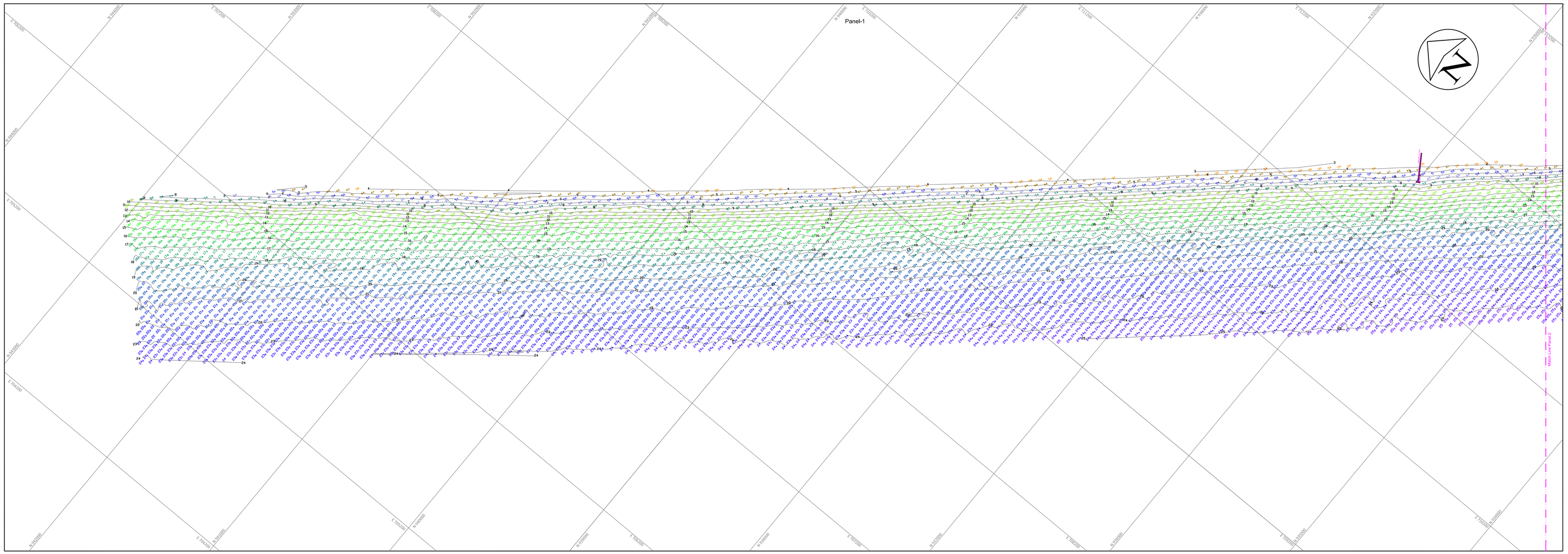
Drawing Title

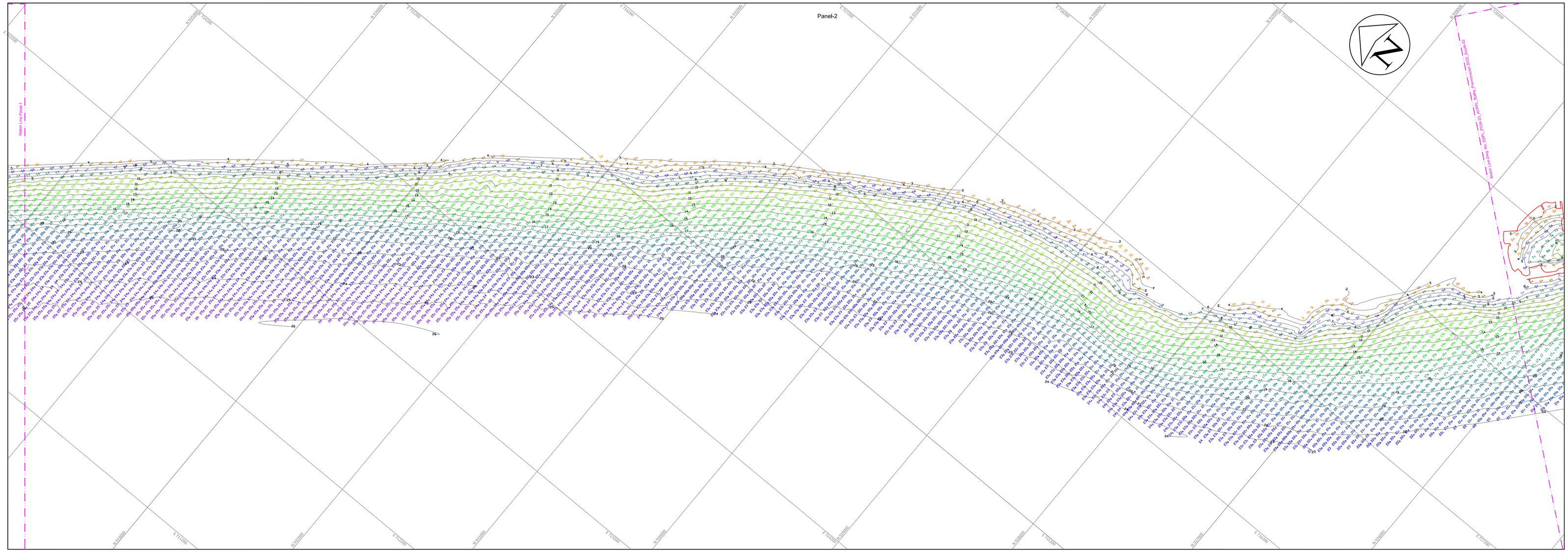
Bathymetry Chart

Rev.No.	Description	Date
0	First issue	04.07.2023

Drawn : S. Khaire	Interpreted : V. Kottukara	Checked : V. Mehta	Approved :

Dwg. No. SSPL_P034-23_AVPPL_Bathy_Premonsoon 2023_South-02





Notes :

1. The observed tide at Vizhinjam Harbour was used to reduce the raw bathy to Chart Datum.

LEGEND

UTM Grid Line & Text

Water Depth in metres and decimetres

Depth contours in metres below Chart Datum

Survey Notes

Survey Vessel	:	Bitmi
Positioning System	:	Trimble SPS 461 DGPS System
Bathymetry acquired using	:	R2Sonic 2020 Multibeam Echo Sounder

Geodetic Parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.257223530
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan

Client

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Bathymetry Chart

Rev.No.	Description	Date
0	First Issue	04.07.2023

Drawn : S. Khaire	Interpreted : V. Kottukara	Checked : V. Mehta	Approved :

Dwg. No. SSPL_P034-23_AVPPL_Bathy_Premonsoon 2023_North-01

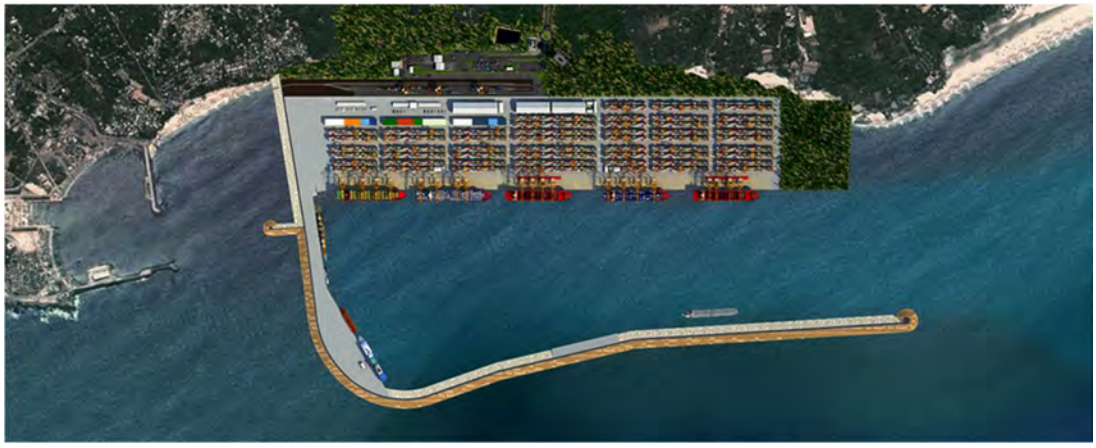
Annexure IV

Environment Monitoring Report

(April 2023 to September 2023)

HALF-YEARLY ENVIRONMENT MONITORING REPORT

FOR THE PERIOD APRIL 2023 TO SEPTEMBER 2023



ADANI VIZHINJAM PORT PVT. LTD. VIZHINJAM, KERALA

Report No.: SEAAL/EMR-AVPPL-2324HY-I

Report Date: 25th OCTOBER, 2023

This Report presents the discussion and the results of Environmental Monitoring at Adani Vizhinjam Port. The monitoring has been conducted and the report has been prepared & issued by Standards Environmental & Analytical Laboratories, Ernakulum-683110 to M/s Adani Vizhinjam Port Pvt Limited, Thiruvananthapuram-695 014

HYR-A	Table of Contents

HYR-1	Introduction

Standards Environmental & Analytical Laboratories is an organization providing Testing Services, Technical Consultancy for Environmental Pollution Control, Designing, Commissioning & Operation of Effluent & Sewage Treatment Plants to clients of various industries, Hotels, Hospitals & Building Apartments. It provides various training for industries and for the budding scientists.

Standards Environmental & Analytical Laboratories was established in 2013 at K.J. Tower, Pathalam, Udhyogamandal, Ernakulam – 683501. The Lab has built a state of art building of 7000 sq. Ft. with fully furnished at 'Standards', Building No. 338/A, B, C, D, E, (Behind BPCL Petrol Pump), Edayar, Muppathadam, P.O., Ernakulam – 683110. The lab is relocated to the new building in June, 2023.It has been provided with sophisticated instruments such as GC-MS, AAS, UV Spectrophotometer, Flame Photometer and other Supporting Instruments with required accuracy & precision.

Standards is guided and lead by highly qualified scientists with rich experiences. Its technical personnel are well trained and competent and dedicated.

Testing Laboratory of Standards is accredited as per ISO/IEC 17025:2017 by NABL for testing of Food & Agricultural Products, Water and Environmental Samples, Medical Accessories under Chemical & Biological Disciplines. It is an "A" Grade laboratory certified by Kerala State Pollution Control Board (KSPCB). It delivers reliable testing services on time to the customers after ensuring the compliance of each stage of the testing activities to the stringent Quality Control and Quality Assurance Criteria established by international forums.

Standards gives Technical Consultancy in the field of Water & Wastewater Treatment and has completed a number of Turn-Key projects to solve the water pollution issues for different clients and making them compliant to the statutory requirements.

Standards had been engaged by Adani Vizhinjam Port Pvt. Ltd. (AVPPL) for performing Environmental Monitoring as per the Plan mentioned in EIA and EC.

AVPPL issued Service Order vide email dated 11-07-2022 which mentions the matrix, parameters, and frequency of environmental monitoring. Standards carried out said environmental monitoring strictly as per above mentioned service order, viz. Ambient Air Monitoring (twice in a week), Ambient Noise Monitoring (fortnightly), Marine Ecological Survey including marine water, sediment, phytoplankton, and zooplankton analysis (monthly), Ground Water and Surface Water Analysis (monthly), Soil Analysis (yearly).

Standards submits monthly reports of Environmental Monitoring which includes details of sampling locations, methodology used, analytical results and summary of reports. The monthly environmental monitoring report provides the information about the present environmental status as per terms and conditions mentioned in service order.

This present report is the consolidated half yearly report over the period from April 2023 to September 2023.

HYR-2	Quality Assurance & Quality Control

The quality assurance and quality control plan include following elements:

- Monitoring and Collection, Preservation &Transportation of samples;
- Sample Registration, Chain of Custody & Report Preparation;
- Laboratory Analysis& Review of Results; and
- Validation of Technical Activities.

HYR-2.1. Monitoring and Collection, Preservation & Transportation of samples:

The authorized Laboratory Sampling Team prepares the checklist for the required Sampling Kits, other auxiliary equipment and Sampling Procedures including Datasheets. The team collects the required items as per the list and visits the sampling site.

The team identifies the appropriate monitoring location as per the agreement and keeps the sampling kits at the identified location. The team notes down the environmental conditions of the site in the sampling data sheets and all other required information. Then the team starts the monitoring activity.

Periodically the team inspects the status of the conditions of the sampling kits and records the necessary data on the sampling data sheet as per the requirements.

After the completion of monitoring as per PCB standards, the team collects the samples and preserves them safely and securely in an appropriately labelled container as per the procedure to prevent from contamination and deterioration.

Then the team returns to the laboratory and takes due care to maintain the integrity of the samples during transport. The team submits the samples and sampling data sheets to the Executives - Sample Registration.

HYR-2.2. Sample Registration, Chain of Custody& Report Preparation:

After receiving the samples, the Executive - Sample Registration examines the sample conditions and the sampling data sheets along with the agreement as per the Checklist and records the findings.

The executive registers the samples for testing in the Sample Entry Register and assigns the unique Sample Code for each sample only if all the criteria are fulfilled. The Executive prepares the Job Card for each sample as per the agreement and enters the allotted Sample Code in the Job Card and on the Test Item. The Test Item is identified throughout its life in the laboratory only by the unique Sample Code.

The executive then delivers the sample to the respective section of the Laboratory and the Job Card along with necessary sampling details required for performing the analysis excluding the details of the origin of the samples. The delivery is recorded in the Sample Delivery Register and the same is acknowledged by the Laboratory Technical personnel.

The information available in the Job Card are the test parameters to be performed, test method to be adopted, units in which the analytical results to be expressed, the due date for completion of analysis and the details about sample storage and retention conditions.

The executive submits the other Customer information and Sample details to the Reporting Section for preparing the Test Reports.

After completion of analysis, the technical personnel enter all the results and dates of analysis in the Job Card and submit the same to Reporting Section.

The Reporting Executive decodes the Job Card with the Test Request details, prepares the Draft Report as per the respective report format and submits the draft report to the Authorized Signatory. This draft report is verified and returned to the Reporting Section for making the final report. Final reports are prepared by

the Reporting Executive with necessary corrections if any and authorized by the Authorized Signatory. Then the Final Test Report is delivered to the customer.

HYR-2.3. Laboratory Analysis& Review of Test Results:

After receiving the Test Items along with the Job Card, the Technical Manager allots the Job to the authorized Technical Personnel. The assigned Technical Personnel performs the allotted tests as per the method mentioned in the Job Card as well as the required Quality Control Checks (QC) and submits the results to the Technical Manger. The Technical Personnel confirms that all the required calibration status of the equipment is valid and the Certified Reference Material are valid. Also, the Technical Personnel ensures that the results of daily verification conform to the specified criteria.

The Technical Manager reviews the results of samples & QC checks and approves the results only if the results of QC checks are compliance to the Acceptance Criteria. Then the Job Card is submitted to the Reporting Section.

HYR-2.4. Validation of Technical Activities:

For the validation of Technical Activities, the laboratory performs Internal Quality Assurance Check, Proficiency Testing and Inter Laboratory Comparison. The Quality Assurance Team prepares Annual Internal Quality Assurance Check (IQC) Plan, Inter laboratory Comparison (ILC)/ Proficiency Testing (PT) Plan.

As per the IQA plan, Quality Assurance Team prepare and send the Test Items to the respective section of the Laboratory. After getting the results, Quality Assurance team evaluates the results against the predefined criteria. The results of evaluation are submitted and discussed during Management Review meeting.

Quality Assurance Team identify and register the suitable PT Scheme authorized by NABL. Also, Quality Assurance Team identifies suitable ILC or conducts by covering at least five NABL accredited Laboratories.

If the QA team conducts ILC, then they evaluate the performance and calculate the Z-score after getting the results of the participating laboratories.

The acceptance criteria for the ILC/PT is ±2. The summary of the PT/ILC is prepared and discussed during the Management Review Meeting.

The Quality Assurance Team monitors the performance of the Laboratory activities by conducting Internal Quality Audits and Vertical Audit periodically. The Audit reports are prepared and discussed during the Management Review Meeting.

HYR-3	Ambient Air Quality Monitoring

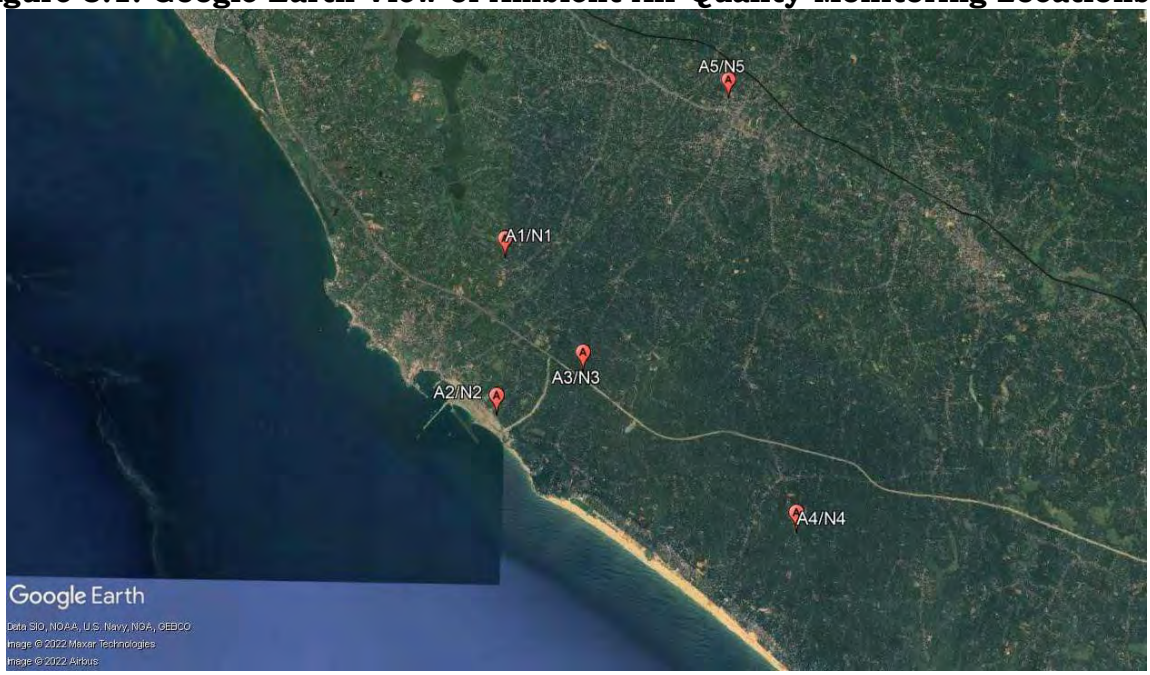
HYR-3.1. Ambient Air Quality Monitoring location details:

This section describes the sampling location, methodology adopted for monitoring and analysis of Ambient Air Quality. The prime objective of the environment monitoring with respect to Ambient Air Quality is to establish the air quality of present condition and its conformity to Applicable Standards. Ambient Air quality monitoring was carried out at five (5) locations including Venganoor, Port Site, Proposed Port Estate Area, Chani and Balarampuram from April 2023 to September 2023.

Table 3.1: Coordinates of Ambient Air Quality Monitoring Locations

Location	Legend	Latitude	Longitude
Venganoor	A1	8°23'55.10"N	77°00'12.19"E
Port Site	A2	8°22'13.73"N	77°00'08.39"E
Proposed Port Estate Area	A3	8°22'41.37"N	77°01'03.17"E
Chani	A4	8°21'02.11"N	77°03'16.59"E
Balarampuram	A5	8°25'43.73"N	77°02'39.99"E

Figure 3.1: Google Earth View of Ambient Air Quality Monitoring Locations



HYR-3.2. Methodology of Sampling and Analysis:

Table 3.2: Ambient Air Quality Monitoring Methodology

Sl. No.	Parameter	Unit	Detection Limit	Method Reference
1.	Particulate Matter (size less than 10 µm) or PM_{10}	µg/m³	5.0	IS 5182 (Part 23): 2006
2.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m³	2.0	EPA 40 CFR Part 50Appendix-L: 1997
3.	Sulphur Dioxide (SO_2)	µg/m³	2.0	IS 5182 (Part 2): 2001
4.	Nitrogen Dioxide (NO_2)	µg/m³	2.0	IS 5182 (Part 6): 2006
5.	Carbon Monoxide (CO)	mg/m³	1.15	IS 5182 (Part 10):1999 (NDIR Method)
6.	Hydrocarbon (HC)	ppm	0.0003	IS 5182 (Part 17):1979

HYR-3.3. National Ambient Air Quality Standards (NAAQS):

Table 3.3: National Ambient Air Quality Standards dated 16th November 2009

Sl. No.	Pollutant, Unit	Time Weighted Average	Concentration in Ambient Air	
			Industrial, Residential, Rural & other areas	Ecologically Sensitive Areas
1.	Sulphur dioxide (SO_2), µg/m³	Annual	50	20
		24 h	80	80
2.	Nitrogen Dioxide (NO_2), µg/m³	Annual	40	30
		24 h	80	80
3.	Particulate matter (size less than 10µm) or PM_{10}, µg/m³	Annual	60	60
		24 h	100	100
4.	Particulate matter (size less than 2.5µm) or $PM_{2.5}$, µg/m³	Annual	40	40
		24 h	60	60
5.	Carbon Monoxide (CO), mg/m³	8 h	02	02
		1 h	04	04
6.	Hydrocarbon (HC), ppm	-	-	-

HYR-3.4. Ambient Air Quality Monitoring Results for the period from April 2023 to September 2023:

Table 3.4: Location – Venganoor (A1)

Venganoor (A1)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03-04-2023	58.9	33.6	4.39	5.71	BDL	BDL
06-04-2023	56.3	31.3	4.27	5.68	BDL	BDL
10-04-2023	65.1	37.9	4.73	6.23	BDL	BDL
13-04-2023	63.8	35.4	4.64	6.49	BDL	BDL
18-04-2023	59.5	30.5	4.58	6.34	BDL	BDL
20-04-2023	57.2	34.2	4.41	5.87	BDL	BDL
24-04-2023	56.7	32.4	4.36	5.63	BDL	BDL
27-04-2023	61.2	33.6	4.42	6.11	BDL	BDL
01-05-2023	64.8	33.2	4.12	5.45	BDL	BDL
04-05-2023	68.4	35.2	4.89	6.20	BDL	BDL
08-05-2023	70.2	36.8	4.25	5.79	BDL	BDL
11-05-2023	67.3	34.2	4.55	6.26	BDL	BDL
15-05-2023	50.1	26.3	4.23	6.78	BDL	BDL
18-05-2023	64.2	33.5	4.28	5.49	BDL	BDL
22-05-2023	63.8	32.8	4.22	5.48	BDL	BDL
25-05-2023	67.4	34.6	4.10	6.25	BDL	BDL
29-05-2023	55.2	28.6	4.36	5.96	BDL	BDL
01-06-2023	53.2	28.4	4.26	4.85	BDL	BDL
05-06-2023	58.7	30.1	4.35	5.36	BDL	BDL
08-06-2023	65.4	32.6	4.51	5.92	BDL	BDL
12-06-2023	51.9	25.3	4.34	4.73	BDL	BDL
15-06-2023	56.8	27.4	4.37	5.32	BDL	BDL
19-06-2023	54.6	28.3	4.11	6.16	BDL	BDL
22-06-2023	61.3	33.6	4.46	6.58	BDL	BDL
26-06-2023	63.2	32.9	4.59	6.41	BDL	BDL
29-06-2023	53.2	30.7	4.25	5.64	BDL	BDL
03-07-2023	59.4	25.3	4.56	4.99	BDL	BDL

Venganoor (A1)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
06-07-2023	52.7	23.9	4.13	4.82	BDL	BDL
10-07-2023	58.6	28.1	4.33	5.11	BDL	BDL
13-07-2023	60.2	29.6	4.66	5.38	BDL	BDL
17-07-2023	50.9	24.2	4.22	4.85	BDL	BDL
20-07-2023	58.1	26.7	4.56	5.18	BDL	BDL
24-07-2023	65.7	29.1	4.69	5.36	BDL	BDL
27-07-2023	57.3	26.2	4.23	5.41	BDL	BDL
31-07-2023	60.2	32.6	4.98	5.22	BDL	BDL
03-08-2023	66.2	30.6	4.96	5.38	BDL	BDL
07-08-2023	58.4	27.8	4.55	5.07	BDL	BDL
10-08-2023	63.1	31.2	4.60	4.99	BDL	BDL
14-08-2023	55.2	22.7	4.25	4.82	BDL	BDL
17-08-2023	60.5	29.1	4.58	5.11	BDL	BDL
21-08-2023	67.1	35.3	4.95	5.51	BDL	BDL
24-08-2023	58.6	24.3	4.37	4.89	BDL	BDL
27-08-2023	52.9	22.4	4.11	4.79	BDL	BDL
31-08-2023	56.7	25.6	4.57	5.03	BDL	BDL
04-09-2023	75.3	37.8	4.99	5.89	BDL	BDL
07-09-2023	69.3	33.6	4.86	5.67	BDL	BDL
11-09-2023	71.1	34.5	4.71	5.42	BDL	BDL
14-09-2023	67.5	31.4	4.36	5.52	BDL	BDL
19-09-2023	66.9	32.9	4.51	5.49	BDL	BDL
21-09-2023	62.5	29.5	4.42	5.35	BDL	BDL
25-09-2023	59.7	27.3	4.68	5.26	BDL	BDL
28-09-2023	57.4	26.4	4.39	5.19	BDL	BDL
NAAQS 2009 Limits	**100**	**60**	**80**	**80**	**4**	**-**

BDL: Below Detectable Limit

Table 3.5: Location – Project Site (A2)

Project Site (A2)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03-04-2023	74.6	38.2	5.26	6.74	BDL	BDL
06-04-2023	69.3	35.9	4.73	6.35	BDL	BDL
10-04-2023	61.8	32.7	4.61	5.92	BDL	BDL
13-04-2023	73.6	38.5	5.37	6.83	BDL	BDL
18-04-2023	77.1	41.3	5.84	7.41	BDL	BDL
20-04-2023	68.2	39.4	5.07	6.96	BDL	BDL
24-04-2023	73.9	38.8	5.22	7.17	BDL	BDL
27-04-2023	75.4	41.1	5.48	7.29	BDL	BDL
01-05-2023	62.3	32.9	4.63	5.78	BDL	BDL
04-05-2023	75.8	38.1	4.13	5.46	BDL	BDL
08-05-2023	68.3	35.8	5.01	6.89	BDL	BDL
11-05-2023	57.9	29.1	5.12	6.45	BDL	BDL
15-05-2023	64.8	33.2	4.88	5.96	BDL	BDL
18-05-2023	56.2	29.4	4.77	5.91	BDL	BDL
22-05-2023	60.6	31.6	4.66	6.02	BDL	BDL
25-05-2023	77.5	39.4	4.22	5.79	BDL	BDL
29-05-2023	61.4	31.7	5.36	7.12	BDL	BDL
01-06-2023	66.3	34.4	4.82	5.97	BDL	BDL
05-06-2023	62.5	31.9	4.76	5.72	BDL	BDL
08-06-2023	59.2	30.2	4.65	5.83	BDL	BDL
12-06-2023	63.7	38.1	5.42	6.11	BDL	BDL
15-06-2023	56.2	35.7	4.53	5.54	BDL	BDL
19-06-2023	59.3	36.5	4.81	5.86	BDL	BDL
22-06-2023	68.5	39.9	5.47	6.37	BDL	BDL
26-06-2023	71.2	40.6	5.65	6.83	BDL	BDL
29-06-2023	68.3	37.3	5.48	6.62	BDL	BDL
03-07-2023	60.9	27.2	4.29	4.95	BDL	BDL
06-07-2023	66.4	33.7	4.48	5.19	BDL	BDL
10-07-2023	54.8	25.4	4.38	4.99	BDL	BDL
13-07-2023	58.6	26.9	4.87	5.36	BDL	BDL

Project Site (A2)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
17-07-2023	61.3	28.5	4.28	5.13	BDL	BDL
20-07-2023	56.7	29.1	4.54	5.35	BDL	BDL
24-07-2023	62.5	31.3	4.86	5.92	BDL	BDL
27-07-2023	69.7	33.6	5.14	5.98	BDL	BDL
31-07-2023	63.9	30.5	4.82	5.13	BDL	BDL
03-08-2023	69.2	35.7	4.69	5.37	BDL	BDL
07-08-2023	70.8	36.6	4.92	5.54	BDL	BDL
10-08-2023	61.5	29.4	4.57	4.88	BDL	BDL
14-08-2023	65.3	30.7	4.63	5.19	BDL	BDL
17-08-2023	67.6	32.5	4.60	5.29	BDL	BDL
21-08-2023	62.4	32.1	4.73	5.10	BDL	BDL
24-08-2023	54.9	25.6	4.18	4.60	BDL	BDL
27-08-2023	51.4	22.2	4.39	4.91	BDL	BDL
31-08-2023	56.9	23.5	4.48	4.87	BDL	BDL
04-09-2023	77.1	32.5	4.86	5.51	BDL	BDL
07-09-2023	75.7	35.3	4.71	5.28	BDL	BDL
11-09-2023	68.5	28.1	4.66	5.00	BDL	BDL
14-09-2023	69.7	33.1	4.68	5.30	BDL	BDL
19-09-2023	71.1	35.1	4.29	4.91	BDL	BDL
21-09-2023	68.4	29.4	4.44	4.85	BDL	BDL
25-09-2023	62.3	30.6	4.38	4.72	BDL	BDL
28-09-2023	61.8	28.0	4.26	5.11	BDL	BDL
NAAQS 2009 Limits	**100**	**60**	**80**	**80**	**4**	**-**

BDL: Below Detectable Limit

Table 3.6: Location – Proposed Port Estate Area (A3)

Proposed Port Estate Area (A3)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03-04-2023	51.6	26.7	4.16	5.62	BDL	BDL
06-04-2023	50.2	27.1	4.35	5.37	BDL	BDL

Proposed Port Estate Area (A3)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
10-04-2023	54.7	30.5	4.29	5.69	BDL	BDL
13-04-2023	62.3	32.9	4.31	5.33	BDL	BDL
18-04-2023	57.9	33.6	4.09	5.81	BDL	BDL
20-04-2023	63.5	34.3	4.48	5.49	BDL	BDL
24-04-2023	59	31.8	4.30	5.54	BDL	BDL
27-04-2023	61.8	32.5	4.19	5.61	BDL	BDL
01-05-2023	58.6	30.1	4.40	5.86	BDL	BDL
04-05-2023	55.2	28.40	4.22	5.45	BDL	BDL
08-05-2023	62.1	32.60	4.78	6.12	BDL	BDL
11-05-2023	68.6	35.9	4.25	5.78	BDL	BDL
15-05-2023	64.2	33.1	4.55	6.4	BDL	BDL
18-05-2023	70.8	36.4	4.12	5.84	BDL	BDL
22-05-2023	55.4	28.3	4.355	6.25	BDL	BDL
25-05-2023	60.1	31.7	4.03	5.26	BDL	BDL
29-05-2023	67.6	34.5	4.44	5.92	BDL	BDL
01-06-2023	53.5	27.6	4.56	5.12	BDL	BDL
05-06-2023	59.1	31.2	4.74	5.63	BDL	BDL
08-06-2023	52.7	33.9	4.16	4.88	BDL	BDL
12-06-2023	57.3	34.5	4.46	5.34	BDL	BDL
15-06-2023	62.9	35.8	4.31	5.92	BDL	BDL
19-06-2023	65.6	36.1	4.87	5.53	BDL	BDL
22-06-2023	62.4	38.4	4.73	5.64	BDL	BDL
26-06-2023	56.7	33.4	4.26	5.39	BDL	BDL
29-06-2023	63.9	36.1	4.65	5.97	BDL	BDL
03-07-2023	59.7	24.8	4.18	4.75	BDL	BDL
06-07-2023	55.1	26.8	4.59	5.08	BDL	BDL
10-07-2023	60.4	28.5	4.65	5.27	BDL	BDL
13-07-2023	63.5	29.4	4.98	5.67	BDL	BDL
17-07-2023	57.6	30.5	4.10	4.92	BDL	BDL
20-07-2023	53.2	25.9	4.45	5.23	BDL	BDL
24-07-2023	59.5	28.8	4.39	5.15	BDL	BDL
27-07-2023	65.4	35.1	4.98	5.87	BDL	BDL

Proposed Port Estate Area (A3)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
31-07-2023	59.4	28.9	4.38	4.89	BDL	BDL
03-08-2023	52.6	21.8	4.68	5.12	BDL	BDL
07-08-2023	48.9	20.5	4.12	4.69	BDL	BDL
10-08-2023	55.2	23.4	4.33	4.92	BDL	BDL
14-08-2023	50.7	26.3	4.26	5.20	BDL	BDL
17-08-2023	54.5	23.6	4.00	4.92	BDL	BDL
21-08-2023	57.1	28.3	4.78	5.19	BDL	BDL
24-08-2023	66.2	30.5	4.62	5.39	BDL	BDL
27-08-2023	58.9	29.3	4.55	5.09	BDL	BDL
31-08-2023	65.8	33.9	4.79	5.44	BDL	BDL
04-09-2023	72.6	32.2	4.35	5.23	BDL	BDL
07-09-2023	65.2	28.6	4.20	5.15	BDL	BDL
11-09-2023	70.4	31.8	4.62	5.48	BDL	BDL
14-09-2023	66.3	31.3	4.39	5.37	BDL	BDL
19-09-2023	63.9	28.8	4.23	5.55	BDL	BDL
21-09-2023	69.2	35.1	4.62	5.69	BDL	BDL
25-09-2023	73.4	32.1	4.55	5.78	BDL	BDL
28-09-2023	67.5	33.5	4.35	5.41	BDL	BDL
NAAQS 2009 Limits	**100**	**60**	**80**	**80**	**4**	**-**

BDL: Below Detectable Limit

Table 3.7: Location – Chani (A4)

Chani (A4)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03-04-2023	56.3	31.6	4.26	5.67	BDL	BDL
06-04-2023	59.2	34.9	4.72	5.86	BDL	BDL
10-04-2023	53.7	32.5	4.19	5.41	BDL	BDL
13-04-2023	56.1	29.4	4.35	5.23	BDL	BDL
18-04-2023	50.8	27.6	4.11	5.65	BDL	BDL
20-04-2023	52.6	28.5	4.16	5.72	BDL	BDL

Chani (A4)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
24-04-2023	54.3	32.7	4.25	5.86	BDL	BDL
27-04-2023	59.4	33.5	4.48	5.93	BDL	BDL
01-05-2023	64.2	33.8	4.55	5.96	BDL	BDL
04-05-2023	55.6	28.2	4.22	5.7	BDL	BDL
08-05-2023	60.1	31.5	4.36	5.84	BDL	BDL
11-05-2023	66.3	34.8	4.12	5.77	BDL	BDL
15-05-2023	58.4	30.1	4.28	5.89	BDL	BDL
18-05-2023	61.2	31.7	4.25	5.61	BDL	BDL
22-05-2023	67.7	34.8	4.11	5.63	BDL	BDL
25-05-2023	65.4	33.1	4.72	5.88	BDL	BDL
29-05-2023	67.3	34.9	4.26	5.91	BDL	BDL
01-06-2023	57.1	30.6	4.31	5.47	BDL	BDL
05-06-2023	58.4	31.4	4.46	5.65	BDL	BDL
08-06-2023	53.2	26.7	4.25	4.81	BDL	BDL
12-06-2023	56.2	27.1	4.29	4.93	BDL	BDL
15-06-2023	56.6	28.3	4.47	5.14	BDL	BDL
19-06-2023	59.5	29.2	4.62	5.38	BDL	BDL
22-06-2023	62.6	32.6	4.74	5.83	BDL	BDL
26-06-2023	51.8	25.9	4.33	4.97	BDL	BDL
29-06-2023	56.7	29.4	4.41	5.34	BDL	BDL
03-07-2023	52.8	26.7	4.65	5.17	BDL	BDL
06-07-2023	56.5	29.3	4.89	5.35	BDL	BDL
10-07-2023	50.9	22.9	4.09	4.72	BDL	BDL
13-07-2023	57.2	26.8	4.56	5.1	BDL	BDL
17-07-2023	60.8	25.6	4.3	4.83	BDL	BDL
20-07-2023	55.5	24.9	4.25	4.98	BDL	BDL
24-07-2023	59.1	28.6	4.22	5.18	BDL	BDL
27-07-2023	56.8	27.3	4.62	5.12	BDL	BDL
31-07-2023	62.7	31.5	4.87	5.69	BDL	BDL
03-08-2023	57.3	28.8	4.49	5.01	BDL	BDL
07-08-2023	61.8	32.1	4.62	5.21	BDL	BDL
10-08-2023	56.7	26.2	4.38	4.98	BDL	BDL

Chani (A4)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
14-08-2023	50.9	23.4	4.21	4.79	BDL	BDL
17-08-2023	56.5	27.9	4.66	5.11	BDL	BDL
21-08-2023	62.7	29.3	4.53	5.06	BDL	BDL
24-08-2023	65.9	33.8	4.46	5.24	BDL	BDL
27-08-2023	64.3	30.6	4.59	5.31	BDL	BDL
31-08-2023	67.6	34.2	4.71	5.45	BDL	BDL
04-09-2023	65.3	33.2	4.68	5.37	BDL	BDL
07-09-2023	60.1	27.5	4.75	5.16	BDL	BDL
11-09-2023	69.6	35.7	4.61	5.47	BDL	BDL
14-09-2023	62.5	30.3	4.15	4.68	BDL	BDL
19-09-2023	70.5	34.1	4.50	4.91	BDL	BDL
21-09-2023	75.2	37.1	4.69	5.42	BDL	BDL
25-09-2023	67.8	34.4	4.42	5.20	BDL	BDL
28-09-2023	59.8	26.6	4.31	4.92	BDL	BDL
NAAQS 2009 Limits	**100**	**60**	**80**	**80**	**4**	**-**

BDL: Below Detectable Limit

Table 3.8: Location – Balarampuram (A5)

Balarampuram (A5)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03-04-2023	58.5	34.3	4.62	5.56	BDL	BDL
06-04-2023	69.3	39.6	4.75	6.23	BDL	BDL
10-04-2023	61.7	37.4	4.81	5.92	BDL	BDL
13-04-2023	64.6	41.9	4.96	6.07	BDL	BDL
18-04-2023	68.2	43.1	5.11	6.36	BDL	BDL
20-04-2023	58.4	36.3	4.27	5.93	BDL	BDL
24-04-2023	65.9	38.6	4.87	6.17	BDL	BDL
27-04-2023	56.1	31.7	4.36	5.82	BDL	BDL
01-05-2023	64.5	33.1	4.12	5.89	BDL	BDL
04-05-2023	55.2	28.6	4.23	6.08	BDL	BDL

Balarampuram (A5)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
08-05-2023	54.6	28.3	4.11	5.78	BDL	BDL
11-05-2023	70.1	36.4	4.25	6.15	BDL	BDL
15-05-2023	60.2	31.4	5.45	7.23	BDL	BDL
18-05-2023	62.4	31.9	4.63	6.15	BDL	BDL
22-05-2023	56.3	29.7	4.52	6.86	BDL	BDL
25-05-2023	50.3	26.6	4.12	5.78	BDL	BDL
29-05-2023	62.5	32.8	4.21	5.96	BDL	BDL
01-06-2023	59.7	32.6	4.35	5.75	BDL	BDL
05-06-2023	61.4	34.3	4.56	5.96	BDL	BDL
08-06-2023	57.9	30.7	4.43	5.51	BDL	BDL
12-06-2023	63.1	35.1	4.69	5.87	BDL	BDL
15-06-2023	64.8	34.9	4.72	6.34	BDL	BDL
19-06-2023	58.4	32.2	4.43	6.03	BDL	BDL
22-06-2023	56.3	30.1	4.31	5.95	BDL	BDL
26-06-2023	59.5	31.6	4.72	6.24	BDL	BDL
29-06-2023	57.7	29.5	4.58	5.64	BDL	BDL
03-07-2023	55.6	28.9	4.24	4.93	BDL	BDL
06-07-2023	63.9	30.8	4.75	5.29	BDL	BDL
10-07-2023	59.4	25.9	4.68	5.12	BDL	BDL
13-07-2023	56.7	27.5	4.35	5.66	BDL	BDL
17-07-2023	60.4	26.7	4.58	5.37	BDL	BDL
20-07-2023	53.7	25.9	4.30	4.68	BDL	BDL
24-07-2023	56.3	30.1	4.31	5.10	BDL	BDL
27-07-2023	61.4	28.6	4.45	5.27	BDL	BDL
31-07-2023	59.1	25.9	4.28	4.93	BDL	BDL
03-08-2023	59.6	31.2	4.51	5.21	BDL	BDL
07-08-2023	67.3	33.6	4.92	5.54	BDL	BDL
10-08-2023	55.6	27.2	4.41	4.92	BDL	BDL
14-08-2023	60.7	31.3	4.75	5.29	BDL	BDL
17-08-2023	63.9	32.8	4.67	5.59	BDL	BDL
21-08-2023	59.4	29.4	4.77	5.45	BDL	BDL
24-08-2023	62.8	32.4	4.61	5.38	BDL	BDL

Balarampuram (A5)						
Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
27-08-2023	65.7	34.3	4.32	5.08	BDL	BDL
31-08-2023	64.9	31.5	4.51	5.43	BDL	BDL
04-09-2023	67.1	32.6	4.29	4.91	BDL	BDL
07-09-2023	73.8	35.2	4.67	5.28	BDL	BDL
11-09-2023	69.5	33.5	4.36	5.46	BDL	BDL
14-09-2023	76.3	37.8	4.51	5.61	BDL	BDL
19-09-2023	68.6	30.4	4.72	5.27	BDL	BDL
21-09-2023	71.9	35.4	4.22	5.31	BDL	BDL
25-09-2023	66.4	31.7	4.68	5.62	BDL	BDL
28-09-2023	60.7	31.6	4.59	5.25	BDL	BDL
NAAQS 2009 Limits	**100**	**60**	**80**	**80**	**4**	**-**

BDL: Below Detectable Limit

HYR-3.5. Monthly Average Results of Ambient Air Quality Monitoring (April 2023 to September 2023)

Table 3.9: Monthly Average Results

Parameter, Unit	NAAQS 2009 Limits	Month	Venganoor (A1)			Port Site (A2)			Proposed Port Estate Area (A3)			Chani (A4)			Balarampuram (A5)		
			Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min
Particulate matter (size less than 10µm) or PM_{10}, µg/ m^3	100	Apr-23	65.1	59.8	56.3	77.1	71.7	61.8	63.5	57.6	50.2	59.4	55.3	50.8	69.3	62.8	56.1
		May-23	70.2	63.5	50.1	77.5	65.0	56.2	70.8	62.5	55.2	67.7	62.9	55.6	70.1	59.6	50.3
		Jun-23	65.4	57.6	51.9	71.2	63.9	56.2	65.6	59.3	52.7	62.6	56.9	51.8	64.8	59.9	56.3
		Jul-23	65.7	58.1	50.9	69.7	61.6	54.8	65.4	59.3	53.2	62.7	56.9	50.9	63.9	58.5	53.7
		Aug-23	67.1	59.9	52.9	70.8	62.2	51.4	66.2	56.7	48.9	67.6	60.4	50.9	67.3	62.2	55.6
		Sep-23	75.3	66.2	57.4	77.1	69.3	61.8	73.4	68.6	63.9	75.2	66.4	59.8	76.3	69.3	60.7
		HY	**75.3**	**60.9**	**50.1**	**77.5**	**65.6**	**51.4**	**73.4**	**60.7**	**48.9**	**75.2**	**59.8**	**50.8**	**76.3**	**62.0**	**50.3**
Particulate matter (size less than 2.5µm) or PM $_{2.5}$, µg/ m^3	60	Apr-23	37.9	33.6	30.5	41.3	38.2	32.7	34.3	31.2	26.7	34.9	31.3	27.6	43.1	37.9	31.7
		May-23	36.8	32.8	26.3	39.4	33.5	29.1	36.4	32.3	28.3	34.9	32.5	28.2	36.4	31.0	26.6
		Jun-23	33.6	29.9	25.3	40.6	36.1	30.2	38.4	34.1	27.6	32.6	29.0	25.9	35.1	32.3	29.5
		Jul-23	32.6	27.3	23.9	33.7	29.6	25.4	35.1	28.7	24.8	31.5	27.1	22.9	30.8	27.8	25.9
		Aug-23	35.3	27.7	22.4	36.6	29.8	22.2	33.9	26.4	20.5	34.2	29.6	23.4	34.3	31.5	27.2
		Sep-23	37.8	31.7	26.4	35.3	31.5	28.0	35.1	31.7	28.6	37.1	32.4	26.6	37.8	33.5	30.4
		HY	**37.9**	**30.5**	**22.4**	**41.3**	**33.1**	**22.2**	**38.4**	**30.7**	**20.5**	**37.1**	**30.3**	**22.9**	**43.1**	**32.3**	**25.9**
Sulphur dioxide (SO_2), µg/m^3	80	Apr-23	4.73	4.48	4.27	5.84	5.20	4.61	4.48	4.27	4.09	4.72	4.32	4.11	5.11	4.72	4.27
		May-23	4.89	4.33	4.10	5.36	4.75	4.13	4.78	4.35	4.03	4.72	4.32	4.11	5.45	4.40	4.11
		Jun-23	4.59	4.36	4.11	5.65	5.07	4.53	4.87	4.53	4.16	4.74	4.43	4.25	4.72	4.53	4.31
		Jul-23	4.98	4.48	4.13	5.14	4.63	4.28	4.98	4.52	4.10	4.89	4.49	4.09	4.75	4.44	4.24
		Aug-23	4.96	4.55	4.11	4.92	4.58	4.18	4.79	4.46	4.00	4.71	4.52	4.21	4.92	4.61	4.32
		Sep-23	4.99	4.62	4.36	4.86	4.54	4.26	4.62	4.41	4.20	4.75	4.51	4.15	4.72	4.51	4.22
		HY	**4.99**	**4.47**	**4.10**	**5.84**	**4.79**	**4.13**	**4.98**	**4.42**	**4.00**	**4.89**	**4.43**	**4.09**	**5.45**	**4.53**	**4.11**
Oxides of Nitrogen	80	Apr-23	6.49	6.01	5.63	7.41	6.83	5.92	5.81	5.56	5.33	5.93	5.67	5.23	6.36	6.01	5.56
		May-23	6.78	5.96	5.45	7.12	6.15	5.46	6.40	5.88	5.26	5.96	5.80	5.61	7.23	6.21	5.78

Parameter, Unit	NAAQS 2009 Limits	Month	Venganoor (A1)			Port Site (A2)			Proposed Port Estate Area (A3)			Chani (A4)			Balarampuram (A5)		
			Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min
(NO_x), µg/m^3		Jun-23	6.58	5.66	4.73	6.83	6.09	5.54	5.97	5.49	4.88	5.83	5.28	4.81	6.34	5.92	5.51
		Jul-23	5.41	5.15	4.82	5.98	5.33	4.95	5.87	5.20	4.75	5.69	5.13	4.72	5.66	5.15	4.68
		Aug-23	5.51	5.07	4.79	5.54	5.08	4.60	5.44	5.11	4.69	5.45	5.13	4.79	5.59	5.32	4.92
		Sep-23	5.89	5.47	5.19	5.51	5.09	4.72	5.78	5.46	5.15	5.47	5.14	4.68	5.62	5.34	4.91
		HY	**6.78**	**5.55**	**4.73**	**7.41**	**5.76**	**4.60**	**6.40**	**5.45**	**4.69**	**5.96**	**5.36**	**4.68**	**7.23**	**5.66**	**4.68**
Carbon Monoxide (CO), mg/m^3	4	Apr-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		HY	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**
Hydrocarbon (HC), ppm	-	Apr-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		HY	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**

***HY- Half Yearly**

HYR-3.6. Graphical representation of Half-Yearly Results (April-2023 to September-2023)

Figure 3.2: Respirable Particulate Matter (PM10)

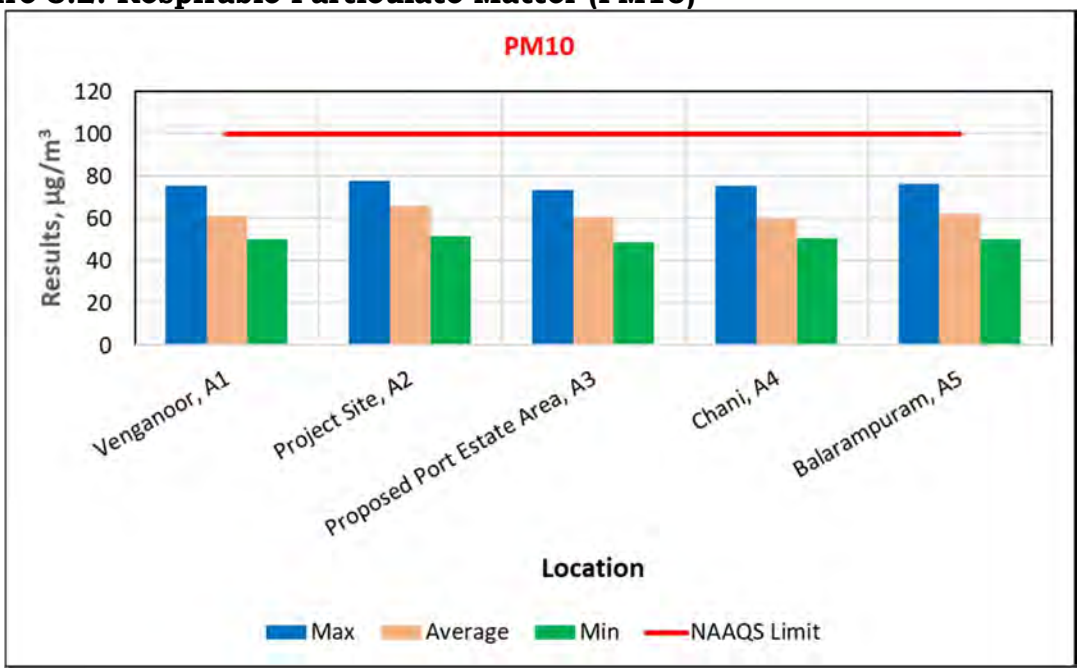


Figure 3.3: Fine Particulate matter (PM2.5)

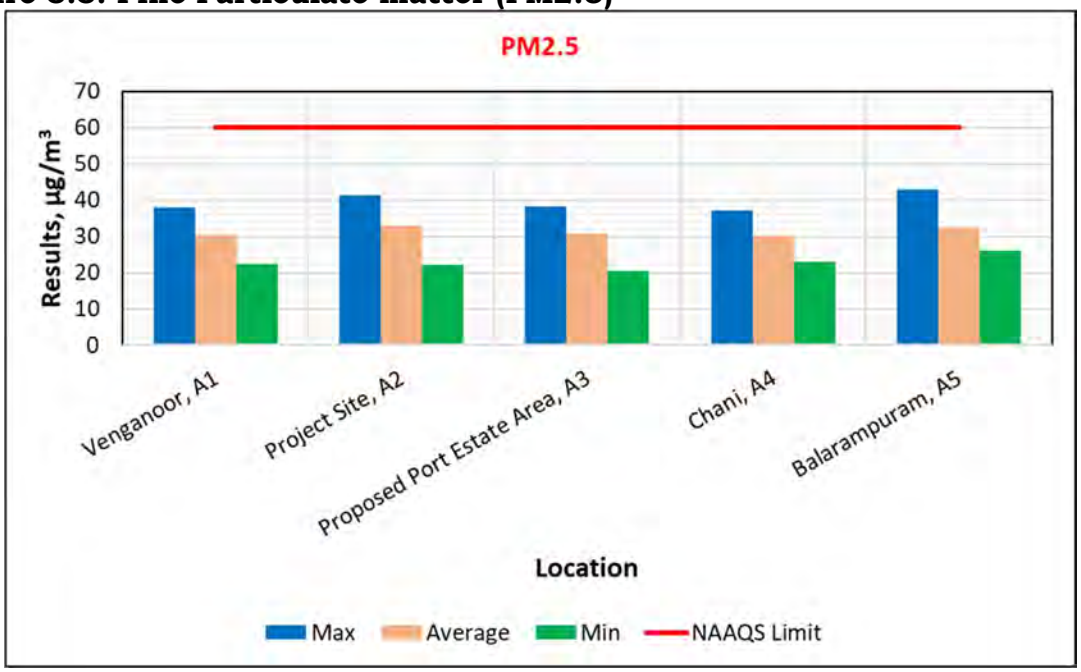


Figure 3.4: Sulphur Dioxide as SO_2

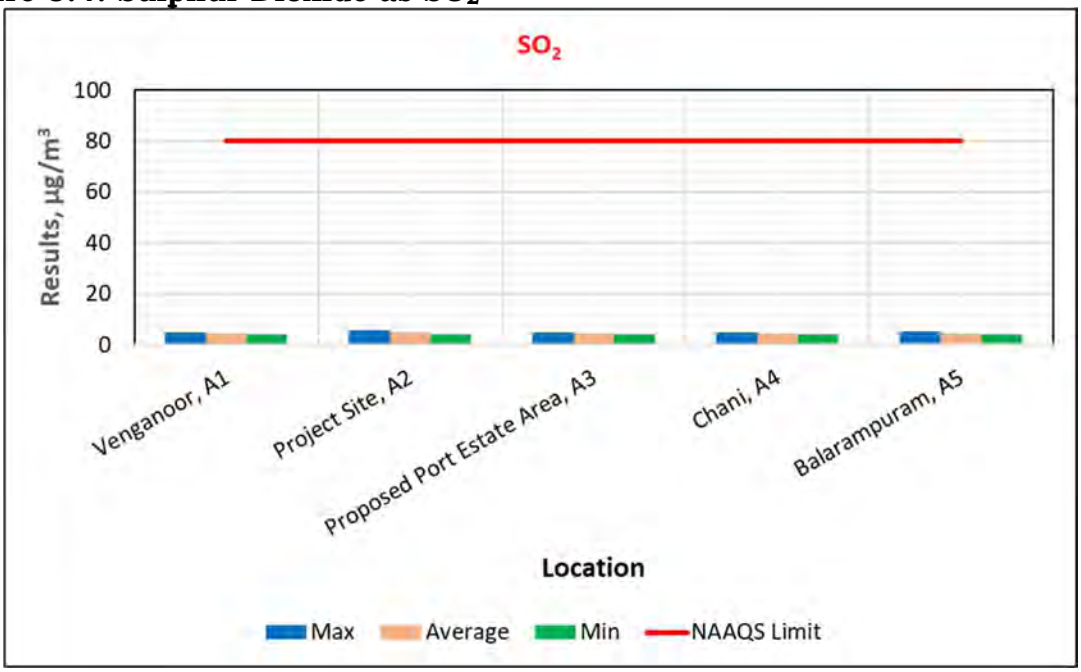
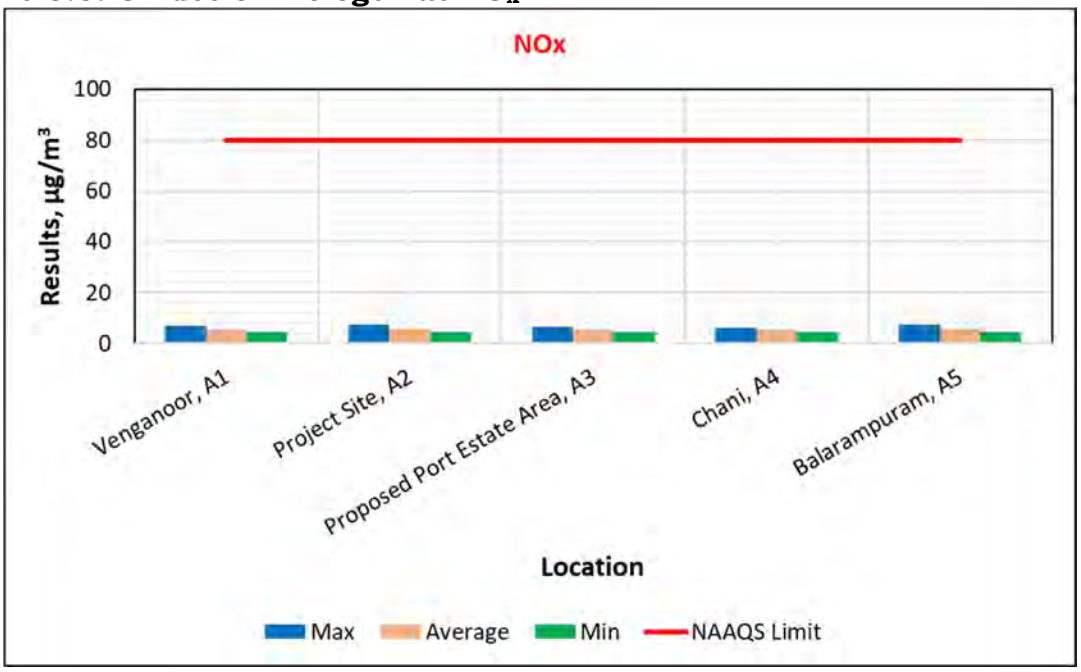


Figure 3.5: Oxides of Nitrogen as NO_x



HYR-3.7. Summary - Ambient Air Quality

During the period of April 2023 to September 2023, following is the summary of ambient air quality results:

a) At the location **Venganoor**:
- PM_{10} was observed in the range between 50.1-75.3 µg/m^3 with an average of 60.9 µg/m^3
- $PM_{2.5}$ was observed in the range between 22.4-37.9 µg/m^3 with an average of 30.5 µg/m^3
- SO_2 was observed in the range between 4.10-4.99 µg/m^3 with an average of 4.47 µg/m^3
- NO_2 was observed in the range between 4.73-6.78 µg/m^3 with an average of 5.55 µg/m^3
- CO & HC were observed below detectable limits.

b) At the location **Port Site**:
- PM_{10} was observed in the range between 51.4-77.5 µg/m^3 with an average of 65.6 µg/m^3
- $PM_{2.5}$ was observed in the range between 22.2-41.3 µg/m^3 with an average of 33.1 µg/m^3
- SO_2 was observed in the range between 4.13-5.84 µg/m^3 with an average of 4.79 µg/m^3
- NO_2 was observed in the range between 4.60-7.41 µg/m^3 with an average of 5.76 µg/m^3
- CO & HC were observed below detectable limits.

c) At the location **Proposed Port Area**:
- PM_{10} was observed in the range between 48.9-73.4 µg/m^3 with an average of 60.7 µg/m^3
- $PM_{2.5}$ was observed in the range between 20.5-38.4 µg/m^3 with an average of 30.7 µg/m^3

- SO_2 was observed in the range between 4.00-4.98 µg/m^3 with an average of 4.42 µg/m^3
- NO_2 was observed in the range between 4.69-6.40 µg/m^3 with an average of 5.45 µg/m^3
- CO & HC were observed below detectable limits.

d) At the location **Chani**:

- PM_{10} was observed in the range between 50.8-75.2 µg/m^3 with an average of 59.8 µg/m^3
- $PM_{2.5}$ was observed in the range between 22.9-37.1 µg/m^3 with an average of 30.3 µg/m^3
- SO_2 was observed in the range between 4.09-4.89 µg/m^3 with an average of 4.43 µg/m^3
- NO_2 was observed in the range between 4.68-5.96 µg/m^3 with an average of 5.36 µg/m^3
- CO & HC were observed below detectable limits.

e) At the location **Balarampuram**:

- PM_{10} was observed in the range between 50.3-76.3 µg/m^3 with an average of 62.0 µg/m^3
- $PM_{2.5}$ was observed in the range between 25.9-43.1 µg/m^3 with an average of 32.3 µg/m^3
- SO_2 was observed in the range between 4.11-5.45 µg/m^3 with an average of 4.53 µg/m^3
- NO_2 was observed in the range between 4.68-7.23 µg/m^3 with an average of 5.66 µg/m^3
- CO & HC were observed below detectable limits.

f) Overall Comparison of Results from **all Locations**:

- PM_{10} was observed with a maximum of 77.5 µg/m^3 at Port Site and a minimum of 48.9 µg/m^3 at Proposed Port Area. The overall average of all locations is 61.8 µg/m^3

- $PM_{2.5}$ was observed with a maximum of 43.1 µg/m³ at Balaramapuram and a minimum of 20.5 µg/m³ at Proposed Port Estate Area. The overall average of all locations is 31.4 µg/m³
- SO_2 was observed with a maximum of 5.84 µg/m³ at Port Site and a minimum of 4.00 µg/m³ at Proposed Port Area. The overall average of all locations is 4.53 µg/m³
- NO_2 was observed with a maximum of 7.41 µg/m³ at Port Site and a minimum of 4.60 µg/m³ at Port Site. The overall average of all locations is 5.56 µg/m³
- CO & HC were always observed below detectable limits at all times at all locations.

The obtained results were compared with National Ambient Air Quality Standards (NAAQS), 2009. The results were well within the limits on all monitoring days at all 5 locations during the monitoring months (from April 2023 to September 2023).

Table 3.10: Overall Summary of Results from all Locations

Parameter	Unit	NAAQS 2009 Limits	Max	Avg.	Min
PM10	µg/m³	100	77.5	61.8	48.9
PM 2.5	µg/m³	60	43.1	31.4	20.5
SO2	µg/m³	80	5.84	4.53	4.00
NOx	µg/m³	80	7.41	5.56	4.60
CO	mg/m³	4	BDL	BDL	BDL
HC	ppm	--	BDL	BDL	BDL

HYR-4	Ambient Noise Monitoring

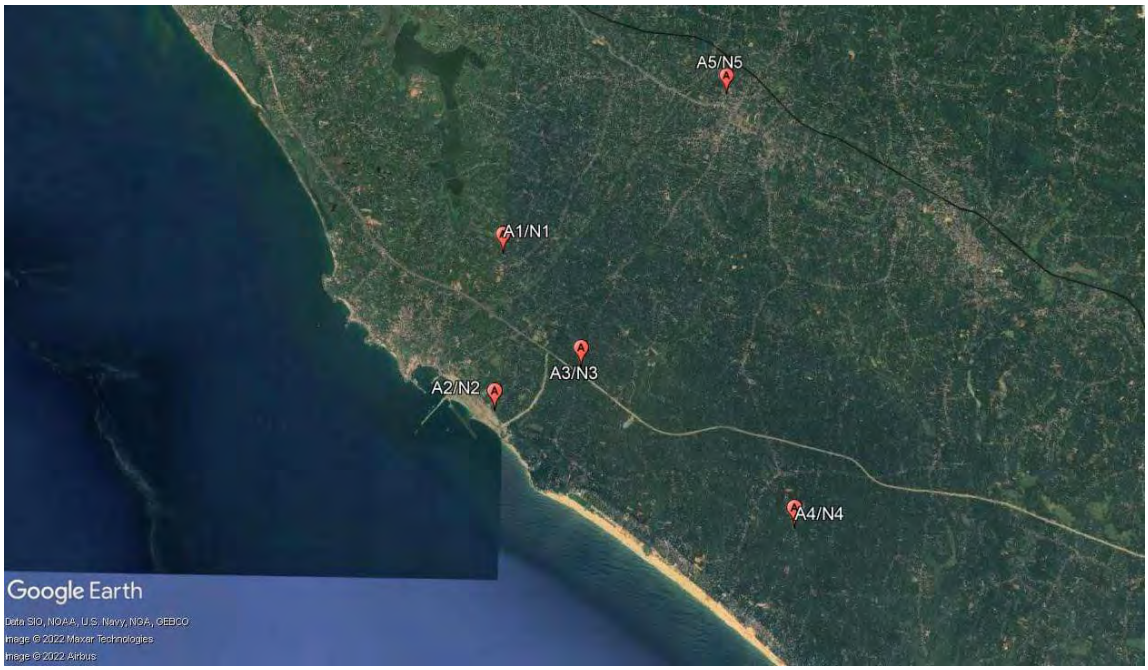
HYR-4.1. Ambient Noise Monitoring location details

This section describes the sampling location, methodology adopted for monitoring ambient noise and analysis of monitored results. Ambient Noise Monitoring during April 2023 to September 2023 was carried out at Venganoor, Port Site, Proposed Port Estate Area, Chani and Balarampuram. Classification of locations as per the Noise Pollution (Regulation & Control) Rules, 2000 (Rules 3 (1) and 4(1)) are as below.

Table 4.1: Coordinates of Ambient Noise Monitoring Locations

Location	Legend	Area Type	Latitude	Longitude
Venganoor	N1	Residential	8°23'55.10"N	77°00'12.19"E
Port Site	N2	Industrial	8°22'13.73"N	77°00'08.39"E
Proposed Port Estate Area	N3	Residential	8°22'41.37"N	77°01'03.17"E
Chani	N4	Residential	8°21'02.11"N	77°03'16.59"E
Balarampuram	N5	Commercial	8°25'43.73"N	77°02'39.99"E

Figure4.1: Google Earth View of Ambient Noise Monitoring Locations



HYR-4.2. Methodology of Sampling

Ambient Noise Monitoring is being carried out as per IS 9989:1981.

HYR-4.3. Ambient Noise Standards

The results obtained were compared with the standards as per the Noise Pollution (Regulation & Control) Rules, 2000 (Rules 3 (1) and 4(1)) given in Table 4.2.

Table 4.2: Ambient Noise Standard

Area Code	Area Type	Limits in dB (A) Leq	
		Day (6 a.m. to 10 p.m.)	Night (10 p.m. to 6 a.m.)
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45

HYR-4.4. Ambient Noise Monitoring Results for the period from April 2023 to September 2023.

Table 4.3: Location –Venganoor, N1 - (Residential Area)

Month	Date	L_{max} Day time	L_{max} Night time	L_{min} Day time	L_{min} Night time	L_{eq} Day time	L_{eq} Night time
		dB (A)					
Apr-23	04-04-2023	89.2	70.3	36.0	34.1	54.3	44.4
	19-04-2023	90.2	75.3	35.2	32.8	54.0	44.1
May-23	05-05-2023	81.5	71.5	35.1	33.9	53.0	43.6
	19-05-2023	88.6	74.7	34.4	33.6	53.0	44.5
Jun-23	06-06-2023	83.7	76.7	36.2	34.7	51.5	43.1
	20-06-2023	80.8	74.5	36.8	36.0	53.8	46.1
Jul-23	04-07-2023	76.6	60.5	49.5	35.4	54.7	40.4
	18-07-2023	81.5	71.5	35.1	33.9	54.1	42.9
Aug-23	04-08-2023	77.1	62.4	46.2	33.4	53.2	41.6

Month	Date	L_{max} Day time	L_{max} Night time	L_{min} Day time	L_{min} Night time	L_{eq} Day time	L_{eq} Night time
		dB (A)					
	18-08-2023	79.5	66.1	41.8	32.5	54.3	42.6
Sep-23	05-09-2023	72.1	68.4	38.9	36.3	53.6	42.4
	06-09-2023	73.9	66.2	35.6	35.2	53.3	41.8
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**55**	**45**

Table 4.4: Location –Port Site, N2 - (Industrial Area)

Month	Date	L_{max} Day time	L_{max} Night time	L_{min} Day time	L_{min} Night time	L_{eq} Day time	L_{eq} Night time
		dB (A)					
Apr-23	05-04-2023	88.7	81.9	45.7	41.5	69.1	62.7
	21-04-2023	84.6	82.2	46.2	45.2	64.2	58.9
May-23	09-05-2023	84.1	81.7	50.4	45.7	62.6	59.5
	23-05-2023	96.2	82.8	48.6	39.6	61.7	60.5
Jun-23	07-06-2023	88.9	79.2	44.1	44.4	61.3	56.3
	21-06-2023	90.7	78.7	45.7	44.2	62.6	59.8
Jul-23	05-07-2023	94.3	72.8	49.3	47.1	66.8	59.0
	19-07-2023	88.6	74.7	49.1	43.9	64.3	58.3
Aug-23	05-08-2023	91.4	74.3	52.6	48.3	68.9	61.6
	19-08-2023	93.7	75.9	48.7	41.3	66.5	58.9
Sep-23	08-09-2023	87.2	77.4	45.2	44.9	69.5	60.8
	12-09-2023	88.6	79.3	47.4	46.3	67.7	59.6
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**75**	**70**

Table 4.5: Location –Proposed Port Estate Area, N3 - (Residential Area)

Month	Date	L_{max} Day time	L_{max} Night time	L_{min} Day time	L_{min} Night time	L_{eq} Day time	L_{eq} Night time
		dB (A)					
Apr-23	07-04-2023	78.5	74.1	33.4	32.9	54.2	43.9
	22-04-2023	95.1	78.9	35.0	33.3	72.2	52.9
May-23	10-05-2023	85.4	72.4	39.9	35.0	54.7	44.3
	24-05-2023	94.7	77.2	33.4	32.9	61.9	54.1
Jun-23	09-06-2023	80.9	73.7	38.0	36.1	54.8	43.7
	23-06-2023	86.5	75.5	38.8	34.6	54.6	44.0
Jul-23	08-07-2023	83.9	70.8	39.3	37.9	53.2	43.3
	21-07-2023	81.7	72.3	42.7	37.3	52.7	41.9
Aug-23	08-08-2023	78.6	69.3	40.8	36.2	54.1	42.6
	22-08-2023	79.4	70.9	43.7	35.8	52.3	41.4
Sep-23	15-09-2023	78.4	71.2	36.5	34.1	54.4	43.9
	20-09-2023	77.3	73.9	37.1	35.7	53.2	42.9
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**55**	**45**

Table 4.6: Location –Chani, N4 - (Residential Area)

Month	Date	L_{max} Day time	L_{max} Night time	L_{min} Day time	L_{min} Night time	L_{eq} Day time	L_{eq} Night time
		dB (A)					
Apr-23	11-04-2023	86.6	72.9	36.3	32.1	54.5	44.7
	28-04-2023	87.4	73.2	37.4	33.3	54.6	43.9
May-23	12-05-2023	85.4	73.5	35.8	33.2	54.1	44.7
	26-05-2023	84.3	75.2	38.2	32.7	54.6	43.7
Jun-23	13-06-2023	83.9	71.2	39.6	35.9	54.0	44.1
	27-06-2023	88.7	75.5	40.2	34.7	54.6	44.4
Jul-23	11-07-2023	79.6	70.7	44.6	39.2	53.6	42.9

Month	Date	L_{max} Day time	L_{max} Night time	L_{min} Day time	L_{min} Night time	L_{eq} Day time	L_{eq} Night time
		dB (A)					
	25-07-2023	82.4	72.4	42.3	37.3	53.5	43.6
Aug-23	09-08-2023	75.1	66.7	43.9	37.3	53.5	41.7
	23-08-2023	78.2	67.3	40.5	36.2	53.6	42.5
Sep-23	22-09-2023	76.2	70.5	36.8	33.9	53.6	43.4
	23-09-2023	78.5	72.9	39.5	36.7	52.8	41.3
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**55**	**45**

Table 4.7: Location –Balarampuram, N5 - (Commercial Area)

Month	Date	L_{max} Day time	L_{max} Night time	L_{min} Day time	L_{min} Night time	L_{eq} Day time	L_{eq} Night time
		dB (A)					
Apr-23	14-04-2023	123.4	86.8	35.7	35.8	72.4	64.4
	29-04-2023	87.1	82.0	41.9	36.7	60.9	53.0
May-23	16-05-2023	88.3	82.1	40.6	38.4	58.5	54.6
	30-05-2023	83.8	76.2	39.0	37.1	59.6	51.3
Jun-23	16-06-2023	86.6	80.0	42.3	36.3	59.8	50.5
	30-06-2023	91.9	76.6	39.8	35.0	59.3	50.7
Jul-23	14-07-2023	85.1	78.6	46.4	39.1	57.6	49.4
	28-07-2023	83.7	80.8	44.1	38.7	58.4	51.4
Aug-23	11-08-2023	81.3	76.7	45.9	38.6	58.4	48.6
	25-08-2023	80.1	75.2	46.4	37.3	58.8	50.6
Sep-23	26-09-2023	76.8	70.3	38.5	36.1	56.7	50.2
	29-09-2023	78.2	68.3	34.6	31.7	55.1	49.8
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**65**	**55**

HYR-4.5. Half Yearly Average Results of Ambient Noise Monitoring (April-2023 to September-2023)

Table 4.8: Half Yearly Average Results

Parameter		Venganoor (N1)	Proposed Port Estate Area (N3)	Chani (N4)	Port Site (N2)	Balarampuram (N5)
		Residential	Residential	Residential	Industrial	Commercial
L_{max} Day time dB (A)	Max	90.2	95.1	88.7	96.2	123.4
	Min	72.1	77.3	75.1	84.1	68.3
	Avg.	81.2	83.4	82.2	89.7	82.5
L_{max} Night time dB (A)	Max	76.7	78.9	75.5	82.8	86.8
	Min	60.5	69.3	66.7	72.8	68.3
	Avg.	69.8	73.3	71.8	78.4	77.8
L_{min} Day time dB (A)	Max	49.5	43.7	44.6	52.6	46.4
	Min	34.4	33.4	35.8	44.1	34.6
	Avg.	38.4	38.2	39.6	47.8	41.3
L_{min} Night time dB (A)	Max	36.3	37.9	39.2	48.3	39.1
	Min	32.5	32.9	32.1	39.6	31.7
	Avg.	34.3	35.1	35.2	44.4	36.7
Leq Day time dB (A)	Max	54.7	72.2	54.6	69.5	72.4
	Min	51.5	52.3	52.8	61.3	55.1
	Avg.	**53.6**	**56.0**	**53.9**	**65.4**	**59.6**
	Limit	**55**	**55**	**55**	**75**	**65**
Leq Night time dB (A)	Max	46.1	54.1	44.7	62.7	64.4
	Min	40.4	41.4	41.3	56.3	48.6
	Avg.	**43.1**	**44.9**	**43.4**	**59.7**	**52.0**
	Limit	**45**	**45**	**45**	**70**	**55**

HYR-4.6. Graphical Representation of Half Yearly Results (April-2023 to September-2023)

Figure 4.2: Residential Area Noise Level

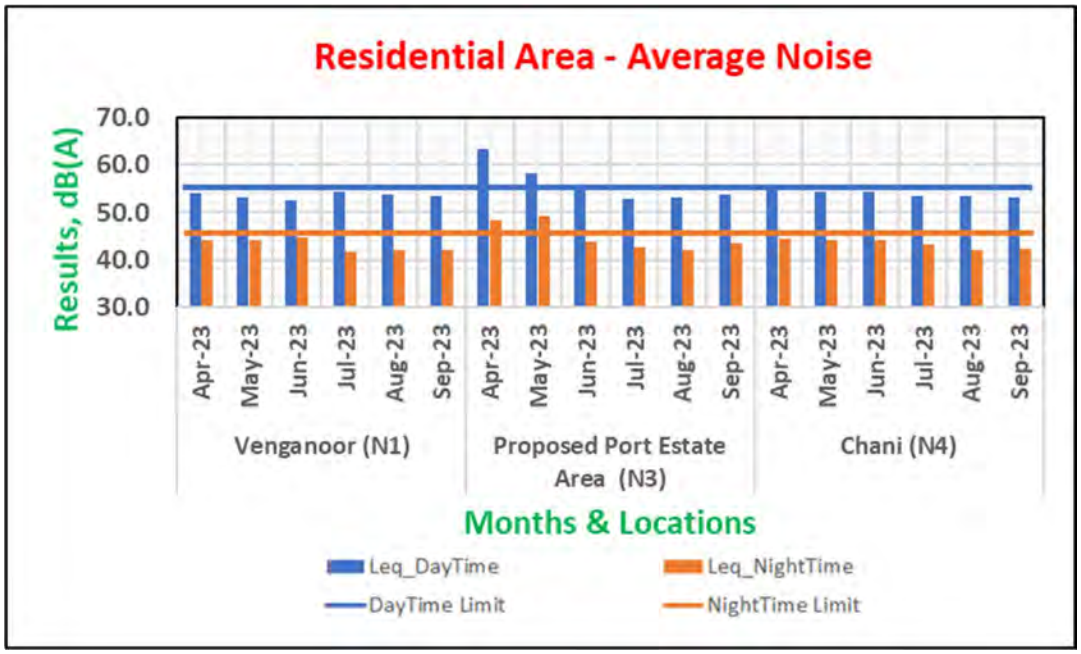


Figure 4.3: Industrial Area Noise Level

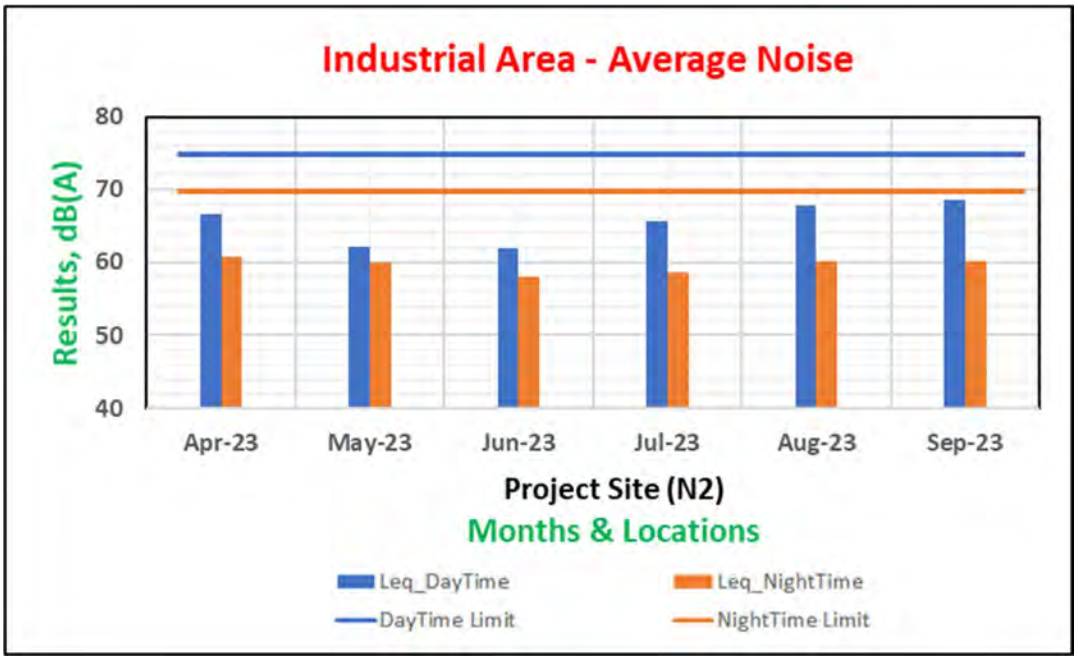
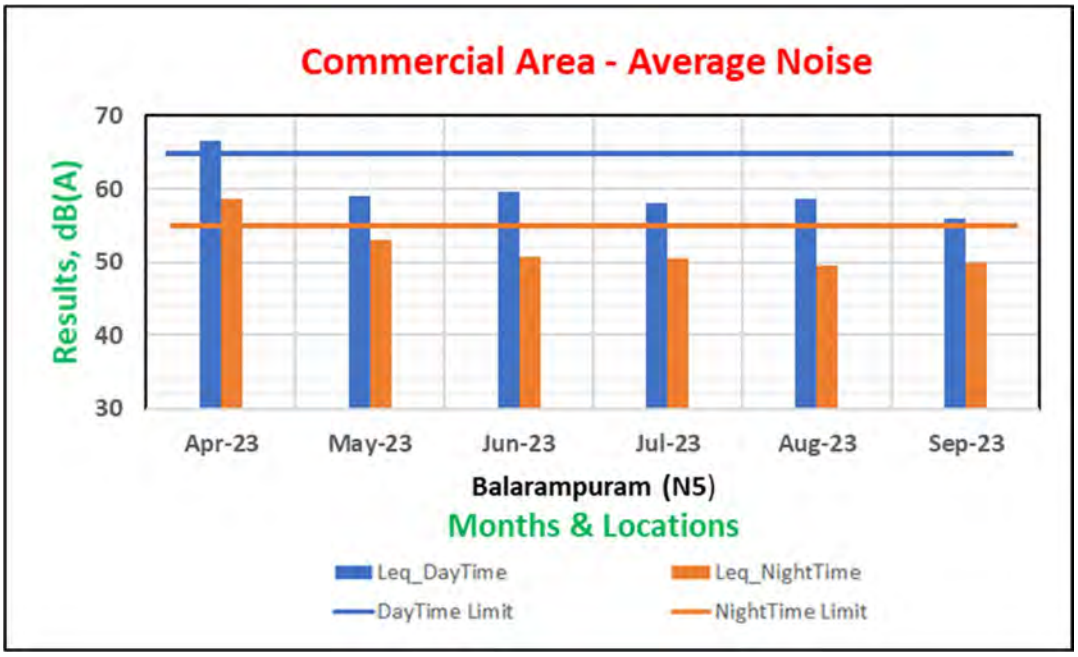


Figure 4.4: Commercial Area Noise Level



HYR-4.7. Summary - Ambient Noise Monitoring

During the period from April 2023 to September 2023, the following is the average noise levels observed.

Table 4.9: Summary - Ambient Noise Monitoring

Parameter		Venganoor (N1)	Proposed Port Estate Area (N3)	Chani (N4)	Port Site (N2)	Balarampuram (N5)
		Residential	Residential	Residential	Industrial	Commercial
		Daytime (Limit: 55) Nighttime (Limit: 45)			Daytime (Limit: 75) Nighttime (Limit: 70)	Daytime (Limit: 65) Nighttime (Limit: 55)
Leq Day time dB (A)	Avg	53.6	56.0	53.9	65.4	59.6
Leq Nighttime dB (A)	Avg	43.1	44.9	43.4	59.7	52.0

- The average Leq values observed at daytime and nighttime are 53.6 dB(A) and 43.1 dB(A) respectively at Venganoor

- The average Leq values observed at daytime and nighttime are 65.4 dB(A) and 59.7 dB(A) respectively at Port Site
- The average Leq values observed at daytime and nighttime are 56.0 dB(A) and 44.9 dB(A) respectively at Proposed Port Estate Area
- The average Leq values observed at daytime and nighttime are 53.9 dB(A) and 43.4 dB(A) respectively at Chani
- The average Leq values observed at daytime and nighttime are 59.6 dB(A) and 52.0 dB(A) respectively at Balarampuram.

The results obtained were compared with Noise Pollution (Regulation & Control) Rule, 2000 (Rule 3(1) and 4(1)) and it is observed that noise readings were within limits during the monitoring months (from April 2023 to September 2023) except Proposed Port Estate on 22-04-2023 during both Day time and Night time due to the noise from the Loud Speaker from the nearby Temple on account of "Ulsavam" and Proposed Port Estate on 24-05-2023 during both Day Time and Night Time due to "Land Clearance Work" being carried out with JCB in the nearby plots.

HYR-5	Marine Water & Sediment Analysis

HYR-5.1. Marine Water and Sediment Sampling Location Details:

This section describes the sampling location, methodology adopted for analysis and the analysis of monitored data for Marine Water and Sediment. Sampling and analysis of marine water at high tide and low tide during from April 2023 to September 2023 carried out at different locations such as Near Kovalam Beach, Proposed Dredging site, South of Break Water, Port Basin, Inner Approach Channel and Kovalam Beach.

Table 5.1: Coordinates of Marine Water and Sediment Sampling Locations

Location	Legend	Latitude	Longitude
Near Kovalam Beach	M1/MS1	8°22'49.29"N	76°58'40.77"E
Proposed Dredging Site	M2/MS2	8°22'31.11"N	76°58'57.92"E
Port Basin	M3/MS3	8°22'06.96"N	76°59'27.85"E
South of Breakwater	M4/MS4	8°21'51.07"N	77°00'00.21"E
Inner Approach Channel	M5/MS5	8°21'12.68"N	77°00'35.14"E
Kovalam Beach	M6/MS6	8°23'08.16"N	76°58'26.09"E

Figure 5.1: Google earth view of Marine Water and Sediment Sampling Locations

HYR-5.2. Methodology of Sampling and Analysis

Table 5.2: Sampling and Analysis Methodology

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
Marine Water Analysis				
1.	Temperature	˚C	1	IS 3025 Part 9: 1984RA 2017
2.	pH Value	-	1	IS 3025 Part 11: 1983 RA 2017
3.	Turbidity	N.T.U.	0.1	IS 3025 Part 10: 1984 RA 2017
4.	Electrical Conductivity (at 25°C)	µmho/cm	1	IS 3025 Part 14:1984 RA 2019
5.	Total Suspended Solids	mg/L	1	IS 3025 Part 17: 1984 RA 2017
6.	Total Dissolved Solids	mg/L	1	IS 3025 Part 16: 1984 RA 2017
7.	Dissolved Oxygen	mg/L	0.2	IS 3025 Part 38:1989RA 2019
8.	Biochemical Oxygen Demand (3 days, 27°C)	mg/L	2	IS 3025 Part 44:1993RA 2019
9.	Floating Materials – Oil, Grease and Scum (Including Petroleum Products)	mg/L	1	IS 3025 Part 39:1991 RA 2019
10.	Nitrite (as NO_2)	mg/L	0.02	IS 3025 Part 34:1988 RA 2019
11.	Nitrate (as NO_3)	mg/L	1	APHA 23rd Edition 4500 -NO_3 B: 2017
12.	Phenolic Compounds (as C_6H_5OH)	mg/L	0.001	IS 3025 Part 43: 1992 RA 2019
13.	Ammonical Nitrogen (as NH_3-N)	mg/L	1	IS 3025 Part 34:1988 RA 2019
14.	Total Nitrogen (as N)	mg/L	1	IS 3025 Part 34:1988 RA 2019
15.	Total Phosphorous (as P)	mg/L	0.01	IS 3025 Part 31 :1988 RA2019
16.	Reactive Phosphorous	mg/L	0.01	IS 3025 Part 31 :1988 RA2019
17.	Polycyclic Aromatic Hydrocarbon	mg/L	0.000005	SEAAL/INS/RWM/SOP/02
18.	Salinity	ppt	0.0036	APHA 23rdEdition 2520 – B: 2017
19.	Total Chlorophyll	mg/m^3	0.1	APHA 23rd Edn:10200.H
20.	Total Coliforms	MPN/100 ml	2	IS 1622: 1981
21.	Faecal Coliforms	MPN /100ml	2	IS 1622: 1981
22.	Phytoplankton	No./100ml	--	APHA 23rd Edn:10200.F
23.	Zooplanktons	No./100ml	--	APHA 23rd Edn:10200.G
Sediment Analysis				
1.	Texture	-	--	SEAAL/EN/SLS/SOP/14
2.	Organic Matter	%	0.1	IS 2720 Part 22:1972
3.	Total Phosphorus (as P)	mg/kg	10	IS 10158: 1982

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
4.	Aluminium (as Al)	mg/kg	5	USEPA 7000B: 2017
5.	Chromium (as Cr)	mg/kg	5	USEPA 7000B: 2007
6.	Copper (as Cu)	mg/kg	1.5	EPA 7000B: 2007
7.	Iron (as Fe)	mg/kg	2.5	USEPA 7000B: 2007
8.	Lead (as Pb)	mg/kg	5	EPA 7000B: 2007
9.	Manganese (as Mn)	mg/kg	1.5	EPA 7000B: 2007
10.	Mercury (as Hg)	mg/kg	0.10	SEAAL/EN/SLS/SOP/13
11.	Zinc (as Zn)	mg/kg	1	USEPA 7000B: 2007
12.	Nickel (as Ni)	mg/kg	2.5	EPA 7000B: 2007
13.	Benthic Organism	No./m^2	1	APHA 23rd Edn:10750.B

HYR-5.3. Marine Water Standards

As per the Environment (Protection) Rules, 1986 Schedule I.

Table 5.3: Marine Water Standard

Parameter	Unit	# E(P)A Rules, 1986
pH Value	-	6.5-9.0
Dissolved Oxygen	mg/L	3.0 mg/L or 40% saturation value; whichever is higher
Colour and Odour	-	No visible colour or offensive odour
Floating Materials (Oil, Grease and Scum) (Including Petroleum Products)	mg/L	*Max.* 10
Faecal Coliforms	MPN/100ml	*Max.* 500
Biochemical Oxygen Demand (3 days, 27°C)	mg/L	*Max.* 5
#: Environment (Protection) Rules, 1986, Schedule I, Table 1.4, Primary Water Quality Criteria for Class – IV Water (For Harbour Waters).		

HYR-5.4. Marine Water Analysis Results for the period from April 2023 to September 2023.

Table 5.4: Marine Water Analysis Results

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
1	Temperature (°C)	Apr-23	High tide	30.1	30.3	30.2	30.2	30.1	30.3
			Low tide	29.4	29.3	29.3	29.3	29.4	29.5
		May-23	High tide	30.4	30.8	30.3	30.6	30.1	30.6
			Low tide	29.1	29.6	29.8	28.9	28.5	29.3
		Jun-23	High tide	29.3	28.6	27.9	30.8	30.0	30.4
			Low tide	27.8	27.4	26.9	25.2	26.3	28.1
		Jul-23	High tide	25.1	25.8	25.2	25.7	25.4	25.9
			Low tide	24.3	24.7	24.8	24.3	24.8	24.5
		Aug-23	High tide	29.3	29.3	30.1	30.1	30.0	30.1
			Low tide	29.9	28.9	28.9	28.3	29.9	29.2
		Sep-23	High tide	24.3	24.2	24.9	25.3	24.7	25.0
			Low tide	25.9	25.6	25.8	24.8	25.6	25.6
2	Colour	Apr-23	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
		May-23	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
		Jun-23	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
		Jul-23	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
		Aug-23	High tide	1	1	1	1	1	1

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
			Low tide	1	1	1	1	1	1
		Sep-23	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
3	pH Value	Apr-23	High tide	7.91	7.90	7.87	7.87	7.90	7.97
			Low tide	7.95	7.93	7.89	7.91	7.93	7.98
		May-23	High tide	8.00	7.99	8.01	7.98	7.95	7.99
			Low tide	8.04	8.02	8.02	8.04	8.03	8.00
		Jun-23	High tide	7.91	7.94	7.96	7.93	7.91	7.94
			Low tide	7.98	8.05	8.05	7.97	7.96	7.98
		Jul-23	High tide	7.68	7.81	7.99	7.96	7.89	7.96
			Low tide	7.93	7.76	7.83	7.89	7.93	7.88
		Aug-23	High tide	7.85	8.11	7.78	7.89	7.79	7.86
			Low tide	7.89	7.86	7.53	7.79	7.83	7.71
		Sep-23	High tide	7.95	8.05	7.81	7.75	7.80	7.80
			Low tide	7.99	7.96	7.59	7.69	7.90	7.78
4	Turbidity (N.T.U.)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	0.5	BDL	BDL
			Low tide	0.10	BDL	BDL	1.6	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	0.2	BDL	BDL
			Low tide	BDL	BDL	BDL	1.0	BDL	BDL

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
		Sep-23	High tide	BDL	BDL	BDL	0.2	BDL	BDL
			Low tide	BDL	BDL	BDL	1.0	BDL	BDL
5	Electrical Conductivity (at 25°C) (µmho/cm)	Apr-23	High tide	52130	50860	51740	50980	51076	51680
			Low tide	52290	50980	51920	51040	51260	52065
		May-23	High tide	50560	50510	50130	50310	50740	50210
			Low tide	50720	50710	50250	50580	50920	50900
		Jun-23	High tide	52670	51980	50820	52460	52900	51590
			Low tide	51650	51320	50680	51460	51330	51220
		Jul-23	High tide	53280	53870	52830	53180	52060	52350
			Low tide	52970	52640	51920	52110	51180	51564
		Aug-23	High tide	55170	54760	53720	53290	53055	53240
			Low tide	54860	53160	52810	52220	52768	52950
		Sep-23	High tide	53987	53254	54008	53478	53791	53975
			Low tide	52998	52347	53478	52617	52110	52689
6	Total Suspended Solids (mg/L)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
7	Total Dissolved Solids (mg/L)	Apr-23	High tide	33890	33066	33640	33156	33287	33613
			Low tide	33980	33142	33742	33184	33458	33865
		May-23	High tide	32830	33066	32570	32690	32970	32620
			Low tide	32960	33142	32650	32860	33070	33070
		Jun-23	High tide	33710	33260	32525	33574	33856	33010
			Low tide	33050	32840	32435	32934	32851	32780
		Jul-23	High tide	34180	34467	33810	34030	33220	33560
			Low tide	33920	33690	33220	33350	32755	33210
		Aug-23	High tide	35309	34890	34180	34106	33881	34160
			Low tide	35120	34188	33238	33421	33756	33717
		Sep-23	High tide	34552	34083	34565	34226	34426	34544
			Low tide	33919	33502	34226	33675	33350	33721
8	Dissolved Oxygen (mg/L)	Apr-23	High tide	6.3	6.7	6.5	6.9	6.6	6.6
			Low tide	6.5	6.8	6.8	6.9	6.8	6.7
		May-23	High tide	6.7	6.8	6.8	6.7	6.9	6.7
			Low tide	7.1	6.9	6.9	6.9	7.2	6.8
		Jun-23	High tide	6.8	6.7	6.7	6.8	6.5	6.6
			Low tide	6.8	6.8	6.8	6.9	6.8	6.9
		Jul-23	High tide	6.9	6.5	6.6	6.4	6.6	6.7
			Low tide	6.8	6.7	6.9	6.7	6.7	6.5
		Aug-23	High tide	6.7	6.5	6.6	6.5	6.4	6.5
			Low tide	6.9	6.6	6.9	6.6	6.7	6.8
		Sep-23	High tide	6.5	6.6	6.5	6.5	6.5	6.6
			Low tide	6.6	6.7	6.8	6.6	6.6	6.7

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
9	Biochemical Oxygen Demand (3 days, 27°C) (mg/L)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
10	Floating Materials (Oil, Grease and Scum) (Including Petroleum Products) (mg/L)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
11	Nitrite (as	Apr-23	High tide	0.036	0.037	BDL	0.052	0.045	0.036

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
	NO_2) (mg/L)		Low tide	0.048	0.051	BDL	0.057	0.051	0.042
		May-23	High tide	0.020	0.040	BDL	BDL	0.050	BDL
			Low tide	0.035	0.050	BDL	BDL	0.070	BDL
		Jun-23	High tide	0.027	0.034	BDL	BDL	0.034	BDL
			Low tide	0.029	0.038	BDL	BDL	0.041	BDL
		Jul-23	High tide	0.024	0.029	0.023	BDL	0.026	BDL
			Low tide	0.026	0.035	0.026	BDL	0.032	BDL
		Aug-23	High tide	0.025	0.029	BDL	BDL	0.031	BDL
			Low tide	0.028	0.028	BDL	BDL	0.039	BDL
		Sep-23	High tide	BDL	0.027	BDL	BDL	0.029	BDL
			Low tide	BDL	0.025	BDL	BDL	0.031	BDL
12	Nitrate (as NO_3) (mg/L)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
13	Phenolic Compounds	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
	(as C_6H_5OH) (mg/L)	May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
14	Ammonical Nitrogen (as NH_3-N) (mg/L)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
15	Total Nitrogen (as N)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
	(mg/L)		Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
16	Total Phosphorous (as P) (mg/L)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
17	Reactive Phosphorous (mg/L)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
18	Polycyclic Aromatic Hydrocarbon (mg/L)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
19	Salinity (ppt)	Apr-23	High tide	34.158	33.625	34.096	33.726	33.761	33.960
			Low tide	34.173	33.674	34.125	33.797	33.892	34.015
		May-23	High tide	33.793	33.755	33.469	33.605	33.928	33.530
			Low tide	33.913	33.906	33.560	33.808	34.064	34.049
		Jun-23	High tide	34.077	33.631	32.881	33.942	34.226	33.379

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
			Low tide	33.418	33.204	32.790	33.295	33.211	33.139
		Jul-23	High tide	34.472	34.854	34.181	34.407	33.682	33.870
			Low tide	34.272	34.058	33.592	33.715	33.113	33.362
		Aug-23	High tide	35.695	34.821	33.578	33.831	33.833	33.925
			Low tide	35.494	34.216	33.138	33.184	33.142	33.466
		Sep-23	High tide	34.930	34.460	34.943	34.600	34.800	34.922
			Low tide	34.290	33.870	34.600	34.043	33.715	34.090
20	Total Chlorophyll (mg/m^3)	Apr-23	High tide	0.5	0.6	0.4	0.6	0.5	0.5
			Low tide	0.7	0.6	0.6	0.7	0.5	0.6
		May-23	High tide	0.5	0.4	0.5	0.4	0.5	0.6
			Low tide	0.8	0.5	0.7	0.6	0.7	0.8
		Jun-23	High tide	0.6	0.5	0.6	0.5	0.4	0.4
			Low tide	0.7	0.6	0.7	0.7	0.6	0.7
		Jul-23	High tide	0.6	0.5	0.5	0.6	0.5	0.5
			Low tide	0.7	0.6	0.6	0.7	0.7	0.6
		Aug-23	High tide	0.6	0.5	0.6	0.5	0.4	0.4
			Low tide	0.7	0.6	0.7	0.7	0.6	0.7
		Sep-23	High tide	0.6	0.5	0.6	0.5	0.4	0.4
			Low tide	0.7	0.6	0.7	0.7	0.6	0.7
21	Total Coliforms (MPN Index/100 mL)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL

Sl. No.	Parameter /unit	Month/Tide		Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
22	Faecal Coliforms (MPN Index/100 mL)	Apr-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-23	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL

HYR-5.5. Graphical representation of Results for marine water

Figure 5.2: Marine Water Analysis for Temperature

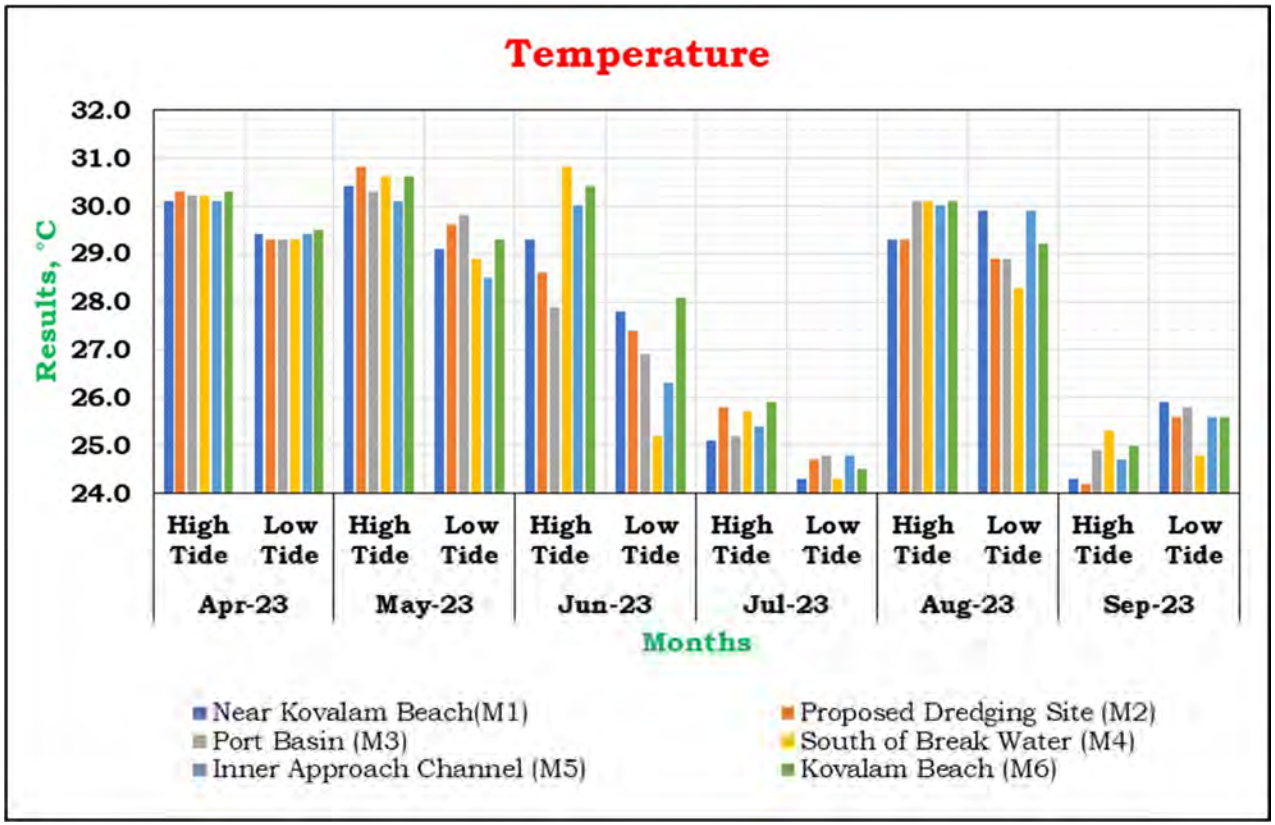


Figure 5.3: Marine Water Analysis for pH

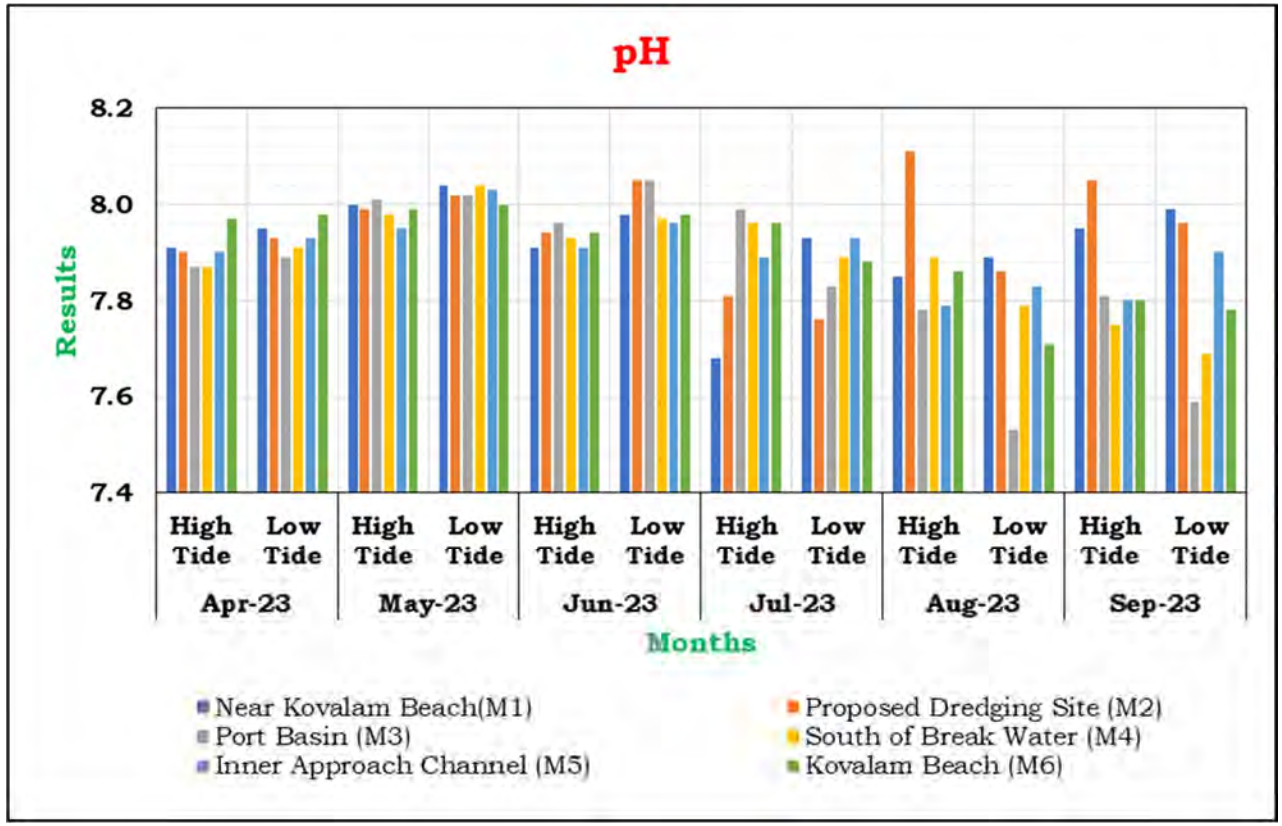


Figure 5.4: Marine Water Analysis for Electrical Conductivity

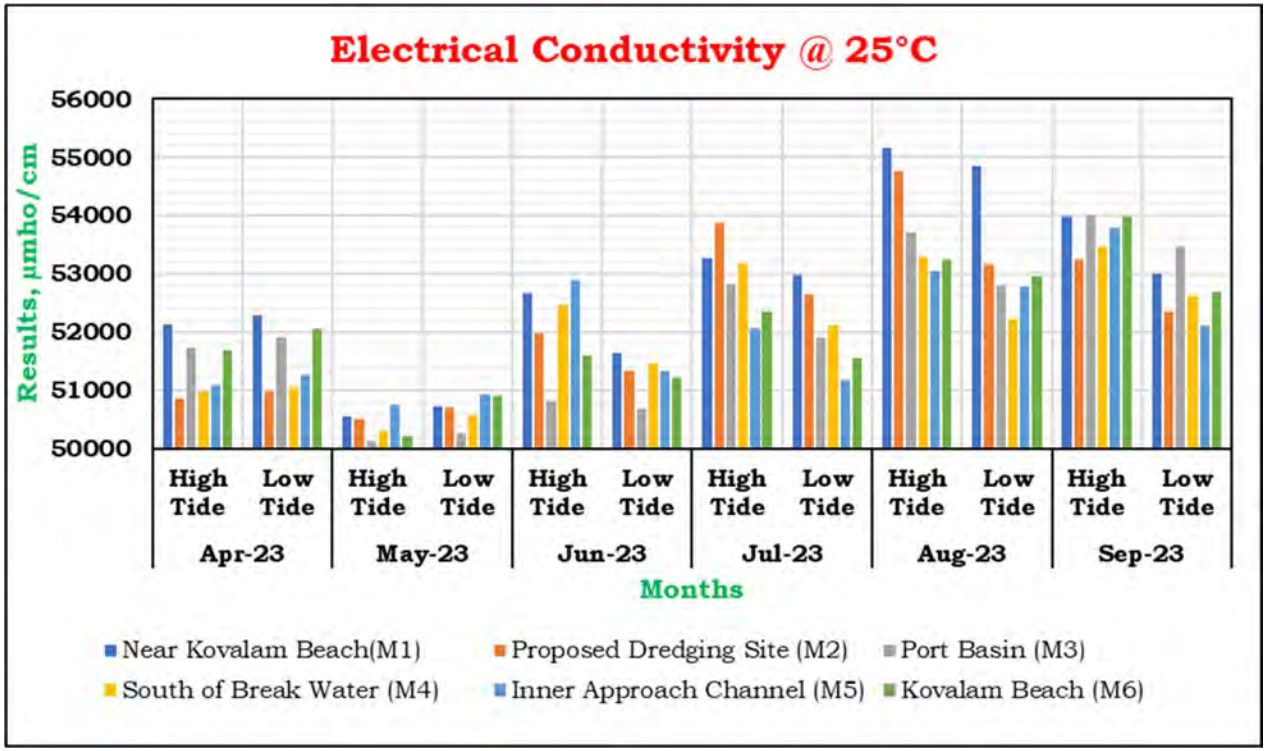


Figure 5.5: Marine Water Analysis for Turbidity

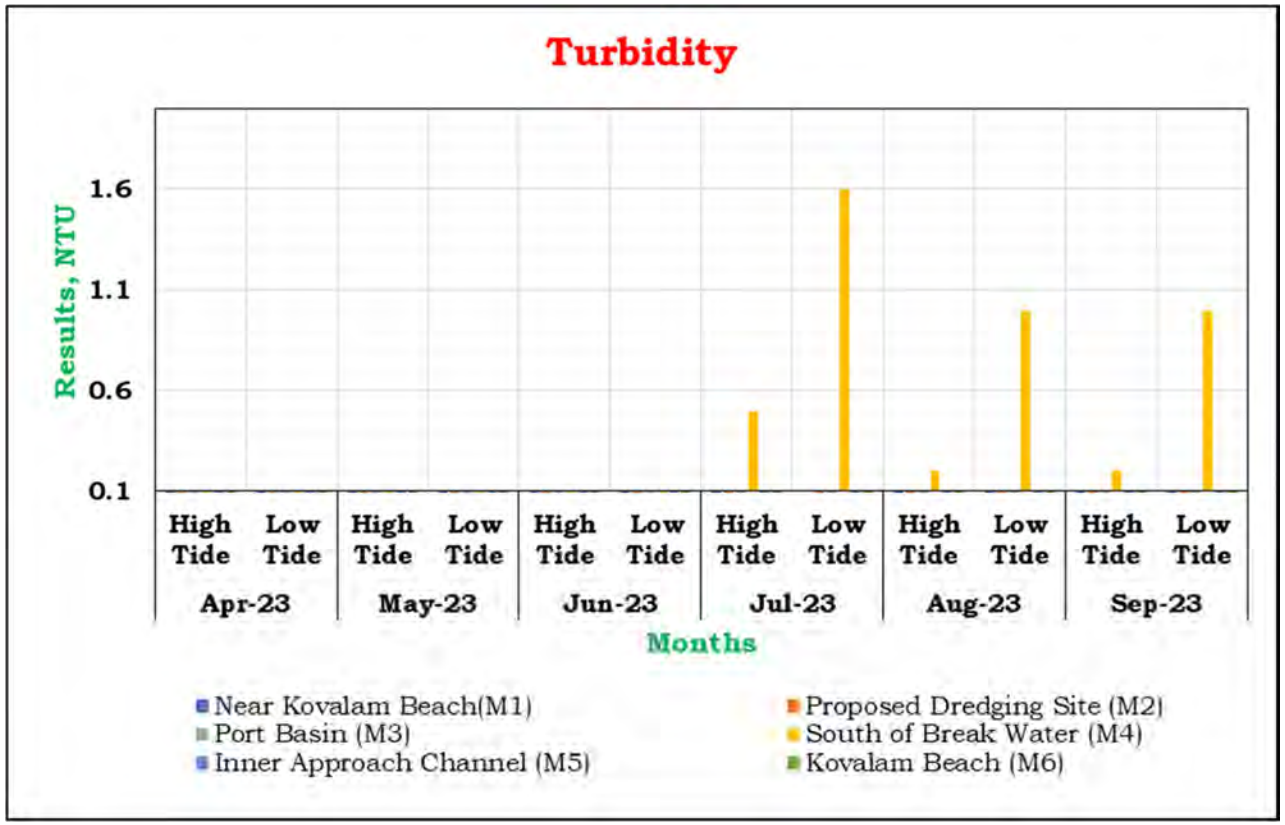


Figure 5.6: Marine Water Analysis for Total Dissolved Solids

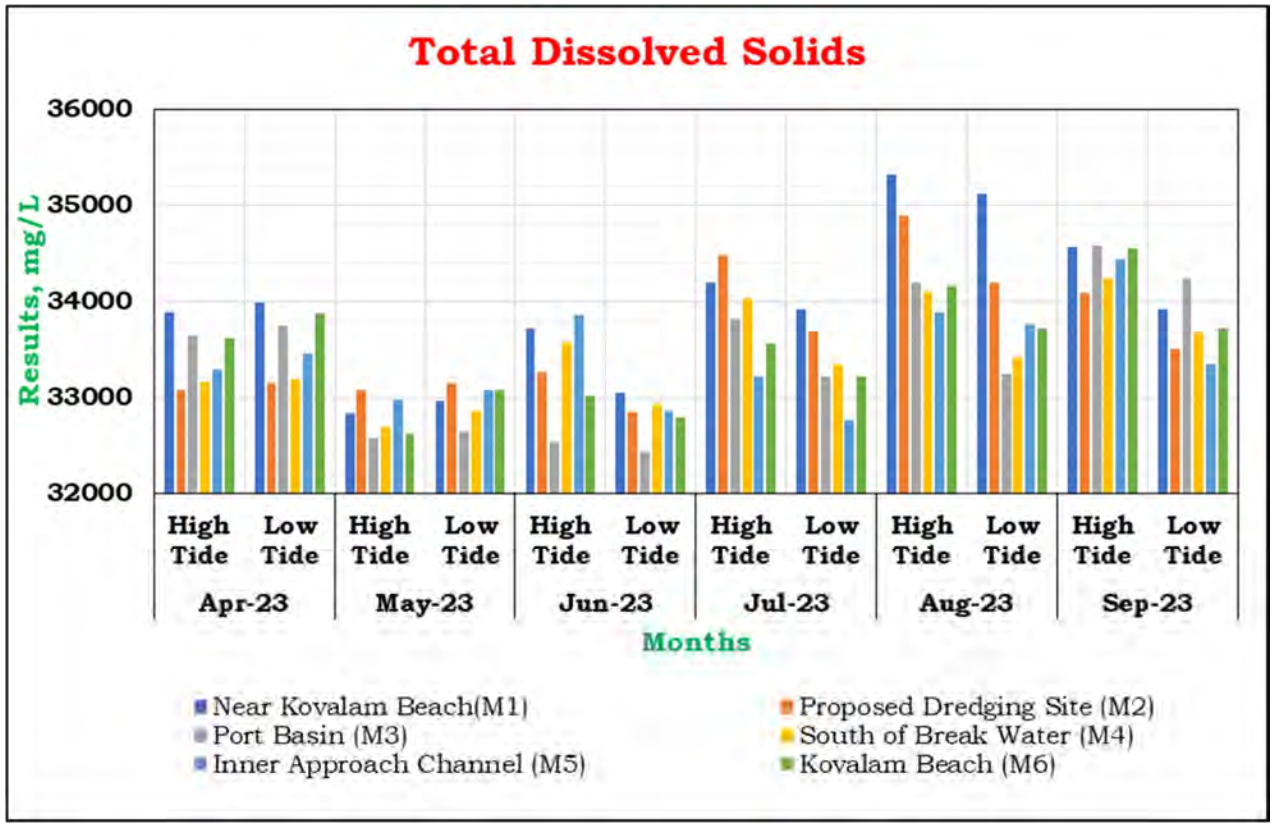


Figure 5.7: Marine Water Analysis for Dissolved Oxygen

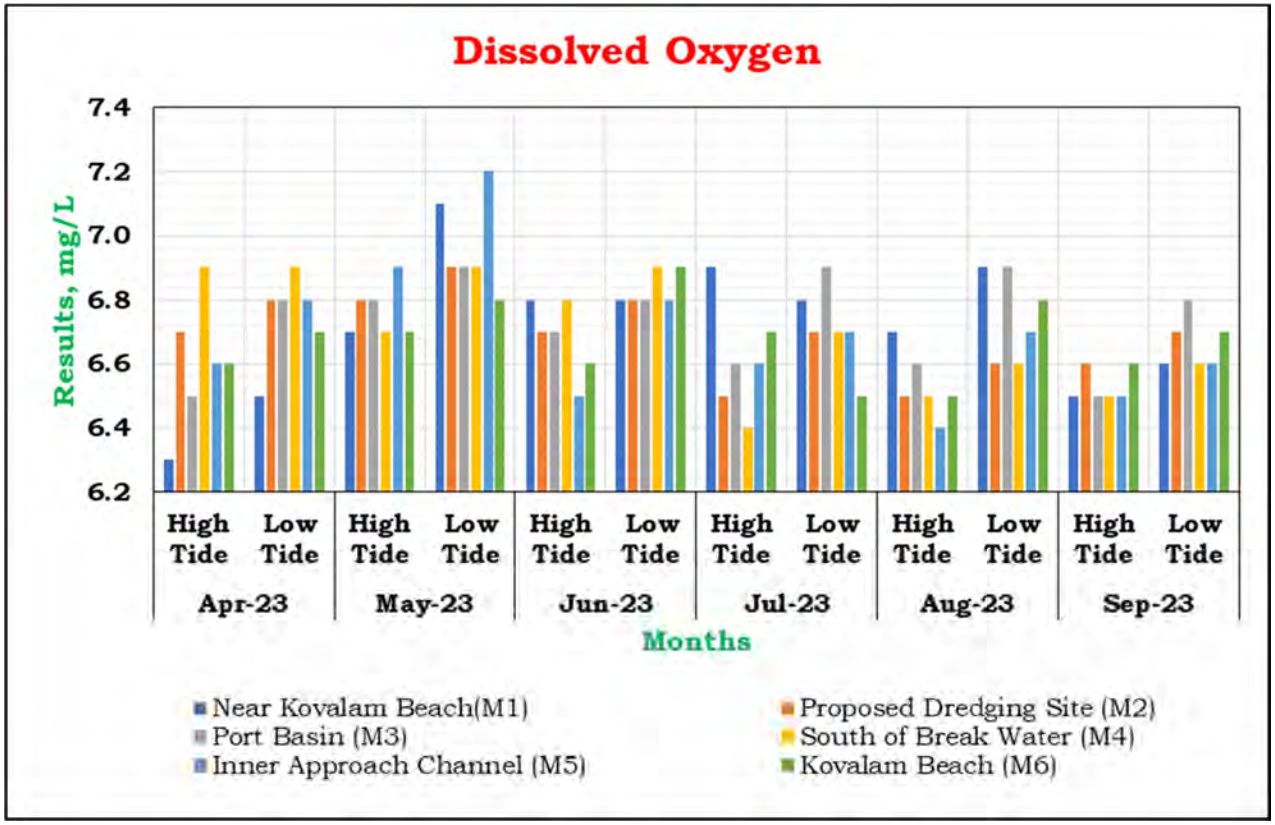


Figure 5.8: Marine Water Analysis for Nitrite as NO_2

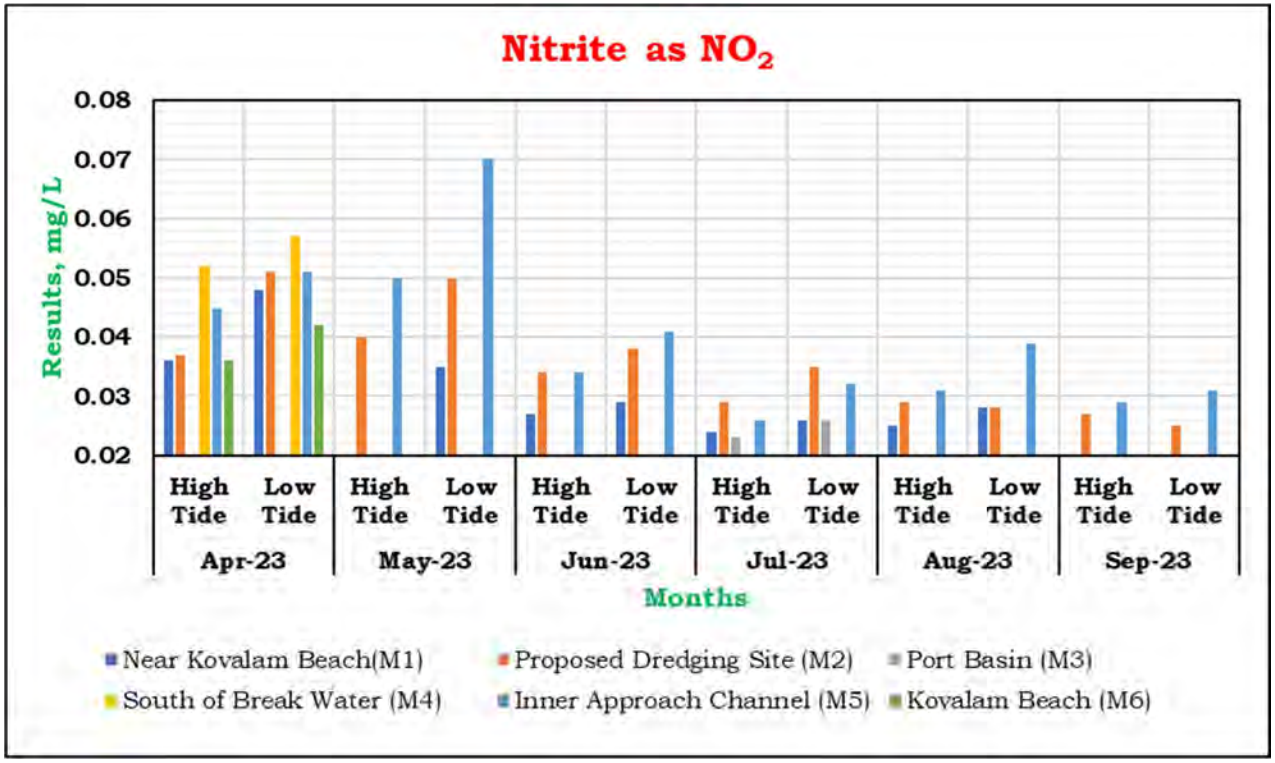


Figure 5.9: Marine Water Analysis for Salinity

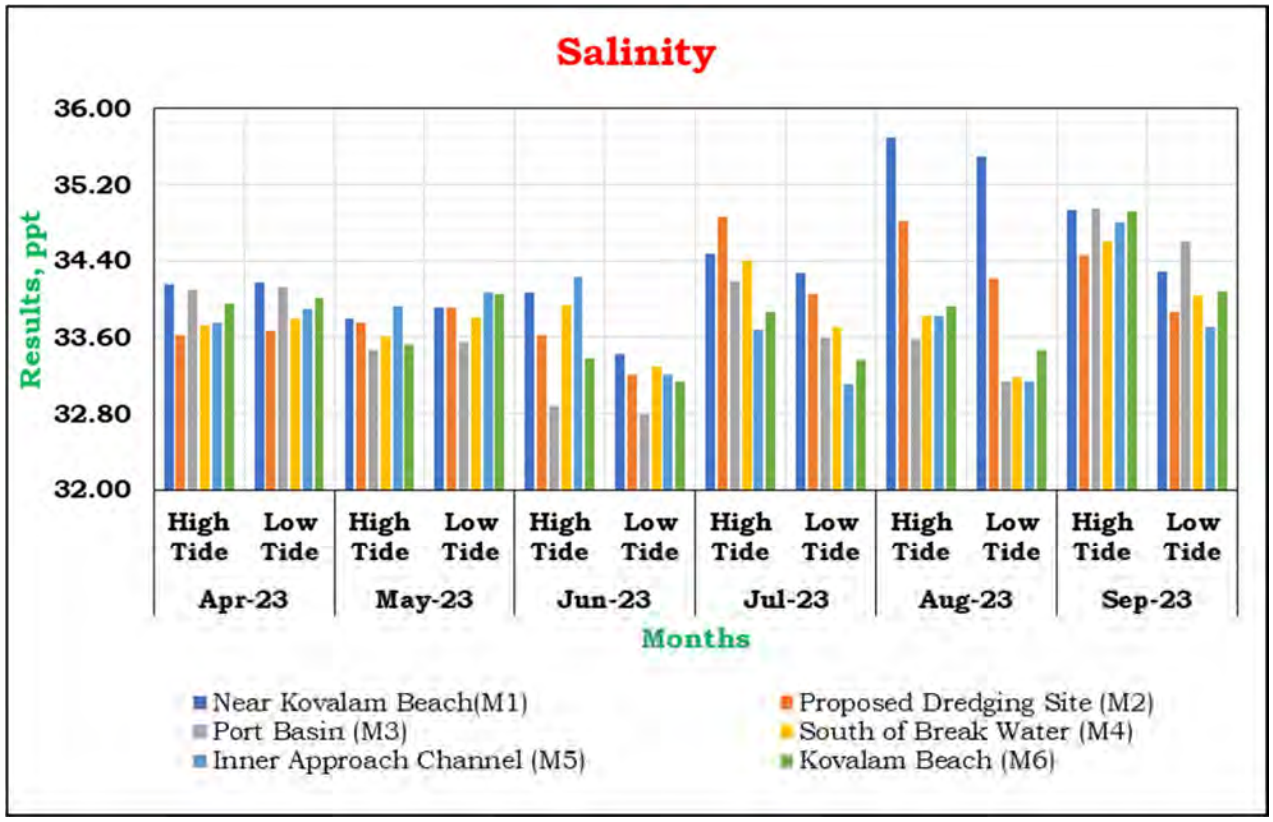
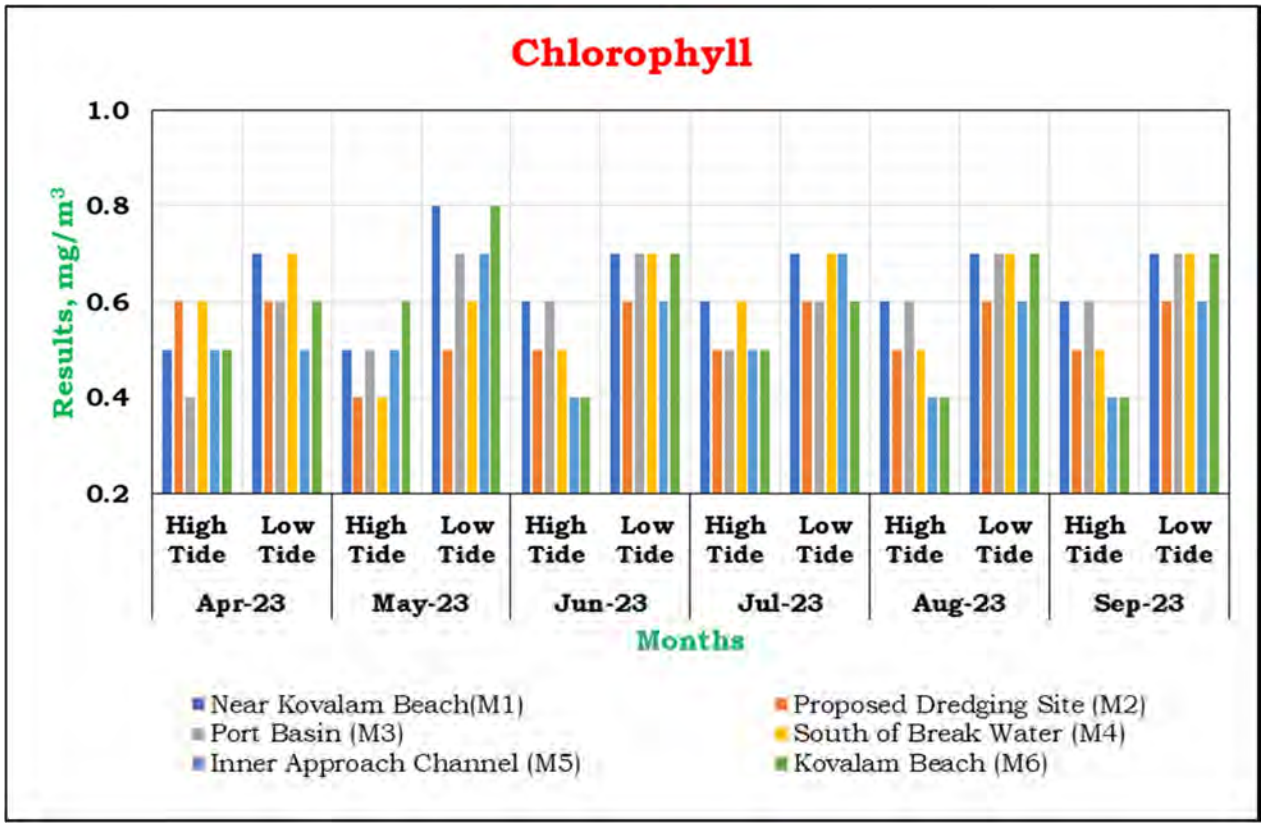


Figure 5.10: Marine Water Analysis for Chlorophyll



HYR-5.6. Summary - Marine water analysis:

During the months from April 2023 to September 2023, following is the summary of the marine water analysis:

a) At the location **Near Kovalam Beach** (low tide & high tide),

- Temperature was observed in the range from 24.3 to 30.4°C
- No visible colour was observed
- pH was observed in the range from 7.68 to 8.04
- Turbidity was observed in the range from BDL to 0.1 NTU
- Electrical Conductivity (at 25°C) was observed in the range from 50560 to 55170 µmho/cm
- Total Dissolved Solids were observed in the range from 32830 to 35309 mg/L
- Dissolved Oxygen was observed in the range from 6.3 to 7.1 mg/L
- Nitrite (as NO_2) was observed in the range from 0.020 to 0.048 mg/L
- Salinity was observed in the range from 33.418 to 35.695 ppt
- Total Chlorophyll was observed in the range from 0.5 to 0.8 mg/m^3
- Total Suspended Solids, Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous, Biological Oxygen Demand, Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below the detection limits.

b) At the location **Proposed Dredging Site** (low tide & high tide),

- Temperature was observed in the range from 24.2 to 30.8°C
- No visible colour was observed
- pH was observed in the range from 7.76 to 8.11
- Electrical Conductivity (at 25°C) was observed in the range from 50510 to 54760 µmho/cm
- Total Dissolved Solids were observed in the range from 32840 to 34890 mg/L

- Dissolved Oxygen was observed in the range from 6.5 to 6.9 mg/L
- Nitrite (as NO_2) was observed in the range from 0.025 to 0.051 mg/L
- Salinity was observed in the range from 33.204 to 34.854 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.6 mg/m^3
- Turbidity, Total Suspended Solids, Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous, Biological Oxygen Demand, Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below the detection limits.

c) At the location **Port basin** (low tide & high tide),

- Temperature was observed in the range from 24.8 to 30.3°C
- No visible colour was observed
- pH was observed in the range from 7.53 to 8.05
- Electrical Conductivity (at 25°C) was observed in the range from 50130 to 54008 µmho/cm
- Total Dissolved Solids were observed in the range from 32435 to 34565 mg/L
- Dissolved Oxygen was observed in the range from 6.5 to 6.9 mg/L
- Nitrite (as NO_2) was observed in the range from BDL to 0.026 mg/L
- Salinity was observed in the range from 32.790 to 34.943 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.7 mg/m^3
- Turbidity, Total Suspended Solids, Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous, Biological Oxygen Demand, Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below the detection limits.

d) At the location **South of Break Water** (low tide & high tide),

- Temperature was observed in the range from 24.3 to 30.8°C
- No visible colour was observed
- pH was observed in the range from 7.69 to 8.04

- Turbidity was observed in the range from BDL to 1.6 NTU
- Electrical Conductivity (at 25°C) was observed in the range from 50310 to 53478 µmho/cm
- Total Dissolved Solids were observed in the range from 32690 to 34226 mg/L
- Dissolved Oxygen was observed in the range from 6.4 to 6.9 mg/L
- Nitrite (as NO_2) was observed in the range from BDL to 0.057 mg/L
- Salinity was observed in the range from 33.184 to 34.600 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.7 mg/m^3
- Total Suspended Solids, Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous, Biological Oxygen Demand, Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below the detection limits.

e) At the location **Inner Approach Channel** (low tide & high tide),

- Temperature was observed in the range from 24.7 to 30.1°C
- No visible colour was observed
- pH was observed in the range from 7.79 to 8.03
- Electrical Conductivity (at 25°C) was observed in the range from 50740 to 53791 µmho/cm
- Total Dissolved Solids were observed in the range from 32755 to 34426 mg/L
- Dissolved Oxygen was observed in the range from 6.4 to 7.2 mg/L
- Nitrite (as NO_2) was observed in the range from 0.026 to 0.070 mg/L
- Salinity was observed in the range from 33.113 to 34.800 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.7 mg/m^3
- Turbidity, Total Suspended Solids, Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous, Biological Oxygen Demand, Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below the detection limits.

f) At the location **Kovalam Beach** (low tide & high tide),

- Temperature was observed in the range from 24.5 to 30.6°C
- No visible colour was observed
- pH was observed in the range from 7.71 to 8.00
- Electrical Conductivity (at 25°C) was observed in the range from 50210 to 53975 µmho/cm
- Total Dissolved Solids were observed in the range from 32620 to 34544 mg/L
- Dissolved Oxygen was observed in the range from 6.5 to 6.9 mg/L
- Nitrite (as NO_2) was observed in the range from BDL to 0.042 mg/L
- Salinity was observed in the range from 33.139 to 34.922 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.8 mg/m^3
- Turbidity, Total Suspended Solids, Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous, Biological Oxygen Demand, Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below the detection limits.

HYR-5.7. Maximum Values observed - Marine water analysis:

During the period from April 2023 to September 2023, the following is the maximum value observed.

Table 5.5: Maximum Values observed

Sl. No.	Parameter /unit	Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
1	Temperature (°C)	30.4	30.8	30.3	30.8	30.1	30.6
2	Colour	1	1	1	1	1	1
3	pH Value	8.04	8.11	8.05	8.04	8.03	8.00
4	Turbidity (N.T.U.)	0.1	BDL	BDL	1.6	BDL	BDL
5	Electrical Conductivity (at 25°C) (µmho/cm)	55170	54760	54008	53478	53791	53975
6	Total Suspended Solids (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
7	Total Dissolved Solids (mg/L)	35309	34890	34565	34226	34426	34544
8	Dissolved Oxygen (mg/L)	7.1	6.9	6.9	6.9	7.2	6.9
9	Biochemical Oxygen Demand (3 days, 27°C) (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
10	Floating Materials (Oil, Grease and Scum) (Including Petroleum Products) (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
11	Nitrite (as NO_2) (mg/L)	0.05	0.05	0.03	0.06	0.07	0.04
12	Nitrate (as NO_3) (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL

Sl. No.	Parameter /unit	Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break Water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
13	Phenolic Compounds (as C_6H_5OH) (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
14	Ammonical Nitrogen (as NH_3-N) (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
15	Total Nitrogen (as N) (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
16	Total Phosphorous (as P) (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
17	Reactive Phosphorous (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
18	Polycyclic Aromatic Hydrocarbon (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
19	Salinity (ppt)	35.695	34.854	34.943	34.600	34.800	34.922
20	Total Chlorophyll (mg/m^3)	0.8	0.6	0.7	0.7	0.7	0.8
21	Total Coliforms (MPN Index/100 mL)	BDL	BDL	BDL	BDL	BDL	BDL
22	Faecal Coliforms (MPN Index/100 mL)	BDL	BDL	BDL	BDL	BDL	BDL

HYR-5.8. Sediment Analysis Results

Table 5.6: Sediment Analysis Results

Sl. No.	Parameter	Unit	Month	Near Kovalam Beach (MS1)	Proposed Dredging Site (MS2)	Port Basin (MS3)	South of Break Water (MS4)	Inner Approach Channel (MS5)	Kovalam Beach (MS6)
1	Texture	-	Apr-23	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
			May-23	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
			Jun-23	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
			Jul-23	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
			Aug-23	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
			Sep-23	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
2	Organic Matter	%	Apr-23	0.43	0.39	0.76	0.47	0.36	0.31
			May-23	0.32	0.44	0.62	0.32	0.25	0.40
			Jun-23	0.46	0.49	0.53	0.39	0.36	0.33
			Jul-23	0.52	0.55	0.60	0.42	0.40	0.38
			Aug-23	0.54	0.55	0.68	0.39	0.40	0.36
			Sep-23	0.50	0.52	0.65	0.37	0.43	0.34
3	Total Phosphorus (as P)	mg/kg	Apr-23	276	238	466	181	135	248
			May-23	156	178	242	210	110	202
			Jun-23	187	165	220	248	169	243
			Jul-23	195	170	225	260	174	251
			Aug-23	208	182	232	274	185	266
			Sep-23	202	189	235	282	190	272
4	Aluminium (as Al)	mg/kg	Apr-23	1275	1161	1359	1262	863	1670
			May-23	1110	1245	1058	1365	1050	1420
			Jun-23	1340	1476	1236	1263	1379	1278
			Jul-23	1436	1510	1314	1338	1480	1364

Sl. No.	Parameter	Unit	Month	Near Kovalam Beach (MS1)	Proposed Dredging Site (MS2)	Port Basin (MS3)	South of Break Water (MS4)	Inner Approach Channel (MS5)	Kovalam Beach (MS6)
			Aug-23	1445	1522	1319	1342	1480	1364
			Sep-23	1450	1530	1324	1340	1475	1368
5	Chromium (as Cr)	mg/kg	Apr-23	BDL	BDL	BDL	BDL	BDL	BDL
			May-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL	BDL	BDL	BDL
6	Copper (as Cu)	mg/kg	Apr-23	BDL	BDL	BDL	BDL	BDL	BDL
			May-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL	BDL	BDL	BDL
7	Iron (as Fe)	mg/kg	Apr-23	5692	2358	7120	1457	1234	1152
			May-23	7452	1854	9460	1124	1065	986
			Jun-23	5670	1567	7468	1657	1479	1165
			Jul-23	6118	1654	7860	1854	1539	1280
			Aug-23	6126	1654	7899	1900	1559	1286
			Sep-23	6118	1650	7887	1836	1542	1278
8	Lead (as Pb)	mg/kg	Apr-23	BDL	BDL	BDL	BDL	BDL	BDL
			May-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL	BDL	BDL	BDL

Sl. No.	Parameter	Unit	Month	Near Kovalam Beach (MS1)	Proposed Dredging Site (MS2)	Port Basin (MS3)	South of Break Water (MS4)	Inner Approach Channel (MS5)	Kovalam Beach (MS6)
			Sep-23	BDL	BDL	BDL	BDL	BDL	BDL
9	Manganese (as Mn)	mg/kg	Apr-23	2.71	2.05	2.47	1.56	1.69	1.82
			May-23	1.87	1.45	2.15	1.78	1.26	1.55
			Jun-23	1.36	1.51	1.66	1.83	1.37	1.26
			Jul-23	1.42	1.56	1.70	1.96	1.45	1.32
			Aug-23	1.53	1.60	1.75	2.00	1.56	1.38
			Sep-23	1.48	1.57	1.72	1.94	1.53	1.32
10	Mercury (as Hg)	mg/kg	Apr-23	BDL	BDL	BDL	BDL	BDL	BDL
			May-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL	BDL	BDL	BDL
11	Zinc (as Zn)	mg/kg	Apr-23	1.36	1.34	1.62	1.84	1.31	1.65
			May-23	1.25	1.78	1.12	1.52	1.06	1.85
			Jun-23	1.36	1.46	1.27	1.36	1.33	1.51
			Jul-23	1.43	1.55	1.38	1.58	1.53	1.72
			Aug-23	1.48	1.66	1.46	1.70	1.59	1.84
			Sep-23	1.46	1.64	1.43	1.69	1.55	1.83
12	Nickel (as Ni)	mg/kg	Apr-23	BDL	BDL	BDL	BDL	BDL	BDL
			May-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL	BDL	BDL	BDL

Sl. No.	Parameter	Unit	Month	Near Kovalam Beach (MS1)	Proposed Dredging Site (MS2)	Port Basin (MS3)	South of Break Water (MS4)	Inner Approach Channel (MS5)	Kovalam Beach (MS6)
Benthic Organism									
13	Micro Benthic Organism	No./m^2	Apr-23	62300	56700	63600	67600	63600	62700
			May-23	61400	59300	61100	63400	65400	64100
			Jun-23	63900	61200	58900	61200	62700	66300
			Jul-23	62300	62900	60200	64600	60800	64800
			Aug-23	63900	61200	58900	61200	62700	66300
			Sep-23	63600	61900	58700	61400	61800	65800
14	Macro Benthic Organism	No./m^2	Apr-23	57600	54600	53400	50600	52900	58400
			May-23	56300	55100	54200	53700	53600	57500
			Jun-23	57800	56800	55700	54300	55100	59600
			Jul-23	58100	55400	56300	56100	56400	60900
			Aug-23	57800	56800	55700	54300	55100	59600
			Sep-23	57600	56400	55400	54900	55500	59800
15	Total Benthos	No./m^2	Apr-23	119900	111300	117000	118200	116500	121100
			May-23	117700	114400	115300	117100	119000	121600
			Jun-23	121700	118000	114600	115500	117800	125900
			Jul-23	120400	118300	116500	120700	117200	125700
			Aug-23	121700	118000	114600	115500	117800	125900
			Sep-23	121200	118300	114100	116300	117300	125600

HYR-5.9. Graphical representation of Results for Sediment analysis

Figure 5.10: Sediment Analysis for Organic Matter

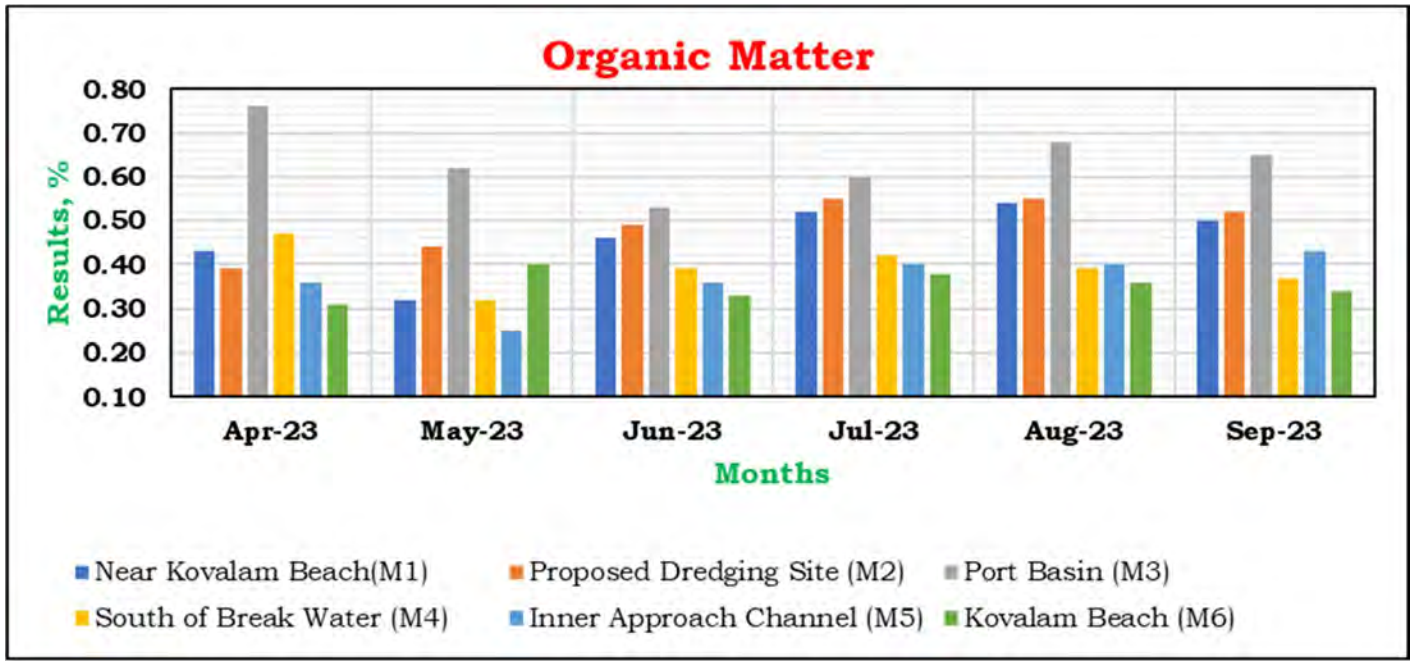


Figure 5.11: Sediment Analysis for Total Phosphorous as P

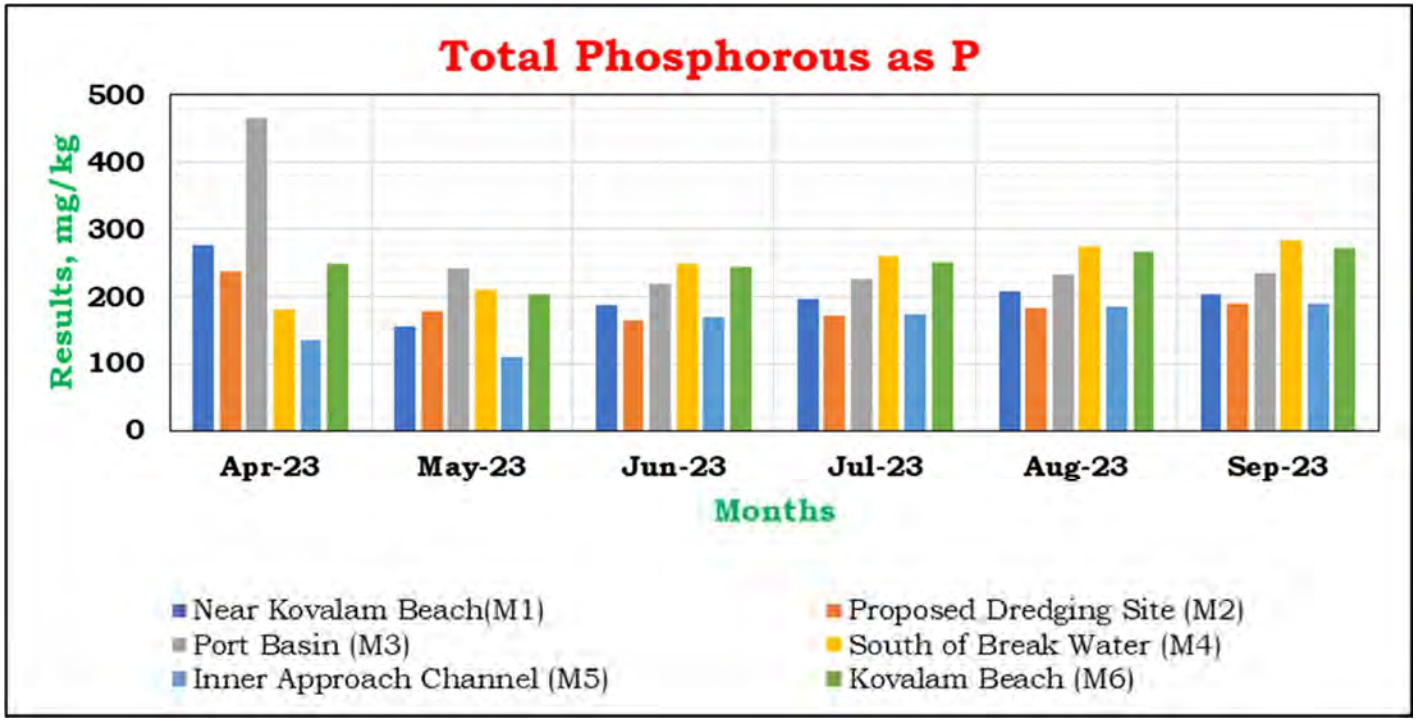


Figure 5.12: Sediment Analysis for Aluminium as Al

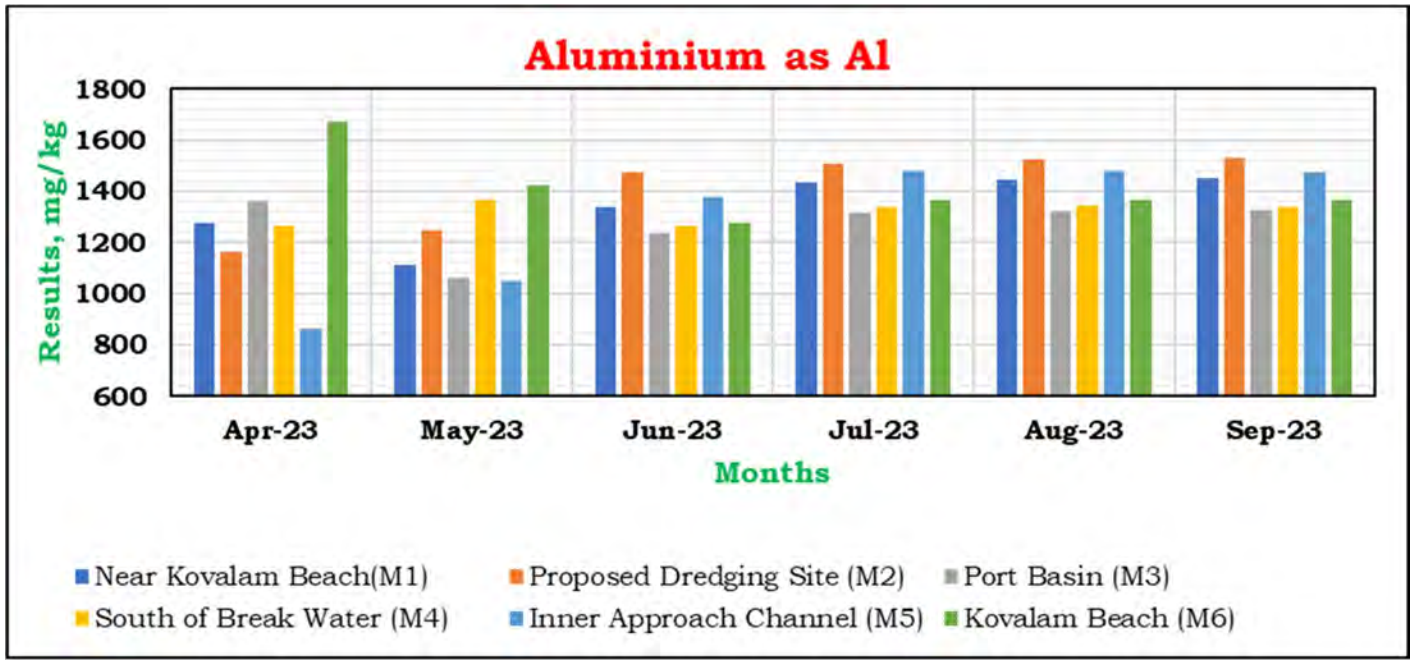


Figure 5.13: Sediment Analysis for Iron as Fe

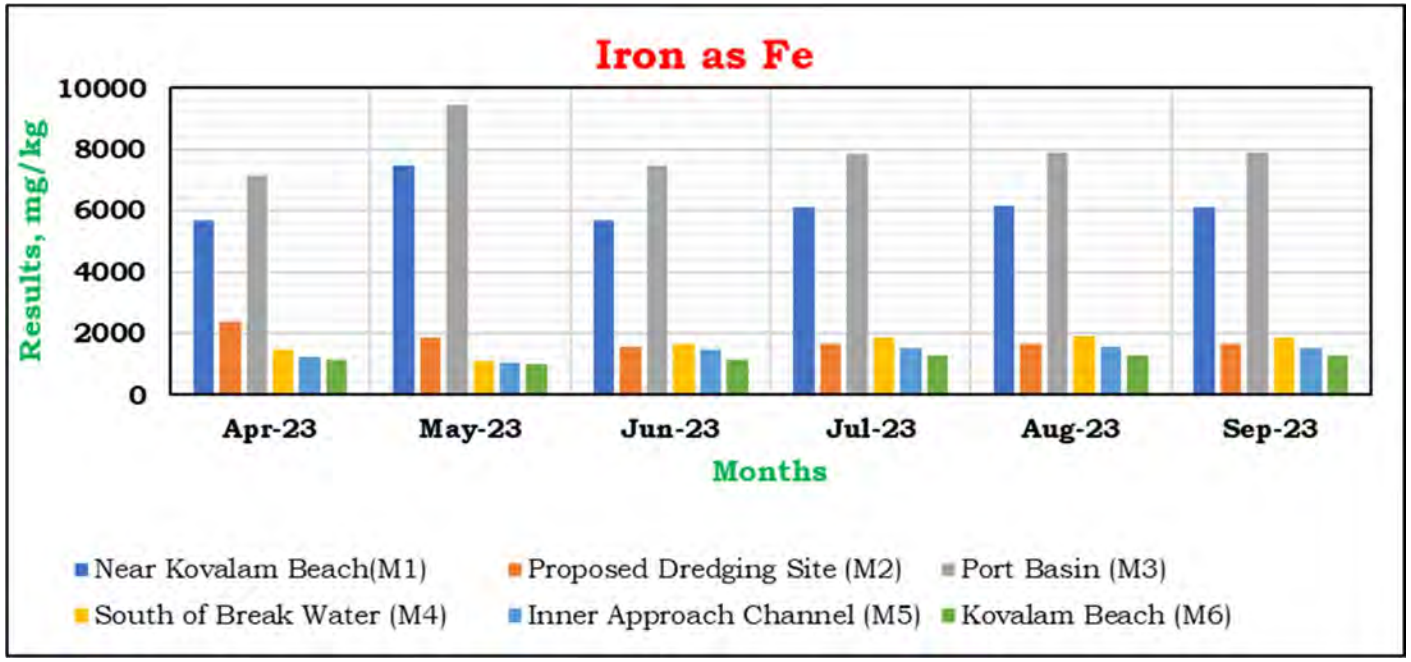


Figure 5.14: Sediment Analysis for Manganese as Mn

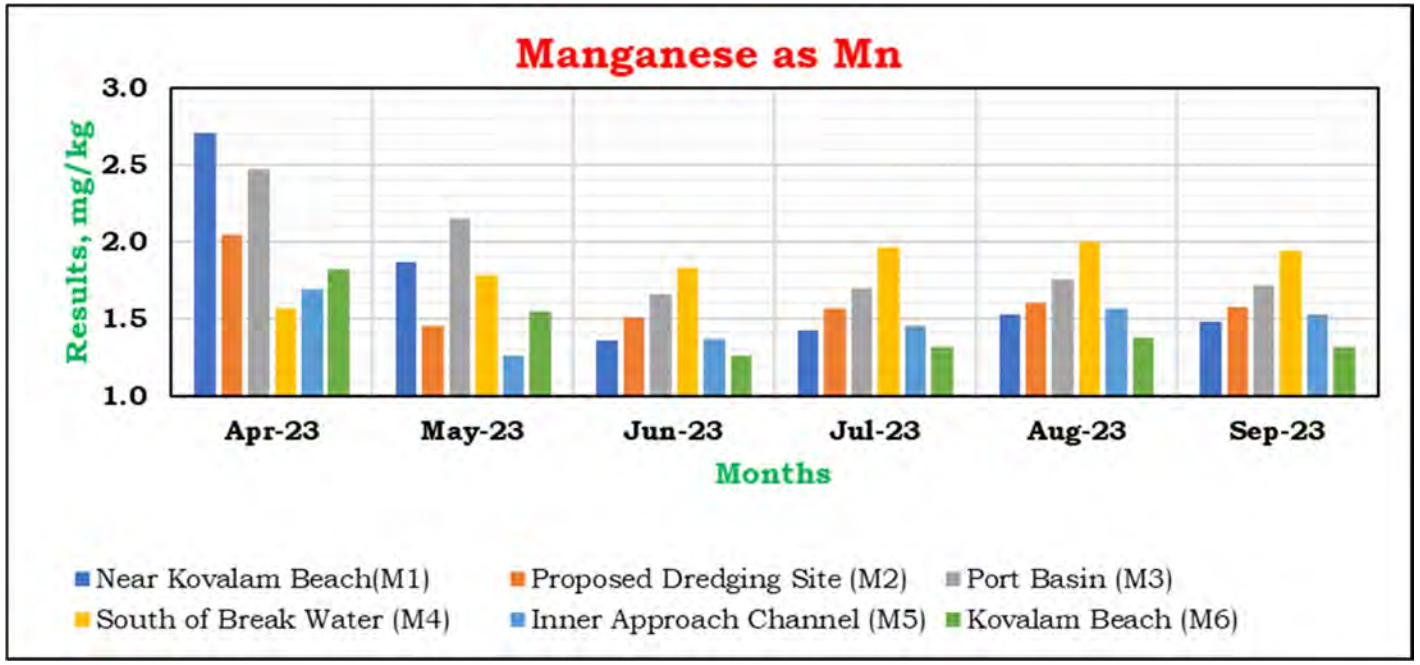


Figure 5.15: Sediment Analysis for Zinc as Zn

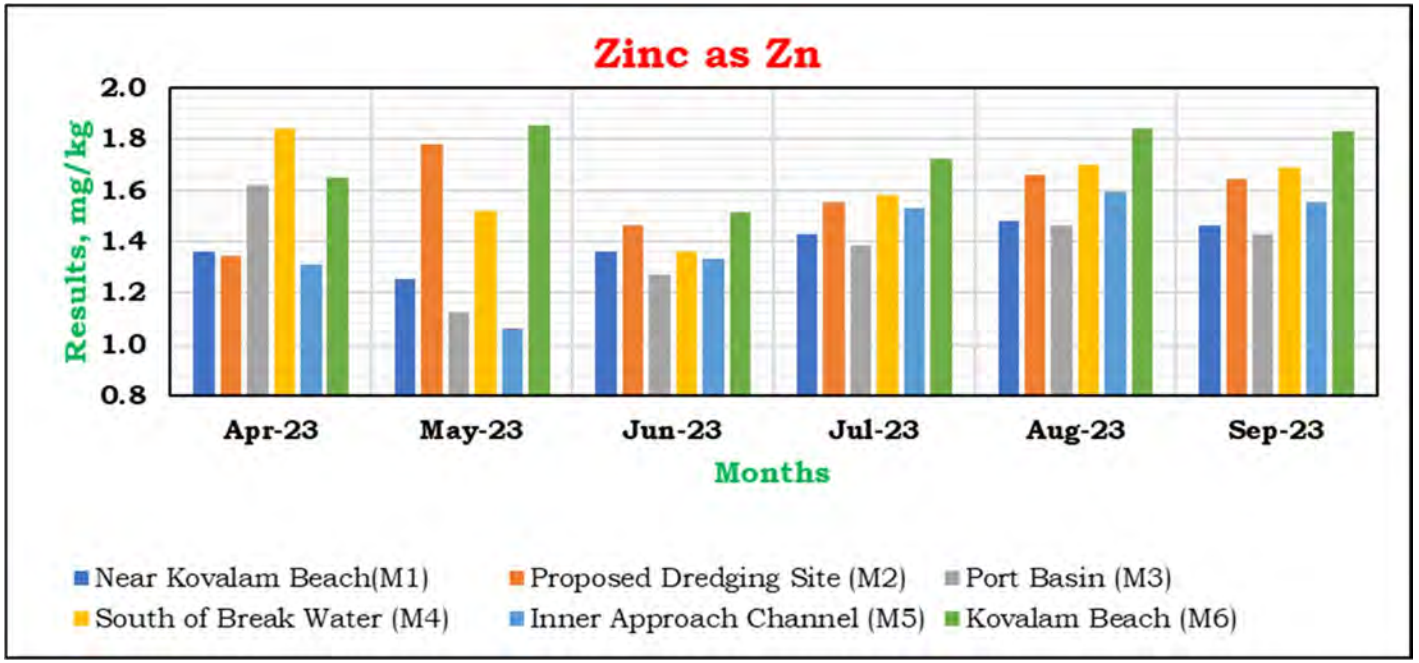
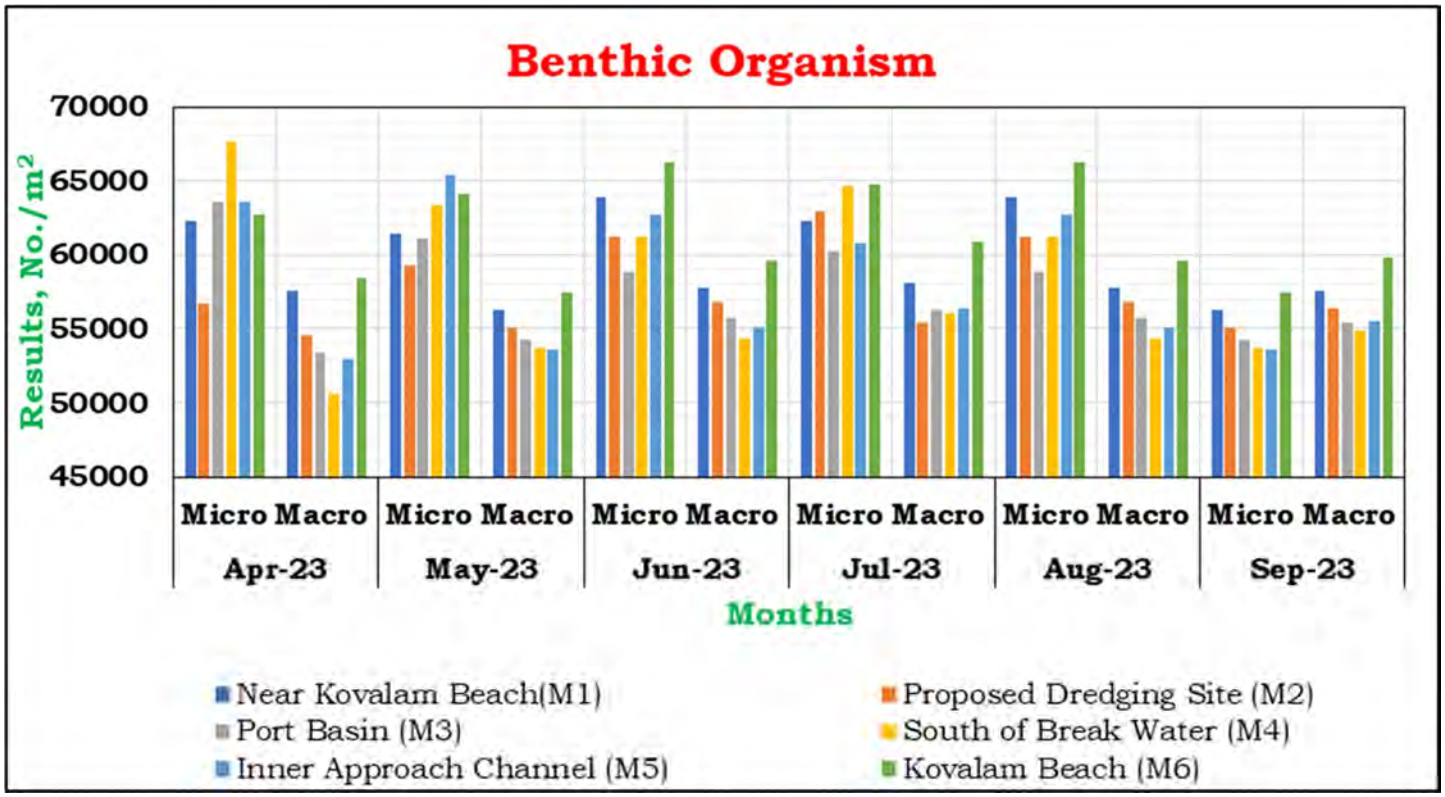


Figure 5.16: Sediment Analysis for Benthic Organism



HYR-5.10. Summary - Sediment Analysis:

During the months from April 2023 to September 2023, following is the summary of sediment analysis:

a) At the location **Near Kovalam Beach**,
- The observed texture was sandy
- Organic matter was observed in the range from 0.32 to 0.54%
- Total Phosphorus (as P) was observed in the range from 156 to 276 mg/kg
- Aluminium (as Al) was observed in the range from 1110 to 1450 mg/kg
- Iron (as Fe) was observed in the range from5670 to 7452 mg/kg
- Manganese (as Mn) was observed in the range from1.36 to 2.71 mg/kg
- Zinc (as Zn) was observed in the range from 1.25 to 1.48 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below the detection limits
- Micro benthic organisms were observed in the range from 61400 to 63900/m^2
- Macro benthic organisms were observed in the range from 56300 to 58100/m^2.

b) At the location **Proposed Dredging Site**,
- The observed texture was sandy
- Organic matter was observed in the range from 0.39 to 0.55%
- Total Phosphorus (as P) was observed in the range from 165 to 238 mg/kg
- Aluminium (as Al) was observed in the range from 1161 to 1530 mg/kg
- Iron (as Fe) was observed in the range from 1567 to 2358 mg/kg
- Manganese (as Mn) was observed in the range from 1.45 to 2.05 mg/kg
- Zinc (as Zn) was observed in the range from 1.34 to 1.78 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below the detection limits
- Micro benthic organisms were observed in the range from 56700 to 62900/m^2

- Macro benthic organisms were observed in the range from 54600 to 56800/m^2.

c) At the location **Port Basin**,

- The observed texture was sandy loam
- Organic matter was observed in the range from 0.53 to 0.76%
- Total Phosphorus (as P) was observed in the range from 220 to 466 mg/kg
- Aluminium (as Al) was observed in the range from 1058 to 1359 mg/kg
- Iron (as Fe) was observed in the range from 7120 to 9460 mg/kg
- Manganese (as Mn) was observed in the range from 1.66 to 2.47 mg/kg
- Zinc (as Zn) was observed in the range from 1.12 to 1.62 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below the detection limits
- Micro benthic organisms were observed in the range from 58700 to 63600/m^2
- Macro benthic organisms were observed in the range from 53400 to 56300/m^2.

d) At the location **South of Break Water**,

- The observed texture was sandy
- Organic matter was observed in the range from 0.32 to 0.47%
- Total Phosphorus (as P) was observed in the range from 181 to 282 mg/kg
- Aluminium (as Al) was observed in the range from 1262 to 1365 mg/kg
- Iron (as Fe) was observed in the range from 1124 to 1900 mg/kg
- Manganese (as Mn) was observed in the range from 1.56 to 2.00 mg/kg
- Zinc (as Zn) was observed in the range from 1.36 to 1.84 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below the detection limits
- Micro benthic organisms were observed in the range from 61200 to 67600/m^2
- Macro benthic organisms were observed in the range from 50600 to 56100/m^2.

e) At the location **Inner Approach Channel**,

- The observed texture was sandy
- Organic matter was observed in the range from 0.25 to 0.43%
- Total Phosphorus (as P) was observed in the range from 110 to 190 mg/kg
- Aluminium (as Al) was observed in the range from 863 to 1480 mg/kg
- Iron (as Fe) was observed in the range from 1065 to 1559 mg/kg
- Manganese (as Mn) was observed in the range from 1.26 to 1.69 mg/kg
- Zinc (as Zn) was observed in the range from 1.06 to 1.59 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below the detection limits
- Micro benthic organisms were observed in the range from 60800 to 65400/m^2
- Macro benthic organisms were observed in the range from 52900 to 56400/m^2.

f) At the location **Kovalam Beach**,

- The observed texture was sandy
- Organic matter was observed in the range from 0.31 to 0.40%
- Total Phosphorus (as P) was observed in the range from 202 to 272 mg/kg
- Aluminium (as Al) was observed in the range from 1278 to 1670 mg/kg
- Iron (as Fe) was observed in the range from 986 to 1286 mg/kg
- Manganese (as Mn) was observed in the range from 1.26 to 1.82 mg/kg
- Zinc (as Zn) was observed in the range from 1.51 to 1.85 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below the detection limits
- Micro benthic organisms were observed in the range from 62700 to 66300/m^2
- Macro benthic organisms were observed in the range from 57500 to 60900/m^2.

g) Summary – Comparison of Results of **All Locations**,

- The observed texture was sandy in all locations except Port Basin which was sandy loam
- Maximum value of Organic matter observed was 0.76% at Port Basin
- Maximum value of Total Phosphorus (as P) observed was 466 mg/kg at Port Basin
- Maximum value of Aluminium (as Al) observed was 1670 mg/kg at Kovalam Beach
- Maximum value of Iron (as Fe) observed was 9460 mg/kg at Port Basin
- Maximum value of Manganese (as Mn) observed was 2.71 mg/kg at Near Kovalam Beach
- Maximum value of Zinc (as Zn) observed was 1.85 mg/kg at Kovalam Beach
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below the detection limits at all locations
- Maximum value of Micro benthic organisms observed was 67600/m^2 at South of Break water
- Maximum value of Macro benthic organisms observed was 60900/m^2 at Kovalam Beach.

HYR-5.11. Marine Water Analysis for Phytoplankton and Zooplankton

Table 5.7: Total Phytoplankton and Zooplankton Results

Parameter	Month	Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
Total Phytoplankton No/100 mL	Apr-23	74307	77730	59621	60484	66543	63941
	May-23	75181	71616	66881	63529	65350	64481
	Jun-23	77542	74176	70567	65324	68148	60862
	Jul-23	86932	81257	75229	70655	72919	64741
	Aug-23	77542	74176	70567	65324	68148	60862
	Sep-23	78948	71372	70272	64718	63971	61990
Total Zooplankton No/100 mL	Apr-23	8654	5576	9575	10400	8011	7633
	May-23	9944	6509	9407	11505	8573	7960
	Jun-23	11362	7047	8865	11103	8218	8317
	Jul-23	12708	7905	9555	10730	9168	8925
	Aug-23	11362	7047	8865	11103	8218	8317
	Sep-23	11587	7043	8813	11045	7981	8387

HYR-5.12. Graphical representation of Results for Marine Phytoplankton and Zooplankton

Figure 5.17: Marine Water Analysis for Total Phytoplankton

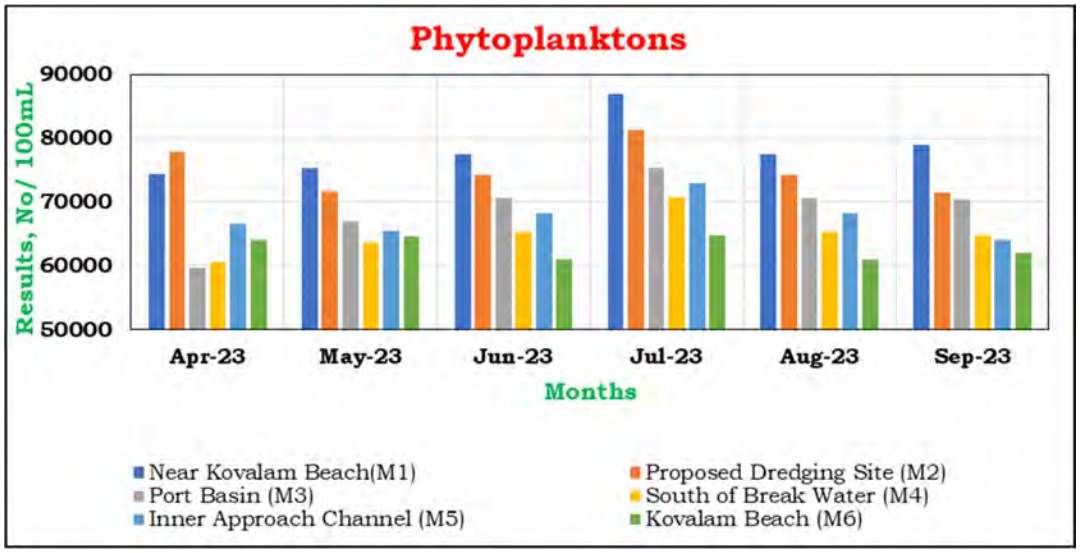
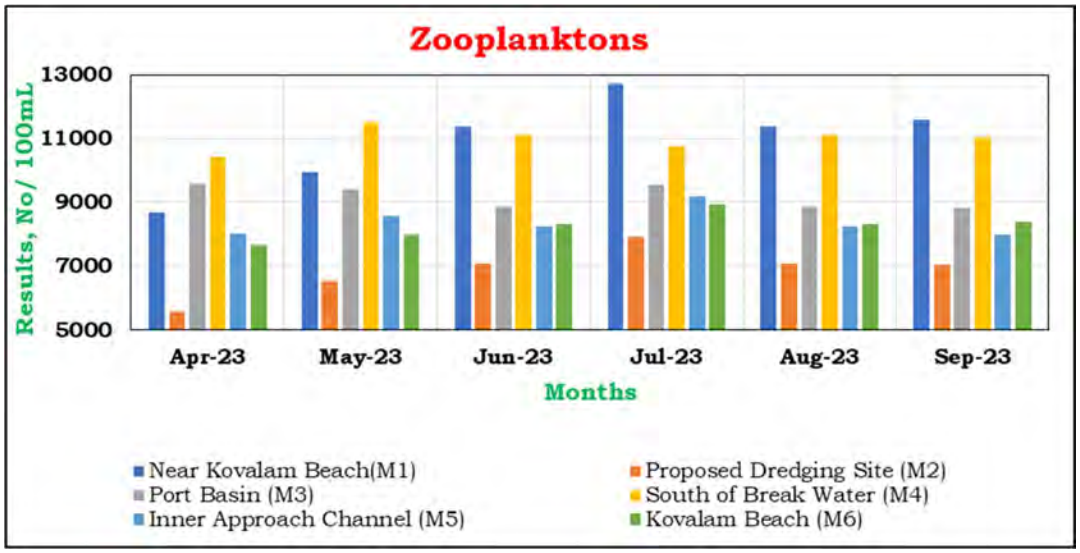


Figure 5.18: Marine Water Analysis for Total Zooplankton



HYR-5.13. Summary-Marine Water Analysis for Phytoplankton and Zooplankton

During the months from April 2023 to September 2023, following is the summary of Marine Water Analysis for Phytoplankton and Zooplankton:

Table 5.8: Summary-Marine Water Analysis for Phytoplankton and Zooplankton Results

Parameter	Range	Near Kovalam Beach (M1)	Proposed Dredging Site (M2)	Port Basin (M3)	South of Break water (M4)	Inner Approach Channel (M5)	Kovalam Beach (M6)
Total Phytoplankton No/100 mL	From	74307	71372	59621	60484	63971	60862
	To	86932	81257	75229	70655	72919	64741
Total Zooplankton No/100 mL	From	8654	5576	8813	10400	7981	7633
	To	12708	7905	9575	11505	9168	8925

a) At the location **Near Kovalam Beach**,
- Total Phytoplankton were observed in the range from 74307 to 86932 No/100 mL
- Total Zooplankton were observed in the range from 8654 to 12708 No/100 mL

b) At the location **Proposed Dredging Site**,
- Total Phytoplankton were observed in the range from 71372 to 81257 No/100 mL
- Total Zooplankton were observed in the range from 5576 to 7905 No/100 mL

c) At the location **Port Basin**,
- Total Phytoplankton were observed in the range from 59621 to 75229 No/100 mL

- Total Zooplankton were observed in the range from 8813 to 9575 No/100 mL

d) At the location **South of Break Water**,
- Total Phytoplankton were observed in the range from 60484 to 70655 No/100 mL
- Total Zooplankton were observed in the range from 10400 to 11505 No/100 mL

e) At the location **Inner Approach Channel**,
- Total Phytoplankton were observed in the range from 63971 to 72919 No/100 mL
- Total Zooplankton were observed in the range from 7981 to 9168 No/100 mL

f) At the location **Kovalam Beach**,
- Total Phytoplankton were observed in the range from 60862 to 64741 No/100 mL
- Total Zooplankton were observed in the range from 7633 to 8925 No/100 mL

g) Summary – Comparison of Results of **All Locations**,
- Maximum value of Total Phytoplankton observed was 86932 No/100 mL at Near Kovalam Beach
- Maximum value of Total Zooplankton observed was 12708 No/100 mL at Near Kovalam Beach.

HYR-6	Ground Water & Surface Water Analysis

HYR-6.1. Ground Water & Surface Water Location Details:

This section describes the sampling location, methodology adopted for analysis and analysis results of Ground Water and Surface Water during the period from April 2023 to September 2023.

Ground water sampling was carried out at three locations including Port Site, PAF Area and Proposed Port Estate Area.

Surface water sampling was carried out at three locations including Poovar West Canal, Vizhinjam Branch Canal and Vellayani Lake.

Table 6.1: Coordinates of Ground Water Location

Location	Legend	Latitude	Longitude
Project Site	G1	8°22'03.72"N	77°00'16.92"E
Proposed Port Estate Area	G2	8°22'24.96"N	77°00'45.84"E
PAF Area	G3	8°22'17.60"N	77°00'11.12"E

Table 6.2: Coordinates of Surface Water Location

Location	Legend	Latitude	Longitude
Poovar West Canal	S1	8°19'22.66"N	77°04'31.70"E
Vizhinjam Branch Canal	S2	8°22'55.59"N	76°59'36.29"E
Vellayani Lake	S3	8°25'31.91"N	76°59'37.10"E

Figure 6.1: Google earth views of Ground Water & Surface Water Sampling Locations

HYR-6.2. Methodology of Sampling and Analysis:

Table 6.3: Ground Water & Surface Water Methodology

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
Surface and Ground Water Analysis				
1.	Colour	Hazen Units	1	IS 3025 Part 4: 1983 RA 2017
2.	Odour	-	--	IS 3025 Part 5: 1983 RA 2018
3.	pH Value	-	1	IS 3025 Part 11: 1983 RA 2017
4.	Turbidity	N.T.U.	0.1	IS 3025 Part 10: 1984 RA 2017
5.	Electrical Conductivity (at 25°C)	µmho/cm	0.001	IS 3025 Part 14:1984 RA 2019
6.	Total Dissolved Solids	mg/L	1	IS 3025 Part 16: 1984 RA 2017
7.	Dissolved Oxygen	mg/L	0.2	IS 3025 Part 38:1989RA 2019
8.	Biochemical Oxygen Demand (3 days, 27°C)	mg/L	2	IS 3025 Part 44:1993RA 2019

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
9.	Oil & Grease	mg/L	1	IS 3025 Part 39: 1991 RA 2019
10.	Aluminium (as Al)	mg/L	0.03	IS 3025 Part 55:2003 RA 2019
11.	Ammonia (as NH_3- N)	mg/L	1	IS 3025 Part 34:1988 RA 2019
12.	Anionic Detergents (as MBAS) Calculated as LAS mol.wt. 288.38	mg/L	0.01	IS 13428 Annex K:2005
13.	Barium (as Ba)	mg/L	0.17	APHA 23rd Edition 3111D:2017
14.	Boron (as B)	mg/L	0.2	IS 3025 Part 57 :2005RA 2017
15.	Calcium (as Ca)	mg/L	1	IS 3025 Part 40: 1991 RA 2019
16.	Chloramines (as Cl_2)	mg/L	1	APHA 23rd Edition 4500 Cl,G:2017
17.	Chloride (as Cl)	mg/L	1	IS 3025 Part 32: 1988 RA 2019
18.	Copper (as Cu)	mg/L	0.016	IS 3025 Part 42: 1992 RA 2019
19.	Fluoride (as F)	mg/L	0.1	APHA 23rd Edition 4500 -F- B, D: 2017
20.	Iron (as Fe)	mg/L	0.1	IS 3025 Part 53: 2003 RA 2019
21.	Magnesium (as Mg)	mg/L	1	IS 3025 Part 46: 1994 RA 2019
22.	Manganese (as Mn)	mg/L	0.016	IS 3025 Part 59: 2006 RA 2017
23.	Mineral Oil	mg/L	0.50	IS 3025 Part 39: 1991 RA 2019
24.	Nitrate (as NO_3)	mg/L	1	APHA 23rd Edition 4500 -NO_3 B: 2017
25.	Phenolic Compounds (as C_6H_5OH)	mg/L	0.001	IS 3025 Part 43: 1992 RA 2019
26.	Selenium (as Se)	mg/L	0.001	APHA 23rd Edition 3114C:2017
27.	Silver (as Ag)	mg/L	0.03	APHA 23rd Edition 3111B:2017
28.	Sulphate (as SO_4)	mg/L	1	IS 3025 Part 24: 1986 RA 2019
29.	Sulphide (as H_2S)	mg/L	0.01	IS 3025 Part 29 :1986RA 2019
30.	Total Phosphate (as PO_4)	mg/L	0.1	IS 3025 Part 31:1988 RA 2019
31.	Total Alkalinity (as $CaCO_3$)	mg/L	1	IS 3025 Part 23: 1986 RA 2019
32.	Total Hardness (as $CaCO_3$)	mg/L	1	IS 3025 Part 21: 2009 RA 2019
33.	Calcium Hardness (as $CaCO_3$)	mg/L	1	IS 3025 Part 40: 1991 RA 2019
34.	Zinc (as Zn)	mg/L	0.008	APHA 23rd Edition 3111B:2017
35.	Sodium (as Na)	mg/L	1	IS 3025 Part 45: 1993 RA 2019
36.	Potassium (as K)	mg/L	0.5	IS 3025 Part 45: 1993 RA 2019
37.	Sodium Absorption Ratio	-	1	IS 11624 : 1986
38.	Cadmium (as Cd)	mg/L	0.003	IS 3025 Part 41: 1992 RA 2019
39.	Cyanide (as CN)	mg/L	0.01	IS 3025 Part 27: 1986 RA 2019
40.	Lead (as Pb)	mg/L	0.01	IS 3025 Part 47: 1994 RA 2019
41.	Mercury (as Hg)	mg/L	0.001	IS 3025 Part 48: 1994 RA 2019
42.	Molybdenum (as Mo)	mg/L	0.07	APHA 23rd Edition 3111D:2017
43.	Nickel (as Ni)	mg/L	0.02	IS 3025 Part 54: 2003 RA 2019
44.	***Pesticide Residues***			

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
i.	Alachlor	µg/L	0.005	SEAAL/INS/RWM/SOP/01
ii.	Atrazine	µg/L	0.005	SEAAL/INS/RWM/SOP/01
iii.	Aldrin/Dieldrin	µg/L	0.005	SEAAL/INS/RWM/SOP/01
iv.	Alpha HCH	µg/L	0.005	SEAAL/INS/RWM/SOP/01
v.	Beta HCH	µg/L	0.005	SEAAL/INS/RWM/SOP/01
vi.	Butachlor	µg/L	0.005	SEAAL/INS/RWM/SOP/01
vii.	Chlorpyrifos	µg/L	0.005	SEAAL/INS/RWM/SOP/01
viii.	Delta HCH	µg/L	0.005	SEAAL/INS/RWM/SOP/01
ix.	2,4D chlorophenoxyacetic acid	µg/L	0.005	SEAAL/INS/RWM/SOP/01
x.	DDT (o,p&p,p- Isomers of DDT, DDE, DDD)	µg/L	0.005	SEAAL/INS/RWM/SOP/01
xi.	Endosulfan (□,□& Sulphate)	µg/L	0.005	SEAAL/INS/RWM/SOP/01
xii.	Ethion	µg/L	0.005	SEAAL/INS/RWM/SOP/01
xiii.	γ HCH (Lindane)	µg/L	0.005	SEAAL/INS/RWM/SOP/01
xiv.	Isoproturon	µg/L	0.005	SEAAL/INS/RWM/SOP/01
xv.	Malathion	µg/L	0.005	SEAAL/INS/RWM/SOP/01
xvi.	Methyl Parathion	µg/L	0.005	SEAAL/INS/RWM/SOP/01
xvii.	Monocrotophos	µg/L	0.005	SEAAL/INS/RWM/SOP/01
xviii.	Phorate	µg/L	0.005	SEAAL/INS/RWM/SOP/01
45.	Polychlorinated Biphenyls (PCB)	mg/L	0.000005	SEAAL/INS/RWM/SOP/03
46.	Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	0.000005	SEAAL/INS/RWM/SOP/02
47.	Total Arsenic (as As)	mg/L	0.002	IS 3025 Part 37:1988 RA 2019
48.	Total Chromium (as Cr)	mg/L	0.05	IS 3025 Part 52 :2003 RA 2019
49.				
a)	Bromoform	mg/L	0.005	SEAAL/INS/RWM/SOP/04
b)	Dibromochloromethane	mg/L	0.005	SEAAL/INS/RWM/SOP/04
c)	Bromodichloroethane	mg/L	0.005	SEAAL/INS/RWM/SOP/04
d)	Chloroform	mg/L	0.005	SEAAL/INS/RWM/SOP/04
50.	*E.coli*	MPN/100 ml	2	IS 1622: 1981
51.	Total Coliforms	MPN/100 ml	2	IS 1622: 1981
52.	FaecalColiforms	MPN/100 ml	2	IS 1622: 1981

HYR-6.3. Ground Water Analysis Results for the period from April 2023 to September 2023:

Table 6.4: Ground Water Analysis Results

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
Organoleptic & Physical Parameters							
1.	Colour	Hazen Units	*Max.* 5	Apr-23	1	1	1
				May-23	1	1	1
				Jun-23	1	1	1
				Jul-23	1	1	1
				Aug-23	1	1	1
				Sep-23	1	1	1
2.	Odour	-	Agreeable	Apr-23	Agreeable	Agreeable	Agreeable
				May-23	Agreeable	Agreeable	Agreeable
				Jun-23	Agreeable	Agreeable	Agreeable
				Jul-23	Agreeable	Agreeable	Agreeable
				Aug-23	Agreeable	Agreeable	Agreeable
				Sep-23	Agreeable	Agreeable	Agreeable
3.	pH Value	-	6.5 to 8.5	Apr-23	7.14	7.36	6.97
				May-23	7.45	7.07	6.90
				Jun-23	7.26	7.18	6.76
				Jul-23	7.71	6.57	6.69
				Aug-23	7.61	6.52	6.66
				Sep-23	7.55	6.45	6.38
4.	Turbidity	N.T.U.	Max. 1	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	0.40	0.20	BDL
				Aug-23	0.20	0.10	BDL
				Sep-23	0.30	0.20	BDL
5.	Total Dissolved Solids	mg/L	Max. 500	Apr-23	276	149	271
				May-23	250	68.0	260
				Jun-23	267	79.0	286
				Jul-23	319	84.0	257
				Aug-23	294	69.9	214

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
				Sep-23	269	55.1	197
General Parameters concerning substances undesirable in excessive amounts							
6.	Aluminium (as Al)	mg/L	Max. 0.03	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
7.	Ammonia (as NH_3-N)	mg/L	Max.0.5	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
8.	Anionic Detergents (as MBAS) Calculated as LAS mol.wt. 288.38	mg/L	Max. 0.2	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
9.	Barium (as Ba)	mg/L	Max. 0.7	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
10.	Boron (as B)	mg/L	Max. 0.5	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
11.	Calcium (as Ca)	mg/L	Max. 75	Apr-23	25.6	15.3	10.6
				May-23	24.8	4.80	10.4
				Jun-23	26.1	5.34	18.6
				Jul-23	24.8	3.20	6.40
				Aug-23	21.6	4.00	13.6

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
				Sep-23	16.0	5.20	14.4
12.	Chloramines (as Cl_2)	mg/L	Max. 4.0	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
13.	Chloride (as Cl)	mg/L	Max.250	Apr-23	126	74.6	164
				May-23	80.7	28.5	128
				Jun-23	76.4	31.6	112
				Jul-23	81.7	38.0	101
				Aug-23	75.5	35.2	95.6
				Sep-23	70.5	25.2	80.5
14.	Copper (as Cu)	mg/L	Max.0.05	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
15.	Fluoride (as F)	mg/L	Max. 1	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
16.	Iron (as Fe)	mg/L	Max.0.3	Apr-23	0.224	0.135	0.161
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	0.240	BDL	0.190
				Aug-23	0.250	BDL	0.150
				Sep-23	0.230	0.200	0.180
17.	Magnesium (as Mg)	mg/L	Max. 30	Apr-23	9.23	7.05	8.14
				May-23	7.30	1.46	11.6
				Jun-23	7.96	1.84	12.8
				Jul-23	6.33	2.44	9.74
				Aug-23	6.33	2.20	3.90
				Sep-23	4.87	2.10	4.38

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
18.	Manganese (as Mn)	mg/L	Max.0.1	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
19.	Mineral Oil	mg/L	Max.0.5	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
20.	Nitrate (as NO_3)	mg/L	Max.45	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
21.	Phenolic Compounds (as C6H5OH)	mg/L	Max. 0.001	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
22.	Selenium (as Se)	mg/L	Max. 0.01	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
23.	Silver (as Ag)	mg/L	Max. 0.1	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
24.	Sulphate (as SO_4)	mg/L	Max. 200	Apr-23	14.2	7.69	21.6

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
				May-23	18.4	4.02	34.7
				Jun-23	15.6	5.34	28.3
				Jul-23	11.2	4.63	30.4
				Aug-23	10.8	3.56	25.4
				Sep-23	8.16	2.45	28.5
25.	Sulphide (as H_2S)	mg/L	Max. 0.05	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
26.	Total Alkalinity (as $CaCO_3$)	mg/L	Max.200	Apr-23	24.6	9.26	10.4
				May-23	73.6	9.95	9.95
				Jun-23	78.1	10.6	11.6
				Jul-23	146	13.9	13.9
				Aug-23	188	11.9	13.9
				Sep-23	168	9.90	15.8
27.	Total Hardness (as $CaCO_3$)	mg/L	Max. 200	Apr-23	94.6	42.4	64.3
				May-23	92.0	18.0	74.0
				Jun-23	96.2	20.6	78.2
				Jul-23	88.0	18.0	56.0
				Aug-23	80.0	14.0	50.0
				Sep-23	60.0	12.0	54.0
28.	Zinc (as Zn)	mg/L	Max. 5	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
Parameters Concerning Toxic Substances							
29.	Cadmium (as Cd)	mg/L	Max. 0.003	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
30.	Cyanide (as CN)	mg/L	Max.0.05	Apr-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
31.	Lead (as Pb)	mg/L	Max. 0.01	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
32.	Mercury (as Hg)	mg/L	Max. 0.001	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
33.	Molybdenum (as Mo)	mg/L	Max. 0.07	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
34.	Nickel (as Ni)	mg/L	Max.0.02	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
35. Pesticide Residues							
i.	Alachlor	µg/L	20	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
ii.	Atrazine	µg/L	2	Apr-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
iii.	Aldrin/Dieldrin	µg/L	0.03	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
iv.	Alpha HCH	µg/L	0.01	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
v.	Beta HCH	µg/L	0.04	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
vi.	Butachlor	µg/L	125	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
vii.	Chlorpyrifos	µg/L	30	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
viii.	Delta HCH	µg/L	0.04	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
ix.	2,4D chlorophenoxyacetic acid	µg/L	30	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
x.	DDT (o,p&p,p-Isomers of DDT, DDE, DDD)	µg/L	1	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
xi.	Endosulfan (α,β & Sulphate)	µg/L	0.4	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
xii.	Ethion	µg/L	3	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
xiii.	γ HCH (Lindane)	µg/L	2	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
xiv.	Isoproturon	µg/L	9	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
xv.	Malathion	µg/L	190	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
xvi.	Methyl Parathion	µg/L	0.3	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
xvii.	Monocrotophos	µg/L	1	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
xviii.	Phorate	µg/L	2	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
36.	Polychlorinated Biphenyls (PCB)	mg/L	Max.0.0005	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
37.	Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	Max.0.0001	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
38.	Total Arsenic (as As)	mg/L	Max. 0.01	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
39.	Total Chromium (as Cr)	mg/L	Max. 0.05	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
40.Trihalomethanes							
a)	Bromoform	mg/L	Max. 0.1	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
b)	Dibromochloromethane	mg/L	Max. 0.1	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
c)	Bromodichloroethane	mg/L	Max. 0.06	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
d)	Chloroform	mg/L	Max. 0.2	Apr-23	BDL	BDL	BDL
				May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Acceptable Limit as per IS 10500: 2012	Month	Port Site (Open well) G1	Proposed Port Estate Area (Open well) G2	PAF Area (Open well) G3
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
Bacteriological Analysis							
41.	E.coli	MPN Index /100 ml	Not Detectable	May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
				Apr-23	BDL	BDL	BDL
42.	Total Coliforms	MPN Index /100 ml	Not Detectable	May-23	BDL	BDL	BDL
				Jun-23	BDL	BDL	BDL
				Jul-23	BDL	BDL	BDL
				Aug-23	BDL	BDL	BDL
				Sep-23	BDL	BDL	BDL
				Apr-23	BDL	BDL	BDL

HYR-6.4. Graphical representation of Results for Ground Water Analysis:

Figure 6.2: Ground Water Analysis for pH

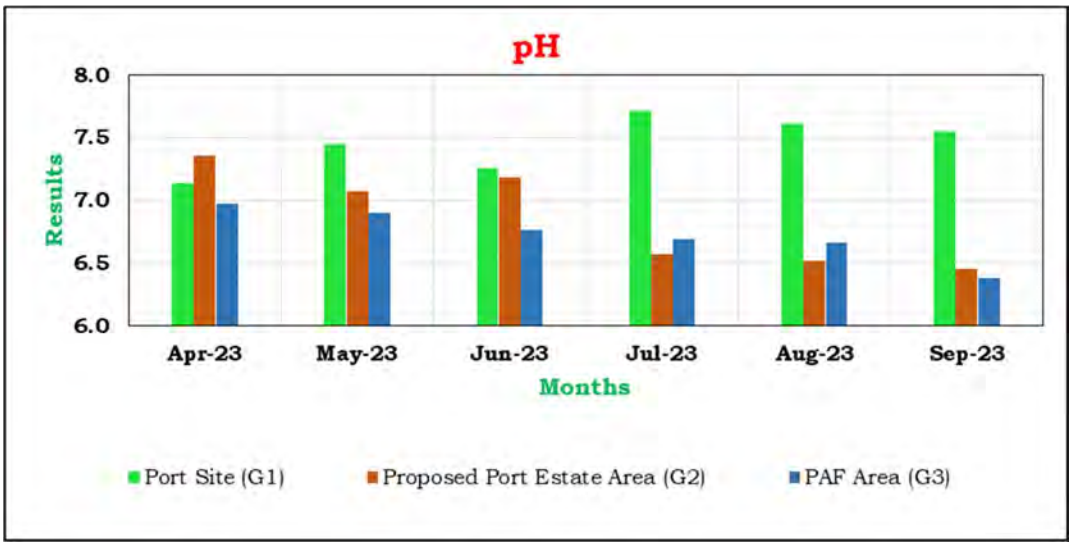


Figure 6.3: Ground Water Analysis for Total Dissolved Solids

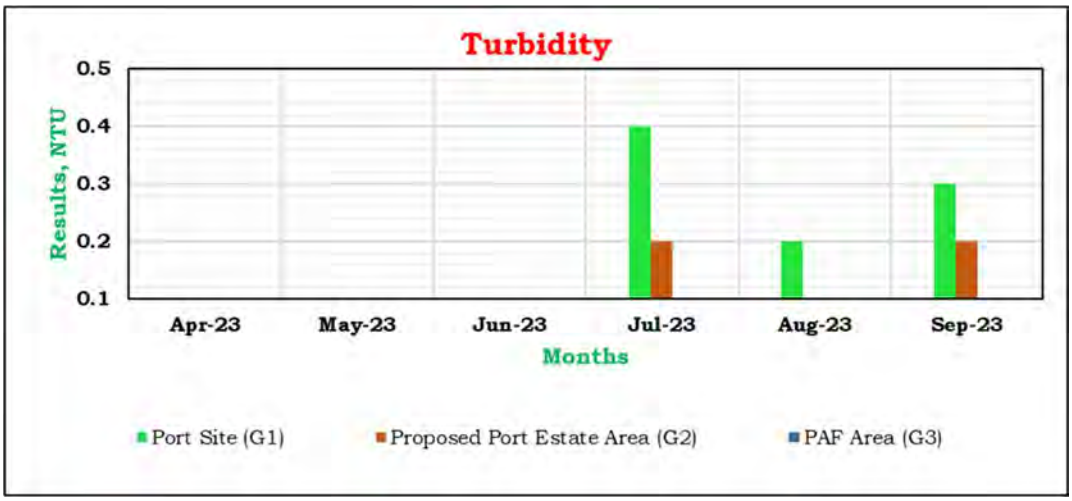


Figure 6.4: Ground Water Analysis for Total Dissolved Solids

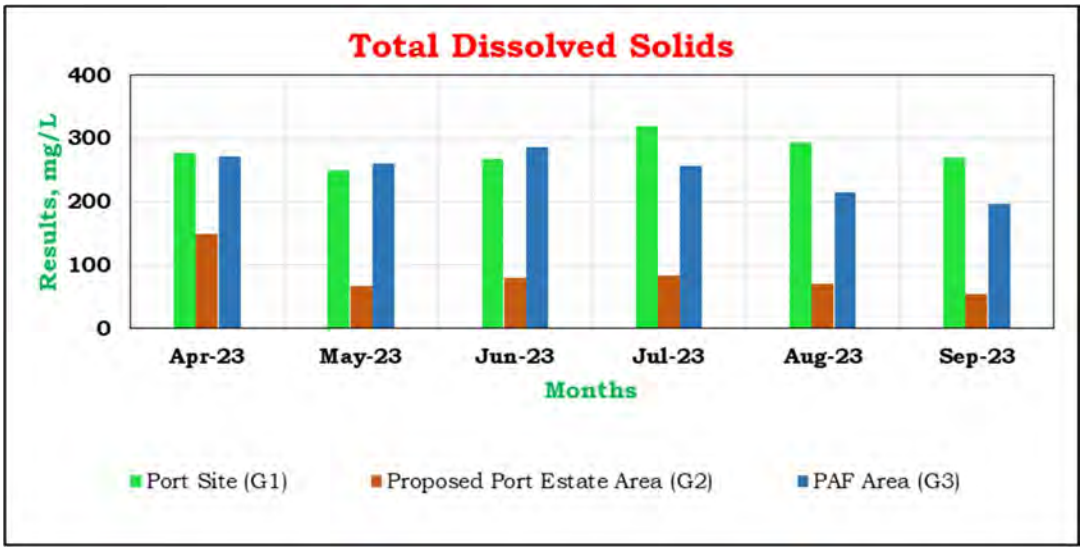


Figure 6.5: Ground Water Analysis for Chloride

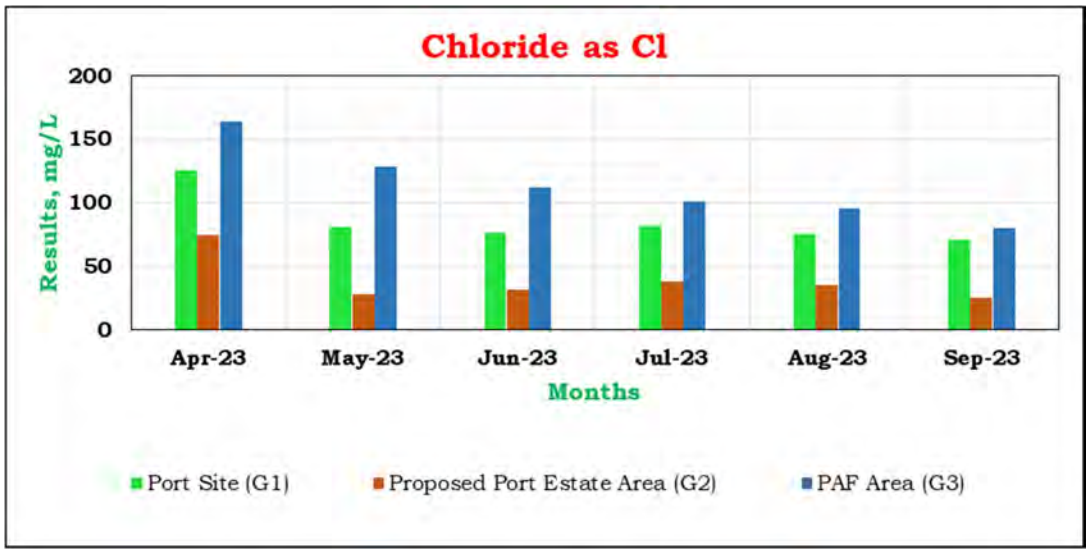


Figure 6.6: Ground Water Analysis for Sulphate as SO_4

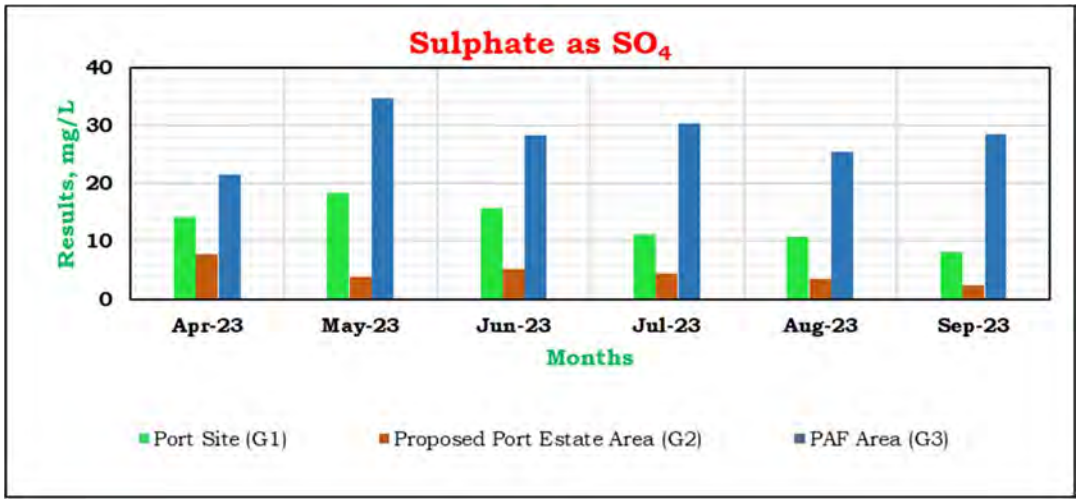


Figure 6.7: Ground Water Analysis for Calcium as Ca

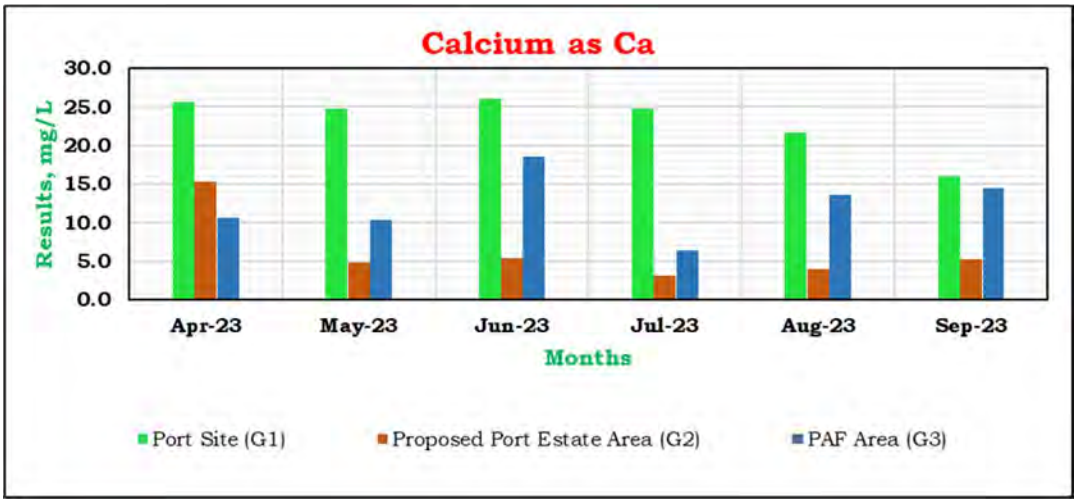


Figure 6.8: Ground Water Analysis for Magnesium as Mg

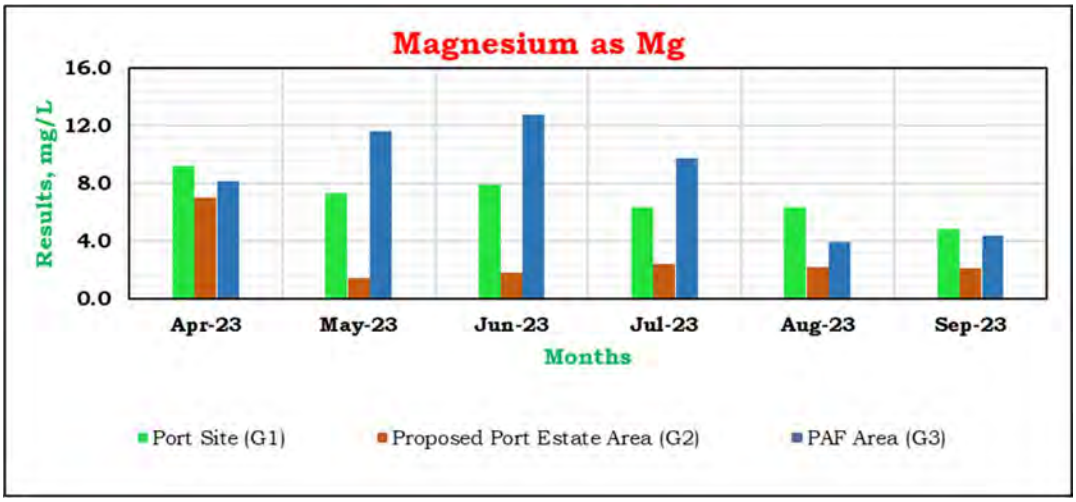


Figure 6.9: Ground Water Analysis for Iron as Fe

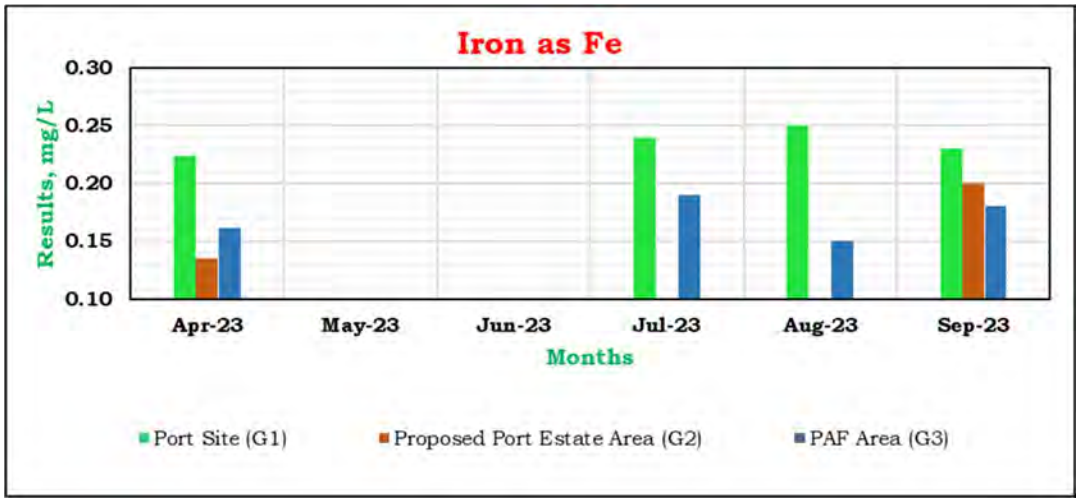


Figure 6.10: Ground Water Analysis for Total Alkalinity as $CaCO_3$

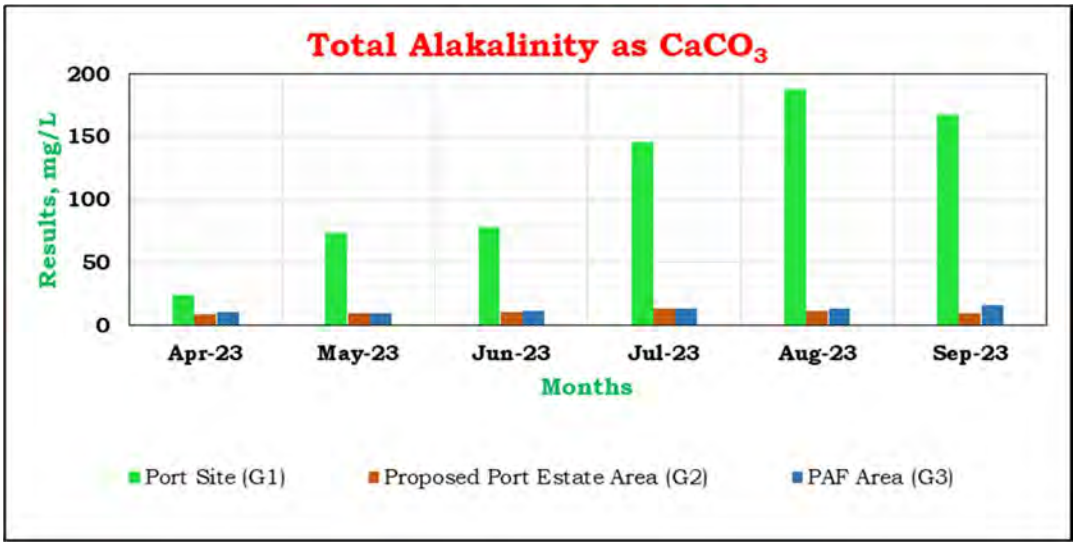
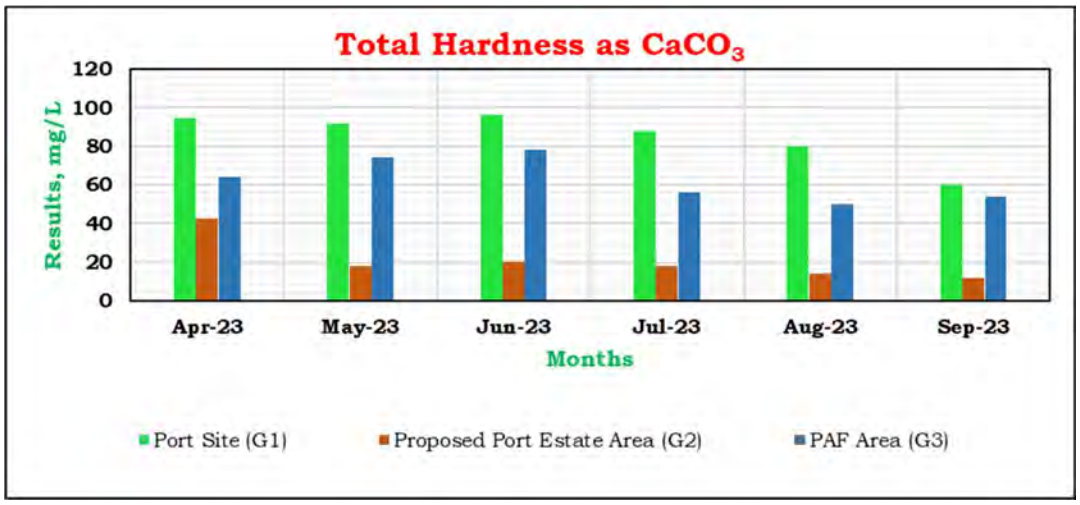


Figure 6.11: Ground Water Analysis for Total Hardness as $CaCO_3$



HYR-6.5. Summary- Ground Water Analysis

During the period from April 2023 to September 2023, following is the summary of ground water analysis:

a) At the location **Port Site** (Open Well),

- Colour observed was 1 Hazen unit and the odour was agreeable
- pH was observed in the range from7.14 to 7.71
- Turbidity was observed in the range from BDL to 0.4 NTU
- Total Dissolved Solids were observed in the range from 250 to 319 mg/L
- Calcium (as Ca) was observed in the range from16.0 to 26.1 mg/L
- Chloride (as Cl) was observed in the range from 70.5 to 126 mg/L
- Iron (as Fe) was observed in the range from BDL to 0.250 mg/L
- Magnesium (as Mg) was observed in the range from 4.87 to 9.23 mg/L
- Sulphate (as SO_4) was observed in the range from 8.16 to 18.4 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 24.6 to 188 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 60.0 to 96.2 mg/L
- Ammonia (as NH_3-N), Manganese (as Mn), Nitrate (as NO_3), Aluminium(as Al), Zinc (as Zn), Anionic Detergents, Barium (as Ba), Boron (as B) Chloramines (as Cl_2),Fluoride (as F), Copper (as Cu), Mineral Oil, Phenolic Compounds(as C_6H_5OH), Selenium (as Se), Silver (as Ag), Hydrogen Sulphide (as H_2S), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Molybdenum (as Mo), Nickel (as Ni), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues, Trihalomethanes, Polychlorinated Biphenyls (PCB) and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detectable limits
- Bacteriological parameters such as *E.coli* and Total Coliforms were not detected.

b) At the location **Proposed Port Estate Area** (Open Well),

- Colour observed was 1 Hazen unit and the odour was agreeable
- pH was observed in the range from 6.45 to 7.36
- Turbidity was observed in the range from BDL to 0.2 NTU
- Total Dissolved Solids were observed in the range from 55.1 to 149 mg/L

- Calcium (as Ca) was observed in the range from 3.20 to 15.3 mg/L
- Chloride (as Cl) was observed in the range from 25.2to 74.6 mg/L
- Iron (as Fe) was observed in the range from BDL to 0.200 mg/L
- Magnesium (as Mg) was observed in the range from 1.46 to 7.05 mg/L
- Sulphate (as SO_4) was observed in the range from 2.45 to 7.69 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 9.26 to 13.9 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 12.0 to 42.4 mg/L
- Ammonia (as NH_3-N), Manganese (as Mn), Nitrate (as NO_3), Aluminium (as Al), Zinc (as Zn), Anionic Detergents, Barium (as Ba), Boron (as B) Chloramines (as Cl_2),Fluoride (as F), Copper (as Cu), Mineral Oil, Phenolic Compounds(as C_6H_5OH), Selenium (as Se), Silver (as Ag), Hydrogen Sulphide (as H_2S), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Molybdenum (as Mo), Nickel (as Ni), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues, Trihalomethanes, Polychlorinated Biphenyls (PCB) and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detectable limits
- Bacteriological parameters such as *E.coli* and Total Coliforms were not detected.

c) At the location **PAF Area** (Open Well),

- Colour observed was 1 Hazen unit and the odour was agreeable
- pH was observed in the range from 6.38 to 6.97
- Total Dissolved Solids were observed in the range from 197 to 286 mg/L
- Calcium (as Ca) was observed in the range from 6.4 to 18.6 mg/L
- Chloride (as Cl) was observed in the range from 80.5 to 164 mg/L
- Iron (as Fe) was observed in the range from BDL to 0.190 mg/L
- Magnesium (as Mg) was observed in the range from 4.38 to 12.8 mg/L
- Sulphate (as SO_4) was observed in the range from 21.6 to 34.7 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 9.95 to 15.8 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 50.0 to 78.2 mg/L
- Turbidity, Ammonia (as NH_3-N), Manganese (as Mn), Nitrate (as NO_3), Aluminium (as Al), Zinc (as Zn), Anionic Detergents, Barium (as Ba), Boron (as B) Chloramines (as Cl_2),Fluoride (as F), Copper (as Cu), Mineral Oil, Phenolic Compounds(as C_6H_5OH), Selenium (as Se), Silver

(as Ag), Hydrogen Sulphide (as H_2S), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Molybdenum (as Mo), Nickel (as Ni), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues, Trihalomethanes, Polychlorinated Biphenyls (PCB) and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detectable limits

- Bacteriological parameters such as *E.coli* and Total Coliforms were not detected.

d) Summary – Comparison of Results of **All Locations**,

- Colour observed was 1 Hazen unit and the odour was agreeable in all locations
- Maximum value of pH observed was 7.71 at Port Site
- Maximum value of Turbidity was 0.4 at Port Site
- Maximum value of Total Dissolved Solids observed was 319 mg/L at Port Site
- Maximum value of Calcium (as Ca) observed was 26.1mg/L at Port Site
- Maximum value of Chloride (as Cl) observed was 164 mg/L at PAF area
- Maximum value of Iron (as Fe) observed was 0.250 mg/L at Port Site Maximum value of Magnesium (as Mg) observed was 12.8 mg/L at PAF area
- Maximum value of Sulphate (as SO_4) observed was 34.7 mg/L at PAF area
- Maximum value of Total Alkalinity (as $CaCO_3$) observed was 188 mg/L at Port Site
- Maximum value of Total Hardness (as $CaCO_3$) observed was 96.2 mg/L at Port Site
- Ammonia (as NH_3-N), Manganese (as Mn), Nitrate (as NO_3), Aluminium (as Al), Zinc (as Zn), Anionic Detergents, Barium (as Ba), Boron (as B) Chloramines (as Cl_2),Fluoride (as F), Copper (as Cu), Mineral Oil, Phenolic Compounds(as C_6H_5OH), Selenium (as Se), Silver (as Ag), Hydrogen Sulphide (as H_2S), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Molybdenum (as Mo), Nickel (as Ni), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues, Trihalomethanes, Polychlorinated Biphenyls (PCB) and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detectable limits at all locations

- Bacteriological parameters such as *E.coli* and Total Coliforms were not detected at all locations.

HYR-6.6. Surface Water Analysis Results for the period from April 2023 to September 2023:

Table 6.5: Surface Water Analysis Results

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
Physical Parameters						
1.	Colour	Hazen Units	Apr-23	1	1	1
			May-23	1	1	1
			Jun-23	1	1	1
			Jul-23	1	1	1
			Aug-23	1	1	1
			Sep-23	1	1	1
2.	Odour	-	Apr-23	Agreeable	Agreeable	Agreeable
			May-23	Agreeable	Agreeable	Agreeable
			Jun-23	Agreeable	Agreeable	Agreeable
			Jul-23	Agreeable	Agreeable	Agreeable
			Aug-23	Agreeable	Agreeable	Agreeable
			Sep-23	Agreeable	Agreeable	Agreeable
3.	pH Value	-	Apr-23	7.42	7.19	7.28
			May-23	7.07	7.86	6.82
			Jun-23	7.25	7.73	7.06
			Jul-23	7.14	6.97	6.95
			Aug-23	7.14	6.85	6.80
			Sep-23	7.20	6.90	6.85
4.	Turbidity	N.T.U.	Apr-23	0.8	1.4	1.2
			May-23	1.4	1.1	0.7
			Jun-23	1.9	1.5	0.9
			Jul-23	2.3	3.0	1.0
			Aug-23	1.9	2.5	1.1
			Sep-23	1.2	2.0	0.8
5.	Electrical Conductivity (at 25°C)	µmho/cm	Apr-23	254	710	642
			May-23	1022	376	263
			Jun-23	1165	487	346
			Jul-23	962	419	235
			Aug-23	951	390	208
			Sep-23	850	241	186
6.	Total Dissolved Solids	mg/L	Apr-23	156	463	387
			May-23	615	190	130
			Jun-23	726	281	183

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Jul-23	624	271	152
			Aug-23	617	247	134
			Sep-23	510	156	120
Chemical Parameters						
7.	Dissolved Oxygen	mg/L	Apr-23	6.60	6.90	7.20
			May-23	6.80	6.80	7.10
			Jun-23	6.70	6.60	6.50
			Jul-23	6.80	6.90	6.40
			Aug-23	6.60	6.50	6.40
			Sep-23	6.30	6.10	6.20
8.	Biochemical Oxygen Demand (3 days, 27°C)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
9.	Oil & Grease	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
10.	Free Ammonia	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
11.	Anionic Detergents (as MBAS) Calculated as LAS mol.wt. 288.38	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
12.	Barium (as Ba)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
13.	Boron (as B)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
14.	Calcium (as Ca)	mg/L	Apr-23	6.86	14.8	14.2
			May-23	14.4	12.8	8.00
			Jun-23	19.3	14.1	10.5
			Jul-23	23.2	19.2	7.20
			Aug-23	32.0	13.6	5.60
			Sep-23	27.2	8.00	10.4
15.	Chloride (as Cl)	mg/L	Apr-23	41.7	168	184
			May-23	617	55.1	48.4
			Jun-23	586	63.6	47.8
			Jul-23	337	77.9	42.8
			Aug-23	297	73.5	39.3
			Sep-23	252	60.4	25.2
16.	Copper (as Cu)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
17.	Fluoride (as F)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
18.	Iron (as Fe)	mg/L	Apr-23	0.26	0.64	BDL
			May-23	0.44	0.43	BDL
			Jun-23	0.36	0.39	BDL
			Jul-23	0.46	0.50	0.39
			Aug-23	0.39	0.45	0.30
			Sep-23	0.35	0.40	0.33
19.	Magnesium (as Mg)	mg/L	Apr-23	4.26	10.8	11.4
			May-23	9.34	4.38	2.92
			Jun-23	10.2	5.13	3.45
			Jul-23	16.6	3.41	2.44
			Aug-23	9.74	3.90	1.46
			Sep-23	6.33	2.44	3.41
20.	Manganese (as Mn)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
21.	Mineral Oil	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
22.	Nitrate (as NO_3)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
23.	Phenolic Compounds (as C_6H_5OH)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
24.	Selenium (as Se)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
25.	Silver (as Ag)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
26.	Sulphate (as SO_4)	mg/L	Apr-23	4.63	13.6	14.2
			May-23	29.3	7.77	6.34
			Jun-23	39.2	10.6	8.33
			Jul-23	41.8	2.41	1.01
			Aug-23	39.8	1.95	1.55
			Sep-23	35.8	2.01	2.01
27.	Total Phosphate (as PO_4)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
28.	Total Alkalinity (as $CaCO_3$)	mg/L	Apr-23	24.1	39.5	7.81
			May-23	23.4	57.7	23.8

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Jun-23	27.6	45.2	25.2
			Jul-23	25.9	129	61.7
			Aug-23	23.8	119	49.5
			Sep-23	19.8	23.8	19.8
29.	Total Hardness (as $CaCO_3$)	mg/L	Apr-23	35.6	76.2	64.8
			May-23	132	50.0	32.0
			Jun-23	143	54.6	33.2
			Jul-23	126	62.0	28.0
			Aug-23	120	50.0	20.0
			Sep-23	100	30.0	40.0
30.	Calcium Hardness (as $CaCO_3$)	mg/L	Apr-23	18.3	36.7	35.1
			May-23	38.7	32.0	20.0
			Jun-23	48.3	35.1	25.4
			Jul-23	58.0	48.0	18.0
			Aug-23	80.0	34.0	14.0
			Sep-23	68.0	20.0	26.0
31.	Zinc (as Zn)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
32.	Sodium (as Na)	mg/L	Apr-23	23.6	71.8	65.4
			May-23	120	25.2	15.0
			Jun-23	129	29.6	22.3
			Jul-23	125	26.8	19.4
			Aug-23	115	22.5	15.8
			Sep-23	110	20.5	13.5
33.	Potassium (as K)	mg/L	Apr-23	1.36	9.22	7.64
			May-23	9.47	6.40	4.25
			Jun-23	11.5	7.36	5.22
			Jul-23	8.50	7.39	4.42
			Aug-23	5.50	4.56	2.46
			Sep-23	4.50	3.45	2.11
34.	Sodium Adsorption Ratio	-	Apr-23	1.742	3.459	3.132
			May-23	6.048	1.549	1.153
			Jun-23	5.905	1.714	1.525
			Jul-23	4.836	1.482	1.591
			Aug-23	4.566	1.383	1.536
			Sep-23	4.932	1.626	0.926
35.	Cadmium (as Cd)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
36.	Cyanide (as CN)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
37.	Lead (as Pb)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
38.	Mercury (as Hg)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
39. Pesticide Residues						
i.	Alachlor	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
ii.	Atrazine	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
iii.	Aldrin/Dieldrin	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
iv.	Alpha HCH	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Sep-23	BDL	BDL	BDL
v.	Beta HCH	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
vi.	Butachlor	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
vii.	Chlorpyrifos	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
viii.	Delta HCH	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
ix.	2,4D chlorophenoxyaceti c acid	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
x.	DDT (o,p&p,p-Isomers of DDT, DDE, DDD)	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
xi.	Endosulfan (α,β & Sulphate)	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
xii.	Ethion	µg/L	Apr-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
xiii.	γ HCH (Lindane)	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
xiv.	Isoproturon	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
xv.	Malathion	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
xvi.	Methyl Parathion	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
xvii.	Monocrotophos	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
xviii.	Phorate	µg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
40.	Polynuclear Aromatic Hydrocarbons	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
	(PAH)		Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
41.	Total Arsenic (as As)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
42.	Total Chromium (as Cr)	mg/L	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
Biological Analysis						
43.	Total Coliforms	MPN Index/100 mL	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL
44.	Faecal Coliforms	MPN Index/100 mL	Apr-23	BDL	BDL	BDL
			May-23	BDL	BDL	BDL
			Jun-23	BDL	BDL	BDL
			Jul-23	BDL	BDL	BDL
			Aug-23	BDL	BDL	BDL
			Sep-23	BDL	BDL	BDL

HYR-6.7. Graphical representation of Results for Surface Water Analysis:

Figure 6.10: Surface Water Analysis for pH value

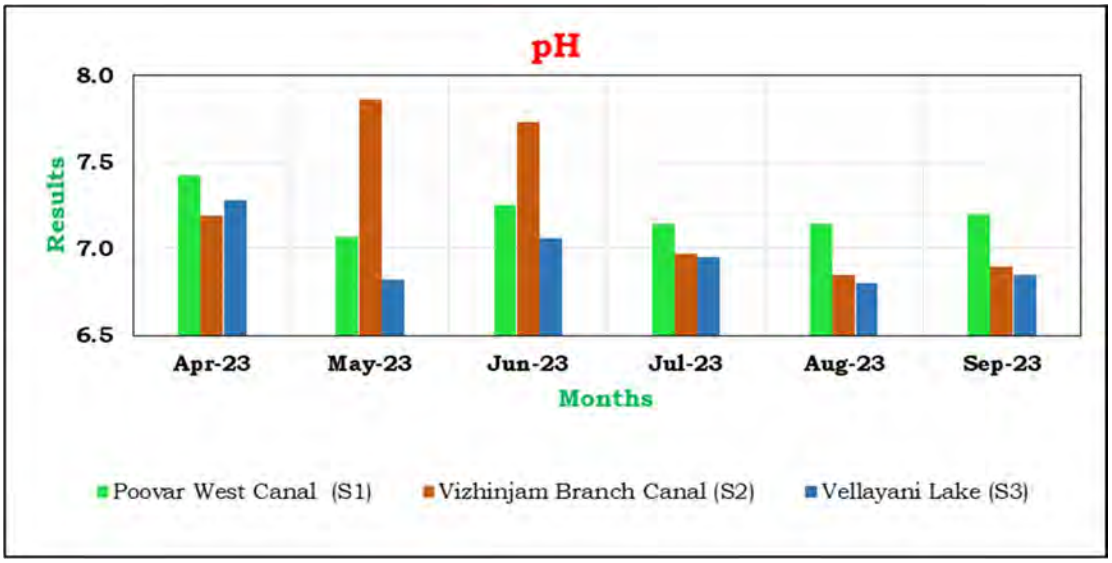


Figure 6.11: Surface Water Analysis for Turbidity

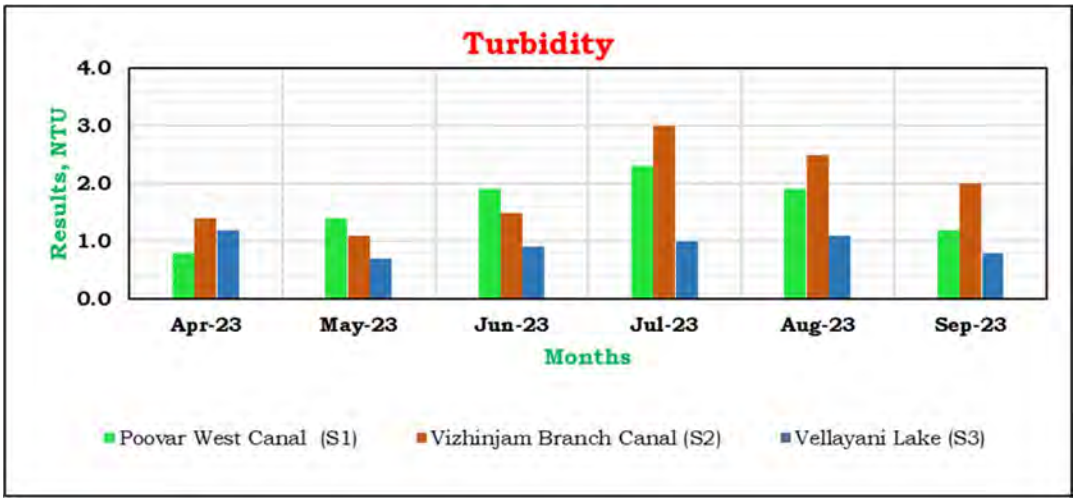


Figure 6.12: Surface Water Analysis for Electrical Conductivity @ 25 °C

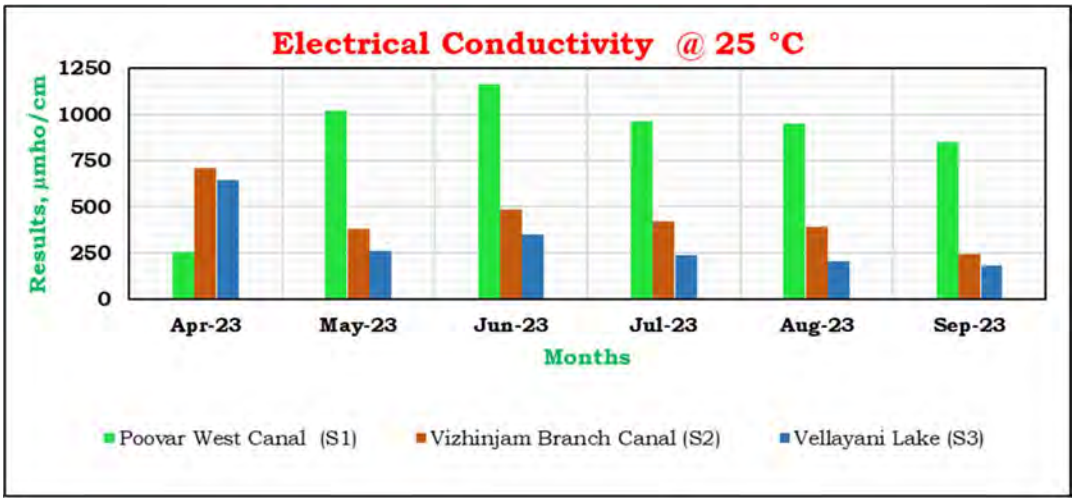


Figure 6.13: Surface Water Analysis for Total Dissolved Solids

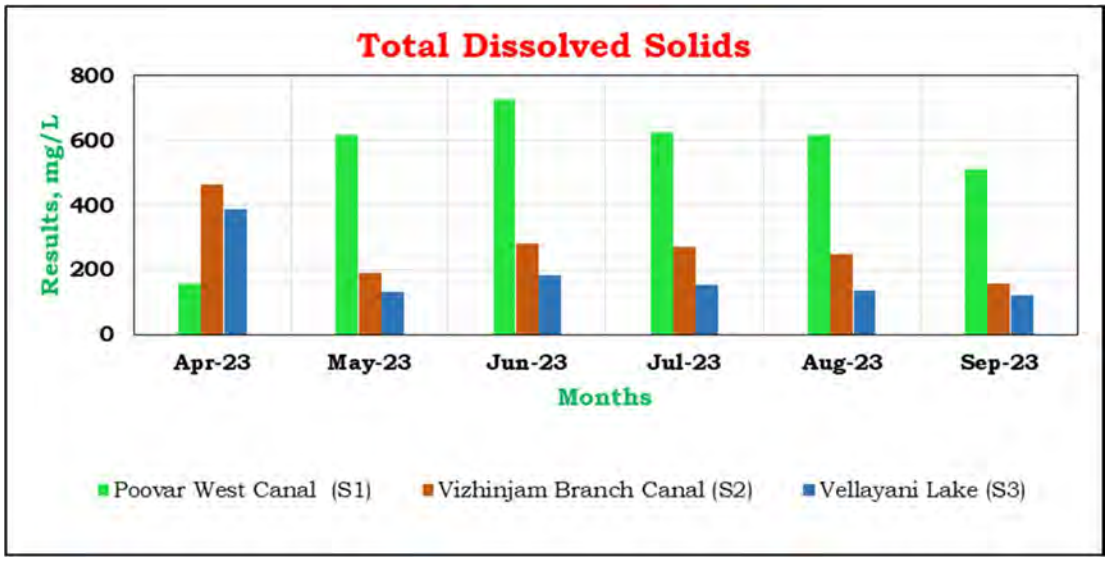


Figure 6.14: Surface Water Analysis for Dissolved Oxygen

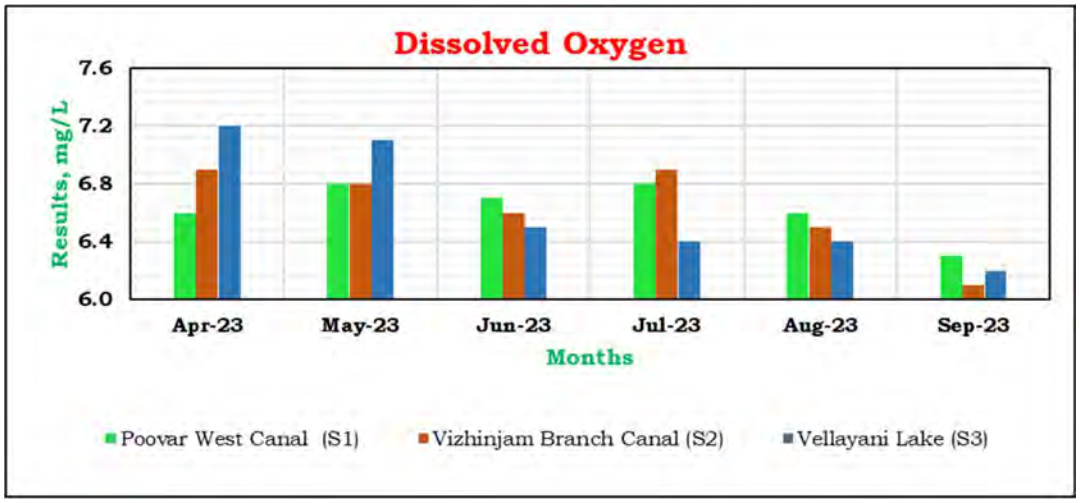


Figure 6.15: Surface Water Analysis for Chloride as Cl

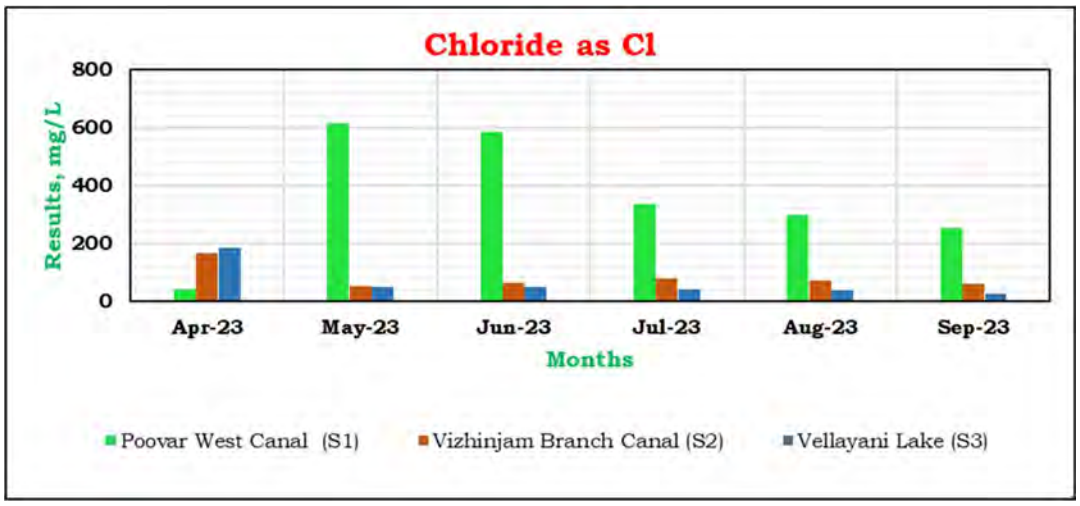


Figure 6.16: Surface Water Analysis for Sulphate as SO_4

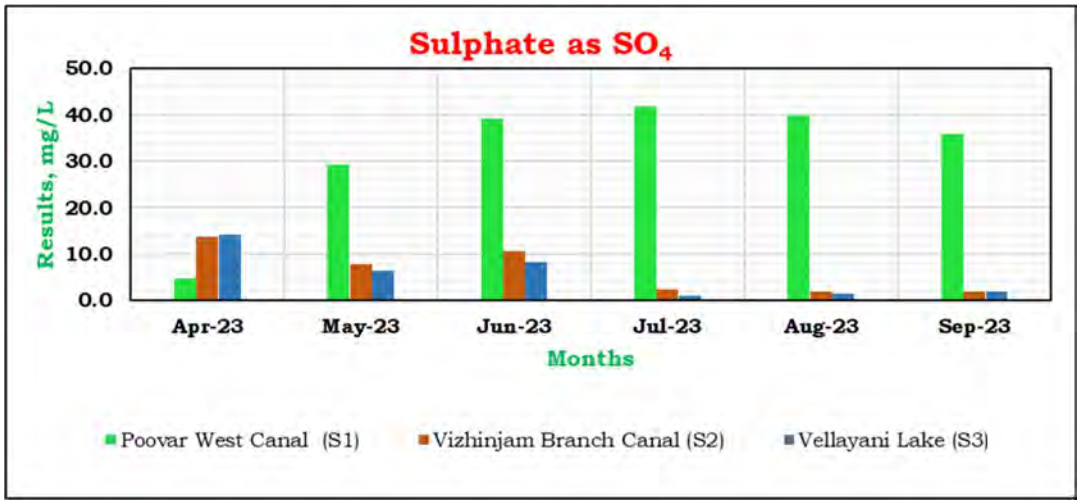


Figure 6.17: Surface Water Analysis for Calcium as Ca

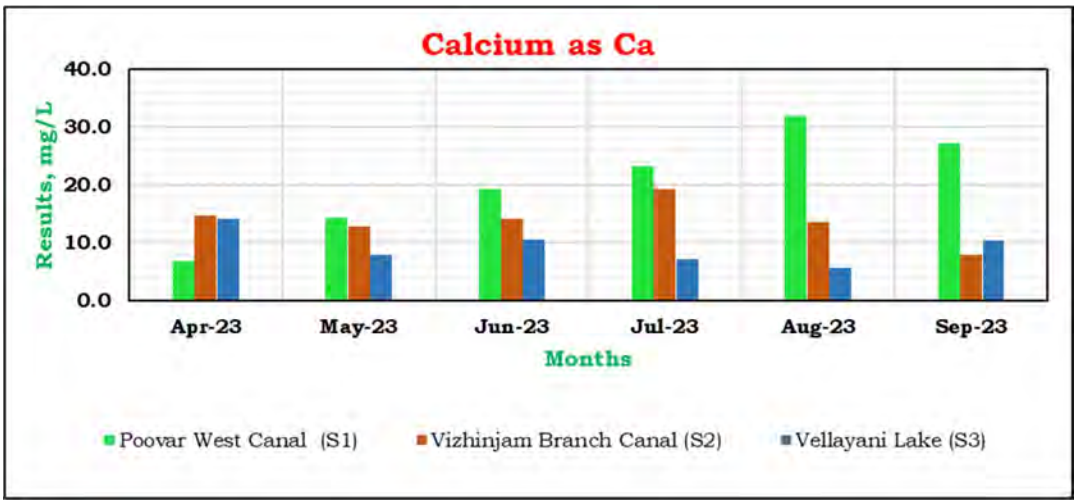


Figure 6.18: Surface Water Analysis for Magnesium as Mg

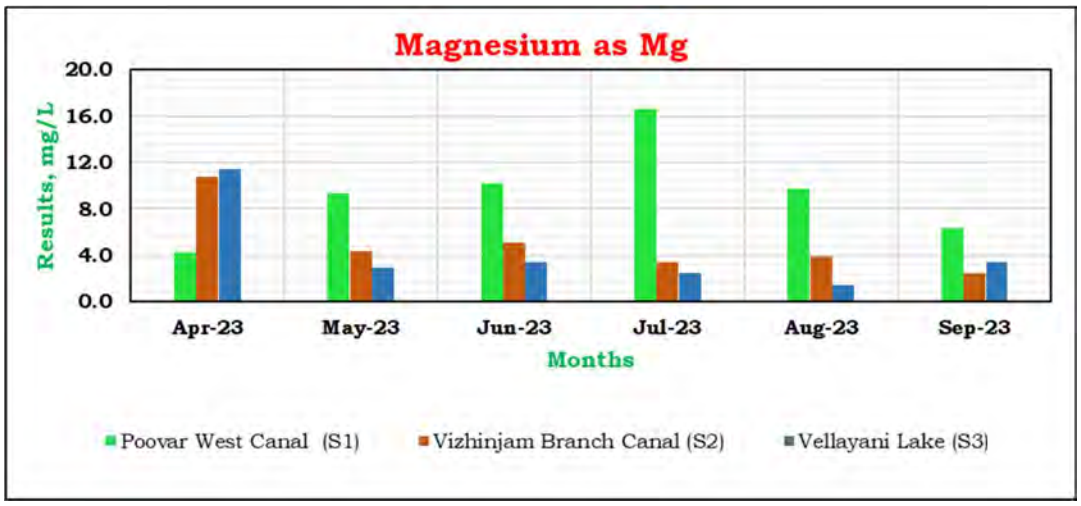


Figure 6.19: Surface Water Analysis for Iron as Fe

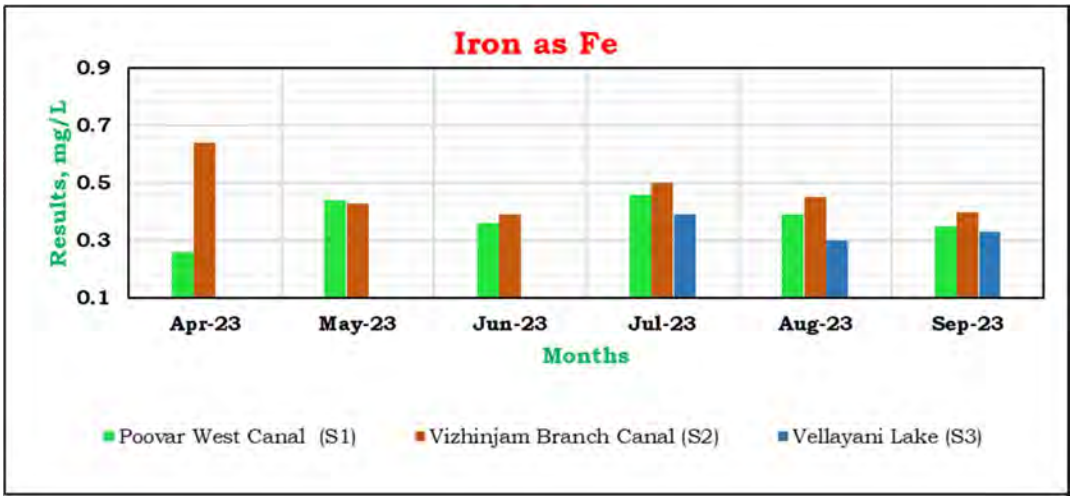


Figure 6.20: Surface Water Analysis for Total Alkalinity as $CaCO_3$

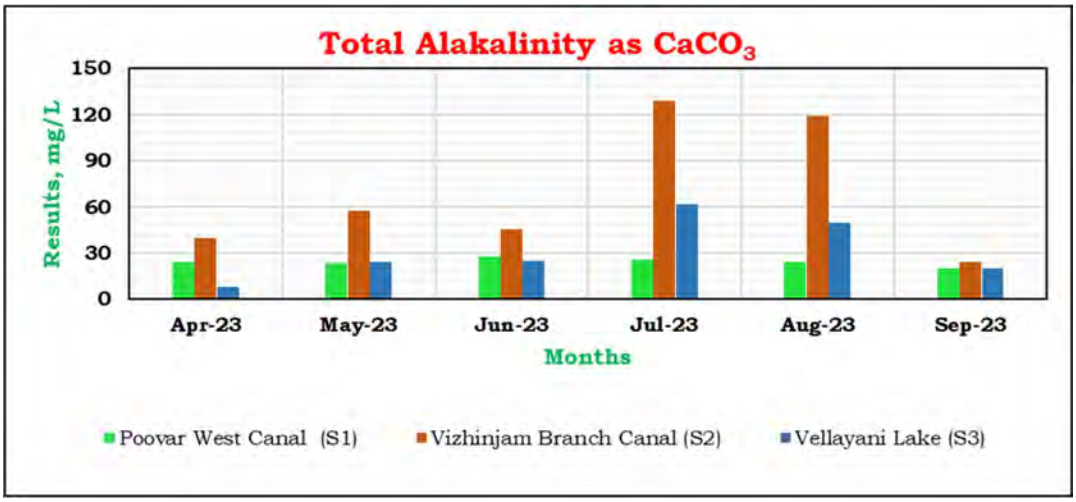


Figure 6.21: Surface Water Analysis for Total Hardness as $CaCO_3$

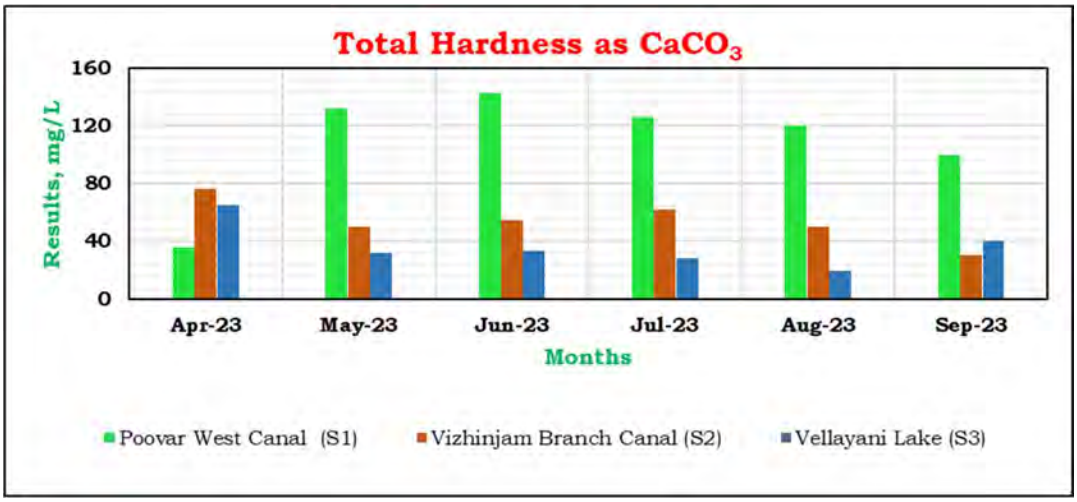


Figure 6.22: Surface Water Analysis for Calcium Hardness as $CaCO_3$

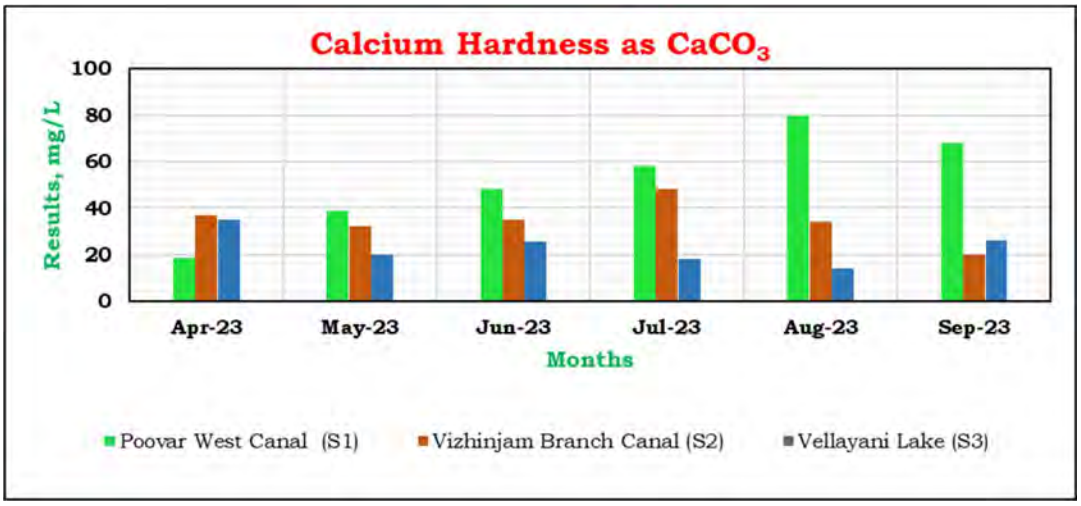


Figure 6.23: Surface Water Analysis for Sodium as Na

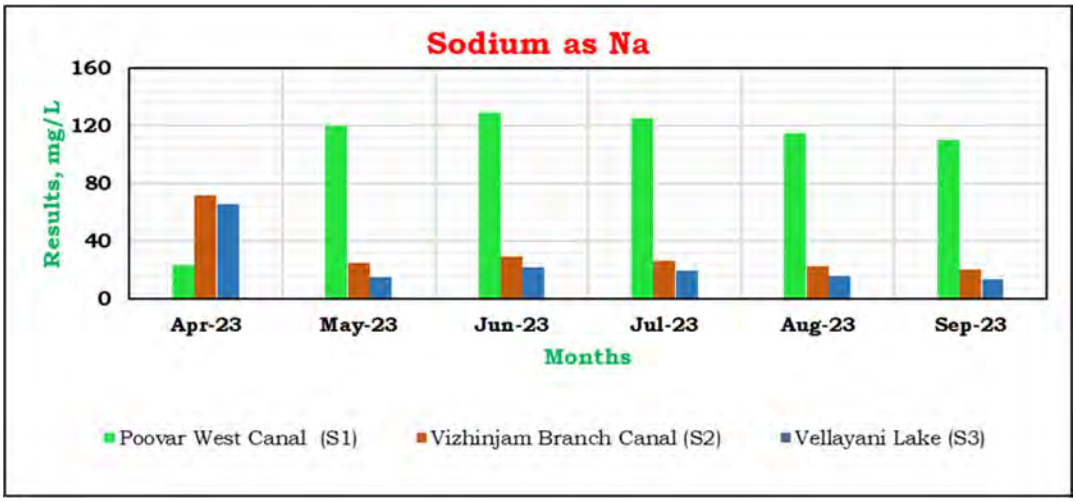


Figure 6.24: Surface Water Analysis for Potassium as K

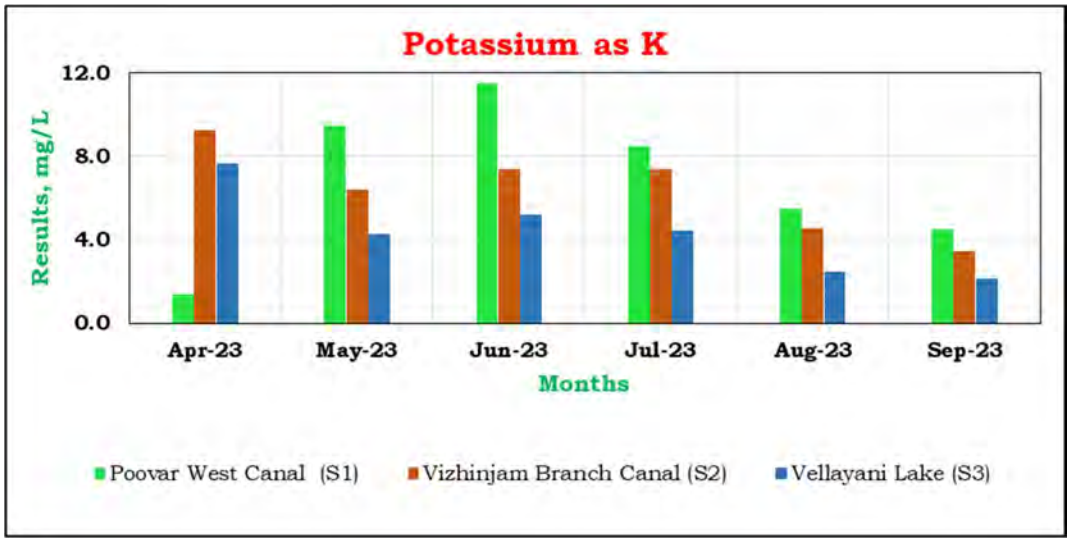
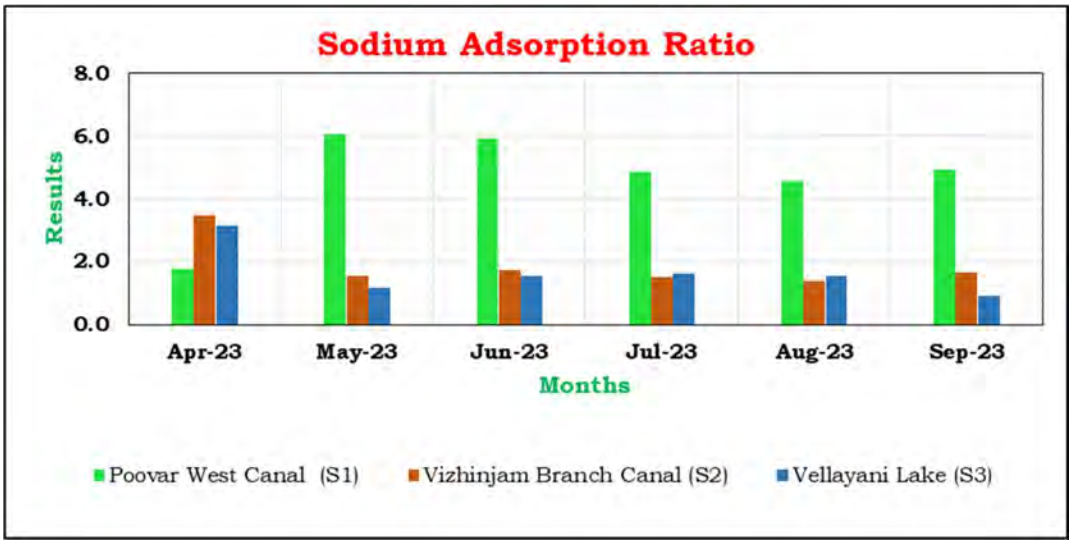


Figure 6.25: Surface Water Analysis for Sodium Adsorption Ratio



HYR-6.8. Summary of Surface water

During the period from April 2023 to September 2023, following is the summary of surface water analysis:

a) At the location **Poovar West Canal**,

- Colour was observed 1 Hazen unit
- Odour was agreeable
- pH was observed in the range from 7.07 to 7.42
- Turbidity was observed in the range from 0.8 to 2.3 NTU
- Total Dissolved Solids were observed in the range from 156 to 726 mg/L
- Electrical Conductivity was observed in the range from 254 to 1165 µmho/cm
- Dissolved Oxygen was observed in the range from 6.30 to 6.80 mg/L
- Calcium (as Ca) was observed in the range from 6.86 to 32.0 mg/L
- Chloride (as Cl) was observed in the range from 41.7 to 617 mg/L
- Iron (as Fe) was observed in the range from 0.26 to 0.46 mg/L
- Magnesium (as Mg) was observed in the range from 4.26 to 16.6 mg/L
- Sulphate (as SO_4) was observed in the range from 4.63 to 41.8 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 19.8 to 27.6 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 35.6 to 143 mg/L
- Calcium Hardness (as $CaCO_3$) was observed in the range from 18.3 to 80.0 mg/L
- Sodium (as Na) was observed in the range from 23.6 to 129 mg/L
- Potassium (as K) was observed in the range from 1.36 to 11.5 mg/L
- Sodium Absorption Ratio was observed in the range from 1.742 to 6.048
- Free Ammonia, Zinc (as Zn),Fluoride, Manganese (as Mn), Nitrate (as NO_3), Total Phosphate (as PO_4), Biochemical Oxygen Demand (3 days, 27°C), Oil & Grease, Anionic Detergents, Barium (as Ba), Boron (as B), Copper (as Cu), Mineral Oil, Phenolic Compounds (as C_6H_5OH), Selenium (as Se), Silver (as Ag), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Total Arsenic (as As), Total Chromium (as

Cr), Pesticide Residues and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detectable limits

- Bacteriological parameters such as Total Coliforms and Faecal Coliforms were not detected

b) At the location **Vizhinjam Branch Canal**,

- Colour was observed 1 Hazen unit
- Odour was agreeable
- pH was observed in the range from 6.85 to 7.86
- Turbidity was observed in the range from 1.1 to 3.0 NTU
- Total Dissolved Solids were observed in the range from 156 to 463 mg/L
- Electrical Conductivity was observed in the range from 241 to 710 µmho/cm
- Dissolved Oxygen was observed in the range from 6.10 to 6.90 mg/L
- Calcium (as Ca) was observed in the range from 8.00 to 19.2 mg/L
- Chloride (as Cl) was observed in the range from 55.1 to 168 mg/L
- Iron (as Fe) was observed in the range from 0.39 to 0.64 mg/L
- Magnesium (as Mg) was observed in the range from 2.44 to 10.8 mg/L
- Sulphate (as SO_4) was observed in the range from 1.95 to 13.6 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 23.8 to 129 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 30.0 to 76.2 mg/L
- Calcium Hardness (as $CaCO_3$) was observed in the range from 20.0 to 48.0 mg/L
- Sodium (as Na) was observed in the range from 20.5 to 71.8 mg/L
- Potassium (as K) was observed in the range from 3.45 to 9.22 mg/L
- Sodium Absorption Ratio was observed in the range from 1.383 to 3.459
- Free Ammonia, Zinc (as Zn), Total Phosphate (as PO_4), Nitrate (as NO_3), Biochemical Oxygen Demand (3 days, 27°C), Oil & Grease, Anionic Detergents, Barium (as Ba), Boron (as B), Copper (as Cu), Fluoride (as F), Manganese (as Mn), Mineral Oil, Phenolic Compounds (as C_6H_5OH), Selenium (as Se), Silver (as Ag), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detectable limits

- Bacteriological parameters such as Total Coliforms and Faecal Coliforms were not detected

c) At the location **Vellayani Lake**,

- Colour was observed 1 Hazen unit
- Odour was agreeable
- pH was observed in the range from 6.80 to 7.28
- Turbidity was observed in the range from 0.7 to 1.2 NTU
- Total Dissolved Solids were observed in the range from 120 to 387 mg/L
- Electrical Conductivity was observed in the range from 186 to 642 µmho/cm
- Dissolved Oxygen was observed in the range from 6.20 to 7.20 mg/L
- Calcium (as Ca) was observed in the range from 5.60 to 14.2 mg/L
- Chloride (as Cl) was observed in the range from 25.2 to 184 mg/L
- Iron (as Fe) was observed in the range from BDL to 0.39 mg/L
- Magnesium (as Mg) was observed in the range from 1.46 to 11.4 mg/L
- Sulphate (as SO_4) was observed in the range from 1.01 to 14.2 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 7.81 to 61.7 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 20.0 to 64.8 mg/L
- Calcium Hardness (as $CaCO_3$) was observed in the range from 14.0 to 35.1 mg/L
- Sodium (as Na) was observed in the range from 13.5 to 65.4 mg/L
- Potassium (as K) was observed in the range from 2.11 to 7.64 mg/L
- Sodium Absorption Ratio was observed in the range from 0.926 to 3.132
- Free Ammonia, Zinc (as Zn), Total Phosphate (as PO_4), Nitrate (as NO_3), Manganese (as Mn), Biochemical Oxygen Demand (3 days, 27°C), Oil & Grease, Anionic Detergents, Barium (as Ba), Boron (as B), Copper (as Cu),Fluoride (as F), Mineral Oil, Phenolic Compounds (as C_6H_5OH), Selenium (as Se), Silver (as Ag), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detectable limits
- Bacteriological parameters such as Total Coliforms and Faecal Coliforms were not detected

d) Summary – Comparison of Results of **All Locations**,

- Colour was observed 1 Hazen unit at all locations
- Odour was agreeable at all locations
- Maximum value of pH observed was 7.86 at Vizhinjam Branch Canal
- Maximum value of Turbidity observed was 3.0N.T.U. at Vizhinjam Branch Canal
- Maximum value of Total Dissolved Solids observed was 726mg/L at Poovar West Canal
- Maximum value of Electrical Conductivity observed was 1165µmho/cm at Poovar West Canal
- Maximum value of Dissolved Oxygen observed was 7.20mg/L at Vellayani Lake
- Maximum value of Calcium (as Ca) observed was 32.0mg/L at Poovar West Canal
- Maximum value of Chloride (as Cl) observed was 617mg/L at Poovar West Canal
- Maximum value of Iron (as Fe) observed was 0.64mg/L at Vizhinjam Branch Canal
- Maximum value of Magnesium (as Mg) observed was 16.6mg/L at Poovar West Canal
- Maximum value of Sulphate (as SO_4) observed was 41.8mg/L at Poovar West Canal
- Maximum value of Total Alkalinity (as $CaCO_3$) observed was 129mg/L at Vizhinjam Branch Canal
- Maximum value of Total Hardness (as $CaCO_3$) observed was 143mg/L at Poovar West Canal
- Maximum value of Calcium Hardness (as $CaCO_3$) observed was 80mg/L at Poovar West Canal
- Maximum value of Sodium (as Na) observedwas129mg/L at Poovar West Canal
- Maximum value of Potassium (as K) observed was 11.5mg/L at Poovar West Canal
- Maximum value of Sodium Absorption Ratio observed was 6.048 at Poovar West Canal
- Free Ammonia, Zinc (as Zn), Total Phosphate (as PO_4), Nitrate (as NO_3), Manganese (as Mn), Biochemical Oxygen Demand (3 days, 27°C), Oil &

Grease, Anionic Detergents, Barium (as Ba), Boron (as B), Copper (as Cu), Fluoride (as F), Mineral Oil, Phenolic Compounds (as C_6H_5OH), Selenium (as Se), Silver (as Ag), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detectable limits at all locations

- Bacteriological parameters such as Total Coliforms and Faecal Coliforms were not detected at all locations.

End of Report

Annexure V

CMFRI Report on Estimation of Marine Fish Landings

केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद)
CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
Vizhinjam Regional Centre, Post Bag No.9 Vizhinjam P.O
Thiruvananthapuram -695 521
Phone:0471-2480224(Off),2480324(Per),2483324(Aqu),2481143(Lab),Fax:2480324

Estimation of Marine Fish Landings Data from the Potential Impact Zones of Vizhinjam International Seaport, Kerala, India

Marine fish landings data from the potential impact zones of Vizhinjam International Seaport was estimated during 2021-22. The approach of Multistage Stratified Random Sampling established by CMFRI to estimate the national fish landings was used to estimate the fish landings from the direct footprint of development (Zone-1, 0- 2 km), potential impact zone (Zone II, 2- 5 km), and control zone (Zone III, 5-10 km) of the proposed project. The basic strata of the aforesaid design will be the landing centres, therefore, for the purpose of this project, all landing centres within a 10-kilometer radius of the Vizhinjam International Sea Port project were selected for fish landings appraisal. Extensive field surveys, experimental fishing, and sample collection on marine fishery resources were all part of the work schedule. An estimated 23934.03 tonnes of fish were landed from the three zones of Vizhinjam port during the reporting period (June 2021–May 2022). According to monthly catch analysis, the peak landings occurred in August, followed by December, and the lowest catch occurred in June 2021. More fish were landed during the monsoon season (39%) compared to the post-monsoon (32%) and pre-monsoon (29%). Landing centres located in the zone I contributed more to the landings (55%), followed by zone II (26%) and zone III (19%).

Fish catch data collected during the present investigation were compared with the baseline data collected during 2011-12 to elucidate the impact of port construction on the fishery activities along the potential impact zones of the project. The approach used to estimate fish landings and the landing centres chosen were both comparable to that of the current study. The total fish catch estimated from June 2021 to May 2022 was 23934 tonnes, which is 3.35 % higher than the baseline catch estimated during 2011-12 (23156 tonnes). The fish landings mainly comprised of pelagic fishes (Tuna, sardines, mackerel, scads, ribbonfishes etc.) followed by demersal fishes and cephalopods. Annual and biannual fluctuations in landings of specific pelagic fishes have been observed from the Vizhinjam coast (earlier fishery and biological studies)

resulting in the huge landings of a particular pelagic fish during one year and witnessing a few landings report of the same species in the coming year and an abundance of a new species. Since the majority (>60%) of the landings comprised of pelagic fishes, fluctuations in the species wise landings (pelagic fishes) are common to Vizhinjam coast. Due to this, the fish landings reported from Vizhinjam and its nearby landing centres were in a mere stagnant phase for years, where couldn't notice a great rise or fall in the annual landings. Monsoon fishery was affected at Vizhinjam for the last few years due to the less number of migrant fishers from the northern side of Thiruvananthapuram coast, this was mainly associated with the construction of the fishing harbour at Perumathura and the availability of suitable berthing facilities at Perumathura harbour during monsoon season. The failure of Southwest monsoon in certain years was also attributed to the fluctuations in the availability of pelagic resources and their recruitment. COVID-pandemic affected the actual fishing days during the last two years and contributed to the fluctuations in the landings. But during 2022, things were in line, and a good quantum of fish was landed during monsoon season with the ever-highest landings (last five years) of Ribbon fishes, Indian oil sardine and Scads. The experimental fishing conducted along the commercial fishing grounds helped to identify the present fishing ground and species composition of various gears. Seasonal and zonal variations of fish catch analysis depicted the highest catch from the direct footprint zone, implying the insignificant impacts of the development phase of Vizhinjam International seaport on the availability of fish resources. The present analysis on the estimation of fish landings from the potential impact zone of Vizhinjam International seaport depicted negligible effects on the fish landings and stated that the current phase of the port (construction phase) has insignificant impacts on the fish availability and landings along the 10 km zone. The impact assessment during the port's operational phase will reveal the fish landing's unique status and availability. Hence, studies need to be conducted during the operational phase to examine its effect on the marine habitat, flora, and fauna.

Surya S

(Project Investigator)

Surya. S
Scientist
Vizhinjam Research Centre of CMFRI
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ESTIMATION OF MARINE FISH LANDINGS DATA FROM THE POTENTIAL IMPACT ZONES OF VIZHINJAM INTERNATIONAL SEAPORT, KERALA, INDIA

FINAL REPORT

***Prepared for** Adani Vizhinjam Port Pvt. Ltd. (AVPPL)*

JUNE 2021-JULY 2022

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(ICAR)
VIZHINJAM REGIONAL CENTRE

FINAL REPORT

ESTIMATION OF MARINE FISH LANDINGS DATA FROM THE POTENTIAL IMPACT ZONES OF VIZHINJAM INTERNATIONAL SEA PORT, KERALA, INDIA

SUBMITTED TO:

Adani Vizhinjam Port Pvt. Ltd. (AVPPL)

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

(ICAR)

VIZHINJAM REGIONAL CENTER

CONTENTS

1. PREFACE

Adani Vizhinjam Port Private Limited (AVPPL) is currently developing an International Deepwater Multipurpose Seaport at Vizhinjam, Thiruvananthapuram District, Kerala State, in a Public-Private Partnership (PPP) with Government of Kerala, (GoK). The port is located 20 km south of the capital city of Thiruvananthapuram. AVPPL engaged CMFRI to conduct primary surveys, estimate marine fish landing data from the potential impact zones identified in the EIA, and compare with the baseline data. CMFRI signed MOU on the first week of April 2021 and initiated the study with literature review, sampling, and data collection from 01.06.2021 onwards. CMFRI also presented the proposed methodology for estimating marine fish landing study in the NGT committee meetings, and the committee approved the same. Detailed sampling was done with specific targets during the post-monsoon, monsoon, and premonsoon season. The sampling was mainly intended to estimate fish catch data from the potential impact zone, i.e., within the 10 km zone of the port. Twelve landing centres were identified and followed a multistage stratified random sampling design for the fish catch estimation. We thank Dr.Gopalakrishnan, Director, CMFRI, for the great support and encouragement. The support extended by Dr. M.K.Anil, HOC, Vizhinjam and Dr. N.K.Sanil, Chairperson of the consultancy cell (CPC), CMFRI, during the investigations, is also gratefully acknowledged.

Ms. Surya S

Scientist,

Finfish Fisheries Division,

CMFRI.

2. EXECUTIVE SUMMARY

During the reporting period (June 2021 to July 2022) for the project entitled 'Estimation of Marine Fish Landings Data from the Potential Impact Zones of Vizhinjam International Seaport, Kerala, India', sampling was carried out within 10 km of Vizhinjam International Sea Port project along the three areas, namely, Direct Footprint of development (Zone I), Potential Impact Zone (Zone II), and Control Zone (Zone III) of the project area to estimate the fish population and fish landings during Monsoon, Post-monsoon season and Pre-monsoon season. The study applied the methodology of Multistage Stratified Random Sampling for landing centre and zone-wise fish catch estimation. The work programme involved extensive field studies and sample collections on marine fishery resources within 10 km of the Vizhinjam International Sea Port project, covering three seasons. The month's sampling plan and methodology of estimation are detailed in the report. During the reporting period (June 2021-May 2022), an estimated 23934.03 tonnes of fish were landed from the three zones of Vizhinjam port. Monthwise catch analysis depicted that the top landings were recorded during August, followed by December, and the minor catch was recorded during June 2021. Monsoon season (39%) contributed more to the fish landings, followed by post-monsoon (32%) and pre-monsoon season (29%). Landing centres located in zone I (Direct footprint zone) contribute more to the landings (55%), followed by zone II (26%) (Potential impact zone) and zone III (19%) (Control zone). Outboard Gillnet (OBGN), Outboard Hook and Line (OBHL) and Outboard Boat seine (OBBS) were the significant gears operated during the study period. The percentage contribution of OBBS was maximum to the total landings during all the months except October and May. The CPUE analyzed for different gears depicted the peak contribution by OBBS during all the months except May. During monsoon season, the highest landing was reported in August (3417030 kg) followed by September, June and July. The dominant species that landed in June 2021 was *Mene maculata,* with a catch of 115943 kg. In July, August and September *Decapterus russelii* were reported as the dominant species. The zone-wise catch during monsoon season showed that zone 1, Direct Footprint Zone, solely contributed to the majority of catch (>80%) and the least contributed by Zone 3 (Control Zone). During post-monsoon season, Zone 2 (Potential impact zone) had reported maximum landing, and Zone 1 (Direct footprint Zone) reported the slightest catch. Analysis of landing centre-wise

catch data showed that Vizhinjam landing centre had reported the highest catch during all the post-monsoon months except December. In December Adimalathura landing centre was registered with the highest catch. The zone-wise catch during pre-monsoon season showed that zone 1, Direct Footprint Zone contributed to the majority of catch. The Zone-2, Potential Impact zone contributed the least. The Vizhinjam landing centre had reported the highest catch during all the pre-monsoon months. The landings were dominated by *Amblygaster sirm* in February, *Euthynnus affinis* in March, *Sardinella gibbosa* in April and *Auxis rochei* in May. Experimental sampling was conducted season-wise to collect the fishing ground information and species composition of dominant fishing units. The fishing ground information for different seasons was plotted season-wise using the Geo coordinates collected from the fishers and experimental sampling and depicted in the report. The fish species composition during different seasons was analyzed and shown in the tables. A total of 337 fish species were identified from the present investigation of fish landing data along the potential impact zones of the project. A detailed account of the current fishing methods is included in the report.

Fish catch data collected during the present investigation were compared with the baseline collected during 2011-12 to elucidate the impact of port construction on the fishery activities along the potential impact zones of the project. The total fish catch estimated from June 2021 to May 2022 was 23934 tonnes, which is 3.35 % higher than the baseline catch estimated during 2011-12 (23156 tonnes). During the monsoon season, a total catch of 9283 tonnes of fish was reported in 2021, while during 2011, 7584 tonnes of fish were recorded and registered an 18% increase in fish catch in 2021. A total of 7658 tonnes of fish were recorded during 2021 post-monsoon season, while in 2011, a catch of 6773 tonnes and an increase of 11.5% were noted during 2021. In the pre-monsoon season, the situation varied and a reduction of 20% of catch happened during 2021 as we compared the data with the baseline information (2021- 6991 tonnes landed, 2011- 8798 tonnes landed). In Zone I, the catch was reported maximum during monsoon season, followed by Pre-monsoon and post-monsoon season during 2021-22, as well as 2011-12. During monsoon season, the highest catch was recorded during 2021-22, while in post-monsoon and pre-monsoon, the maximum catch was recorded during 2011-12. . In zone II, Post monsoon catches were more during 2011-12 and 2021-22, followed by pre-monsoon. There was absolutely nil catch reported from zone II in 2011-12 during the monsoon season while a few catches were reported from zone II during the monsoon season in

2021-22. Post-monsoon and pre-monsoon, catches were recorded high during 2021-22 than in 2011-12. In zone III, Pre-monsoon catches were more during both the study periods and there was no catch during monsoon season in 2011-12, while a few catches were reported during monsoon season in 2021-22. During post and pre-monsoon, the maximum catch was recorded during 2021-22 than 2011-12. During 2011, Vizhinjam (49%) contributed more to the landings, followed by Poonthura (14%), Puthiyathura (12%), Poovar (10%), Pallam (3%), Erayammanthura (3%), Adimalathura (3%), Chempakaramanthura (3%), Karumkulam (2%), Kochupally (1%), Kovalam (<1%) and Kochuthura (<1%). While in 2021, Vizhinjam (55%) contributed more to the landings, followed by Adimalathura (11%), Poonthura (11%), Puthiyathura (7%), Pulluvila (5%), Poovar (5%), Karumkulam (3%), Pallam (3%), Panathura (<1%), Kovalam (<1%), and Kochuthura (<1%). The experimental fishing conducted along the commercial fishing grounds helped to identify the present fishing ground and species composition of various gears. Seasonal and zonal variations of fish catch analysis depicted the highest catch from the direct footprint zone, implying the insignificant impacts of the development phase of Vizhinjam International seaport on the availability of fish resources. The present analysis on the estimation of fish landings from the potential impact zone of Vizhinjam International seaport depicted negligible effects on the fish landings and stated that the current phase of the port (construction phase) has insignificant impacts on the fish availability and landings along the 10 km zone. The impact assessment during the port's operational phase will reveal the fish landing's unique status and availability. Hence, studies need to be conducted during the operational phase to examine its effect on the marine habitat, flora, and fauna.

3. THE TEAM

Sl.No.	Name	Designation	Project role
1	Dr. A Gopalakrishnan	Director	Director
2	Dr.N.K.Sanil	Principal Scientist	Chair person, CPC
3	Dr. M. K. Anil	PS and Scientist In Charge, CMFRI, (Vizhinjam)	Project Associate
4	Dr. Somy Kuraikose	Principal Scientist	Project Associate
5	Dr. Santhosh B	Principal Scientist	Project Associate
6	Dr. Jasmine, S.	Principal Scientist	Project Associate
7	Dr. Saleela, K. N.	Senior Scientist	Project Associate
8	Dr. Shelton Padua	Scientist	Project Associate
9	Mrs. Surya S,	Scientist	Project leader
10	Mrs. Gomathi P	Scientist	Project Associate
11	Mr. Ambarish P Gop	Scientist	Project Associate
12	Dr. Reshma Gills	Scientist	Member CPC
13	Dr. Jose Kingsly,	Sr. Technical officer	Technical support
14	Dr. V. A. Leslie	Sr. Technical officer	Technical support
15	Mrs.Sindhu Augustine	Technical officer	Technical support
16	Mr. K.K. Suresh	Sr. Technical officer	Technical support
17	Shri. B. Raju	Sr. Tech. Asst	Technical support
18	Shri Albert Idu	Tech. Asst.	Technical support
19	Mrs. Arathy R Pillai	Supporting staff	Skilled support
20	Mr. Hareesh Nair	Chief Administrative Officer	Administrative Assistance
21	Mr. Prashant Kumar	Chief Finance & Accounts Officer	Financial assistance
22	Mr. P.S. Anilkumar	AC.TO	Member secretary, CPC
23	Ms. Angel Gomez	Young professional	Data collection and reporting
24	Mr. Dispin Das Y	Field Assistant	Data collection

4. LIST OF TABLES

5. LIST OF PLATES

6. LIST OF FIGURES

7. BACKGROUND

Adani Vizhinjam Port Private Limited (AVPPL) is currently developing an International Deepwater Multipurpose Seaport at Vizhinjam, Thiruvananthapuram District, Kerala State, in a Public-Private Partnership (PPP) with the Government of Kerala (GoK). Appeals challenging the Environmental and CRZ Clearance (EC) granted to the Vizhinjam project were filed as per the NGT Act, 2010. The Delhi Bench of NGT has upheld the EC granted to the project vide its judgment dated 02.09.2016. An expert committee has been constituted to oversee compliance and adherence to the NGT judgment and also compliance with the EC issued by MoEF&CC (F.No.11-122/2011-IA.III dated 03.01.2014) for Vizhinjam Port.

During the NGT Expert Committee dated 06.09.2019, the committee suggested that Fishery data shall be collected with proper methodologies and procedure as per discussion with CMFRI and Fishery Department and During the NGT Expert Committee dated 24.09.2020. Dr. Anil, Principal Scientist and Head, CMFRI, informed that the secondary fishery data of the project area is not available with CMFRI. Therefore, since secondary fishery data is unavailable with CMFRI and they do not have continuous data regarding the landing centres of the study area, AVPPL engaged CMFRI to conduct primary surveys and estimate marine fish landing data from the potential impact zones. CMFRI initiated the study with a literature review, sampling, and data collection from 01.06.2021 onwards.

CMFRI also presented the proposed methodology for the estimation of marine fish landing study in the NGT committee meetings, and the same was approved by the committee.

8. INTRODUCTION

As part of its various programs for the state's development, the Government of Kerala (GoK). has identified the development of Vizhinjam International Deepwater Multipurpose Seaport. GoK has formed a separate company, viz. Vizhinjam International Seaport Limited (VISL) is a special purpose company that would act as implementing agency for the development of the green field port at Vizhinjam in Thiruvananthapuram district, Kerala. The location of the Vizhinjam port is given below; (Fig. 8.1)

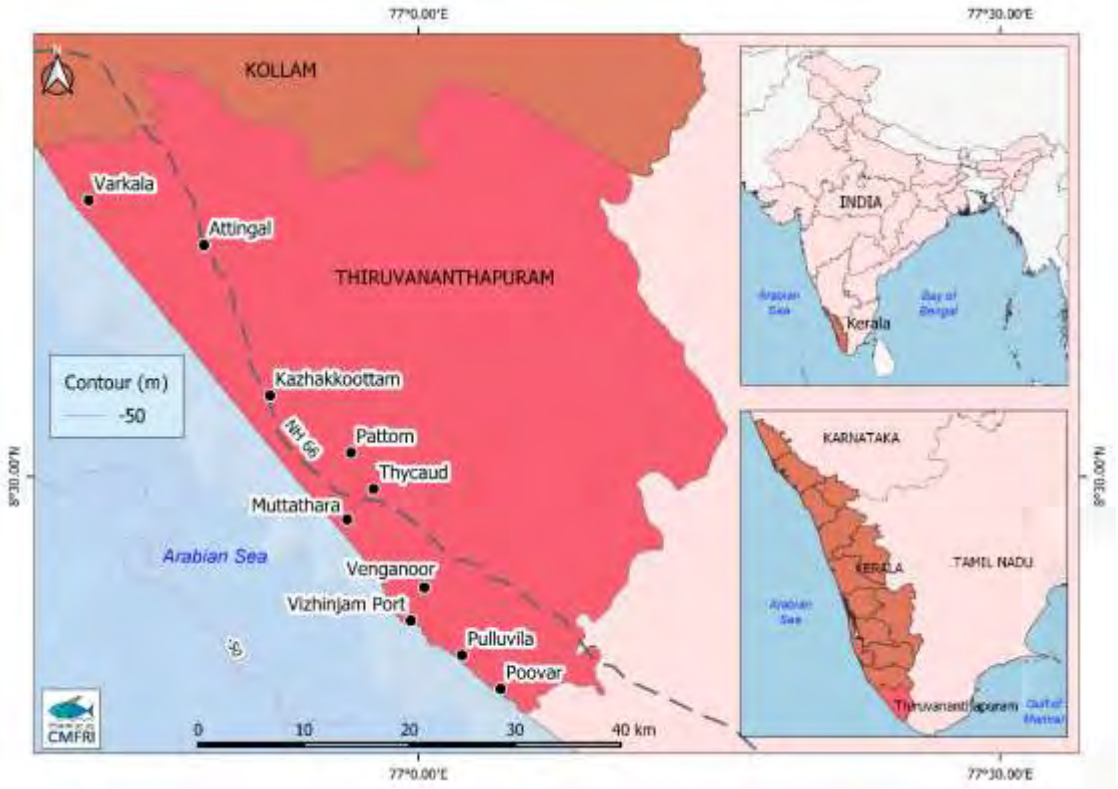


Fig.8.1. Map showing the location of Vizhinjam Port

NGT appointed expert committee has been constituted to oversee compliance and adherence to the NGT judgment and also compliance with the EC issued by MoEF. During the NGT Expert Committee dated 06.09.2019, the committee suggested that fishery data shall be collected with proper methodologies and procedures as per discussion with CMFRI to assess the impact of port construction on the fish availability along the potential zones. CMFRI is the nodal agency in India to monitor and evaluate the commercial exploitation of marine fishery

resources. CMFRI also suggests policy decisions on craft and gears operated along Indian waters to respective state governments. CMFRI was involved in the baseline data collection during the EIA stage for Vizhinjam Port in 2011-12. The result of the study elucidated the total fish landings by fishing sector from the Vizhinjam fishing harbour and adjacent fishing villages. A comparative statement on fish landings recorded before the construction of Vizhinjam port and present fish landings will elucidate the effects of development activities along the project area. With the background information, CMFRI Vizhinjam Regional Centre studied the estimation of marine fish landings data from the potential impact zone of Vizhinjam port. MoU was signed during the first week of April 2021 and a team of scientific personnel of CMFRI with expertise in different themes related to marine capture fisheries and biodiversity was entrusted the work.

8.1 OBJECTIVES OF STUDY

- The objective of the project is to estimate the fish population and fish landings within 10 km of Vizhinjam International Sea Port project for three seasons such as monsoon, pre-monsoon and post-monsoon from three areas, namely, Direct Footprint of development, Potential Impact Zone, and Control Zone of the project area.
- Assessment of Fishery resources, landings and species composition of the study area based on commercial as well as experimental fishing.

9. METHODOLOGY FOR THE ESTIMATION OF MARINE FISH LANDINGS IN INDIA

The work programme involves extensive field studies and sample collections on marine fishery resources within 10 km of the Vizhinjam Port project, covering three seasons (Monsoon, Post-monsoon and Pre-monsoon). The result of the studies conducted along the above areas would prove whether any quantifiable change is visible in the status of the fishery due to the construction of Vizhinjam port.

The work is scheduled as follows;

Table No. 9.1. Work Schedule

<table>
<tr><td>June 2021</td><td colspan="2">Literature review & Initial arrangements for the project.</td></tr>
<tr><td rowspan="4">1st June 2021- 31st May 2022</td><td colspan="2">Sampling and Data collection.</td></tr>
<tr><td>Monsoon season</td><td>1st Jun- 30th Sep 2021</td></tr>
<tr><td>Post monsoon season</td><td>1st Oct 2021- 31st Jan 2022</td></tr>
<tr><td>Pre-monsoon season</td><td>1st Feb- 31st May 2022</td></tr>
<tr><td>1st June 2022- 31st July 2022</td><td colspan="2">Data analysis and preparation of project report.</td></tr>
<tr><td>31st July 2022</td><td colspan="2">Submission of Project Report</td></tr>
</table>

During the reporting period (June 2021 to July 2022), marine fisheries surveys have been conducted off the Vizhinjam coast covering three zones: the Direct Foot Print Zone, Potential impact Zone and Control Zone of the Vizhinjam port from Poovar in the north to Poonthura in the south zone. The estimation of fish landings data from June 2021 to May 2022 is narrated in the present report. The analysis of fish catch data estimated the assessment of the availability of fishery resources landed at the landing centres, its nature of exploitation and species composition of landings

9.1 STUDY AREA AND SAMPLING SITE

The study area was divided into three zones depending on the distance from the project site: the study area of three impact zones is given in Figure 9.1.1.

- **Zone 1** (Core Zone): **0-2 km** from the proposed project site
- **Zone 2** (Moderate Imp**act Zon**e): **2-5 km** from the proposed project site
- **Zone 3** (Low Impact **Zone): 5-10 km** from the proposed project site

Fig .9.1.1. Study area of the Project

Landing centres selected for the present study and their coordinates

- POONTHURA 8°26'06.5"N 76°56'58.1"E
- PANATHURA 8°24'27.8"N 76°58'07.9"E
- KOVALAM 8°23'44.7"N 76°58'23.5"E
- VIZHINJAM 8°22'41.6"N 76°59'28.7"E
- ADIMALATHURA 8°20'57.0"N 77°01'27.9"E
- KOCHUPALLI 8°20'43.7"N 77°01'47.8"E
- CHEMPARAMANTHURA 8°20'34.9"N 77°01'59.0"E
- ERAYAMANTHURA 8°20'23.4"N 77°02'14.8"E
- PALLAM 8°20'14.2"N 77°02'25.1"E
- PUTHIYATHURA 8°19'57.4"N 77°02'44.6"E
- KOCHUTHURA 8°19'42.1"N 77°03'04.0"E
- KARUMKULAM 8°19'27.9"N 77°03'21.9"E
- POOVAR 8°19'00.9"N 77°03'55.7"E

The estimation of marine landings from the potential impact zone of Vizhinjam port is a separate project and it is not under the objective of CMFRI's all-India data collection project. The data thus generated will be for this project specifically and won't be a part of CMFRI's national landings estimation. The procedure and sampling design followed by CMFRI to estimate the national landings data will be followed in the present study to estimate the landings data from the potential impact zones. Two field staff were recruited exclusively under this project for data collection and they are specifically working on the data collection, experimental sampling and species composition analysis.

9.2 Methodology of Multistage Stratified Random Sampling for fish catch estimation

The stratification over time is a calendar month. One zone and a calendar month is a space-time stratum and primary stage sampling units are landing centre days. If in a zone, there are 20 landing centres, there will be 20 x 30 = 600 landing centre days in that zone for that month (of 30 days). For observation purposes, a month is divided into three groups, each of 10 days. From the first five days of a month, a day is selected at random, and the next five consecutive days are automatically selected. From this, three clusters of two consecutive days are formed. Normally, in a month, there will be 9 clusters of two days each. Among the total number of landing centres in the given zone, 9 centres are selected with replacement and allotted to the 9 cluster days described earlier. Thus in a month, nine landing centre days are observed. The observation is made in a center from 1200 hrs to 1800 hrs on the first day and from 0600 hrs to 1200 hrs on the second day. For the intervening period of these two days, the data are collected by an inquiry from 1800 hrs of the first day of observation to 0600 hrs of the second day of observation of a landing center-day, which is termed as 'night landing '. The `night landing' obtained by inquiry on the second day covering the period of 1800 hrs of the first day to 0600 hrs of the next day are added to the day landings to arrive at the landings for one (landing centre day) day (24 hours).

Selection of units and recording of landings

It may not be practical to record the catches of all boats landed during an observation period if the number of boats/craft landings is large. A sampling of the boats/craft becomes essential. When the total number of boats landed is 15 or less, the landings from all the boats are enumerated for catch and other particulars. When the total number of boats exceeds 15, the following procedure is followed to sample the number of boats (Alagaraja, 1984). From the boats, the catches are normally removed in baskets of standard volume. The weight of fish contained in these baskets is known, and the weight of fish in each boat under observation is obtained.

Procedure for estimating marine fish landings during a month

Monthly estimate for a zone

Without stratification of a zone (also applicable to single centre zone)

Let N be the number of days (fishing days) in a month, Q be the number of centres in the zone and n be the number of selected landing centre days.Let ***p*** be the number of periods of observation for the selected landing centre day.

p = 1 corresponds to 1200 – 1800 hrs on the first day of observation

p = 2 corresponds to 0600 – 1200 hrs on the second day of observation

p = 3 corresponds to night landings obtained by enquiry of the boats, landing after

1800 hrs on the first day and before 0600 hrs on the second day

Let *Ngdp* be the total number of craft (boat) of gear type *g* (from now on referred to as unit) landed during d^{th} selected landing centre day in the p^{th} period of observation.

Let *ngdp* be the number of selected units of type ***g*** on the *d*th landing centre day during the *p*th period of observation.

Let *ysgdpi* be the catch of the species s landed by the *i*th selected unit of *g*th type unit on *d*th selected day during *p*th period of observation.

Let $\hat{Y}_{sgdp}$ be the estimated total landings of species ***s*** by unit type ***g*** on the *d*th landing centre day during *p*th period of observation.

Then,

$$\hat{Y}_{sgdp} = \frac{N_{gdp}}{n_{gdp}} \sum_{i=1}^{ngdp} y_{sgdpi} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Let $\hat{Y}_{sgd}$ be the estimated total landings of species ***s*** by *g*th type of unit on *d*th day and

$$\hat{Y}_{sgd} = \sum_{p=1}^{3} \hat{Y}_{sgdp} \qquad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

[Note : The night landings (p=3) are obtained by enquiry and usually estimated by enquiry from the number of each type of unit landed and average catch per unit]. The estimated total landings (*sg* $\hat{Y}$) of species ***s*** by *g*th type of unit for the month is obtained as

$$\hat{Y}_{sg} = \frac{NQ}{n} \sum_{d=1}^{n} \hat{Y}_{sgd} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Estimated total landings (*d* $\hat{W}$) for the selected landing centre day is obtained as

$$\hat{W}_d = \sum_s \sum_g \hat{Y}_{sgd} \text{ (summed over all gear and for all species) } \ldots\ldots\ldots\ldots (4)$$

The estimated total landings *g* $\hat{Y}$ of all species by *g*th type of unit for the month is obtained as

$$\hat{Y}_g = \sum_s \hat{Y}_{sg} \text{ (Summed over all species landed by } g^{th} \text{ type of unit) } \ldots\ldots (5)$$

The estimated total landings $\hat{Y}$s of species landed by all types of units for the month is

$$\hat{Y}_s = \sum \hat{Y}_{sg} \qquad \text{(Summed over all types of units) } \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Estimated total landings $\hat{Y}$ for the month overall types units and all species are given by

$$\hat{Y} = \sum \hat{Y}_g = \sum \hat{Y}_s \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Using the above formulae, fish catch details of landing centre is calculate in monthly basis.

Instructions to the field staff during data collection

The work programme for a month will be issued to the field staff towards the third week of the previous month. The place, date and time of observation will be indicated in the programme.

- The official should reach the landing centre at least 15 minutes before the commencement of the observation time and the official will have to make a local inquiry on the number of units gone for fishing and the number of units expected to land during his observation period. This information is required to determine the number of units selected for observation.
- Whether there is fishing or no fishing, the work schedule should be strictly adhered to and the official should be at the landing centre during the entire period of observation.
- In the case of landing centres comprising more than one landing point, the official may collect data at the point where a maximum number of units are expected to land. The number of units landed at the other point(s) should be indicated with a plus (+) sign along with the total number of units landed at the point where he makes the observation.
- The data to be collected comprise (i) the total number of fishing units landed by actual count and their time of arrival (ii) the detailed species-wise breakup of landings and other ancillary information about a selected number of fishing units and (iii) data on 'night landings'. The landings after 1800 hrs. of the first day of observation and before 0600 hrs of the second-day observation have been termed 'night landings', which have to be collected in the morning of the second day by inquiry.
- The actual load of landings must be weighed. In case the landings are heavy, at least one basket of various groups of fish should be weighed and the total weight should be obtained by multiplying this weight by the total number of baskets as far as practicable.

Recording of details of landings

- Names of species of all commercially important fishes and shellfishes should be recorded. In case identification up to species, level is not possible, at least a generic name should be indicated. The names of fishes that come under 'Miscellaneous' may be given in a footnote. Indicating fisheries resources by common names like prawns, tunnies, sharks, rays, skates etc. should be avoided. In case of doubt, local names may be used and the specimens are collected and identified at the laboratory wherever such facilities exist or sent to the headquarters for identification.
- Name of the centre, date and time be given if the number of species does overlap to the next page/sheet.

- The type of gear is to be specified along with the local name. Expansions of the abbreviations used for gear shall be indicated at the bottom of the form.

Special instructions

- The total number of fishing units landed by actual count and their time of arrival
- The detailed species wise breakup of landings and other ancillary information about a selected number of fishing units.
- Data on 'night landings'. The landings after 1800 hrs of the first day of observation and before 0600 hrs of the second-day observation have been termed 'night landings' which have to be collected in the morning of the second day by enquiry.
- Names of species of all commercially important fishes and shellfishes should be recorded.
- Type of gear & craft is to be specified.
- Length of craft
- Departure and arrival of fishing units.
- Distance of fishing ground is the shortest distance from the shore
- Direction from landing centre
- Depth of fishing ground
- No. of hauls
- Duration of actual fishing
- Manpower employed
- Species & its weight
- State of sea and sky
- Direction of wind
- Direction of current
- Price statistics
- In the case of multiple gear operations, data from individual gear may be recorded separately.

9.3 Sampling plan & details

The monthly sampling plan for landing centre visit and data collection is given in Table9.3

Table No. 9.3.1 Sampling plan & details

The date and time of the landing centre visit are given below:

Sl no.	JUNE		JULY		AUGUST	
	Date	**Landing centre**	**Date**	**Landing centre**	**Date**	**Landing centre**
1.	02/06/2021	Karumkulam Erayammanthura	02/07/2021	Karumkulam Poovar	02/08/2021	Poovar Adimalathura
2.	03/06/2021	Karumkulam Erayammanthura	03/07/2021	Karumkulam Poovar	03/08/2021	Poovar Adimalathura
3.	05/06/2021	Pallom Kochuthura	05/07/2021	Pallom Kochuthura	04/08/2021	Pallom Kochuthura
4.	07/06/2021	Vizhinjam Adimalathura	07/07/2021	Kovalam Panathura	05/08/2021	Panathura Karumkulam
5.	08/06/2021	Vizhinjam Adimalathura	08/07/2021	Vizhinjam Erayammanthura	06/08/2021	Kochuthura Karumkulam
6.	10/06/2021	Poonthura Panathura	09/07/2021	Vizhinjam Erayammanthura	09/08/2021	Poonthura Puthiyathura
7.	11/06/2021	Poonthura	12/07/2021	Chemparamanthura Adimalathura	10/08/2021	Poonthura Puthiyathura
8.	14/06/2021	Kovalam Poovar	13/07/2021	Chemparamanthura Adimalathura	12/08/2021	Adimalathura Kovalam
9.	15/06/2021	Adimalathura Poovar	15/07/2021	Poovar Kovalam	13/08/2021	Adimalathura Karumkulam
10	16/06/2021	Adimalathura Pallom	16/07/2021	Poovar Poonthura	16/08/2021	Vizhinjam Erayammanthura
11	17/06/2021	Erayammanthura	19/07/2021	Kochuthura Poonthura	17/08/2021	Vizhinjam Erayammanthura
12	18/06/2021	Erayammanthura Karumkulam	21/07/2021	Panathura	18/08/2021	Kochuthura Panathura
13	19/06/2021	Karumkulam	22/07/2021	Adimalathura Karumkulam	24/08/2021	Puthiyathura Vizhinjam

14	21/06/2021	Kochuthura Kovalam	23/07/2021	Adimalathura Karumkulam	25/08/2021	Puthiyathura Vizhinjam
15	22/06/2021	Pallom	26/07/2021	Puthiyathura Vizhinjam	26/08/2021	Karumkulam Poovar
16	23/06/2021	Adimalathura Vizhinjam	27/07/2021	Puthiyathura Vizhinjam	27/08/2021	Karumkulam Poovar
17	24/06/2021	Adimalathura Vizhinjam	29/07/2021	Erayammanthura Chemparamanthura	31/07/2021	Kovalam Panathura
18	26/06/2021	Panathura Kochuthura	30/07/2021	Erayammanthura Chemparamanthura		
19	28/06/2021	Puthiyathura Chemparamanthura				
20	29/06/2021	Puthiyathura Chemparamanthura				

Sl no.	SEPTEMBER		OCTOBER		NOVEMBER	
	Date	Landing centre	Date	Landing centre	Date	Landing centre
1.	02/09/2021	Poonthura Poovar	4/10/2021	Adimalathura Vizhinjam	02/11/2021	Poovar Karimkulam
2.	03/09/2021	Poonthura Poovar	5/10/2021	Adimalathura Vizhinjam	03/11/2021	Poovar Karimkulam
3.	06/09/2021	Puthiyathura Karimkulam	6/10/2021	Pallom Kochuthura	05/11/2021	Puthiyathura Erayammanthura
4.	07/09/2021	Puthiyathura Karimkulam	7/10/2021	Poonthura Poovar	06/11/2021	Puthiyathura Erayammanthura
5.	09/09/2021	Chemparamanthura Erayammanthura	8/10/2021	Poonthura Poovar	08/11/2021	Adimalathura Vizhinjam
6.	10/09/2021	Chemparamanthura Erayammanthura	11/10/2021	Kovalam Panathura	09/11/2021	Adimalathura Vizhinjam
7.	13/09/2021	Pallom Panathura	12/10/2021	Puthiyathura Karimkulam	11/11/2021	Chemparamanthura Kovalam
8.	14/09/2021	Adimalathura	13/10/2021	Puthiyathura Karimkulam	12/11/2021	Chemparamanthura
9.	15/09/2021	Kochuthura Adimalathura	16/10/2021	Kochuthura Kovalam	15/11/2021	Panathura Poonthura
10	16/09/2021	Vizhinjam Chemparamanthura	18/10/2021	Panathura Pallom	16/11/2021	Poonthura
11	17/09/2021	Vizhinjam Chemparamanthura	20/10/2021	Poovar Adimalathura	17/11/2021	Vizhinjam Adimalathura
12	20/09/2021	Panathura Poonthura	21/10/2021	Poovar Adimalathura	18/11/2021	Vizhinjam Adimalathura
13	21/09/2021	Poovar Poonthura	22/10/2021	Vizhinjam Chempakaramanthura	20/11/2021	Kochuthura Pallom

14	22/09/2021	Poovar	23/10/2021	Vizhinjam Chempakaramanthura	22/11/2021	Karimkulam Kochupalli
15	23/09/2021	Vizhinjam Adimalathura	25/10/2021	Erayammanthura Puthiyathura	23/11/2021	Karimkulam Kochupalli
16	24/09/2021	Vizhinjam Adimalathura	26/10/2021	Erayammanthura Puthiyathura	25/11/2021	Kovalam Adimalathura
17	27/09/2021	Kovalam Kochuthura	27/10/2021	Karimkulam Poonthura	26/11/2021	Poonthura Adimalathura
18	27/09/2021	Karumkulam Poonthura	28/10/2021	Karimkullam Poonthura	27/11/2021	Poonthura Kochuthura
19	28/09/2021	Erayammanthura Puthiyathura			29/11/2021	Pallom Panathura
20	29/09/2021	Erayammanthura Puthiyathura				

Sl. No	DECEMBER		JANUARY		FEBRUARY	
	Date	Landing centre	Date	Landing centre	Date	Landing centre
1.	02/12/2021	Karimkulam Poovar	02/01/2021	Karumkulam Poovar	02/02/2021	Poovar Adimalathura
2.	03/12/2021	Karimkulam Poovar	03/01/2021	Karumkulam Poovar	03/02/2021	Poovar Adimalathura
3.	06/12/2021	Pallom Puthiyathura	05/01/2021	Pallom Kochuthura	04/02/2021	Pallom Kochuthura
4.	07/12/2021	Erayammanthura Puthiyathura	07/01/2021	Kovalam Panathura	05/02/2021	Panathura Karumkulam
5.	08/12/2021	Erayammanthura	08/01/2021	Vizhinjam Erayammanthura	06/02/2021	Kochuthura Karumkulam
6.	09/12/2021	Poonthura Kochupally	09/01/2021	Vizhinjam Erayammanthura	09/02/2021	Poonthura Puthiyathura
7.	10/12/2021	Poonthura Kochupally	12/01/2021	Chemparamanthura Adimalathura	10/02/2021	Poonthura Puthiyathura
8.	13/12/2021	Adimalathura Chemparamanthura	13/01/2021	Chemparamanthura Adimalathura	12/02/2021	Adimalathura Kovalam
9.	14/12/2021	Adimalathura Chemparamanthura	15/01/2021	Poovar Kovalam	13/02/2021	Adimalathura Karumkulam
10	17/12/2021	Poovar Karimkulam	16/01/2021	Poovar Poonthura	16/02/2021	Vizhinjam Erayammanthura
11	18/12/2021	Kochuthura Panathura	19/01/2021	Kochuthura Poonthura	17/02/2021	Vizhinjam Erayammanthura
12	20/12/2021	Vizhinjam Pallom	21/01/2021	Panathura	18/02/2021	Kochuthura Panathura
13	21/12/2021	Vizhinjam Poonthura	22/01/2021	Adimalathura Karumkulam	24/02/2021	Puthiyathura Vizhinjam

14	22/12/2021	Puthiyathura Poonthura	23/01/2021	Adimalathura Karumkulam	25/02/2021	Puthiyathura Vizhinjam
15	23/12/2021	Puthiyathura Adimalathura	26/01/2021	Puthiyathura Vizhinjam	26/02/2021	Karumkulam Poovar
16	24/12/2021	Adimalathura	27/01/2021	Puthiyathura Vizhinjam	27/02/2021	Karumkulam Poovar
17	27/12/2021	Pallom Kovalam	29/01/2021	Erayammanthura Chemparamanthura		
18	29/12/2021	Panathura Kochuthura	30/01/2021	Erayammanthura Chemparamanthura		

Sl no.	MARCH		APRIL		MAY	
	Date	Landing centre	Date	Landing centre	Date	Landing centre
1.	02/03/2021	Poonthura Poovar	4/04/2021	Adimalathura Vizhinjam	02/05/2021	Poovar Karimkulam
2.	03/03/2021	Poonthura Poovar	5/04/2021	Adimalathura Vizhinjam	03/05/2021	Poovar Karimkulam
3.	06/03/2021	Puthiyathura Karimkulam	6/04/2021	Pallom Kochuthura	05/05/2021	Puthiyathura Erayammanthura
4.	07/03/2021	Puthiyathura Karimkulam	7/04/2021	Poonthura Poovar	06/05/2021	Puthiyathura Erayammanthura
5.	08/03/2021	Chemparamanthura Erayammanthura	8/04/2021	Poonthura Poovar	08/05/2021	Adimalathura Vizhinjam
6.	09/03/2021	Chemparamanthura Erayammanthura	11/04/2021	Kovalam Panathura	09/05/2021	Adimalathura Vizhinjam
7.	13/03/2021	Pallom Panathura	12/04/2021	Puthiyathura Karimkulam	11/05/2021	Chemparamanthura Kovalam
8.	14/03/2021	Adimalathura	13/04/2021	Puthiyathura Karimkulam	12/05/2021	Chemparamanthura
9.	15/03/2021	Kochuthura Adimalathura	16/04/2021	Kochuthura Kovalam	15/05/2021	Panathura Poonthura
10.	16/03/2021	Vizhinjam Chemparamanthura	18/04/2021	Panathura Pallom	16/05/2021	Poonthura
11.	17/03/2021	Vizhinjam Chemparamanthura	20/04/2021	Poovar Adimalathura	17/05/2021	Vizhinjam Adimalathura
12.	20/03/2021	Panathura Poonthura	21/04/2021	Poovar Adimalathura	18/05/2021	Vizhinjam Adimalathura
13.	21/03/2021	Poovar Poonthura	22/04/2021	Vizhinjam Chempakaramanthura	20/05/2021	Kochuthura Pallom
14.	22/03/2021	Poovar	23/04/2021	Vizhinjam Chempakaramanthura	22/05/2021	Karimkulam Kochupalli
15.	23/03/2021	Vizhinjam Adimalathura	25/04/2021	Erayammanthura Puthiyathura	23/05/2021	Karimkulam Kochupalli
16.	24/03/2021	Vizhinjam Adimalathura	26/04/2021	Erayammanthura Puthiyathura	25/05/2021	Kovalam Adimalathura
17.	27/03/2021	Kovalam Kochuthura	27/04/2021	Karimkulam Poonthura	26/05/2021	Poonthura Adimalathura
18.	27/03/2021	Karumkulam Poonthura	28/04/2021	Karimkullam Poonthura	27/05/2021	Poonthura Kochuthura
19.	28/03/2021	Erayammanthura			29/05/2021	Pallom

		Puthiyathura				Panathura
20.	29/03/2021	Erayammanthura Puthiyathura				

The photographs of the different landing centres selected from the direct foot print, potential impact zone and the control zones are given below

Plate 9.3.1 Photographs of the landing centres-Vizhinjam, Poovar, Puthiyathura & Karumkulam

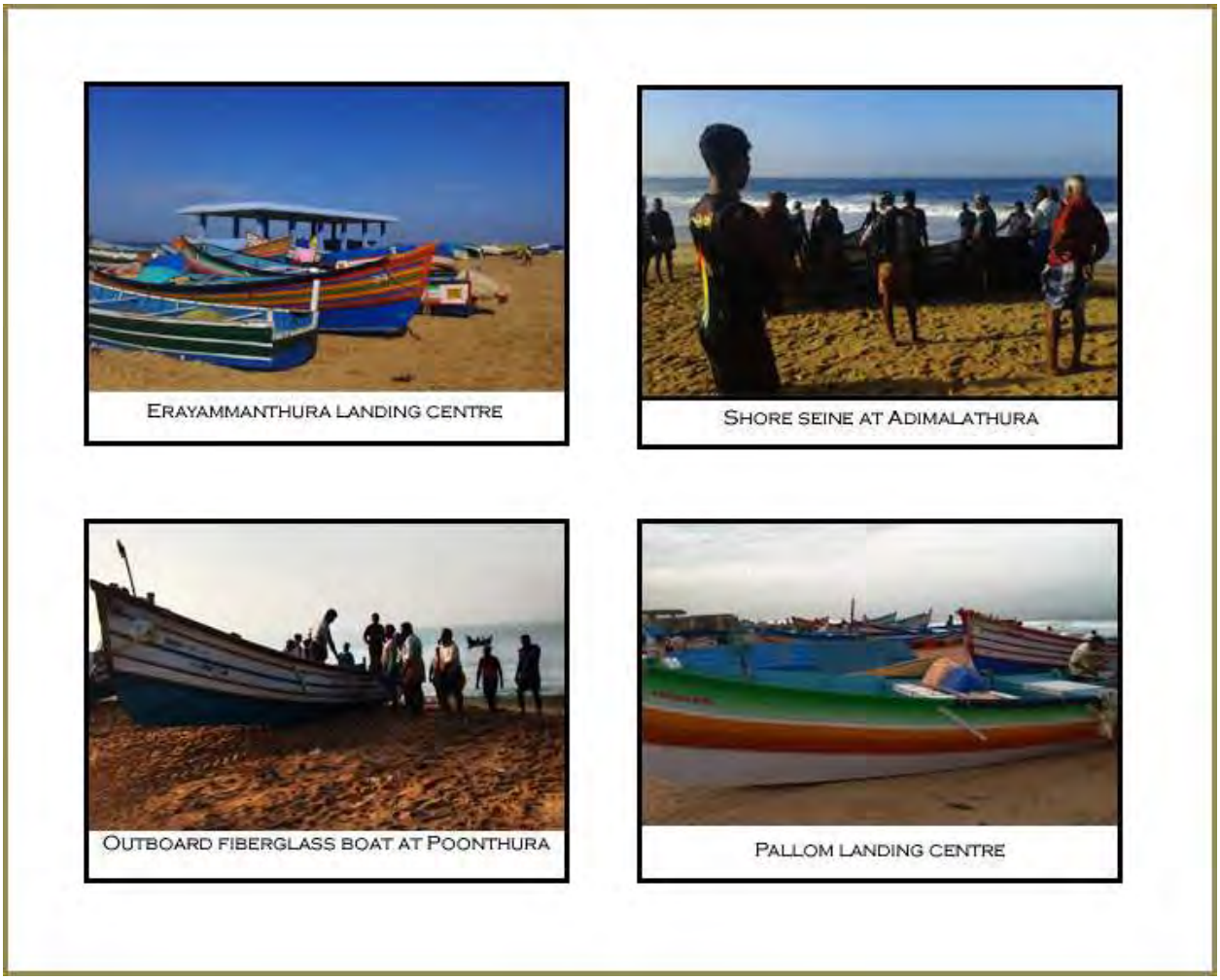


Plate 9.3.2. Photographs of the landing centres -Erayammanthura , Adimalathura, Poonthura & Pallom

Plate 9.3.3. Photographs of the landing centres -Panathura, Chempakaramanthura & Kovalam

10. RESULTS

10.1 General profile of fish landings from 2016-2020

(India, Kerala &Thiruvanathapuram)

Fisheries are an important source of food, nutrition, employment and income in India. The sector provides livelihoods to about 16 million fishers and fish farmers at the primary level and almost twice the number along the value chain. Fish, an affordable and rich source of animal protein, is one of the healthiest options to mitigate hunger and malnutrition. India has rich and diverse fisheries resources ranging from deep seas to lakes, ponds, and rivers and more than 10% of the global biodiversity in terms of fish and shellfish species. The marine fisheries resources are spread along the country's vast coastline and 2.02 million square km Exclusive Economic Zone (EEZ) and 0.53 million sq.km continental shelf area. The sector has immense potential to more than double the fishers and fish farmers incomes, as envisioned by the government.The share of the fisheries sector in the total GDP (at current prices) increased from 0.40% in 1950-51 to 1.03% in 2017-18, recording an increase of 157%. The sector contributed Rs. 1,75,573 crore to the GDP (at current prices) during FY 2017–18 (Ministry of Statistics and Programme Implementation, 2020). The sector has been showing steady growth in the total Gross Value Added and accounts for about 6.58% share of Agricultural GDP. The total fisheries potential of India has been estimated at 22.31 million metric tons (in 2018), of this, the marine fisheries potential stands at an estimated 5.31 million metric tons and the inland fisheries potential been estimated at 17 million metric tons. In recent years, fish production in India has registered an average annual growth rate of more than 7%. The fish production in the country has shown continuous and sustained increments since 1947. The total fish production in the country rose from 0.752 million metric tons in 1950-51 to 13.42 million metric tons (provisional) during FY 2018-19. Of this, the marine fisheries contributed 3.71 million metric tons and the inland fisheries contributed 9.71 million metric tons. During FY 2018-19, 71% of marine fisheries potential has been harnessed and the inland fisheries potential harnessed during the same period stands at 58%. The marine fisheries sector is dominated by the socio-economically backward artisanal and small-scale fishers whose lives are closely intertwined with the oceans and seas. However, 75 percent of the total marine fish production comes from the mechanized sector, 23 percent from the motorized sector and only 2 percent from the

artisanal sector. Despite stagnation in the growth of marine capture fish production over the years, the dependency of traditional marine fishers on marine capture fisheries for livelihoods has been increasing. It is only imperative that sustainable alternative livelihood opportunities like mariculture activities are developed and promoted.

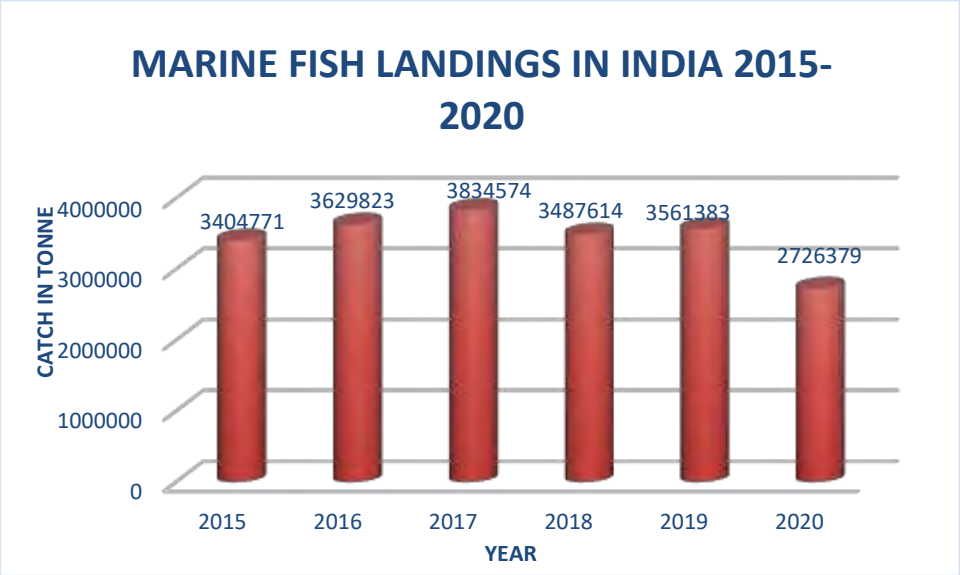


Fig. 10.1.1 Marine fish landings in India during 2015 to 2020

Kerala, one of the major maritime states of India, situated on the southwest coast of the Indian sub continent with an area of about 38863 Sq km, which makes about 1.27% of the Indian Territory. The state is separated from the rest of India by the western Ghats in the east and the Arabian Sea in the west. Kerala has a coastline of 589.5 kilometers, forms 10% of India's total coastline. With a coastline of over 590 kilometers, and an exclusive economic zone (EEZ) of 218536 Sq Km, Kerala has a significant marine fisheries sector that has long been an important source of occupation and livelihood for the coastal population of the state. It is estimated that about 8 lakh people earn their livelihood from capture and allied works in marine fisheries in the 222 fishing villages situated along the coastline of the state. The coastal line is spread over nine districts of Kerala and the state export fish products worth Rs. 5008.54 crores accounting for roughly 3% of the state revenue. Kerala's share in the national marine fish production is around 13%.

A very rich marine wealth with a large variety of fish and a highly skilled population of fishermen have made Kerala a leading producer and consumer of fish. The high rainfall and a large number of rivers make the Kerala coast especially fertile for fish. One specialty of the Kerala coast is the mudbanks, known as chakara in Malayalam. It is the formation of clay and organic matters on the coast after monsoon where the sea remaining calm, resulting in good harvest of fish.

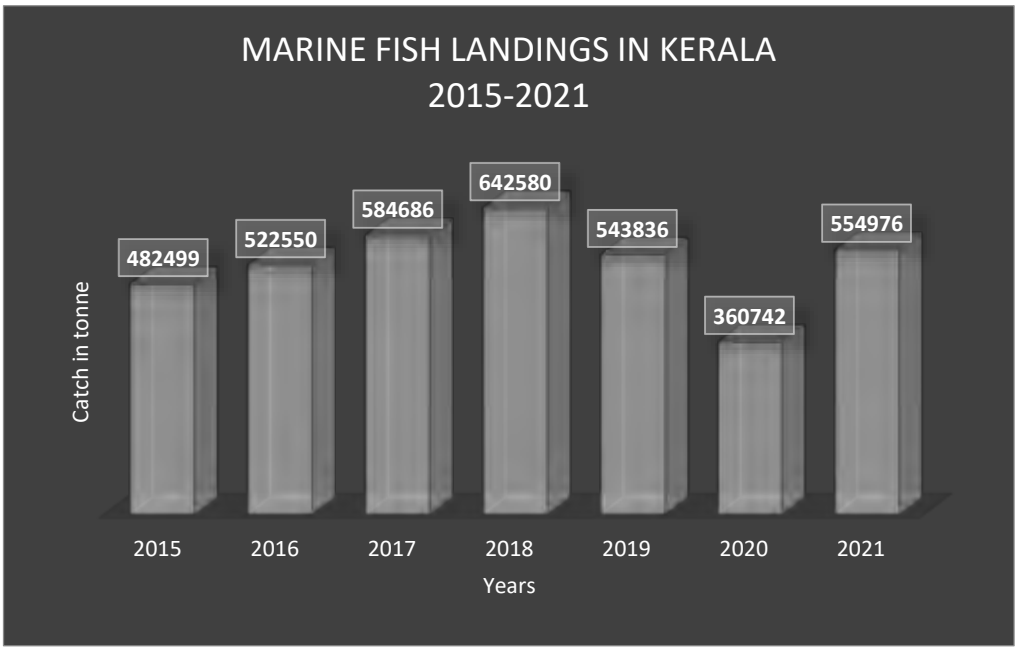


Fig. 10.1.2. Marine fish landings in Kerala during 2015 to 2021

Vizhinjam (Lat. 8°22'41.6"N 76°59'28.7"E), is one of southern Kerala's foremost vital artisanal fish landing centres, encased by two rocky promontories extending into the ocean, giving an ensured bay managing excellent openings for fishing operations indeed amid heavy monsoon. Two monsoon seasons prevail in this region: the southwest and the northeast. The southwest monsoon starts in May or June and continues until almost the start of August. The northeast monsoon is shorter-term and begins in October and closes by November. A more prominent portion of the precipitation is determined from the southwest monsoon. The fishery of this centre too changes concurring to the monsoon. Motorization started amid the centre of 1982 and has brought about the substitution of non-motorized crafts for motorised ones to a large degree.

Consequently, a decline in the effort by non-motorised traditional crafts was noticeable from 1984 onwards. Fishing is carried out at Vizhinjam throughout the year and is confined mainly to the inshore waters having a depth of 10-20 m and extending up to 24 km from the coast. The breakwater facility at Vizhinjam fishing harbour is an added advantage for berthing and launching the crafts, even during the monsoon months. Hence during the peak monsoon months, many fishermen from Anchengo to Colachel migrate to Vizhinjam along with their craft and gear for fishing. But construction of fishing harbours at Perumathura in the north and Thengaipatnam in the south has resulted in a decline in their migration and the failure of the southwest monsoon added to the decline in monsoon fishing activity in recent years. The inshore areas of the southwest coast between Vizhinjam and Cape Comorin are rich in young ones of both pelagic and demersal fishes. Pelagic finfishes continue to be the dominant group, constituted chiefly by tunas, clupeids, mackerels, carangids and ribbonfishes. Targeted fishing for the coastal tuna species, *Auxis rochei*, is being actively carried out by traditional and motorised units.

The annual marine landings in Thiruvanthapuram district during 2015-2021 are given in Figure 10.1.3. The sampling design divided the whole Thiruvananthapuram district into two zones namely K1 and K2. All of the landing centres for the current study were located within the K1 zone, which stretches from Kollencode in the south to Poonthura in the north. The annual landings of K1 zone during 2016-2021 are given in Fig. 10.1.4. Among the different landing centres of K1 zone, Vizhinjam contributes more to the annual landings. As a result of motorization, the area of fishing extended to 20-25 km off Vizhinjam coast at a depth range of 60-80 m, whereas the traditional crafts were confined to the 10 km range from the shore at a depth of 40-50 m. Due to the rocky bottom, trawl fishing is not undertaken, but a variety of traditional gears are operated in this centre to exploit the fishery, and resources, both pelagic and demersal, in different seasons depending on the types of fish available and the seasonal climatic changes. These included drift nets, other gill nets, hooks and lines, shore seines and boat seines. Major gears such as boat seine, drift net, hooks and lines, roll vala, and some minor gears such as chalavala, netholivala and konchuvala are seasonal in their operation. Reduction in the effort of non-motorised crafts which operate gears like chalavala and netholivala together with the climatic changes can be a reason for the decline in the catch of resources like sardines, *Thryssa* and silverbellies.

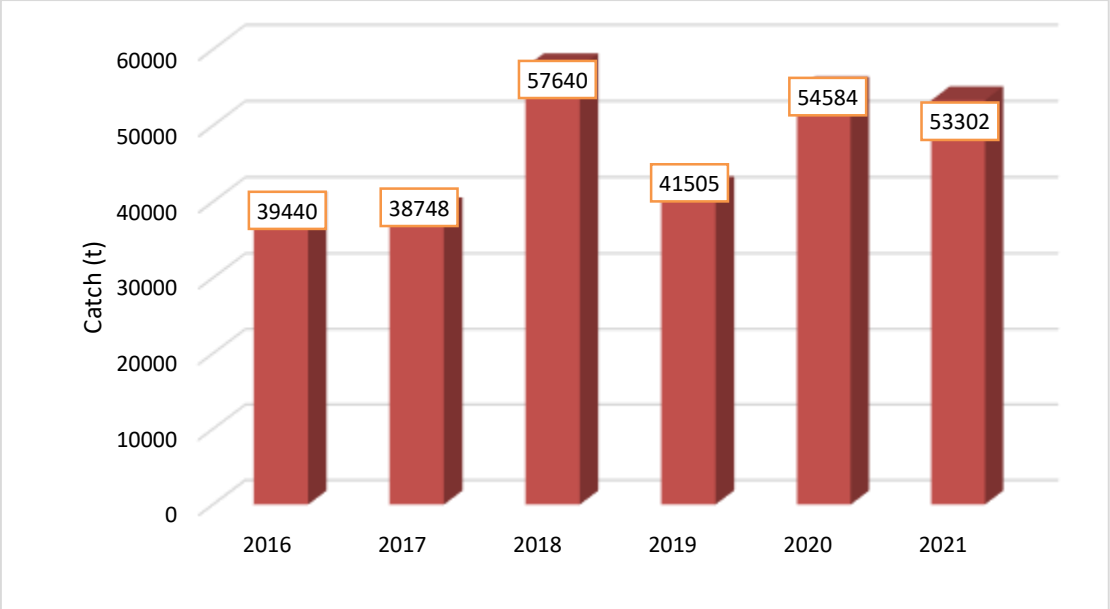


Fig. 10.1.3. Marine fish landings in Thiruvananthapuram (2016-2021) (K1 &K2 zone)

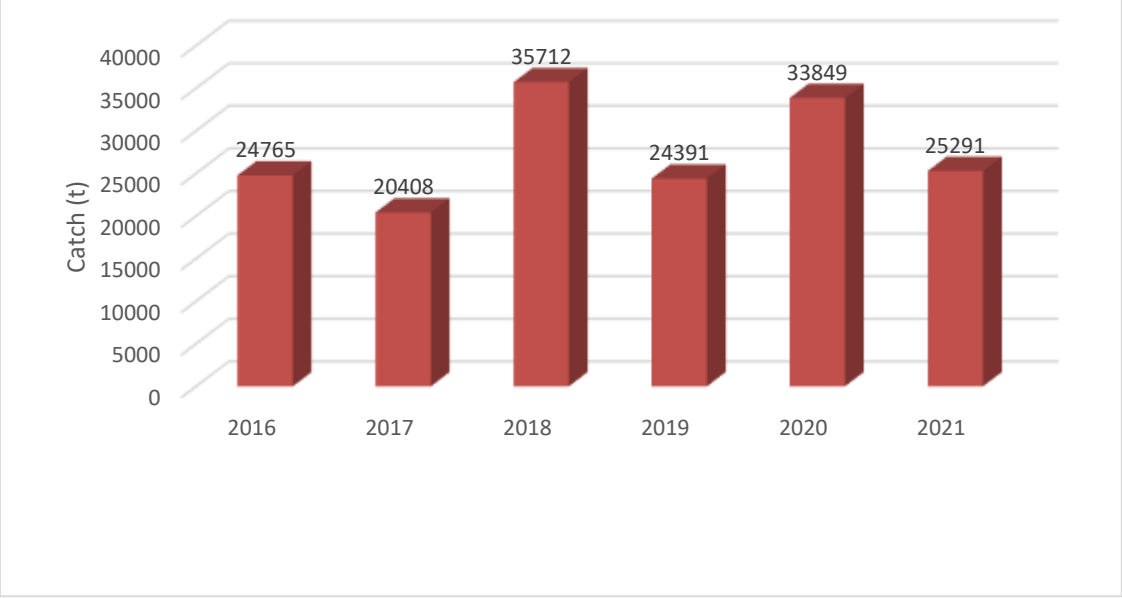


Fig.10.1.4. Marine fish landings at K1 zone of Thiruvananthapuram district (2016-2021)

The major fishing gears operated along the K1 zone comprised of OBBS (Boat seine), OBGN (Gillnet), OBHL (Hook and Line), OBSS (Outboard shore seine), OBOTHS (outboard

other gears), and NM- Non motorized units operating hand lines, gillnets and Hook and line. The No. of fishing units operated along the K1 zone is given in Fig. 10.1.5 and Table. 10.1.1.

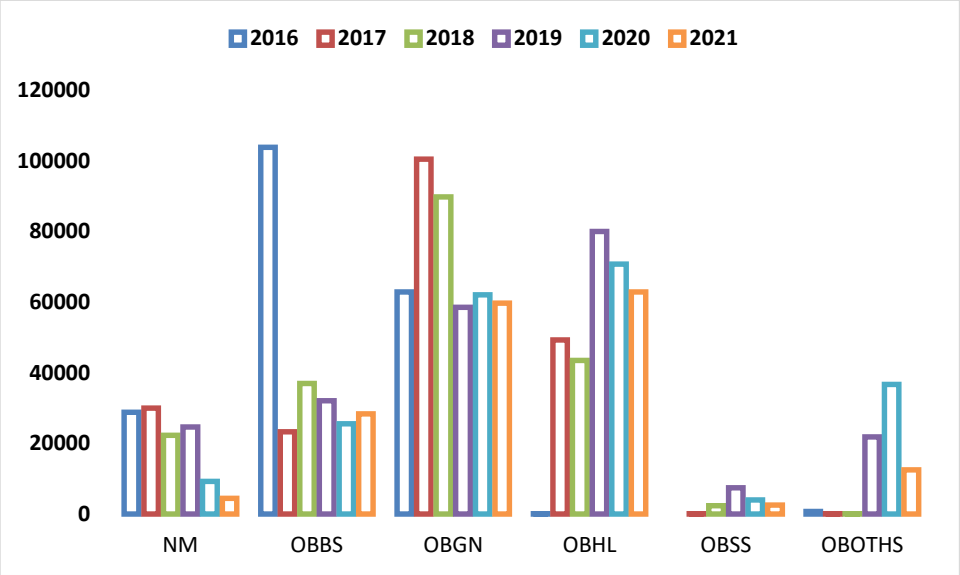


Fig. 10.1.5. No. of fishing units operated along the K1 zone of Thiruvanathapuram coast (2016-2021)

(OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBSS- Outboard shore seine OBOTHS- outboard other gears, NM- Non motorized units)

Table.10.1.1 No. of units operated along the K1 zone of Thiruvanathapuram coast (year wise)

Year	NM	OBBS	OBGN	OBHL	OBSS	OBOTHS
2016	28826	103879	62881	16	0	776
2017	30050	23328	100529	49316	173	178
2018	22364	37016	89874	43581	2377	70
2019	24729	32107	58572	80090	7515	21887
2020	9302	25631	62140	70766	4044	36776
2021	4493	28399	59743	62943	2553	12520

The general trend in the distribution of fishing gears operated from the K1 zone and the CPUE (Catch Per Unit Effort) of different gears are shown in Fig. 10.1.6, Fig. 10.1.7. and Table. 10.1.2.

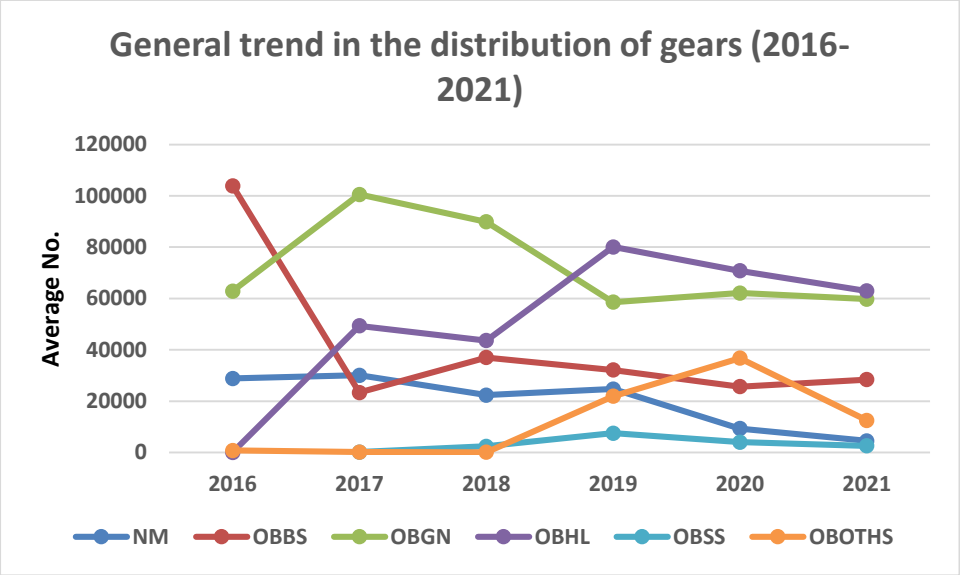


Fig.10.1.6. Gear distribution trends from 2016-2021

(OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBSS- Outboard shore seine OBOTHS- outboard other gears, NM- Non motorized units)

Table.10.1.2 CPUE (kg) of different gears (Year wise)

Year	NM	OBBS	OBGN	OBHL	OBSS	OBOTHS
2016	-	293.7	84.91	71.46	71.1	-
2017	24.94	308.2	85.41	78.54	17.0	35.75
2018	35.73	524.0	114.15	109.64	186.3	521.61
2019	26.93	328.5	63.13	62.89	119.4	161.97
2020	27.72	410.2	134.31	77.12	144.8	236.28
2021	24.57	460.8	78.34	81.12	138.6	156.22

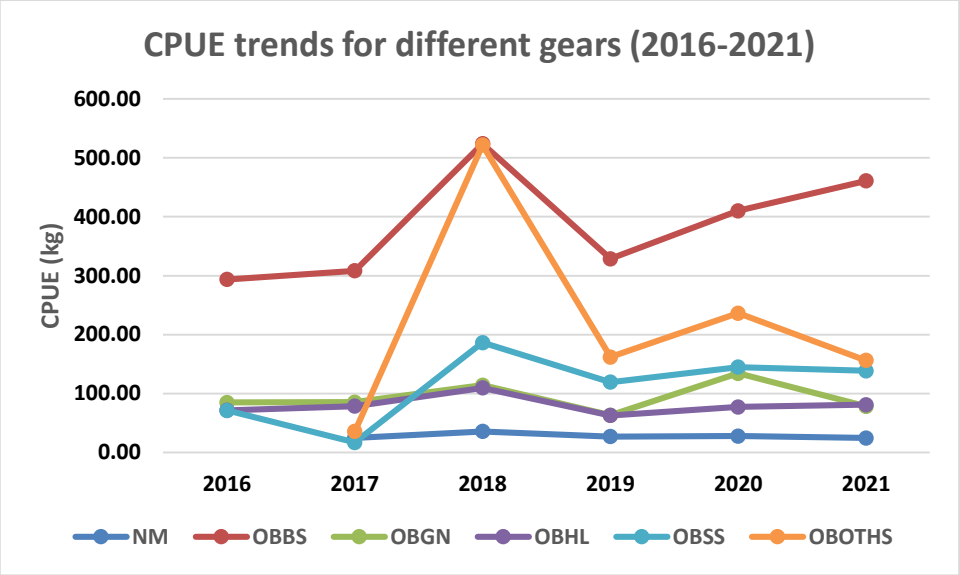


Fig.10.1.7 Trends in the CPUE of different gears from 2016-2021

An overview of the fish landings data estimated during the reporting period (June 2021-May 2022)

During the reporting period (June 2021-May 2022) an estimated 23934.033 tonnes of fish were landed from the three zones of Vizhinjam port. Monthwise- landing centre-wise catch data is shown in Fig.10.1.8 and table.10.1.3. The season-wise and zone-wise catch during the reporting period is shown in Fig.10.1.9. and Fig10.1.10. The annual catch per unit effort (CPUE) of major gears operated along the coast during the reporting period is given in Fig.10.1.14. and table 10.1.6. The number of fishing efforts (boats) operated along the zone during the reporting period is depicted in Fig.10.1.12. and table 10.1.4. and the annual catch gear-wise is depicted in Fig.10.1.13 table 10.1.5.

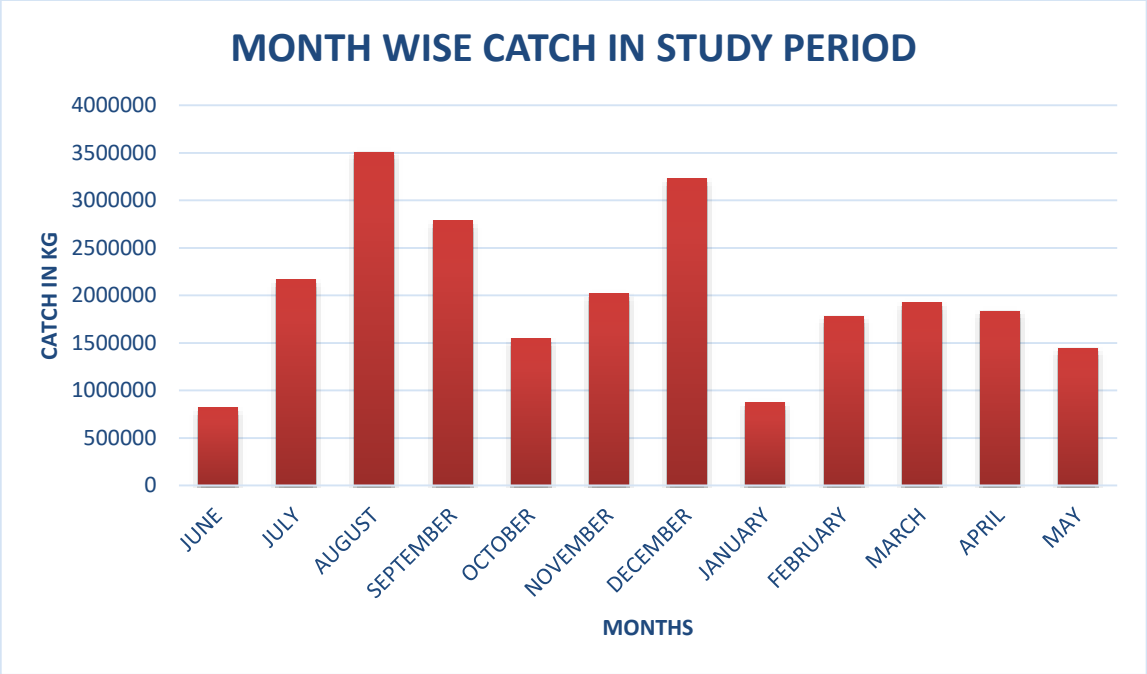


Fig.10.1.8. Month wise fish catch (kg) during the reporting period

Table. 10.1.3. Landing centre wise fish catch data (in tonnes)

Landing centres/ Months	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22
Poovar	17.9	0.9	17.2	45.5	89.2	37.2	189.8	69.8	360.2	233.9	145.6	129.3
Karumkulam	2.0	1.8	0.0	93.4	11.4	31.5	145.6	20.2	68.8	88.5	92.9	74.7
Kochuthura	0.0	0.0	0.0	0.0	0.0	3.1	5.0	3.4	2.5	11.3	1.5	11.3
Puthiathura	10.0	112.5	26.7	89.1	192	348.6	155.4	113	106	217	185	85.3
Pallam	2.4	61.4	33.6	0.0	53.4	74.9	49.0	29.8	76.2	234	19.5	70.9
Pulluvila	4.7	0.0	2.5	41.6	138	71.9	406.0	79.3	51.0	60.2	323	62.5
Adimalathura	10.1	13.4	13.9	85.1	87.7	329.5	1209	174	168	237	224	16.2
Vizhinjam	770.2	1975	3417	2431	749	644.1	530.1	205	588	448	547	890
Kovalam	0.4	1.9	0.0	0.0	0.0	1.8	6.6	6.4	2.7	3.3	2.6	0.0
Panathura	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.3	0.0	0.1	0.0
Poonthura	1.5	0.2	0.0	0.0	221.	472.3	533.8	168	358	393	294	104

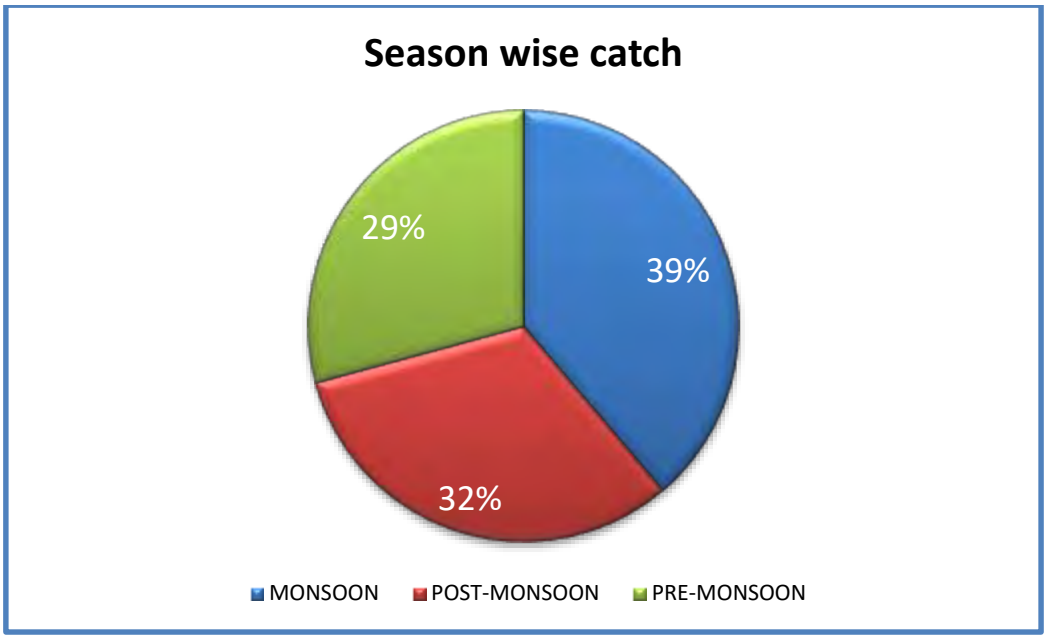


Fig.10.1.9. Season wise fish catch during the reporting period

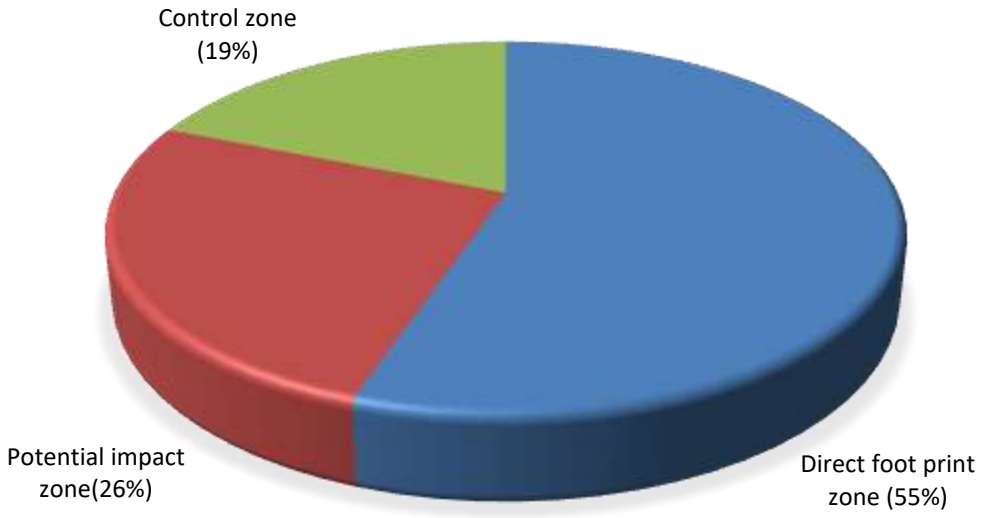


Fig.10.1.10. Zone wise total catch (Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone)

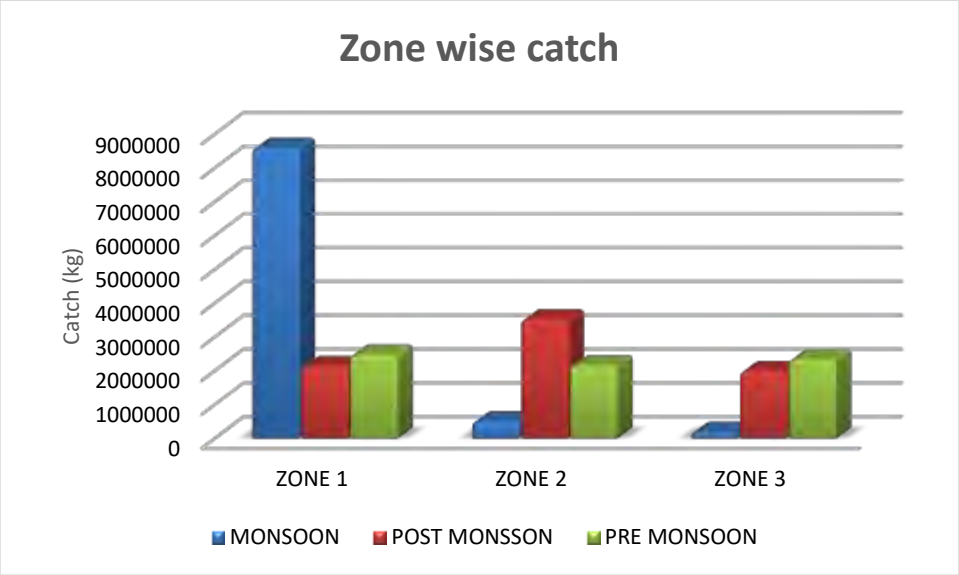


Fig.10.1.11. Zone wise (Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone) fish catch during different seasons

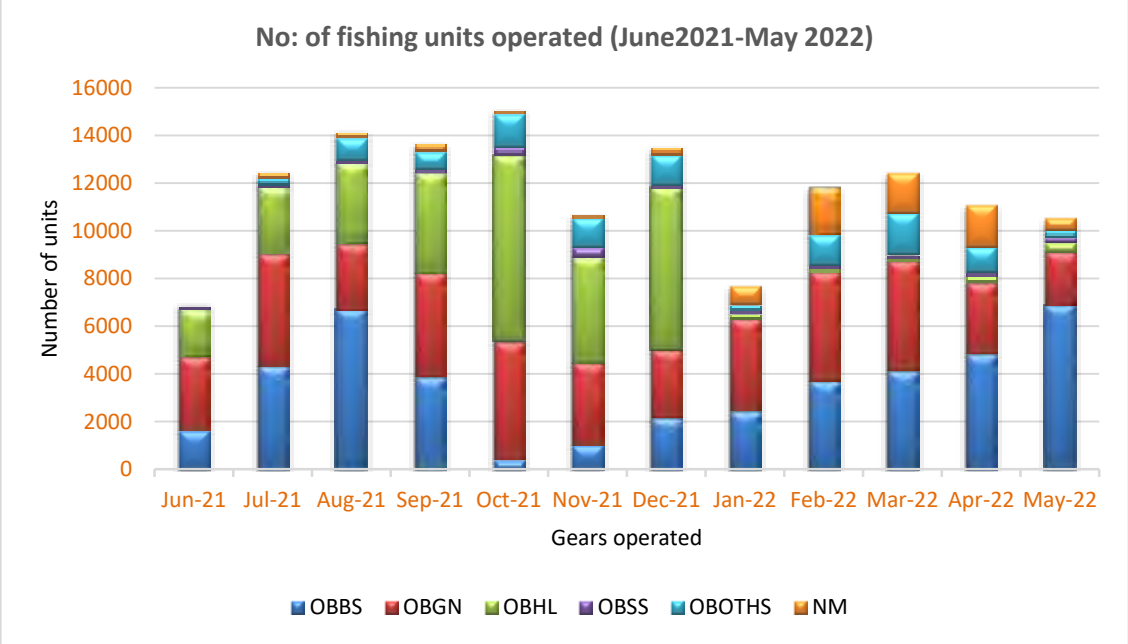


Fig.10.1.12. . No. of fishing units operated during the reporting period

Table. 10.1.4. No. of fishing units operated along the zone (OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBOTHS- outboard other gears, NM- Non motorized units)

MONTH	OBBS	OBGN	OBHL	OBSS	OBOTHS	NM
Jun-21	1652	3086	1992	109	-	94
Jul-21	4348	4718	2781	106	277	243
Aug-21	6690	2794	3368	126	945	273
Sep-21	3911	4345	4206	164	723	321
Oct-21	430	4947	7790	356	1407	153
Nov-21	1029	3452	4431	421	1222	161
Dec-21	2181	2832	6797	140	1246	331
Jan-22	2471	3850	218	144	247	772
Feb-22	3713	4567	163	132	1288	2005
Mar-22	4168	4578	131	148	1724	1712
Apr-22	4875	2987	249	175	1041	1781
May-22	6893	2235	408	198	301	531

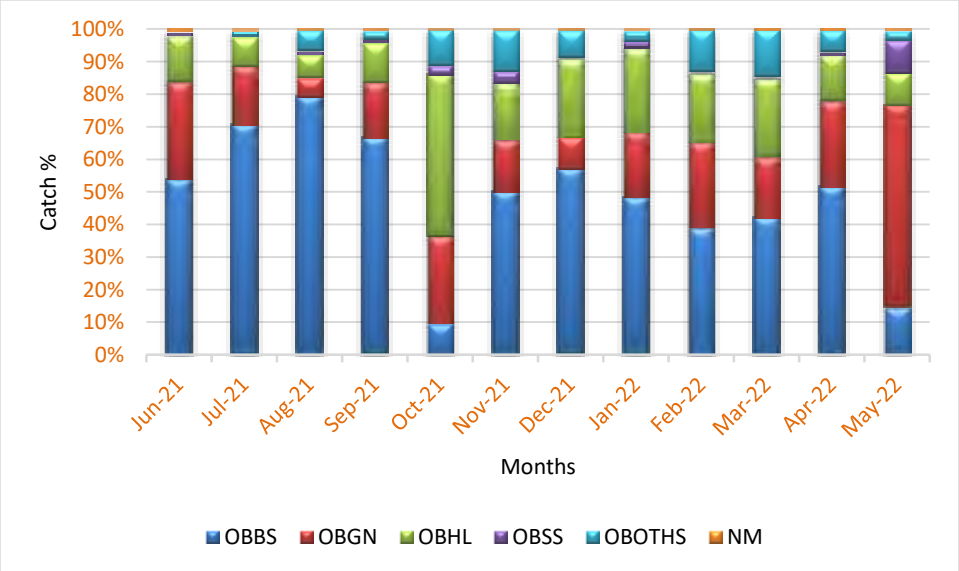


Fig.10.1.13. Percentage contribution of different gears in fish landing center from the period of June 2021-May 2022

Table. 10.1.5. Fish catch (kg)landed by different gears during the reporting period

(OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBSS- Outboard shore seine OBOTHS- outboard other gears, NM- Non motorized units)

MONTHS/ GEARS	OBBS (KG)	OBGN (KG)	OBHL (KG)	OBSS (KG)	OBOTHS (KG)	NM (KG)
Jun-21	441242	247702	114917	10374	-	4914
Jul-21	1532237	393401	189897	4459	40143	7804
Aug-21	2785078	208822	246790	41109	221267	7798
Sep-21	1856803	480523	335970	29570	74377	8496
Oct-21	151090	413151	763351	46712	166341	1528
Nov-21	1010071	326516	349311	73735	253957	3595
Dec-21	1845279	319493	779916	16484	262509	6540
Jan-22	420439	174563	224893	18381	28584	2378
Feb-22	700797	465431	375437	11815	227326	2139
Mar-22	813700	361638	462252	11768	275461	2877
Apr-22	947535	488221	254805	20771	120046	4489
May-22	211730	897224	142137	148043	41307	4574

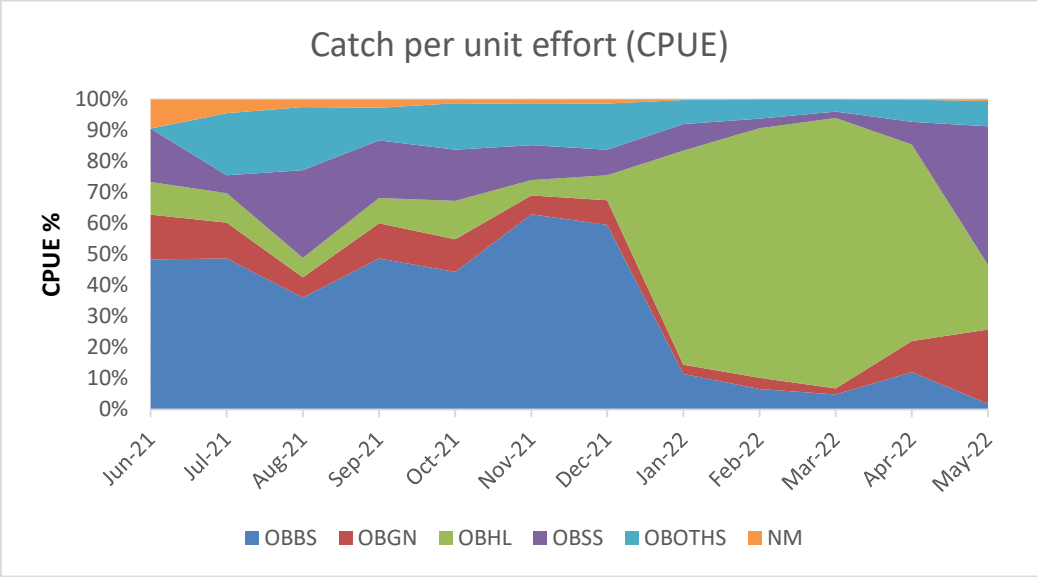


Fig.10.1.14. CPUE of different gears during the reporting period

Table No. 10.1.6 Catch per unit effort (KG) of different gears during June 2021-May 2022

(OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBSS- Outboard shore seine OBOTHS- outboard other gears, NM- Non motorized units)

MONTHS/ GEARS	OBBS (KG)	OBGN (KG)	OBHL (KG)	OBSS (KG)	OBOTHS (KG)	NM (KG)
Jun-21	267.10	80.27	57.69	95.17	0.00	52.28
Jul-21	352.40	83.38	68.28	42.07	144.92	32.12
Aug-21	416.30	74.74	73.27	326.26	234.14	28.56
Sep-21	474.76	110.59	79.88	180.30	102.87	26.47
Oct-21	351.37	83.52	97.99	131.21	118.22	9.99
Nov-21	981.60	94.59	78.83	175.14	207.82	22.33
Dec-21	846.07	112.82	114.74	117.74	210.68	19.76
Jan-22	170.15	45.34	1031.62	127.65	115.72	3.08
Feb-22	188.74	101.91	2303.29	89.51	176.50	1.07
Mar-22	195.23	78.99	3528.64	79.51	159.78	1.68
Apr-22	194.37	163.45	1023.31	118.69	115.32	2.52
May-22	30.72	401.44	348.38	747.69	137.23	8.61

10.2 MONSOON SEASON

Fish landings data collected for the monsoon season started on June 2021 and ended in September 2021. Landing centre-wise fish landings (tonnes) during monsoon season are depicted in Fig. 10. 2.1

Fig. 10.2.1.Landing centre-wise fish landings (tonnes) during monsoon season

10.2.1 Fish population & its landing

During monsoon season, the catch was reported mainly from the Vizhinjam landing centre. Detailed landings on landing centre wise for June, July, August and September 2021

were given in Fig. 10.2.1.c, Fig. 10.2.1.d, Fig.10.2.1.e and Fig.10.2.1.f respectively. The zone-wise and gear-wise catch during monsoon season is depicted in Fig.10.2.1.a and Fig10.2.1.b

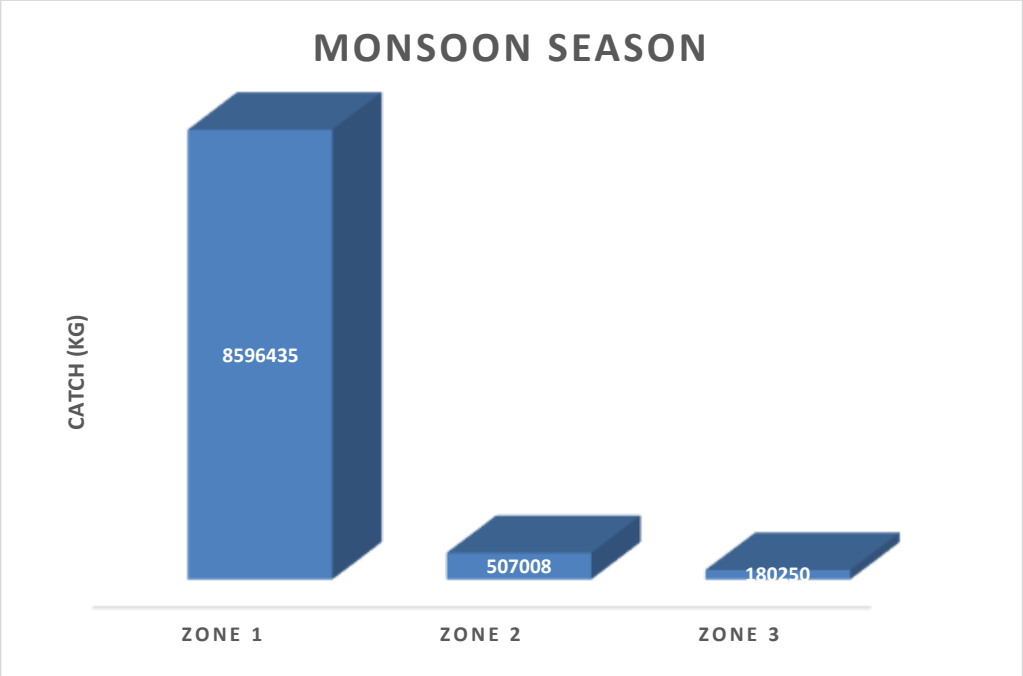


Fig.10.2.1.a Zone wise fish catch (kg) during monsoon season

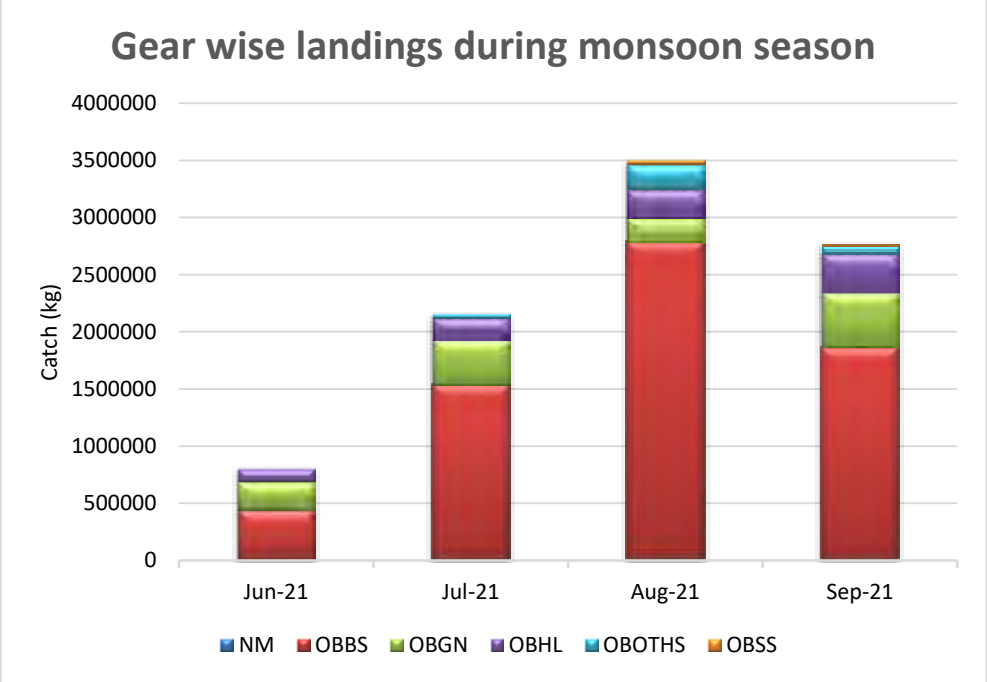


Fig.10.2.1.b Gear wise fish landings during monsoon season

Landing centre-wise fish catch data during the monsoon season

Detailed analysis of the month-wise fish landings at different landing centres during the monsoon season was carried out, and the results are given below.

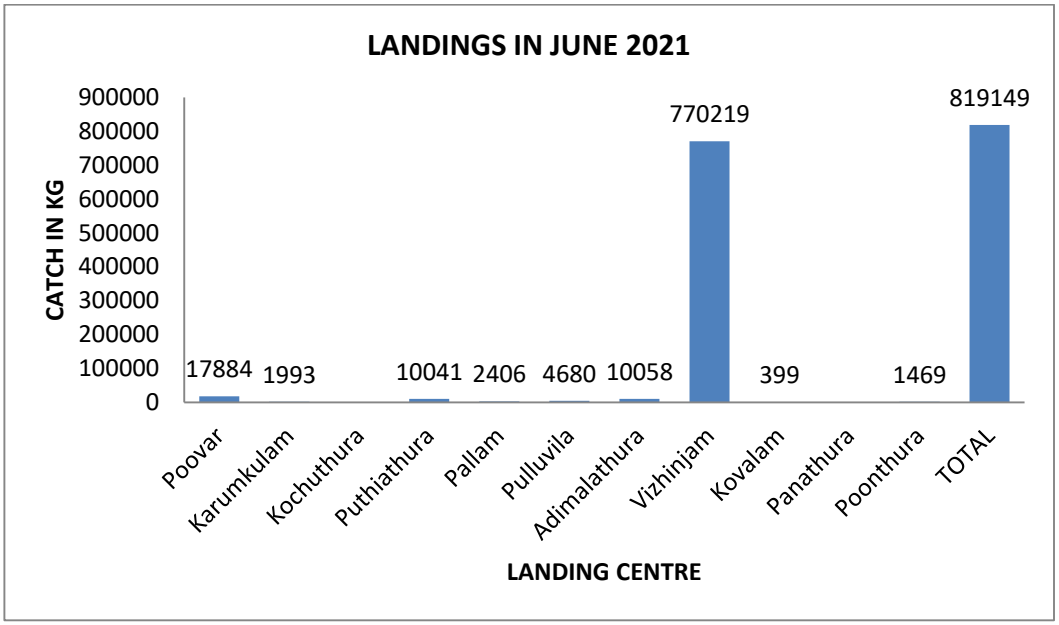


Fig.10.2.1.c Fish landings (kg) during June 2021 at different landing centers

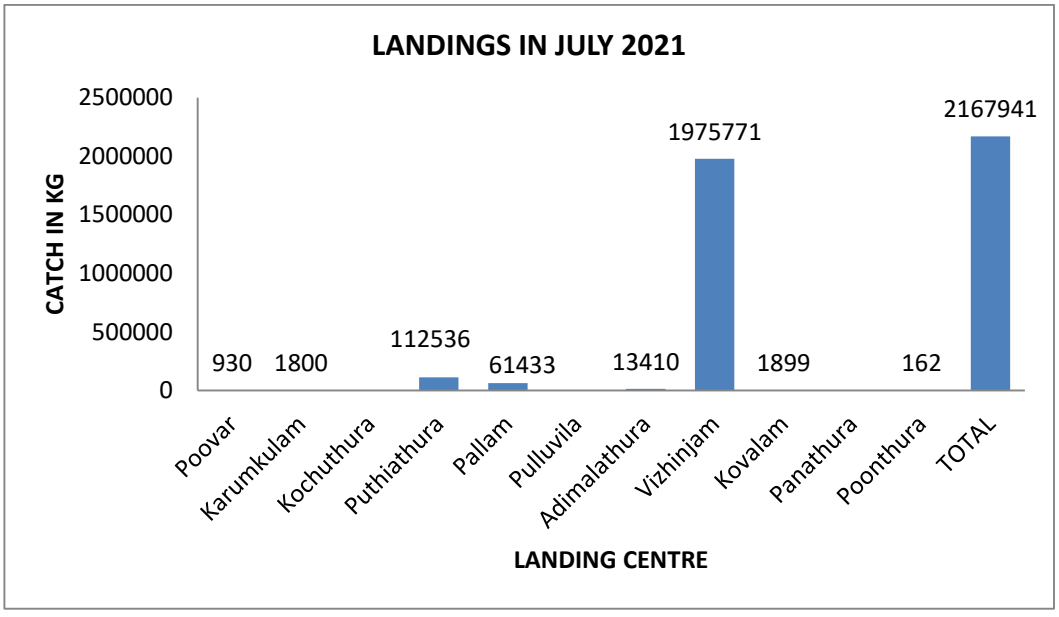


Fig.10.2.1.d Fish landings (kg) during July 2021 at different landing centers

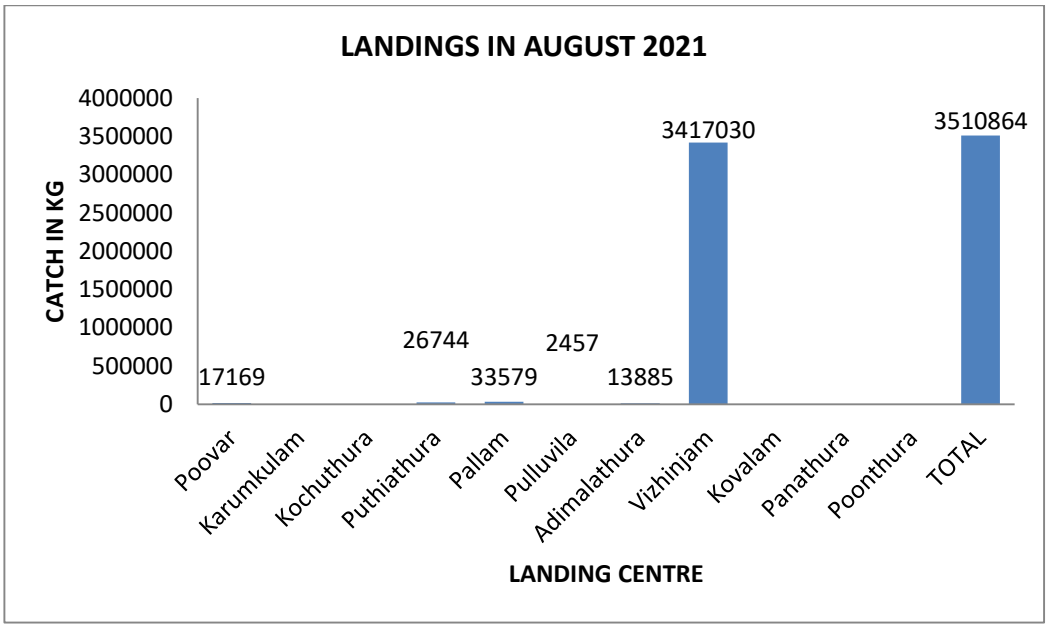


Fig.10.2.1.e Fish landings (kg) during August 2021 at different landing centers

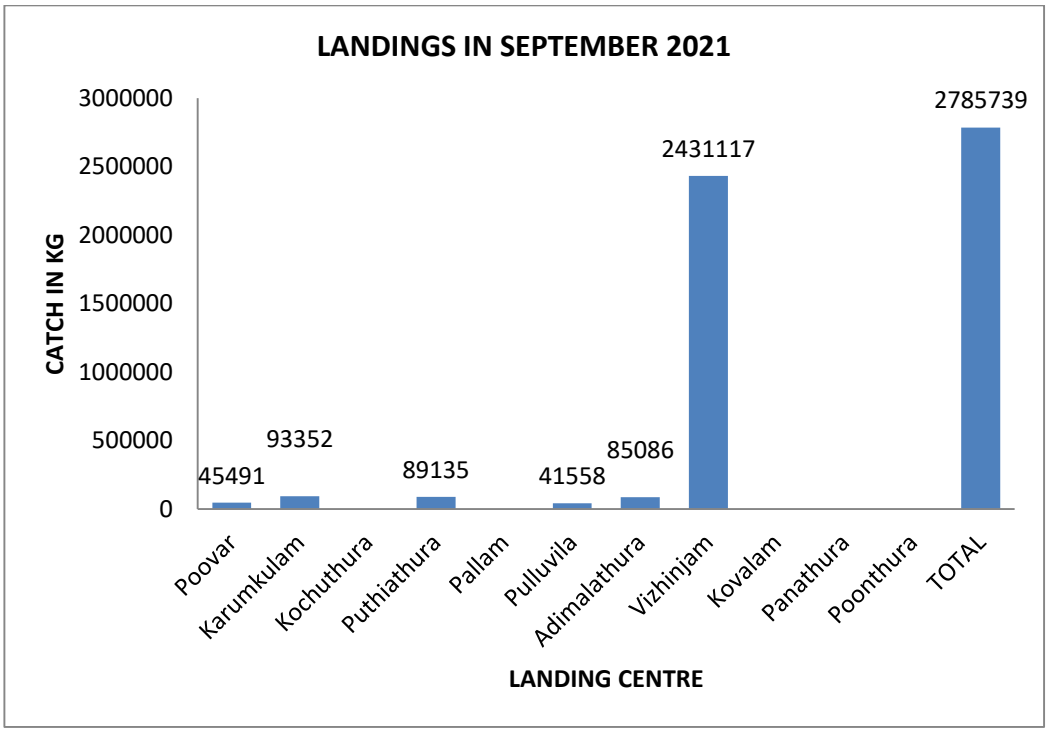


Fig.10.2.1.f Fish landings (kg) during September 2021 at different landing centers

The fishing ground information during the monsoon season is given in Fig. 10.2.1.g

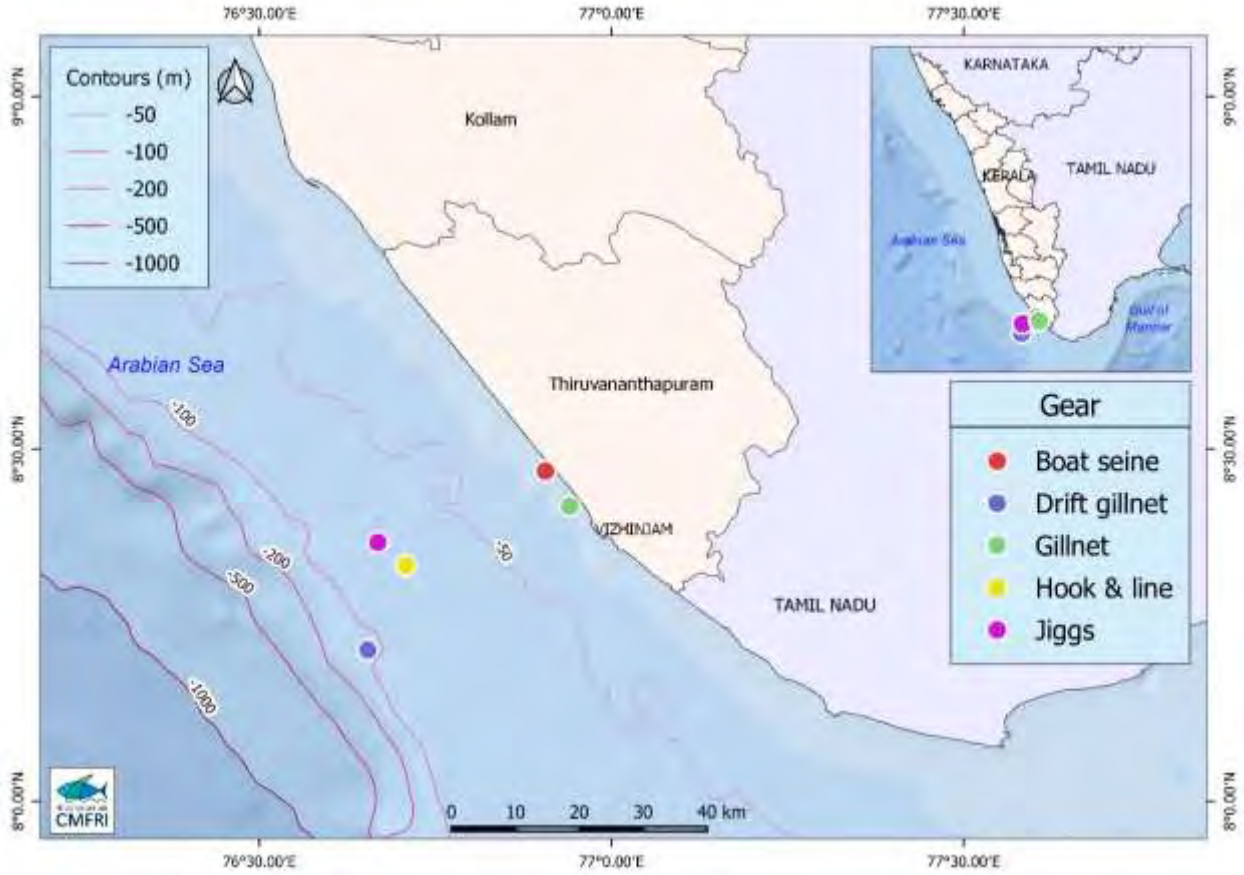


Fig.10.2.1.g Fishing ground information of major gears operating during the monsoon season

The monthly landings of different species during the monsoon season are given in Table 10.2.1.a, 10.2.1.b, 10.2.1.c. & 10.2.1.d.

Table. 10.2.1.a Fish species landed and its catch in June 2021 (Kg)

SPECIES	CATCH (Kg)
Ablennes hians	95
Acanthocybium solandri	26
Alepes djedaba	7
Alepes kleinii (A. kalla) (A. para)	22
Alutera monoceros	1746
Amblygaster sirm (Sardinella sirm)	1849
***Anthias* spp.**	2600
Atule mate(Alepes mate)	3069

Auxis rochei	112532
Auxis thazard	24481
Caranx ignobilis	1200
Caranx sexfasciatus	39
***Caranx* spp.**	288
Cephalopholis argus	26
Cephalopholis miniata(C. miniatus)	26
Cephalopholis sonnerati	1440
Coryphaena hippurus	3733
***Cynoglossus* spp.**	46
Decapterus kurroides	3588
Decapterus macrosoma	1387
Decapterus russelli(D. dayi)	49001
***Decapterus* spp.**	1196
Diodon hystrix	2
Dussumieria acuta	96178
Elagatis bipinnulata	104
Encrasicholina punctifer (Stolephorus punctifer)	52883
***Encrasicholina* spp.**	7061
Epinephelus chlorostigma	52
Epinephelus coioides	10
Epinephelus diacanthus	10
Epinephelus longispinis	104
Epinephelus ongus	3120
***Epinephelus* spp.**	78
Erythrocles schlegelii	20887
Euthynnus affinis	20849
Fistularia petimba (F. villosa)	13
***Gnathanodon* spp.**	867
Hemiramphus lutkei (H. marginatus)	35
***Hemiramphus* spp.**	13979
Hyporhamphus xanthopterus	364
Istiophorus platypterus	2324
***Johnieops* spp.**	1170
Kajikia audax (Tetrapterus audax)	3869

Katsuwonus pelamis	2132
Lactarius lactarius	395
***Leiognathus* spp.**	8785
Lethrinus lentjan	78
Lutjanus fulvus(L. vaigiensis)	104
Lutjanus johnii	26
Lutjanus lutjanus(L. lineolatus)	156
Lutjanus russelli	156
Manta birostris	2678
Mene maculate	115943
***Mobula* spp.**	1820
Mugil cephalus	51
***Myripristis* spp.**	867
Nemipterus bipunctatus(N. delagoae)	972
Nemipterus japonicus	4568
Nemipterus randalli(Nemipterus mesoprion)	286
***Nemipterus* spp.**	104
Odonus niger	108
Otolithes cuvieri	260
Otolithes ruber	1217
Parascolopsis aspinosa	1213
Parupeneus indicus	867
Pellona ditchela	7
Penaeus indicus	11753
Penaeus monodon	1130
Platycephalus indicus	260
Pomadasys maculatus (P. maculatum)	260
Portunus pelagicus	52
Portunus sanguinolentus	572
Priacanthus hamrur	1927
***Priacanthus* spp.**	26
Pristipomoides filamentosus	218
Rachycentron canadum	3479
Rastrelliger kanagurta	34637
Sarda orientalis	7261
Sardinella fimbriata	3813

Sardinella gibbosa	3949
***Sardinella* spp.**	271
Sargocentron (Holocentrus) diadema (H. diadema)	1213
Saurida tumbil	634
Saurida undosquamis	364
Scomberoides commersonnianus	18
Scomberomorus commerson	6949
Scomberomorus guttatus	10684
Secutor insidiator	73
Selar crumenophthalmus	30635
Sepia pharaonis	947
Sepioteuthis lessoniana	49
Sphyraena forsteri	52
Sphyraena jello	99
Sphyraena obtusata	522
Sphyraena putnamae	2710
***Sphyraena* spp.**	676
Stolephorus commersonnii	15808
Stolephorus indicus	4299
***Stolephorus* spp.**	40350
Stolephorus waitei	31440
Sufflamen frenatum(S. capistratus)	111
***Synaptura* spp.**	156
***Synodus* spp.**	104
Terapon jarbua	416
Terapon theraps (Eutherapon theraps)	1733
***Thryssa* spp.**	2808
Thunnus albacares	3900
Trachinocephalus myops	130
Trachinotus blochii	35
Trichiurus lepturus	2600
Tylosurus crocodilus (Strongylura crocodilus)	78
***Upeneus* spp.**	1846
Upeneus sulphurous	416

Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	940
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	6885
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	4712
TOTAL	**819149**

Table. 10.2.1.b Fish species landed and its catch in July 2021 (Kg)

SPECIES	CATCH (Kg)
Ablennes hians	4860
Acanthocybium solandri	1620
Alectis ciliaris	135
Alectis indica	41
Alepes djedaba	765
Alepes kleinii (A. kalla) (A. para)	6177
***Alopias* spp.**	855
Alutera monoceros	24144
***Anthias* spp.**	
Atule mate(Alepes mate)	8008
Auxis rochei	103795
Auxis thazard	14577
Carangoides coeruleopinnatus	638
Carangoides hedlandensis	47
***Carangoides* spp.**	306
Caranx heberi (C. sem)	162
Caranx hippos	872
Caranx ignobilis	5156
Caranx sexfasciatus	169
***Caranx* spp.**	2012
Caranx tille	844
Cephalopholis miniata(C. miniatus)	14
Cephalopholis sonnerati	307

Cephalopholis urodeta	2535
Chanos chanos	1080
Charybdis feriatus(C. cruciata)	537
Charybdis natator	62
Chirocentrus nudus	51
Cookeolus japonicus	113
Coryphaena hippurus	18254
Cynoglossus macrolepidotus (C. arel)	1443
***Cynoglossus* spp.**	3713
Dasyatis microps	450
Decapterus macarellus	72
Decapterus russelli(D. dayi)	504208
***Decapterus* spp.**	2100
Dussumieria acuta	108092
Encrasicholina devisi (Stolephorus devisi)	1485
Encrasicholina punctifer (Stolephorus punctifer)	229990
***Encrasicholina* spp.**	33502
Epinephelus bleekeri	41
Epinephelus diacanthus	2317
Epinephelus malabaricus	189
Epinephelus radiatus	1605
Erythrocles schlegelii	4613
Euthynnus affinis	60361
Fistularia petimba (F. villosa)	515
Gerres filamentosus	1048
Gymnosarda unicolor	248
Gymnura poecilura	855
***Hemiramphus* spp.**	2813
Himantura imbricata(Amphotistius imbricatus)	1958
***Himantura* spp.**	450
Iniistius bimaculatus	27
Istiompax indica (Makaira indica)	6368
Istiophorus platypterus	10683
Johnius carutta	720
***Johnius* spp.**	10824
Kajikia audax (Tetrapterus audax)	8861
Katsuwonus pelamis	1664

Lactarius lactarius	2211
Lagocephalus inermis	7200
Leiognathus brevirostris	229
Leiognathus equula(L. equulus)	1292
***Leiognathus* spp.**	11028
Lepturacanthus savala	27900
Lethrinus lentjan	604
Lobotes surinamensis	419
Lutjanus johnii	270
Lutjanus lutjanus(L. lineolatus)	1679
Lutjanus vita	945
Manta birostris	38859
Megalaspis cordyla	5765
Mene maculate	205980
Metapenaeus dobsoni	129
Mobula alfredi (Manta alfredi)	270
***Mobula* spp.**	2438
Nemipterus bipunctatus(N. delagoae)	32664
Nemipterus japonicus	4327
Nemipterus randalli(Nemipterus mesoprion)	4724
***Nemipterus* spp.**	117
Neotrygon kuhlii (Dasyatis kuhlii)	450
Nibea maculate	54
Odonus niger	351
Opisthopterus tardoore	208
Otolithes cuvieri	5803
Otolithes ruber	15292
***Otolithes* spp.**	50
Pampus argenteus	1890
Parapenaeopsis stylifera	450
Parapercis alboguttata	24
Parascolopsis eriomma	38
Parastromateus (Formio) niger(F. niger)	9018
***Parupeneus* spp.**	225
Pellona ditchela	10117
***Pempheris* spp.**	28
Penaeus canaliculatus	88

Penaeus indicus	12363
Penaeus monodon	718
Photopectoralis bindus (Leiognathus bindus)	54
Pomadasys maculatus (P. maculatum)	11250
Portunus pelagicus	719
Portunus sanguinolentus	8766
Priacanthus hamrur	2813
Pristipomoides filamentosus	900
Pristipomoides typus	356
Rachycentron canadum	5494
Rastrelliger kanagurta	105156
Rhinobatos obtusus	630
Sarda orientalis	20300
Sardinella fimbriata	11250
Sardinella gibbosa	21715
Sardinella longiceps	1406
Saurida gracilis	113
***Saurida* spp.**	4814
Saurida tumbil	9631
Saurida undosquamis	16095
Scoliodon laticaudus	33
Scolopsis bimaculata	292
Scomberoides tala	233
Scomberomorus commerson	9377
Scomberomorus guttatus	789
Secutor insidiator	6874
Selar crumenophthalmus	27057
Selaroides leptolepis	28
Sepia pharaonis	6477
***Sepia* spp.**	135
Sepioteuthis lessoniana	54
Seriolina nigrofasciata	243
Sillago sihama	52
Sphyraena forsteri	1125
Sphyraena jello	2778
Sphyraena obtusata	8165
Sphyraena putnamae	1324
Stolephorus commersonnii	55055

Stolephorus indicus	34696
***Stolephorus* spp.**	41267
Stolephorus waitei	65178
Sufflamen frenatum(S. capistratus)	249
Terapon jarbua	9744
Terapon theraps (Eutherapon theraps)	56
Thryssa mystax	38
***Thryssa* spp.**	10463
Thunnus albacares	608
Torpedo marmorata	270
Trachinocephalus myops	473
Trichiurus lepturus	6150
Upeneus sulphureus	1524
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	5400
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	10119
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	33932
Xiphias gladius	630
Zebrias synapturoides	23
TOTAL	**2167941**

Table. 10.2.1.c Fish species landed and its catch in August 2021 (Kg)

SPECIES	CATCH (Kg)
Ablennes hians	448
Acanthocybium solandri	830
Alectis ciliaris	771
Alectis indica	50
Alepes djedaba	1937
Alepes kleinii (A. kalla) (A. para)	290
Alutera monoceros	24153
Amblygaster sirm (Sardinella sirm)	31
Atule mate(Alepes mate)	4628
Auxis rochei	57368
Auxis thazard	14874

Caesio and Pterocaesio chrysozona(C. chrysozona)	1240
Carangoides malabaricus	1535
***Carangoides* spp.**	480
Caranx heberi (C. sem)	306
Caranx hippos	65
Caranx ignobilis	13616
Caranx sexfasciatus	65
***Caranx* spp.**	1671
Cephalopholis sonnerati	316
Charybdis (Goniohellenus) smithii	93
Charybdis feriatus(C. cruciata)	217
Chirocentrus dorab	10
Coryphaena hippurus	18705
Cynoglossus macrolepidotus (C. arel)	888
***Cynoglossus* spp.**	3250
Dagetichthys commersonnii(Synaptura commersonnii)	20
Decapterus russelli(D. dayi)	1464713
***Decapterus* spp.**	191
Dussumieria acuta	71828
Encrasicholina devisi (Stolephorus devisi)	1033
Encrasicholina punctifer (Stolephorus punctifer)	45295
***Encrasicholina* spp.**	124674
Epinephelus chlorostigma	108
Epinephelus longispinis	41
Epinephelus ongus	910
Epinephelus undulosus	230
Euthynnus affinis	185863
Fistularia petimba (F. villosa)	546
Gazza minuta	124
***Gazza* spp.**	156
Gerres filamentosus	730
Hilsa kelee	16
Iniistius bimaculatus	44
Istiompax indica (Makaira indica)	1033
***Johnieops* spp.**	1155
Johnius borneensis (Johnieops vogleri)	256

Johnius sina (Johnieops sina)	758
***Johnius* spp.**	6058
Kajikia audax (Tetrapterus audax)	2080
Lactarius lactarius	325
Lagocephalus inermis	2113
***Leiognathus* spp.**	21355
Lepturacanthus savala	508
Lethrinus lentjan	1289
Lethrinus nebulosus(L. choerorhynchus, L. fraenatus)	173
Lobotes surinamensis	740
Lutjanus johnii	777
Lutjanus lutjanus(L. lineolatus)	7865
Lutjanus russelli	108
***Lutjanus* spp.**	24
Megalaspis cordyla	1488
Mene maculate	69436
Nemipterus bipunctatus(N. delagoae)	5395
Nemipterus japonicas	11896
Nemipterus randalli(Nemipterus mesoprion)	27469
Nibea maculate	5922
Odonus niger	139
Otolithes cuvieri	8281
Otolithes ruber	5968
***Otolithes* spp.**	325
Pampus argenteus	604
Parapenaeopsis stylifera	41
Parapercis alboguttata	73
Parastromateus (Formio) niger(F. niger)	4030
Parupeneus indicus	3404
Pellona ditchela	4396
***Pempheris* spp.**	8
Penaeus canaliculatus	59
Penaeus indicus	21253
Penaeus monodon	108
Penaeus semisulcatus	167
Pomadasys maculatus (P. maculatum)	2708
Portunus pelagicus	1300
Portunus sanguinolentus	5009

Priacanthus hamrur	1479
***Priacanthus* spp.**	1066
Rachycentron canadum	5338
Rastrelliger kanagurta	80982
Sarda orientalis	8415
Sardinella fimbriata	3416
Sardinella gibbosa	10762
***Sardinella* spp.**	1495
Sargocentron (Holocentrus) rubrum (H. ruber)	7
***Saurida* spp.**	1936
Saurida tumbil	47013
Saurida undosquamis	10612
Scolopsis bimaculata	78
Scolopsis ciliate	78
Scomberoides commersonnianus	3640
Scomberoides lysan	72
Scomberomorus commerson	10253
Scomberomorus guttatus	35
Selar crumenophthalmus	21195
Selaroides leptolepis	101
Sepia pharaonis	15621
Seriolina nigrofasciata	1536
Siganus canaliculatus(S. oramin)	3467
Sillago sihama	3548
Sphyraena obtusata	66333
Sphyraena putnamae	28207
***Sphyraena* spp.**	3663
Stolephorus commersonnii	20398
Stolephorus indicus	21157
***Stolephorus* spp.**	201097
Stolephorus waitei	199199
Sufflamen frenatum(S. capistratus)	426
***Synodus* spp.**	758
Terapon jarbua	4847
***Thenus* spp.**	12
***Thryssa* spp.**	8659
Thunnus albacares	3796

Trachinocephalus myops	66
Triacanthus biaculeatus (T. brevirostris)	40
Trichiurus lepturus	161548
Upeneus sulphureus	1918
Uraspis uraspis	20
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	599
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	227332
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	58189
TOTAL	**3510864**

Table. 10.2.1.d Fish species landed and its catch in September 2021 (Kg)

SPECIES	CATCH (Kg)
Ablennes hians	87
Aesopia cornuta	1
Alepes djedaba	2507
***Alepes* spp.**	233
Alutera monoceros	26740
Amblygaster sirm (Sardinella sirm)	12965
Amphioctopus marginatus	87
Atule mate(Alepes mate)	25834
Auxis rochei	3241
Auxis thazard	7176
***Carangoides* spp.**	199
Caranx heberi (C. sem)	7764
Caranx hippos	2020
Caranx ignobilis	7556
Caranx sexfasciatus	264
***Caranx* spp.**	3478
Caranx tille	1011
Cephalopholis sonnerati	325
***Cephalopholis* spp.**	28
Chanos chanos	61
Chirocentrus nudus	217
Coryphaena hippurus	16379

Cynoglossus macrolepidotus (C. arel)	173
Dasyatis microps	867
Decapterus kurroides	102200
Decapterus russelli(D. dayi)	870969
***Decapterus* spp.**	375
***Drepane* spp.**	3
Dussumieria acuta	31955
Elagatis bipinnulata	3380
Encrasicholina punctifer (Stolephorus punctifer)	390
Epinephelus bleekeri	361
Epinephelus diacanthus	169
Epinephelus malabaricus	56
***Epinephelus* spp.**	9
Euthynnus affinis	172356
Fistularia petimba (F. villosa)	930
Gerres filamentosus	488
Istiompax indica (Makaira indica)	11050
Istiophorus platypterus	4063
Jellyfish	867
***Johnius* spp.**	428
Lates calcarifer	433
Leiognathus berbis	130
***Leiognathus* spp.**	5229
Lepturacanthus savala	5339
Lutjanus kasmira	243
Lutjanus lutjanus(L. lineolatus)	172036
Manta birostris	22913
Megalaspis cordyla	10483
Mene maculate	203764
Metapenaeus dobsoni	2383
Nemipterus bipunctatus(N. delagoae)	24765
Nemipterus japonicas	8950
Nemipterus randalli(Nemipterus mesoprion)	47904
***Nemipterus* spp.**	7656
Nibea maculate	4420
***Nuchequula* spp.**	87
Odonus niger	706
Ostorhinchus fleurieu	1481

Otolithes ruber	5781
Pampus argenteus	214
***Paramonacanthus* spp.**	122
Parastromateus (Formio) niger(F. niger)	25692
Pellona ditchela	45
Photopectoralis bindus (Leiognathus bindus)	195
Platax teira	289
Portunus pelagicus	806
Portunus sanguinolentus	3899
Priacanthus hamrur	1148
Rachycentron canadum	4629
Rastrelliger kanagurta	182693
Rhinobatos obtusus	607
Sarda orientalis	9153
Sardinella fimbriata	1408
Sardinella gibbosa	225198
Sardinella longiceps	2074
***Sardinella* spp.**	101
***Saurida* spp.**	5091
Saurida tumbil	4766
Saurida undosquamis	19546
Scolopsis bimaculata	37
Scolopsis ciliate	49
Scomberoides commersonnianus	10204
Scomberomorus commerson	39161
Selar crumenophthalmus	25606
Sepia aculeate	139
Sepia pharaonis	32419
***Sepia* spp.**	30
Seriolina nigrofasciata	1047
Siganus canaliculatus(S. oramin)	101
Siganus javus	61
Sillago sihama	4
Sphyraena barracuda	1668
Sphyraena obtusata	16806
Sphyraena putnamae	49860
Stolephorus commersonnii	47621
Stolephorus indicus	534
***Stolephorus* spp.**	901
Stolephorus waitei	10833

Sufflamen frenatum(S. capistratus)	181
Synodus indicus	260
Terapon jarbua	3429
Terapon theraps (Eutherapon theraps)	390
Thenus unimaculatus(t. orientalis)	40
***Thryssa* spp.**	5275
Trachinocephalus myops	9
Trachinotus blochii	488
Trichiurus lepturus	89721
Upeneus sulphureus	1993
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	8938
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	44125
***Uroteuthis(Photololigo)(Doryteuthis)* spp.**	343
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	59742
***Uroteuthis(Photololigo)(Loligo)* spp.**	2083
TOTAL	**2785739**

10.2.2 EXPERIMENTAL FISHING IN MONSOON SEASON

BOATSEINE SAMPLING

Plate 10.2.2.a Photograph showing the experimental fishing using Boatseine during Monsoon season

Table. 10.2.2.a Gear details of Boat seine

Gear	Boat Seine
Date	29/08/2021
Craft	Outboard plywood
Horse Power	19.8 hp
Direction	North-west
Departure	4.50 a.m

Arrival	5.45 p.m
No: Hauls	13
Distance	7 NM
Depth	16 m

Table. 10.2.2.b Species details of boatseine sampling

SPECIES	TOTAL WEIGHT (Kg)	LENGTH RANGE (cm)
Sardinella gibbosa	20	13-17.3
Sardinella longiceps	3	14.2-17.8
Decapterus russelli	130	14.3-20.2
Trichurus lepturus	12	44.1-45.7
Mene maculata	10	8-11.5
Carangx heberi	15	14.3-14.7
Ratrelliger kanagurta	2	22.3-24.8
Megalapsis cordya	1	16.8-17.3
Dussumeria acuta	6	14.6-15.2
Loligo duvacelli	73	33.8-36
Stolephorus indicus	1	9-10

DISCO NET SAMPLING

Plate.10.2.2.b Photograph showing the experimental fishing using Disconet during Monsoon season

Table.10.2.2.c Gear details of Disconet

Gear	Disco net
Date	July 29 2021
Craft	Outboard Plywood
Horse Power	9.9 + 9.9 hp
Direction	North West
Departure	5.15 am
Arrival	3.30 pm
No: Hauls	2

Distance	4 NM
Depth	8m

Table 10.2.2.d Species details of Disco net (Trammel net) sampling

SPECIES	TOTAL SAMPLE WEIGHT (Kg)	LENGTH RANGE (cm)
Penaeus indicus	35	9.0-11.0
Penaeus monodon	6	11-13.5
Upeneus sulphureus	3	12.2-14.6

10.3 POST MONSOON SEASON

Fish landings data collected for the post-monsoon season started in October 2021 and ended in January 2021. Landing centre-wise fish catch data (in tonnes) during monsoon season is depicted in Fig. 10.3.1

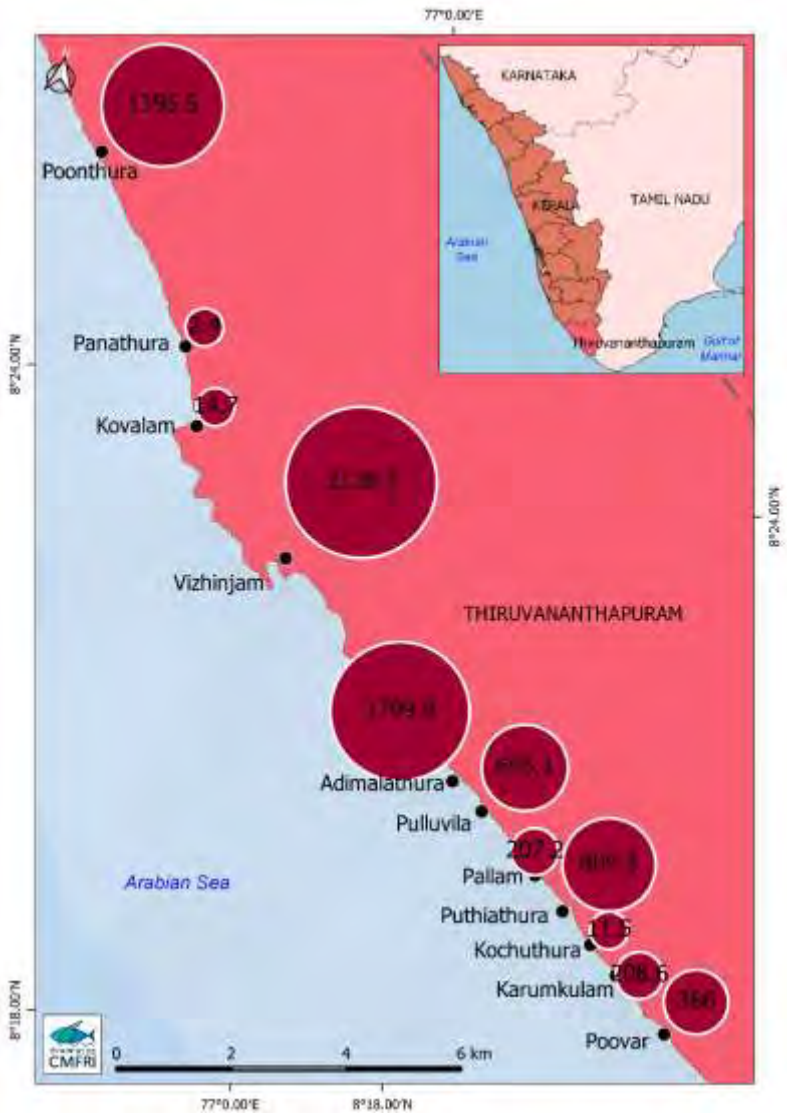


Fig.10.3.1.Landing centre wise fish landings (tonnes) during post-monsoon season

10.3.1 Fish population & its landing

During the post-monsoon season, the catch was reported from all the landing centres. Detailed landings on landing centre-wise for October, November, December 2021 and January 2022 were given in Fig. 10.3.1.c, Fig. 10.3.1.d, Fig. 10.3.1.e., and Fig. 10.3.1.f., respectively. Zone

wise (Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone) fish catch data and the gear wise landings were given in Fig.10.3.1.a and fig.10.3.1.b

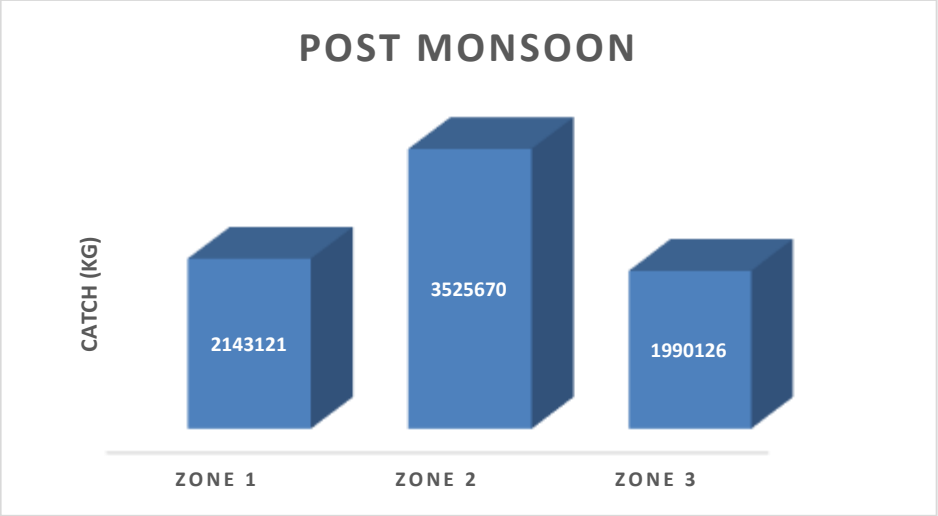


Fig.10.3.1.a Zone wise Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone) fish catch during post monsoon season

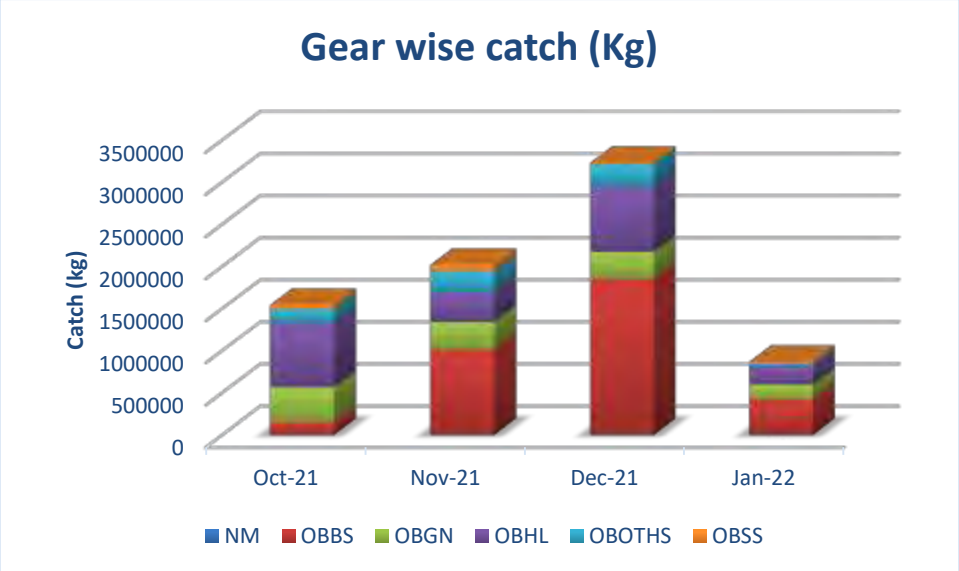


Fig.10.3.1.b Gear wise fish landings during post monsoon season

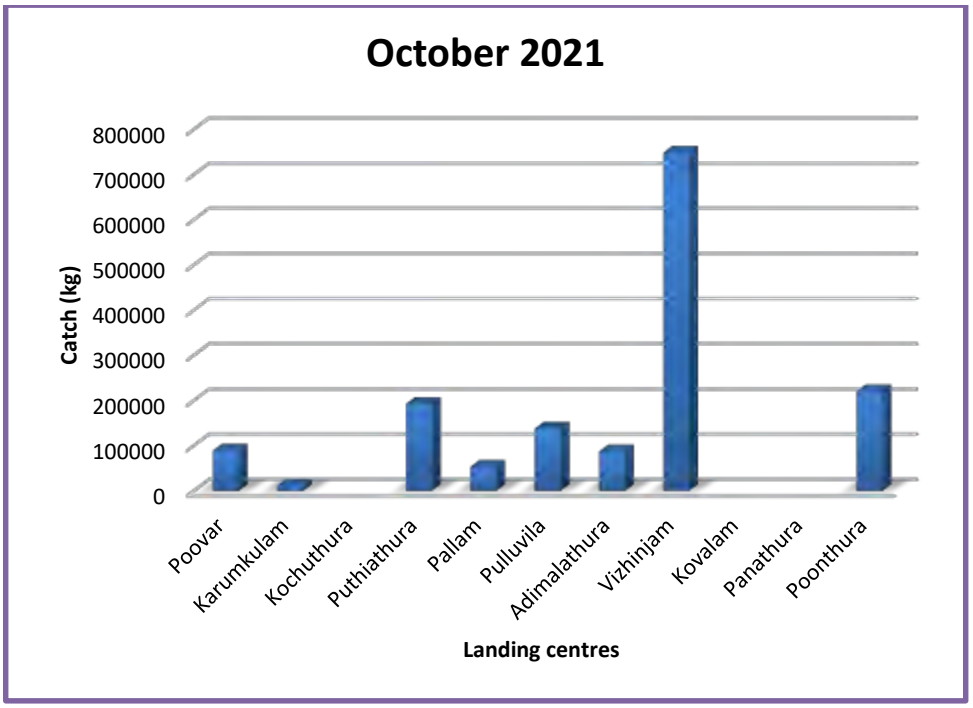


Fig.10.3.1.c Post monsoon landings (October 2021) at different landing centers

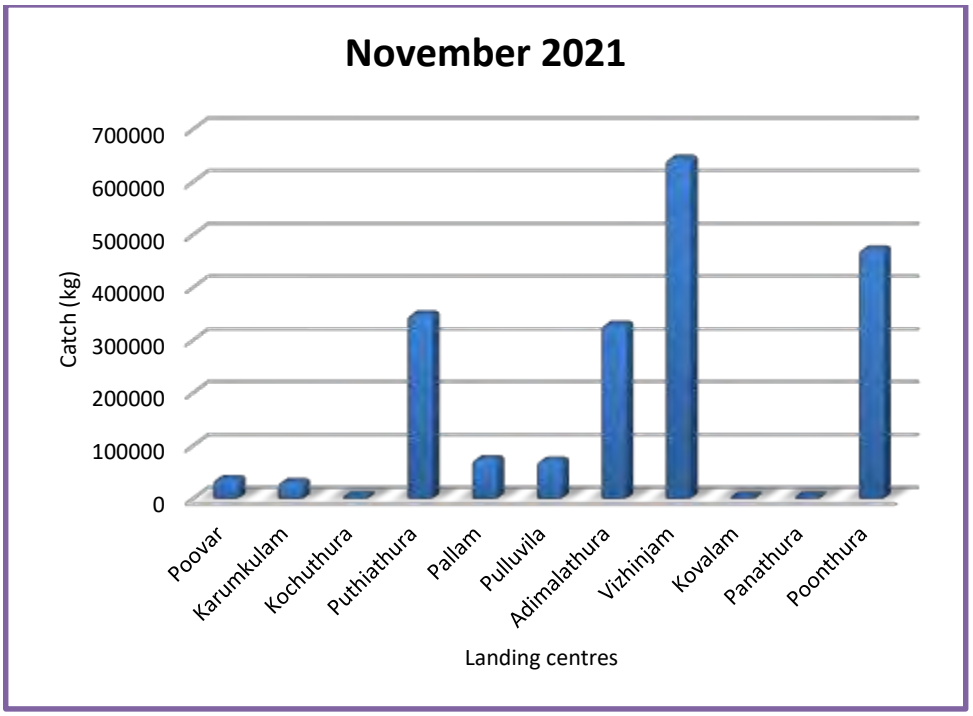


Fig.10.3.1.d. Post monsoon landings (November 2021) at different landing centers

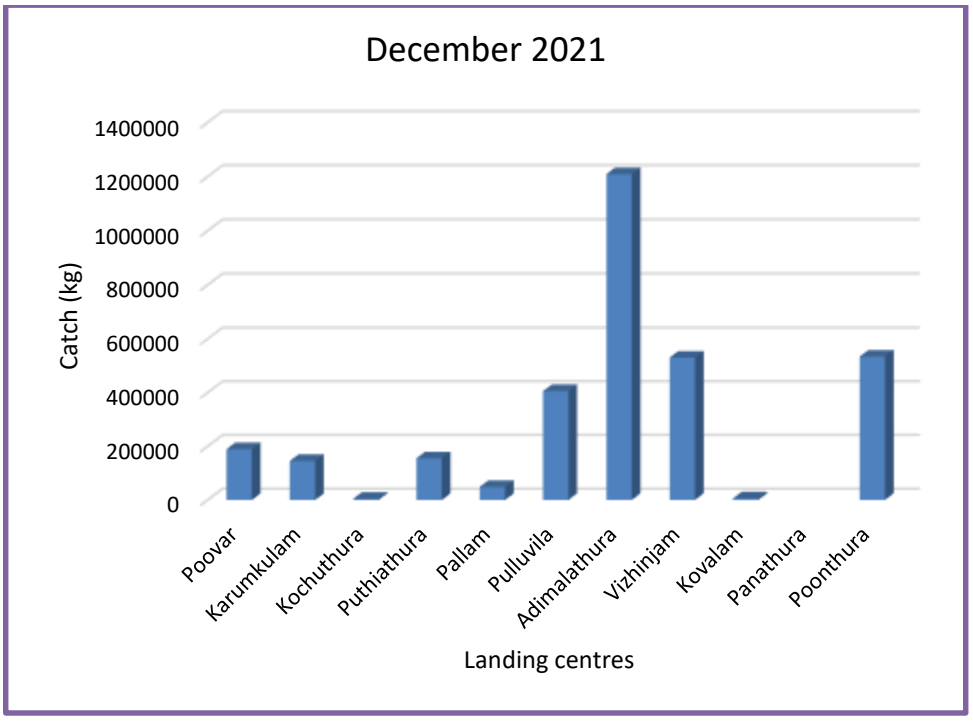


Fig.10.3.1.e Post monsoon landings (December 2021) at different landing centers

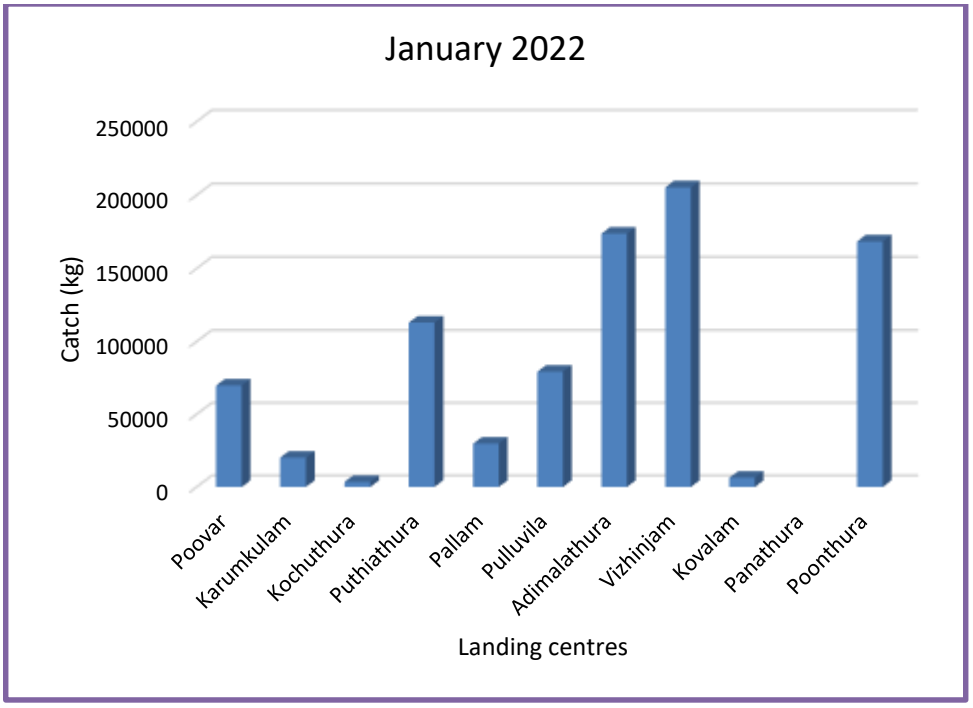
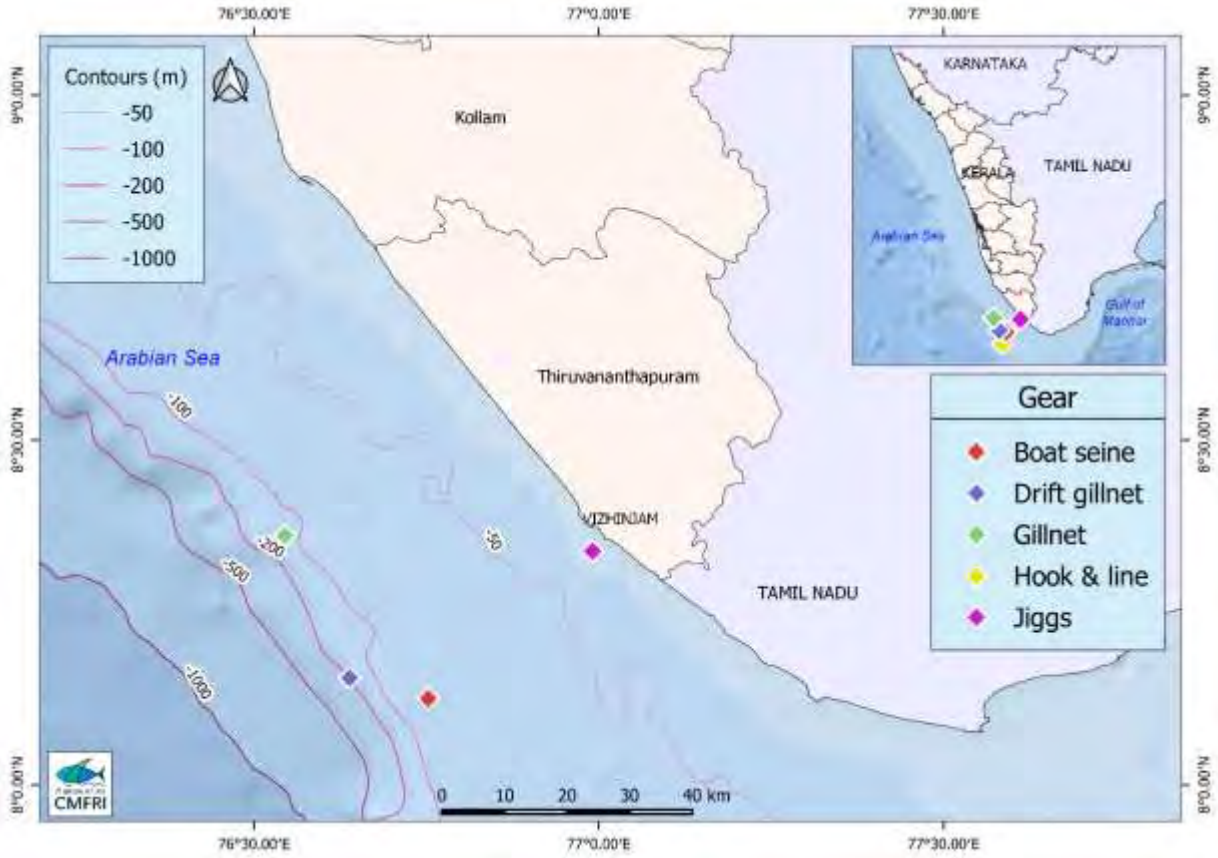


Fig.10.3.1.f Post monsoon landings (January 2022) at different landing centers

The fishing ground information of major gears during post-monsoon season is given in Fig. 10.3.1.g



10.3.1.g Fishing ground information of major gears operating during post monsoon season

The monthly landings of different species during the Post monsoon season are given in Table 10.3.1.a, 10.3.1.b, 10.3.1.c. & 10.3.1.d

Table. 10.3.1.a Fish species landed and its catch in October 2021 (Kg)

SPECIES	CATCH (Kg)
Ablennes hians	**2726**
Acanthocybium solandri	**1820**
Alepes djedaba	**47321**
Alepes kleinii (A. kalla) (A. para)	**1033**
Amblygaster sirm (Sardinella sirm)	**2006**

***Anthias* spp.**	**1950**
Arius maculates	**39**
Atule mate(Alepes mate)	**112965**
Auxis rochei	**42635**
Auxis thazard	**12475**
Carangoides malabaricus	**117**
Caranx heberi (C. sem)	**20514**
Caranx hippos	**1986**
Caranx ignobilis	**4030**
Caranx sexfasciatus	**231**
***Caranx* spp.**	**78**
Cephalopholis sonnerati	**117**
Chanos chanos	**8**
Charybdis feriatus(C. cruciata)	**65**
Chirocentrus dorab	**390**
Chirocentrus nudus	**52**
Coryphaena hippurus	**22115**
***Cynoglossus* spp.**	**708**
Dasyatis microps	**130**
Decapterus kurroides	**6033**
Decapterus russelli(D. dayi)	**62753**
***Decapterus* spp.**	**8237**
***Drepane* spp.**	**4**
Dussumieria acuta	**5603**
Elagatis bipinnulata	**2003**
***Encrasicholina* spp.**	**8103**
Epinephelus bleekeri	**3023**
Epinephelus chlorostigma	**2373**
Epinephelus coioides	**1365**
Epinephelus flavocaeruleus	**488**
Epinephelus malabaricus	**293**
Erythrocles schlegelii	**65086**
Euthynnus affinis	**167333**
Fistularia petimba (F. villosa)	**960**
Gazza minuta	**83**
***Hemiramphus* spp.**	**156**

Heteropriacanthus cruentatus (Priacanthus cruentatus)	**3510**
Hyporhamphus affinis(Hemirhamphus archipelagicus)	**329**
Hyporthodus octafasciatus	**33**
Istiompax indica (Makaira indica)	**8304**
***Johnius* spp.**	**10**
Leiognathus brevirostris	**277**
***Leiognathus* spp.**	**6475**
Lepturacanthus savala	**42416**
Lethrinus lentjan	**22**
Lutjanus fulvus(L. vaigiensis)	**1560**
Lutjanus lutjanus(L. lineolatus)	**156**
Megalaspis cordyla	**77018**
Mene maculate	**18799**
Mugil cephalus	**25**
***Myripristis* spp.**	**1365**
Nemipterus bipunctatus(N. delagoae)	**26689**
Nemipterus japonicas	**2889**
Nibea maculate	**1879**
***Octopus* spp.**	**1398**
Odonus niger	**683**
Otolithes cuvieri	**218**
Otolithes ruber	**3465**
***Otolithes* spp.**	**21**
***Panulirus* spp.**	**16**
Parascolopsis aspinosa	**9588**
***Parupeneus* spp.**	**195**
Pellona ditchela	**44**
***Pempheris* spp.**	**405**
Perna indica	**31**
Photopectoralis bindus (Leiognathus bindus)	**618**
Portunus pelagicus	**557**
Portunus sanguinolentus	**5031**
Priacanthus hamrur	**14164**
***Priacanthus* spp.**	**1240**
Pristipomoides filamentosus	**6028**

Pristipomoides typus	**30388**
Rachycentron canadum	**5944**
Rastrelliger kanagurta	**142714**
Rhinobatos obtusus	**325**
Sardinella fimbriata	**390**
Sardinella gibbosa	**44628**
Sardinella longiceps	**260**
***Sardinella* spp.**	**31**
***Sargocentron (Holocentrus)* spp.**	**1365**
Saurida tumbil	**1066**
Saurida undosquamis	**19456**
Scomberoides commersonnianus	**7791**
Scomberomorus commerson	**16818**
Secutor insidiator	**47**
Selar crumenophthalmus	**115800**
Sepia pharaonis	**56030**
Seriolina nigrofasciata	**1138**
Sphyraena obtusata	**7150**
***Sphyraena* spp.**	**96**
Stolephorus commersonnii	**20201**
Stolephorus indicus	**6831**
***Stolephorus* spp.**	**26644**
Stolephorus waitei	**4914**
Terapon jarbua	**3256**
***Thryssa* spp.**	**297**
Trichiurus lepturus	**157484**
Tylosurus crocodilus (Strongylura crocodilus)	**2600**
Upeneus sulphureus	**3113**
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	**1950**
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	**7028**
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	**9185**
***Uroteuthis(Photololigo)(Loligo)* spp.**	**2368**
TOTAL	**1542173**

Table. 10.3.1.b Fish species landed and its catch in November 2021 (Kg)

SPECIES	CATCH (Kg)
Ablennes hians	**499**
***Acanthurus* spp.**	**18**
Alepes djedaba	**723**
Alepes kleinii (A. kalla) (A. para)	**43**
***Alepes* spp.**	**20**
Amblygaster sirm (Sardinella sirm)	**36849**
Atule mate(Alepes mate)	**24539**
Auxis rochei	**58635**
Auxis thazard	**2557**
Carangoides coeruleopinnatus	**33**
Carangoides malabaricus	**38**
Caranx heberi (C. sem)	**9778**
Caranx hippos	**26**
Caranx ignobilis	**30238**
***Caranx* spp.**	**120**
Cephalopholis sonnerati	**310**
Cephalopholis urodeta	**9100**
Chanos chanos	**4**
Charybdis natator	**55**
Chirocentrus dorab	**375**
Cookeolus japonicus	**324**
Coryphaena hippurus	**13189**
Cynoglossus macrolepidotus (C. arel)	**347**
Decapterus kurroides	**5759**
Decapterus macrosoma	**4100**
Decapterus russelli(D. dayi)	**663475**
Elagatis bipinnulata	**1517**
Encrasicholina punctifer (Stolephorus punctifer)	**11553**
***Encrasicholina* spp.**	**433**
Epinephelus areolatus	**46**
Epinephelus coioides	**30**
Epinephelus diacanthus	**780**
Epinephelus epistictus	**2464**
Epinephelus longispinis	**618**

Epinephelus malabaricus	**69**
Epinephelus ongus	**585**
Epinephelus radiates	**64**
***Epinephelus* spp.**	**436**
Epinephelus undulosus	**181**
Erythrocles schlegelii	**18593**
Euthynnus affinis	**95714**
Filimanus heptadactyla (Polynemus heptadactylus)	**333**
Fistularia petimba (F. villosa)	**2550**
Gerres filamentosus	**4630**
Gymnura poecilura	**61**
Himantura imbricata(Amphotistius imbricatus)	**8429**
Hyporthodus octafasciatus	**42**
Ilisha filigera	**832**
Istiompax indica (Makaira indica)	**2340**
Istiophorus platypterus	**5327**
***Johnius* spp.**	**125**
Karalla dussumieri (Leiognathus dussumieri)	**6424**
Katsuwonus pelamis	**60**
Lactarius lactarius	**26**
Leiognathus equula(L. equulus)	**7**
***Leiognathus* spp.**	**6699**
Lethrinus lentjan	**7150**
Lipocheilus carnolabrum	**286**
Lutjanus kasmira	**130**
Lutjanus lutjanus(L. lineolatus)	**33**
Megalaspis cordyla	**79549**
Megalops cyprinoides	**52**
Mene maculate	**10248**
Monodactylus argenteus	**55**
Mugil cephalus	**130**
Narcine timlei	**72**
Nemipterus bipunctatus(N. delagoae)	**55862**
Nemipterus japonicas	**720**
Nemipterus randalli(Nemipterus mesoprion)	**646**
Nibea maculate	**569**
***Octopus* spp.**	**504**

Odontanthias rhodopeplus	**70**
Odonus niger	**10**
Ostorhinchus fleurieu	**79**
Otolithes ruber	**17780**
Parapercis alboguttata	**18**
Parascolopsis eriomma	**377**
Pellona ditchela	**222**
***Pempheris* spp.**	**15**
Perna indica	**11795**
Photopectoralis bindus (Leiognathus bindus)	**1397**
Plotosus lineatus (P. anguillaris)	**39**
Pomadasys guoraca	**29**
Pomadasys maculatus (P. maculatum)	**52**
Portunus pelagicus	**662**
Portunus sanguinolentus	**1055**
Priacanthus hamrur	**19605**
***Priacanthus* spp.**	**577**
Pristigenys refulgens	**60**
Pristipomoides filamentosus	**18154**
Pristipomoides multidens	**30**
***Pristipomoides* spp.**	**1000**
Pristipomoides typus	**5083**
Promethichthys Prometheus	**24**
Pseudotriacanthus strigilifer	**11**
Rachycentron canadum	**2788**
Rastrelliger kanagurta	**177837**
Rhinobatos annandalei	**180**
Sarda orientalis	**1669**
Sardinella fimbriata	**3000**
Sardinella gibbosa	**210330**
Saurida tumbil	**318**
Saurida undosquamis	**12917**
Scomberoides commersonnianus	**21**
Scomberoides tol	**1667**
Scomberomorus commerson	**32515**
Secutor insidiator	**766**
Selar crumenophthalmus	**139182**
Sepia pharaonis	**26867**
***Sepia* spp.**	**83**

Siganus canaliculatus(S. oramin)	**73**
Sillago sihama	**59**
Sphyraena obtusata	**28923**
Sphyraena putnamae	**21**
***Sphyraena* spp.**	**564**
Stolephorus commersonnii	**7180**
Stolephorus indicus	**1542**
***Stolephorus* spp.**	**1375**
Stolephorus waitei	**2685**
Strongylura strongylura	**1900**
Sufflamen frenatum(S. capistratus)	**266**
Terapon jarbua	**1720**
***Thryssa* spp.**	**500**
Thunnus albacares	**29610**
Thunnus obesus	**711**
***Torpedo* spp.**	**2976**
Trachinocephalus myops	**131**
Trichiurus lepturus	**48965**
Upeneus sulphureus	**554**
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	**850**
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	**751**
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	**7521**
***Uroteuthis(Photololigo)(Loligo)* spp.**	**1874**
Zebrias synapturoides	**22**
TOTAL	**2017185**

Table. 10.3.1.c Fish species landed and its catch in December 2021 (Kg)

SPECIES	CATCH (Kg)
Abalistes stellatus	16
Ablennes hians	447
***Aethaloperca* spp.**	304
Alectis indica	5235

Alepes djedaba	1903
***Alepes* spp.**	135
Amblygaster sirm (Sardinella sirm)	152422
Aphareus rutilans	3375
Arius arius	34
Arius maculatus	1935
Atule mate(Alepes mate)	6629
Auxis rochei	167163
Auxis thazard	7214
Brama orcini	9
Canthidermis maculata	41
Carangoides malabaricus	310
***Carangoides* spp.**	72
Caranx heberi (C. sem)	4390
Caranx hippos	103
Caranx ignobilis	9587
***Caranx* spp.**	719
Cephalopholis sonnerati	5963
Cephalopholis urodeta	20346
Charybdis natator	58
Chirocentrus dorab	108
Chirocentrus nudus	529
Coryphaena hippurus	47218
Cynoglossus macrolepidotus (C. arel)	101
Cypselurus poicilopterus	14850
Decapterus kurroides	7
Decapterus macarellus	850522
Decapterus macrosoma	2908
Decapterus russelli(D. dayi)	30959
Diagramma picta	32
Drepane punctata	4
Dussumieria acuta	435
Elagatis bipinnulata	8234

Encrasicholina punctifer (Stolephorus punctifer)	1935
***Encrasicholina* spp.**	17820
Epinephelus areolatus	247
Epinephelus bleekeri	189
Epinephelus coioides	27
Epinephelus diacanthus	7659
Epinephelus epistictus	1099
Epinephelus longispinis	128
Epinephelus malabaricus	90
Epinephelus merra	270
Epinephelus radiates	387
***Epinephelus* spp.**	223
Epinephelus undulosus	485
Erythrocles schlegelii	4146
Euthynnus affinis	84307
***Exocoetus* spp.**	540
Filimanus heptadactyla (Polynemus heptadactylus)	22
Fistularia petimba (F. villosa)	323
Gerres filamentosus	240
***Gerres* spp.**	4
Gnathanodon speciosus	594
Gymnosarda unicolor	378
Gymnura poecilura	1349
***Gymnura* spp.**	868
Hemiramphus far	23671
Heteropriacanthus cruentatus (Priacanthus cruentatus)	608
Himantura imbricata(Amphotistius imbricatus)	300
Hyporhamphus affinis(Hemirhamphus archipelagicus)	350
Ilisha filigera	783
Iniistius bimaculatus	59
Istiompax indica (Makaira indica)	6392
Istiophorus platypterus	2729
***Johnius* spp.**	387
Kathala axillaris	701

Katsuwonus pelamis	84939
Lactarius lactarius	1508
Lagocephalus sceleratus	32
Leiognathus berbis	3000
Leiognathus brevirostris	3
***Leiognathus* spp.**	11658
Lethrinus lentjan	7985
Lipocheilus carnolabrum	441
Lutjanus argentimaculatus	135
Lutjanus fulviflamma(L. fulviflammus)	842
Lutjanus fulvus(L. vaigiensis)	540
Lutjanus johnii	18
Lutjanus lutjanus(L. lineolatus)	838
Lutjanus quinquelineatus	68
Lutjanus rivulatus	878
***Lutjanus* spp.**	108
Makaira nigricans	945
Megalaspis cordyla	46048
Megalops cyprinoides	1433
Mene maculate	24617
Monodactylus argenteus	297
Mugil cephalus	75
Naucrates doctor	12
Nemipterus bipunctatus(N. delagoae)	13216
Nemipterus randalli(Nemipterus mesoprion)	55
***Nemipterus* spp.**	7
Neotrygon kuhlii (Dasyatis kuhlii)	517
Nibea maculate	1217
Odontanthias rhodopeplus	95
Odonus niger	2104
Ostorhinchus fleurieu	34
Otolithes cuvieri	49

Otolithes ruber	1202
Pampus argenteus	338
Panulirus homarus	27
Parascolopsis aspinosa	56
Parascolopsis eriomma	385
Parupeneus indicus	20
Pellona ditchela	368
***Pempheris* spp.**	25
Perna indica	3375
Pinjalo pinjalo	2532
***Plectorhinchus (Gaterin)* spp.**	21
Pomadasys argenteus	120
Pomadasys guoraca	135
Portunus sanguinolentus	5315
Priacanthus hamrur	21093
Pristipomoides filamentosus	15629
Pristipomoides typus	5456
Psenes cyanophrys (Ariomma cyanophrys)	7
Pseudotriacanthus strigilifer	11
Rachycentron canadum	1884
Rastrelliger kanagurta	300056
Rhinobatos obtusus	362
Sarda orientalis	327
Sardinella fimbriata	70538
Sardinella gibbosa	231610
Sargocentron (Holocentrus) rubrum (H. ruber)	34
***Saurida* spp.**	20
Saurida tumbil	284
Saurida undosquamis	835
Scolopsis bimaculata	45
Scolopsis vosmeri	50
Scomberoides commersonnianus	4305
Scomberoides tol	1372
Scomberomorus commerson	101114
Scomberomorus guttatus	4636

Secutor insidiator	1308
Selar crumenophthalmus	556010
Sepia pharaonis	17337
***Siganus* spp.**	24
Sillago sihama	33
Sphyraena barracuda	646
Sphyraena forsteri	2144
Sphyraena jello	285
Sphyraena obtusata	29471
Sphyraena putnamae	298
***Sphyraena* spp.**	340
Stolephorus commersonnii	15630
Stolephorus indicus	3937
***Stolephorus* spp.**	3335
Stolephorus waitei	2325
Sufflamen frenatum(S. capistratus)	4033
Synodus indicus	207
Terapon jarbua	1480
Terapon theraps (Eutherapon theraps)	37
Thenus unimaculatus(t. orientalis)	583
***Thryssa* spp.**	1072
Thunnus albacares	32401
Thunnus obesus	236
Thunnus tonggol	169
Torpedo marmorata	6727
Trachinotus baillonii	20
Trichiurus lepturus	41057
Turbinella(Xancus) pyrum(X. pyrum)	274
Upeneus sulphureus	11379
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	10
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	4615
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	9474
***Uroteuthis(Photololigo)(Loligo)* spp.**	2396
Total	**3230221**

Table. 10.3.1.d. Fish species landed and its catch in January 2022 (Kg)

SPECIES	CATCH (Kg)
Abalistes stellatus	27
Ablennes hians	669
Acanthocybium solandri	2007
***Acanthurus* spp.**	46
Alepes djedaba	2808
Alepes kleinii (A. kalla) (A. para)	20
Alutera monoceros	78
Amblygaster sirm (Sardinella sirm)	150798
Arius maculatus	194
***Arius* spp.**	520
Atule mate(Alepes mate)	2323
Auxis rochei	79743
Auxis thazard	7991
Canthidermis maculata	620
Carangoides coeruleopinnatus	51
***Carangoides* spp.**	600
Caranx heberi (C. sem)	746
Caranx hippos	66
Caranx ignobilis	1569
Caranx sexfasciatus	1233
***Caranx* spp.**	325
Cephalopholis sonnerati	5546
Charybdis natator	20
Chirocentrus dorab	161
Chirocentrus nudus	130
Cookeolus japonicus	192
Coryphaena hippurus	2820
***Cynoglossus* spp.**	124
Dagetichthys commersonnii(Synaptura commersonnii)	156
Decapterus kurroides	488
Decapterus macrosoma	15171
Decapterus russelli(D. dayi)	39222
Drepane punctata	27
Dussumieria acuta	255
Elagatis bipinnulata	2405

Encrasicholina punctifer (Stolephorus punctifer)	1073
***Encrasicholina* spp.**	11544
Epinephelus areolatus	1332
Epinephelus bleekeri	371
Epinephelus chlorostigma	2411
Epinephelus coioides	156
Epinephelus diacanthus	17
Epinephelus epistictus	569
Epinephelus fasciatus	853
Epinephelus longispinis	166
Epinephelus malabaricus	131
***Epinephelus* spp.**	2174
Epinephelus undulosus	1276
Erythrocles schlegelii	7708
Euthynnus affinis	22064
***Exocoetus* spp.**	2470
Filimanus heptadactyla (Polynemus heptadactylus)	21
Fistularia petimba (F. villosa)	965
Gymnura poecilura	20
***Gymnura* spp.**	738
Hemiramphus far	351
Himantura imbricata(Amphotistius imbricatus)	117
Hyporhamphus affinis(Hemirhamphus archipelagicus)	169
Iniistius bimaculatus	23
Istiompax indica (Makaira indica)	1251
Istiophorus platypterus	6996
***Johnius* spp.**	53
Katsuwonus pelamis	3094
Lactarius lactarius	108
***Leiognathus* spp.**	7207
Lepturacanthus savala	447
Lethrinus lentjan	1104
Lethrinus nebulosus(L. choerorhynchus, L. fraenatus)	163
Lipocheilus carnolabrum	519
Lutjanus argentimaculatus	536
Lutjanus fulviflamma(L. fulviflammus)	109
Lutjanus fulvus(L. vaigiensis)	49
Lutjanus johnii	37
Lutjanus lutjanus(L. lineolatus)	4002
Lutjanus quinquelineatus	81

Lutjanus rivulatus	33
***Lutjanus* spp.**	43
Megalaspis cordyla	14100
Megalops cyprinoides	313
Mene maculata	3157
***Mobula* spp.**	98
Monodactylus argenteus	81
Mugil cephalus	72
Nemipterus bipunctatus(N. delagoae)	6843
Nemipterus randalli(Nemipterus mesoprion)	1017
***Nemipterus* spp.**	18
Nibea maculata	42
Odontanthias rhodopeplus	616
Odonus niger	4186
Otolithes ruber	228
Parapercis alboguttata	7
Parascolopsis eriomma	401
Parastromateus (Formio) niger(F. niger)	27
Parupeneus indicus	247
Pelates quadrilineatus	19
***Pempheris* spp.**	770
Perna indica	5850
Pinjalo pinjalo	818
Platax teira	155
***Plectorhinchus (Gaterin)* spp.**	153
Polydactylus plebeius(Polynemus plebeius)	10
Pomadasys furcatus	436
Pomadasys maculatus (P. maculatum)	27
Portunus sanguinolentus	4010
Priacanthus hamrur	2573
***Priacanthus* spp.**	81
Pristigenys refulgens	23
Pristipomoides filamentosus	18164
Pristipomoides typus	1422
Rachycentron canadum	1428
Rastrelliger kanagurta	99464
***Rhinobatos* spp.**	191
Rhinobatos variegatus	233
Sarda orientalis	1288
Sardinella fimbriata	1582

Sardinella gibbosa	51129
***Sardinella* spp.**	975
Sargocentron (Holocentrus) rubrum (H. ruber)	406
Saurida tumbil	211
Saurida undosquamis	1495
Scatophagus argus	16
Scolopsis bimaculata	302
Scolopsis ciliata	25
***Scolopsis* spp.**	137
Scolopsis vosmeri	16
Scomberoides commersonnianus	139
Scomberoides tol	1558
Scomberomorus commerson	4165
Selar crumenophthalmus	83456
Selaroides leptolepis	7145
Sepia pharaonis	6540
***Sepia* spp.**	60
Siganus canaliculatus(S. oramin)	26
Siganus javus	59
Sillago sihama	54
Sphyraena barracuda	195
Sphyraena forsteri	258
Sphyraena jello	229
Sphyraena obtusata	1723
Sphyraena putnamae	1205
***Sphyraena* spp.**	440
Stolephorus commersonnii	537
Stolephorus indicus	13
***Stolephorus* spp.**	1180
Sufflamen frenatum(S. capistratus)	1852
***Synodus* spp.**	46
Terapon jarbua	314
Terapon puta	17
Thunnus albacares	1404
***Torpedo* spp.**	878
Trachinocephalus myops	55
Trachinotus baillonii	33
Trachinotus blochii	750
Trichiurus lepturus	13629
Upeneus sulphureus	135

Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	355
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	27129
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	65482
***Uroteuthis(Photololigo)(Loligo)* spp.**	19760
Xiphias gladius	1853
TOTAL	**869238**

10.3.2 EXPERIMENTAL FISHING IN POST- MONSOON SEASON

BOATSEINE SAMPLING

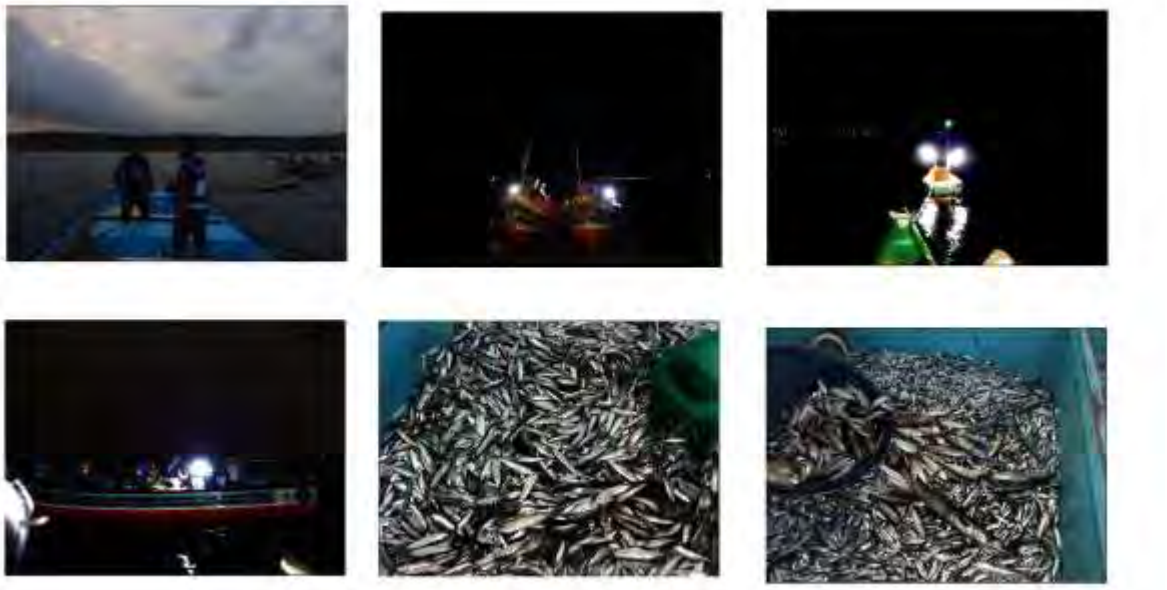


Plate 10.3.2.a Photograph showing the experimental fishing using Boat seine during Post-monsoon season

Table . 10.3.2.a Gear details of Boatseine

Gear	BOAT SEINE
Date	12th October 2021
Craft	Outboard fibreglass
Horse Power	9.9+25 hp
Direction	West
Departure	5.15 p.m
Arrival	6.00 a.m
No: Hauls	4
Distance	19 NM
Depth	65 m

Table 10.3.2.b Species details Boat seine sampling

Species	Total Sample Weight (Kg)	Length Range (Cm)
Sardinella gibbosa	240	10-13
Rastrelliger kanagurta	15	20-24
Amblygaster sirm	120	12.5-15
Uroteuthis duvaucelii	3	30-32
Sphyraena putnamae	3	45-46.2
Selar crumenophthalmus	4	18-24.3

GILL NET SAMPLING

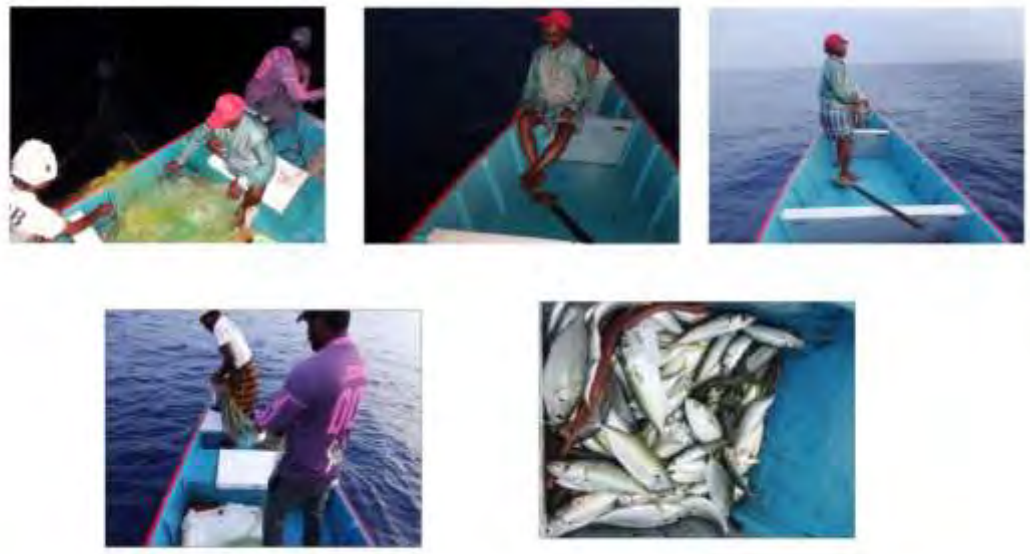


Plate 10.3.2.b Photograph showing the experimental fishing using Boat seine during Post-monsoon season

Table 10.3.2.c Gear details of Gillnet

Gear	Gillnet
Date	7th November 2021
Craft	Outboard fiberglass
Horse Power	9.9 hp
Direction	South west
Departure	4.30 am
Arrival	10.45 am
No: Hauls	1
Distance	5 NM
Depth	16 m

Table 10.3.2.d Species details Gillnet sampling

Species	Total Sample Weight (Kg)	Length Range (Cm)
Decapterus russelli	1	10-14.5
Selar crumenopthalmus	7	22-32.5
Rastrelliger kanagurta	18	16-27.9
Fistularia petimba	1	38.1-49.6
Alepes djedaba	2	15.2-20.1

SHORE SEINE SAMPLING

Plate 10.3.2.c Photograph showing the experimental fishing using Shore seine during Post-monsoon season

Table 10.3.2.e Gear details of Shore seine

Gear	Shoreseine
Date	15th October 2021
Craft	Outboard fiberglass
Horse Power	9.9+9.9 hp
Direction	West
Departure	6.05 am
Arrival	7.50 am
No: Hauls	1
Distance	2 NM
Depth	16 m

Table 10.3.2.f Species details of Shoreseine sampling

Species	Total Sample Weight (Kg)	Length Range (cm)
Leiognathus sp.	18	6-10
Atule mate	14	9-16
Stolephorous sp.	85	8.5-12
Rastrelliger kanagurta	5	23-26
Megalapsis cordyla	12	24-33
Jelly fih	52	-

10.4 PRE-MONSOON SEASON

Fish landings data collected for the Pre-monsoon season started in February 2022 and ended by May 2022. Landing centre-wise fish catch data (tonnes) during monsoon season is depicted in Fig. 10.4.1.

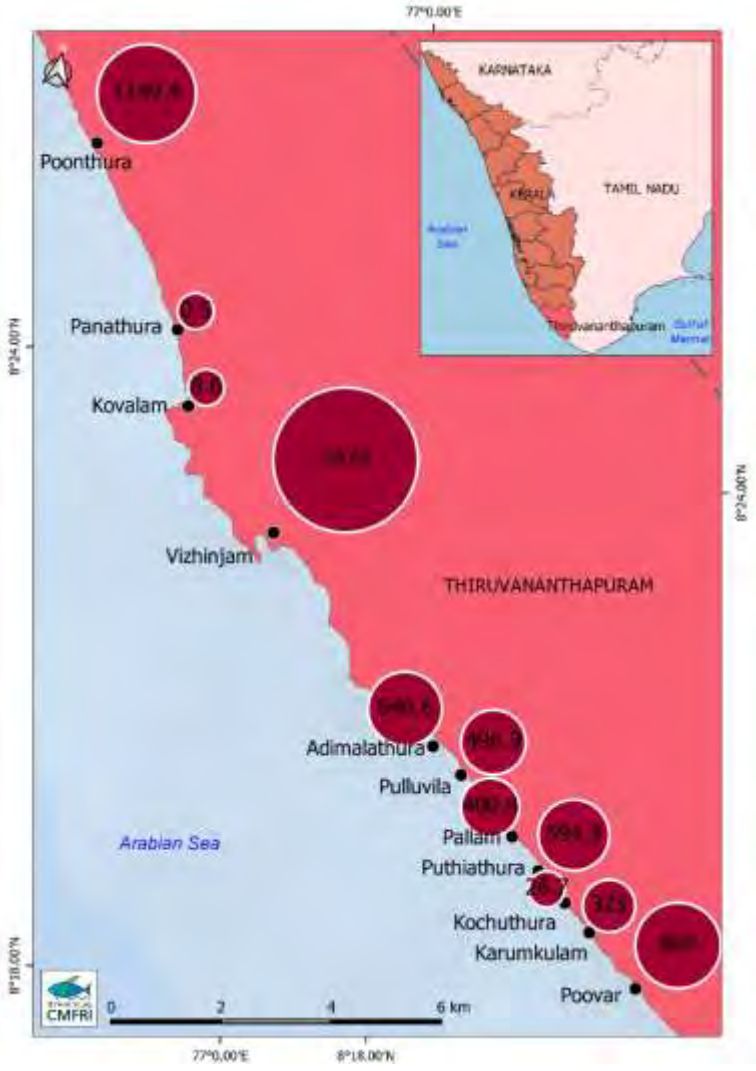


Fig.10.4.1. Landing centre wise fish landings (tonnes) during pre-monsoon season

10.4.1Fish population & its landing

During the pre-monsoon season, the catch was reported from all the landing centres. Detailed landings on landing centre-wise for February, March, April and May 2022 were given in Fig.

10.4.1.c, Fig. 10.4.1.d, Fig. 10.4.1.e., and Fig. 10.4.1.f, respectively. Zonewise fish catch and gearwise landings during pre-monsoon season were given in Fig.10.4.1.a &10.4.1.b

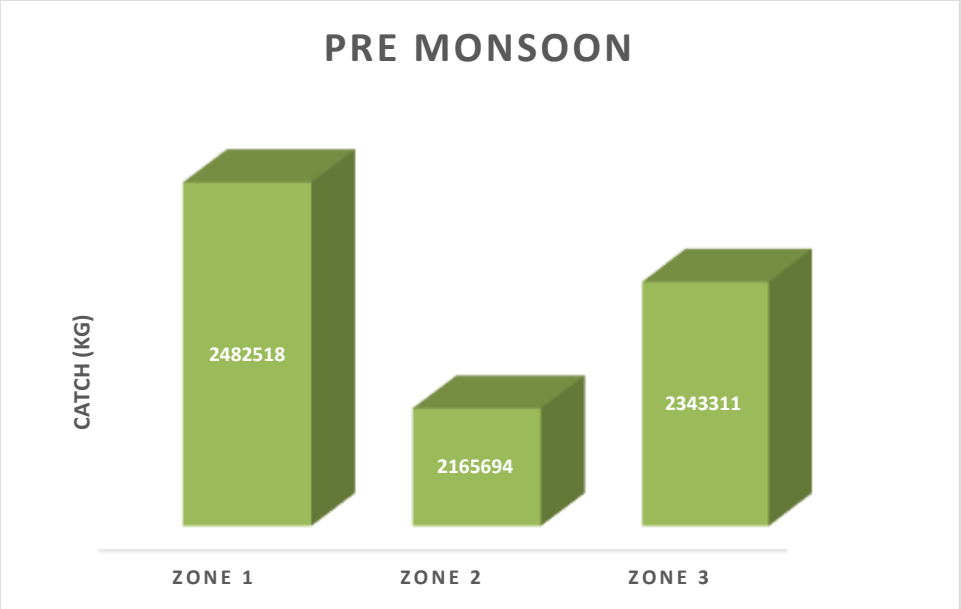


Fig.10.4.1.a Zone wise catch during pre-monsoon season

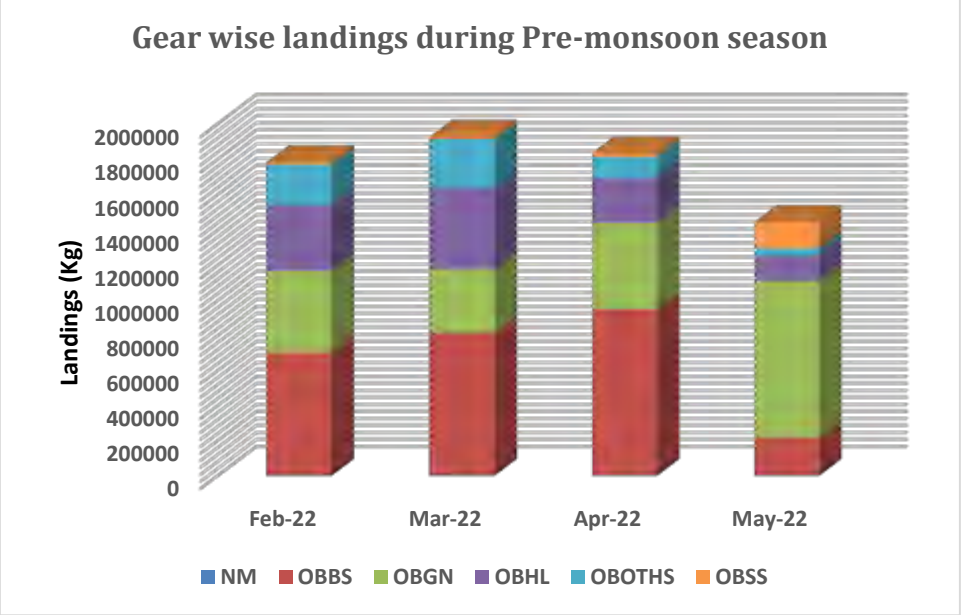


Fig.10.4.1.b Gear wise fish landings during pre-monsoon season

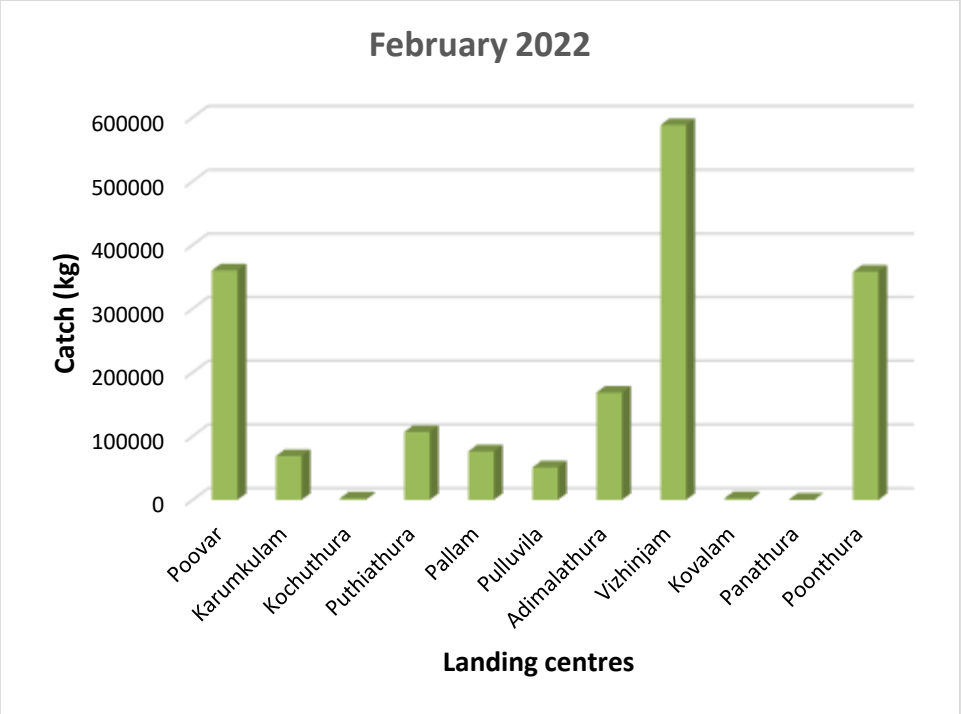


Fig.10.4.1.c Fish landings (kg) during February 2022 at different landing centers

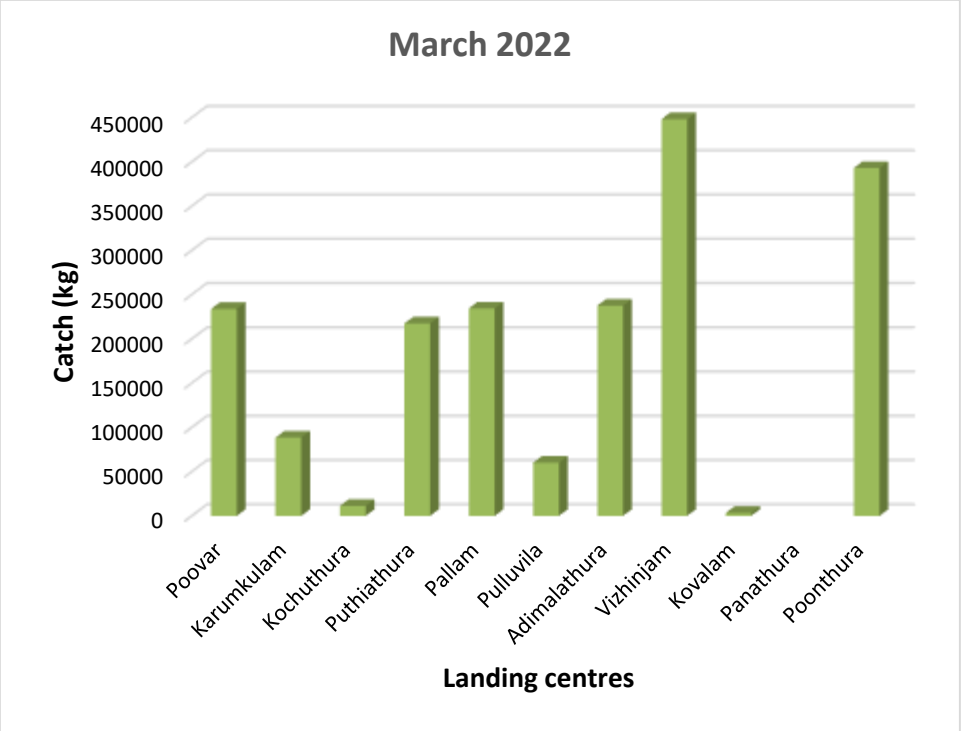


Fig.10.4.1.d. Fish landings (kg) during March 2022 at different landing centers

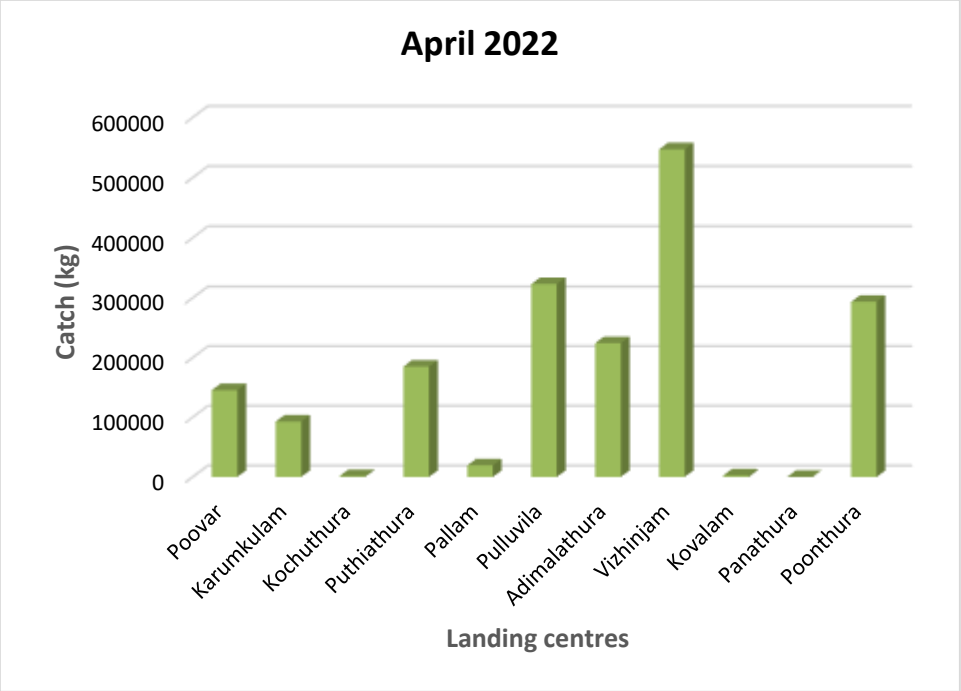


Fig.10.4.1.e Fish landings (kg) during April 2022 at different landing centers

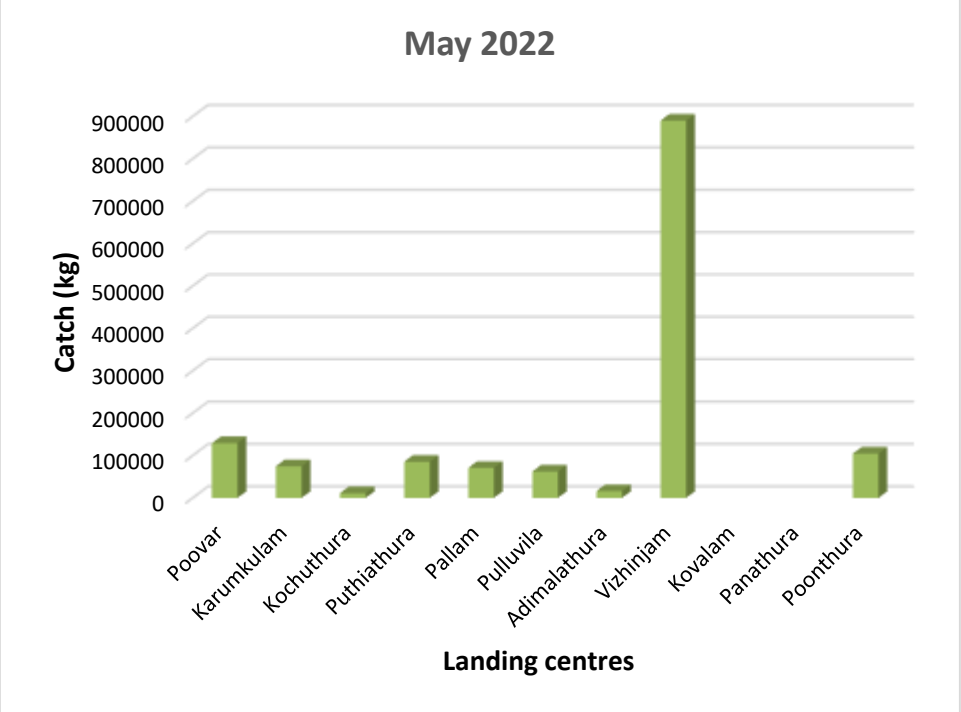


Fig.10.4.1.f Fish landings (kg) during May 2022 at different landing centers

The fishing ground information of major gears during Pre-monsoon is given in Fig.10.4.1.g

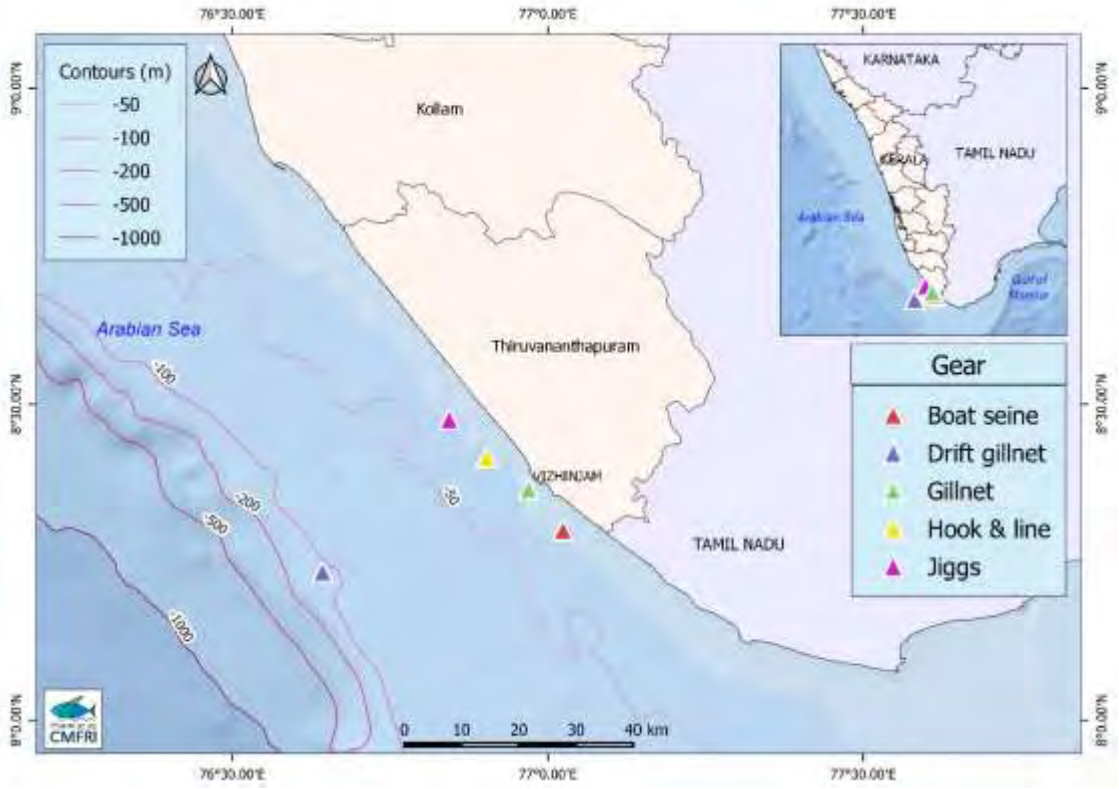


Fig.10.4.1.g Fishing ground information of major geragears during Pre-monsoon

The monthly landings of different species during the Pre - monsoon season are given in Table 10.4.1.a, 10.4.1.b, 10.4.1.c & 10.4.1.d.

Table. 10.4.1.a Fish species landed and its catch in February 2022 (Kg)

SPECIES	CATCH (kg)
Ablennes hians	279
Acanthocybium solandri	3484
***Aethaloperca* spp.**	3880
Alectis ciliaris	40
Alepes djedaba	2333
Alepes kleinii (A. kalla) (A. para)	12
Alutera monoceros	1144
Amblygaster sirm (Sardinella sirm)	244582
Atropus atropos	11

Atule mate(Alepes mate)	4538
Auxis rochei	64568
Auxis thazard	65398
Canthidermis maculata	6840
Carangoides hedlandensis	408
Carangoides malabaricus	24
***Carangoides* spp.**	306
Caranx heberi (C. sem)	4205
Caranx hippos	165
Caranx ignobilis	3869
Caranx sexfasciatus	258
Cephalopholis sonnerati	6679
Cephalopholis urodeta	10863
Chanos chanos	6
Charybdis natator	190
***Cheilopogon* spp.**	5540
Chirocentrus dorab	80
Chirocentrus nudus	24
Cookeolus japonicus	322
Coryphaena hippurus	29254
Cynoglossus macrolepidotus (C. arel)	84
***Cynoglossus* spp.**	548
Dasyatis microps	163
Decapterus kurroides	342
Decapterus macarellus	31
Decapterus macrosoma	29142
Decapterus russelli(D. dayi)	61314
Elagatis bipinnulata	1807
***Encrasicholina* spp.**	384
Epinephelus areolatus	2361
Epinephelus bleekeri	1048
Epinephelus chlorostigma	3305
Epinephelus diacanthus	6663
Epinephelus epistictus	804
Epinephelus longispinis	671
Epinephelus malabaricus	1296
Epinephelus radiates	520
***Epinephelus* spp.**	273
Epinephelus undulosus	80
Erythrocles schlegelii	14978

Euthynnus affinis	130614
***Exocoetus* spp.**	3730
Filimanus heptadactyla (Polynemus heptadactylus)	474
Fistularia petimba (F. villosa)	1205
Gazza minuta	36
Gephyroberyx darwinii	40
Gerres filamentosus	2617
Gymnosarda unicolor	19
Gymnura poecilura	578
Hemiramphus far	33587
Himantura imbricata(Amphotistius imbricatus)	10284
Hyporhamphus affinis(Hemirhamphus archipelagicus)	216
Hyporhamphus xanthopterus	4
Hyporthodus octafasciatus	40
***Hyporthodus* spp.**	1955
***Iniistius* spp.**	109
Istiompax indica (Makaira indica)	28040
Istiophorus platypterus	24446
***Johnius* spp.**	180
Kajikia audax (Tetrapterus audax)	7000
Katsuwonus pelamis	21197
***Leiognathus* spp.**	5669
Lepturacanthus savala	261
Lethrinus lentjan	5256
Lipocheilus carnolabrum	442
Lutjanus argentimaculatus	560
Lutjanus fulvus(L. vaigiensis)	241
Lutjanus lutjanus(L. lineolatus)	2619
Lutjanus quinquelineatus	482
***Lutjanus* spp.**	450
Makaira nigricans	2250
Manta birostris	360
Megalaspis cordyla	65229
Mene maculate	48708
Mugil cephalus	16
Nemipterus bipunctatus(N. delagoae)	36716
Nemipterus japonicas	180
Nemipterus randalli(Nemipterus mesoprion)	636
Nibea maculate	152
***Octopus* spp.**	127

Odontanthias rhodopeplus	1017
Odonus niger	15299
Ostichthys acanthorhinus	96
Otolithes ruber	4533
***Otolithes* spp.**	414
Oxyporhamphus micropterus	240
***Oxyporhamphus* spp.**	81
Panulirus homarus	47
Parascolopsis eriomma	192
Parupeneus heptacanthus (P. cinnabarinus)	22
Parupeneus indicus	22
Pelates quadrilineatus	65
***Pempheris* spp.**	128
Photopectoralis bindus (Leiognathus bindus)	832
Pinjalo pinjalo	287
Platax teira	187
Pomadasys furcatus	192
Pomadasys maculatus (P. maculatum)	485
Portunus pelagicus	136
Portunus sanguinolentus	1011
Priacanthus hamrur	12364
Pristipomoides filamentosus	19678
Pristipomoides typus	13447
Rachycentron canadum	960
Rastrelliger kanagurta	230593
Rhinobatos variegates	98
Sarda orientalis	2922
Sardinella fimbriata	4404
Sardinella gibbosa	104694
Sargocentron (Holocentrus) diadema (H. diadema)	3
Saurida tumbil	468
Saurida undosquamis	9655
Scolopsis bimaculata	155
Scolopsis vosmeri	16
Scomberoides commersonnianus	204
Scomberoides tala	84
Scomberoides tol	2078
Scomberomorus commerson	9996
Scomberomorus guttatus	5400
Secutor insidiator	2136

Selar crumenophthalmus	164750
Selaroides leptolepis	6089
Sepia aculeate	10
Sepia pharaonis	15574
Sillago sihama	137
Sphyraena barracuda	1305
Sphyraena forsteri	773
Sphyraena jello	652
Sphyraena obtusata	3209
Sphyraena putnamae	2287
***Sphyraena* spp.**	16
Stolephorus commersonnii	648
Stolephorus indicus	137
***Stolephorus* spp.**	678
Stolephorus waitei	1556
Strongylura strongylura	1092
Sufflamen frenatum(S. capistratus)	7215
Terapon jarbua	1201
Terapon puta	54
Thenus unimaculatus(t. orientalis)	163
Thunnus albacares	14505
***Torpedo* spp.**	89
Trachinocephalus myops	376
Trichiurus lepturus	40738
Turbinella(Xancus) pyrum(X. pyrum)	233
Upeneus sulphureus	457
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	35086
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	3533
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	8596
***Uroteuthis(Photololigo)(Loligo)* spp.**	24
Xiphias gladius	5280
TOTAL	**1782945**

Table. 10.4.1.b Fish species landed and its catch in March 2022 (Kg)

SPECIES	CATCH (Kg)
Ablennes hians	774
Acanthocybium solandri	622

***Aethaloperca* spp.**	1782
Acanthopagrus arabicus	135
Alectis ciliaris	33
Alectis indica	49
***Alectis* spp.**	20
Alepes djedaba	2828
Alutera monoceros	8165
Amblygaster sirm (Sardinella sirm)	2653
Amphioctopus marginatus	12
Aphareus rutilans	5265
Arius arius	1796
***Arius* spp.**	772
Atule mate(Alepes mate)	5566
Auxis rochei	189419
Auxis thazard	50504
***Caesio and Pterocaesio* spp.**	76
Canthidermis maculata	65
Carangoides coeruleopinnatus	1026
Carangoides hedlandensis	86
***Carangoides* spp.**	459
Caranx heberi (C. sem)	1164
Caranx ignobilis	26443
Caranx sexfasciatus	556
Carcharhinus leucas	5636
Cephalopholis argus	38
Cephalopholis miniata(C. miniatus)	506
Cephalopholis sonnerati	3958
Cephalopholis urodeta	7934
Chanos chanos	5
Charybdis feriatus (C. cruciata)	45
Charybdis natator	8
Coryphaena hippurus	16582
Cynoglossus macrolepidotus (C. arel)	48
***Cynoglossus* spp.**	248
Dasyatis microps	212
Decapterus macarellus	16770
Decapterus macrosoma	109672
Decapterus russelli(D. dayi)	142949
Drepane punctata	459
Echinorhinus brucus	2025

Elagatis bipinnulata	2131
Eleutheronema tetradactylum	27
Encrasicholina punctifer (Stolephorus punctifer)	9143
Epinephelus areolatus	82
Epinephelus bleekeri	116
Epinephelus chlorostigma	2111
Epinephelus diacanthus	2170
Epinephelus epistictus	2588
Epinephelus longispinis	2421
Epinephelus malabaricus	1847
Epinephelus ongus	486
***Epinephelus* spp.**	1936
Epinephelus undulosus	529
Erythrocles schlegelii	1547
Euthynnus affinis	240182
Exocoetus volitans	1181
Fistularia petimba (F. villosa)	2977
Gerres filamentosus	3124
***Gerres* spp.**	72
Gymnothorax fimbriatus	10665
Gymnura poecilura	740
Hemiramphus far	2490
Heteropriacanthus cruentatus (Priacanthus cruentatus)	3060
Hilsa kelee	32
Himantura imbricata(Amphotistius imbricatus)	3570
***Himantura* spp.**	203
Hyporhamphus affinis(Hemirhamphus archipelagicus)	310
Hyporthodus octafasciatus	394
Iniistius bimaculatus	49
Istiompax indica (Makaira indica)	2336
Istiophorus platypterus	6910
Kajikia audax (Tetrapterus audax)	1944
Katsuwonus pelamis	7801
***Leiognathus* spp.**	4160
Lepturacanthus savala	2573
Lethrinus lentjan	12403
Lethrinus nebulosus(L. choerorhynchus, L. fraenatus)	76
Lipocheilus carnolabrum	392

Lobotes surinamensis	20
Lutjanus fulvus(L. vaigiensis)	260
Lutjanus indicus	733
Lutjanus johnii	388
Lutjanus lutjanus(L. lineolatus)	3009
Lutjanus quinquelineatus	305
Lutjanus rivulatus	432
Lutjanus vitta	21
Maculabatis gerrardi (Himantura gerrardi)	135
Makaira nigricans	324
Manta birostris	3094
Megalaspis cordyla	32138
Megalops cyprinoides	31
Mene maculata	53971
Metapenaeus dobsoni	360
Monodactylus argenteus	11
Mugil cephalus	103
Nemipterus bipunctatus(N. delagoae)	18513
Nemipterus randalli(Nemipterus mesoprion)	1754
***Octopus* spp.**	81
Odontanthias rhodopeplus	226
Odonus niger	15923
Ostichthys acanthorhinus	101
Otolithes ruber	1260
Pampus argenteus	11
Parapercis alboguttata	15
***Parapercis* spp.**	16
Parascolopsis aspinosa	810
Parascolopsis eriomma	50
Parupeneus heptacanthus (P. cinnabarinus)	7
Pellona ditchela	2030
Pomadasys maculatus (P. maculatum)	76
Portunus pelagicus	552
Portunus sanguinolentus	585
Priacanthus hamrur	9613
Pristigenys refulgens	10
Pristipomoides filamentosus	8186
Pristipomoides multidens	1
Pristipomoides typus	22754
Rachycentron canadum	1679

Rastrelliger kanagurta	237498
Remora remora	63
Rhinobatos obtusus	258
***Rhinobatos* spp.**	310
Rhinobatos variegatus	72
Sarda orientalis	849
Sardinella fimbriata	6484
Sardinella gibbosa	53767
***Sargocentron (Holocentrus)* spp.**	810
Saurida tumbil	8
Saurida undosquamis	4069
Scolopsis bimaculata	349
Scomberoides commersonnianus	6492
Scomberoides tala	168
Scomberoides tol	1708
Scomberomorus commerson	3795
Secutor insidiator	759
Selar crumenophthalmus	181704
Selaroides leptolepis	91827
Sepia pharaonis	9691
Sphyraena barracuda	1613
Sphyraena forsteri	1063
Sphyraena jello	2814
Sphyraena obtusata	15098
Sphyraena putnamae	40
Stolephorus commersonnii	10915
Stolephorus indicus	22618
***Stolephorus* spp.**	7493
Stolephorus waitei	20667
Strongylura strongylura	165
Sufflamen frenatum(S. capistratus)	3895
Synodus indicus	45
Terapon jarbua	897
Thryssa mystax	32
Thunnus albacares	3912
Thunnus obesus	284
Trachinocephalus myops	90
Trachinotus blochii	11
Trichiurus lepturus	9823
Turbinella(Xancus) pyrum(X. pyrum)	180

Upeneus sulphureus	245
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	64056
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	6592
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	21428
***Uroteuthis(Photololigo)(Loligo)* spp.**	8122
Xiphias gladius	3186
TOTAL	**1927696**

Table. 10.4.1.c Fish species landed and its catch in April 2022 (Kg)

SPECIES	CATCH (kg)
Ablennes hians	1871
Acanthocybium solandri	2081
Acanthopagrus arabicus	271
Alectis indica	10
***Alectis* spp.**	108
Alepes djedaba	6695
Alepes kleinii (A. kalla) (A. para)	62
Alepes vari	598
Alutera monoceros	83
Amblygaster leiogaster(Sardinella leiogaster)	1040
Amblygaster sirm (Sardinella sirm)	17907
Atule mate(Alepes mate)	6248
Auxis rochei	124038
Auxis thazard	97987
***Caesio and Pterocaesio* spp.**	563
Carangoides hedlandensis	416
***Carangoides* spp.**	319
Caranx heberi (C. sem)	19134
Caranx ignobilis	6383
Caranx sexfasciatus	481
***Caranx* spp.**	130
Cephalopholis sonnerati	4204
Cephalopholis urodeta	1838
Chanos chanos	52

Charybdis feriatus (C. cruciata)	10
Chirocentrus dorab	2
Cookeolus japonicus	39
Coryphaena hippurus	10887
Decapterus kurroides	520
Decapterus macarellus	12133
Decapterus macrosoma	6333
Decapterus russelli(D. dayi)	147962
Dipterygonotus balteatus (D. leucogrammicus)	765
Elagatis bipinnulata	1092
Encrasicholina punctifer (Stolephorus punctifer)	32709
***Encrasicholina* spp.**	8570
Epinephelus areolatus	410
Epinephelus bleekeri	676
Epinephelus chlorostigma	1049
Epinephelus diacanthus	1421
Epinephelus epistictus	2340
Epinephelus longispinis	39
Epinephelus malabaricus	1087
Epinephelus ongus	2158
***Epinephelus* spp.**	145
Erythrocles schlegelii	3078
Euthynnus affinis	161092
Exocoetus volitans	1530
Fistularia petimba (F. villosa)	2239
Gerres filamentosus	2733
***Gerres* spp.**	338
Gnathanodon speciosus	378
Heteropriacanthus cruentatus (Priacanthus cruentatus)	139
Himantura imbricata(Amphotistius imbricatus)	3531
Hyporhamphus xanthopterus	243
Iniistius bimaculatus	154
Istiompax indica (Makaira indica)	2427
Istiophorus platypterus	4534
***Istiophorus* spp.**	2600
Kajikia audax (Tetrapterus audax)	1213
Katsuwonus pelamis	24917
Lagocephalus inermis	4
***Leiognathus* spp.**	4310
Lethrinus lentjan	2305

Lipocheilus carnolabrum	992
***Lobotes* spp.**	354
Lobotes surinamensis	198
Lutjanus argentimaculatus	1135
Lutjanus fulvus(L. vaigiensis)	31
Lutjanus johnii	1803
Lutjanus lutjanus(L. lineolatus)	2293
Lutjanus quinquelineatus	40
Lutjanus rivulatus	234
Lutjanus russelli	100
***Lutjanus* spp.**	52
Lutjanus vitta	38
Maculabatis gerrardi (Himantura gerrardi)	35
Makaira nigricans	4862
Manta birostris	4102
Megalaspis cordyla	10330
Megalops cyprinoides	145
Mene maculata	80497
Mugil cephalus	330
Nemipterus bipunctatus(N. delagoae)	38392
Nemipterus randalli(Nemipterus mesoprion)	578
***Nemipterus* spp.**	624
Neotrygon kuhlii (Dasyatis kuhlii)	9
Nibea maculata	26
Odontanthias rhodopeplus	3
Odonus niger	3898
Otolithes ruber	12696
Parapercis alboguttata	52
Parascolopsis eriomma	187
Parupeneus heptacanthus (P. cinnabarinus)	73
***Pempheris* spp.**	450
Photopectoralis bindus (Leiognathus bindus)	400
Portunus pelagicus	37
Portunus sanguinolentus	17
Priacanthus hamrur	5178
Pristipomoides filamentosus	5886
Pristipomoides typus	1040
Rachycentron canadum	1426
Rastrelliger kanagurta	237301
Sardinella fimbriata	8328

Sardinella gibbosa	369970
***Sardinella* spp.**	3784
Sargocentron (Holocentrus) rubrum (H. ruber)	259
Saurida tumbil	379
Saurida undosquamis	3287
Scoliodon laticaudus	255
Scolopsis bimaculata	94
Scolopsis vosmeri	13
Scomberoides commersonnianus	7310
Scomberoides tala	26
Scomberoides tol	26
Scomberomorus commerson	6504
Selar crumenophthalmus	79837
Selaroides leptolepis	25879
Sepia pharaonis	3622
Seriolina nigrofasciata	67
Siganus canaliculatus(S. oramin)	67
Sphyraena barracuda	952
Sphyraena forsteri	2579
Sphyraena jello	1330
Sphyraena obtusata	8658
Sphyraena putnamae	879
Stolephorus commersonnii	11132
Stolephorus indicus	57735
***Stolephorus* spp.**	8645
Stolephorus waitei	12860
Strongylura strongylura	607
Sufflamen frenatum(S. capistratus)	3630
***Thryssa* spp.**	78
Thunnus albacares	4014
Trachinocephalus myops	599
Trachinotus blochii	52
Trichiurus lepturus	2274
Upeneus sulphureus	139
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	29062
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	4898
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	4521
***Uroteuthis(Photololigo)(Loligo)* spp.**	8376
Xiphias gladius	6665

TOTAL	1835867

Table. 10.4.1.d Fish species landed and its catch in May 2022 (Kg)

SPECIES	CATCH (kg)
Ablennes hians	2637
Acanthocybium solandri	752
Alectis ciliaris	662
Alepes djedaba	8898
Alepes kleinii (A. kalla) (A. para)	333
Alepes melanoptera (A. melanopterus)	654
***Alepes* spp.**	26
Alutera monoceros	18
Amblygaster sirm (Sardinella sirm)	541
Atule mate(Alepes mate)	6034
Auxis rochei	255170
Auxis thazard	152560
Caranx heberi (C. sem)	21574
Caranx ignobilis	1006
Cephalopholis formosa	21
Cephalopholis sonnerati	2353
Cephalopholis urodeta	2113
Chanos chanos	17
Charybdis feriatus (C. cruciata)	62
Coryphaena hippurus	8866
Dagetichthys commersonnii(Synaptura commersonnii)	152
Decapterus russelli(D. dayi)	3019
Diagramma picta	36
Dipterygonotus balteatus (D. leucogrammicus)	155
Dussumieria acuta	10
Elagatis bipinnulata	911
Encrasicholina punctifer (Stolephorus punctifer)	23021
***Encrasicholina* spp.**	8766
Epinephelus areolatus	659
Epinephelus bleekeri	87
Epinephelus chlorostigma	62
Epinephelus diacanthus	1057

Epinephelus longispinis	156
Epinephelus malabaricus	42
***Epinephelus* spp.**	436
Erythrocles schlegelii	4171
Euthynnus affinis	136449
Fistularia petimba (F. villosa)	1857
Gazza minuta	2
Gerres filamentosus	149
***Himantura* spp.**	1033
Iniistius bimaculatus	222
Istiophorus platypterus	2042
Jellyfish	117
***Johnius* spp.**	1418
Kathala axillaris	4862
Katsuwonus pelamis	1517
Lactarius lactarius	8121
Leiognathus brevirostris	63
***Leiognathus* spp.**	7255
Lethrinus lentjan	3467
Lethrinus nebulosus(L. choerorhynchus, L. fraenatus)	104
Lipocheilus carnolabrum	7
Lutjanus argentimaculatus	338
Lutjanus bohar	124
Lutjanus indicus	52
Lutjanus johnii	10
Lutjanus lutjanus(L. lineolatus)	8800
Lutjanus rivulatus	21
Manta birostris	16420
Megalaspis cordyla	16804
Megalops cyprinoides	121
Mene maculata	92321
Monodactylus argenteus	44
Mugil cephalus	69
Nemipterus bipunctatus(N. delagoae)	58670
Nemipterus japonicus	28
Nemipterus randalli(Nemipterus mesoprion)	1108
***Nemipterus* spp.**	87
Nibea maculata	2750
Odonus niger	4576
Opisthopterus tardoore	258

Otolithes cuvieri	20
Otolithes ruber	7345
***Otolithes* spp.**	29
Pampus argenteus	13
Parapercis alboguttata	34
Pellona ditchela	20
***Pempheris* spp.**	134
Penaeus indicus	3589
Penaeus monodon	390
Pinjalo pinjalo	468
Plotosus lineatus (P. anguillaris)	14
Pomadasys maculatus (P. maculatum)	607
Portunus sanguinolentus	13
Priacanthus hamrur	834
Pristipomoides filamentosus	163
Rachycentron canadum	8625
Rastrelliger kanagurta	171254
Sarda orientalis	4661
Sardinella fimbriata	2486
Sardinella gibbosa	93341
Sardinella longiceps	49677
***Sardinella* spp.**	277
Saurida tumbil	366
Saurida undosquamis	9517
Scoliodon laticaudus	878
Scolopsis bimaculata	390
Scolopsis vosmeri	52
Scomberoides commersonnianus	346
Scomberoides lysan	72
Scomberoides tol	887
Scomberomorus commerson	5344
Secutor insidiator	1546
Selar crumenophthalmus	28652
Selaroides leptolepis	878
Sepia pharaonis	7002
Sphyraena forsteri	2281
Sphyraena jello	620
Sphyraena obtusata	9781
Sphyraena putnamae	248
***Sphyraena* spp.**	176

Stolephorus commersonnii	21999
Stolephorus indicus	4793
***Stolephorus* spp.**	9955
Stolephorus waitei	92275
Sufflamen frenatum(S. capistratus)	1665
Synodus indicus	104
Terapon jarbua	1719
Thryssa mystax	23
***Thryssa* spp.**	872
Thunnus albacares	737
***Torpedo* spp.**	10
Trachinocephalus myops	669
Trichiurus lepturus	982
Tylosurus crocodilus (Strongylura crocodilus)	1788
Upeneus sulphureus	8295
Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)	549
Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)	1953
Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)	3269
***Uroteuthis(Photololigo)(Loligo)* spp.**	55
Xiphias gladius	1950
TOTAL	**1445015**

10.4.2 EXPERIMENTAL FISHING IN PRE-MONSOON SEASON

JIGGS SAMPLING

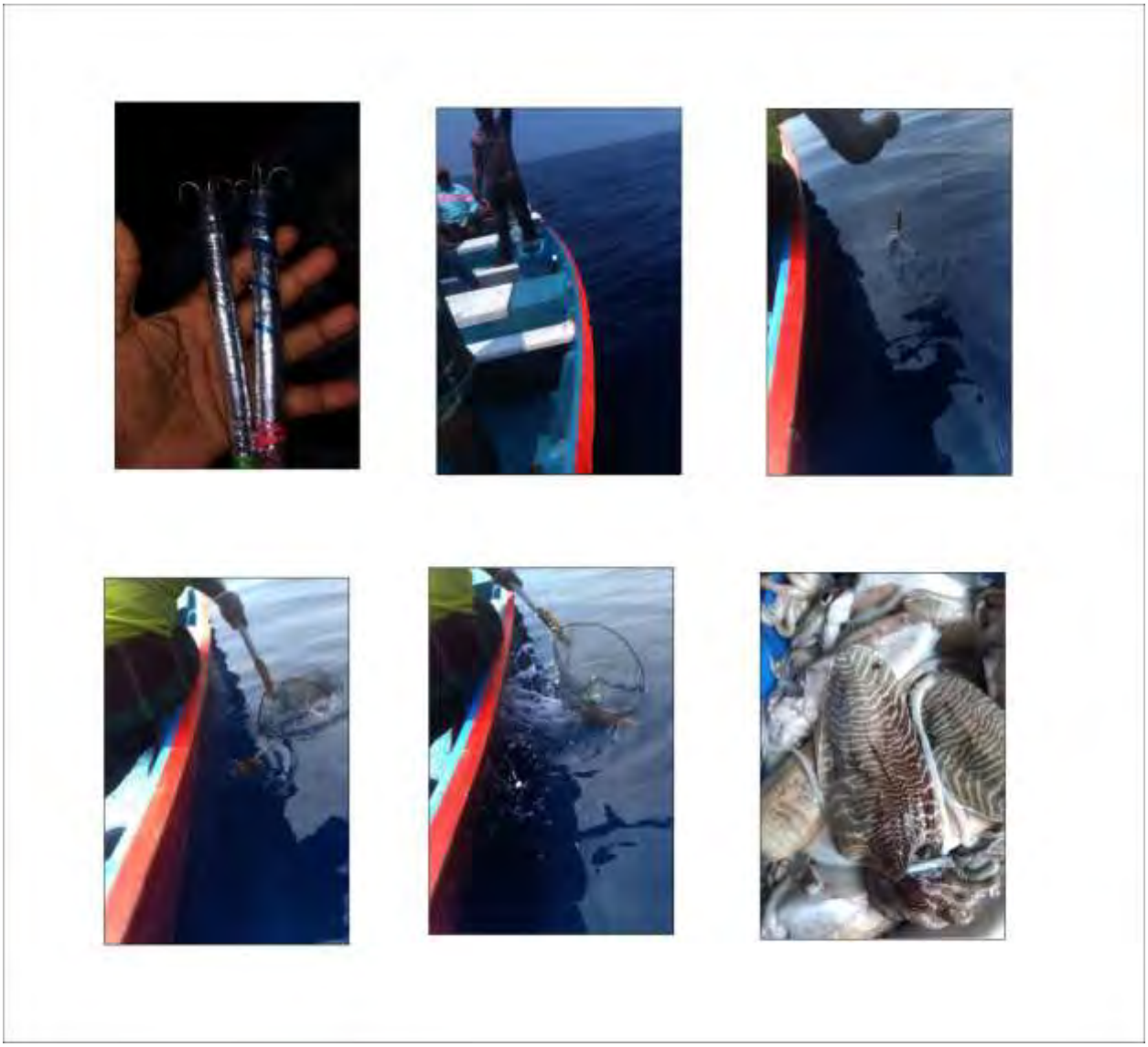


Plate 10.4.2.a Photograph showing the experimental fishing using Jiggs during Pre-monsoon season

Table 10.4.2.a Gear details of Jiggs

Gear	Jiggs
Date	10th March 2022
Craft	Outboard fiberglass
Horse Power	9.9 hp
Direction	West
Departure	4.35 am
Arrival	2.50 pm
No: Hauls	50
Distance	11 NM
Depth	33 m

Table 10.4.2.b Species details of jiggs samplig

Species	Total Sample Weight (kg)	Length Range (Cm)
Sepia pharonis	23	**25-65**

HOOK & LINESAMPLING

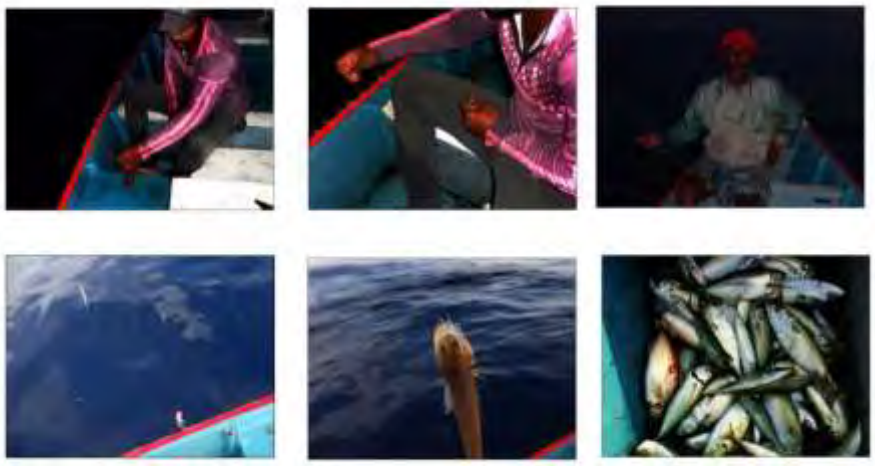


Plate 10.4.2.b Photograph showing the experimental fishing using Hook &Line during Pre-monsoon season

Table 10.4.2.c Gear details of Hook & Line

Gear	Hook & Line
Date	5th February 2022
Craft	Outboard fiberglass
Horse Power	9.9 hp
Direction	Northwest
Departure	4.15 am
Arrival	2.00pm
No: Hauls	40
Distance	10 NM
Depth	45 m

Table 10.4.2.d Species details of Hook&Line sampling

Species	Total Sample Weight (kg)	Length Range (Cm)
Saurida undosquimis	5	19-27
Rastrelliger kanagurta	7	20-27
Selar crumenophthalmus	12	19-26
Fistularia petimba	3	45-58
Atule mate	2	14-18

DRIFT GILLNET SAMPLING

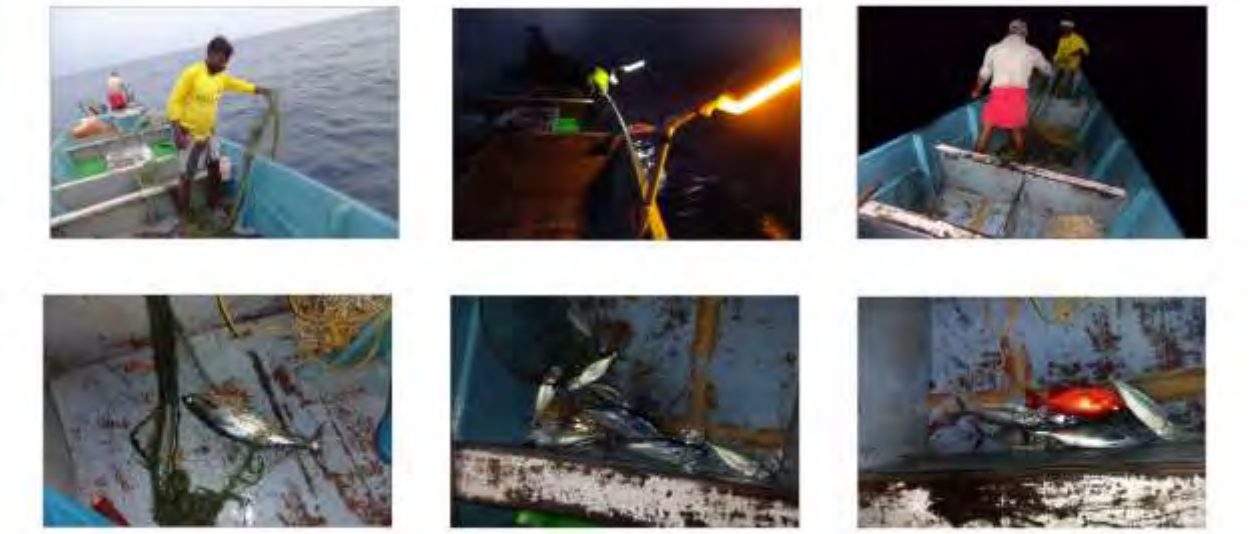


Plate 10.4.2.c. Photograph showing the experimental fishing using Driftgillnet during Pre-monsoon season

Table 10.4.2.e. Gear details of Driftgillnet

Gear	Drift gillnet
Date	11th January 2022
Craft	Outboard fiberglass
Horse Power	9.9+25 hp
Direction	North west
Departure	3.00 pm
Arrival	4.25 am
No: Hauls	1
Distance	33 NM
Depth	69 m

Table 10.4.2.f Species details of Driftgillnet sampling

Species	Total Sample Weight (Kg)	Length Range (Cm)
Auxis thazard	6	26-45
Euthynnus affinis	18	29-47
Scomberomorous tol	2	25-28
Rastrelliger kanagurta	15	19-27.2
Priacanthus hamrur	2	25.3 – 27.9

SHORE SEINE SAMPLING

Plate 10.4.2.d Photograph showing the experimental fishing using Shoreseine during Pre-monsoon season

Table 10.4.2.g Gear details of Shoreseine

Gear	Shoreseine
Date	03 February 2022
Craft	Outboard fiberglass
Horse Power	9.9+9.9 hp
Direction	West
Departure	6.15 am
Arrival	8.00 am
No: Hauls	1
Distance	1.5 NM
Depth	12 m

Table 10.4.2.h Species details of shoreseine sampling

Species	Total Sample Weight (Kg)	Length Range (Cm)
Sardinella gibbosa	110	7.5-14
Stolephorous sp.	7	9-12
Rastrelliger Kanagurta	2	23-25.5

10.5 FISHING METHODS

Trivandrum coast is one of the major traditional fishing zones of Kerala where, Vizhinjam Landing Centre (8º 22' 30" N, 76º 59' 15" E), is one of the important fish landing centres in Thiruvananthapuram and fish landings occur all over the year by employing crafts and gears according to the seasonal requirements and availability of fishes. Fishing is carried out by traditional crafts and gears, fitted with outboard engines, vessels fitted with inboard engines and other modern gears are not able to operate along the coast due to the patchy rocks and steep sloping continental shelf of this region. During the last decade, there was a complete transition from wooden crafts to fibre boats which made crafts lighter and enabled an increase in the speeds of the fishing vessels. Most of the traditional crafts along the coast ranged from 25 to 40 feet overall length (OAL). Two outboard engines with 9.9 HP each are used for propulsion. Drift gillnet forms the major gear in fishing operations along the coast, followed by mechanized hooks and line and boat seines. The details of some of the artisanal gears collected during the data collection programme are given below;

Boat seine (Thattu madi)

This gear is made up of four net pieces, known as ara vala, kuralu madi, thelinga madi, and ka vala made of nylon and has three parts, (i) a short wide-mouthed conical bag called the madi or net proper made of nylon, (ii) a platform known as thattu attached to the lower part of the gear (iii) two long wings attached to the margin of the thattu on either side known as era vala. Each wing or era vala measures 150 m in length with 40 meshes breadth, each measuring 1.5 m from one knot to the nearest knot. The distal extremity of the wings on either side is also attached with two nylon ropes known as Kamba. Two catamarans or fibreglass coated plywood boats are employed for operating this gear. The gear is loaded in one catamaran/boat and venture into the sea along with the other catamaran/boats. When a fish shoal is sighted, the net is shot and one of the warps is handed over to the crew in the other catamaran/ boat. The two boats move apart and encircle the shoal in the direction opposite to the movement of the shoal. Later on, two boats come close, hauls the net simultaneously and unload the fishes from the bag portion of the net into one boat. The fishermen continue fishing operations if catches are satisfactory. The fishing season is June to October. The fishes caught in this gear are carangids, ribbonfishes, catfishes, clupeids, sciaenids, pomfrets, *Sphyraena* spp., *Sillago sihama,* balistids,

Priacanthus spp.etc. Along the Vizhinjam coast the main gear used for squid during monsoon season (July-November) is boat seine. The motorized FRP boats fitted with outboard engines of fishers from Anjuthengu to Kollamkodu concentrate on fishing at Vizhinjam. Boat seines operated 3 to 10 km from the shore within 20 to 35 m depth. Boat seines are also operated from two catamarans of 5 m size comprising six fishermen who row the same with oars. This type of fishing is carried out from Vizhinjam to Poonthura or Vizhinjam to Pulluvila, up to 18 fathoms and about 3 km from shore. Squids, anchovies, sardines, prawns, carangids, tuna, sciaenids, *Nemipterus* spp., *Lactarius lactarius*, pomfrets and mullets are caught in this gear.

Plate 10.5.1. Boat seine catch and its operation

Plate.10.5.2. Boat siene fishing using lights and its catch

Gillnets

Gillnets are the most common gear operated along the Thiruvananthapuram coast from time immemorial. Different modifications can be made possible in the gillnet ing on resource availability. The various modified gillnets are;

Monofilament gill net (Roll vala, Kangoose vala): The size of the gear is 100 to 120 m in length with 15 m breadth having 62 mm mesh size. Head rope is of 3 mm thickness with small floats attached at every 3.5 m length and for every float a stone sinker of 150 g is attached. In addition to the small floats at every tenth float 5litre, empty oil can or large spherical-shaped float is also attached. (Fig Fig 10.5.1.). A total of 30 spherical floats are used in each gill net. From May to September, when the sea becomes turbid fishers adjust the float line to 3 m, and during October to April and during the full moon phase, 15 m float lines are used and again during the new moon phase the float lines are reduced to 7 to 8 m length. This gear is mainly

employed for catching tunas and mackerel. The float line is attached with 150 numbers of 3-inch floats arranged at intervals of 2 m and small stone sinkers corresponding to each float tied to the foot rope of the gear. The end of the net has a floating line of 45 m on which 2 five-litre empty cans functions asfloats and the foot rope bears a four kg stone sinker. The gear is preferred due to its light weight and low visibility during daytime.

Fig 10.5.1 Ayala vala

Fig.10.5.2 Netholi vala

Fig.10.5.3 Chala vala

Fig.10. 5.4 Chala vala catch

Idakettuvala

Idakettuvala is a modification of gillnet, usually with a length of 1000-1500 m and breadth of 3.25 m. The mesh size of the net is 45 mm. Head rope is of 3 mm thickness with small floats attached at every 3.5 m length. A total of 300-350 floats are used in the net, with every float, a stone sinker of 150 g is attached. Stone as well as lead sinkers are used in the net. Lead sinkers are tied at every 40-45 cm interval and they are tied with the foot rope. Two empty cans are attached with the main line at both ends to identify the gear in the sea and taking up of the gear. The gear is opearating in the morning hours. Outboard plywood or Outboard fiberglass crafts are used for fishing. Catches include *Nemipterus* spp., Croackers , crabs and many juvenile fishes.

Fig.10.5.5. Idakettuvala

Fig.10.5.6. Detangiling of Idakettuvala

Drift gill net (Valiya vala, Ozhukku vala):

These gears operated throughout the year have a 9 m breadth with 100 mm mesh size. On the 4 mm thickness float line, 120 mm-sized floats are attached at an interval of 2.5 m. After every 15 small floats, one five-litre empty oil can is used as floats and one kg stone sinkers tied at both ends of the gear. Thirty-two-foot boats for single-day fishing operation within 5 to 25 NM and 40-footer fishing boats with fish hold for multiday fishing of 5 to7 days are seen. These boats usually operate beyond 50 to 60 NMwith a manpower of four fishermen. For multi-day fishing, 15 to 30 blocks of ice are generally required to preserve the catches. From November to March, fishing is conducted up to 50 to 60 NM and during June to September, fishing is confined to 5 to 25 NM. The area of fishing operation is from Kanyakumari to Varkala, with operations that start at 2 pm and the boats reach the fishing ground by 5 to 6 pm. After shooting the gear, it is hauled in after 5 hours and large tunas, seer fish, sharks etc. are caught.

Fig.10. 5.7 Drift gillnet

Bottom set gill net (Thathuvala):

This gear has 3 m breadth and is made up of 62 mm mesh size monofilaments. Float line is made of 3 mm thickness rope and every three-meters a small float is attached. Two-foot ropes of 1.5 mm thickness are used for attaching small lead sinkers (20 g) at 40 cm interval and the second rope is used for attaching the net. This gear is operated up to 3 nautical miles from the shore and usually operates within 1 to 1.5 nautical miles from the shore. Three to eight fishermen will be involved in fishing from a boat. In this gear, the disentangling of the fish caught is highly time-consuming and labor-intensive. Catches include flatfishes, crabs, prawns, croakers, skates, rays and chanks. This gear is operated from 5 to 9 am.

Plate. 10.5.3. Bottom set gillnet

Trammel Net (Disco Vala/Konchu vala):

This gear is made up of three layered netting approximately 300 m in length. The mesh size of the inner net is 48 to 50 mm and the outer two layers of netting are 100 to 120 mm. Head and foot ropes are of 2 mm thickness. The breadth of the gear is 2 fathoms. The float line measures 30 fathoms. At both ends of the gear, three numbers of 5-litre empty oil cans were tied as floats. Besides, sinkers weighing 3 kg were also attached at the end of the foot rope. At every 40 cm of the foot rope, a lead sinker of 50 g size, and every three meters of a head rope, a small float was also attached. The gear is characterized by two head ropes and two two-foot ropes, that is, head ropes for attaching the three layers of netting and also for attaching 100 floats and the foot rope for attaching sinkers respectively. A single trammel net unit requires 3.6 kg (3 pieces of 1.2 kg) netting. Trammel nets were operated from 6 am to 7 pm. Usually, 4 to 7 fishermen go for this fishing in a single boat and gear is hauled every 30 minutes.

Fig .10.5.8 Trammel net used to catch shrimp

Hook and line fishing

Hand line (Aachil) is characterized by the main line of nylon monofilament twines ranging from 15 to 20 m with many branch lines tied at intervals of 1.5 m on the mainline and hooks at their distal end (Plate 10.5.4). At the end of the main line, 0.5 kg iron sinker is attached. The 15 m longlines are used during the night, and the 7 m longline during the daytime. The monofilament twines are categorized as numbers 40, 60, 80 etc. based on their thickness; with the smaller the number, the thicker the twine. For day fishing, number 80 main lines with number 60 branch line are used, while for night fishing, number 30 is used for both main and branch lines. Similarly, different types of hooks categorized into numbers are used. Hooks used for day fishing range from number 8 to 13, while hook number 15 is used for night fishing. The hand lines are operated from 28-foot fiberglass coated plywood boats (FPB) fitted with 9.9 HP outboard (usually two) engines. Three to four fishermen go fishing, and each of them operates a hand line. Fuel consumptionwas estimated at about 7 litres per hour with

consumption of about 10 litres of kerosene. Apart from FRP boats, catamarans are also employed for the hand-line operations.

Plate 10.5.4. Hand lines

Hand lines with jigs for squid and cuttlefish are made up of monofilament twines number 80 (mainline) with 28 fathoms length with in 1 m of number 60 branch attached. Six to ten branch lines with jigs (Plate.10.5.5) are tied at an interval of 1 to 1.5 m along the main line. Motorized fibre reinforced plastic (FRP) boats fitted with outboard engines with manpower of 6 to 7 are employed in jigging operations. A jig-like device made of a long thin steel rod attached with four hooks is used for capturing cuttlefishes and the crab is tied to the middle of the rod as bait. Spindle-shaped lead weight covered using glittery ribbon with attached hooks was also used. Once the cuttlefish get entangled in the hook, the lines are lifted to collect the catch. Hand jigging is employed both day and night. Occasionally a few catamarans are also employed for squid fishing which is again carried out during day and night. The peak season for the operation of handlines is during October -November period. Several units of FADs (Fish Aggregating devices) are placed within 15 to 30 m depths by the local fishermen which are located using GPS at regular intervals. The fishing is conducted in areas ranging from 5 to 15 km from the shore, mainly concentrated along Poovar to Varkala coastline. Fishing for cuttlefish using FADs is carried out only during the daytime.

Plate.10.5.5. Squid jigs and its catch

Long line fishing

Traditional long line (Choora Mattu/ Ayiram choonda) is mainly used for catching tunas. November to March is the peak longline fishing season along this coast which is operated for tunas, cobia, groupers and snappers. Mainline of number 80 monofilament nylon twine five nautical miles in length with 3 m branch line of twine numbers 60 to 70 attached with hooks are employed (Plate 10.5.6). The distance between each hook is 10 m and at the end of every 50th hook, a float (5-litre empty oil) is tied using 1.5 mm thick rope of 75 m length and a sinker (300 g) tied with 15 cm rope. 20 floats are used for every 1000 hooks. The hook number 9 is used for tuna, 8 for cobia and 6 and 7 for groupers. The area of operation is from 15 to 25 nautical miles (NM) from shore having depths of 48 to 72 fathoms. These crafts usually venture into the sea by 2 am to reach the fishing ground by 5 am, and shooting the lines takes one hour. The hauling of the gear starts after 6.00 am. Sardines stored in ice boxes are used as baits. Reef long line (Paruamatu): This long line is used mainly for catching Pristipomoides spp., rock cod, carangids, skates, cobia etc. The main line is made up of the number 120 monofilament twine

of 4 NM length with 1.5 m branch lines made up of number 80 monofilaments attached with hook number 9. The distance/length between each hook is 5 m and for every 100 hooks, a floating line is tied using 1.5 mm thickness rope of 125 m length and two 5 litre empty oil cans are tied to the float line for floatation besides a sinker (300 g) tied with 15 cm rope. The total number of floats used is about 20 for a long line with 300 hooks (Fig.6). The depth of operation is 55, 65, 75 and 110 fathoms at a distance of 30-110 NM from shore.

Shark long line (Shravu mattu):

In this long line billfishes, sailfish, sharks, yellowfin tuna and rays are caught using either variety of live coastal tunas or mackerel as bait. The main line is made up of Number 140 monofilament nylon twine with 25 to 90 m branch lines made up of number 110 monofilaments attached with 1 foot long thin silver wire-rope made of 20 strands connected using a swivel, to which hook Number 2 or 3 is attached at their distal end. The distance/length between each hook is measured at 50 m with a total of 100 hooks.

Plate 10.5.6. Longliners used to catch Tuna, shark, Seerfishes and big carangids (a)

Plate 10.5.7. Longliners used to catch Tuna, shark, Seerfishes and big carangids (b)

Shore seines (Karamadi)

The Shore-seines are operated from the sea shore and are locally known as Kara madi, indicating fishing operation from the shore. A shore-seine has three parts, the warps or kamba, the wings or kayaru and madi the funnel-shaped bag net. Ara vala forms the bottom portion of the gear, constituting the bag, which measures 20 m in length with a mesh size of 6 mm. The cod end of the gear is 5 m in breadth. Mel madi or Neriya vala part of gear is attached to the anterior margin of the ara vala, which is 15 m in length with 20 mm mesh size on Ara valaside, and 30 mm mesh size towards the mouth of the gear. The wings or Kayaru is made of nylon, ranged from 600 m to 900 m and are attached along the lateral margins of the mel madi with mesh size increasing from the proximal to the distal extremity. The warp or Kamba is made of split nylon fibre rope, measuring 200m to 250 m length and is attached to the wings. Mode of operation: This gear is operated by canoes or fiberglass boats of 28 to 36 feet. The gear is loaded into the vessel and before leaving the shore one of the warps is handed over to a group of fishermen on shore. The vessel then makes a semi-circular course while shooting the net and as soon as the vessel reaches the shore, the remaining warp is handed over to the second group of fishermen. The two groups comprising 20 to 40 numbers of fishermen on the shore haul the net simultaneously. Meanwhile three or four fishermen jump into the area along the sea enclosed by the warps and beats/splash the waves to scare the fishes, forcing them to enter in the gear. As the hauling progresses, the groups of fishermen on the shore come closer and gear is dragged ashore. The fishing season is from October to May. Shore seine operations are mostly conducted after sighting a shoal in the near shore waters. The catch usually comprises inshore pelagic fishes and shrimps such as anchovies, silver bellies, carangids, sardines, mullets, mackerel, *Saurida* sp., squids, *Acetes* spp. etc.

Plate.10.5.8. Shore seine operation and its catch

10.6 SEASONAL VARIATIONS IN FISH CATCH AND FISHING OPERATIONS

Fisheries are one of the significant communities owing to its ecological, recreational, economic and aesthetic roles. The productivity of water determines the health of the water body in terms of the abundance and health of fishes occupying all the trophic levels. Fishes are relatively sensitive to most habitat disturbances, fishes may try to avoid stressful ecosystems, so the availability of fishes varies from season to season. Data collected during the present study was tabulated to analyze the seasonal difference in fish catch and population and also the different fishing operations that existed in the area. We tried to collect the geo coordinates to understand the different fishing locations during different seasons. The overall picture of the fishing operations during different seasons are given in Figure.10.6.1

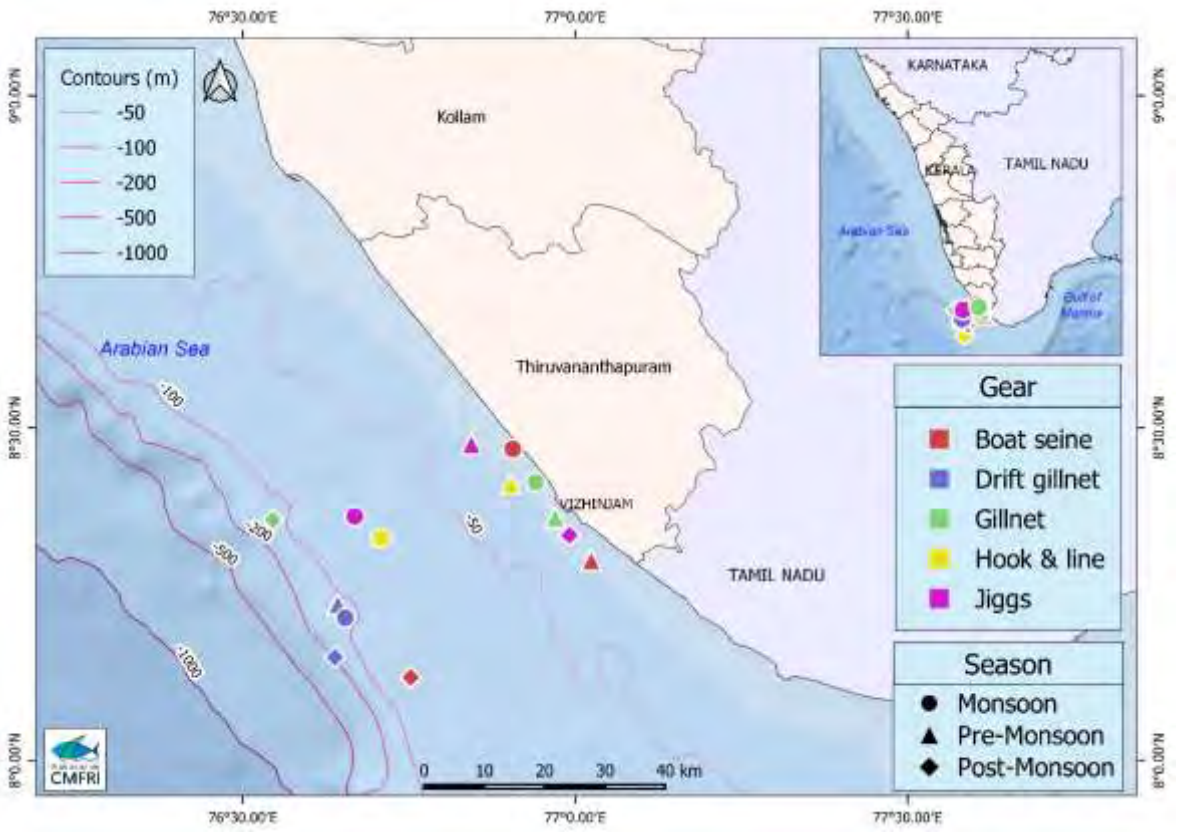


Fig.10.6.1 Fishing locations by different gears during different seasons

The fish catch, the number of fishing units (efforts), Catch Per Unit Effort, and average CPUE during different seasons, zone wise is given in Fig.10.6.2, Fig.10.6.3 and Fig.10.6.4

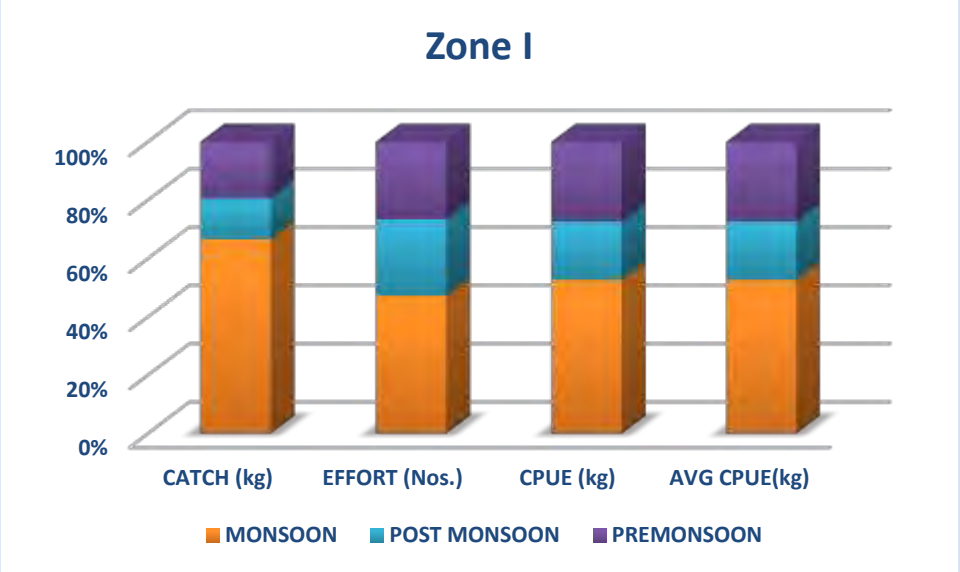


Fig.10.6.2 Graph shows the Fish catch, No. of efforts, CPUE and Average CPUE during monsoon season from Zone I

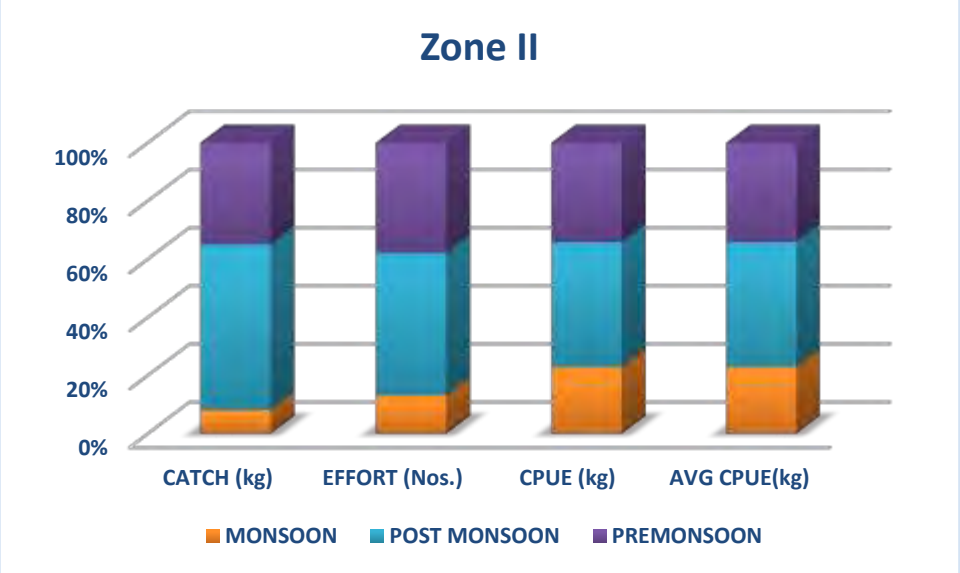


Fig.10.6.3 Graph shows the Fish catch, No. of efforts, CPUE and Average CPUE during monsoon season from Zone II

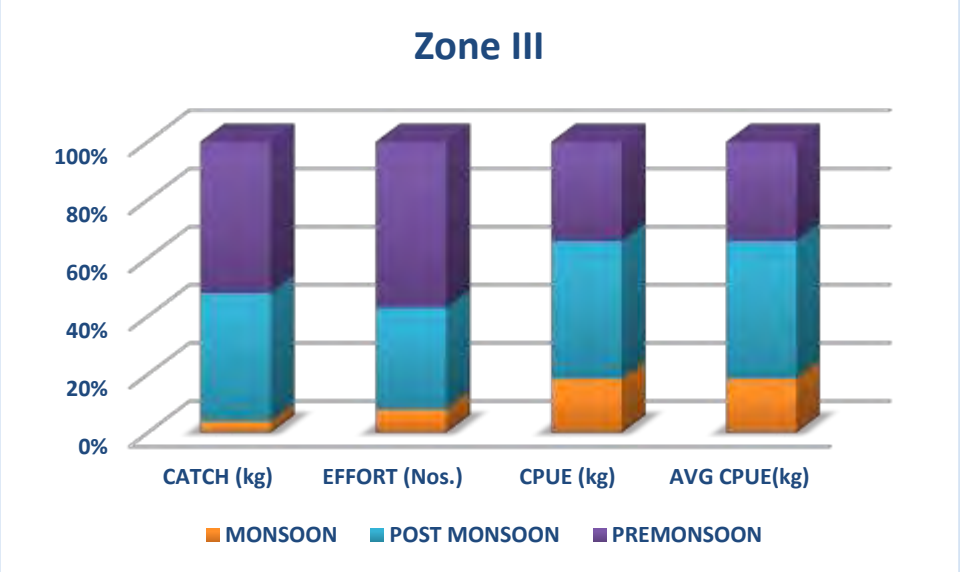


Fig.10.6.4 Graph shows the Fish catch, No. of efforts, CPUE and Average CPUE during monsoon season from Zone III

The total fish catch and average fish catch reported during June 2021- May 2022 during different seasons from different zones are represented in Fig.10.6.5 and Fig.10.6.6

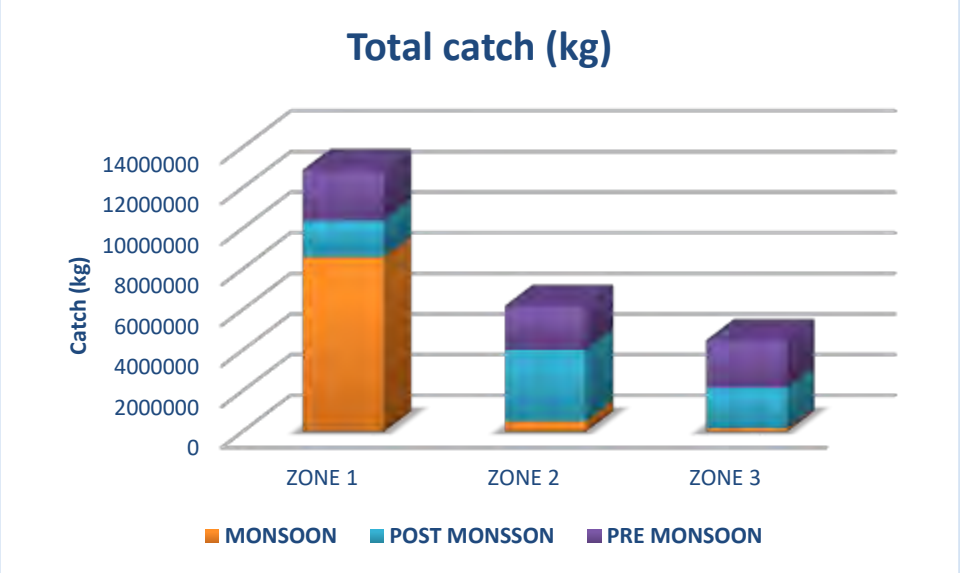


Fig.10.6.5 Total fish catch, season wise-zone wise

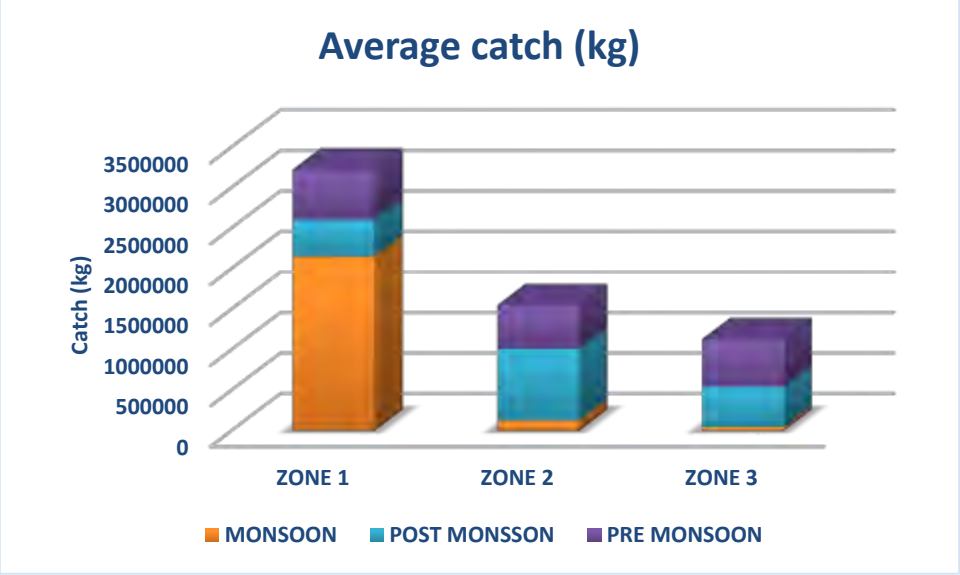


Fig.10.6.6 Average fish catch, season wise-zone wise

10.7 COMPARISON OF PRESENT FISH CATCH DATA WITH THE BASELINE INFORMATION COLLECTED DURING 2011-12

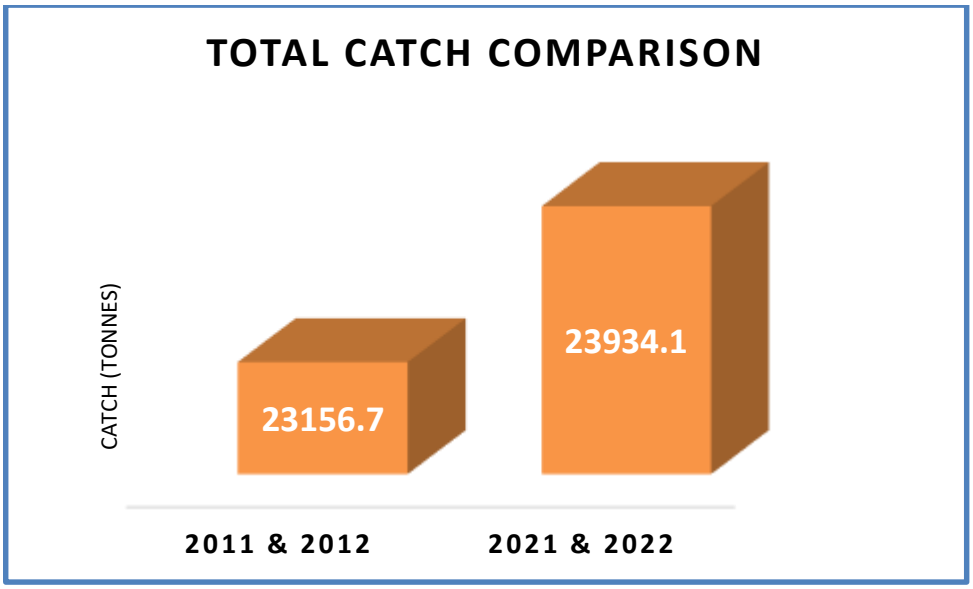
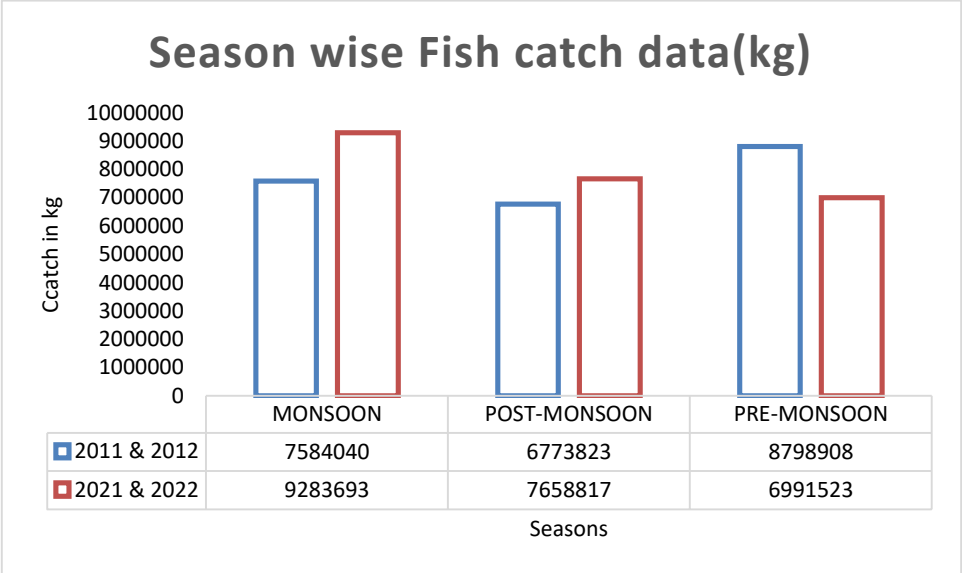


Fig.10.7.1. Fish catch data 2011-12 & 2021-22



10.7.2. Season wise Fish catch data (kg)

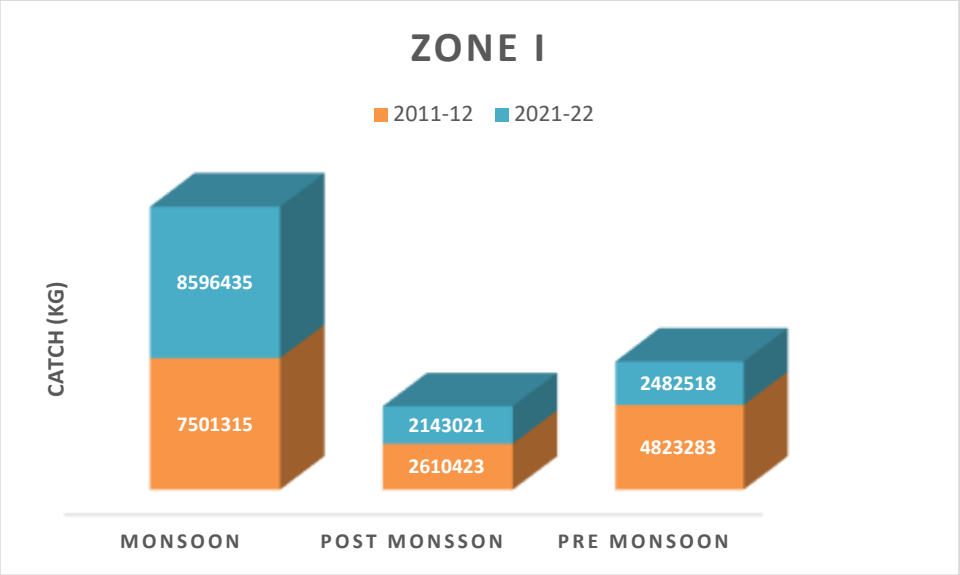


Fig.10.7.3. Season wise fish catch data in Zone I during2011-12 & 2021-22

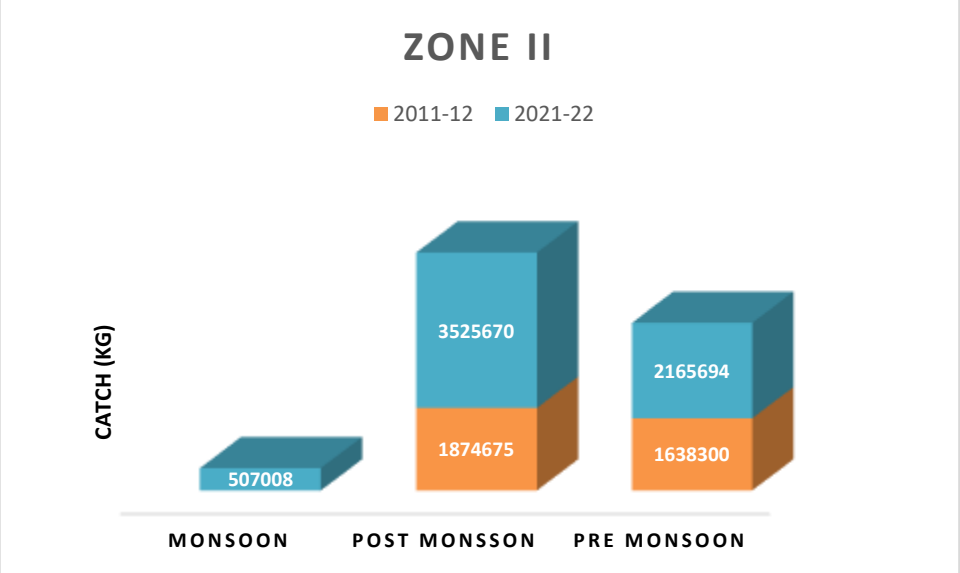


Fig.10.7.4 Season wise fish catch data in Zone II during2011-12 & 2021-22

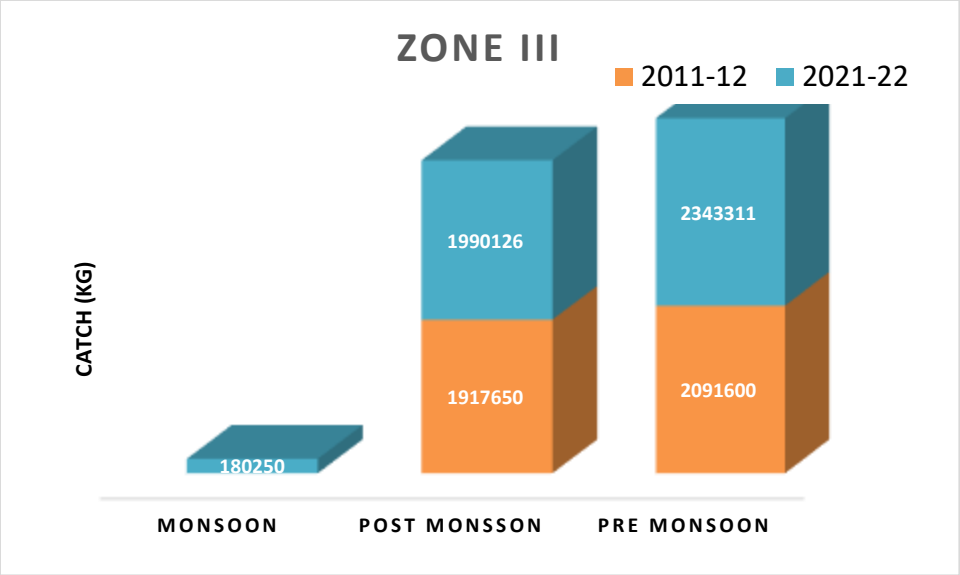


Fig.10.7.5. Season wise fish catch data in Zone III during 2011-12 & 2021-22

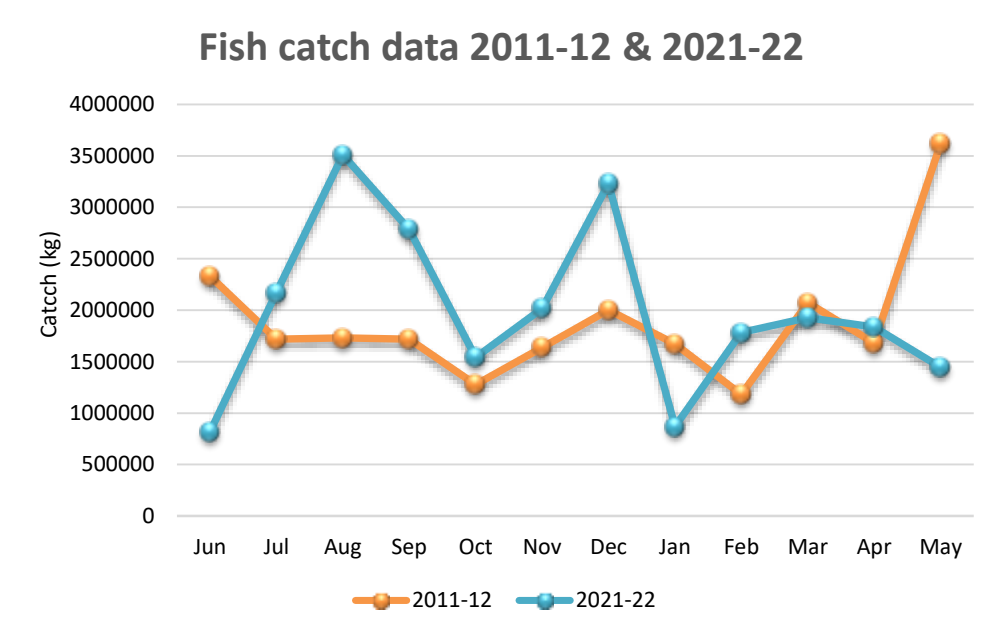


Fig.10.7.6. Comparison of month wise Fish catch data 2011-12 & 2021-22

2011-2012

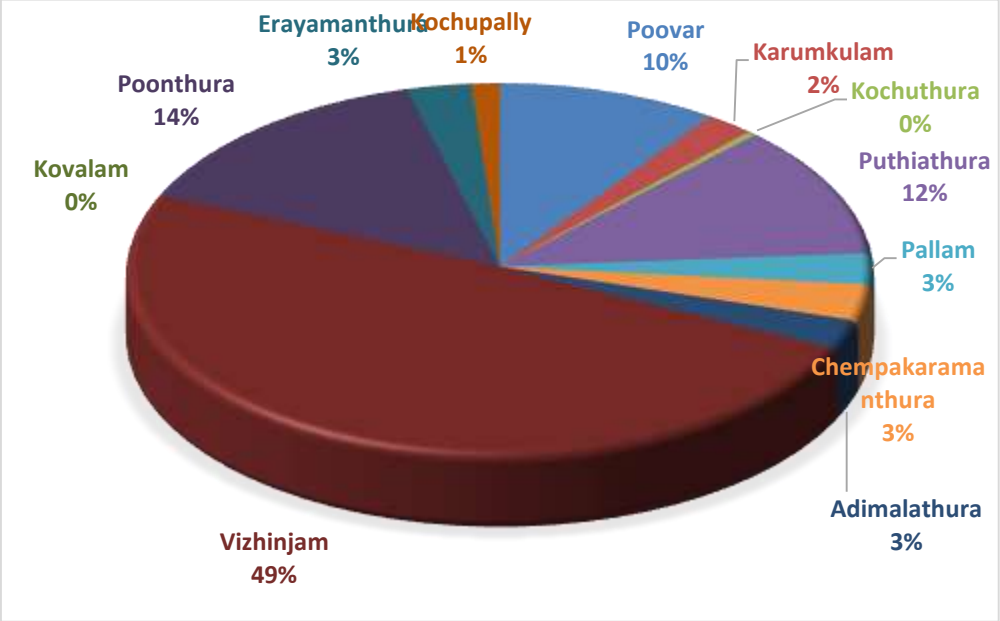


Fig.10.7.7. Landing centre wise fish catch during 2011-12

2021-2022

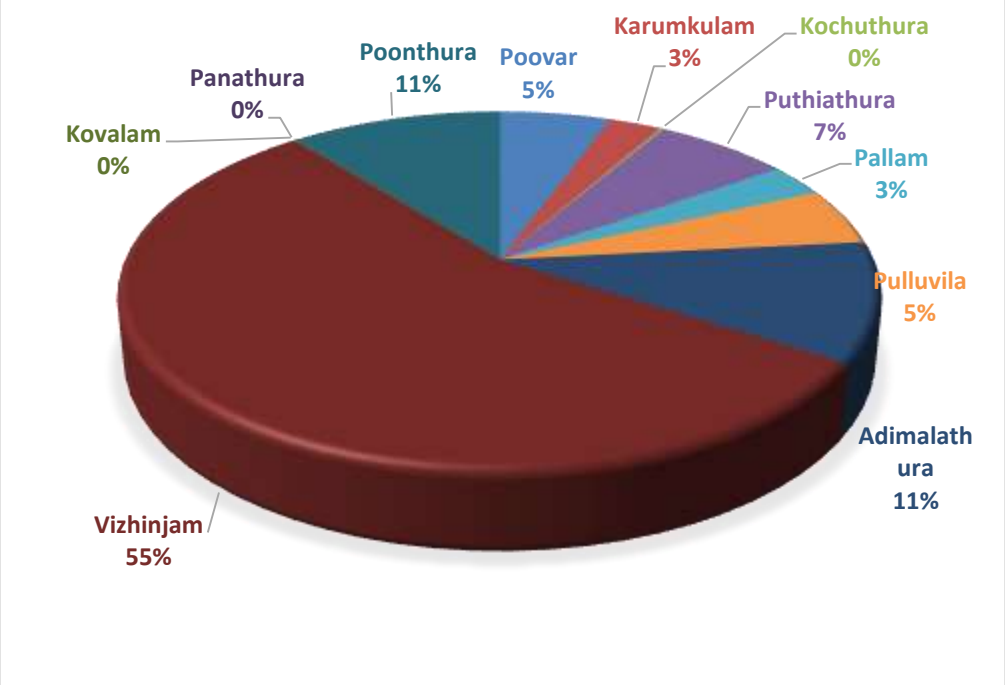


Fig.10.7.8. Landing centre wise fish catch during 2021-22

11. SUMMARY

The marine fisheries resources of India are spread along the country's vast coastline of 8118 km, 2.02 million square km Exclusive Economic Zone (EEZ) and 0.53 million sq.km continental shelf area. The total fish production in the country rose from 0.752 million metric tons in 1950-51 to 13.42 mmt (provisional) during FY 2018-19. Of this, the marine fisheries contributed 3.71 mmt and the inland fisheries contributed 9.71mmt. During FY 2018-19, 71% of marine fisheries potential has been harnessed and the inland fisheries potential harnessed during the same period stands at 58%. The marine fisheries sector is dominated by the socio-economically backward artisanal and small-scale fishers whose lives are closely intertwined with the oceans and seas. However, 75%of the total marine fish production comes from the mechanized sector, 23%from the motorized sector and only 2 %from the artisanal sector. As per the Handbook of fishery statistics, 2020, marine production was estimated at 3.72 mmt. The marine fish landings of India during the last five years (2015-2020) showed fluctuations in its landings mainly owing to the loss of fishing days during the pandemic period, of which, the highest landing of 3.83 mmt was recorded during 2017 while the lowest during 2020 with 2.73 mmt. Gujarat held the first position in fish landings during the last couple of years, followed by Tamil Nadu. Kerala occupies the third position in marine fish landings, while during 2020, Karnataka took the lead and occupied the third position and Kerala was drawn down to the fourth position. The marine fish landings of Kerala from 2015-2021 indicated a fluctuating trend showing a peak landing of 6.42 lakh tonnes during 2018 and the lowest in 2020 with 3.6 lakh tonnes. The fluctuations were mainly due to the decline in the landings of Indian oil sardine (*Sardinella longiceps*) along the Kerala coast.

Vizhinjam, one of the most productive coasts of Kerala, contributes significantly to the fish landings. The breakwater facility at Vizhinjam harbour is an added advantage for berthing and launching the crafts, even during the monsoon months. Hence during the peak monsoon months, many fishermen from Anchengo to Colachel migrate to Vizhinjam along with their craft and gear for fishing. The marine fish landings of Vizhinjam (K1 zone of the Thiruvananthapuram district) during 2015-2021 depicted a landing pattern with significant ups and downs. During 2015, there recorded a landing of 24791 tonnes, reduced to 20408 tonnes during 2016, then raised to ever peak of 35711.8 tonnes in 2018 and coming down to the lowest landing of 24391 tonnes, replenished to 33849 tonnes in 2020 and again down to 25291 tonnes

in 2021. Vizhinjam, the landings are mainly contributed by the pelagic fishes like Tuna, Scads, Mackerels, ribbon fishes, sardines, anchovies etc. These resources are showing high fluctuations in their landings and that resulted in the dynamic fish landings at Vizhinjam.

The distribution of gears along the Vizhinjam coast (K1 zone) from 2016-2021 indicated the decline in the number of boat seine followed by the fluctuating status of Outboard gillnets, increasing trend in the No. of Outboard Hook and line and the gradual reduction in the Non-motorized units. During the study period, which included the post-monsoon, pre-monsoon, and monsoon periods, the fishery was observed from 13 fish landing centres, including Vizhinjam, Poovar, Karumkulam, Kochuthura, Puthiyathura, Pallom, Erayamanthura, Chempakaramanthura, Kochupalli, Adimalathura, Kovalam, Panathura and Poonthura. During the reporting period (June 2021-May 2022) an estimated 23934.033 tonnes of fish were landed from the three zones of Vizhinjam port. Monthwise- landing centre wise catch data depicted that, the maximum landings were recorded during August followed by December and the least catch was recorded during June 2021. Monsoon season (39%) contributed more to the fish landings, followed by post monsoon (32%) and pre monsoon season (29%). Landing centres located in the zone I (direct foot print zone) contribute more to the landings, followed by zone II (potential impact zone) and zone III (control zone). Outboard Gillnet (OBGN), Outboard Hook and Line (OBHL) and Outboard Boat seine (OBBS) were the major gears operated during the study period. The percentage contribution of OBBS was maximum to the total landings during all the months except October and May. The CPUE analyzed for different gears depicted that, it was high for OBBS during all the months except May.

MONSOON SEASON

During monsoon season, the highest landing was reported in August (3417030 Kg) followed by September, June and July. The dominant species that landed in June 2021 was *Mene maculata* with a catch of 115943 kg. In July, August and September *Decapterus russelii* were reported as the dominant species. The zone-wise catch during monsoon season showed that zone 1, Direct Footprint Zone solely contributed to the majority of catch (>80%) and the least contributed by Zone 3, Control Zone. Experimental sampling was done mainly in Boatseine and the catch was mainly constituted by *Decapterus russelii* and other 10 species. The catch during experimental sampling by Disco net was mainly composed of *Penaeus indicus* followed by *Penaeus monodon and Upeneus sulphureus.* During monsoon months the highest number of species landed in July with 154 species. The number of species that landed in June, August and September were 116, 130 and 115, respectively. The analysis of gear-wise

landings during monsoon depicted that Boat seine contributed more to the landing all the months.

POST MONSOON SEASON

During the postmonsoon season, Zone 2- the potential impact zone reported maximum landing and Zone 1- Direct footprint Zone reported the least catch. Analysis of landing centre-wise catch data shows that Vizhinjam landing centre had reported the highest catch during all the post monsoon months except December. In December, Adimalathura landing centre was reported with the highest catch. The dominant species that landed during October was *Euthynnus affinis* with a species diversity of 108. In November *Decapterus russelli* species constituted a major catch and the species diversity of the month was 134. *Decapterus macarellus* was the major catch in December and *Amblygaster sirm* in January. Species diversity in December was 171 and in January was 160. During post-monsoon season the experimental sampling was done by Boat seine, Gill net and Shore seine. A total of 6 species were reported from Boat seine collection, 5 from Gill net and Shore seine collection. The analysis of gear-wise landings during post-monsoon depicted that except October, boat seine contributed more to the landing in all the months. In October outboard Hook and Line contributed more.

PRE-MONSOON SEASON

The -wise catch during pre-monsoon season showed that zone 1, Direct Footprint Zone contributed to the majority of the catch. The Zone-2, the Potential impact zone, contributed the least. The Vizhinjam landing centre had reported the highest catch during all the pre-monsoon months.The landings were dominated by *Amblygaster sirm* in February, *Euthynnus affinis* in March, *Sardinella gibbosa* in April and *Auxis rochei* in May. The species diversity was 160 in February, 166 in March, 143 in April and 132 in May. The major fishing gear contributed to the fishery was Boat seine in February, March and April months and Gillnetter in May. The experimental sampling during pre-monsoon was done by using drift gill net, jiggs, shore seine and hook and line. A total of 5 species were collected from drift gill net and hook and line, three species from shore seine and one species using jigs.

SEASONAL VARIATIONS

Fish catch data collected during the reporting period were analyzed seasonally to determine the variations. Monsoon season (39%) contributes more to the fishery, followed by Post monsoon (32%) and Pre-monsoon (29%). The maximum catch was recorded from Zone I (High impact zone) followed by Zone II (Moderate impact zone) and Zone III (Low Impact

zone). Zone-wise catch analysis depicted that, in Zone I, Catch was reported maximum during monsoon season followed by Pre-monsoon and post-monsoon season. The distribution and number of fishing units in Zone I was maximum during monsoon season and recorded a similar distributional pattern during post and pre-monsoon. The CPUE was maximum recorded during monsoon, followed by Pre-monsoon and post-monsoon season.

In Zone II, the catch was recorded maximum during post- monsoon season, followed by pre-- monsoon season, and the least during monsoon season. The maximum fishing units operated during post-monsoon season followed by pre-monsoon and monsoon seasons. The CPUE was reported maximum during Post monsoon followed by Pre-monsoon and monsoon season.

In Zone III, the maximum catch was recorded in the Pre-monsoon season, followed by Post monsoon and the least during the monsoon season. Pre-monsoon season with a maximum number of fishing operations, followed by Post monsoon and monsoon season. But the CPUE was recorded as high post-monsoon, followed by pre-monsoon and monsoon season.

COMPARISON WITH THE BASELINE DATA

Fish catch data collected during the present investigation were compared with the baseline collected during 2011-12 to elucidate the impact of port construction on the fishery activities along the potential impact zones of the project. The total fish catch estimated from June 2021 to May 2022 was 23934 tonnes, which is 3.5 % higher than the baseline catch estimated during 2011-12 (23156 tonnes). There is no significant variation in fish catch as we compared the present study with the baseline information.

We compared the season-wise catch data of the present study with the baseline data to analyze the seasonal variations during these years. During the monsoon season, a total catch of 9283 tonnes of fish was reported in 2021, while during 2011, 7584 tonnes of fish were recorded and had shown an increase in fish catch of 18% during 2021. A total of 7658 tonnes of fish were recorded during 2021, Post monsoon season, while in 2011 recorded, a catch of 6773 tonnes and an increase of 11.5% was noted during 2021. In the pre-monsoon season, the situation varied and a reduction of 20% of catch happened during 2021 as we compared the data with the baseline information (2021- 6991 tonnes landed, 2011- 8798 tonnes landed)

In Zone I, the catch was reported maximum during monsoon season, followed by Pre-monsoon and post-monsoon season during 2021-22, as well as 2011-12. During monsoon season, the highest catch was recorded during 2021-22; in post-monsoon and premonsoon, the maximum catch was recorded during 2011-12. In zone II, Post monsoon catches were more during 2011-12 and 2021-22, followed by pre-monsoon. There was absolutely nil catch in 2011-12 during monsoon season. During the post-monsoon and pre-monsoon high catches were recorded during 2021-22. In zone III, Pre-monsoon catches were more during both the study periods and there was no catch during the monsoon season in 2011-12. During post and -monsoon, the maximum catch was recorded during 2021-22.

Monthwise detailed comparison is given below;

June 2011 & June 2021

The total landings during 2011 and 2021 were 2332225 kg and 819149 kg, respectively. If we compare the landings between June 2011 and June 2021, there is a reduction in fish landings during 2021 and recorded a percentage decline of about 64%. The species composition also varies, with less valued fishes recorded during June 2021. The number of fishing days in June 2021 was comparatively less due to heavy rain and rough sea conditions. Fishers now agree with the government's weather warning signals after the Okhi cyclone incident in 2017. The loss of actual fishing days was one factor that led to less catch in June 2021.

July 2011 & July 2021

The total landing in 2011 was 1719325 kg and in 2021 was 2167941 kg. The comparison of fish landings (July 2011 and July 2021) depicted a 20% increase during July 2021. The species composition of various crafts and gear will be comparable, but the quantity varies.

August 2011 & August 2021

The total landings reported during 2011 were 1730440 kg and in 2021 were 3510864 kg and showed a 50.71% increase in the landings during July 2021.

September 2011& September 2021

In September 2011, the total landing was reported as 1802050 kg, and in 2021, the fish catch was 2785739 kg. Landings during September 2021 showed a 35% increase in the catch.

October 2011 & October 2021

The total landings in 2011 and 2021 were 1277882 kg and 1542173 kg, respectively, showing a 17% increase in landings during 2021. From October onwards, almost all landing centres around the port started functioning.

November 2011 & November 2021

The total landings reported in November 2011 and November 2021 were 1639138 kg and 2017185 kg, respectively and registered an increase of 19% in 2021.

December 2011 & December 2021

The total landings reported in December 2011 and December 2021 were 2082357 kg and 3230221 kg. There is an increase of 55.12% in the fish catch during 2021 December.

January 2011 & January 2022

The total landings reported in January 2011 and January 2022 were 1673396 kg and 869238 kg. The 48.055% decrease in fish catch was recorded in January 2022.

February 2011 & February 2022

The total landings reported in February 2011 and February 2022 were 1181491 kg and 1782945 kg respectively and recorded a 50.90% increase in the fish catch during February 2022.

March 2011 & March 2022

The total landings reported in March 2011 and March 2022 were 2072042 kg and 1927696 kg respectively and recorded a 6.966 % decrease in fish catch.

April 2011 & April 2022

The total landings reported in April 2011 and April 2022 were 1679875 kg and 1835867 kg, respectively, and reported a 9.28593% increase in the fish catch during April 2022.

May 2011 & May 2022

The total landings reported in May 2011 and May 2022 were 3619775 kg and 1445015 kg respectively and a reduction of 60.08% reduction in the fish catch was reported in May 2022. The loss of fishing days during extreme environmental conditions and the monthly fluctuations in the landing of pelagic resources may be the reason for the decline.

The month-wise fish species dominance was also compared and it is given below;

June 21- The dominant species in June 2011 was *Decapterus russelii* with a total catch of 395000 kg, but in June 2021, it was *Mene maculata* with a catch of 115943 kg. The lowest catch reported in June 2011 was for *Panulirus homarus* with 225 kg, and in 2021 it was *Diodon hystrix* with 2 kg.

July 21- The dominant species in July 2011 was *Aluterus monoceros* with a total catch of 292500 kg, but in 2021 was *Decapterus russelii* with a catch of 504208 kg. Species with the lowest catch reported in 2011 and 2021 were *Panulirus homarus*(lobster) with 250 kg and *Cephalopholis miniata* with 14 kg, respectively.

August 21- The dominant species in 2011 was *Rastrelliger kanagurta* with a catch of 259375 kg ,as in 2021 *Decapterus russelli* with 1464713 kg. *Sargocentron (Holocentrus) rubrum* with 7 kg is the least during 2021 and *Panulirus homrarus* during 2011.

September 21- *Rastrelliger kanagurta* reported the highest catch in 2011 with 228175 kg and *Decapterus russelli* with 870969 kg reported highest during 2021. *Megalaspis cordyla* with 100 kg was the least species reported in 2011, whereas *Aesopia cornuta* with 1 kg in 2021.

October 21- *Euthynnus affinis* showed the highest catch in October 2011 and 2021 with 169325 kg and 167333 kg respectively. *Loligo duvauceli* with 75 kg and *Drepane* spp. showed the least landing during 2011 and 2011 respectively.

November 21- *Rastrelliger kanagurta* shows the highest catch with 222625 kg and *Decapterus macrosoma* with 100 kg was the least during 2011. *Decapterus russelli* with a catch of 663475 kg and *Chanos chanos* with 4 kg in 2021 was the highest and lowest catch, respectively.

December 21- *Decapterus macarellus* showed the highest catch with 850522 kg in 2021 and *Auxis rochei* in 2011 with landings of 225000 kg. *Caranx* spp. has been reported as the least catch in 2011(250 kg) and *Leiognathus brevirostris* was the least caught fish with landings of 3 kg in 2021.

January 22- *Rastrelliger kanagurta* formed the highest catch in 2012 with 318875kg and *Amblygaster sirm* with 150798 kg catch was highest in 2022. *Panulirus.homarus* (296kg) and *Parapercis alboguttata* (7 kg) recorded the least catch in 2012 and 2022 respectively.

February 22- *Amblygaster sirm* was reported as the highest catch in 2022 with a catch 244582 kg and *Sargocentron (Holocentrus) diadema* (3 kg) was reported least. *Rastrelliger kanagurta* led highest in 2012 with a catch 278650 kg and *Panulirus homarus* showed the least catch with 16 kg.

March 22- *Rastrelliger kanagurta (*355500 kg) and *Euthynnus affinis* (240182 kg) have been reported as the highest catch during 2011 and 2022, respectively. *Panulirus homarus* with catch 42 kg and *Pristipomoides multidens* with 1 kg recorded least in 2011 and 2022 respectively.

April 22- Highest catch reported in 2012 and 2022 was *Rastrelliger kanagurta* (399550 kg) and *Sardinella gibbosa* (369970 kg), respectively and *Priacanthus hamrur* (100 kg) and *Chirocentrus dorab* (2kg) was the lowest catch in 2012 and 2022 respectively.

May 22- *Auxis rochei* (255170 kg) recorded the highest catch and *Gazza minuta* (2 kg) was the least catch in 2022 while *Rastrelliger kanagurta* (382250 kg) reported the highest catch and *Sufflamen frenatum* (875kg) been the lowest catch in 2012.

Comparison of fish catch data landing centre-wise during 2011-12 and 2021-22

The fish catch data were estimated landing centre-wise and compared to elucidate the fluctuations in landing and it is given below; During 2011-12, Vizhinjam (49%) contribute more to the landings followed by Poonthura (14%), Puthiyathura (12%), Poovar (10%), Pallam (3%), Erayammanthura((3%), Adimalathura (3%), Chempakaramanthura (3%), Karumkulam (2%), Kochupally (1%), Kovalam (<1%) and Kochuthura (<1%). While in 2021-22, Vizhinjam (55%) contributed more to the landings, followed by Adimalathura (11%), Poonthura (11%),

Puthiyathura (7%), Pulluvila (5%), Poovar (5%), Karumkulam (3%), Pallam (3%), Panathura (<1%), Kovalam (<1%), and Kochuthura (<1%).

The fish landings of different landing centres located in the study zones mainly comprised of pelagic fishes (Tuna, sardines, mackerel, scads, ribbonfishes etc) followed by demersal fishes and cephalopods. Annual and biannual fluctuations in landings of specific pelagic fishes have been observed from the Vizhinjam coast (earlier fishery and biological studies) resulting in the huge landings of a particular pelagic fish during one year and witnessing a few landings report of the same species in the coming year and an abundance of a new species. Since the majority (>60%) of the landings comprised of pelagic fishes, fluctuations in the species wise landings (pelagic fishes) are common to Vizhinjam coast. Due to this, the fish landings reported from Vizhinjam and its nearby landing centres were in a mere stagnant phase for years, where couldn't notice a great rise or fall in the annual landings. Monsoon fishery was affected at Vizhinjam for the last few years due to the less number of migrant fishers from the northern side of Thiruvananthapuram coast, this was mainly associated with the construction of the fishing harbour at Perumathura and the availability of suitable berthing facilities at Perumathura harbour during monsoon season. The failure of Southwest monsoon in certain years was also attributed to the fluctuations in the availability of pelagic resources and their recruitment. COVID-pandemic affected the actual fishing days during the last two years and contributed to the fluctuations in the landings. But during 2022, things were in line, and a good quantum of fish was landed during monsoon season with the ever-highest landings (last five years) of Ribbon fishes, Indian oil sardines and Scads. The present study witnessed the insignificant impacts of the port during its construction phase on the fish landings along the potential impact zones.

12. Conclusion and Recommendations

Fish landings survey along the potential impact zone of the Adani Vizhinjam Port Private Limited (AVPPL) from June 2021 to May 2022 recorded **23934.033** tonnes of fish catch which registered an increase of 3.35 % compared to the total landings reported in 2011. A total of 337 fish species were recorded from the present investigation of the species composition of fishes. The fish population was estimated from 13 landing centres such as Poovar, Karumkulam, Kochuthura, Puthiyathura, Pallom, Erayammanthura, Chempakaramanthura, Kochupally, Adimalathura, Vizhinjam, Kovalam, Panathura and Poonthura. Among these landing centres, Erayammanthura, Chempakaramanthura, and Kochupally showed very little catch, and the catch was brought together at Pulluvila and considered Pulluvila instead of the above three in final catch estimates. The experimental fishing conducted along the commercial fishing grounds helped to identify the present fishing ground and species composition of various gears. Seasonal and zonal variations of fish catch analysis depicted the highest catch from the direct footprint zone, implying the insignificant impacts of the development phase of Vizhinjam on the availability of fish resources. During the landing centre survey, fishers opined on the change in the fishing ground and the extended duration of fishing. The impact assessment during the port's operational phase will reveal the fish landing's unique status and availability. Hence, studies need to be conducted during the operational phase to examine its effect on the marine habitat, flora, and fauna.

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INDEX

Shorthand	Description
Zone 1	Foot Print Zone
Zone 2	Potential impact Zone
Zone 3	Control Zone
GDP	Gross domestic product
CPUE	Catch Per Unit Effort
FY	Financial Year
EEZ	Exclusive Economic Zone
HP	Horse power
Spp.	Species
GPS	Global Positioning System
OAL	Length Overall
FPB	Fiberglass Coated Plywood Boats
FADS	Fishing Aggravating Devices
FRP boats	Fiber Reinforced Plastic Boats
OBBS	Outboard Boatseine
OBGN	Outboard Gillnet
OBHL	Outboard Hook & Line
OBOTHS	Outboard Others Gears
NM	Non Motorized Units
t	Tonnes
g	Gram
nm	Nautical Mile
km	Kilometer
m	Meter
mm	Millimeter
etc	Et Cetera

Annexure VI

CSR Activities by AVPPL

(April 2023 to September 2023)

CSR REPORT VIZHINJAM

APRIL 2023 - SEPTEMBER 2023

Adani Vizhinjam Port Pvt. Ltd, 2nd Floor.
01, Port Operation Building, Mulloor Road, Mulloor,
Trivandrum-695521

CSR REPORT VIZHINJAM FOR THE PERIOD OF APRIL 2023 - SEPTEMBER 2023

Adani Foundation, the CSR arm of Adani Group has been implementing the CSR activities of Adani Vizhinjam Port Pvt. Ltd since 2016 at Vizhinjam. Every month, Adani Foundation touches more than ten thousand people through its various CSR activities. In continuation to that, the Adani Foundation has done many activities in the following heads during the reporting period (April 2023-September 2023).

1. Education
2. Community Health
3. Sustainable Livelihood Development
4. Community Infrastructure Development
5. Others

1. Education

Following are the major and ongoing activities under Education.

1. Online Education Support Programme with Topper.Com learning platform
2. Follow up of Venal Thumbi- 'Summer Butterflies' Camp – Cartoon & Bird watching group.
3. Poets and Men of Literature Meets

1.1. Online Education Support Programme with Topper.Com learning platform

As part of the national initiative of Adani Foundation in Education vertical by collaborating with "toppr.com" to train and equip the unprivileged students for many state/national entrance/competitive examinations, 249 students (7^{th} to 12^{th} standards) have been selected from Vizhinjam, Kerala. Online coaching at free of cost in customized content for board curriculum, competitive, entrance and scholarship examinations - JEE, NEET, CLAT, NDA, NTSE, NSO, IMO, KVPY and so on is provided for the selected students as part of the programme. This advance pack includes videos, concepts, exercises, questions search, dedicated mentors/councilors, unlimited practice sessions, test preparation and Ask

Doubts 24x7. All the students have been using the application with the mentoring support of the in-charge teachers from the respective schools.

1.2. Follow up of Venal Thumbi- Summer Butterflies – Camp – Cartoon & Bird watching group.

As the follow-up of the 'Venal Thumbi', summer camp, which was organized by Adani Foundation in collaboration with Kerala State Library Council & C V Smarka Grandsala, Mukkola, Vizhinjam during summer vacation, two groups were formed for follow up trainings, a cartoon group and a bird watching group. The bird watching group has been monitored by a famous birder, Mr. Kiran, who was the Resource Person for the summer camp. Another group for training is Cartoon group, which has been monitoring by famous cartoonist Mr. Hari Charutha, who was also the resource person for the summer camp. The mentors have been evaluating students' creatives and providing guidance and suggestions for improvement. Resource materials and other learning tools have been provided. Two designated WhatsApp groups were formed for this purpose. Great responses have been getting from the part of the students.

1.3. Poet and men of Literature Meets
a). National Reading week Celebrations - 24.06.2023

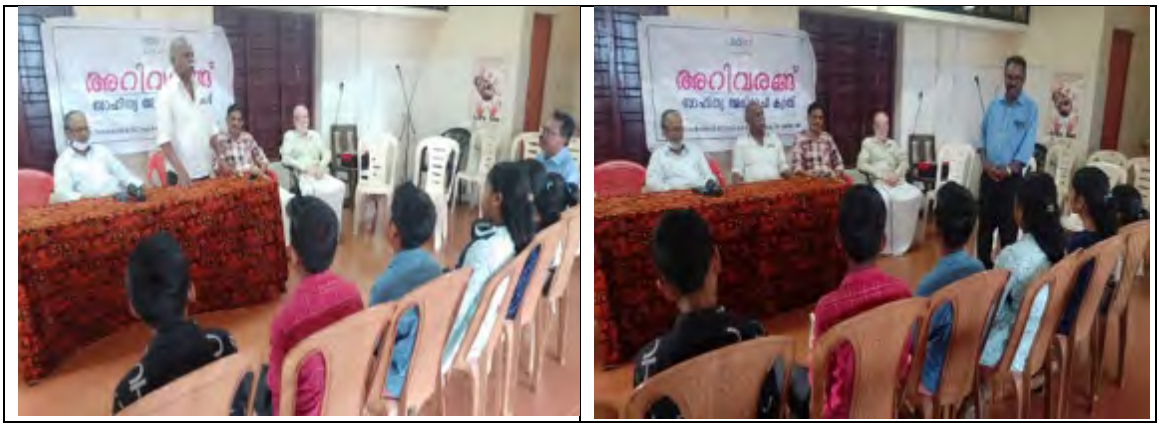
The monthly poets and men of literature meet was organized on 24.06.2023 at C.V. Smaraka Grandhasala for selected students of Vizhinjam. On the auspicious occasion of National Reading week celebrations, the theme of the literature

meeting was on the poems of Mahakavi Shri.P N. Panicker. The national reading day commemorates the death anniversary of PN Panicker, widely recognized as the "Father of the Library Movement" in the state of Kerala. This year weeklong celebrations were arranged by the state. Reading is a crucial activity that offers numerous benefits, including relaxation, learning, concentration, and the improvement of communication skills. In an era before the dominance of the internet and television, reading served as a primary medium of communication. National Reading Day, observed on the anniversary of P.N. Panicker's death, pays homage to his visionary ideals, immense passion, and unwavering dedication to promoting reading as a catalyst for personal and societal development. The day encourages individuals to embrace the pleasures of reading, delve into the vast knowledge contained within books, and acknowledge the transformative impact of reading on individuals and communities alike. As part of the celebration appreciation notes were prepared by the students on P. N Panicker and presented in the poets and men of literature meet. Shri. Retnakaran, one of the poets and men of literature narrated the story on "Ee Theeram Shantham" a book written by him on P.N. Panicker. He also explained the importance of reading. A total of 20 children participated in the half day long meet. It was decided to conduct the next meeting on the coming second Saturday of July 2023.

b). Poet and men of Literature Meet- 08.07.2023

The monthly poets and men of literature meet was organized on 08.07.2023 at C.V. Smaraka Grandhasala for selected students of Vizhinjam. The theme of the literature meet was the literary works of great writer Shri. Vaikom Muhamed Basheer. Shri. Rentakaran, one of the poets and men of literature spoked about

the literary works of Shri. Vaikom Muhamed Basheer to the children with a special narration of a story "Neelavelicham", one of his works. He specially mentioned that the focus of his writings was against the social evils which affected much in the social fabric of Kerala Society. Appreciation notes were prepared by the students on the literary work of Shri. Vaikom Muhammed Basheer. Then one of the famous Poet and writer from Vizhinjam Shri. Mulloor Madhu interacted with the children. A total of 15 children participated in the half day long meet.



2. COMMUNITY HEALTH

Following are the major activities conducted under Community Health.

1. Service of Mobile Health Care Unit (MHCU)
2. SuPoshan
3. Kitchen Garden - Safe to Eat Vegetables for All Homes (SEVAH)
4. Farm School & Landscape maintenance at Port site
5. Cancer Care Support
6. Patient care support programme
7. Convergence of Govt. Schemes
8. Lifestyle disease detection camps
9. Eye Screening Camp

2.1. Service of Mobile Health Care Unit (MHCU)

summary – April- Sept 2023

- During the period, the Vizhinjam MHU has visited 10 sites weekly and three General health camps and has provided 7247 treatments.
- Total 455 New registrations were done during the period.
- Done 262 Gloco tests.
- Done 29 HB tests.
- 14 Home visit
- Done one awareness session on lifestyle disease.
- 10 Health Camps were conducted in addition to the regular service.
- Celebrated elder abuse awareness day by releasing the national report on elder abuse prepared by HelpAge India with an awareness program in association with CV Smaraka Grandhasala.

Detailed Report

SN	MHU Sites/Halt Point	April	May	June	July	Aug	Sep	Total
1	New Church	136	157	203	202	120	124	**942**
2	Kadaykkulam Resident's Association	81	71	97	80	42	55	**426**
3	Karayadivila	196	234	173	176	164	129	**1072**
4	Kanjiramvilla	114	146	135	119	89	77	**680**
5	Nehru Memorial Library, Theruvu	123	182	97	153	191	101	**847**
6	SNDP Hall, Kovalam	133	153	88	118	165	103	**760**
7	Gateway Resident's Association Hall	117	99	128	95	148	78	**665**
8	Township Colony	91	71	98	77	105	58	**500**
9	Marian Nagar, Kottappuram	74	93	123	74	105	61	**530**
10	ICDS HArbour	46	91	108	38	60	49	**392**
11	Medical camps	0	348	0	0	45	40	**3433**
Total		**1111**	**1645**	**1250**	**1132**	**1234**	**875**	**7247**

Details of Gluco test conducted during the period.

Total Tests			Total Positive cases of Blood Sugar		
Male	Female	Total	Male	Female	Total
17	50	67	7	28	35
28	59	87	9	19	28
6	37	43	1	13	14
9	37	46	3	19	23
1	18	19	0	7	7
61	**201**	**262**	**20**	**86**	**107**

Details of total HB test done during the period

Total Tests			Total Positive cases of Blood Sugar		
Male	**Female**	**Total**	**Male**	**Female**	**Total**
2	7	9	0	2	2
4	7	11	1	3	4
4	3	7	0	1	1
0	2	2	0	2	2
10	**19**	**29**	**1**	**8**	**9**

Details of awareness programmes conducted during the period.

S.N	Topic	Venue of the camp	Date of the camp	Total
1	Lifestyle disease	MAriyan nagar	28/4/2023	27
2	Lifestyle disease	TSS Kottappuram	19/5/2023	26
3	Lifestyle Disease	TSS Kottappuram	26/5/2023	20
4	Elder Abuse	THennoorkonam	15/6/2023	40
5	General health	Venganoor girl's School	24/7/2023	22
6	General health	Chowara	19/8/2023	10
Total				**145**

Details of Home visits conducted during the period.

S.N	Name of the beneficiary	Age	Gender	Date	Site name	Reason for the visit
1	Silvapicha	83	M	14-04-23	Marianagar	Bedridden
2	Celesteenamma	74	F	14-04-23	MArianagar	Bedridden
3	Reethamma	61	F	23-05-23	Kanjiramvilla	Bedridden
4	SuharaBeevi	75	F	24-05-23	SNDP	Bedridden
5	Reethamma	61	F	26-05-23	Kanjiramvilla	Bedridden
6	Arogyamary	80	F	26-05-23	Kanjiramvilla	Bedridden
7	Mary	70	F	23-06-23	Mariyan nagar	Bedridden
8	Mariyam Pushpam	75	F	27-06-23	Mariyan Nagar	Bedridden
9	Thankam	75	F	30-06-23	ICDS	Bedridden
10	Mariyam Pushpam	75	F	21-07-23	Mariyan Nagar	Bedridden
11	Thankam	75	F	14-07-23	ICDS	Bedridden
12	Mariyam Pushpam	75	F	18-08-23	Mariyan Nagar	Bedridden
13	Thankam	75	F	25-08-23	ICDS	Bedridden

Case stories

a). Mr. Cleetus, Age: 62, Male, Mariyan Nagar Kottappuram Vizhinjam Trivandrum Kerala

Mr. Cleetus 62 years old male residing at Mariyan nagar colony, Kottappuram Vizhinjam. Cleetus was a fisherman, and he was regular for fishing at Vizhinjam Sea, He was going for fishing in his friend's boat. And one day while going for fishing got high bp and got stroke and his on-side body paralysed, now its six years after that incident, He was not able to walk before after doing many physiotherapies now he can walk with someone's help, so the Tripod was a needed assistive device for him to walk alone. But he has no budget for that, he and his wife Alphonsa are looking after everything with the only elderly pension money, so it was too much expensive for them, So Helpageindia's assistive device giving was a merciful help to them now in the house Alphonsa his wife is

not inside also Cletus can move to washroom for his needs with the help pf the tripod.

Cleetus has four children all are married and living separately, but no one is looking for them, and he is staying in one room house with small kitchen and the top is asbestos sheet, no other facilities having collecting water from the public tap. Now every week Vizhinjam MHU is providing medicines for him for hypertension before he was taking medicines from Vizhinjam PHC. Now he is very much happy for the service of the helpage india and and his wife always prays for the helpageindia team for the wonderful service they received.


b). **Shantha, Age: 89, Female, Aluninnavill, Kovalam, Trivandrum, Kerala**


Shantha is a widow, and she is 89 years old and residing at one of her daughter's houses at Aluninnavilla colony Kovallam, Vizhinjam. In the house her daughter and family are staying in, they are taking care of Shantha very well and doing all medical needs. She is having elderly problems and not able to walk, bedridden,

taking medicines for Hypertension, Diabetes Mellitus and DLP. She is receiving her elderly pension and her daughter using the money for Shanta's hospital needs.

It was very much difficulty that taking her to the hospitals without a wheelchair, and daughter of Shantha tried a lot for getting a wheelchair from somewhere else, finally she thought of buying one, but they were not affordable for that so could not buy, and finally their dream come true through HelpAge India project "Sugamya". And really, she is very happy that now even with anyone's help she can move herself to the kitchen and so. And the family was very much happy for this because they need not struggle too much when taking shantha to the hospital.

The Wheelchair was handed over to Shantha by Dr. Anil Balakrishnan, Head CSR, South India in the presence of Ward counsellor Mr. Nizamudin. And really, she is so much happy and grateful to HelpAge India.

c). Thankam, Age: 75 Female, Pallithura Harbour, Vizhinjam Trivandrum Kerala

Thankam is not able to walk and she is regularly visited by HelpAge India's medical consultant team, she is having the treatment for Diabetes mellitus, systemic hypertension, coronary artery disease (cold), dyslipidaemia and peripheral vertigo and she is satisfied and very much happy with our approach and consulting, before our approach she was struggling a lot for the treatment, Because she was using the treatment of Vizhinjam primary health centre and she used to spend rupees 100 for one side for the auto charge, and also need

many peoples help to carry her to hospital so she was not also used to go to Hospital regularly.

Thankam is widow, her husband died before 10 years, she has one daughter and her husband also died in an accident, and she has two children, and her daughter is going to a school as helper in the kitchen the children are studying, so the family has poor background. And when school time comes, she is alone at home so sometimes neighbors offer food for her.

Before her hospital expenses were not ok with the old age pension now, she is having the free medicines and diabetes check-ups, so she is happy for that.

d). Thankam, Age: 65 Female, Mulloor, Vizhinjam Trivandrum Kerala

Thankam is a cancer patient, and she is regularly visited by HelpAge India's medical consultant team, she is also having the treatment for Diabetes mellitus, systemic hypertension, coronary artery disease (cold), dyslipidemia and peripheral vertigo. She is satisfied and very happy with our approach and consulting. Before our first visit she was struggling a lot for the treatment, because she was using the treatment of Vizhinjam Primary Health Centre and used to spend rupees 100 for one side for the auto charge, and need many

peoples help to carry her to hospital, so she was not used to go to hospital regularly.

Thankam is a widow, her husband died before six years, she is with her daughter, among them two boys and one girl all are married, and she is staying with the daughter, Thankam is receiving the old age pension and with that money only she looks after her expenses.

Earlier her pension amount was not sufficient for her treatment, but now, she is having free medicines and diabetes checkups from Adani Group, so she is happy about that.

e). Vilasini, 69 years, Deepa House, Kanjiramvilla, Mulloor P.O. Trivandrum

Employment Status: Unemployed

She lives in Kanjiramvilla at Mulloor. She is living with her daughter and son-in-law. Both are daily wage earners. There are no other sources of income for this family. She is left alone at home during the day. It is pathetic for a 69-year-old lady to stay at home all alone during the day. No one is there to take care of her during this period. The family look after everything and they keep the food for her and go to work as she is bedridden. The team also facilitated Covid vaccination at her doorstep and it was highly beneficial for her and family. MHU team is doing the follow up for her for the health needs and always giving mental support. The team also appraised the family through phone calls regarding the

health issues of Vilasini. And now she is happy that there are people to take care of and do the needful for her timely.

2.2. SUPOSHAN (SDG No.2 and SDG No4)

SuPoshan is the healthcare initiative of Adani Foundation aimed to curb malnutrition and anemia among children below 5 years of age and women in reproductive age. The focus of SuPoshan project is on behavior change at family and at community level for healthy nutrition for children, women, and adolescent with family as a unit. SuPoshan Sanginis are the key change agent who promotes right knowledge, skills, and attitudes through family counseling. During the reporting month, SuPoshan activities reached 8633 families in nineteen wards of CSR intervention with focus on creating awareness on various health related behavior change communication strategies. Following are the major activities conducted under SuPoshan during the months of April - September 2023.

a) **Community reach-out**

Breakup of Community Engagement program during the period

Sl. No	Programme	April	May	June	July	Aug	Sep	Total
1	Household visits	938	837	965	995	1003	1178	**5916**
2	Family based counseling	176	131	193	268	278	290	**1336**
3	Anganwadi Visits	41	57	67	61	88	71	**385**
4	Focus Group Discussions	28	42	16	38	64	69	**257**
5	Village Level Events	5	14	9	12	16	23	**79**
6	Anthropometric Measurements	101	78	122	169	124	65	**659**
	Total	**1290**	**1159**	**1372**	**1543**	**1573**	**1696**	**8633**

Family Based Counselling

Family based counselling includes special attention and care of children identified as Severe Acute Malnourished, Moderate Acute Malnourished, Pregnant and Lactating mothers. Sanginis give counselling to the family as they

are the supporting factor in the overall development of the targeted people. This reporting period, sanginis gave counselling to 1336 families including pregnant women and lactating mothers.

Anganwadi visits

Sanginis visited 385 anganwadis in Kottukal during the reporting period. Sanginis visited their respective Anganwadis weekly doing activities entrusted them and growth monitoring. Anganwadi Visits helps the Sanginis and Anganwadi Workers for the interaction that includes the heath update of the targeted people such as children under 3 years to 10 years, Newborn babies, Adolescent girls, and Women of reproductive age group.

Focused Group Discussions

During the period, Sanginis coordinated a total of 257 Focused Group Discussion for Teenagers, Mothers' and pregnant and lactating mothers.

Village Level Events

Sanginis coordinated 79 Village events in Kottukal Panchayath during the period.

Anthropometry

During the reporting period, SuPoshan Sanginis have done universal anthropometry. Sanginis screened 659 children across Kottukal Panchayath.

Other community events/celebrations on days of importance

Menstrual Hygiene Day

- Menstrual hygiene is essential to girls and women's health and well-being. Unfortunately, millions of girls and women worldwide lack access to proper menstrual hygiene facilities and products. World Menstrual Hygiene Day is a global event observed annually on May 28th to raise awareness about the importance of menstrual hygiene and break the silence and stigma surrounding menstruation. Each year, a specific theme is chosen for World Menstrual Hygiene Day to focus on different aspects of menstrual hygiene management. The 2023 Menstrual Hygiene Day theme is making menstruation a normal fact of life by 2030. The overarching goal is to build a world where no one is held back because they menstruate by 2030. Vizhinjam site celebrated Menstrual Hygiene Day Activities such as poster competition, awareness rally, focused group discussions and village level meetings. Awareness session gave light on Menstrual Hygiene Management, proper usage of Homemade cotton pads, disposal of pads in right ways and Hygiene techniques.

Sl.No	Activity	Area	Participants	Sangini-in charge
1	Poster Competition	Adimalathura & Ambalathumoola	32	Prabha & Treesa
2	Awareness Rally	Adimalathura & Ambalathumoola	32	Prabha & Treesa
3	Focused Group Discussions	18 wards of Kottukal Panchayath	88	Jayakumari, Ajitha, Rejitha, Raji, Athira, Rani, Reshmi, Prabha & Treesa
4	Village Level Meetings	Payyattuvila, Avanakuzhy, Chowara, Adimalathura & Ambalathumoola	112	Raji, Athira, Rani, Reshmi, Prabha & Treesa
5	Family Counselling	18 wards of Kottukal Panchayath	66	Jayakumari, Ajitha, Rejitha, Raji, Athira, Rani, Reshmi, Prabha & Treesa, Prabha & Treesa
			330	

- **Preveshanolsavam - Anganwadi Re-Opening**

Anganwadis are the focal point for implementation of all the health, nutrition, and early learning initiatives. A typical Anganwadi center provides basic health care in a village. It is a part of the Indian public health care system. Basic health care activities include contraceptive counseling and supply, nutrition education and supplementation, as well as pre-school activities. All sanginis were engaged in Anganwadi reopening ceremony all over 19 wards of Kottukal Panchayath on June 30, 2023. Sanginis were engaged in coordination activities with anganwadi workers.


- **World Environment Day celebrations as part of SuPoshan activities**

World Environment Day (WED) is celebrated annually on 5 June to encourages awareness and action for the protection of the environment. It is supported by many non-governmental organizations, businesses, government entities, and represents the primary United Nations outreach day supporting the environment. World Environment Day 2023 is hosted by Côte d'Ivoire and supported by the Netherlands and the theme was focus on solutions to plastic

pollution under the campaign #BeatPlasticPollution. It is a reminder that people's actions on plastic pollution matters. The steps governments and businesses are taking to tackle plastic pollution are the consequence of this action. Fortune SuPoshan done plantation drive by planting 212 saplings of Curry Leaves, Papaya, Tulsi, Lemon and Alma. SuPoshan sanginis planted these saplings in the targeted population of Children under 5 years, Pregnant and Lactating mothers, and Adolescent children houses.

- **World Breastfeeding Week**

World Breastfeeding Week is a global healthcare event celebrated annually in the first week of 2023 August 1st to 07th. During the entire week, various international and local organizations join hands in promoting the importance of breastfeeding benefits to newborns and mothers. World Breastfeeding Week also promotes, defends, and supports women's rights to breastfeed their babies anytime and anywhere. This year theme for the week was "Enabling Breastfeeding: making a difference for working parents". The World Health Organization (WHO) and United Nations International Children's Emergency Fund (UNICEF) recommend optimal breastfeeding that includes exclusively breastfeeding (only breastmilk without any additional food or water, exception to oral rehydration solution, drops and syrups) a child during the first six months of life, and then continuing to breastfeed until the age of two years, with the addition of suitable and sufficient supplementary foods. Vizhinjam site celebrated World Breastfeeding Week 2023 in the following way:

Sl. No	Date	Type of Activity	No. of participants	Type of Participants	Topics Covered	Villages Covered
1	01-08-2023	Organized the Launch of World Breastfeeding	112	Pregnant Women, Mothers &	Assuring the importance of breastfeeding	19 wards

Sl. No	Date	Type of Activity	No. of participants	Type of Participants	Topics Covered	Villages Covered
		Week 2023 & Awareness rally		Lactating Mothers		
2	02-08-2023	Focus Group Discussions & Family Counselling	43	Lactating mothers' & Pregnant Mothers	Role of family in breastfeeding, Importance of breastfeeding, Promotion of breast rather than formula or animal milk	8 wards
		Family Counselling	22			
3	03-08-2023	Poster Competition	31	Adolescent Children & Lactating Mothers	Importance of Breastfeeding	10 wards
		FGD	54	Lactating Mothers & Mothers	promoting awareness regarding milk substitute & Importance of Family	
4	04-08-2023	Focused group discussion on building awareness among men's group and Mother-in-laws	67	Husbands and Mothers of children under 5 years	Video representation on importance of continued Breastfeeding till 2 years, Support from family members to mothers	11 wards
5	05-08-2023	Family Counselling	68	Mothers of children under 5 years, Pregnant and Lactating Mothers	Nutritional Value of Breastfeeding, Importance of Colostrum	12 wards
6	06.08.2023	FGD	102	Pregnant and Lactating Mothers	Importance of Breastfeeding	9 wards
7	07.08.2023	Poster Competition	34	Adolescent Children	Breastfeeding and its value for betterment of family	11 wards
Total			**533**			

- **National Nutrition Month celebrations**

Poshan Maah, also known as National Nutrition Month, is an annual event in India aimed at raising awareness about the importance of nutrition and promoting healthy dietary habits. The theme for Poshan Maah 2023 is *"Suposhit Bharat, Sakshar Bharat, Sashakt Bharat,"* which translates to "Nutrition-rich India, Educated India, and Empowered India." This theme underscores the critical interplay between nutrition, education, and empowerment in the country's development. "Suposhit Bharat," is a critical component of India's public health and the cornerstone of human development. It signifies the nation's commitment to addressing the pervasive issue of malnutrition and promoting the health and well-being of its citizens. "Sakshar Bharat," is aimed at empowering children through universal access to quality education and to help leverage technology and online resources to reach remote and underserved communities, especially in the wake of the COVID-19 pandemic. "Sashakt Bharat" or "Empowered India" emphasises the importance of gender mainstreaming and women's empowerment in tackling nutritional issues. Women, as primary caregivers, play a central role in ensuring the nutritional well-being of their families.

Vizhinjam site celebrated Poshan Maah 2023 in the following way:

Sl. No	Type of Activity	No. of participants	Type of Participants	Topics Covered	Villages Covered
1	Poshan rally	392	Lactating mothers, adolescent Children, Mothers,	Organized 14 Poshan Rally on importance of 1000 days with RPA, importance of consuming millets,	19 wards

Sl. No	Type of Activity	No. of participants	Type of Participants	Topics Covered	Villages Covered
			Family Members	importance of complementary feeding with the mothers of 2-5 years children, importance of WASH practices and awareness on Anaemia with Adolescent girls / RPA	
2	Poshan Salah (Family Counselling)	696	Lactating mothers, adolescent Children, Mothers, Family Members	Danger sign during pregnancy, IFA consumption, diversified diet, with Pregnant Women, Safe cooking practices with available millets, Age-appropriate diet by using different food groups– locally available, Handwash with soap, menstrual hygiene	19 wards
3	Poshan Samvad(Focus Group Discussions)	334	Lactating mothers, adolescent Children, Mothers, Family Members	Organized 20 FGDs on the importance of Nutrition myths and misconceptions during pregnancy, Stay nourished and save money - choice of food, Handwashing demo	19 Wards
4	Poshan Mela(Recipe Competition)	227	Lactating mothers, adolescent Children, Mothers, Family Members	Organized 10 Poshan Mela on the theme of Recipes using Take Home Ration & Organic colors from locally available fruits & vegetables	19 wards
5	Poshan Yukt Ahaar(Cooking Demo)	22	Lactating mothers, adolescent Children, Mothers, Family Members	Organized 10 cooking demo on Plant-based recipes for pregnant women, Iron rich recipe with spinach, take home ration Kerala breakfast recipes	10 wards

Monthly Sangini Trainings

One day training has been provided to Sangines every month on topics to be focused on for coming months. In addition to the weekly review meetings, the monthly meetings also evaluating the programmes during the month and plan out for the next month.

Training by HO - Training of Training

ASO attended a two-day training program on 22nd 2023 September & 23rd 2023 September at Adani Shanthigram. The primary aim of the SuPoshan Training of Trainers is to cultivate an engaging and collaborative learning environment. The first day started with registration & Inauguration. The inauguration was done by Dr. Priti Adani, Chairperson, Adani Foundation, Mr. Angshu Mallick, CEO, Adani Wilmar & Mr. V.S. Gadhavi, Executive Director, Adani Foundation followed by addressing the participants. First session was Brief Presentation about Adani

Foundation by Kavita Sardana, Advisor, Health & nutrition followed by session on Malnutrition – a global concern with Data highlights, endline evaluation results, learning & cascading impact by Rozina Sulthana, Regional SuPoshan Head. Trainers also had insightful learning on the Journey of 1000 days – Maternal Nutrition (Pregnancy, Lactation *w.r.t.* Nutritional requirement, physical state & emotional well-being, assessing maternal nutrition status and its relationship with health outcomes - LBW, IMR & MMR & IYCF - Building a strong foundation through breastfeeding -nourishing the brain for tomorrow by Dr. Nilesh Thakor, Assistant Professor in Gujarat, Writing Case study, photography by Mr. Chandra, Communication Team, Adani Foundation, Nurturing and nourishing the 7 P's by Mr. Ketan Doshi, former employee of Adani Group. And the day ended with a fruitful session. Second day of training had sessions like Steps to inculcate ownership in the communities by empowering mothers, sensitizing men, and senior leaders by involving all stakeholders by Ms. Ankur Vaidya, DD Communications, ICDS, Gandhi Nagar, WASH w.r.t. Malnutrition by Mr. Tejas, WASH officer, UNICEF, Gandhi Nagar, Use of Web-Application, Data Analysis, Session on AI by HO SuPoshan team & presentations from all sites and ended with impactful knowledge.

2.3. Safe to Eat Vegetables for All Homes (SEVAH) - 1280 Household homestead vegetable garden.

The Kitchen Garden programme, Safe to Eat Vegetables for all homes (SEVA) progressed commendably with 1280 households. The kitchen garden programme is intended to cultivate pesticide free organic homely needs of

vegetables at the space available within each home stead. Since the start of the programme from 2020-21, the following was the number of beneficiaries covered.

Sl. no	**year**	**No. of Beneficiaries covered**
1	2020-21	280
2	2021-22	500
3	2022-23	500
Total		**1280**

The seed money kept by each member has been used for further cycles of cultivation. Vanitha Karshika Karma Sena, one of the livelihood groups formed as part the CSR activities has been helping to produce seedlings. During the period a total of 355 beneficiaries were distributed with seedlings and Plant protection items produced by Vanitha Karsheeka Karma Sena at Farm School.

Distribution Details.

Sl no	Name of area	Nos of seedlings distributed
1	Manali	975
2	Vizhinjam	300
3	kovalam	600
4	Avanakuzhy	300
5	Valiyavila	300
6	Edathekonam	300
7	Adimalathura	300
8	Mannotukonam	300
9	Payattuvila	300
10	Punnkulam	300
11	Pulinkudi	300
12	Chowara	300
13	Ambalathumoola	300
	Total	**4875**

During the period, Kitchen Garden ongoing cycle is in its the last stage of activity. Many of the homesteads at present have taken the maximum output from the planted materials. It was estimated that per house in average of 30 t0 40 kg of vegetable were harvested in a period of one month with an average price of 40 to 50 Rs for each vegetable existing market price.

Sl No	**Item of Vegetable**	**Average Quantity Harvest Per month**
1	Brinjal	62 kg
2	Bhindi	53 kg
3	Chilly	42 kg
4	Yard Long Beans	47 kg
5	Tomato	23 kg
	Total	**247 kg**

2.4. Farm School

The Farm school activities are progressing commendably during the reporting period. The Farm School serves as a community school for agricultural learning. It is set in a majestic landscape with a bamboo house as training house and a lawn set in the shape of a leaf, symbolizing the solar energy receptor and plant food factory, thus ultimately the factory feeding humanity, and key oxygen producing organ for mother earth. Farm school has the functional specification of Horticultural Garden and honey production unit, Crop Museum (to house possible Crop Introduction for Vizhinjam), Vegetable and nutrition Garden, Vegetable nursery, Hi tech banana Farming.

New Cultivation

At farm school new crops have been planted by using planting material raised in farm school nursery itself every month.

The salient aspect of farming during the period was the blooming of sunflowers which is cultivated in an area of 10 cents for the purpose of taking seeds. It is expected to harvest a total of 10 kilograms of sunflower seeds which is edible and proposed to sale through outlet.

The details of the harvested vegetables from farm school during the period is listed below.

Sl no	Item	April	May	June	July	Aug	Sept	Total
		Qty						
1	Bhindi	29.00	110.00	47.00	5.50	55.50		**247.00**
2	Cucumber	140.00	24.50	30.00	8.00	6.00	71.00	**279.50**
3	Spinach					25.00	21.50	**46.50**
4	Bitter Guard		1.00				29.00	**30.00**
5	Lady's Finger (Green)						13.50	**13.50**
6	Lady's Finger (Long)						11.50	**11.50**
7	Tomato	2.00	2.20	1.50	0.50	3.50	15.75	**25.45**
8	Cluster beans	17.25	11.50	11.50	12.50	6.00	20.50	**79.25**
9	Salad Cucumber	88.00	88.00	54.00	2.50	8.25		**240.75**
10	Brinjal Round	7.25	15.00	16.00	40.50	38.00	27.00	**143.75**
11	Brinjal Long		2.50	3.00	4.50	4.50	11.50	**26.00**
12	Chilly	2.00	2.20	2.50	3.00	0.25	1.00	**10.95**
13	Guva	0.35	2.30	3.50	3.00	3.00	8.50	**20.65**
14	Tapico	172.00	67.50					**239.50**
15	Sapota		12.50	2.50	1.50	1.25	2.00	**19.75**
16	Pappaya	12.00	13.00	7.00	3.00	3.75	5.75	**44.50**
17	Drumstick		1.75					**1.75**
18	Palak (@ Rs 10/per bundle)	1.00						**1.00**
19	Amaranthus	50.00	41.00	57.00				**148.00**
20	Drumstick	8.00						**8.00**
21	Curry Leave			2.00				**2.00**
22	Jamba	11.70	21.00	21.00				**53.70**
23	Brinjal Long	7.25						**7.25**
24	Rambutan				1.50			**1.50**
25	Snake guard	32.00	39.00			5.00	48.00	**124.00**
26	Yard long Beans	28.00	97.00	77.00	9.00	22.00	63.50	**296.50**
27	Pumpkin		2.70	2.50				**5.20**
28	Nenthran	3.00	9.00	2.00	2.00	147.50	233.00	**396.50**

Sl no	Item	April	May	June	July	Aug	Sept	Total
		Qty						
29	Rasakadali					2.25	4.00	**6.25**
30	Kaveri Banana						2.50	**2.50**
31	Pookathali					3.00	8.00	**11.00**
32	Annaan banana					8.00		**8.00**
33	Morris Banana						10.00	**10.00**
34	Monthan			4.00				**4.00**
35	White Kappa			12.00				**12.00**
36	Red Banana	13.00			10.00			**23.00**
37	Poovan	17.00			4.00			**21.00**
38	Coriander leaf	0.50					0.50	**1.00**
Total		**641.30**	**563.65**	**356.00**	**111.00**	**342.75**	**608.00**	**2,622.70**

Vermi Compost

A new vermi compost pit with a dimension of 3.2x1.5x.7, is install in farm school during the period.

Field visit – HSS Venganoor School

Field visit Field visit by Venganoor HSS students at farm school. Total 350 students came, and they were introduced to Miyawaki forest area, Banana plantation, Biogas plant, Vermicompost and farming techniques which includes drip irrigation, weed management, using mulch films.

Maintenance @ GIS

At GIS, a total of No of 180 plants planted, comes to an age of 1.5 years the starting flowering and fruiting. The security concerned were on full alert as the

Jamaba (Bell fruit) is not complete harvesting stage. A separate Karmasena member who oversees GIS even does the cultivation of vegetable @ the entire spaces of fruits which are planted.

Pomegranate Plantation

A total area of twenty-nine cents located by AVPPL GIS is utilized for pomegranate cultivation in the above said areas. All one hundred plants planted were in good health condition and have demands for new manure application.

Horticulture Land scaping at port

The Horticulture land scaping at port site is maintaining by Vanitha Karsheeka Karma Sena, one of the livelihood groups formed as part the CSR activities. The maintenance activities include utilization fertilizers, pruning of plants, Removing weeds and irrigation.

2.5. Cancer Care Support - providing nutritious Food supplements & Medicines to poor cancer patients.

Cancer care food support has continued this month also. A total no of 127 patients were provided with food support during the period. This is in addition to regular house visits to the families of the suffering patients for consolation and for providing further mental strength.

List of Patients provided nutritious support during the period.

Sl.No	Month	No. of Patients supported
1	April	20
2	May	20
3	June	18
4	July	18
5	Aug	23
6	Sept	28
	Total	**127**

Cancer Medicines to Abhayam Charitable Society for distribution

Medicines relating to cancer cure were handed over to Abhayam Charitable Society for its further distribution to the needy patients. A total n of 30 patients were given the above support through Abhayam charitable society managed by Sr. Lucia.

2.6. Patient care support programme/Benevolent support programme

As part of the patient care support programme, community volunteers along with MHCU team have been visiting the houses of bedridden patients and providing the following support during the reporting period.

The List of Patients visited by Community Volunteers and CSR team during the period is as follows.

Sl.No	Month	No. of Patients supported
1	April	12
2	May	7

Sl.No	Month	No. of Patients supported
3	June	9
4	July	10
5	Aug	10
6	Sept	12
	Total	**60**

2.7. Community Awareness programmes

Adani Foundation has been conducting community awareness sessions in the project affected area with the support of Locally trained community Resource persons. One of the livelihood groups, promoted under the CSR of AVPPL/AF-Karsheeka Karma Sena is coordinating the campaign. All the community Resource persons are selected from the project affected area and trained by AVPPL/AF.

The theme of the community awareness programme for the current financial was decided as various grant-in-aid schemes of state and central Governments. As part of it an action plan for the year was prepared and started the activities. The first activity was the collection of details on various Govt. schemes from various govt. departments. As decided a training programme was provided to selected community volunteers on the theme. The first theme for the training programme was on various banking schemes coordinating by the lead bank, Indian Overseas Bank, Thiruvananthapuram.

ToT of Community Volunteers on Govt Schemes

A one-day training & Orientation programme conducted on 28/04/2023 regarding the Govt Schemes and its implications in the community. As a

beginning Lead Bank Resource Person Mr. Jayakumaran Nair briefed about the various Insurance, Health, and banking schemes for individual as well as for the SHG groups. 47 community members participated in this program. This was an interactive program.


As part of it an action plan for the year was prepared and started the activities. During the period following community awareness sessions were concentrated on spreading the message of Govt Schemes like Atal Pension Yojana, PMJJBY and PMSBY. In addition to that information regarding the CSR activities and skill development courses was also briefed in the sessions. The details of the community awareness programmes during the period are as follows.

Sl No	Date	Venue with Ward	No of Participants
1	22-05-23	Venganoor	15
2	30.05.23	Vizhinjam	16
3	01-06-23	Mukkola	15
4	01-06-23	Kanjiram Vila -Mukkola	16
5	04-06-23	Vellam Kolli-Mulloor	15
6	04-06-23	Vitharuthanvila-Mukkola	16
7	10-06-23	Muduparavila -Venganoor	17
8	02-07-23	Manali-Venganoor	13
9	08-07-23	Kidarakuzhi-Venganoor	15
10	11-07-23	Mukkuvankuzhi-Venganoor	13
11	21-07-23	Mukkola	20
12	22-07-23	Kalluvettankuzhi-Venganoor	17

Sl No	Date	Venue with Ward	No of Participants
13	23-07-23	Venganoor	19
14	27-07-23	Venganoor	20
15	28-07-23	Sarvashakthipuram	15
16	28-07-23	Mulloor	17
17	30-07-23	Kidarakuzhi	16
18	01-08-23	Vizhinjam	15
19	02-08-23	Pallithura	17
20	05-08-23	Mukkuvankuzhi	15
21	06-08-23	Kidarakuzhi-Mulloor	17
22	06-08-23	Kidarakuzhi-Mulloor	23
23	07-08-23	Mulloor	20
24	07-08-23	Kalluvettankuzhi-Venganoor	16
25	15-07-23	Kidarakuzhi	15
26	23-08-23	Vizhinjam	20
27	26-08-23	Manali	16
28	27-08-23	Vallamkolly	18
29	30-07-23	Kidarakuzhi	17
	Total		**484**

2.8. Convergence of Govt. Schemes

The convergence of Govt. Grant-in-aids schemes in CSR activities is progressing well during the reporting period. Information regarding various schemes have been shared through the WhatsApp groups named "Phoenix – for Widows and divorced" and 'Shalabhangal- Butterflies for children under 18yrs old.

Information regarding various schemes were circulated during the period as follows:

Sl.No	Month	No. of Schemes covered
1	April	11
2	May	17
3	June	10
4	July	5
5	Aug	11
6	Sept	16
	Total	**70**

Special Enrollment drive for various Govt. grant-in-aid schemes

As part of the convergence of various govt. schemes special enrolment drive cum awareness camps were organized during the reporting period as follows

Sl No	Venu	Date	Participants	Conversion
1	Residence Association office, Pulinkudi	30.06.2023	49	44
2	NSS Karayogam, Venganoor	09.09.2023	25	5
3	NSS Karayogam, Mulloor	15.09.2023	65	11
4	Vizhinjam Vadakkum Bhagam Muslim Jamayath	21.09.2023	60	10
5	Pulinkudi Residence Association Kottukal Industrial Training School	13.07.2023	10	2
6	District Tourism Society Office -Kovalam	29.07.2023	17	3
7	Kudumbhasree ADS, Kottukal Gram Panchayat Home – Kudumbhasree ADS, Secretary, Kottukal	31.07.2023	54	5
Total			**280**	**80**

The special drive provided the information and chance to get enrolled for the following schemes.

- E-Shram
- Pradhanamanthri Jeevan Jyothi Bheema Yojana
- Pradhanamanthri Suraksha Bheema Yojana
- Atal Pension Scheme

2.9. Lifestyle Disease detection Camps

As part of the community health initiatives, lifestyle disease detection camps have been organized in association with Kerala Social Security Mission, Govt. of Kerala and grass roots organisations. During the period 9 such camps were conducted as follows

Sl.No	Month	Date	Venue	Screened
1	May	18.05.2023	St. Mary's HSS, Vizhinjam	162
2	May	28.05.2023	St. Mary's HSS, Vizhinjam	
3	June	08.06.2023	Nehru Smaraka Grandhasala	62
4	June	26.06.2023	St. Mary's HSS, Vizhinja	148
5	July	13.07.2023	Pulinkudi Residence Association -Vivekanada Industrial Training School	50
6	July	24.07.2023	HSS For Girls Venganoor	164
7	Aug	10.08.2023	CDS office, Kottukal, Uchakkada	64
8	Aug	17.08.2023	Jai Christ Library, Adimalathura	78
9	Sept	21.09.2023	Vadakkum Bhagam Muslim Jamaath	94
Total				**822**

The MHU of Adani Foundation provides proper guidance and consultation for all the referred patients based on the results obtained from the camp.

The details of various tests are as follows.

Sl. No	Type of Tests	Tested	Total Screened		
			Male	Female	Total
1	Blood Pressure	Tested	291	531	822
		Referred	8	9	17
2	Blood Sugar	Tested	291	531	822
		Referred	16	18	34
3	Total Cholesterol	Tested	291	531	822
		Referred	42	59	101
4	Blood Count	Tested	291	531	822
		Referred	2	8	10
5	Urine Sugar	Tested	291	531	822
		Referred	2	4	6
6	Urine Albumin	Tested	291	531	822
		Referred	6	9	15
7	Creatine	Tested	291	531	822
		Referred	1	2	3
8	Urea	Tested	291	531	822
		Referred	1	0	1
9	Uric Acid	Tested	291	531	822
		Referred	0	0	0
10	ECG	Tested	291	531	822
		Referred	0	0	0
11	Bilirubin	Tested	291	531	822
		Referred	5	2	7
12	HB	Tested	291	531	822
		Referred	55	84	139
Total		**Tested**	291	531	822
		referred	**138**	**195**	**333**

2.10. Eye Screening camps

As part of the health initiatives under the CSR of AVPPL/AF five eye screening Camps were organized during the reporting period with the support of Regional Institute of Ophthalmology -Govt Eye Hospital, Trivandrum as follows.

Sl No	Dates	Camp Place	Number of Patients	Number of Patients Suggested Specs	Number of Patients suggested Cataract Surgery
1	11-08-2023	District Tourism Cooperative Society Kovalam	86	31	5

Sl No	Dates	Camp Place	Number of Patients	Number of Patients Suggested Specs	Number of Patients suggested Cataract Surgery
2	19-08-2023	Trivandrum Social Service Society Vizhinjam	135	23	0
3	26-08-2023	Vizhinjam Vadakkum Bhagam Muslim Jamayath	125	50	10
4	09-09-2023	NSS Karayogam Venganoor	101	44	13
5	15-09-2023	NSS Karayogam Mulloor	106	70	11
Total			**553**	**218**	**39**

Spectacles Frame Selection

Aftyer completing the Eye Screening camps, spectacle selection camps were also conducted in the same location for reffered people.

2.11. Satwara-Project

Satwara, one of the initiatives for fostering craft works and promoting artisans by Adani Foundation nationally. As part of this programme, an institute

fostering craft in Vizhinjam namely SISP (Sebastian Indian Social project) were asked to furnish models of bowls and Lamps in coconut shells. The materials made were send to HO for Corporate gifting.

SUSTAINABLE LIVELIHOOD DEVELOPMENT (SLD)

The projects under SLD included,

1. Competitive Exam Preparation
2. Digital Literacy – E-Learnings
3. Skill Development Programme &
4. Livelihood Development Programme

3.1 "Coaching for Victory" – Competitive Exam Coaching Programme

Offline Training Classes

Progressing the offline training sessions for the Competitive Exam Preparation candidates based on the notifications declared by the Central/State Government job openings under different departments. The sessions are going on at Sahridayananda Library Hall, Uchakkada, Mulloor from 22nd June 2023 onwards. Subject wise classes for syllabus-based examinations are focusing on regular daily mock tests. In FY 2023-24, achieved 46 admissions from the community youths for attending competitive exam preparation classes. Intensive syllabus-based training is providing for the candidates by the experts.

Learning Activities

In addition to the offline classes, other learning methods have been progressing simultaneously as follows.

- Study materials like Rank file pages, easy study methods from You Tube and voice clips related to the daily test topics links have been shared to groups on a regular basis.
- Different vacancy announcements from Central and State government have also been circulating through digital media.
- Daily mock test for a score of 30 has been conducted on a regular basis.
- After the successful completion of every day mock test the top scorers will be announced by the coordinator in the group.
- From this year onwards, a 100 marks mock test purely based on the previous question papers is conducted on regular weekends and the results will be announced through the groups.

The training sessions are bases on the following topics,

i. General English.

ii. Mathematics.
iii. Indian Constitution.
iv. Malayalam.
v. General Knowledge.
vi. History.

Notifications from the Government agencies were circulated on a weekly basis through the social media groups.

Achievements:

- ✓ 100% of the candidates are applying and attending Central/State Govt. examinations.
- ✓ 33 candidates from the CEP batches attended the Police Constable examination in the July month.
- ✓ In total 15 candidates are included in 55 several 10th/+2/Degree Level Shortlists/ Ranklists published by Kerala Public Service Commission.
- ✓ Mr. Vishnu S R, 380th Rank in Police Constable Examination (Kasargod District) received the advice memo and joined for training on 2nd September 2023 at Kannur Police Training Academy.
- ✓ Mr. Stenu J at 933rd Rank in Police Constable (Trivandrum Dist.) and Jobin J got 1661st Rank in Police Constable (Malappuram Dist.).
- ✓ Mr. Jayashankar S, 8th Rank in Police Constable Examination (Special Recruitment) received the Advice Memo from KPSC
- ✓ Ms. Jayasree S S, 12th Rank in Confidential Assistant Examination received the Advice Memo during the period .
- ✓ Mr. Vishnu S R, 380th Rank in Police Constable Examination (Kasargod District) received the advice memo for joining.

Details of the achievers are as follows,

Achievers Details - 2022-23					
Sl. No	**Name of the Candidate**	**Category Number**	**Selected Job Roles**	**Eligibility Level**	**Status**
1	Vishnu K	548/19	Last Grade Servant (Idukki)	Plus Two	Joined on 12-11-2022
		609/21	Company Board Last Grade	Plus Two	Preliminary Exam passed. Selected for Main Exam
		368/21	Village Field Assistant (Kasargod)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		558/21	Bevco Lower Division Clerk	Plus Two	Preliminary Exam passed. Selected for Main Exam
		027/22	Beat Forest Officer (Pathanamthitta)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		600/21	Prison Officer Men	Plus Two	Preliminary Exam passed. Selected for Main Exam
		466/21	India Reserve Battalion (Regular Wing)	Plus Two	Preliminary Exam passed. Selected for Main Exam
2	Vishnu S R	609/21	Company Board Last Grade	Plus Two	Preliminary Exam passed. Selected for Main Exam
		530/19	Civil Police Officer (Kasargod)	Plus Two	Achieved 380th Rank, received advice memo & joined on 02-09-2023
		368/21	Village Field Assistant (Idukki)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		558/21	Bevco Lower Division Clerk	Plus Two	Preliminary Exam passed. Selected for Main Exam
		027/22	Beat Forest Officer (Pathanamthitta)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		600/21	Prison Officer Men	Plus Two	Preliminary Exam passed. Selected for Main Exam
		466/21	India Reserve Battalion (Regular Wing)	Plus Two	Preliminary Exam passed. Selected for Main Exam
3	Jayasankar	609/21	Company Board Last Grade	Plus Two	Preliminary Exam passed. Selected for Main Exam
		340/20	Civil Police Officer (Trivandrum)	Plus Two	Achieved 8th Rank, Advice Memo Received & Joined on 17-08-2023
		530/19	Civil Police Officer (Trivandrum)	Plus Two	Achieved 383rd Rank
		368/21	Village Field Assistant (Trivandrum)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		558/21	Bevco Lower Division Clerk	Plus Two	Preliminary Exam passed. Selected for Main Exam
		653/21	Company Board /Corporation Assistant (KSRTC/KLDB)	Degree	Preliminary Exam passed. Selected for Main Exam
		388/19	Sub Inspector of Police	Degree	Supplementary List
		600/21	Prison Officer Men	Plus Two	Preliminary Exam passed. Selected for Main Exam
		251/21	Bevco Assistant	Degree	Preliminary Exam passed. Selected for Main Exam
		466/21	India Reserve Battalion (Regular Wing)	Plus Two	Preliminary Exam passed. Selected for Main Exam

Achievers Details - 2022-23					
Sl. No	**Name of the Candidate**	**Category Number**	**Selected Job Roles**	**Eligibility Level**	**Status**
4	Gopika R Murali	207/19	Lower Division Clerk (Malappuram District)	Plus Two	Joined on 28-11-2022
		94/20	Civil Police Officer (Women)	Plus Two	Physical Exam Passed. Waiting for Rank List.
		245/20	Firewomen	Plus Two	Selected for the Physical Examination.
		609/21	Company Board Last Grade	Plus Two	Preliminary Exam passed. Selected for Main Exam
		368/21	Village Field Assistant (Trivandrum)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		558/21	Bevco Lower Division Clerk	Plus Two	Preliminary Exam passed. Selected for Main Exam
		653/21	Company Board /Corporation Assistant (KSRTC/KLDB)	Degree	Preliminary Exam passed. Selected for Main Exam
		251/21	Bevco Assistant	Degree	Preliminary Exam passed. Selected for Main Exam
		027/22	Beat Forest Officer (Trivandrum)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		089/19	Secretariate Office Assistant (Special Recruitment)	Plus Two	Preliminary Exam passed. Selected for Main Exam
5	Jobin J	466/21	India Reserve Battalion (Regular Wing)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		027/22	Beat Forest Officer (Wayanad)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		530/19	Civil Police Officer (Malappuram)	Plus Two	Achieved 1661st Rank
6	Sreedevi G S	652/21	Prison Officer Women	Plus Two	Preliminary Exam passed. Selected for Main Exam
		609/21	Company Board Last Grade	Plus Two	Preliminary Exam passed. Selected for Main Exam
7	Jishnu Vinayan	368/21	Village Field Assistant (Kozhikode)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		530/19	Civil Police Officer (Thrissur)	Plus Two	Physical Exam Passed. Waiting for Rank List.
		466/21	India Reserve Battalion (Regular Wing)	Plus Two	Preliminary Exam passed. Selected for Main Exam
8	Sreekanth S Nair	466/21	India Reserve Battalion (Regular Wing)	Plus Two	Preliminary Exam passed. Selected for Main Exam
		530/19	Civil Police Officer (Thrissur)	Plus Two	Physical Exam Passed. Waiting for Rank List.
9	Anoop Mohan	466/21	India Reserve Battalion (Regular Wing)	Plus Two	Preliminary Exam passed. Selected for Main Exam
10	Reshma	558/21	Bevco Lower Division Clerk	Plus Two	Preliminary Exam passed. Selected for Main Exam
		609/21	Company Board Last Grade	Plus Two	Preliminary Exam passed. Selected for Main Exam
11	Rani	609/21	Company Board Last Grade	Plus Two	Preliminary Exam passed. Selected for Main Exam
12	Karthika G	653/21	Company Board /Corporation Assistant (KSRTC/KLDB)	Degree	Preliminary Exam passed. Selected for Main Exam

Achievers Details - 2022-23					
Sl. No	**Name of the Candidate**	**Category Number**	**Selected Job Roles**	**Eligibility Level**	**Status**
		026/22	Company Board /Corporation Assistant (KSFE/KSEB/KMML)	Degree	Preliminary Exam passed. Selected for Main Exam
		027/22	Beat Forest Officer (Idukki)	Plus Two	Preliminary Exam passed. Selected for Main Exam
13	Chithra K	368/21	Village Field Assistant	Plus Two	Preliminary Exam passed. Selected for Main Exam
		747/21	Data Entry Operator	Plus Two	Preliminary Exam passed. Selected for Main Exam
14	Stenu J	530/19	Civil Police Officer (Trivandrum)	Plus Two	Achieved 933rd Rank
15	Jayasree S S	277/18	Confidential Assistant	Plus Two	Achieved 12th Rank, Advice Memo Received & Joined on 21-08-2023

3.2 Digital Literacy E-Learning Programme

The digital literacy training is also progressing at community venues. Achieved 79 admissions during the period for the training. In this reporting month, some of the batches registered in the previous FY are going on in different locations and many completed successfully.

The programme covers internet banking, social media, mobile banking, Digi locker, MS office, cyber security, barcode etc. The programme helped in making the people equip on online transactions, bill payments like KSEB, water bills, school fee payments and e-commerce activities without any others help.

The Digital Literacy Batch beneficiaries installed many useful mobile applications like BHIM App, SAKSHAM App and Digi-Locker.

Due to the upgradation process ongoing from HO, the Digital Literacy courses are on hold for few days. Artificial Intelligence, Cyber Crimes, Cyber Laws etc...

are planning to integrate with the existing relevant modules. Once the modules are designed, batches will start accordingly.

3.3. SKILL DEVELOPMENT PROGRAMME

Employability Skilling Programmes

- In this FY 2023-24, ASDC is continuing five different domain courses for the community youths in and around Vizhinjam area. All the batches will start only after successfully conducting the Induction Programme.
- The number of trainees in different domains started in FY 2023-24 and going on at centre are as follows,

Sl. No.	Course Name	Eligibility	Duration	Certification	Venue of Classes	Participants
1	Beauty Therapist - BT	10th	340 hrs	ASDC & ASAP	CSR Office, Mukkola	25
2	Self Employed Tailor – SET (2 batches)	10th	340 hrs	ASDC & ASAP	VizMart Livelihood Centre, Vizhinjam	34
3	General Duty Assistant – GDA (2 Batches)	10th	420 hrs	ASDC & ASAP	Transit Campus, Mukkola	44
4	Domestic Data Entry Operator - DDEO (2 batches)	10th	400 hrs	ASDC & ASAP	Transit Campus, Mukkola	48
4	**Total**					**151**

General Duty Assistant (Batch 3 & 4)

Progressing 2 batches for General Duty Assistant course started from 1st June 2023 onwards with 44 trainees in total. Ms. Sheeja M is handling the sessions at the centre. The batches are arranged in Morning shift and Afternoon shift.

International Nurses Day Celebrations -2023

On 12th May 2023, ASDC Vizhinjam Centre celebrated International Nurses Day at centre with several programmes. The session was started with a prayer song by Ms. Aryananda, GDA Trainee. Ms. Sandhyamol, GDA trainee welcome all the guests to the programme. Sister Lucia, Mr. Sebastian Britto, Programme Manager, AF were in the guest panel. Ms. Jeni, GDA trainee did a talk on the Florence Nightingale and remembered us about the importance of the day. All the social activities done by the social reformer was well briefed on that occasion by the presenter.

On this important day, we lighted candles in the remembrance of Dr. Vandana Das who was killed by police arrested person at Thaluk Hospital, Kottarakkara, Kerala on 10th May 2023. The light was shared by the guest panel to all the participants and did prayer in silence for her soul to Rest in Peace.

Sister Lucia is having 30 years of working experience as nurse in Government Hospital and more than 20 years in social care services in Vizhinjam and nearby areas. Now also she is taking care of the cancer patients in and around Vizhinjam area. She reminds her professional career start and the situations faced through these long services to the community. She was very excited to share her 50 more years of experience with our trainees. She motivated them to follow their passion and to become an employee. She also defined the importance of nursing profession and the need of attitude to help others. Mr. Sebastian Britto gave the nurses day wishes to all the trainees and shared some experiences related to the profession.

31 GDA candidates were placed during the period.

Beauty Therapist (Batch 1)

The Beauty Therapist course with 25 trainees started on 8th May 2023 ended on 7th September 2023. All the trainees completed the LMS online assessment, Practical and Viva Assessments.



Guest Lecture

A guest lecture session was conducted for the ongoing Beauty Therapist batch trainees on 10th August 2023 at the centre. The session was handled by Ms. Nadiya, who has 12 years of experience in the beautician field and has been running her own Beauty Parlor at Puthiyathura for the last 8 years. She gave a detailed brief on Saree Trapping and Hindu Bridal Makeup. These topics were practiced and redemonstrated by the trainees.



Farewell Celebration

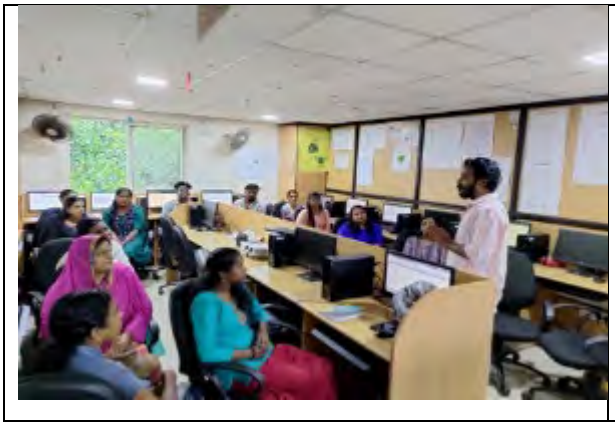
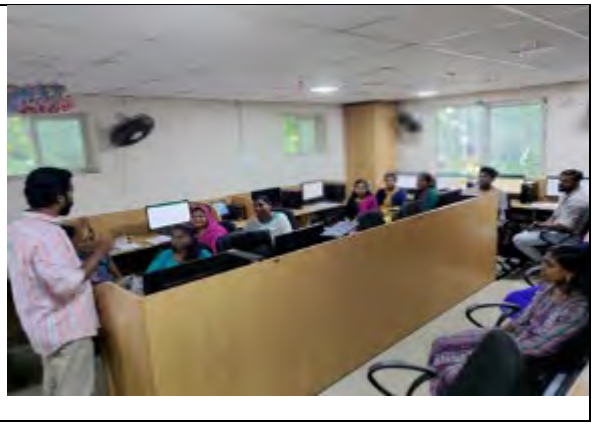
Beauty Therapist batch trainees arranged a farewell celebration on 7th September 2023 as part of completing their training sessions at centre. Mr. George Zen P T, Project Officer, AF Vizhinjam, Mr. Anurag M J, Centre Head, ASDC Vizhinjam along with other team members participated in the same. Many of the trainees shared their feedback and experiences in training under Vizhinjam centre. A cake cutting ceremony was done on the occasion as per the arrangements made by the trainees. All the team members conveyed wishes and motivated them to become employed.


Domestic Data Entry Operator- (Batch 1 & 2)

After successfully completing the Induction programme, the Domestic Data Entry Operator batches were started on 28th June 2023, with 48 trainees. The batches are divided into the morning batch and afternoon batch in which having 24 trainees respectively. Theory and Practical trainings are going on at the centre as per the plan.


Motivation Session

A motivation session for the Domestic Data Entry Operator ongoing batch trainees was conducted on 21st September 2023. Mr. Stephen Vinod, Project Officer, AF Vizhinjam handled the session. He explained about the employment challenges facing the youths and motivated them to use their skill acquired through trainee for their employment. He also tried to engage them in several ice breaking activities and shared his working experiences.

Experience Sharing Session

One of the previous DDEO batch trainees, Ms. Mubeena N visited the centre on 20th September 2023. She was placed at State Bank of India (SBI), Shanthi Nagar branch, Trivandrum as a contract staff in Data Entry

Operator. She shared her training experience under Vizhinjam centre and experience about the job she is continuing. She explained very well and understood ongoing batch trainees about the importance of employment in their life. She was happy about the experience sharing and wishes all the success to the trainees.

Self Employed Tailoring (Batch 1 & 2)

The Self-Employed Tailoring batch started on 8th May 2023 with 19 and 15 trainees respectively was ended on 2nd September 2023. All the trainees completed their LMS, Practical and Viva assessments. Ms. Priya, an experienced trainer handled the practical and viva assessments at centre.

Certificate Distribution

Hardcopy certificates for the previous batch completed trainees were distributed at the centre on 9th September 2023. Mr. Sebastian Britto, Program Manager, AF Vizhinjam and Mr. Sreejith S, Placement Manager, ASDC Vizhinjam attended and distributed the certificates to the trainees. Trainees shared their feedback and experiences about the training under Vizhinjam centre.

Farewell Celebration

Self Employed Tailor batches started on 8th May 2023 with 34 trainees from the communities ended on 2nd September 2023 after successfully completing the LMS, Practical and Viva assessments. On 5th September 2023, SET batch trainees arranged a farewell celebration at the centre. Mr. George Zen P T, Project Officer, AF Vizhinjam, Mr. Stephen Vinod, Project Officer, AF Vizhinjam and Mr. Sreejith S, Placement Manager, ASDC Vizhinjam participated in the same along with other CSR and ASDC staff members. Trainees shared their experiences and feedback on the training provided under Vizhinjam centre. Ms. Preeja, Trainer-SET shared her training experience and motivated them to use their skills to earn money for their family.

Placement Details

After completing the batches, total 37 trainees from the SET & BT courses were Self-Employed and 7 from the BT & DDEO batches were placed in several organizations at Trivandrum as salaried. The details are as follows,

Adani Skill Development Centre – Vizhinjam					
Candidate Placement Details - September 2023					
Sr. No.	**Course**	**Full Name**	**Employment Type**	**Employer Name**	**Salary**
1	Self Employed Tailor	Sharafiya Beevi	Self Employed		3,000
2	Self Employed Tailor	Reji B	Self Employed		4,000
3	Self Employed Tailor	Liji V	Self Employed		3,500
4	Self Employed Tailor	Fathima H	Self Employed		4,000
5	Self Employed Tailor	Resmi S S	Self Employed		3,000
6	Self Employed Tailor	Jayaprabha J	Self Employed		4,000
7	Self Employed Tailor	Mubeena N	Self Employed		3,000
8	Self Employed Tailor	Reshmi R R	Self Employed		3,000
9	Self Employed Tailor	Juliet J	Self Employed		3,000
10	Self Employed Tailor	Shajina N	Self Employed		4,000
11	Self Employed Tailor	Subi J S	Self Employed		3,000

Adani Skill Development Centre – Vizhinjam					
Candidate Placement Details - September 2023					
Sr. No.	Course	Full Name	Employment Type	Employer Name	Salary
12	Self Employed Tailor	Reshma B M	Self Employed		4,000
13	Self Employed Tailor	Vinitha R S	Self Employed		3,000
14	Self Employed Tailor	Nisha Beegam R	Self Employed		3,500
15	Self Employed Tailor	Kadeeja Beevi R	Self Employed		3,500
16	Self Employed Tailor	Salma Beevi R	Self Employed		3,500
17	Self Employed Tailor	Remya C	Self Employed		4,500
18	Self Employed Tailor	RoslinRS	Self Employed		3,000
19	Self Employed Tailor	Veena V	Self Employed		3,000
20	Self Employed Tailor	AbidaS	Self Employed		3,000
21	Self Employed Tailor	SanthiS	Self Employed		4,500
22	Self Employed Tailor	RamseenaM	Self Employed		3,000
23	Self Employed Tailor	SanthiR	Self Employed		4,000
24	Self Employed Tailor	Alphonsa B	Self Employed		3,000
25	Self Employed Tailor	Reshma S	Self Employed		3,000
26	Self Employed Tailor	Cindy Clitus	Self Employed		4,000
27	Self Employed Tailor	SufinaN	Self Employed		4,000
28	Self Employed Tailor	Reseena Beevi	Self Employed		4,000
29	Self Employed Tailor	Minimol S	Self Employed		4,500
30	Beauty Therapist	Shifana D S	Self Employed		4,000
31	Beauty Therapist	Bhadra L M	Self Employed		4,000
32	Beauty Therapist	Arya L M	Self Employed		4,000
33	Beauty Therapist	Soniya	Self Employed		4,000
34	Beauty Therapist	Soumya O	Self Employed		4,000
35	Beauty Therapist	Anusree Gopan	Self Employed		4,000
36	Beauty Therapist	Soorya G	Self Employed		4,000
37	Beauty Therapist	Rudra Biju B	Self Employed		4,000
38	Beauty Therapist	Vidhya V C	Salaried	Nadiya Beauty Solution	5,000
39	Beauty Therapist	Nithya J S	Salaried	Soniya Beauty Parlour	5,000
40	Beauty Therapist	Praveena A	Salaried	Fairness Beauty Parlor	5,000
41	Beauty Therapist	Judy G	Salaried	Nadiya Beauty solution	5,000
42	Beauty Therapist	Saranya K	Salaried	Fairness Beauty Parlor	5,000
43	Beauty Therapist	Fazila B R	Salaried	Nadiya Beauty solution	5,000
44	Domestic Data Entry Operator	Victor L	Salaried	Lulu Hyper Market	5,000

Self-Employment Details

Ms. Viji S, our last year batch Beauty Therapist trainee started her training under Vizhinjam centre on 16th November 2023 and successfully completed the training on 15th March 2023. She

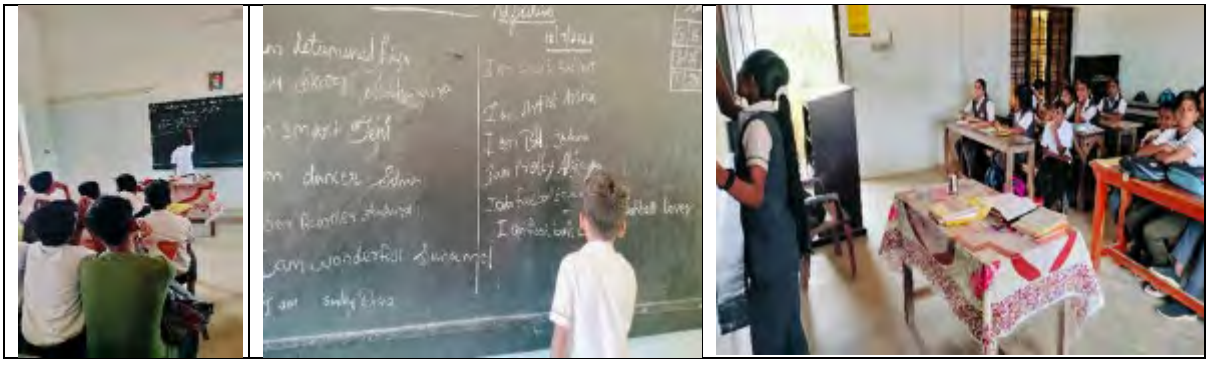
got the placement opportunity in the march month itself in a beauty parlor named – Feather Touch Beauty Parlor, Pulluvila. She was a good learner and a hard worker, completed her 3 months in that parlor. She was very much confident to start her own Beauty Parlor – Uvaa Beauty Parlor, Vizhinjam.

Language & Soft Skill Training

Soft Skill portions like Communication skills, Language skills are provided to the domain trainees as per the SOP. M. Kavitha is handling the soft skill portions for the ongoing domain batches. Online sessions are provided for the DEO, GDA and BT trainees for covering the soft skill portions.

Basic Functional English (Batch 1-5)

As part of the request from the St. Mary's Higher Secondary School, Kottapuram, 146 students were registered under Vizhinjam centre for the Basic Functional English course. These students are divided into 5 batches for conducting the classes at the school. School management provided necessary support on batch registration, documents sharing and arranging the classes along with their regular timetable. Ms. Kavitha T R handles the batches. Classroom training and learn with fun activities are provided for the students for the better learning. The classes are monitored by the school principal, and we are getting very good feedback from the management.



General Activities

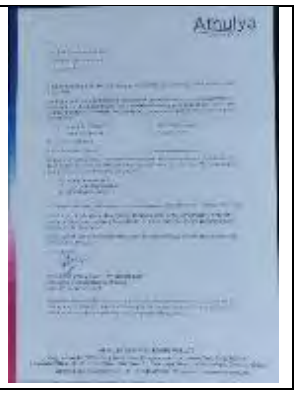
Nutrition Week – Guest Lecture

As the first week of September month is observed as the Nutrition Week, which is aiming to address the multifaceted challenges of malnutrition and promote healthier lifestyles across the nation. Considering the importance of the programme, ASDC Vizhinjam centre conducted a guest lecture session about the importance of the day handled by Ms. Meera Mariyam Skaria, Project Officer – Suposhan, Adani Foundation, Vizhinjam on 7th September 2023.

The session was arranged for the ongoing General Duty Assistant and Domestic Data Entry Operator batch trainees at centre and started at 11am. Following points were discusses in the session,

- Importance of nutrition.
- What is malnutrition and anaemia.
- How to take normal food intake regarding My plates concept
- Five rights of Ayush poshan regarding food intake.
- Importance of Water intake.
- Importance of breast milk.

Letter of Intent (LoI) for placements



Adani Skill Development Centre Vizhinjam signed a Letter of Intent (LoI) with Athulya Assisted Living Pvt. Ltd on 18th September 2023 for the placement support for General Duty Assistant (GDA) trainees.

Athulya Home Care is one of the emerging patient care support centres in India having branches in Kerala, Tamil Nadu, Karnataka and Telangana. They are providing very good support in patient care and giving good packages for the employees also. Mr. Shreeraj Nair, Regional Manager & Ms. Zareena Wahab, HR Manager, Athulya Senior Care handed over the signed LoI to Mrs. Sreejith, Placement Manager, ASDC Vizhinjam. With the validity of 1 year, they are interested to take our trained GDA trainees as Patient Care Assistant, Home Health Care Assistant and General Duty Assistant job roles with a package range of Rs. 11,000/- to 15,000/- per month.

SAKSHAM DAY Celebration 2023

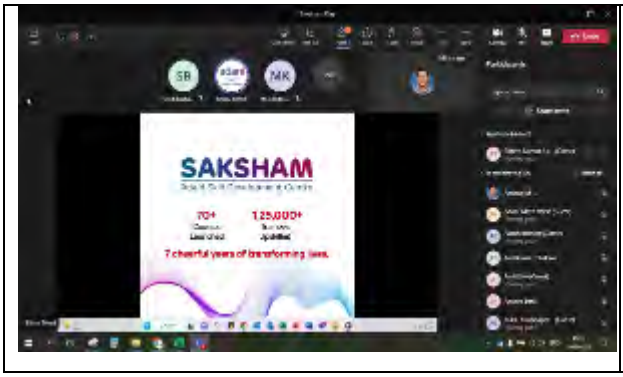
As Adani Skill Development Centre completed 7 years of skilling, Vizhinjam centre also celebrated "SAKSHAM DAY" on 16th May 2023 at centre. The importance of the day was briefed for the ongoing domain batch trainees and celebrated the day with Cake cutting ceremony. Trainees from the Beauty

Therapist and Domestic Data entry Operator batch trainees participated in the same. At Self Employed Tailor training centre, sweets were distributed to the trainees and to the livelihood group members at VizMart.

A virtual event was conducted by the HO team at 3pm on the same day through Teams-platform. Mr. Amit Thakker, Head Operations, ASDC welcome all the guests and participants to the celebration event. Shri. Vasant Gadhavi, Executive Director Adani Skill Development Centre formally inaugurated the celebration programme. Mr. Dhruv Trivedi, Manager MIS, ASDC gave a brief on 7 years of success in skill training of ASDC. He also shared a video of the year wise growth and success in training as well as in placement also. Achievements and awards earned by ASDC in these 7 years of travel was also included in the same presentation.

Secondly, the employees who completed maximum number of courses in E-Vidyalaya – E-Learning platform of Adani group were recognized on that occasion. Those achievers shared their experience of continuous e-learning on E-Vidyalaya and briefed about how these learning helps in their professional as well as personal growth.

Some of the selected stories of the successful trainees captured from different locations were showed in the session. Ms. Viswakala, Beauty Therapist trainee's story was selected from Vizhinjam centre. In that video, she shared her journey from the begin of the training till her current stage in that video.



Mango Day Celebration

As the National Mango Day is observed on 22nd July 2023, Vizhinjam centre also conducted some activities based on the importance of the day. A learn with fun activity was given to our Basic Functional English students to create a writeup and to draw pictures on the same. All the students were actively participated and shared their assignment work with us.

World Youth Skills Day -2023

Adani Skill Development Centre Vizhinjam conducted World Youth Skill Day '23 celebrations with several programmes and sessions on 15th July 2023, 10 am at CSR Office building. The celebration started with a prayer song by the GDA trainees and then Mr. Sreejith S, Placement Manager, ASDC Vizhinjam welcomed all the guests. The celebration was formally inaugurated by Mr. Rakesh, Senior Project Officer, Adani Foundation Vizhinjam with a brief about the scope of new technologies in our future life. A speech about the importance of the day was given by Mr. George Zen P T, Project Officer-Livelihood, Adani Foundation Vizhinjam and the new technologies merits and demerits were discussed by Mr. Stephen Vinod, Project Officer, Adani Foundation Vizhinjam. The scope of new technologies and the like courses planed by the ASAP team in Community Skill Parks was briefed by Mr. Ankur A, Programme Manager, ASAP Kerala.

As part of effective learning, many learn with fun activities were given and those were completed with good talents by the trainees. Trainers took initiatives to do those works and support them very well. They did some craft works, paper works, Fibre material works and other extracurricular activities

for showcasing the tasks. Looking into the talents, trainers were very much happy to appreciate the talented efforts take by the trainees by giving some prices. Our guest felicitated some of the best talented workers in that occasion.

The new technology for future was very well explained and presented by Mr. Anilkumar B S, IOT Trainer, ASDC Vizhinjam. He presented the details about the Internet of Things (IOT), Artificial Intelligence (AI) and 3D Printing technologies to all the participants with some sample videos. The session was very much enthusiastic for the participants in which they were thinking about the new upgradations. He also explained the contents with some real time examples.

In this year SAKSHAM DAY, Adani Skill Development Centre introduce a new learning methodology called "METAVERSE" to all in which many course are started training using a Virtual Reality (VR) device. As a real view, trainees can see and experience the skill training through the device. This will be a new revolution in the skill training and in the education fields. The VR technology was introduced to the Vizhinjam team members by Mr. Anurag M J, Centre Head, ASDC Vizhinjam. The METAVERSE were projected on the screen for all the participants to see how it looks and works. All the learn with fun works done by the domain batch trainees were exhibited in the Beauty Therapist classroom. Our IOT based Smart Farming model, some interesting games for measuring their skills were also in the exhibition. All the participants visited the exhibition and participated in the skilling games.

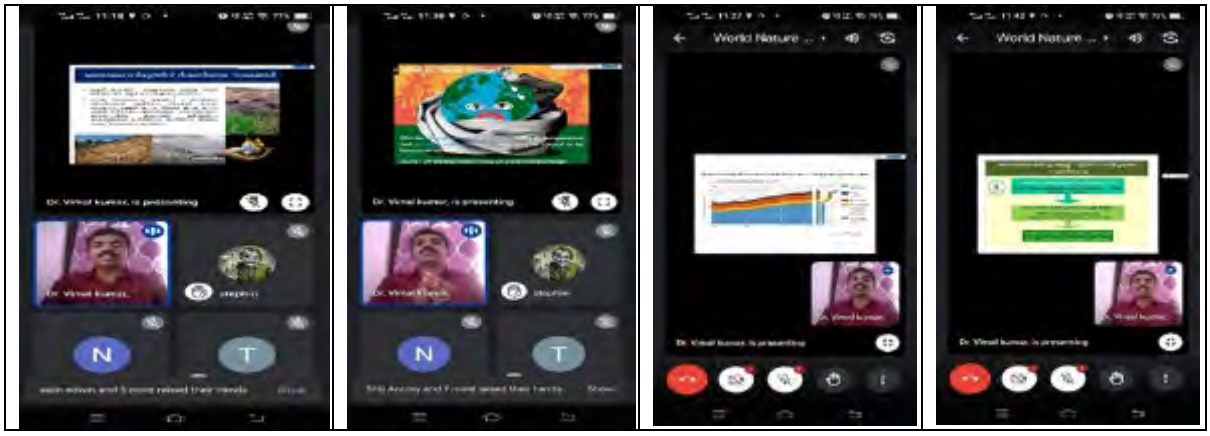
Ms. Sheeja M, GDA trainer, ASDC Vizhinjam gave thanks to all the participants, and the team members for taking their efforts for the celebrations and the celebrations ends by 12:30pm.

World Nature Conservation Day

As the World Nature Conservation Day is observed on 28th July, Vizhinjam centre conducted an online session for all the trainees and team members related with sharing the importance of the day. The online session was handled by Dr. Vimalkumar C S, Principal Scientific Officer, Kerala State Biodiversity Board through google meet. The session was attended by 108 members.

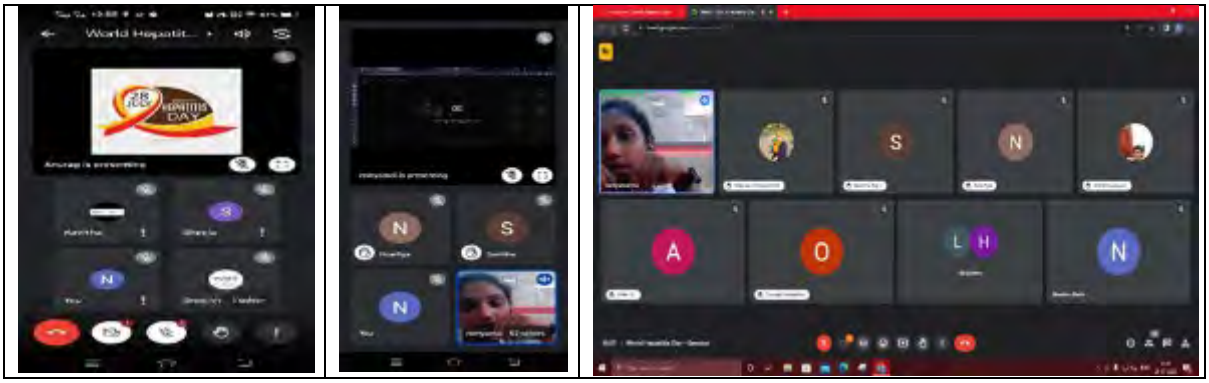
Points Discussed,

- Climate Change.
- Impacts on Climate Change.
- Importance of Biodiversity Conservation.
- Why Biodiversity Conservation.
- Actions to be taken to reduce biodiversity loss.



World Hepatitis Day

Vizhinjam conducted an online session related with the World Hepatitis Day on 28th July 2023. The session was handled by Ms. Reshma Shaiju, Lecturer, Nightingale Nursing College, Bengaluru. She gave details about the Hepatitis and its causes. The session was quite informative because regarding this type of disease many of the participants were not very much aware. 62 members participated in the session including our ongoing batch GDA trainees and their parents also.



Community Skill Park, Vizhinjam

The Civil construction work for Community Skill Park (CSP) is completed inside Vizhinjam Port area in association with Additional Skill Acquisition Programme (ASAP) and the internal paneling and other electrical works are progressing. The land handover by Vizhinjam International Sea Port Ltd. team to the ASAP team for construction having 3 storied building as Ground Floor for office space, Seminar Hall Training Rooms, G-1 Floor for IT lab & Other Training room facilities including Library, Meeting room, Faculty room. We are planning to start High End Port related courses according to the anticipated vacancies abroad as well as in the top organizations. ASAP will hand over the building as per the MoU with Govt.

From ASDC, course finalization process is in its final stage which will be happen after further discussions. High-end courses from the sectors like, Logistics, Health Care, Hospitality, IT-ITEs are preferred as per considering the placement market. The course finalization will be completed as earlier and will move forward with the infrastructure works. As of now the course are planning to have in 3 different levels as follows,

1) Post Graduate Diploma Courses.

2) Diploma Courses.
3) Certified Courses.

Highlights of CSP Infrastructure

- Sewage Treatment Plant - **STP 20 KLD MBBR** - Moving bed biofilm reactor (MBBR) is a biological technology used for wastewater treatment process suitable for municipal and industrial application. KLD - Volume of Collection / Equalization tank
- Water Treatment Plant - **WTP** for purifying the water from the Kerala Water Authority pipeline connection.
- Transformer of **250 KVA** with a **HT Outdoor Yard**. Planned provision for power back up placement.
- The **11 KV HT Power** electricity connection from KSEB. Separate HT supply lines in classroom and labs to cater high end electrical equipment used for training.
- **Heavy Machinery Lab** with one special entry gate, for ease of logistics. A **container** can get entered from the gate.
- **13 Passenger Lift** and Staircase with proper **Firefighting and Exit** plan.
- **Hostel** with capacity of 24 boys, 24 girls, 2 separate dining halls, 2 warden rooms, 1 sick room and visitor space.

Every window open-up towards greenery since the building is in **Green Valley** area. Highly ventilated and soothing environment for the purpose of education & training.

Area Details of Constructed Portion in CSP Campus

Area Details of Training Blocks		
Sl. No.	Location	Floor Area (Meter. Square)
1	Lower Ground Floor (G-1)	988.18
2	Ground Floor	988.18
3	Terrace Floor	27.44
	Total Area	2002.80
Area Details of Hostel Blocks		
Sl. No.	Location	Floor Area (Meter. Square)
1	Ground Floor	254.72
2	First Floor	411.40
3	Second Floor	414.57
4	Third Floor	409.46
5	Terrace Floor	32.20
	Total Area	1522.35
Area Details of Service Building		
Sl. No.	Location	Floor Area (Meter. Square)
1	Security Cabin	14.04
2	Pump Room	21.44
3	Electrical & DG Room	60.10
	Total Area	95.58
	Gross Area Constructed	3621.73

Other Facilities		
Sl. No.	Facility	Demarcated for
1	Car Parking	28 Vehicles
2	Two-Wheeler Parking	35 Vehicles
3	Open Area for Lawn in front of building	Sufficient
4	Open Area for Students Outdoor Activities	Sufficient

Weekly review meeting has been arranged every Tuesday at Port Operation Building with Dr. Anil Balakrishnan, Head CSR, Southern Region, Dr. T M George, Technical Advisor, CSP Vizhinjam, Mr. Anurag M J, Centre Manager, ASDC Vizhinjam and Mr. Sreejith S, Placement Manager, ASDC Vizhinjam.

Actions:

1. Regular follow up on the status of the agreement with ASAP Kerala.
2. Course details were shared with ASAP team for integrating the same with the agreement.
3. Courses were finalized and prepared course curriculum for the submission.
4. Meeting with ODEPC & NORKA ROOTS teams related with the abroad placement procedures.
5. Follow Up on the draft MoU from ODEPC for abroad placement.
6. Meeting with Adani Trivandrum International Airport for identifying the upcoming vacancies and their placement procedures.
7. Monthly review meeting attending with AF HO team.
8. Mr. Sreejith S visited some of the companies having vacancies related to the shipping and logistics. Collected contacts and details for further discussions.

9. Mr. Anilkumar B S is developing contents for the IoT course integrated in POTM and for a separate programme in Diploma in IoT.

3.4. LIVELIHOOD UPDATES

Status of existing livelihood groups

Sl No	Group	Type of Business/ Status up to March 2020	Business Status during the Month
1	Clean 4 U (5 Members)	• Hi Tech Cleaning for Flats, Hospitals, Offices, water tank, Vehicle and Public Institutions • Hosted a new web site www.clean4u.info for the customer registration. • The turnover during the year was Rs.4,10,000/-	• The clients included offices, hospitals, flats... • Average monthly turnover was close to Rs. 1 laksh • Supplied contract cleaning cum housekeeping staff to CSR, ASDC, POB, Driver's toilet block at port and ITD Company. • Turnover for the period is Rs. 625800/-
2	Anaswara Poultry Unit (7Members)	• Hi-tech poultry with 14 cages of 630 chicken for 7 members • The total revenue for the group for the financial year is Rs. 4,00,000/-	• Ongoing • Average monthly earning per family is Rs. 4800/- • Turnover for the period is Rs. 72220/-
3	Thripti Poultry Unit (7 Members)	• Hi-tech poultry with 14 cages capacity of 630 chicken for 7-member group • The total revenue for the group for the financial year is Rs. 4,41,000/-	• Ongoing • Average monthly earning per family Rs. 4,600/-. • Turnover for the period is Rs. 72220/-
4	Harbour Canteen Unit (5 Members)	Canteen unit specially for traditional seafood's The total revenue for the group for the financial year is Rs. 20,19,600/-	• Daily turnover of Rs. 4,500/- to Rs. 5,000/- and gets an average profit of Rs.490 /-per day • Canteen runs in the building of Harbour Engineering Department • Average monthly turnover was close to Rs. 92,200/- • Turnover for the period is Rs. 571934/-
5	Sreebhadra Big Shopper Unit (3 Members)	Big shopper / Cloth Bag / Nonwoven Bag Unit The group has made a turnover of Rs.1,44,000/-for the current financial year	• Supplying cloth bags face mask etc. • Got order for Rs. 18,300/- during the month. • Turnover for the period is Rs. 105400/-

Sl No	Group	Type of Business/ Status up to March 2020	Business Status during the Month
6	Eco Shop unit (3 members)	Selling of fresh vegetables at Viz Mart • The turnover of the group for the last six months was Rs. 8,80,000/-	• Procuring vegetables from the local farmers, Farm School and selling at Viz Mart. • Monthly turnover for the month was Rs. 52600-. • Turnover for the period is Rs. 238057/-
7	Vizhinjam Karshika Karmasena (4 Members)	Clearing of vegetation and other Agri works Turn over for the last three months was 90,000/-	• The clean Campaign including community cleaning and the cleaning of public places are coordinating by the Group. • Vegetation cleaning and the plastic collection at port site is entrusted with this group. • Progressing the selling of fertilizer, growbags, plants etc. • Turnover for the month is 76,800/- • Turnover for the period is Rs. 443700/-
8	Prime Events (5 Members)	• Power Laundry Unit and Steam Pressing • Consultancy partner for Viz Mart – Livelihood market	• Steam pressing and hi-tech power laundry progressing. • Turnover for the month is Rs. 4,700/- • Turnover for the period is Rs. 35500/-
9	Data Plus (3 Members)	• Data entry Photostat, projects, designing and online jobs. • The group has made a turnover of Rs.7,40.000 for the financial year	• Turnover for the month is Rs. 13,810/ • Turnover for the period is Rs. 93314/-
10	Thattukkada Unit (3 members)	• Shop for preparation & selling of steam-based snacks • The shop has made a turnover of 3,60,000/- for the financial year	• The unit provide only the breakfast. • Daily turnover reached to Rs. 2400- 2700/- • Turnover for the period is Rs. 240000/-
11	You Me & Tea Café (3 members)	• Canteen unit, traditional Kerala Foods. • Made a turnover of Rs. 7,50,000/-in 7 months	• Averages daily turnover reached to 2,700- 3,500. • Monthly Turnover of the group was Rs. 67812/- • Worker's canteen is entrusted with the group • Turnover for the period is Rs. 571934/-
12	SRM Stitching & Garments unit	• Spot stitching and garments	• Express stitching and selling of lady's garments are the services.

Sl No	Group	Type of Business/ Status up to March 2020	Business Status during the Month
	(3 Members)	• The group has made a turnover of Rs. 2,14,000/- in six-month time	• Turnover for the month is Rs. 9240/- • Turnover for the period is Rs. 66189/- • One of the group members selected as the Voucher based trainer for Self Employed Trainer conducting by ASDC
13	Turn to fresh - organic shop (3 members)	• Virgin coconut oil, natural pickles, and other provisional items • The group has made a turnover of Rs. 1,00,000/- in 3 months.	• Wholesale dealer for provisions tie up with Paul Raj & Company • The Nestle Products and mineral water is also progressing as a separate counter. • The turnover for the month was Rs. 62777/- • Turnover for the period is Rs. 1305971/-
14	SWAP Data Services (3 Members)	• Providing online services like PAN card, notice printing and designing, art works, Photostat, Money Transfer etc....	• Providing data services and Photostat • They have been getting Rs. 17528/- turnovers in last month. • A new CSP- Customer Service Point of SBI was started at Viz Mart during the period • Turnover for the period is Rs. 93000/-
15	SPANDHAN AM Patient Care Unit (5 Members)	• Providing patient care services for bedridden patients in houses as well as in nearby hospitals.	• Office is functioning at Viz Mart • Six members got placed in home-based patient care. • Turnover for the month is Rs. 84,000/- • Turnover for the period is Rs. 504000/-
16	Samudra Activity Group	• Making of fresh fish pickles and other pickle items.	• Registration activities are under process.
17	Lottery, Tender Coconut	• Selling of Kerala State Lottery tickets and tender Coconut	• Temporarily closed
18	Milk and Milk products – Milma Parlor	• Selling of Milk and Milk products	• Progressing the preparation of shop for starting a milk and milk product selling counter at Viz Mart • Turnover for the month is Rs. 167623/- • Turnover for the period is Rs. 828951/-

Sl No	Group	Type of Business/ Status up to March 2020	Business Status during the Month
19	Port Canteen	• Canteen unit, traditional Kerala Foods. Specially working for port drivers	• Turnover for the month is Rs. 62856/- • Turnover for the period is Rs. 436000/-

VIZMART

Viz Mart, the consotium of livelihood groups, the selling counter at Viz Mart, Farm School, workers canteen and snacks counter at port premises are progressing well during the period.

Inauguration of Customer Service Point @ State Bank of India

The customer service point of State Bank of India was inaugurated at Vizmart Vizhinjam by CSR Head Southern Region Dr. Anil Balakrishnan. The programme was inaugurated with lighting the lamp by Manager followed other dignitaries including manager Supplyco, CSR Head Adani Vizhinjam, Vizhinjam Circle Inspector of Police. The officials of the nearby police station were also present on the occasion, wishing the Community members a successful endower with a new model of banking services.

Onam-Vegetable Mart Run by Vanitha Karshika Karmasena

Vanitha Karshika Karmasena organized a vegetable outlet during Onam season from 25 th August to 28 th August 2023 in association with Civil Supplies Corporation, Govt. of Kerala. The mart was inaugurated by Smt.Sindhu Vijayakumar, Ward Councilor, Venganoor Ward Councilor in the presence of Civil Supplies Corporation officials. The vegetables were sourced from various local farmers and from Farm school. As per the agreement Civil Supplies Corporation

provides the temporary physical structure of shops and Karma Sena is entrusted with the procurement and sale. 4% of the total sales to be given to Civil Supplies Corporation. During these days a total of Rs. 26,780/- worth sales recorded in the counter.

Onam Kit as part of CER of AVPPL

Viz Mart/Turn to Fresh, one of the livelihood groups got an order of 700 Onam Grocery kits worth Rs. 1000/- from Mining Department under the CER of Adani Vizhinjam Port Pvt. Ltd during the reporting month. This was consisting of 16 grocery items with a vegetable kit for preparing Onam Sadhya. As all the items were procured and delivered in time, Mining department appreciated the efforts. All the CSR team including ASDC team actively participated in the packing of Onam Kits.

In addition to that as part of Employee Volunteering Program of Adani Vizhinjam Port Pvt Ltd another 283 kits were also prepared and provided to the community during the period.

New Office for Vanitha Karsheeka Karmsena

Vanitha Karsheeka Karma Sena, one of the livelihood groups formed as part the CSR of AVPPL/AF opened their new office at Farm School premises. This was done on the 1st day of Malayalam Calander year, Chingam. All the team members of CSR along with Vanitha Karsheeka Karma Sena team were present during the opening.


Vegetation clearing work -Karmasena.

Karmasena this month completed work on clearing of vegetation at karimballikara, labour office and area cleaning of Security building sites.


Cloth Mat Making Training Programme @ PTM Maruthoorkonam

As part of the expansion of livelihood groups, Adani Foundation and Kottukal Gram panchayath jointly organized a 6-day cloth mat making training Program. The training was inaugurated by Smt. Ambili, ward member, Kottukal gram Panchayat. 23 women from Kottukal Gram Panchayat participated in this training program for Six days. The topics for the training were 1. Group Orientation & Awareness on

Adani Foundation Projects ,2. Self-Management,3. Cash Management 4. Debt & Leadership were discussed and followed by a hands-on training for two days of Cloth Mat Making at Farm School Mukkola. Among the 23, two groups with four members each were formed to start a group venture. The 40% subsidy will be provided by AVPPL as livelihood promotion of project affected people. Block Panchayat is also agreed to provide a small percentage of project cost as working capital. The details of the sessions are as follows

Sl No	**Date**	**Topics**
1	11.09.2023	Orientation-Enterprises, Different group
2	14.09.2023	Self-Management-Goal, Role, Responsibility, Time Time Management
3	16.09.2023	Cash Management- Income & Expenditure, Policies of Cash Flow (Inflow & Outflow)
4	19.09.2023	Debt Management & Leadership-Financial Management, Group Leadership
5	21.09.2023	Mat Making- Practical Session
6	22.09.2023	Mat Making Practical Session

Individual- micro–Enterprise Initiatives

AF has been supporting group enterprise since 2017 onwards, last year a new initiative of individual enterprise support programme started, under this programme the following enterprises were progressing during the reporting period.

Status of existing livelihood groups

Sl No	**Name**	**Type of Business**
1	Sulekha	Street Shop (Food Counter)

Sl No	Name	Type of Business
2	Peter	Cobbler
3	Baby	Petty Shop (Grocery & Snacks Items)
4	Sheeja Suresh	Grocery Shop
5	Sindhu	Tailoring Shop
6	Nirmala	Fish Vending
7	Jepsi	Fish Vending
8	Gulastic Amma	Fish Vending

3.5. Sports Support

Sports Support to St. Mary's School Kottappuram

The sports training support to St. Mary's School Kottappuram is progressing well during the reporting period. The training support includes coaching to Football, Basketball, and volleyball has been providing daily two hours after class hours 6 days in a week. In addition to that coaching support for athletic items has also been provided for selected students.

Nutritious food support including milk, boiled egg and banana has also been provided as part of the programme for selected students. The playground in the school premises is using for the purpose.

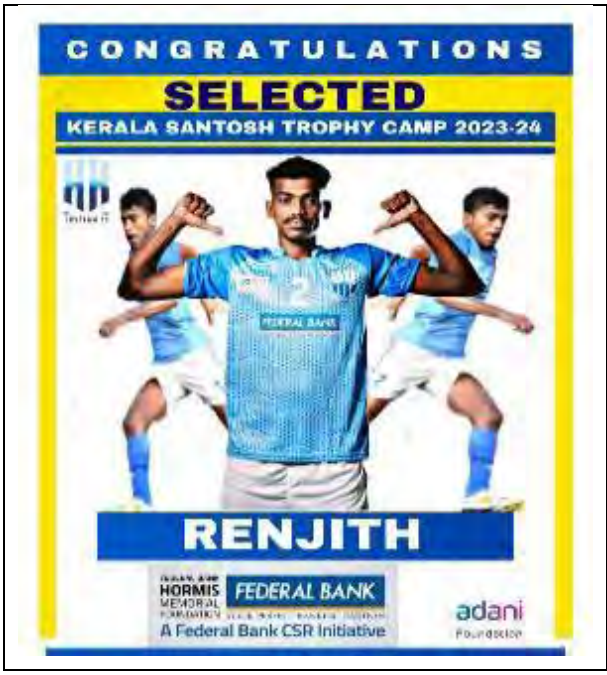
St. Mary's School football team become the champions of Sub district championship during the period.


Sports support to Kovalam FC

As part of the sport support programme, sports, gymnastics equipment and jerseys were distributed to the players of Kovalam Football Club during the period. Dr. Anil Balakrishnan, Head CSR, Southern region handed over the materials to the officials of Kovalam FC. Cash awards and prizes were also distributed to the team members and academy players during the function basis of their outstanding performance. Mr. Ignatius, Manager and the National Star of Kovalam FC, presided over the function in the presence of Mr. Ebin Rose, Head Coach. During the year Kovalam FC started a training program with a tag name "Vision 2047" in tune with All India Football Federation to take the Indian team to the top four in Asian ranking father to World Cup including Kovalam FC team.


Adani Foundation has been supporting the selected players from coastal part of Vizhinjam of Kovalm FC, a professional football club in Trivandrum. The support has been providing in the form of Nutritious food supplements practice materials and motivation sessions for players. Some of the achievements during the period are as follows.

- Mr. Ranjith & Mr. Manoj got selection to Kerala Santhosh Trophy coaching camp 2023-24
- Mr. Genesh, Mr. Sadhil have been selected for Neyyatinkara Sub District football team in senior category.
- Rohan, Hashim, Noyel have been selected for Neyyatinkara Sub District football team in junior category.
- Muhamed & Rishan have been selected for Neyyatinkara Sub District football team in senior category.
- Sharon, Remis, Anfas, Shynold, were selected to Trivandrum District Youth Team
- Fayis was selected to Alappuzha District Youth Team
- Genesh was selected to Trivandrum school district senior team.



4. COMMUNITY INFRASTRUCUTRE DEVELOPMENT

4.1. Community Health Centre, Vizhinjam

Progressing the construction work of Community Health Center at Vizhinjam. The project cost is Rs. 7.79 cr where the Government component of Rs.482 lakhs and CSR component of 297 lakhs from Adani Foundation. Adani Foundation handed over the first installment of Rs.1.18 crores on 03.10.2018 and the Second installment of Rs. 1.18 crores on 24.04.2023 to the Harbour Engineering Department. The final installment will be transferred only after the completion of the work. Progress of the work is as follows.

The basement floor is proposed as parking space. The entire basement floor is completed in RCC. Huge water storage facility (capacity of 1.0 lakh litre) is constructed to pump water to various levels of the new building. Electrical works, fire and safety works are almost completed in this floor.

Ground Floor and First floor are designed to provide inpatient and outpatient services, specialty clinics. The structure is fully completed, and interior works are progressing. Electrical works are almost completed for ground floor. False ceiling for the ground floor progressing whereas for the first floor this work not yet started. Fabrication works are simultaneously carried out in ground floor as well as first floor.

As the existing CHC do not have any facilities for Gynecology, the second floor of the building is proposed to function as gynecology ward. In this floor, all works including external painting completed.

4.2. Gangayar Canal

The proposed maintenance to ensure proper water flow and desilting of Gangayar had been entrusted Minor Irrigation Department under the supervision of Harbour Engineering Department. The initial project cost was Rs.89 lakhs, in equal share of AVPPL and VISL. AVPPL transferred Rs. 60 lakhs as half share through VISL to Minor Irrigation Department. The work includes.

- Desilting of waste up to 1 km from the mouth of the canal
- Core wall (Break water) to block sand iteration at the southern side of the exiting Fishing Harbour
- Installation of three Silt breakers at 500 m & a footbridges
- Fencing of both sides

The status of the work during the period is as followings,

- Completed the desilting of waste up to 1 km from the mouth of the canal,
- Slit breakers are installed.
- The construction of the footbridge was completed.
- The sidewall construction is completed,
- Started the fencing work of both sides,
- As requested by the Vizhinjam Parish committee a waste water drainage work has been started at the Canal side during the period


4.3. Kottukal School

As part of CSR activities, the construction of the second floor of Kottukal school was initiated by Adani Foundation at the request of Kottukal Gram Panchayat and school. Earlier there were not enough classrooms on the ground floor and first floor and more children were accommodated in each class. Adani Foundation done an estimate and a plan for a second floor consisting of 3 new classrooms.

At the time of construction, the plinth area of the existing reinforced concrete building was nearly 2135.sq feet and each floor supported on reinforced concrete columns and intermediate beams. The ground floor is entirely utilized as an auditorium for conducting PTA meetings and cultural programmes every year. The first floor comprises of a staff room, 3 classrooms, a corridor and pathway leading to the adjacent building. Work for the second floor started by demolishing the sidewall near the terrace area. The top surfaces of 16 existing columns (450X300mm each) were chipped off and existing reinforcements were treated rust free. Based on the structural drawings, columns with required reinforcements were extended and concrete laid stage by stage to a level up to

2. 70m. At this stage, longitudinal reinforced beams (230mmx 450mm) and cross beams of size were constructed above these columns. About 2.64 MT Fe415 grade was required. Concrete grade m25 was widely used after cube strength determination of concrete for 7- and 28-days testing. Concrete cubes were cast and tested at every stage. Necessary curing of concrete is carried out during various stages of construction. Entire Concrete castings were performed during school weekends.

Precast concrete solid blocks each of size(400X200X200) mm were laid in order to divide the entire area into 3class rooms of size 6.30m x 6.30m. Appropriate openings were provided for installing fully panelled doors (1.20m width X 2.55m H ,3nos) hard wood fully glazed windows (2.40m X 1.40m 9 nos) and ventilators (1.2mX0.45m, 3nos). Block masonry work resumed above beam construction to a height upto 3.15m. Staircase from first floor led to passageway (22.7m length) of second floor and to classrooms. One side of passageway is enclosed by parapet wall for a height of 1.20m. External plaster 20mm thick and internal plastering 12 mm thick is carried out wherever necessary. The existing floor slab of the second level and passageway were covered with vitreous floor tiles (60 cm X 60cm and 6 mm thick). Electrical work was done in each classroom. Provisions for Tube lights, fans, switchboards, communication cable, speaker point etc were made. The roof of the building is entirely steel truss work with galvalume sheeting structurally designed to withstand wind loads. The steel truss roof supported on extended columns extends beyond the passageway to avoid rainwater coming in.6 vertical pipes (RHS 50X100) are embedded above the parapet wall for a height of 3.15m. Appropriate pvc pipes 110mm diameter and prefabricated galvalume sheet gutters of good quality were provided for effective drainage rainwater.

INAUGURATION OF SECOND FLOOR FOR KOTTUKAL LP SCHOOL 2023

As the construction of the second floor for Govt LP School at Kottukal school was successfully completed under the CSR activities, the handing over ceremony was done during the reporting period. The new floor has 3 spacious classrooms and can accommodate nearly 120 students together. The inauguration of handing over was conducted before the school reopening day - on 30th May 2023 presided over by Adv. Suresh Kumar, President District Panchayat, and inaugurated by honourable Minister for Education and Labour, Shri V. Shivankutty.

Shri Susheel Nair, Head of Corporate Affairs, Adani Vizhinjam Port Private Limited, Dr. Anil Balakrishnan, CSR Head Adani Foundation, South Zone, Shri.M. Manmohan, President, Athiyanoor Block Panchayat, Shri Jerome Das, President Kottukal Grama Panchayat, Smt.Gita, Vice President, Kottukal Panchayat, Shri M.T Pradeep, Chairman, Standing Committee-Development, Kottukal Gram Panchayat, Shri. Deepu Chairman, Standing Committee -Education and Health, Sulochana, Chairperson, Standing Committee-Social welfare, and Adv. S Hari Kumar were other dignitaries on stage.

The programme, well managed by CSR staff team started at 10 am by cutting the ribbon, unveiling the plaque, and lighting the lamp by honorable Minister. Dr. Anil Balakrishnan delivered the welcome speech highlighting the CSR activities of AVPPL. Education Minister in his speech expressed gratitude

towards Adani Foundation for timely constructing the classrooms and developing the school.

An appreciation letter and a memento were awarded to the CSR team by the Minister. Keys of the news classrooms were officially handed over to Smt.Bindhu.

4.4. GRANDHASALA UCHAKKADA

The Uchakkada library is entirely a new construction in 3 cents of land was finished and handed over during the reporting period. The building is two storeyed with open terrace area. The ground floor is designed to function as a

library and the first floor to be allocated for conducting CSR activities. The plinth area of the building is 1183.76 sq. feet.

Inuguration & handing over

The new two-storied building constructed by Adani Foundation for 'Sahrudayananda' library, which was established in the year 1946 at Vizhinjam under the Corporate Social Responsibility projects of Adani Vizhinjam Port Pvt. Ltd was inaugurated by the Hon'ble Minister for Ports, Museums and Archeology Mr. Ahmed Devarkovil on the auspicious occasion of National Reading week celebration. Hon'ble MLA for Kovalam Constituency Adv. M Vincent presided over the function.

In his inaugural speech, the Minister said that this service provided by Adani Foundation will always be an example for the society, on this auspicious occasion, when the reading week celebration is being held at the national level in memory of Mr. P.N Panikkar who raised reading as the main tool for the growth of the individual and the society. In his speech, the Minister also highlighted the role of reading in making a person perfect.

Adv. M Vincent MLA, president of the inaugural function shared about the role of libraries in social progress. He also commented that the social responsibility activities carried out by Adani Foundation are very impressive and commendable.

The Hon'ble Minister also inaugurated the new batch of 'Coaching 4 Victory', a free competitive examination preparation programme conducted by Adani Foundation to help the young women and men of Vizhinjam and surrounding areas to participate in competitive examinations and get government employment.

Adani Foundation built the two-storied building for the library as per the request of elected representatives and the office bearers in a situation where it was not possible to store about 13,000 existing books and carry out other activities due to inadequacy of basic facilities.

Mr. Sushil Nair, Head Corporate Affairs, Adani Port Pvt. Ltd, Smt. C. Omana, Mullur Ward Councilor were the chief guests for the inauguration ceremony. Dr. Anil Balakrishnan Head, CSR Adani Foundation welcomed the gathering.

Mr. SK Vijayakumar, Regional Convener Library Council, Mr. Suresh Uchakada, Block Congress President, Mr. Radhakrishnan, BJP representative, Mr. Kamaraj, CPI representative conveyed their greetings.

The minister handed over the key to the new building to the president of the library Mr. Suresh V.S. Minister also presented gifts on behalf of Adani Foundation to the candidates who won competitive exams and secured government jobs through coaching for Victory, a free competitive exam training program conducted by Adani Foundation. The classes for Coaching for Victory will be held every week from Monday to Friday from 10 am to 1 pm in the new library hall.

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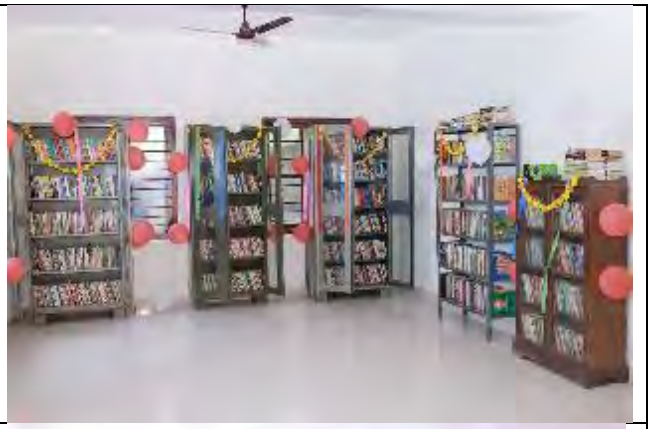
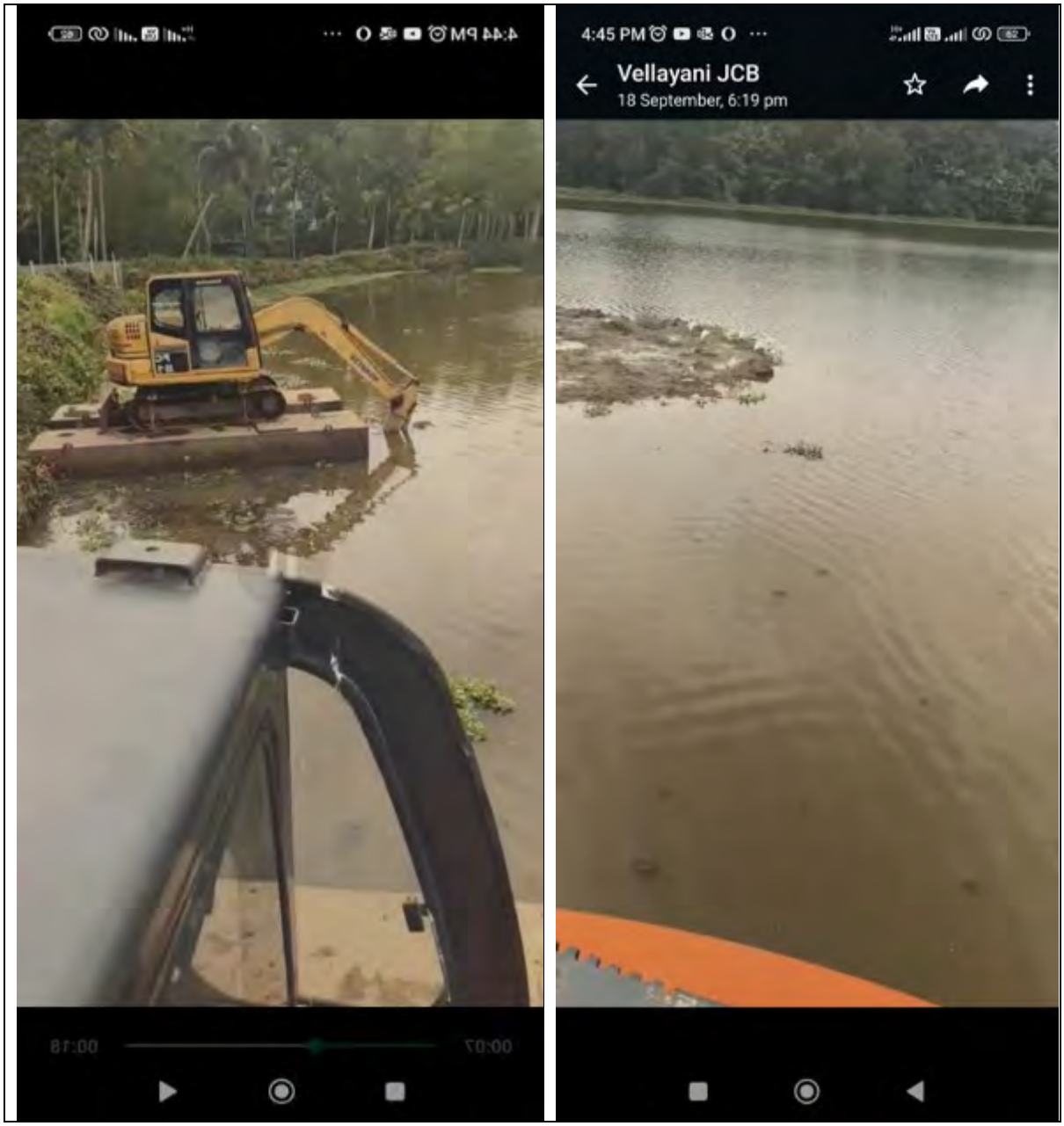


Water-Hyacinth Cleaning @ Vellayani Lake

As a continuation regarding the previous work done for Vellayani Lake, cleaning of water hyacinth weed was extended to the entire area of the selected on-going site. The wedding was done using Hitachi machines four numbers housed on barges floating on water. In a period of one month approximately 15000 tons of water hyacinth were removed from the lake area. The program was supported by Localize as well as Venganoor Panchayath. The work was intended as it is the source of drinking water to nearby four panchayath and the upcoming vizhinjam port in specific.



4.5. Other major projects under progress

Sl No	Project	
1	Model Anaganwadi, Vizhinjam (Nr. Police Station)	• 1500 Sqft Montessori model Anganwadi at Govt. Vizhinjam LP School compound. • The plan and the location approved by social welfare department. • Land permission received from Social Welfare department. • As the area is notified for road widening, suggested for location shift. • New Location identified.

Sl No	Project	
		• Awaiting the building permission from TVM Corporation • Received the approval of ICDS and Education Department for new location at the school premises
2	MRF	• As per the request received from Trivandrum Municipal Corporation it has been decided to construct an MRF at harbor ward. Land for the same will be allotted by the Harbour Engineering Department. The operation of the unit will be done by Trivandrum Municipal Corporation under the technical support of Suchithwa Mission and Clean Kerala Company. A Haritha Karma Sena will be formed for the daily collection of waste after the commissioning of the proposed unit. The MRF will be included. • 3500 sqft building. • Shredding Machine • Baling Machine • Dust remover and • Conveyor belt • Compound wall • Internal roads • Estimate, BOQ and plans are ready. • A MoU is finalized to demystify the role of all the stakeholders. • Transferred Rs. 44.77 lakhs to VISL as half share • AS sanctioned by TVM Corporation
4	Playground	• AS per the request of Kottappuram community a playground has been agreed to develop at Vizhinjam. • Harbour Engineering Department provided an acre of land for the purpose. • Sports Kerala Foundation has submitted a project at an estimated cost of Rs. 1.75 crore to establish the playground. • As got the NFA approval, instruction given to TCD for transferring the half share of amount Rs. 87.5 lakhs to VISL

5. OTHERS

Inauguration of Gate Complex @ Vizhinjam Port

Gate complex with most modern technologies was inaugurated along with security building on 26th 2023 by honorable minister of Finance Shri. Balagopalan. The programme was presided over by honorable minister of Port Shri. Ahammed Devarkovil. Speaking on the occasion the finance minister briefed about the need of the port and its significance for future growth of Kerala economy and as an asset to our nation. CSR team coordinated the mobilization of community members, invitations, comparing of the programme and overall stage arrangements.

Inauguration of Workshop Building @ Vizhinjam Port

The port Workshop building, intended to undertake repair & Maintenance work of the Ships & Allied Wessel's was inaugurated on 17th 2023 by the honorable minister for Law, Industries, and coir, Shri. P. Rajeev. The programme was presided over by the honorable minister of Port Shri. Ahammed Devarkovil. Speaking on the occasion the industry minister spoke on the upcoming industrial corridor extending from Vizhinjam to end of ring road. This will open larger opportunity for youth and technically trained personals for new industrial startup and for the purpose of undertaking import and export business.

Visit of Adani Parivar

The Chairman Adani Group, Shri. Gautham Santhilal Adani, Chairperson Adani Foundation, Dr. Prithi G, Adani, and chief Executive officer of Adani Ports and SEZ Limited & the director of Adani Airport Holdings limited Shri. Karan Adani had a private visit to Vizhinjam port on 21.05.2023. The whole staff of Adani Vizhinjam Port Pvt. Ltd. and Adani Foundation extended a warm welcome to the chiefs of the company. The chairman along with the higher officials reviewed the ongoing port activities and extended his happiness on the progress of the port construction activities.

The chairperson of Adani Foundation Dr. Prithi Adani was greeted by officials under the leadership of Dr. Anil Balakrishnan, later she was invited to look into the products exhibited by various craft artisans of Vizhinjam as part of the Sathwaro programme of Adani Foundation. This program was inaugurated by Dr, Prithi Adani by Lighting the lamp. She along with Dr. Anil Balakrishnan went around the exhibition stalls to look into the craft man ship of Vizhinjam artisans. The exhibited items included Bamboo products, SISP products, Viz Mart units products like stitching materials of SRM, organic vegetables of Vanitha Karasheeka Karma Sena & farm school, organic products of Turn to fresh, cakes of cake making unit, wood craft materials of Vishagam wood craft, bottle arts, Nettipattoms, swachhagraha craft of students, hand embroidery products, locally made millets and cereals.

The chairperson expressed her happiness in seeing the craft man ship. This was followed by interaction with Livelihood group members, Community Volunteers, Sanginis & members of Patient Care Unit.

A memento was given to Chairperson of Adani Foundation to extend the happiness and gratitude of foundation and ASDC Staff. All staff members were introduced to chairperson By Dr. Anil Balakrishnan.

During the high lunch session, the top-level dignitaries had the opportunity to interact with Shri. GSA, Dr. Prithi Mam &Shri. Karan Adani. On this occasion the Minister for Port. Shri. Ahammed Devarkovil was also a part of this meeting. Expressing happiness toward the staff on their good work, high level dignitaries left the port by 3 PM.

Celebration of Adani Day

June 24th the birthday of Respected Chairman Shri. Gautham Shanthilal Adani was celebrated as "Adani Day" in all the Business locations across India. At HO level Adani Group honored the Indian team Members who won the 1983 Cricket World Cup. This event was telecast live across all the sites through Social Media Channels. Along with this Blood donation camps were conducted across nations as a mark for this eventful day and 20621 units of blood were donated.

At Vizhinjam Port under the leadership of CSR a blood donation camp organized in collaboration with Regional Cancer Centre Trivandrum. Almost all staff members who are healthy enough donated blood in two days' time.

World Environment Day

World Environment Day is celebrating every year on 5th June globally to raise awareness and encourage action towards protecting our environment. The theme for the current year was focused on solutions to plastic pollution under the campaign #BeatPlasticPollution. It was a reminder that people's actions on plastic pollution matters. The day was observed to dedicate on raising citizen awareness and action for safe environment, free of plastic in and around Vizhinjam international port vicinity. This was done in aligning with this year's international theme of "Beat Plastic Pollution". The extensive range of programmes were organized as a daylong event at the level of CSR and environment division of Adani Vizhinjam Port to remind staff and public on their actions around plastic that matters to environment.

The highlight of the programme was the plastic collection drive organized by the environment department and CSR of AVPPL. Participation was ensured among fisherman's community, thus helping in collection of plastic from offshore locations using two motorboats. Similar drive was organized at the on shore along the beach adjoining port. This was undertaken by staff of AVPPL, and CSR as Employ volunteering programme (EVP).

The programme started with general introduction to the importance of the day by Dr Anil Balakrishnan CSR, Head south India and Mr. Hebin Chenthamarakshan, Head, Environment Department. The staff members were thus divided to various groups for plastic collection drive on various selected

regions of port. Nearly 120 staff members including 15 women staff participated in the event lasted for 2 hours from 4 pm to 6pm. Plastic of various grades collected by 5 teams formed for the purpose includes plastic bags, bottles, food covers, aluminum foils, and termo- coals. A total quantity of 428 kg of plastic gathered, including 28 kg from marine ecosystems.

All arrangements were made so that the plastic collected will reach the end user in different usable forms through, Qrexbio solutions -Attingal, Trivandrum, an expert agency and vendor in solid waste management and biomining for further conversion into a different utility subsequent to plastic processing.

It was astonishing for the participant staff to see this much quantum of plastic collected even in a span of 2 hours' time. As solution to make plastic free port locale, it was hence decided to conduct EVP drive once in a month for serving purpose of making Vizhinjam International port a total plastic free Zone.

World Elder Abuse Awareness Day 2023

Theme: Women & Ageing: Invisible or Empowered?

Adani Foundation in association with HelpAge India and CV memorial Library celebrated World Elder Abuse Awareness Day on the them Women & Ageing: Invisible or Empowered? at CV memorial Library, Vizhinjam on 15th June 2023. The programme was inaugurated by Mrs. Suja, CDPO, Social Justice Department, Govt. of Kerala. The keynote address was delivered by Mr. John Paul, Sub Inspector, Vizhinjam police Station, in charge for women, children and aged as part of Janamaithi programme of Govt. of Kerala.

The Special report on the theme prepared by HelpAge India was released jointly by Vizhinjam SI Shri. John Paul and Vizhinjam CDPO Mrs. Suja during the program.

Three women, Sister Teresa (Nun), Holy Cross congregation, Vizhinjam, Mrs. Subhadra, Retd. HM SVLP School & voluntary Resource Person for Monthly poets and men of Literature and Mrs. Rosamma, Retd. Superintendent, Agriculture College, Vellayani & the president of Snehasanthram Old age home were honored for their commendable social service during the programme.

Mr. Sebastian Britto.A. G, Programe Manager, Adani Foundation, Vizhinjam delivered the message of the day. Mr. Rajan John, Social Protection Officer, HelpAge India briefed about the finding on study report. Fifty elder people were participated in the programme.

It was decided to have a monthly gathering of elder people and the first meeting was fixed on 12th July 2023 at C.V. Memorial Library, Vizhinjam. An organizing committee was also constituted including nine members from various grass route organizations for the follow-up of elder people's gatherings.

Senior Citizen Forum

As the follow-up of world elder abuse awareness day celebration, a senior citizen forum was formed. Mr. George Zen, consultant for livelihood initiative of Adani Foundation is entrusted with the activities of the forum. An initial discussion was held after the gathering of world elder abuse awareness day celebration and selected seven in charge persons for the gathering from community. The first gathering of the forum was conducted on 12th July 2023 at C.V. Smaraka Grandhasala, Thennoorkonam. The Program was started at 3:30 pm with a prayer and message by Mr. George Zen. 35 elders were present in the gathering. Shri. Sebastian Britto Senior Program Manager-Adani Foundation performed fun activities with a message of loving each other. It was decided to conduct the next gathering during Onam in the month of August 2023. All the elders were happy and decided to increase the numbers.

Adani Foundation Day Celebration

The 27th Adani Foundation Day was celebrated by CSR team with all the livelihood members, Skill trainees and community volunteers. Dr. Anil Balakrishnan, Head, CSR South region inaugurated the celebration by cutting a cake at Farm School premises. Skill trainees performed some cultural activities like Thiruvathira, Group Songs etc... as part of the celebrations. Hon: Port Minister for state, Kovalm MLA & CEO AVPPL were greeted AF on the day. All those activities were captured as a video and shared with the HO. On 11th August 2023, All the team members participated in the Foundation Day virtual celebration. The videos taken by all the sites were also screened as part of the celebration.


Independence Day Celebration

The 77th India Independence Day was celebrated on 15th August 2023 at Skill training Centre. All the ongoing batch trainees participated in the celebration in the same dress code. Trainees were delivered speeches on the famous freedom fighters like Mahatma Gandhi, Subash Chandra Bose, Jawaharlal Nehru etc... Trainees performed patriotic songs on that occasion and played a video which tells the history of the India Independence.


Organ Donation Day

As 13th August 2023 is observed as the Organ Donation Day, an Eye donation campaign was conducted to commemorate the day by collecting the Eye Donation Consent Forms. As part of the campaign 100 consent forms were collected from staff, trainees, and Livelihood Group members. It was hand over to Mrs. Shanthi B T, Counsellor, Regional Institute of Ophthalmology, Govt. Eye hospital, Medical College, Trivandrum on the day.

National Youth Day

As we all know, Youths are the strength of a nation…. AF Vizhinjam celebrated the International Youth Day '23 with a session and activities on 12th August 2023 at Transit Campus with 72 participants. A session on the theme was handle by Dr. Sarika A R, Scientist, Kerala State Council for Science Technology and Environment, Trivandrum. Skill trainees who had received achievements in Sports, Games and in other activities through representing Schools/Colleges in Sub-District/Revenue District/ District/State/National Levels were appreciated during the programme.

During the session following points were discussed in detail,

- Importance of International Youth Day.
- Green Energy.
- Important of Education among youths.
- Skills for the Future & Skills for Green Jobs.
- Sustainable development goals.
- IKIGAI (Pictorial Representation) – Japanese Secret Way to a Long & Happy Life.
- Visions of Youth by Vivekananda & APJ Abdul kalam.


Birthday of Respected Chairperson – EVP support to poor & needy along with Onam Celebration

29th August 2023 is the birthday of respected chairperson of Adani Foundation, Dr. Priti G Adani. On the same day Kerala is also celebrating "Thiruvonam" the sate festival. Onam, the harvest festival of Kerala, is a time of coming together, celebrating nature's bounty, and cherishing the rich traditions of Kerala culture. Onam is also the festival of Love and sympathy. It symbolizes the context of prosperity and harmony.

But AVPPL/AF family came to know that, in the vicinity of Vizhinjam Port there are around 300 poor families of widows and bedridden patients who cannot afford the Onam Sandhya. In this contest on the auspicious occasion of the birthday of respected chairperson and the on Thiruvonam, Adani Foundation Vizhinjam, Adani Vizhinjam Port Pvt. Ltd planned to provide Onam grocery kits consists of different groceries to prepare Onam Sadhya to those poor people under its Employee Volunteering Programme.

As requested, 56 Employees expressed their willingness to provide a total of 108 grocery kits. Each grocery kit contains 16 grocery items like Rice, Sugar, coconut oli, green grams, dal, chili powder, coriander powder, lemon pickle, banana chips, jaggery chips, payasam mix, big onion, small onion, potato, pappadam and tea powder.

With the active participation of Adani Foundation staff, livelihood group members and community volunteers packed all the 108 grocery kits and provided the same to the doorsteps of the poor patients by 26th August 2023.
It was an act of kindness; the Adani Family extend the hands of support by providing the Onam kit under EVP.A video was made on the distribution and sent to the same to respected chairperson. She acknowledges it by stating that "Thank you very much, such a beautiful birthday gift, my sincerest thanks to team Vizhinjam."

In addition to that AF team along with livelihood members celebrated onam and the birthday of respected chairperson. The celebration was inaugurated by Dr. Anil Balakrishnan, Head CSR, Southern region by cutting a birthday cake of respected chairperson followed by cultural programmes. A participatory Onam Sadhya was also arranged, all the livelihood members were actively participated to prepare the Hi-Lunch.

Teachers Day Celebration

Teacher's Day was celebrated with several activities at ASDC training centre on 5th September 2023. Trainees of all the batches felicitate each trainer with red roses as part of the importance of the day. They conveyed their wishes to all the trainers and shared their happiness for training them for a better future.

As part of the special day, some of the trainees handled the batches and took sessions in the presence of their trainers. They selected some topics and taught their classmates on the topics. They performed very well, and they understood the efforts that a trainer is taking for training a batch of trainees.

The cake cutting ceremony was conducted at the centre by the staff members Mr. Anurag M J, Centre Head, Vizhinjam felicitated each trainer and appreciated them for the efforts they made from formation to completion of a batch. He wishes all of them all success.

Senior Citizen Forum - Celebrated World Elders Day Program

As part of the community engagement programme Adani Foundation has formed a senior citizen forum at Vizhinjam. The second gathering of the Forum was done on 30th September 2023. As part of World Elders Day celebration, a session was organized by HelpAge India for senior Citizens at C V Smaraka Grandhashala. The Program was started at 3:00 pm. 30 elders were present. Mr. Jhon Paul, Sub Inspector of Police and in charge of Janamaithri Police programme, Vizhinjam took a session on the importance of the day. After the session Shri. Jhony, Adani Foundation performed fun activities with the elders.

Capacity Building - Training at Entrepreneurship Development Institute of India (EDI) Ahmedabad on "Business Plan Preparation and Reporting Enterprise Performance".

A three-Day Training organized by the HO Adani Foundation at EDI Ahmedabad on 25th,26th & 27th September regarding business plan preparation and reporting was attended by 25 participants all over the nations wherever of Adani Foundation has its presents.

The training handled by reputed institute EDI on various aspects on livelihood startups and how to maintain its sustainability. A Series of cases were discussed for preparation of business plan it is blueprint for undertaking the business activity. The meeting was represented by senior project officer Rakesh and Livelihood Member Mrs. Suraja on behalf of CSR Vizhinjam. Meeting was attended by the Executive Director Mr. Vasanth Gandhvi IAS and Mr. Chandra Sekhar Gowda COO of Adani Foundation. The following deadlines were given as a part of the follow up activities of the training held.

1. Business Plan to be presented to site team by October 5th
2. One Business plan of Existing Group to HO by October 7th
3. A Follow-up on training by EDI Faculty on 9th October.
4. Business Plan for remaining enterprise group by October 25th
5. Business Plan Progress Report to all groups to Ho by November 10th

Press Releases

1:30 PM

കോട്ടുകാൽ : കോട്ടുകാൽ ഗവ. LPS ന് പുതിയ മന്ദിരം

തദ്ദേശ ഉപതിരഞ്ഞെടുപ്പ് ഫലം: എൽ.ഡി.എഫ് 7, യു.ഡി.എഫ് 7, എൻ.ഡി.എ 1, സ്വതന്ത്രൻ 4

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തിരുവനന്തപുരം: കോട്ടുകാൽ ഗവ. LPSനായി നിർമിച്ച പുതിയ കെട്ടിടം മന്ത്രി വി.ശിവൻകുട്ടി ഉദ്ഘാടനം ചെയ്തു

Thiruvananthapuram, Thiruvananthapuram | May 20, 2024

സ്കൂൾ കെട്ടിടം നാടിന് സമർപ്പിച്ചു

കോട്ടുകാൽ

ഗവ. എൽപിഎസ് കോട്ടുകാലിൽ മൂന്ന് ക്ലാസ് മുറികളുള്ള പുതിയ മന്ദിരം മന്ത്രി വി ശിവൻകുട്ടി ഉദ്ഘാടനംചെയ്തു. അദാനി തുറമുഖ കമ്പനിയുടെ സാമൂഹ്യ പ്രതിബദ്ധതാ പദ്ധതിയിൽ ഉൾപ്പെടുത്തിയാണ് നിർമാണം. ജില്ലാ പഞ്ചായത്ത് പ്രസിഡന്റ് സുരേഷ് കുമാർ അധ്യക്ഷനായി. കമ്പനി കോർപറേറ്റ് അഫയേഴ്സ് ഹെഡ് സുശീൽ നായർ, സിഎസ്ആർ ഹെഡ് അനിൽ ബാലകൃഷ്ണൻ, പി എസ് ഹരികുമാർ, എം വി മൻമോഹൻ, ജറോം ദാസ്, ഗീത, എം ടി പ്രദീപ്, ദീപു, സുലോചന, ബിന്ദു എന്നിവർ സംസാരിച്ചു.

ദേശാഭിമാ

കോട്ടുകാൽ ഗവ.എൽ.പി.എസിന് പുതിയ മന്ദിരം

Adani Foundation

Upskilling is a key component of this community-based intervention. The Sanginis promote behavioural change by sharing knowledge of best practices, carry out health assessments and refer severe cases to Nutrition Rehabilitation Centres. Empowering them through digital innovation will lead to greater impact on the ground.

#TechForGood #DigitalInnovation #Nutrition #ITskills #CapacityBuilding #PoshanAbhiyaan #Suposhan

Like Comment Share

Adani Foundation

Adani Foundation
6 May ·

Our force of 46 women #volunteers in Vizhinjam (Kerala) is being trained to conduct #awareness programs in their communities. The focus this year is to support at least 1000 people to avail Govt. schemes like Atal Pension Yojana, PMJJBY, PMSBY etc to reduce their economic burden.

#TrainingOfTrainers #CommunityEngagement #GovernmentSchemes #AdaniFoundation #CSR #Kerala #WomenEmpowerment

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You, Maya G Ratheesh and 74 others

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Mathrubhumi
മാതൃഭൂമി

ഉച്ചക്കട സഹൃദയാനന്ദ വായനശാലയ്ക്കു പുതിയ കെട്ടിടം

07/06/2023 NEYYATTINKARA Pg 02

സഹൃദയാനന്ദ വായനശാല മന്ദിര സമുച്ചയം തുറന്നു

കേരള കൗമുദി

ഉച്ചക്കട സഹൃദയാനന്ദ വായനശാലയ്ക്ക് പുതിയ മന്ദിരം

വിഴിഞ്ഞം ഉച്ചക്കട സഹൃദയാനന്ദ വായനശാലയ്ക്ക് പുതിയ ഇരുനില മന്ദിരം നിർമിച്ചു നൽകിയ അദാനി ഫൗണ്ടേഷൻ ഉച്ചക്കടയിൽ നടത്തിയ ചടങ്ങിൽ

വ്യക്തിയെ പരിപൂർണനാക്കുന്നതിൽ വായനയുടെ പങ്ക് വലുത്: അഹമ്മദ് ദേവർകോവിൽ

വിഴിഞ്ഞത്ത് നിർമിക്കുന്ന പ്ലാസ്റ്റിക് സംസ്കരണ പ്ലാന്റ് മാതൃക

തീരദേശത്ത് പ്ലാസ്റ്റിക് സംസ്കരണ പദ്ധതി

വിഴിഞ്ഞം∙ തീരദേശത്ത് സമഗ്ര പ്ലാസ്റ്റിക് ശേഖരണ സംസ്കരണ പദ്ധതി വരുന്നു. അദാനി തുറമുഖ കമ്പനി, വിഴിഞ്ഞം രാജ്യാന്തര തുറമുഖ കമ്പനി(വിസിൽ), നഗരസഭ എന്നിവ ചേർന്ന് നടപ്പാക്കുന്ന മെറീറിയൽ റിക്കവറി ഫെസിലിറ്റി (എംആർഎഫ്) എന്ന പദ്ധതിക്ക് സാങ്കേതിക അനുമതി ലഭിച്ചു. നഗരസഭയിൽ നിന്നുള്ള നിർമാണ അനുമതി ലഭിക്കാൻ കാരുകുളമാണെന്ന് ബന്ധപ്പെട്ട അധികൃതർ അറിയിച്ചു. പ്രദേശത്തെ പതിത കർമസേനകൾ വഴി ശേഖരിക്കുന്ന പ്ലാസ്റ്റിക് സഞ്ചിച്ച് ചെറിയ കട്ടകളും ചെറു തരികളുമാക്കി പുനരുപയോഗത്തിനു സജ്ജമാക്കുന്നതാണ് പദ്ധതി. ചെറു കട്ടകൾ റോഡു നിർമാണം പോലുള്ളവയ്ക്കും പ്ലാസ്റ്റിക് തരികൾ പുനർ പ്ലാസ്റ്റിക് വസ്തു നിർമിതികൾക്കും ഉപയോഗിക്കാനാണ് ഉദ്ദേശമെന്ന് ബന്ധപ്പെട്ടവർ പറഞ്ഞു. ഹാർബർ എൻജി. വകുപ്പ് ലഭ്യമാക്കുന്ന 15 സെന്റ് സ്ഥലത്താണ് പദ്ധതി നിർമാണം. യന്ത്രസാമഗ്രികളുൾപ്പെടെയുള്ള അടിസ്ഥാന നിർമിതികൾ അദാനിയും വിസിലുമായി ചേർന്നു സിഎസ്ആർ ഫണ്ട് വിനിയോഗിച്ചു സജ്ജമാക്കും. നഗരസഭയ്ക്കാണ് പരിപാലന ചുമതല. കിൽ കേരള ടെക്നിക്കൽ കമ്പനിക്കാണ് നടത്തിപ്പു ചുമതല. കോസ്റ്റൽ പൊലീസ് സ്റ്റേഷനു സമീപ സ്ഥലത്താണ് പ്ലാന്റ് സ്ഥാപിക്കുക. പ്രതിദിനം ഒരു ടൺ പ്ലാസ്റ്റിക് പൊടിക്കാൻ ശേഷിയുള്ളതാണ് പ്ലാന്റ്. പദ്ധതി നടപ്പാക്കലിനു മുന്നോടിയായി ശുചിത്വമിഷൻ, നഗരസഭ, അദാനി തുറമുഖ കമ്പനി എന്നിവ ചേർന്ന് പ്രദേശത്ത് വിപുലമായ ബോധവൽക്കരണ പരിപാടികൾ നടത്തുമെന്നും ബന്ധപ്പെട്ട അധികൃതർ അറിയിച്ചു.

ുടരുന്ന സാഹചര്യത്തിൽ തിരുവനന്തപ,

സഹൃദയാനന്ദ വായനശാലയുടെ പുതിയ ഇരുനില മന്ദിരം ഉദ്ഘാടനം ചെയ്തു

വിഴിഞ്ഞം:അദാനി വിഴിഞ്ഞം തുറമുഖത്തിന്റെ സാമൂഹ്യപ്രതിബദ്ധത പദ്ധതിയിൽ ഉൾപ്പെടുത്തി വിഴിഞ്ഞംഉച്ചക്കട സഹൃദയാ നന്ദ വായനശാലയ്ക്കായി അദാനി ഫൗണ്ടേഷൻനിർമ്മിച്ചു നൽകിയ പുതിയ ഇരുനില മന്ദിരം തുറമുഖ വകുപ്പ് മന്ത്രി

റഞ്ച് അലർട്ട് അതിശക്തമായ മഴ തുട

അദാനി വിഴിഞ്ഞം പോർട്ട് ലിമിറ്റഡ് പ്ലാസ്റ്റിക് നിർമാർജന യജ്ഞം സംഘടിപ്പിച്ചു

06.06.2023

വിഴിഞ്ഞം:പരിസ്ഥിതി ദിനാചാരണത്തിന്റെ ഭാഗമായി അദാനി വിഴിഞ്ഞംപോർട്ട്‌ലിമിറ്റഡ് (എവിപിപിഎൽ)പരിസ്ഥിതി വകുപ്പിന്റെ സഹകരണത്തോടെ പ്ലാസ്റ്റിക് നിർമാർജന യജ്ഞം സംഘടിപ്പിച്ചു.120 ജീവനക്കാർ പങ്കെടുത്ത യജ്ഞത്തിൽവിഴിഞ്ഞംതുറമുഖ പരിസരവും തീരക്കടലും

കോട്ടുകാൽ : കോട്ടുകാൽ ഗവ. LPS ന് പുതിയ മന്ദിരം

തദ്ദേശ ഉപതിരഞ്ഞെടുപ്പ് ഫലം: എൽ.ഡി.എഫ് 7, യു.ഡി.എഫ് 7, എൻ.ഡി.എ 1, സ്വതന്ത്രൻ 4

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വിഴിഞ്ഞം:പരിസ്ഥിതി ദിനാചാരണത്തിന്റെ ഭാഗമായി അദാനി വിഴിഞ്ഞംപോർട്ട്‌ലിമിറ്റഡ് (എവിപിപിഎൽ)പരിസ്ഥിതി വകുപ്പിന്റെ സഹകരണത്തോടെ പ്ലാസ്റ്റിക് നിർമാർജന യജ്ഞം സംഘടിപ്പിച്ചു.120 ജീവനക്കാർ പങ്കെടുത്ത യജ്ഞത്തിൽവിഴിഞ്ഞംതുറമുഖ പരിസരവും തീരക്കടലും ശുചീകരിച്ചതിൽ 428 കിലോ പ്ലാസ്റ്റിക് മാലിന്യം ശേഖരിച്ചു. ഇതിൽ 128 കിലോ കടലിൽ നിന്നാണ് ലഭിച്ചത്.വിഴിഞ്ഞത്തെ മത്സ്യത്തൊഴിലാളിക ളുടെ നേതൃത്വത്തിൽ വള്ളങ്ങൾ ഉപയോഗി ച്ചാണ് തീരക്കടലിലെ പ്ലാസ്റ്റിക് ശേഖരിച്ചത്. അദാനി സിഎസ്ആർ വിഭാഗം മേധാവി ഡോ.അനിൽ ബാലകൃഷ്ണൻ,പരിസ്ഥിതി വിഭാഗംമേധാവി ഹെബിൻ ചെന്താമരാക്ഷൻ എന്നിവർ നേതൃത്വം നൽകി.

പ്പ്റ്റംബറിൽ എത്തും

സഹൃദയാനന്ദ വായനശാലയ്ക്ക് പുതിയ ഇരുനില മന്ദിരം

മാതൃഭൂമി ന്യൂസ്

മുഴങ്ങി വൈറ്റ് ഹൗസ്, പറഞ്ഞ് പ്രധാനമന്ത്രി

ഹോട്ടൽ ഉടമയുടെ കൊലപാതകം; കേസ് നടക്കാവ് പൊലീസിന് കൈമാറി

നിർമ്മാർജ്ജന യജ്ഞം: 428 കിലോ പ്ലാസ്റ്റിക്ക് വാരി

വിഴിഞ്ഞം: പരിസ്ഥിതി ദിനാചാരണത്തിന്റെ ഭാഗമായി അദാനി വിഴിഞ്ഞം പോർട്ട് ലിമിറ്റഡ് (എ.വി.പി.പി.എൽ) പരിസ്ഥിതി വകുപ്പിന്റെ സഹകരണത്തോടെ പ്ലാസ്റ്റിക് നിർമ്മാർജ്ജന യജ്ഞം സംഘടിപ്പിച്ചു. വിഴിഞ്ഞം തുറമുഖ പരിസരവും തീരക്കടലും ശുചീകരിച്ചു.

എ.വി പി പി എല്ലിന്റെ കോർപ്പറേറ്റ് സോഷ്യൽ റെസ്പോൺസിബിലിറ്റി, പരിസ്ഥിതി വിഭാഗങ്ങളുടെ നേതൃത്വത്തിൽ നടന്ന പരിപാടിയിൽ 120 ജീവനക്കാർ പങ്കെടുത്തു. മത്സ്യത്തൊഴിലാളികളുടെ നേതൃത്വത്തിൽ വള്ളങ്ങൾ ഉപയോഗിച്ചാണ് തീരക്കടലിലെ പ്ലാസ്റ്റിക് ശേഖരിച്ചത്. 428 കിലോ പ്ലാസ്റ്റിക് മാലിന്യം ശേഖരിച്ച സംസ്കരണത്തിനായി കൈമാറി. ഇതിൽ 128 കിലോ കടലിൽ നിന്നാണ് ശേഖരിച്ചത്.

അദാനി സി.എസ്.ആർ വിഭാഗം മേധാവി ഡോ. അനിൽ ബാലകൃഷ്ണൻ, പരിസ്ഥിതി വിഭാഗം മേധാവി ഹെബിൻ ചെന്തമാരാക്ഷൻ എന്നിവർ സംസാരിച്ചു.

ലോക വയോജന പീഡന വിരുദ്ധ ബോധവൽക്കരണ ദിനം ആഘോഷിച്ചു

ദേശാഭിമാനി Fri, 16 June 2023

NG

അദാനി തുറമുഖ കമ്പനിയുടെ സാമൂഹ്യ പ്രതിബദ്ധതാ പദ്ധതിയുടെ ഭാഗമായി നിർമ്മിച്ച സഹൃദയാനന്ദ വായനശാലയുടെ ഇരുനില മന്ദിരം മന്ത്രി അഹമ്മദ് ദേവർകോവിൽ ഉദ്ഘാടനം ചെയ്തു

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വിഴിഞ്ഞം ● അദാനി ഗ്രൂപ്പിന്റെ സാമൂഹിക പ്രതിബദ്ധത വിഭാഗമായ അദാനി വിൽമാറിന്റെ സഹായത്തോടെ നടപ്പാക്കി വരുന്ന സുപോഷൺ പദ്ധതിയുടെ ഭാഗമായി കോട്ടുകാൽ ഗ്രാമ പഞ്ചായത്തിലെ 32 അങ്കണവാടി പരിധികളിൽ 30 വരെ വിവിധ പരിപാടികൾ സംഘടിപ്പിക്കും.

ഇതോടനുബന്ധിച്ച് ബോധവൽക്കരണം, റാലി, പോസ്റ്റർ മത്സരം, ഫാമിലി കൗൺസലിങ്ങും നടത്തും. സെബാസ്റ്റ്യൻ ബ്രിട്ടോ,മീര, രാകേഷ്, പി.ടി.ജോർജ് സെൻ,സ്റ്റീഫൻ വിനോദ്, അനുരാഗ്, മായ,ലിംന, രാധ എന്നിവർ നേതൃത്വം നൽകും.

ഇടവക പ്രതിനിധികളുമായി കലക്ടർ ചർച്ച നടത്തി

വിഴിഞ്ഞം ● ...

സൗജന്യ കേൾവി പരിശോധന ക്യാമ്പ്

മംഗളം

സൗജന്യ നേത്ര പരിശോധന ക്യാമ്പ് നടത്തി

വിഴിഞ്ഞം: അദാനി വിഴിഞ്ഞം തുറമുഖ കമ്പനിയുടെ സാമൂഹ്യ പ്രതിബദ്ധത പദ്ധതിയുടെ ഭാഗമായി തിരുവനന്തപുരം ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് റീജണൽ മെറ്റാമോളജിയുടെയും മുല്ലൂർ എൻ.എസ്.എസ് കരയോഗത്തിന്റെയും മുല്ലൂർ വാർഡിന്റെയും കുടുംബശ്രീ എ.ഡി.എസിന്റെയും സംയുക്താഭിമുഖ്യത്തിൽ സൗജന്യ നേത്ര പരിശോധന ക്യാമ്പ് സംഘടിപ്പിച്ചു.

മുല്ലൂർ എൻഎസ്എസ് കരയോഗം മന്ദിരത്തിൽ നടന്ന ക്യാമ്പ് മുല്ലൂർ വാർഡ് കൗൺസിലർ ഓമന ഉദ്ഘാടനം ചെയ്തു. എൻ.എസ്.എസ്. വനിതാ സമാജം സെക്രട്ടറി ശ്രീലേഖ സ്വാഗതം ആശംസിച്ചു.എൻ.എസ്.എസ് കരയോഗം പ്രസിഡന്റ് മോഹനചന്ദ്രൻ നായർ അധ്യക്ഷത വഹിച്ചു.

അദാനി ഫൗണ്ടേഷൻ മാനേജിങ് ഹെഡ് സക്കീർ ഡിനേറ്റർ ജോർജ്ജി സെബ പി.റ്റി, എൻ.എസ്.എസ് താലൂക്ക് യൂണിയൻ ഭരണസമിതി അംഗവും മേഖല കൺവീനറുമായ ശ്രീകുമാർ കരയോഗം സെക്രട്ടറി ശിവൻകുട്ടി, അദാനി ഫൗണ്ടേഷൻ പ്രോജക്ട് ഓഫീസർ വിനോദ് ,ആശ തുടങ്ങിയവർ പ്രസംഗിച്ചു. റിജണൽ മെറ്റീരിയോളജി വിഭാഗത്തിലെ ഡോ.ഗോപിക,ഡോ.ആര്യ എന്നിവർ പരിശോധനക്കിക്ക് നേതൃത്വം നൽകി.

THIRUVANANTHAPURAM Edition
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കേരള കൗമുദി

HOME / KERALA / SPECIAL

തുറമുഖം യാഥാർത്ഥ്യമാക്കുന്നതിനൊപ്പം വിഴിഞ്ഞംകാർക്ക് അദാനിയുടെ വക എന്തൊക്കെയാണ് ലഭിക്കുന്നതെന്ന് അറിയുമോ?

Monday 04 September, 2023 12:06 PM

വിഴിഞ്ഞം: വിഴിഞ്ഞം അന്താരാഷ്ട്ര തുറമുഖത്തിനായുള്ള കുറ്റൻ ക്രെയിനുകളുമായുള്ള കപ്പൽ

ഒരു മാസം നീളുന്ന സുപോഷൺ പദ്ധതിയുമായി അദാനി ഫൗണ്ടേഷൻ



09-09-2023

വിഴിഞ്ഞം: ദേശീയ പോഷണ മാസാചാരണ ത്തോടനുബന്ധിച്ച് അദാനി വിൽമാറിന്റെ സഹായത്തോടെ നടപ്പിലാക്കി വരുന്ന സുപോഷൺ പദ്ധതിയുടെ ഭാഗമായി സെപ്റ്റംബർ 30 വരെ കോട്ടുകാൽ ഗ്രാമ പഞ്ചായത്തിലെ 32 അംഗൻവാടി ഏരിയയിൽ വിവിധ പരിപാടികൾ സംഘടി പ്പിക്കും.അഞ്ചു വയസ്സിൽ താഴെയുള്ള കുട്ടികളിലെ പോഷകശോഷണവും സ്ത്രീകളിലെയും കൗമാരക്കാരായ പെൺകുട്ടികളിലെയും വിളർച്ചയും ഇല്ലായ്മ ചെയ്യുന്നതിനായി അദാനി ഗ്രൂപ്പിന്റെ സാമൂഹ്യ പ്രതിബദ്ധത വിഭാഗമായ അദാനി ഫൗണ്ടേഷൻ നടത്തി വരുന്ന പദ്ധതിയാണ് സുപോഷൺ.കോട്ടുകാൽ പഞ്ചായത്തിലെ വിവിധ സ്ഥലങ്ങളിൽ

സൗജന്യ നേത്ര പരിശോധന ക്യാമ്പ് നടത്തി

09-09-2023

വിഴിഞ്ഞം:അദാനി വിഴിഞ്ഞം തുറമുഖം കമ്പനിയുടെ സാമൂഹ്യ പ്രതിബദ്ധത പദ്ധതിയുടെ ഭാഗമായി തിരുവനന്തപുരം ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് റീജണൽ ഒഫ്താൽ മോളജിയുടെയും നഗരസഭ വെങ്ങാനൂർ വാർഡിന്റെയുംകുടുംബശ്രീഎ.ഡി.എസിന്റെ സംയുക്താഭിമുഖ്യത്തിൽ സൗജന്യ നേത്ര പരിശോധന ക്യാമ്പ് സംഘടിപ്പിച്ചു. വെങ്ങാനൂർ വിദ്യാധിരാജ സ്മാരക എൻഎസ്എസ് കരയോഗ മന്ദിരത്തിൽ നടന്ന ക്യാമ്പ് വെങ്ങാനൂർ വാർഡ് കൗൺസിലർ സിന്ധു വിജയകുമാർ

സൗജന്യ നേത്ര പരിശോധന ക്യാമ്പ് നടത്തി

15.09-2023

വിഴിഞ്ഞം:അദാനി വിഴിഞ്ഞം തുറമുഖം കമ്പനിയുടെ സാമൂഹ്യ പ്രതിബദ്ധത പദ്ധതിയുടെ ഭാഗമായി തിരുവനന്തപുരം ഇൻസ്റ്റിറ്റ്യൂട്ട്ഓഫ് റീജണൽ ഒഫ്താൽമോളജി യുടെയും മുല്ലൂർഎൻ.എസ്.എസ്കരയോഗ ത്തിന്റെയും,മുല്ലൂർ വാർഡിന്റെയും, കുടുംബശ്രീഎ.ഡി.എസിന്റെയും സംയുക്താ ഭിമുഖ്യത്തിൽ സൗജന്യ നേത്ര പരിശോധന ക്യാമ്പ് സംഘടിപ്പിച്ചു .മുല്ലൂർഎൻഎസ്എസ് കരയോഗം മന്ദിരത്തിൽ നടന്ന ക്യാമ്പ് മുല്ലൂർ വാർഡ്കൗൺസിലർ ഓമന ഉദ്ഘാടനം

അദാനി ഫൗണ്ടേഷൻ

വിഴിഞ്ഞം● അദാനി തുറമുഖ ഫൗണ്ടേഷന്റെ ലോക യുവജന നൈപുണ്യ ദിനാചരണം നടത്തി. സീനിയർ പ്രൊജക്റ്റ് ഓഫിസർ ആർ. രാകേഷ് ഉദ്ഘാടനം നിർവഹിച്ചു.ജോർജ് സെൻ, സ്റ്റീഫൻ വിനോദ്, എ. അങ്കൂർ, എസ്. അനിൽകുമാർ എം.ജെ. അനുരാഗ് എന്നിവർ പ്രസംഗിച്ചു.

ലോക യുവജന നൈപുണ്യ ദിനം ആചരിച്ചു

വിഴിഞ്ഞം: അദാനി തുറമുഖ ഫൗണ്ടേഷനുകീഴിൽ വിഴിഞ്ഞത്ത് പ്രവർത്തിക്കുന്ന അദാനി സ്കിൽ ഡെവലപ്മെന്റ് സെന്ററിൽ ലോക യുവജന നൈപുണ്യ ദിനം ആചരിച്ചു. മുക്കോലയിലുള്ള സെന്ററിൽ നടന്ന പരിപാടിയുടെ ഉദ്ഘാടനം അദാനി ഫൗണ്ടേഷൻ സീനിയർ പ്രൊജക്ട് മാനേജർ രാകേഷ് നിർവഹിച്ചു. തുടർന്ന് പുതിയ സാങ്കേതിക വിദ്യാകോഴ്സുകളെ പരിചയപ്പെടുത്തുന്ന ക്ലാസ് ട്രെയ്നർ അനിൽകുമാർ നയിച്ചു. അതോടൊപ്പം അദാനി സ്കിൽ ഡെവലപ്മെന്റ് സെന്റർ പുതിയതായി ആരംഭിച്ച മെറ്റാവേർസ് എന്ന നൂതന നൈപുണ്യ പരിശീലന രീതിയെ സെന്റർ ഹെഡ് എം.ജെ. അനുരാഗ് പരിചയപ്പെടുത്തി.

Adani Group
1,417,267 followers
2w

Empowering Communities: In Vizhinjam, Kerala, the Adani Foundation is making a difference by launching an initiative to raise awareness about government schemes. Through the training of 46 dedicated female volunteers, we aim to support 1,000 people in availing of the benefits and reducing their economic burden. Together, we will create a stronger, more empowered community.
#ProjectGoodness #GrowthWithGoodness

Adani Foundation

Adani Foundation
11 Jul

Development of Community #infrastructure assets have the power to accelerate various socio-economic outcomes. Take for example the new Uchakkada Library building in Vizhinjam, Kerala. Its inauguration has opened a universe of knowledge for our students, with 13000+ books of various genres housed on the ground floor and a coaching centre on the upper floor to help students prepare for competitive exams.

Under the guidance of 12 expert teachers, the centre will organize training sessions for children aspiring to reach the next level in their field of study. Improving efficiencies in #learning is one of the major focus areas for the Adani Foundation, and we hope that this dedicated building gives an impetus to #EducationForAll in the region.

#CommunityDevelopment #Vizhinjam #Kerala #AdaniFoundation #GrowthWithGoodness #Library #Books #Training #Education #Knowledge

അദാനി ഫൗണ്ടേഷൻ സാമൂഹിക പ്രതിബദ്ധതയുടെ ഭാഗമായി കോവളം എഫ്സിയിൽ പരിശീലനം നേടുന്ന കുട്ടികൾക്ക് കായിക ഉപകരണങ്ങളും ജഴ്സിയും സമ്മാനിക്കുന്നു

ജഴ്സി സമ്മാനിച്ചു

നെയ്യാറ്റിൻകര • അദാനി ഫൗണ്ടേഷൻ സാമൂഹിക പ്രതിബദ്ധതയുടെ ഭാഗമായി കോവളം എഫ്സിയിൽ പരിശീലനം നേടുന്ന കുട്ടികൾക്ക് കായിക ഉപകരണങ്ങളും ജഴ്സിയും സമ്മാനിച്ചു. അദാനി ഗ്രൂപ്പ് സൗത്ത് ഇന്ത്യ സിഎസ്ആർ ഹെഡ് അനിൽ ബാലകൃഷ്ണൻ ഉദ്ഘാടനം ചെയ്തു. വിഴിഞ്ഞം സിഎസ്ആർ ഹെഡ് സെബാസ്റ്റ്യൻ, കോവളം എഫ്സി മാനേജർ ഇഗ്നേഷ്യസ്, മുഖ്യ പരിശീലകൻ എബിൻ റോസ്, ബെനിസ്റ്റൻ തുടങ്ങിയവർ പ്രസംഗിച്ചു. മികച്ച കളിക്കാർക്ക് പുരസ്കാരങ്ങളും നൽകി. ഫുട്ബോൾ രാജ്യാന്തര തലത്തിൽ കളിക്കാൻ, കളിക്കാരെ തയാറാക്കുന്നതിനു വേണ്ടി 'വിഷൻ 2047' എന്ന പദ്ധതി ആസൂത്രണം ചെയ്തതായി ബന്ധപ്പെട്ടവർ അറിയിച്ചു.

അതിലൂടെ ഇന്ത്യൻ ടീമിനെ 'ലോക കപ്പ്' മത്സരത്തിൽ എത്തിക്കുകയാണ് ലക്ഷ്യമെന്നും അവർ വിശദീകരിച്ചു.

മാറിയെന്നും പരാതിയുണ്ട്.

വെള്ളായണി കായൽ നവീകരണം ആരംഭിച്ചു

വിഴിഞ്ഞം: വെങ്ങാനൂർ ഗ്രാമപഞ്ചായത്തിന്റെയും അദാനി ഫൗണ്ടേഷന്റെയും നേതൃത്വത്തിൽ വെള്ളായണി കായൽ നവീകരണം ആരംഭിച്ചു.

കുടിവെള്ളസ്രോതസായ കായൽ കുളവാഴയും ആഫ്രിക്കൻ പായലും താമരയും കൊണ്ട് നിറഞ്ഞതോടെ മത്സ്യങ്ങളുടെ ആവാസ വ്യവസ്ഥയ്ക്ക് തന്നെ വെല്ലുവിളിയായി മാറി. മാലിന്യങ്ങൾ കൊണ്ട് ചതുപ്പായി മാറിക്കൊണ്ടിരിക്കുന്ന വെള്ളായണി കായലിനെ വീണ്ടെടുക്കുന്നതിനും കായലും പരിസ്ഥിതിയും സംരക്ഷിച്ചുകൊണ്ട് ഉത്തരവാദിത്വ ടൂറിസം പരിപാടികളും സംഘടിപ്പിക്കാൻ ഗ്രാമപഞ്ചായത്ത് നടപടികൾ സ്വീകരിച്ചു.

ഇത്തരം പ്രവർത്തനങ്ങളുടെ ഭാഗമായാണ് ഗ്രാമപഞ്ചായത്ത് അദാനി ഫൗണ്ടേഷനുമായി ചേർന്ന് പ്രവർത്തനങ്ങൾ ആരംഭിച്ചിരിക്കുന്നത്. ഇതോടൊപ്പം ജലസേചന വകുപ്പിന്റെ മെക്കാനിക്കൽ വിഭാഗവുമായി കൂടിച്ചേർന്നുകൊണ്ടും വീഡ് ഹാർവെസ്റ്റ് യന്ത്രം ഉപയോഗിച്ച് നവീകരണ പ്രവർത്തനങ്ങൾ ആരംഭിക്കും. കായലിനെ പൂർണമായും വീണ്ടെടുക്കുന്നതുവരെ നവീകരണ പ്രവർത്തനങ്ങൾ തുടരുമെന്ന് ഗ്രാമപഞ്ചായത്ത് പ്രസിഡന്റ് ആർ. എസ്. ശ്രീകുമാർ അറിയിച്ചു.

കേരള കൗമുദി

താലൂക്കുതല പദവിയിലേക്ക് ഉയരാ
വിഴിഞ്ഞം സാമൂഹ്യാരോഗ്യ കേന്ദ്രം

സൗജന്യ നേത്ര ചികിത്സാ ക്യാംപ്

കോവളം● അദാനി ഫൗണ്ടേഷൻ സാമൂഹിക പ്രതിബദ്ധത പരിപാടികളുടെ ഭാഗമായി ജില്ലാ ടൂറിസം ഡവലപ്പ്മെന്റ് കോ- ഓപ്പറേറ്റിവ് സൊസൈറ്റി, സ്വാഗത് നഗർ റസി. അസ്സോസിയേഷൻ എന്നിവ ചേർന്ന് സൗജന്യ നേത്ര ചികിത്സാ ക്യാംപ് നടത്തി. ഗവ കണ്ണാശുപത്രിയിലെ വിദഗ്ധർ പരിശോധനകൾക്ക് നേതൃത്വം നൽകി.

വെള്ളാർ അഷ്ടപാലൻ ,ജോർജ് സെൻ, മായ, വിനോദ്, കോവളം സുകേശൻ , വീരഭദ്രൻ എന്നിവർ സംബന്ധിച്ചു.

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ിറി പാർട്ടി യോഗത്തിൽ പ്രധാനമന്ത്രി ന

അന്താരാഷ്ട്ര യുവജന ദിനമാചരിച്ചു.

13 -08-2023

കോവളം:അദാനി സ്ക്കിൽ ഡവലപ്പ്മെന്റ് സെന്ററിന്റെ ആഭിമുഖ്യത്തിൽ യുവജന ദിനാചരണം നടത്തി.മുക്കോല അസാപ് ട്രാൻസിറ്റ് ക്യാമ്പസിൽ വച്ച്നടന്ന പരിപാടി അദാനി ഫൌണ്ടേഷൻ പ്രോഗ്രാം മാനേജർ സെബാസ്റ്റ്യൻ ബ്രിട്ടോ ഉദ്ഘാടനം ചെയ്തു. കേരള ശാസ്ത്ര സാങ്കേതിക പരിസ്ഥിതി കൗൺസിൽ യുവ ശാസ്ത്രജ്ഞ ഡോ. ശാരിക എ.ആർ പരിസ്ഥിതി സൗഹൃദ ജീവിത രീതികൾ വിശദീകരിച്ചു.യുവതീ യുവാക്കൾ

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സൗജന്യ നേത്ര ചികിത്സാ ക്യാമ്പ്സംഘടിപ്പിച്ചു

12-08-2023

കോവളം:അദാനി ഫൗണ്ടേഷൻ സാമൂഹ്യ പ്രതിബദ്ധതാ പരിപാടിയുടെ ഭാഗമായി തിരുവനന്തപുരംജില്ലാടൂറിസംഡെവലപ്പ്മെ കോ ഓപ്പറേറ്റീവ് സൊസൈറ്റിയുംസ്വാഗത് നഗർ റസിഡൻസ് അസ്സോസിയേഷനും സംയുക്തമായി സൗജന്യ നേത്ര ചികിത്സാ ക്യാമ്പ്സംഘടിപ്പിച്ചു.തിരുവനനന്തപുരം

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തിരുവനന്തപുരം: അദാനി സ്കിൽ ഡെവലപ്മെന്റ് സെന്റർ മുക്കോല അസാപ് ട്രാൻസിറ്റ് ക്യാമ്പസിൽ യുവജന ദിനാചരണം നടത്തി

Thiruvananthapuram, Thiruvananthapuram · Aug 14, 2023

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അവയവദാന സമ്മത പത്രങ്ങൾ കൈമാറി

18.08.2023

വിഴിഞ്ഞം:ലോക അവയവ ദാന ദിനാഘോഷം നടത്തി.അദാനി ഫൗണ്ടേഷനും അദാനി സ്കിൽ ഡവലപ്പ്മെന്റ് സെന്ററും സംയുക്ത മായി ദേശീയ അന്ധതാ നിവാരണ പരിപാടി യുടെ ഭാഗമായി റീജിയണൽ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ്ഓഫ്താൽമോളജി,ഗവ.കണ്ണാശുപത്ര മെഡിക്കൽ കോളേജുമായി ചേർന്ന് നടത്തിയ ബോധവത്ക്കരണ ക്യാമ്പയിന്റെ ഭാഗമായി 100 നേത്രദാന സമ്മത പത്രങ്ങൾ

നേത്ര പരിശോധന ക്യാമ്പ്

28.08-2023

വിഴിഞ്ഞം:അദാനി വിഴിഞ്ഞം തുറമുഖം കമ്പനിയുടെ സാമൂഹ്യ പ്രതിബദ്ധത പദ്ധതി യുടെ ഭാഗമായി തിരുവനന്തപുരം ഇൻസ്റ്റി റ്റ്യൂട്ട് ഓഫ് റീജണൽ ഒഫ്താൽമോളജി, വിഴിഞ്ഞം വടക്കുംഭാഗം മുസ്ലിം ജമാഅത്ത്, ഡോ.എ.പി.ജെ അബ്ദുൽ കലാം പബ്ലിക് സ്കൂൾ എന്നിവർ സംയുക്തമായി നേത്രപരി ശോധന ക്യാമ്പ് സംഘടിപ്പിച്ചു. ഡോ.എ. പി.ജെ അബ്ദുൽ കലാം സ്കൂളിൽ വെച്ച് നടന്ന ക്യമ്പ് വിഴിഞ്ഞം സർക്കിൾ ഇൻസ് പെക്ടർ പ്രജീഷ് ശശി ഉദ്ഘാടനം ചെയ്തു. ജമാഅത്ത് പ്രസിഡൻറ് അബ്ദുൽറഹീം അധ്യക്ഷത


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Annexure VII

Compliance to Conditions of KCZMA Recommendation

Annexure VII

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
(i)	The developmental works and the construction of the structures may be undertaken as per the plans approved by the concerned local Authorities, local administration, conforming to the existing local and central rules and regulations including the existing provisions of CRZ Notification.	**Complied** All the construction activities are being carried out as per existing Central/local rules. Necessary permissions under CRZ Notification 2011 & its amendments have been obtained. Further, necessary approvals from concerned Statutory Departments/Agencies have been obtained for the construction designs/drawings relating to construction activities as mentioned hereunder: • Consent to Establish (CTE) No. PCB/HO/TVM/ICE/08/2015 dated 15.09.2015 valid up to 31.07.2018 was renewed from Kerala State Pollution Control Board (KSPCB) vide Consent No. PCB/HO/TVM/ICE-R/02/2018, dated 19.07.2018 valid up to 31.07.2023 and further renewed T vide Consent No. KSPCB/TV/ICE/10029484/2023 dated 30.07.2023 valid up to 31.07.2028 (A Copy of the same is enclosed as **Annexure I**). • Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 7.12.2015. • CTE for Temporary Mobile Crusher at Vizhinjam port project site was obtained for the port construction activities vide Consent No. KSPCB/TV/ICE/10023574/2023 dated 15.04.2023 valid up to 14.04.2026 (A Copy of the same is enclosed as **Annexure XIII**). • CTE for consumer pump inside the Vizhinjam port premises was obtained on 07.03.2021 (Consent No.: PCB/TVM-DO/NTA/PTP/15/2021) for the period of 5 years valid up to 28.02.2026. • Consent to Operate (CTO) for Explosives Storage at Chappath area was obtained on 20.07.2021 (Consent No.: PCB/TVM-DO/ICO/NTA/HCS/49/2021) valid up to 31.12.2024. • As per the exemption granted by GoK G.O. No. 310/2015/LSGD dated 01/10/2015, AVPPL is not required to obtain any further building

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
		permits/permission to construct port related building within the port premises.
(ii)	Since the project envisages development of roads, infrastructural facilities, dredging of the lake and kayals proper environmental safety measures must be ensured.	**Complied** All safety measures are being adopted. Full-time Environment & Safety professionals are employed by AVPPL, contractors & subcontractors, to oversee the implementation of environmental safety measures. Organizational Structure for Environment, Health, and Safety (EHS) & CSR for construction phase is enclosed as **Annexure XII**. All work plans are executed after assessing the defined EHS plans. It is also submitted that dredging of lakes or kayals are not envisaged as part of this project.
(iii)	The project proponent must obtain necessary clearance separately from the Kerala State Pollution Control Board, Health Department and other appropriate Authorities when such implementation programmes are undertaken.	**Complied** CTE has been obtained from KSPCB vide Consent No. PCB/HO/TVM/ICE/08/2015, dated 15.09.2015 valid up to 31.07.2018. Subsequently, the CTE was renewed vide Consent No. PCB/HO/TVM/ICE-R/02/2018 dated 19.07.2018 valid up to 31.07.2023. The CTE was further renewed vide Consent No. KSPCB/TV/ICE/10029484/2023 dated 30.07.2023 valid up to 31.07.2028 (A Copy of the same is enclosed as **Annexure I**).
(iv)	The construction should be undertaken, if any with least damages to the existing mangroves. A buffer zone of 50m shall be provided for mangroves present in the area.	**Not Applicable** There are no mangroves in the vicinity of the project area.
(v)	The project proponent must take necessary arrangements for disposal of solid wastes and for the treatment of effluents / wastes. It must be ensured that the effluents/solid	**Being Complied** No solid waste is being disposed in the CRZ area. Bio-degradable waste is being treated in an Organic Waste Converter (OWC) installed at site and output is being used as manure in greenbelt development. A Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
	wastes are not discharged into the backwater area/sea.	in accordance with the CRZ Notification is being implemented. The work order to develop the STP with capacity of 50 KLD has been awarded to M/s. Starcon Infra Projects (I) Pvt. Ltd.
(vi)	The project proponent should provide necessary facilities for official of the Kerala Coastal Zone Management Authority (KCZMA) for inspection of the project site and its premises at any time.	**Noted** All necessary support will be extended to officials of KCZMA during inspection of the project/site visit; at any time.
(vii)	The KCZMA may be duly informed of any construction/developmental works/major activities undertaken in the CRZ area of the project	**Being Complied** • Member Secretary KCZMA is also the member secretary of NGT appointed committee; the committee meets every six months to review the compliance of Environmental & CRZ Clearance and the progress of the project are being presented. • Regular meetings are held with officials of KCZMA to appraise them on various project related activities. • HYCRs are being furnished to KCZMA including the details of the development works. Following construction activities have taken place till September 2023: • During the compliance period, 0.065 Mm^3 material has been dredged and a total 3.96 Mm^3 dredged material has been utilized for reclamation of 48.61 Ha area of land. • Boundary wall construction and port approach road work along available front has been completed at various locations; remaining construction work is on hold owing to several local disputes as well as R&R issues. • Excavation for levelling in the backup area considering present and future port development activities.

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
		• Following construction is in progress: Container Berth Deck Slab in-situ concreting works, RMQC Rail fixing works, Bollard & Fender fixing works, CRMG Crane unloading corridor CBM works, Breakwater Construction works (Profiling works), Wave Wall and Crown Slab erection works, Container Berth Rehabilitation works, Container Berth Rock Bund works, retaining wall erection works, Container Backup Yard development works, Yard 1E IT & Automation works, Approach Road Works and Fuel Station works.
(viii)	Environmental clearance must be obtained from the Ministry of Environment & Forests.	**Complied** Environment & CRZ Clearance (EC) has been obtained from Ministry of Environment & Forest vide MoEF letter dated 03.01.2014 (F.No.11-122/2011-IA.III). Due to the validity limit of Five (05) years at the time, the EC was valid till 02.01.2019. Thereafter, as per EIA Notification 2006 and Office Memorandum (O.M.) dated 12.04.2016, the validity of the EC will stand automatically is for Seven (07) years and therefore considered up to 02.01.2021. Further, as per the provisions of MoEF&CC, the validity of the EC may be further extended for a maximum period of three years. VISL had submitted online application and required documents on PARIVESH for extension of EC. The Proposal was considered in the 247th EAC meeting of Infra-1 committee and MoEF&CC vide letter No. IA/KL/MIS/178082/2020 dated 29.12.2020 have extended the validity of EC of Vizhinjam Seaport by three (03) years till 02.01.2024. Further, considering the outbreak of COVID-19 pandemic, MoEF&CC have issued Notification (SO-221 E) dated 18.01.2021 such that the period from the 01.04.2020 to the 31.03.2021 shall not be considered for the purpose of calculation of validity of existing ECs. Therefore, the EC of Vizhinjam Seaport is valid till 02.01.2025.

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2023 to September 2023		
S. No.	**Conditions**	**Compliance Status as on 30.09.2023**
(ix)	An adequate financial provision has to be made for environmental protection measures.	**Complied** A total of approx. Rs. 40 Crore has been set aside for environmental protection measures as per the EIA report. Till date, an amount of Rs. 28.64 Crores has been spent on environmental protection measures. The activity-wise fund break-up and expenditure is enclosed as **Annexure XI**.
(x)	Scrutiny fee of Rs. 10,00,000/- (Rupees Ten lakh only) to be remitted under the head account 1425-800-97 applications for scrutiny fee etc. for CRZ clearance, in the district/Sub Treasury concerned, if private parties are involved in the project and the challan receipt in original be forwarded to the Science & Technology Department quoting this letter.	**Not Applicable** The condition is not applicable since the application for EC was submitted by Vizhinjam International Seaport Ltd. (VISL), a Government of Kerala (GoK) undertaking.

Annexure VIII

Compliance of the Commitments made during Public Hearing

Annexure VIII

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
1	Good compensation package for all livelihood issues have been included for all related PAPs for all affected sectors including the fisheries sector. Strict adherence to EMP compliance with all relevant rules and regulations will be done	**Being Complied** In consultation with the fishermen, enhanced livelihood compensation of Rs. 106.79 Crores was sanctioned by GoK and distributed by VISL to fishermen as livelihood compensation, instead of Rs. 8.55 crores, as suggested earlier in the EIA. Till 30.09.2023 an amount of Rs. 106.59 Crores have been disbursed for a total number of 2697 Livelihood Affected Persons (LAPs) whose verification was complete in all respects; this includes boat owners to whom kerosene is supplied free of cost during the breakwater construction period. Remaining disbursals would be done as soon as possible. *(Source: VISL)* There are 5 identified areas for EMP as per EIA: Port Site, Road/Rail Corridor, Warehouse Area, PAF (Project Annex Facility) and Backup Areas. Recommendation of the construction EMP for these areas are being implemented in strict adherence to EMP with all relevant rules and regulations is being done. Status of construction stage EMP in matrix format is enclosed as **Annexure IX**.
2	Land under the Jamaath which includes Karimppaly, Magham, Varuthari Pally, etc. need to be protected and should not be acquired.	**Complied** These lands have not been acquired.
3	Compensation for the land acquired (rail/road connectivity and back up areas) are paid promptly and any for additional land required also will be paid in the same way.	**Complied** Compensation for all the acquired land has been disbursed along with R&R package. Similar policy will be followed for the remaining extent of land acquisition also as per rules in force viz-a-viz applicable. *(Source: VISL)*
4	Additional fish landing centre will be constructed	**Being Complied** The planning work for the fish landing centre (Rs. 16.00 crores) and the fishery breakwater (Rs. 131.12 crores) had been initiated as part of the funded work component of the concession agreement with AVPPL. Based on studies on

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
		tranquillity carried out by CWPRS, Pune studies on tranquillity at the proposed new fishing harbour, the landing centre needs to be relocated after construction of an extension of seaward breakwater of the old fishing harbour. GoK is finalising the way forward to build the additional fish landing centre for the benefit of the local fishermen. *(Source: VISL)*
5	Existing harbour will be improved under the CSR provisions of the project	**Being Complied** Tender for modernization of the existing fishing harbour was invited by HED and work awarded. However, the works could not be initiated due to sectoral protests among different fishermen groups. GoK has formed a higher-level committee to prepare a master plan for the old fishing harbour. Related Government Departments are coordinating to resolve the differences and to arrive at an acceptable plan in consultation with all the stakeholders. *(Source: VISL)*
6	Fisherman will get first preference to cross the ship channel	**Will be Complied** Will be complied as per the applicable laws and during standard operating procedure (SOP) formulation.
7	GoK/VISL will monitor the shore line changes during construction and operational phases. If necessary, intervention to arrest erosion will be carried out.	**Being Complied** Based on the Shoreline Monitoring Plan prepared by L&T Infra Engineers Ltd (L&T IEL) under the guidance of National Institute of Ocean Technology (NIOT), Shoreline monitoring is being carried out by agency Shankar Surveys Pvt, Ltd. (SSPL) for a stretch of 40 km (20 km on both sides of the project site) and reports are being regularly submitted to Ministry of Environment and Forests & Climate Change (MoEF&CC) as a part of the HYCRs. The scope covers broadly as follows: • Wave Observations • Onshore Cross beach profiling • Offshore Cross beach profiling • Littoral Environmental Observations (LEO) • Beach Sampling • Multi-beam Echo Sounder (MBES) survey • River cross section surveys • Grab Sampling • Current & Tide Observations • Weather Observations

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
		• Marine Water Sampling Shoreline Monitoring Report by SSPL for the period April 2023 to September 2023 is enclosed as **Annexure II**. L&T IEL had prepared Mathematical Modelling Reports based on available Shoreline Monitoring data; which were vetted by NIOT. Five mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC; as detailed below: **Data Period** / **Submitted with HYCR for the Period** Feb 2015 to Feb 2017 / Apr 2017 to Sep 2017 Mar 2017 to Feb 2018 / Apr 2018 to Sep 2018 Mar 2018 to Feb 2019 / Apr 2019 to Sep 2019 Mar 2019 to Feb 2020 / Apr 2020 to Sep 2020 Mar 2020 to Feb 2021 / Apr 2021 to Sep 2021 Mar 2021 to Sep 2022 / Apr 2022 to Sep 2022 Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data for the period October 2022 to September 2023 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. The mathematical modelling report for the period October 2022 to September 2023 vetted by NIOT is given as **Annexure III**.
8	Water supply provision to the Vizhinjam fishing village	**Complied** Kerala Water Authority (KWA) set up a 3.00 MLD water supply scheme for the project with the source of water being Vellayani Lake which was commissioned in April 2013 by VISL by expending an amount of Rs. 7.10 Crores. The net availability of treated water from this supply scheme is 2.49 MLD of potable water out of which 1.49 MLD of water shall be distributed to the local people as part of social welfare measures of VISL. The balance 1.0 MLD was to be used for port related activities. However, at present, the entire treated water from the scheme is being utilised by the community. For Operation & Maintenance (O&M) of the same, an

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
		amount of Rs. 5.38 crores have been spent up to 31.03.2021. From 04.04.2019 onwards, O&M of the scheme is being done by KWA. An additional amount of Rs. 1.74 Crores has been sanctioned and deposited by VISL to KWA to extend piped water connections for treated water supply facilities to the community at Kottapuram Village. More than 1000 free domestic water connections have been given to the project affected areas. KWA now have adequate coverage of water supply around the port and project affected areas. VISL is coordinating with local body representatives to identify water shortage areas and taking effort to resolve the same. *(Source: VISL)*
10	Railway work will be initiated after Environment Clearance (EC)	**Will be Complied** Konkan Railway Corporation Limited (KRCL) has been engaged for turnkey execution of the project. Out of the total rail route length of 10.7 km, 9.0 km is planned to be passing through an underground tunnel to minimize the disturbance to the local population. Detailed Project Report (DPR) has been approved by Southern Railway. Geophysical and geomorphological studies, flood mapping studies and hydrogeological studies have also been completed. EC amendments in this regard had been submitted to MoEF&CC on 17.08.2022 vide Proposal No. IA/KL/NCP/285459/2022 and File No. 11-122/2011-IA.III. The Expert Appraisal Committee (EAC) during their 308th and 322nd meetings held on 15.09.2022 and 21.03.2023, 22.03.2023 respectively apprised the proposal. The additional information and clarification sought on account of vibration impact and subsidence due to underground railway construction by the EAC during the meeting has been prepared by Council of Scientific & Industrial Research (CSIR) – Central Institute of Mining and Fuel Research (CIMFR), Dhanbad and ready for submission to MoEF. *(Source: VISL)*
11	Job Opportunity - Preference will be given to local people during construction stage	**Being Complied** Preference is being given to local people based on Skill & competency during the construction stage. Out of an average of 1116 persons (employees, staff

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
		and construction workers) engaged at site for different construction activities during the compliance period, 444 people are from Kerala and out of them 185 are from nearby wards of the project site.
13	Take all possible measures for judicial use of lighting system as part of the Green Port concept to reduce the carbon footprint	**Will be Complied** Is being considered with appropriate planning.
16	Waste management is included in the EMP and C&D waste management is part of the SWMP.	**Being Complied** Adequate budgetary provision has been kept for waste management as part of EMP as well as CSR. As mentioned in EIA, contractors have been made responsible for management of Waste. All contractors working at site are following the waste management practices in line to waste management rules 2016, as amended. A dedicated integrated solid waste management facility is planned which will be constructed along with project. Additionally, as a part of CSR activities, AVPPL are taking up activities with respect to solid waste management (Refer **Annexure VI**).
17	Upgradation of PHC at Vizhinjam will be carried out	**Being Complied** The construction work of Community Health Center at Vizhinjam is progressing and civil works are completed. The project cost is Rs. 7.79 Crores where the Government component is of Rs. 482 Lakhs and CSR component is of Rs. 297 Lakhs from Adani Foundation. Adani Foundation handed over the first instalment of Rs. 1.18 Crores on 03.10.2018 and the Second instalment of Rs. 1.18 Crores on 24.04.2023 to the Harbour Engineering Department. The final instalment will be transferred only after the completion of the work. Progress of the work is as follows. The basement floor is proposed as parking space. The entire basement floor is completed in RCC.

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
		Huge water storage facility (capacity of 1.0 lakh litre) is constructed to pump water to various levels of the new building. Electrical works, fire and safety works are almost completed in this floor. Ground Floor and First floor are designed to provide inpatient and outpatient services, specialty clinics. The structure is fully completed, and interior works are progressing. Electrical works are almost completed for ground floor. False ceiling for the ground floor progressing whereas for the first floor this work not yet started. Fabrication works are simultaneously carried out in ground floor as well as first floor. As the existing CHC do not have any facilities for Gynaecology, the second floor of the building is proposed to function as gynaecology ward. In this floor, all works including external painting completed. The requirements for additional hospital staff and equipment have been estimated and the health department is in the process of its procurement.  **Community Health Centre, Vizhinjam**
19	Appropriate compensation will be given to the resort owners as per the regulatory	**Being Complied** Resort owners evicted have been compensated for land and not for the structures since they were in violation of CRZ notification. Remaining land of

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
	advice of KCZMA and MoEF since the resorts are seen to be located in No Development Zone (NDZ) as per CRZ Notification 2011	2.865 Ha is to be acquired by Land Acquisition (LA) process; for which notification has been published and the acquisition is in an advanced stage. *(Source: VISL)*
20	Rail, Road, Coastal and Inland Waterways connectivity will be ensured to the rest of Kerala and other Indian Peninsula Ports	**Being Complied** Multi-Modal (Road, Rail & Coastal) connectivity is within the scope of the project and this will be fully materialised once all phases of the project are implemented. Konkan Railway Corporation Limited (KRCL) has been engaged for turnkey execution of the project. Out of the total rail route length of 10.7 km, 9.0 km is planned to be passing through an underground tunnel to minimize the disturbance to the local population. Detailed Project Report (DPR) has been approved by Southern Railway. Geophysical and geomorphological studies, flood mapping studies and hydrogeological studies have also been completed. EC amendments in this regard had been submitted to MoEF&CC on 17.08.2022 vide Proposal No. IA/KL/NCP/285459/2022 and File No. 11-122/2011-IA.III. The Expert Appraisal Committee (EAC) during their 308th and 322nd meetings held on 15.09.2022 and 21.03.2023, 22.03.2023 respectively apprised the proposal. The additional information and clarification sought on account of vibration impact and subsidence due to underground railway construction by the EAC during the meeting has been prepared by Council of Scientific & Industrial Research (CSIR) – Central Institute of Mining and Fuel Research (CIMFR), Dhanbad and ready for submission to MoEF. *(Source: VISL)* Road connectivity approval from National Highways Authority of India (NHAI) is in progress. In-principle approval received for the junction between NH66 and port road. Detailed design and methodology for the final approval is under preparation.

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
		Development of Coastal shipping and Inland Waterways connectivity are being planned to the rest of Kerala and other peninsular ports by Government Departments concerned. *(Source: VISL)*
21	Waste Management, Water Treatment plants, etc. will be part of an operational EMP	**Being Complied** A Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner in accordance with the CRZ Notification is being implemented. The order to develop the STP with capacity of 50 KLD has been awarded to M/s. Starcon Infra Projects (I) Pvt. Ltd.
23	VISL will ensure that appropriate dredging and reclamation methodology as suggested in EIA report will be adopted to contain the turbidity within applicable limits.	**Being Complied** During the compliance period, 0.065 Mm^3 material has been dredged and a total 3.96 Mm^3 dredged material has been utilized for reclamation of 48.61 Ha area of land. The turbidity details for the compliance period are given in **Annexure IV**.
24	Appropriate measures relating to maintenance of health, hygiene, safety and security will be implemented as per EIA report	**Being Complied** Appropriate institutional mechanism for maintenance of health, hygiene, safety, security has been put in place. An officer of VISL has been designated as Head (EHS & CSR) for effective implementation of the stipulated EHS safeguards & CSR activities. AVPPL, the concessionaire executing the project has also appointed officers for EHS & CSR. In addition to the above, independent environment, health and safety consultants have been appointed as required in the concession agreement signed with AVPPL. Organizational Structure for Environment, Health, and Safety (EHS) & CSR for construction phase is enclosed as **Annexure XII**. It is also ensured that contractors working at site also deploy EHS professional to implement suggested EMP measures. Proper provisions for maintenance of health, hygiene, safety, security for workforce has also been provided/ensured.
25	VISL will ensure that livelihood issues of Mussel collectors are	**Being Complied** Government Orders have been issued for disbursal of Rs. 12.65 Crore for 271 mussel collectors. Till date 262 Mussel collectors have collected the

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
	addressed as per the EIA report	compensation amount totalling to Rs. 12.36 Crore. Although they were offered alternate livelihood plan through cage fishing, they opted for one-time settlement citing the risks involved in such fishing. *(Source: VISL)*
26	VISL will ensure all the project components i.e., including road/rail connectivity are implemented in time. In addition the planned CSR and EMP measures will also be implemented and monitored to ensure the socio-economic development of the region.	**Being Complied** Refer point 20 above. CSR activities are detailed in **Annexure VI**. Status of construction stage EMP in matrix format is enclosed as **Annexure IX**.
27	The implementation of the EMP/RAP/CSR will be ensured through the institutional and regulatory mechanism with regular monitoring and periodic compliance reports to the MoEF	**Being Complied** Refer point 24 above. Regular monitoring of Environment Parameters are being carried out. Detailed Monitoring Reports for the period April 2023 to September 2023 is enclosed as **Annexure IV**. Half Yearly Compliance Reports (HYCRs) which are six monthly reports on the status of compliance of the stipulated clearance conditions including results of monitored data are regularly submitted to all the concerned regulatory authorities/agencies. As per the MoEF&CC Notification dated 26.11.2018, wherein submission of HYCRs by email/soft copy is declared acceptable, therefore the HYCR for the period October 2022 to March 2023 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA via email dated 30.05.2023 (a copy of the email is enclosed as **Annexure XIV**). Additionally, as per the MoEF&CC Office Memorandum dated 14.06.2022, the HYCR for the period October 2022 to March 2023 has been

<table>
<tr><th colspan="3">Compliance of the Response/Commitments made during Public Hearing</th></tr>
<tr><th>S. No.</th><th>Responses/Commitments</th><th>Status as on 30.09.2023</th></tr>
<tr><td></td><td></td><td>submitted online through newly developed compliance module in the PARIVESH Portal.</td></tr>
<tr><td>28</td><td>Special care will be taken to minimise the tree felling in the backup area and to plan the development in tune with the topography.</td><td>Being Complied
Being complied with the extent possible, but in line with the technical requirements of the project. Due permission is taken for tree felling from concerned department (Forest Department).

AVPPL, in collaboration with Forest department, have carried out planting of 40,040 trees in two Phases in adequate land as identified by social Forest Department, for a total area of 29.65 Ha spending Rs. 254.50 Lakhs. This has sufficiently covered the requirement of compensatory afforestation required for the development of Vizhinjam Port. Details of the same are provided below:
<table>
<tr><th>Phase</th><th>Location</th><th>Area (ha)</th><th>No. of Trees</th><th>Cost (Rs. Lakhs)</th></tr>
<tr><td>1</td><td>Sainik School, Kazhakootam</td><td>12.05</td><td>15,540</td><td>80.50</td></tr>
<tr><td>2</td><td>Kerala University Campus, Karyavattom</td><td>12.60</td><td>16,500</td><td rowspan="2">174.00</td></tr>
<tr><td>2</td><td>STP, Muttathara</td><td>5.00</td><td>8,000</td></tr>
<tr><td colspan="2">Total</td><td>29.65</td><td>40,040</td><td>254.50</td></tr>
</table></td></tr>
<tr><td>31</td><td>The number of fishermen who will be temporarily affected in the Adimalathura stretch have been assessed and livelihood restoration measures have been framed for the construction period</td><td>Being Complied
Earlier it was proposed that the fishermen at Adimalathura will be compensated for the construction period of three years, treating them as temporarily affected. However, based on the request of the fishermen (stating that demarcation of the shipping channel and movement of ships would affect them permanently) their compensation has been enhanced considering seven years of livelihood loss. The GoK order to this</td></tr>
</table>

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
		effect has been issued on 31.05.2018 and compensation has been disbursed to 602 eligible fishermen amounting to a total of Rs. 36.42 Crore. *(Source: VISL)*
33	An Area Development Plan (ADP) is being prepared by CEPT University (Ahmedabad) for planned development of the region to avoid haphazard development.	**Being Complied** An Integrated Area Development Plan was prepared through CEPT University, Ahmedabad in consultation with Town Planning as early as in 2012. Tourism Department, Industries Department and other line departments were consulted during the review by an expert committee constituted by GoK. An updated area development plan shall be prepared based on the observations. *(Source: VISL)*
34	Maximum 3 ships are expected per day in phase I. Appropriate traffic mechanism to cross the ship channel for fisherman with first priority will be practised as is happening in Cochin Port where fishing harbour, container berth, navy, shipyard, inland water transport etc are co-existing	**Will be Complied** Restrictions on fishing will be as per the applicable laws.
36	Implementation of CSR measures and planned development of the region through well designed area development plan will arrest the formation of slums and the like.	**Being Complied** Details of CSR activities carried out during the compliance period are given in **Annexure III**. Refer point 33 above for area development plan.
37	"Inconvenience Allowances" during construction period of three years to the fisherman (As per EIA Report)	**Complied** An amount of Rs. 27.18 Crores have been sanctioned by the GoK as inconvenience compensation in the form of kerosene in November 2017. The entire Rs. 27.18 Crore has been given to the disbursal agency (Matsyafed) for the work. Sanction has been accorded for a further period of one year for eligible motorised boats and the

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
		amount is being disbursed to fishermen. *(Source: VISL)*
38	As per the Entitlement Framework, Hardship Allowance is suggested in the EIA/EMP for resort workers who lost their job due to acquisition of the resort	**Complied** Compensation for livelihood loss; Rs 6.08 Crores out of allocated Rs. 6.11 Crores has been disbursed to 211 out of 213 number of resorts workers and settled completely. The remaining two workers were unable to provide the requisite necessary documents and therefore could not be confirmed for disbursement. *(Source: VISL)*
40	Ensure that all EMP related aspects are properly implemented during construction and operational phase	**Being Complied** As the project is in construction stage, construction stage EMP is being implemented. Operation stage EMP will be implemented during operation stage. Refer **Annexure IX** for status of construction stage EMP.
41	A dedicated port road directly connecting to NH-47 bypass is envisaged.	**Being Complied** This is part of the concession agreement and is in the process of being developed. Refer point 26 above.
43	The port project will not affect the inflow of Neyyar river and AVM canal	**Not Applicable** Not affected since both are away from the project site.
44	The port road will be access controlled for the exclusive use of container and related port movements. The suggestion for a new approach road can be considered on technical feasibility and subject to surrendering of adequate land by the beneficiaries	**Not Applicable** The port road will not be access controlled and connectivity for the residents will not be affected.
46	Reconstruction of Roads in the nearby area- Adequate provisions have been made for the old fishing harbour and its linkage roads as it will be adopted as a part of best practice and beautification process	**Being Complied** Being complied on a routine basis through HED; the maintenance agency for the fishing harbour and the coastal road network.

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
47	The development of the warehouse area will be taken up	**Will be Complied** This is part of the proposed port estate development.
49	CSR activity suggested a skill development centre to equip the local people to adapt to the industrial needs of port/tourism and fisheries so that they can be appropriately employed based on their merit. However during construction period the EIA study has suggested to adequately employ local population to the maximum extent possible	**Being Complied** Additional Skill Acquisition Program (ASAP) is a GoK initiative aimed to impart required skills to local youth for improving their employability. ASAP proceeded with the construction of a Community Skill Park (CSP) in an area of 1.5 acres of land at Vizhinjam and the infrastructure is completed. It will operate on a PPP model wherein 25,000 sq. ft. building with facilities for students' hostel are constructed by GoK by ASAP with ADB assistance, whereas the operation of the centre with logistics and other high-end courses are being taken up by Adani Skill Development Centre (ASDC) as per agreement with GoK/ASAP/VISL. The Civil construction work for Community Skill Park (CSP) is completed inside Vizhinjam Port area in association with Additional Skill Acquisition Programme (ASAP) and the internal panelling and other electrical works are progressing. The land handover is by VISL to the ASAP team for construction having 3 storied building as Ground Floor for office space, Seminar Hall Training Rooms, G-1 Floor for IT lab & Other Training room facilities including Library, Meeting room, Faculty room. It is planned to start high end Port related courses according to the anticipated vacancies arising in the port, in other the top organizations as well as abroad. ASAP is planning to handover the building by the end of this year. Preference is being given to local people based on Skill & competency during the construction stage. Out of an average of 1116 persons (employees, staff and construction workers) engaged at site for different construction activities during the compliance period, 444 people are from Kerala and out of them 185 are from nearby wards of the project site.
51	Only prohibited area for fishing is inside the	**Will be Complied**

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2023**
	breakwater. However, fishing will be restricted along ship channel and port limits subject to safety norms and operational requirements.	Restrictions on fishing will be as per the applicable laws.
52	The existing notification of the Vizhinjam Port includes the Vizhinjam Fishing harbour. The revised Notification will include the Vizhinjam Deep Water Port based on revised Port limit provided in the EIA report. Except inside the breakwater of the Deep-Water Port in all other areas of the port limit fishing is allowed with all safety and operational restrictions.	**Will be Complied** GoK notified the limits of the Vizhinjam International Deepwater Multipurpose Seaport and altered the limits of the existing Vizhinjam Port (Vizhinjam Fishing harbour) vide G.O. (P) No. 22/2019/F&D dated 21.05.2019. Vizhinjam fishing harbour is excluded from revised notification. Restrictions on fishing will be as per the applicable laws.
53	There will only be a movement of 8 barges per day during the construction period of 3 years and the same will not be a hindrance for the fisherman to cross since this is far less than the number of ships being crossed by them daily in the international ship channel.	**Noted for Compliance** Barge movement will be planned as per the requirements in such a way that it will not be a hindrance to fishermen.
56	The cruise terminal proposed in the project, will promote tourism in the Kovalam-Poovar belt and the region may become the cruise hub/tourism gate way of India in future	**Noted** Once the first phase of port becomes operational, it would naturally attract cruise tourism. Based on the development of cruise business, dedicated cruise berths will be planned in a phased manner. Action is also being taken in consultation with the State Tourism Department, to design port linked tourism packages focussing on the Kovalam-Vizhinjam-Poovar tourism corridor.

Annexure IX

Status of Environment Management Plan

Annexure IX

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
1	Capital dredging	Marine water quality Marine ecology	o Check turbidity levels with baseline levels as reference during entire monitoring programme o Preparation of Dredge/reclamation Management plan o Discharge of waste into sea will be prohibited o Oil Spill control measures will be adopted o Ensure that slop tanks will be provided to barges/ workboats for collection of liquid/ solid waste o Marine environmental monitoring as per environmental monitoring programme	**Being Compiled** o During the compliance period, 0.065 Mm^3 material has been dredged and a total 3.96 Mm^3 dredged material has been utilized for reclamation of 48.61 Ha area of land. o The turbidity details for the compliance period are given in **Annexure IV**. o Dredging Management plan has been prepared. o Discharge of waste into sea is prohibited and not being carried out. o Procurement of oil spill pollution response equipment is under progress presently. o Marine Environmental Monitoring at 5 locations as per the Environment Monitoring Plan prescribed in EIA has commenced since August 2016, one additional marine water monitoring location has been added from October 2017 after suggestion from NGT committee and the parameters are comparable with baseline. o Six monthly monitoring reports are regularly submitted to regulatory authorities as a part of Half Yearly EC Compliance Reports (HYCRs).
2	Material transport	Air Quality	o Most of the Breakwater stones will be transported from the	**Being Complied** o Presently stones for construction of breakwater are

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
	and construction activities		quarries to the nearest harbour. From there through Barges it will be transported to project site. This is will avoid substantiate flow of Heavy Vehicles during construction Phase thereby minimizing impact on Air and Noise Quality in the project region. o To reduce impacts from exhausts, emission control norms will be enforced / adhered. o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt o Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving	being transported from nearby quarries by trucks through road network to the Vizhinjam site. From the project site, the stones are unloaded onto barges for marine dumping through loud out facilities within the port. o It is ensured that all vehicles entering the Port have a valid PUC certification. o Adequate sized construction yard has been provided for storage of construction materials, equipment tools, earthmoving equipment, etc. o The dumpers have speed governors ensuring adherence to speed limit. o Signage for speed control are displayed inside port area restricting vehicle speed to 20km/hr. o Water sprinkling is carried out for supressing dust. o It is ensured that all trucks transporting material are covered by tarpaulin. o Regular awareness programme on various Environment aspects is being imparted to workers and employees.

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			equipment etc. o Provide enclosures on all sides of construction site o Movement of material will be mostly during non-peak hours. o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic o Water sprinkling will be carried out to suppress fugitive dust o Environmental awareness program will be provided to the personnel involved in developmental works o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation	
		Noise	o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB o Procurement of machinery / construction equipment will be	**Being Complied** o Noise levels are being monitored every fortnight and are found to be well within the permissible limits within the project area. o Contractors are also monitoring the Noise level in their work area and results are within the stipulated limits. o Protective gear like earplugs, muffs are provided to

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			done in accordance with specifications conforming to source noise levels less than 75 dB (A) o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors o Noise attenuation will be practiced for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimise noise impacts o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like	workers exposed to noise level beyond threshold limits. o Acoustic Barriers and Enclosures shall be set up wherever necessary for noisy equipment. o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, is being used. o No pilling activity carried out during the compliance period.

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			earplugs, muffs, etc. o Ambient noise levels will be monitored at regular intervals	
		Disturbance to Natural Drainage pattern	o Port development is mostly on reclaimed land o Rainwater/surface water harvesting pond included in design o Existing drainage near port boundary (backup area) will be integrated with port storm water drainage & management plan o Existing drains / Streams that are passing in ware house area will not be closed/ diverted. And these streams will be de-silted and enhanced to improve their carrying capacities	**Being Complied** o Measures have been taken for maintaining the natural flow of the streams debouching in the construction site, by laying drain pipes beneath the temporary road. o A study has been conducted to access the rainwater harvesting potential and recommend for planning accurate, successful and implementable rainwater harvesting management system within the proposed sites for the sustainable development of existing groundwater resources and thereby suitable rainwater harvesting structures are recommended. In order to capture, store and reuse a percentage of the estimated runoff, rainwater collection and storage sumps are recommended at suitable locations. o A Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner in accordance with the CRZ Notification is being implemented. The order to develop the STP with capacity of 50 KLD has been awarded to M/s. Starcon Infra Projects (I) Pvt. Ltd. o Drains/streams passing through the port area are not closed/diverted.

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
		Vegetation and Strain on existing infrastructure	o Port development is planned mostly on reclaimed land; o Land use at backup area, PAF Zone and warehouse area will be mostly coconut plantation and low mixed plantation o Adequate green belt will be developed in port and its associated (backup area, PAF, warehouse and road & rail connectivity). o Temporary workers camp with self-sufficient infrastructure facilities.	**Being Complied** o Although a natural greenbelt exists, the greenbelt of adequate width with suitable species as identified in the EIA will be developed in all possible areas including back-up areas and along the boundary of the project area in line with the establishment of the project. A greenbelt development plan has been considered in the Master Plan and adequate budgetary provision has been kept for this purpose. Landscape development work has been completed at several locations in the port areas. o Care is taken to limit the felling of trees to the bare minimum. Due permission is taken for trees being cut down as a result of the port development from concerned department (Forest Department). o AVPPL, in collaboration with Forest department, have carried out planting of 40,040 trees in two Phases in adequate land as identified by social Forest Department, for a total area of 29.65 Ha spending Rs. 254.50 Lakhs. This has sufficiently covered the requirement of compensatory afforestation required for the development of Vizhinjam Port. o There are no labourers residing in the labour camps. It is ensured that construction workers who are staying outside in the contractor rented houses/apartments are provided with necessary infrastructure facilities.

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
		Existing Traffic	o NH-47 bypass under construction around 2.0 km from the proposed Port site and the Transportation of construction materials will be carried out during non- peak hours. Hence a dedicated road of 45 M RoW is proposed to connect site with NH Bypass o Regularization of truck movement o Majority of rock for breakwater construction will be transported through sea route via barges from nearby quarry sites o A dedicated rail network of approximately 15 km is proposed from port to Nemom railway station	**Being Complied** o Development of dedicated road connectivity approach road (2.0 km) from the port to the NH-47 Bypass is in progress. Road connectivity approval from National Highways Authority of India (NHAI) is in progress. It was jointly decided that AVPPL will resubmit the revised plan after integrating it with Outer Ring Road (ORR) Intersection plan of NHAI. AVPPL integrated both the plans and the revised plan of junction point after integrating with the interchange proposed by NHAI was submitted to the NHAI. o Traffic monitoring & regularization is being carried out for maximum efficiency. o Transportation of construction materials is being carried out taking into account the non-peak traffic timing and local restrictions during festivals, strikes, etc. o Konkan Railway Corporation Limited (KRCL) has been engaged for turnkey execution of the project. Out of the total rail route length of 10.7 km, 9.0 km is planned to be passing through an underground tunnel to minimize the disturbance to the local population. Detailed Project Report (DPR) has been approved by Southern Railway. Geophysical and geomorphological studies, flood mapping studies and hydrogeological studies have also been completed. EC amendments in this regard had been

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
				submitted to MoEF&CC on 17.08.2022. The Expert Appraisal Committee (EAC) during their 308th and 322nd meetings held on 15.09.2022 and 21.03.2023, 22.03.2023 respectively apprised the proposal. The additional information and clarification sought on account of vibration impact and subsidence due to underground railway construction by the EAC during the meeting has been prepared by Council of Scientific & Industrial Research (CSIR) – Central Institute of Mining and Fuel Research (CIMFR), Dhanbad and ready for submission to MoEF. *(Source: VISL)*
3.	Land Reclamation	Existing Water Resources like Groundwater and surface water	o Land to be reclaimed will be separated from adjoining land by creating containment bund. o Return sea water will be sent back to sea through appropriate channels.	**Being Complied** o During the compliance period, 0.065 Mm^3 material has been dredged and a total 3.96 Mm^3 dredged material has been utilized for reclamation of 48.61 Ha area of land. o During dredging return sea water is sent back to sea through appropriate channels. o The existing drains are maintained for unhindered disposal of surface drainage water.
4.	Solid Waste Management	Soil quality	o Construction waste will be used within port site for filling of low lying areas. o Composted bio-degradable waste will be used as manure in	**Being Complied** o Construction waste is used within port site for filling of low lying areas in line to C&D Waste Management Rules 2016, as amended. o Contractors working at the site have been made

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			greenbelt. o Other recyclable wastes will be sold. o Excavated soil at backup, PAF Zone and ware house area will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. o General refuse generated on-site will be collected in waste skips and separated from construction waste. o Burning of refuse at construction sites will be prohibited. o All control measure will be taken to avoid the contamination of groundwater during construction phase	responsible for management of Solid Waste during construction stage. They are complying with the provisions pertaining to management of Solid Waste in line to Solid Waste Management Rules 2016, as amended. o An Organic Waste Converter (OWC) has been installed at site and is operating for bio-degradable waste; output is being used as manure in greenbelt development. o General refuse waste is being stored separately and sent to approved recyclers and/or sold. o No burning of refuse at construction sites is being done. o There is no disposal of waste in the project area which may lead to groundwater contamination.
5.	Handling of hazardous wastes	Human safety and property loss	o Adequate safety measures as per OSHA standards will be adopted o Construction site will be secured by fencing with controlled/limited entry points. o Hazardous materials such as	**Being Complied** o Adequate safety measures as per OSHA standards are adopted as and when necessary as per the HSE Plan. o Construction site is being secured by fencing wherever possible with controlled/limited entry points. Boundary wall construction is ongoing at available fronts. o Medical facilities including first aid are available for

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms. o Medical facilities including first aid will be available for attending to injured workers. o Handling and storage as per statutory guidelines. o Positive isolation procedures will be adhered o Hazardous wastes will be disposed through approved KSPCB/CPCB vendors.	attending to injured workers. Ambulance is also available at site for shifting the injured to the nearby hospitals. o Handling and storage of Hazardous Materials is being done as per statutory guidelines. o Hazardous waste is disposed through approved KSPCB/CPCB vendors.
6.	Water Resources	Water scarcity / Pollution	o Water requirement during the construction is expected to be around 0.10 MLD o Water will be sourced from Vellayani lake o Avoid/minimise the loss during conveyance o Optimized utilization of the water o Care will be taken to prevent the runoff from the construction site	**Being Complied** o KWA set up a 3.00 MLD water supply scheme for the project with the source of water being Vellayani Lake. The net availability of treated water from this supply scheme is 2.49 MLD of potable water out of which 1.49 MLD of water shall be distributed to the local people as part of social welfare measures of VISL. The balance 1.0 MLD was to be used for port related activities. However, at present, the entire treated water from the scheme is being utilised by the community.

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			to the nearby natural streams, if any	o The water for construction purposes for the port is being sourced from the open market/private suppliers. o Care is being taken to prevent the runoff from the construction site to the nearby natural streams.
7.	Fishing	Fishermen and fishing villages	o Signboards will be placed at the construction activities in order to make fishermen aware of the ongoing construction activities o Necessary marker buoys will be installed o Interactions will be initiated with the fishing community before commencement of construction works	**Being Complied** o Signboards have been placed for demarcation of construction area. o Navigational buoys/marker buoys are placed in the marine area for fishing boats to maintain a safe distance from the areas of breakwater construction. o The number of buoys for monitoring in the project area has been optimized, considering the safety of fishermen and ease of movement during construction. o Using the technological advancement the dedicated CSR team of AVPPL are in constant touch with the fishermen/fishing community members to facilitate the flow of various project related information/updates. o AVPPL CSR team also provides regular updates to the committee which has been formed by the local church representatives adjoining to the port area, who in turn pass on port project execution information to the fishermen.
8.	Tourism	Effect on tourism	o Tourism activity is observed at Kovalam located about 2.0 km	**Being Complied** o The tourism activity in the nearby Kovalam area is not

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			towards the North of Proposed Port. Mathematical Modelling studies on shoreline changes show the insignificant impact due to the port development on the existing coastline. However, the Shoreline monitoring during construction as well as operation Phases were proposed. o A cruise terminal and related facilities is part and parcel of the project. This is to largely compensate the losses made o For all acquired properties and land adequate compensation will be provided based on legally valid documents	impacted by the construction of the port. o Shoreline monitoring for a stretch of 40 km (20 km on both sides of the project site) is being done and reports are regularly submitted to regulatory authorities. o Once the first phase of port becomes operational, it would naturally attract cruise tourism. Based on the development of cruise business, dedicated cruise berths will be planned in a phased manner. Action is also being taken in consultation with the State tourism department, to design port linked tourism packages focussing on the Kovalam-Vizhinjam-Poovar tourism corridor o Resort owners evicted have been compensated for land and not for the structures since they were in violation of CRZ notification. Remaining land of 2.865 Ha is to be acquired by Land Acquisition (LA) process; for which notification has been published and the acquisition is in an advanced stage. (Source: VISL)
9	Breakwater	Change in shoreline	o Shoreline monitoring shall be carried out o Suitable Shoreline protection measures will be implemented based on the observations	**Being Complied** o Comprehensive Shoreline Monitoring is being carried out under the technical Guidance of NIOT and Six monthly monitoring reports are being submitted regularly as part of EC & CRZ Compliance. The existing Shoreline Monitoring consists of: o Wave Observations

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
				o Onshore Cross beach profiling o Offshore Cross beach profiling o Littoral Environmental Observations (LEO) o Beach Sampling o Multi-beam Echo Sounder (MBES) survey o River cross section surveys o Grab Sampling o Current Observations o Tide Observations o Weather Observations o Water Sampling o L&T Infrastructure Engineering Ltd. (L&T IEL) had prepared Mathematical Modelling Reports based on Shoreline Monitoring data; which were vetted by National Institute of Ocean Technology (NIOT). o Suitable Shoreline protection measures will be implemented based on the observations, if any.
10	Effect on existing fishing harbour	Movement of fishing boats	o Detailed modelling studies have been carried out on tranquillity conditions in the fishing harbour with port development. The studies reveal that the tranquillity conditions will be improved in fishing harbour with	**Being Complied** o Wave, current and tide data are being monitored along with the shoreline monitoring of 40 km stretch. Based on the above, the modelling studies done at the EIA stage has been further evaluated. o During operation phase traffic of Marine vessel/fishing boats will be planned without affecting each other as per

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			construction of the port. Further minor accretion happening within the fishing harbour will be arrested o Traffic of Marine vessel/ fishing boats will be planned without affecting each other o Adoption of fishing harbour to manage it to perform as per International standard o A new fishing harbour provided under CSR initiatives because of additional tranquillity creator. o Loss of livelihood will be either taken care of in the new port premises or adequately compensated mostly in the form of employment	the applicable laws. o Based on the recommendation of the study carried out by Central Water and Power Research Station (CWPRS), the Harbour Engineering Department (HED) has prepared the preliminary design and estimate for the extension of seaward breakwater of the existing fishing harbour. However, detailed design, including physical model study, is required before its construction. Discussions between Fisheries Department and Ports Department, Government of Kerala (GoK) and consultation with the fishermen community are ongoing. GoK would be soon finalising the plan of action to develop and make available the additional fish landing facilities for the benefit of the local fishermen. *(Source: VISL)* o In consultation with the fishermen, enhanced livelihood compensation of Rs. 106.79 Crores was sanctioned by GoK and distributed by VISL to fishermen as livelihood compensation, instead of Rs. 8.55 crores, as suggested earlier in the EIA. Till 30.09.2023 an amount of Rs. 106.59 Crores have been disbursed for a total number of 2641 Livelihood Affected Persons (LAPs) whose verification was complete in all respects; this includes boat owners to whom kerosene is supplied free of cost

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
				during the breakwater construction period. Remaining disbursals would be done as soon as possible. *(Source: VISL)*
11	Shoreline changes	Erosion/accretion	Final shoreline Impact management plan will be prepared in consultation with agencies like CESS/INCOIS, NGO and local bodies and will implemented.	**Being Complied** o NIOT has been engaged to give technical advice on aspects related to shoreline monitoring & shoreline evolution. o Comprehensive Shoreline Monitoring is being carried out under the technical Guidance of NIOT and six monthly monitoring reports are being submitted regularly as part of EC & CRZ Compliance. o Wave, current and tide data are being monitored a 40 km stretch. o L&T IEL had prepared Mathematical Modelling Reports based on Shoreline Monitoring data; which were vetted by NIOT.

Environmental Management Plan – Rail*/Road Corridors *No Construction work was carried out during the compliance period in the rail corridor			
S. No.	**Environmental Impacts and Issues**	**Mitigation Measures**	**Status as on 30.09.2023**
1	Environmental Management and Monitoring Facility Equipment for EMP (Meters, Vehicles and Buildings)	o This will include institutional requirements, training, environmental management and monitoring. Provision for purchasing required equipment.	**Noted for Compliance** o An Environment Management Cell has been established to look after day-to-day affairs like Monitoring, Training, etc. o Appropriate institutional mechanism for maintenance of health, hygiene, safety, security has been put in place. An officer of VISL has been designated as Head (EHS & CSR) for effective implementation of the stipulated EHS safeguards & CSR activities. AVPPL, the concessionaire executing the project has also appointed officers for EHS & CSR, Horticulture. In addition to the above, independent environment, health and safety consultants have been appointed as required in the concession agreement signed with AVPPL. Organizational Structure for Environment, Health, and Safety (EHS) & CSR for construction phase is enclosed as **Annexure XII**. o It is also ensured that contractors working at site also deploy EHS professional to implement suggested EMP measures. Proper provisions for maintenance of health, hygiene, safety, security for workforce in labour colony has also been provided/ ensured. o Necessary equipment will be purchased; adequate provisions have been made in the budget for the same. o Third party environmental monitoring through NABL accredited laboratory has commenced since August 2016 and the monitoring results are satisfactory.

Environmental Management Plan – Rail*/Road Corridors *No Construction work was carried out during the compliance period in the rail corridor			
S. No.	**Environmental Impacts and Issues**	**Mitigation Measures**	**Status as on 30.09.2023**
2	Altered Road embankment	o Retaining walls and gabions should be provided	**Noted for Compliance** o AVPPL had awarded the work to Kerala State Remote Sensing and Environment Centre (KSREC) to undertake study on Groundwater impact due to construction of port approach road. o KSREC have studied the impact due to construction of port approach road. o Recommendations of KSREC are being implemented and suitable mitigation measures as suggested in the KSREC report are being adopted during construction.
3	Dust	o Water should be sprayed during the construction phase, at mixing sites, and temporary roads. o In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to prevent dust. o Vehicles delivering materials should be covered to reduce spills and dust blowing off the load.	**Being Compiled** o Regular Water Sprinkling is done on the approach road by water tankers. o Water spraying is carried out at regular intervals after compaction o Tarpaulin cover is used in vehicles delivering materials.
4	Air Pollution	o Vehicles and machinery are to be maintained so that emissions conform to National and State standards. o All vehicles and machineries should obtain Pollution Under Control Certificates (PUC).	**Being Complied** o Ambient air quality monitoring is carried out at 5 locations as per the Environment Monitoring Plan prescribed in EIA and has commenced since August 2016, the results obtained are within the limits prescribed by National Ambient Air Quality

Environmental Management Plan – Rail*/Road Corridors *No Construction work was carried out during the compliance period in the rail corridor			
S. No.	**Environmental Impacts and Issues**	**Mitigation Measures**	**Status as on 30.09.2023**
			Standards (NAAQS) o It is ensured that all vehicles entering port have Pollution Under Control (PUC) Certificate.
5	Noise	o Machinery and vehicles will be maintained to keep their noise to a minimum. o Construction of noise barriers of an average length of 100m and eight feet height wherever necessary. o Proper maintenance of the rail track and rail wagon, by frequent lubrication to avoid frictional noise. o Regular monitoring shall be carried out as per the Environmental Monitoring Plan.	**Being Compiled** o All the machinery and vehicles are maintained to keep the noise at minimum o Noise monitoring is being done since August 2016, and the readings are within the limits at port site o Regular monitoring of ambient Noise is carried out since August 2016 as per the Environmental Monitoring Plan prescribed in EIA and results are within the prescribed limit at port site.
6	Loss of low lying land and ponds	o Impacted ponds can be enhanced by constructing bridged structures like Gabions to avoid plugging of springs. o Mitigation/Compensation shall be affected for the completely impacted ponds. o At Chainage km 6.500 the Railway alignment goes below the Existing NH and then at km 6.600 it will hit pond. The pond will be excavated partially and the soil material shall be used to fill in the western part and an equivalent area lost may be	**Will be complied** o AVPPL had awarded the work to KSREC to undertake study on Groundwater impact due to construction of port approach road and also suggest mitigation measures. o For impacted ponds in road alignment an elevated road is planned as suggested by KSREC. Other suitable mitigation measures as suggested in the KSREC report will be adopted during construction. o Konkan Railway Corporation Limited (KRCL) has been engaged for turnkey execution of the project. Out of the total rail route length of 10.7 km, 9.0 km is planned to be passing

Environmental Management Plan – Rail*/Road Corridors *No Construction work was carried out during the compliance period in the rail corridor			
S. No.	**Environmental Impacts and Issues**	**Mitigation Measures**	**Status as on 30.09.2023**
		excavated to compensate the loss of effective pond area.	through an underground tunnel to minimize the disturbance to the local population. Detailed Project Report (DPR) has been approved by Southern Railway. Geophysical and geomorphological studies, flood mapping studies and hydrogeological studies have also been completed. EC amendments in this regard had been submitted to MoEF&CC on 17.08.2022. The Expert Appraisal Committee (EAC) during their 308th and 322nd meetings held on 15.09.2022 and 21.03.2023, 22.03.2023 respectively apprised the proposal. The additional information and clarification sought on account of vibration impact and subsidence due to underground railway construction by the EAC during the meeting has been prepared by Council of Scientific & Industrial Research (CSIR) – Central Institute of Mining and Fuel Research (CIMFR), Dhanbad and ready for submission to MoEF. *(Source: VISL)*
7	Flood Impacts and Cross Drainage Structures	o Formation level should be raised according to the design and the cross drainage structures suitably planned for the flood events.	**Being Complied** o During the construction, care was taken such that the formation level is as per suitable design and the cross drainage structures are also being implemented.
8	Alteration of drainage	o In sections along watercourses, earth and stone will be properly disposed of so as not to block rivers and streams, thereby preventing any adverse impact on water quality. o All necessary measures shall be taken to	**Will be Complied** o AVPPL had awarded the work to KSREC to undertake study on Groundwater impact due to construction of port approach road and also suggest mitigation measures. o For impact on water quality, suitable mitigation measure as suggested in the KSREC report will be adopted.

Environmental Management Plan – Rail*/Road Corridors *No Construction work was carried out during the compliance period in the rail corridor			
S. No.	**Environmental Impacts and Issues**	**Mitigation Measures**	**Status as on 30.09.2023**
		prevent earthworks and stone works from impeding cross drainage at streams and canals or existing irrigation and drainage systems in conformity to the Contractors visual integration and management plan and EMP.	
9	Contamination from Wastes	o All justifiable measures will be taken to prevent the wastewater produced during construction from entering directly into rivers and irrigation systems.	**Being Complied** o Measures are being taken up to prevent the wastewater produced during construction from entering directly into rivers and irrigation systems. o A Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner in accordance with the CRZ Notification is being implemented. The order to develop the STP with capacity of 50 KLD has been awarded to M/s. Starcon Infra Projects (I) Pvt. Ltd. o No waste water is disposed into the water bodies.
10	Borrow pits	o Borrow pits are to be identified, opened and closed after consultations and proper documentation.	**Will be Complied as and when required**
11	Quarrying and Material sources	o Quarrying will be carried out at approved and licensed quarries only.	**Will be Complied** The road constructed so far has been made with material available on site.
12	Soil Erosion and Soil Conservation	o On slopes and other suitable places along the two proposed corridors, trees and grass should be planted.	**Will be Complied** o AVPPL had awarded the work to KSREC to undertake study on Groundwater impact due to construction of port approach road. KSREC has submitted the final report with

Environmental Management Plan – Rail*/Road Corridors *No Construction work was carried out during the compliance period in the rail corridor			
S. No.	**Environmental Impacts and Issues**	**Mitigation Measures**	**Status as on 30.09.2023**
		o On sections with filling and deep cutting their slopes should be covered by sod, or planted with grass, etc. o If existing irrigation and drainage system, ponds are damaged, they will be suitably repaired. o Retaining walls and gabions shall be suitably provided.	recommendations and AVPPL is in the process of constructing the approach road to port. o Suitable mitigation measures as suggested in the KSREC report will be adopted during construction.
13	Loss of agricultural topsoil	o Arable land should not be used for topsoil borrowing. o Topsoil will be kept and reused after excavation is over. o Any surplus to be used on productive agricultural land.	**Being Complied** o Arable land is not being used for topsoil borrowing o The topsoil excavated is being stored and will be reused during development of greenbelt.
14	Compaction of Soil and Damage to Vegetation	o Construction vehicles should operate within the Corridor of Impact avoiding damage to soil and vegetation.	**Being Complied** o Construction vehicles are being operated only alongside the road boundary; thereby avoiding damage to soil and vegetation.
15	Loss of trees and Avenue Planting	o Areas of trees cleared will be replaced according to Compensatory Afforestation Policy under the Forest Conservation Act - 1980. o Landscaping shall be done at major junctions.	**Being Compiled** o Although a natural greenbelt exists, the greenbelt of adequate width with suitable species as identified in the EIA will be developed in all possible areas including back-up areas and along the boundary of the project area in line with the establishment of the project. A greenbelt development plan has been considered in the Master Plan and adequate

Environmental Management Plan – Rail*/Road Corridors *No Construction work was carried out during the compliance period in the rail corridor			
S. No.	**Environmental Impacts and Issues**	**Mitigation Measures**	**Status as on 30.09.2023**
			budgetary provision has been kept for this purpose. Landscape development work has been completed at several locations in the port areas including turning circle. o Care is taken to limit the felling of trees to the bare minimum. Due permission is taken for trees being cut down because of the port development from concerned department (Forest Department). o AVPPL, in collaboration with Forest department, have carried out planting of 40,040 trees in two Phases in adequate land as identified by social Forest Department, for a total area of 29.65 Ha spending Rs. 254.50 Lakhs. This has sufficiently covered the requirement of compensatory afforestation required for the development of Vizhinjam Port. o Plantation of saplings along the road margins, road junctions and road medians are being carried out as part of the greenbelt development plan.
16	Vegetation clearance	o Tree clearing within the ROW should be avoided beyond that which is directly required for construction activities and/ or to reduce accidents. o Especially in plantation and house garden areas both along road and rail alignment.	**Being Complied** o Care is taken to limit the felling of trees to the bare minimum. o Permission for trees being cut down because of the port development has been obtained from concerned department (Forest Department).
17	Fauna	o Construction workers should protect natural resources and animals. Hunting of birds and other local animals is prohibited.	**Being Complied** o Regular awareness sessions are conducted for the construction workers regarding importance of natural resources and animals.

Environmental Management Plan – Rail*/Road Corridors *No Construction work was carried out during the compliance period in the rail corridor			
S. No.	**Environmental Impacts and Issues**	**Mitigation Measures**	**Status as on 30.09.2023**
			o Hunting of birds & other local animals is strictly prohibited
18	Traffic Jams and congestion	o If there is traffic congestion during construction, measures should be taken to relieve it as far as possible with the co-operation of the traffic police.	**Being Complied** o In order to avoid traffic congestion, if any, during the construction of the road, measures will be taken to relieve it as far as possible with the co-operation of the traffic police.
19	Health and Safety	o All contractors' staff and workers must wear high visibility purpose made overalls or trousers/waist coat at all times. All operators working with any materials above head height (even in trenches) must wear hard hats all at times on the worksite.	**Being Compiled** o All the workers are provided with Personal Protective Equipment's (PPE) and it is ensured that they wear it all the time o Also all the contractors working at site have a dedicated health and safety person to oversee the work carried out.
20	Pollution of Streams parallel or along the alignments	o Construction material/waste should be disposed of properly so as not to block or pollute streams or ponds with special attention to confining concrete work.	**Being Complied** o Construction materials/waste are being disposed properly; so as not to block or pollute streams or ponds.
21	Cultural Remains	o Construction should be stopped until authorised department assess the remains to preserve Archaeological relics and cultural structures like Temples, mosques and churches. o Archaeologists will supervise the excavation to avoid any damage in the relics.	**Will be Complied** o A cultural heritage management plan including a procedure to be followed in case of chance find is being prepared. Same will be implemented for preservation of Archaeological sites and any cultural/archaeological structure found.

Environment Management Plan – Warehouse Area* (Construction Phase) *Minimal work was carried out in Warehouse area during compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
1	Material transport and construction activities	Air Quality/Dust	o To reduce impacts from exhausts, emission control norms will be enforced / adhered. o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards. o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt. o Providing adequately sized construction yard for storage of construction materials, equipment, tools, earthmoving equipment, etc. o Provide enclosures on all sides of construction site o Movement of material will be mostly during non-peak hours. o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic o Water should be sprayed during the construction phase, at mixing sites, and temporary roads. o In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried	**Complied** o Monthly Environment Monitoring is being carried out and all the parameters are within the stipulated limit o It is ensured that all vehicles entering the area have a valid PUC certification o It is ensured that all the vehicles entering the site are following speed limit o Tarpaulin cover is used in vehicles o Water sprinkling is carried out to arrest dust generation. o Environment awareness programs are being carried out for staff/contractors on a regular basis.

Environment Management Plan – Warehouse Area* (Construction Phase) *Minimal work was carried out in Warehouse area during compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			out at regular intervals to prevent dust. o Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. o Environmental awareness program will be provided to the personnel involved in developmental works. o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation.	
		Noise	o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB. o Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A). o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors. o Noise attenuation will be practiced for noisy equipment by employing suitable techniques	**Complied** o Ambient Noise is being monitored fortnightly for Day & Night time and results are within the prescribed limit. o Construction equipment machinery procurement is done in accordance with specifications conforming prescribed standard. o Personnel engaged in construction activity are provided with appropriate PPE's (Earplugs/muffs)

Environment Management Plan – Warehouse Area* (Construction Phase) *Minimal work was carried out in Warehouse area during compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			such as acoustic controls, insulation and vibration dampers. o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimize noise impacts. o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. o Ambient noise levels will be monitored at regular intervals	
2	Construction of Buildings, Roads, Sheds, etc.	Vegetation and Strain on existing infrastructure	o Most of the land is covered with coconut trees and few other trees. Trees that are cut down will be accounted for and the same no. of trees of the same or some other species will be replanted at another location to compensate for the loss of greenery.	**Being Complied** o Care is taken to limit the felling of trees to the bare minimum. Due permission is taken for trees to be cut down because of the port development from the concerned department (Forest Department). o AVPPL, in collaboration with the Forest department, have carried out planting of 40,040 trees in two Phases in adequate land as identified by social Forest Department, for a total area of 29.65 Ha spending Rs. 254.50 Lakhs. This has sufficiently covered the requirement of compensatory afforestation required for

Environment Management Plan – Warehouse Area* (Construction Phase) *Minimal work was carried out in Warehouse area during compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
				the development of Vizhinjam Port.
		Water Environment	o The streams 1 and 2 will be made to avoid entering the warehouse area by diverging them into the Karichal River. o A tunnel like arrangement with RCC structures will be used so as to not affect the streams (3 and 4) that will go through the warehouse area. The streams will be made to go under the warehouse areas through the tunnel. o Another option is to divert the stream through the boundary o An application has been filed with the irrigation department for permission.	**Will be Complied** o Will be appropriately planned in consultation with the concerned departments.
			o The low lying area in the region is already made use by the local people, and has been degraded. There are no active ecological systems in the area. As far as possible, during operation phase the network of streams that add to the low lying area of the region will be diverted or channeled under the constructed buildings to avoid impact to the low lying area. o Filling of low lying areas (if required) shall be done	**Will be Complied** o Will be appropriately planned in consultation with the concerned departments. o In G.O. dated GO(MS)No.27/2022/AGRI dated 18.04.2022, the government verified the area in detail and have given permission and order for the conversion of the 24.7980 Ha of paddy land for use of port activities.
			o Construction waste such as cement, paint, and	**Will be Complied**

Environment Management Plan – Warehouse Area* (Construction Phase) *Minimal work was carried out in Warehouse area during compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			other construction waste will flow into the downstream parts of the streams and Karichal River. Construction will be avoided during rainy season. Good housekeeping practices, such as cement being stored in dry areas will be taken care of. Labour camps will be provided with proper support services.	
		Disturbance to Natural Drainage pattern	o As mentioned above, formidable measures will be taken to avoid the disturbance to the natural flow of water. If some structure or building comes in the way of the existing flow of water, the flow will be redirected to the closest stream in the drainage pattern. o In sections along watercourses, earth and stone will be properly disposed of so as not to block rivers and streams, thereby preventing any adverse impact on water quality. o All necessary measures shall be taken to prevent earthworks and stone works from impeding cross drainage at streams and canals or existing irrigation and drainage systems in conformity EMP.	**Will be Complied**
		Existing Traffic	o Transportation of construction materials will be carried out during non- peak hours.	**Will be Complied**

Environment Management Plan – Warehouse Area* (Construction Phase) *Minimal work was carried out in Warehouse area during compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			o Regularization of truck movement. o Existing roads shall be strengthened and shall be used for the construction material transportation.	
3	Solid Waste Management	Soil quality	o Construction waste will be used within warehouse site for filling of low lying areas. o Composted bio-degradable waste will be used as manure in greenbelt. Other recyclable wastes will be sold. o Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. o General refuse generated on-site will be collected in waste skips and separated from construction waste. o Burning of refuse at construction sites will be prohibited.	**Will be Complied**

Project Annex Facility (PAF) Zone - Construction Phase *Construction work was carried out in a limited way during the compliance period in PAF Zone				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
1	Material transport and construction activities	Air Quality/Dust	o To reduce impacts from exhausts, emission control norms will be enforced / adhered. o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards. o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt. o Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc. o Provide enclosures on all sides of construction site o Movement of material will be mostly during non-peak hours. o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic o Water should be sprayed during the construction phase, at mixing sites, and temporary roads o In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to prevent dust.	**Complied** o Monthly Ambient Air Monitoring is being carried out and all the parameters are within the stipulated limits. o It is ensured that all vehicles entering the area have a valid PUC certification o Vehicles entering the site are following speed limit. o Tarpaulin cover is used for vehicles transporting the construction material o Water sprinkling is carried out on the temporary roads by contractors o Environment awareness program is provided to the personnel engaged in development work

Project Annex Facility (PAF) Zone - Construction Phase *Construction work was carried out in a limited way during the compliance period in PAF Zone				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			o Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. o Environmental awareness program will be provided to the personnel involved in developmental works. o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation.	
		Noise	o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB. o Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A). o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors. o Noise attenuation will be practiced for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. o High noise generating activities such as piling	**Complied** o Ambient Noise is being monitored fortnightly for Day & Night time and results are within the prescribed limits. o Construction equipment machinery procurement is done in accordance with specifications conforming prescribed standard. o Personnel engaged in construction activity are provided with appropriate PPE's (Earplugs/muffs)

Project Annex Facility (PAF) Zone - Construction Phase *Construction work was carried out in a limited way during the compliance period in PAF Zone				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimise noise impacts. o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. o Ambient noise levels will be monitored at regular intervals	
2	Construction of Buildings, Roads, Parking features, etc.	Vegetation and Strain on existing infrastructure	o Most of the land is covered with coconut trees and few other trees. Trees that are cut down will be accounted for and the same no. of trees of the same or some other species will be replanted at another location to compensate for the loss of greenery. o There are very few existing buildings and infrastructure on the PAF zone area land which will be acquired and people in that area will be rehabilitated.	**Being Complied** o Due permission is taken for trees to be cut down because of the port development from concerned department (Forest Department). o AVPPL, in collaboration with the Forest department, have carried out planting of 40,040 trees in two Phases in adequate land as identified by social Forest Department, for a total area of 29.65 Ha spending Rs. 254.50 Lakhs. This has sufficiently covered the requirement of compensatory afforestation required for the development of Vizhinjam Port. o Land acquisition has been completed by following due process.
		Existing Traffic	o Transportation of construction materials will be	**Being Complied**

Project Annex Facility (PAF) Zone - Construction Phase *Construction work was carried out in a limited way during the compliance period in PAF Zone				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			carried out during non-peak hours. o Regularization of truck movement. o The existing roads shall be strengthened and shall be used for the construction material transportation.	o Transportation of construction materials is being carried out taking into account the non-peak traffic timing and local restrictions during festivals, strikes, etc. o Traffic monitoring & regularization is being carried out for maximum efficiency. o Existing roads are being used for transportation of construction material.
		Solid Waste	o Construction waste will be used within port site for filling of low lying areas. o Composted bio-degradable waste will be used as manure in greenbelt. Other recyclable wastes will be sold. o Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. o General refuse generated on-site will be collected in waste skips and separated from construction waste. o Burning of refuse at construction sites will be prohibited.	**Being Complied** o Construction waste is used within port site for filling of low lying areas in line to C&D Waste Management Rules 2016, as amended. o No burning of refuse at construction sites is being done. o Contractors working at the site have been made responsible for management of Solid Waste during construction stage. They are complying with the provisions pertaining to management of Solid Waste in line to Solid Waste Management Rules 2016, as amended.

BACK UP AREA – Construction Phase Construction of buildings is ongoing in reclaimed area during the compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
1	Material transport and construction activities	Air Quality	o To reduce impacts from exhausts, emission control norms will be enforced / adhered. o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt o Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc. o Provide enclosures on all sides of construction site o Movement of material will be mostly during non-peak hours. o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic o Water sprinkling will be carried out to suppress fugitive dust o Environmental awareness program will be provided to the personnel involved in developmental works o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation	**Being Complied** o Ambient air quality monitoring is carried out at 5 locations (including one location at port site) as per the Environment Monitoring Plan prescribed in EIA and has commenced since August 2016, the results obtained are within the limits prescribed by NAAQS o It is ensured that all vehicles entering the port have PUCs o Water sprinkling is being carried out at regular intervals over the temporary road during transportation of materials. o All the trucks transporting material are covered by tarpaulin cover. o Signage's for speed control are placed within the port area o Adequate storage for construction material is provided within the port area on reclaimed land o Environmental awareness program is being regularly carried out for contractors working at site.

BACK UP AREA – Construction Phase Construction of buildings is ongoing in reclaimed area during the compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
		Noise	o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB o Procurement of machinery/construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A) o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors o Noise attenuation will be practiced for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimise noise impacts o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. o Ambient noise levels will be monitored at regular intervals	**Being Compiled** o All the machinery and vehicles are maintained to keep the noise at minimum o Regular Ambient Noise monitoring is being carried as per the Environmental Monitoring Plan prescribed in EIA since August 2016, and the readings are within the limits at port site. o Personnel exposed to noise levels beyond threshold limits are provided with protective gear. o No pilling activity was carried out during the compliance period. o During the compliance period, 0.065 Mm^3 material has been dredged and a total 3.96 Mm^3 dredged material has been utilized for reclamation of 48.61 Ha area of land.

BACK UP AREA – Construction Phase Construction of buildings is ongoing in reclaimed area during the compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
2	Construction Activities	Water Environment	o Formation level should be raised according to the design and the cross drainage structures suitably planned for the flood events. o All justifiable measures will be taken to prevent the wastewater produced during construction from entering directly into the water bodies.	**Being Compiled** o During the construction, care was taken such that the formation level is as per suitable design and the cross drainage structures are also being implemented. o An STP will be developed along with the port and the sewerage and storm water flow from two streams near the port will be treated in the proposed STP. o No waste water is disposed into the water bodies.
		Land Environment	o On slopes and other suitable places along the two proposed corridors, trees and grass should be planted. o On sections with filling and deep cutting their slopes should be covered by sod, or planted with grass, etc. o If existing irrigation and drainage system, ponds are damaged, they will be suitably repaired. o Retaining walls and gabions shall be suitably provided.	**Being Complied** o Plantation of saplings along the port boundary are planned as part of the master plan development/greenbelt development plan. o Retaining walls or gabions are suitably provided.
			o Arable land should not be used for topsoil borrowing. o Topsoil will be kept and reused after excavation is over.	**Will be Complied** o Topsoil is not being used for borrowing. o If any topsoil needs to be excavated, the same will be stored in a designated area

BACK UP AREA – Construction Phase Construction of buildings is ongoing in reclaimed area during the compliance period				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2023**
			o Any surplus to be used on productive agricultural land.	and will be utilized for greenbelt development as per the greenbelt development plan.
			o Construction vehicles should operate within the Backup Areas avoiding damage to soil and vegetation.	**Being Complied** o Construction vehicles are being operated only alongside the road and port boundaries; thereby avoiding damage to soil and vegetation.
			o Areas of trees cleared will be replaced according to Compensatory Afforestation Policy under the Forest Conservation Act - 1980. o Landscaping shall be done at major junctions.	Refer point No.15 of Environment Management Plan – Road/Rail Corridors
			o Tree clearing within the backup areas should be avoided beyond that which is directly required for construction activities and/or to reduce accidents.	**Will be Complied** o Tree clearing is done only for the purpose of development of port and/or for avoiding causalities due to natural calamities where the trees were standing very dangerously.

Annexure X

Navigational Buoys Layout

NAVIGATIONAL BUOYS CO-ORDINATES

MARK	EASTING	NORTHING	LONGITUDE	LATITUDE
S1	722539.307	922402.554	E77° 01' 14.63"	N8° 20' 22.29"
B1	721854.229	923133.710	E77° 00' 52.37"	N8° 20' 46.20"
B2	721562.327	922860.234	E77° 00' 42.79"	N8° 20' 37.35"
B3	721194.234	923838.116	E77° 00' 30.92"	N8° 21' 09.23"
B4	720902.327	923564.635	E77° 00' 21.34"	N8° 21' 00.38"
B5	720616.597	924454.611	E77° 00' 12.15"	N8° 21' 29.39"
B6	720324.921	924180.886	E77° 00' 02.57"	N8° 21' 20.53"
B7	720034.219	925003.040	E76° 59' 53.21"	N8° 21' 47.33"
B8	719845.999	924664.709	E76° 59' 47.00"	N8° 21' 36.36"
B10	719366.948	924969.680	E76° 59' 31.40"	N8° 21' 46.36"
B12	719160.008	925313.725	E76° 59' 24.69"	N8° 21' 57.59"
FB1	722539.307	918698.554	E77° 01' 14.01"	N8° 18' 21.75"

PORT ENTRY LIGHT
RADAR TOWER
PHASE 1 BREAKWATER
BEACON
PHASE 2 BREAKWATER
PHASE 3 BREAKWATER
PORT SIDE BUOY
STAR BOARD SIDE BUOY
SOUTH CARDINAL BUOY
FAIRWAY BUOY
FB1
B12
B10
B8
B7
B6
B5
B4
B3
B2
B1
S1
MULTI PURPOSE BERTH
CONTAINER BERTH
CONTAINER YARD PHASE 1
PHASE 2
PHASE 3
PHASE 4
700 DIA
TURNING CIRCLE -18.4 m CD
APPROACH CHANNEL -18.4 m CD
APPROACH CHANNEL -20.8 m CD
600
800
400
400
300
400
400
400

LEGEND

- PORT SIDE BUOY
- STAR BOARD SIDE BUOY
- SOUTH CARDINAL BUOY
- FAIRWAY BUOY
- BEACON (BN)
- PORT ENTRY LIGHT (PEL)
- RADAR TOWER

By: PRAVEEN BOLLE Date: 25-08-2023
Project: VIZHINJAM Discipline: CIVIL

ISSUED FOR INFORMATION

Rev	Description	By	Signed	Date
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
2	UPDATE BUOY'S AS PER REPORT AND ADDED RADAR TOWER	YP	PB	25-08-2023
1	UPDATED FISHERY HARBOUR NAVIGATIONAL LIGHT & PORT FAIRWAY BUOY	YP	PB	22-10-2018
0	ISSUED FOR INFORMATION	YP	PB	21-09-2018

Last Modified :- Aug 25, 2023 - 5:50pm

SCALES SHOWN ARE FOR AN A1 SIZE ORIGINAL DRAWING

Sub Contractor

EPC Contractor: HOWE Benchmarking Infrastructure

Concessionaire: adani
ADANI VIZHINJAM PORT PRIVATE LIMITED

Independent Engineer

Consultant

Concessioning Authority
PRINCIPAL SECRETARY TO GOVT.
DEPARTMENT OF PORTS
GOVERNMENT OF KERALA

Drawn: YP | Check: PB
Designed: PB | Verified: JB
Approved: - | -
Date: 21-09-2018

Drawing Title
DEVELOPMENT OF CONTAINER TERMINAL AT VIZHINJAM PORT
MARINE FACILITIES
GENERAL
PORT NAVIGATIONAL AIDS LAYOUT

HEPIPL Drawing No	Consultant/Contractor Drawing No	Rev
H251-E-MFC-GEN-DC-L-I-001	-	2

Annexure XI

EMP Expenditure

Annexure XI

S. No.	Environmental Management Plan	Commitment in EIA	April 2023 to Sep 2023	Total Till date
		(in Rs. Crores)		
1	Cost of Contractors EMP for all planned EMP implementation measures (Action plan report)	1	-	1.07
2	Cost of Capacity building- Training and Institutional strengthening (Training workshop)	0.2	-	0.05
3	Compensatory afforestation for the green cover lost for the port and its associated facilities (2500 plants per Ha for 25 Ha area)	1.25	-	2.54
4	Air quality monitoring at sensitive locations	0.252	0.067	3.732
5	Water quality monitoring at major water bodies	0.054		
6	Noise monitoring at sensitive locations	0.009		
7	Soil quality monitoring at sensitive locations	0.002		
8	Marine water quality and sediment and marine biology	1.08		
9	Shoreline changes	0.3	0.68	17.148
10	Cost of Median planting with a suitable species of creepers and metallic wire mesh fencing along the road (2000 m long median planting)	0.83	-	0.972
11	Solid waste management (sector wise)- Collection disposal system	2.5	0.18	0.415
12	Storm water Management	5	-	0.3
13	Marine Life Protection out of Oil Spill (Provision for scavenger boat) One tugboat with booms and skimmer and dust exhausting equipment	20	-	0
14	Cost of scavenger boat including manpower (Cost of boat)	0.2	0.01	0.01
15	Dust Sweeper (2 Nos.)	0.6	-	0
16	Air Pollution Control (Four water tankers for wetting of road surface and springing system)	1	0.12	0.93
17	Water and waste water treatment plants	4	-	0.025
18	Battery of toilets with bimonthly maintenance provision	1	-	0.53
19	Desilting and strengthen of Streams	0.5	-	0.6
20	Enhancement of water bodies (ponds along road & rail)	0.1	-	0.25
21	Enhancement of religious structures (Temple)	0.05	-	0.067
22	Cultural property rehabilitation cost for sacred grove	0.01	-	0
TOTAL		**39.937**	**1.057**	**28.639**

Annexure XII

Environment Health, Safety & CSR Organizational Structure

Annexure XII

Environment Health, Safety & CSR Organizational Structure:

S. No.	Name	Designation	Experience	Qualification	Organization
1.	Prasad Kurien	GM-Environment	30 years	B-Tech Civil Engg., M-Tech Env Engg., PMP	VISL
2.	Dr. Nehru Kumar Vaithilingam	Environmental Expert (Independent Engineer)	27 years	BE Civil Engg., ME Env Engg., PhD Env	Indian Institute of Technology Madras
3.	Anil Balakrishnan	National Head SLD and Southern Regional head for CSR	26 Years	MSW, Phd.	Adani Foundation
4.	Hebin C	Head – Environment	17 Years	MS, Oceanography & Coastal Area Studies	AVPPL
5.	Jesse Benjamin Fullonton	Assistant Manager - Environment	13 Years	BSc. Chemical Tech; Msc. Env. Tech	AVPPL
6.	Arumugam S	Assistant Manager - Safety, Environment and Health	4 Years	M.Tech – Industrial Safety Engineering	AVPPL
7.	Sebastian Britto. A. G	Programme Manager	27 Years	MA, Economics	Adani Foundation
8.	Rakesh R. S	Sr. Project Officer	26 Years	MBA, Bsc Agriculture	Adani Foundation
9.	Stephen Vinod	Project Officer	23 Years	BA, Economics	Adani Foundation
10.	George Zen	Consultant – Livelihood	38 Years	BA, Sociology	Adani Foundation
11.	Maya G	Project Officer Community Health	14 Years	BA, IT-TTC	Adani Foundation
12.	Meera Mariyam Skariah	Asst. SuPoshan Officer	6 Years	MSW	Adani Foundation
13.	Radha S	Engineer	9 Years	MTech	AVPPL

S. No.	Name	Designation	Experience	Qualification	Organization
14.	Limna B	Senior Assistant	16 Years	Pre-degree, ITI	AVPPL
15.	Anurag MJ	Project Officer	10 Years	MSc. Computer Science	Adani Skill Development Centre
16.	Sreejith	Placement Manager	10 Years	MBA (Marketing)	Adani Skill Development Centre
17.	Kavitha TR	Trainer – Language & Soft Skill	15 Years	MA, B.Ed. (Eng.), SET, CTET, MA Sociology	Adani Skill Development Centre
18.	Neethu V Nath	Trainer – Domestic Data Entry Operator	5 Years	MTech (Computer Science)	Adani Skill Development Centre
19.	Mini Jose	Trainer – Beauty Therapist	13 Years	S.S.L.C, Diploma in Fashion Technology, Diploma in Beauty Therapy,	Adani Skill Development Centre
20.	Sheeja. M	Trainer – General Duty Assistant	10 years	BSc Nursing	Adani Skill Development Centre
21.	Anilkumar BS	Trainer - IOT	22 years	BTech (ECE)	Adani Skill Development Centre
22.	Sreekutty SR	Horticulture Assistant	1 year	BSc Botany	AVPPL
23.	Shaji Joseph	Safety Executive	14 Years	Diploma in mechanical & Diploma in fire and safety	HOWE

Annexure XIII

CTE for Temporary Crusher Plant

FILE NO : KSPCB/TV/ICE/10023574/2023
Date of issue : 15-04-2023

KERALA STATE POLLUTION CONTROL BOARD

CONSENT TO ESTABLISH

ISSUED UNDER

The Water (Prevention & Control of Pollution) Act, 1974

The Air (Prevention & Control of Pollution) Act, 1981

and

The Environment (Protection) Act, 1986

As per Application No. : 10023574
Dated : 06-03-2023

To

Adani Vizhinjam Port Pvt Ltd - Mobile Crusher
Muloor, Mulloor PO, Vizhinjam, Trivandrum

Consent No. : KSPCB/TV/ICE/10023574/2023
Valid Upto : 14-04-2026

1. GENERAL

1.1. This integrated consent is granted subject to the power of the Board to withdraw consent, review and make variation in or revoke all or any of the conditions as the Board deems fit

1	**VALIDITY**	14-04-2026
2	Name and Address of the establishment	Adani Vizhinjam Port Pvt Ltd - Mobile Crusher Muloor, Mulloor PO, Vizhinjam, Trivandrum E-Mail : hebin.c@adani.com Contact Number : 9099056757
3	Occupier Details	CEO AVPPL Adani Vizhinjam Port Pvt LTD Mulloor Post, Vizhinjam, Thiruvananthapuram, kerala - 695521 E-Mail : hebin.c@adani.com Contact Number :
4	Local Body	Vizhinjam zonal
5	Survey Number	284/16 Block no 14
6	Village	Vizhinjam
7	Taluk	Neyyattinkara
8	District	THIRUVANANTHAPURAM
9	Capital Investment(Rs in Lakhs)	800.0
10	Scale	Medium
11	Category	ORANGE
12	Annual fee(Rs) Total Fee remitted(Rs)	47000.0 141000.0
13	Activity	Installation of temporary mobile crusher within Vizhinjam Port premises for the production of aggregates @ 3600 TPD for the construction of the port.
14	Machinery details	Jaw Crusher 200 HP, Cone Crusher 220 HP, Vibrator 40 HP, Accessories 730 HP (Total 1190 HP)

2. SPECIFIC CONDITIONS

2.1. The unit shall be established as in the approved site location drawing attached. No change/alteration shall be done without obtaining prior approval of the Board.
2.2. This consent is granted subject to the power of the Board to review and make variations in all or any of the conditions as per section 21 of the Air (Prevention and Control of Pollution) Act 1981 and section 25 of the Water (Prevention and Control of pollution) Act 1974.
2.3. This consent unless withdrawn earlier and subject to condition no. 2.2 shall be valid for three years from the date of issue.
2.4. The date of commissioning shall be intimated, at least one month in advance, to the District Office of the Board.
2.5. Consent to Operate shall be obtained before commissioning the unit under the Water (Prevention and Control of Pollution) Act, the Air (Prevention and Control of Pollution) Act and the relevant Rules under Environment (Protection) Act. For this, application shall be submitted one month in advance.
2.6. The applicant shall comply with the instructions that the Board may issue from time to time regarding prevention and control of air, water, land and sound pollution.
2.7. Any change in the particulars furnished in the references or in the identity of the occupier / authorized agent is to be intimated to the Board forthwith.
2.8. Signboard showing the name of the establishment and important Consent details shall be displayed at the entrance of the unit.
2.9. The domestic waste water shall be discharged through septic tank and soak pit system as follows.
i) Septic tank as per IS 2470 (Part 1): 1985
ii) Soak pit with sealed bottom, honey comb side wall 65 cm thick 2 mm sand all around.
2.10. There shall not be any fugitive emission from the premises.
2.11. PM10 in the ambient air at the boundary shall not exceed 100μg/m3. PM2.5 in the ambient air at the boundary shall not exceed 60μg/m3
2.12. The sound level at 1m outside the boundary of the site should not exceed the ambient noise standards applicable for the adjoining areas.
2.13. The crushers, conveyors and classifiers shall be installed inside prefabricated sound proofed building with adequate roofing/false roofing.
2.14. The exhaust from the engines shall be dispersed through stacks of height 1.5m above the top of the prefabricated building.
2.15. The shortest distance from any of the tracks/crusher/screen to the nearest residence/public building/place of worship shall not be less than 100m and the minimum setback to any side shall not be less than 25m.
2.16. Adequate number of water sprinklers shall be provided all along the site.
2.17. Minimum water storage facility of 10,000 litres shall be provided.
2.18. Internal roads shall be tarred/metaled/concreted.
2.19. Green belt with suitable species of trees/curtain plants shall be provided within and along the boundary of the premises.
2.20. This consent is issued subject to the site plan and affidavit dated , and is liable to be revoked if any information furnished is found false or misleading on verification.
2.21. This Consent is granted based on the agreement dated executed between the Adani Vizhinjam Port Private Limited and The Governer of Kerala. The products generated shall be used exclusively for the purpose intended as per the said agreement only.

2.22. The lease agreement shall be valid, failing which the Consent will become invalid automatically.

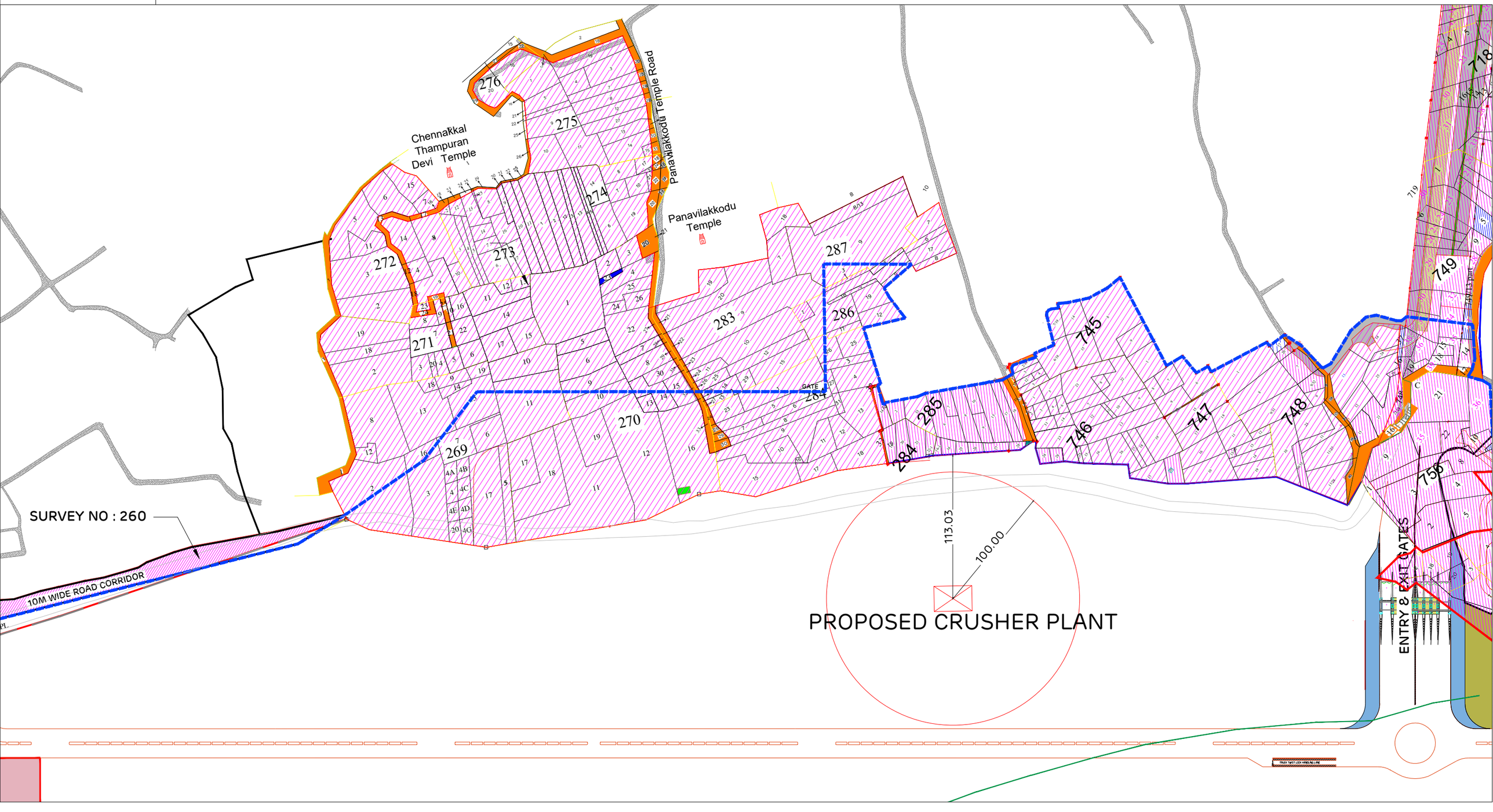
SIGNATURE OF ISSUING AUTHORITY

ENVIRONMENTAL ENGINEER

SITE PLAN FOR SKID MOUNTED CRUSHER

District	-	Thiruvananthapuram
Taluk	-	Neyyatinkara
Village	-	Vizhinjam
Block No.	-	14

NAME OF INDUSTRY :



Annexure XIV

Email Submission of HYCR for the Period

October 2022 to March 2023

From:	Jesse Fullonton
To:	Jesse Benjamin Fullonton; Hebin Chenthamarakshan
Subject:	Fwd: EC_F. No. 11-1222011-IA.III dated 03.01.2014-Submission of Half Yearly EC Compliance Report (HYCR) - Oct 2022 to Mar 2023 - Reg.
Date:	Wednesday, May 31, 2023 10:01:44 AM
Attachments:	VISL_Forwarding _Letter_EC_Compliance_Oct2022 to Mar 2023.pdf

---------- Forwarded message ---------
From: **Santhosh Sathyapal** <sathyapal@vizhinjamport.in>
Date: Tue, 30 May, 2023, 18:24
Subject: Fwd: EC_F. No. 11-1222011-IA.III dated 03.01.2014-Submission of Half Yearly EC Compliance Report (HYCR) - Oct 2022 to Mar 2023 - Reg.
To: Jesse.Fullonton@gmail.com <Jesse.Fullonton@gmail.com>, hebin048@gmail.com <hebin048@gmail.com>

---------- Forwarded message ---------
From: **Santhosh Sathyapal** <sathyapal@vizhinjamport.in>
Date: Tue, May 30, 2023 at 6:15 PM
Subject: EC_F. No. 11-1222011-IA.III dated 03.01.2014-Submission of Half Yearly EC Compliance Report (HYCR) - Oct 2022 to Mar 2023 - Reg.
To: <rosz.bng-mef@nic.in>, <rosz.bng-mefcc@gov.in>
Cc: <Ssuresh.cpcb@nic.in>, <tvpmro@gmail.com>, <Kushal.vashist@gov.in>, <kczmasandtd@gmail.com>, <zobangalore.cpcb@nic.in>, <pamidisuneel@gmail.com>, Rajesh Jha <Rajesh.Jha@adani.com>, Jesse Benjamin Fullonton <jesse.fullonton@adani.com>, Hebin <Hebin.C@adani.com>, CEO VISL <ceo@vizhinjamport.in>, MD VISL <md@vizhinjamport.in>

Dear Sir/Madam,

Kindly ignore my earlier mail on the subject matter.

MoEF&CC had issued Environmental Clearance and CRZ Clearance (EC) on 3rd January 2014 to the proposed Vizhinjam International Multipurpose Deepwater Seaport at Vizhinjam in Thiruvananthapuram District of Kerala State. (EC No. F.No.11 - 122/2011 - IA. III) and subsequently extended the EC validity up to 2nd January 2024 (excluding Covid 2019 additional validity) with the same terms and conditions.

Kindly find attached the Half Yearly Compliance Report (HYCR) for the period from October 2022 to March 2023 and the forwarding letter for records and reference.

Acknowledgement on receipt of the email with contents is highly appreciated.

With Best Regards,

Dr. Santhosh Sathyapal

General Manager-Environment (i/c)

Vizhinjam International Seaport Limited

Thiruvananthapuram

VIZHINJAM INTERNATIONAL SEAPORT LIMITED

(A Government of Kerala Undertaking)

Vizhinjam International Seaport Thiruvananthapuram

Vizhinjam International Deepwater Multipurpose Seaport

Half Yearly Compliance Report (HYCR) of Conditions of Environmental and CRZ Clearance for the Period April 2023 to September 2023

November 2023