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 2022 to September 2022

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 2022

Vizhinjam International Seaport Limited

(A Government of Kerala Undertaking)

VISL/ 53 /2021-GM1 (E)/ 657 **31st October 2022**

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 for Vizhinjam International Multipurpose Deepwater Seaport for the period of **April 2022 to September 2022** – 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 cited 1) 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 the reference cited 2). Subsequently, the validity of EC was extended by MoEF&CC dated 29th December 2020 (vide reference cited 4).

The Half Yearly Compliance Report (HYCR) of the conditions stipulated in the cited references for the period from **April 2022 to September 2022** is enclosed herewith for record and reference.

As per the MoEF&CC Letter (vide the reference cited 3), wherein submission of HYCRs by email / soft copy is declared acceptable, therefore the HYCR for the period **April 2022 to September 2022** 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

Managing Director & CEO
Encl: As Stated Above

Copy to: MD & CEO Adani Vizhinjam Port Private Ltd. (AVPPL), 3rd Floor, Aspinwall House, Kuravankonam, Trivandrum, Kerala-695 003.

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
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. Copy of the renewed CTE was submitted to Ministry of Environment and Climate Change (MoEF&CC) with the Half Yearly Compliance Report (HYCR) for the period April 2018 to September 2018.
(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 & Co. (SAC) for a stretch of 40 km (20 km on both sides of the project site) and reports are being regularly submitted to MoEF&CC as a part of the HYCR. 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 Observations • Tide Observations • Weather Observations • Marine Water Sampling • Turbidity Measurements Regular shoreline monitoring has been carried out during the compliance period till

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		15.08.2022. SAC could not conduct shoreline monitoring field data collection along some of the coastal areas and at the port site since 16.08.2022 due to protests by the Latin Archdiocese and others. As on the end of the compliance period, the situation has not subsided and the shoreline monitoring has been affected due to the ongoing agitation by the local people. Shoreline Monitoring Report by SAC for the period April 2022 to September 2022 is enclosed as **Annexure I**. SAC shall resume the full scope of shoreline monitoring once the safe and secure working conditions in the areas are ensured. 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 As per the instructions of the NGT Appointed Shoreline Monitoring Cell vide Minutes of Meeting dated 19.04.2022, *The reporting period of NIOT shall be half yearly verified with LNTIEL analysis period and shall match with EC compliance reporting period*. Therefore, as a part of data synchronization with the HYCR Period (October – March and April – September), Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data from March 2021 to September 2022 to L&T IEL for mathematical modelling to assess the impact on shoreline

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		under the guidance of NIOT. Hereafter, the data period for the mathematical modelling reports will be October to September. The mathematical modelling report for the period March 2021 to September 2022 vetted by NIOT is given as **Annexure II**. From all the data analyses and model studies carried out by L&T IEL, it has been concluded that there was minimal variation on shoreline, beach morphology and water quality compared to the previous years and that the port construction has not induced any additional changes to these parameters in the vicinity of the port.
(iii)	The capital dredged material (7.6 Mm^3) shall be utilized for reclamation of berths.	**Being Complied** No dredging or reclamation was carried out during the compliance period from April 2022 to September 2022. During previous compliance periods, the dredged material amounting to 2.90 Mm^3 has been utilized for reclamation.
(iv)	Additional fish landing centre shall be developed as part of the proposed Vizhinjam port for upliftment of fisheries sector.	**Being Complied** Based on studies on tranquillity Central Water and Power Research Station (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 to facilitate the local fishermen. Design and estimates are being prepared by Harbour Engineering Department (HED) and once those are finalised and submitted to Vizhinjam International Seaport Limited (VISL), the extension of the seaward breakwater of the old fishing harbour and new fish landing centre would be taken up by GoK. *(Source: VISL)*
(v)	The project shall be executed in such a manner that there is minimum	**Being Complied** Following is being practiced to ensure minimum disturbance to fishing activity:

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	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. • 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 III**). • Turbidity buoys at 3 locations identified by NIOT had been deployed and continuous monitoring was carried out to assess the real time turbidity. The turbidity details for the compliance period are given in **Annexure I**. However, no dredging or reclamation was carried out during the compliance period from April 2022 to September 2022.
(vi)	Steps would be taken to safeguard the interests of the fisheries sector as detailed in the Resettlement Action Plan	**Being Complied** In consultation with the fishermen, enhanced livelihood compensation of Rs. 101.86 Crores was sanctioned by GoK, instead of Rs. 8.55 crores; as suggested earlier in the EIA stage. Till

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	(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).	30.09.2022 an amount of Rs. 99.94 crores have been disbursed for a total number of 2640 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. Verification of documents of a few remaining LAPs is in progress. *(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 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. *(Source: VISL)* **Fish Landing Centre**: The work for the fish landing centre (Rs. 16.00 crores) and the fishery breakwater (Rs. 131.12 crores) had been initiated

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		as part of the funded work component of the concession agreement with AVPPL. However, 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 to facilitate 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. Government has formed a higher level committee to prepare a master plan for the old fishing harbour. *(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 planned so as to commission the same along with the completion of the new fishing landing facilities. *(Source: VISL)* **Skill Development:** Additional Skill Acquisition Program (ASAP) is a GoK initiative aimed to impart required skills to students 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 as per agreement with GoK/ ASAP/VISL.

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		CSP building construction is completed with a 3 storied building; 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. Adani is planning to start High End Port related courses to suite the anticipated vacancies arising in the port and other top organizations. ASAP is planning to handover the building by the end of December 2022 once the building is completed in all respects including final finishing works. Preference will be given to local students based on qualification skill and aptitude.  **Community Skill Park** **Environmental Sanitation/Solid Waste Management:** 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 - Karsheeka Karma Sena is coordinating the clean campaign. Most of the 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, 648 women-days were recorded for the campaign.

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		In view of onset of monsoon season a month-long awareness campaign on cleanliness, hygiene, and precautions to prevent the communicable diseases in rainy season in the entire communities of Vizhinjam had been conducted jointly by Adani Foundation and Thiruvananthapuram Municipal Corporation on 25.05.2022.  **Cleaning Campaign** As per the request received from Thiruvananthapuram Municipal Corporation it is decided to construct an MRF at harbour ward. Land for the same has been allotted by Harbour Engineering Department (HED). The operation of the unit will be done by Trivandrum Municipal Corporation under the technical support of Suchithwa Mission and Clean Kerala Company and Socio Economic Foundation. 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. Activities carried out by AVPPL/Adani Foundation as a part of CSR intervention for

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		fishermen, fishing community and fisheries sector for the period of April 2022 to September 2022 is given in **Annexure IV**.
(vii)	Rail connectivity shall be parallel to the harbour road on elevated structures at +4/5.00 m level without affecting the entry to the existing harbor.	**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 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 meeting considered this amendment on 15.09.2022. As per the MoM, EAC had observed that the proposed changes should be considered as scope change rather than amendment. The scope change and other observations/clarifications sought by the committee are under preparation for further submission for the EC proposal. *(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 action initiated by the District Collector Thiruvananthapuram. *(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	**Will be Complied** Currently project is under construction. This shall be complied during operational phase.

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	material like ballast water, oily water or sludge, sewage, garbage etc. The emission of NOx & SOx shall remain within permissible limits.	
(x)	CSR activities shall cover villages within 10 km radius of the project.	**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. 179.18 Lakhs has been spent on CSR activities during the compliance period (April 2022 to September 2022) as shown below: **S. No. / Head / Amount (Rs. Lakhs)** 1 — Education — 30.46 2 — Community Health — 55.19 3 — Sustainable Livelihood Development — 32.44 4 — Community Infrastructure Development — 53.40 5 — General Administration — 7.69 **Total — 179.18** Details on CSR activities carried out by AVPPL during compliance period (April 2022 to September 2022) are enclosed as **Annexure IV**.
(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.

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		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. Considering that the procurement of pollution response equipment will be in line with the development of the port, the final OSDCP will be submitted to ICG for approval prior to commissioning of the port; when the pollution response equipment are 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 2022 to September 2022is enclosed as **Annexure V**.
(xiii)	The responses/ commitments made during public hearing shall be complied with in letter and spirit.	**Being Complied** AVPPL are 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 2022 to September 2022 is enclosed as **Annexure VI**.
(xiv)	All the recommendation of the EMP shall be complied with in letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF along with half yearly compliance report to MoEF-RO.	**Being Complied** Project is in construction stage. Out of the 5 identified EMP areas, work has started in Port Site (Building construction in back up yard), Road/Rail Corridor and in PAF (Project Annex Facility)). Recommendations of the Construction stage EMP for these areas are being implemented. Status of construction stage EMP in matrix format is enclosed as **Annexure VII**.

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(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. 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.

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		The water for construction purposes for the port is being sourced from the open market/private suppliers. On an average about 14 KLD water is being consumed for construction related activities during the compliance period (April 2022 to September 2022). During the months of August 2022 and September 2022 works were stalled due to the ongoing protests and strike by the Latin Archdiocese and others.
(xviii)	The Hazardous waste generated shall be properly collected and handled as per the provision of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.	**Being Complied** Contractors working at site, under the EPC Contractor Howe, have obtained separate consents from KSPCB for handling Hazardous Waste. During this compliance period (April 2022 to September 2022) 0.23 KL of used oil had been generated and it is being stored as per Hazardous Waste Rules at site and further disposed to authorized (CPCB/KSPCB) waste oil handlers. During the months of August 2022 and September 2022 works were stalled due to the ongoing protests and strike by the Latin Archdiocese and others.
(xix)	No hazardous chemicals shall be stored in the Coastal Regulation Zone area.	**Being Complied** 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.	**Complied** Only batching plant wash/reject is generated from the construction activity presently. For the same, a settling tank is constructed and used for collection and recycling of all wash water generated.
(xxi)	Sewage Treatment facility should be provided in accordance with the CRZ Notification.	**Will be Complied** Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner is being planned and will be implemented in line with CRZ Notification along with the commissioning of the project.
(xxii)	No solid waste will be disposed of in the Coastal Regulation Zone area. The solid waste shall be properly collected, segregated and	**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

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	disposed as per the provision of Solid Waste (Management and Handling) Rules, 2000.	and output is being used as manure in greenbelt development.  **OWC**  **OWC Compost used in Greenbelt** The dry waste is being properly collected, segregated and disposed in line to 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	**Being Complied** 7 DG sets are presently on standby at site and being used only in case of emergency purposes. These are compliant to CPCB guidelines.

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	properly collected and disposed as per the Rules. Project proponent shall install necessary oil spill mitigation measures.	Concrete storage with dyke constructed for separation is used for containment. If any oil spill occurs, it shall be properly collected and disposed as per the Rules.
(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.	**Will be Complied** The project is in construction phase and the same shall be complied during operational phase.
(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**: 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 done for the median of the approach road.

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		 **Greenbelt along the Median of Approach Road** **Compensatory Afforestation**: AVPPL, in collaboration with Forest department, have carried out compensatory afforestation of approximately 15,540 trees on 12.05 Ha land; as identified by social Forest Department in Sainik School, Trivandrum (at an aerial distance of 24 km from the Vizhinjam Port project site). Rs. 80.50 Lakhs has been spent towards Phase-I of the compensatory afforestation at Sainik School. The plantation is in its third year of growth.
(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. 2.09 Crores has been utilized towards EMP implementation measures during compliance period April 2022 to September 2022. Till date, an amount of Rs. 23.48 Crores has been spent on environmental protection measures. The EMP expenditure is enclosed as **Annexure VIII**.

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S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
(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 IX**.
(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 amendments. All the construction designs/drawings relating to the proposed construction activities must have approvals of the concerned Statutory Departments / Agencies.	**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 State Pollution Control Board vide Consent No. PCB/HO/TVM/ICE-R/02/2018, dated 19.07.2018 valid up to 31.07.2023. • Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 7.12.2015. • CTE for consumer pump inside the Vizhinjam port premises was obtained on 07.03.2021

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		(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 avoid any damage to the environment.	**Complied** On an average 626 Nos. of employees, staff and construction workers were engaged in the port construction activities on a daily basis during the compliance period October 2021 to March 2022. Staff of EPC contractor and other contractor's workers are not allowed to enter the port area since 16.08.2022 due to ongoing agitation by Latin Archdiocese and others. Presently, during the compliance period, the contractors have demobilized and 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.
(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 & Ground water quality is monitored on a monthly basis in line to Environment Monitoring Plan prescribed in EIA and analysis reports are enclosed as **Annexure III**. 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	**Being Complied** Quarry material is being obtained from approved quarry sites only.

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
	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 sites for such materials must be secured so that they shall not leach into the ground water.	Earth cutting generated from road corridor construction at present are dumped in truck terminal area. • 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.
(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, AVPPL have obtained Environmental Clearance (EC) from the State Environmental Impact Assessment Authority (SEIAA) and Consent to Operate (CTO) from KSPCB for the following granite building stone quarries: • Block No. 29, Re-Survey No. 120/10 in Manickal Village, Nedumangad Taluk, Thiruvananthapuram District, Kerala (Details

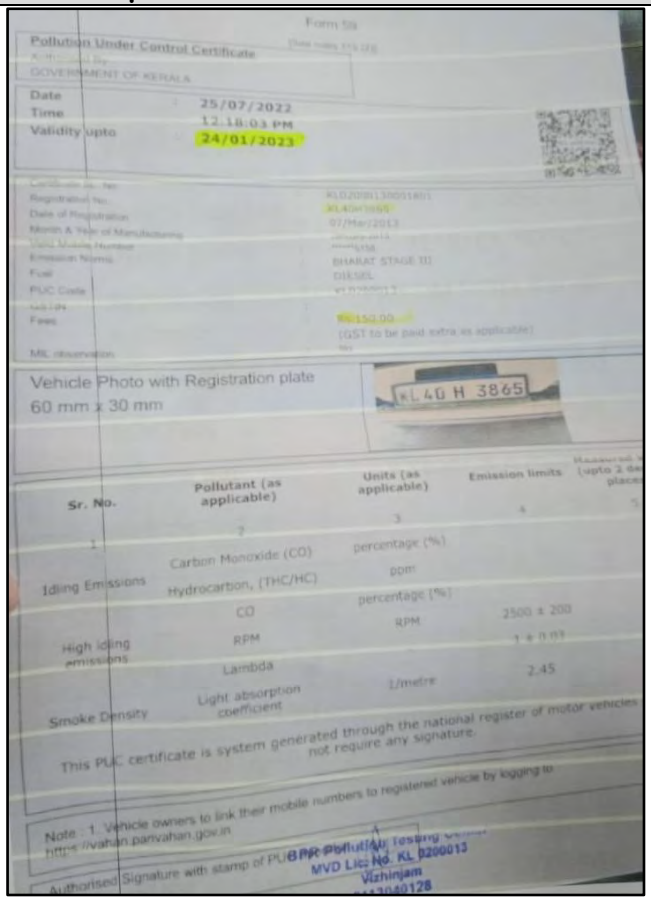
Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period April 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		submitted along with the HYCR for the period October 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 vide EC No. 80/Q/2022 dated 23.07.2022 (**Annexure X**). Subsequently CTO has also been obtained from KSPCB vide Consent No. KSPCB/TV/ICO/10005098/2022 dated 25.07.2022 valid up to 15.03.2027 (**Annexure XI**). • Block No. 30, Re-Survey No. 341/6 in Koodal Village, Konni Taluk, Pathanamthitta District, Kerala vide EC No. 88/Q/2022 dated 02.08.2022 (**Annexure XII**). Subsequently CTO has also been obtained from KSPCB vide Consent No. KSPCB/PT/ICO/10005066/2022 dated 02.08.2022 valid up to 01.08.2025 (**Annexure XIII**). • Block No. 37, Re-Survey Nos. 554/1, 554/5 & 554/6 in Nagaroor Village (Kadavilla), Chirayinkeezhu Taluk, Thiruvananthapuram District, Kerala vide EC No. 92/Q/2022 dated 16.08.2022 (**Annexure XIV**). Subsequently CTO has also been obtained from KSPCB vide Consent No. KSPCB/TV/ICO/10005087/2022 dated 27.08.2022 valid up to 31.05.2025 (**Annexure XV**). In case of new quarries, necessary approvals will be obtained from the competent authority. Apart from these, the concessionaire is also sourcing rocks from the following private quarry owners in Kerala:

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		• 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. • Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner is being planned and will be implemented in line with CRZ Notification along with the commissioning of the project. • 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 limits at all locations on all monitoring days during the 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 2022 to September 2022

<table>
<tr><th>S. No.</th><th>Conditions</th><th>Compliance Status as on 30.09.2022</th></tr>
<tr><td></td><td></td><td>months (from April 2022 to September 2022).
• Summary of the Ambient Air Quality Monitoring (AAQM) during the compliance period April 2022 to September 2022 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>µg/m³</td><td>78.4</td><td>51.7</td><td>22.8</td><td>100</td></tr>
<tr><td>$PM_{2.5}$</td><td>µg/m³</td><td>40.5</td><td>27.2</td><td>12.6</td><td>60</td></tr>
<tr><td>SO_2</td><td>µg/m³</td><td>5.08</td><td>2.71</td><td>BDL</td><td>80</td></tr>
<tr><td>NO_2</td><td>µg/m³</td><td>7.86</td><td>4.22</td><td>2.16</td><td>80</td></tr>
<tr><td>CO</td><td>mg/m³</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>
• Detailed Monitoring Reports for the period April 2022 to September 2022 is attached as Annexure III).</td></tr>
<tr><td>(vii)</td><td>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.</td><td>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.</td></tr>
<tr><td>(viii)</td><td>Adequate precautions shall be taken during transportation of the construction material so that it does not affect the environment adversely.</td><td>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</td></tr>
</table>

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		• 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  **Water Sprinkling in Progress**  **Tarpaulin Covered Truck**

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		 **PUC Certificate**
(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	**Noted for Compliance**

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
	existing ones, if necessary in the interest of environment and the same shall be complied with.	
(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 financial closure and final approval of the project by the concerned authorities and the date of start of land development work.	**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 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	**Noted for Compliance**

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
	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.	
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 respective competent authorities.	**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 valid up to 31.07.2018 was renewed from State Pollution Control Board vide Consent No. PCB/HO/TVM/ICE-R/02/2018, dated 19.07.2018 valid up to 31.07.2023. • Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 7.12.2015. • 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

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		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 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.	**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 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

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		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, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	**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 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 2021 to March 2022 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 2021 to March 2022 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA vide email dated 28.05.2022 (a copy of the email is enclosed as **Annexure XVI**). 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 2022 to September

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 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		2022 are enclosed as **Annexure III**. Additionally, summary of monthly Environment monitoring results are 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 Zonal Office of CPCB and the SPCB.	**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 2021 to March 2022 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA via email dated 28.05.2022 (a copy of the email is enclosed as **Annexure XVI**).
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:	Shoreline Monitoring Report (April 2022 to September 2022)
Annexure II:	Modelling Report (March 2021 to September 2022)
Annexure III:	Environment Monitoring Report (April 2022 to September 2022)
Annexure IV:	CSR Activities by AVPPL (April 2022 to September 2022)
Annexure V:	Compliance to Conditions of KCZMA Recommendation
Annexure VI:	Compliance of the Commitments made during Public Hearing
Annexure VII:	Status of Environment Management Plan
Annexure VIII:	EMP Expenditure
Annexure IX:	Environment Health, Safety & CSR Organizational Structure
Annexure X:	EC for Aryanadu Quarry
Annexure XI:	CTO for Aryanadu Quarry
Annexure XII:	EC for Koodal Quarry
Annexure XIII:	CTO for Aryanadu Quarry
Annexure XIV:	EC for Kadavilla-2&3 Quarry
Annexure XV:	CTO for Kadavilla-2&3 Quarry
Annexure XVI:	Email Submission of HYCR for the Period October 2021 to March 2022

Annexure I

Shoreline Monitoring Report

(April 2022 to September 2022)

SHANKAR SURVEYS

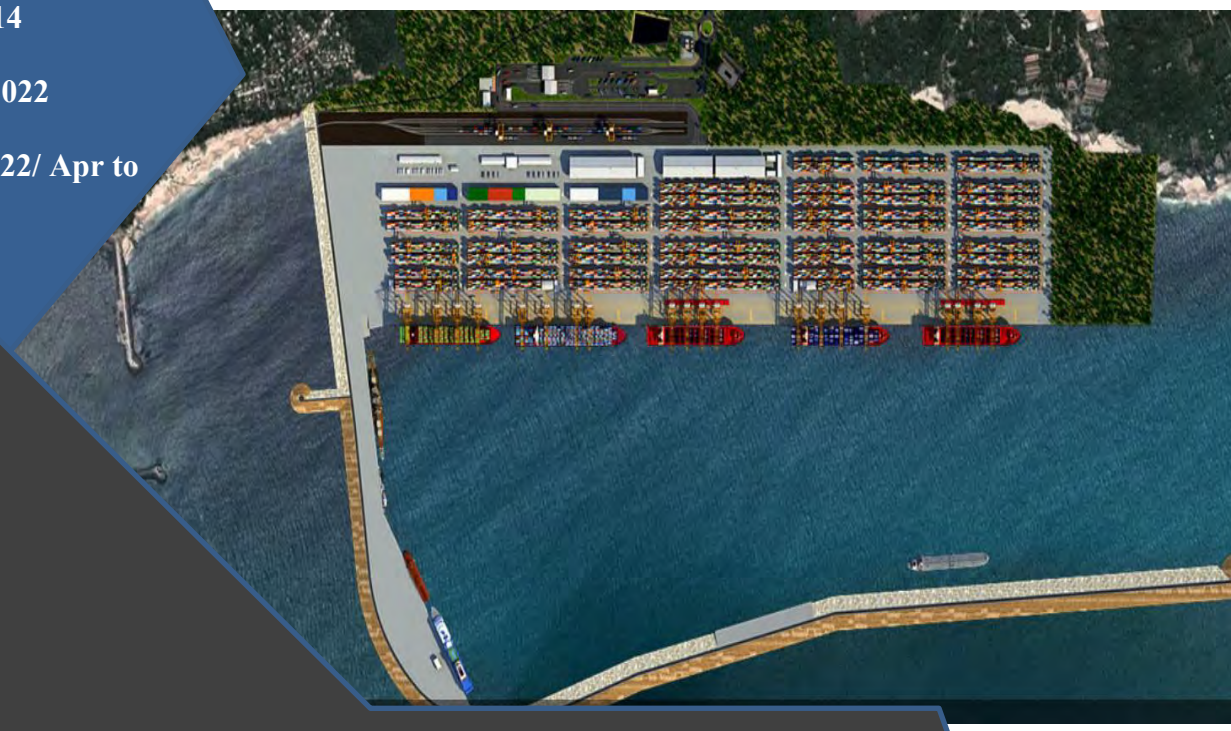
Adani Vizhinjam Port Pvt. Ltd.

OCEANOGRAPHIC AND BATHYMETRIC DATA COLLECTION FOR ASSESSMENT OF SHORELINE CHANGES

Shankar And Co.
115, Neco Chambers,
CBD Belapur,
Navi Mumbai – 400 614

Date: 21st November 2022

SAC Ref # SAC/P199-22/ Apr to Sep 2022 Rev 1



HALF YEARLY REPORT
(APRIL TO SEPTEMBER 2022)

"APPROVAL SHEET"

Prepared by:	*Signed*	*Date*
V Mehta		*21/11/2022*

Checked and Approved by:	*Signed*	*Date*
S Philip		*21/11/2022*

REVISION CONTROL

Date	Rev	Section / Page No.	Remarks	Comment by
14/11/2022	0		Submitted for approval	
21/11/2022	1	Sec 1, Pg 7	Corrected the text	AVPPL
		Sec 3, Pg 13	Corrected the text, added a separate bullet point for sled survey as suggested	AVPPL
		Sec 5.6, Pg 32	Blank space removed	AVPPL
		Sec 6.3, Pg 47	Removed the text in the note as suggested	AVPPL
		Sec 6.4, Pg 53, 54 and 55	Removed September from the graph; added rainfall description	AVPPL
		Sec 6.5, Pg 56	Corrected the text as suggested	AVPPL
		Sec 6.5, Pg 57	Added one more CSP location in Figure 6-12 as suggested	AVPPL
		Sec 6.8, Pg 61 - 63	Graphs for nearshore survey carried out for June 2022 added	AVPPL
		Sec 6.9, Pg 64	Added area wise table of groynes distribution	AVPPL
		Sec 6.12, Pg 83	Photograph of flagged turbidity buoy along with dates of FIRs lodged provided	AVPPL

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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
SAC	Shankar And Co.
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 And Co. (SAC), 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.
Current Speed	The speed at which a water body moves in the ocean. The speed is denoted in cm/s
Rip Current	A relatively strong, narrow current flowing outward from the beach through the surf zone
Current Direction	The direction **towards which** the currents are flowing. A westerly current implies that the currents are flowing from east to west
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
Turbidity	Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air.

1 EXECUTIVE SUMMARY

The **Vizhinjam International Deepwater Multipurpose Seaport** is a prestigious 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)

① Shankar And Co, hereinafter referred to as SAC, based in Navi Mumbai has been awarded the contract by AVPPL 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, vide the service order; SO 5700267194.

As part of the study, NIOT provided a wave rider buoy to be deployed off Mulloor and the data and watch & ward of the buoy was to be monitored by SAC. Turbidity measurements at three locations from three levels is to be monitored on a real time basis, for which turbidity measuring buoys were deployed in the month of November 2019.

This report provides the results of the data collected for the half yearly period from April to September 2022. All co-ordinates in the reports and charts 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 (wave, meteorological parameters and tide) at one location, to measure current for 30 days each, at four locations, during 3 different seasons; Pre-monsoon (Mar-May), monsoon (Jun-Oct), and Post-monsoon period (Nov-Feb), to measure in real-time turbidity from three levels and three locations, 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, littoral environmental observation and river crossing survey. All these are to be carried out for a period of 3 years commencing June 2019.

A Google Earth image, showing the Multibeam survey area; locations of the observations, including the wave/current, tide and Automatic Weather Station (AWS) measurement location, is given in Figure 2-1 and Figure 2-2.

P1, P2 and P3 correspond to Acoustic Doppler Current Profiler (ADCP) locations and P4 corresponds to both, ADCP and wave location.

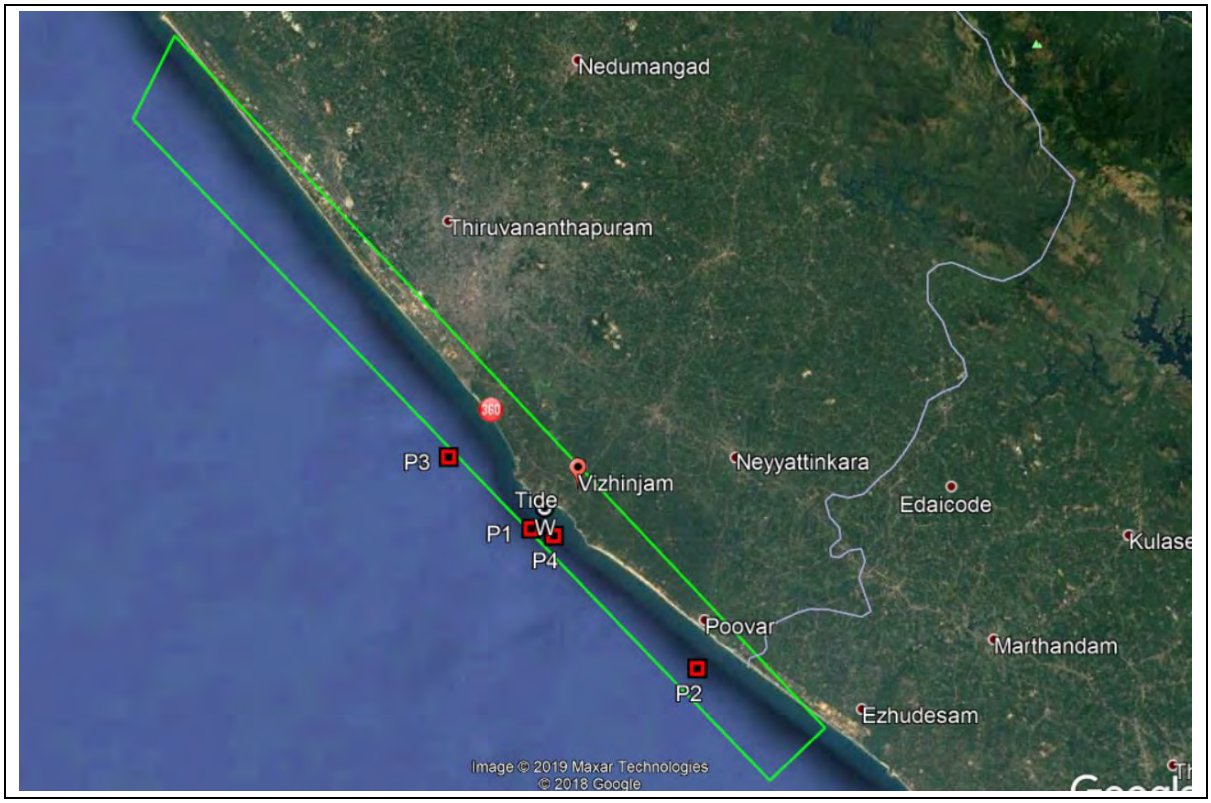


Figure 2-1: General Survey Location

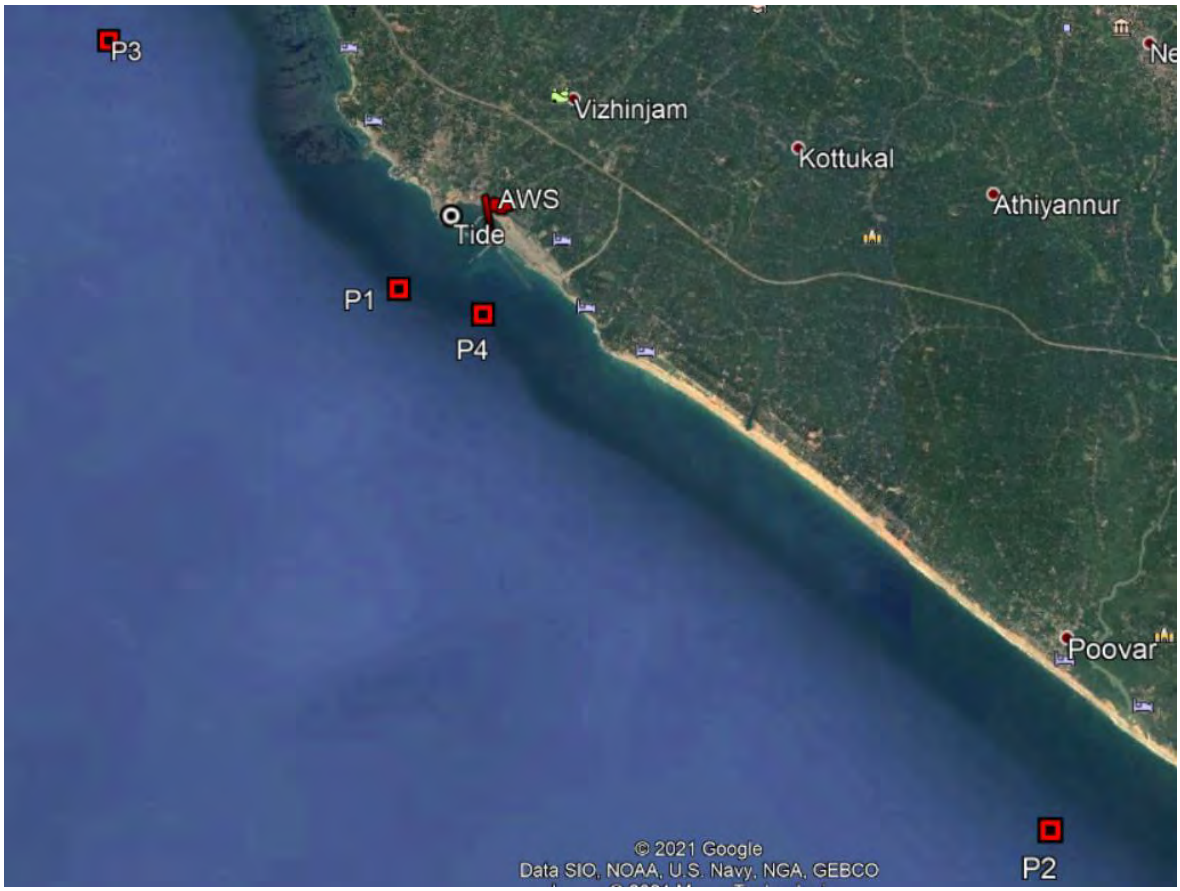


Figure 2-2: MetOcean Locations

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 increases progressing 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 mobilise 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 CSP locations).
- 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.
- Bathymetry/cross section survey for 500m length of rivers debouching in a 40 km stretch of the coast.
- 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.
- Current measurements (both magnitude and direction) using Acoustic Doppler Current Profiler (ADCP) at four locations, as marked in Figure 2-1, for the duration of full tidal cycle/30 days each during Pre-monsoon (Mar-May), Monsoon (Jun-Oct) and Post-monsoon period (Nov-Feb).
- Wave observations using WRB Datawell DWG-G shall be carried out at one location as marked on the location map.
- 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).
- Continuous monitoring of turbidity at 3 location (1 upstream & 2 downstream of dredging location) - Online meter (3 levels) to be installed on buoys and data to be displayed at system in office.
- 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.

3.1 Location Coordinates

The location co-ordinates for the current and wave observations are given below:

Table 3-1: Current / Wave locations

Location Co-ordinates WGS-84 Spheroid, UTM Projection, CM 75 East, Zone 43, North			
Name	**Latitude**	**Longitude**	**Depth w.r.t CD (m)**
ADCP - P1 (Vizhinjam)	08° 21' 55.4"N	76° 58' 51.6"E	22.1
ADCP- P2 (Poovar)	08° 17' 35.8"N	77° 04' 03.5"E	23.1
ADCP- P3 (Pachalloor)	08° 24' 08.6"N	76° 56' 16.1"E	21.9
ADCP/Wave - P4 (Mulloor)	08° 21' 42.3"N	76° 59' 33.9"E	22.9

The current observations are to be carried out for 30 days in each of the seasons at the above locations.

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

Table 3-2: 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' 33.68"N	76° 59' 16.65"E	2.711

The Gill Metpack Automatic Weather Station with rain gauge was installed on the terrace of the Port Control Office building. The following table shows the coordinates of the AWS installation:

Table 3-3: 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 (on top of Port Control Office building)	08° 22’ 22.75” N	76° 59' 39.62" E	12.785

The wind sensor was installed at a height of 14.235m above MSL (14.785m above CD). As suggested by NIOT and as per the WMO standard, 7% of the speed was reduced to derive the wind speeds at 10m above MSL.

3.2 Turbidity Monitoring

Turbidity buoys were deployed in the month of November 2019 to measure the water turbidity at three locations. The turbidity from three different depths, i.e. surface, mid-depth and bottom was measured.

The location co-ordinates of the turbidity buoys are provided below:

Table 3-4: Turbidity buoy Locations

TURBIDITY BUOY LOCATIONS WGS-84, UTM Projection, CM 75° East, Zone 43, North						
Buoy No.	Latitude	Longitude	Water Depth (m)	Depth of sensor placement (m)		
				Surface	Mid-depth	Bottom
Turbidity Buoy-1	08° 20' 58.60" N	77° 00' 08.10" E	22.3	5.0	10.0	15.0
Turbidity Buoy-2	08° 21' 49.90" N	76° 59' 14.30" E	22.0	5.0	10.0	15.0
Turbidity Buoy-3	08° 22' 20.01" N	76° 59' 12.54" E	14.4	4.0	8.0	12.0

3.3 Beach and Water Sampling

A total of 81 beach samples were to be collected in one season, as part of the contract. The samples were to be analyzed for grain size distribution as per Wentworth classification. The samples were collected in the months of April and September 2022 for the pre-monsoon and monsoon 2022 periods respectively. The coordinates of the beach sampling locations are provided in the table below.

Table 3-5: 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
BS-9	8° 17.2984’ N	77° 6.1765’ E

BEACH SAMPLING LOCATIONS		
WGS-84, UTM Projection, CM 75° East, Zone 43, North		
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
BS-43	8° 23.1727' N	76° 58.6741' E

BEACH SAMPLING LOCATIONS		
WGS-84, UTM Projection, CM 75° East, Zone 43, North		
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
BS-77	8° 30.3450' N	76° 53.2940' E

BEACH SAMPLING LOCATIONS WGS-84, UTM Projection, CM 75° East, Zone 43, North		
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

The water samples (132 from four locations) were collected and analysed for TSS as per IS 3025, Part 17:1984 (reaffirmed 2012); Turbidity was analysed as per IS 3025, Part 10:1984 (reaffirmed 2012) technical specifications. The salinity was analysed as per American Public Health Association (APHA) guidelines.

The water samples were collected in the month of April 2022 for the pre-monsoon period and also in the month of June 2022 for the monsoon period.

The location co-ordinates of water sampling locations are provided below:

Table 3-6: Water Sampling Locations

WATER SAMPLING LOCATIONS WGS-84, UTM Projection, CM 75° East, Zone 43, North			
Location	**Water Depth (m)**	**Latitude**	**Longitude**
L1 (Mulloor)	21.1	08° 21.923' N	76° 58.860' E
L2 (Proposed Dredge dumping)	23.2	08° 21.705' N	76° 59.565' E
L3 (Pachalloor)	27.4	08° 24.143' N	76° 56.268' E
L4 (Poovar)	23.0	08° 17.597' N	77° 04.058' 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: Watch keeping vessel MFB Hannemol

Figure 4-2: Transit vessel MFB Sindhu Yatra Matha

Figure 4-3: Multibeam Survey boat MV Samuel 3

4.3 Personnel

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

Table 4-2: Personnel

Shankar And Co.	
Name	**Designation**
Rajinder Singh Sandhu	Project Manager
Vishtasp Mehta	Project Manager
Vishnu K.	Party Chief / Surveyor
Amal Thahir	Party Chief / Surveyor
Vishnu Haridas	Land / Hydrographic Surveyor
Ajeesh A.S.	Trainee Surveyor
Sanjeevanee Khaire	Data Processor (Navi Mumbai office)
Adani Vizhinjam Port Pvt. Ltd.	
Name	**Designation**
Hebin C.	Manager - Environment
Jesse Fullonton	Assistant Manager - Environment

5 SURVEY EQUIPMENT DETAILS

5.1 Wave Rider Buoy

The Datawell DWR (G) Wave Rider Buoy (WRB) was deployed by NIOT in collaboration with VISL and AVPPL, under a tripartite agreement and is being monitored and maintained by SAC. A Datawell DWR (G) was supplied and installed for the project. The WRB was programmed to measure all the wave parameters at half-hourly intervals. The data is transmitted on a real time basis via the HF antenna to the receiver set up at Ayur Bay resort.

The system consists of WRB with HF whip/LED flasher, GPS antenna, internal data logger, RX-D receiver with HF antenna and acquisition and post processing software w@ves21. The system has a GPS receiver mounted on a buoy along with HF radio for data transmission in real time. The system has an accuracy of 1 cm + 0.5% of vertical motion; resolution of 1cm and range of ± 30 m at the sampling rate of 1.28 Hz. The directional accuracy and resolution are 1.5° within the range of 0° to 360°.

Since the WRB is GPS based, it does not require any calibration.

5.1.1 Principles of wave measurement

The GPS wave buoy measurement principle bears a strong analogy with the Doppler-shift phenomenon of a car passing nearby, blowing its horn. The GPS system calculates the velocity of the buoy from changes in the frequency of GPS signals. The velocities are integrated with time to determine buoy displacement. In practice the GPS system uses signals from multiple satellites to determine three-dimensional buoy motion. A gravity sensitive accelerometer in the buoy measures wave height by means of vertical acceleration of the platform of the buoy.

5.1.2 Instrument Mooring

The mooring arrangement incorporates the following components between the sea bottom and the mooring eye underneath the buoy: a sinker or anchor weight, polypropylene rope, nylon covered galvanized steel cable (combination rope) and associated terminals, floats, rubber cords with associated terminals, swivels, ballast chain, anodes and shackles and cotter pins.

A schematic of the mooring of WRB is given below:

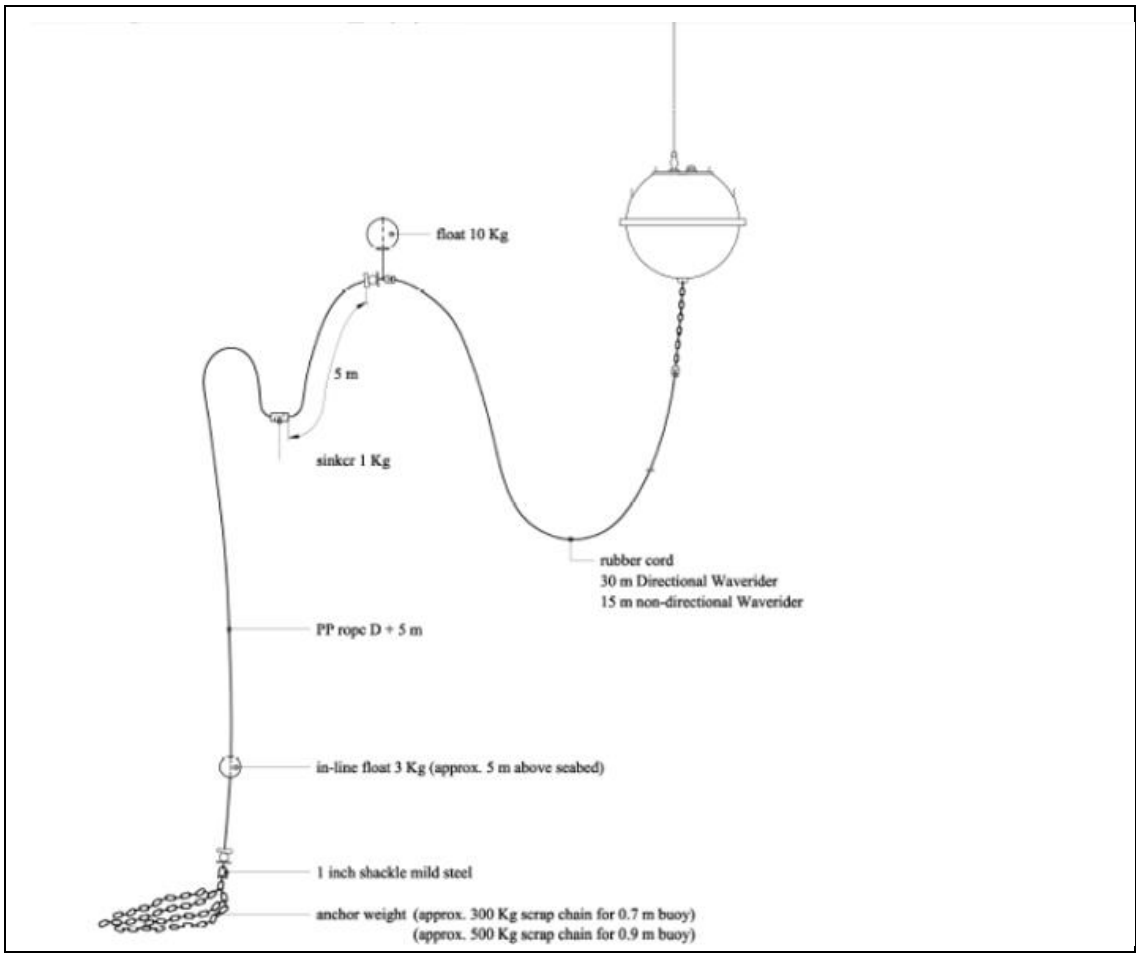


Figure 5-1: WRB Mooring Diagram

A highly elastic rubber cord is essential for high quality wave measurements. It allows the buoy to follow the wave motion, thus guaranteeing that the measured motion of the buoy is indeed the same as the desired motion. The buoy was deployed using single point mooring with free-floating method. The mooring design was configured as per the site conditions, followed by the mooring suggestions provided by the supplier. As frequent fishing activities were observed at the deployment location, one boat was anchored near the WRB without hindering the wave data measurements along with sufficient crew on board for around the clock watch-keeping.

A photograph of WRB deployed at the location is shown below:

Figure 5-2: WRB deployed at site

5.2 Current Meter

Teledyne Workhorse Sentinel 600 KHz Acoustic Doppler Current Profilers (ADCP) and Nortek Aquadopp 600 KHz ADCP's were installed at locations P1, P2, P3 and P4, namely, Vizhinjam, Poovar, Pachalloor and Mulloor respectively, for one season. The current speed and direction were measured at intervals of every 10 minutes from surface to seabed at every 1m bin. Data from three various depths i.e. at the surface, mid-depth and bottom at each location are provided in the report. A few field photographs of ADCP installation are shown below.

Figure 5-3: ADCP deployment at Poovar

Figure 5-4: ADCP deployed at Vizhinjam

5.3 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 a 6m long pipe to ensure 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.

In the month of December 2021, the level of the BM-2 benchmark at Vizhinjam Mosque was amended by SOI. Accordingly, the 'z' value of the temporary benchmark marked on the wharf was also re-established by transferring the level from BM-2 and fixed at 2.711m above Chart Datum.

A photograph of the tide gauge location is shown below:

Figure 5-5: Tide Gauge

The specifications of Valeport Tidemaster ATG is provided below:

Model	:	Tidemaster
Type	:	Vented Strain Gauge with stainless steel mounting
Range	:	Standard 10 dBar (~10m)
Accuracy	:	±0.1 % Full scale

5.4 Automatic Weather Station (AWS)

A Gill Metpack Automatic Weather Station (AWS) was installed on the terrace 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 data logger 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 5-6: AWS on top of Port Control Office building

5.5 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 5-7: RTK System with base station and rover

5.6 Multibeam Echo Sounder System

An R2Sonic 2020 Multibeam Echo Sounder, operating at a frequency of 500 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 roll/pitch/heave sensor. Great care was taken to mount the heads and pitch/roll/heave sensor as accurately as possible and the final calibration was carried out during sea trials prior to each survey. The calibration values obtained in the month of April 2022 are given below.

Table 5-1: MBES Calibration results

Parameter	Value	Comments
Latency	0.00s	Trimble SPS 461 positioning system
Roll	-2.20°	DMS accuracy 0.05° in roll
Pitch	-11.00º	DMS accuracy 0.05° in pitch
Yaw	-5.00º	Accuracy better than 0.2°

5.7 DGPS Positioning System

Vessel positioning was carried out by the Trimble SPS 461 dual antenna DGPS system which also provides the 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 navigatio34n 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 (Position Dilution of Precision) and along-line distances were logged to the hard drive.

5.7.1 DGPS Consistency Check

In order to determine the integrity and reliability of the positioning system, the system was checked for its consistency during mobilization. The DGPS calibration for the month of April 2022 is provided in this report.

After installing the Trimble SPS 461 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 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 limit. The scatter plot of the DGPS calibration is shown in the figure below.

Figure 5-8: Scatter Plot of DGPS calibration on board MV Samuel 3

Table 5-2: DGPS Calibration results

AVERAGE POSITIONS		
POINT	**LATITUDE**	**LONGITUDE**
A	8° 22' 34.48" N	76° 59' 29.88" E
B	8° 22' 34.71" N	76° 59' 30.11" E
Distance between points		**10.09 m**
Measured Distance		**10.00 m**
Difference		**0.09 m**

5.7.2 Gyrocompass Calibration

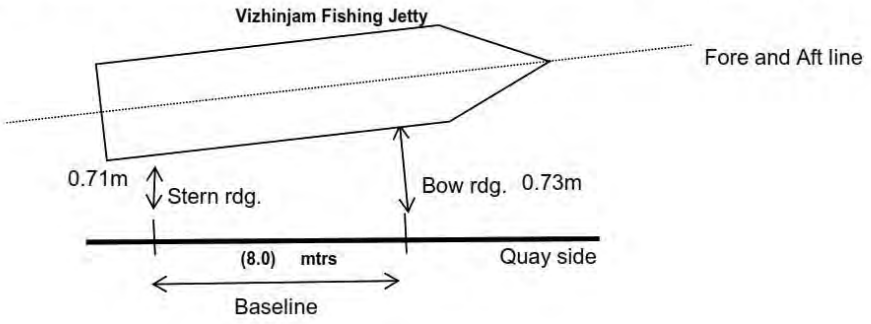
The calculated heading of the vessel was compared with the recorded gyrocompass heading to derive a calculated-observed (C-O) value, which was entered into the navigation software before commencing the survey. The gyro calibration for the month of April 2022 is provided in the figure below.

GYRO CALIBRATION
(Quay Offset Method)

Job	**AVPPL Shoreline Monitoring**	**Job No**	**P167-19**
Client	**AVPPL**	**Vessel**	**MV Samuel 3**
Location	**Vizhinjam Fishing Jetty**	**Date**	**19-Apr-22**
Gyro S/N	**5829R86695**		

Quay heading(T)	**Baseline length(m)**	**Gyro Name : TRIMBLE**	**Quayside on:**
45.63	**8.00**	**S/No. 5829R86695**	**Starboard**

Observations				**Calculations**			
Time	Gyro (true)	Bow	Stern	Calc. angle	Calculated Heading	True Quay Hdg	C-O
10:40:00	45.9	0.7	0.8	0.72	45.18	45.63	0.45
10:40:10	45.6	0.6	0.9	2.15	43.45	45.63	2.18
10:40:20	45.4	0.8	0.5	-2.15	47.55	45.63	-1.92
10:40:30	45.7	0.8	0.9	0.72	44.98	45.63	0.65
10:40:40	45.6	0.9	0.7	-1.43	47.03	45.63	-1.40
10:40:50	45.4	0.5	0.7	1.43	43.97	45.63	1.66
10:41:00	45.5	0.8	0.5	-2.15	47.65	45.63	-2.02
Average	**45.59**	**0.73**	**0.71**	**-0.10**	**45.69**	**45.63**	**-0.06**



Note: Drawing not on scale only for representaion purpose

Signed			
Designation	**Name**	**Signature**	**Date**
Surveyor	**Vishnu Haridas**		**19-Apr-22**
Party Chief	**Amal M Thahir**		**19-Apr-22**

Figure 5-9: Gyrocompass Calibration on board MV Samuel 3

5.8 Turbidity Monitoring

Optic sensors manufactured by Ponsel, France were used to measure the turbidity at all locations. The sensors are installed on a 6m buoy which houses a telemetry module. A battery which is charged by solar panels fitted on the buoy is used to power the system. The buoy is deployed on a two-point mooring system as shown in the figure below.

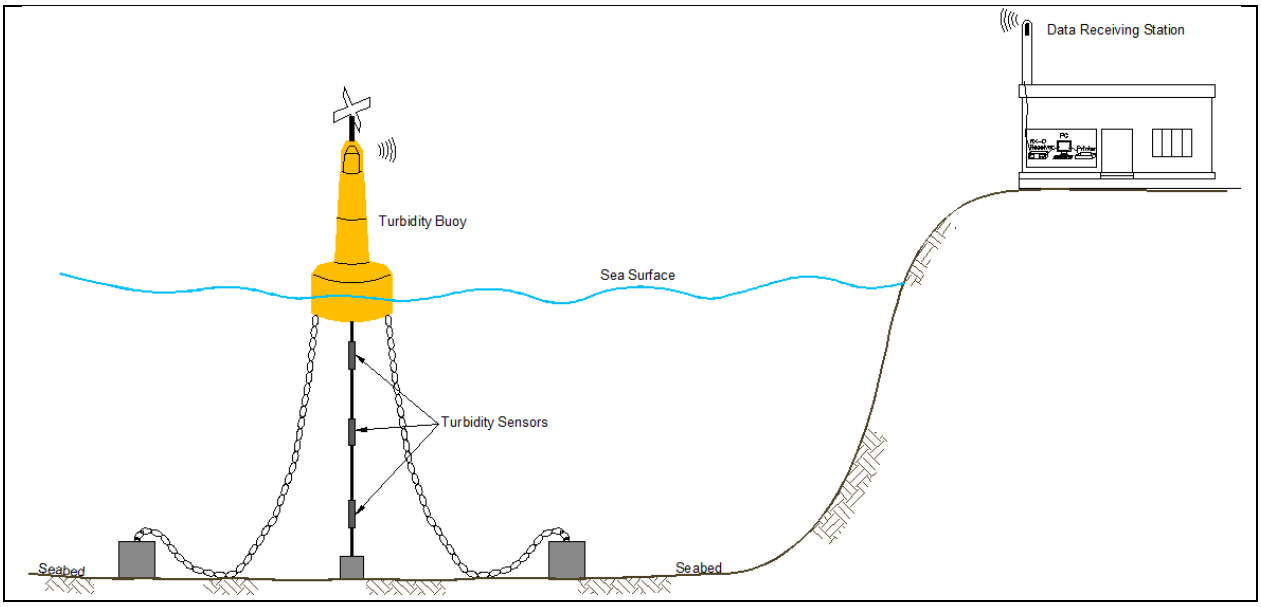


Figure 5-10: Turbidity buoy Mooring Diagram

The sensor details are provided below:

Make	:	Ponsel by Aqualabo France
Sensor Type	:	Nephelo/TU
Range	:	0 to 2000 NTU

The data from the turbidity buoys was transmitted and recorded on the server at an interval of every 10 minutes. A photograph of a turbidity buoy is shown in the figure below.

Figure 5-11: Turbidity Buoy-3

6 SURVEY RESULTS

6.1 Tidal Measurements

The tides were observed near the Coast Guard jetty. The tide is referenced to the chart datum. The jetty top value has been fixed at 2.711m above Chart Datum, and the sensor was lowered to 5.10m below the jetty top, corresponding to a correction factor of 2.389m. An image of the TBM is provided below:

Figure 6-1: Location of TBM

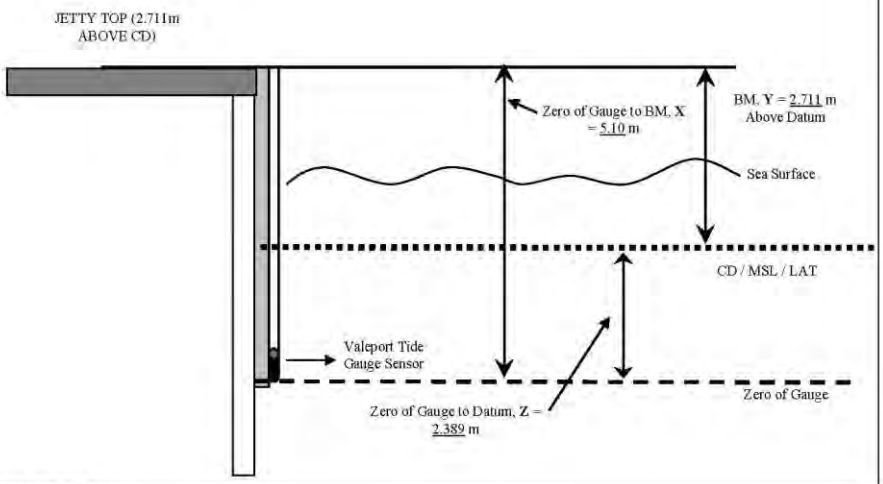
The offset calculation of the Tidemaster tide gauge based on the 'jetty top' value is given in the figure below:

TIDE GAUGE INSTALLATION

Job Number	P199-22	**Project**	Shoreline Monitoring at Vizhinjam
Client	Adani Vizhinjam Port Pvt. Ltd.		
Location	Vizhinjam	**Installation Date**	14/07/2022
Tide Gauge Sr. No.	75804	**Party Chief**	Amal Thahir

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	**Amal Thahir / Vishnu K.**
Date	**28/06/2022**

Checked the level from zero of the gauge to BM on: 14/07/2022

Calculations:

X, Length from Bench Mark to Zero of Tide Gauge	**5.10 m**
Y, Level of Bench Mark above Datum	**2.711 m**
Z, Tide Correction factor, Z=X - Y	**2.389 m**
Tide height in m above Datum = Raw Tide reading - Z	

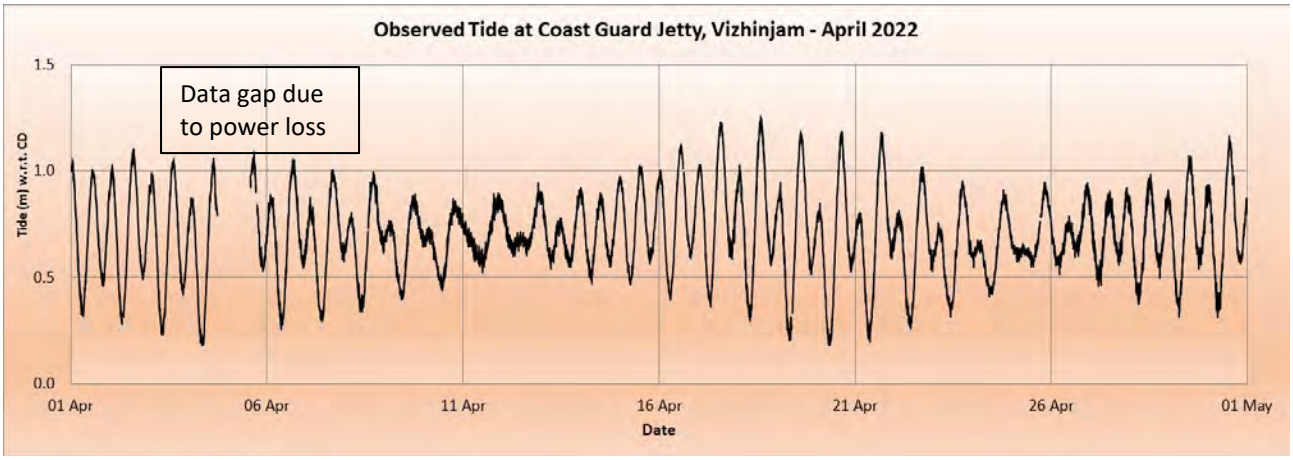
Signature:

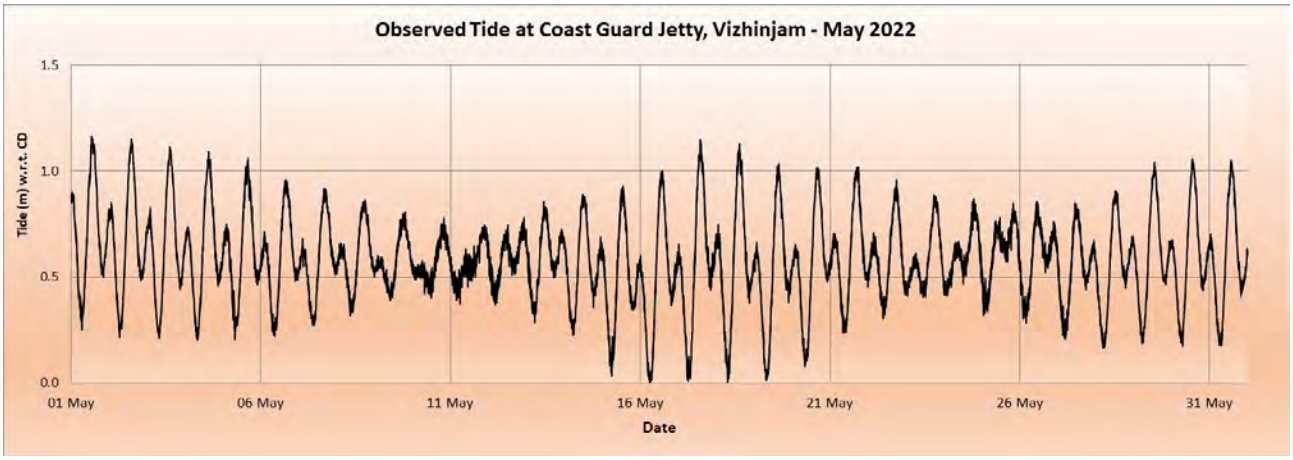
Surveyor / Engineer	**Vishnu K.**
Party Chief	**Amal Thahir**

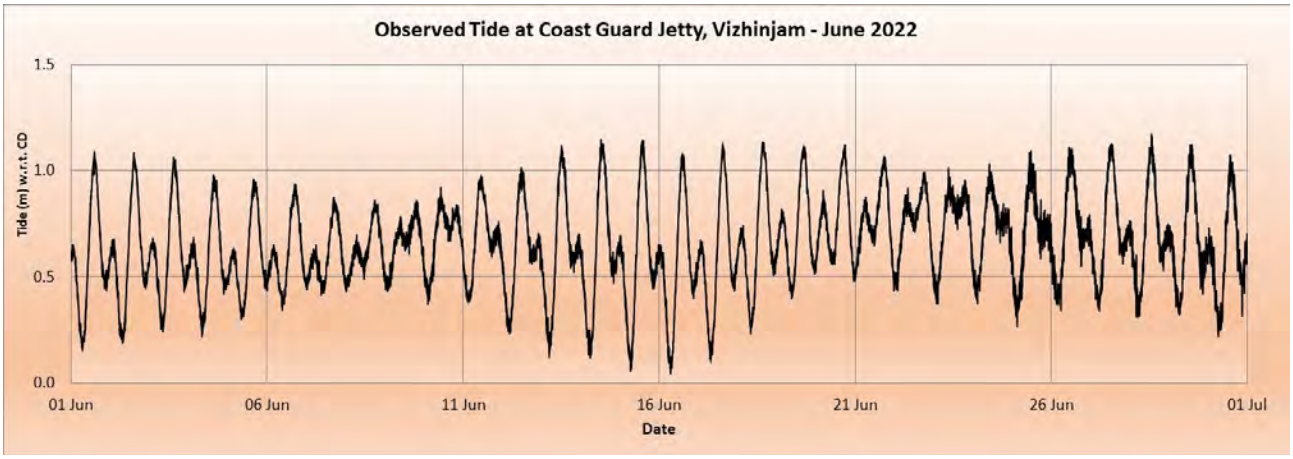
DOC-SAC Tide Gauge Installation Rev 0

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.







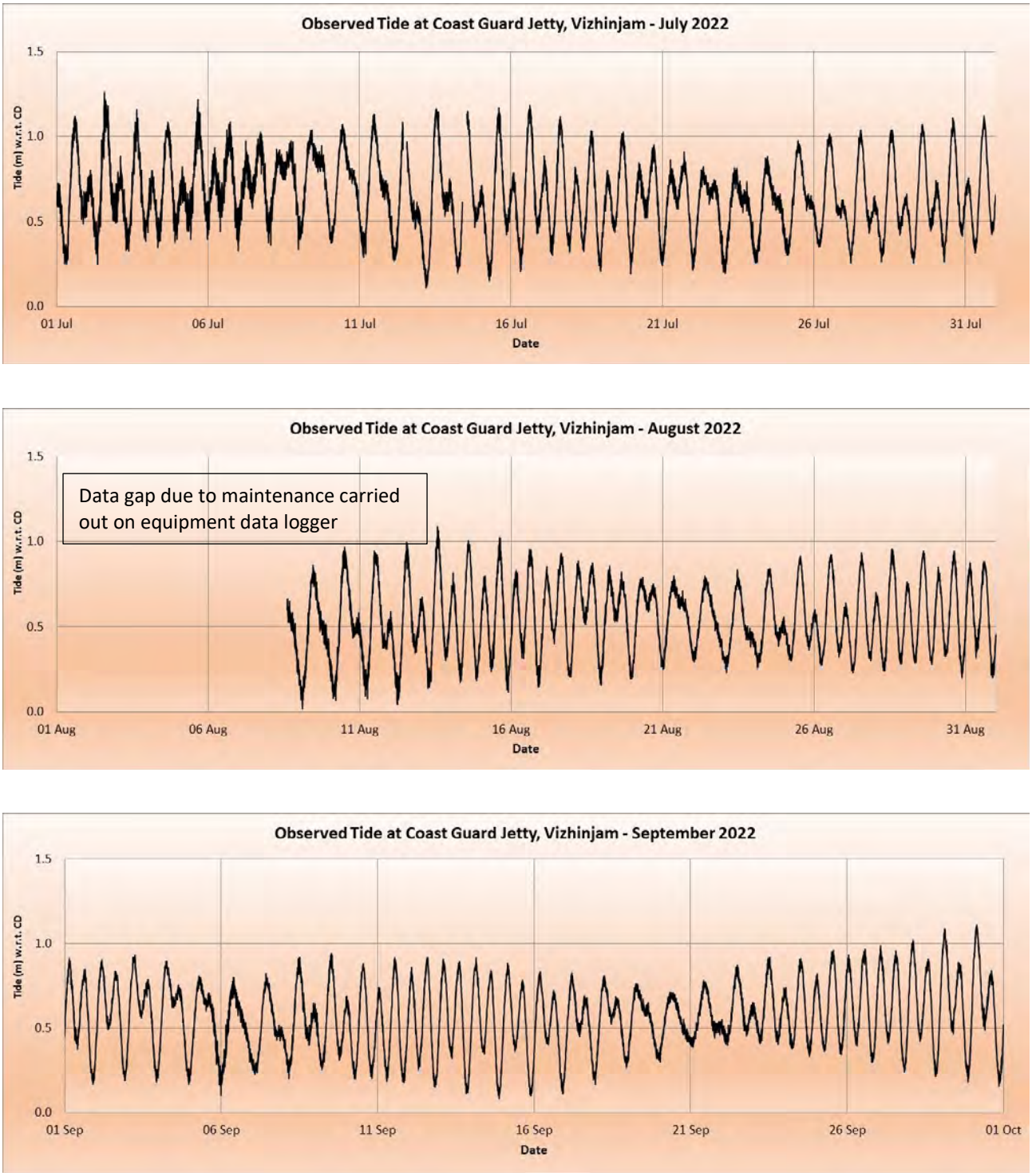


Figure 6-3: Time series of tide

6.2 Wave Measurements

The data from the WRB (provided by NIOT) was downloaded and processed to produce the time series and rose diagram, which are provided below:

Refer to the following rose plots of significant height (Hs) v/s direction for the entire period from April to September 2022:

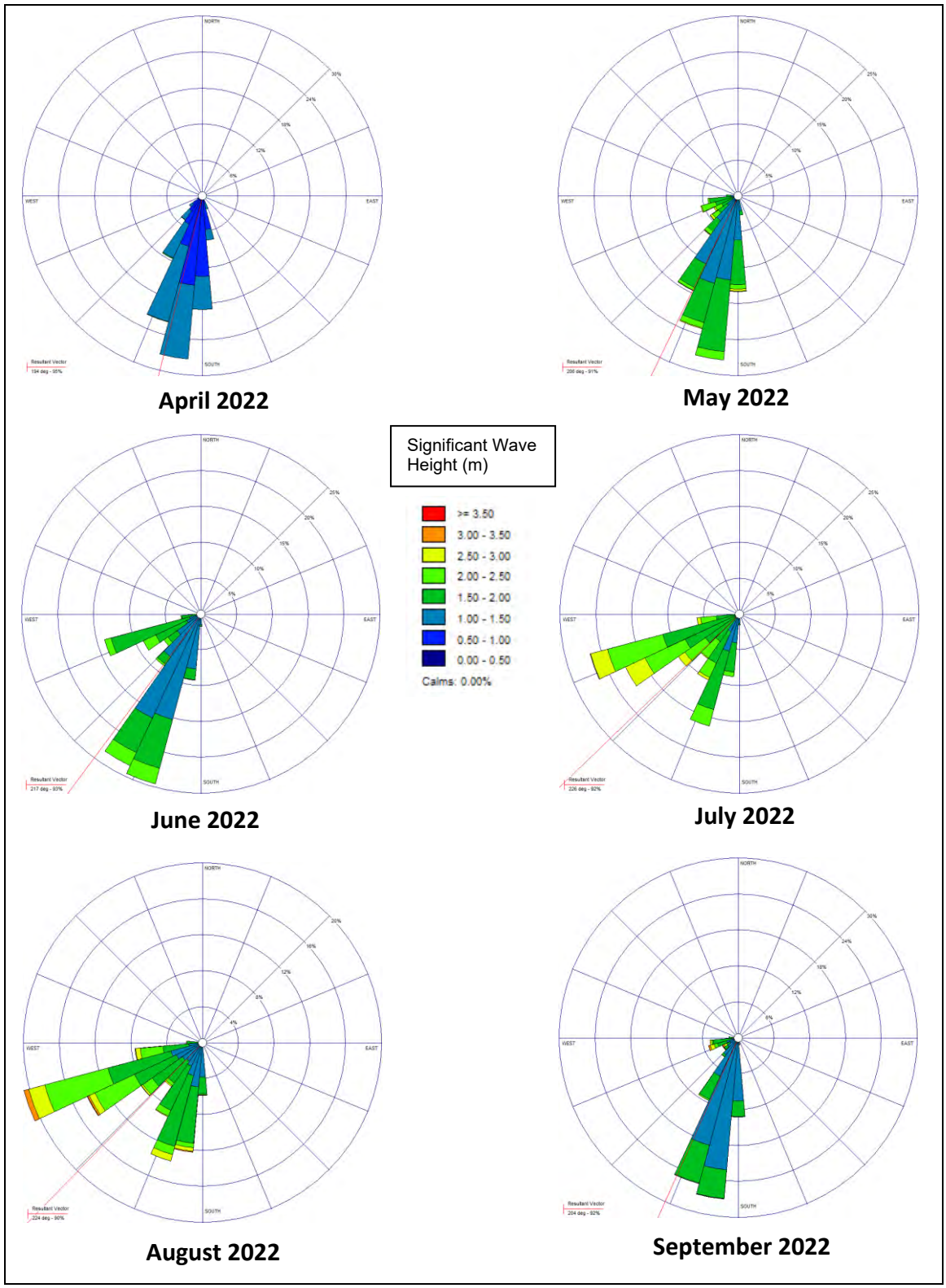


Figure 6-4: Wave Rose (Hs in metre v/s Direction)

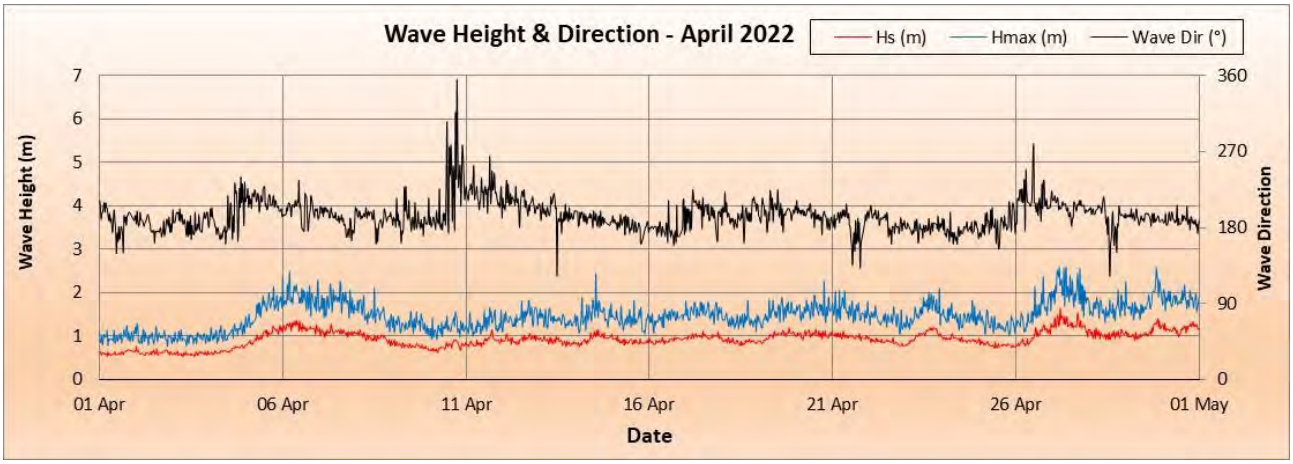
The following table provides the monthly maximum significant wave height (Hs) and wave period (Tp) observed during the period from April to September 2022.

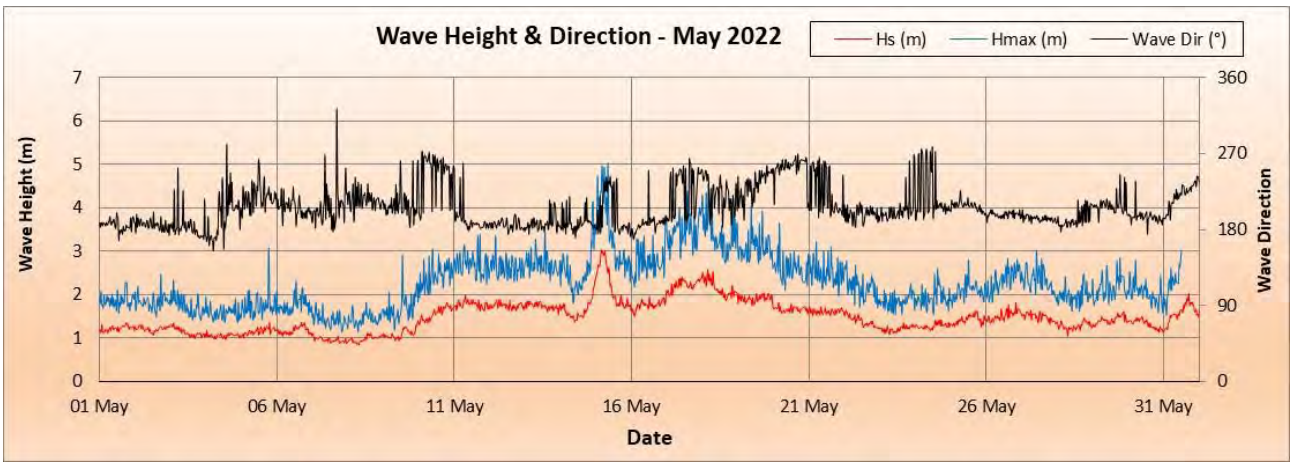
Table 6-1: Monthly maximum Hs, Hmax and Tp

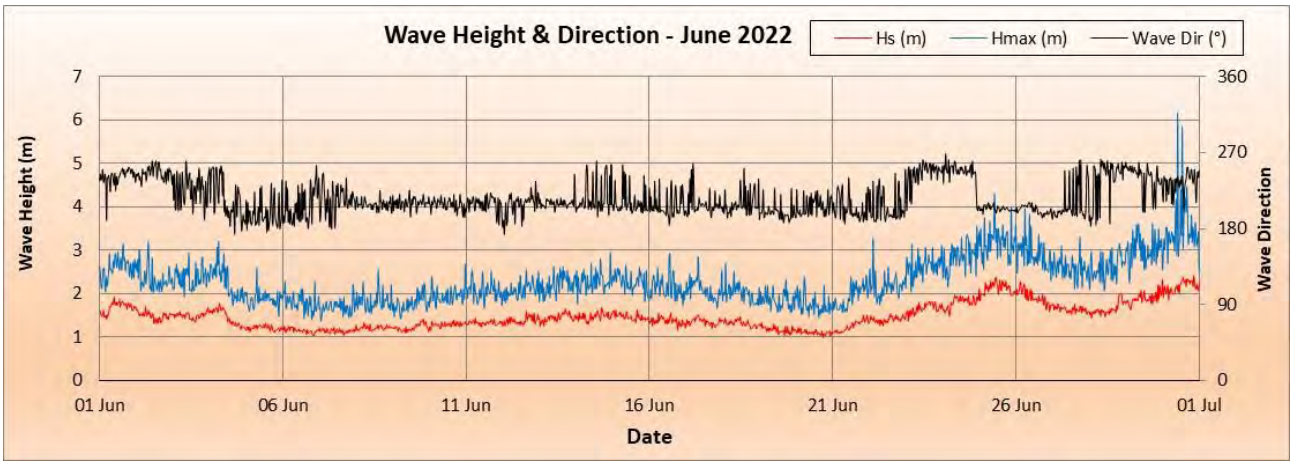
Maximum significant wave height (Hs), Hmax and Maximum wave period (Tp)				
Month	**Hs (m)**	**Predominant Direction (°)**	**Hmax (m)**	**Tp (sec)**
April 2022	1.64	194	2.59	20.00
May 2022	3.03	206	5.04	20.00
June 2022	2.42	217	6.18	20.00
July 2022	3.01	226	6.41	20.00
August 2022	3.51	224	5.96	22.20
September 2022	3.57	204	6.87	18.18

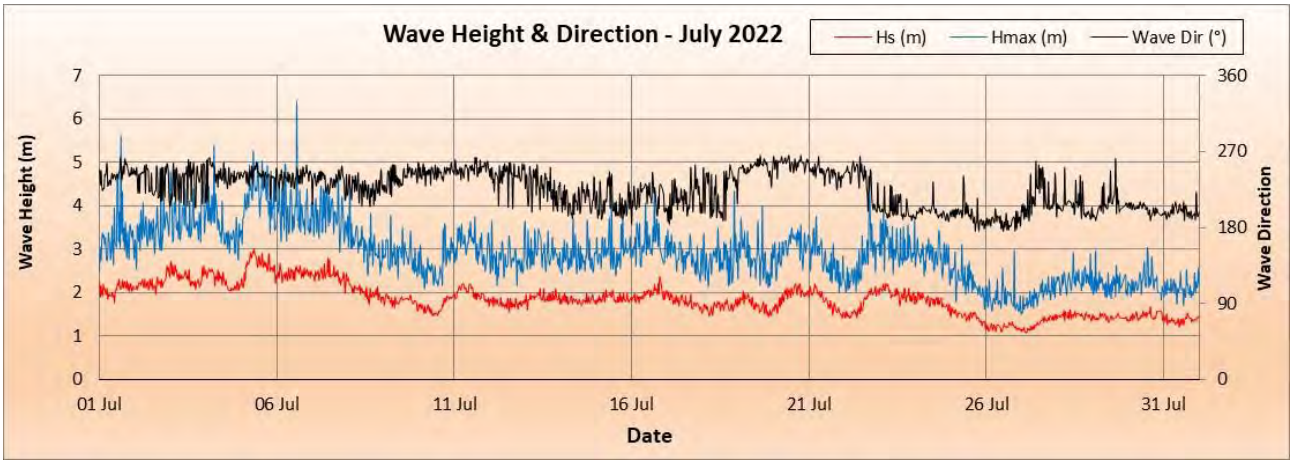
The above table indicates that with the onset of monsoon, the wave heights increased.

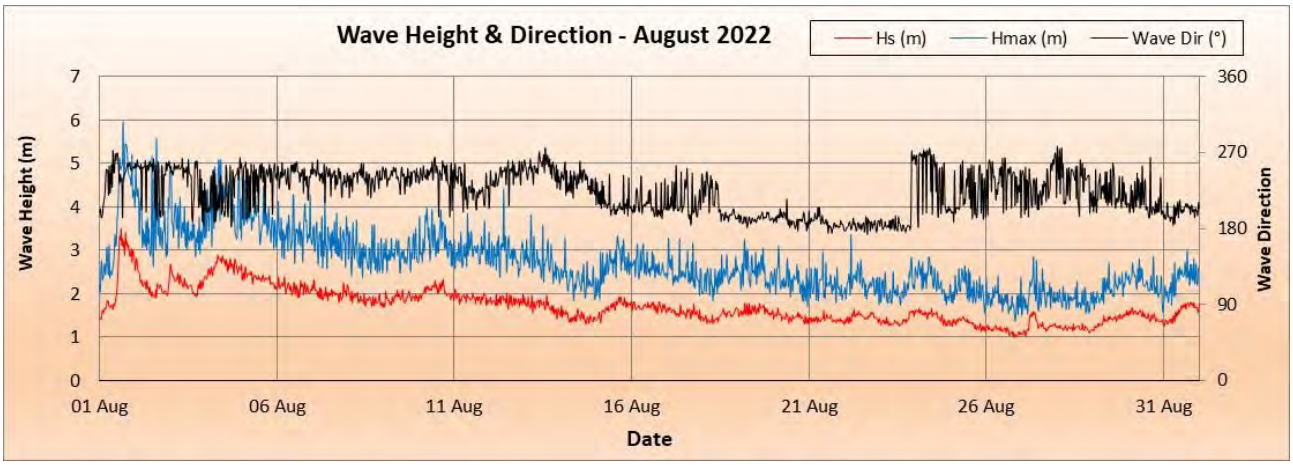
The time series of wave data from April to September 2022 is shown below.


Wave Height & Direction - April 2022
Hs (m)
Hmax (m)
Wave Dir (°)
Wave Height (m)
Wave Direction
0
1
2
3
4
5
6
7
0
90
180
270
360
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Date


Wave Height & Direction - May 2022
Hs (m)
Hmax (m)
Wave Dir (°)
Wave Height (m)
Wave Direction
0
1
2
3
4
5
6
7
0
90
180
270
360
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Date


Wave Height & Direction - June 2022
Hs (m)
Hmax (m)
Wave Dir (°)
Wave Height (m)
Wave Direction
0
1
2
3
4
5
6
7
0
90
180
270
360
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Date





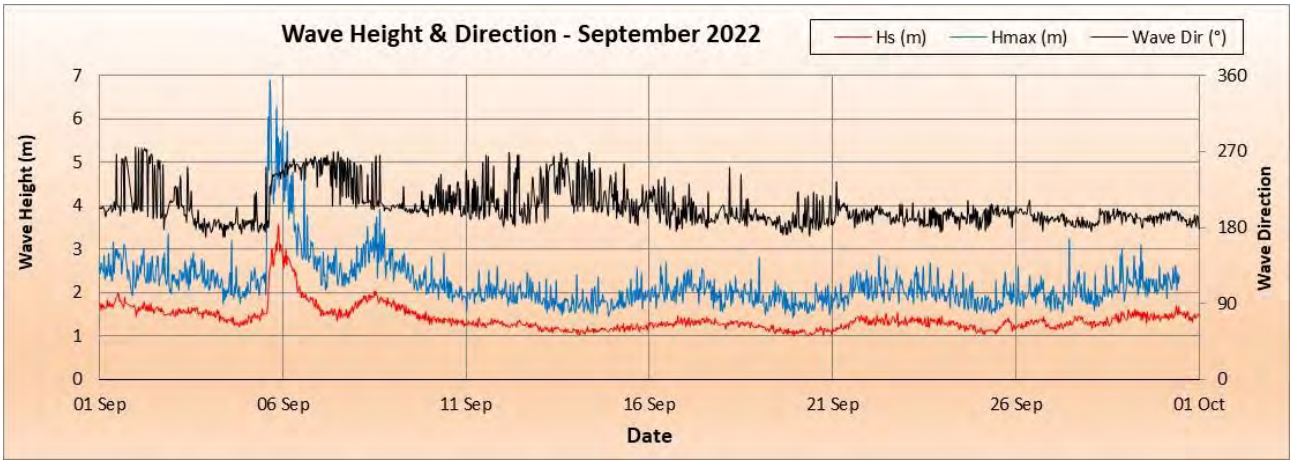


Figure 6-5: Time series of wave parameters

6.3 Current Measurements

Current meters were deployed at four locations during for monsoon 2022 period to measure the speed and direction of the current at three different levels, i.e., surface, mid-depth and near bottom.

The following table gives the details of the ADCPs in the survey area for the monsoon 2022 season.

Table 6-2: ADCP mooring locations

Location	Water Depth (m)	Latitude	Longitude	Frequency
P1 (Vizhinjam)	22.1	08° 21' 55.4"N	76° 58' 51.6"E	600 kHz
P2 (Poovar)	23.1	08° 17' 35.8"N	77° 04' 03.5"E	600 kHz
P3 (Pachalloor)	21.9	08° 24' 08.6"N	76° 56' 16.1"E	600 kHz
P4 (Mulloor)	22.9	08° 21' 42.3"N	76° 59' 33.9"E	600 kHz

Note: The retrieval of the current meters is still pending due to continued inclement weather conditions and due to the local protests since August 2022. The results of the current measurements shall be furnished in the next half yearly report

6.4 Measurement of Meteorological Parameters

The automatic weather station was installed on the terrace of the Port Control Office building. The wind data from April to September 2022 is compiled and presented in the form of rose plots below.

Note: Due to water ingress into the data logger of the AWS system on 12th June, no data is available from 12th June to 29th July 2022 as the unit had to be sent for repairs. The data logger developed a snag again on 6th August 2022. The system was disassembled and sent again for maintenance. As a result of increased agitation faced from the locals, entry to the port was prohibited and installation of the AWS on top of the Port Office building is pending. Hence, no AWS data is available for the month of September 2022.

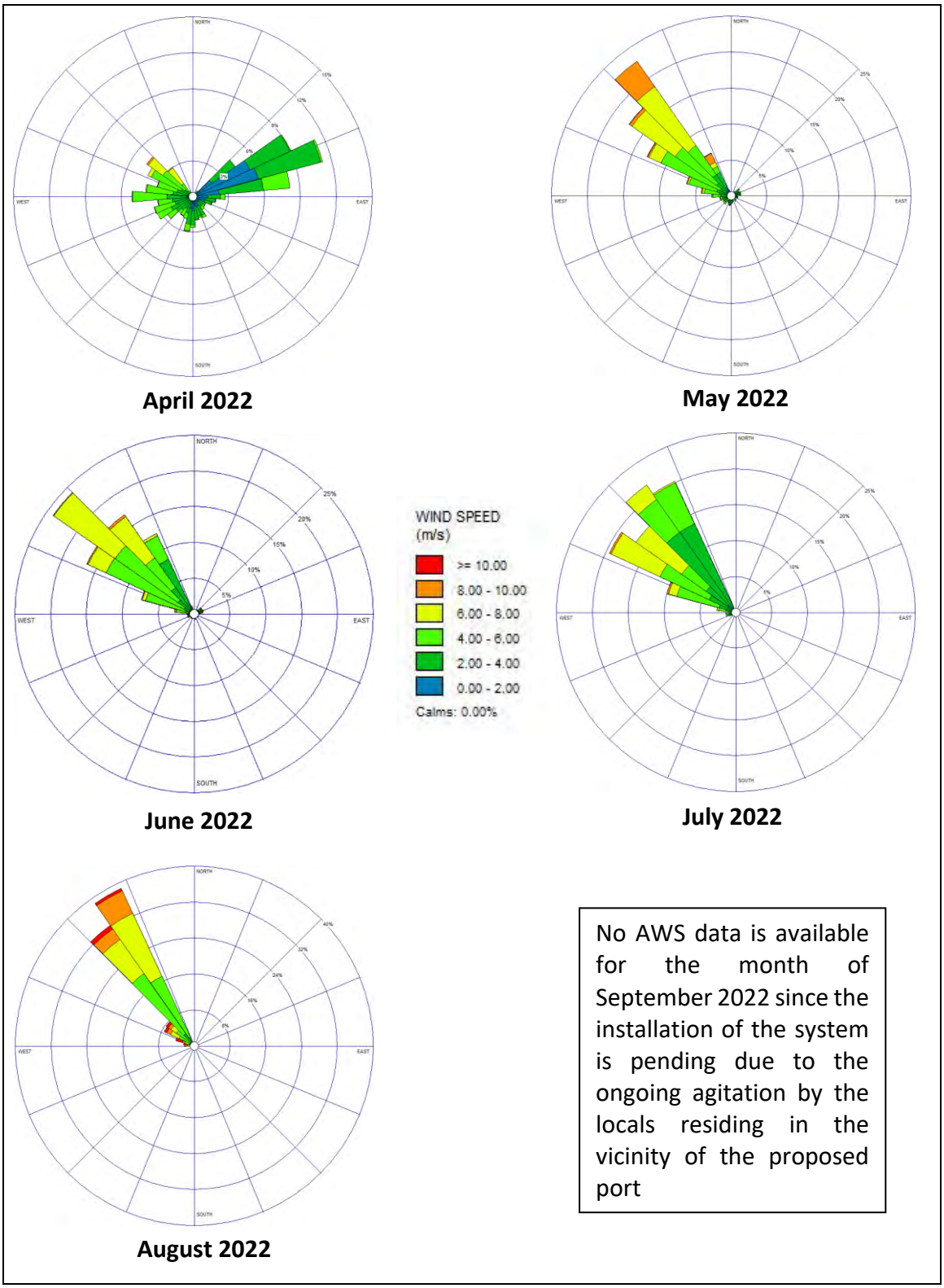


Figure 6-6: Wind rose (Speed in m/s vs direction)

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

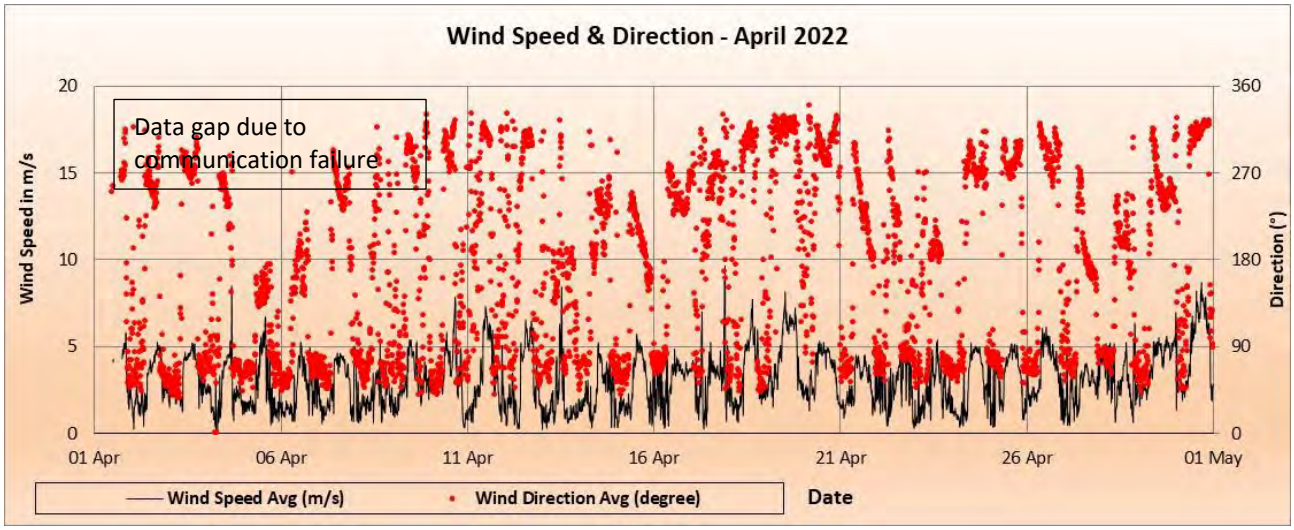
Table 6-3: Monthly maximum wind speed from landside

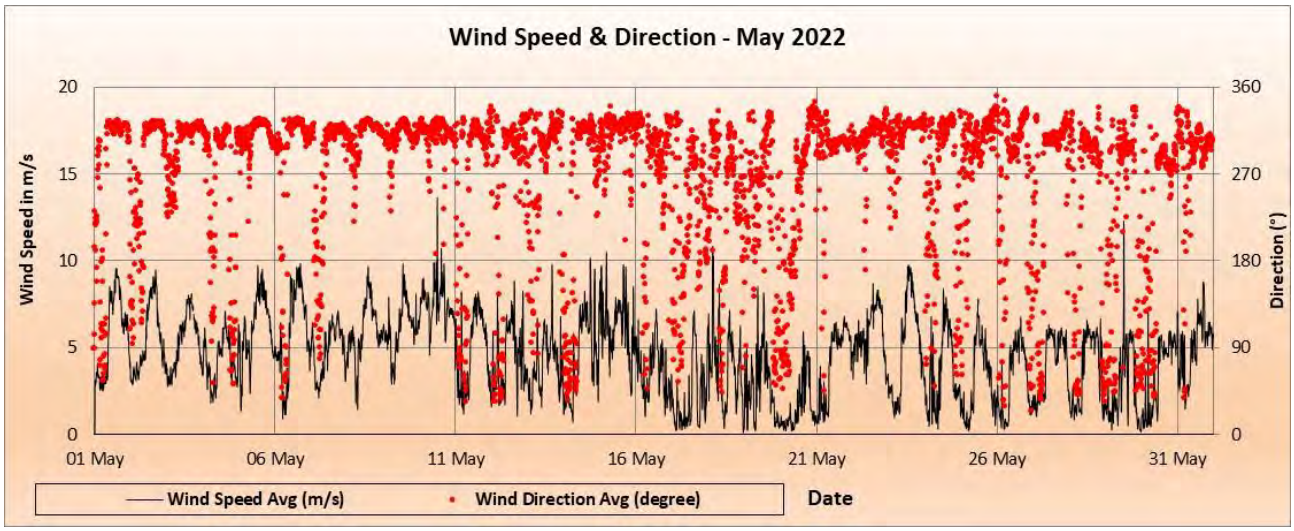
Month	Wind Speed (m/s)	Predominant Direction (°)
April 2022	6.72	74.72
May 2022	8.22	95.43
June 2022	6.01	83.02
July 2022	5.62	123.91
August 2022	8.17	115.75
September 2022	Data not available	

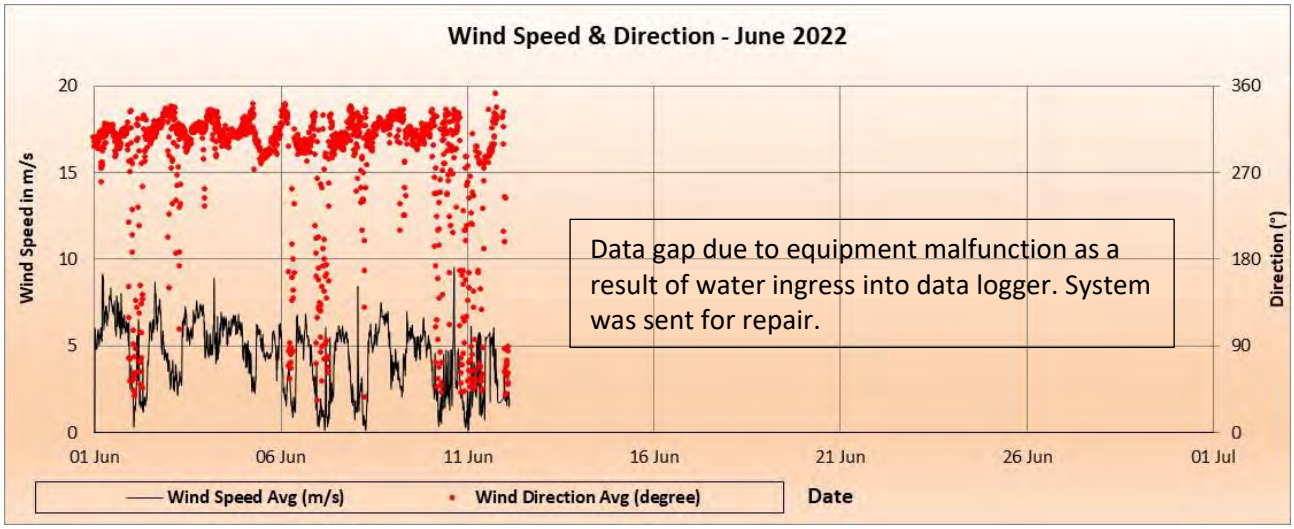
Table 6-4: Monthly maximum wind speed from seaside

Month	Wind Speed (m/s)	Predominant Direction (°)
April 2022	9.58	267.33
May 2022	13.64	307.59
June 2022	9.47	309.31
July 2022	9.52	310.73
August 2022	19.68	322.97
September 2022	Data not available	

The time series of wind data from April to September 2022 is shown below.


Wind Speed & Direction - April 2022
Data gap due to communication failure
Wind Speed in m/s
Direction (°)
0
5
10
15
20
0
90
180
270
360
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 2022
Wind Speed in m/s
Direction (°)
0
5
10
15
20
0
90
180
270
360
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 2022
Data gap due to equipment malfunction as a result of water ingress into data logger. System was sent for repair.
Wind Speed in m/s
Direction (°)
0
5
10
15
20
0
90
180
270
360
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Date

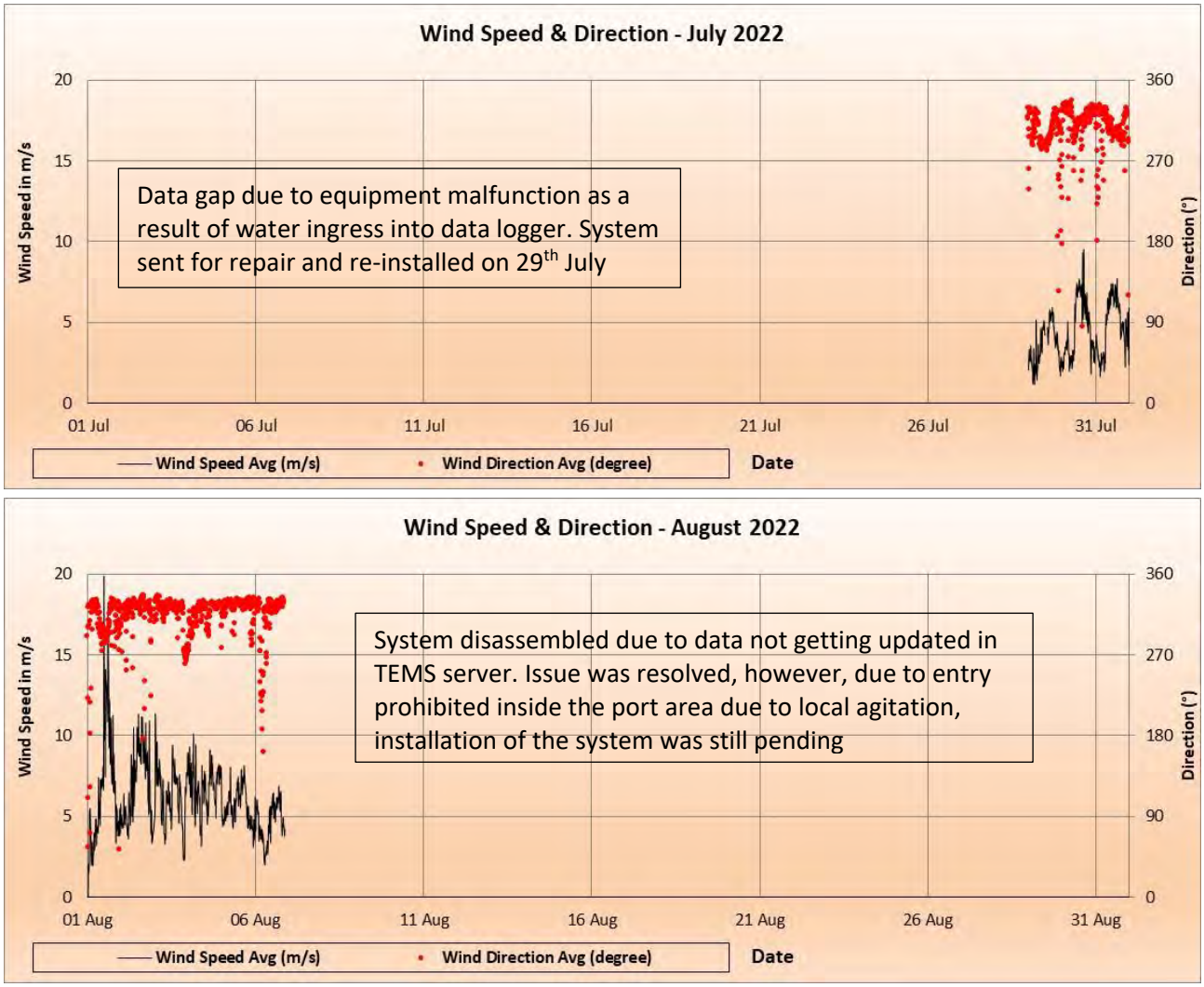


Figure 6-7: Time series of wind data

The percentage occurrence tables for atmospheric pressure, temperature and relative humidity for the period of April to September 2022 are shown below.

Table 6-5: Frequency distribution of atmospheric pressure

Frequency Distribution	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
Atm. Pressure (mb)	**Percentage Occurrence**					
<1000	0.00	0.00	0.00	0.00	0.00	Data not available
1000-1004	1.66	11.01	0.58	8.33	5.78	
1004-1008	55.76	68.03	83.62	83.33	85.68	
>1008	42.58	20.96	15.80	8.33	8.54	
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	

Table 6-6: Frequency distribution of temperature

Frequency Distribution	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
Temperature (°)	**Percentage Occurrence**					
20-24	0.83	0.43	1.99	0.00	5.29	Data not available
24-28	45.57	66.75	85.81	100.00	94.71	
28-32	53.60	32.83	12.20	0.00	0.00	
>32	0.00	0.00	0.00	0.00	0.00	
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	

Table 6-7: Frequency distribution of relative humidity

Frequency Distribution	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
Rel. Humidity (%)	**Percentage Occurrence**					
50-60	0.00	0.04	0.00	0.00	0.00	Data not available
60-70	3.30	0.87	0.00	0.00	0.00	
70-80	46.73	17.04	8.35	0.00	2.89	
>80	49.98	82.04	91.65	100.00	97.11	
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	

The frequency histograms for atmospheric pressure, temperature and relative humidity for the period of April to September 2022 are shown below.

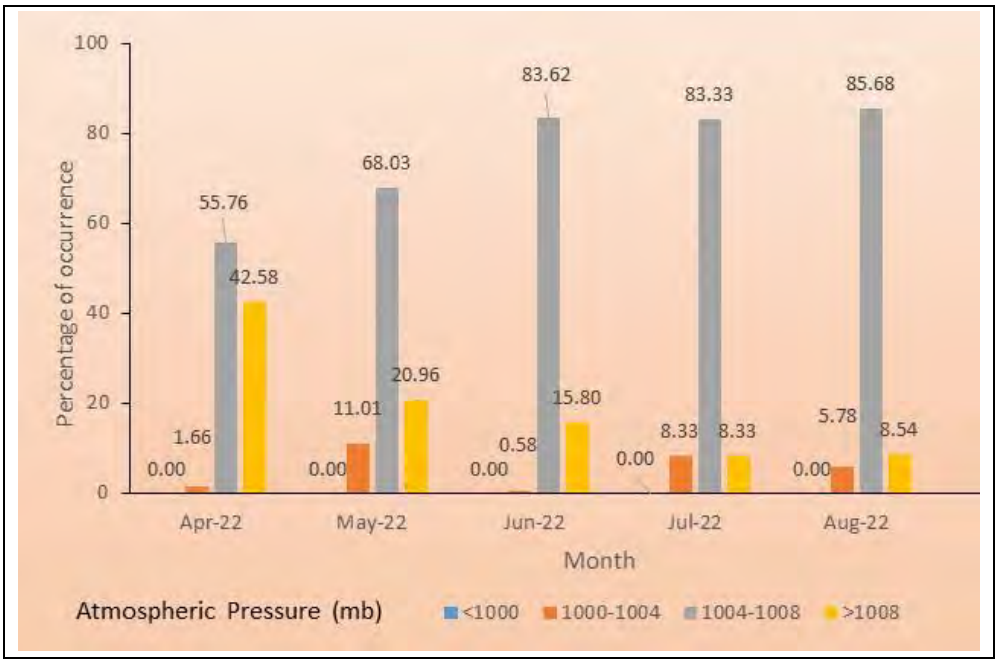


Figure 6-8: Histogram of atmospheric pressure

Figure 6-9: Histogram of temperature

①

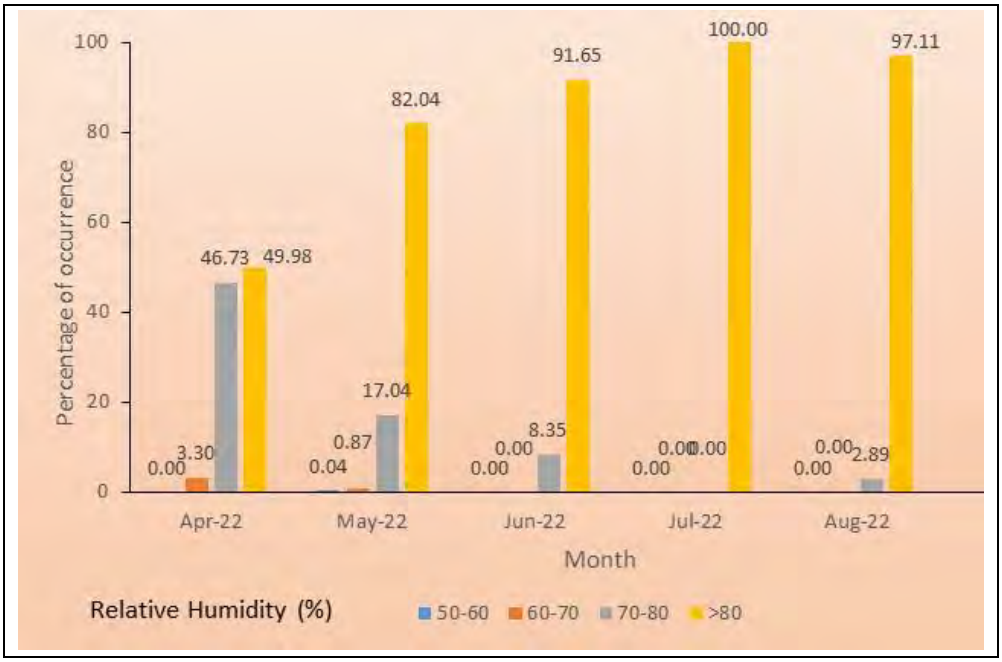


Figure 6-10: Histogram of relative humidity

The following table shows the amount of rainfall received during the entire period from April to September 2022.

Table 6-8: Cumulative rainfall

Month	Cumulative Rainfall (mm)
April 2022	50.6
May 2022	144.6
June 2022	124.8
July 2022	24.2
August 2022	86.6
September 2022	Not Available

The histogram of rainfall for the entire period is provided in the image below.

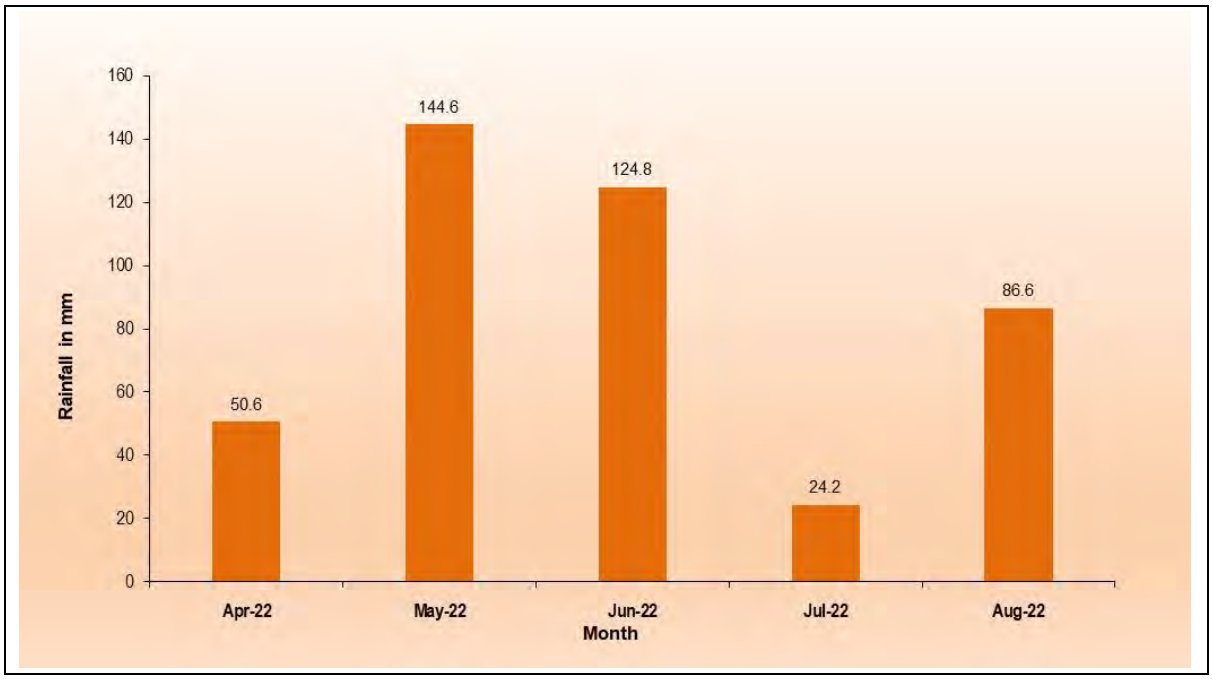


Figure 6-11: Histogram of cumulative rainfall

① The data reveals that the temperature increased gradually from April to August 2022. The maximum occurrence of relative humidity readings greater than 80% was observed in the month of July 2022 as a result of active monsoon. During the period of observation, the majority of atmospheric pressure readings were between 1004-1008 mb. The cumulative rainfall in August 2022 was 86.6mm. Due to the AWS malfunctioning, the monsoon rainfall is not depicted accurately.

6.5 Littoral Environment Observations

The LEO was carried out at all 81 locations from April to July 2022. In the month of August 2022, 64 locations were covered, and 54 locations were covered in September 2022. The locations in which the LEO could not be carried out was 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 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 northerly trend in the pre-monsoon 2022 period and towards south during the monsoon months. 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 2022	23.07	North	CSP 25	Karumkulam
May 2022	27.23	North	CSP 78	Valiyaveli
June 2022	42.39	South	CSP 55	Punthura
July 2022	33.68	South	CSP 78	Valiyaveli
August 2022	21.18	South	CSP 81	Thumba
September 2022	18.12	Bi-directional	CSP 78	Valiyaveli

A pictorial representation of the alongshore current direction the pre-monsoon and monsoon 2022 period is shown in the Google Earth image below.

①

Figure 6-12: Representation of surface current direction from April to September 2022

6.6 Photographic Documentation

Photographic documentation was carried out for all the 81 locations for the months of April to July 2022, coinciding with the cross-shore profiling. Due to the local agitation, photographic documentation could only be carried out 64 locations in the month of August and 54 locations in the month of September 2022.

The latest photographs for the month of September 2022 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.

6.7 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 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 personnel onboard.

There is a steep hill which lies on the CSP 35 line, due to which cross-shore profiling is not possible in the onshore area.

Due to extremely unfavorable weather from the months of May to September 2022 and also due to the local protests, the cross-shore profiling for the offshore region could not be carried out.

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 CRISMATIC 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, Beach and 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, Beach and Seawall
CSP-12			Seawall
CSP-13	ST. MATHEW'S CHURCH	PARUTHIYOOR	Seawall
CSP-14	CHURCH OF CHRIST		Beach and 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 CHURH	KARUMKULAM	Beach
CSP-23			Beach
CSP-24			Beach
CSP-25			Beach
CSP-26			Beach
CSP-27	GOTHAMBU ROAD	PULLUVILA	Beach
CSP-28			Beach
CSP-29			Beach
CSP-30			Beach
CSP-31	ADIMALATHURA CATHOLIC CHURCH	ADIMALATHURA	Beach
CSP-32			Beach

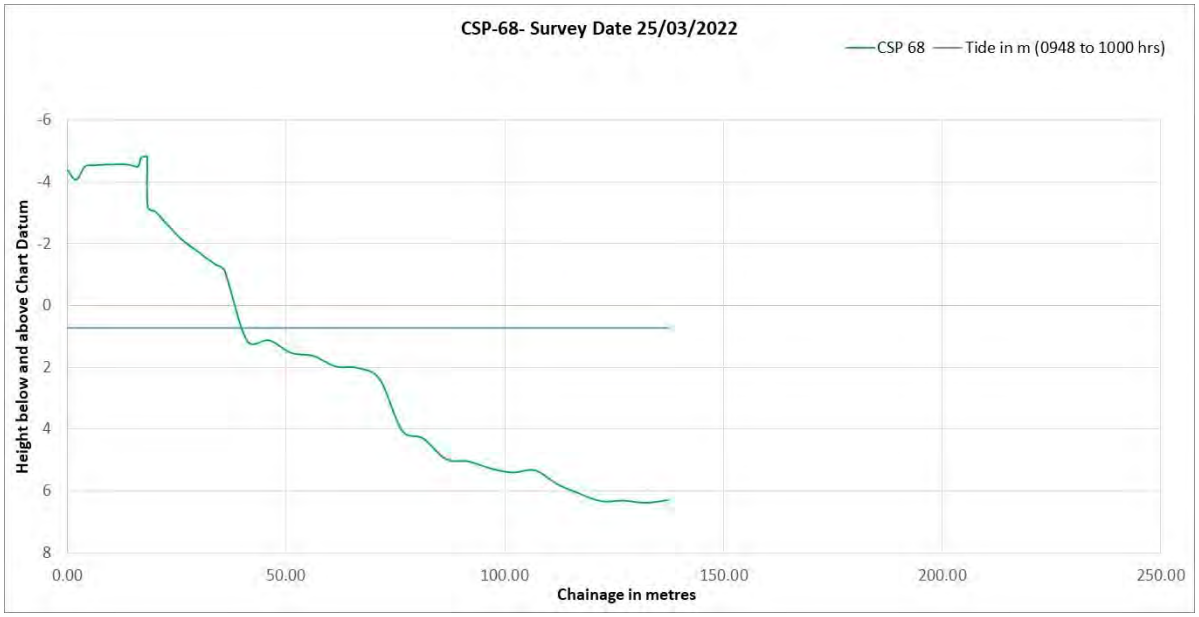
CSP NO.	LANDMARK	LOCATION	SITE CONDITION
CSP-33			Beach
CSP-34			Beach
CSP-35	AZHIMALA TEMPLE	AZHIMALA	Rocky Area
CSP-35A	AZHIMALA TEMPLE	AZHIMALA	Beach
CSP-36	NAGAR BHAGAVATHY TEMPLE	MULLUR	Beach
CSP-37			Beach
CSP-38	ADANI PORT RECLAMATION AREA	ADANI PORT OFFICE VIZHINJAM	Beach
CSP-39			Beach
CSP-40			Beach
CSP-40A			Beach
CSP-41	VIZHINJAM LIGHT HOUSE	KOVALAM	Beach and Rocky Area
CSP-42			Beach
CSP-43			Beach
CSP-44			Beach and Seawall
CSP-45			Beach and Seawall
CSP-46			Beach and Seawall
CSP-47	SAMUDRA BEACH PARK		Beach and 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
CSP-56			Seawall
CSP-57			Groyne Nos. 32 and 33 in the vicinity, Beach and Seawall
CSP-58	BEEMA PALLY	BEEMA PALLY	Groyne Nos. 34 to 36 in the vicinity, Beach and Seawall
CSP-59			Seawall
CSP-60			Groyne No. 37 in the vicinity, Beach and Seawall
CSP-61	CHERIYATHURA SPORTS GROUND	CHERIYATHURA	Groyne Nos. 38 to 42 in the vicinity, Beach and Seawall
CSP-62			Groyne Nos. 43 to 47 in the vicinity, Beach and Seawall

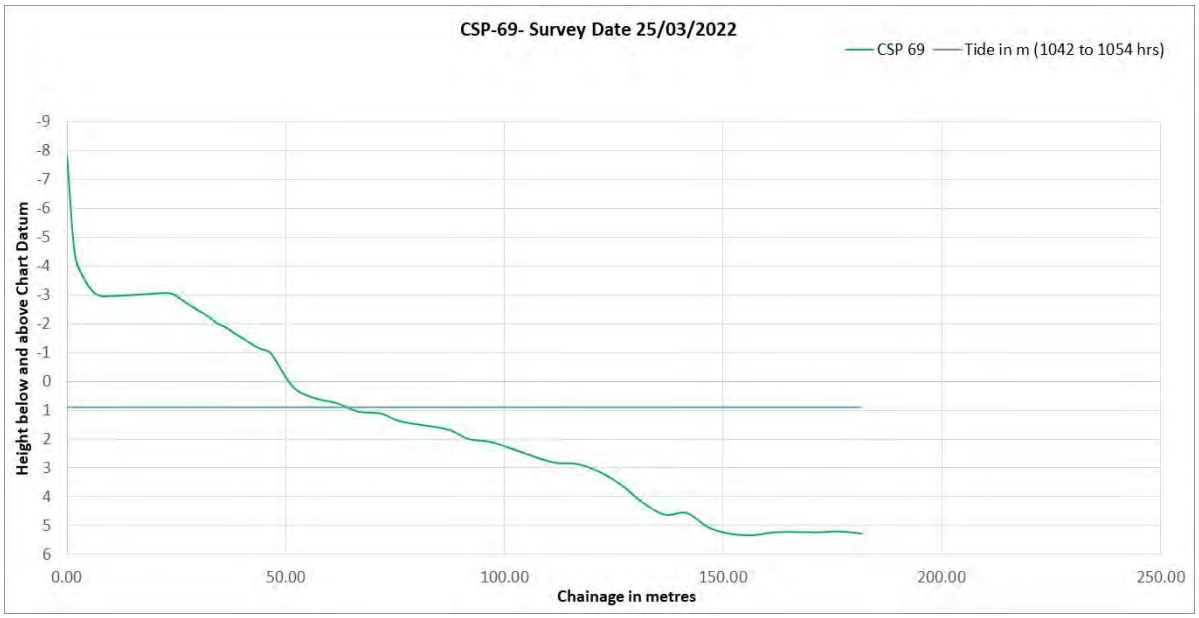
CSP NO.	LANDMARK	LOCATION	SITE CONDITION
CSP-63	VALIYATHURA BRIDGE	VALIYATHURA	Groyne Nos. 48 to 51 in the vicinity, Beach and Seawall
CSP-64			Seawall, Valiyathura Bridge
CSP-65			Seawall
CSP-66			Beach and Seawall
CSP-67			Beach
CSP-68	SHANGUMUGHAM BEACH	SHANGUMUGHAM	Beach
CSP-69			Beach
CSP-70	ST.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

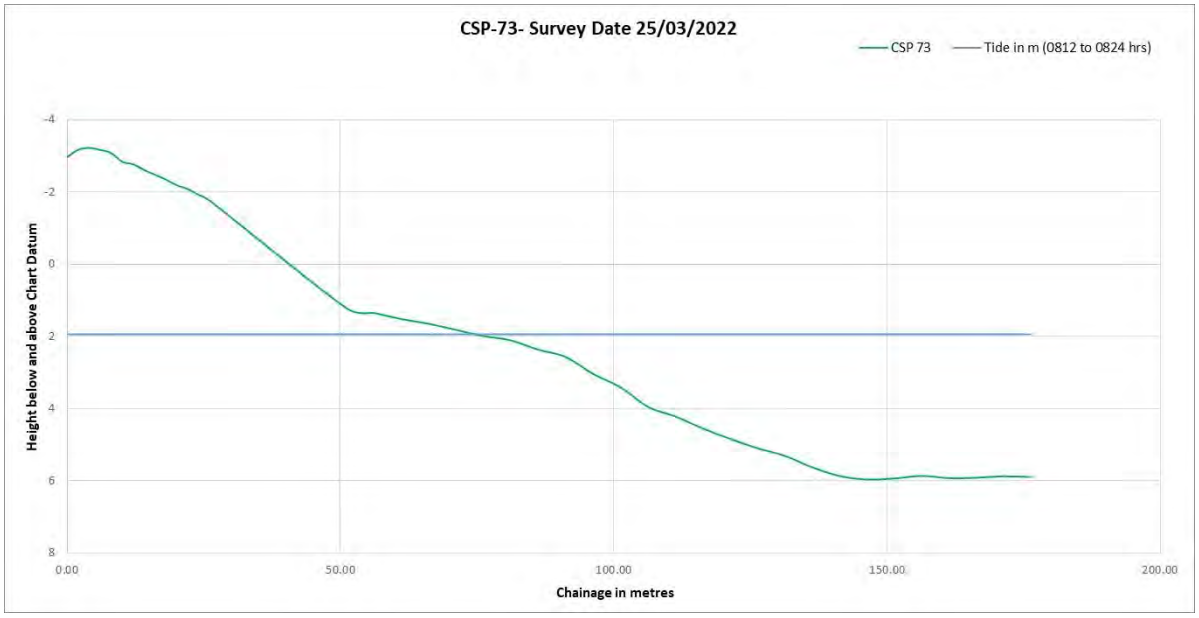
6.8 Near-shore (Sled Survey)

The near-shore survey could only be carried out, in a favourable weather window on 25th June 2022 along 4 lines, i.e, CSP-68, CSP-69, CSP-73 and CSP-74. The activity could not be carried in the other months due to continuous inclement weather conditions.

① The graphs for the lines carried out using pressure sensor in the month of June 2022 are provided below.


CSP-68- Survey Date 25/03/2022
CSP 68
Tide in m (0948 to 1000 hrs)
Height below and above Chart Datum
-6
-4
-2
0
2
4
6
8
0.00
50.00
100.00
150.00
200.00
250.00
Chainage in metres


CSP-69- Survey Date 25/03/2022
CSP 69
Tide in m (1042 to 1054 hrs)
Height below and above Chart Datum
-9
-8
-7
-6
-5
-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



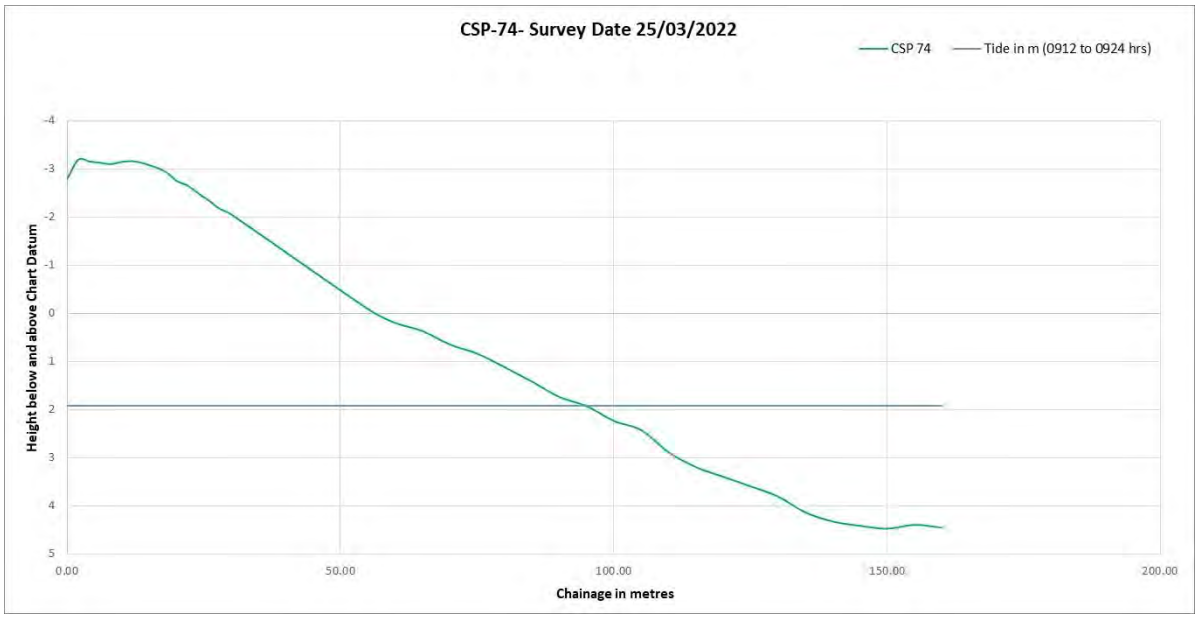


Figure 6-13: Graphs of near-shore survey

6.9 Shoreline Monitoring Survey

The entire 41 km of shoreline was surveyed from April to July 2022. In the month of August 2022, the stretch from CSP 18 to 40 could not be approached due to the local agitation and protests, whereas in the month of September 2022, the stretches from locations 15 to 41 and 53 to 56 could not be surveyed for the same reason. 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.

① The area wise distribution of groynes is shown in the table below:

Table 6-11: Area wise distribution of groynes

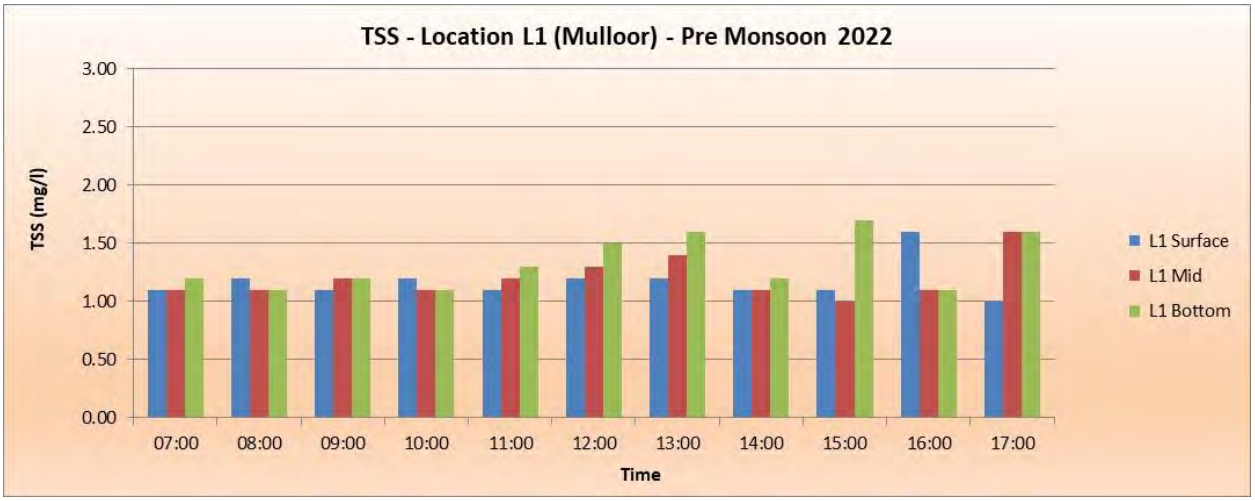
Area	Number of Groynes	North / South of the Port Area
Edappadu Beach	1	South
Vallavilay	12	South
Neerody	11	South
Pozhiyoor	5	South
Panathura	1	North
Punthura	2	North
Beemapally	4	North
Cheriyathura	10	North
Valiyathura	5	North

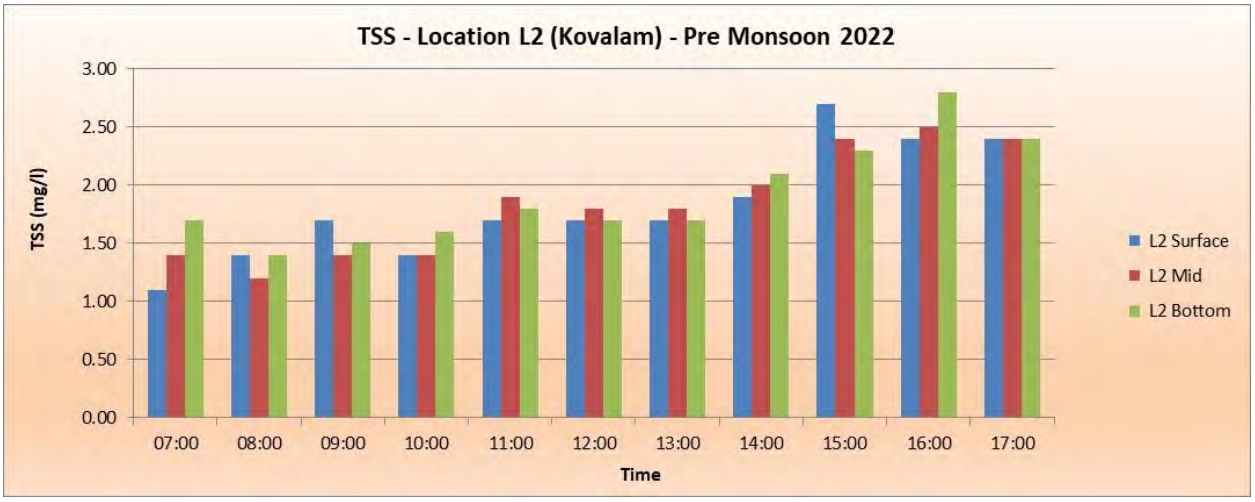
6.10 Water Sampling

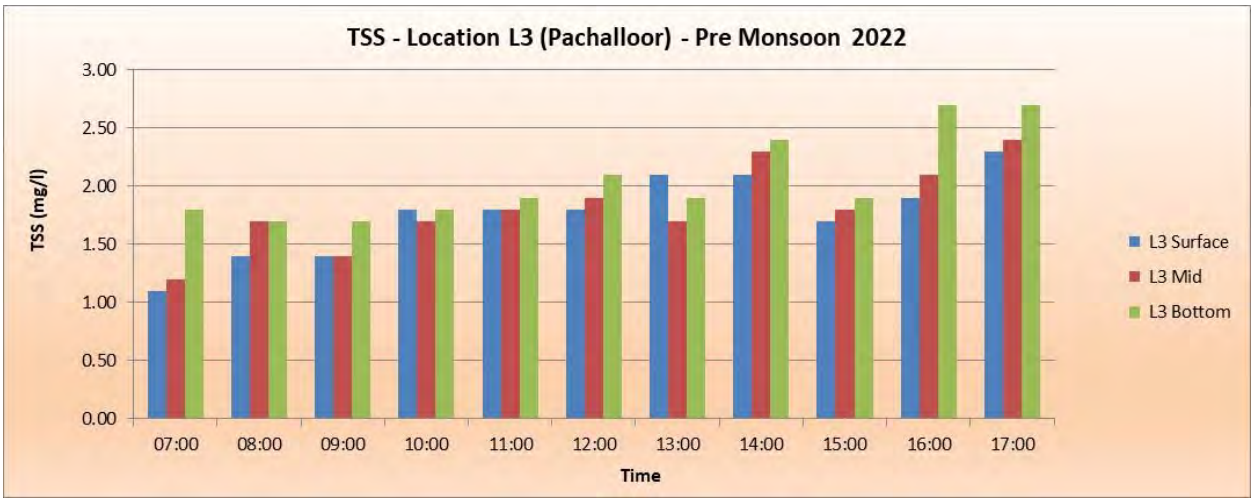
Water samples were collected from 4 locations, namely, L1 (Mulloor), L2 (Kovalam), L3 (Pachalloor) and L4 (Poovar) from three levels: surface, mid-depth and near bottom during the pre-monsoon 2022 season from 15th to 18th April 2022 and the monsoon 2022 season from 21st to 24th June 2022 . The parameters measured were Total Suspended Solids (TSS), turbidity and salinity at NABL accredited laboratory in Kochi (Standard^{s} Environmental & Analytical Laboratories, Accreditation and Approval: NABL as per ISO 17025:2005).

The time series for Total Suspended Solids (in mg/l) for the pre-monsoon 2022 period are provided below.

The time series for Total Suspended Solids (in mg/l) for all the locations for the post-monsoon 2021 period are provided below.


TSS - Location L1 (Mulloor) - Pre Monsoon 2022
TSS (mg/l)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
Time
L1 Surface
L1 Mid
L1 Bottom


TSS - Location L2 (Kovalam) - Pre Monsoon 2022
TSS (mg/l)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
Time
L2 Surface
L2 Mid
L2 Bottom


TSS - Location L3 (Pachalloor) - Pre Monsoon 2022
TSS (mg/l)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
Time
L3 Surface
L3 Mid
L3 Bottom

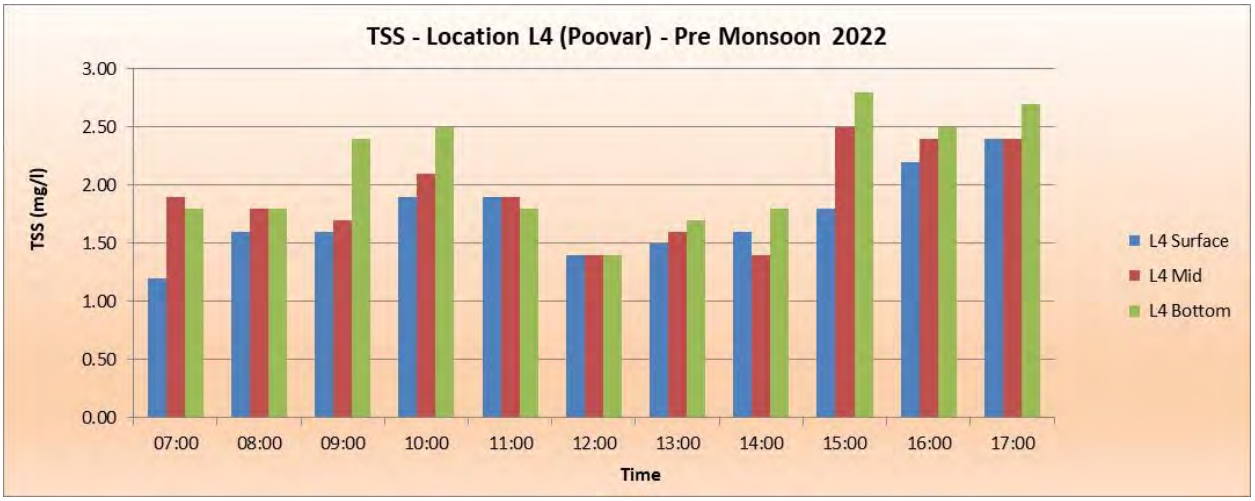
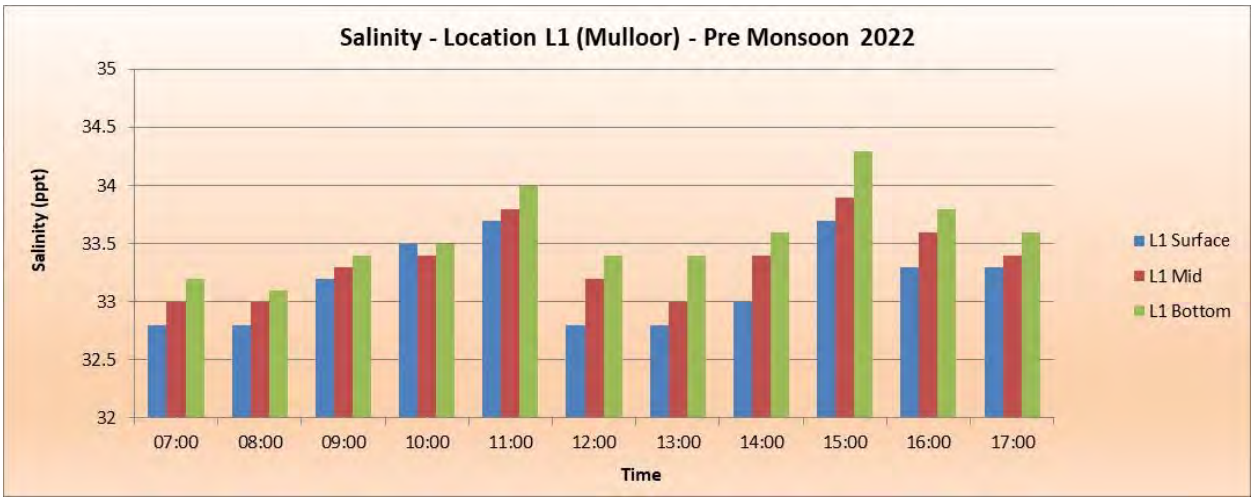
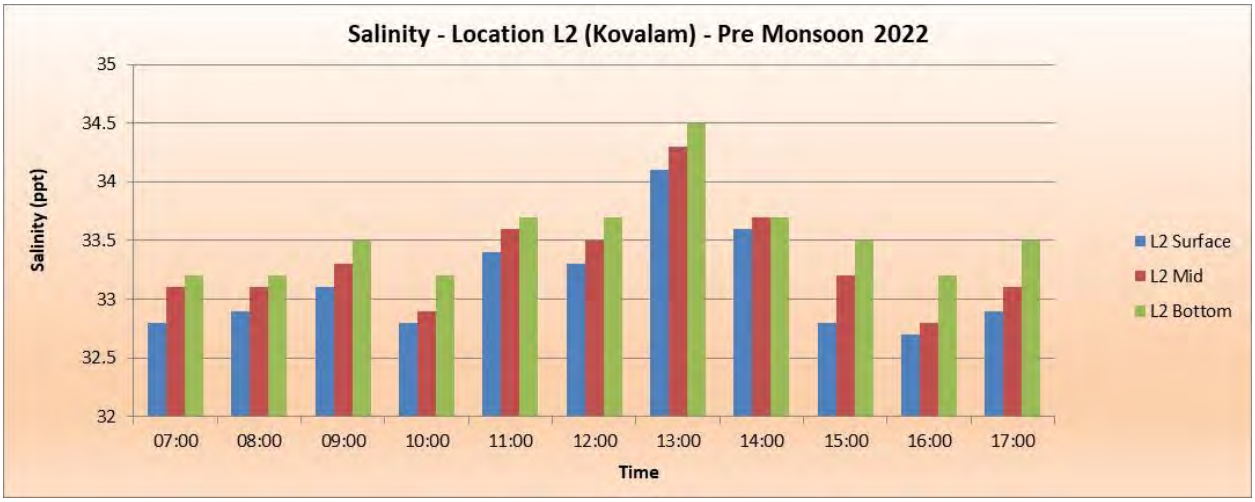


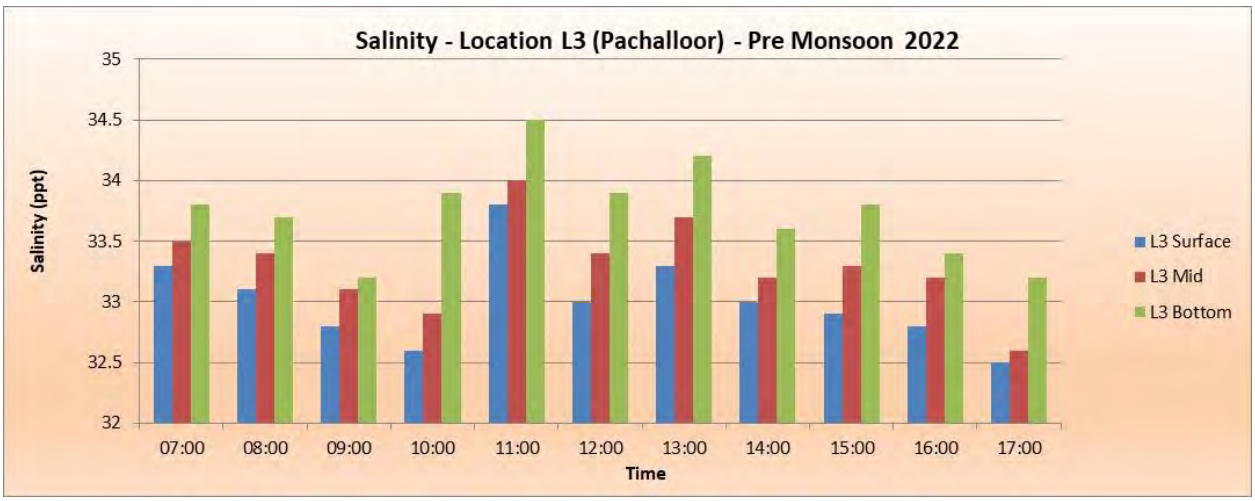
Figure 6-14: Time Series of TSS

The maximum TSS recorded was 2.8 mg/dl near the bottom at Location L4 (Poovar).

The histograms for salinity at all three levels for all the locations are given as follows.







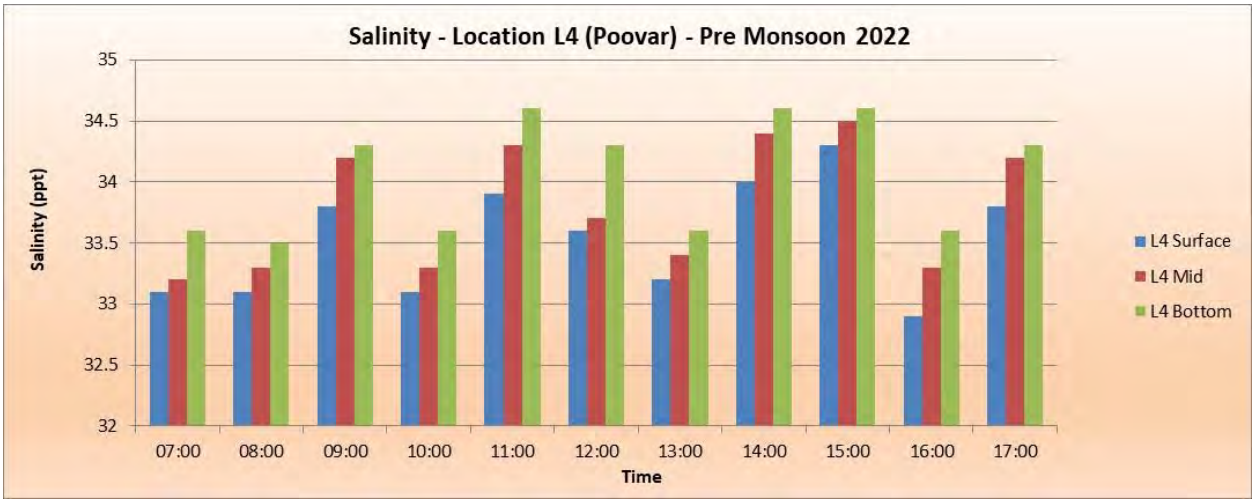
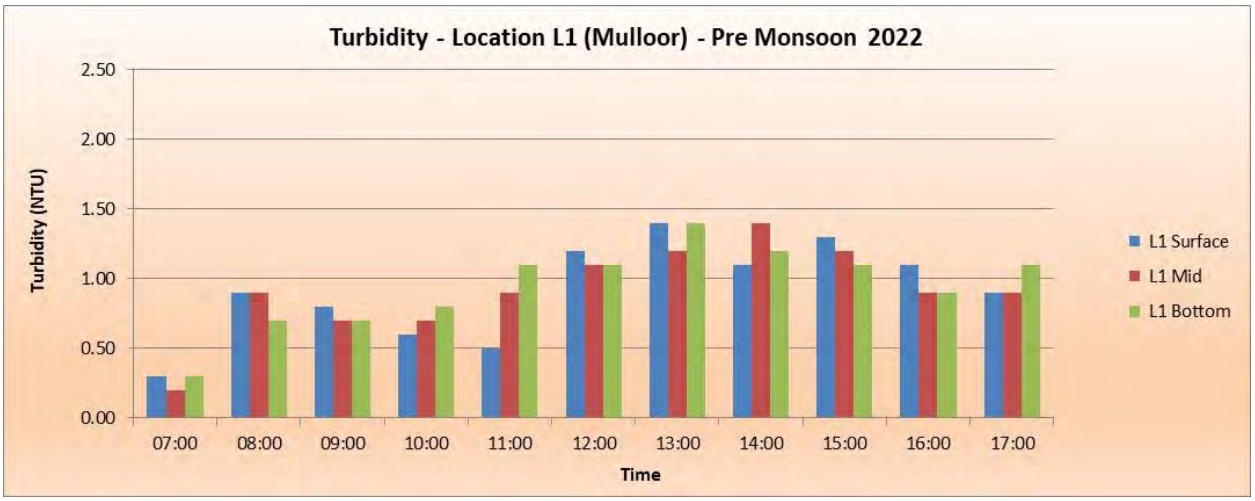
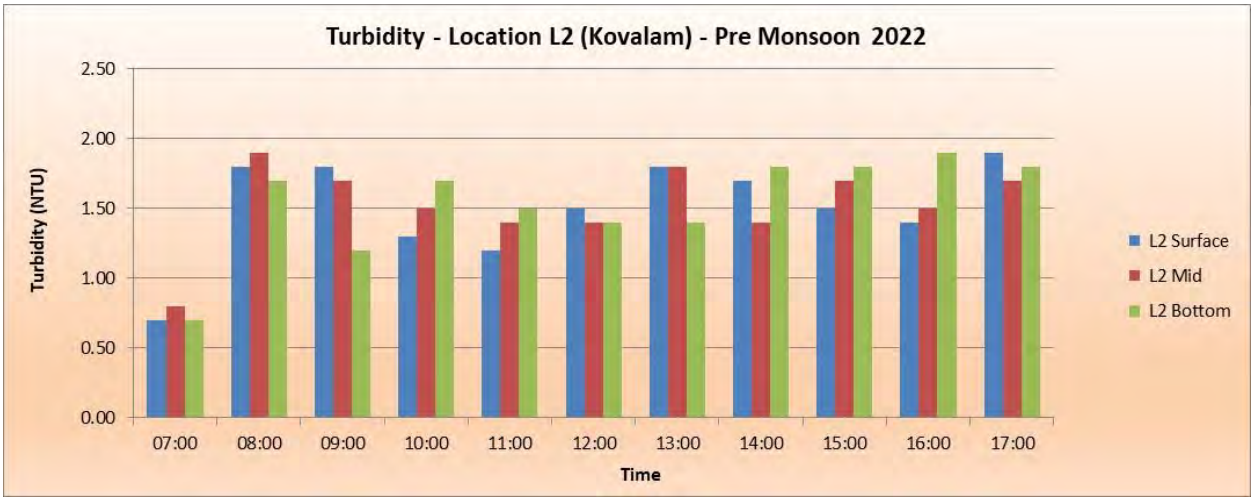


Figure 6-15: Time Series of salinity

The salinity at all locations is seen to be between 32.5 and 34.6 parts per thousand (ppt).

The histograms for turbidity at all levels for the locations is shown below.





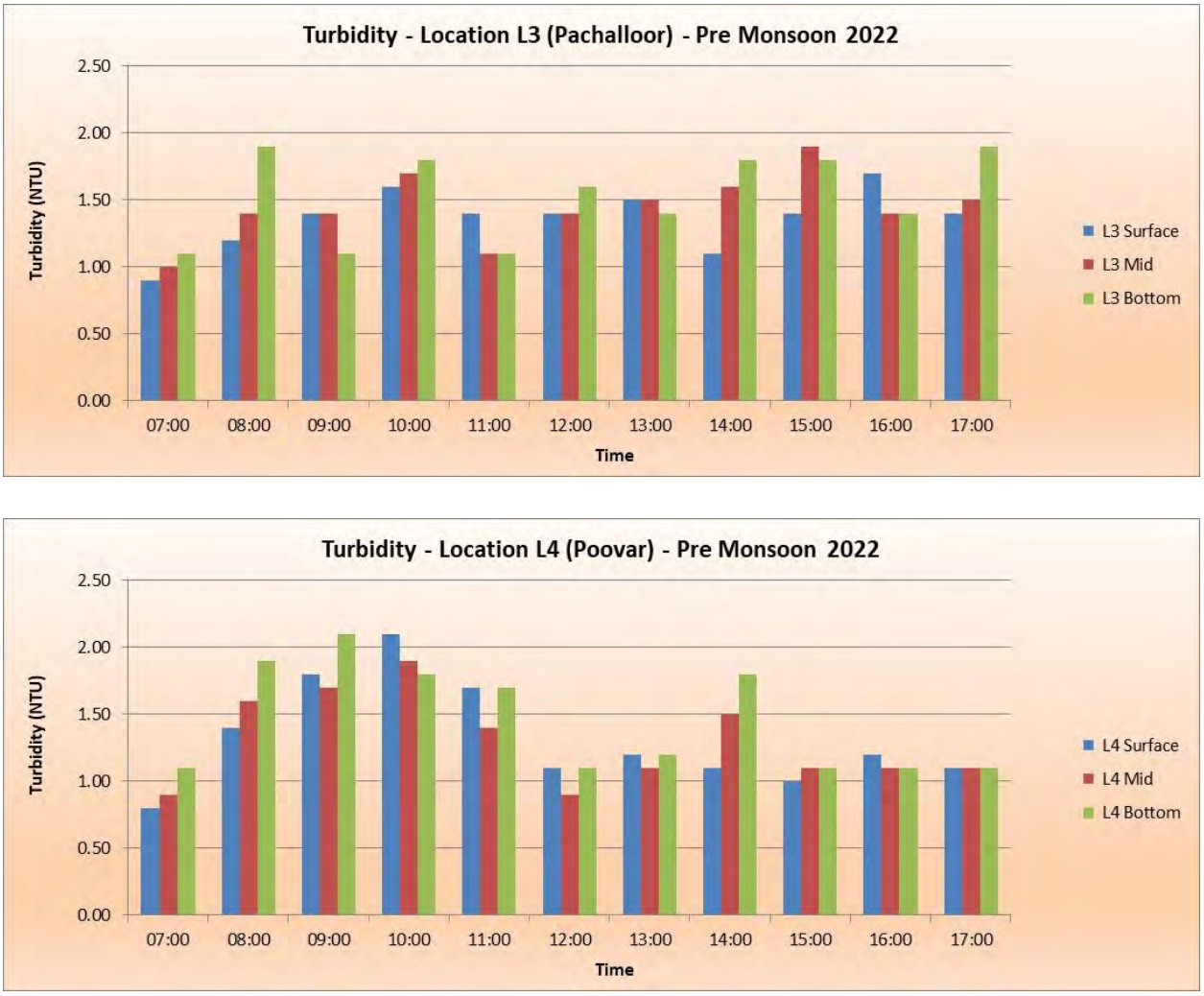
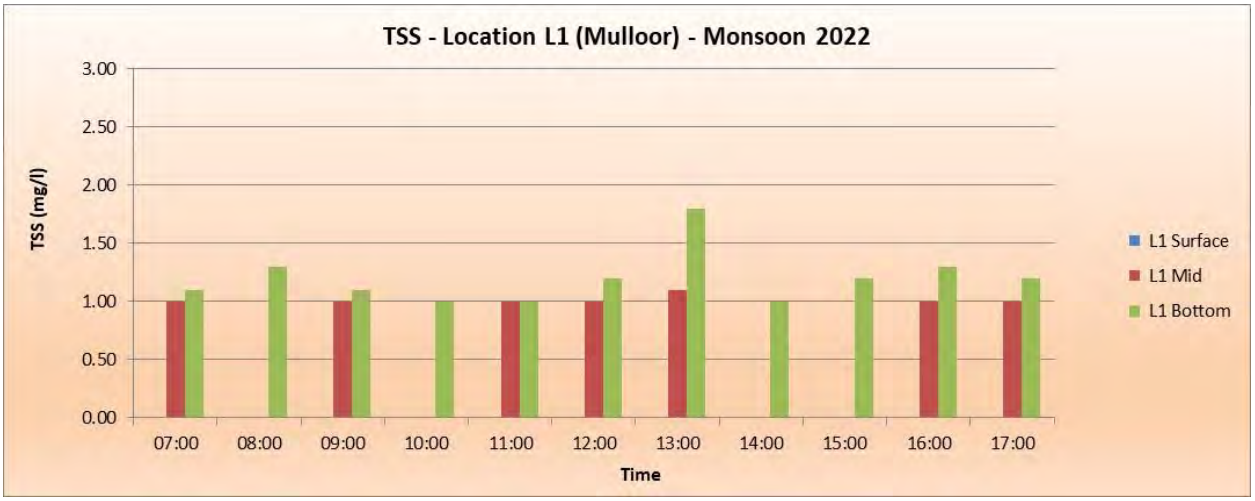
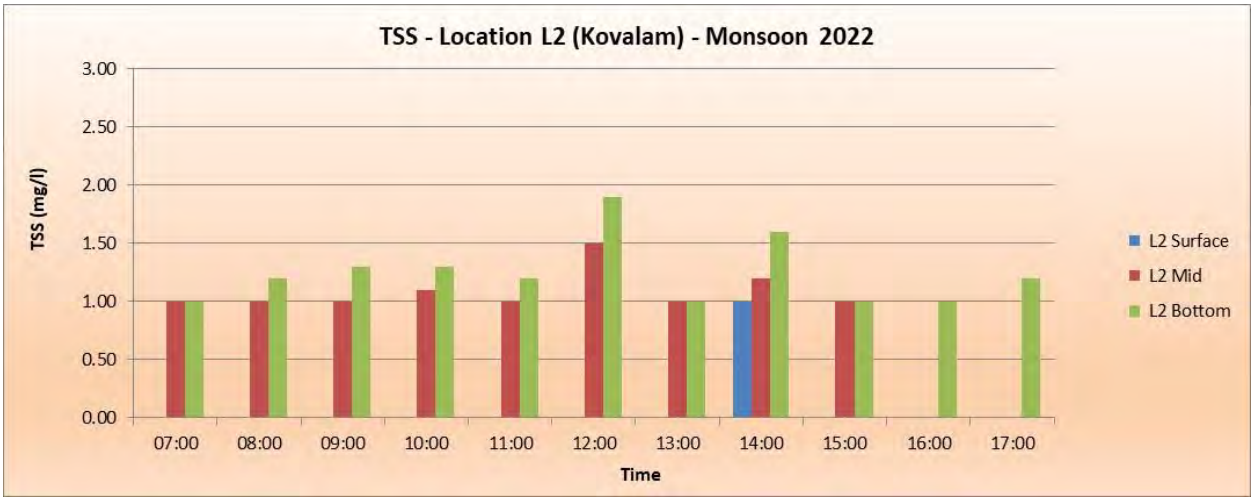


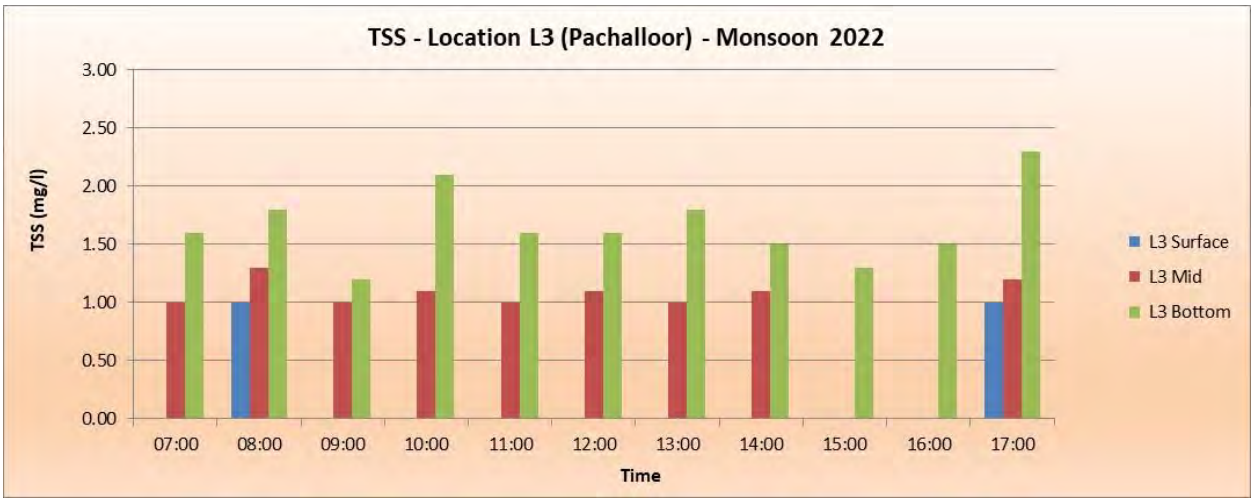
Figure 6-16: Time Series of Turbidity at water sampling locations

The maximum turbidity recorded for the pre-monsoon 2022 period was 2.1 NTU near the surface and also at the bottom at Location L4 (Poovar).

The time series for Total Suspended Solids (in mg/l) for all the locations for the monsoon 2022 period are provided below.


TSS - Location L1 (Mulloor) - Monsoon 2022
TSS (mg/l)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
Time
L1 Surface
L1 Mid
L1 Bottom


TSS - Location L2 (Kovalam) - Monsoon 2022
TSS (mg/l)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
Time
L2 Surface
L2 Mid
L2 Bottom


TSS - Location L3 (Pachalloor) - Monsoon 2022
TSS (mg/l)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
Time
L3 Surface
L3 Mid
L3 Bottom

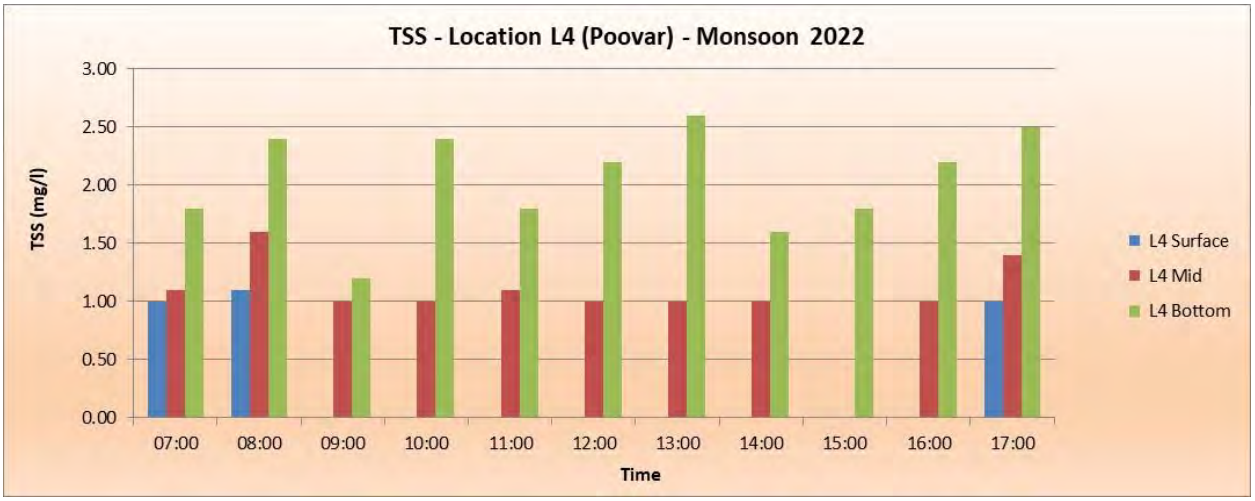
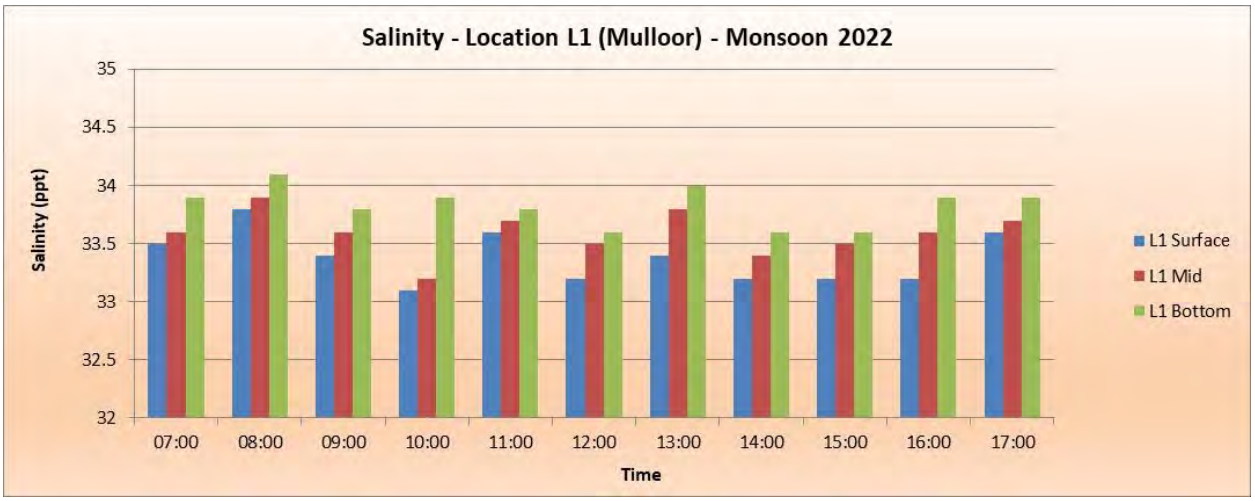


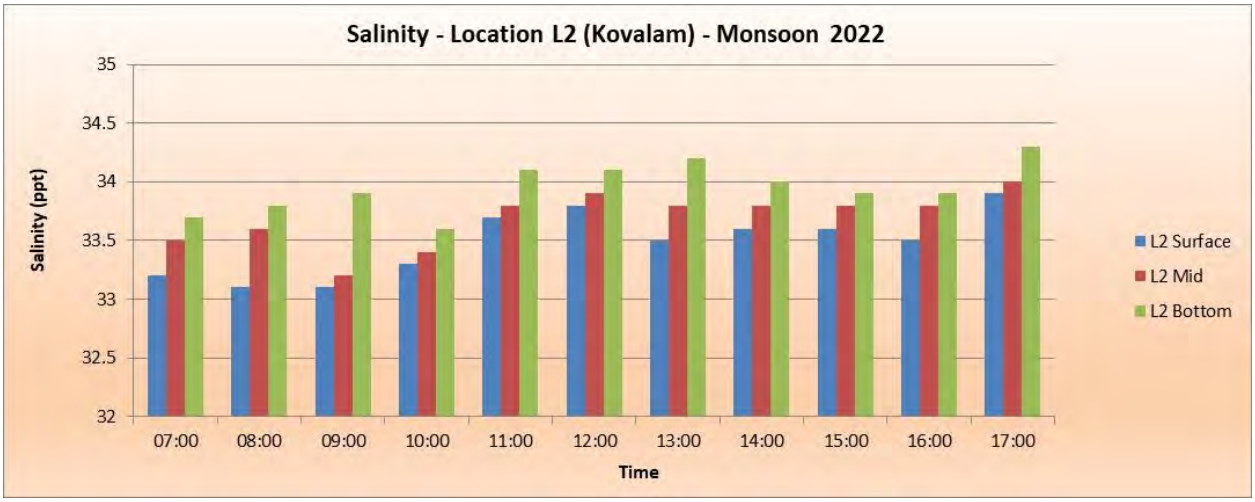
Figure 6-17: Time Series of TSS

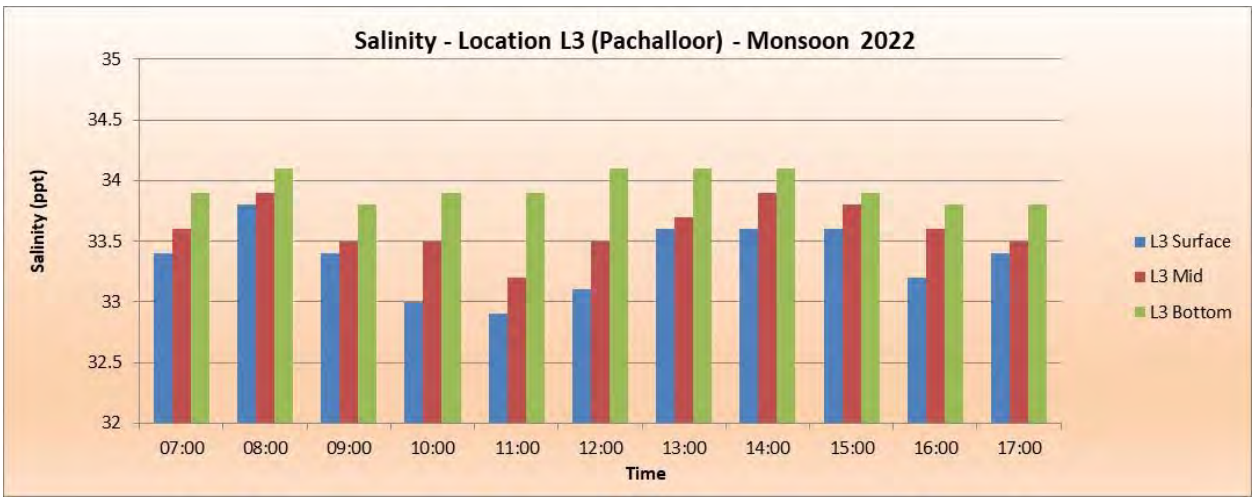
The maximum TSS recorded was 2.6 mg/l near the bottom at Location L4 (Poovar).

Note: TSS values below 1 md/l are Below Detectable Limit (BDL) of the system and are hence not shown on the bar charts.

The histograms for salinity at all three levels for all the locations are given as follows.







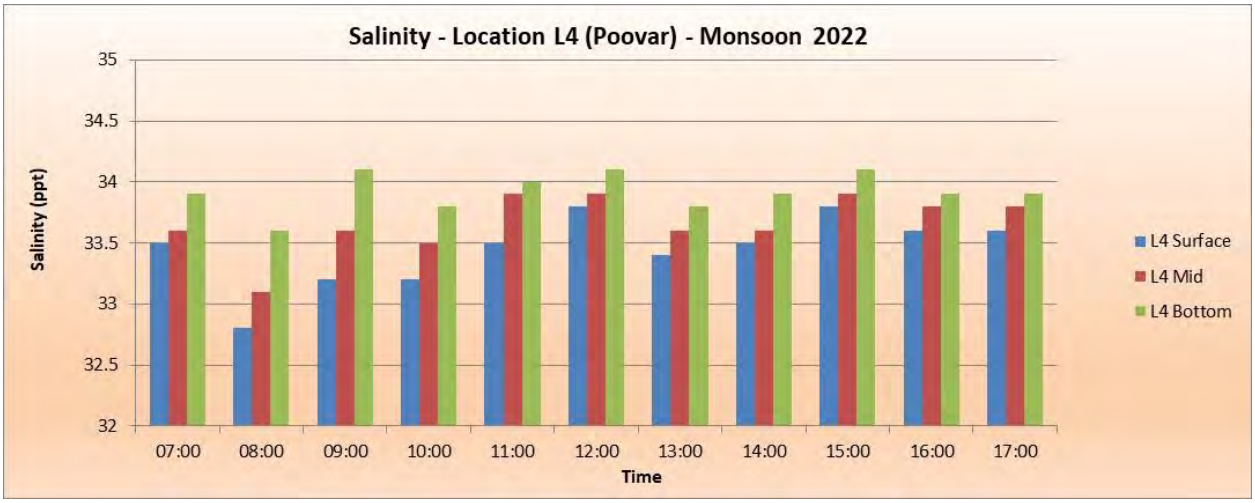
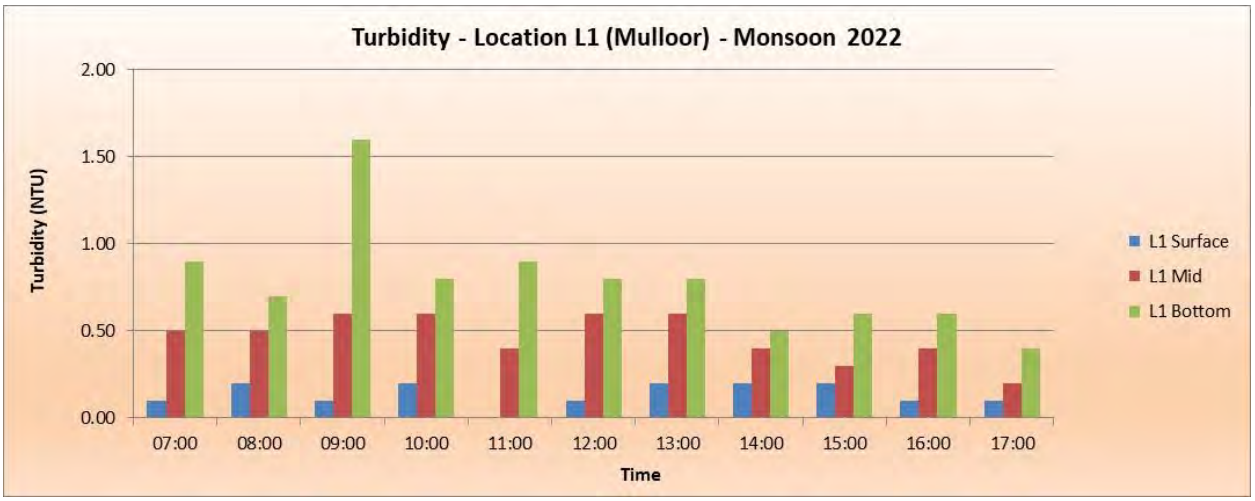


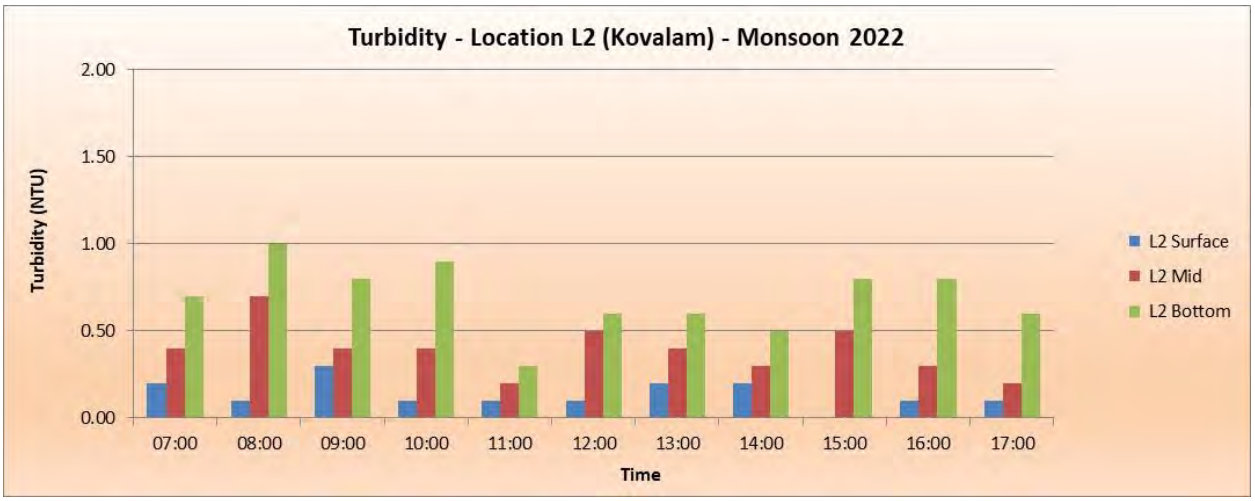
Figure 6-18: Time Series of salinity

The salinity at all locations is seen to be between 32.8 and 34.3 parts per thousand (ppt).

The histograms for turbidity at all levels for the locations is shown below. The maximum turbidity recorded was 1.9 NTU near the bottom at Location L3 (Pachalloor).

Note: Turbidity values below 0.1 NTU are Below Detectable Level (BDL) of the system and are hence not displayed on the bar charts.





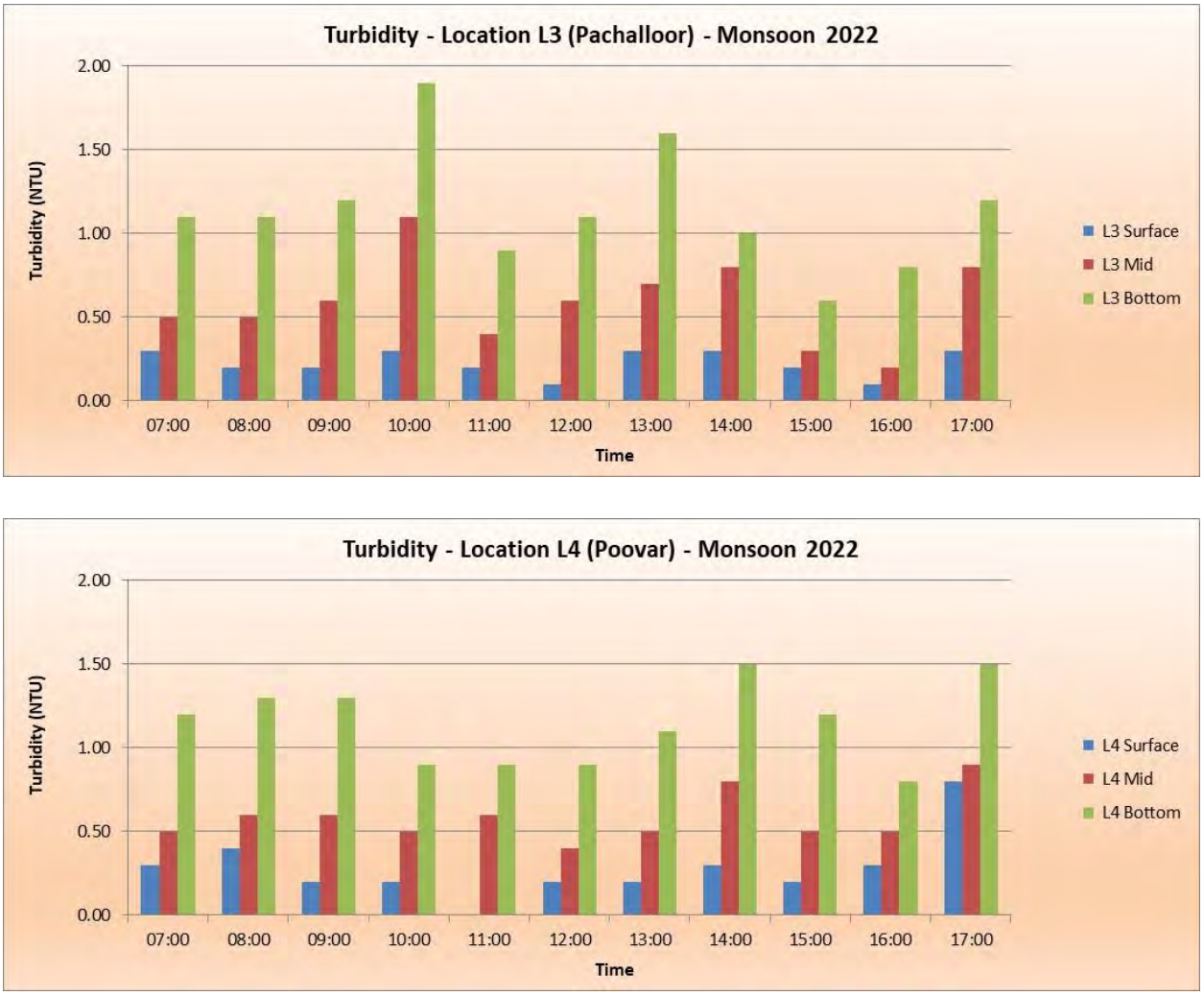


Figure 6-19: Time Series of Turbidity at water sampling locations

6.11 Beach Sampling

Beach samples were collected from 65 out of the 81 locations for the pre-monsoon 2022 period. The samples which could not be collected due to lack of beach were BS-3, BS-6, BS-11 to BS-14, BS-35, BS-49 to BS-52, BS-56, BS-59 and BS-63 to BS-65 and BS-68.

Beach samples were also collected for the monsoon 2022 period from 45 out of 81 locations. The samples which could not be collected due to lack of beach were BS-3, BS-48 to BS-52, BS-63, BS-65 and BS-66. BS-23 to BS-41 and BS-53 to BS-60 could not be collected as a result of the ongoing agitation faced from the locals residing in these areas. The samples have been sent to the laboratory to be analyzed for grain size distribution as per Wentworth classification.

The following table shows the D50 value (in mm) of the sediments collected along with the soil classification (Wentworth classification is followed) for the pre-monsoon 2022 period.

Table 6-12: Beach sample soil classification (Pre-monsoon 2022)

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-1	0	100	0	100	0.5546	Coarse Sand
BS-2	0	100	0	100	0.3751	Medium Sand
BS-3	Not collected					
BS-4	0	100	0	100	0.4530	Medium Sand
BS-5	0	100	0	100	0.3163	Medium Sand
BS-6						
BS-7	0	100	0	100	0.5316	Coarse Sand
BS-8	0	100	0	100	0.4140	Medium Sand
BS-9	0	100	0	100	0.3746	Medium Sand
BS-10	0	100	0	100	0.4712	Medium Sand
BS-11	Not collected					
BS-12	Not collected					
BS-13	Not collected					
BS-14	Not collected					
BS-15	0	100	0	100	0.4724	Medium Sand
BS-16	0	100	0	100	0.4918	Medium Sand
BS-17	0	100	0	100	0.5092	Coarse Sand
BS-18	0	100	0	100	0.4481	Medium Sand
BS-19	0	100	0	100	0.4722	Medium Sand
BS-20	0	100	0	100	0.4738	Medium Sand
BS-21	0	100	0	100	0.4720	Medium Sand
BS-22	0	100	0	100	0.5486	Coarse Sand
BS-23	0	100	0	100	0.7168	Coarse Sand
BS-24	0	100	0	100	0.6181	Coarse Sand
BS-25	0	100	0	100	0.5176	Coarse Sand
BS-26	0	100	0	100	0.5863	Coarse Sand
BS-27	0	100	0	100	0.4830	Medium Sand
BS-28	0	100	0	100	0.5989	Coarse Sand
BS-29	0	100	0	100	0.5055	Coarse Sand
BS-30	0	100	0	100	0.4245	Medium Sand
BS-31	0	100	0	100	0.5665	Coarse Sand
BS-32	0	100	0	100	0.5657	Coarse Sand
BS-33	0	100	0	100	0.5999	Coarse Sand
BS-34	0	100	0	100	0.4833	Medium Sand
BS-35	Not collected					
BS-35A	0	100	0	100	0.4546	Medium Sand

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-36	0	100	0	100	0.5864	Coarse Sand
BS-37	0	100	0	100	0.4863	Medium Sand
BS-38	0	100	0	100	0.5016	Coarse Sand
BS-39	0	100	0	100	0.3321	Medium Sand
BS-40	0	100	0	100	0.5995	Coarse Sand
BS-40A	0	100	0	100	0.1934	Fine Sand
BS-41	0	100	0	100	0.4328	Medium Sand
BS-42	0	100	0	100	0.1554	Fine Sand
BS-43	0	100	0	100	0.3263	Medium Sand
BS-44	0	100	0	100	0.2327	Fine Sand
BS-45	0	100	0	100	0.2404	Fine Sand
BS-46	0	100	0	100	0.3891	Medium Sand
BS-47	0	100	0	100	0.3405	Medium Sand
BS-48	0	100	0	100	0.3507	Medium Sand
BS-49	Not collected					
BS-50	Not collected					
BS-51	Not collected					
BS-52	Not collected					
BS-53	0	100	0	100	0.3819	Medium Sand
BS-54	0	100	0	100	0.3815	Medium Sand
BS-55	0	100	0	100	0.4182	Medium Sand
BS-56	Not collected					
BS-57	0	100	0	100	0.4406	Medium Sand
BS-58	0	100	0	100	0.4150	Medium Sand
BS-59	Not collected					
BS-60					0.4247	Medium Sand
BS-61	0	100	0	100	0.3318	Medium Sand
BS-62	0	100	0	100	0.3600	Medium Sand
BS-63	Not collected					
BS-64	Not collected					
BS-65	Not collected					
BS-66	0	100	0	100	0.3251	Medium Sand
BS-67	0	100	0	100	0.3327	Medium Sand
BS-68	Not collected					
BS-69	0	100	0	100	0.3909	Medium Sand
BS-70	0	100	0	100	0.3733	Medium Sand
BS-71	0	100	0	100	0.4212	Medium Sand
BS-72	0	100	0	100	0.3651	Medium Sand
BS-73	0	100	0	100	0.3348	Medium Sand
BS-74	0	100	0	100	0.3619	Medium Sand
BS-75	0	100	0	100	0.3499	Medium Sand

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-76	0	100	0	100	0.3850	Medium Sand
BS-77	0	100	0	100	0.3597	Medium Sand
BS-78	0	100	0	100	0.3511	Medium Sand
BS-79	0	100	0	100	0.3764	Medium Sand
BS-80	0	100	0	100	0.3956	Medium Sand
BS-81	0	100	0	100	0.3990	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 pre-monsoon 2022 period.

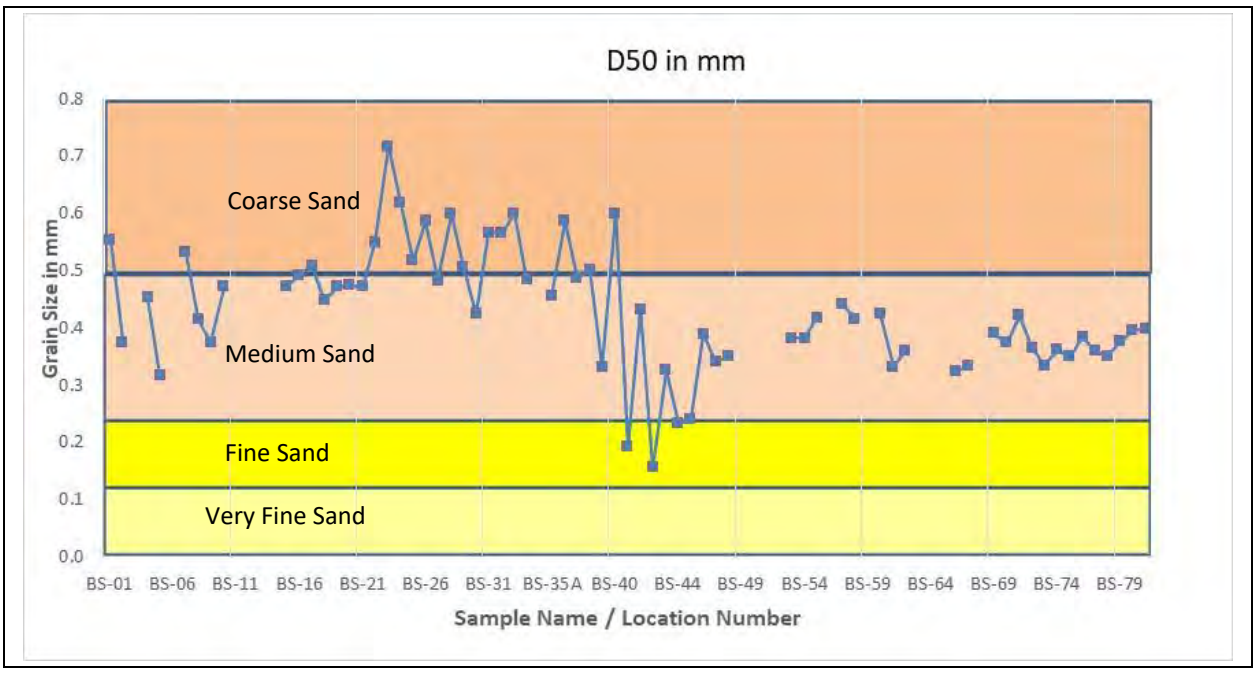
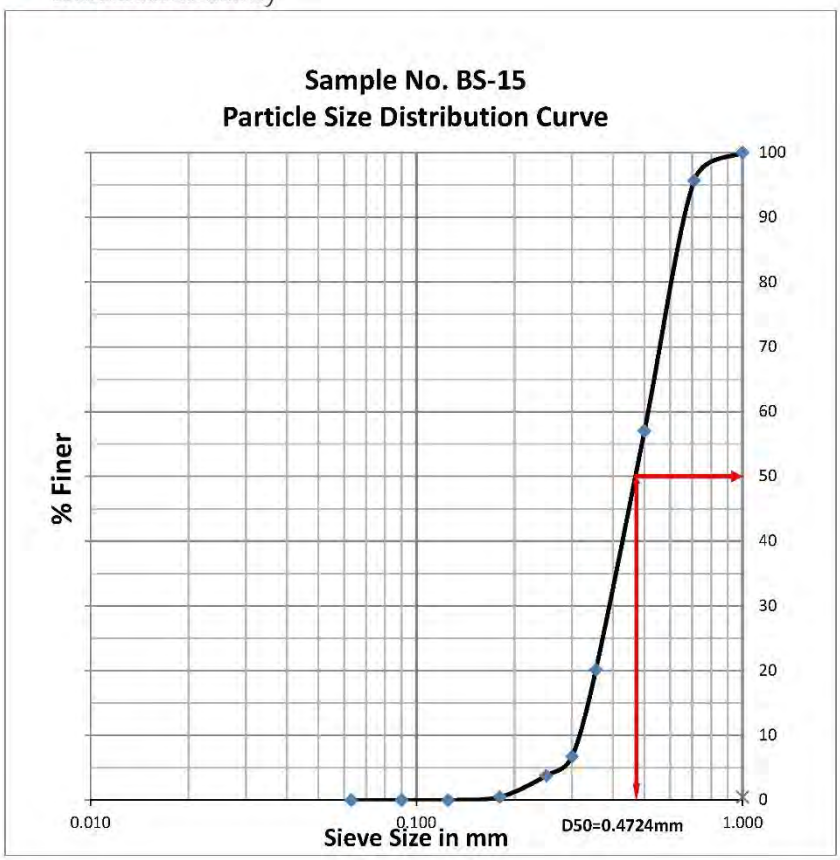


Figure 6-20: Distribution of D50 value of beach samples (Pre-monsoon 2022 period)

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

Standard[S] Environmental Monitoring



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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

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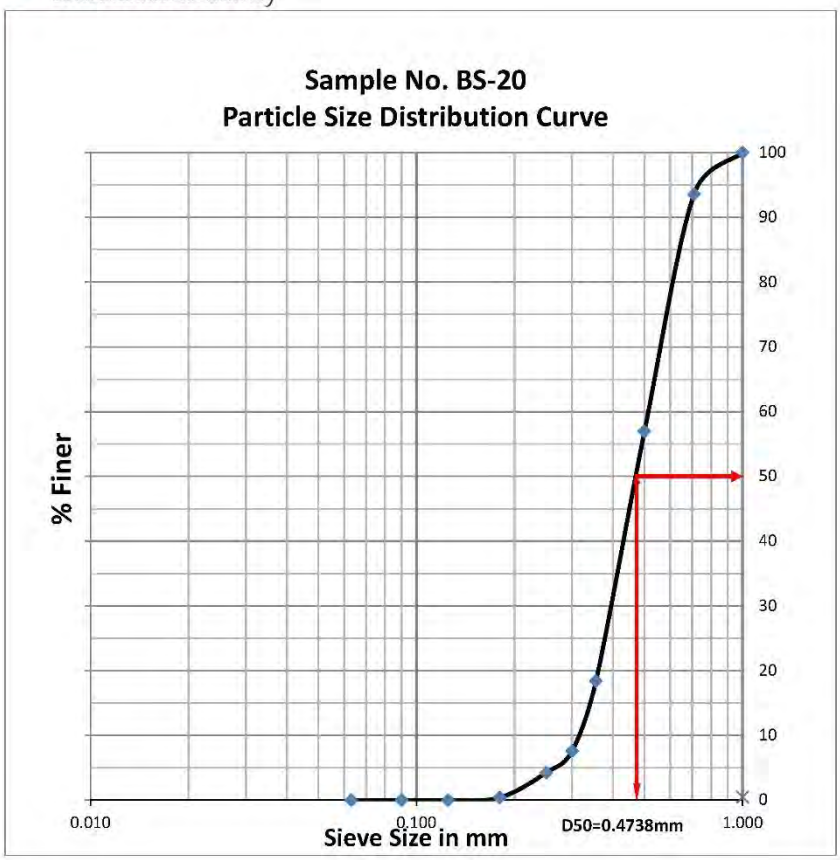
Figure 6-21: Grain size distribution curve for BS-15 (Pre-monsoon 2022)

Standard[S] Environmental Monitoring



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Web: www.sealabs.in, E-mail: seaalab@gmail.com

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Figure 6-22: Grain size distribution curve for BS-20 (Pre-monsoon 2022)

Standard[S] Environmental Monitoring

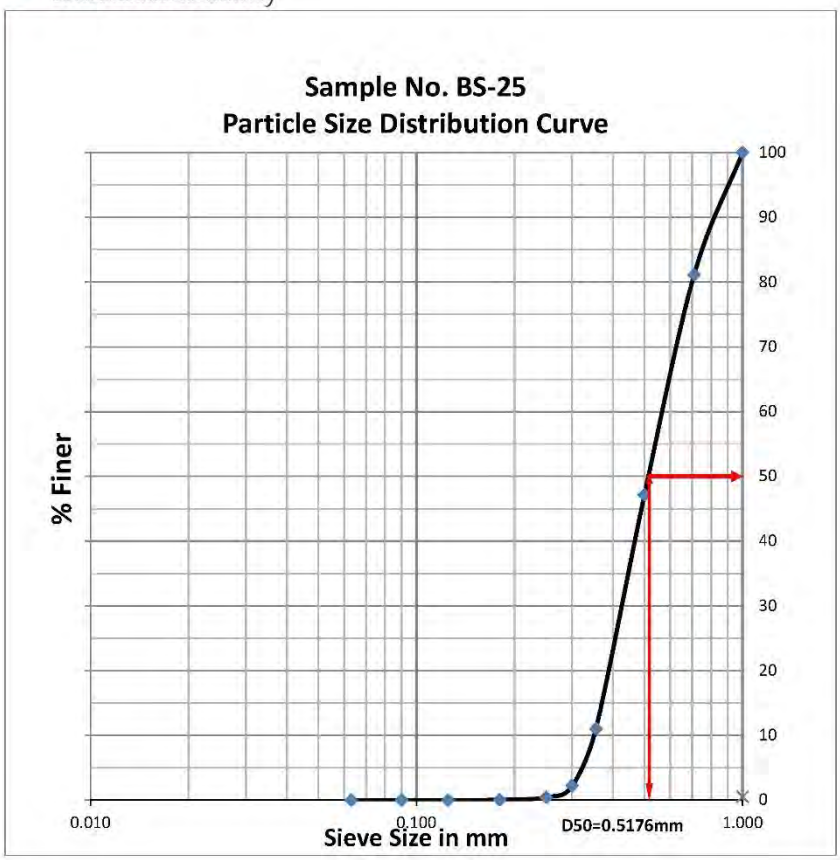

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Figure 6-23: Grain size distribution curve for BS-25 (Pre-monsoon 2022)

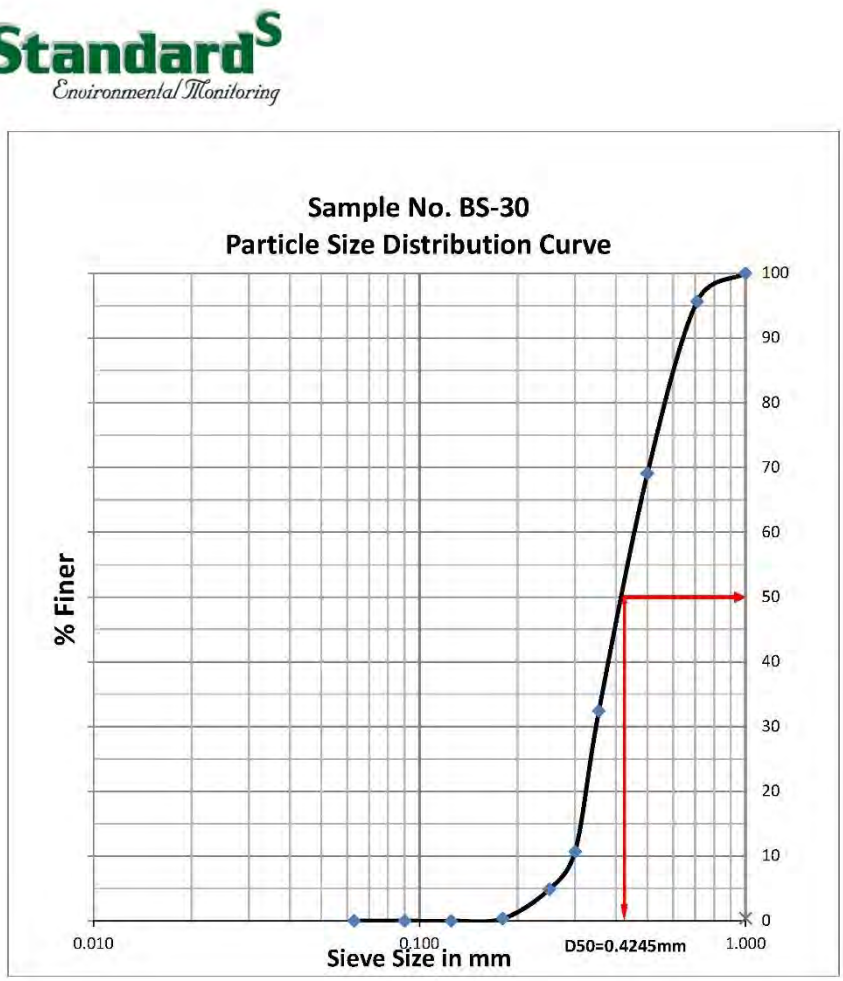

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Figure 6-24: Grain size distribution curve for BS-30 (Pre-monsoon 2022)

6.12 Turbidity Measurements

Turbidity is the cloudiness or haziness of a fluid caused by suspended solids that are usually invisible to the naked eye. It is generally expressed as Nephelometric Turbidity Units (NTU).

Nepheleisthe, Greek word for "cloud" and metric means “measure”. Nephelometric, therefore, means "measuring cloudiness." All turbidity measurements detect the amount of light either transmitted through or scattered by the particles in a sample of water. Most nephelometers measure the scattered light at 90° (the light source and the detector are oriented at right angles to each other.) If more light is able to reach the detector it means that there are many small particles scattering the source beam. If less light reaches the detector it indicates less particles in the water, and hence less turbidity. The amount of light scattered is influenced by many aspects of the particles, like colour, shape, and reflectivity.

Turbidity monitoring buoys were deployed at three locations and the turbidity was measured at three different depths i.e. surface, mid-depth and bottom.

A summary of the maximum turbidity data (measured in NTU) recorded for the period of April to September 2022 at each turbidity buoy location is placed in the table below.

Note: Data from Turbidity Buoy-2 is not available after 15th August 2022 as a result of communication failure. This buoy was flagged earlier, probably by some of the locals involved in the ongoing agitation.

①

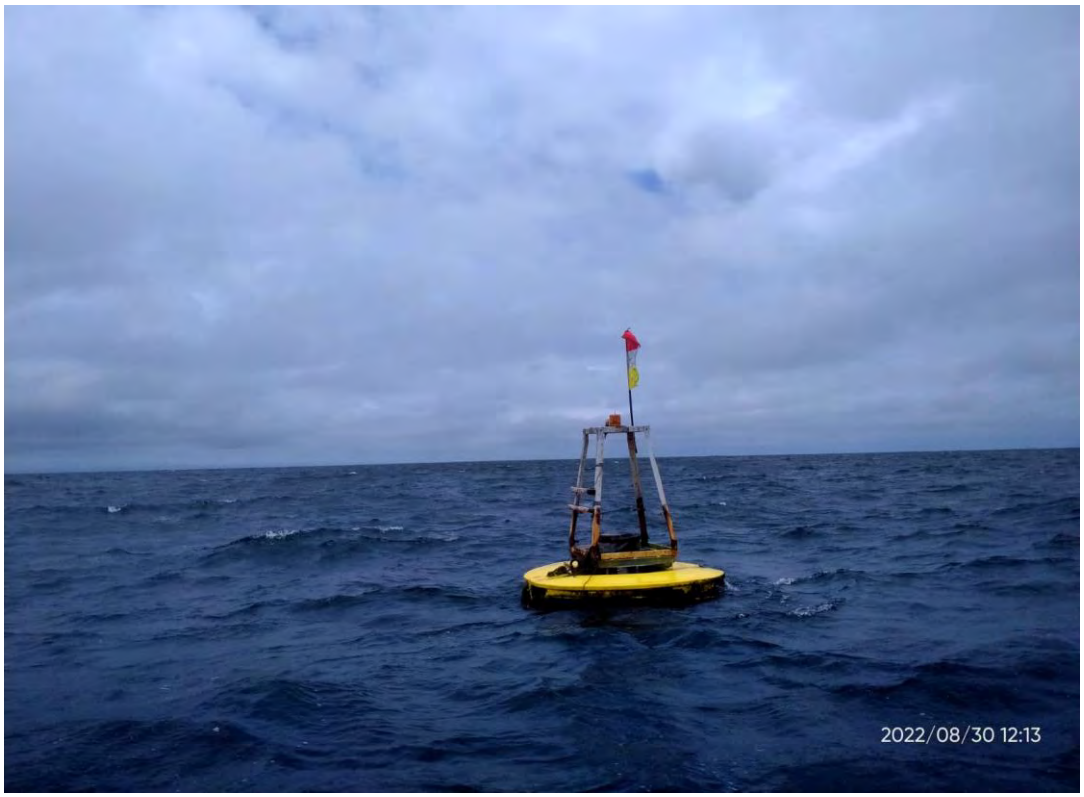


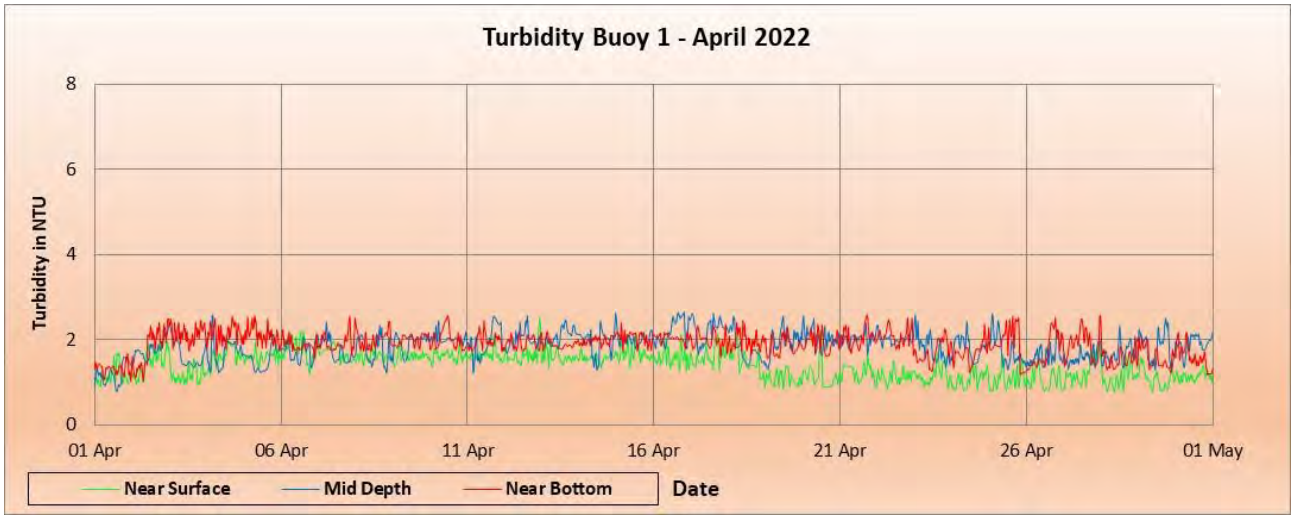
Figure 6-25: Turbidity Buoy-2 flagged by protesting locals

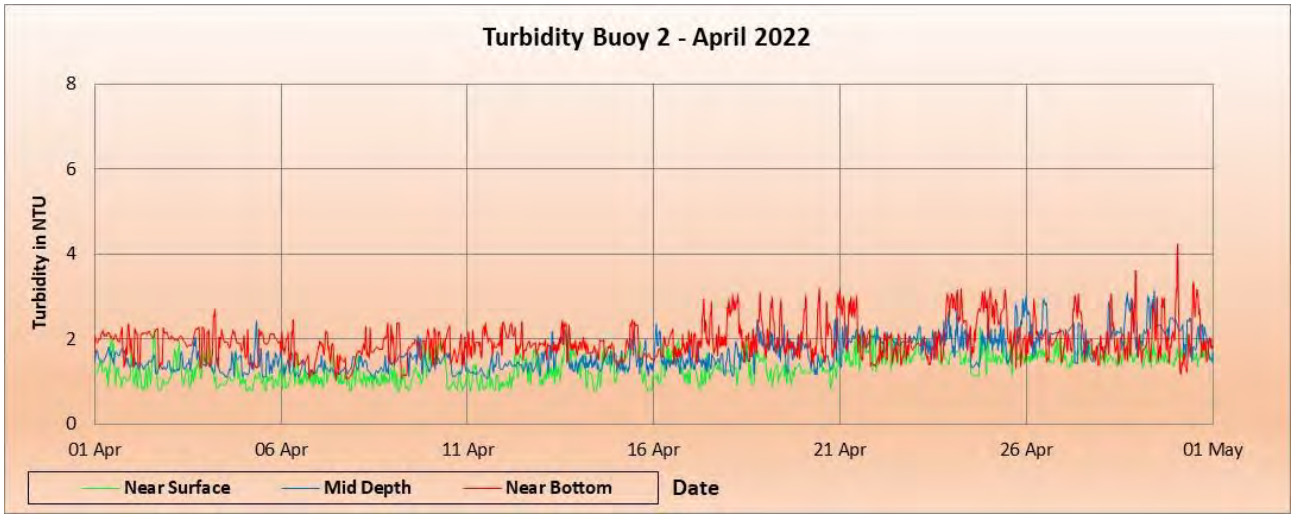
On 12th September 2022, this buoy was reported to have gone missing from its location. The FIRs were lodged with the coastal police station as well as with Vizhinjam police station on 13th and 14th September 2022. Several days later, only a broken part of the buoy was found by the Poovar Coastal Police near Kollamkode and the same was handed over to the survey team on 1st October 2022.

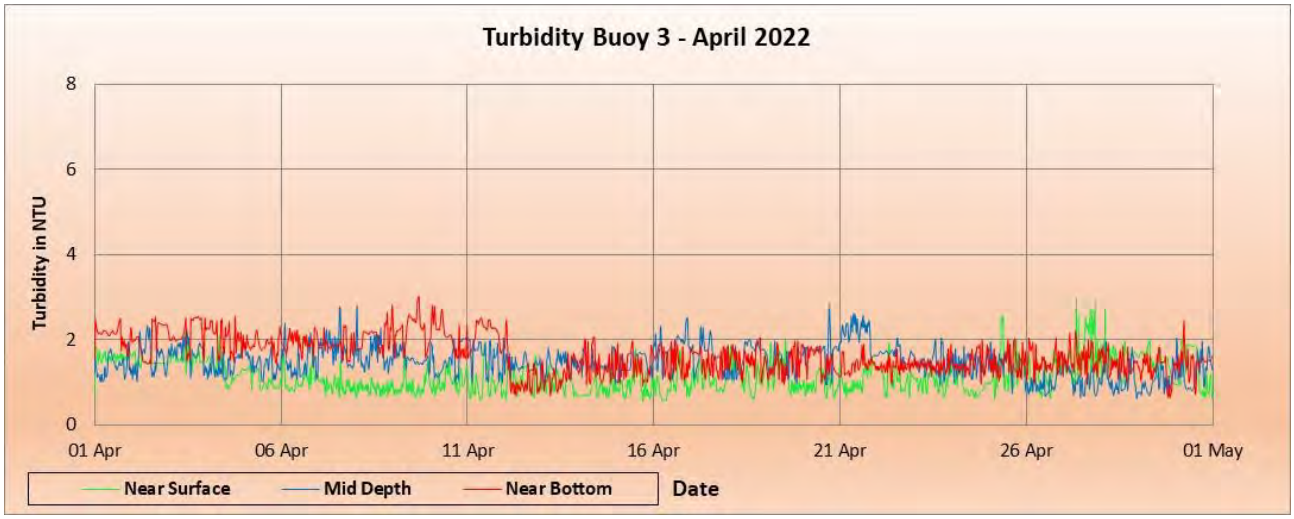
Table 6-13: Summary of maximum turbidity values in NTU

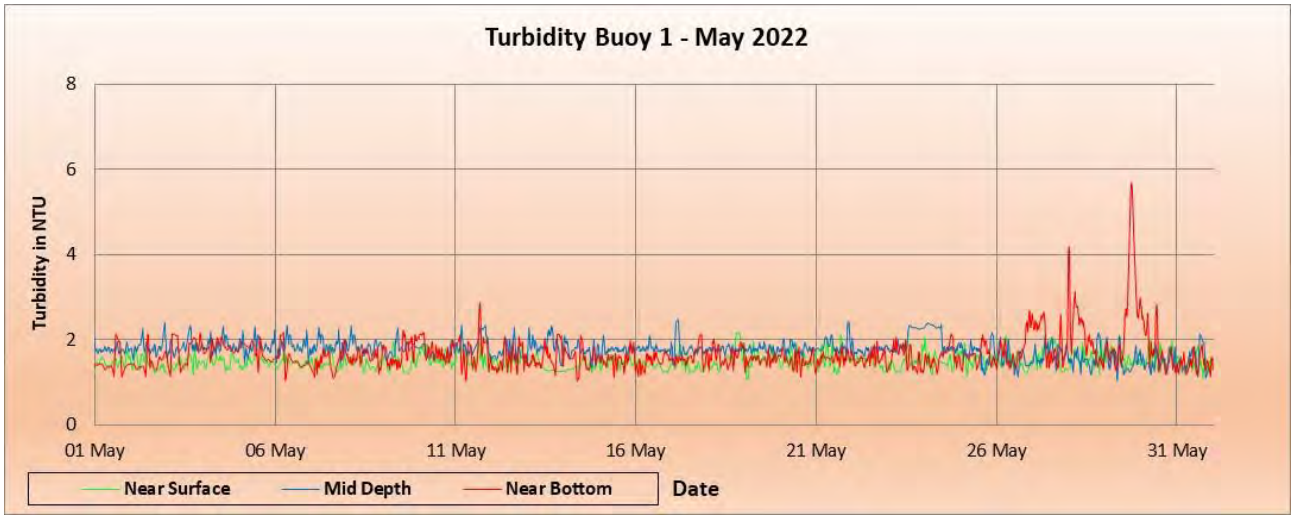
Location	Maximum Turbidity (NTU)	Depth	Month and Year
Turbidity Buoy-1	5.69	Near bottom	May 2022
Turbidity Buoy-2	5.65	Near bottom	July 2022
Turbidity Buoy-3	4.79	Mid depth	August 2022

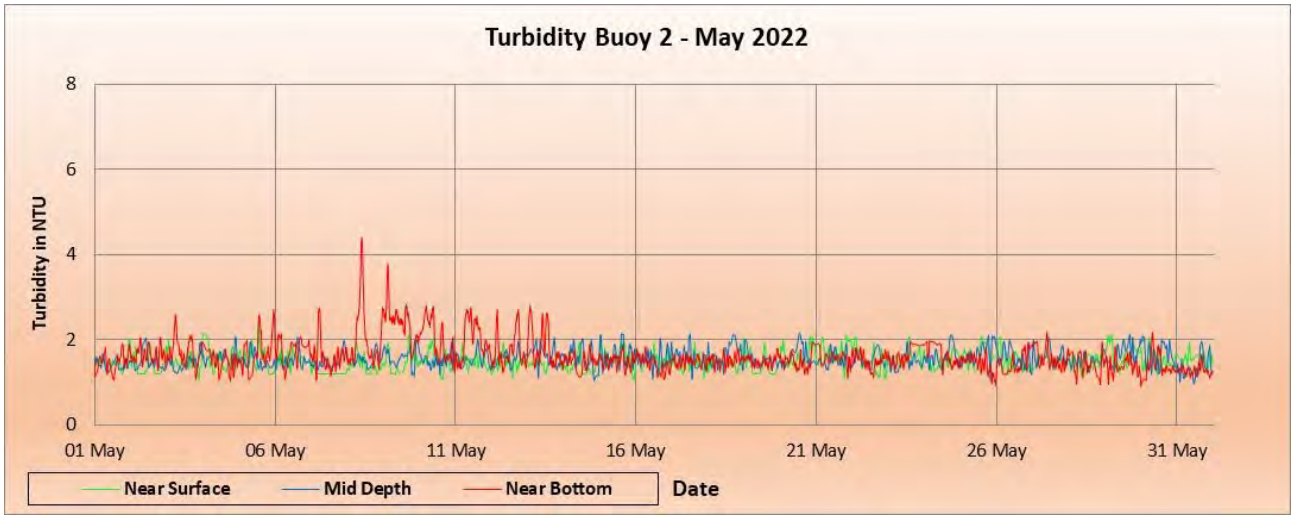
The time series curves of turbidity measurements from April to September 2022 are shown below.

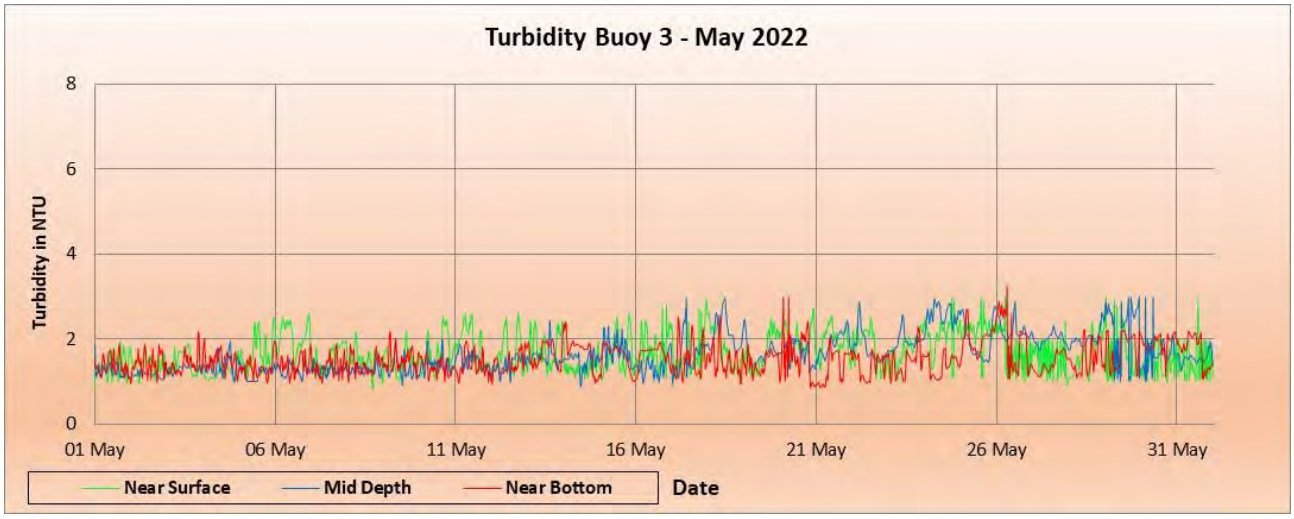

Turbidity Buoy 1 - April 2022
Turbidity in NTU
8
6
4
2
0
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Near Surface
Mid Depth
Near Bottom
Date

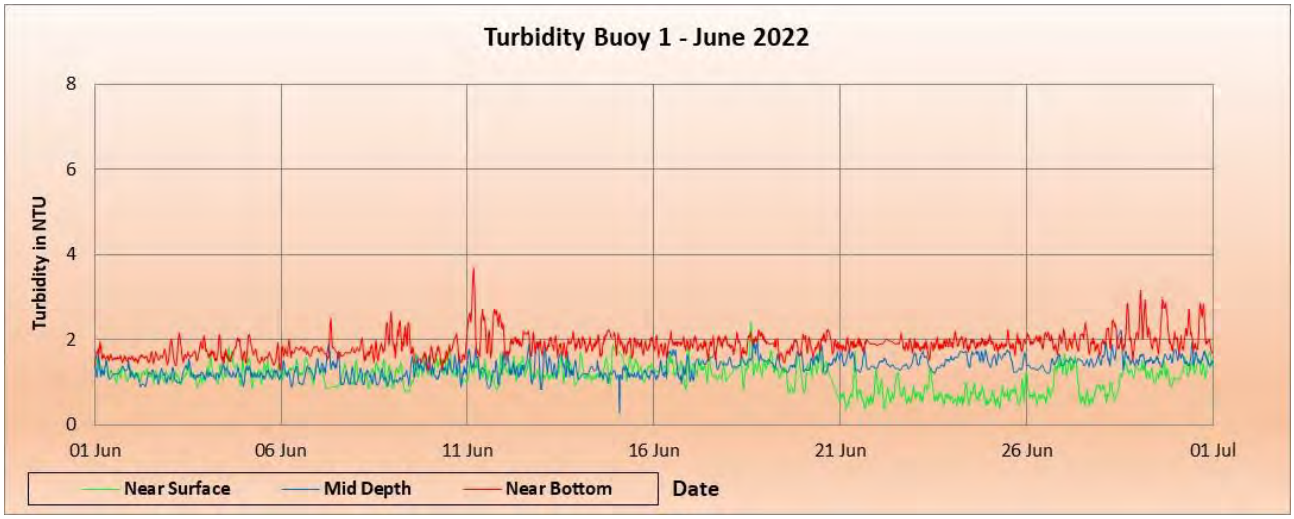

Turbidity Buoy 2 - April 2022
Turbidity in NTU
8
6
4
2
0
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Near Surface
Mid Depth
Near Bottom
Date

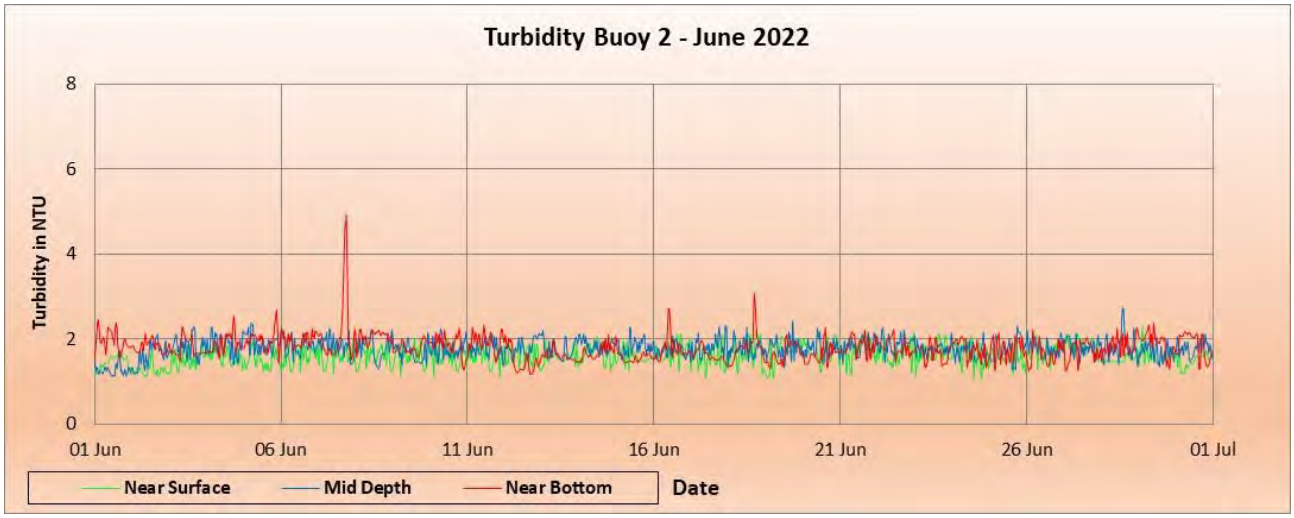

Turbidity Buoy 3 - April 2022
Turbidity in NTU
8
6
4
2
0
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Near Surface
Mid Depth
Near Bottom
Date

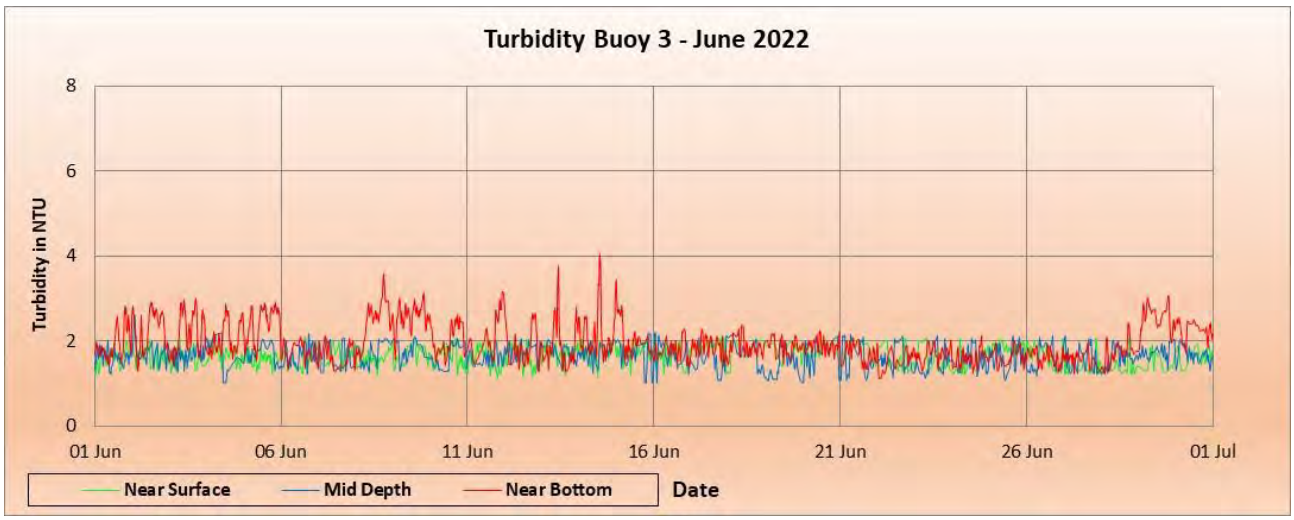

Turbidity Buoy 1 - May 2022
Turbidity in NTU
0
2
4
6
8
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Near Surface
Mid Depth
Near Bottom
Date

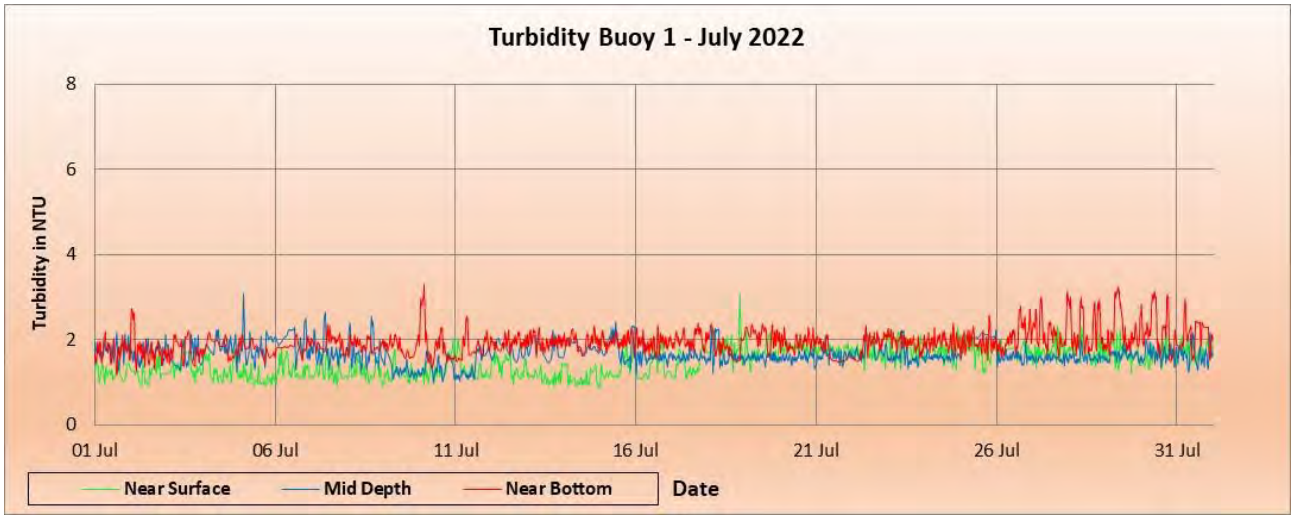

Turbidity Buoy 2 - May 2022
Turbidity in NTU
0
2
4
6
8
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Near Surface
Mid Depth
Near Bottom
Date

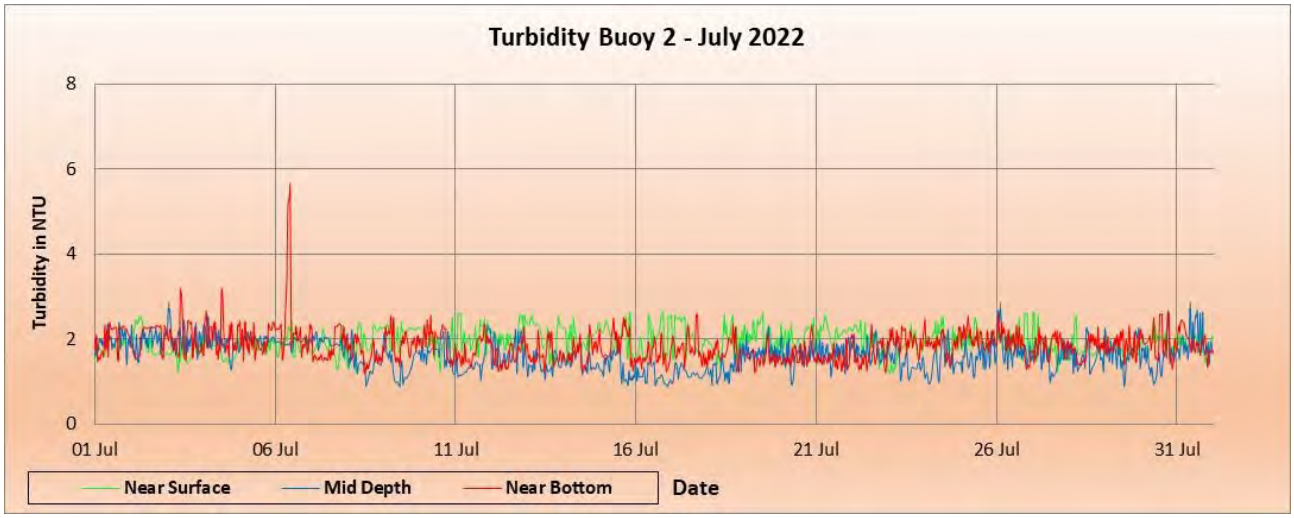

Turbidity Buoy 3 - May 2022
Turbidity in NTU
0
2
4
6
8
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Near Surface
Mid Depth
Near Bottom
Date

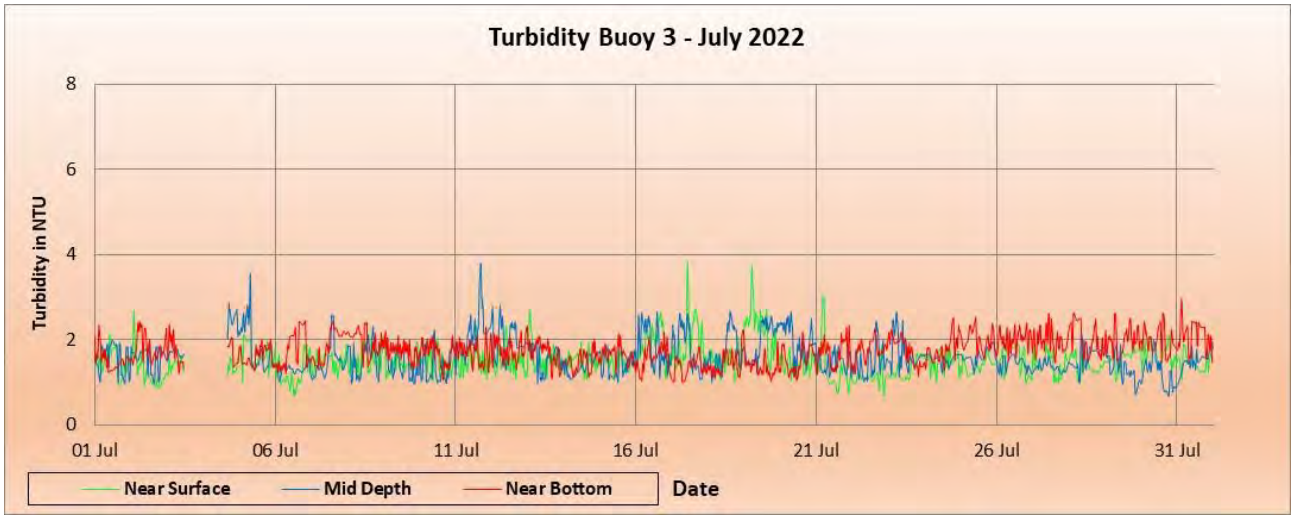

Turbidity Buoy 1 - June 2022
Turbidity in NTU
0
2
4
6
8
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Near Surface
Mid Depth
Near Bottom
Date

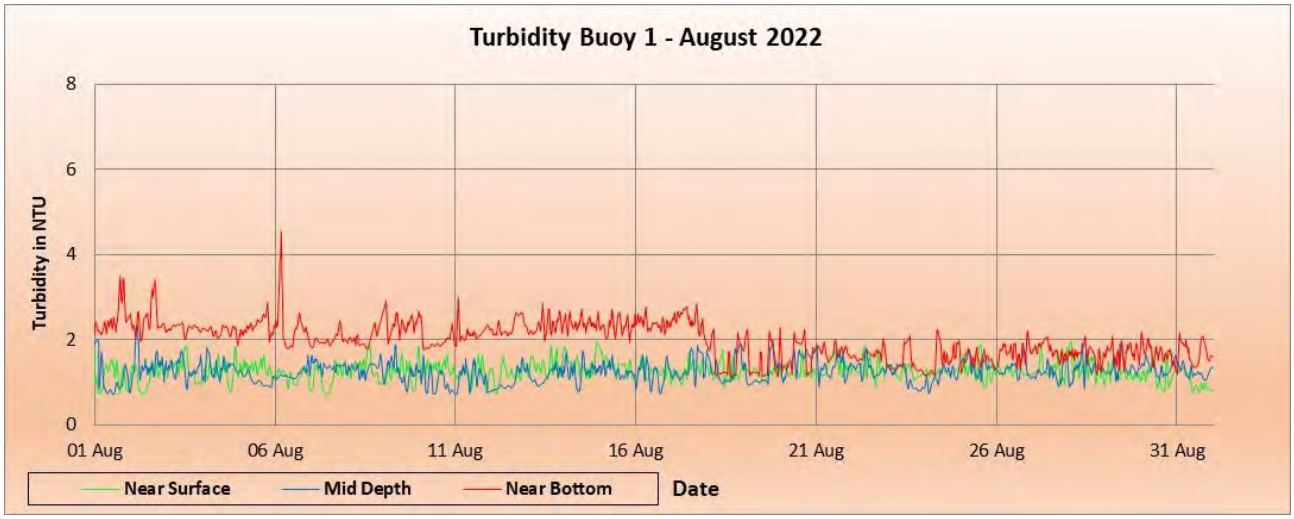

Turbidity Buoy 2 - June 2022
Turbidity in NTU
0
2
4
6
8
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Near Surface
Mid Depth
Near Bottom
Date

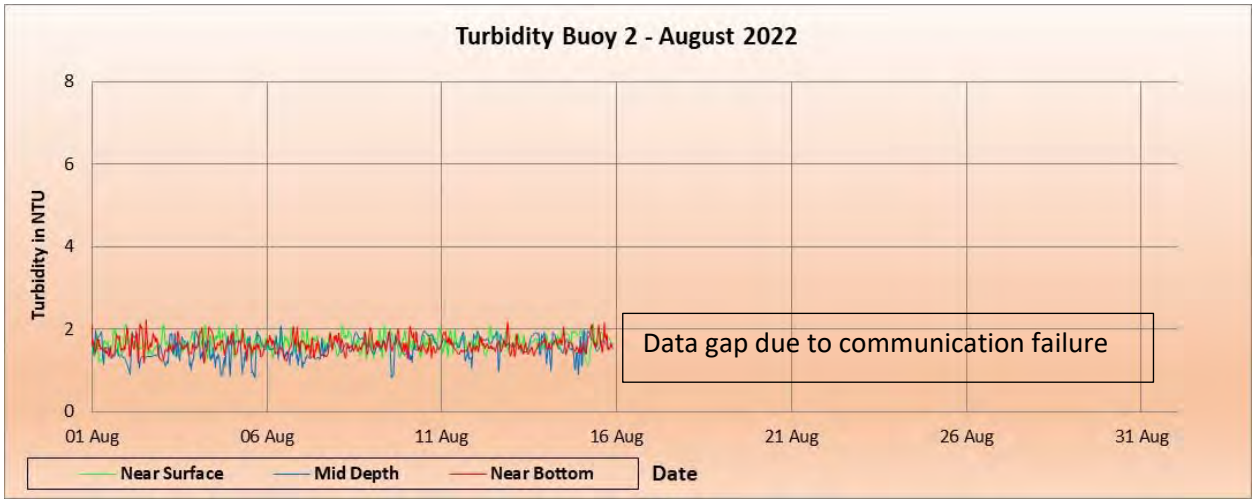

Turbidity Buoy 3 - June 2022
Turbidity in NTU
0
2
4
6
8
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Near Surface
Mid Depth
Near Bottom
Date

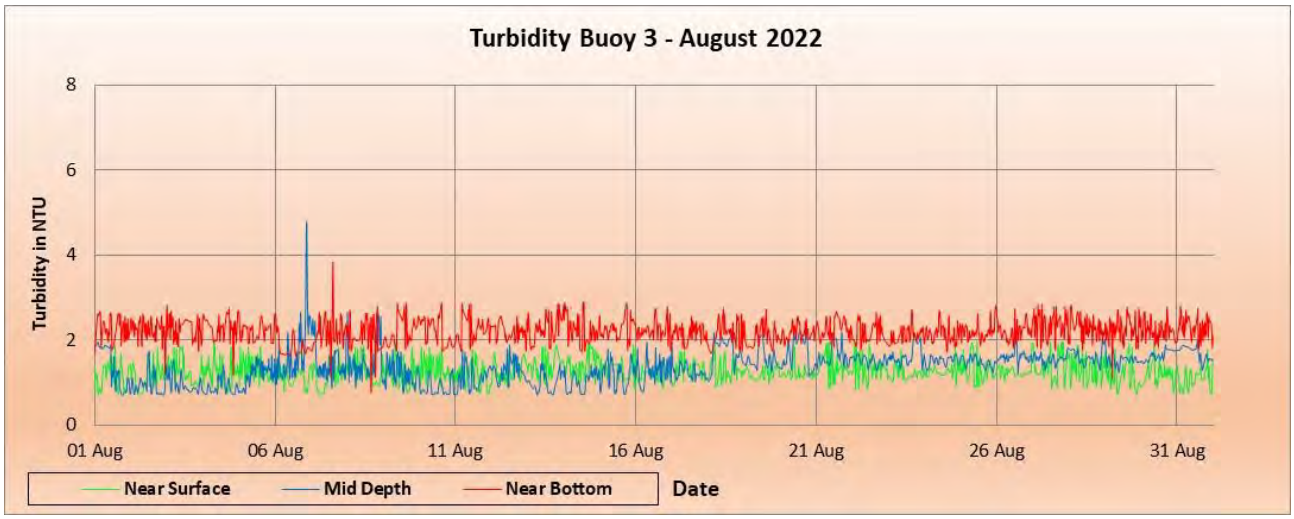

Turbidity Buoy 1 - July 2022
Turbidity in NTU
8
6
4
2
0
01 Jul
06 Jul
11 Jul
16 Jul
21 Jul
26 Jul
31 Jul
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 2 - July 2022
Turbidity in NTU
8
6
4
2
0
01 Jul
06 Jul
11 Jul
16 Jul
21 Jul
26 Jul
31 Jul
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 3 - July 2022
Turbidity in NTU
8
6
4
2
0
01 Jul
06 Jul
11 Jul
16 Jul
21 Jul
26 Jul
31 Jul
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 1 - August 2022
Turbidity in NTU
8
6
4
2
0
01 Aug
06 Aug
11 Aug
16 Aug
21 Aug
26 Aug
31 Aug
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 2 - August 2022
Turbidity in NTU
8
6
4
2
0
01 Aug
06 Aug
11 Aug
16 Aug
21 Aug
26 Aug
31 Aug
Data gap due to communication failure
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 3 - August 2022
Turbidity in NTU
8
6
4
2
0
01 Aug
06 Aug
11 Aug
16 Aug
21 Aug
26 Aug
31 Aug
Near Surface
Mid Depth
Near Bottom
Date

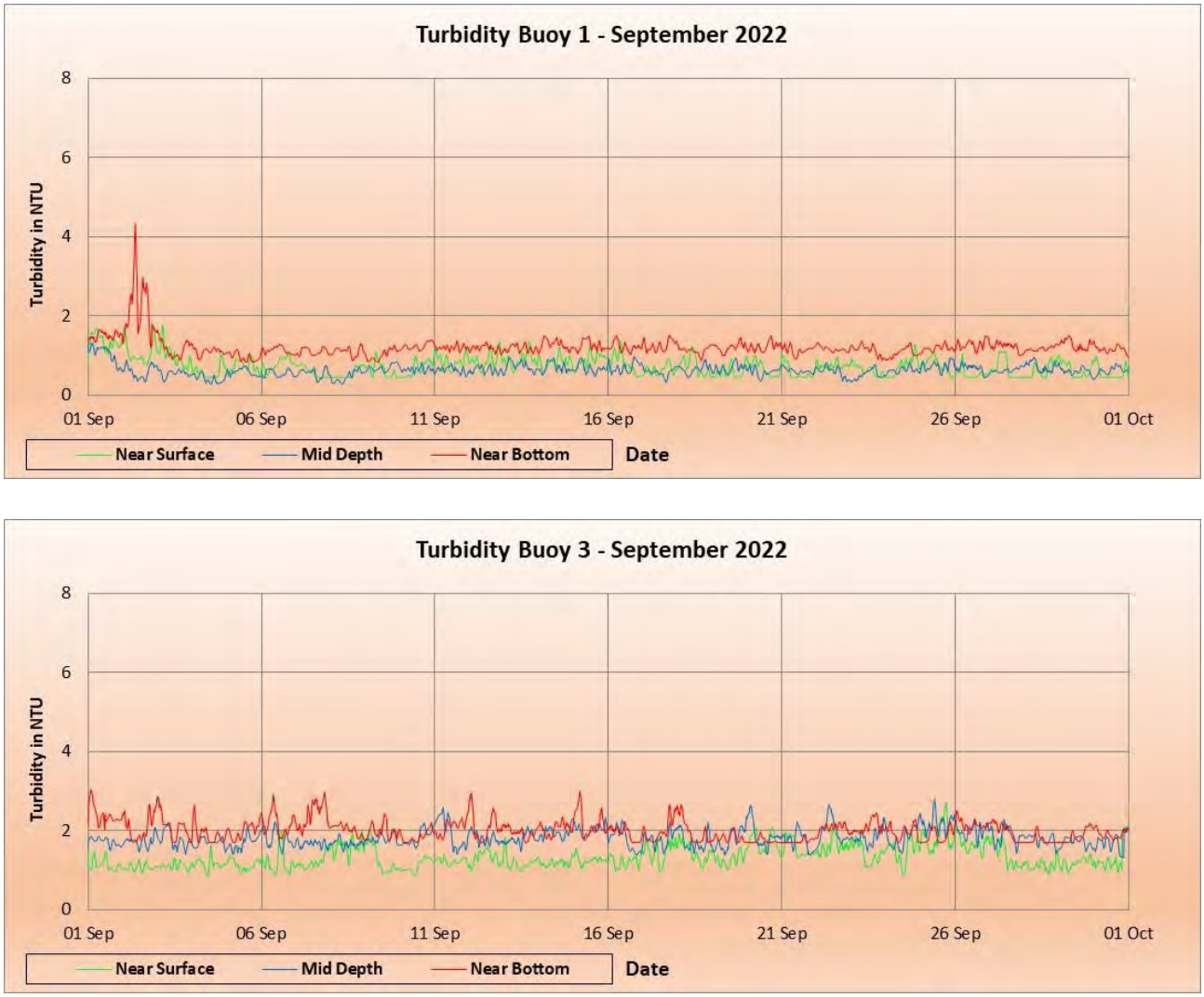


Figure 6-26: Time Series of Turbidity measurements

The validation of turbidity sensor data was carried out for the monsoon 2022 period. The samples were collected on 22nd , 23rd and 24th June 2022. The following table provides the turbidity values measured from the buoys and from that of the collected samples, which were analyzed for turbidity as per IS 3025, Part 10:1984 (reaffirmed 2017) in a NABL approved laboratory.

Table 6-14: Turbidity Values

Turbidity Values in NTU						
Buoy No.	**Observed from Buoy**			**Values from Collected Water Samples**		
	Sur	**Mid**	**Bot**	**Sur**	**Mid**	**Bot**
Turbidity Buoy-1	0.53	1.37	1.90	0.70	1.20	1.80
Turbidity Buoy-2	1.74	1.93	1.61	1.50	1.80	1.80
Turbidity Buoy-3	1.54	1.61	1.94	1.40	1.70	1.90

On comparing both the values, the integrity of the data obtained from the turbidity buoy sensors can be verified and it can be inferred that the sensors are performing as desired.

6.13 Bathymetry

Survey Location

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

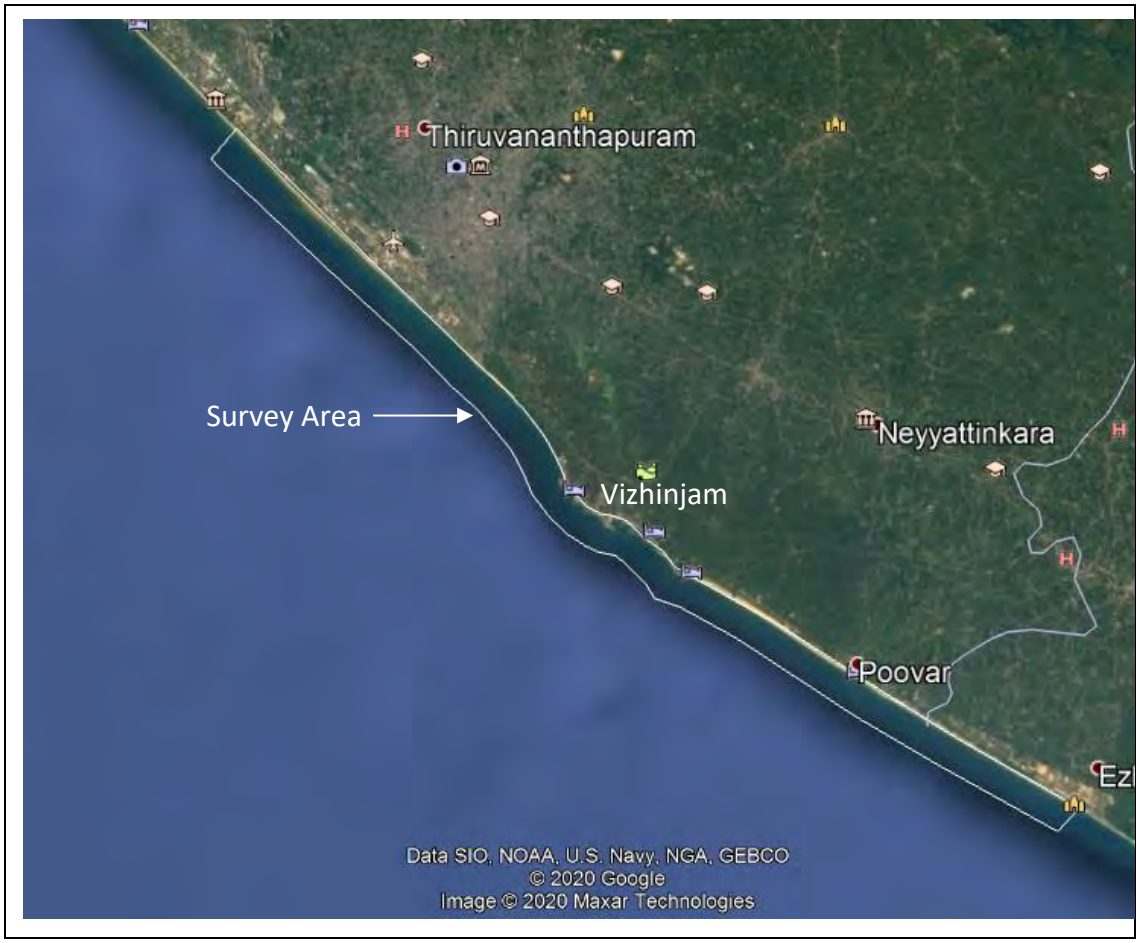


Figure 6-27: Bathymetry area coverage

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 using a multibeam echo sounder.

The maximum depth recorded by multibeam echo sounder is 24.8m 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.

7 WEATHER

During the months of May to September 2022, the weather was extremely unfavourable for survey operations. In the month of April 2022, while carrying out the offshore cross-shore profiles, due to the breakers near shore, the boat had to take a turn between 4 to 5m water depth, due to heavy breakers in the nearshore section, considering the safety of personnel and equipment on board.

8 REFERENCES

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

- AVPPL Service order 5700267194 dated 3rd May 2019
- Web site https://www.vizhinjamport.in/home.html, and https://www.vizhinjamport.in/download/Feasibility-Report.pdf
- WMO manual, section 5.2.2
- SAC Project Execution Plan SAC/P167-19/PEP AVPPL
- Monthly survey reports from April to September 2022

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 with the onset of monsoon. The maximum wind speeds were blowing from the northwesterly direction.
3. The long-shore current speed was recorded in the southerly direction in the monsoon months.
4. The maximum Total Suspended Solids recorded was 2.8 mg/l near the bottom at Location L4 (Poovar) for the pre-monsoon 2022 period and 2.6 mg/l near the bottom at Location L4 (Poovar) again for the monsoon 2022 period.
5. The salinity was in the range of 32.5 and 34.6 ppt for the water samples collected in pre-monsoon period and between 32.8 and 34.3 ppt for the samples collected during the as well as monsoon 2022 period.
6. The maximum turbidity recorded for the pre-monsoon 2022 period was 2.1 NTU near the surface and also at the bottom at Location L4 (Poovar). For the monsoon 2022

period, the maximum turbidity recorded was 1.9 NTU near the bottom at Location L3 (Pachalloor).

7. At the location of the turbidity buoys, the maximum turbidity recorded at Location 1 was 5.69 NTU near the bottom in the month of May 2022, maximum turbidity measured at Location 2 was 5.65 NTU near the bottom in the month of July 2022 and that recorded at Location 3 was 4.79 NTU at mid-depth in the month of August 2022.
8. The beach samples consisted mainly of coarse to medium sand. At four locations, fine sand has been observed, namely, BS-40A, BS-42, BS-44 and BS-45.
9. The seabed is seen to slope gently towards the southwest. The maximum depth recorded by multibeam echo sounder is 24.8m 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 2022

Figure 1- September CSP 01

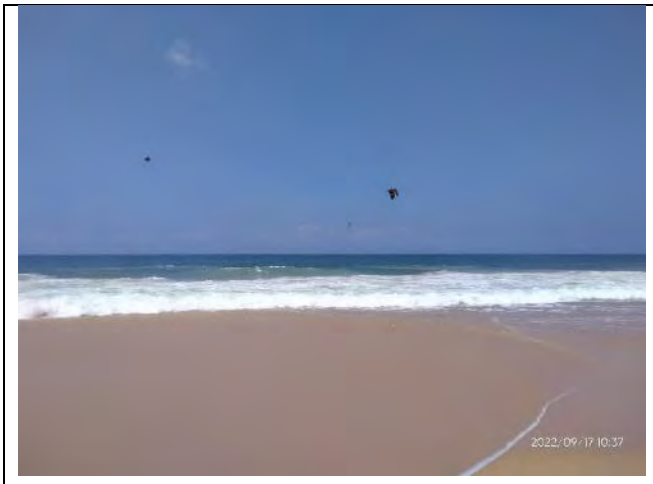



Figure 2- September CSP 02

Figure 3- September CSP 03

Figure 4- September CSP 04



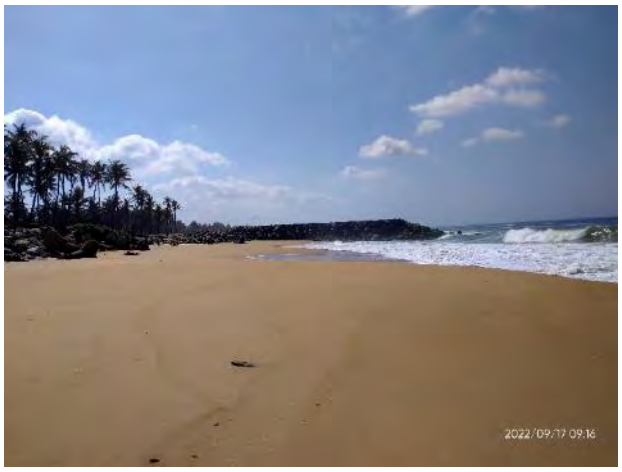
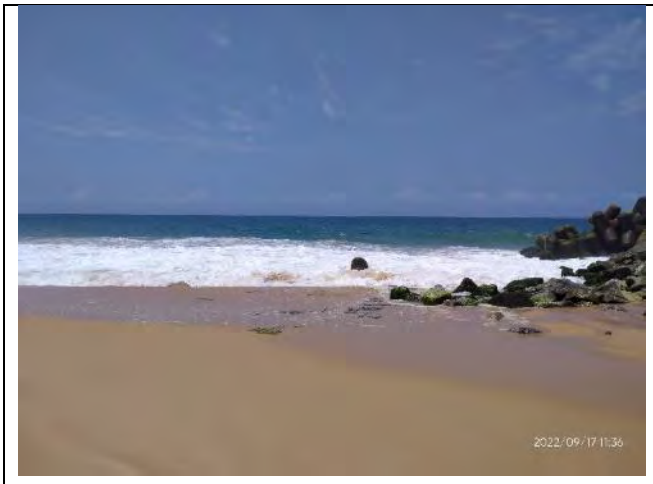



Figure 5- September CSP 05

Figure 6- September CSP 06



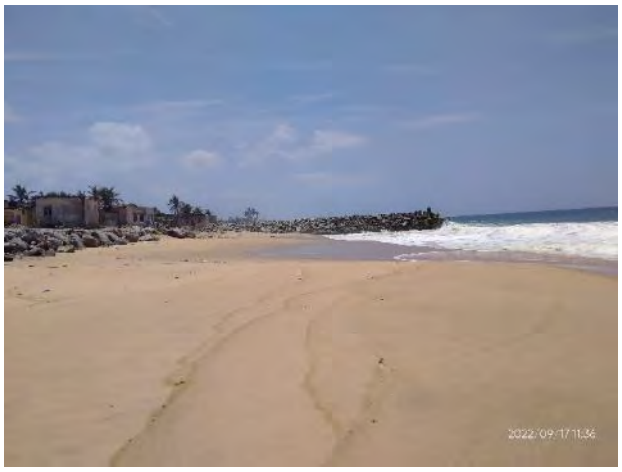



Figure 7- September CSP 07

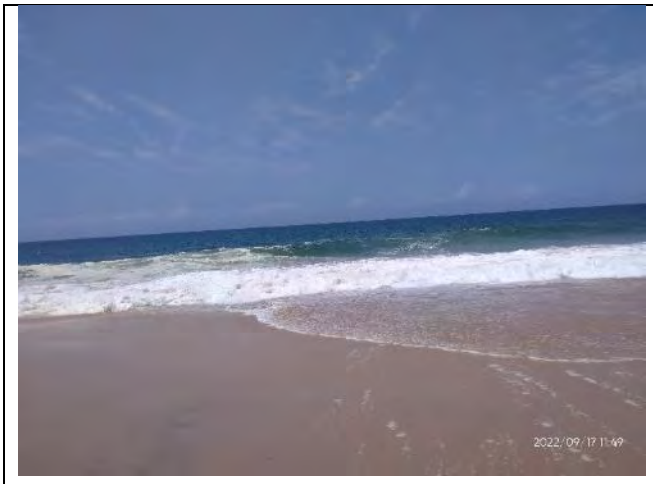
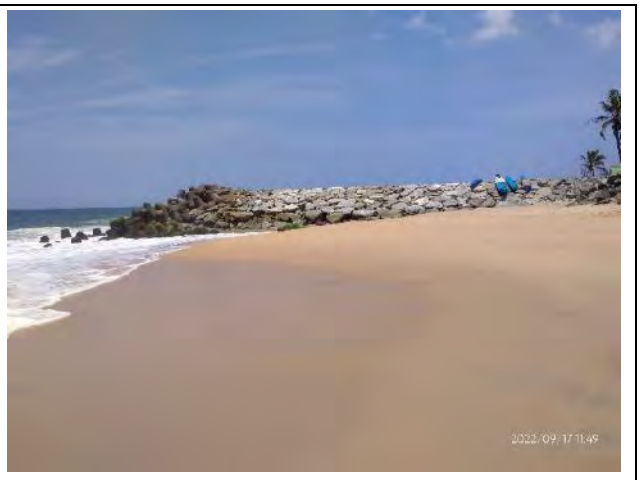
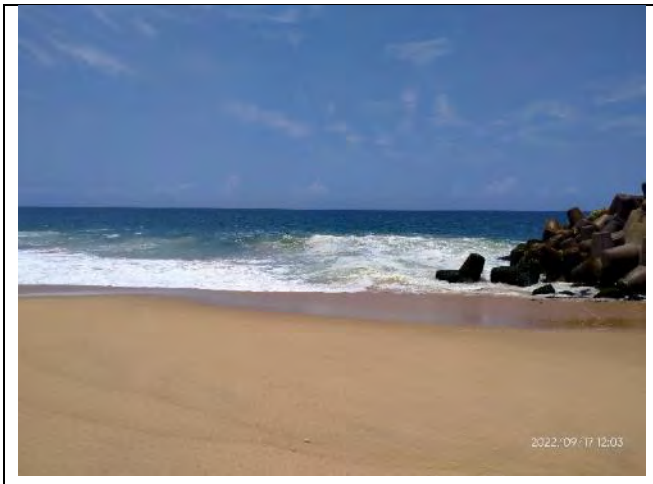



Figure 8- September CSP 08



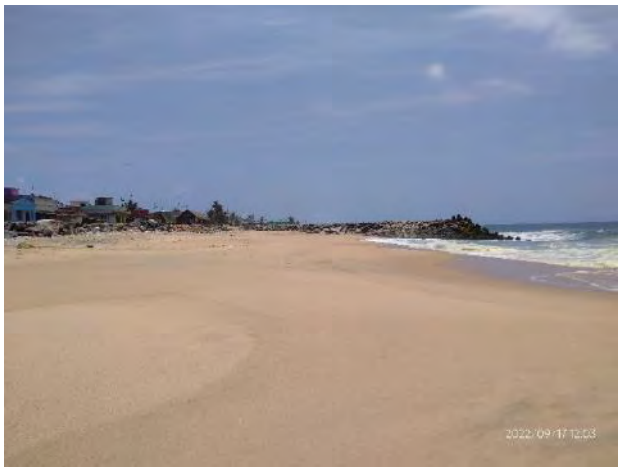



Figure 9- September CSP 09

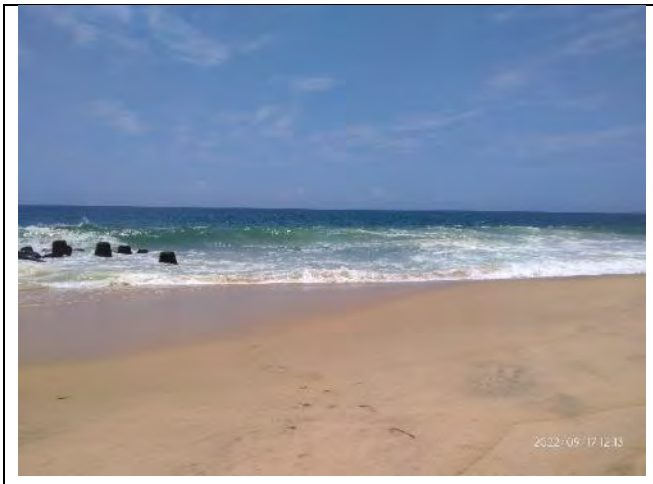



Figure 10- September CSP 10

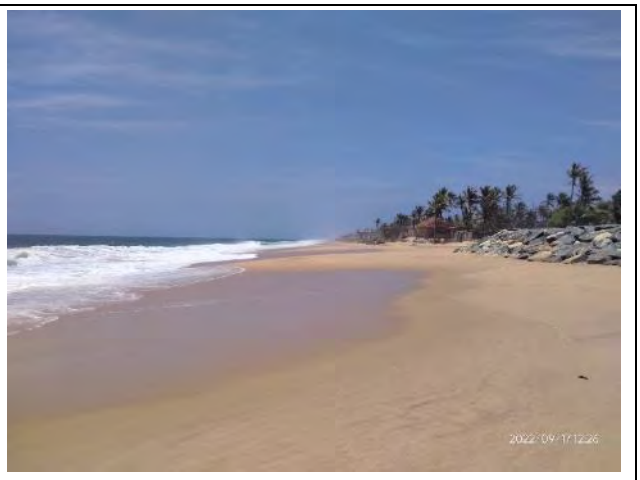


Figure 11- September CSP 11




Figure 12- September CSP 12

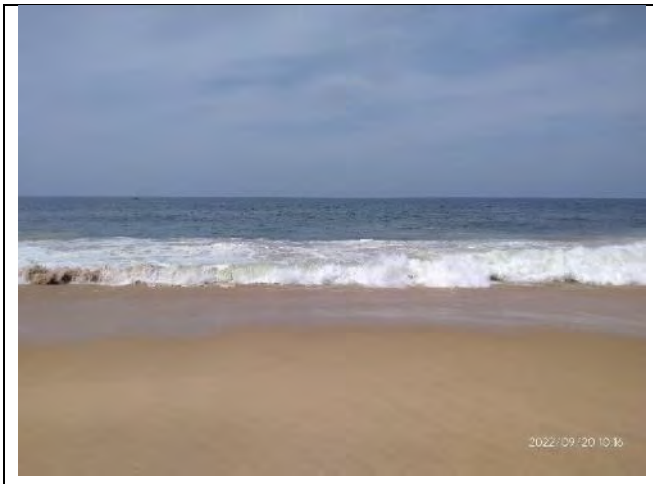


Figure 13- September CSP 13

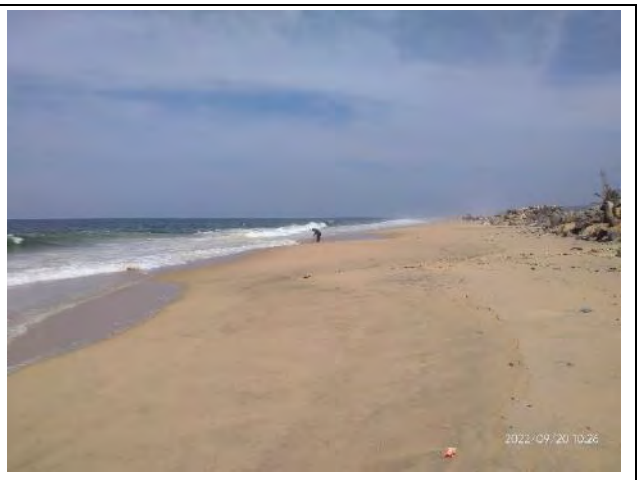



Figure 14- September CSP 14



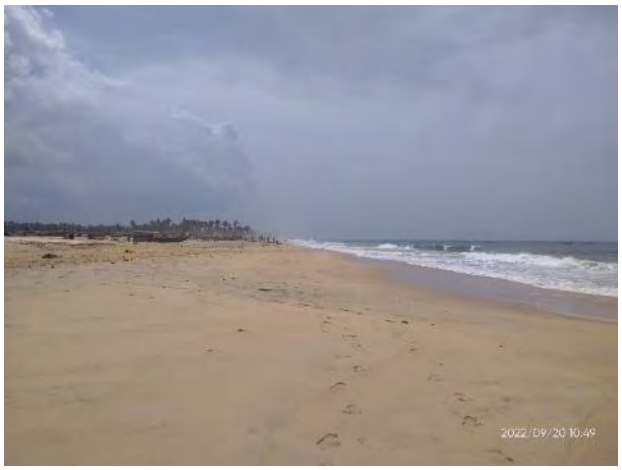
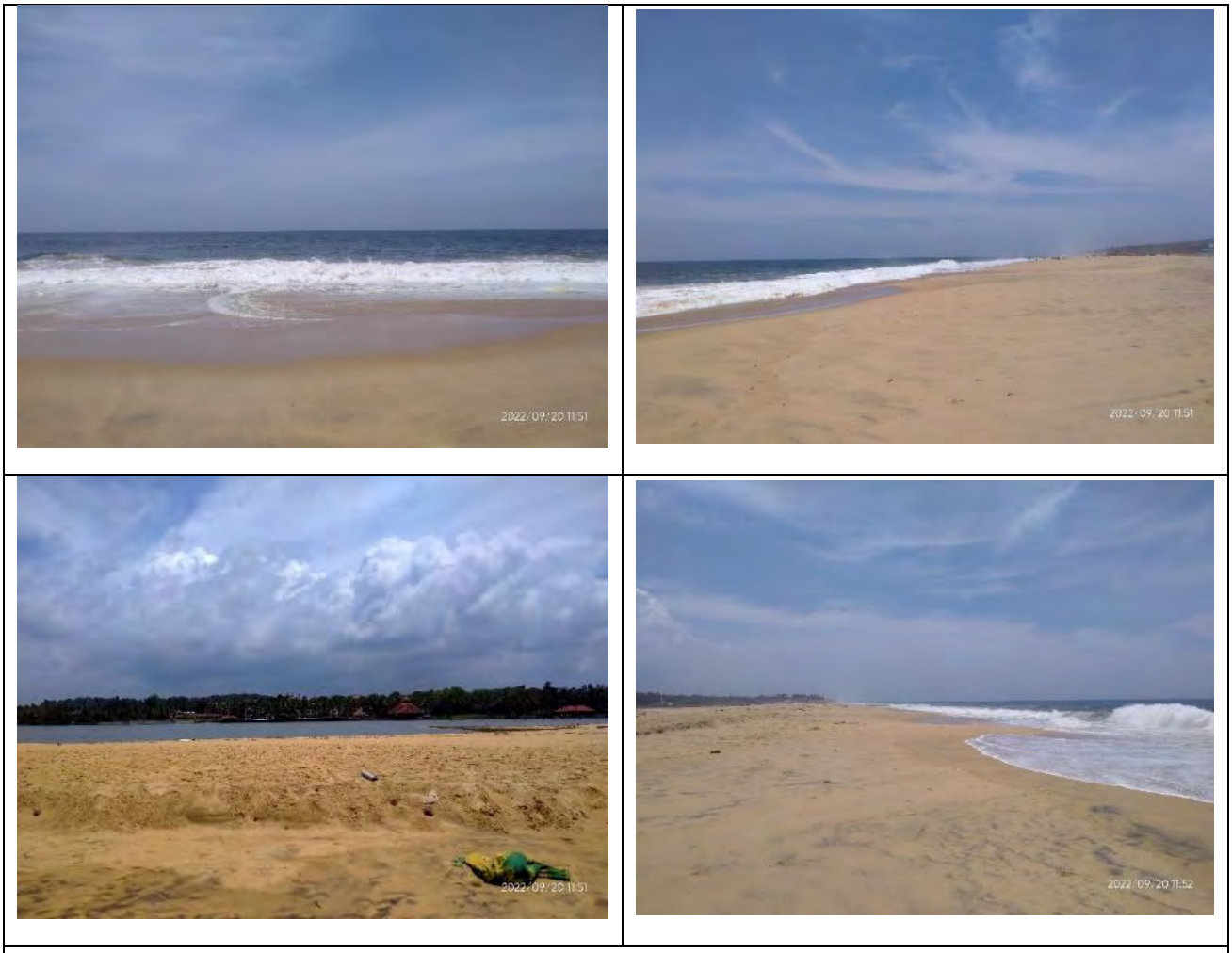



Figure 15- September CSP 15



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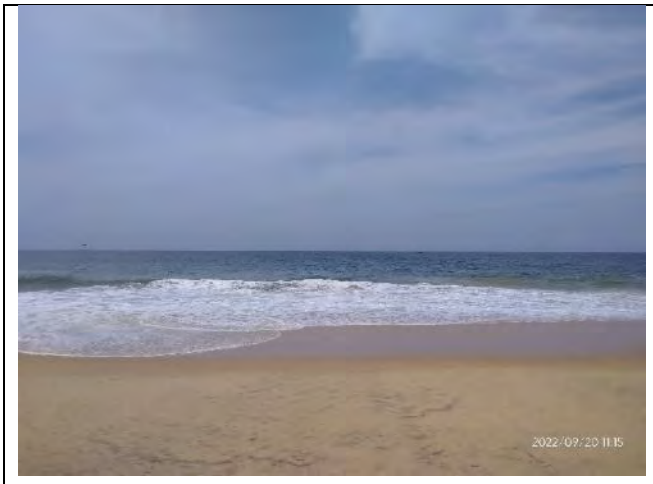


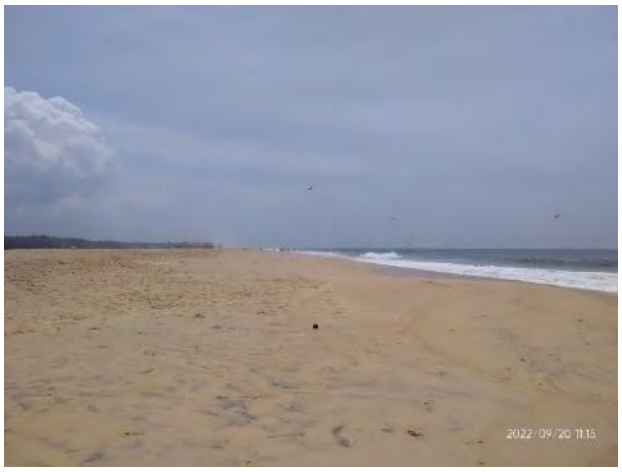



Figure 17- September CSP 17

Figure 18- September CSP 18

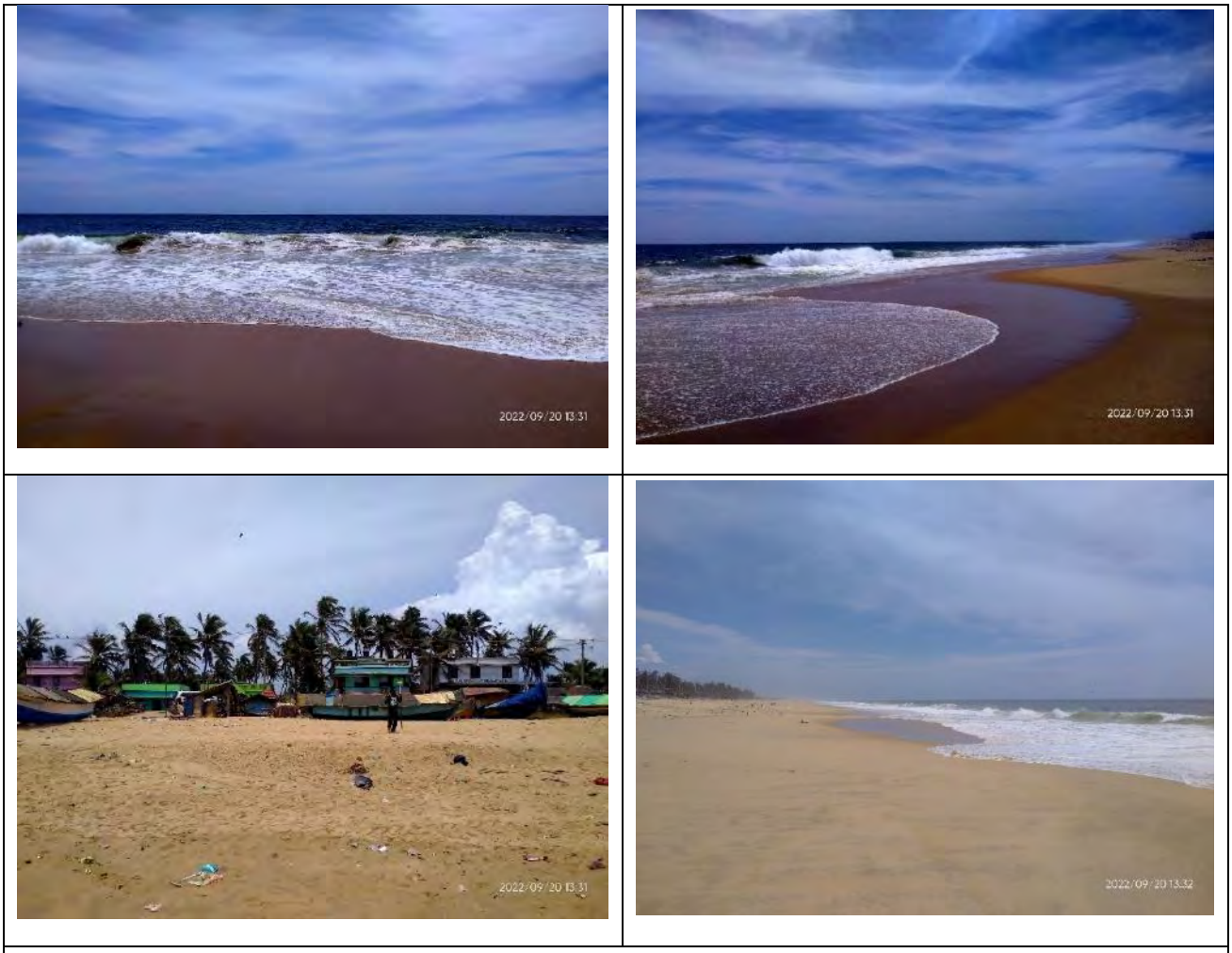
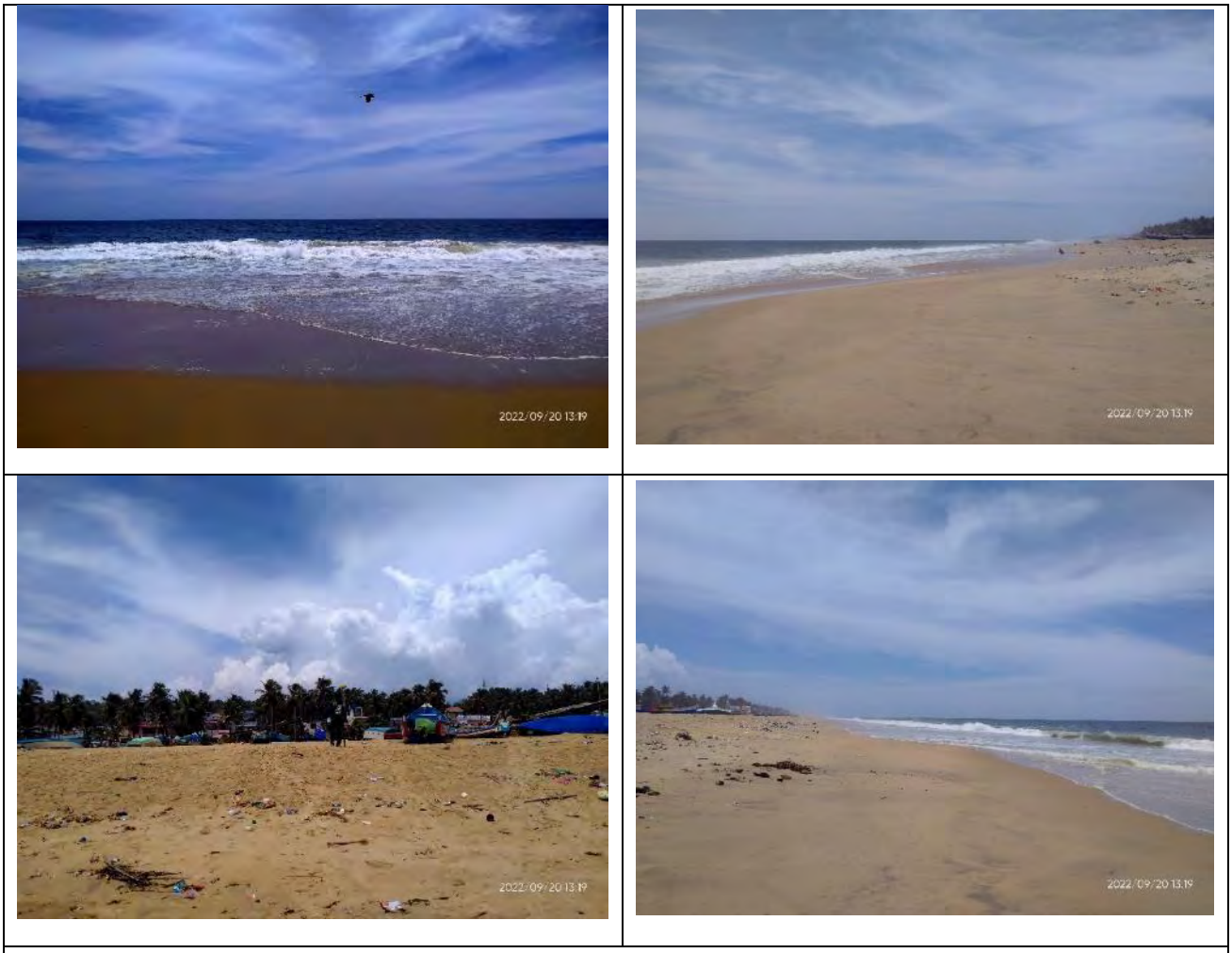


Figure 19- September CSP 19



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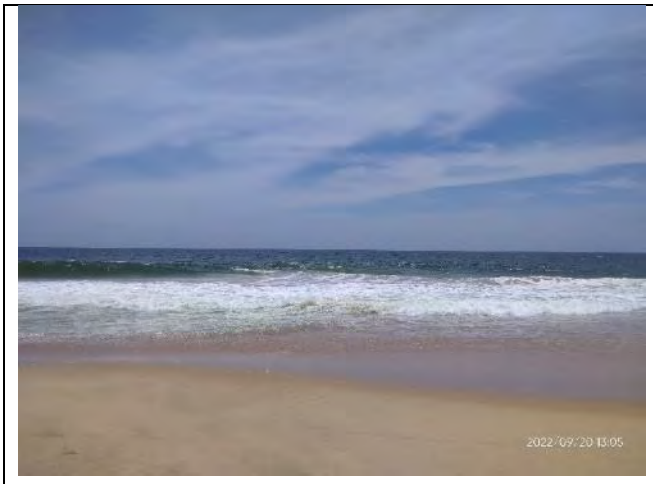


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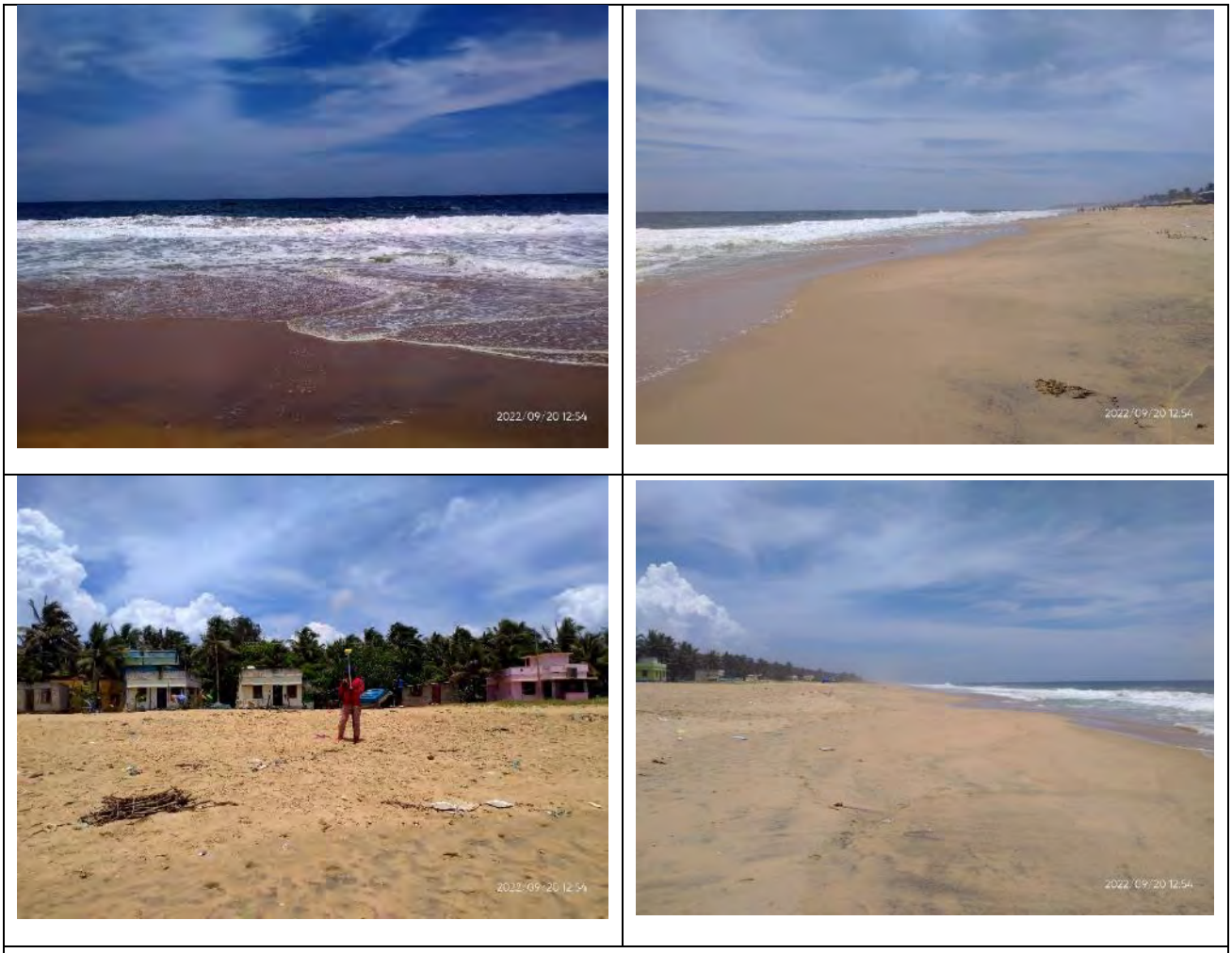


Figure 22- September CSP 22

Figure 23- September CSP 42

Figure 24- September CSP 43




Figure 25- September CSP 44

Figure 26- September CSP 45




Figure 27- September CSP 46

Figure 28- September CSP 47




Figure 29- September CSP 48

Figure 30- September CSP 49

Figure 31- September CSP 50

Figure 32- September CSP 51

Figure 33- September CSP 52

Figure 34- September CSP 61

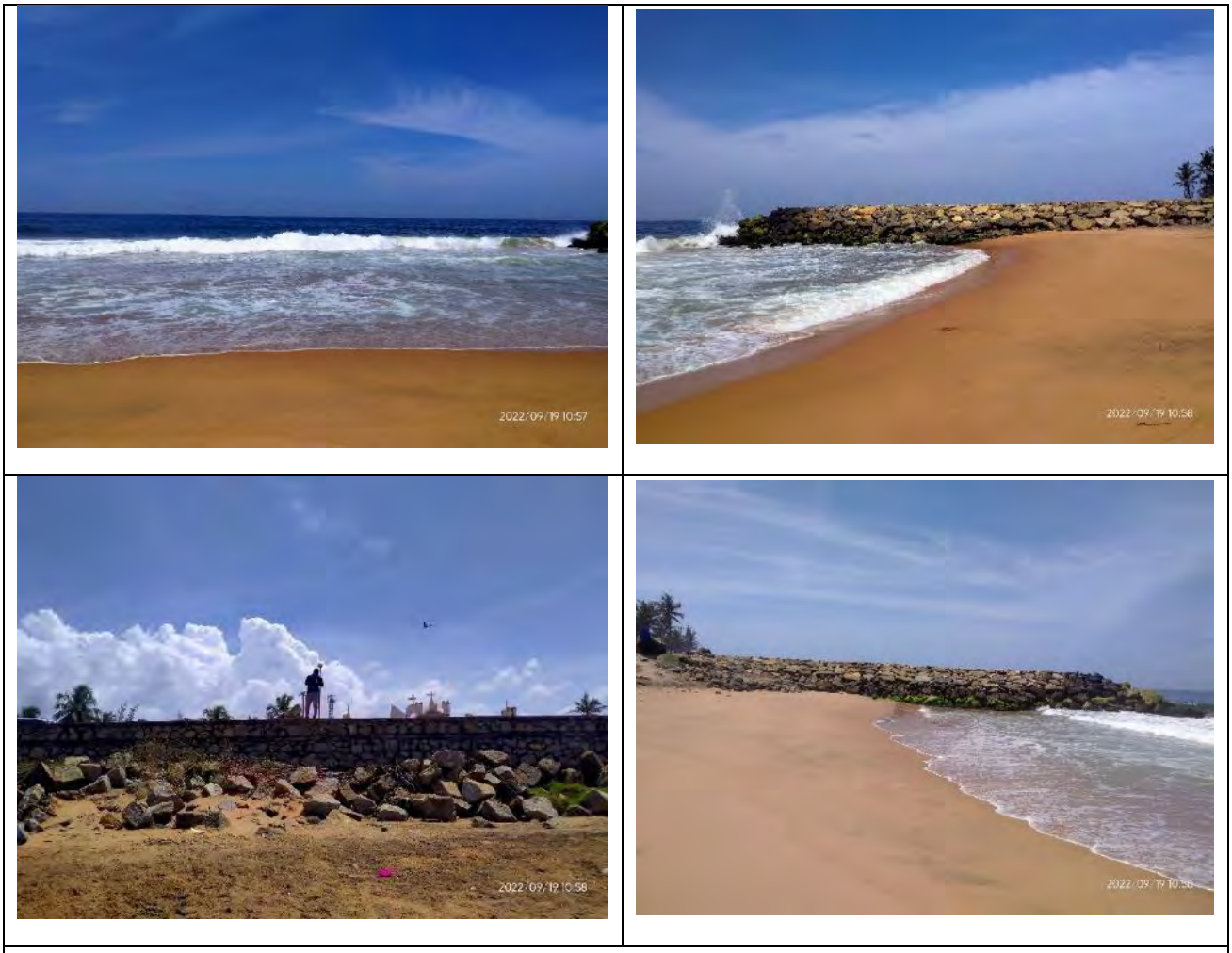


Figure 35- September CSP 62




Figure 36- September CSP 63

Figure 37- September CSP 64

Figure 38- September CSP 65

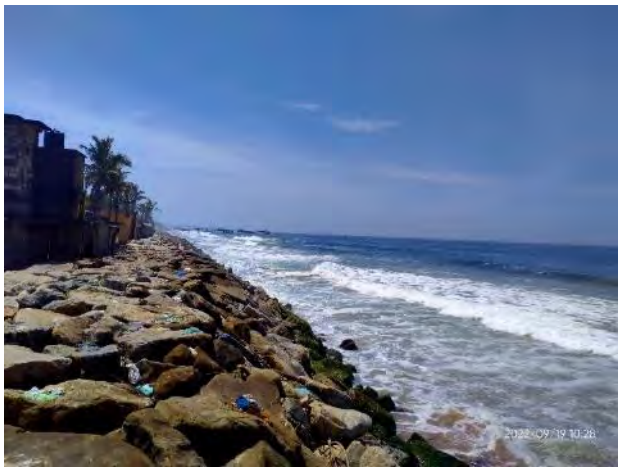
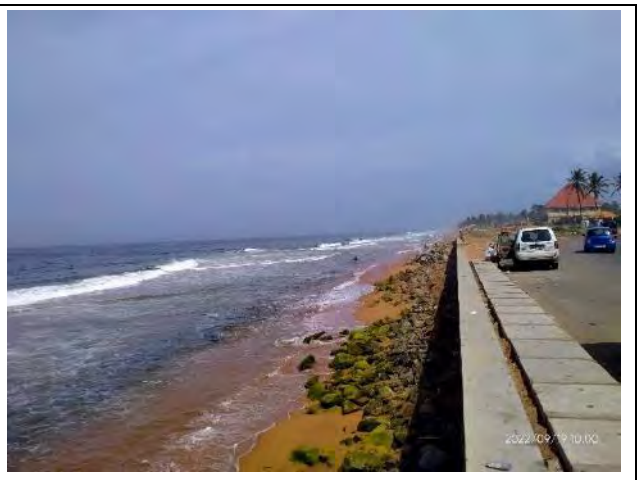


Figure 39- September CSP 66

Figure 40- September CSP 67



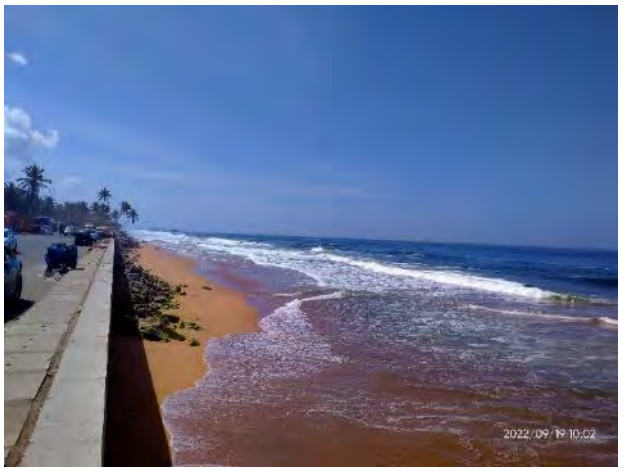


Figure 41- September CSP 68

Figure 42- September CSP 69

Figure 43- September CSP 70

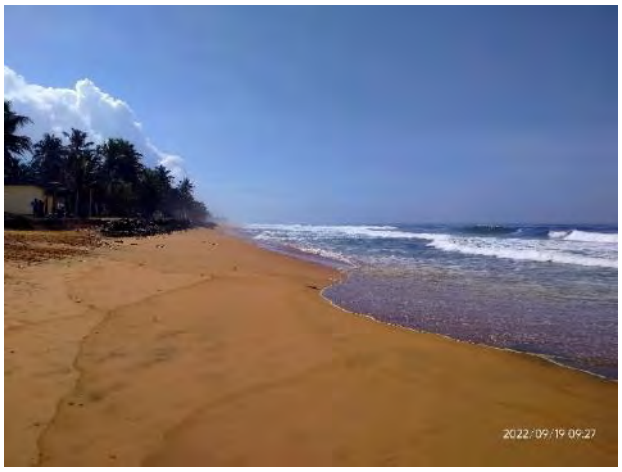


Figure 44- September CSP 71

Figure 45- September CSP 72

Figure 46- September CSP 73

Figure 47- September CSP 74



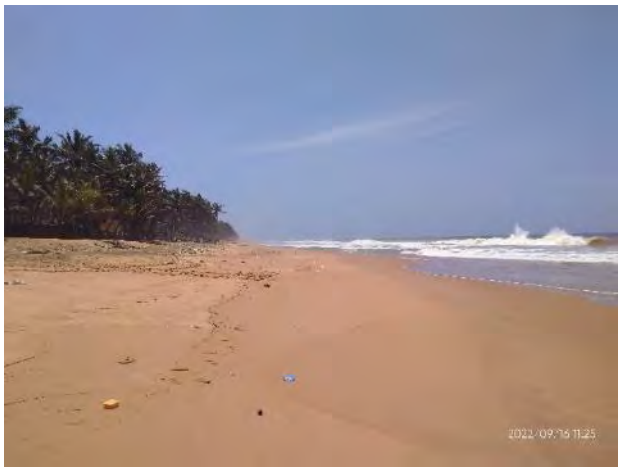



Figure 48- September CSP 75

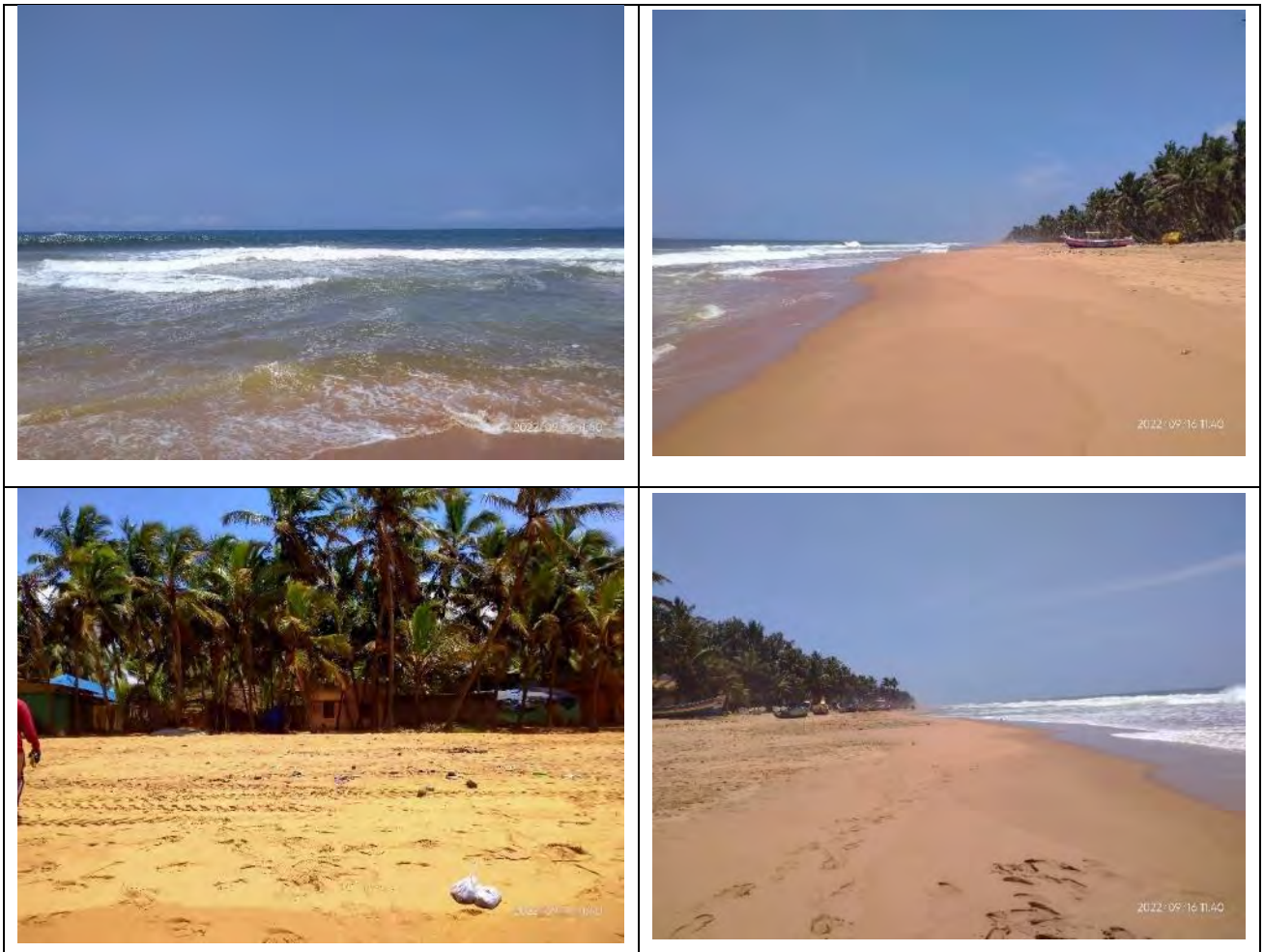


Figure 49- September CSP 76

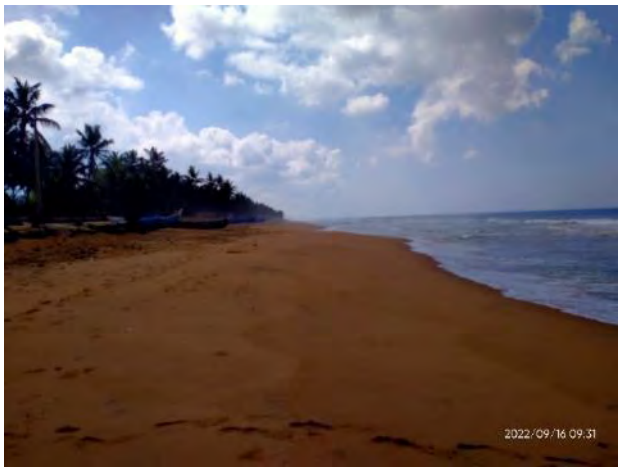


Figure 50- September CSP 77

Figure 51- September CSP 78

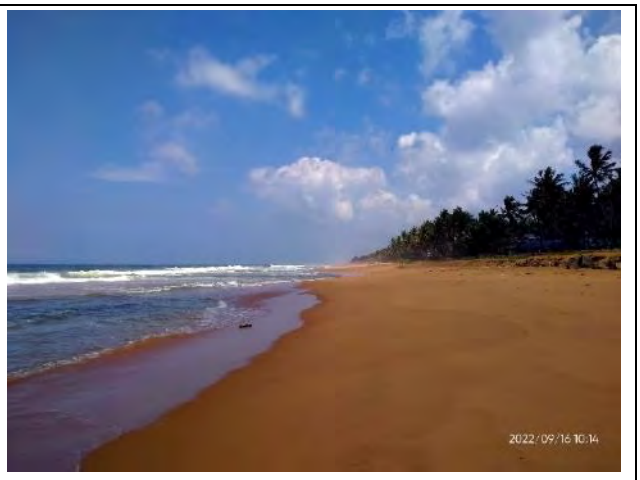


Figure 52- September CSP 79



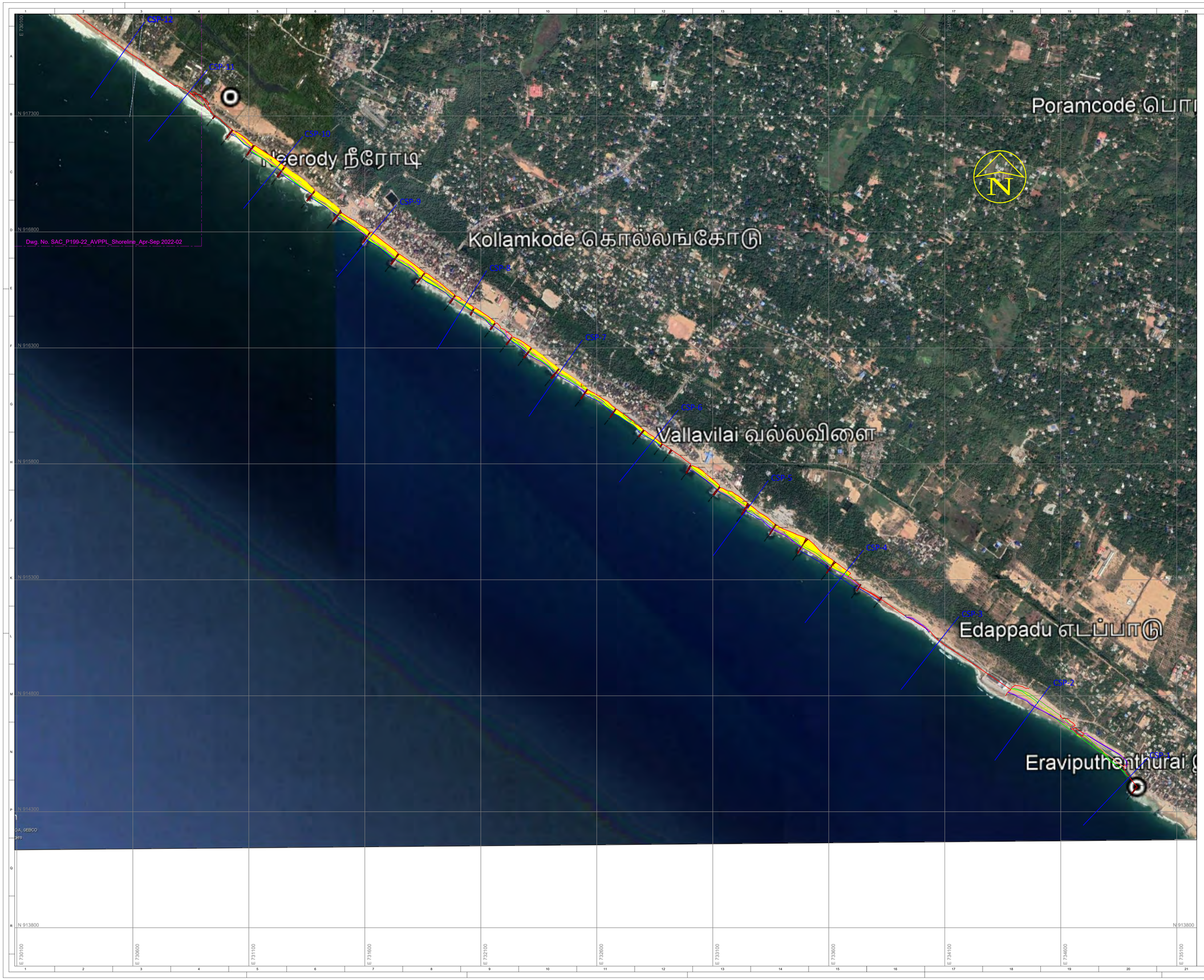

Figure 53- September CSP 80




Figure 54- September CSP 81

Annexure II

Overlay of Month on Month GPS Survey Charts



Notes :

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

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2022
- SHORELINE MAY 2022
- SHORELINE JUNE 2022
- SHORELINE JULY 2022
- SHORELINE AUGUST 2022
- SHORELINE SEPTEMBER 2022

Survey Notes

Surface Positioning : Geomax Zenith (GPS Mode)

Geodetic Parameters :

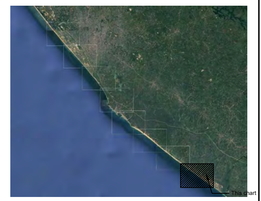
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.3142454m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
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 AND CO.
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

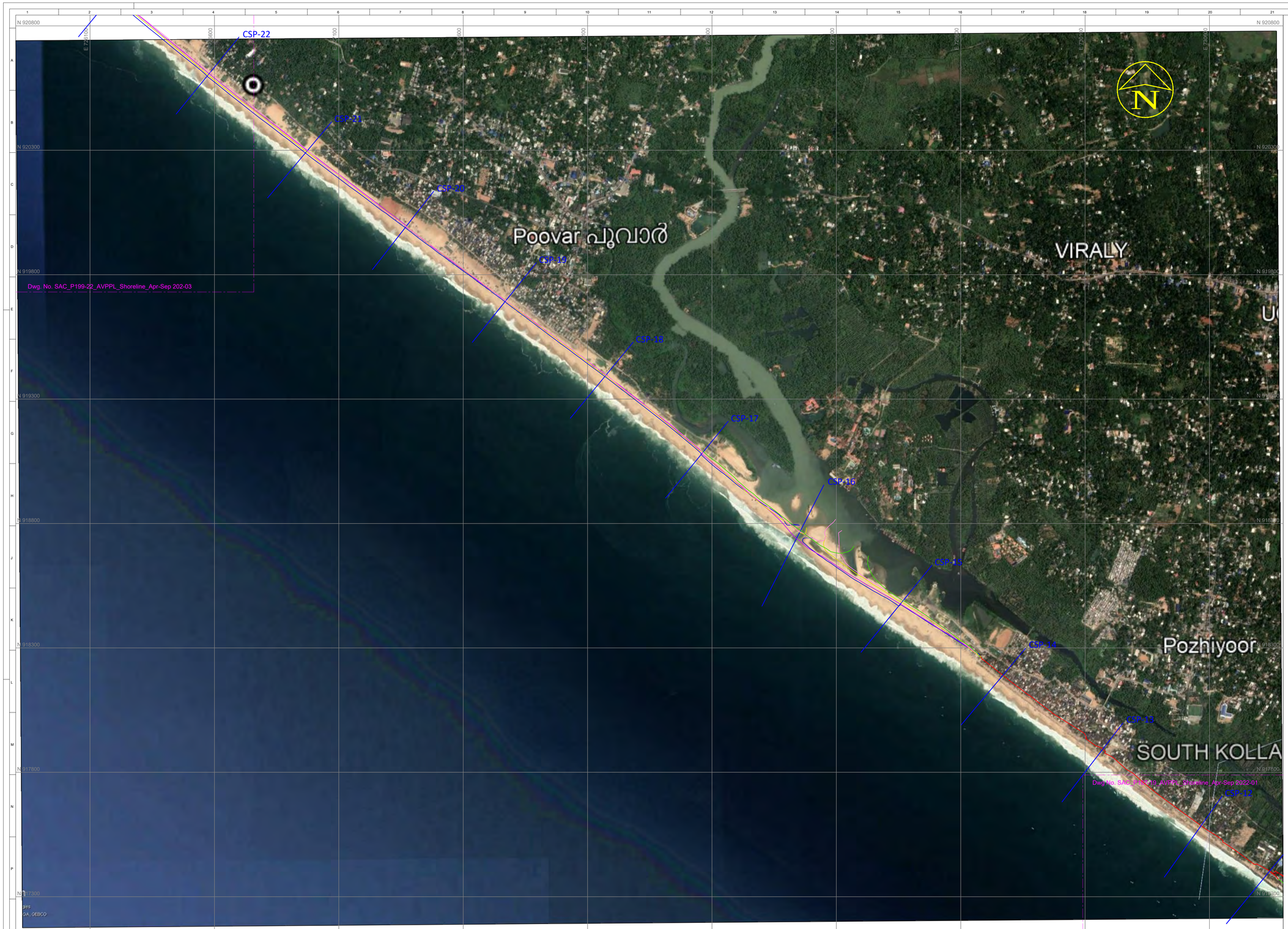
Drawing Title

Shoreline Monitoring Chart

Rev No.	Description	Date
0	First issue	10.11.2022

Drawn : S. Khaire | Interpreted : Vishnu K. | Checked : V. Mehta | Approved : S. Philip

Dwg. No. SAC_P199-22_AVPPL_Shoreline_Apr-Sep 2022-01



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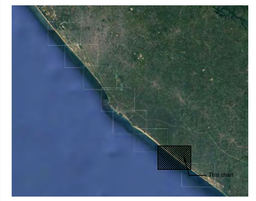
Semi-Minor Axis	:	6356752.3142451m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 5000

100 0 100 200 300 400 500metres

Key Plan



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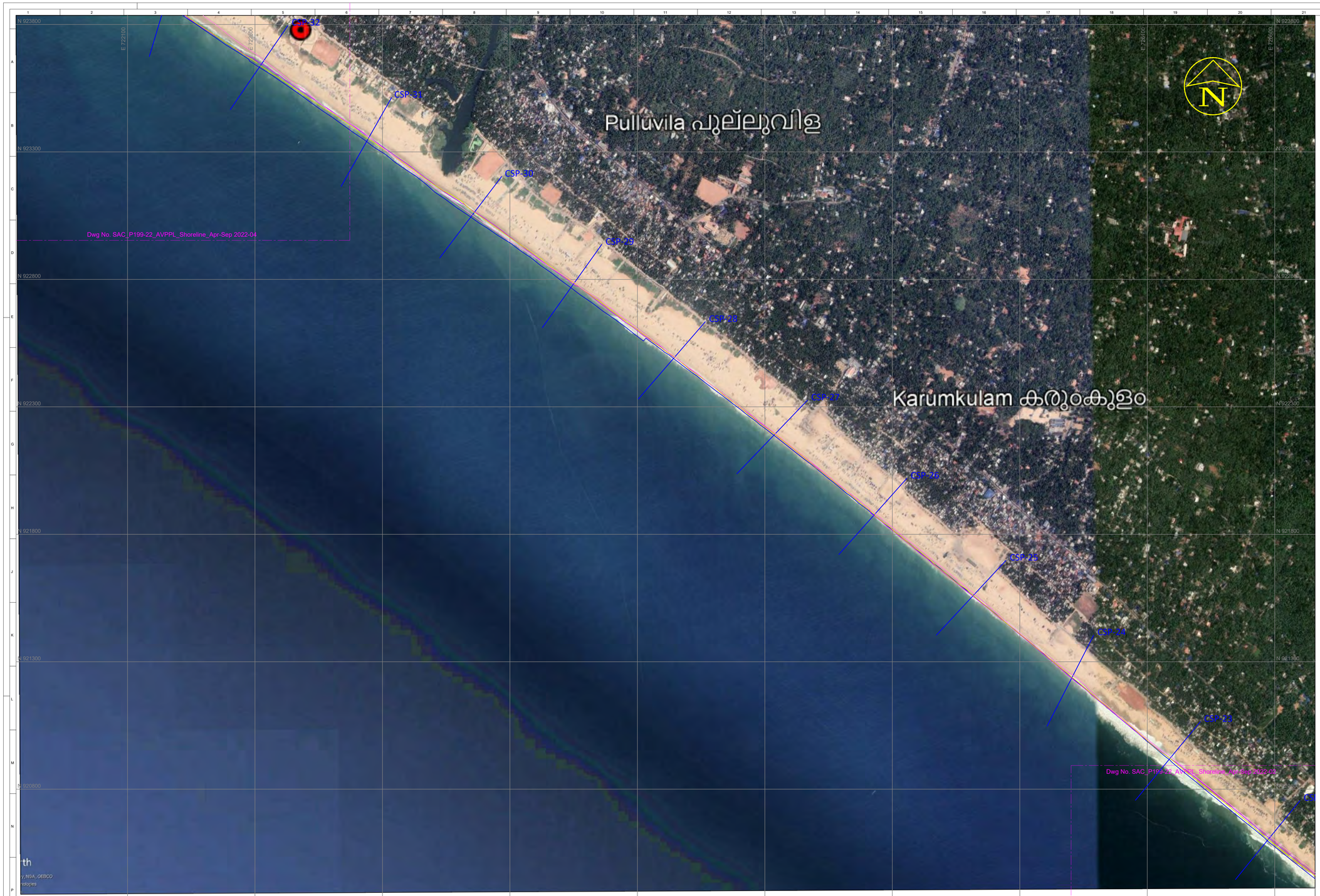
Dwg. No. SAC_P199-22_AVPPL_Shoreline_Apr-Sep 202-02



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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

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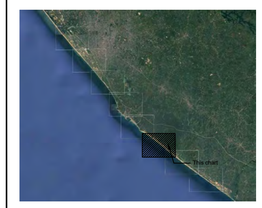
Key Plan



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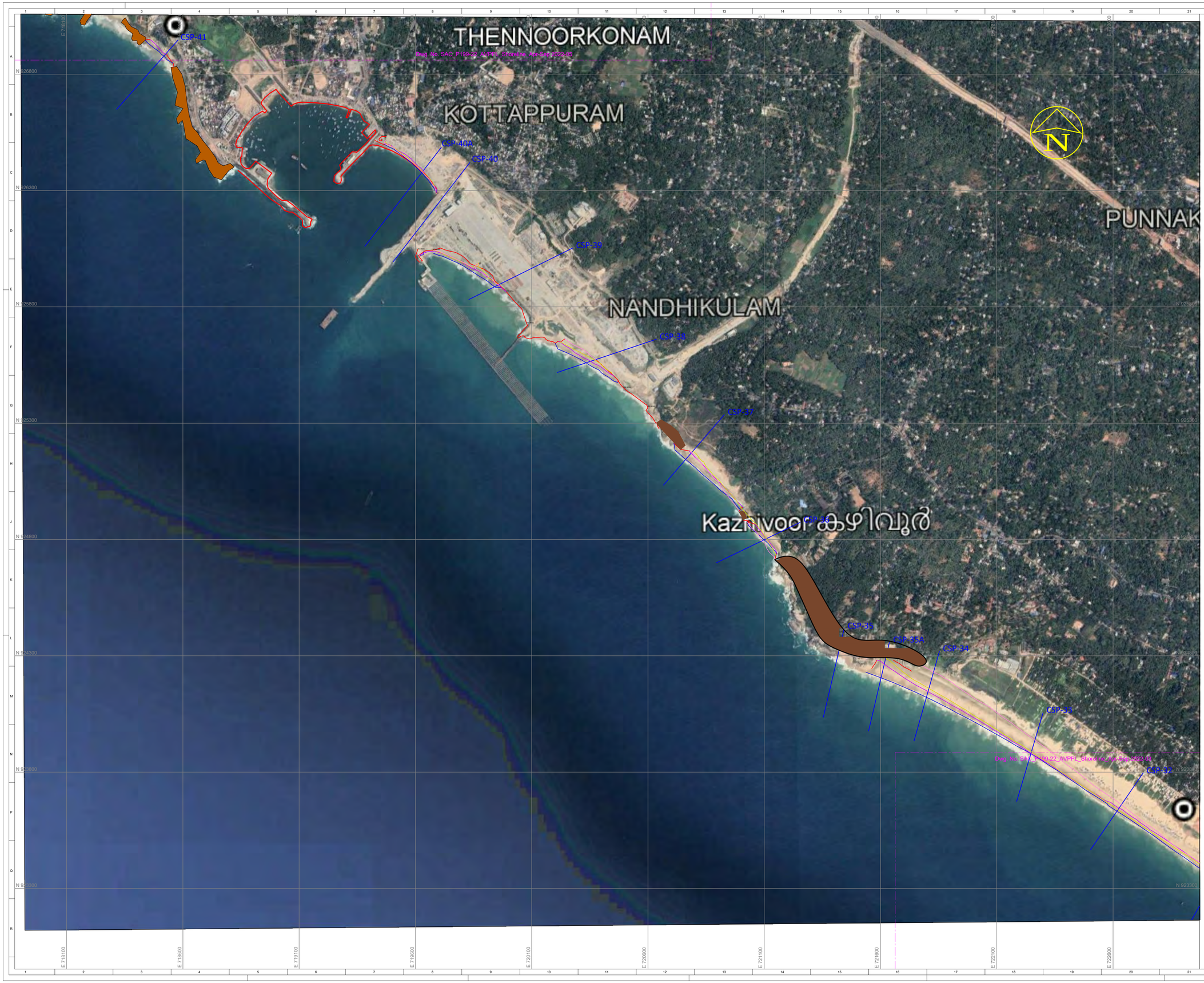
Dwg. No. SAC_P199-22_AVPPL_Shoreline_Apr-Sep 2022-03



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Latitude of Origin	:	0° N (Equator)
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Units	:	Metres

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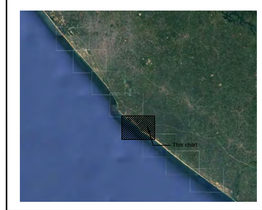
Key Plan



Client

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

Survey Contractor

SHANKAR AND CO.
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

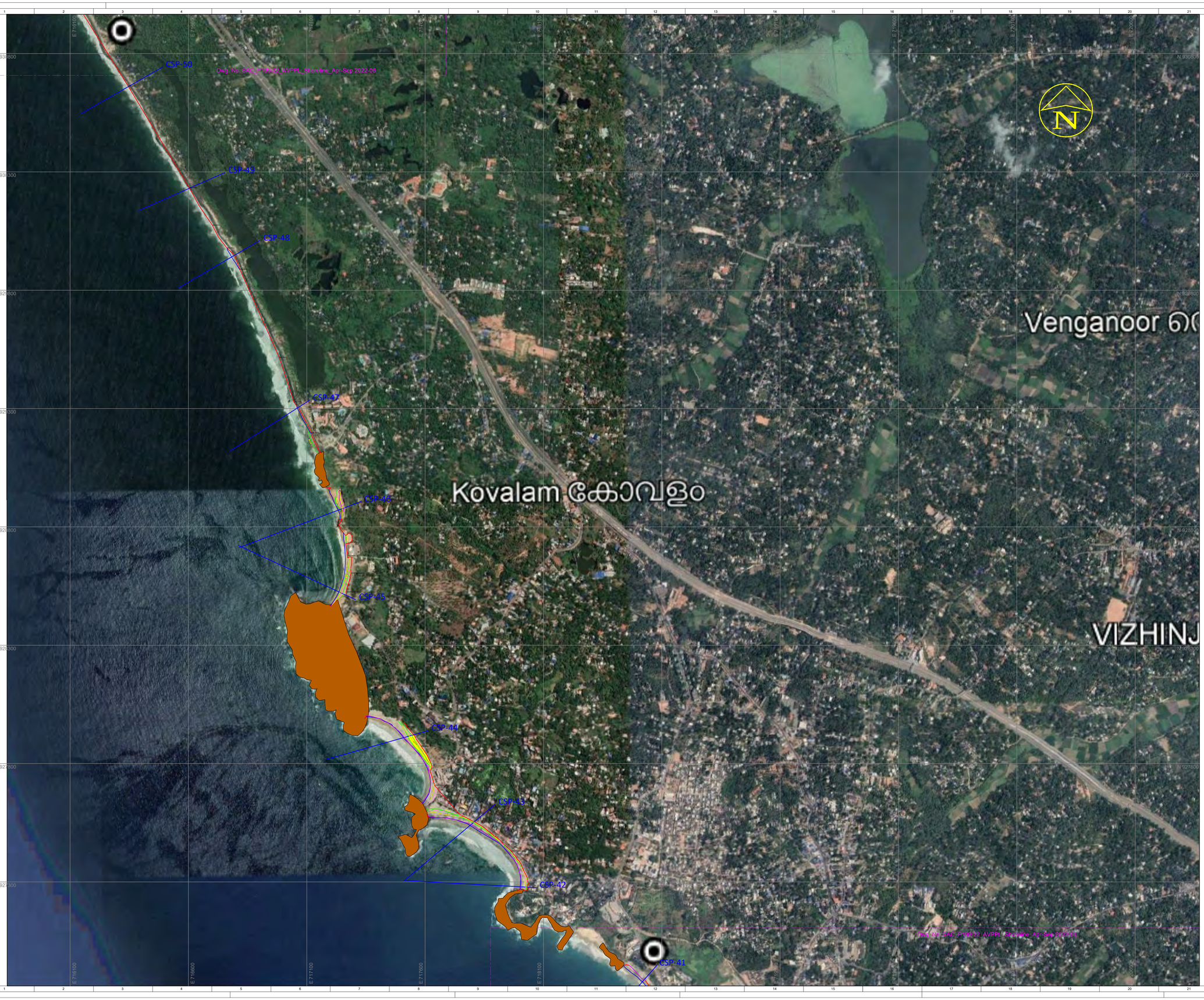
Drawing Title

Shoreline Monitoring Chart

Rev No.	Description	Date
0	First issue	10.11.2022

Drawn : S. Khaire	Interpreted : Vishnu K.	Checked : V. Mehta	Approved : S. Philip

Dwg. No. SAC_P199-22_AVPPL_Shoreline_Apr-Sep 2022-04



Notes :

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

LEGEND

- GROYNES
- BEACH
- ROCK
- SEAWALL
- SHORELINE APRIL 2022
- SHORELINE MAY 2022
- SHORELINE JUNE 2022
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Survey Notes

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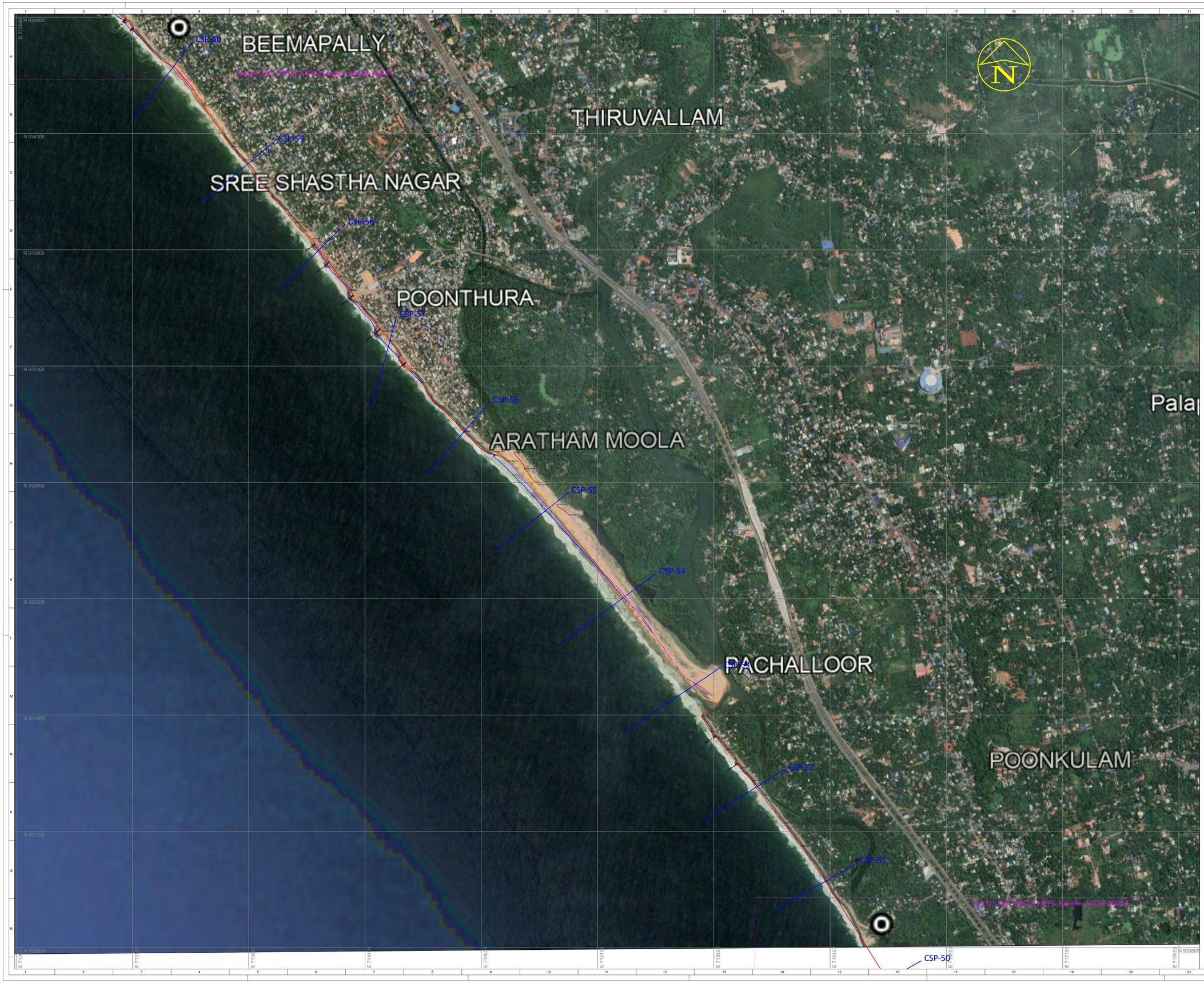
Dwg. No. SAC_P199-22_AVPPL_Shoreline_Apr-Sep 2022-05



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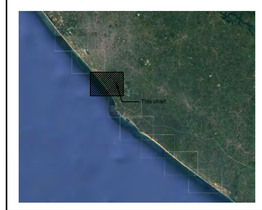

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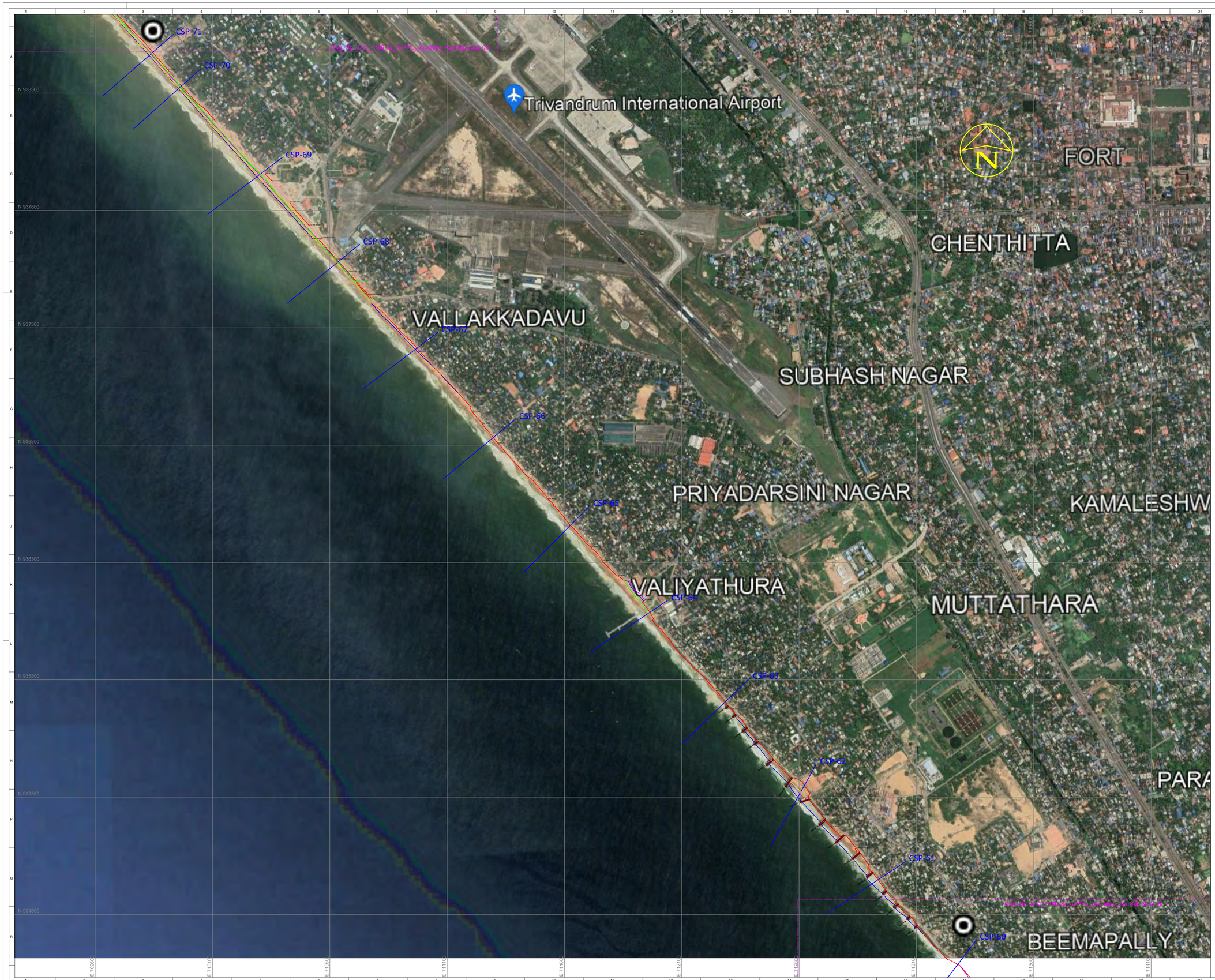
Dwg. No. SAC_P199-22_AVPPL_Shoreline_Apr-Sep 2022-06



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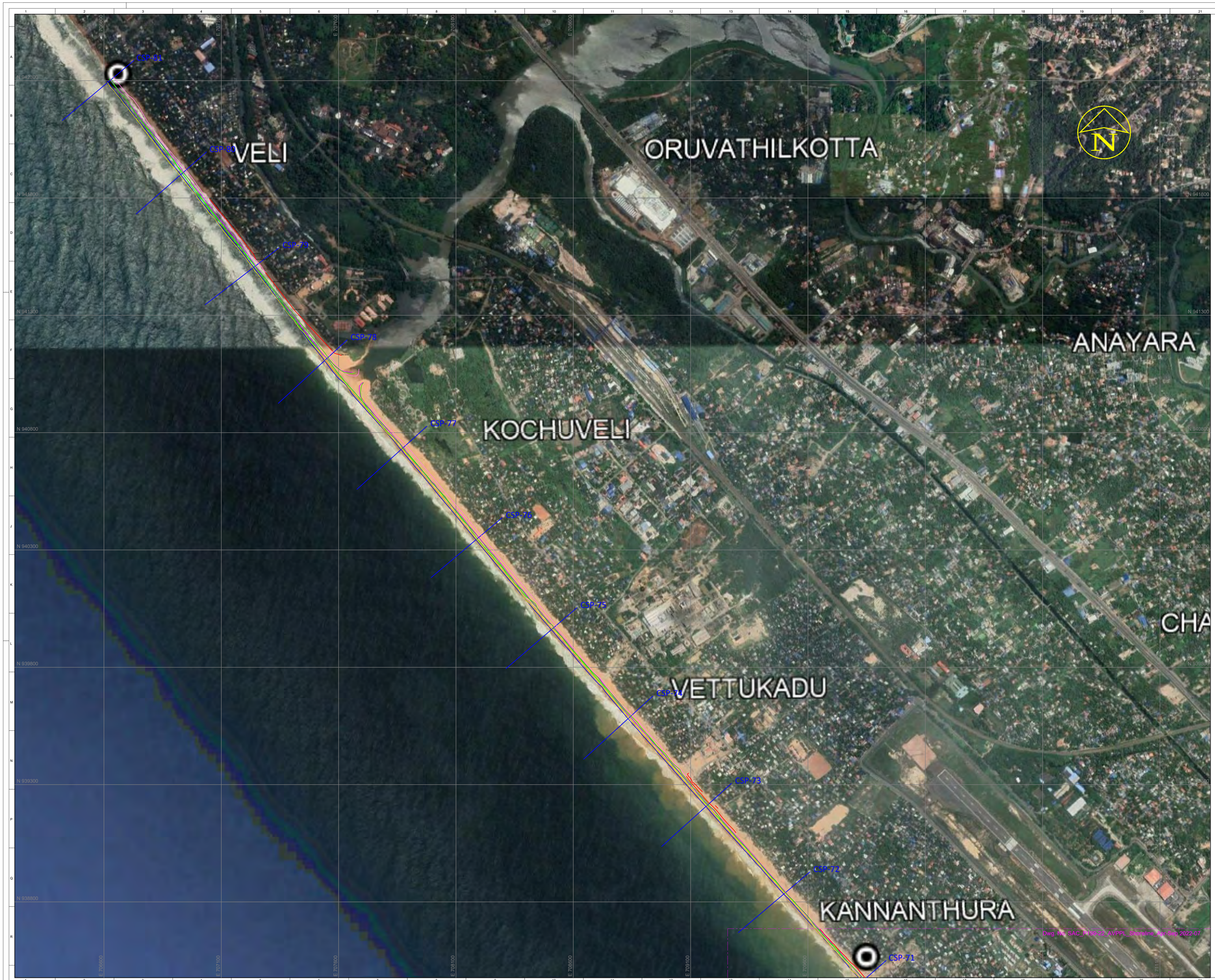

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Drawn : S. Khaire | Interpreted : Vishnu K. | Checked : V. Mehta | Approved : S. Philip

Dwg. No. SAC_P199-22_AVPPL_Shoreline_Apr-Sep 2022-08

Annexure II

Modelling Report

(March 2021 to September 2022)

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 (Mar 2021 – Sep 2022)	**Project No.:** C1221501	
Title: Model Study Report (March 2021 – September 2022)	**Document No.:** RP004	**Rev.:** 0

File path:
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Notes:

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Revision Details:

0	21/11/2022	First Submission	TTN		RRJ		PRJ	
Rev.	**Date**	**Details**	**Init.**	**Sign.**	**Init.**	**Sign.**	**Init.**	**Sign.**
			Prepared		**Checked**		**Approved**	

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LIST OF ABBREVIATIONS

ADCP	: Acoustic Doppler current profiler
ATG	: Automatic Tide Gauge
AVPPL	: Adani Vizhinjam Port Private Limited
AWS	: Automatic Weather Station
CD	: Chart Datum
CS	: Cross Section
CSP	: Cross Shore Profile
E	: East
EOF	: Empirical Orthogonal Function
FSINPVT	: Fugro Survey India Private Limited
GNSS	: Global Navigation Satellite System
GPS	: Global Positioning System
HD	: Hydrodynamics
H_{m0}	: Wave height
H_s	: Significant Wave Height
HTL	: High Tide Level
IMD	: Indian Meteorological Department
LNTIEL	: L & T Infrastructure Engineering Limited
LST	: Longshore Sediment Transport
LSTR	: Longshore Sediment Transport Rate
MBES	: Multi Beam Echo Sounder
MSL	: Mean Sea Level
N	: North
NCEP	: National Centers for Environmental Prediction
NHO	: Naval Hydro graphic Chart
NIOT	: National Institute of Technology
NOAA	: National Oceanic and Atmospheric Administration

NTU	: Nephelometric Turbidity Unit
NW	: North West
OSAS	: Ocean Science and Surveying
OSU	: Oregon State University
OTIS	: OSU Tide Inversion Software
OTPS	: OSU Tide Prediction Software
PCA	: Principal Component Analysis
PBW	: Partial Break Water
RTK	: Real Time Kinetic
S	: South
SAC	: Shankar And Co.
SBES	: Single Beam Echo Sounder
SE	: South East
SSW	: South-South West
SW	: South West
SWAN	: Simulation of WAves Near shore
T_p	: Peak Wave period
TSS	: Total Suspended Solids
VISL	: Vizhinjam International Seaport Limited
VSCS	: Very Severe Cyclonic Storm
W	: West
WRB	: Wave Rider Buoy
WSW	: West South West

Executive Summary

Government of Kerala 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 Government of Kerala 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 concessionnaire. 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 2020, LNTIEL submitted a report based on the data received from February 2015 - February 2021. 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 accompanying model study for the data collected in March 2021 to February 2022. AVPPL entrusted LNTIEL to conduct data analysis and modelling. 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 March 2021-September 2022 to assess the impact of port development.

Following are the summaries 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 7 transect lines perpendicular to the shore; four on the North of port, two on the South of port and one near the port. Cross sections of bathymetries from Pre monsoon 2015 to Pre monsoon 2022 were compared.
- The observed wave data provided by AVPPL for the period of March 2021 to August 2022 is analysed and compared with the observed wave data for February 2018 to August 2021. 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 pre-monsoon, monsoon and post-monsoon of 2021 and Pre-monsoon 2022 at four locations: Pachalloor, 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 0.8 m/s.

However, occasionally maximum current speed observed during all the seasons is in the range of 0.9 to 1.0 m/s.

- Continuous monitoring of turbidity using buoys has been carried out during March 2021 to September 2022 in three locations. It is perceptible from time series plots that the turbidity fluctuates all year round, though the values were lower than 4 NTU for almost all the time showing that the water is clear.
- 81 locations at 0.5 km interval were opted to collect beach sediments for each season.
- Further LNTIEL extracted (+) 2 m contour from cross shore profile data. The time series plot of (+) 2 m contour over seven 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 seven-year data are shown at Neerody, Pozhiyoor, Karumkulam, Panathura, Beemapally and Vettucaud locations.
- 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. So 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) Near Shore Wave Transformation

- Offshore wave data from March 2021 to August 2022 was obtained from ECMWF and near shore wave transformation was carried out with the latest bathymetry using SWAN model.
- The wave parameters are extracted from the swan model at the point of Wave rider buoy deployment location and compared with the observed wave data
- From observations, it was evident that the simulated and observed wave data were almost identical indicating good correlation.

b) 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, 2020 and 2021) 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)

c) 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 6 years data (Feb 2015 – Feb 2022, Feb-Feb is considered since most beach profiles have built up, even though the scope of this report is Feb 2021-Sep 2022). The northerly and southerly (annual average) long shore sediment movement in south stretch is in the range of 0.16 to 0.18 M m^3/yr (Northwards) and -0.15 to -0.16 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).

d) Analysis of beach volume

- An analysis was done to calculate the sediment volume from the available beach profile data. LNTIEL used average profiles and filled data gaps using an interpolation technique to carry out the analysis.
- The beach profile volume and seabed profile volume combined represents the net volume (m^3/m alongshore). The Feb 2015 (start of survey) profile is considered as baseline to estimate the volume changes.
- From the volume analysis it was found that near the port, the net volume change is minimal and it remains so for stretches near the port location. Only net volume change seems to be higher in stretches of Valiyathura, Shangumugham and beyond towards Northern Kerala. Therefore since around the port and upto a significant distance (at least 10km to the north of the port) the net volume change is minimal, the port cannot have effects on what is happening in Valiyathura, Shangumugham and beyond otherwise the effects would have shown in the nearby regions as well

e) 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. 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

LNTIEL carried out data analysis and model studies for the aforementioned project and it was found that wave activity has increased in this location in past three years post Ockhi Cyclone. From the model studies it was found that the bathymetry of the port location has no effect on the current patterns and the current patterns have remained fairly the same. The port has no effect on the erosion and accretion at Valiyathura & Shangumugham, hence concluded from all the analyses.

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 February 2021, 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 measured oceanographic data from March 2021 to September 2022 and has awarded the job to LNTIEL for carrying out the data analysis and accompanying model study for the data collected in this period. This report contains the analysis of data & required model studies carried out to fulfil the scope of work.

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.

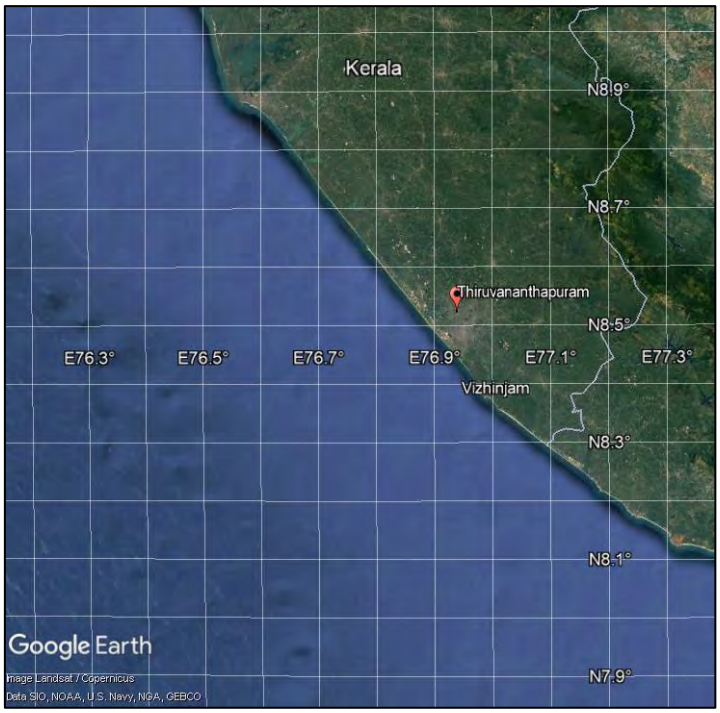


Figure 1-1 Location map of Vizhinjam

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

2 Data Analysis

AVPPL has measured oceanographic data from March 2021 to February 2022 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 March 2021 to August 2022. WRB shutdown due to battery drainage from 9th June 2021 to 24th June 2021 has been reported by Shankar and Co. Shankar and Co. has also reported that the WRB drifted from its original location on 28th November 2021. Further it was recovered the next day and sent to NIOT, Chennai for maintenance and the same was redeployed on 24th January 2022.
2	Long term observation of water level variations for the period March 2021 to August 2022
3	Current data for one month for each season (Pre-monsoon, Monsoon and Post-monsoon) from March 2021 to February 2022 – 4 locations, and for one month for Pre-monsoon season from March 2022 – August 2022.
4	Measurement of wind speed and direction from March 2021 to August 2022
5	Turbidity data from March 2021 to August 2022 in 10 min intervals collected from three locations near the port area
6	Surveyed bathymetry for the Pre-Monsoon 2021, Post Monsoon 2021 and Pre-monsoon 2022.
7	Cross shore beach profiles at 81 locations which cover approximately 40 km along the coastline. To be noted that data is missing due to Covid surge during January 2022.
8	Littoral Environment Observations
9	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 March 2021 to 31st August 2022 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.

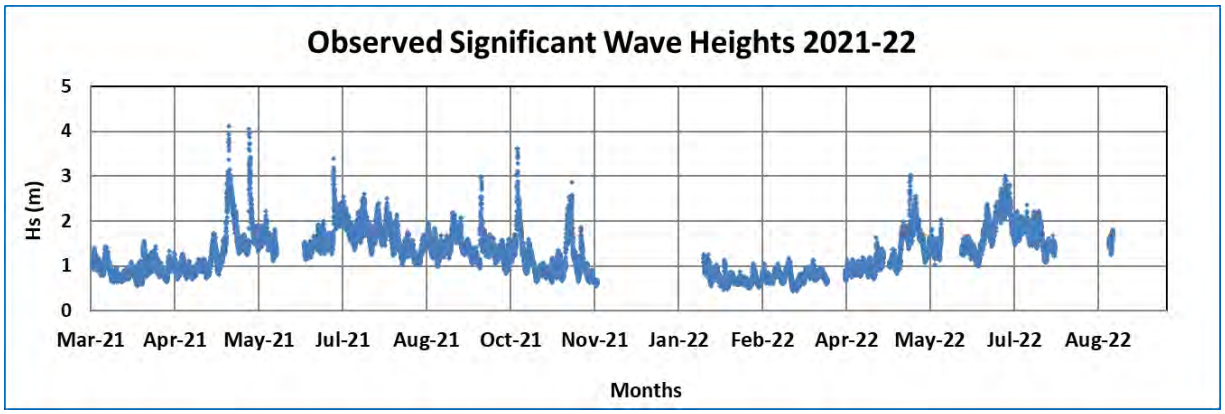


Figure 2-1 Temporal plot of wave height for observed wave data

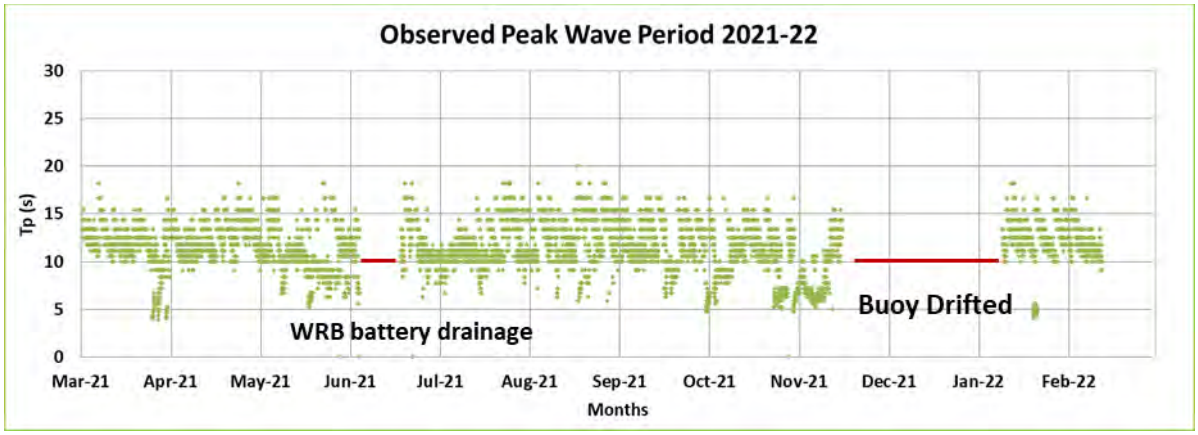


Figure 2-2 Temporal plot of peak wave period for observed wave data

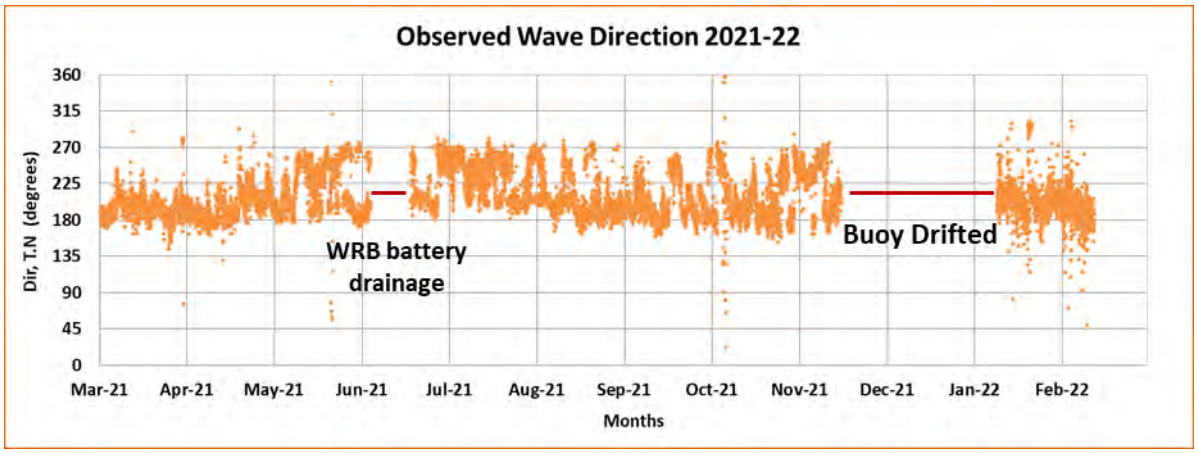


Figure 2-3 Temporal plot of wave direction for observed wave data

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 3.5 – 4 m during monsoon period and episodic events.

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 monsoon season, wave direction is mainly from SW to W and 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 Storm events observed during Mar 2021 to Feb 2022

S. No.	Date	Reason	Intensity
1	14th to 19th May 2021	Cyclone Tauktae	Extremely Severe Cyclonic Storm
2	23rd May to 28th May 2021	Cyclone Yaas	Extremely Severe Cyclonic Storm
3	10th – 14th July 2021	Low pressure area over West-Central and adjoining Northwest Bay of Bengal	Low pressure area
4	26th to 27th September 2021	Cyclone Gulab	Cyclonic Storm
5	16th to 17th October 2021	Low pressure area over coastal areas of north Andhra Pradesh & south Odisha and adjoining West-Central Bay of Bengal. Low pressure area over Lakshadweep and adjoining southeast Arabian sea off Kerala coast.	Low pressure area
6	10th to 12th November 2021	Depression BOB 05	Depression
7	12th to 14th November 2021	Cyclonic circulation over north interior Tamil Nadu & neighbourhood in lower tropospheric levels.	Cyclonic circulation

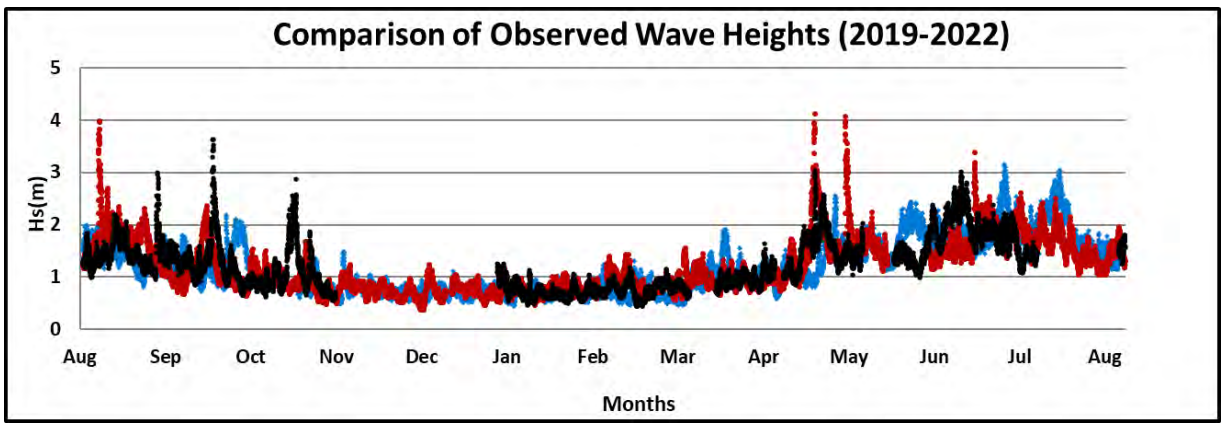


Figure 2-4 Comparison of wave heights for past 3 years (2019 – 2022)

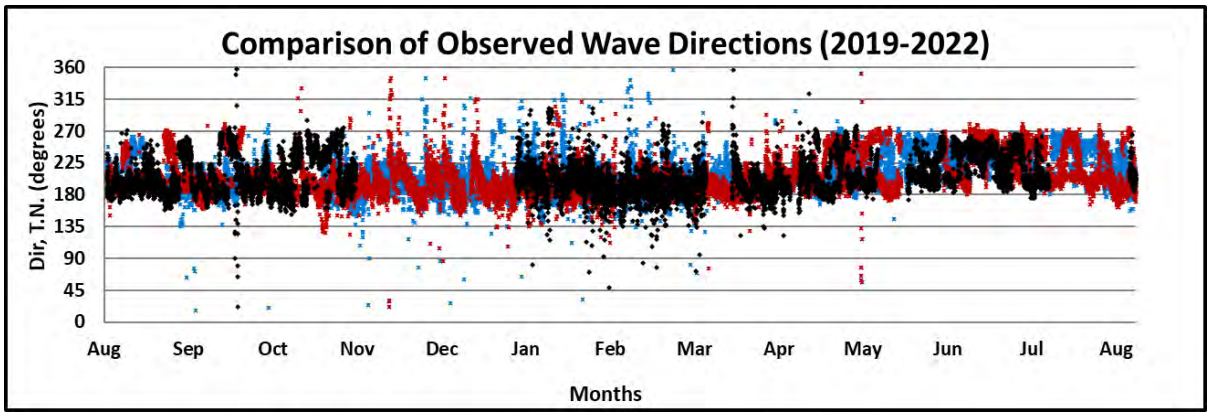
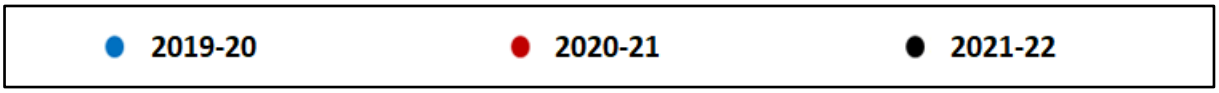


Figure 2-5 Comparison of wave directions for past 3 years (2019 – 2022)



Legend of wave height and wave directions plots (2019 – 2022)

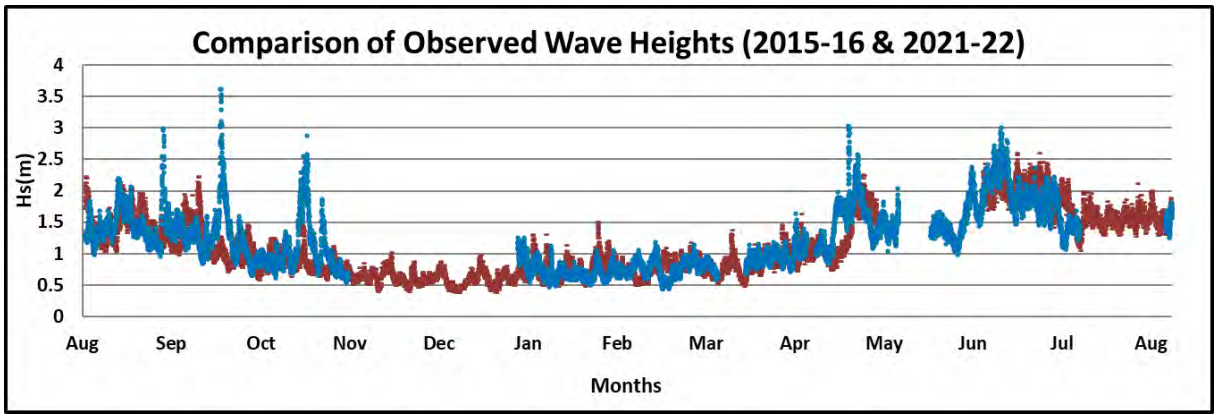


Figure 2-6 Comparison of wave heights (2015-16 & 2021-22)

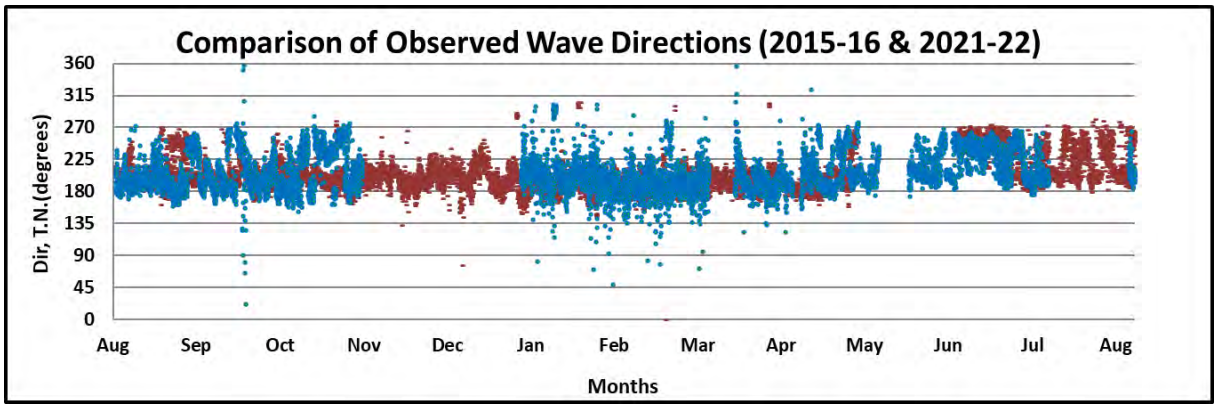


Figure 2-7 Comparison of wave directions (2015-16 & 2021-22)

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. Compared to 2015-16 data, a greater number of higher wave events were noticed in the years 2018 – 2022. This shows that the wave activity is increasing all along the coast. In September 2021, Cyclone Gulab crossed India and passed into Arabian Sea causing rise in 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 old 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, OSAS collected data at 08° 22' 33.68" N, 76° 59' 16.65" E and at a depth of 3.3 m. Shankar & Co. collected data from July 2019 to February 2020 and March 2020 to February 2021. These data were reported in the earlier reports by LNTIEL.

Subsequently, Shankar And Co. (SAC) collected data, at the above mentioned location, for the period March 2021 to August 2022. 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 and it can be seen in Figure 2-8. LNTIEL has applied tidal correction to all bathymetries and cross shore profile data as required.

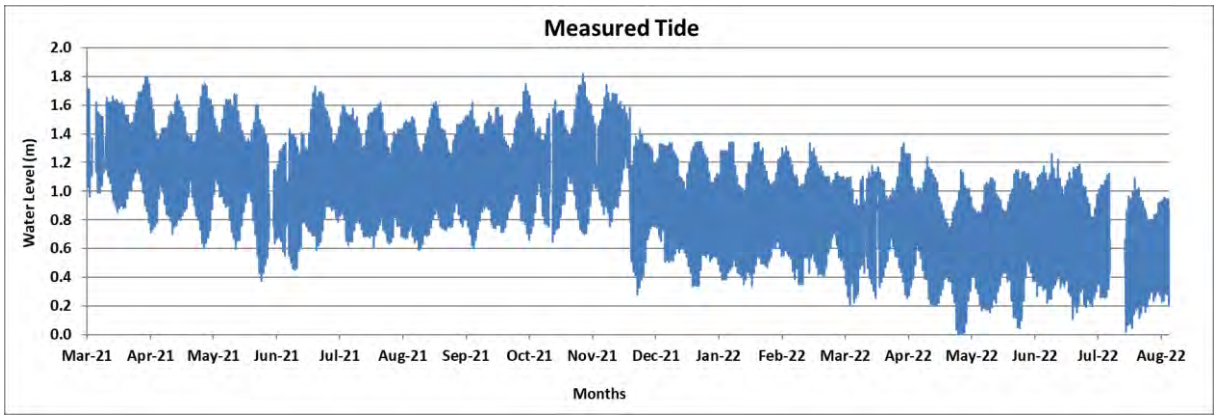


Figure 2-8 Tide data measured during Mar 2021 to Aug 2022

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 each season from March 2021 to February 2022 (Pre-monsoon, Monsoon and Post-monsoon), and for one month for Pre-

monsoon season from March 2022 to August 2022. The data collected for each season are presented in Figure 2-10 to Figure 2-33.

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

Table 2-3 Observed Current Speed and Direction (March 2021 to August 2022)

Location and Depth (CD,m)	Coordinates		Pre Monsoon		Monsoon		Post Monsoon	
	Latitude	Longitude	Current Speed Range (m/s)	Predominant Current Direction	Current Speed Range (m/s)	Predominant Current Direction	Current Speed Range (m/s)	Predominant Current Direction
Vizhinjam 21.1	$8^0$21'55.4"	$76^0$58'51.6"	0.1-0.90	NW	0.1-0.45	SE	0.1-0.60	SE
Poovar 23.0	$8^0$17'35.8"	$77^0$04'03.5"	0.1-0.85	NW	0.1-0.50	SE	0.1-0.30	SE
Pachalloor 21.4	$8^0$24'08.6"	$76^0$56'16.1"	0.1-0.70	NW	0.1-0.85	SE	0.1-0.65	SE
Mulloor 23.2	$8^0$21'42.3"	$76^0$59'33.9"	0.1-0.40	NW	0.1-0.60	SE	0.1-0.65	SE

The current speed and the current direction for different seasons at four different locations are shown in Figure 2-18 to Figure 2-33. Start and end times of observed currents in three seasons is as shown in Table 2-4.

Table 2-4 Current observation timeline (March 2021-February 2022)

Location	Coordinates		Pre Monsoon		Monsoon		Post Monsoon	
	Latitude	Longitude	Start date	End date	Start date	End date	Start date	End date
Pachalloor	$8^0$24'08.6"	$76^0$56'16.1"	22/04/21	23/05/21	24/08/21	23/09/21	05/02/22	07/03/22
Vizhinjam	$8^0$21'55.4"	$76^0$58'51.6"	22/04/21	23/05/21	24/08/21	18/09/21	04/02/22	08/03/22
Mulloor	$8^0$21'42.3"	$76^0$59'33.9"	22/04/21	23/05/21	24/08/21	21/09/21	05/02/22	08/03/22
Poovar	$8^0$17'35.8"	$77^0$04'03.5"	22/04/21	23/05/21	24/08/21	12/09/21	04/02/22	05/03/22

Table 2-5 Current observation timeline (March 2022-August 2022)

Location	Coordinates		Pre Monsoon	
	Latitude	Longitude	Start date	End date
Pachalloor	$8^0$24'08.6"	$76^0$56'16.1"	10/03/22	09/04/22
Vizhinjam	$8^0$21'55.4"	$76^0$58'51.6"	11/03/22	12/04/22
Mulloor	$8^0$21'42.3"	$76^0$59'33.9"	10/03/22	08/04/22
Poovar	$8^0$17'35.8"	$77^0$04'03.5"	10/03/22	09/04/22

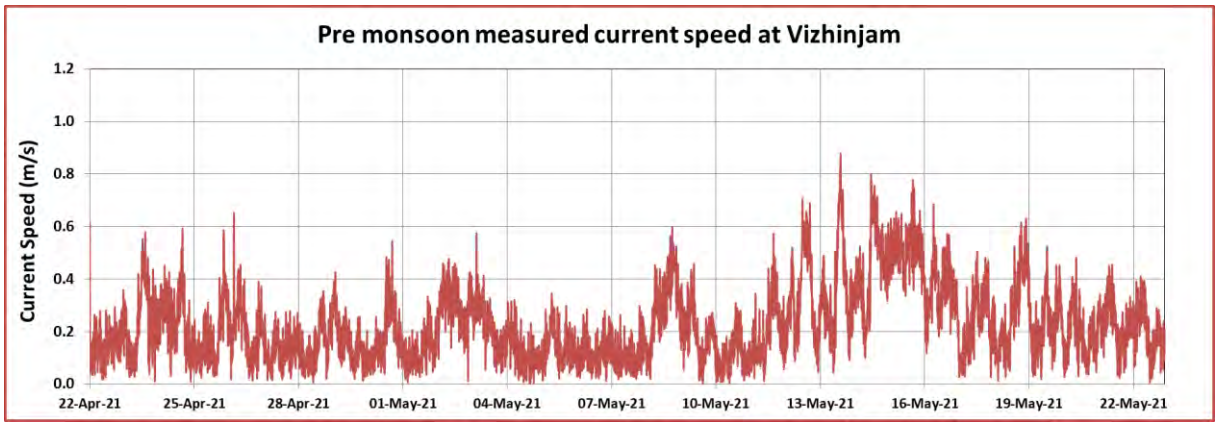


Figure 2-10 Pre-Monsoon measured current speed at Vizhinjam during April-May 2021

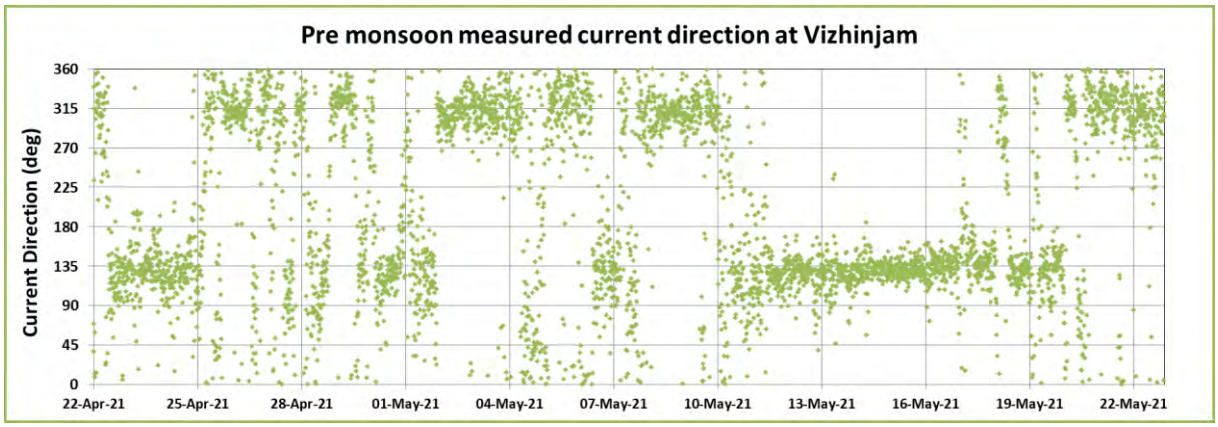


Figure 2-11 Pre-Monsoon measured current direction at Vizhinjam during April-May 2021

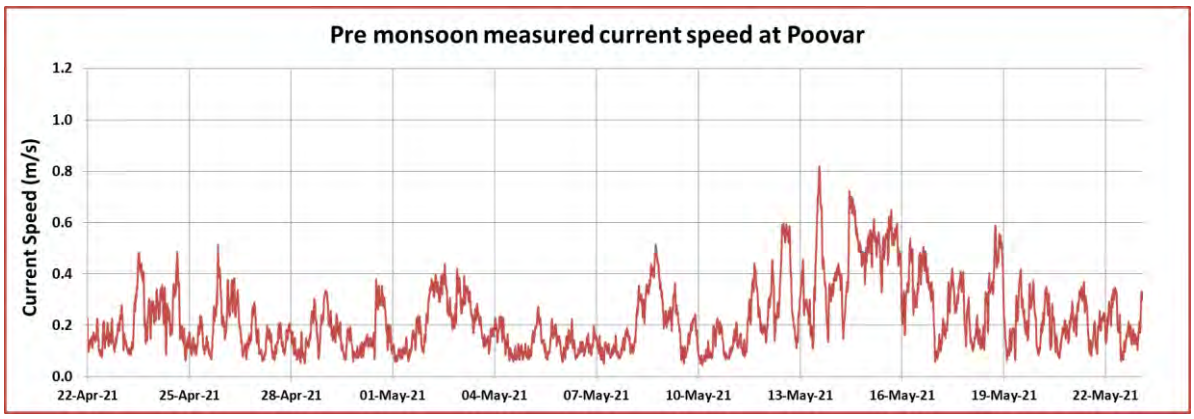


Figure 2-12 Pre-Monsoon measured current speed at Poovar during April-May 2021

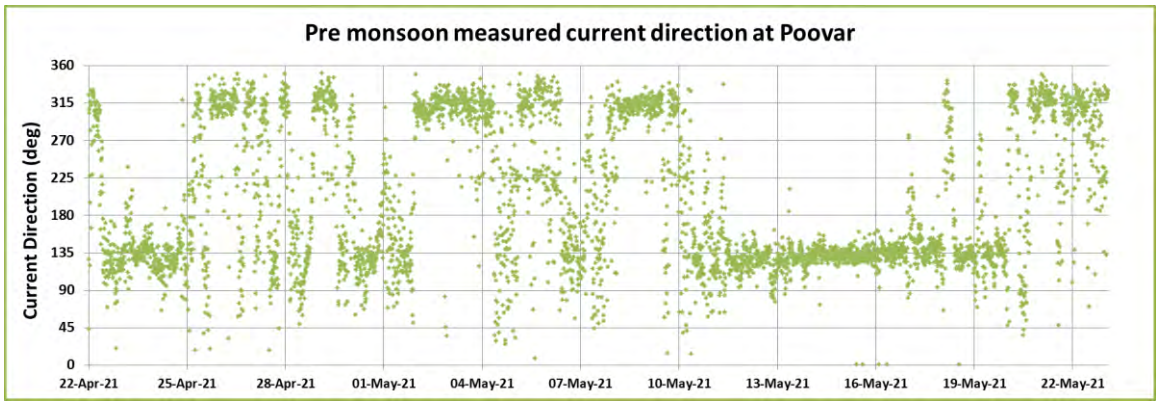


Figure 2-13 Pre-Monsoon measured current direction at Poovar during April-May 2021

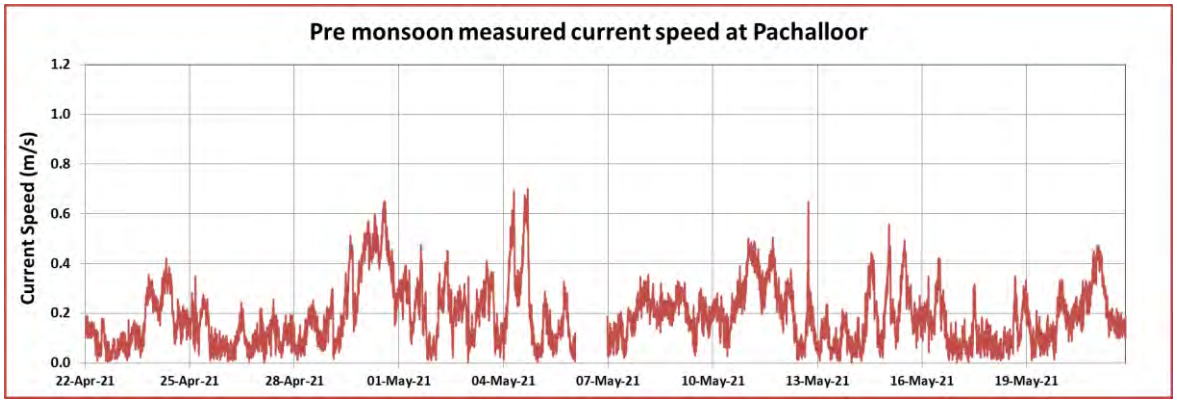


Figure 2-14 Pre-Monsoon measured current speed at Pachalloor during April-May 2021

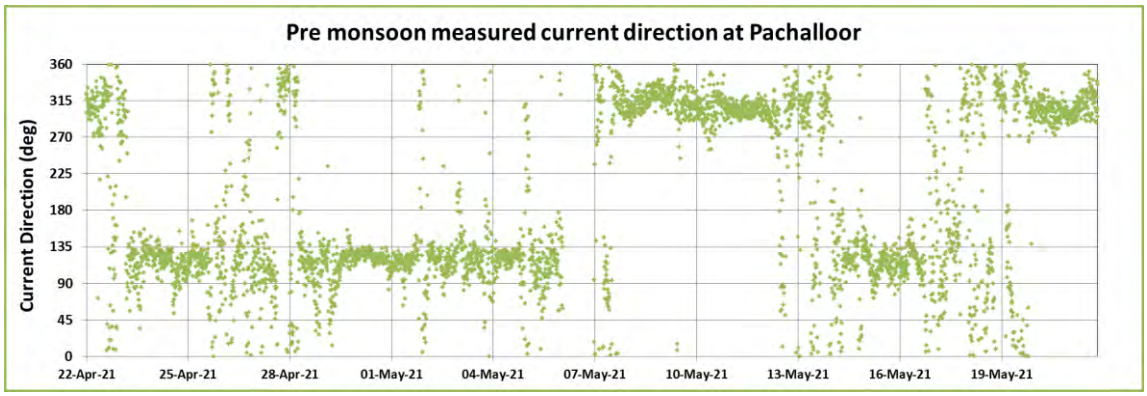


Figure 2-15 Pre-Monsoon measured current direction at Pachalloor during April-May 2021

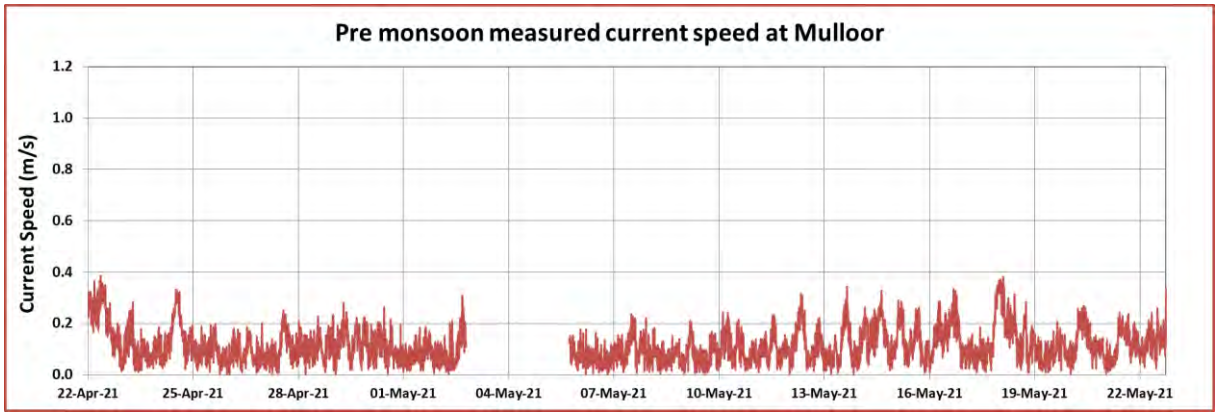


Figure 2-16 Pre-Monsoon measured current speed at Mulloor during April-May 2021

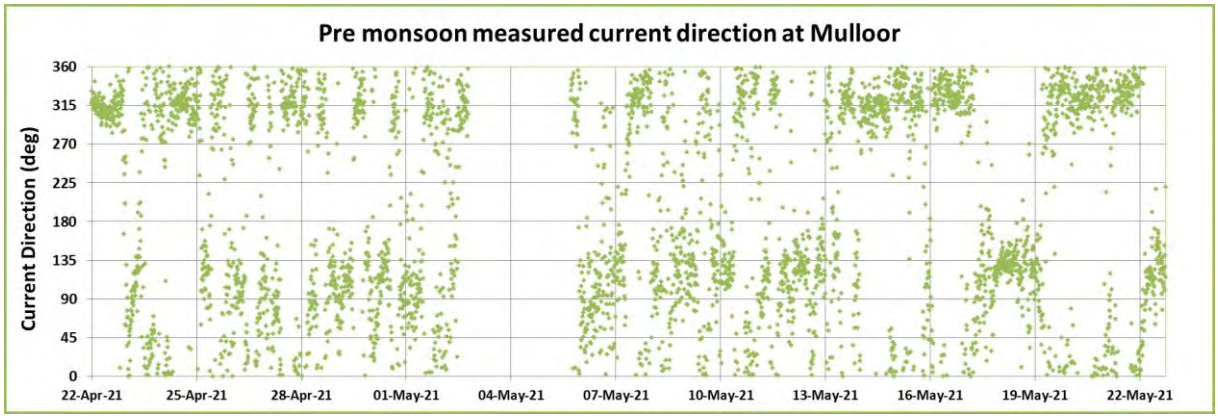


Figure 2-17 Pre-Monsoon measured current direction at Mulloor during April-May 2021

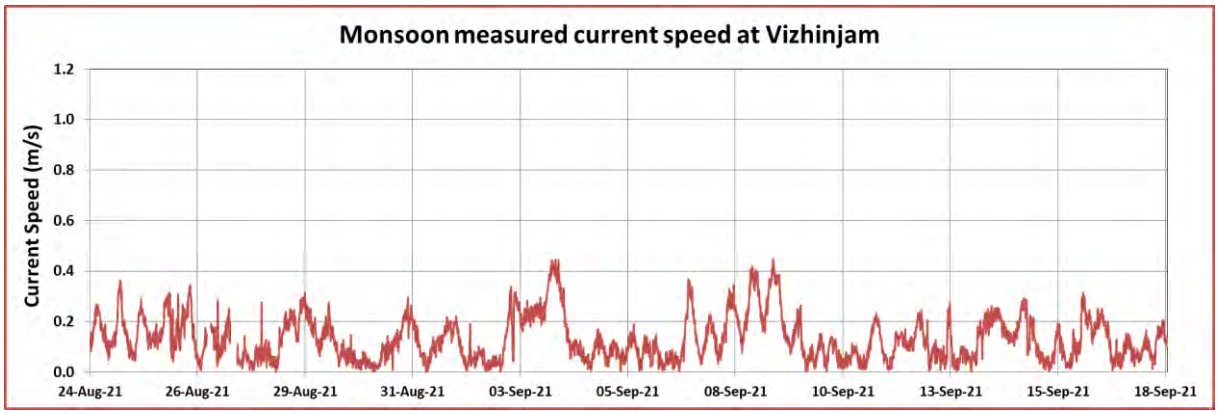


Figure 2-18 Monsoon measured current speed at Vizhinjam during Aug to Sept 2021

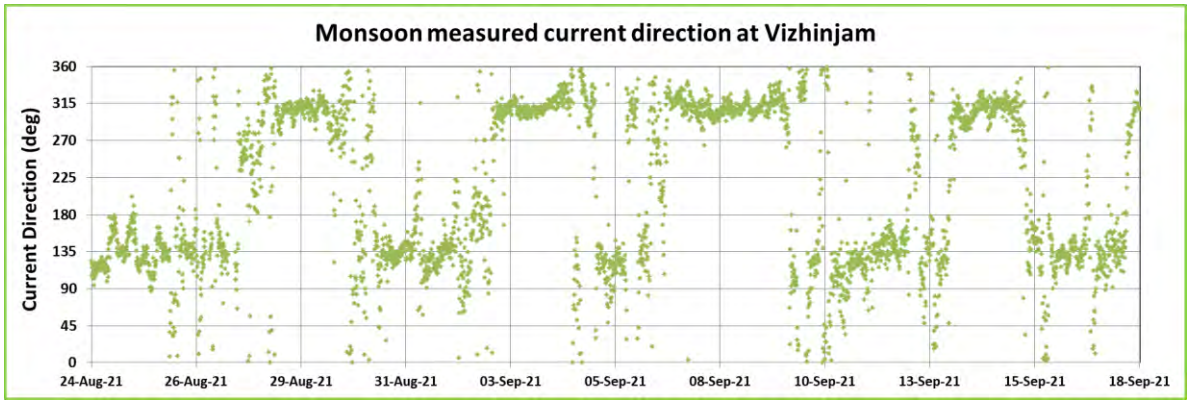


Figure 2-19 Monsoon measured current direction at Vizhinjam during Aug to Sept 2021

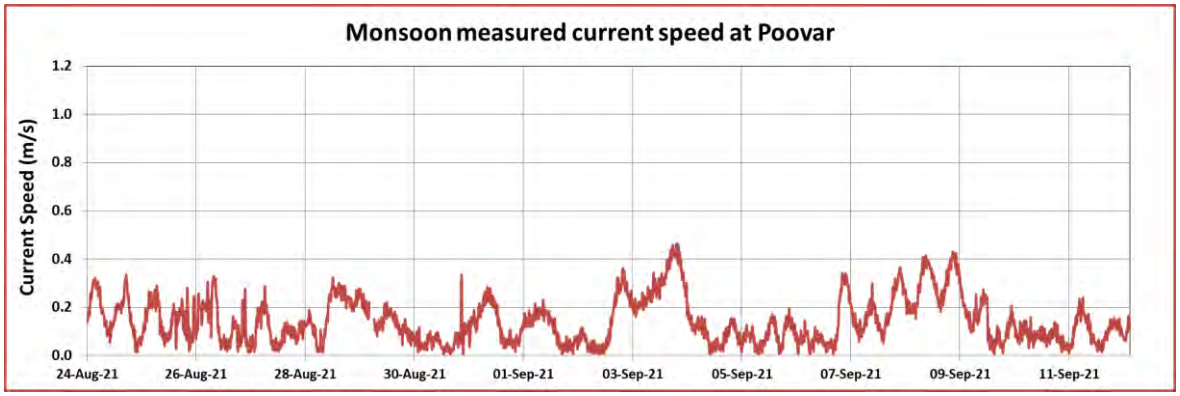


Figure 2-20 Monsoon measured current speed at Poovar during Aug to Sept 2021

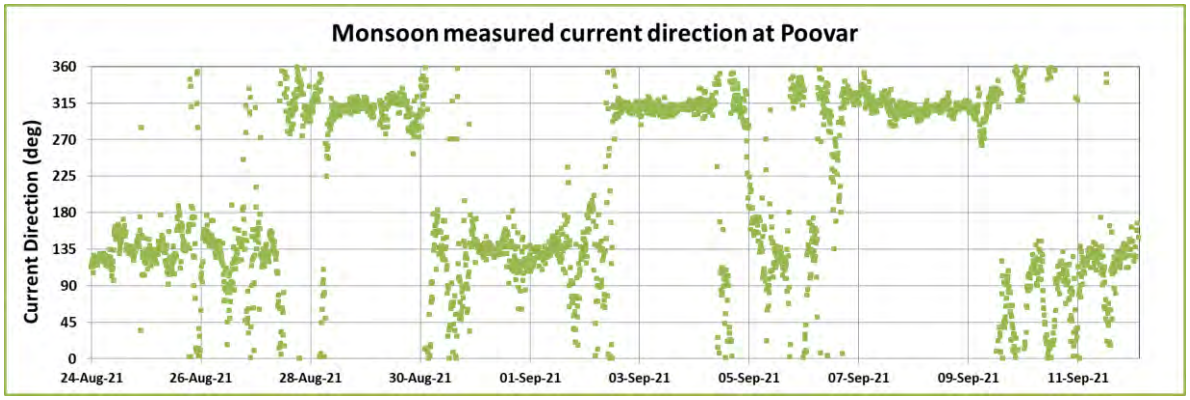


Figure 2-21 Monsoon measured current direction at Poovar during Aug to Sept 2021

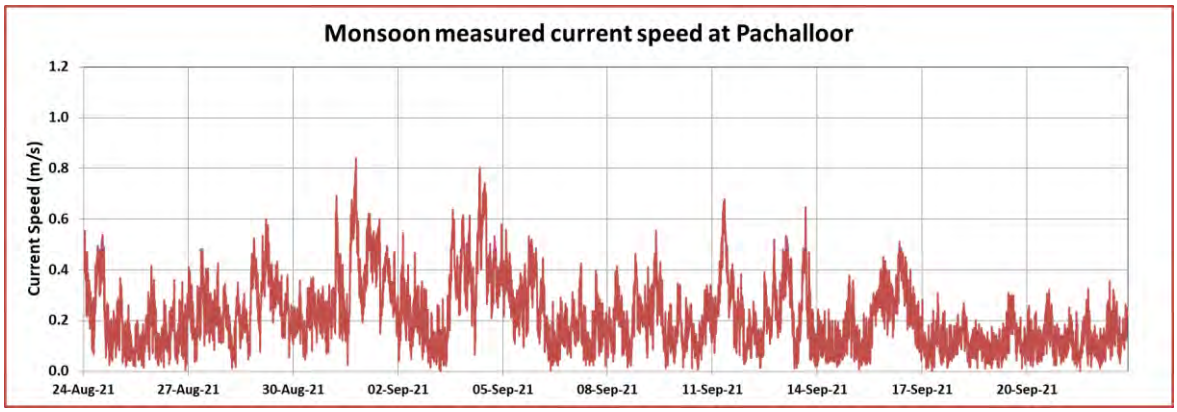


Figure 2-22 Monsoon measured current speed at Pachalloor during Aug to Sept 2021

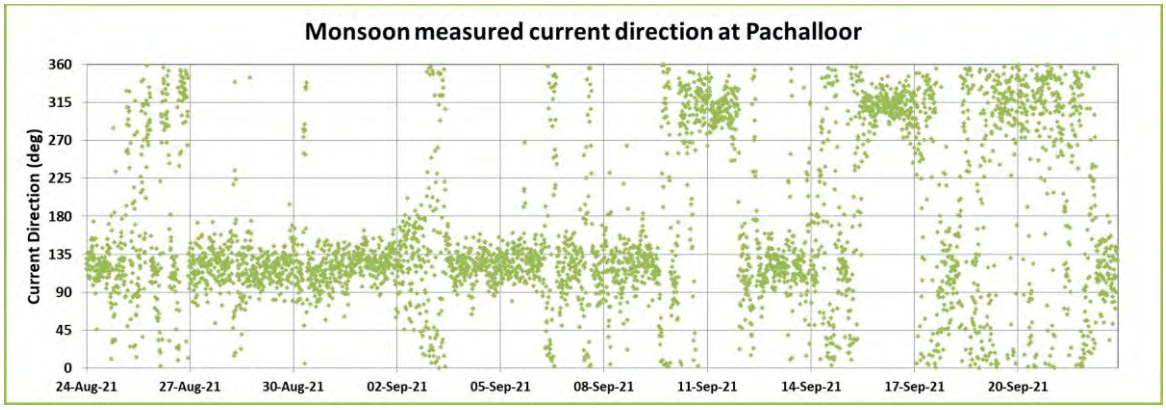


Figure 2-23 Monsoon measured current direction at Pachalloor during Aug to Sept 2021

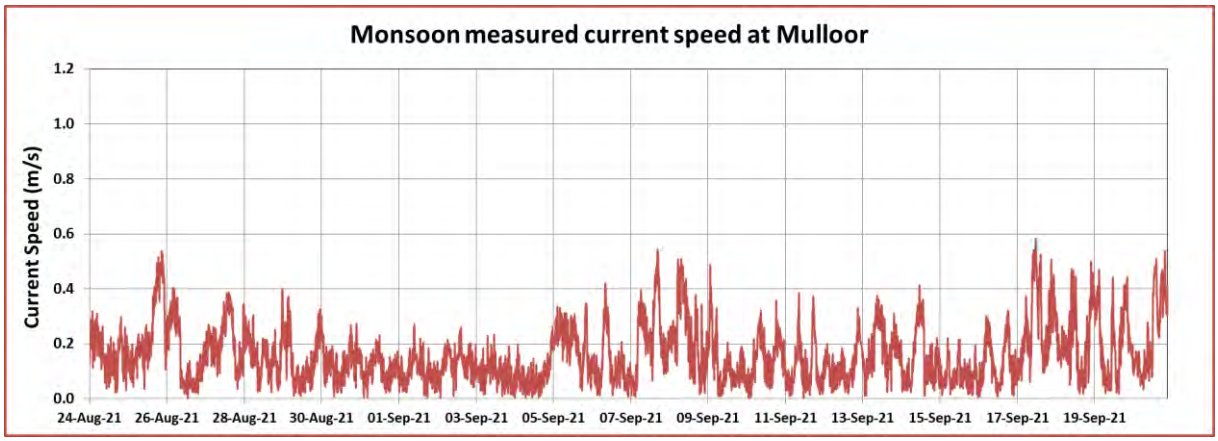


Figure 2-24 Monsoon measured current speed at Mulloor during Aug to Sept 2021

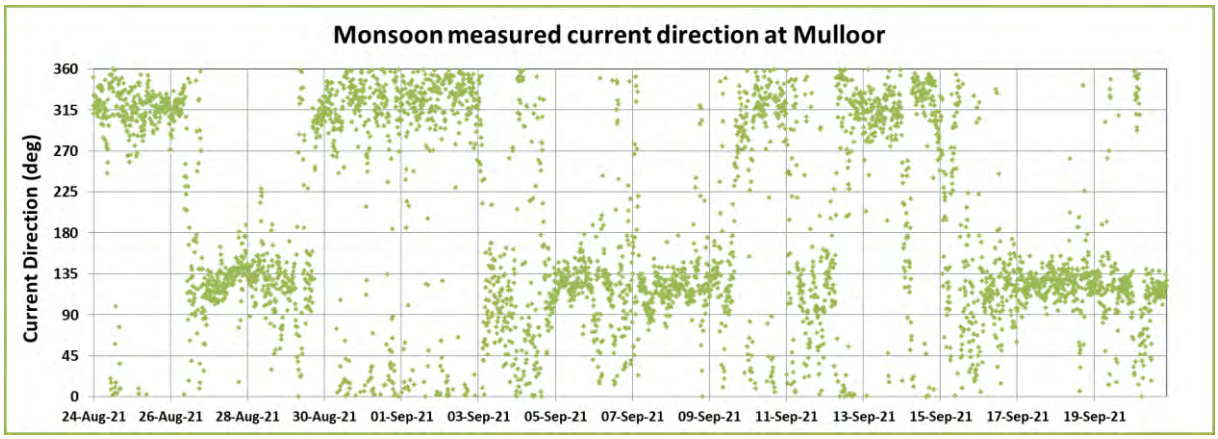


Figure 2-25 Monsoon measured current direction at Mulloor during Aug to Sept 2021

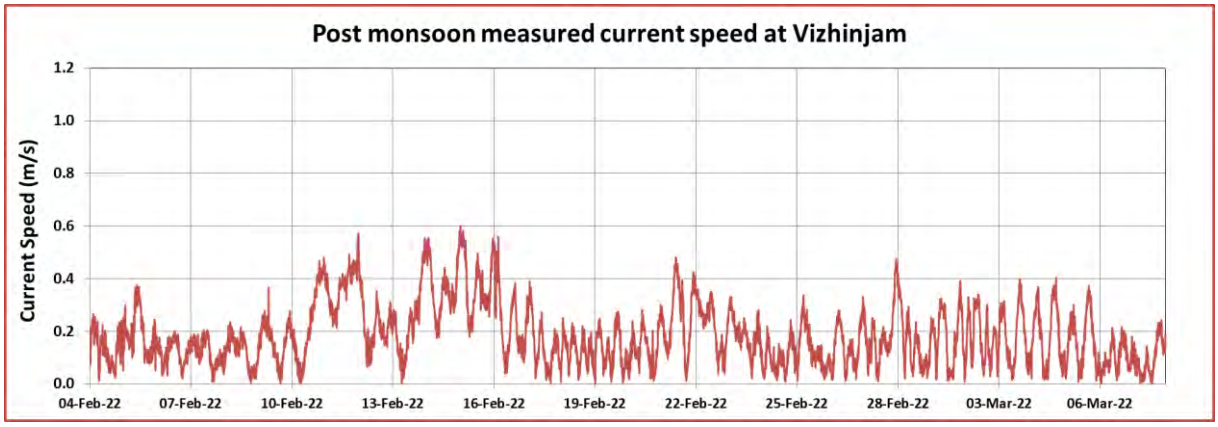


Figure 2-26 Post Monsoon measured current speed at Vizhinjam during Feb to Mar 2022

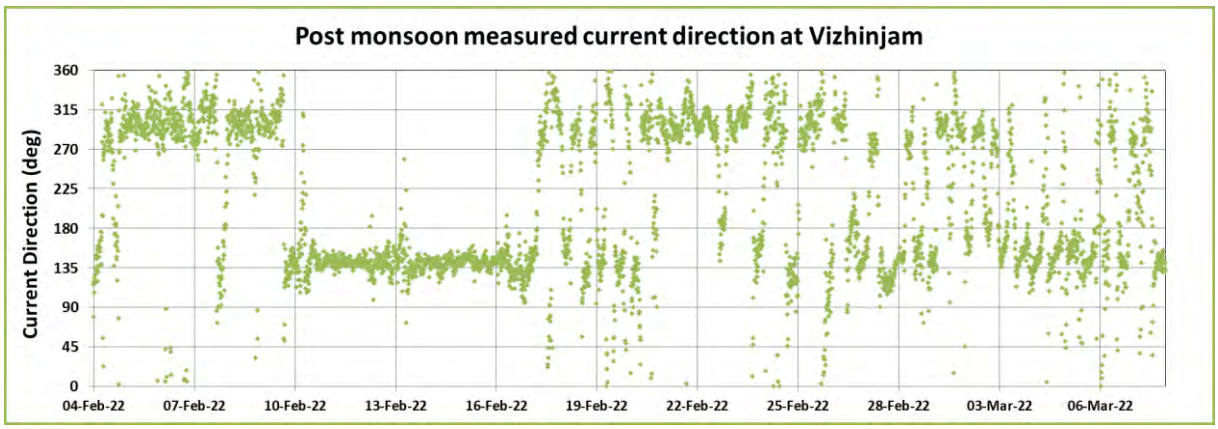


Figure 2-27 Post Monsoon measured current direction at Vizhinjam during Feb to Mar 2022

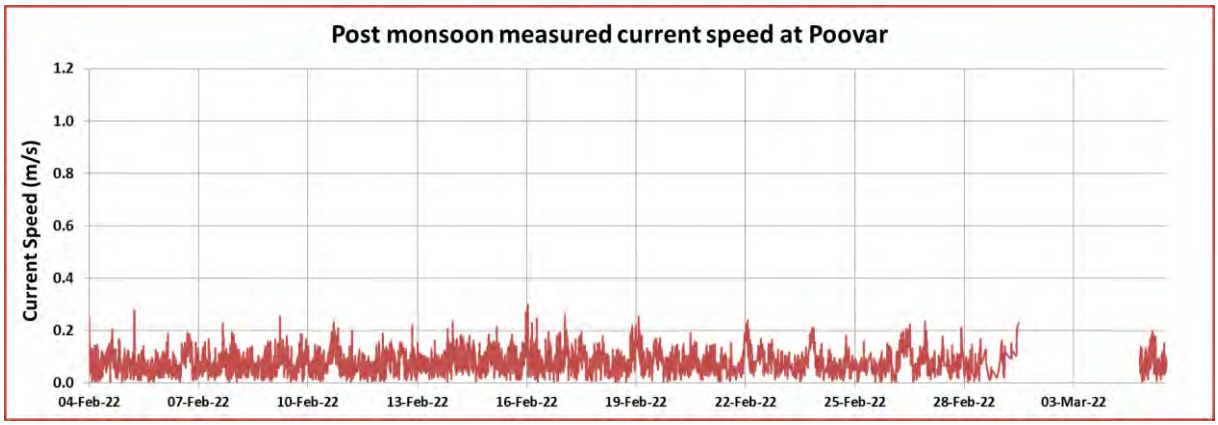


Figure 2-28 Post Monsoon measured current speed at Poovar during Feb to Mar 2022

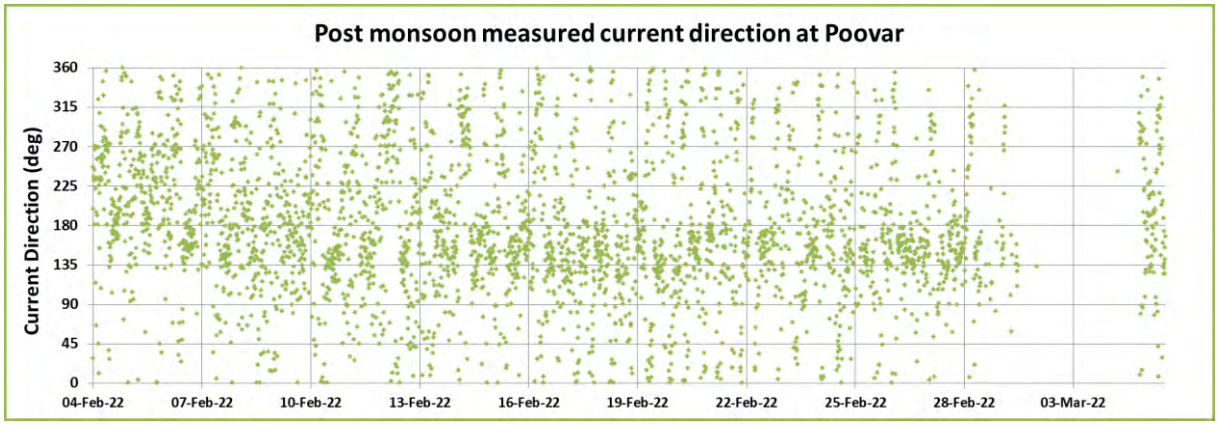


Figure 2-29 Post Monsoon measured current direction at Poovar during Feb to Mar 2022

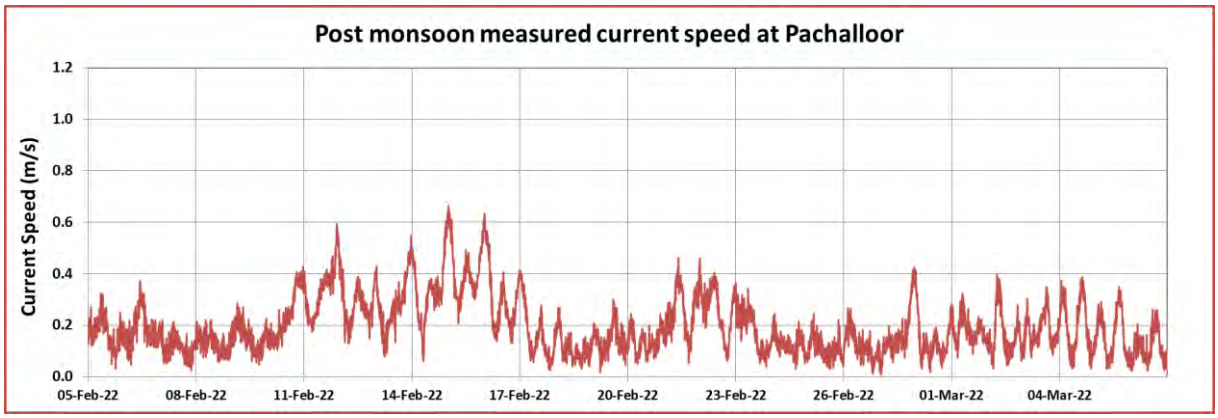


Figure 2-30 Post Monsoon measured current speed at Pachalloor during Feb to Mar 2022

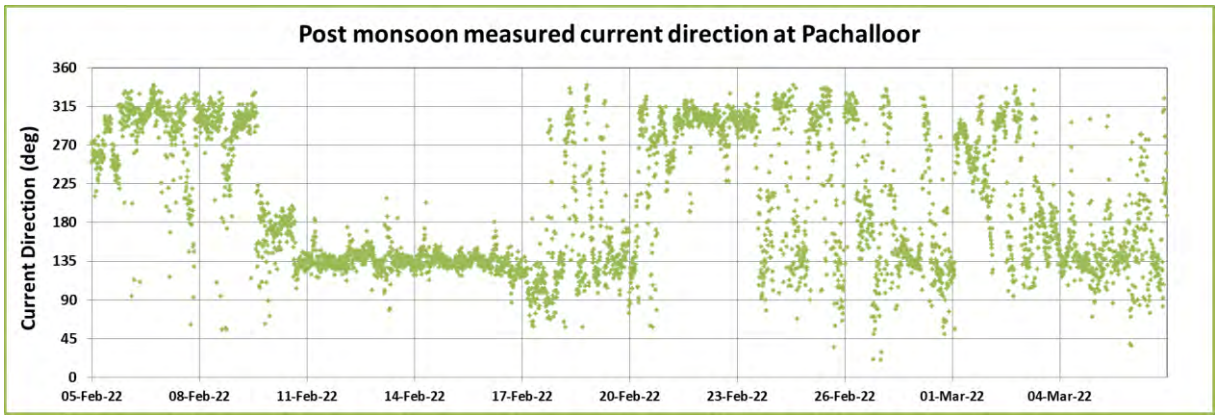


Figure 2-31 Post Monsoon measured current direction at Pachalloor during Feb to Mar 2022

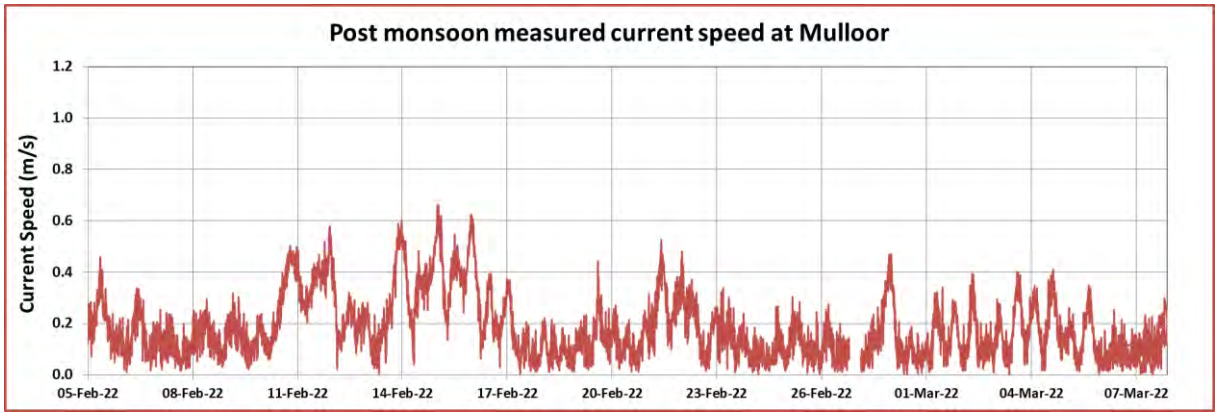


Figure 2-32 Post Monsoon measured current speed at Mulloor during Feb to Mar 2022

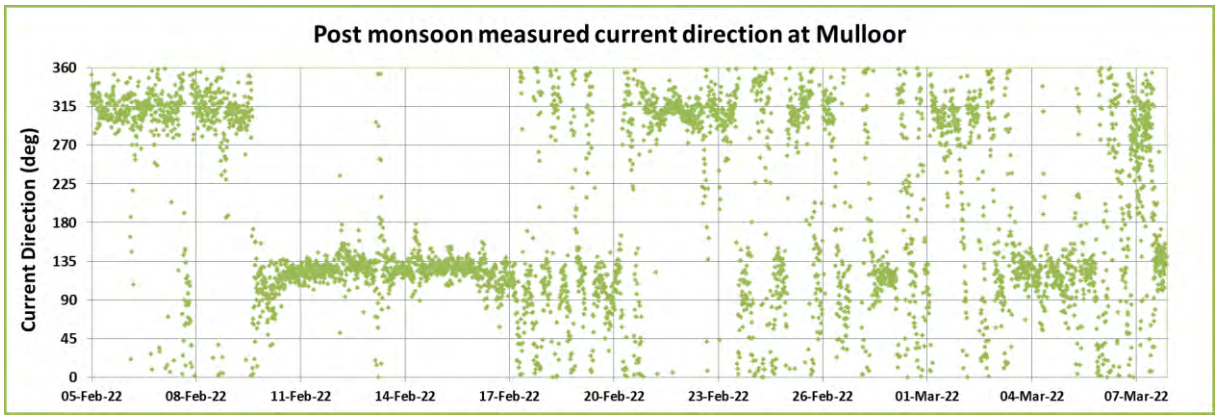


Figure 2-33 Post Monsoon measured current direction at Mulloor during Feb to Mar 2022

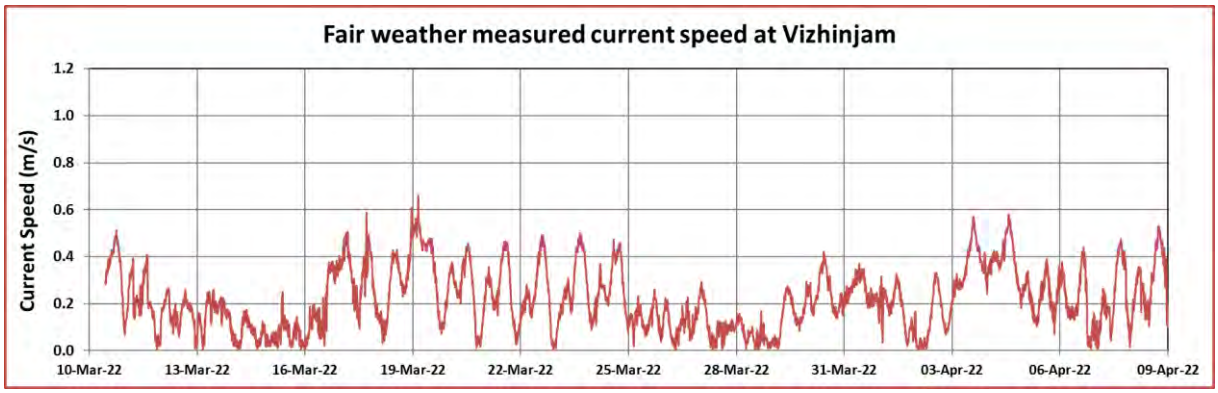


Figure 2-34 Fair Weather measured current speed at Vizhinjam during Mar to Apr 2022

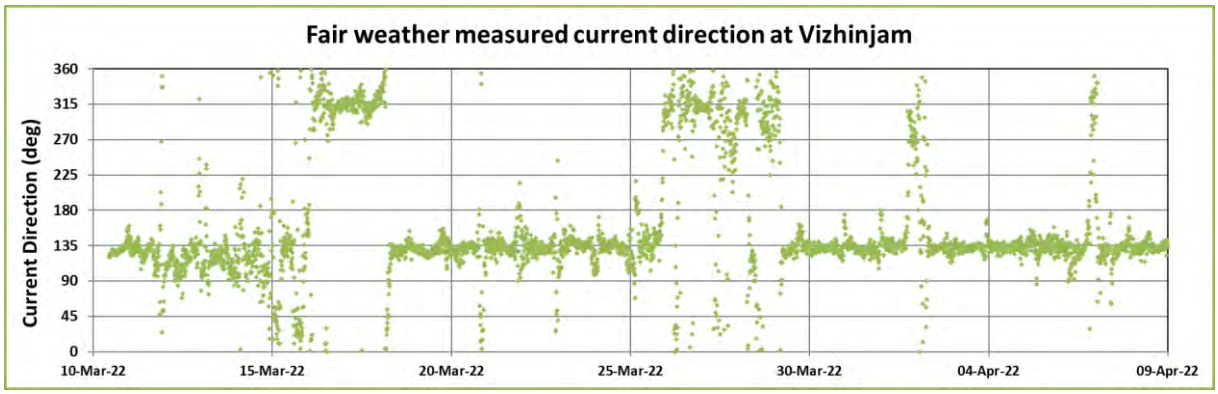


Figure 2-35 Fair Weather measured current direction at Vizhinjam during Mar to Apr 2022

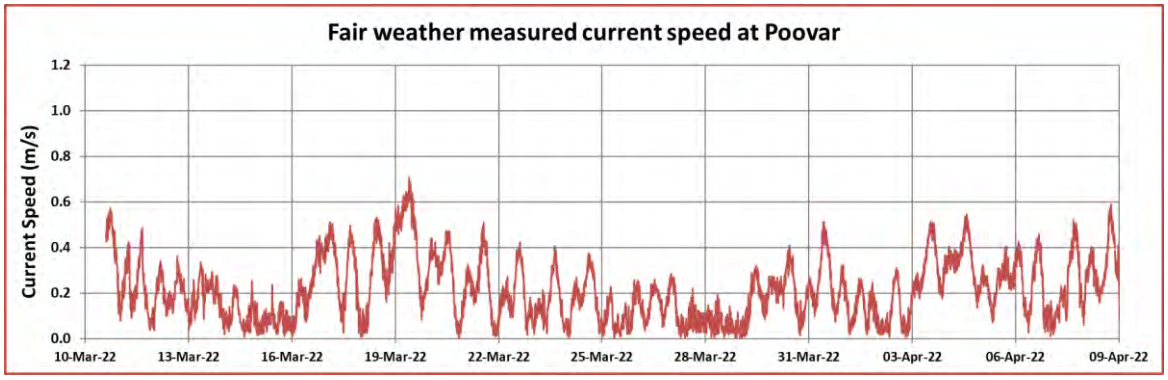


Figure 2-36 Fair Weather measured current speed at Poovar during Mar to Apr 2022

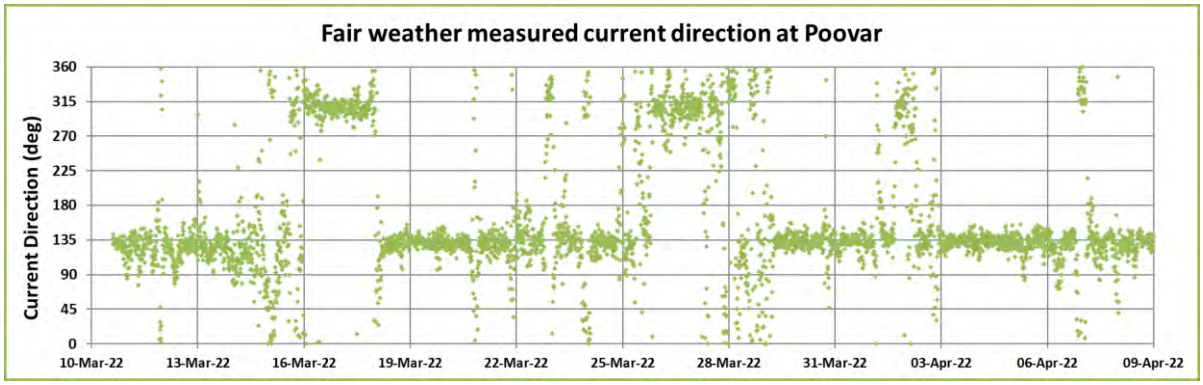


Figure 2-37 Fair Weather measured current direction at Poovar during Mar to Apr 2022

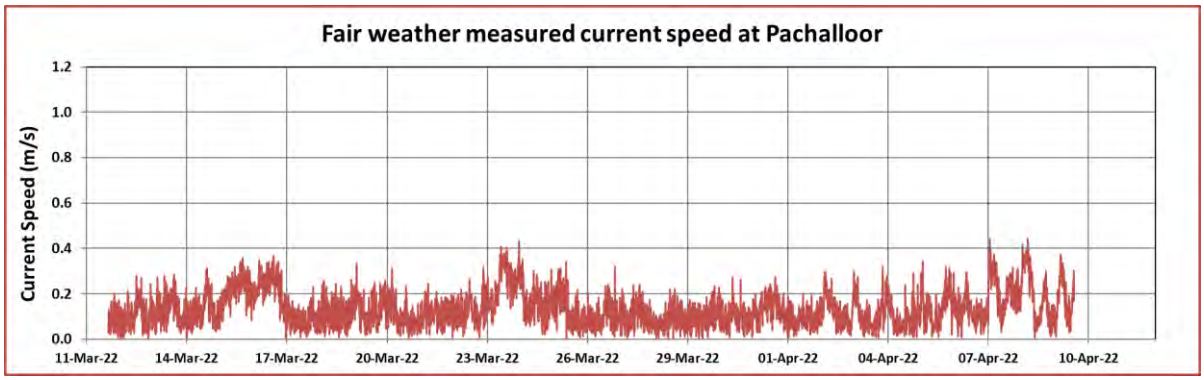


Figure 2-38 Fair Weather measured current speed at Pachalloor during Mar to Apr 2022

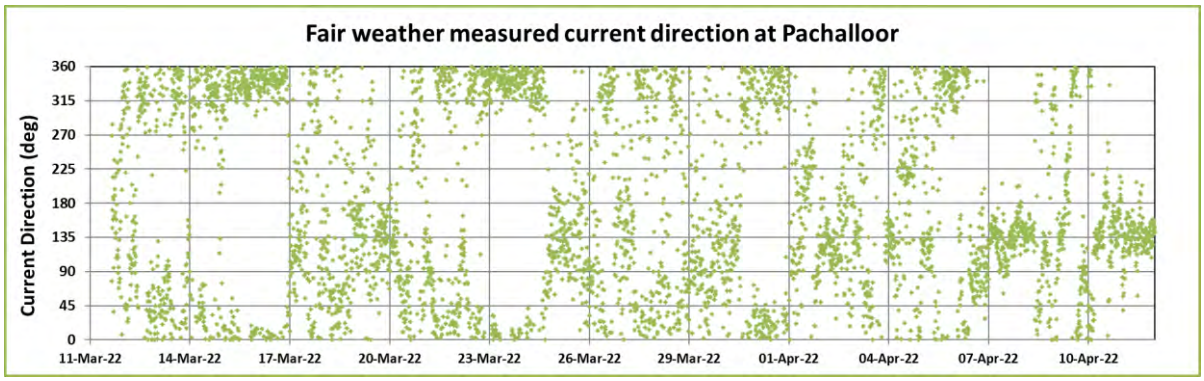


Figure 2-39 Fair Weather measured current direction at Pachalloor during Mar to Apr 2022

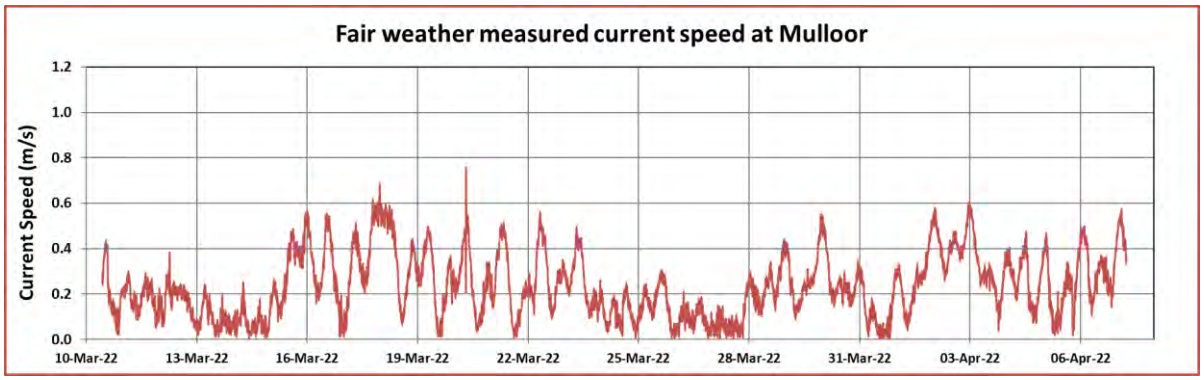


Figure 2-40 Fair Weather measured current speed at Mulloor during Mar to Apr 2022

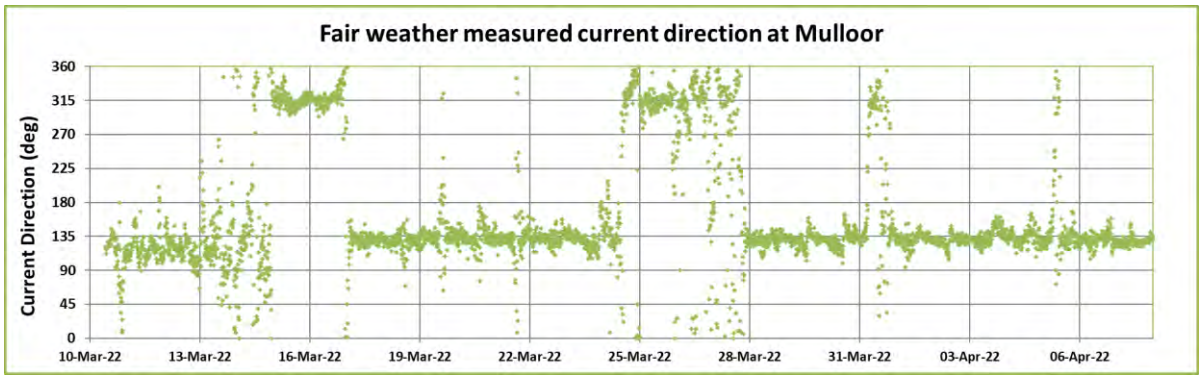


Figure 2-41 Fair Weather measured current direction at Mulloor during Mar to Apr 2022

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

AVPPL provided the measurement of wind speed and direction from 1st March 2021 to 31st August 2022. The mostly wind speed varies from 2 to 6 m/s and the maximum wind speed measured is 24 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 2-43 and Figure 2-44.

Figure 2-42 Location of AWS

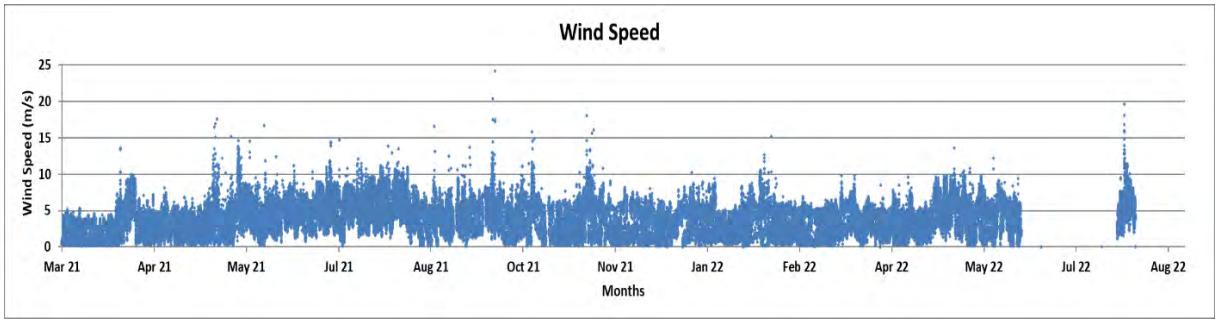


Figure 2-43 Wind speed measured during March 2021 to August 2022

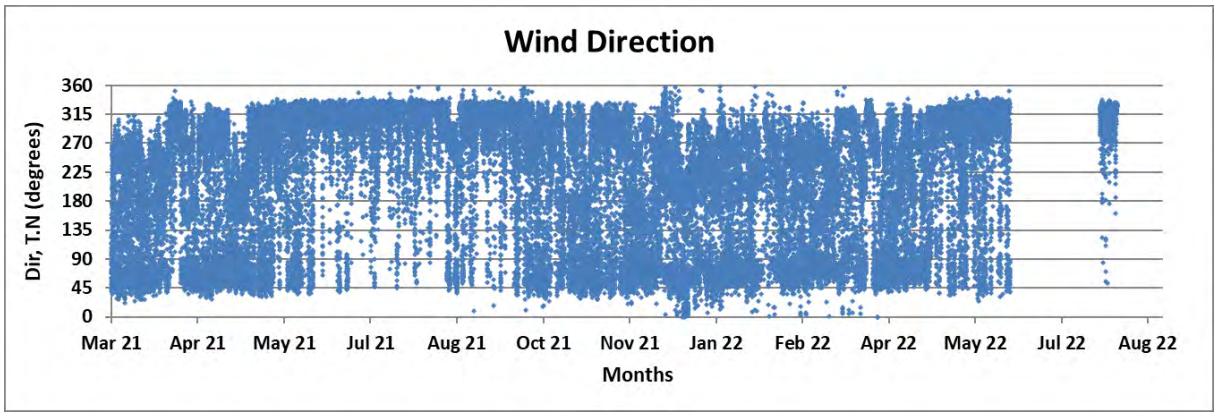


Figure 2-44 Wind direction measured during March 2021 to August 2022

2.5 Turbidity

AVPPL has provided the turbidity data from 1st March 2021 to 31st August 2022 in 10 min intervals collected from three locations near the port area as presented in Figure 2-45 using turbidity buoys.

Figure 2-45 Location of Turbidity Buoys

The time series plotted using this turbidity data are presented in Figure 2-46 to Figure 2-48 for all the three locations.

Legend for turbidity time series plots

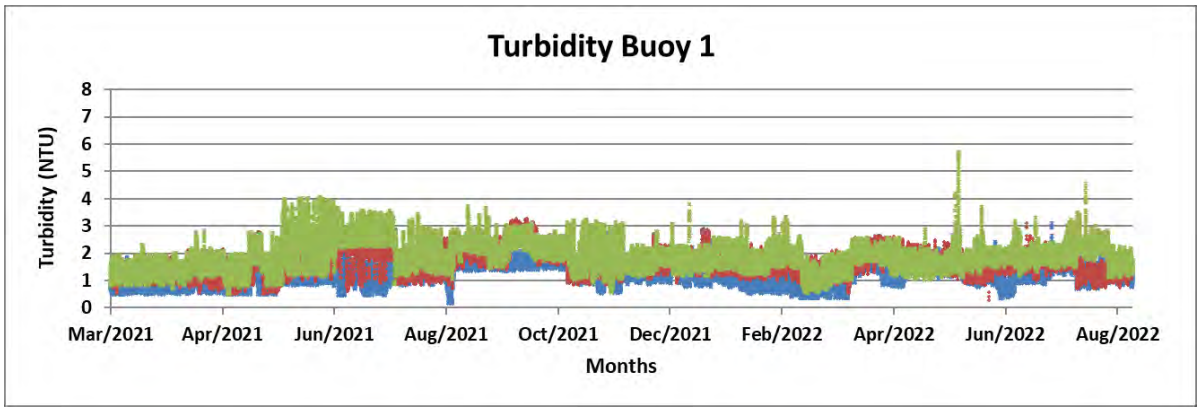


Figure 2-46 Time series plotted with the turbidity data collected from Turbidity Buoy 1

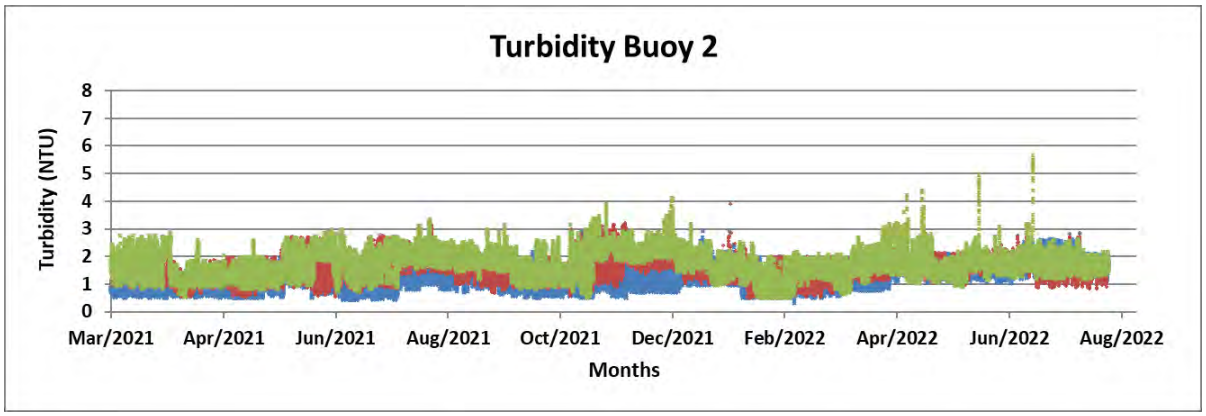


Figure 2-47 Time series plotted with the turbidity data collected from Turbidity Buoy 2

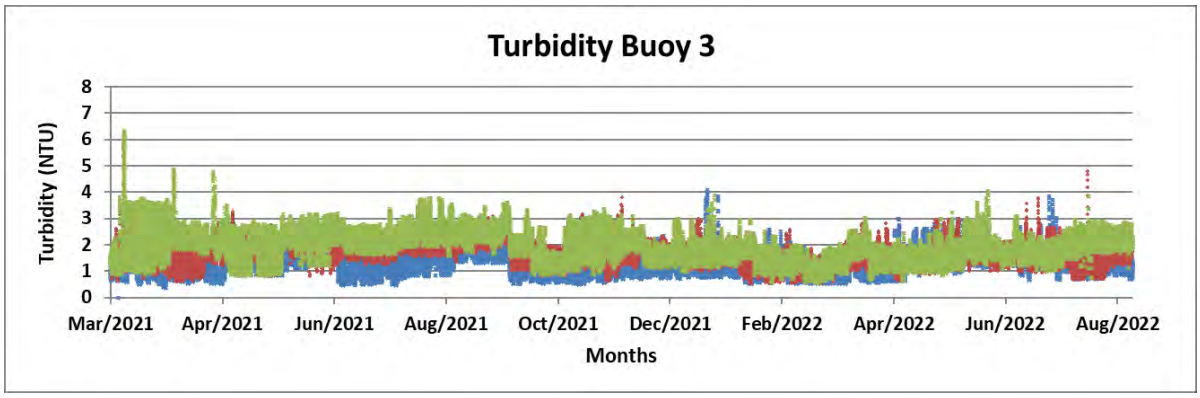


Figure 2-48 Time series plotted with the turbidity data collected from Turbidity Buoy 3

It is perceptible from time series plots that the turbidity fluctuates all year round. It may be noted that the values were lower than 4 NTU for almost all the time.

2.6 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 the Pre-Monsoon 2021, Post Monsoon 2021 and Pre Monsoon 2022 are shown in Figure 2-49, Figure 2-50 and Figure 2-51 respectively.

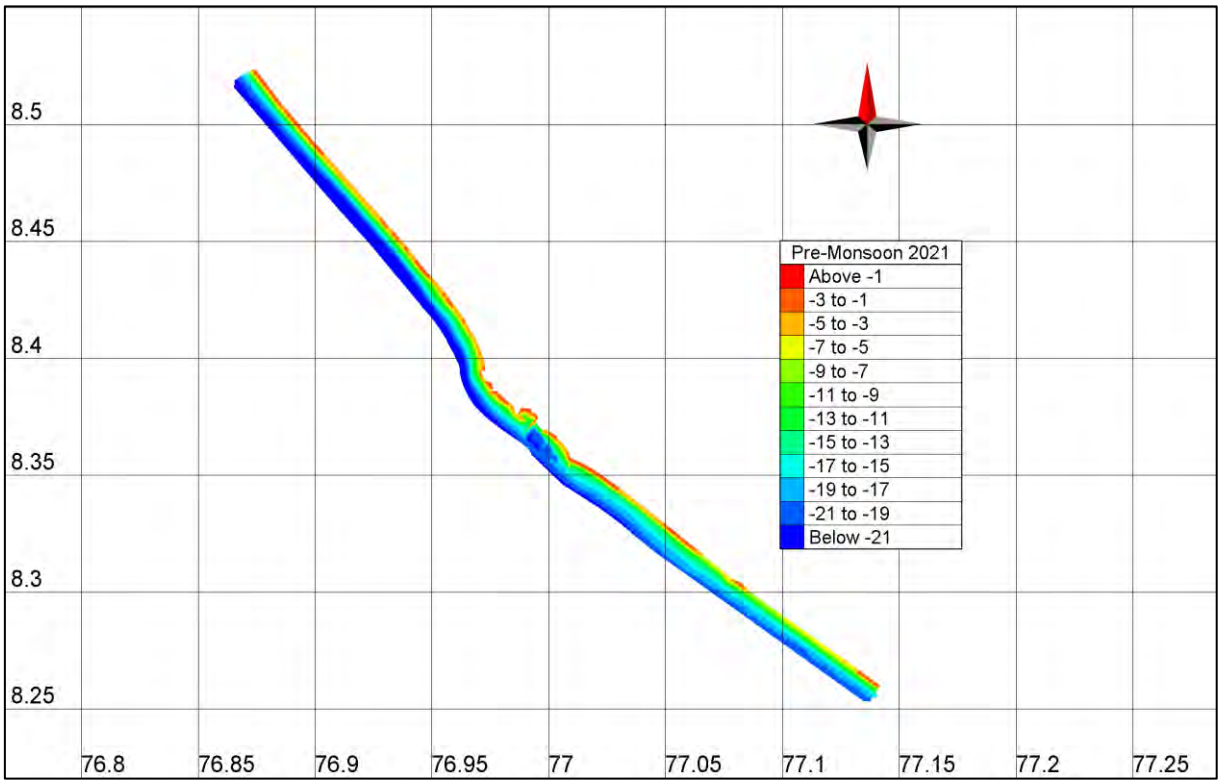


Figure 2-49 Bathymetry survey data using MBES for Pre-Monsoon 2021

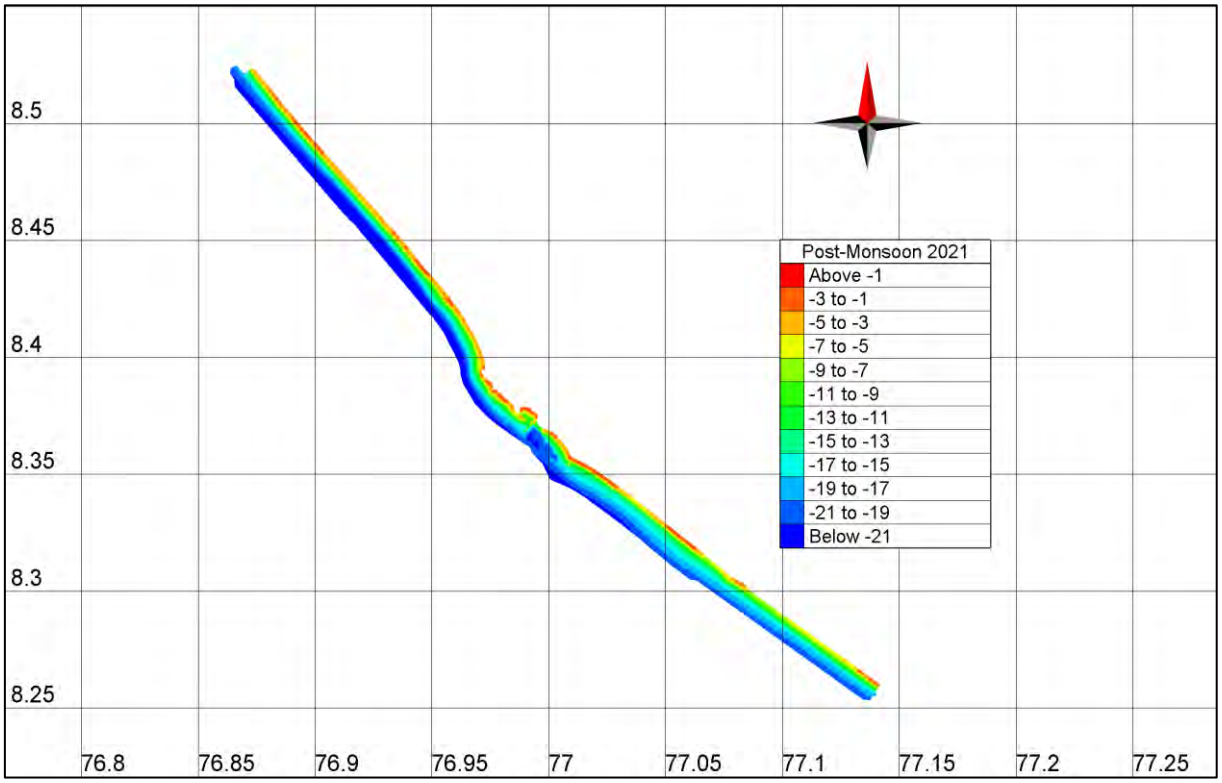


Figure 2-50 Bathymetry survey data using MBES for Post Monsoon 2021

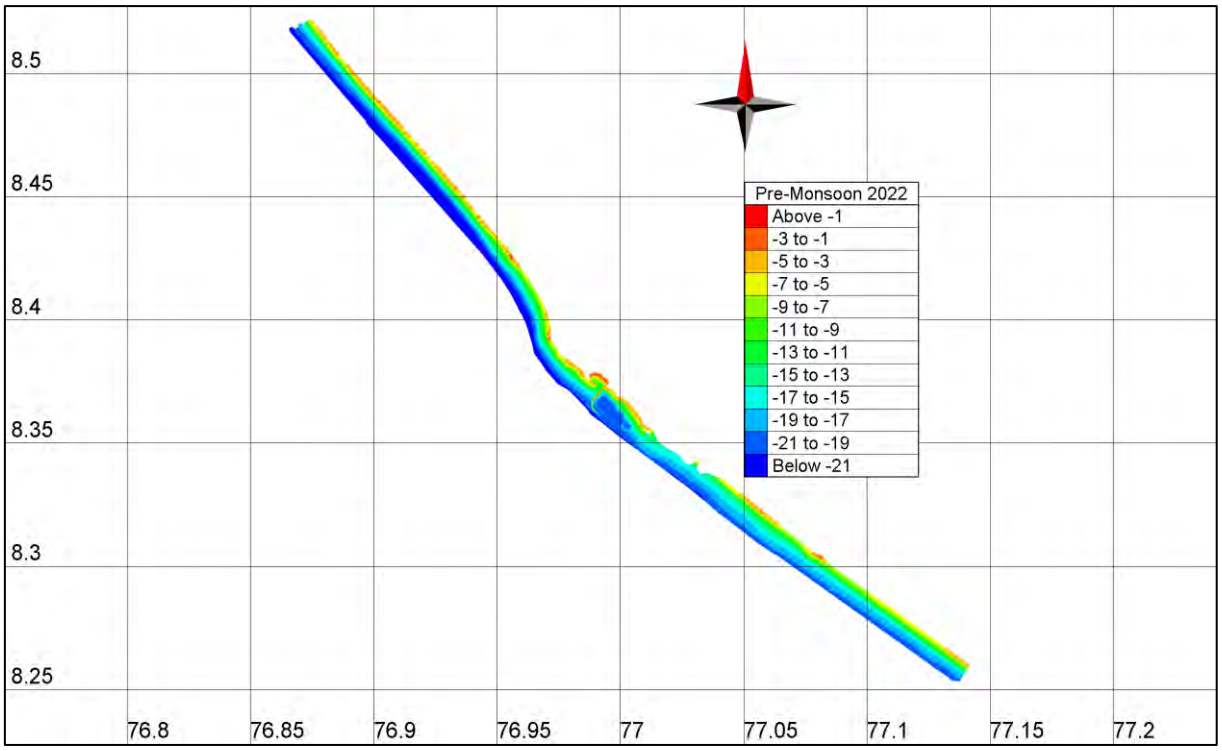


Figure 2-51 Bathymetry survey data using MBES for Pre-Monsoon 2022

A comparison was made between Pre-Monsoon 2020 MBES data and Pre-Monsoon 2021 MBES data as shown in Figure 2-52. The same comparison was done for Post monsoon 2020 and Post monsoon 2021 MBES data and is shown in Figure 2-53. The comparisons of bathymetry between pre monsoon 2021 and post monsoon 2021 are presented in Figure 2-54.

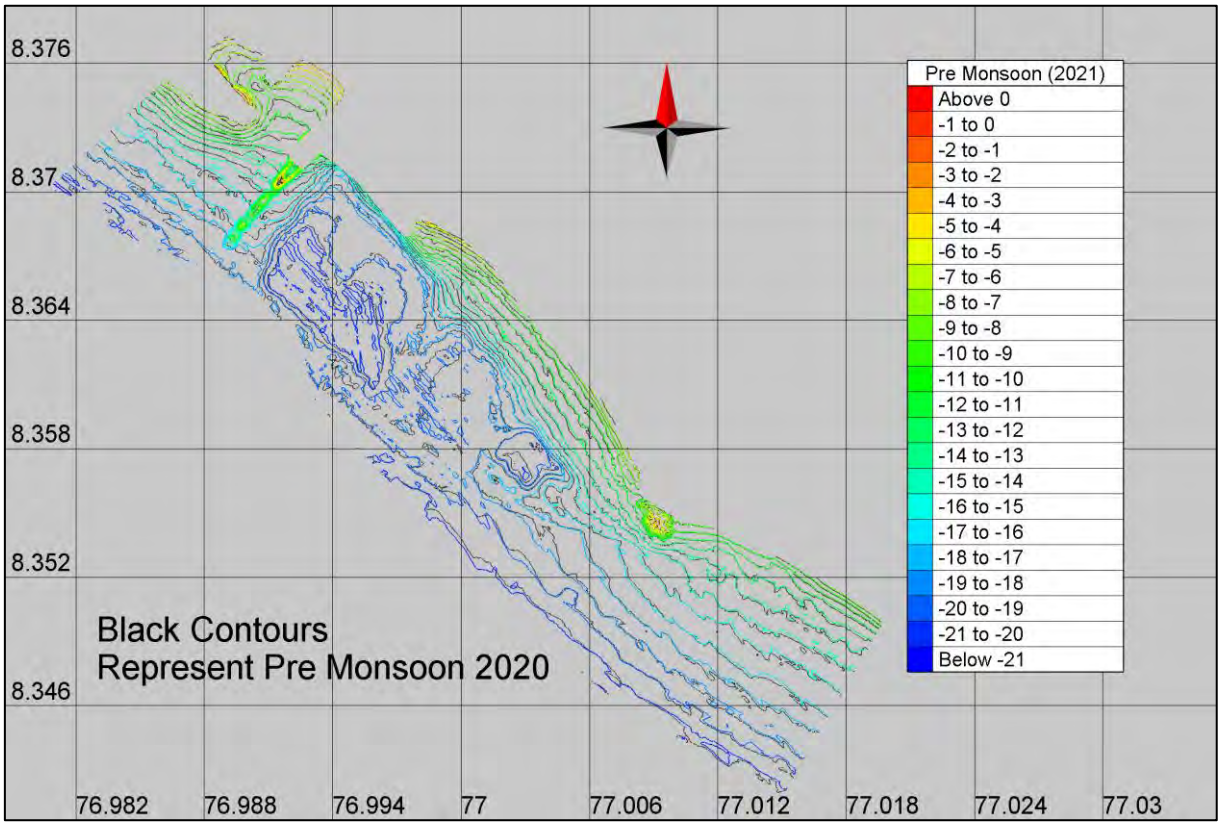


Figure 2-52 Difference in Bathymetry during Pre monsoon 2020 and 2021

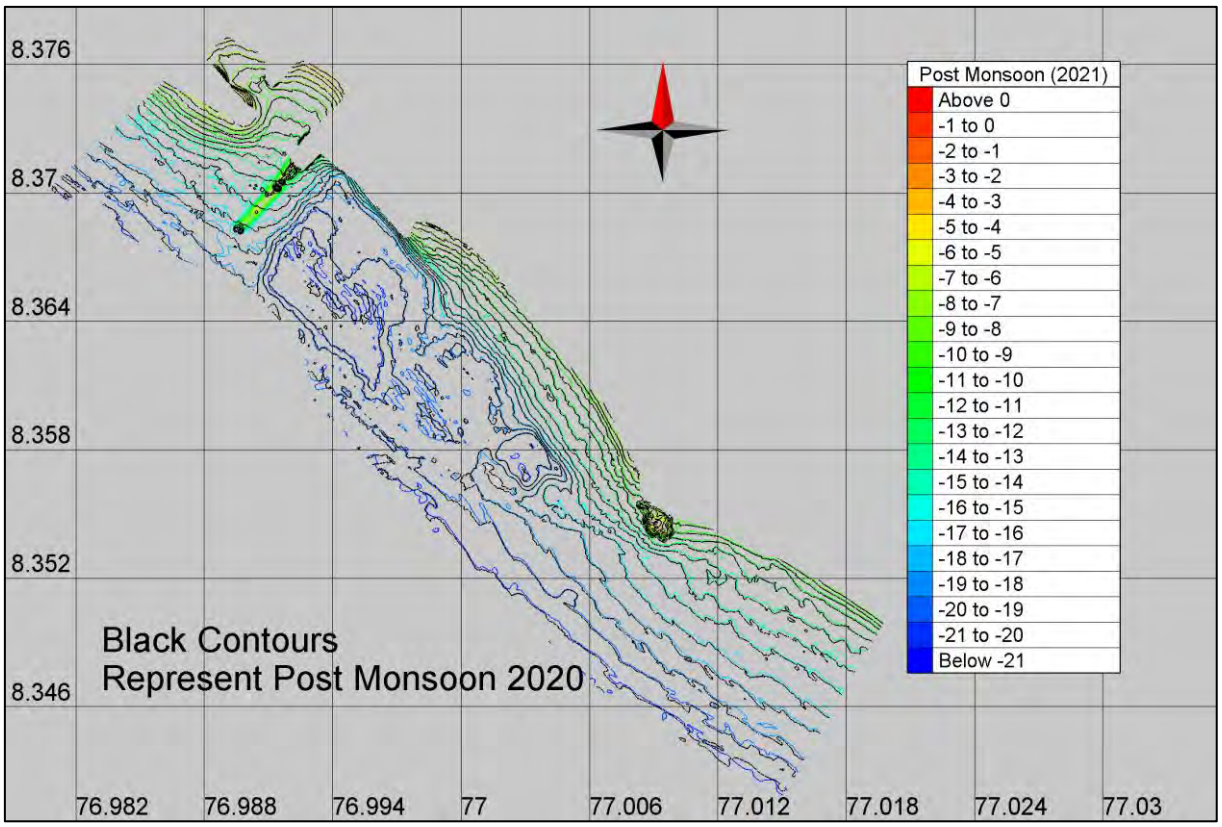


Figure 2-53 Difference in Bathymetry during Post monsoon 2020 and 2021

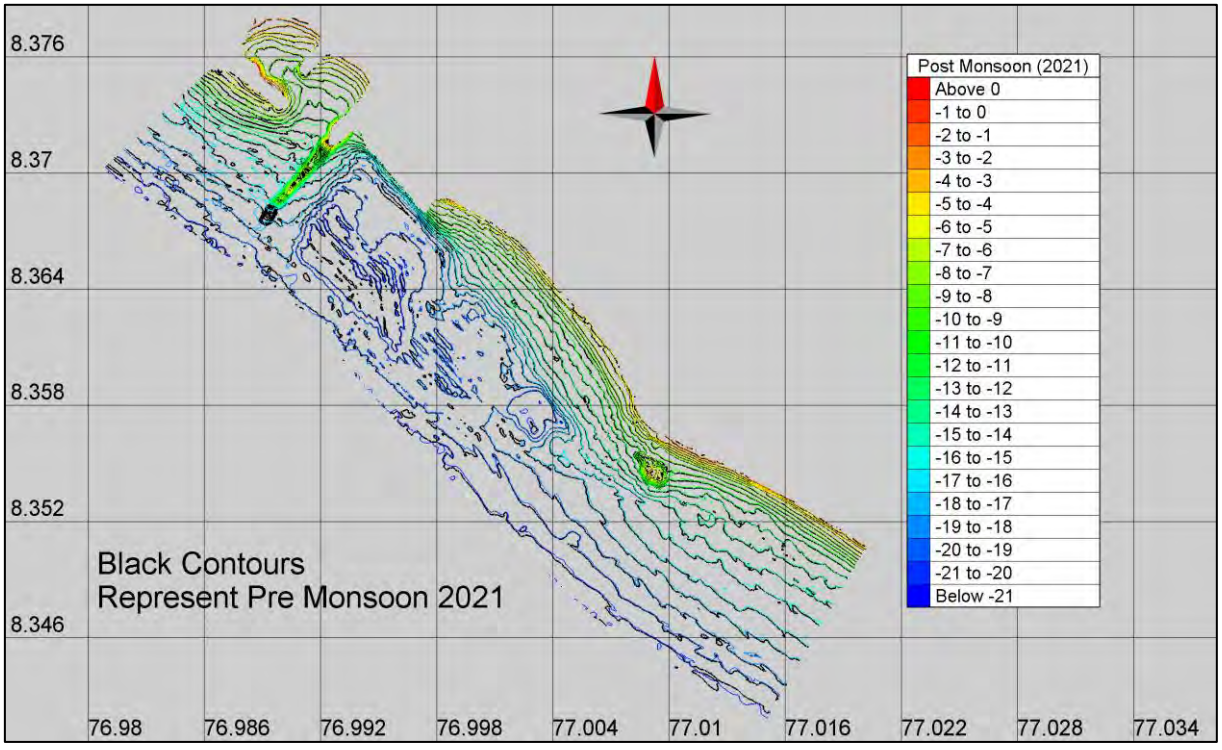


Figure 2-54 Difference in Bathymetry during Pre monsoon and Post monsoon 2021

Along with these comparisons, similar comparisons of bathymetry in Valiyathura and Shangumugham region were also carried out and are presented from Figure 2-52 to Figure 2-57.

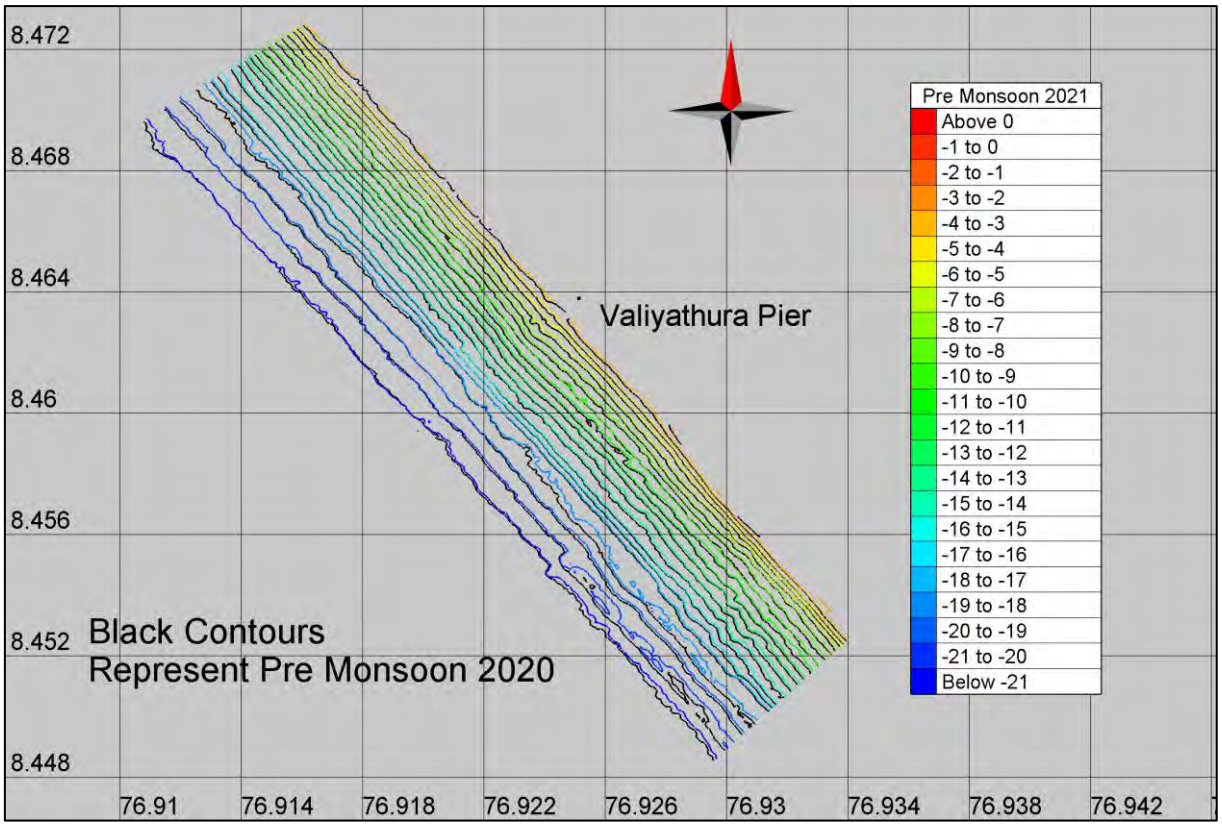


Figure 2-55 Difference in Bathymetry Pre monsoon 2020 and 2021 in Valiyathura region

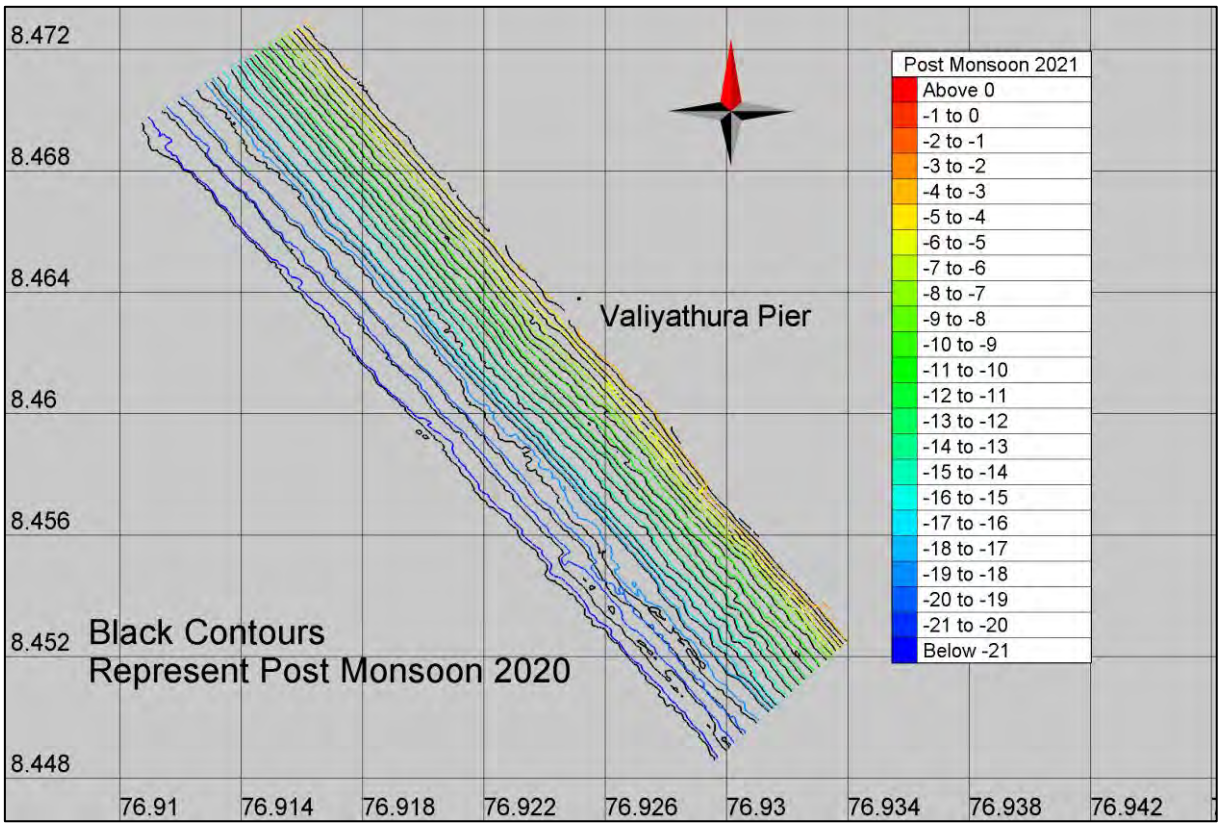


Figure 2-56 Difference in Bathymetry Post monsoon 2020 and 2021 in Valiyathura region

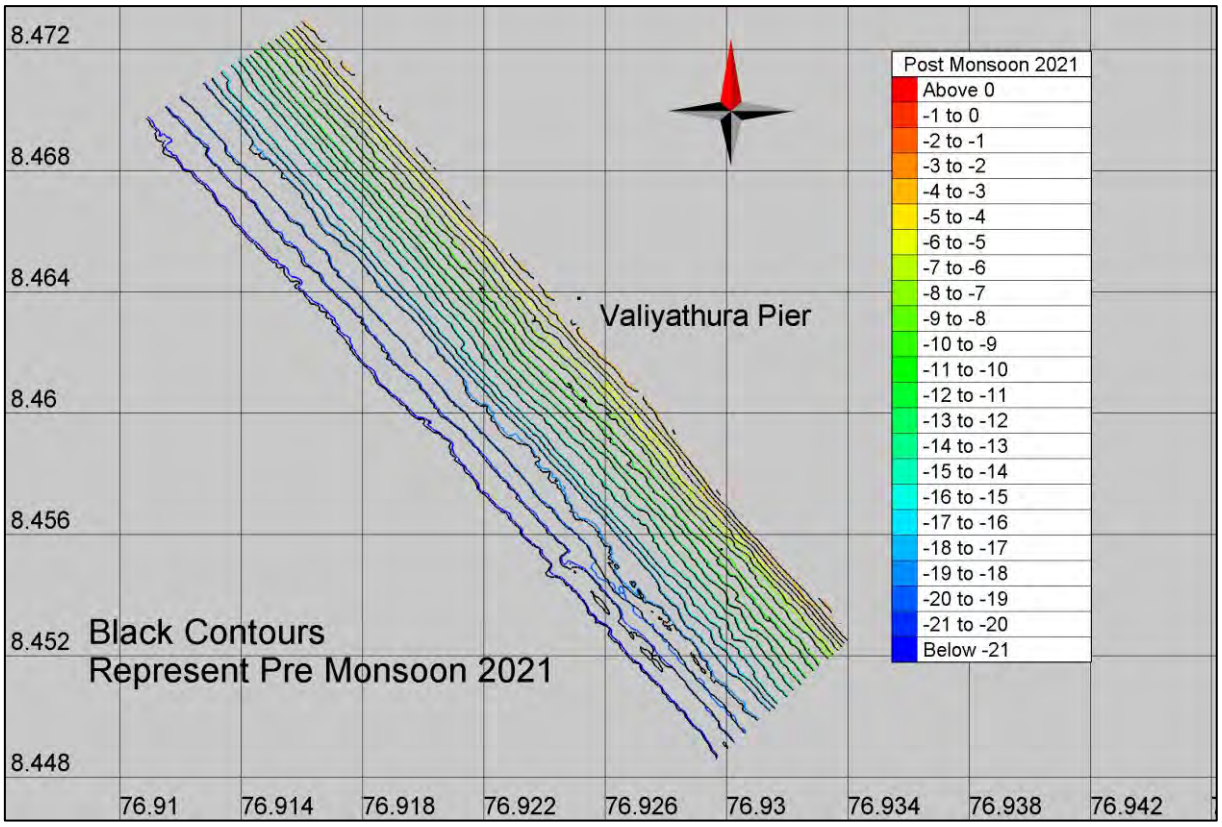


Figure 2-57 Difference in Bathymetry during Pre monsoon and Post monsoon 2021 in Valiyathura region

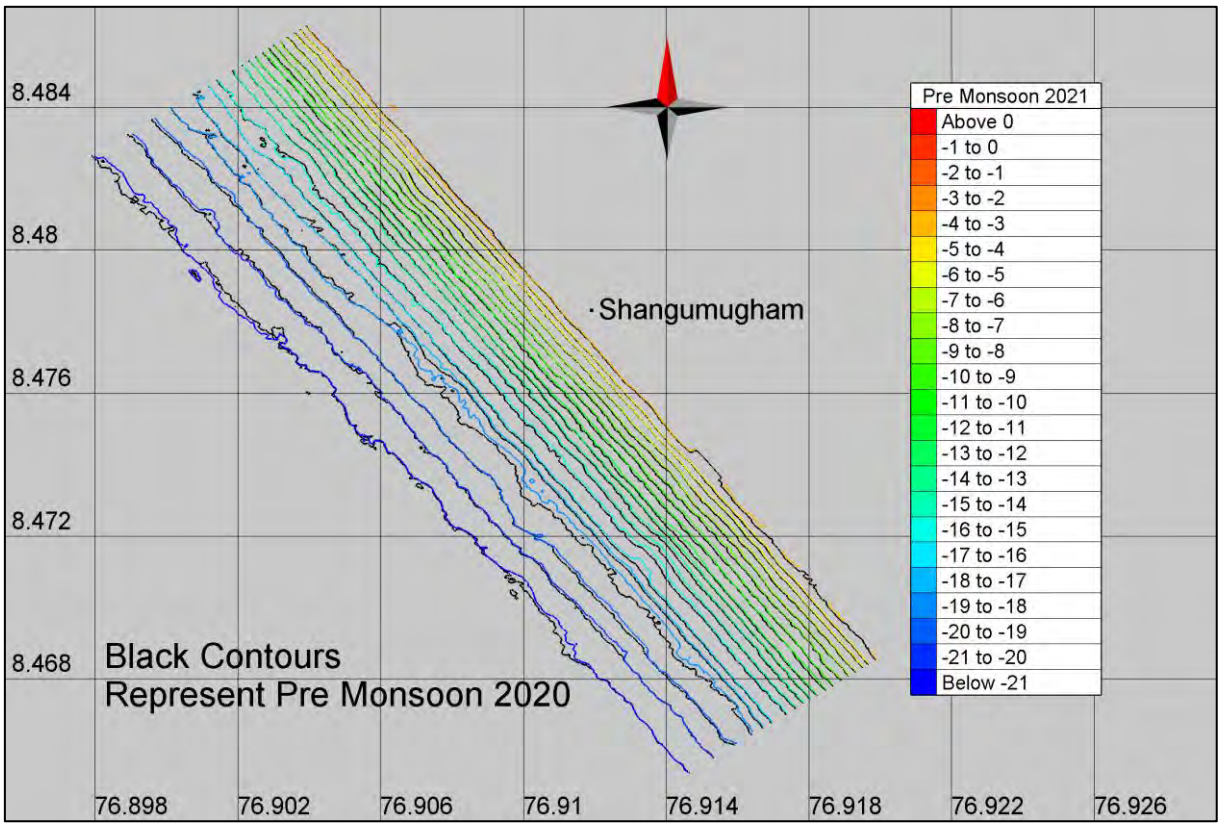


Figure 2-58 Difference in Bathymetry Pre monsoon 2020 and 2021 in Shangumugham region

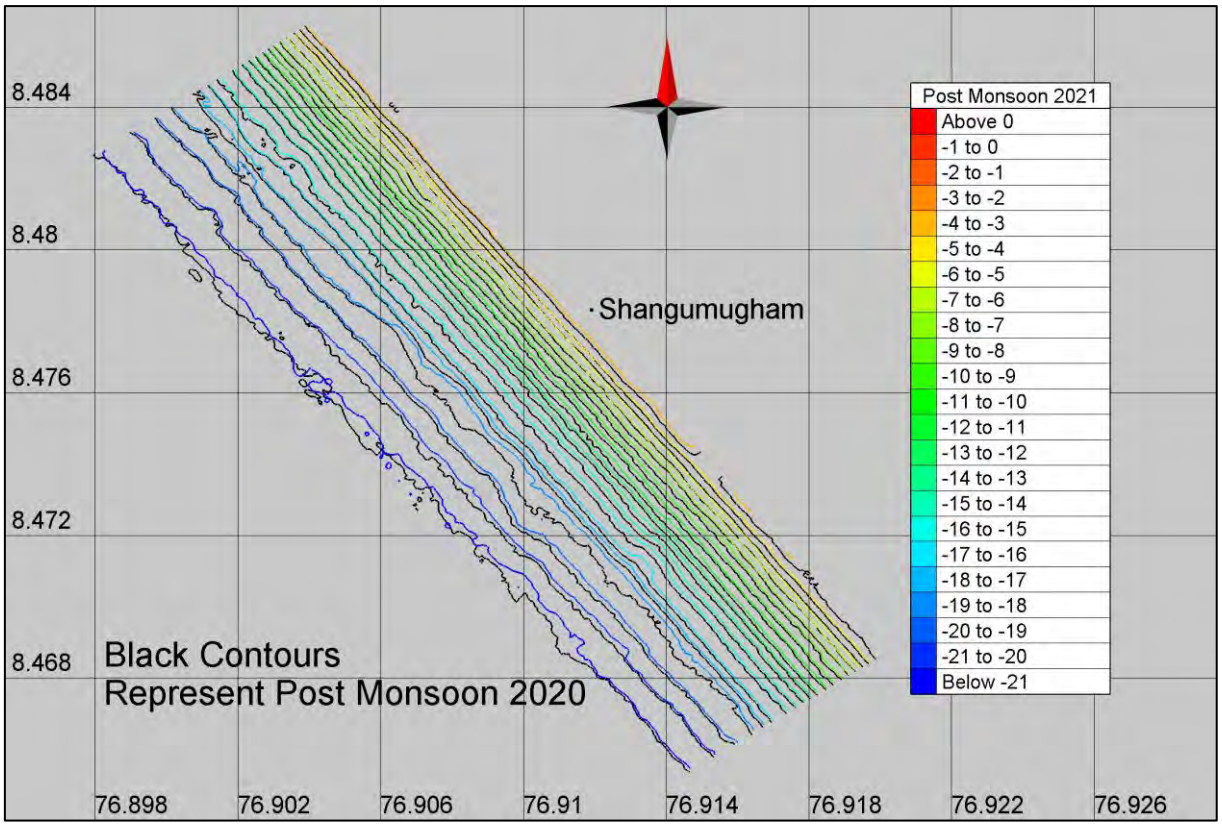


Figure 2-59 Difference in Bathymetry Post monsoon 2020 and 2021 in Shangumugham region

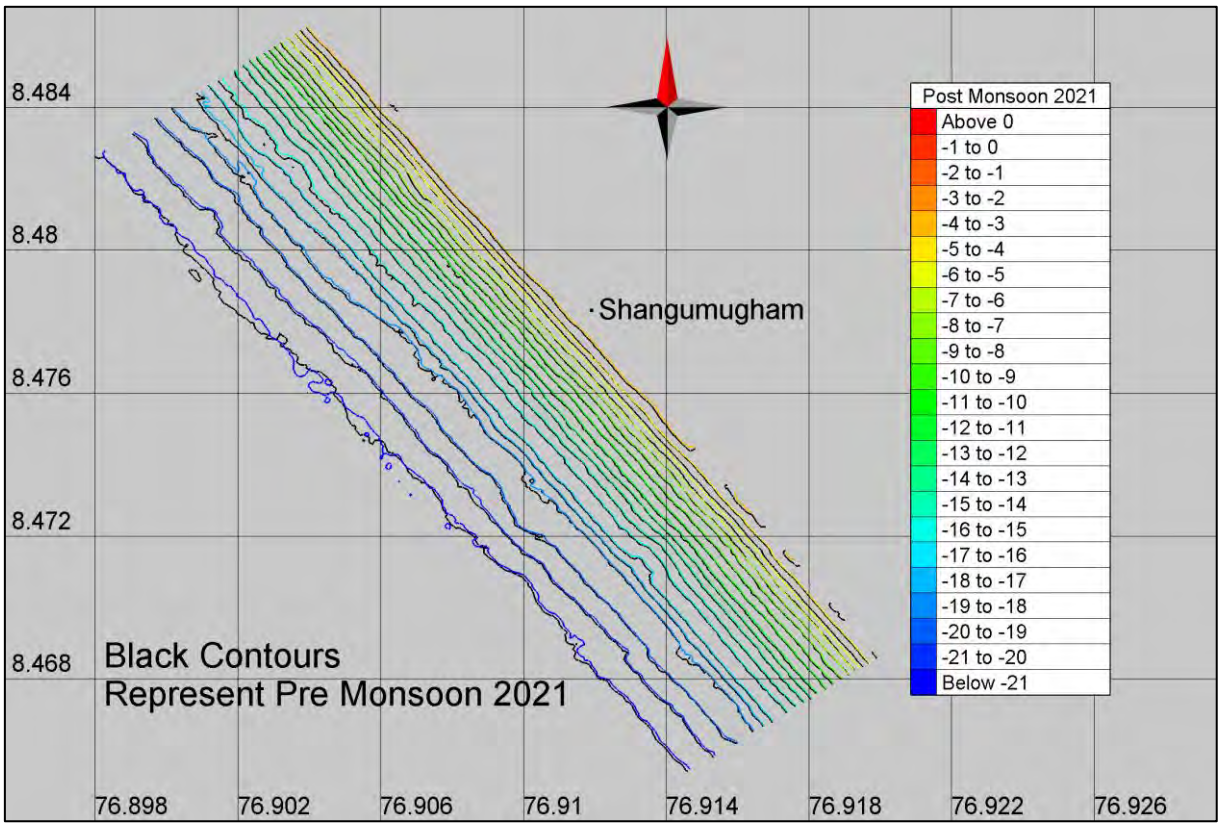


Figure 2-60 Difference in Bathymetry during Pre monsoon and Post monsoon 2021 in Shangumugham region

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 and Pre monsoon 2022). The locations of these sections are as shown in Figure 2-61. 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.

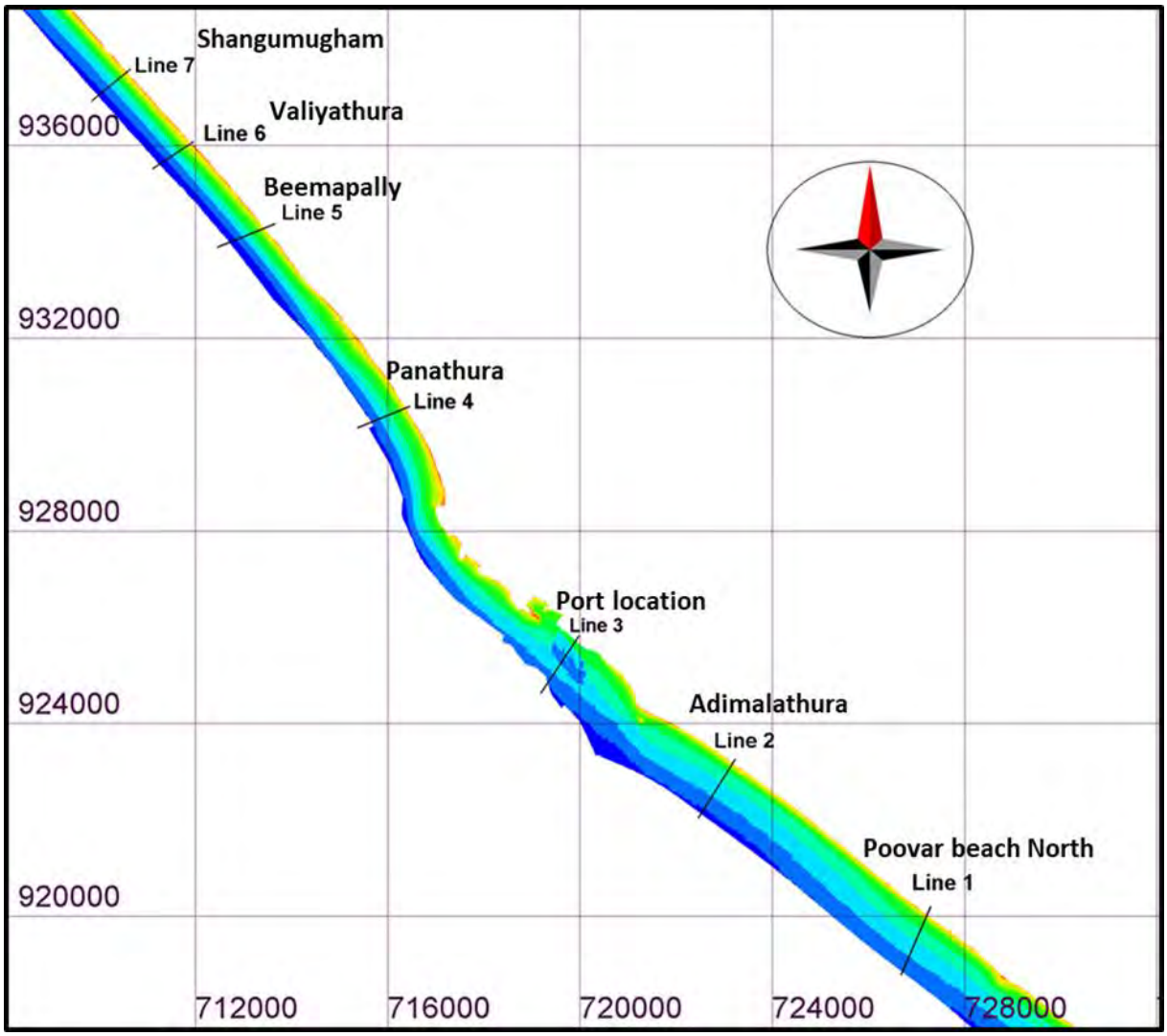


Figure 2-61 Location of the selected transect lines

Figure 2-62 to Figure 2-103 shows the comparison of Pre monsoon and Post monsoon of seven years (2015, 2016, 2017, 2018, 2019, 2020 & 2021) bathymetry data and Pre monsoon 2021 bathymetry along the selected sections.

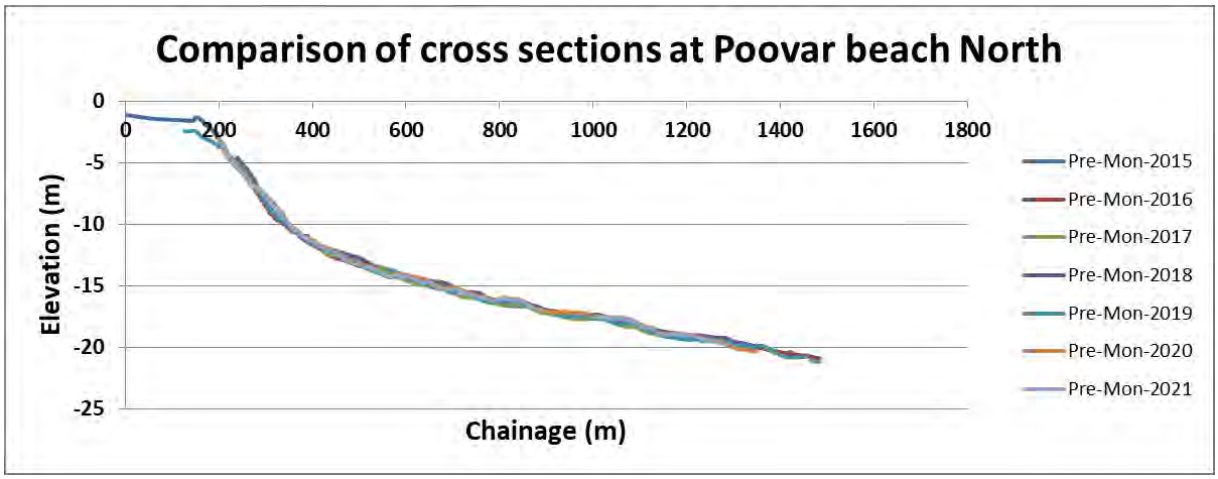


Figure 2-62 Bathymetry – Cross section comparison at Poovar beach North (Pre-monsoon)

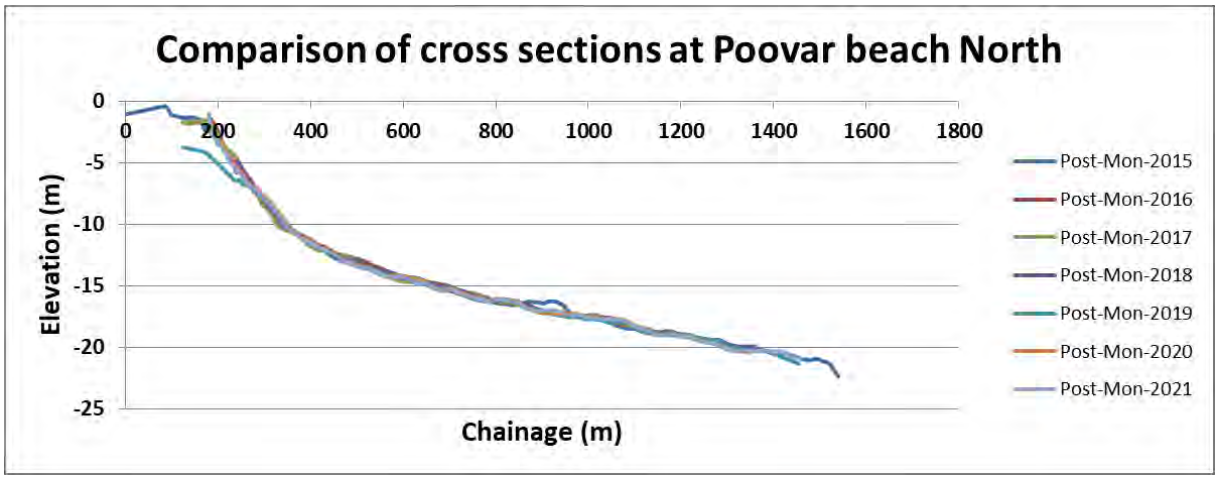


Figure 2-63 Bathymetry – Cross section comparison at Poovar beach North (Post-monsoon)

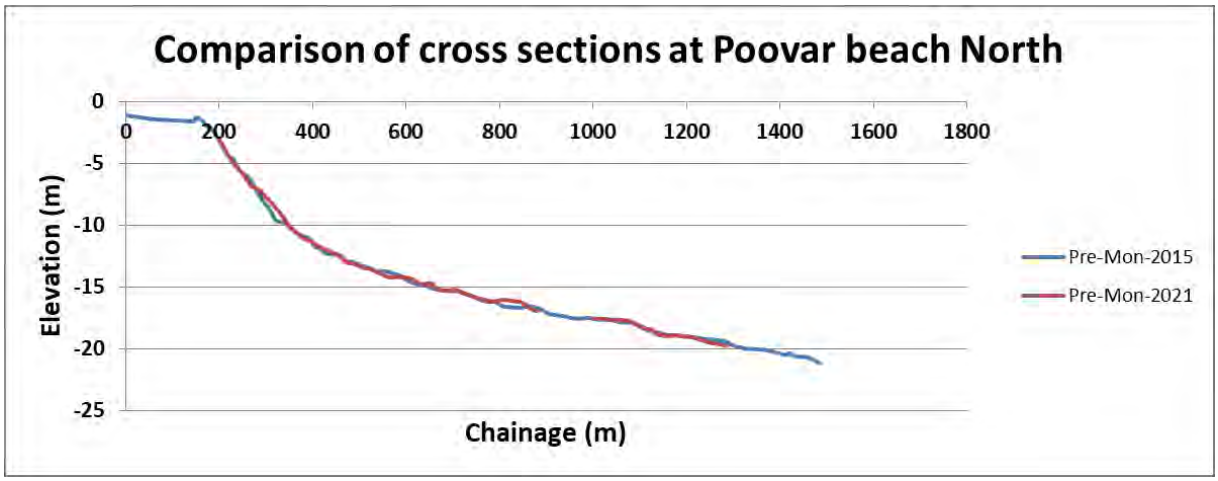


Figure 2-64 Bathymetry – Cross section comparison between 2015 and 2021 at Poovar beach North (Pre-monsoon)

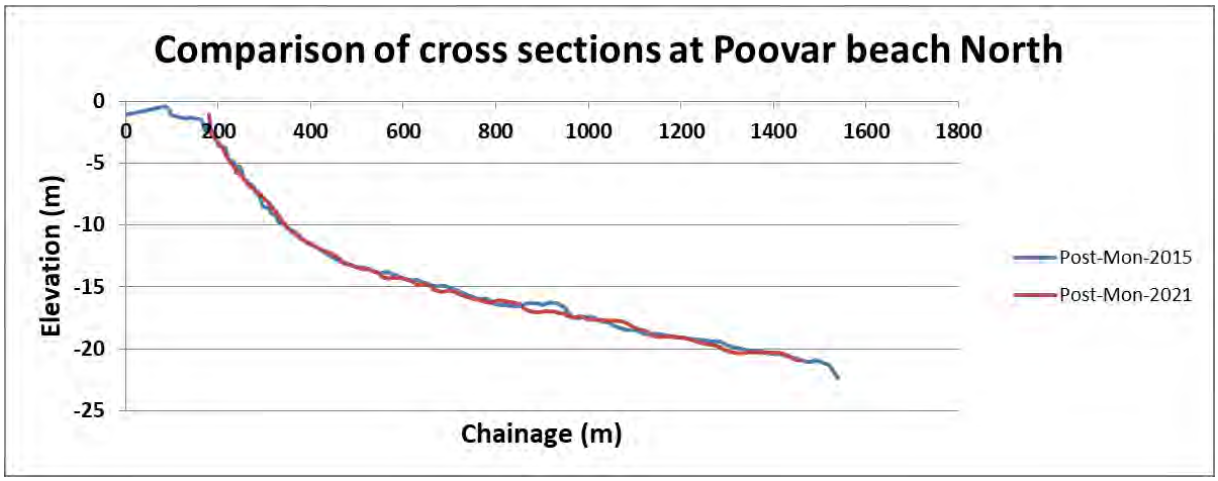


Figure 2-65 Bathymetry – Cross section comparison between 2015 and 2021 at Poovar beach North (Post-monsoon)

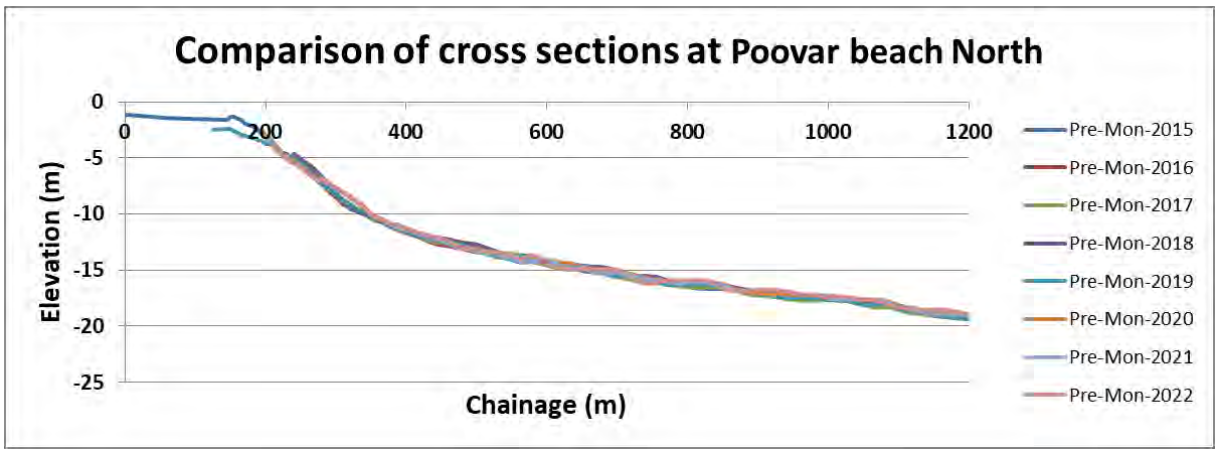


Figure 2-66 Bathymetry – Cross section comparison at Poovar beach North (Pre-monsoon)

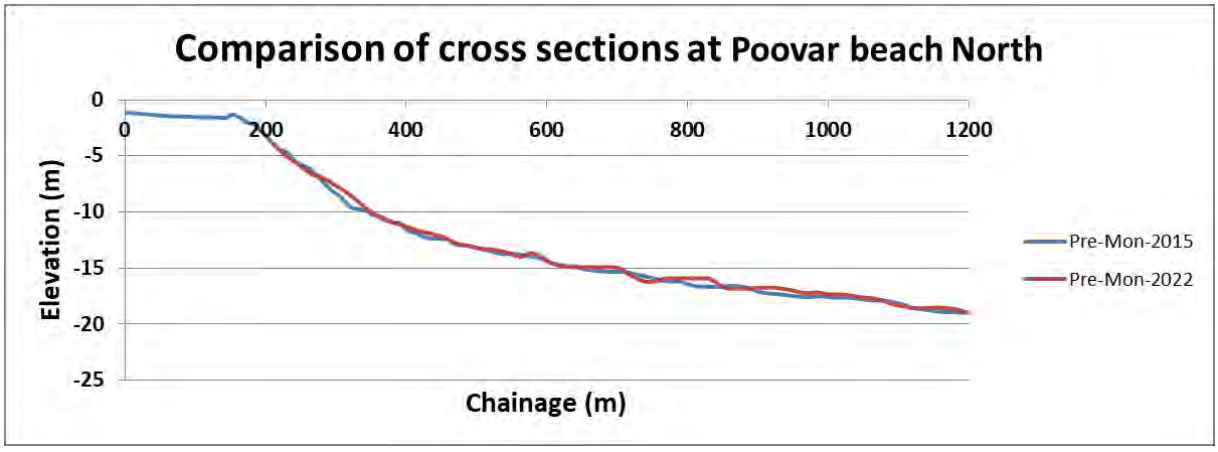


Figure 2-67 Bathymetry – Cross section comparison between 2015 and 2022 at Poovar beach North (Pre-monsoon)

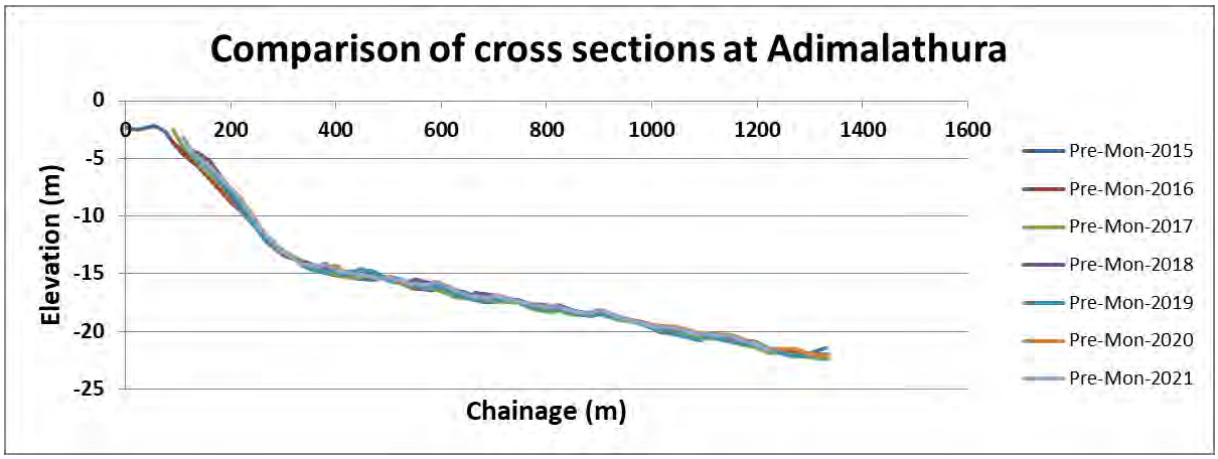


Figure 2-68 Bathymetry – Cross section comparison at Adimalathura (Pre-monsoon)

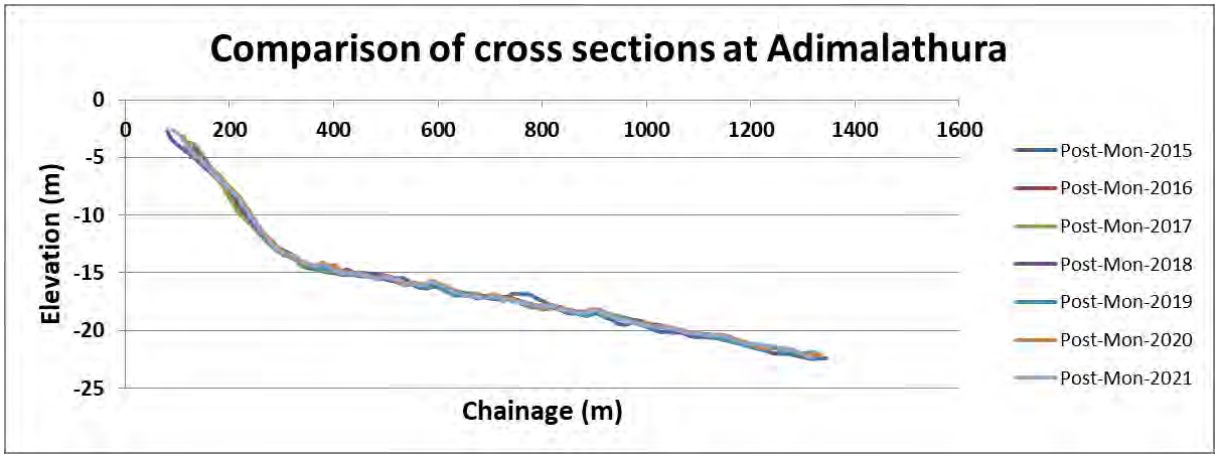


Figure 2-69 Bathymetry – Cross section comparison at Adimalathura (Post-monsoon)

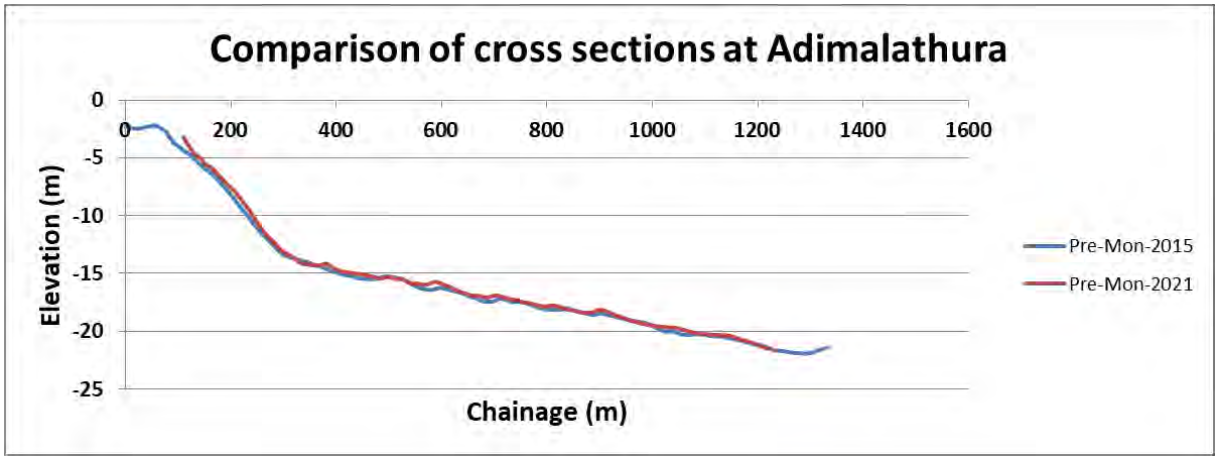


Figure 2-70 Bathymetry – Cross section comparison between 2015 and 2021 at Adimalathura (Pre-monsoon)

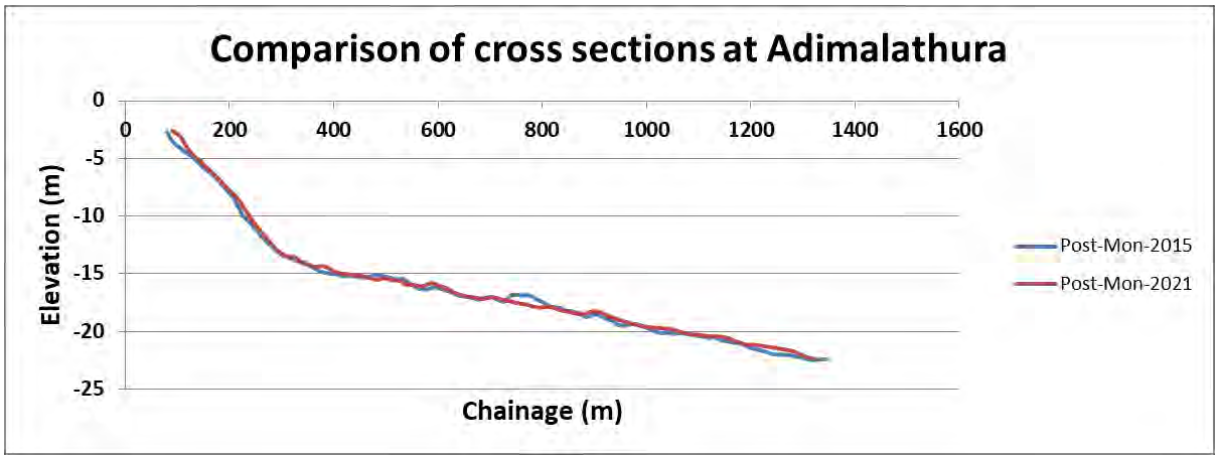


Figure 2-71 Bathymetry – Cross section comparison between 2015 and 2021 at Adimalathura (Post-monsoon)

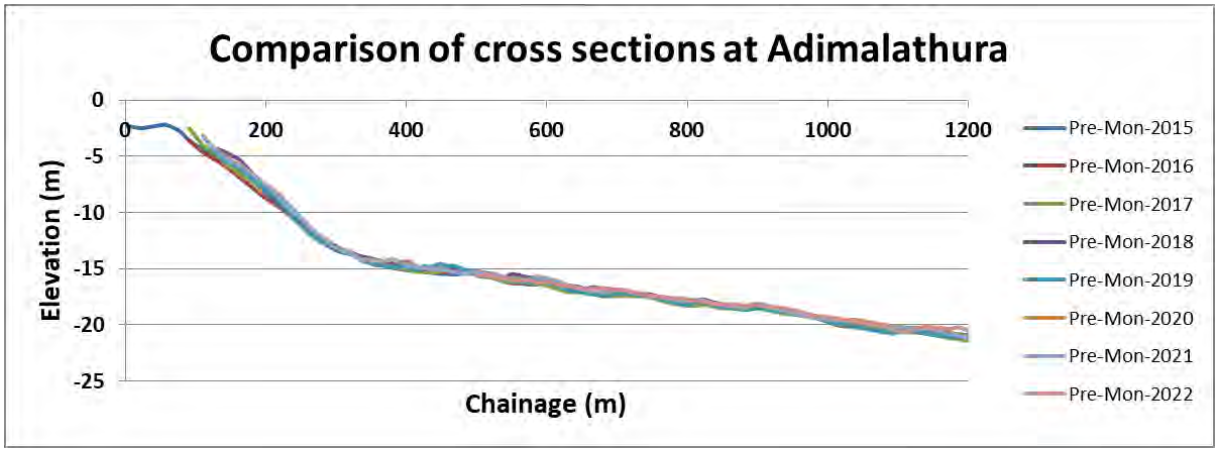


Figure 2-72 Bathymetry – Cross section comparison at Adimalathura (Pre-monsoon)

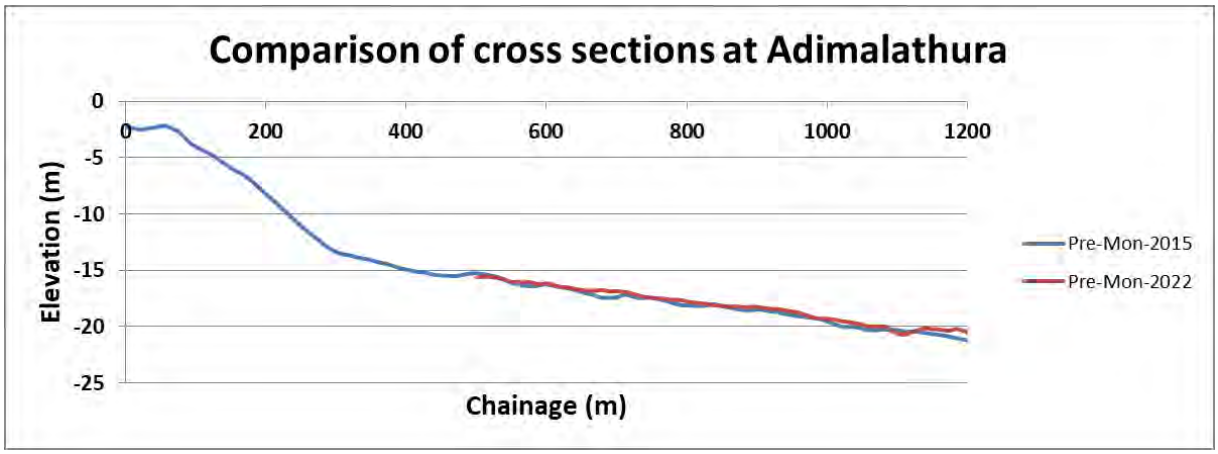


Figure 2-73 Bathymetry – Cross section comparison between 2015 and 2022 at Adimalathura (Pre-monsoon)

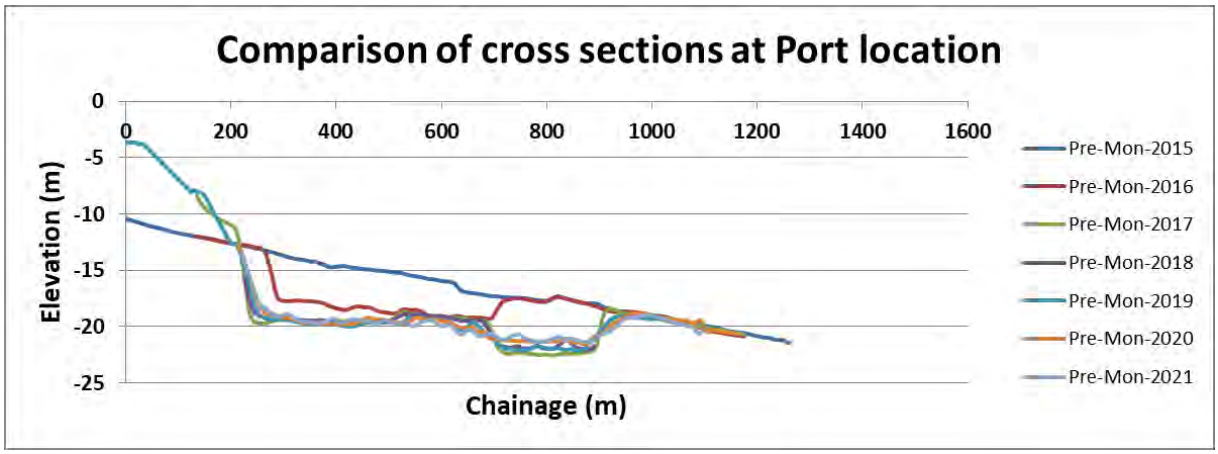


Figure 2-74 Bathymetry – Cross section comparison at Port location (Pre-monsoon)

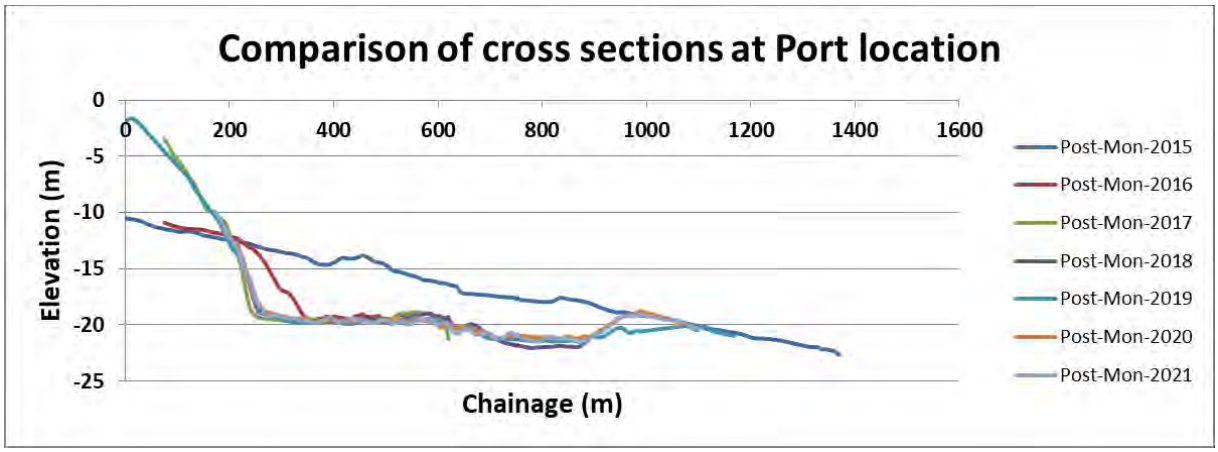


Figure 2-75 Bathymetry – Cross section comparison at Port location (Post-monsoon)

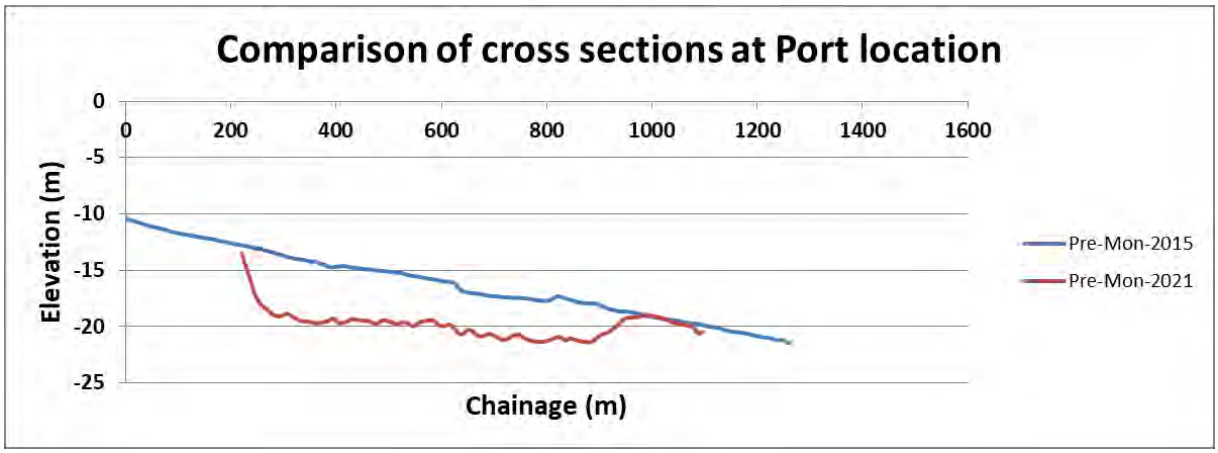


Figure 2-76 Bathymetry – Cross section comparison between 2015 and 2021 at Port location (Pre-monsoon)

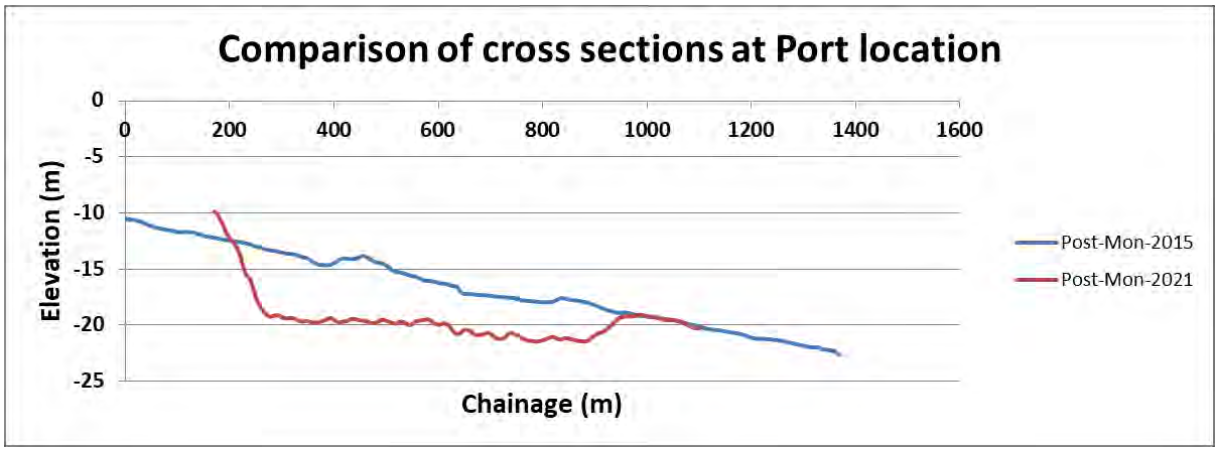


Figure 2-77 Bathymetry – Cross section comparison between 2015 and 2021 at Port location (Post-monsoon)

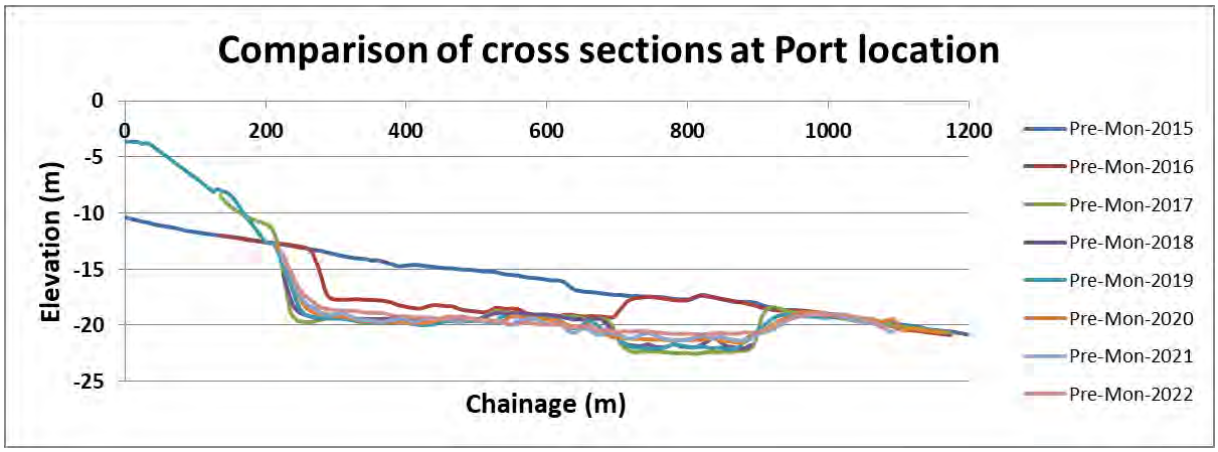


Figure 2-78 Bathymetry – Cross section comparison at Port location (Pre-monsoon)

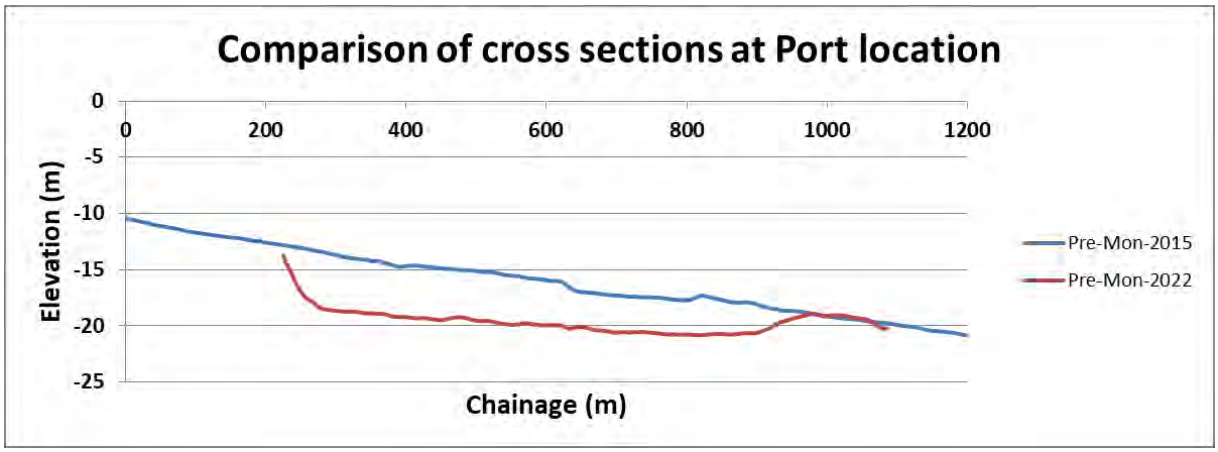


Figure 2-79 Bathymetry – Cross section comparison between 2015 and 2022 at Port location (Pre-monsoon)

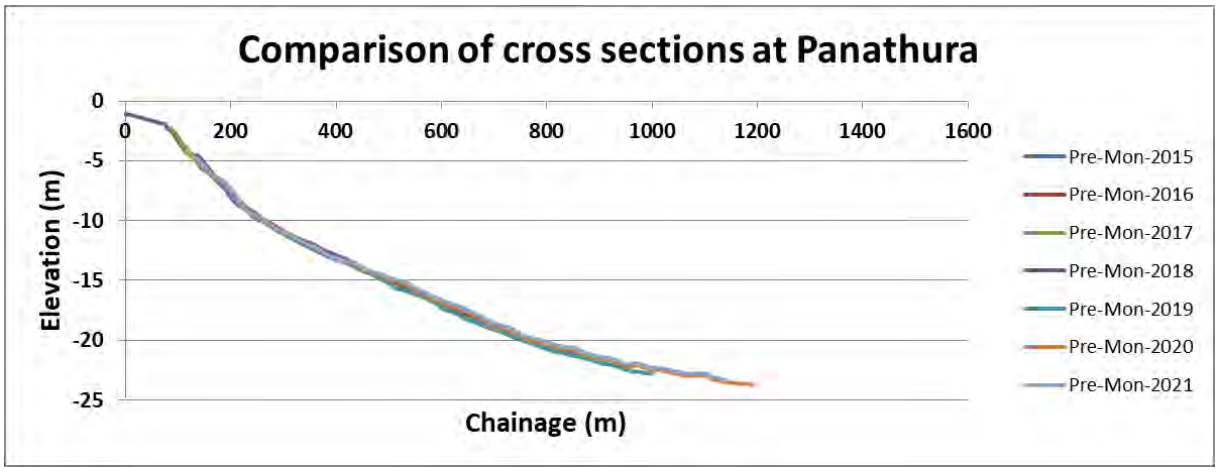


Figure 2-80 Bathymetry – Cross section comparison at Panathura (Pre-monsoon)

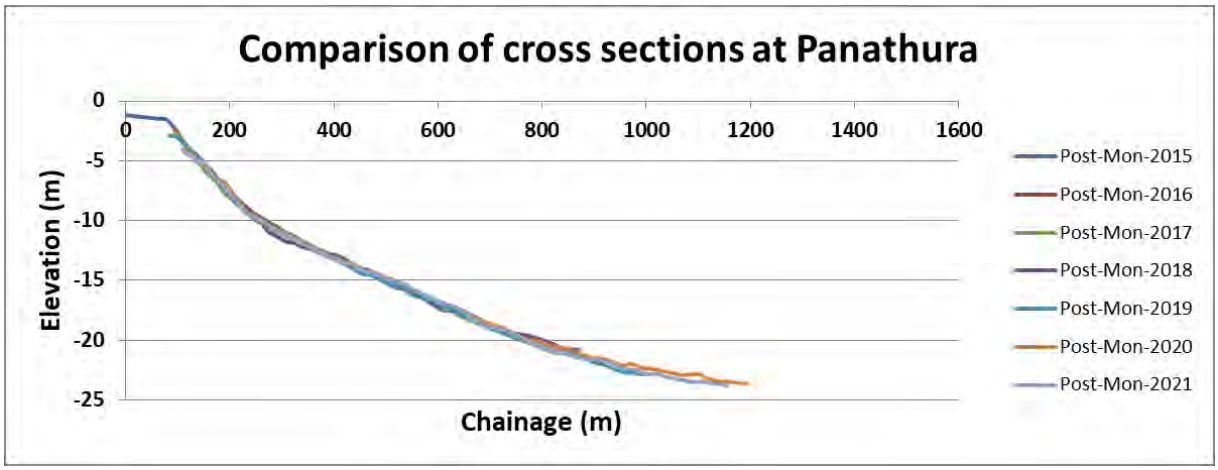


Figure 2-81 Bathymetry – Cross section comparison at Panathura (Post-monsoon)

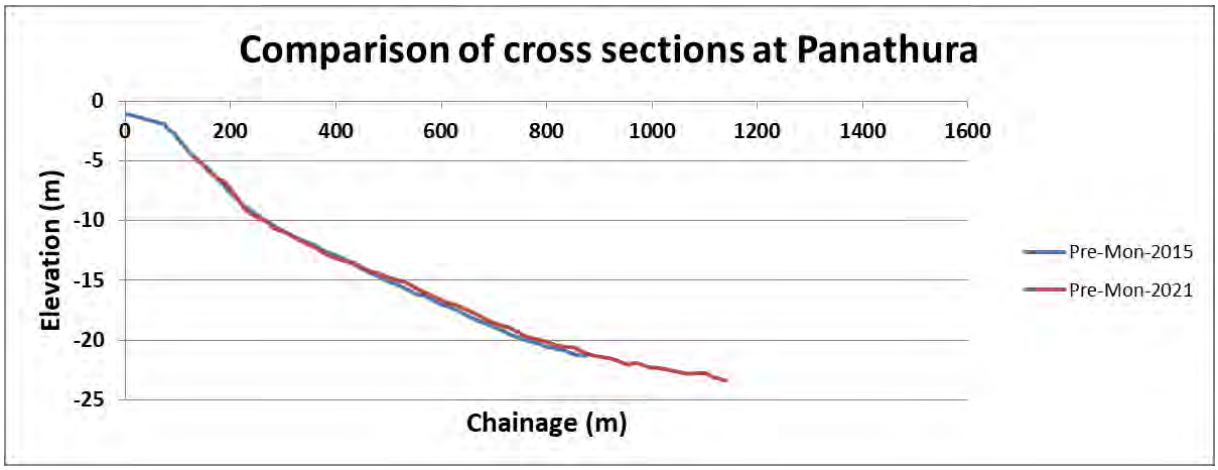


Figure 2-82 Bathymetry – Cross section comparison between 2015 and 2021 at Panathura (Pre-monsoon)

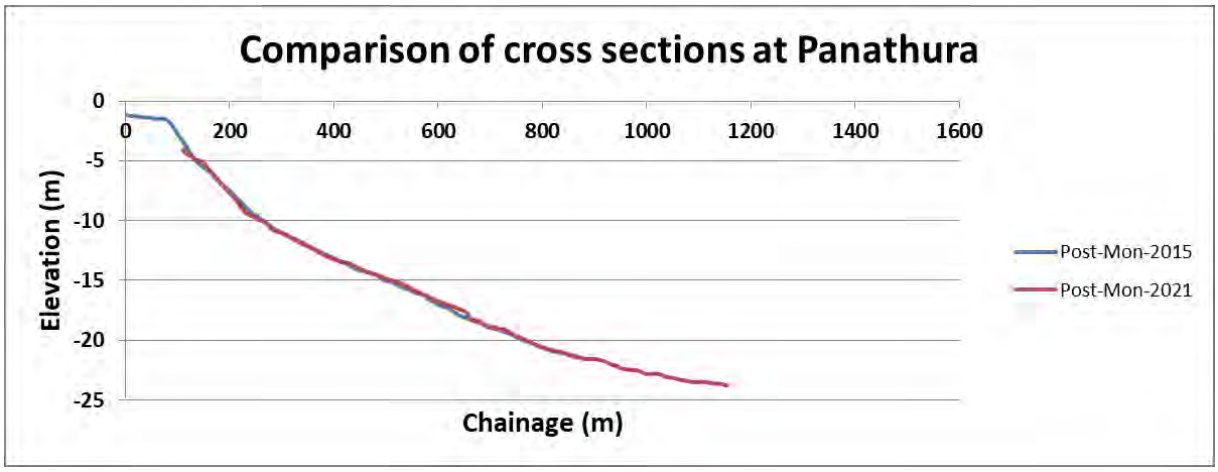


Figure 2-83 Bathymetry – Cross section comparison between 2015 and 2021 at Panathura (Post-monsoon)

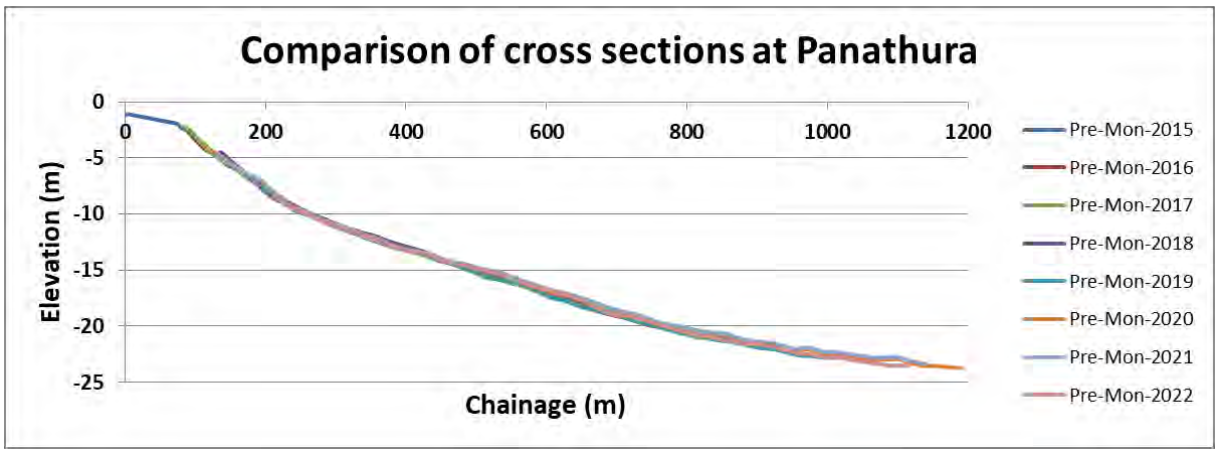


Figure 2-84 Bathymetry – Cross section comparison at Panathura (Pre-monsoon)

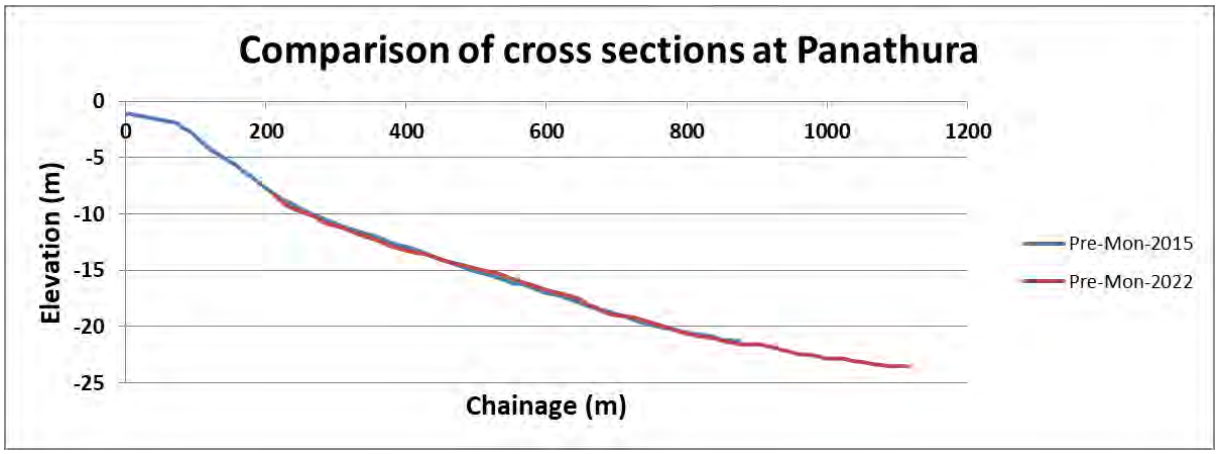


Figure 2-85 Bathymetry – Cross section comparison between 2015 and 2022 at Panathura (Pre-monsoon)

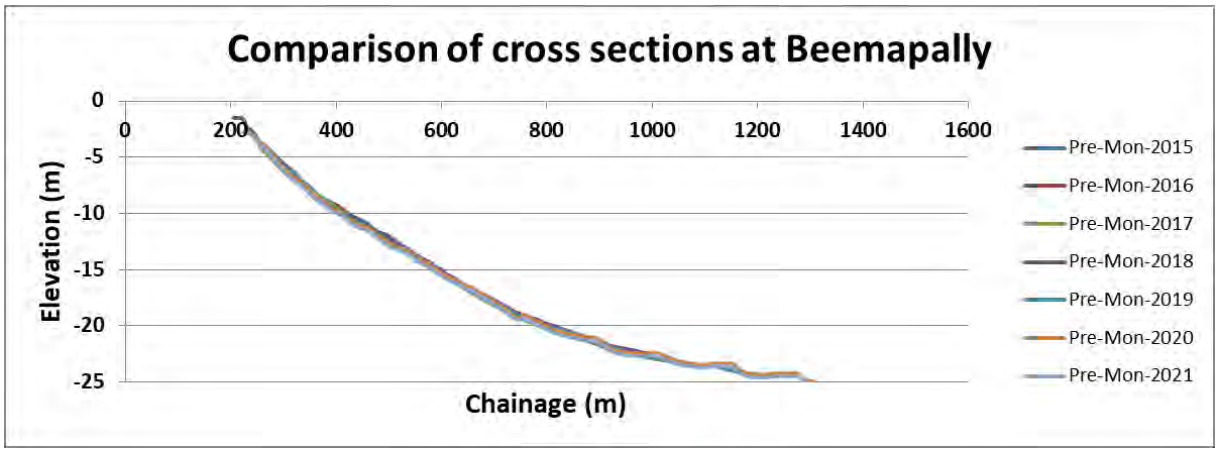


Figure 2-86 Bathymetry – Cross section comparison at Beemapally (Pre-monsoon)

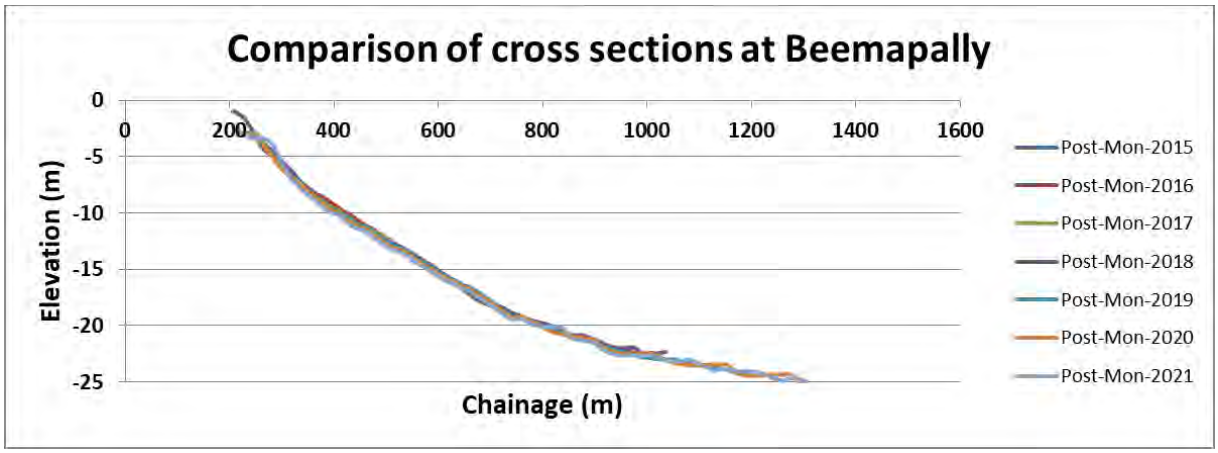


Figure 2-87 Bathymetry – Cross section comparison at Beemapally (Post-monsoon)

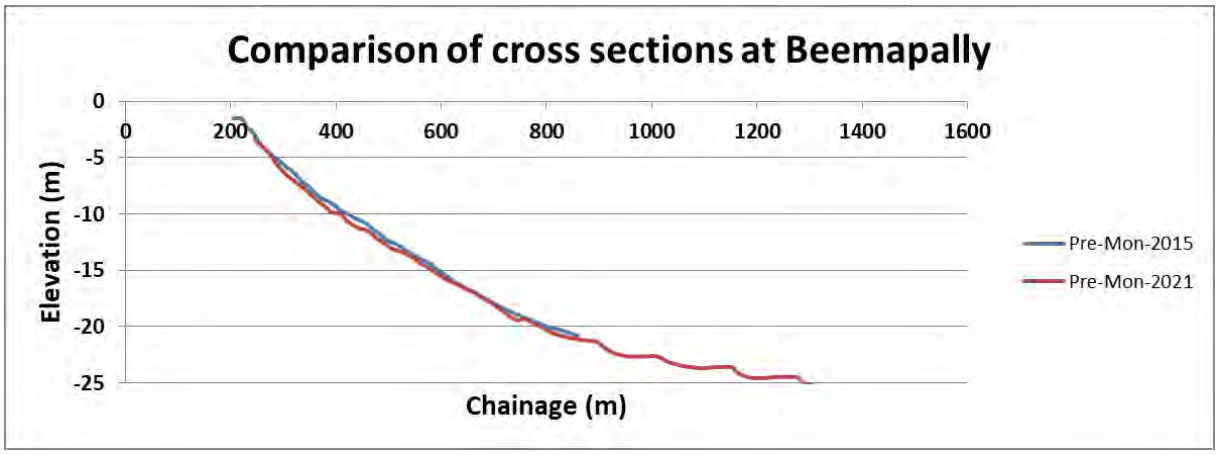


Figure 2-88 Bathymetry – Cross section comparison between 2015 and 2021 at Beemapally (Pre-monsoon)

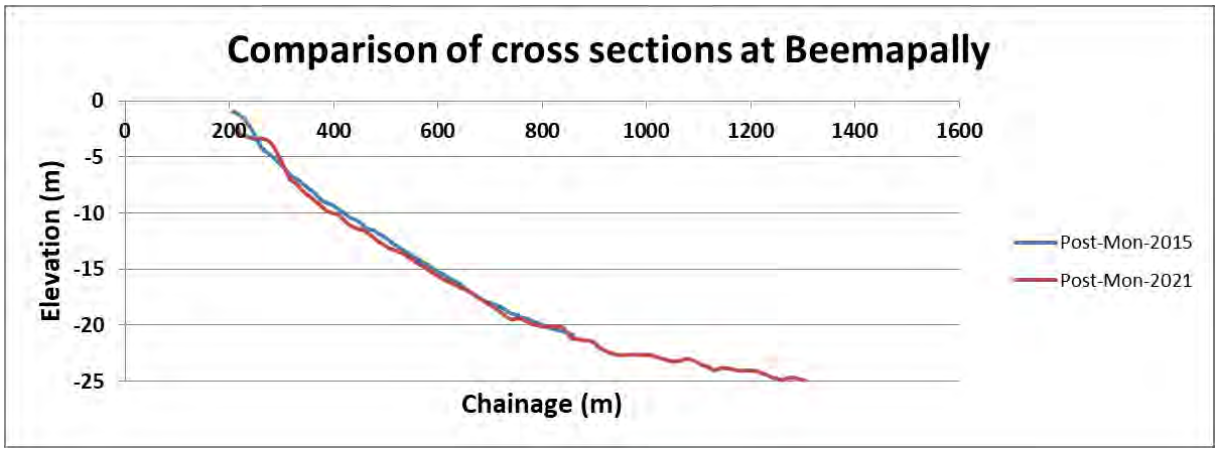


Figure 2-89 Bathymetry – Cross section comparison between 2015 and 2021 at Beemapally (Post-monsoon)

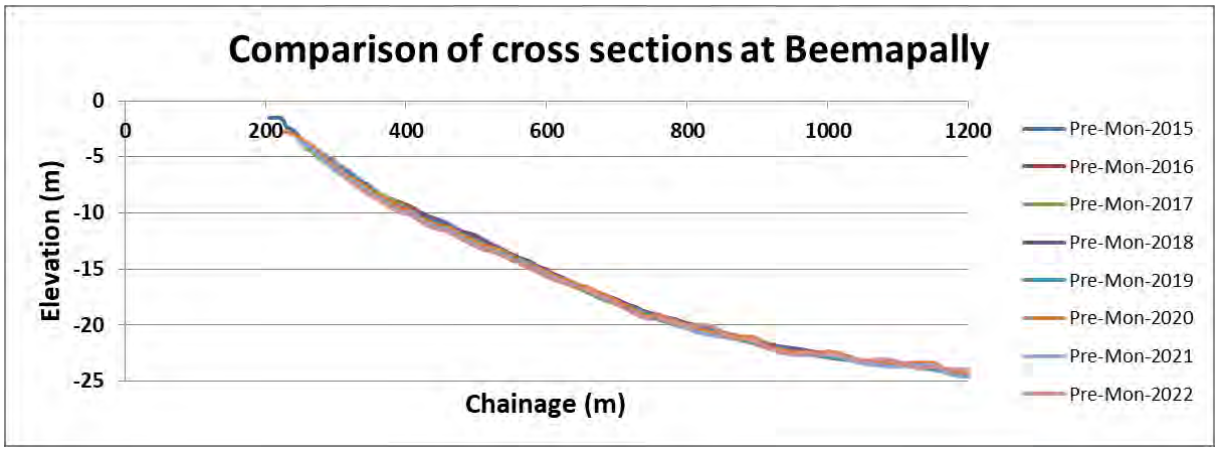


Figure 2-90 Bathymetry – Cross section comparison at Beemapally (Pre-monsoon)

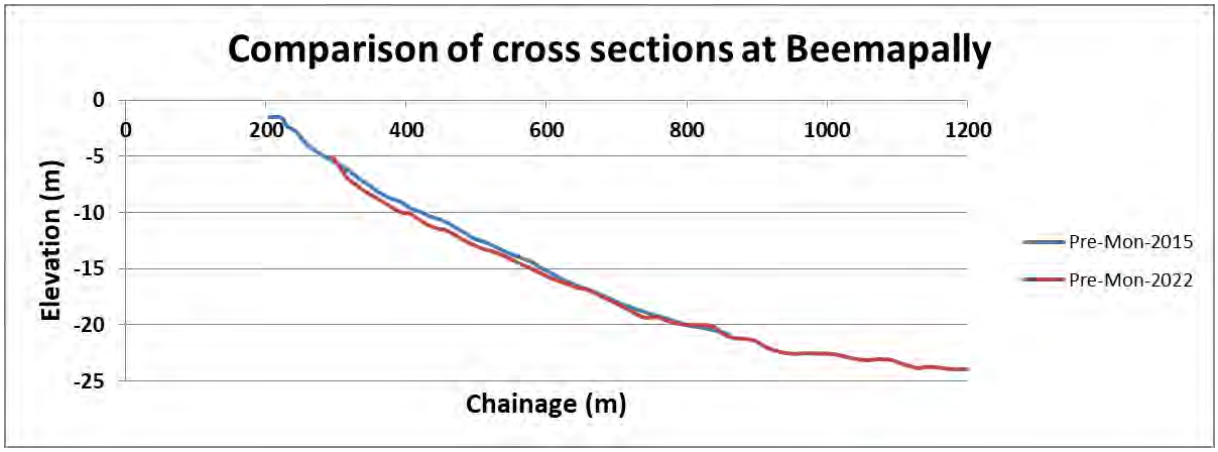


Figure 2-91 Bathymetry – Cross section comparison between 2015 and 2022 at Beemapally (Pre-monsoon)

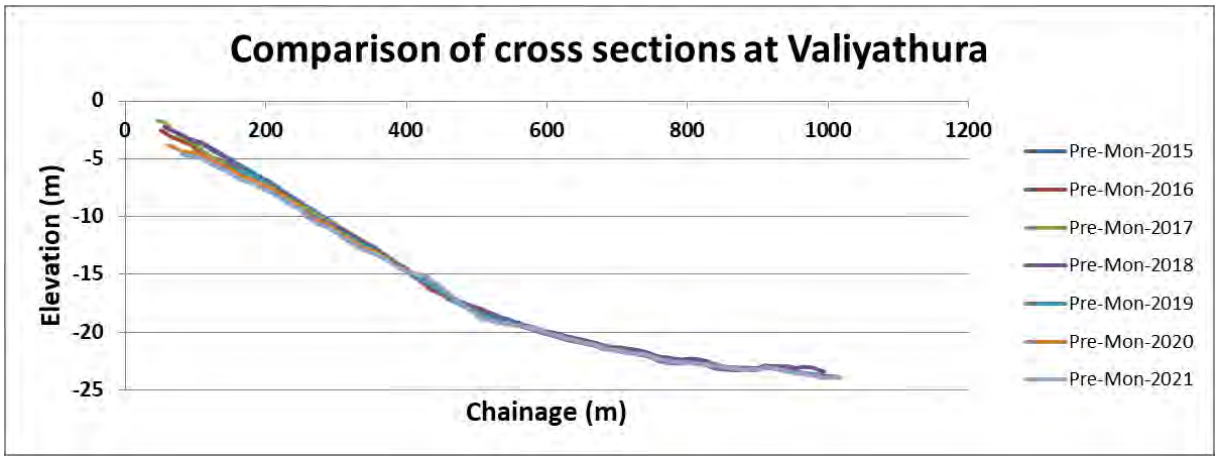


Figure 2-92 Bathymetry – Cross section comparison at Valiyathura (Pre-monsoon)

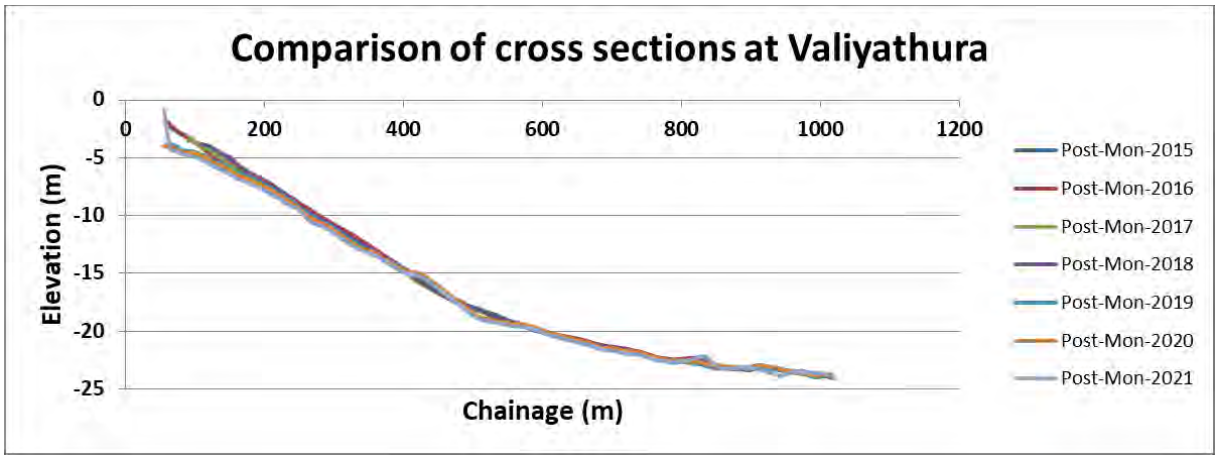


Figure 2-93 Bathymetry – Cross section comparison at Valiyathura (Post-monsoon)

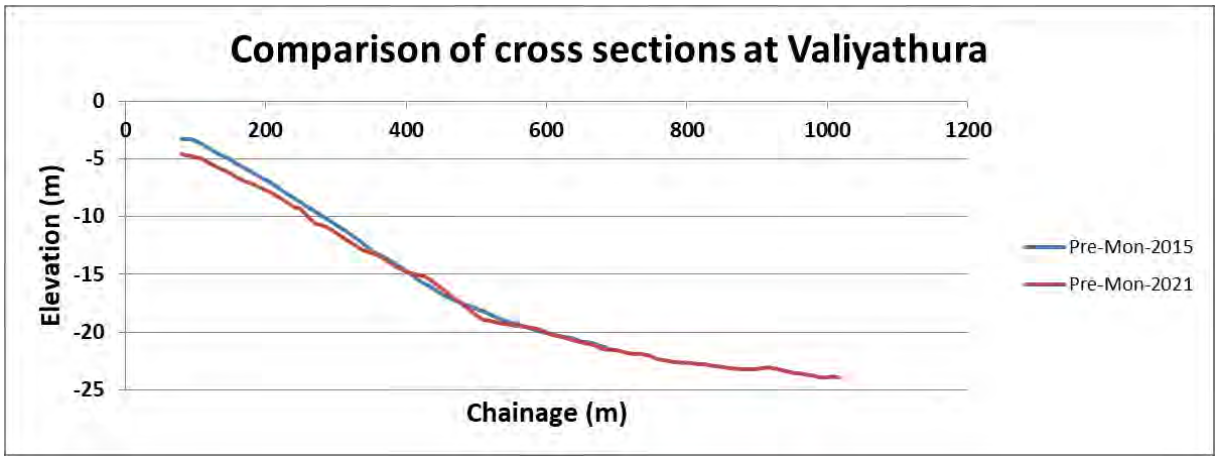


Figure 2-94 Bathymetry – Cross section comparison between 2015 and 2021 at Valiyathura (Pre-monsoon)

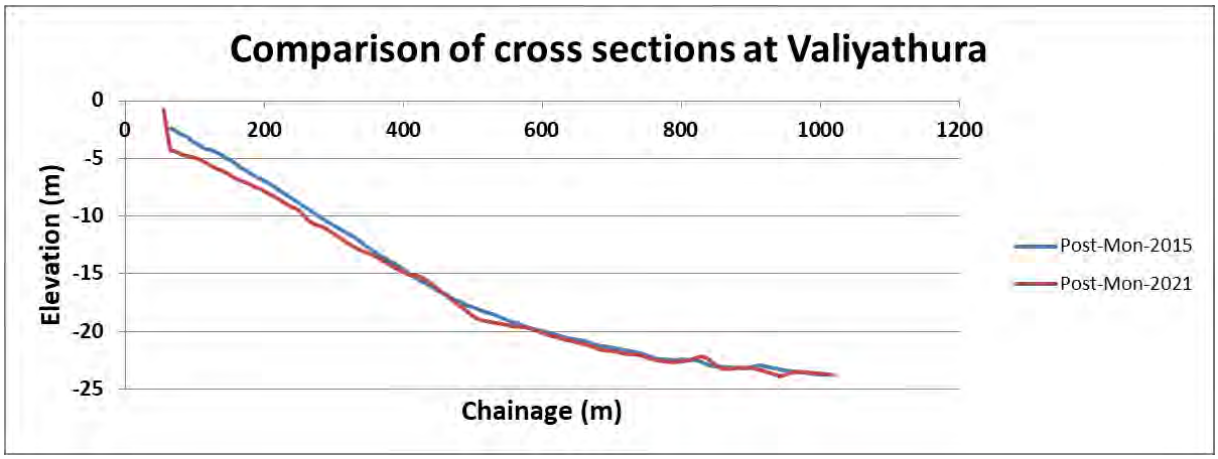


Figure 2-95 Bathymetry – Cross section comparison between 2015 and 2021 at Valiyathura (Post-monsoon)

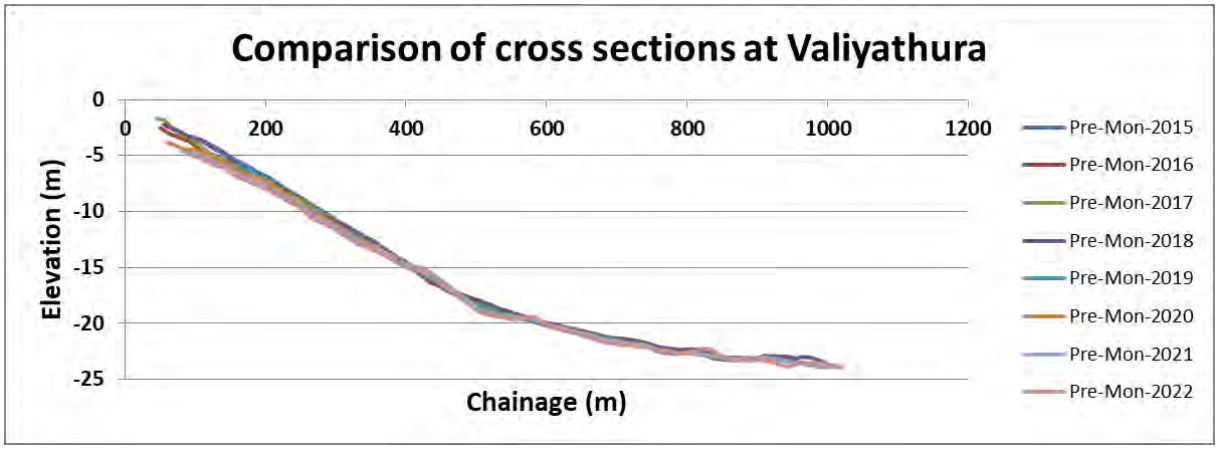


Figure 2-96 Bathymetry – Cross section comparison at Valiyathura (Pre-monsoon)

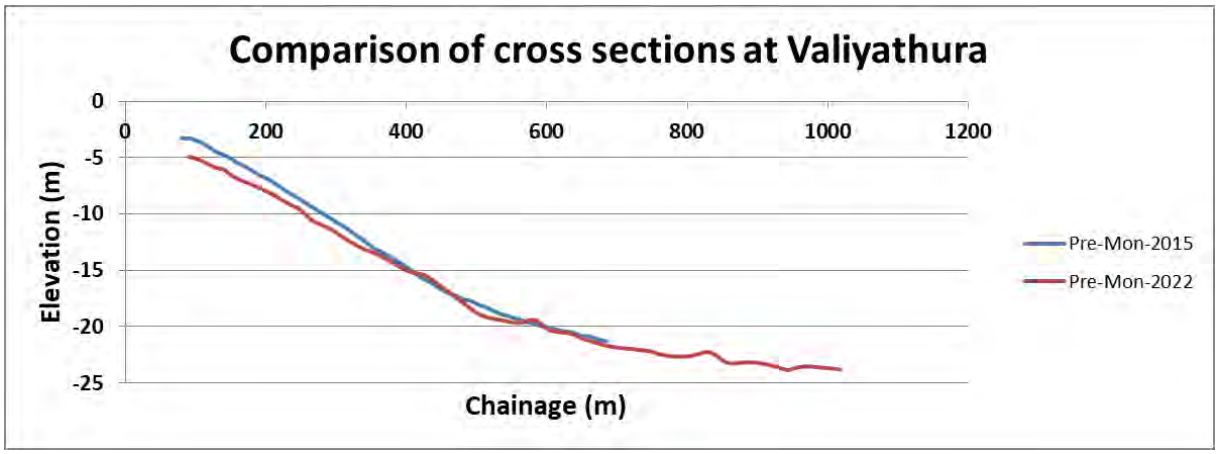


Figure 2-97 Bathymetry – Cross section comparison between 2015 and 2022 at Valiyathura (Pre-monsoon)

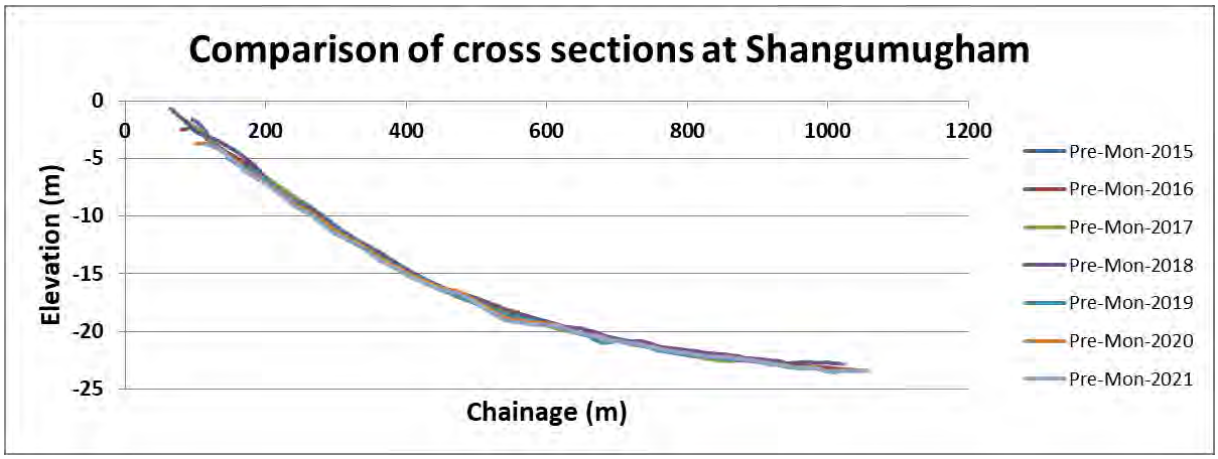


Figure 2-98 Bathymetry – Cross section comparison at Shangumugham (Pre-monsoon)

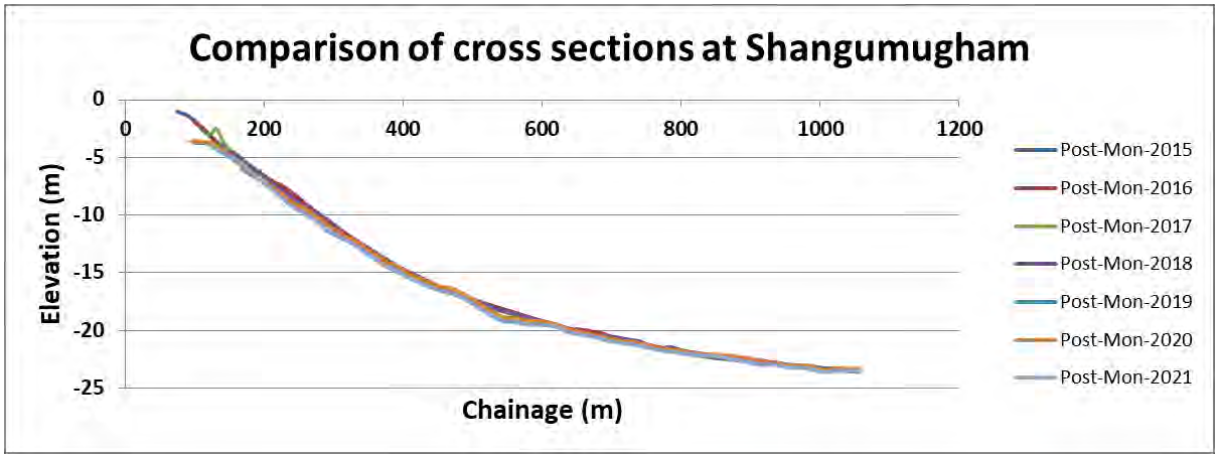


Figure 2-99 Bathymetry – Cross section comparison at Shangumugham (Post-monsoon)

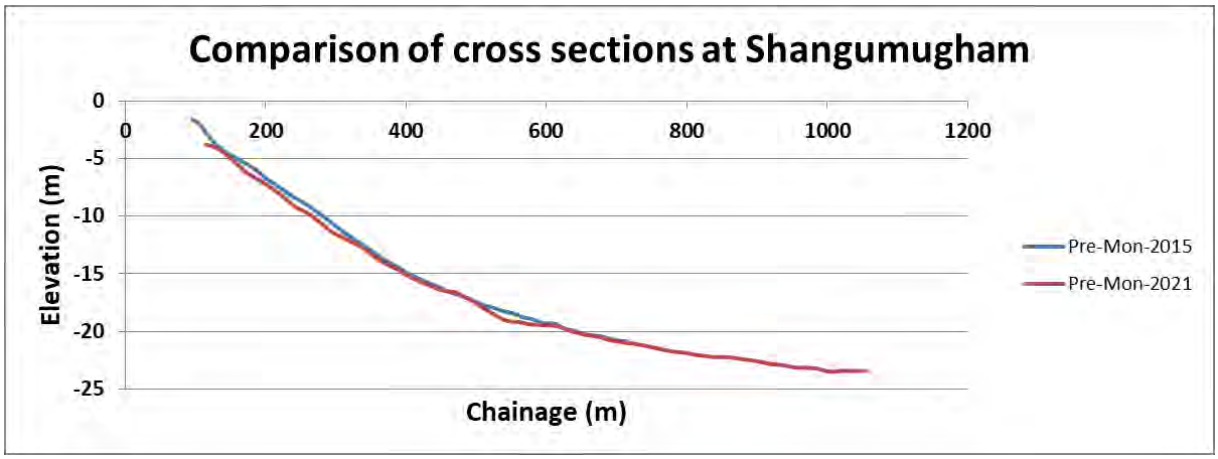


Figure 2-100 Bathymetry – Cross section comparison between 2015 and 2021 at Shangumugham (Pre-monsoon)

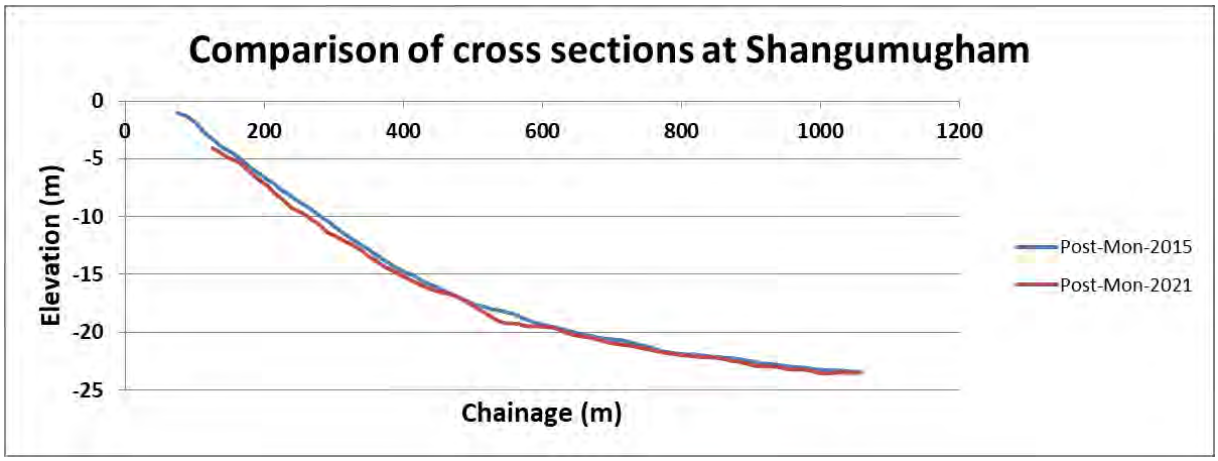


Figure 2-101 Bathymetry – Cross section comparison between 2015 and 2021 at Shangumugham (Post-monsoon)

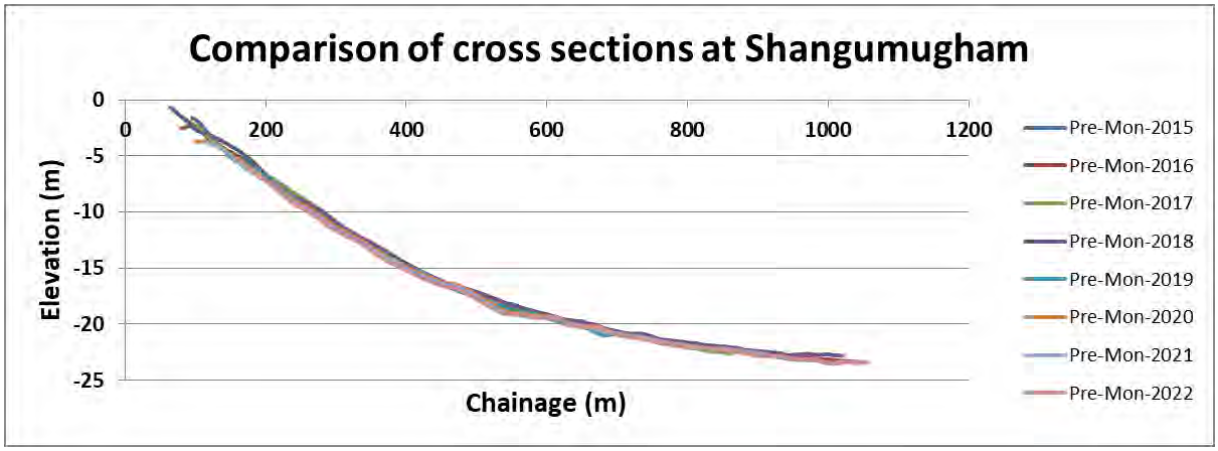


Figure 2-102 Bathymetry – Cross section comparison at Shangumugham (Pre-monsoon)

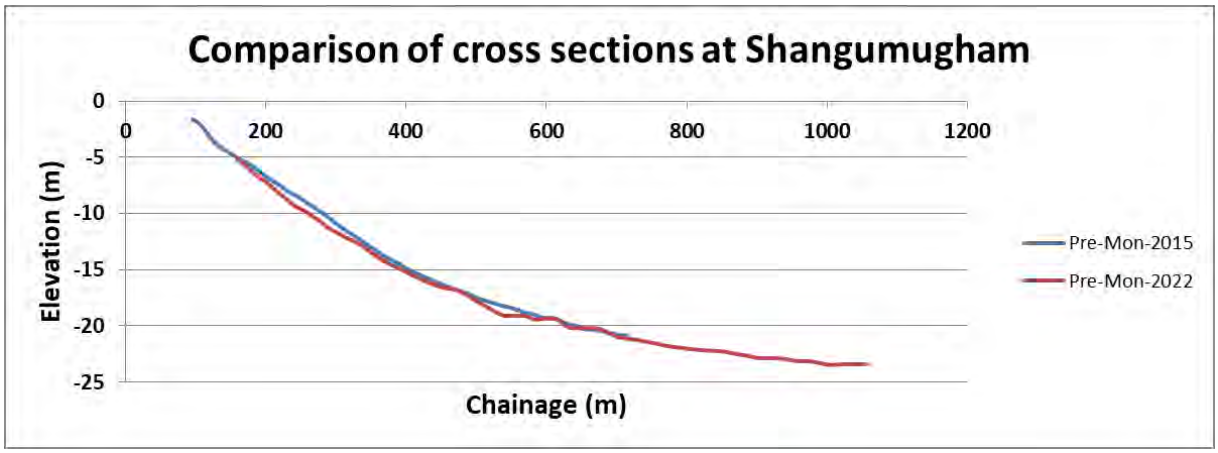


Figure 2-103 Bathymetry – Cross section comparison between 2015 and 2022 at Shangumugham (Pre-monsoon)

2.7 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 August 2022 is available. The cross-shore profile locations are shown in Figure 2-104.

Figure 2-104 Cross Shore Profile Locations

AVPPL provided names of the 81 locations and the respective landmarks for easy identification and discussion. Table 2-6 shows the names of the landmarks and the corresponding CSP numbers.

Table 2-6 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 NO.	Land Mark	Location	Remarks
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-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 NO.	Land Mark	Location	Remarks
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-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 NO.	Land Mark	Location	Remarks
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

2.7.1 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 2-105) due to inaccessible depths and due to rough weather condition during survey period (i.e. whenever rough weather occurred in the period March 2021 to February 2022). May 2021, June 2021, July 2021, October 2021, November 2021, and January 2022 months data were removed from analysis which did not pass the quality control. The details of data included in analysis were shown in Table 2-7.

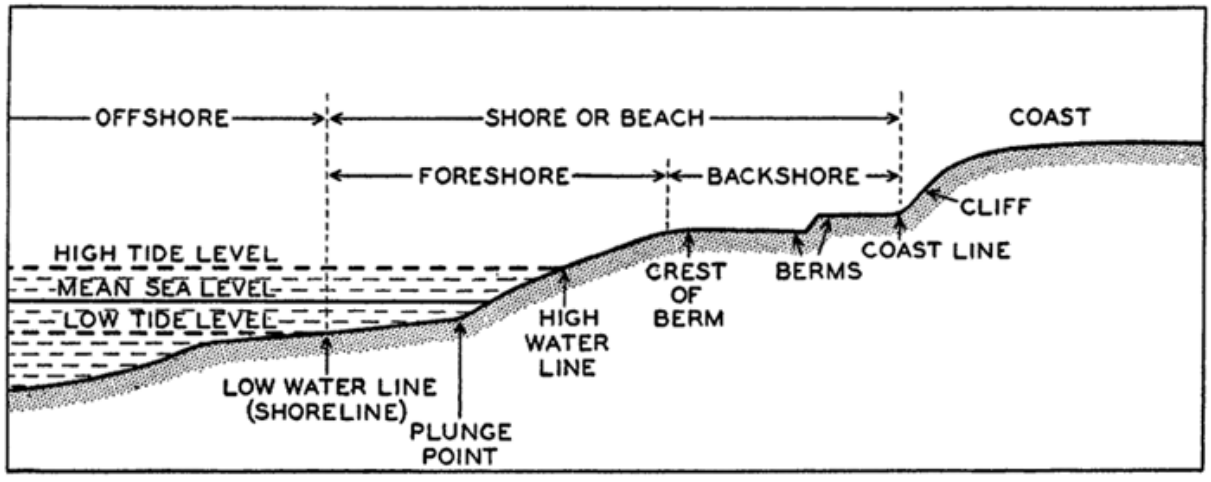


Figure 2-105 Beach profile terminology

Status of data received								
	2015	2016	2017	2018	2019	2020	2021	2022
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		

Table 2-7 Details of CSP data included in analysis

2.7.2 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 April 2021 to March 2022, the seasons will be as follows:

Pre-Monsoon 2020 – April 2021 to May 2021

Monsoon 2020 – June 2021 to September 2021

Post-Monsoon 2020 – October 2021 to November 2021

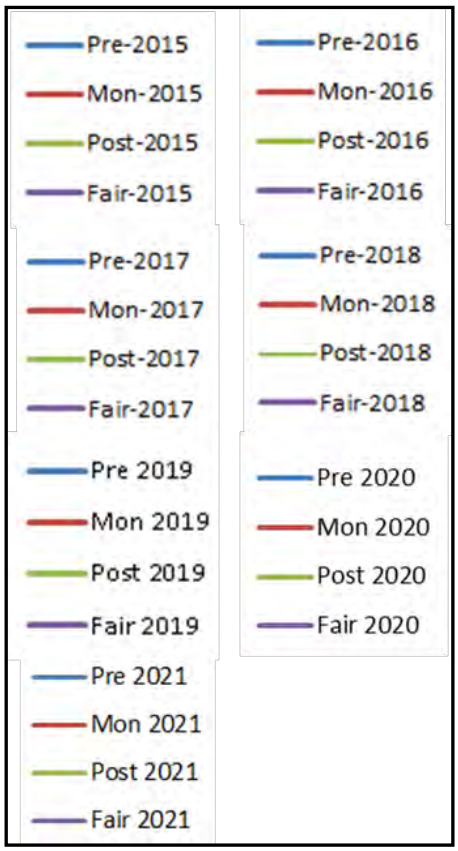
Fair Weather 2020 – December 2021 to March 2022

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 2-106 to Figure 2-153. In Figure 2-106, 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 2-106) shows comparison of profiles of different seasons in a particular year (Seasonal charts) and second chart (Figure 2-107) shows comparison of profiles of different years of a particular season (Yearly charts).

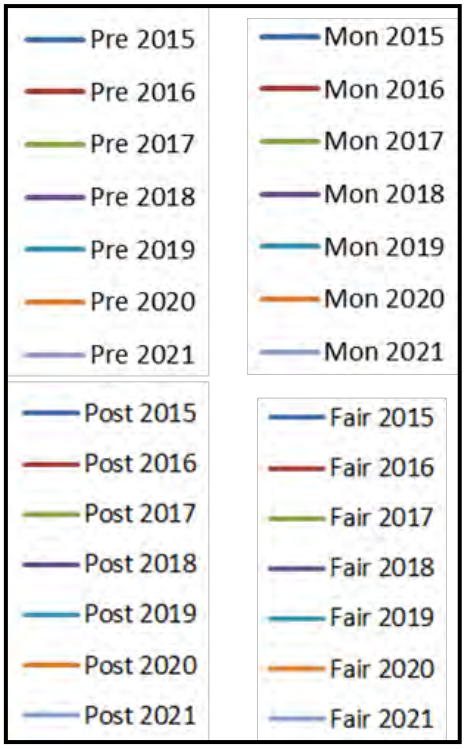
Legend: CSP – Cross Shore Profile, CS – Cross Section

Table 2-8 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



Legend of yearly charts

2.7.2.1 Stretch 1

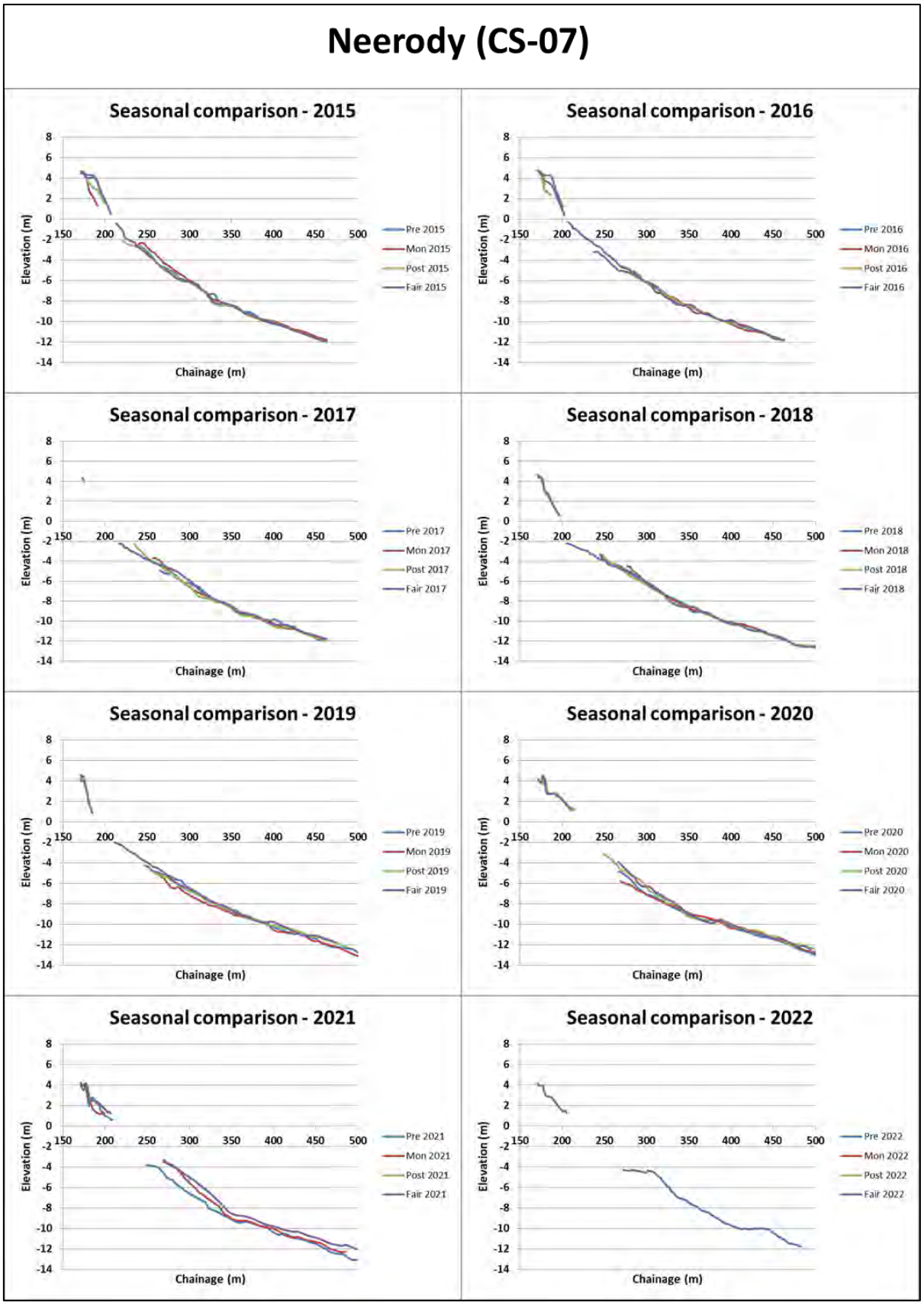


Figure 2-106 Profiles at Neerody (CS 07) – Seasonal comparison

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 over six years. In this stretch, construction activities (groins that were constructed by Government of Kerala.) were noticed during fair weather season of 2019.

From Figure 2-106 and Figure 2-107, it can be noticed that the seasonal variations were very minimal. However, minimal accretion was observed in foreshore zone during Ockhi (December 2017).

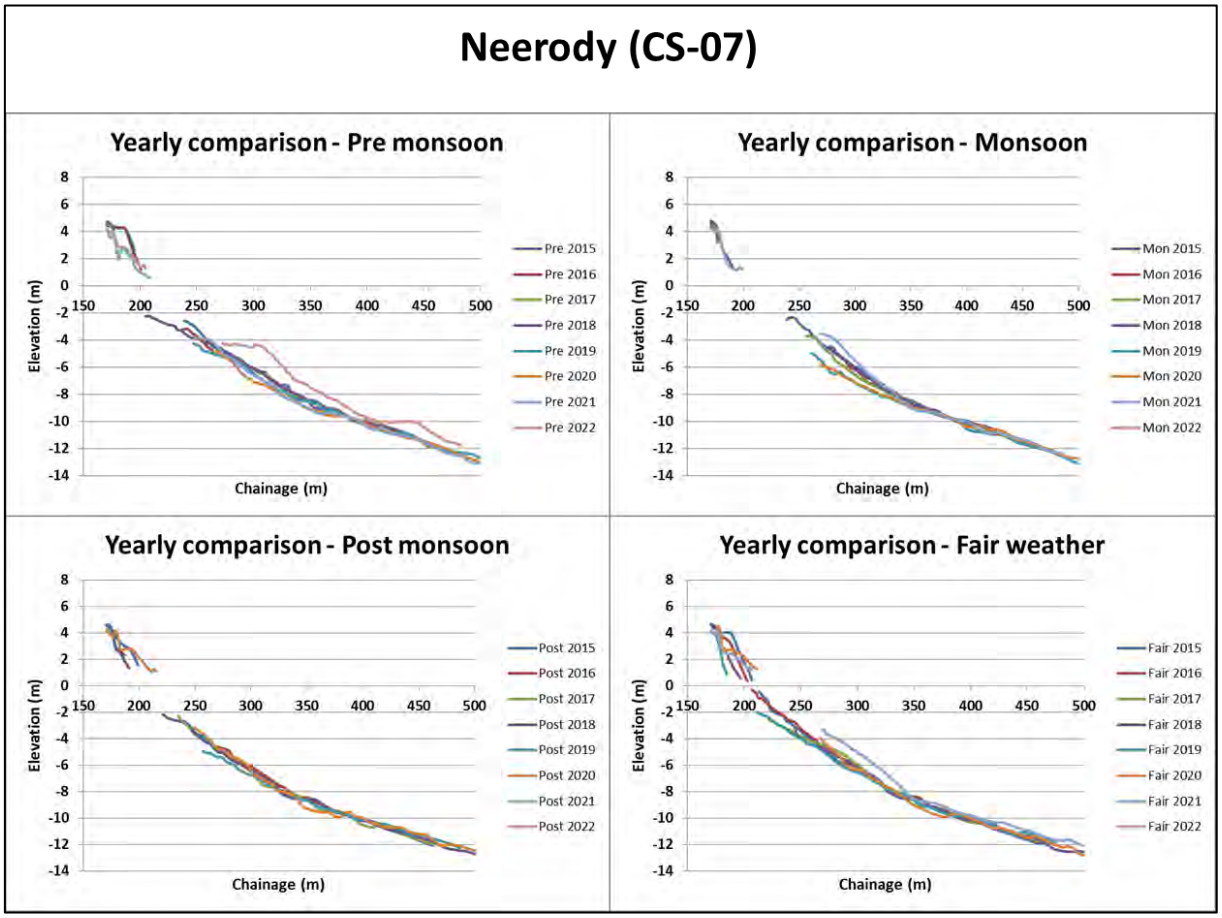


Figure 2-107 Profiles at Neerody (CS 07) – Yearly comparison

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 over six years data. 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.

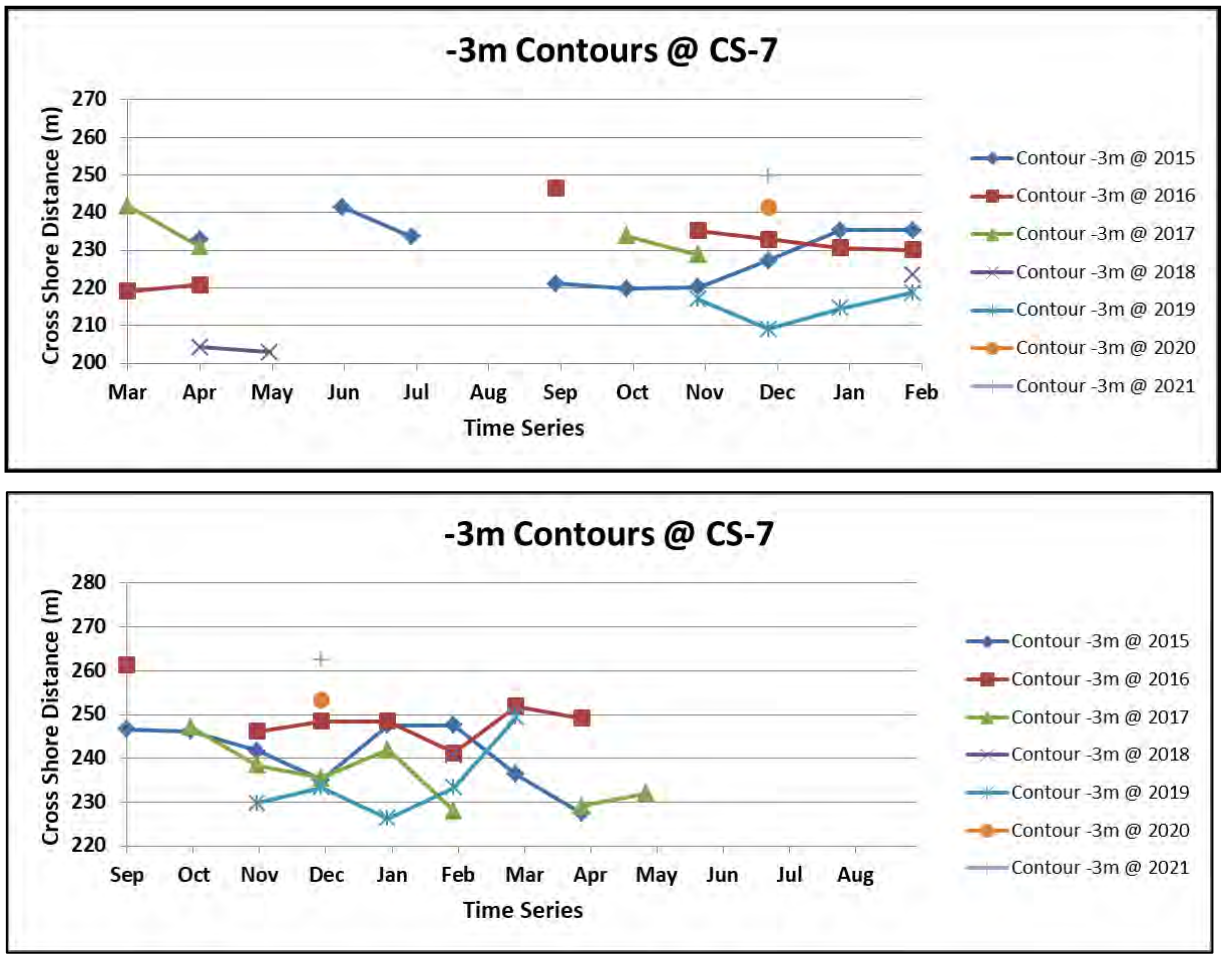
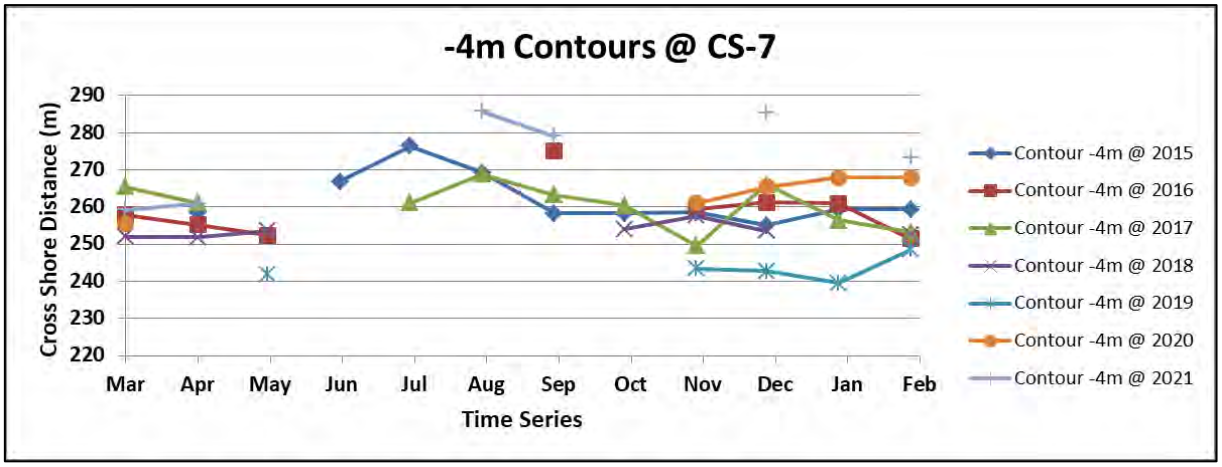


Figure 2-108 Time series of (–) 3 m contour at Neerody (CS 07)



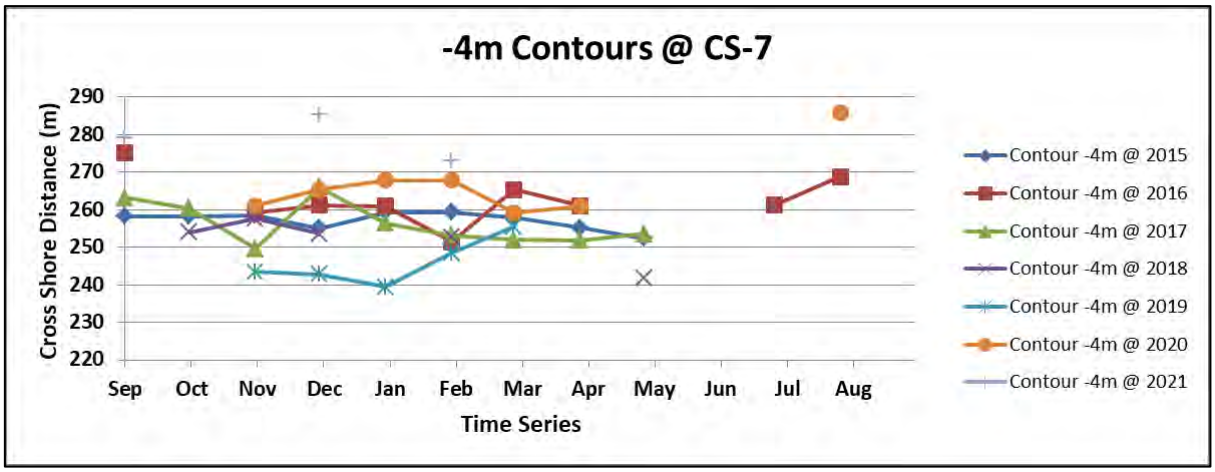
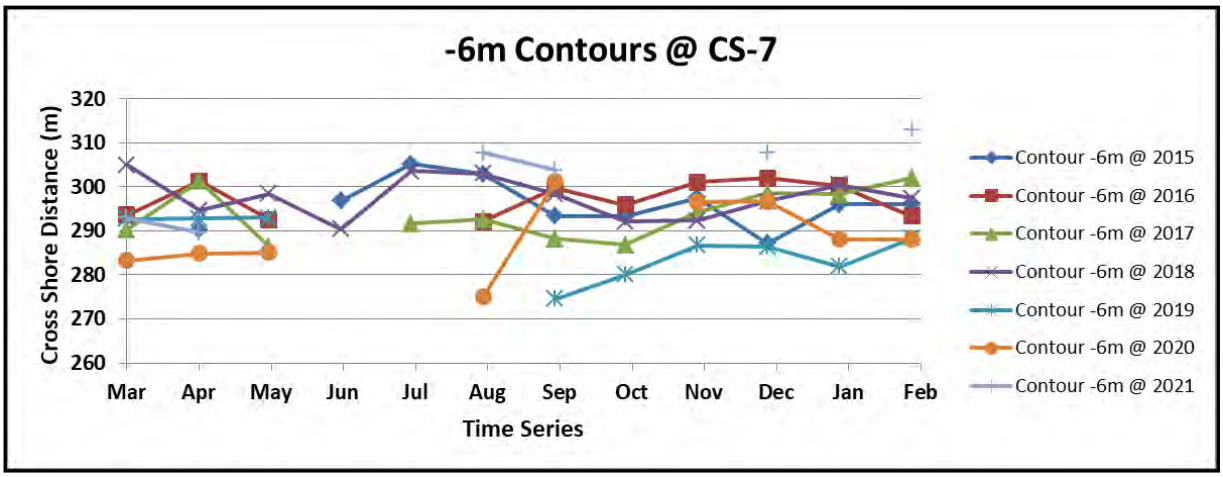


Figure 2-109 Time series of (–) 4 m contour at Neerody (CS 07)



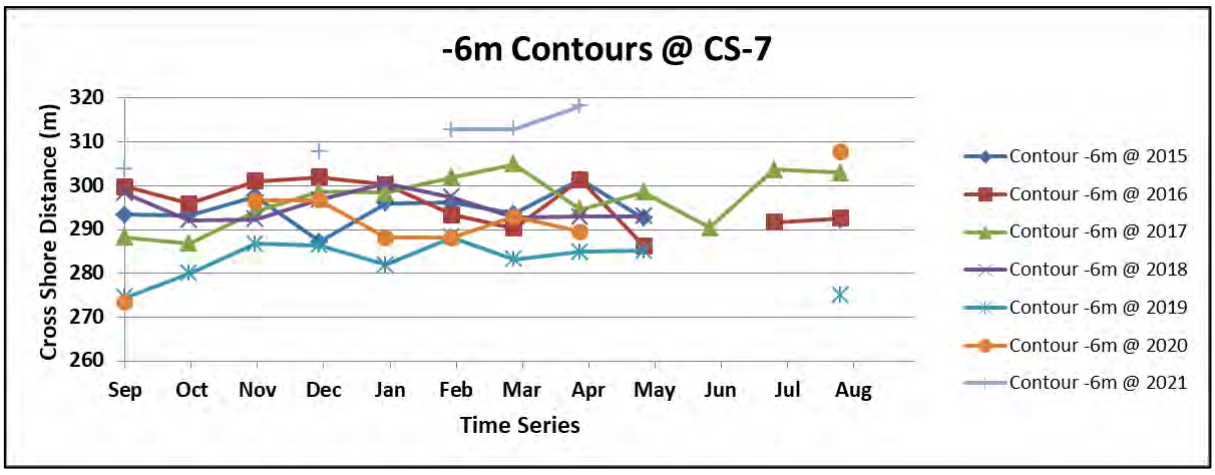


Figure 2-110 Time series of (–) 6 m contour at Neerody (CS 07)

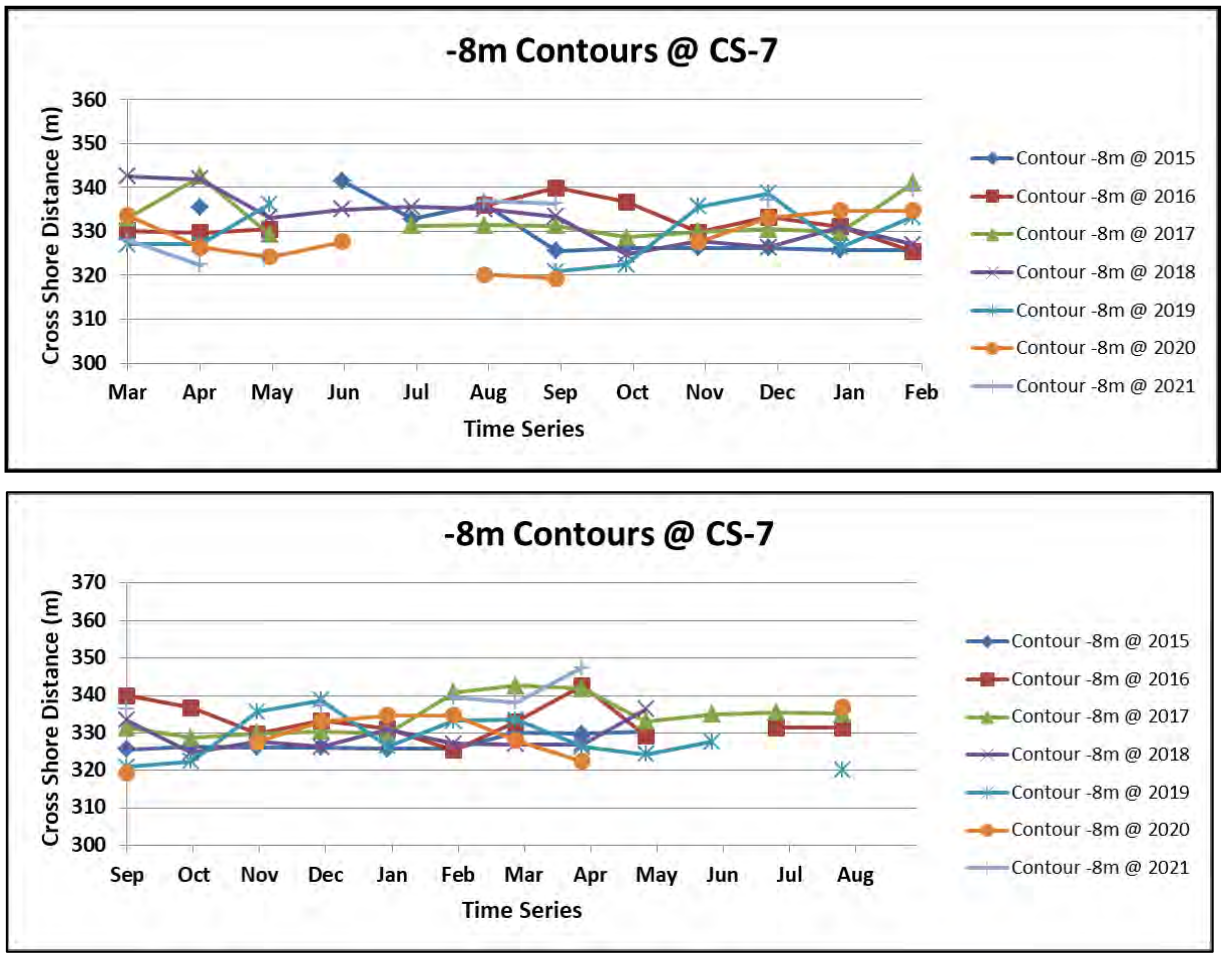
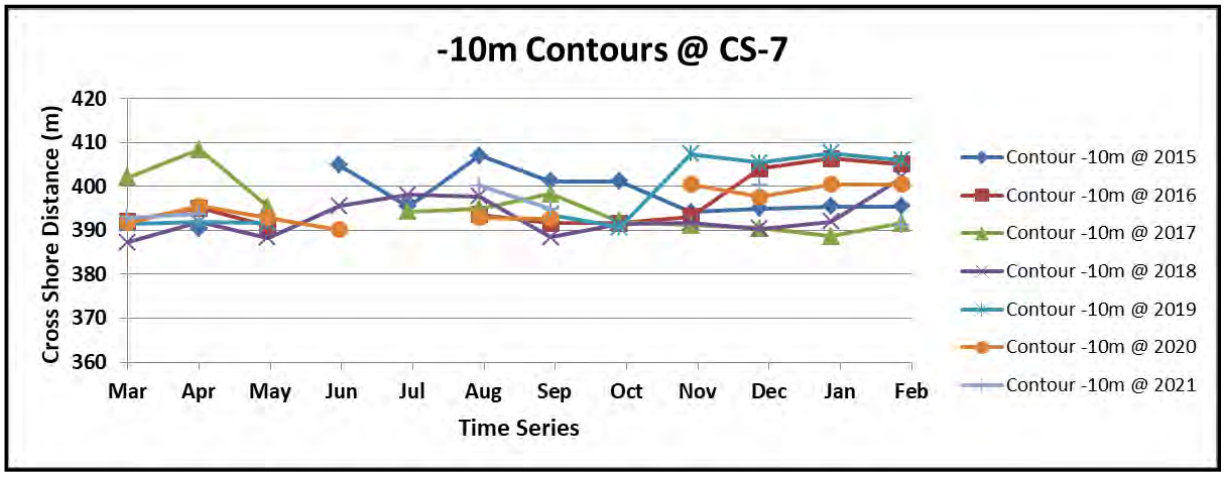


Figure 2-111 Time series of (–) 8 m contour at Neerody (CS 07)



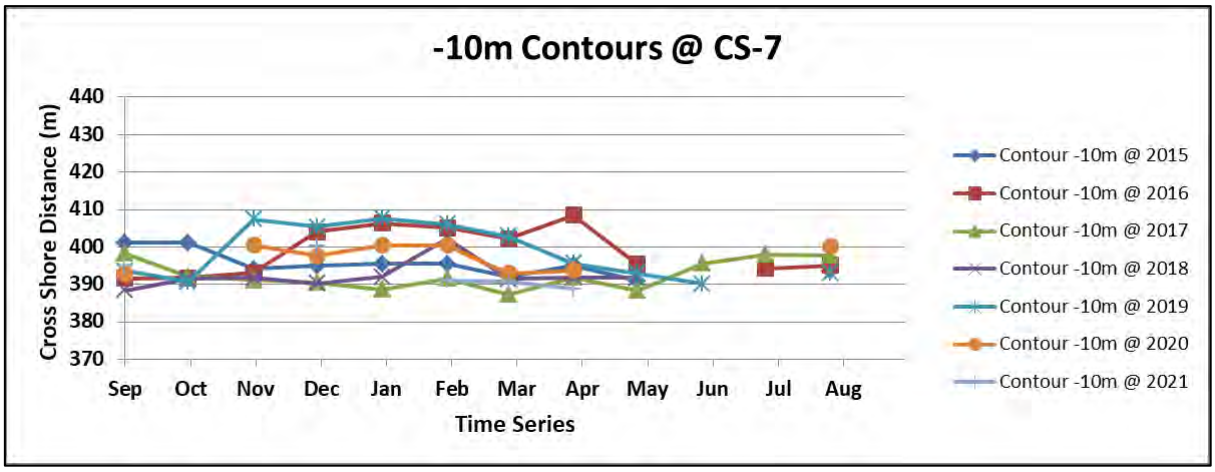


Figure 2-112 Time series of (–) 10 m contour at Neerody (CS 07)

In addition to above, continuous variation of contour distances over 7 years was provided for better clarity as shown in Figure 2-113.

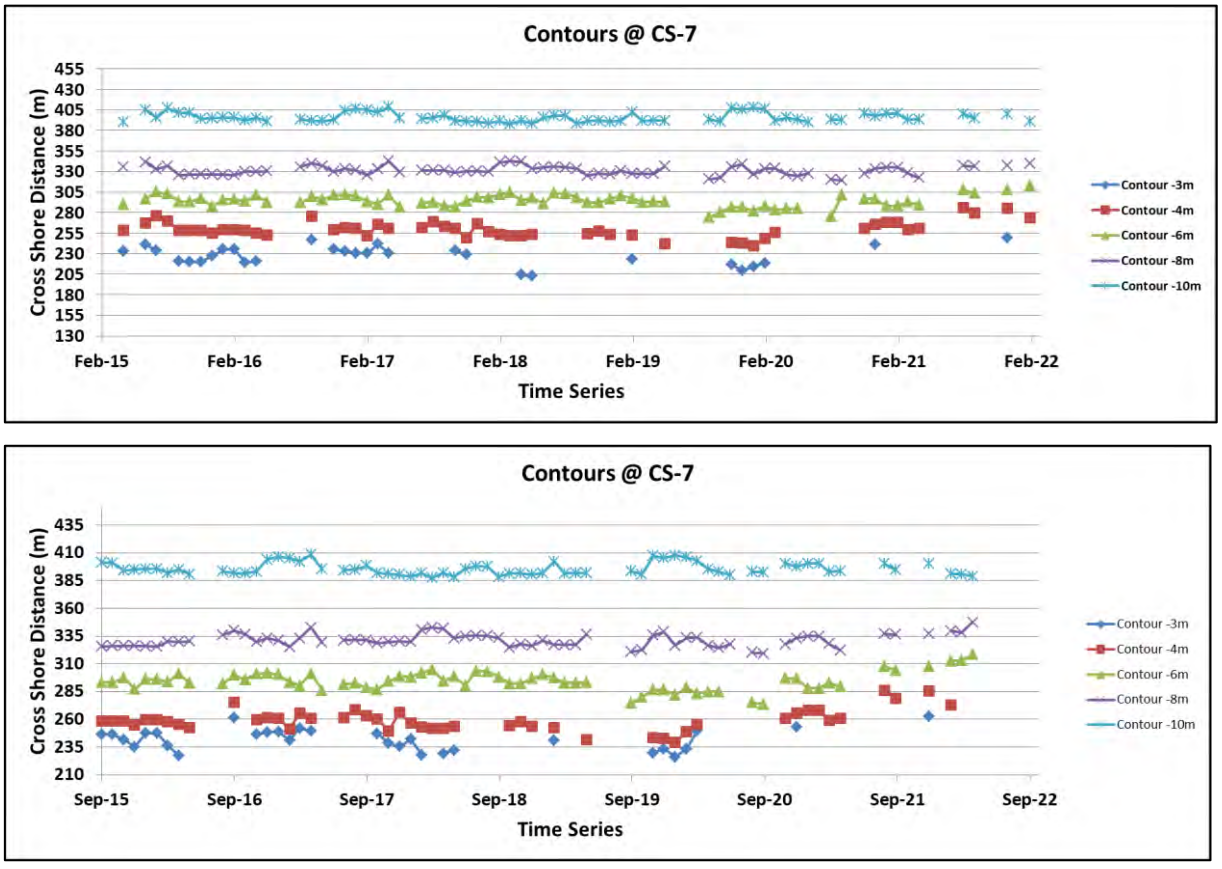


Figure 2-113 Continuous time series of contours at Neerody (CS 07)

2.7.2.2 Stretch 2

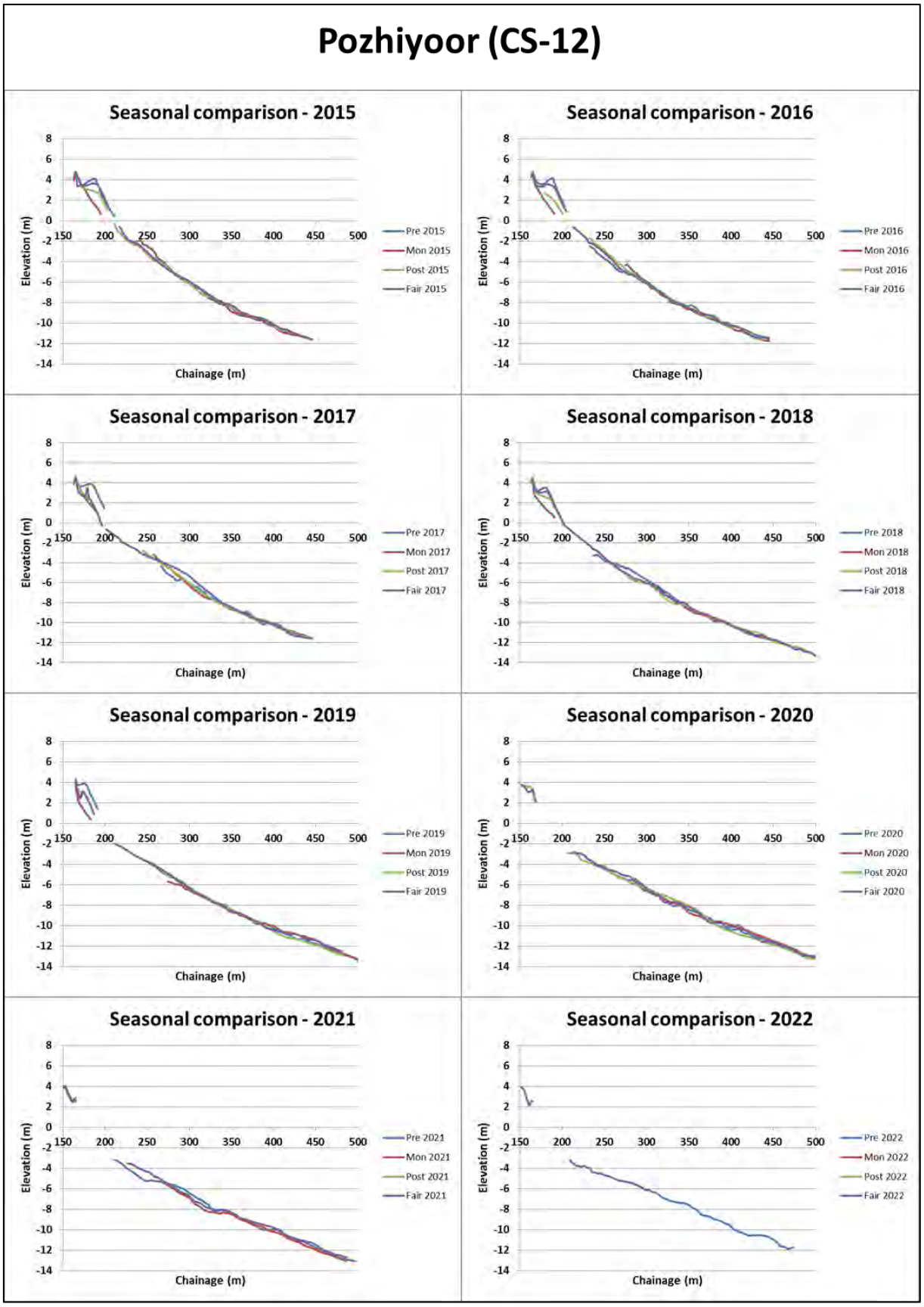


Figure 2-114 Profiles at Pozhiyoor (CS 12) – Seasonal comparison

Beach was present in front of seawall in the stretch of CS 11 to CS 14 till Feb 2022. Subsequently seawall was noticed throughout the year in this stretch. Among these sections, CS 12 which is at Pozhiyoor in Kerala was chose to illustrate the seasonal trends over seven years.

From Figure 2-114 and Figure 2-115, 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.

In 2017 the coast experienced a very severe cyclonic storm (IMD Classification) named Ockhi (December 2017) during fair weather season and the cyclone resulted in severe erosion all along the coast. After Ockhi, erosion was noticed during fair weather 2017 and pre monsoon 2018 seasons on the land side.

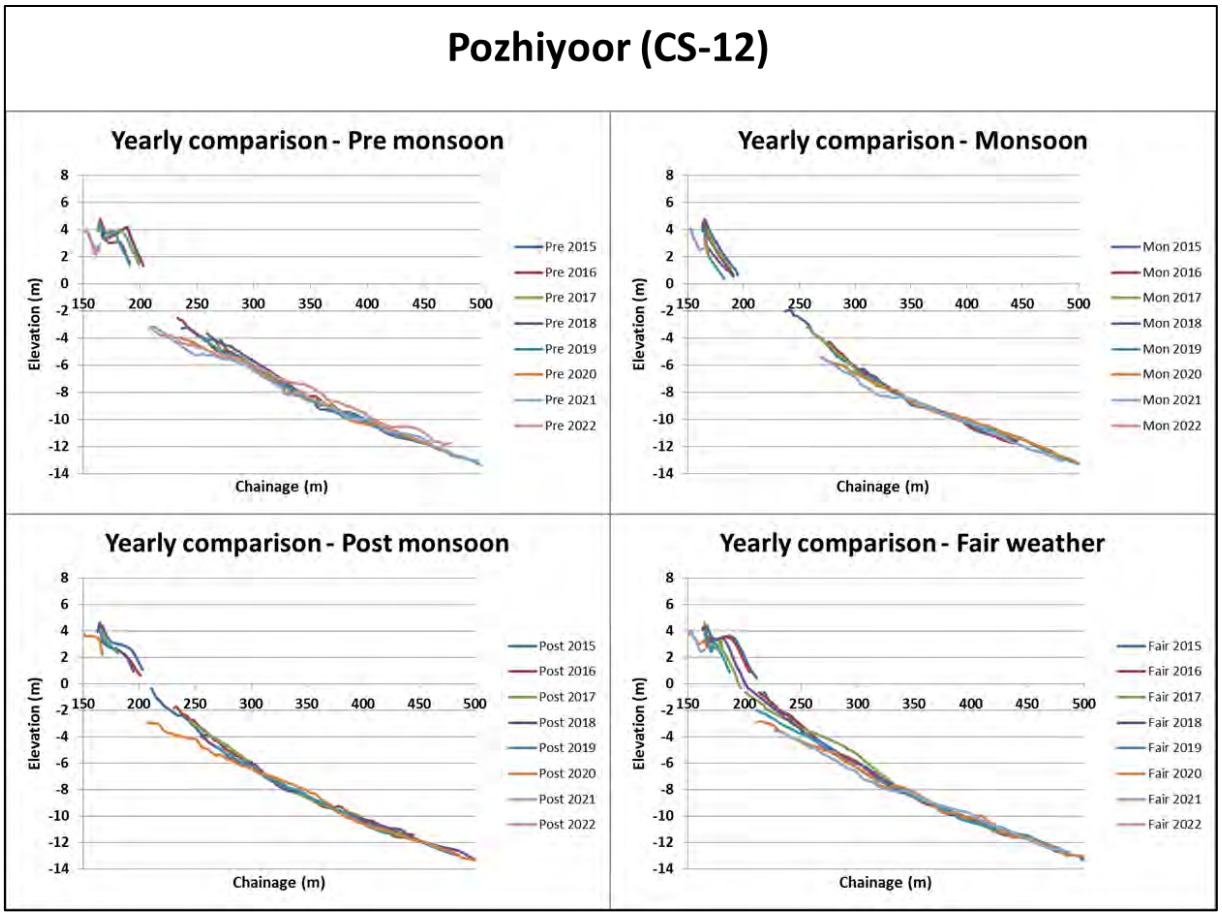


Figure 2-115 Profiles at Pozhiyoor (CS 12) – Yearly comparison

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 over seven years.

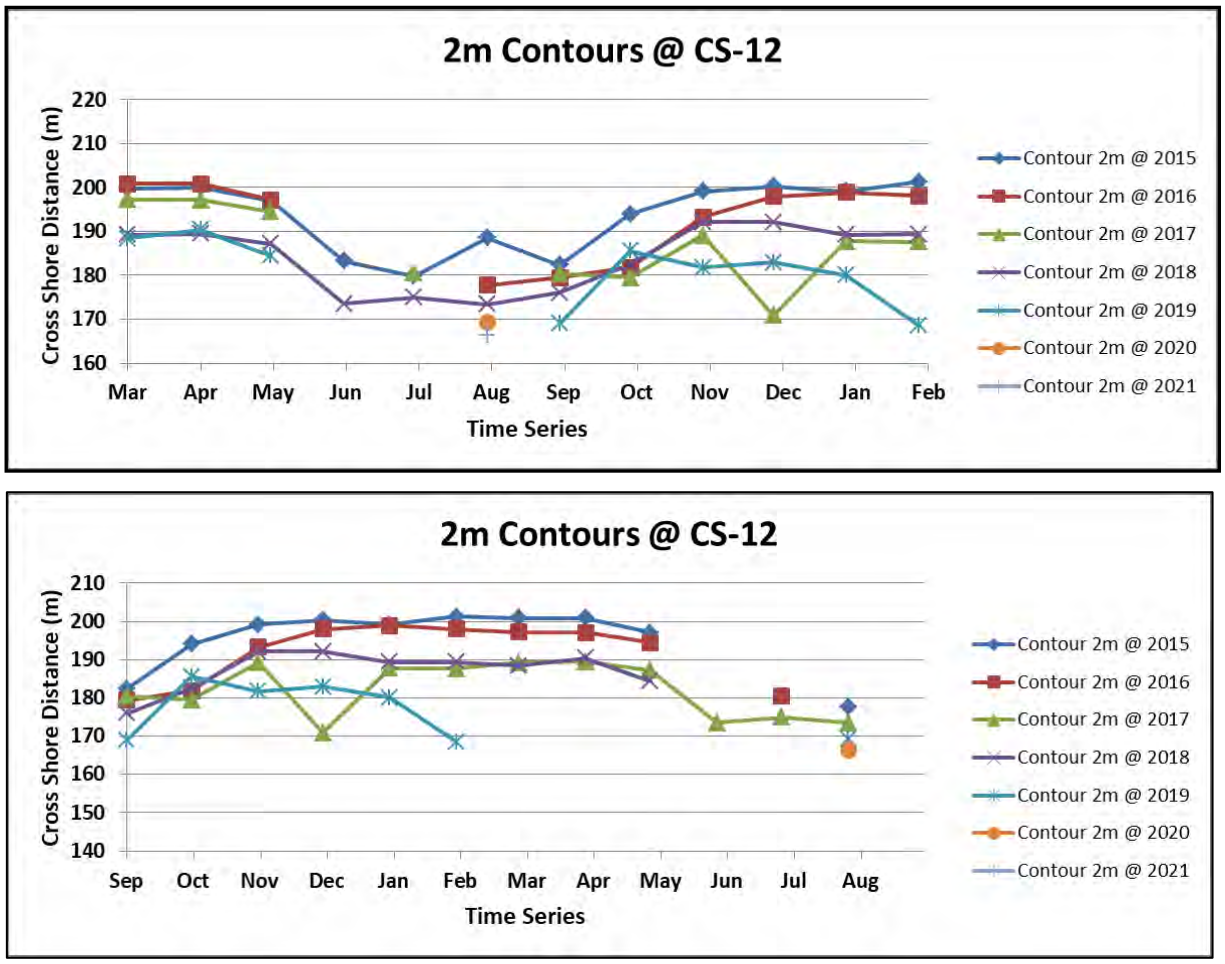
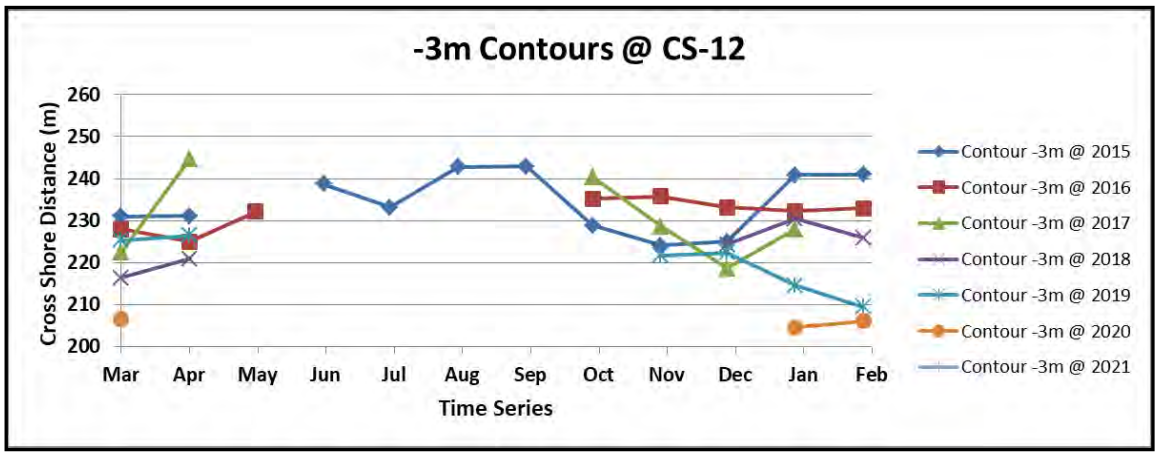


Figure 2-116 Time series of (+) 2 m contour at Pozhiyoor (CS 12)

Figure 2-116 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.



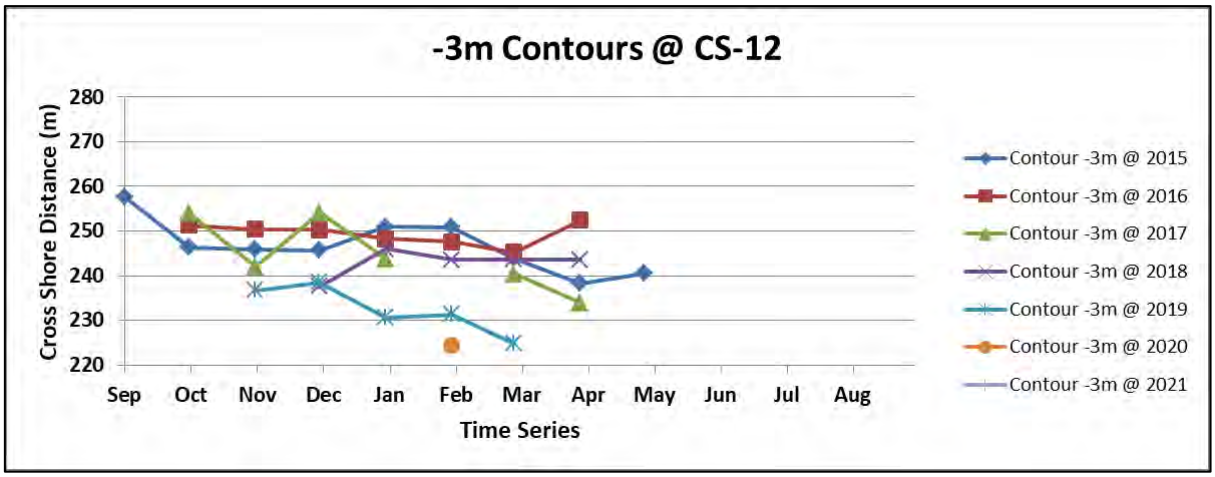
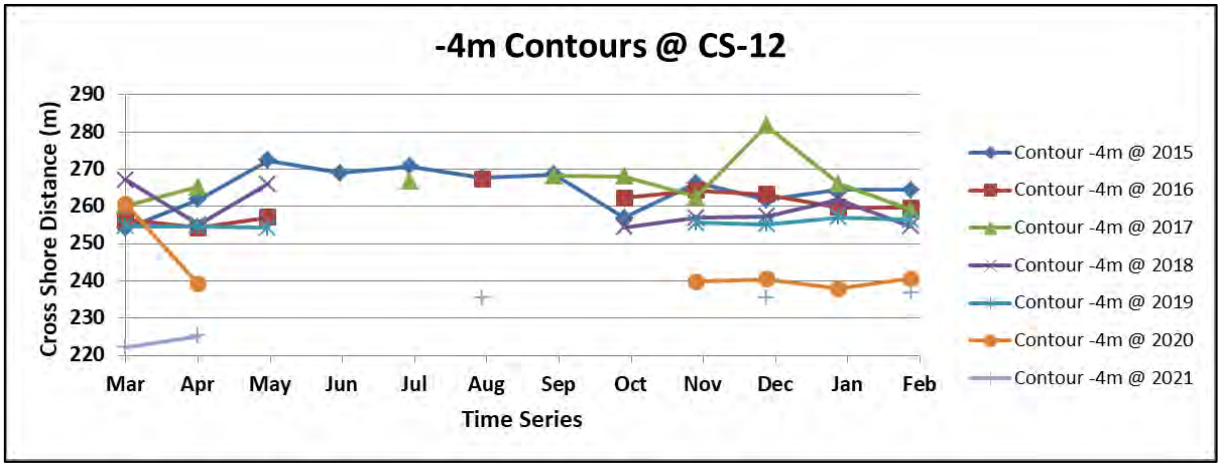


Figure 2-117 Time series of (–) 3 m contour at Pozhiyoor (CS 12)



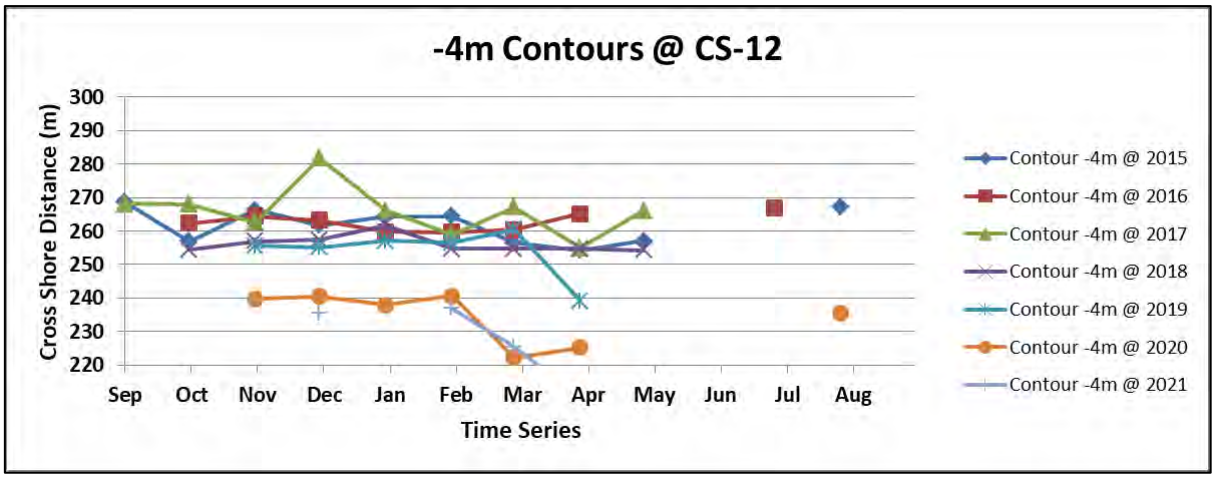


Figure 2-118 Time series of (–) 4 m contour at Pozhiyoor (CS 12)

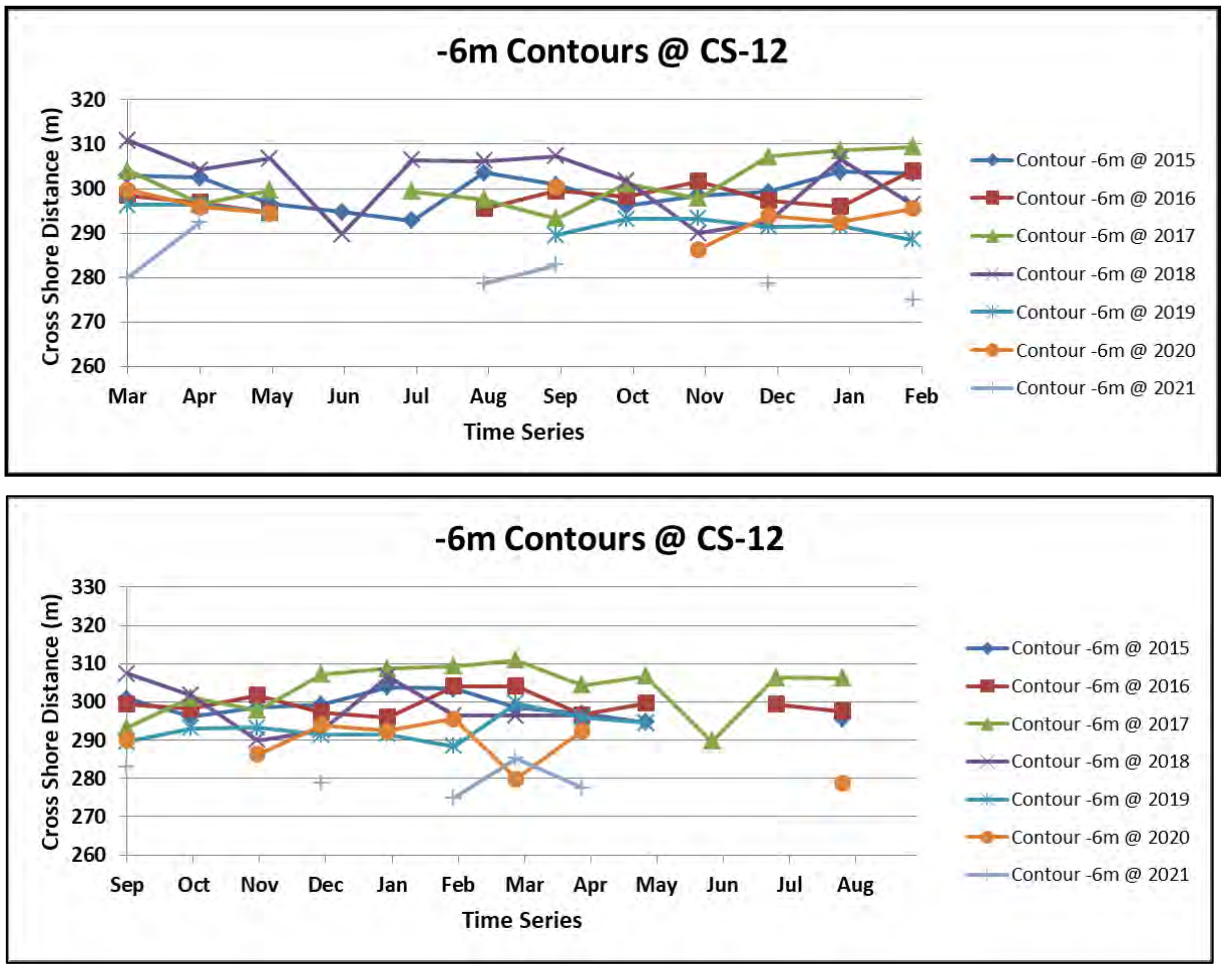
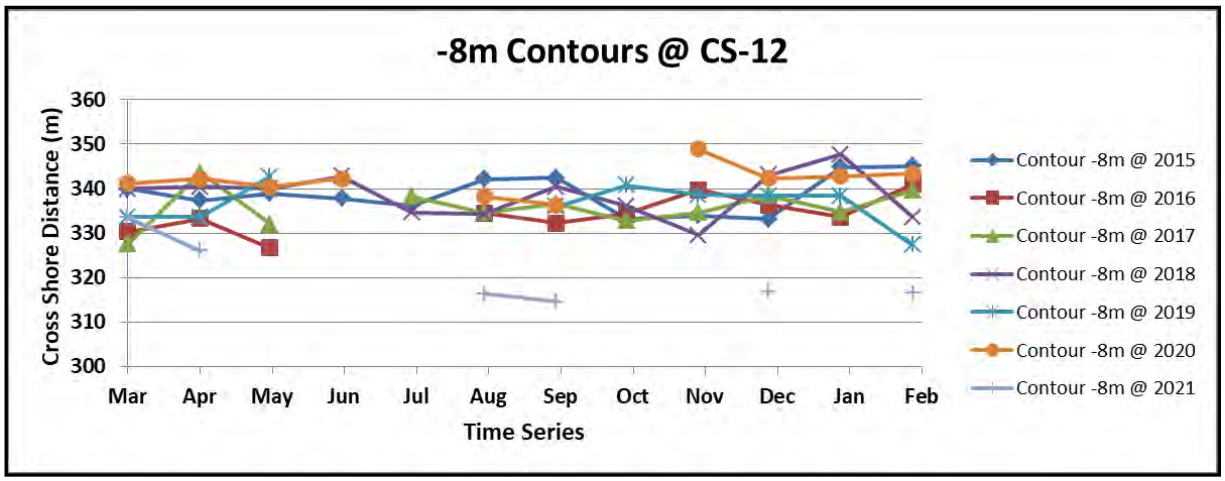


Figure 2-119 Time series of (–) 6 m contour at Pozhiyoor (CS 12)



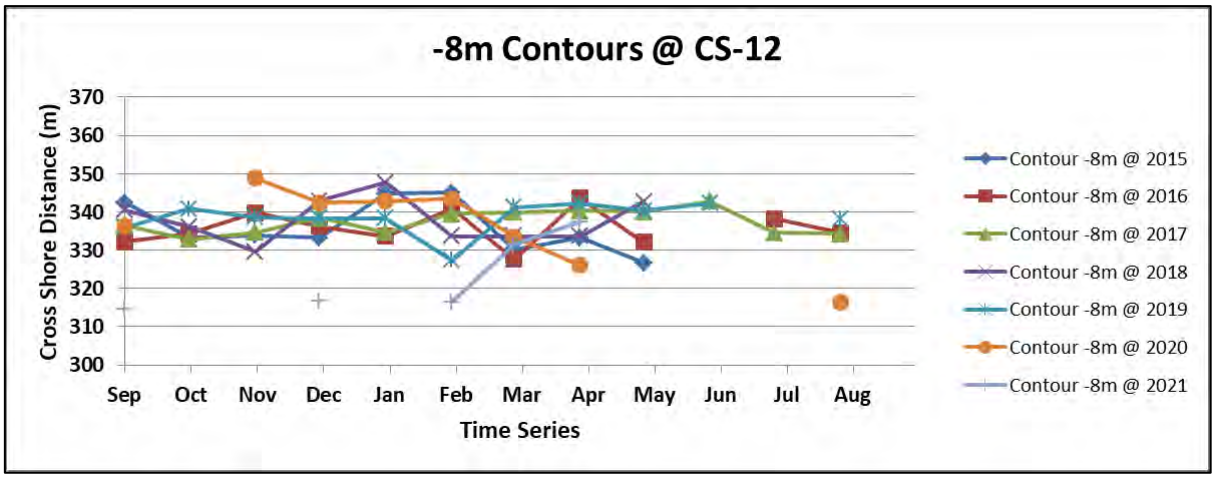
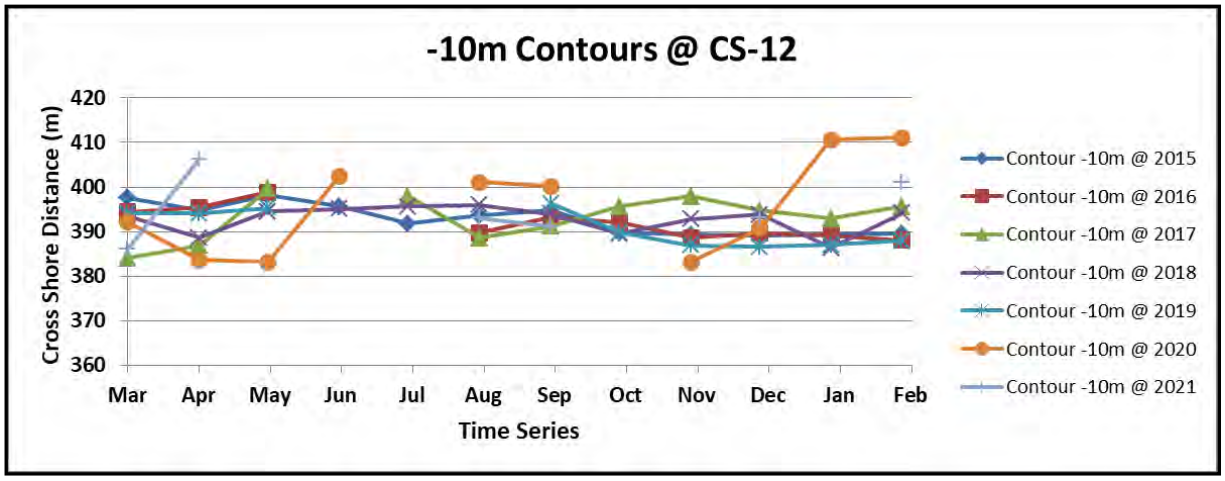


Figure 2-120 Time series of (–) 8 m contour at Pozhiyoor (CS 12)



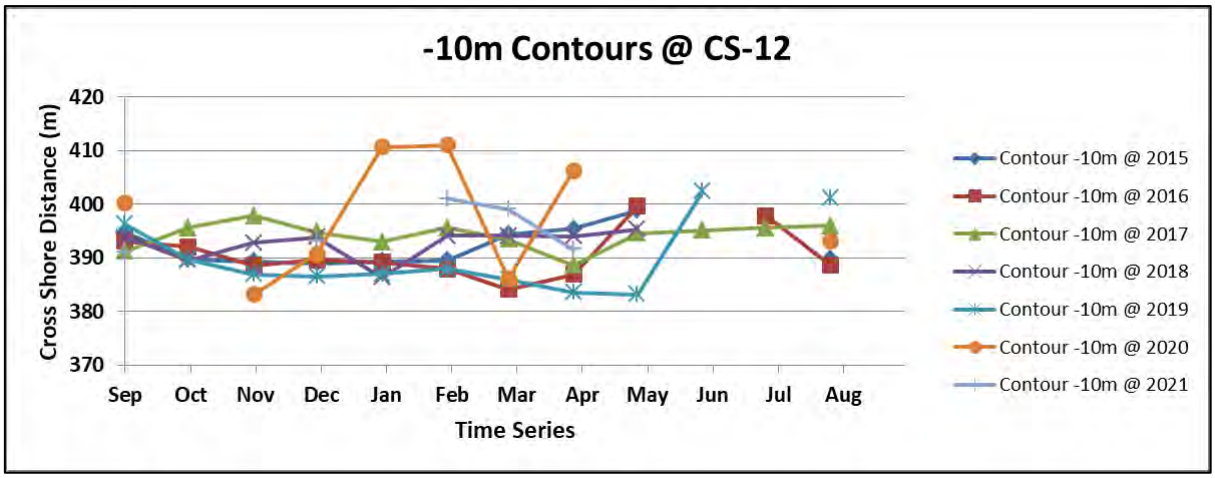


Figure 2-121 Time series of (–) 10 m contour at Pozhiyoor (CS 12)

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 2-122.

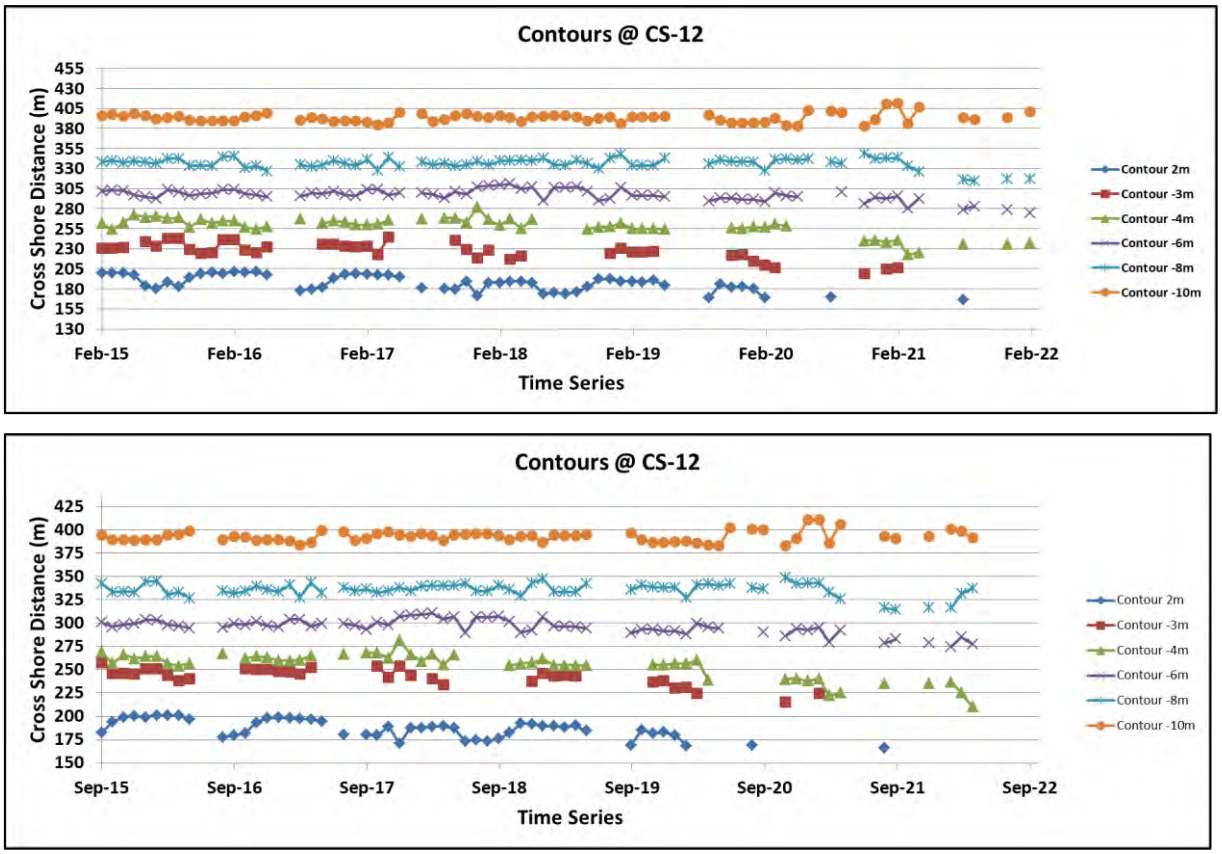


Figure 2-122 Continuous time series of contours at Pozhiyoor (CS 12)

Figure 2-122 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. This phenomenon in turn indicates that cross shore transport is predominant in this stretch. 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.

2.7.2.3 Stretch 3

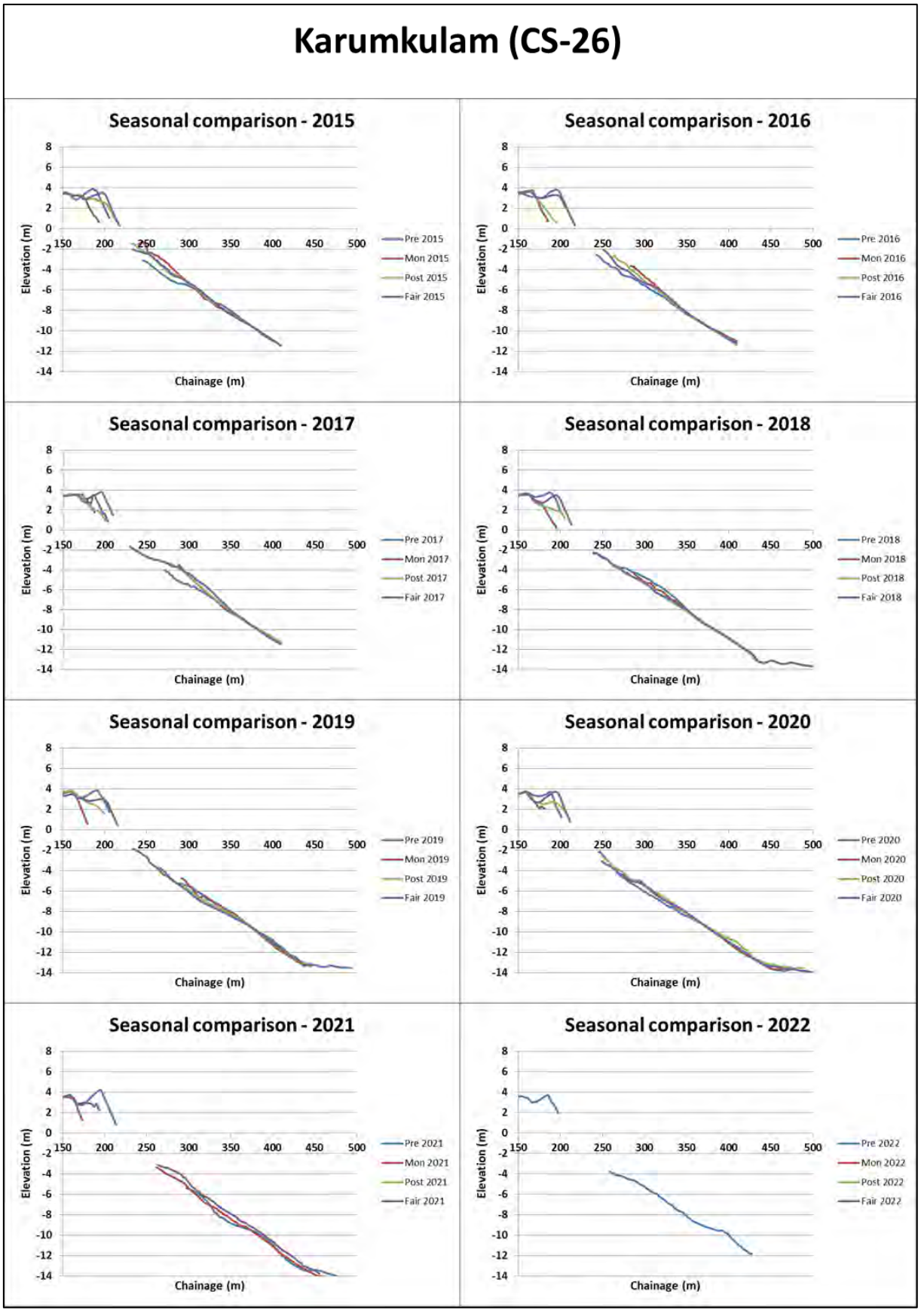


Figure 2-123 Profiles at Karumkulam (CS 26) – Seasonal comparison

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 2-123, 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 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.

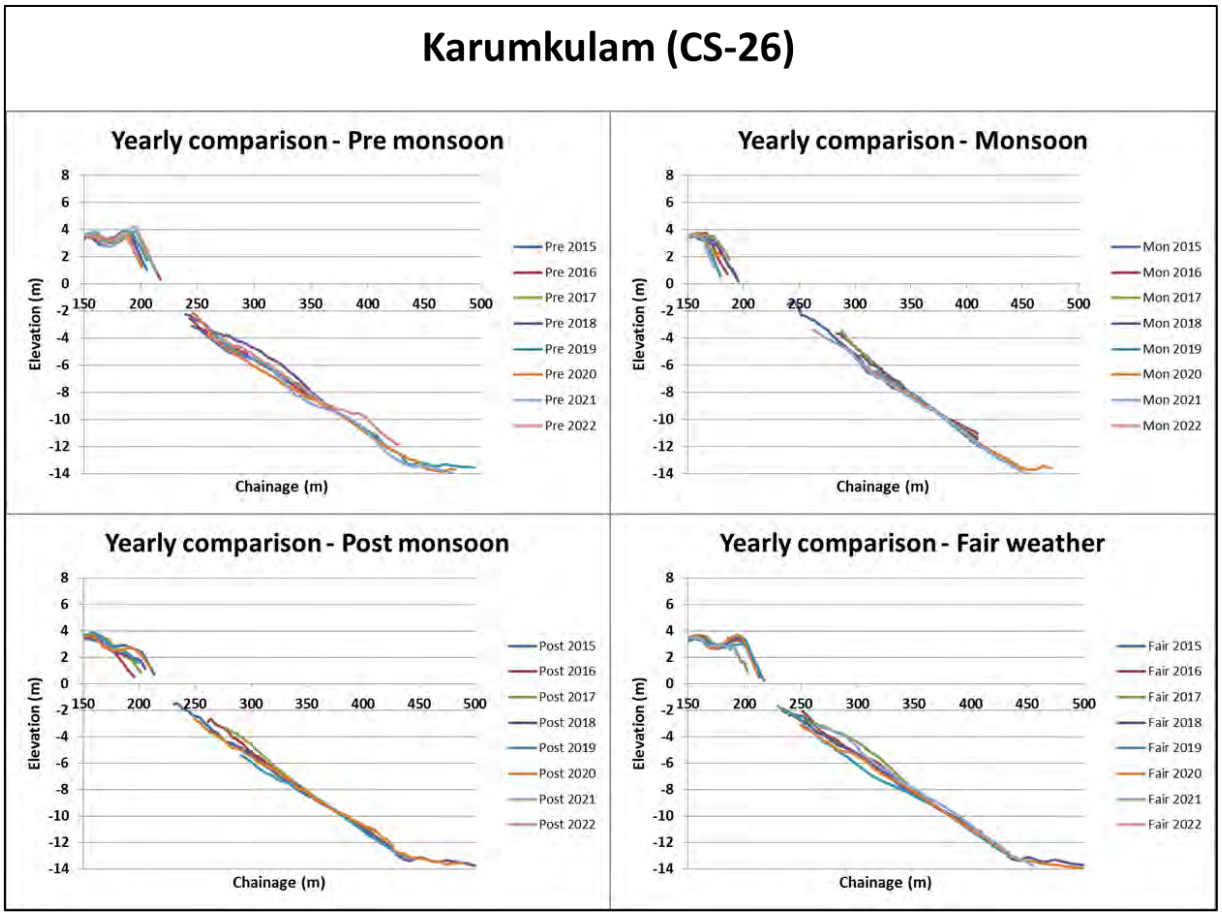
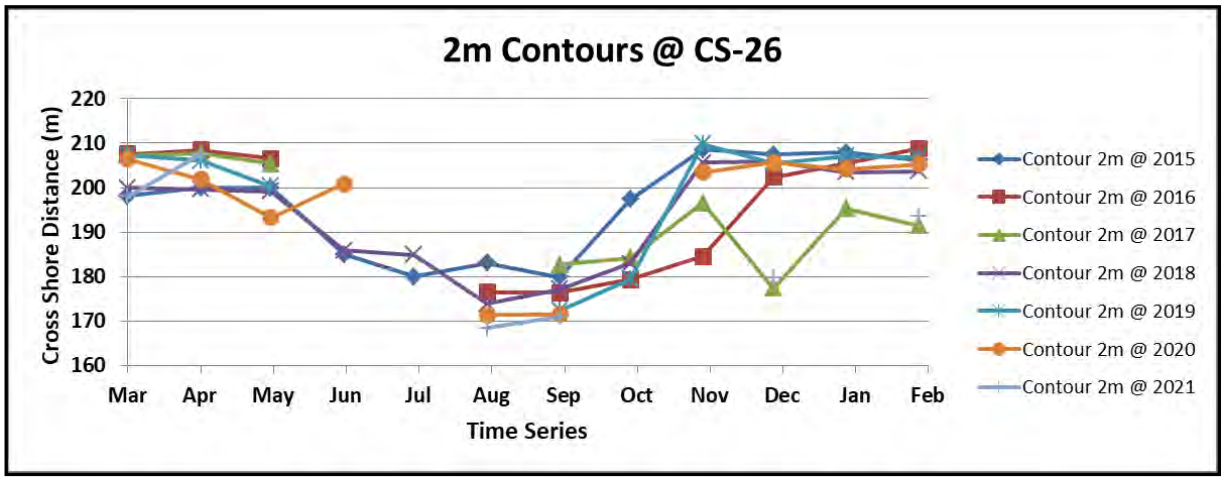


Figure 2-124 Profiles at Karumkulam (CS 26) – Yearly comparison

Figure 2-124 plots represent comparison of profiles of season over different years. These plots suggest that yearly trend was as per normal sequence till post monsoon 2017. After this, the impact of Ockhi cyclone can be evidently noticed in fair weather 2017 and pre-monsoon 2018 seasonal profiles. The coast is undergoing processes to recover from this 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 over seven years 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 2-125 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. 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. The recent storms are proving to be further detrimental to the beach accretion.



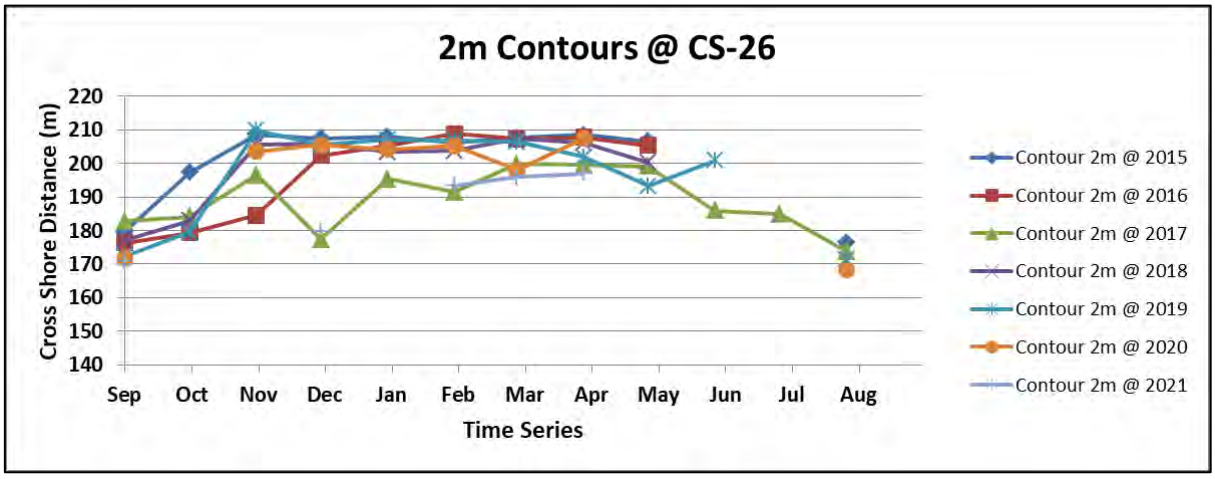
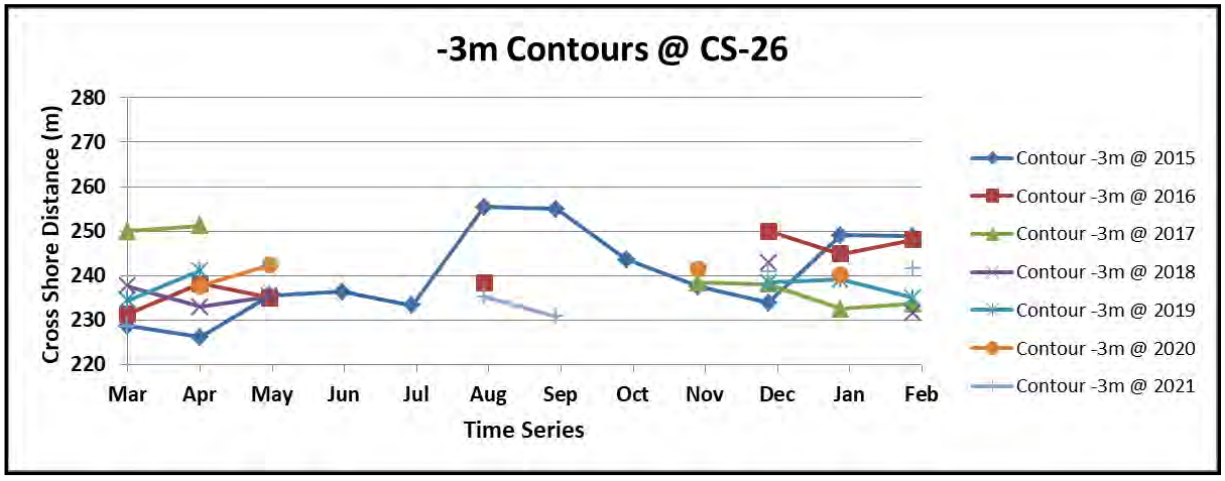


Figure 2-125 Time series of (+) 2 m contour at Karumkulam (CS 26)



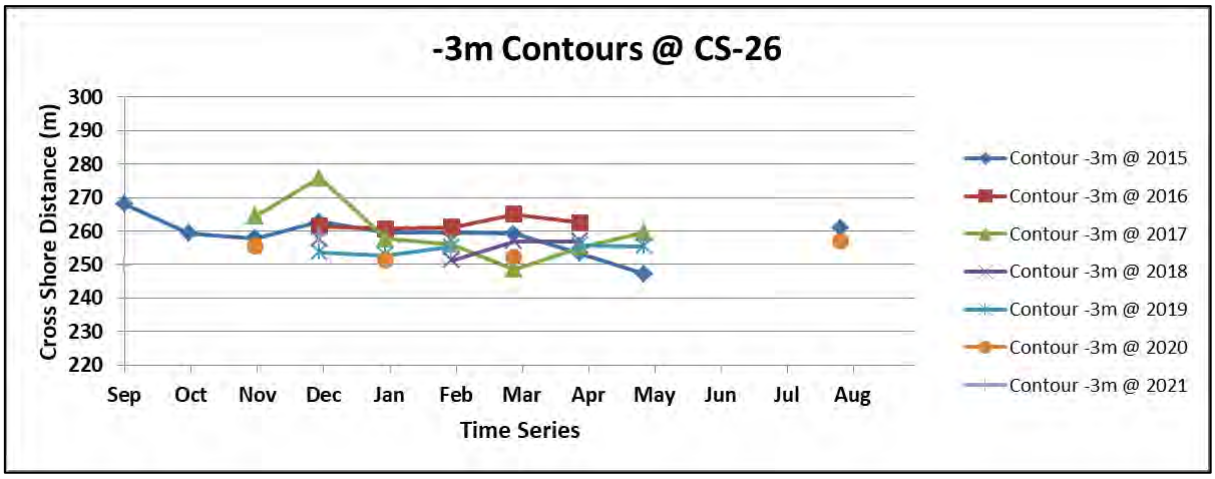
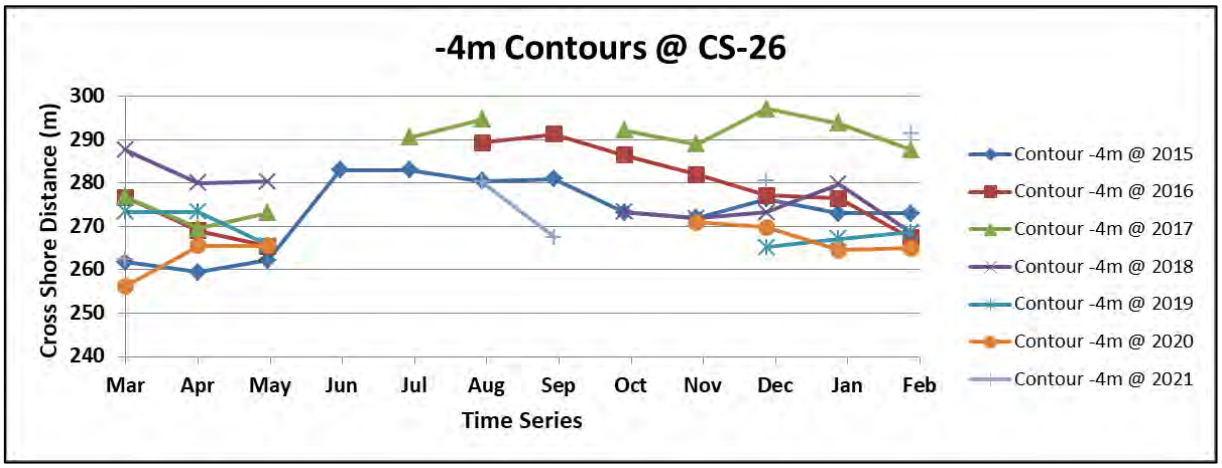


Figure 2-126 Time series of (–) 3 m contour at Karumkulam (CS 26)



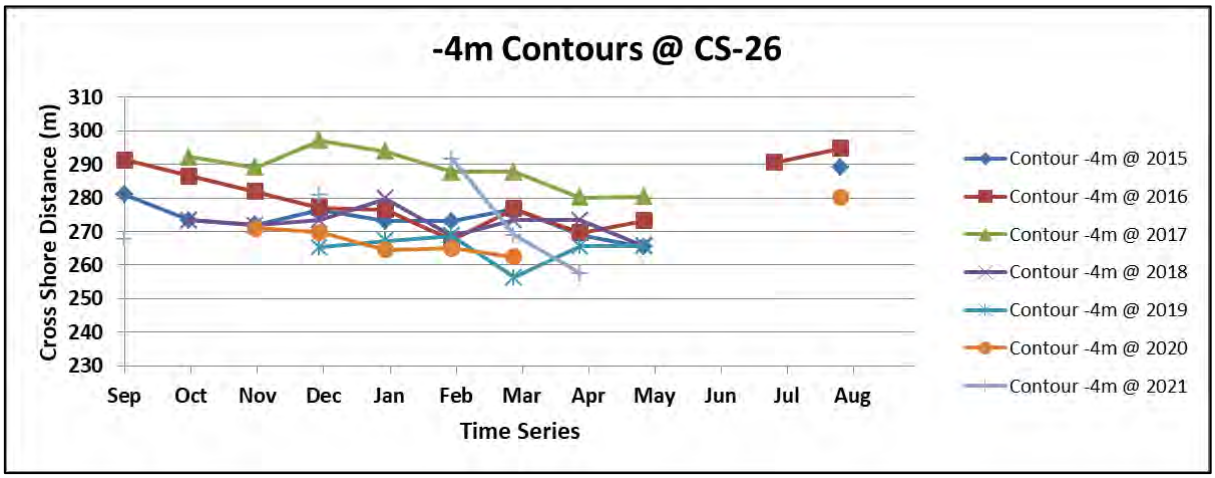


Figure 2-127 Time series of (–) 4 m contour at Karumkulam (CS 26)

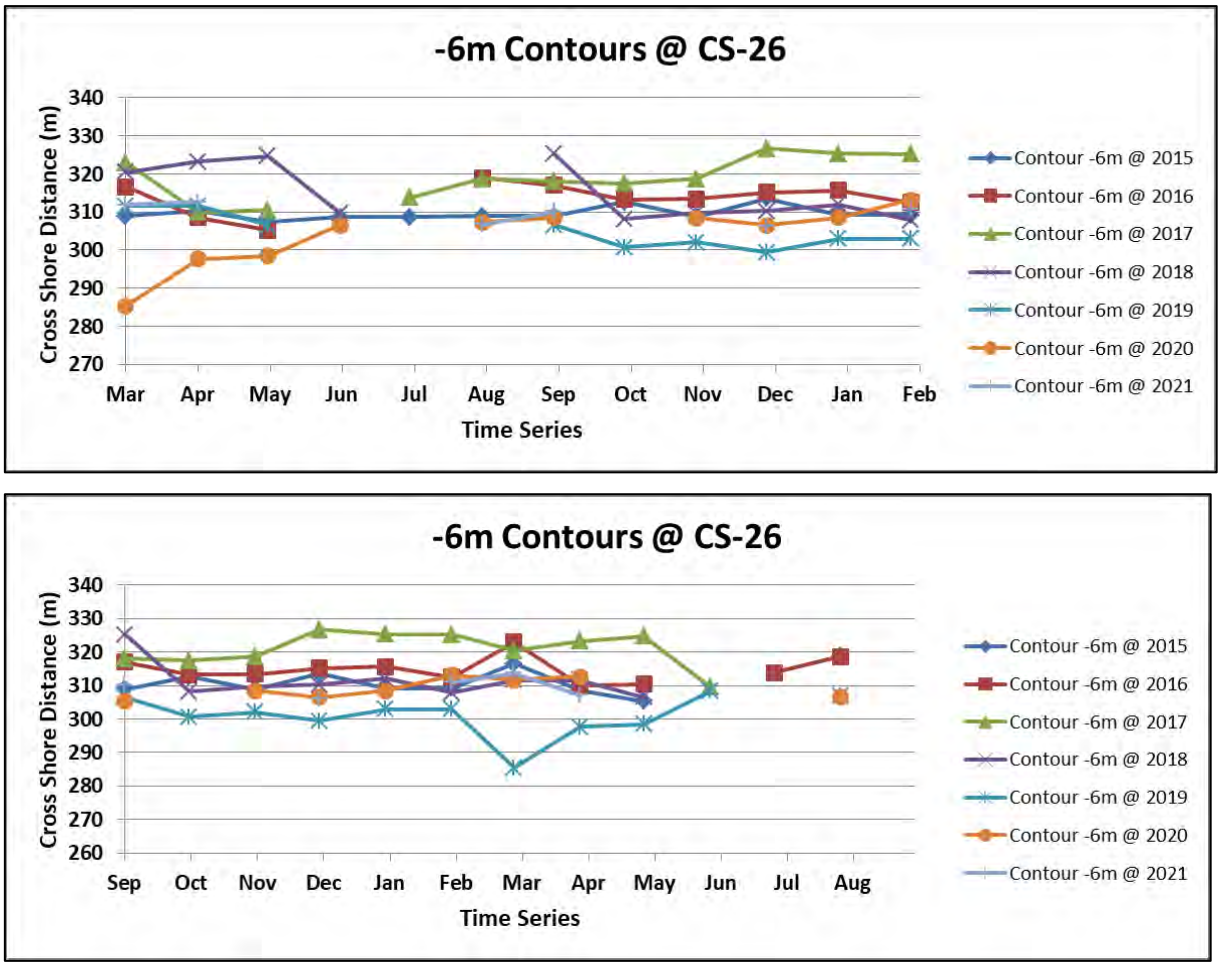
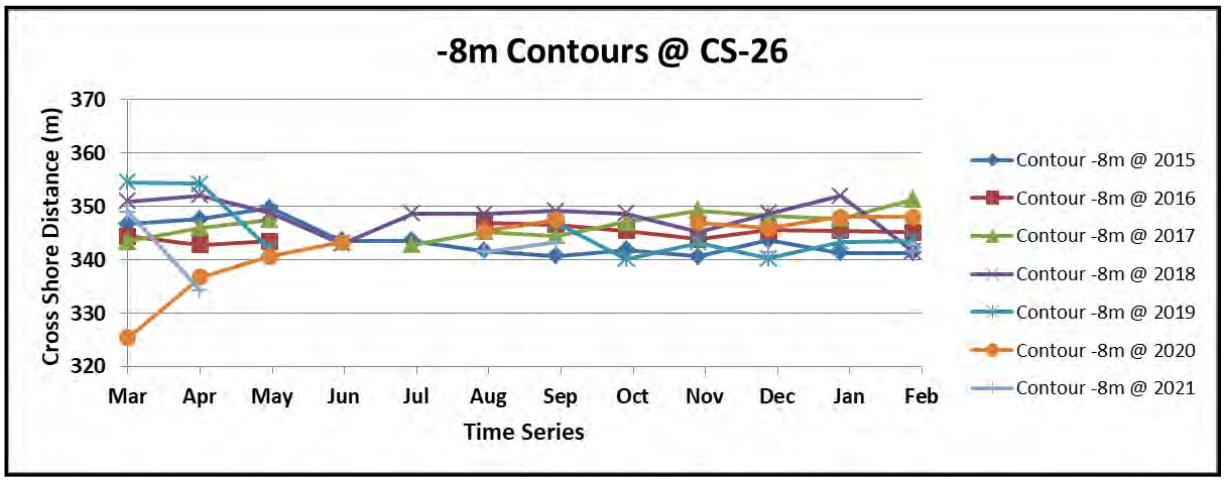


Figure 2-128 Time series of (–) 6 m contour at Karumkulam (CS 26)



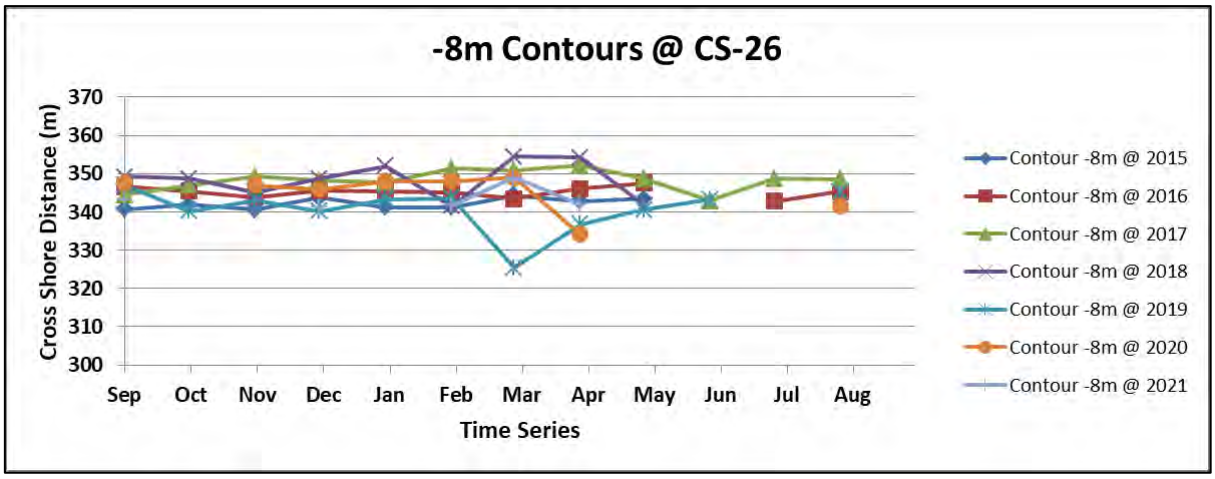
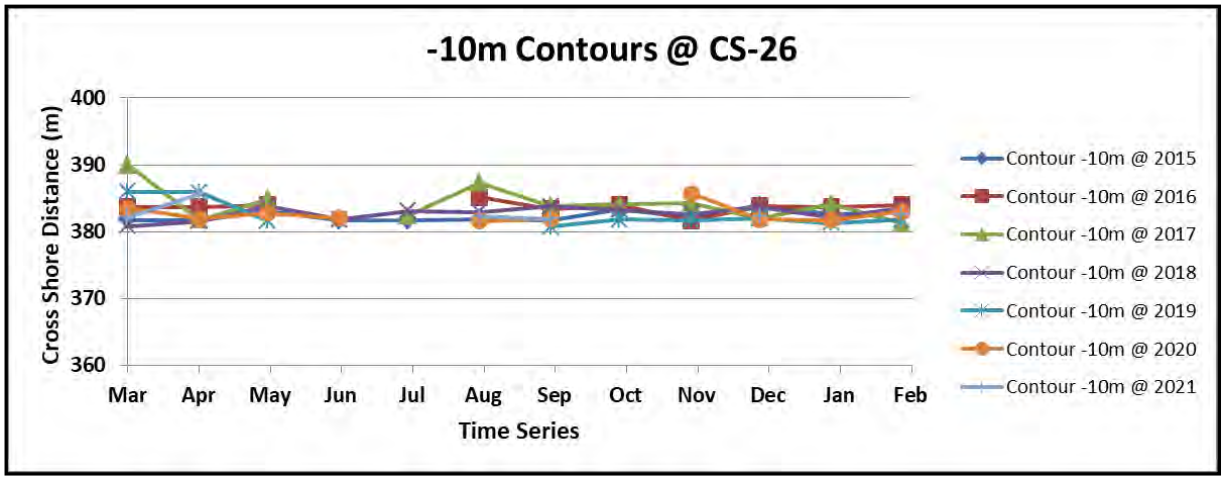


Figure 2-129 Time series of (–) 8 m contour at Karumkulam (CS 26)



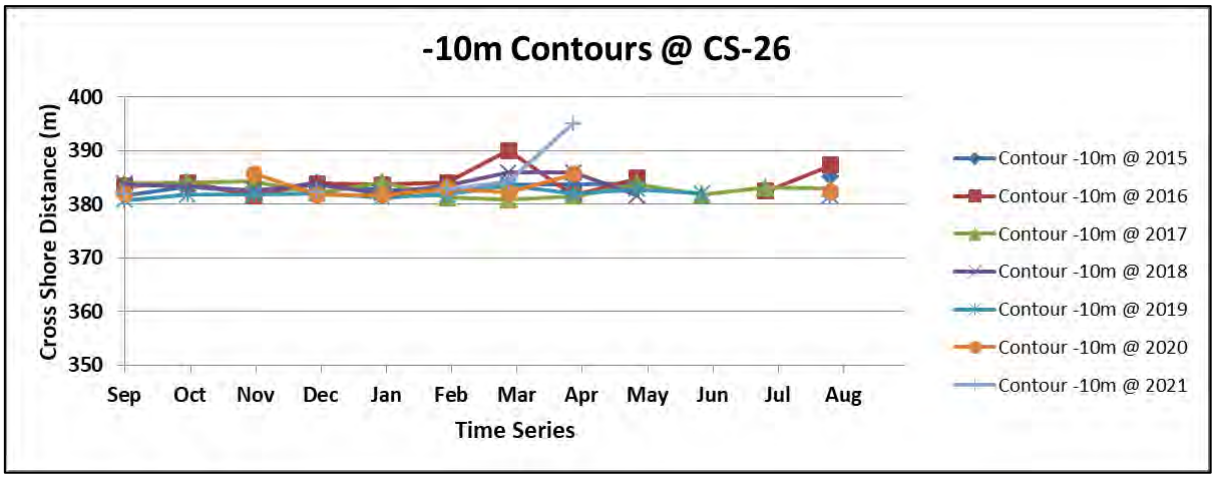


Figure 2-130 Time series of (–) 10 m contour at Karumkulam (CS 26)

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 2-131.

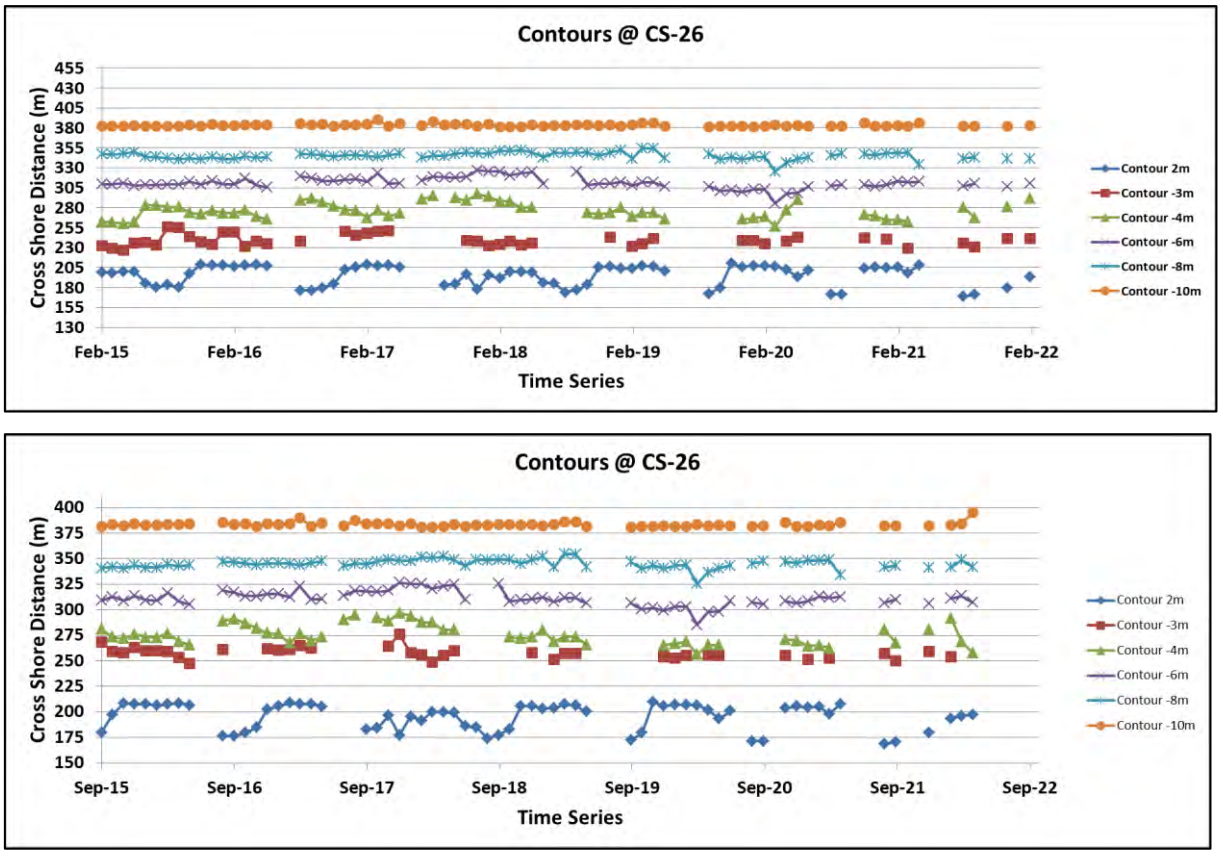


Figure 2-131 Continuous time series of contours at Karumkulam (CS 26)

Figure 2-131 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. This phenomenon in turn indicates that cross shore transport is predominant in this stretch.

2.7.2.4 Stretch 4

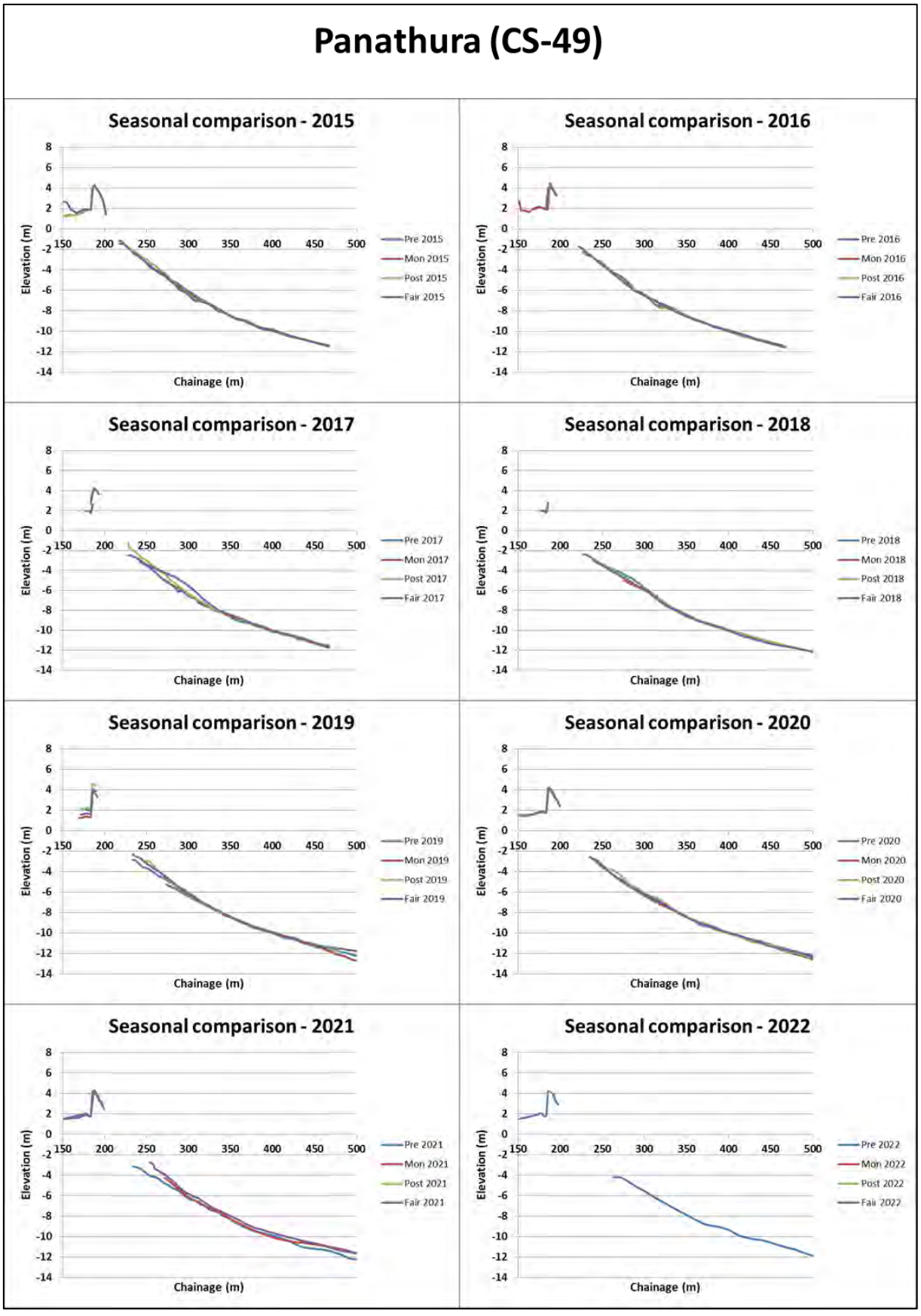


Figure 2-132 Profiles at Panathura (CS 49) – Seasonal comparison

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 2-132, it can be noticed that the seasonal variations are very minimal. However, accretion was observed in foreshore zone during Ockhi (December 2017). Figure 2-133 plots represent comparison of profiles of different seasons over different years. These plots suggest that there was an accretion in offshore region during fair weather 2017 and pre-monsoon 2018 seasons.

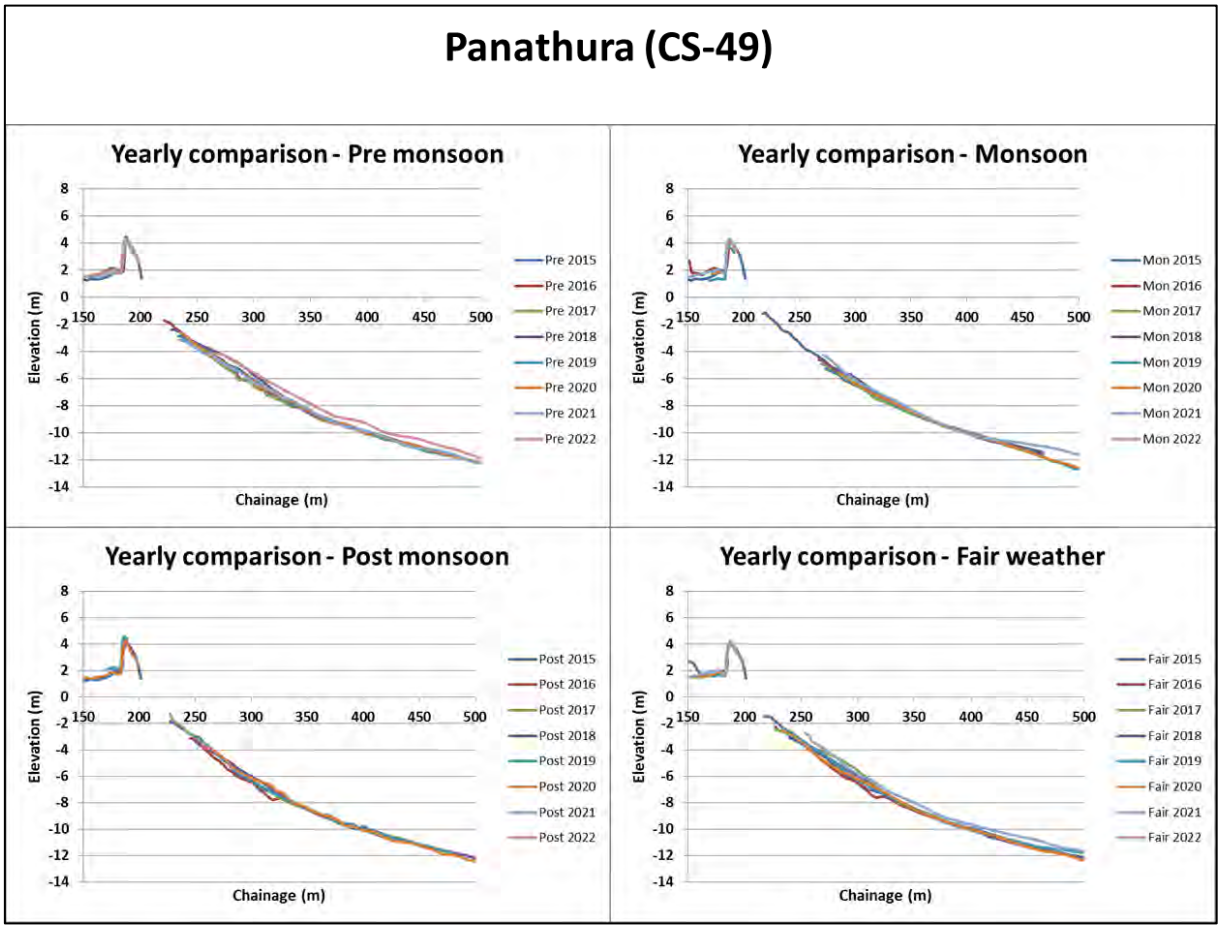


Figure 2-133 Profiles at Panathura (CS 49) – Yearly comparison

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. 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.

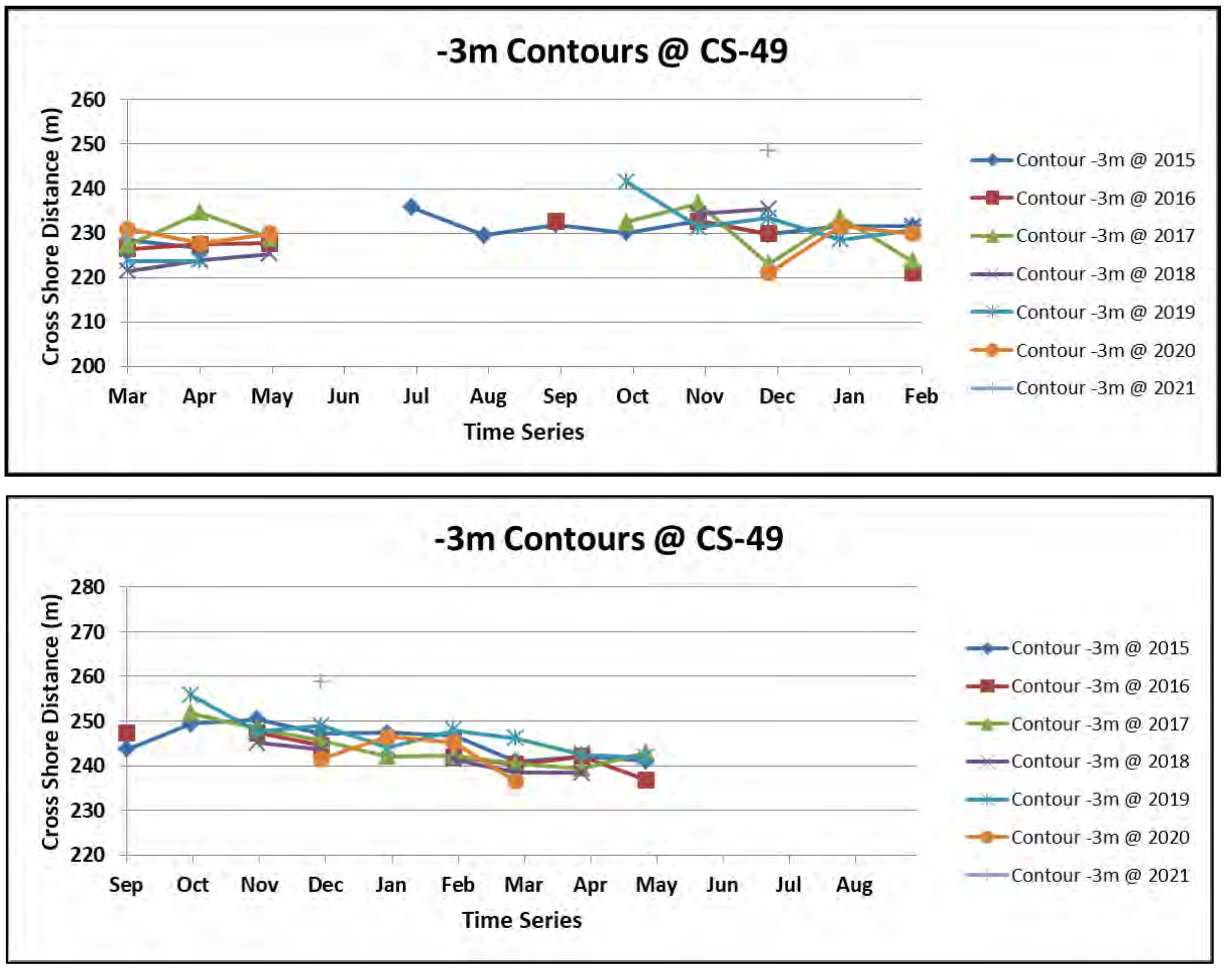
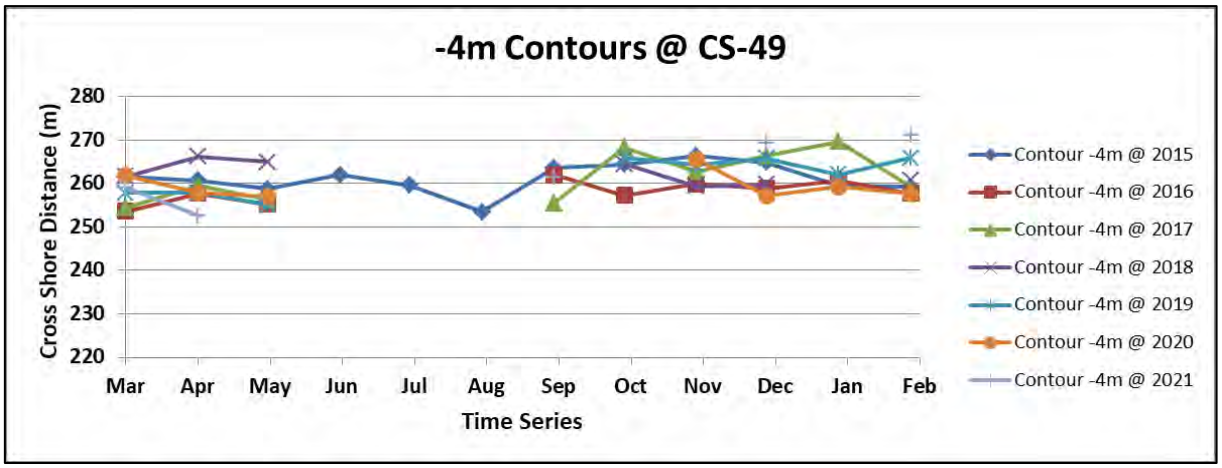


Figure 2-134 Time series of (–) 3 m contour at Panathura (CS 49)



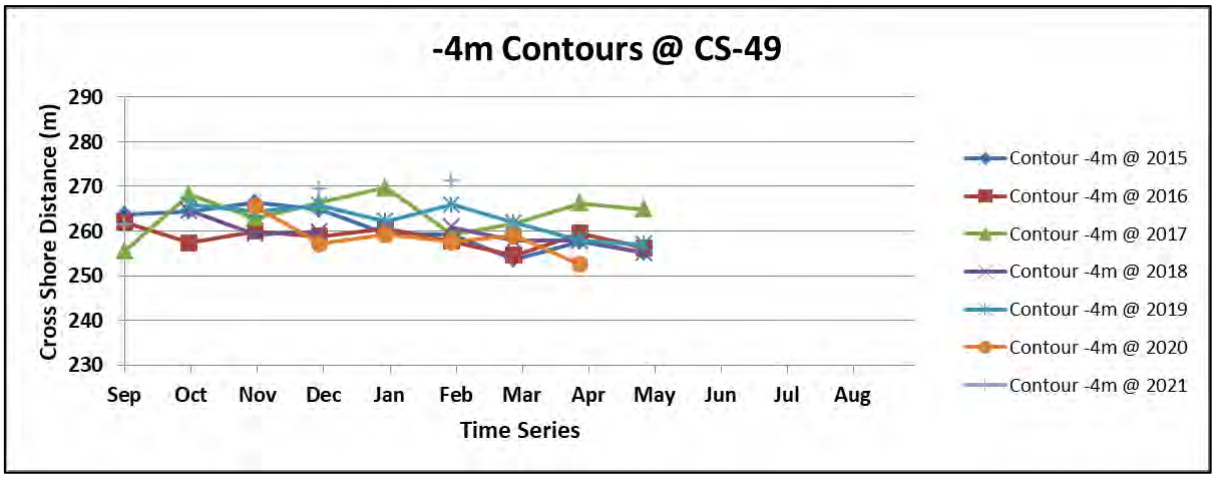
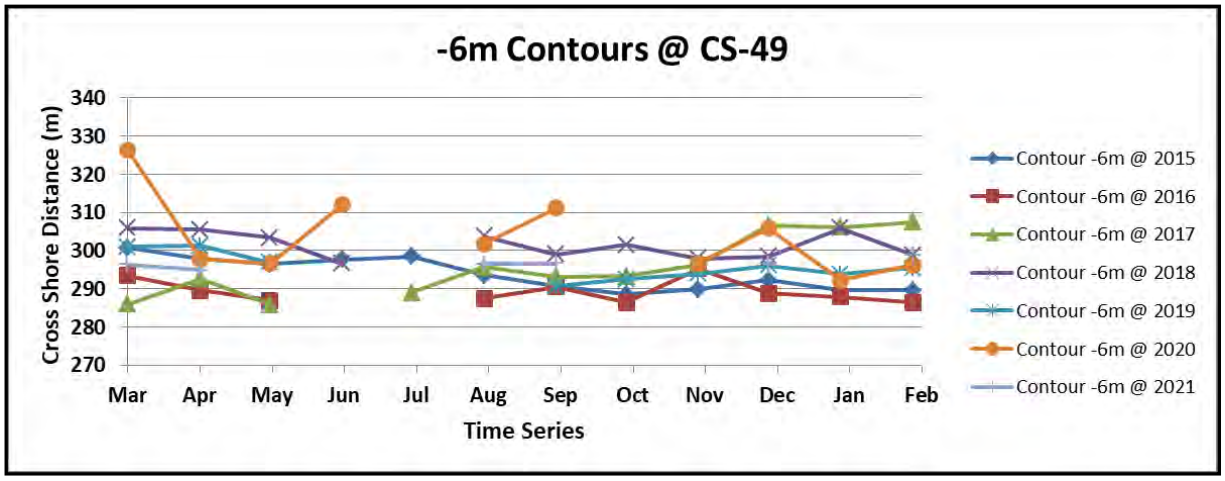


Figure 2-135 Time series of (–) 4 m contour at Panathura (CS 49)



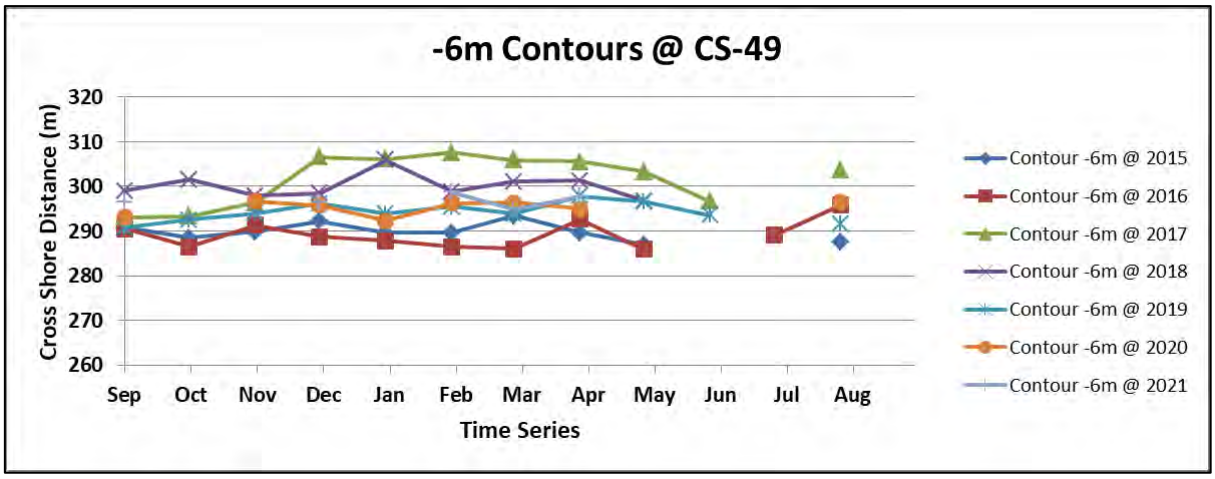


Figure 2-136 Time series of (–) 6 m contour at Panathura (CS 49)

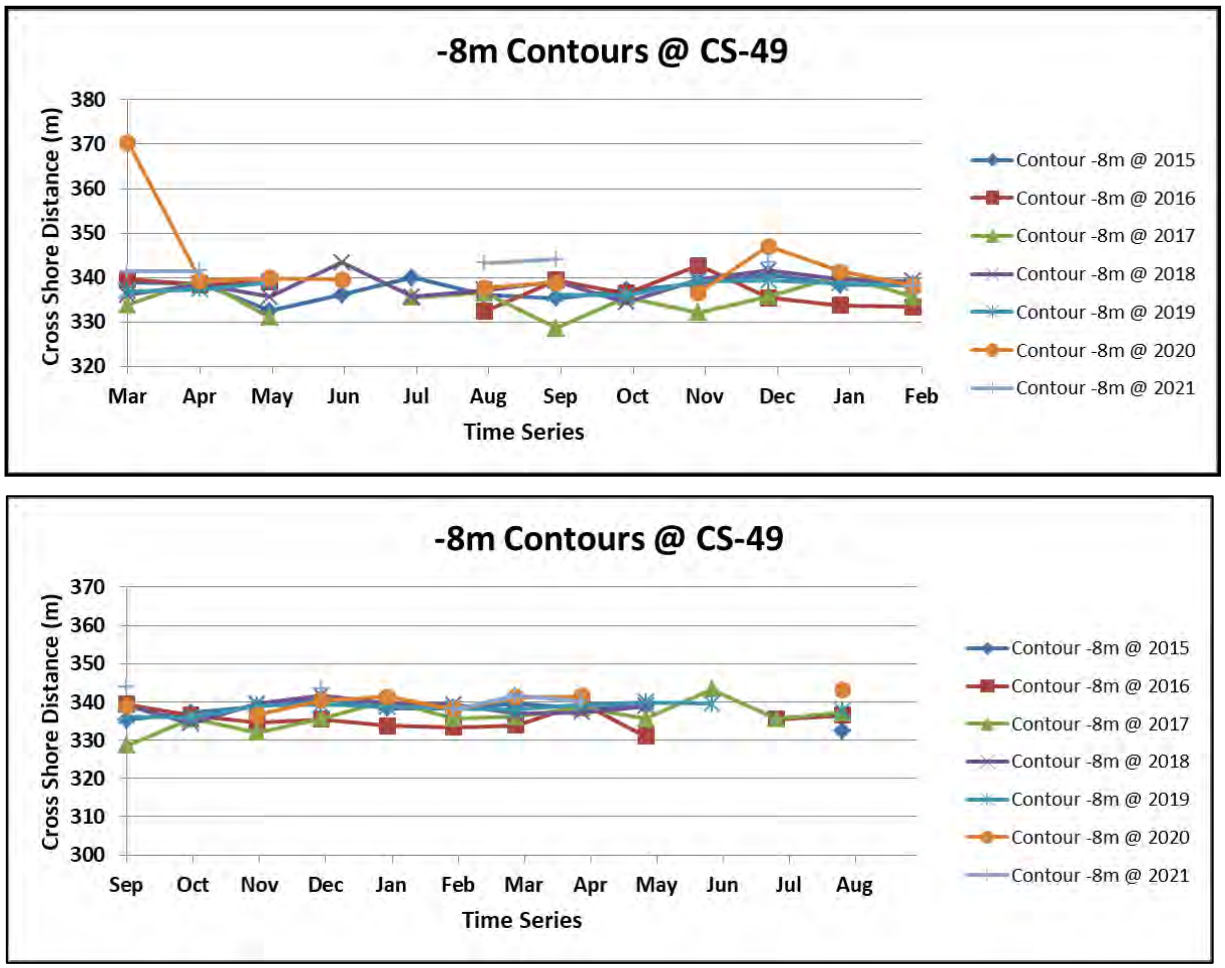
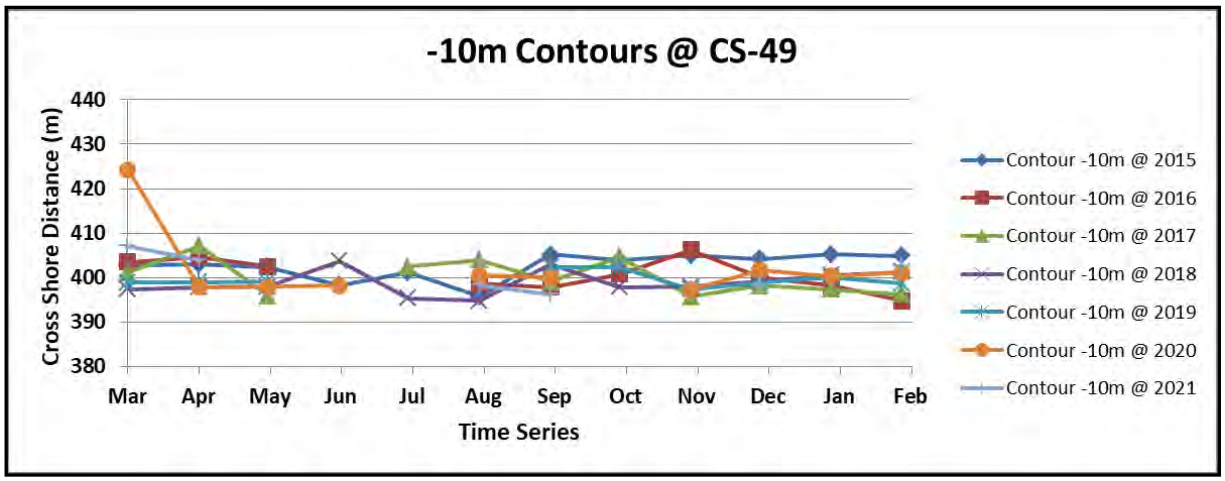


Figure 2-137 Time series of (–) 8 m contour at Panathura (CS 49)



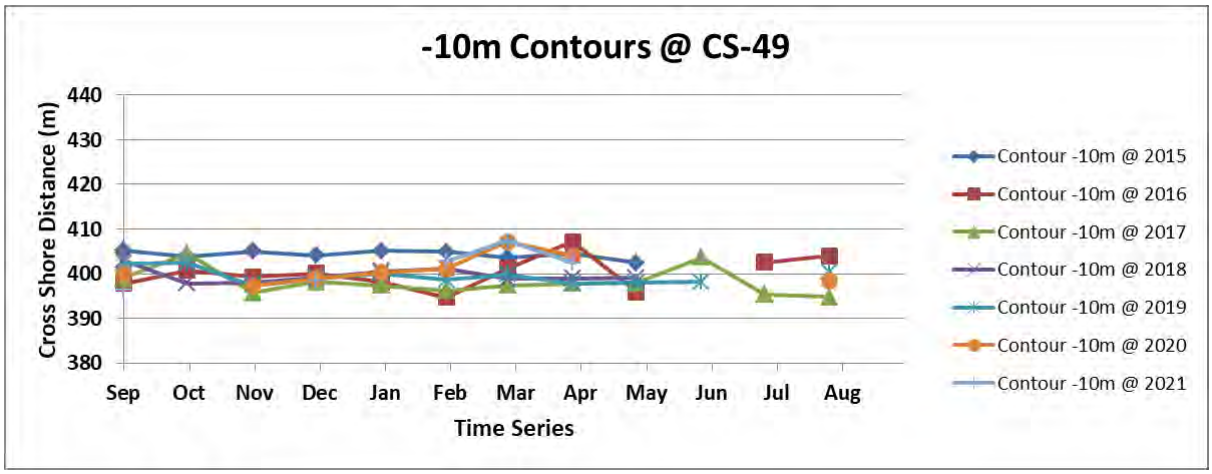
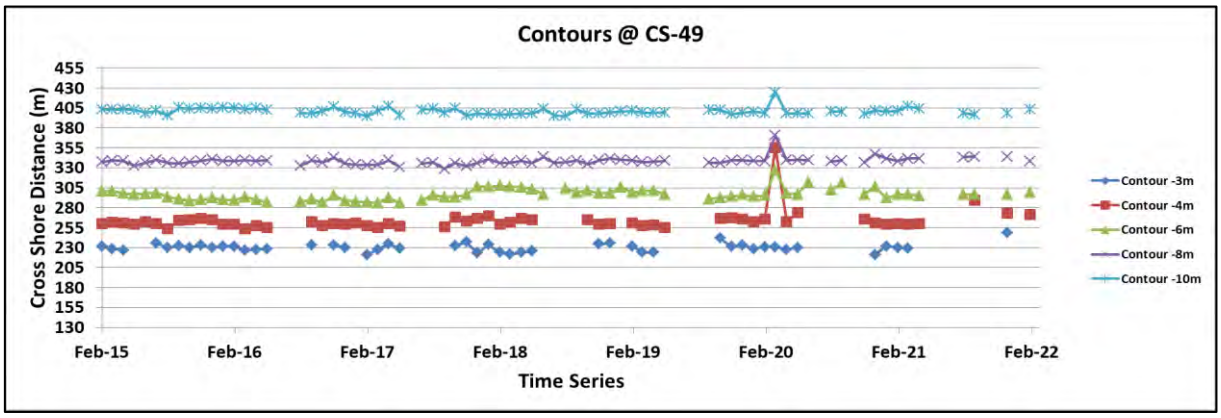


Figure 2-138 Time series of (–) 10 m contour at Panathura (CS 49)

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 2-139.



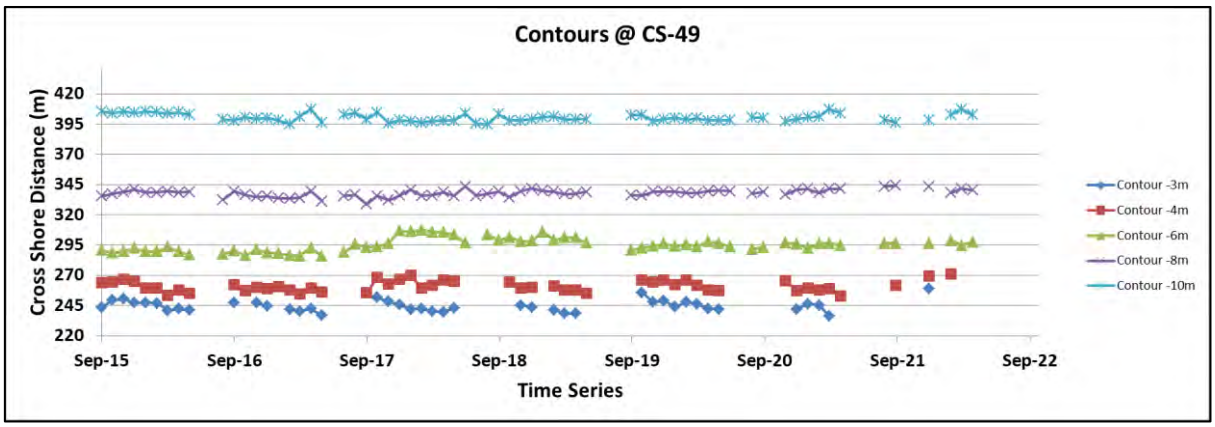


Figure 2-139 Continuous time series of contours at Panathura (CS 49)

2.7.2.5 Stretch 5

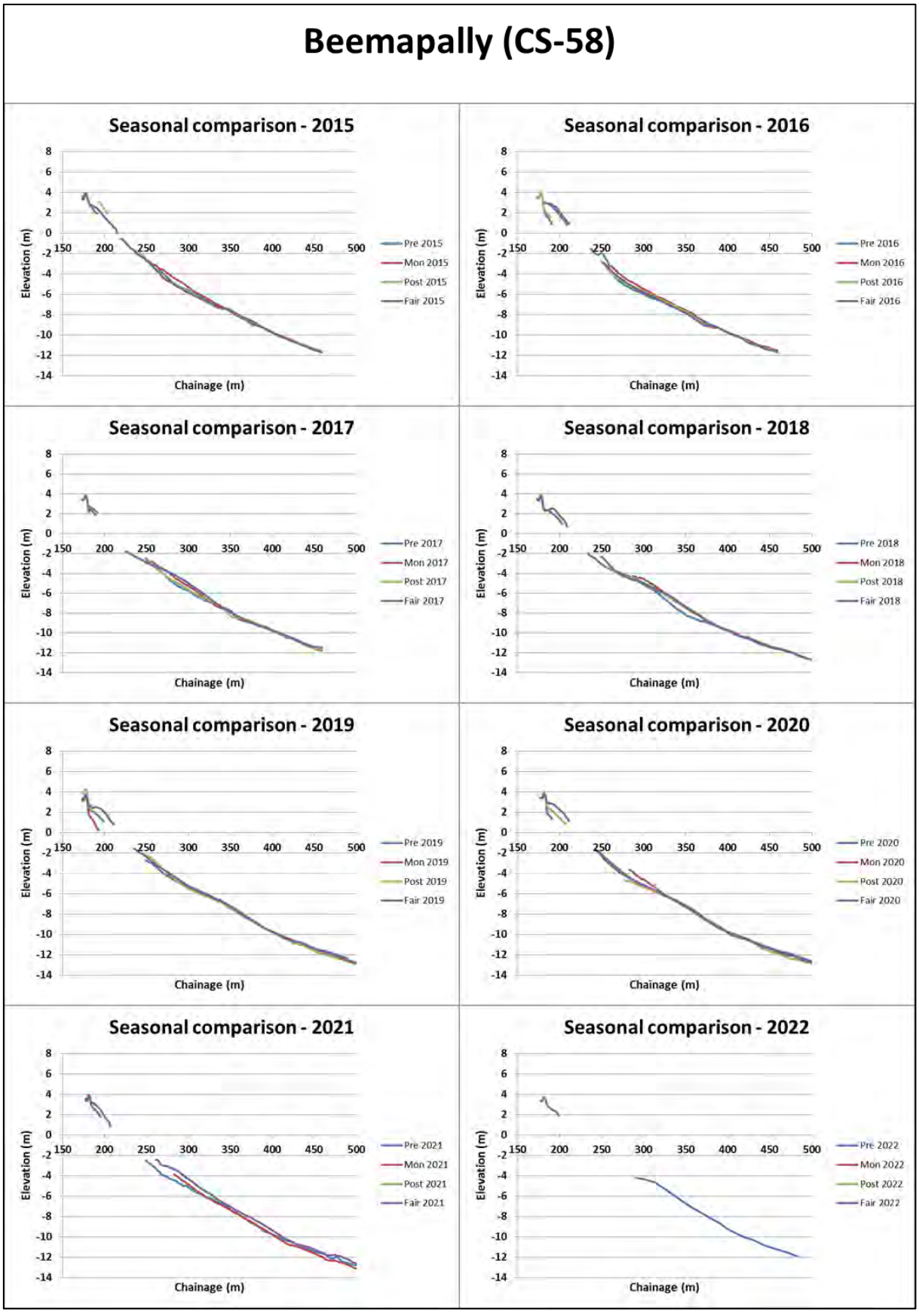


Figure 2-140 Profiles at Beemapally (CS 58) – Seasonal comparison

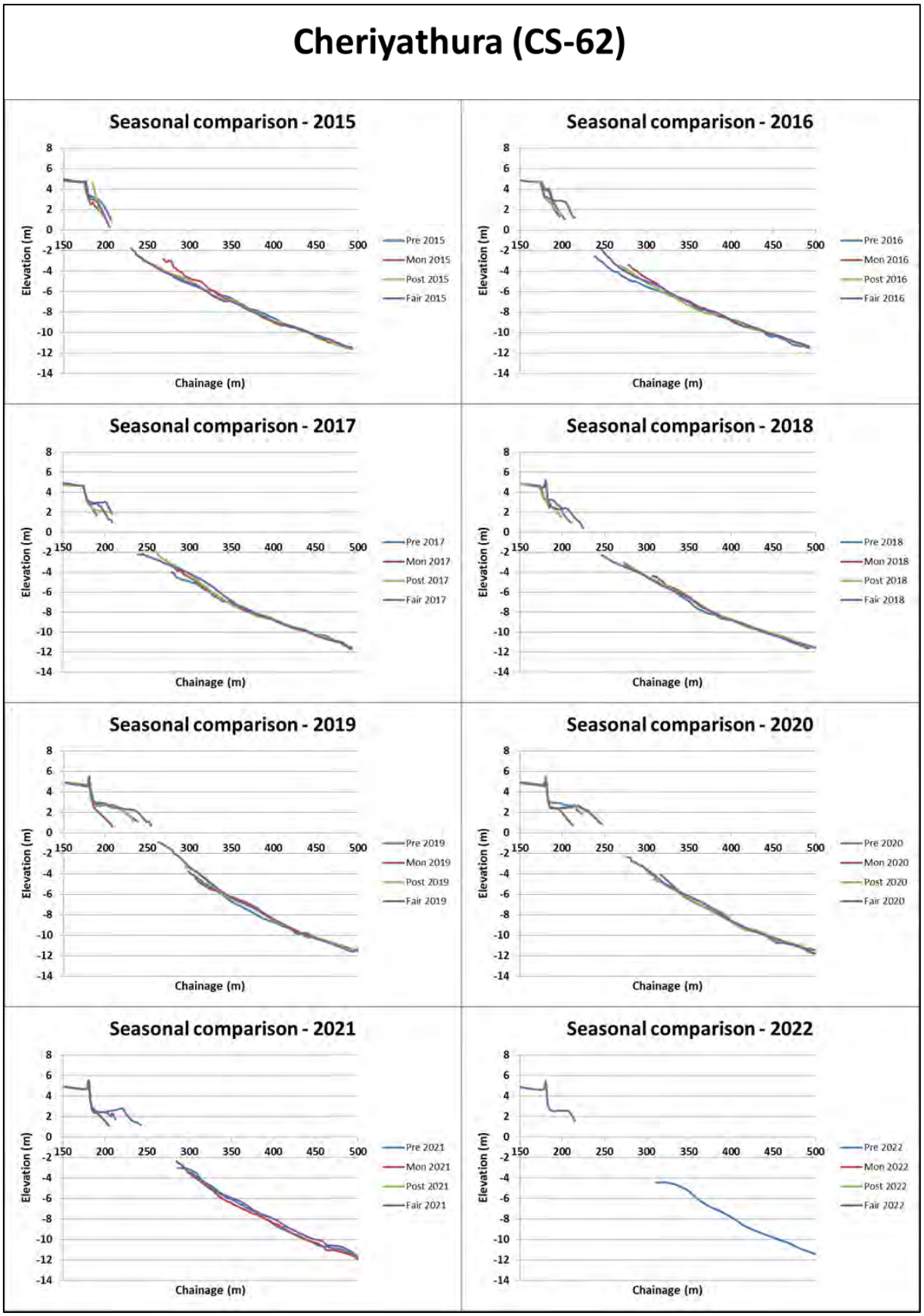


Figure 2-141 Profiles at Cheriyathura (CS 62) – Seasonal comparison

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 2-142). 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 2-140 and Figure 2-141, 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. Recently, 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 2-142 Groyne construction activities after commencement of survey

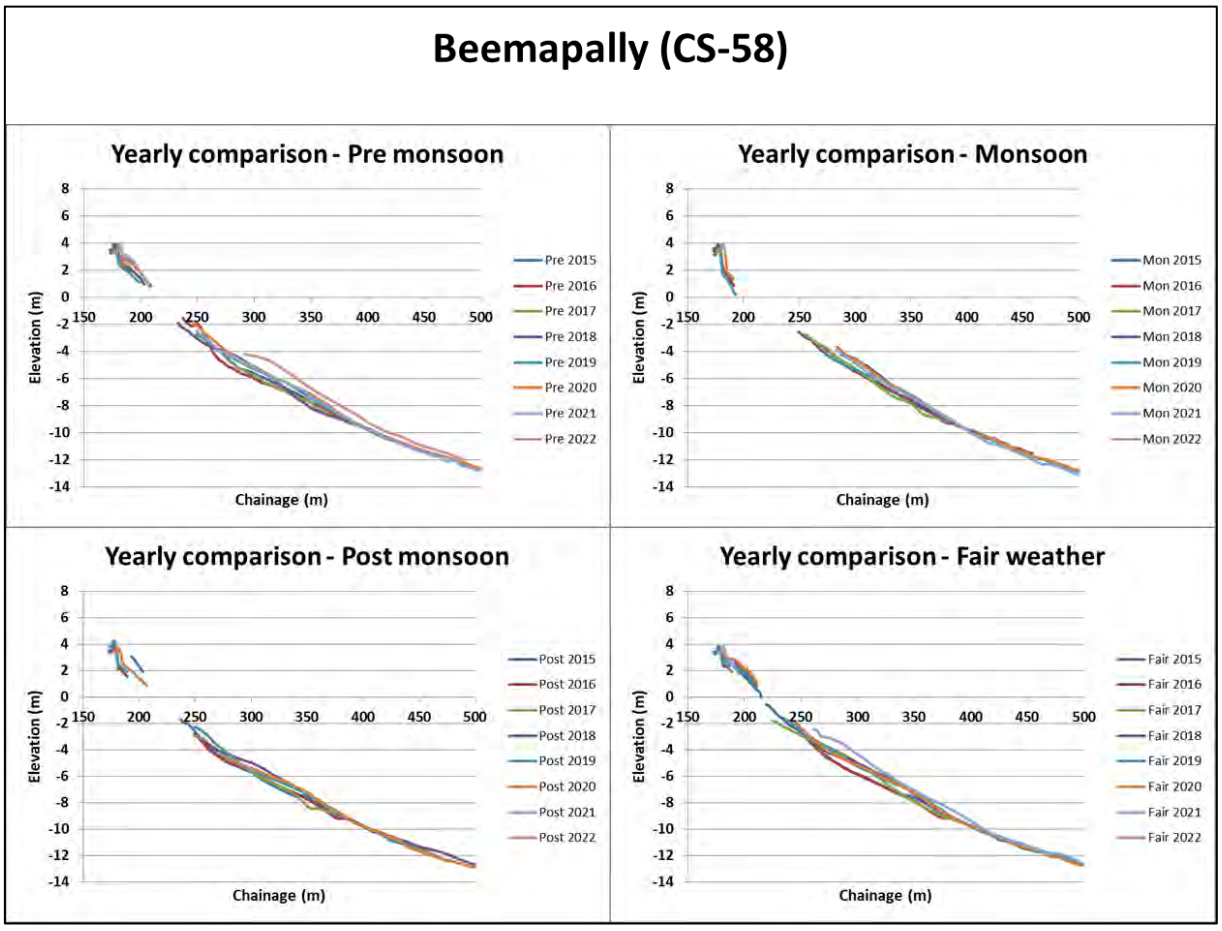


Figure 2-143 Profiles at Beemapally (CS 58) – Yearly comparison

Figure 2-143 plots represent comparison of profiles of a particular season over different years. These plots suggest that yearly trend was as per normal sequence till post monsoon 2017. During fair weather season of 2017, unprecedented event Ockhi cyclone hit the coast and impact of Ockhi cyclone can be evidently noticed in fair weather 2017 and pre-monsoon 2018 seasonal profiles. Subsequently lasting accretion can be noticed in offshore region as shown in yearly comparison plot of fair weather seasons. Also, fair weather profiles can be categorised into two sets based on their pre and post Ockhi behaviour.

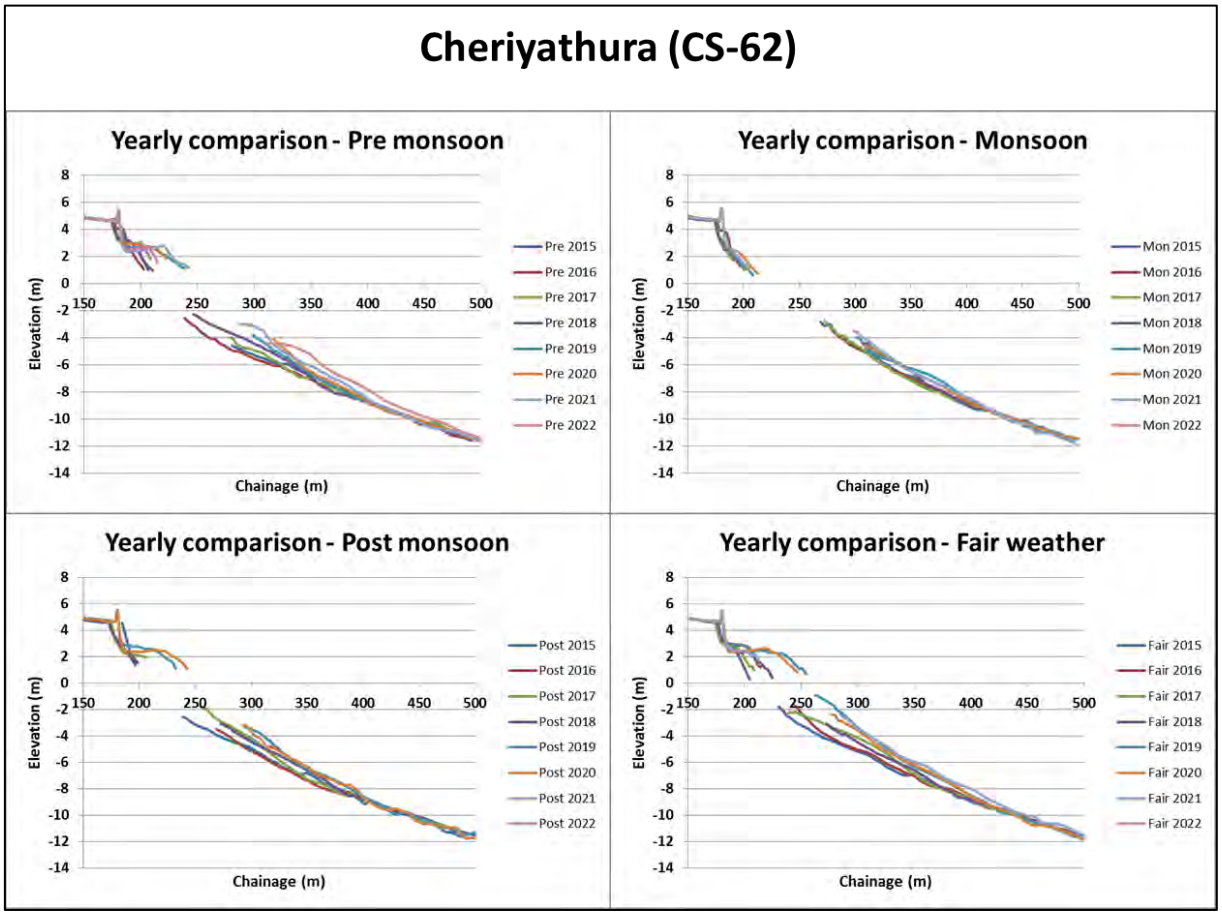
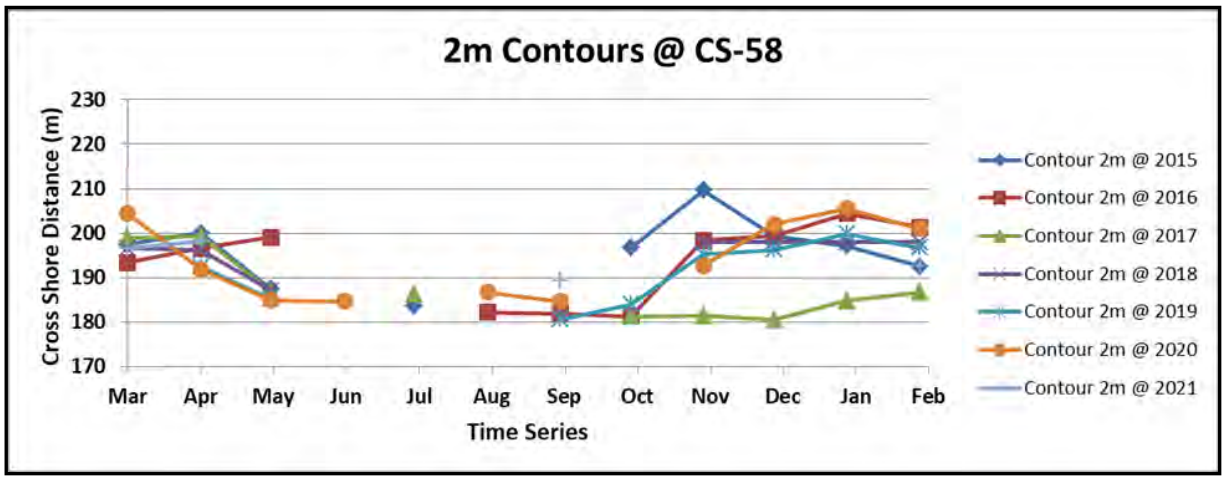
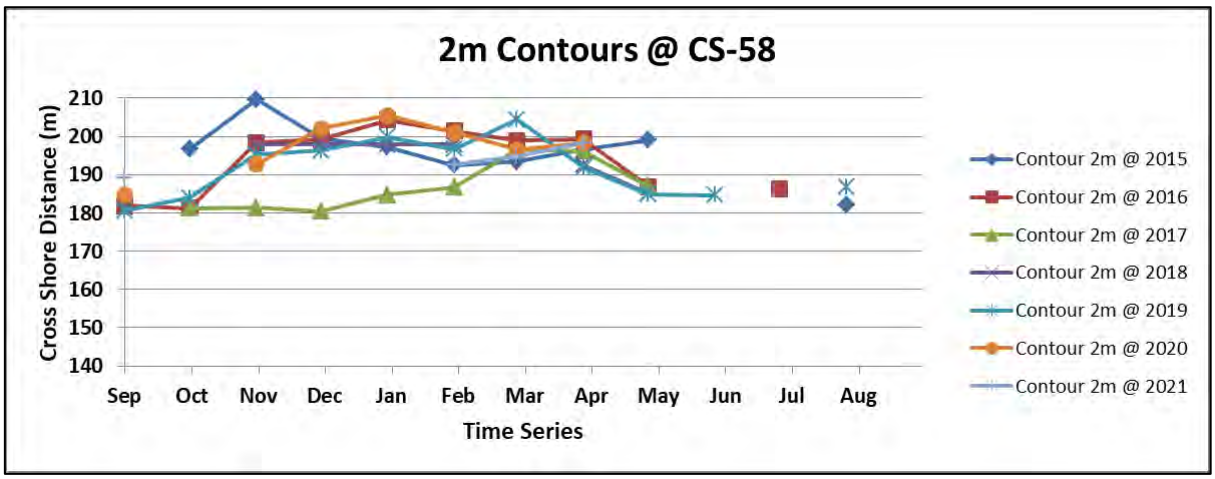


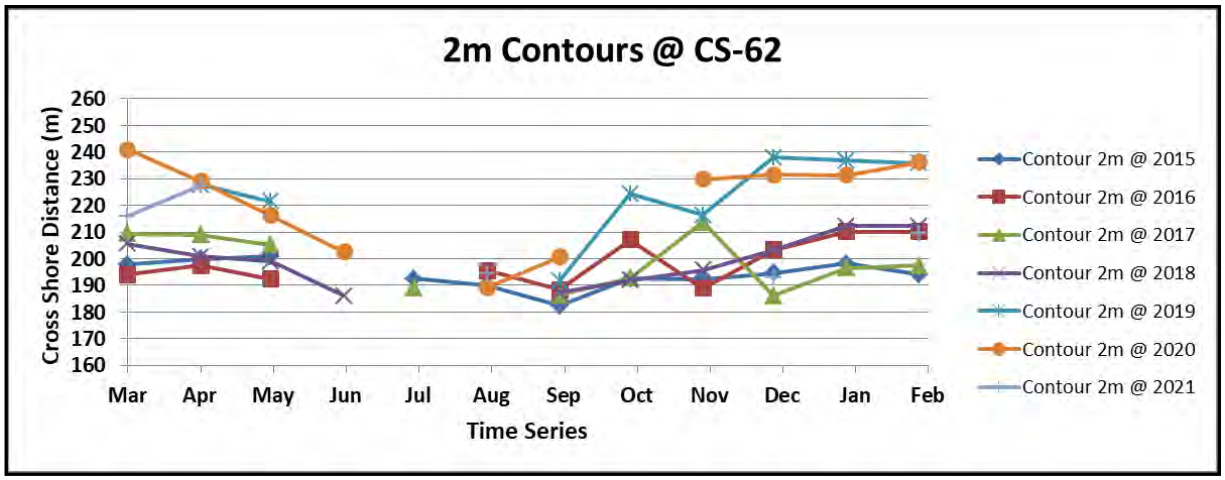
Figure 2-144 Profiles at Cheriyathura (CS 62) – Yearly comparison

Figure 2-144 plots represent comparison of profiles over different years. 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 show 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 seven year 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.


2m Contours @ CS-58
Cross Shore Distance (m)
230
220
210
200
190
180
170
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Time Series
Contour 2m @ 2015
Contour 2m @ 2016
Contour 2m @ 2017
Contour 2m @ 2018
Contour 2m @ 2019
Contour 2m @ 2020
Contour 2m @ 2021


2m Contours @ CS-58
Cross Shore Distance (m)
210
200
190
180
170
160
150
140
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Time Series
Contour 2m @ 2015
Contour 2m @ 2016
Contour 2m @ 2017
Contour 2m @ 2018
Contour 2m @ 2019
Contour 2m @ 2020
Contour 2m @ 2021


2m Contours @ CS-62
Cross Shore Distance (m)
260
250
240
230
220
210
200
190
180
170
160
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Time Series
Contour 2m @ 2015
Contour 2m @ 2016
Contour 2m @ 2017
Contour 2m @ 2018
Contour 2m @ 2019
Contour 2m @ 2020
Contour 2m @ 2021

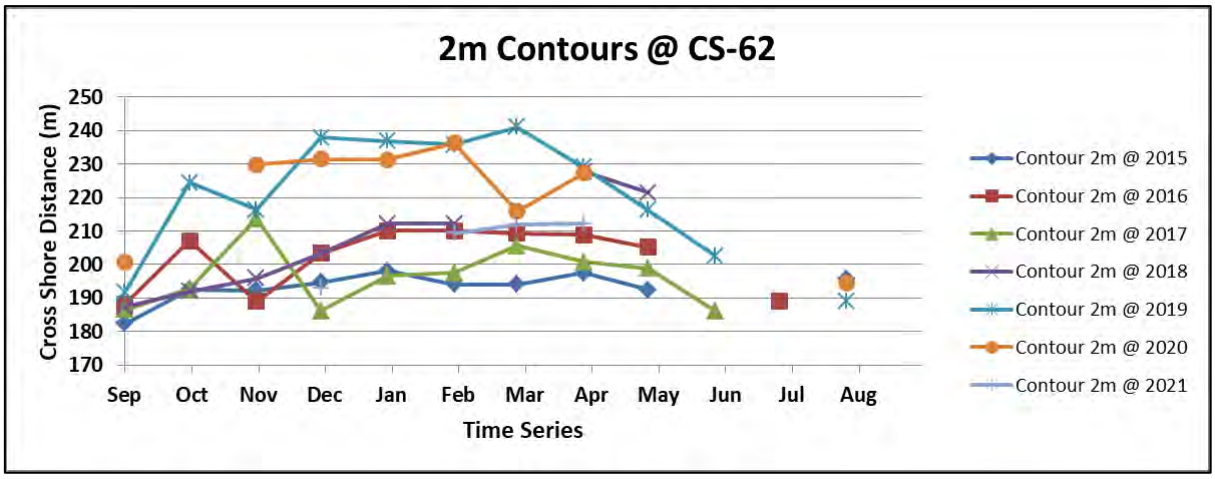
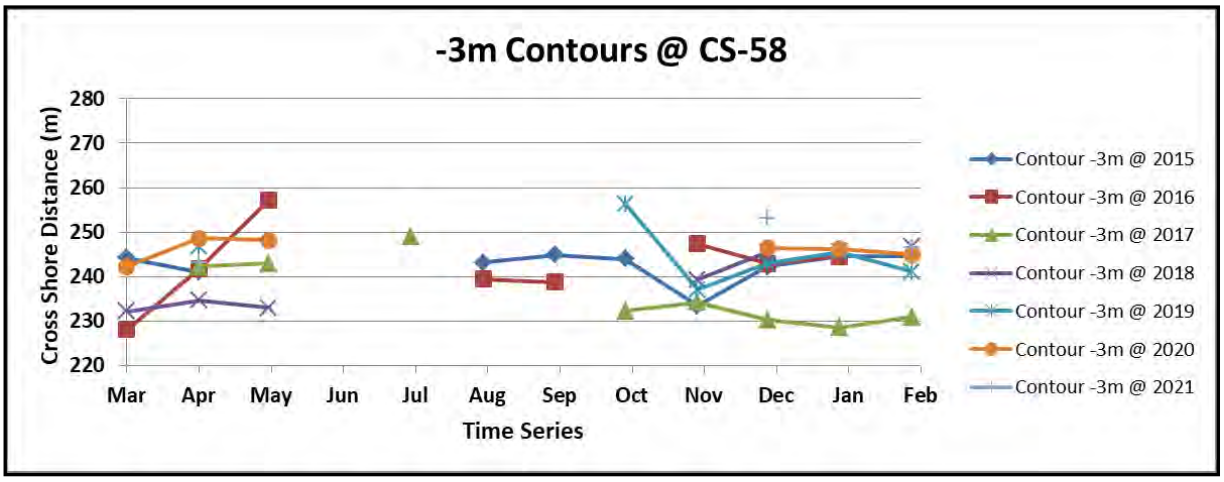
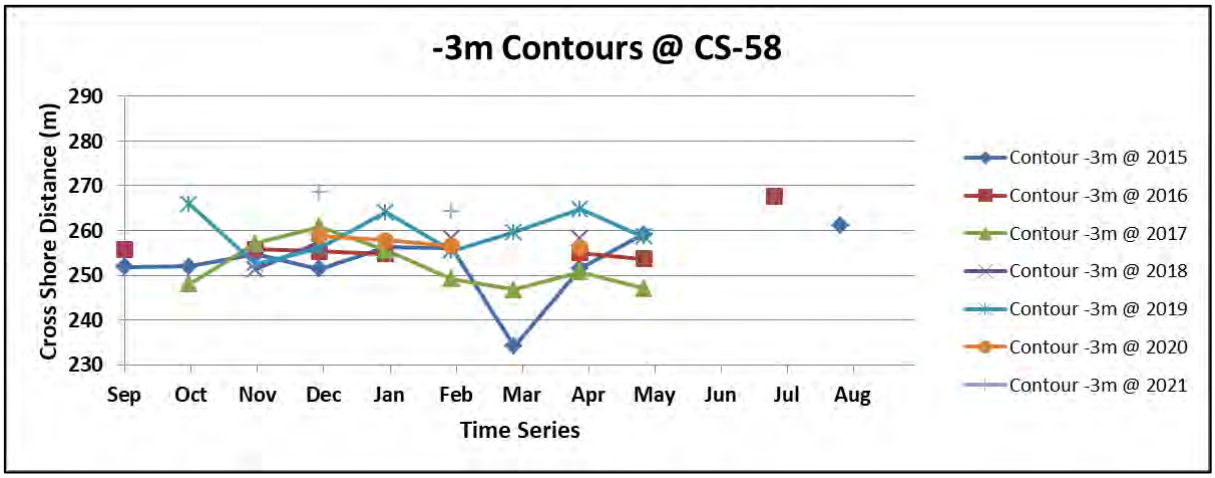


Figure 2-145 Time series of (+) 2 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)





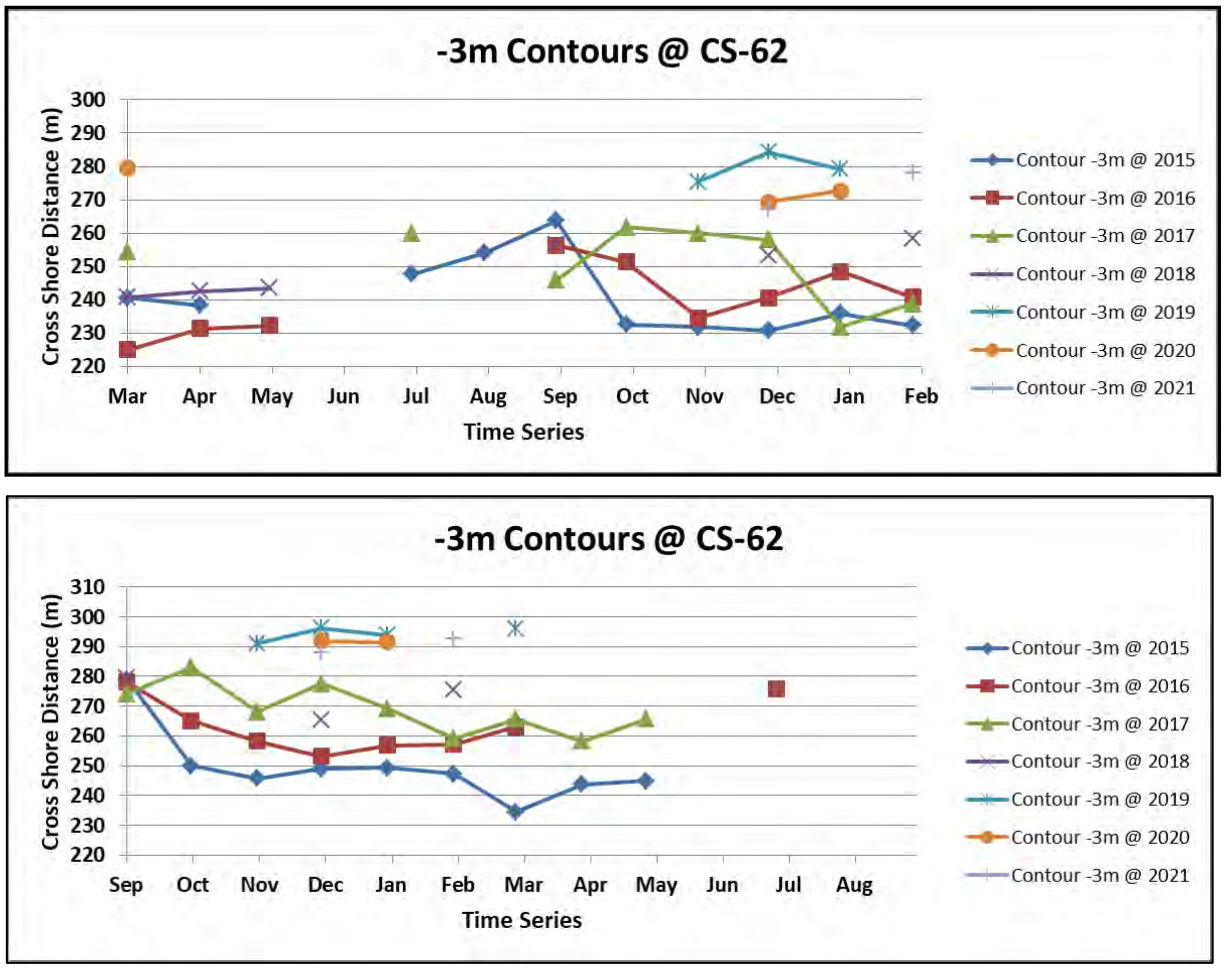
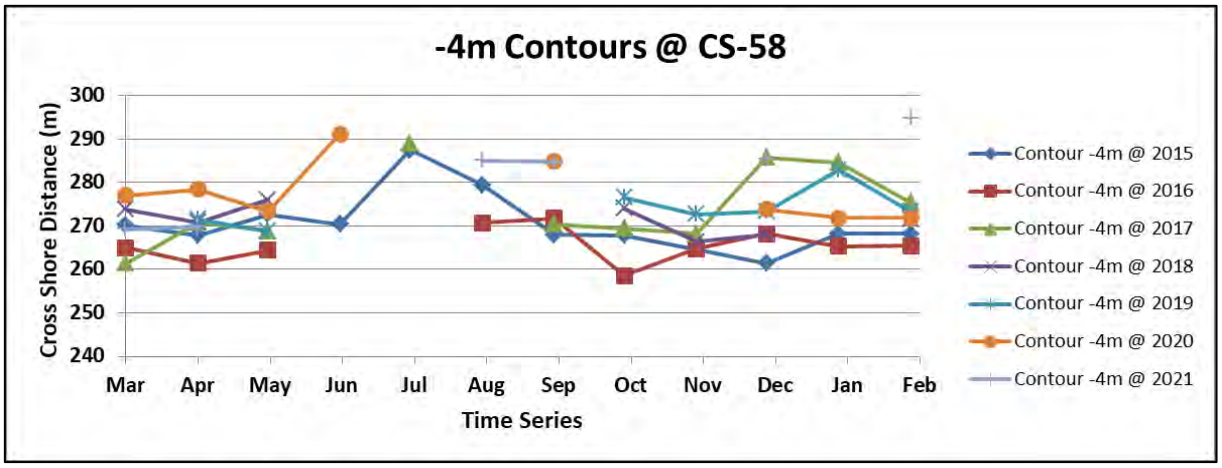
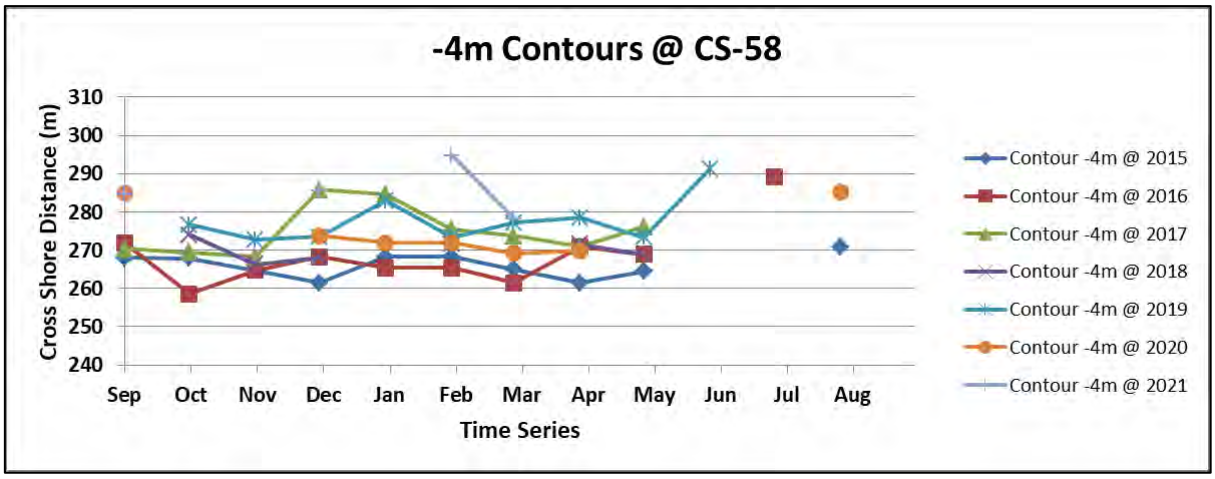
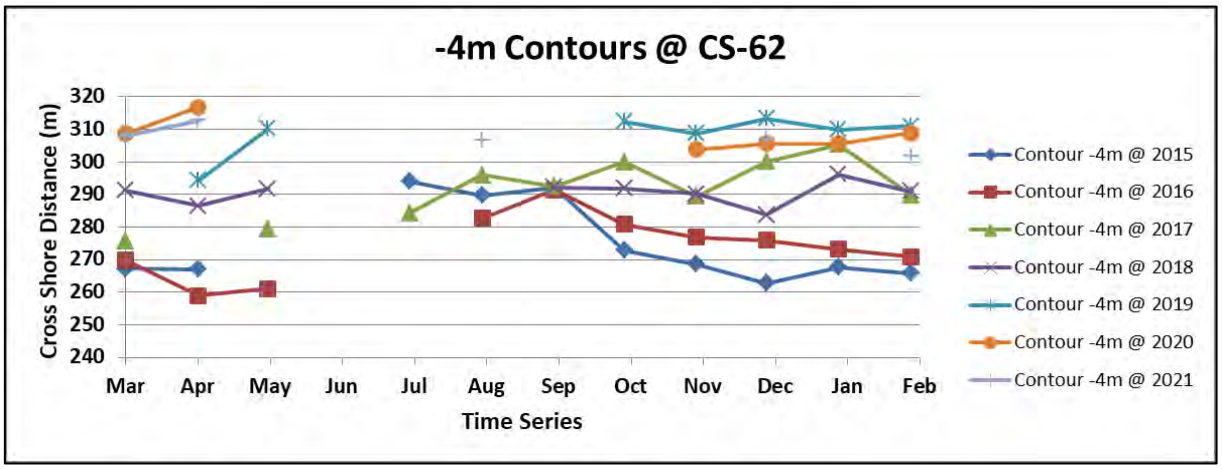


Figure 2-146 Time series of (–) 3 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)







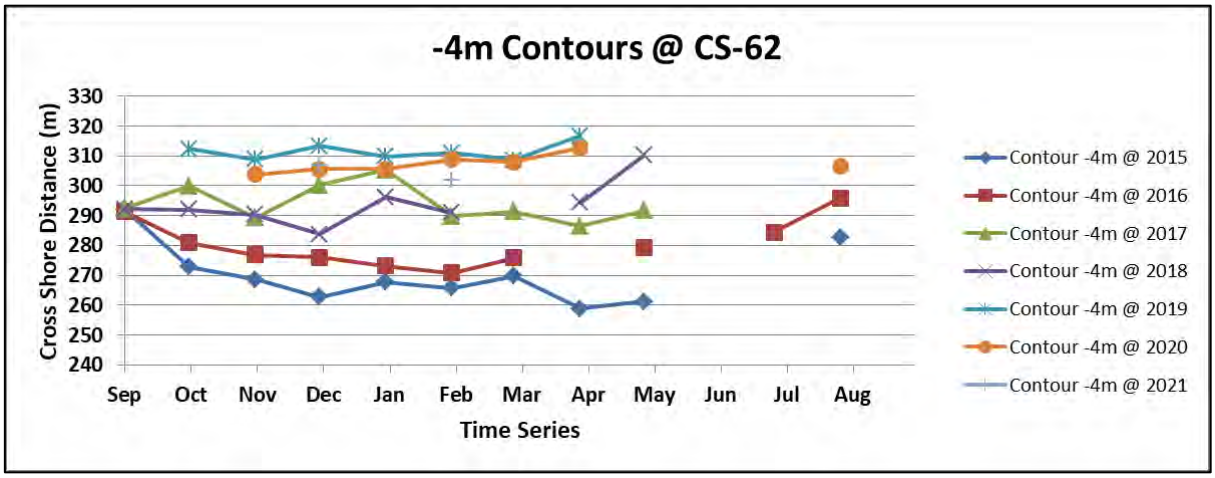
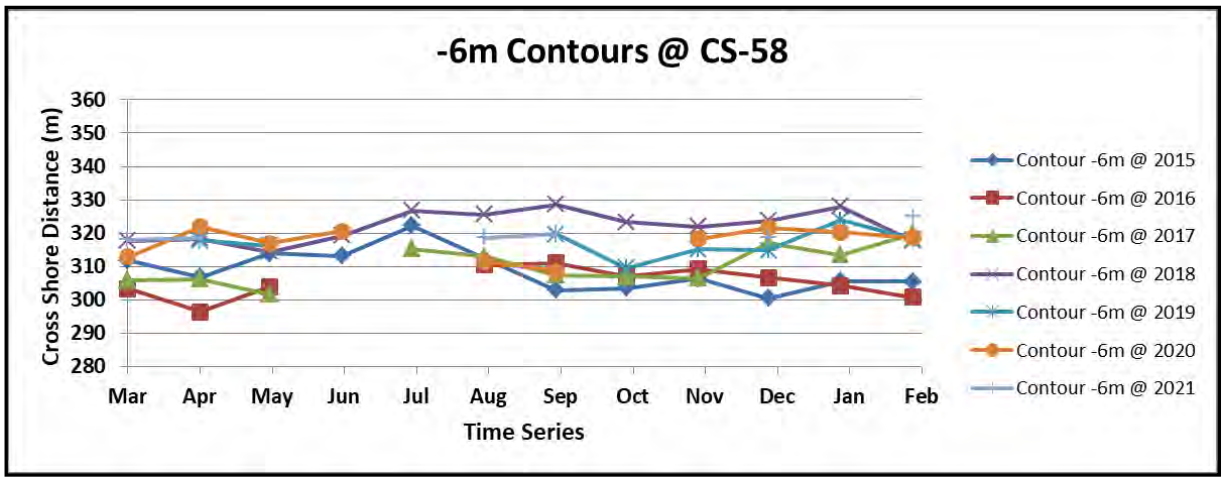
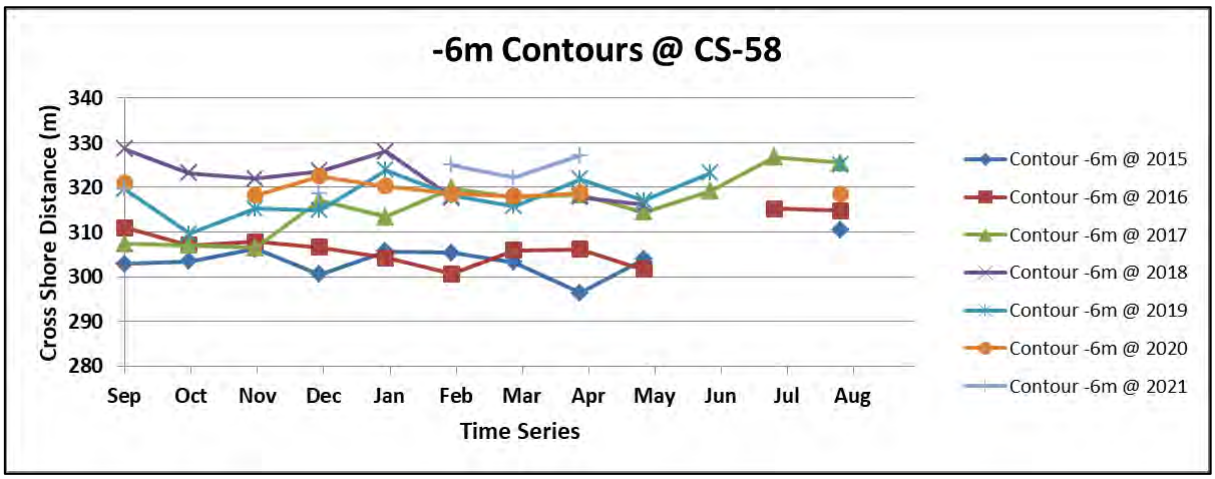
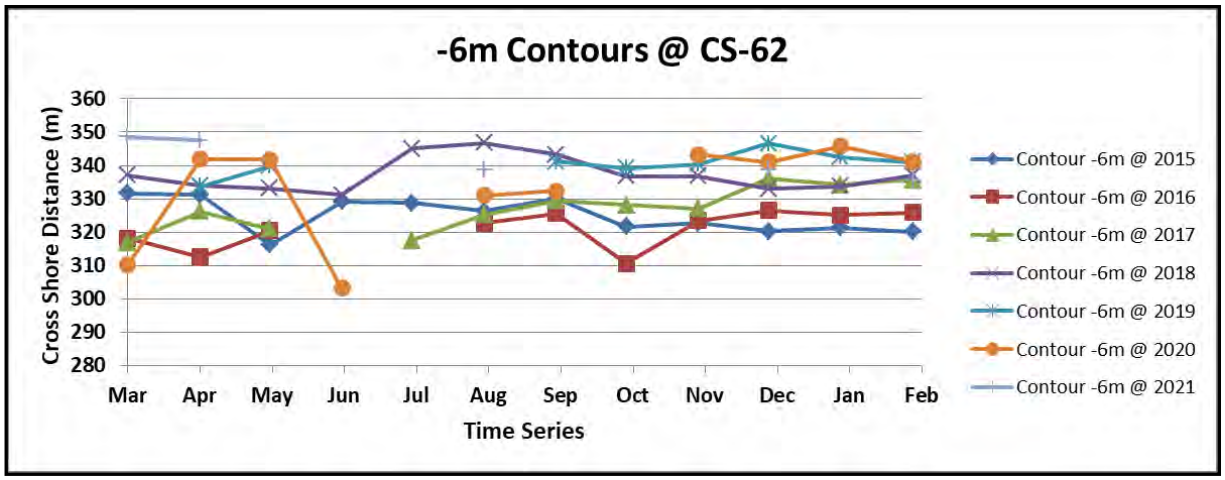


Figure 2-147 Time series of (–) 4 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)


-6m Contours @ CS-58
Cross Shore Distance (m)
360
350
340
330
320
310
300
290
280
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Time Series
Contour -6m @ 2015
Contour -6m @ 2016
Contour -6m @ 2017
Contour -6m @ 2018
Contour -6m @ 2019
Contour -6m @ 2020
Contour -6m @ 2021


-6m Contours @ CS-58
Cross Shore Distance (m)
340
330
320
310
300
290
280
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Time Series
Contour -6m @ 2015
Contour -6m @ 2016
Contour -6m @ 2017
Contour -6m @ 2018
Contour -6m @ 2019
Contour -6m @ 2020
Contour -6m @ 2021


-6m Contours @ CS-62
Cross Shore Distance (m)
360
350
340
330
320
310
300
290
280
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Time Series
Contour -6m @ 2015
Contour -6m @ 2016
Contour -6m @ 2017
Contour -6m @ 2018
Contour -6m @ 2019
Contour -6m @ 2020
Contour -6m @ 2021

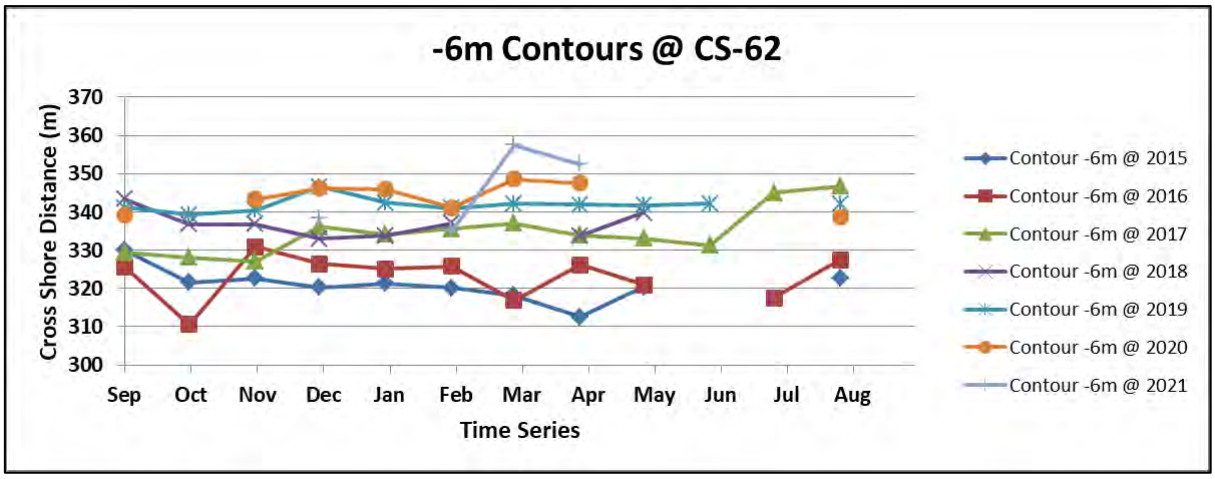
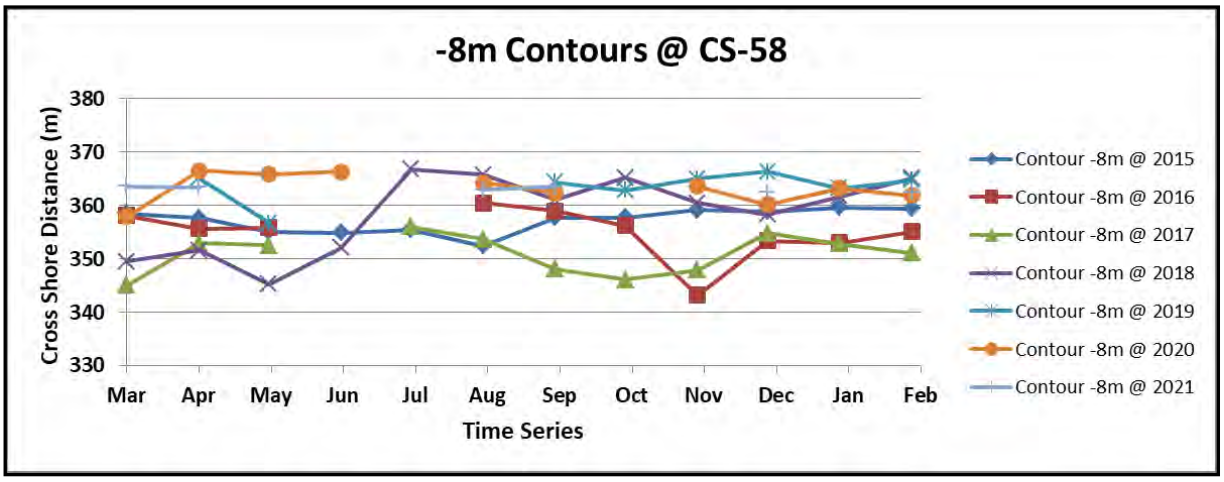
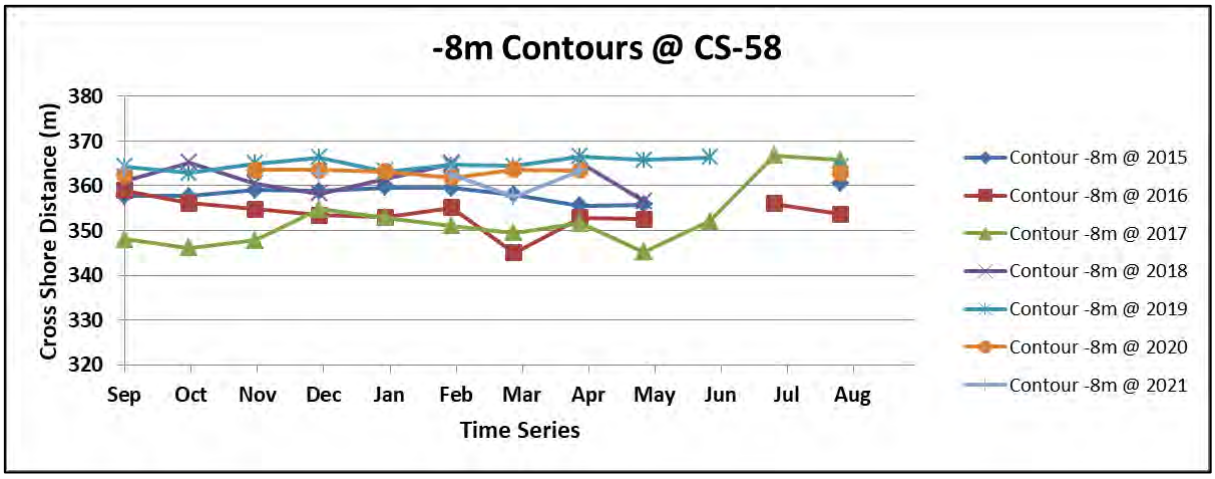


Figure 2-148 Time series of (–) 6 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)





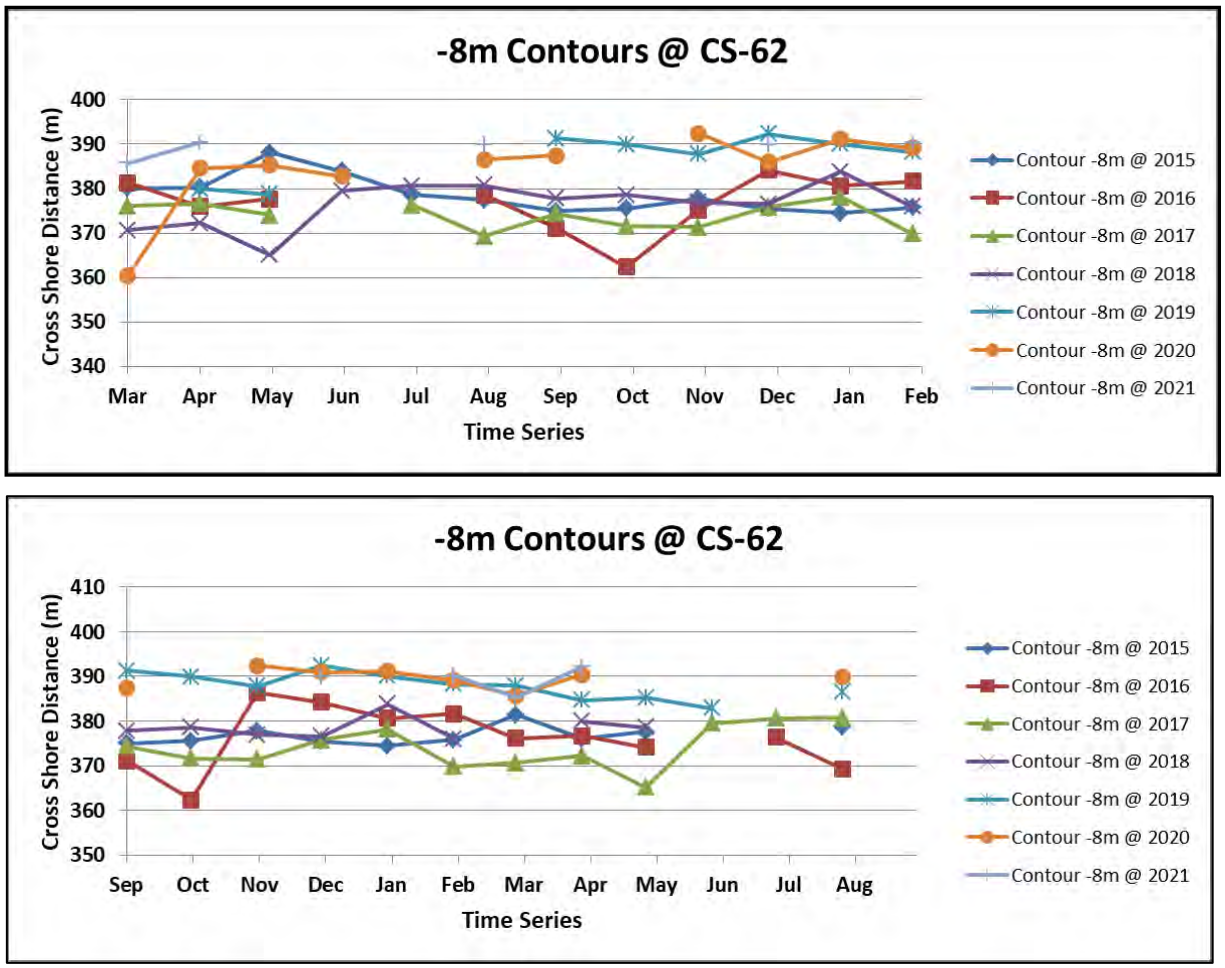
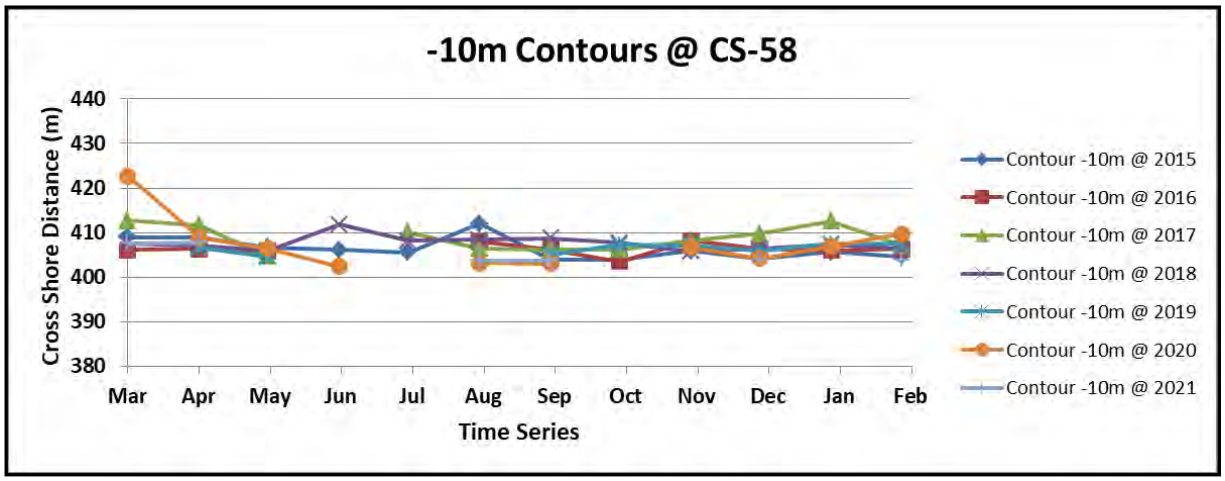


Figure 2-149 Time series of (–) 8 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)



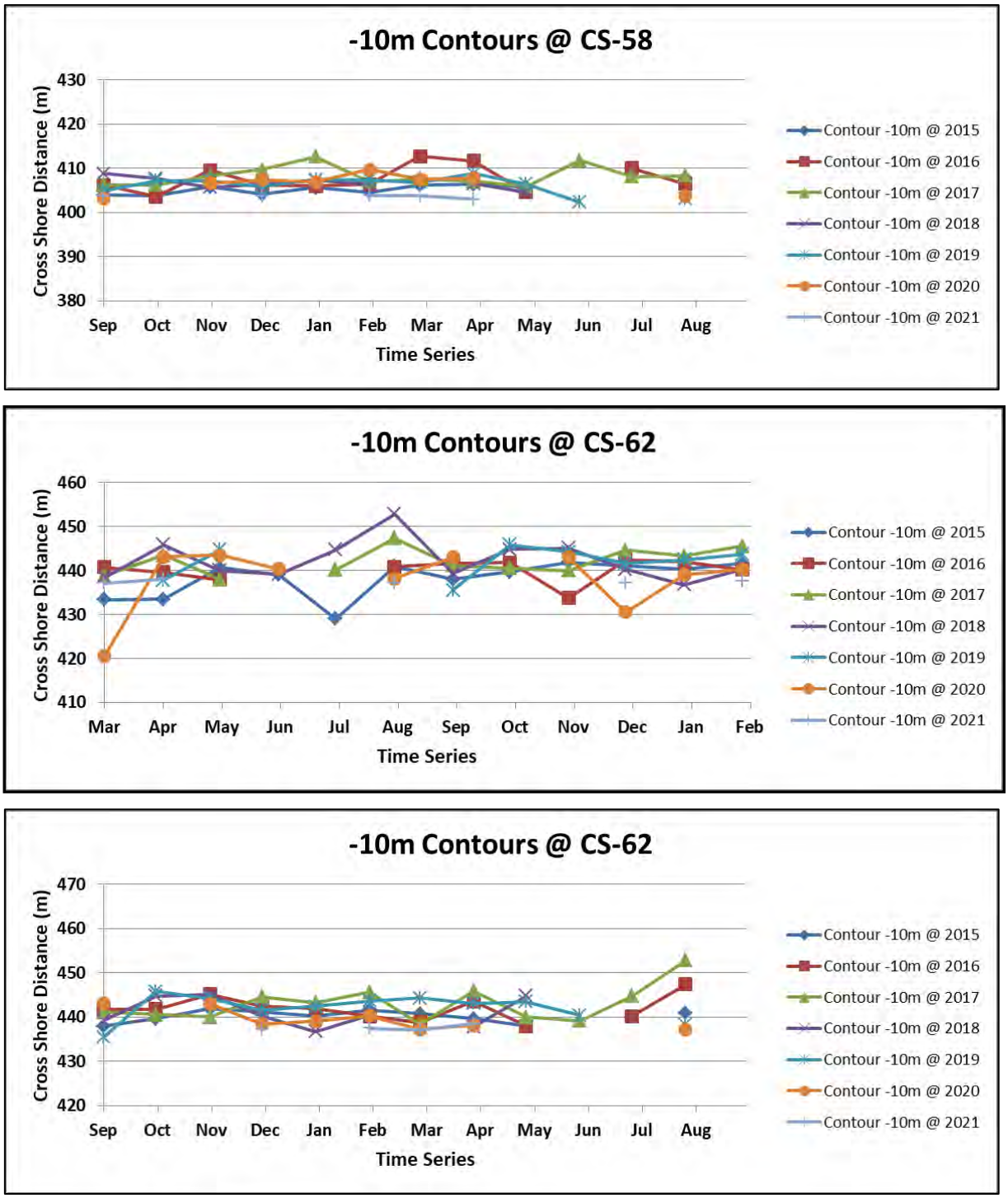
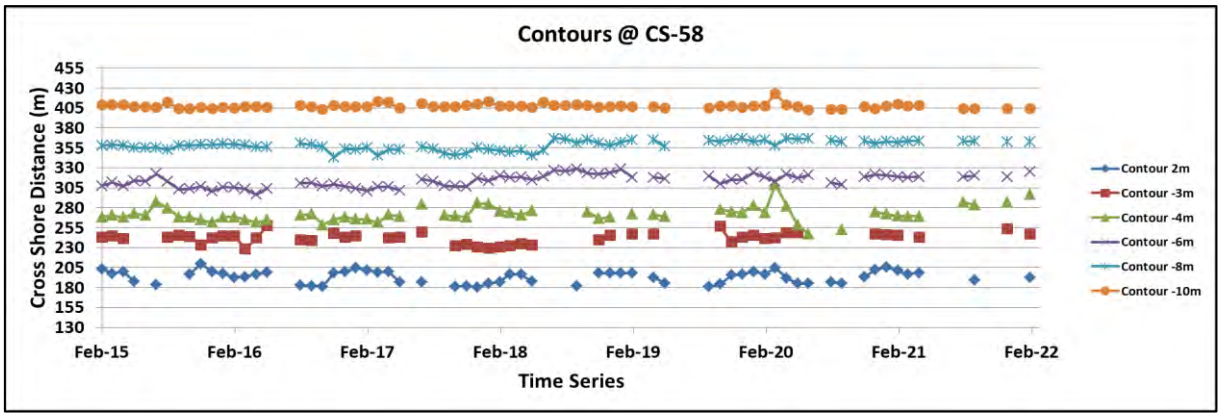
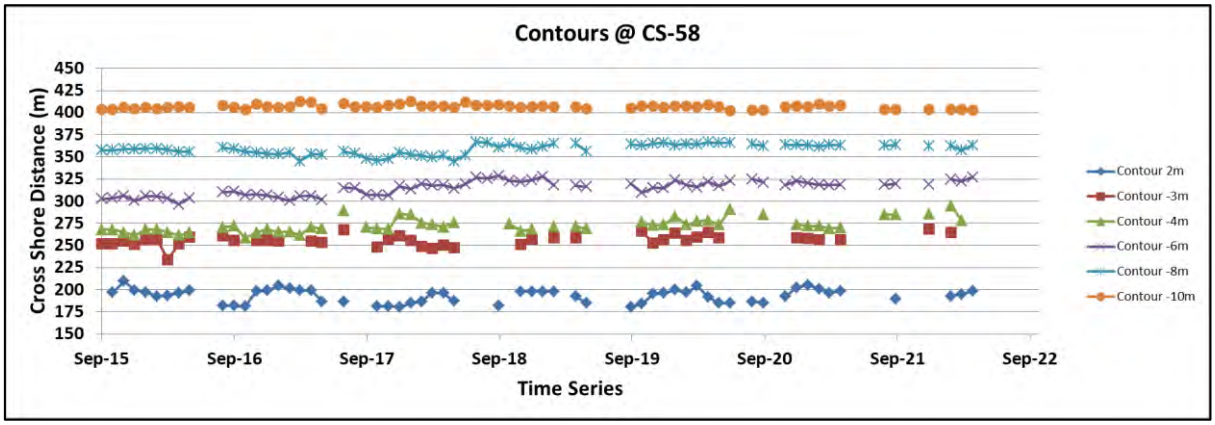
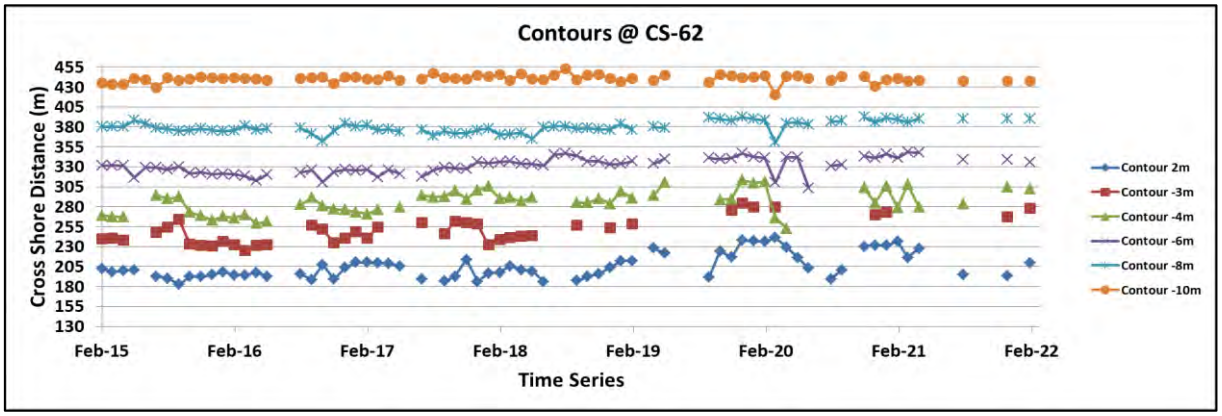


Figure 2-150 Time series of (–) 10 m contour at Beemapally and Cheriyathura (CS 58 & CS 62)

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 2-151.







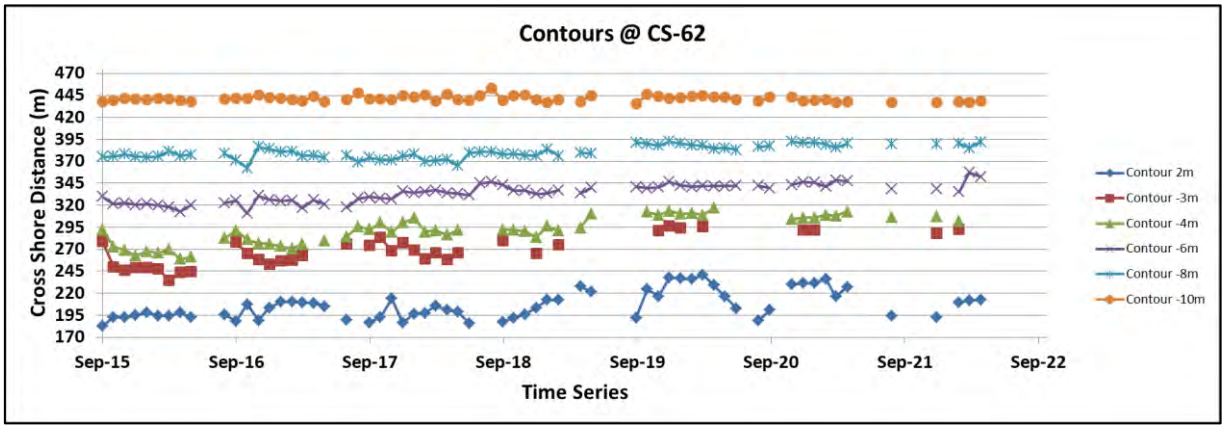


Figure 2-151 Continuous time series of contours at Beemapally and Cheriyathura (CS 58 & CS 62)

2.7.2.6 Stretch 6

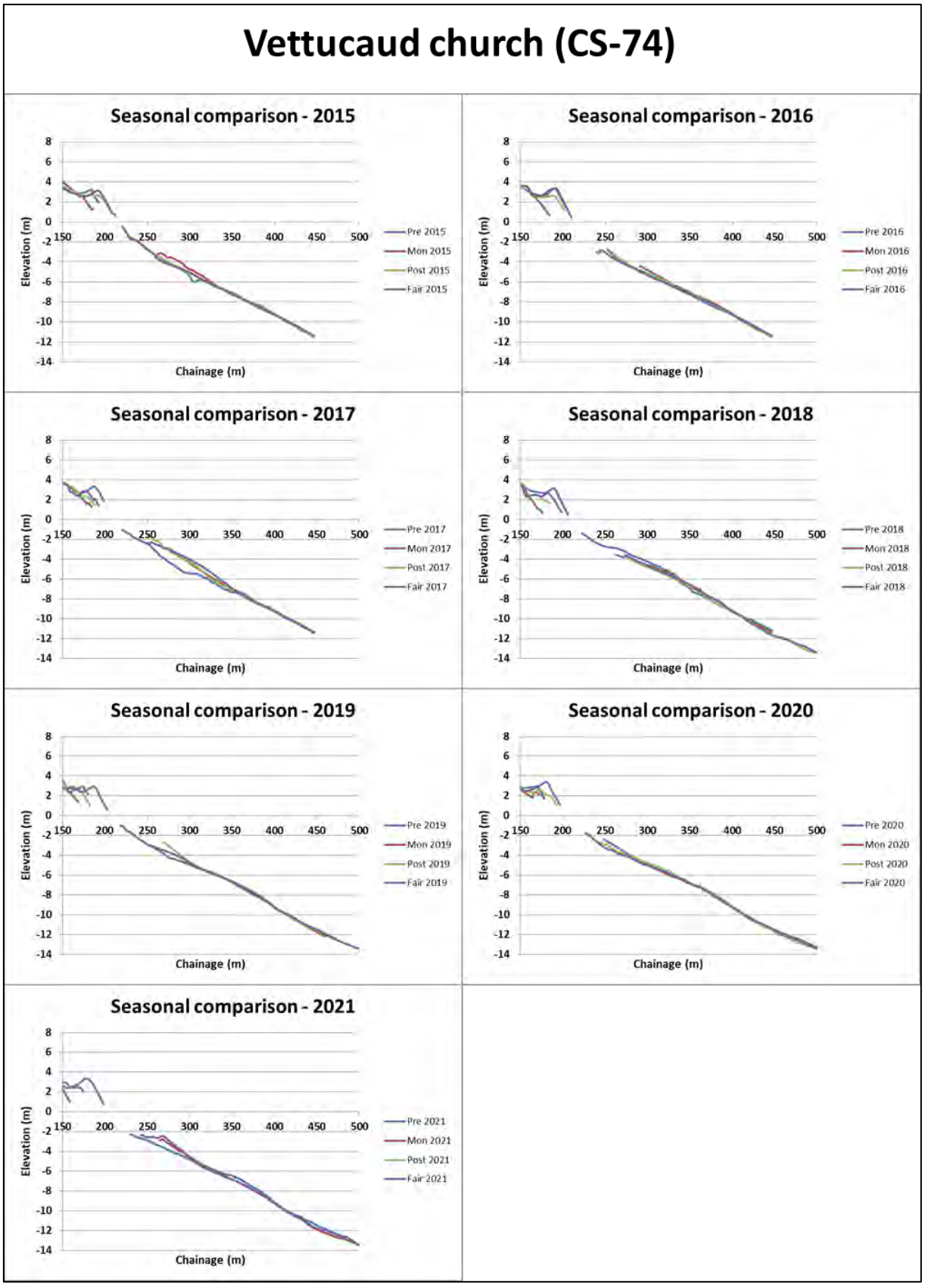


Figure 2-152 Profiles at Vettucaud (CS 74) – Seasonal comparison

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 seven years. From Figure 2-152, 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. Recently, this has been compounded by the prevalence of the higher events related to storms.

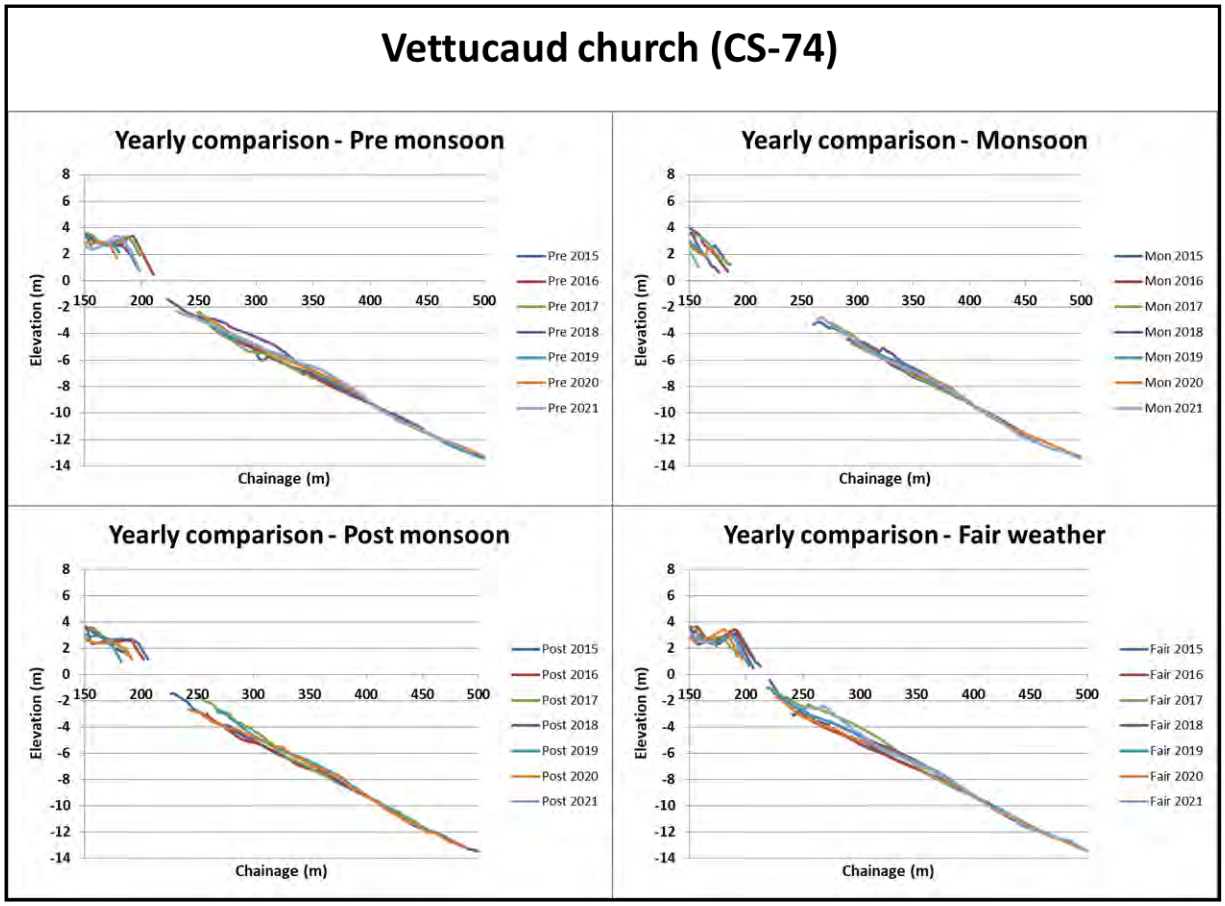


Figure 2-153 Profilesra at Vettucaud (CS 74) – Yearly comparison

Figure 2-153 plots represent comparison of profiles of season over different years. These plots suggest that yearly trend was as per normal sequence till post monsoon 2017. After this, the impact of Ockhi cyclone can be evidently noticed in fair weather 2017 and pre-monsoon 2018 seasonal profiles. The coast is undergoing processes to recover from this 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 over seven years 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.

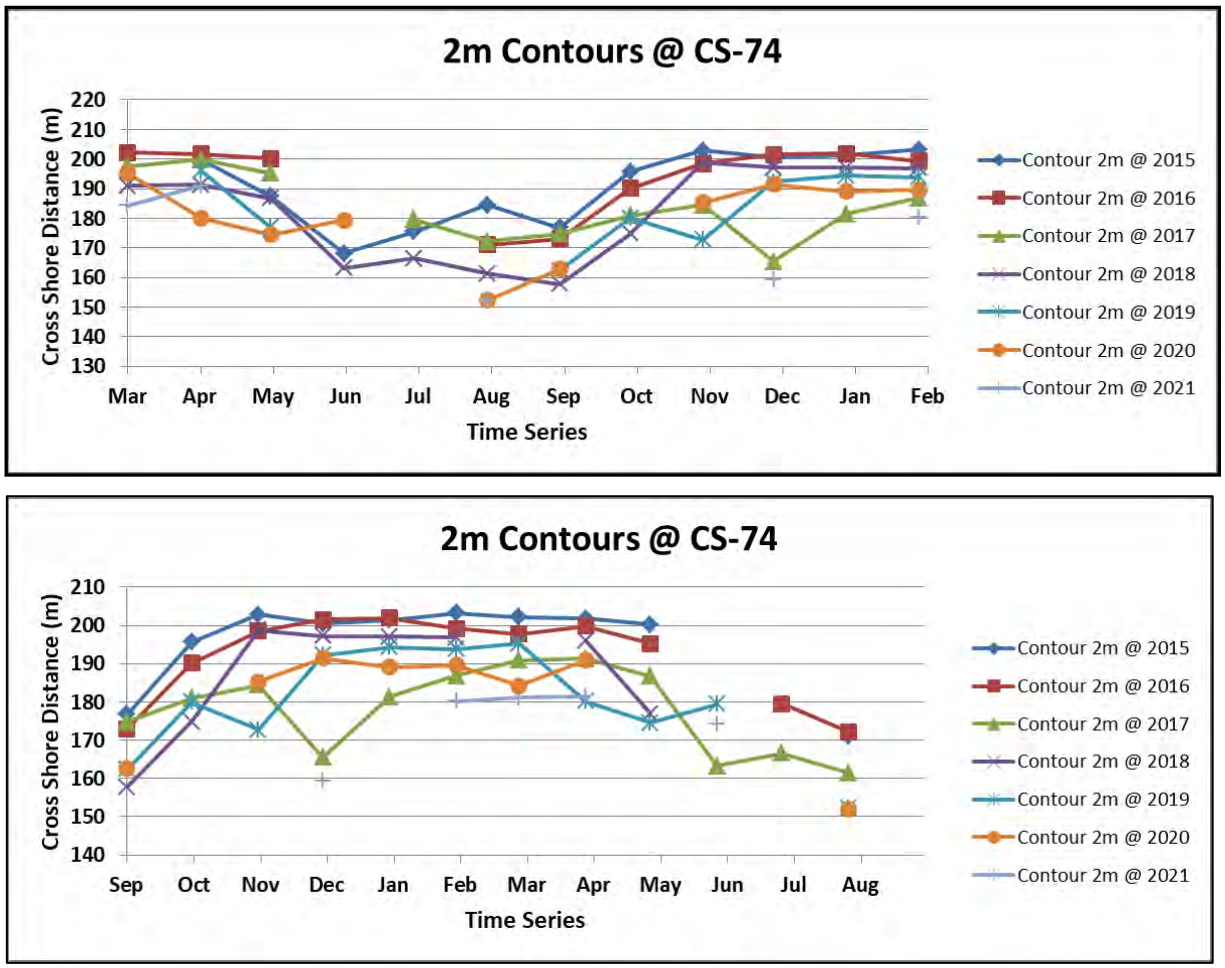
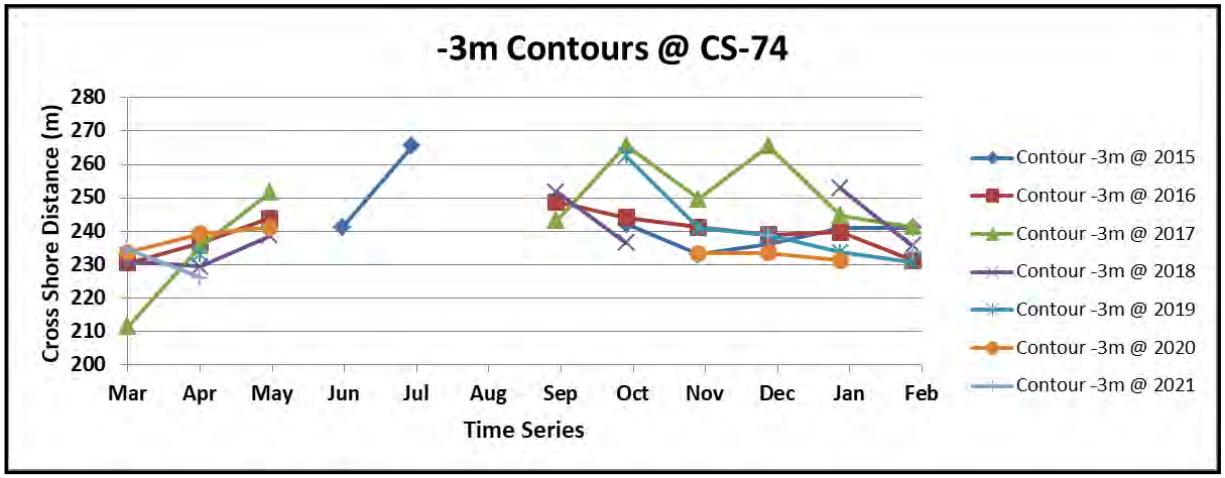


Figure 2-154 Time series of (+) 2 m contour at Vettucaud (CS 74)

Figure 2-154 was 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. The recent storms are proving to be further detrimental to the beach accretion.



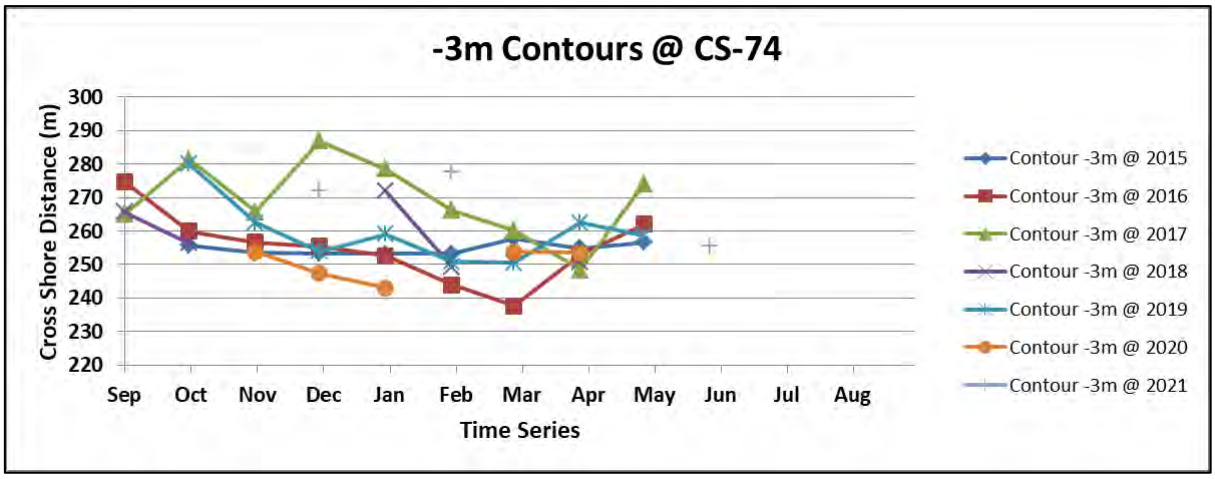
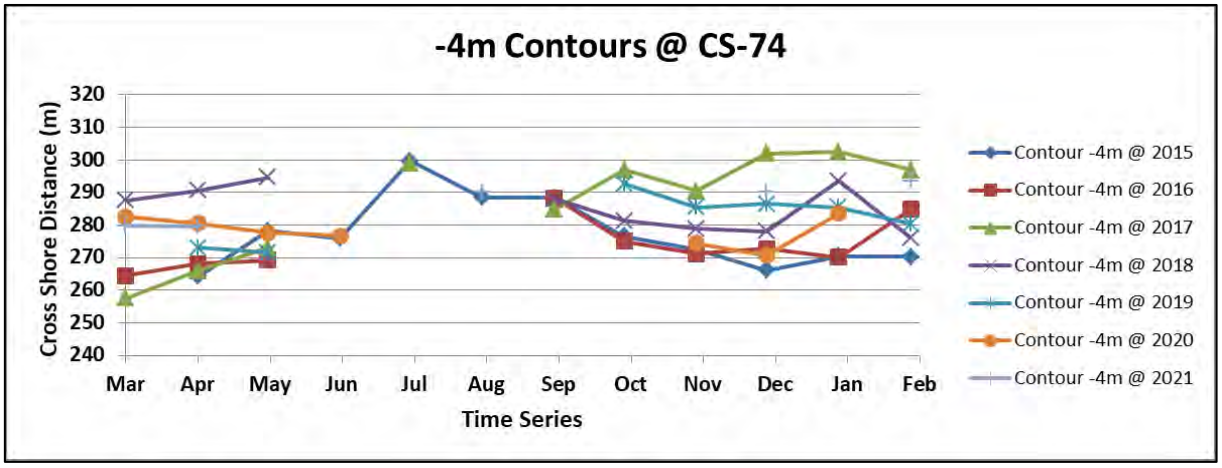


Figure 2-155 Time series of (–) 3 m contour at Vettucaud (CS 74)



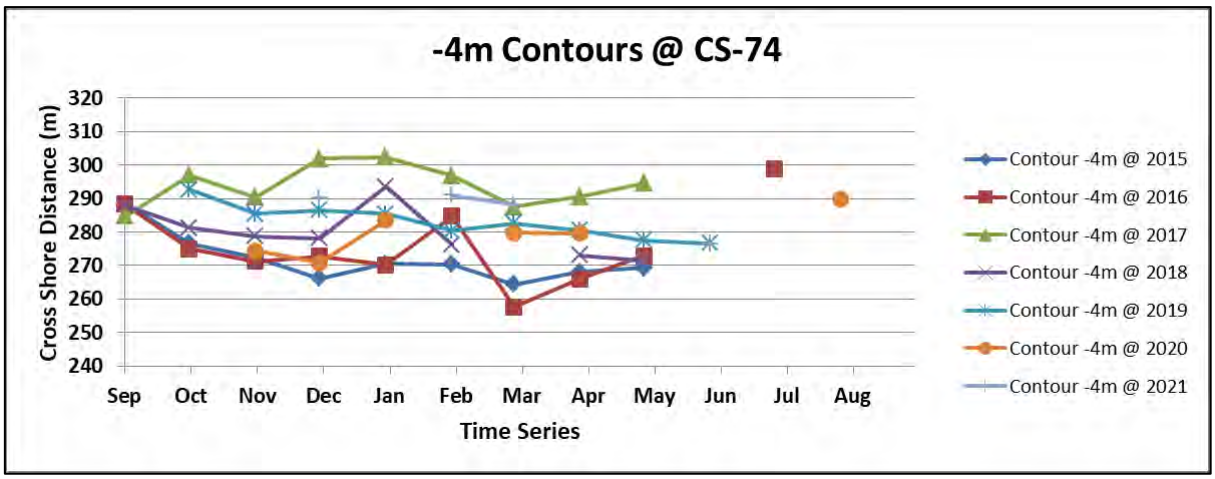


Figure 2-156 Time series of (–) 4 m contour at Vettucaud (CS 74)

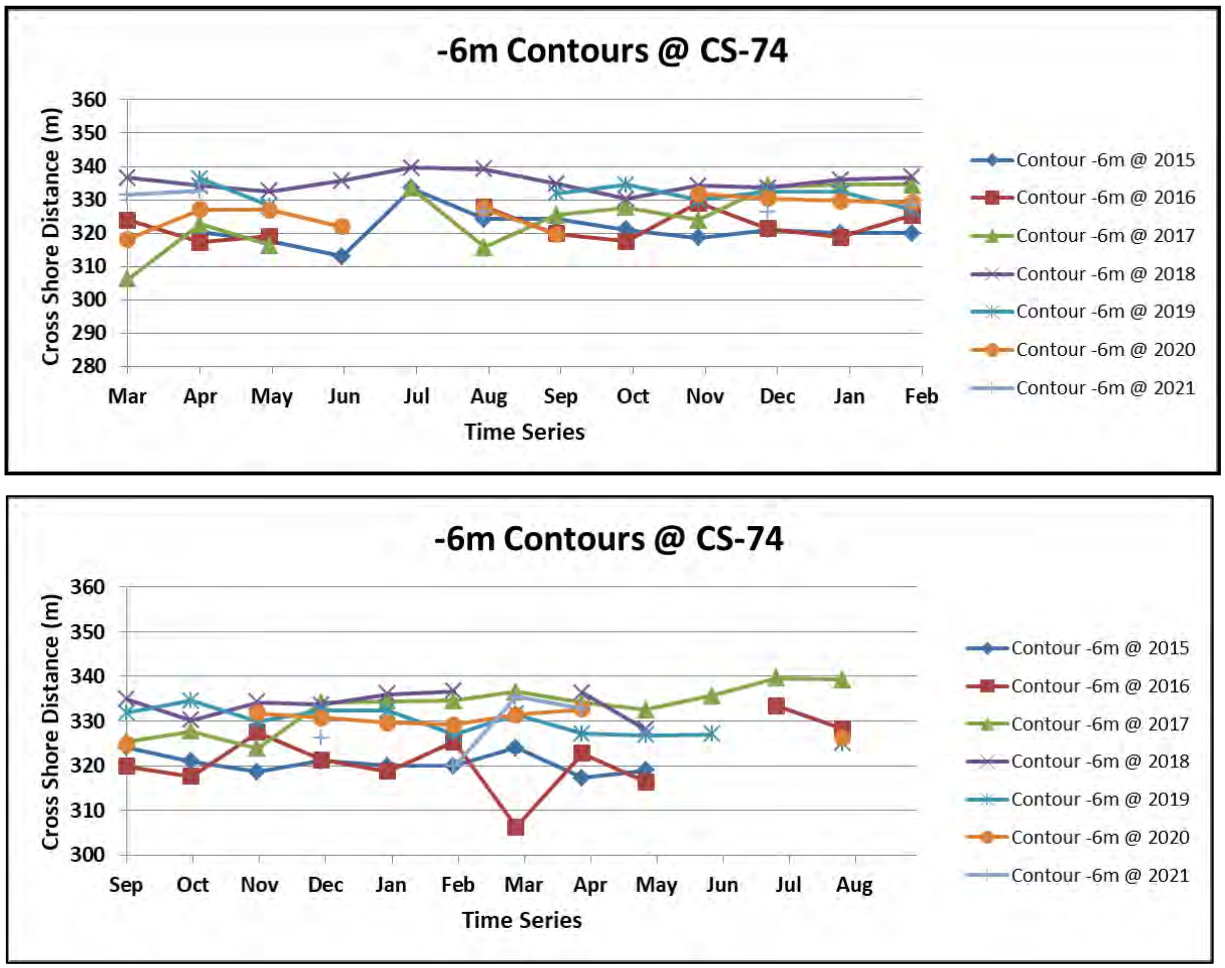
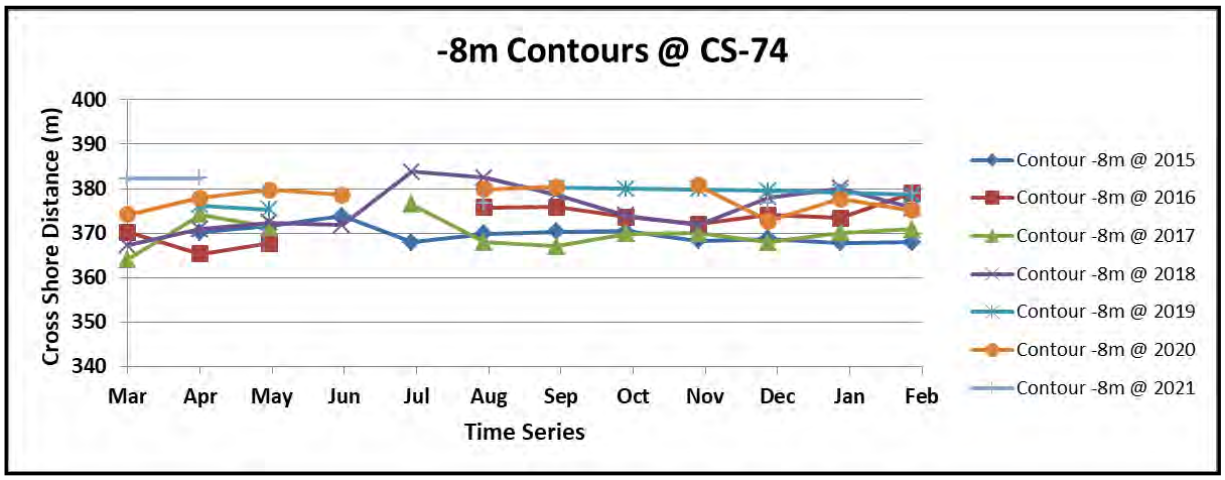


Figure 2-157 Time series of (–) 6 m contour at Vettucaud (CS 74)



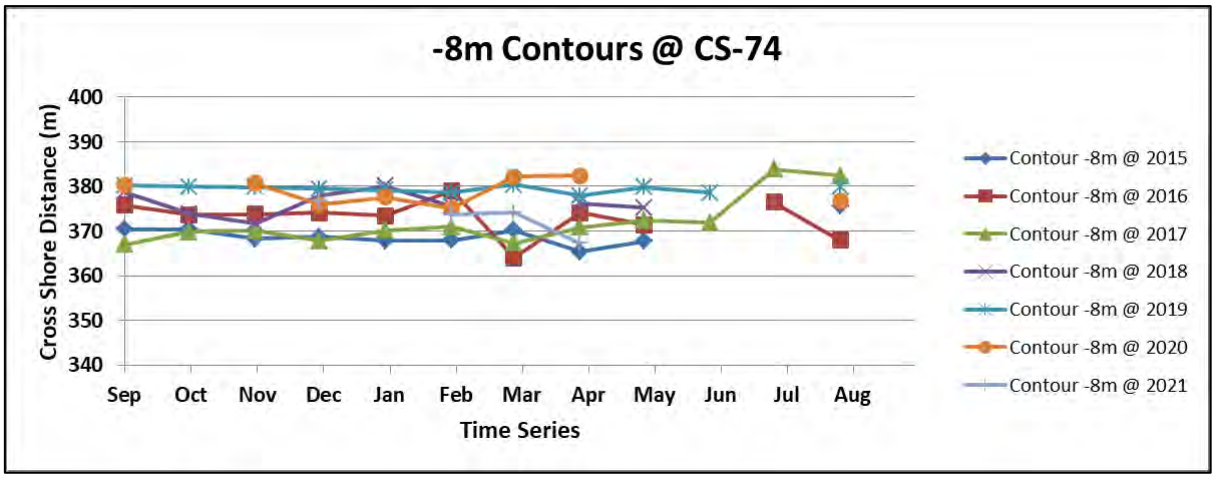
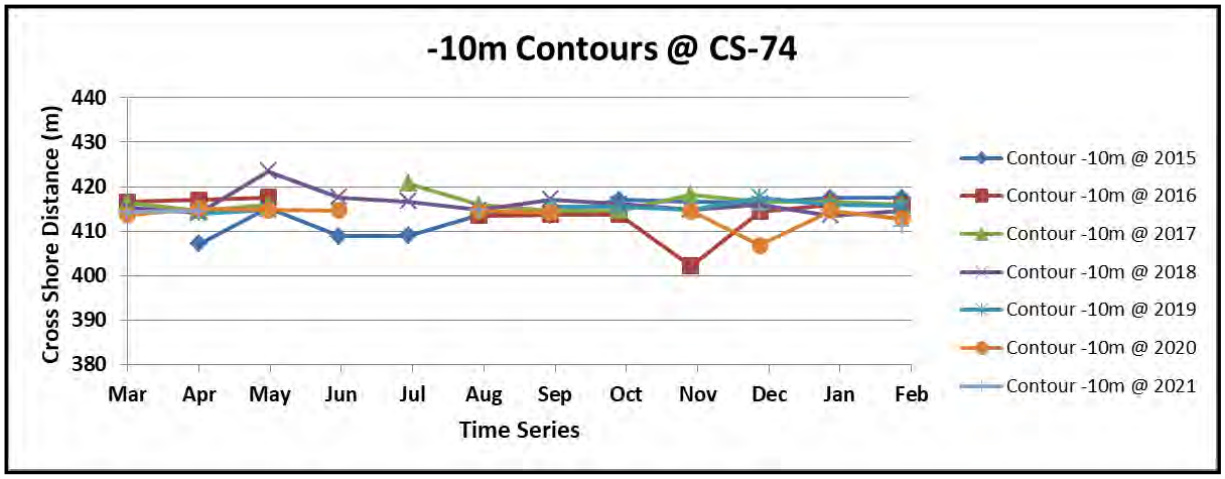


Figure 2-158 Time series of (–) 8 m contour at Vettucaud (CS 74)



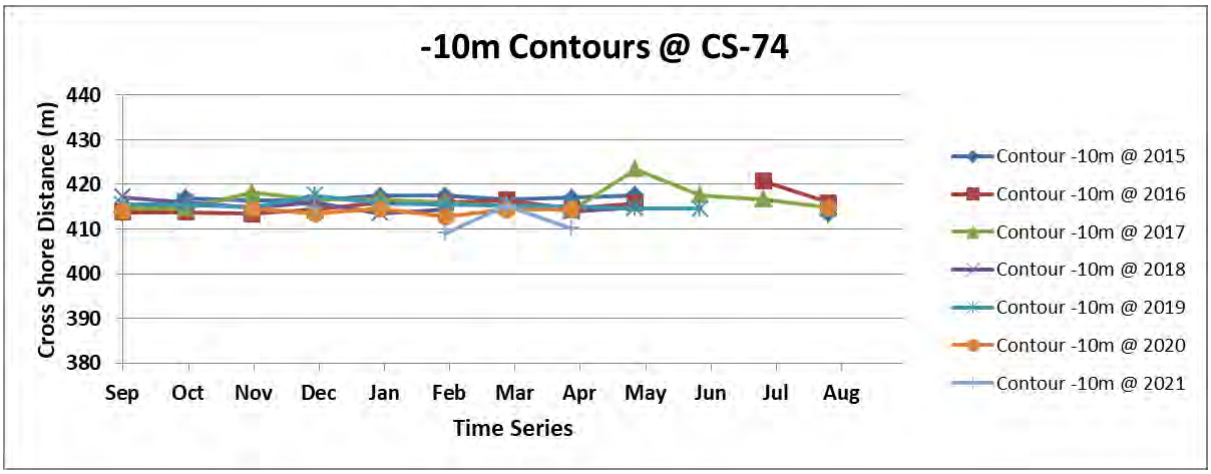


Figure 2-159 Time series of (–) 10 m contour at Vettucaud (CS 74)

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 2-160.

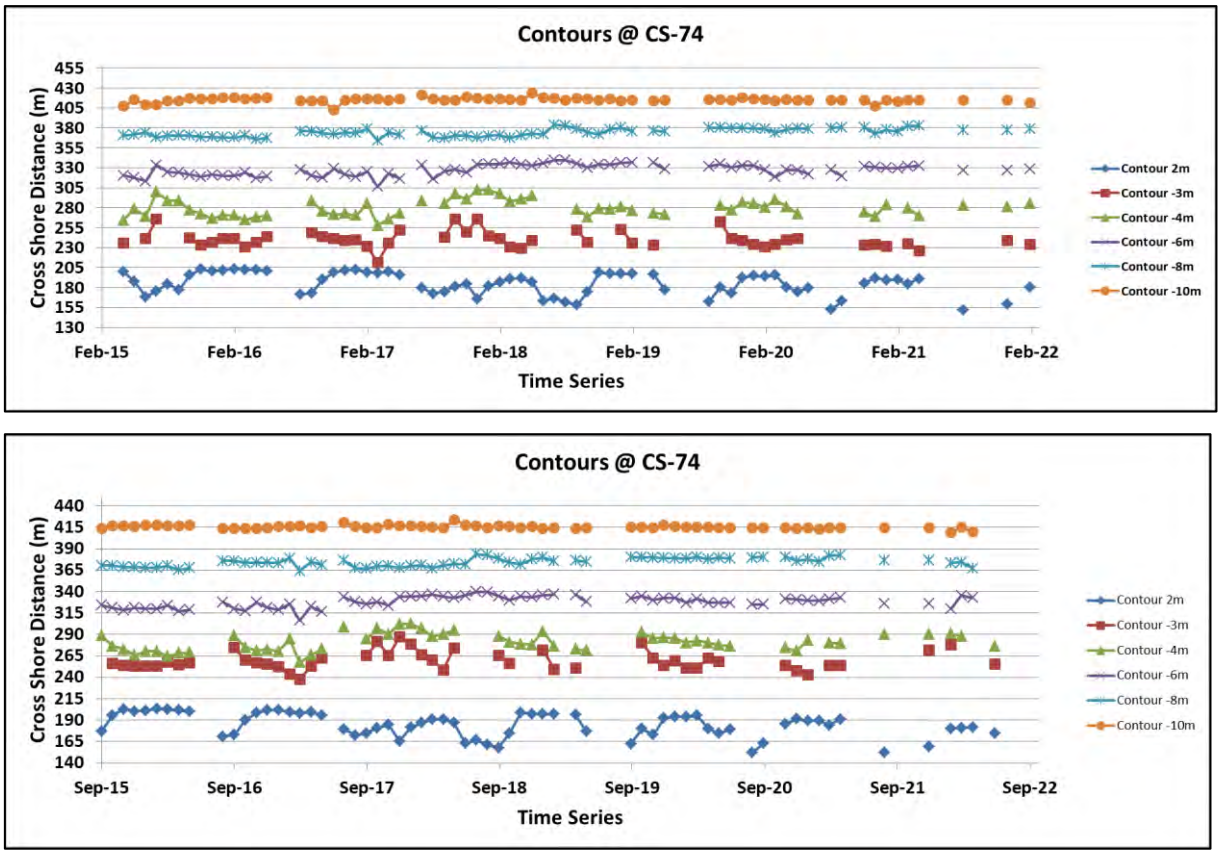


Figure 2-160 Continuous time series of contours at Vettucaud (CS 74)

Figure 2-160 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. This phenomenon in turn indicates that cross shore transport is predominant in this stretch.

2.7.3 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.

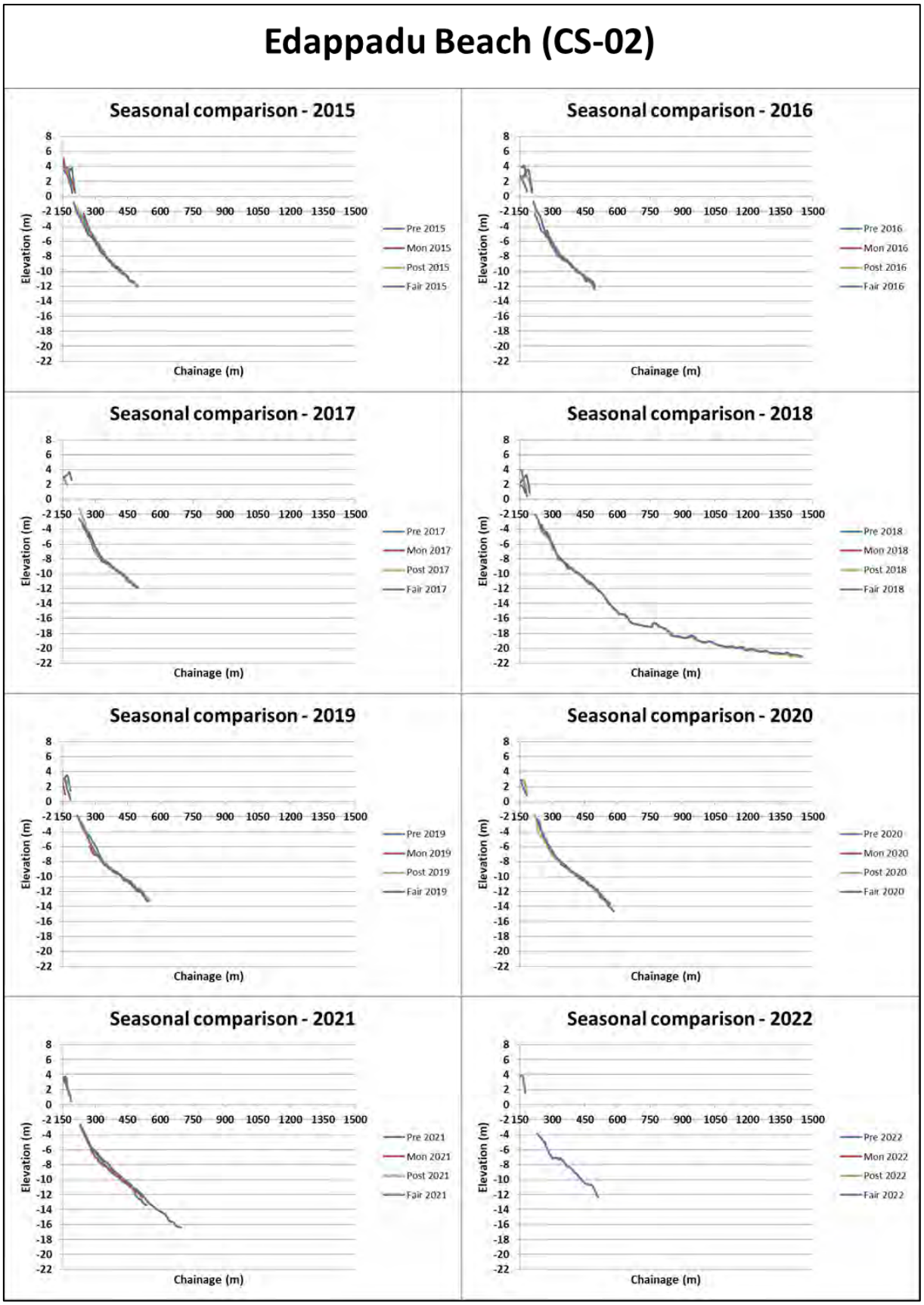


Figure 2-161 Profiles at Edappadu beach (CS 02) – Seasonal comparison

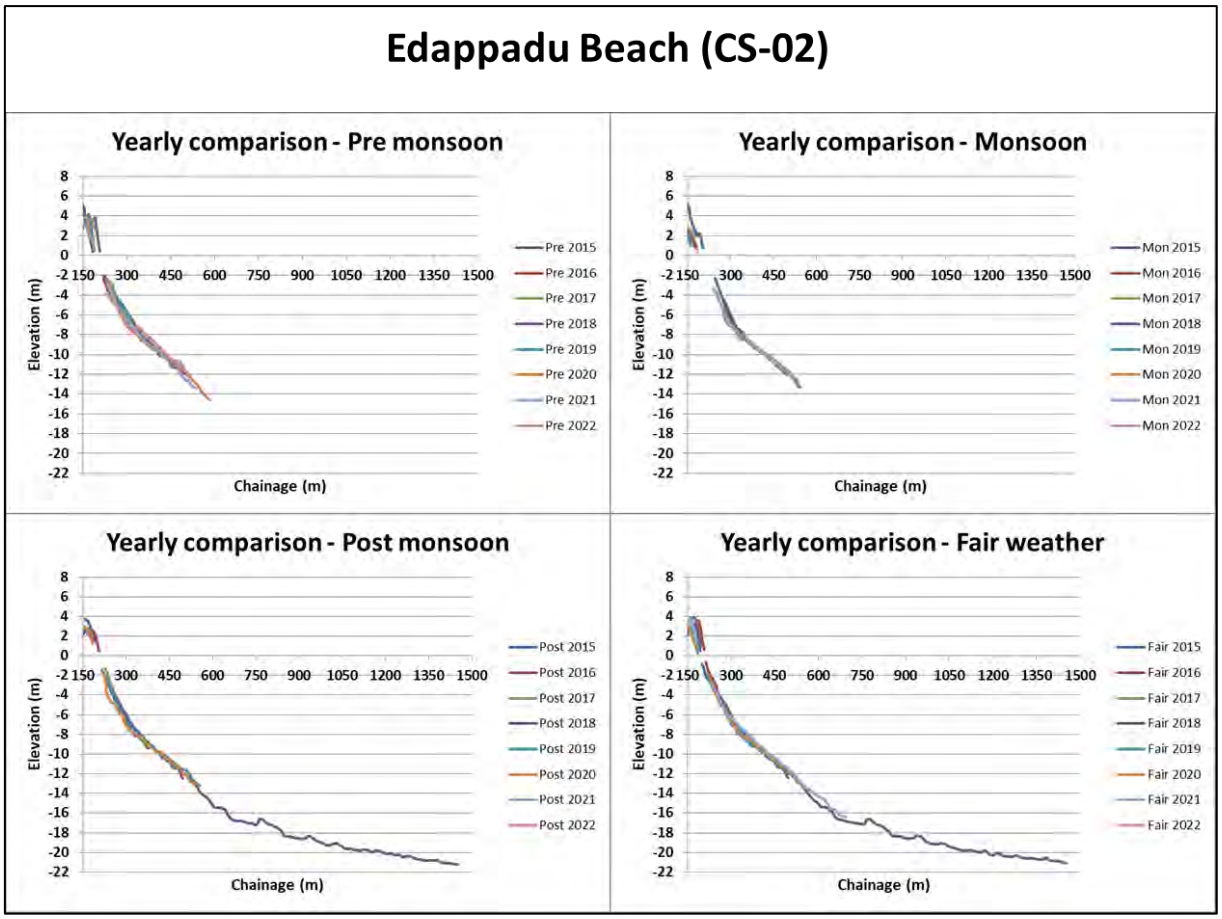


Figure 2-162 Profiles at Neerody (CS 07) – Yearly comparison

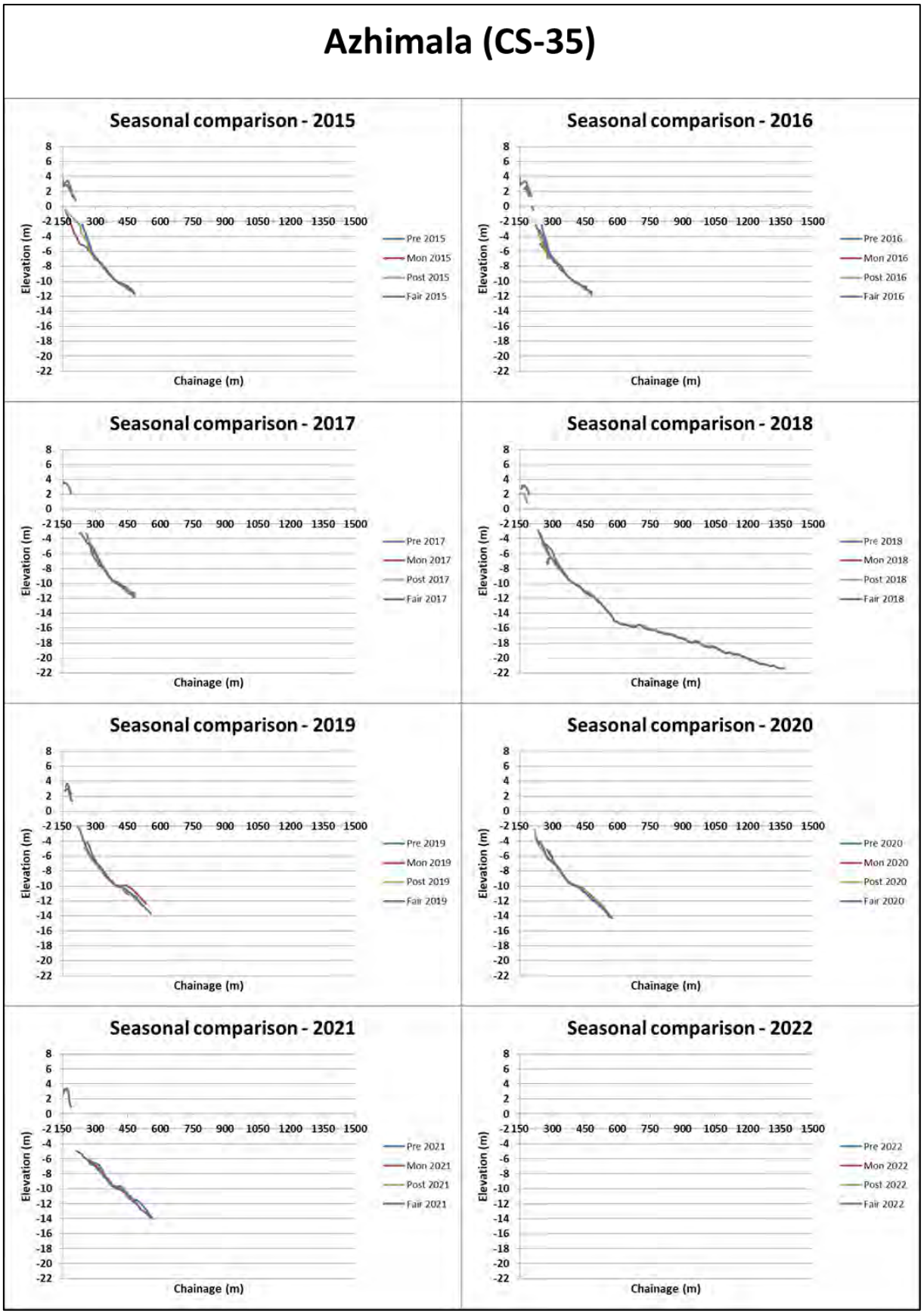


Figure 2-163 Profiles at Azhimala (CS 35) – Seasonal comparison

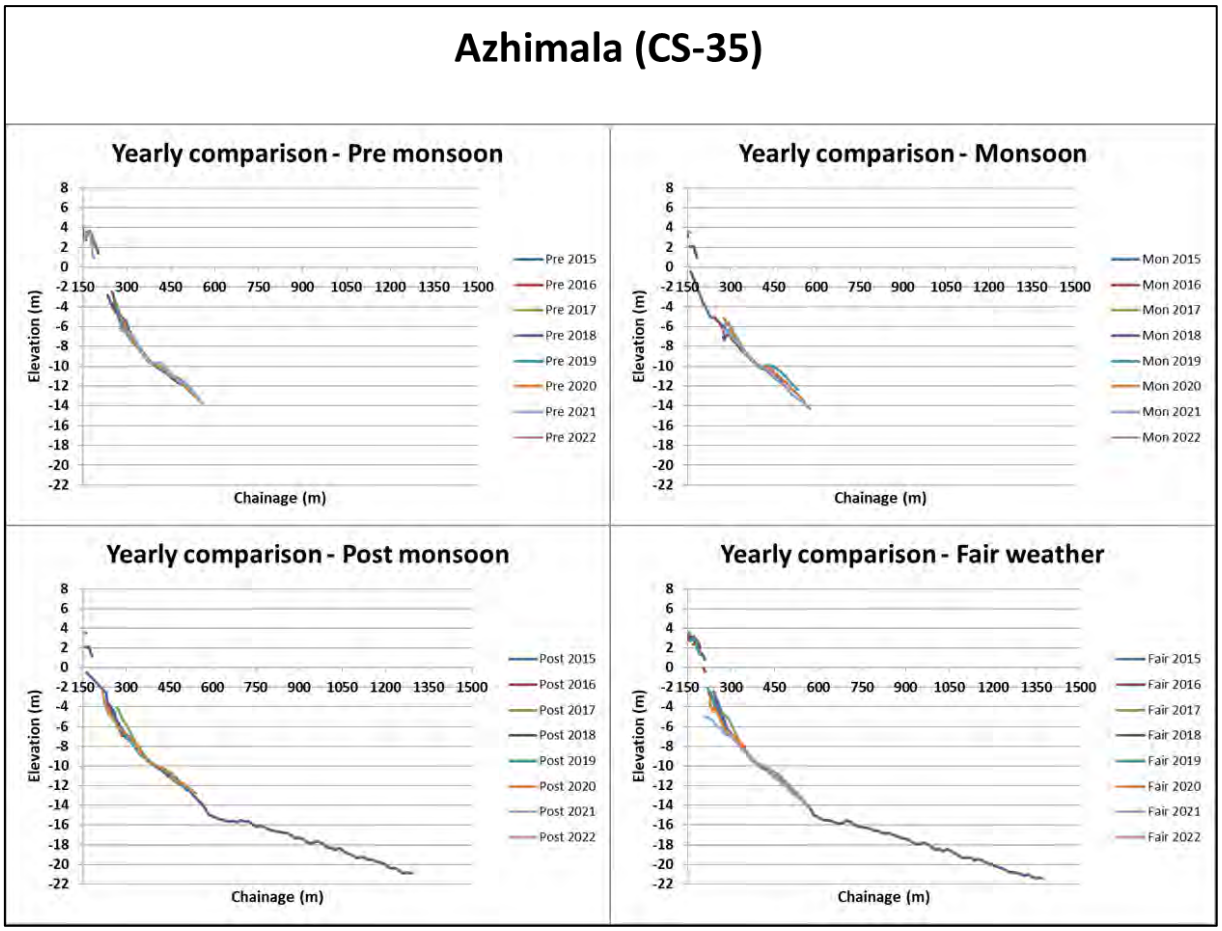


Figure 2-164 Profiles at Azhimala (CS 35) – Yearly comparison

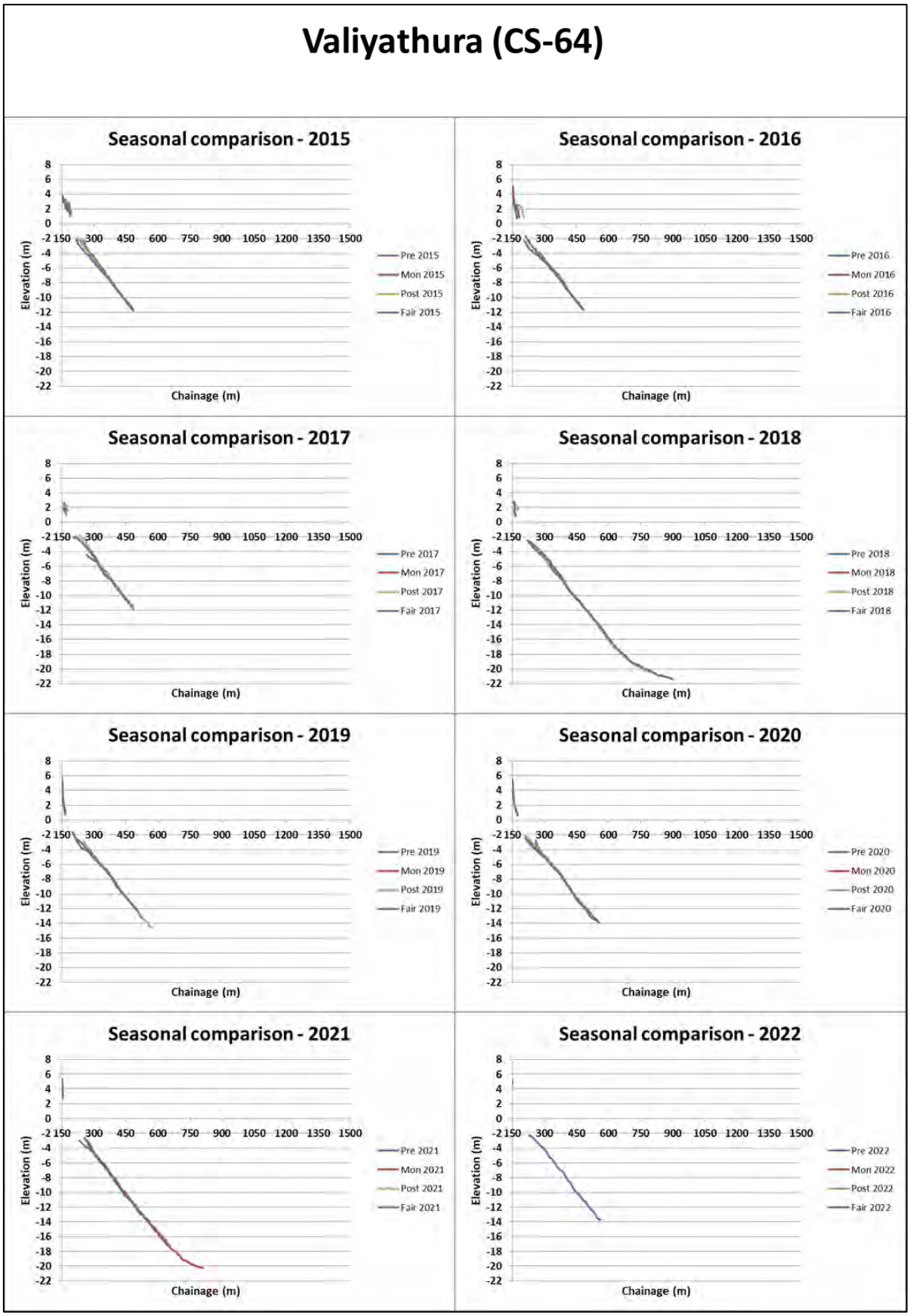


Figure 2-165 Profiles at Valiyathura (CS 64) – Seasonal comparison

Valiyathura (CS-64)

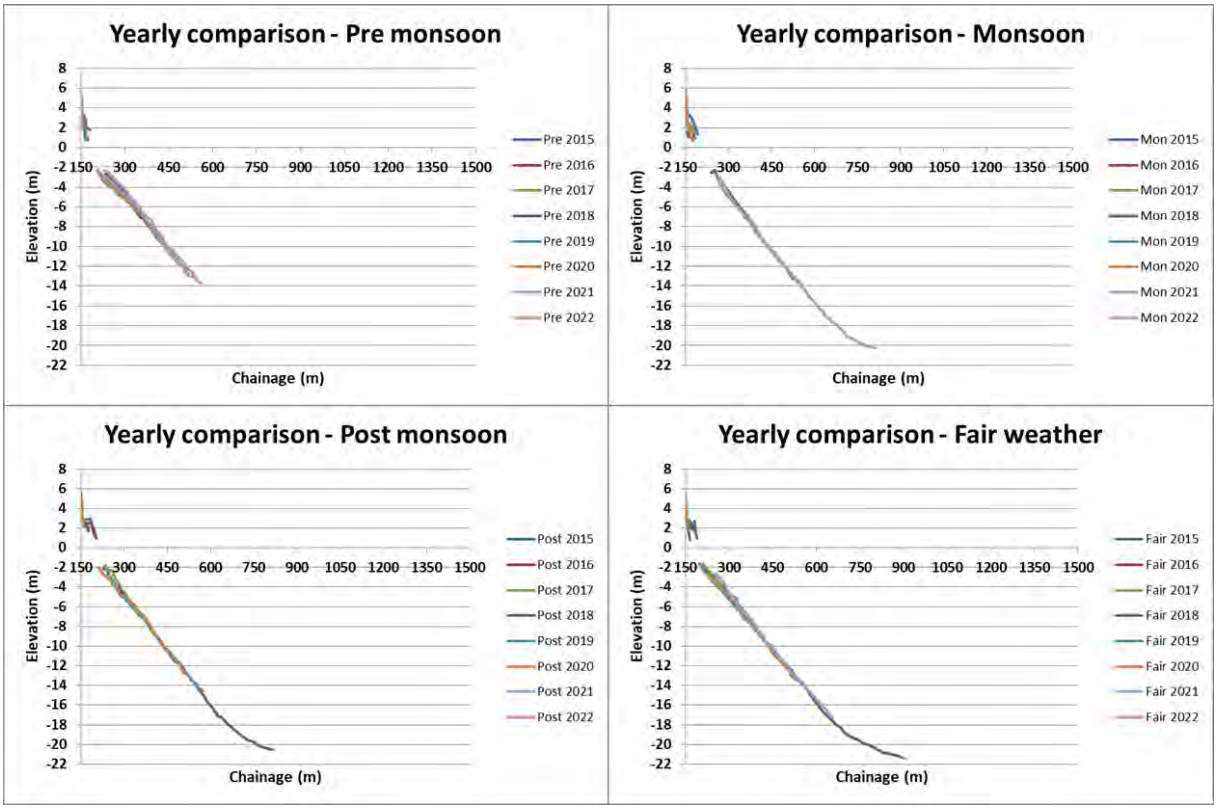


Figure 2-166 Profiles at Valiyathura (CS 64) – Yearly comparison

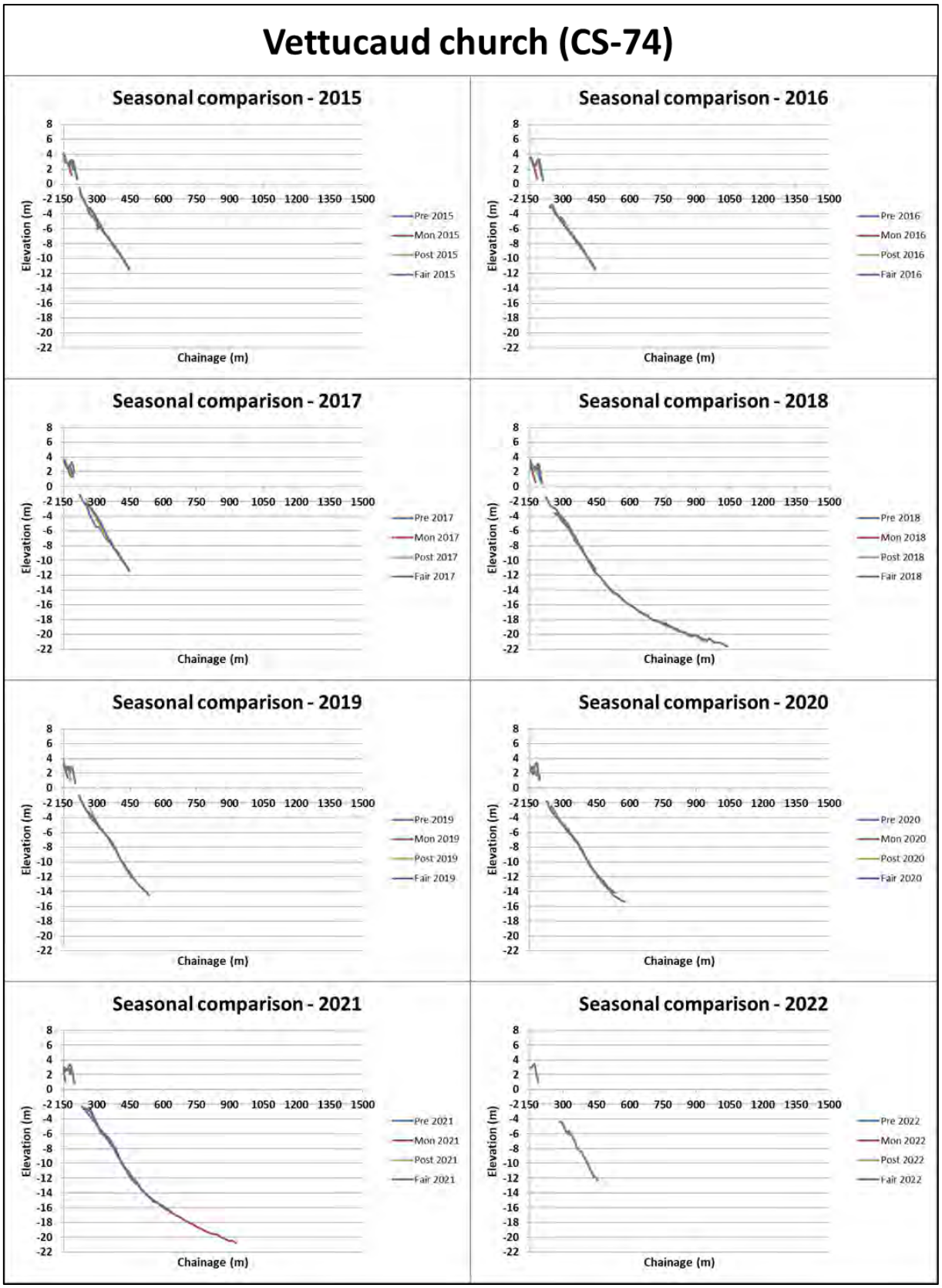


Figure 2-167 Profiles at Vettucaud Church (CS 74) – Seasonal comparison

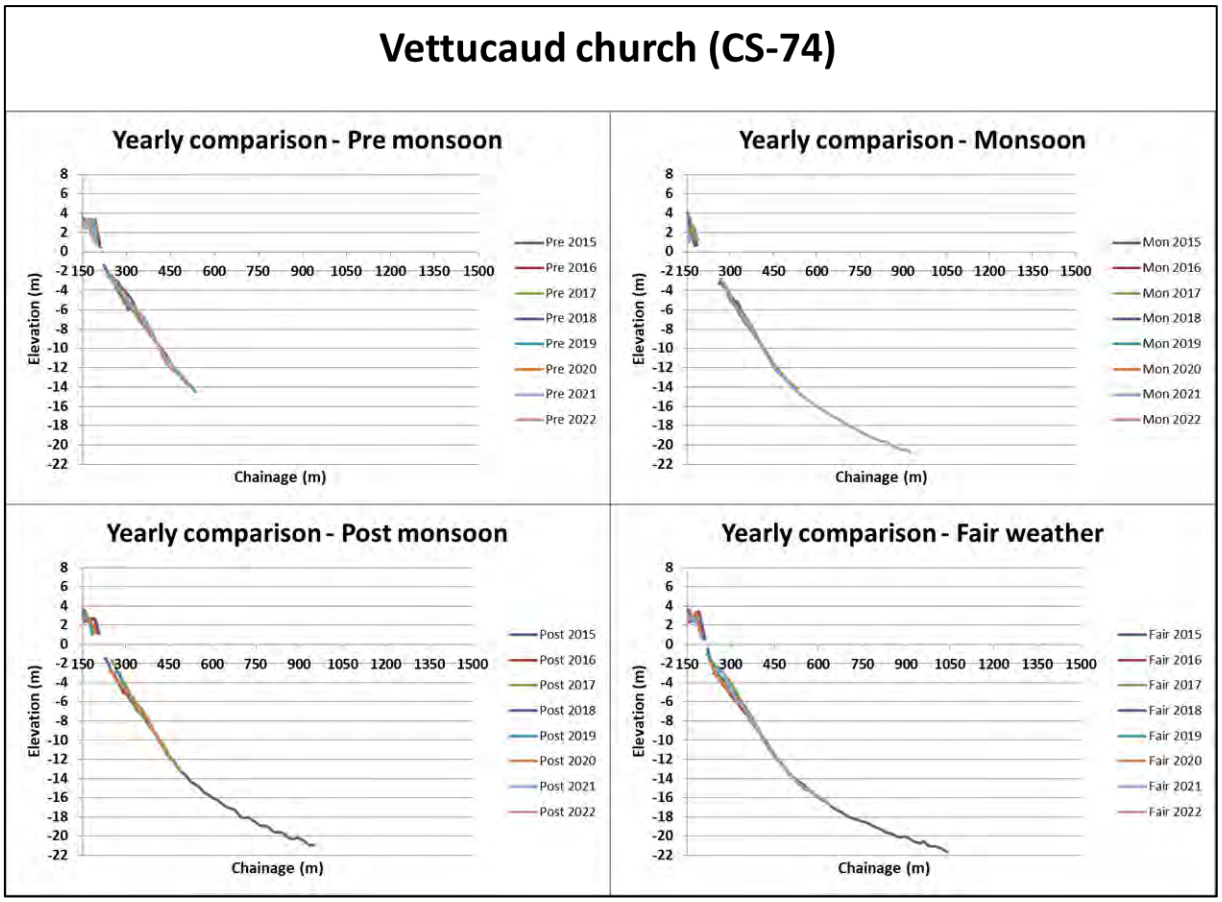


Figure 2-168 Profiles at Vettucaud Church (CS 74) – Yearly comparison

2.7.4 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 2-169 to Figure 2-174 show the variation of contours with respect to contours of February 2016. February 2016 was taken as the reference year in this case. Figure 2-175 to Figure 2-180 shows the variation of contours relative to the previous year (yearly rates).

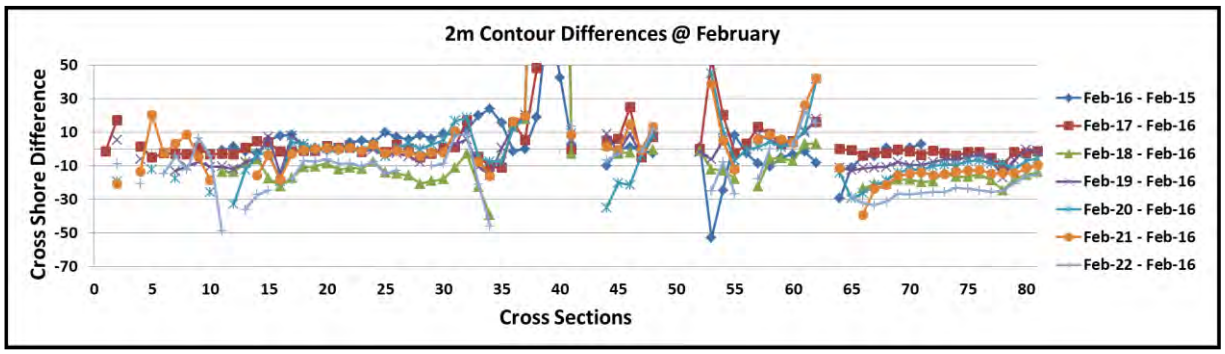


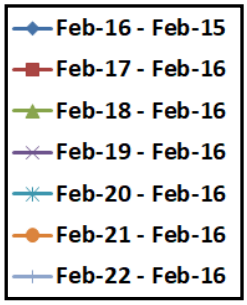
Figure 2-169 Alongshore comparison of (+) 2m contour differences during February

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 2-169 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). 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 were shown in Figure 2-170 to Figure 2-174.



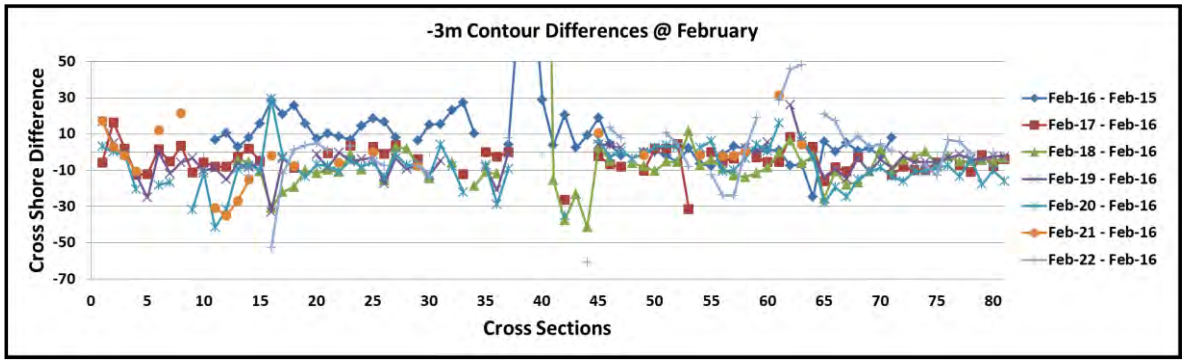


Figure 2-170 Alongshore comparison of (-) 3m contour differences during February

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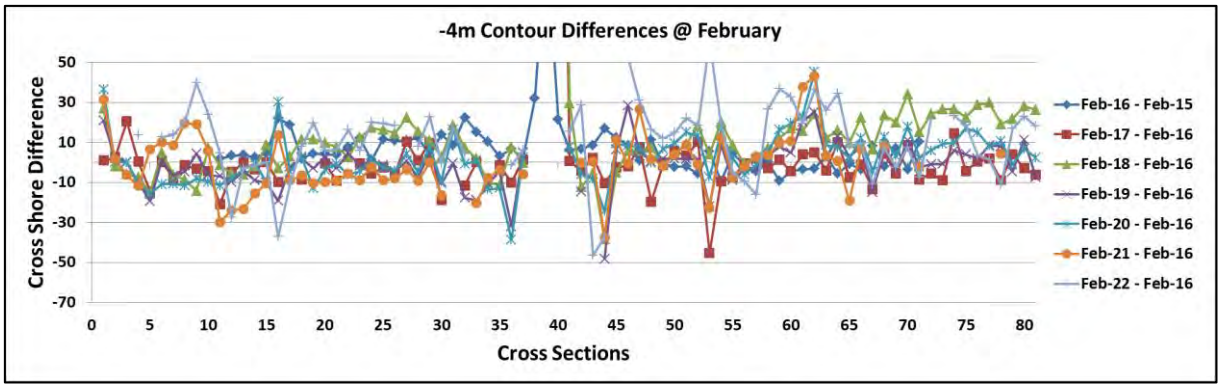


Figure 2-171 Alongshore comparison of (-) 5m contour differences during February

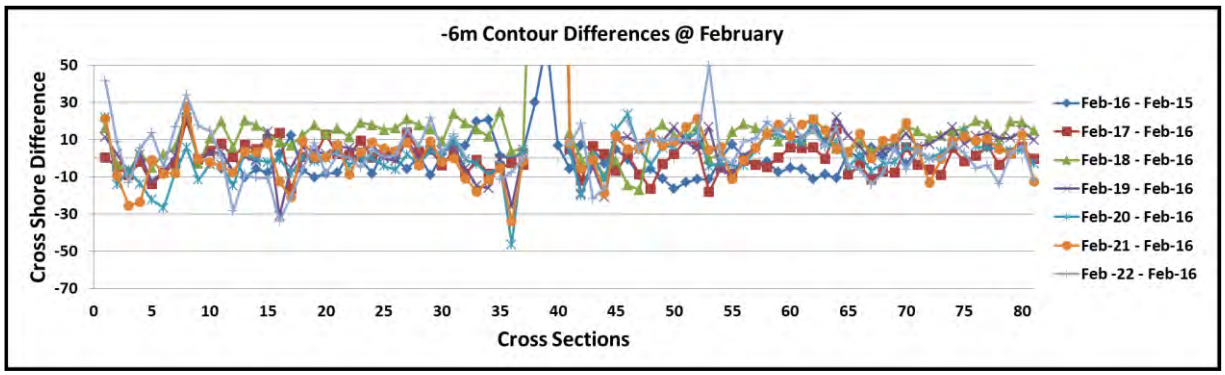


Figure 2-172 Alongshore comparison of (-) 6m contour differences during February

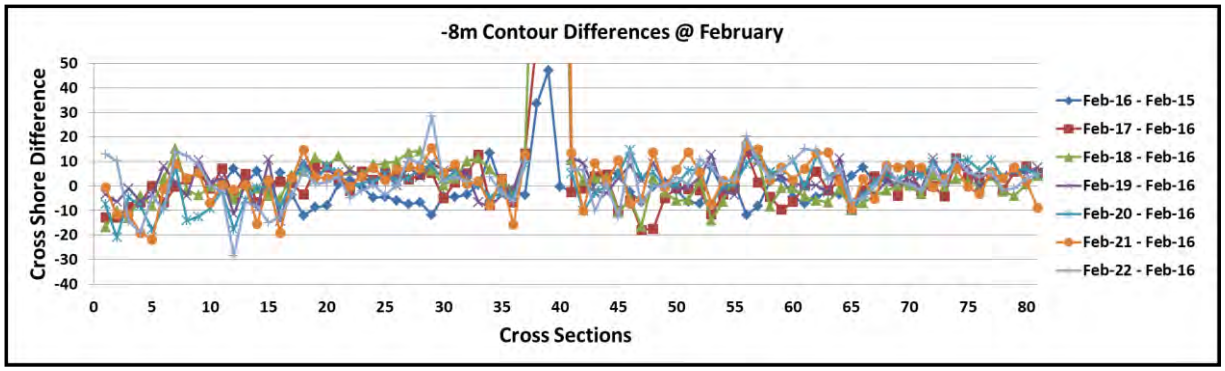


Figure 2-173 Alongshore comparison of (-) 8m contour differences during February

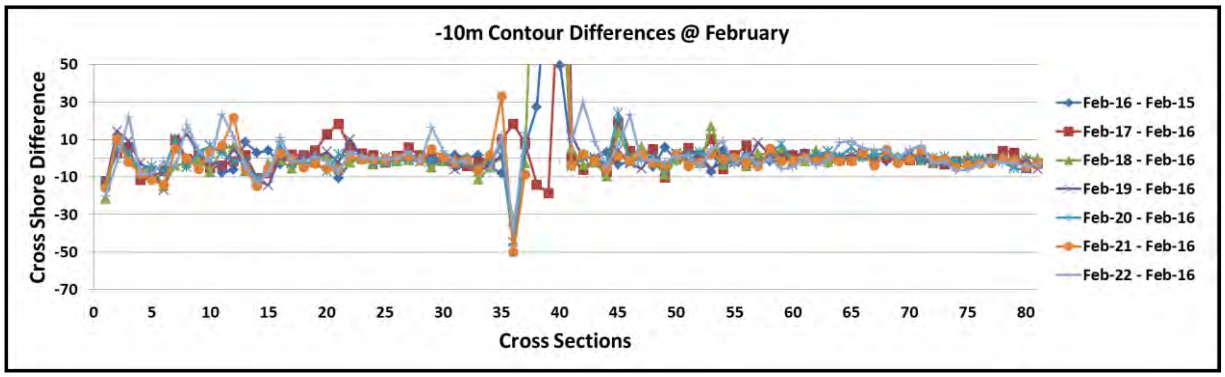


Figure 2-174 Alongshore comparison of (-) 10m contour differences during February

2.7.5 Alongshore comparison of contour yearly rates

LNTIEL analysed the yearly rates during February month. Figure 2-175 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). Post Ockhi coast experienced seasonal variations and rates can be noticed from Feb-19 – Feb-18 series (Violet) and Feb-20 – Feb-19 series (Cyan). From these we can observe 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.

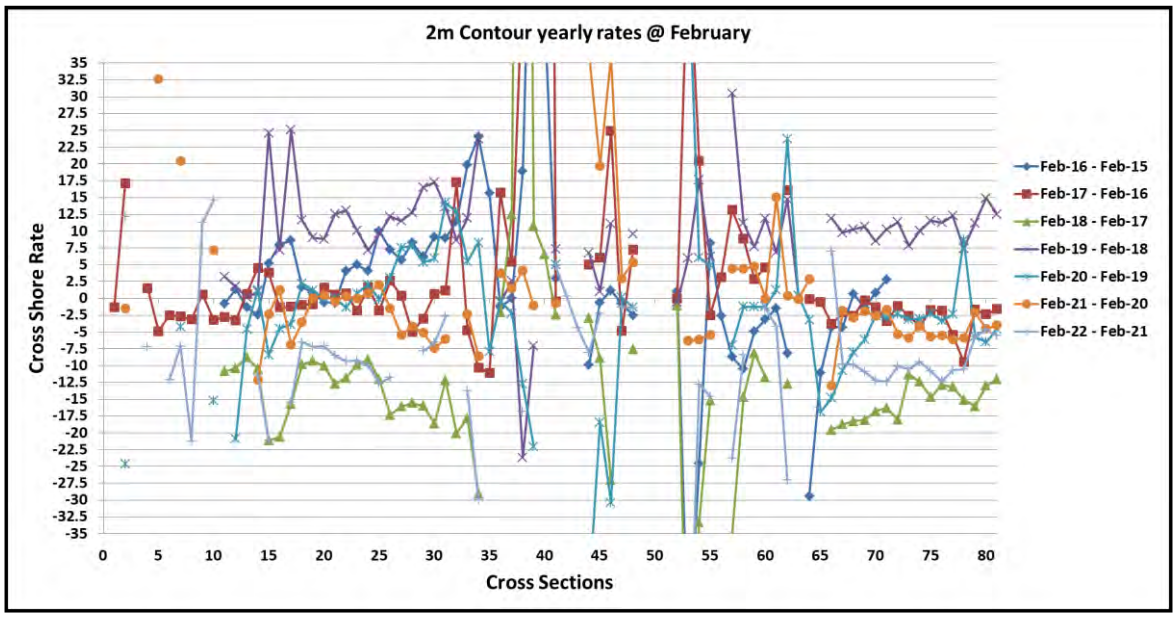


Figure 2-175 Alongshore comparison of (+) 2m contour yearly rates during February

Similarly, -3m, -4m, -6m, -8m and -10m contour differences are shown in Figure 2-176 to Figure 2-180.

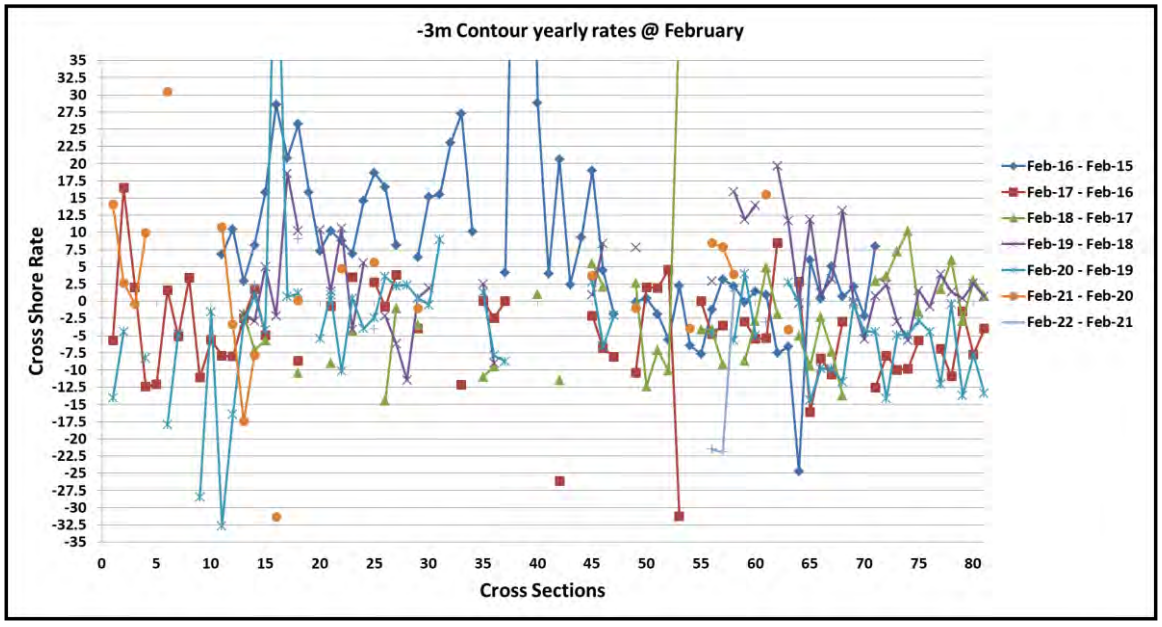


Figure 2-176 Alongshore comparison of (-) 3m contour yearly rates during February

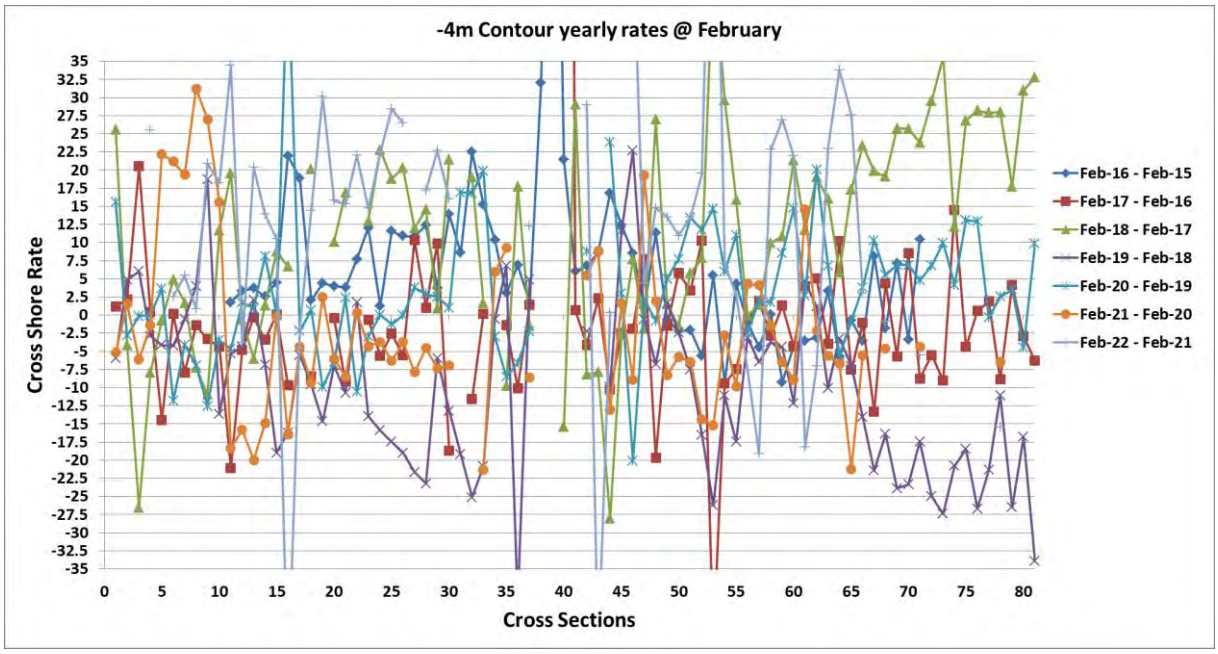


Figure 2-177 Alongshore comparison of (-) 4m contour yearly rates during February

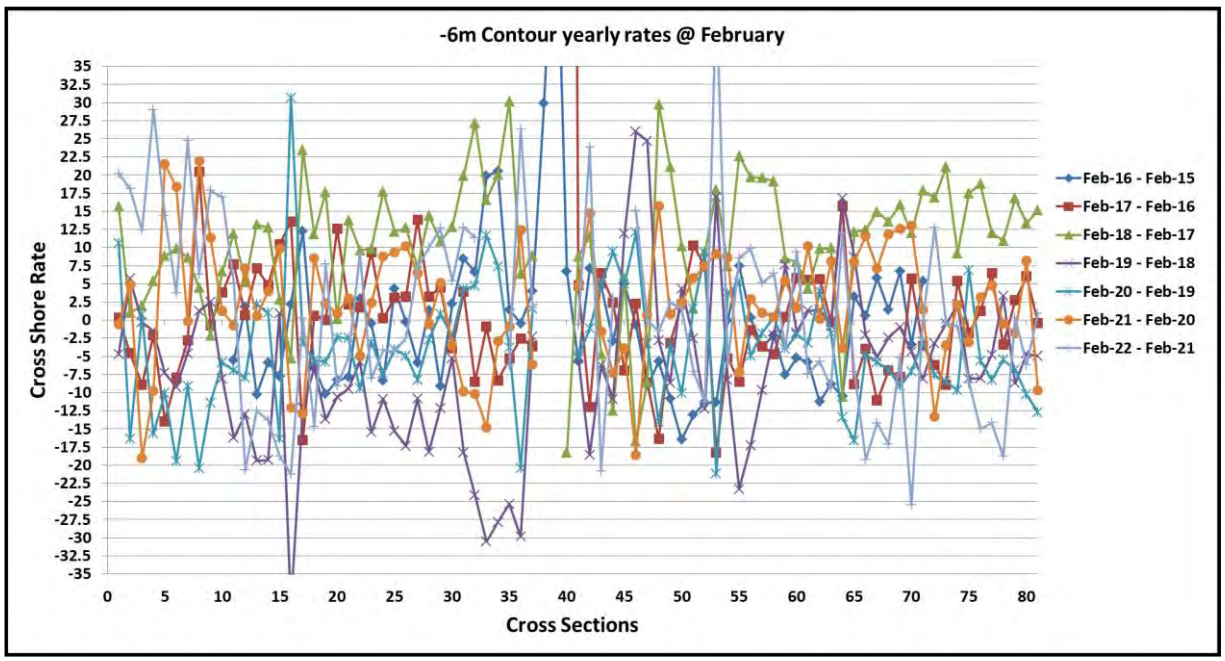


Figure 2-178 Alongshore comparison of (-) 6m contour yearly rates during February

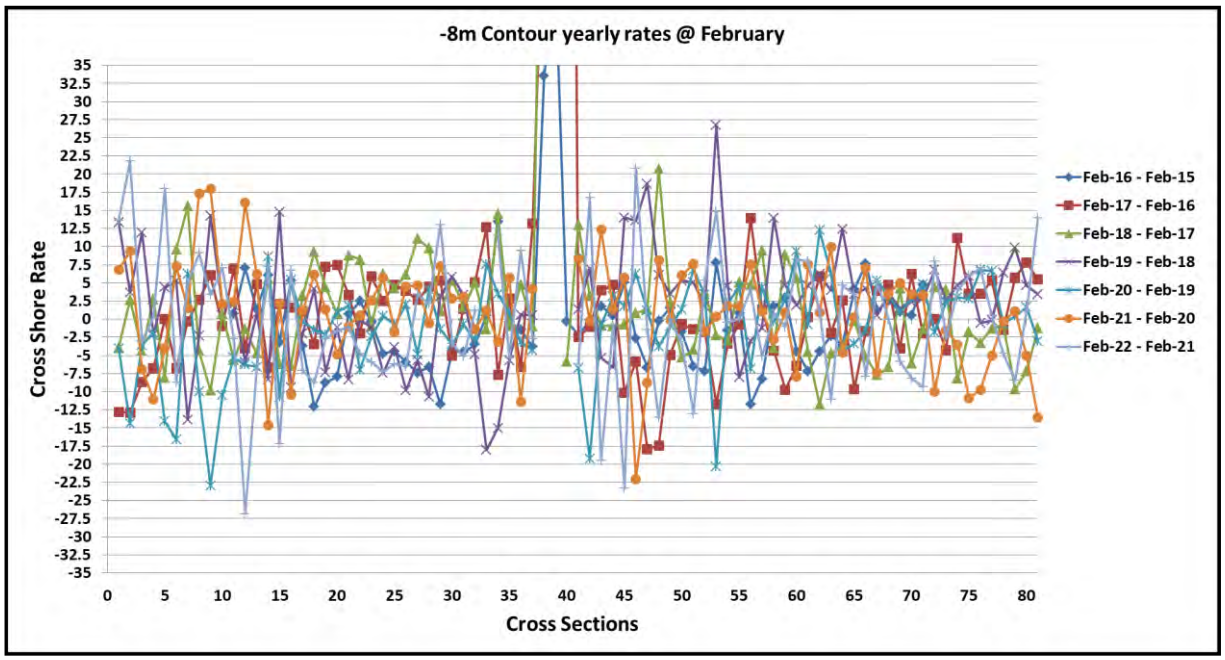


Figure 2-179 Alongshore comparison of (-) 8m contour yearly rates during February

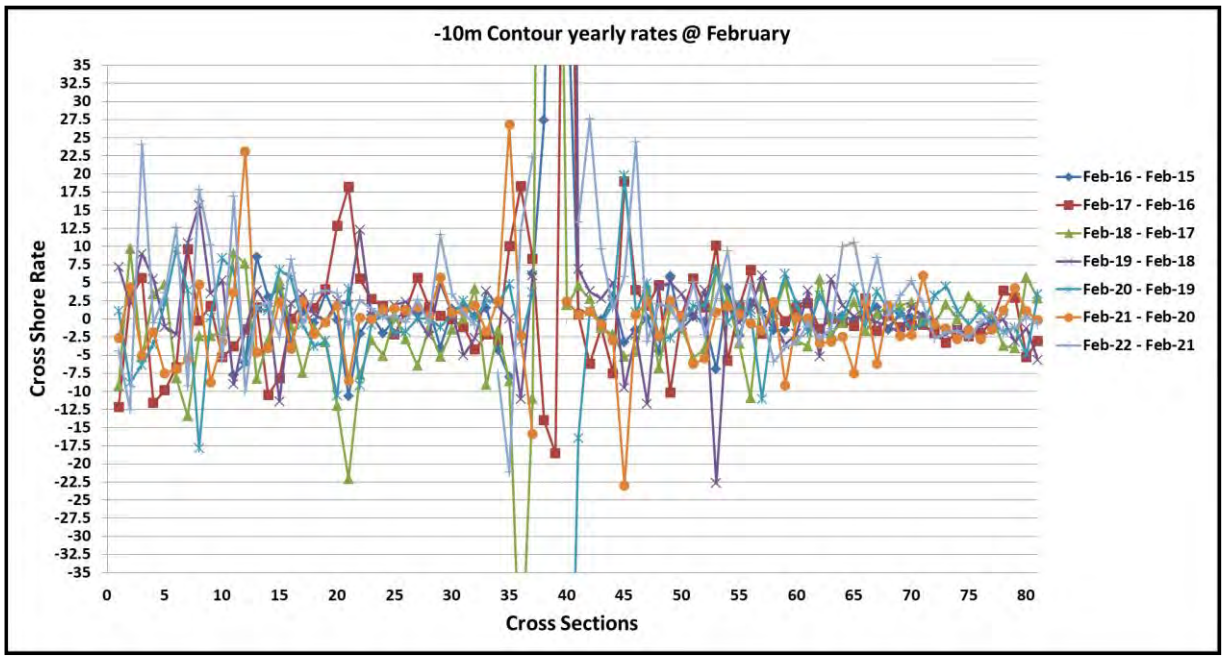


Figure 2-180 Alongshore comparison of (-) 10m contour yearly rates during February

2.7.6 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 2-181 to Figure 2-189. The respective DoCs are shown in plots with dash lines and their intersection points are also shown.

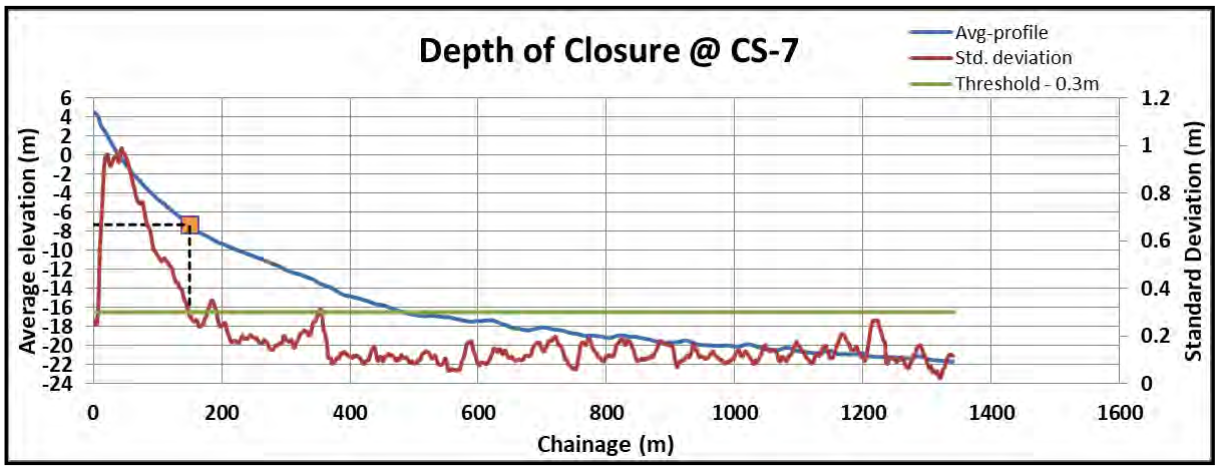


Figure 2-181 Depth of closure at Neerody location (CS 7)

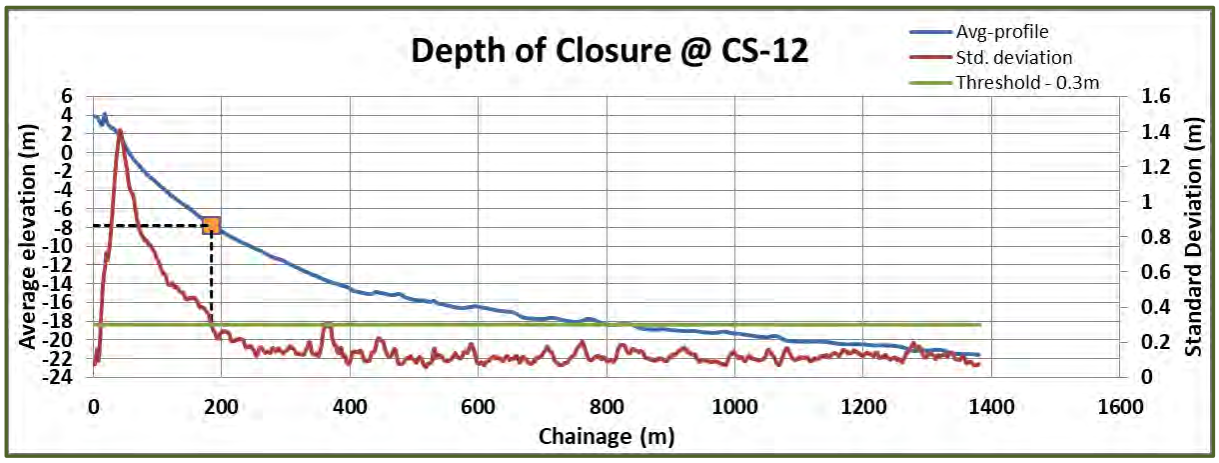


Figure 2-182 Depth of closure at Pozhiyoor location (CS 12)

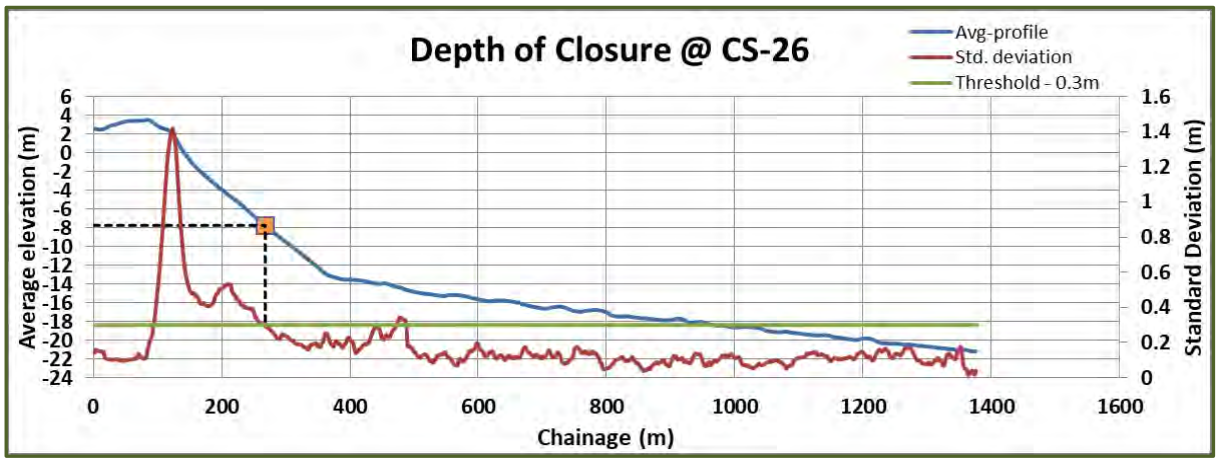


Figure 2-183 Depth of closure at Karumkulam location (CS 26)

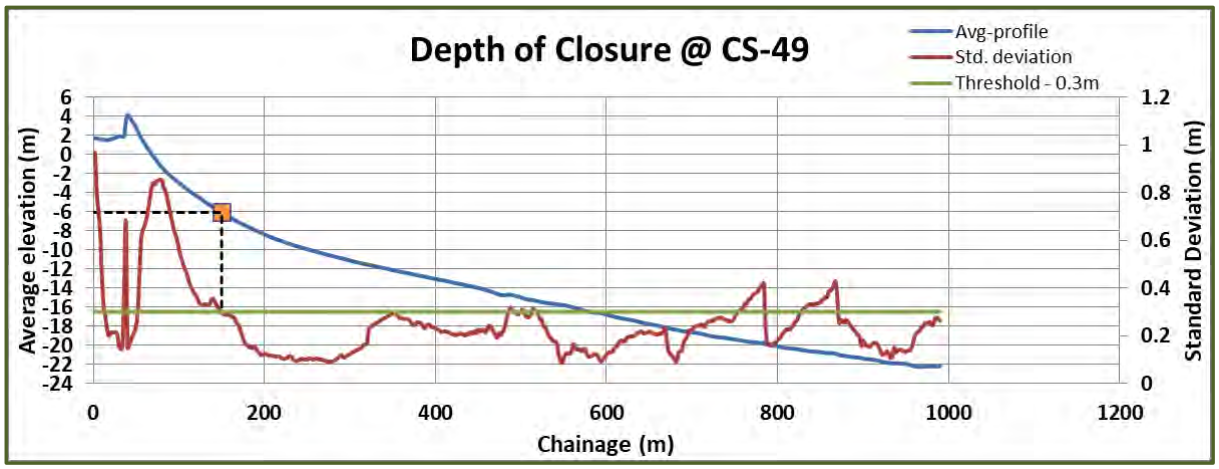


Figure 2-184 Depth of closure at Panathura location (CS 49)

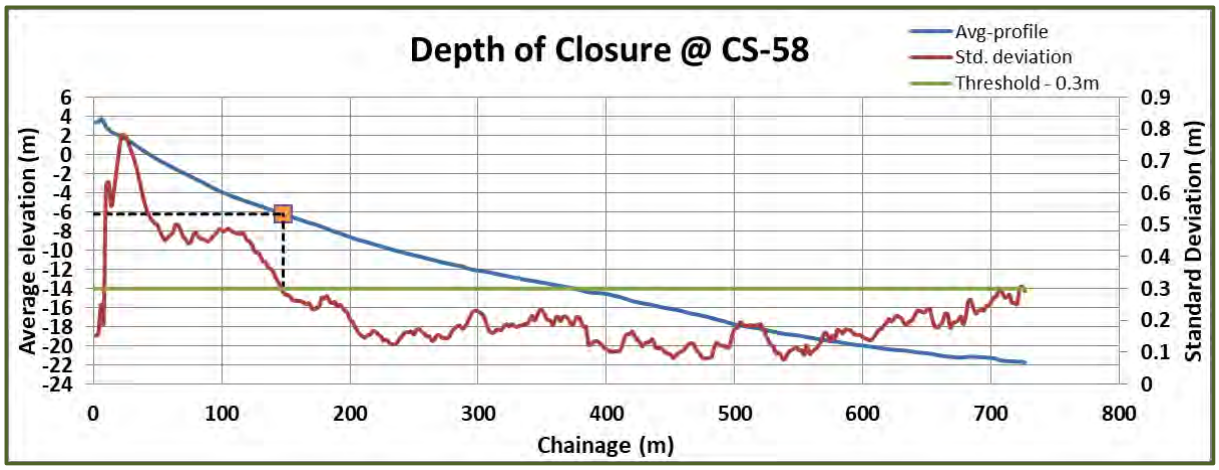


Figure 2-185 Depth of closure at Beemapally location (CS 58)

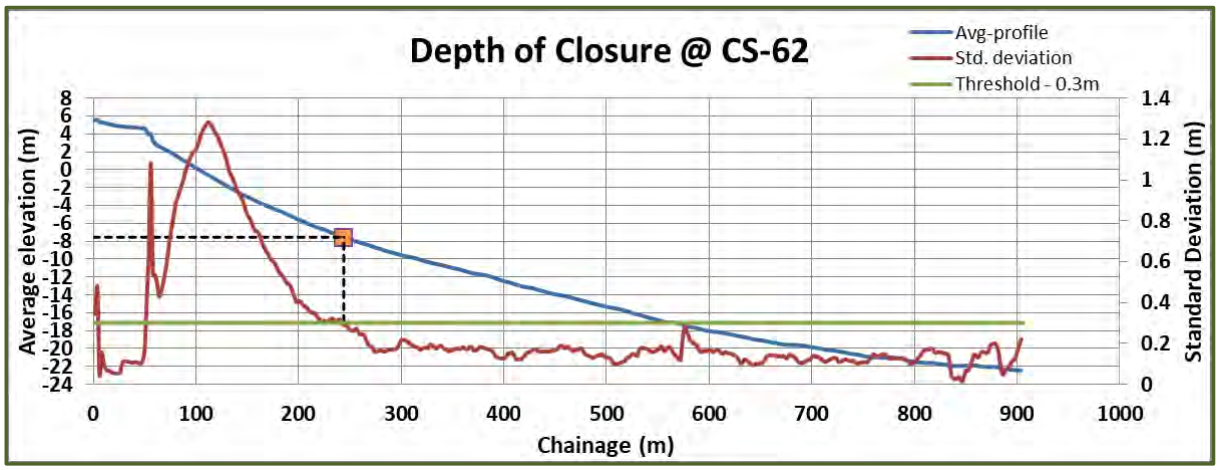


Figure 2-186 Depth of closure at Cheriyathura location (CS 62)

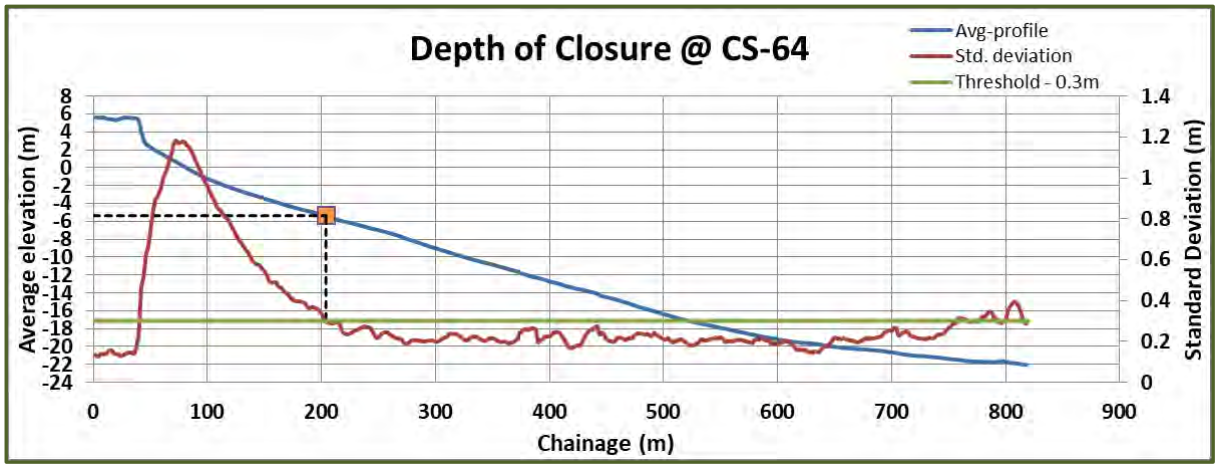


Figure 2-187 Depth of closure at Valiyathura location (CS 64)

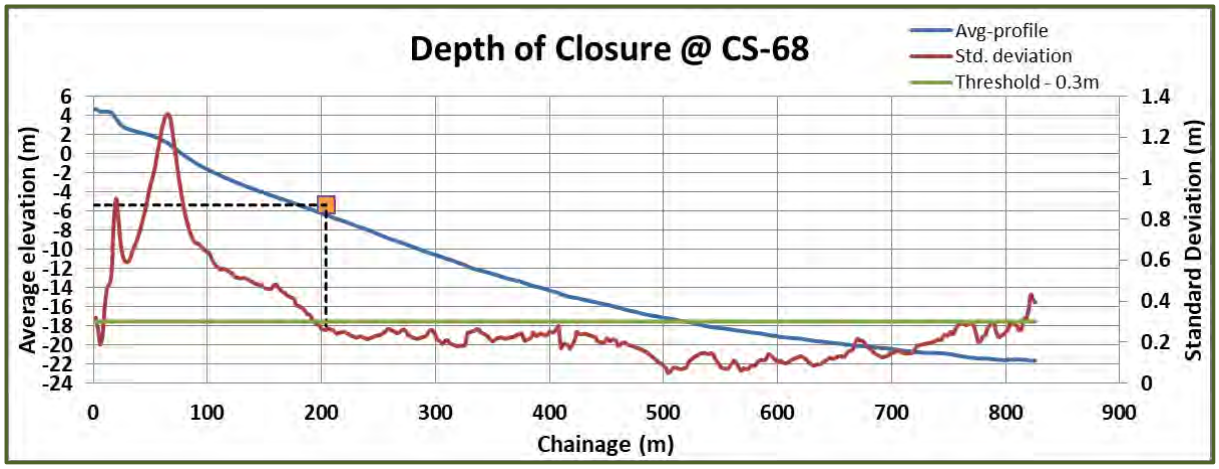


Figure 2-188 Depth of closure at Shangumugham location (CS 68)

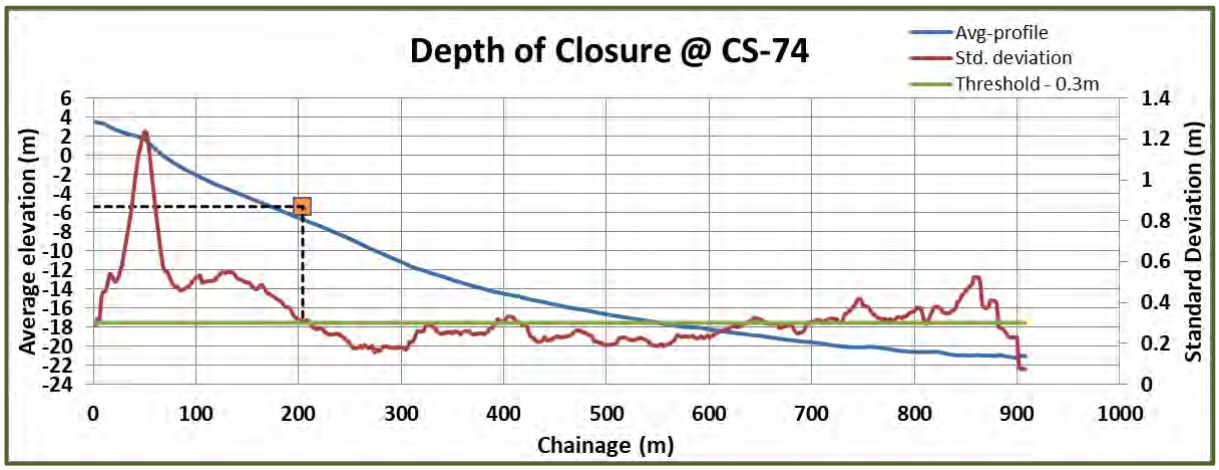


Figure 2-189 Depth of closure at Vettucaud location (CS 74)

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 February 2022. The focus was given to alongshore current behaviour over months. Some of the observations are shown in Figure 2-190 to Figure 2-207.

Legend of Leo observation charts

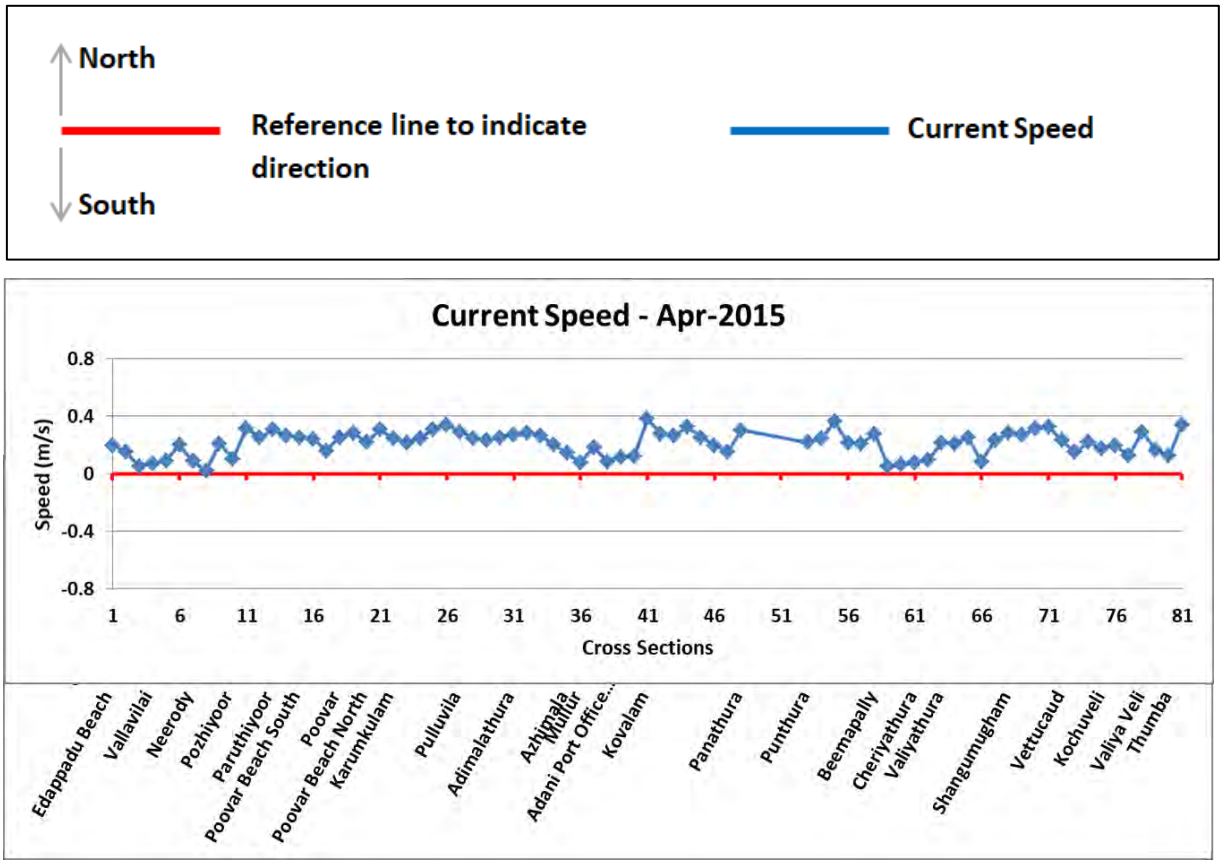


Figure 2-190 Alongshore current speed during April 2015

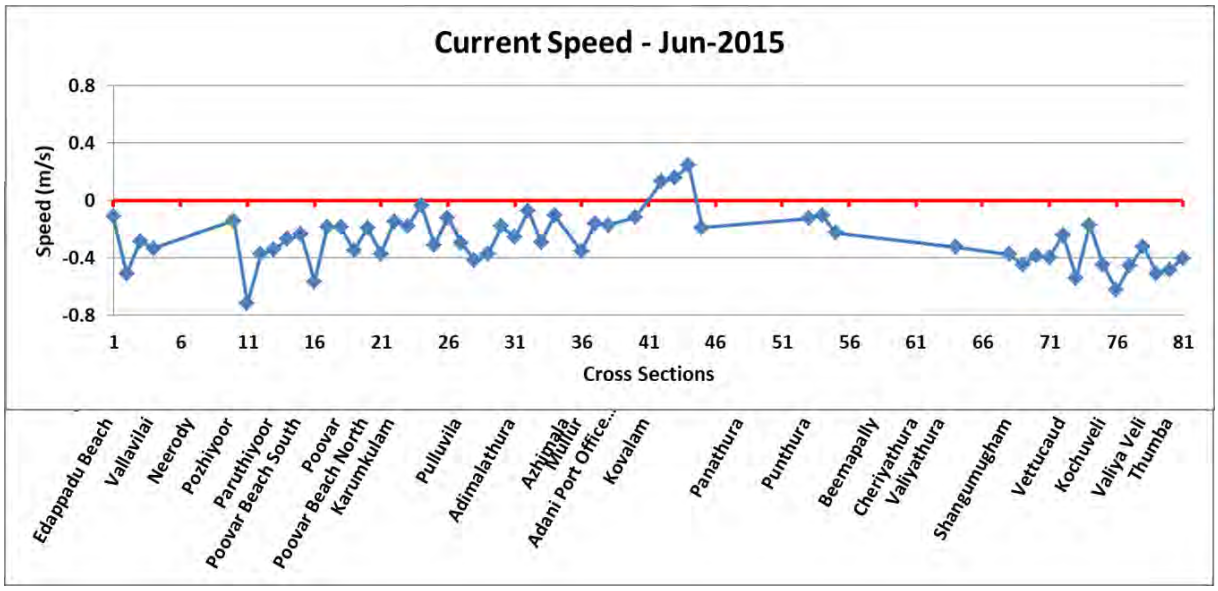


Figure 2-191 Alongshore current speed during June 2015

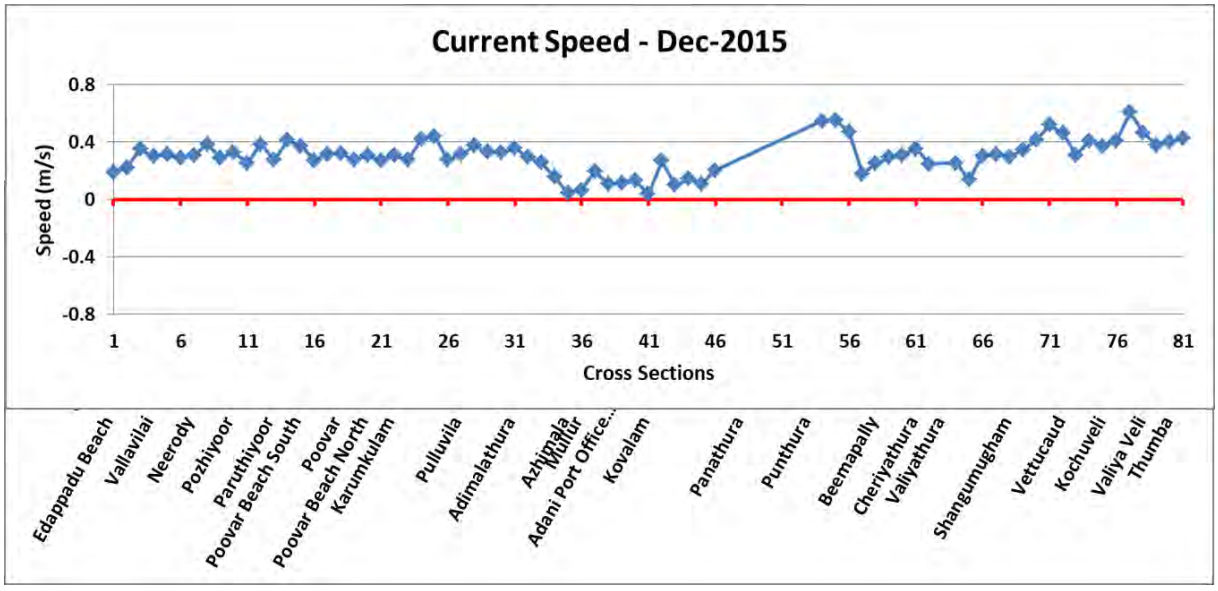


Figure 2-192 Alongshore current speed during December 2015

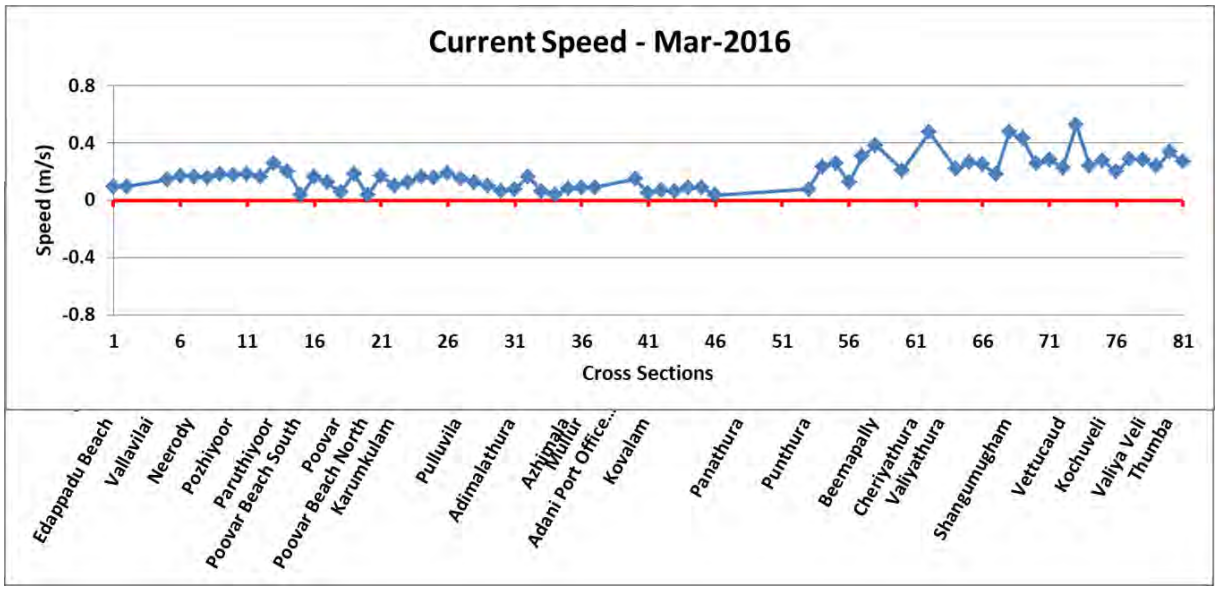


Figure 2-193 Alongshore current speed during March 2016

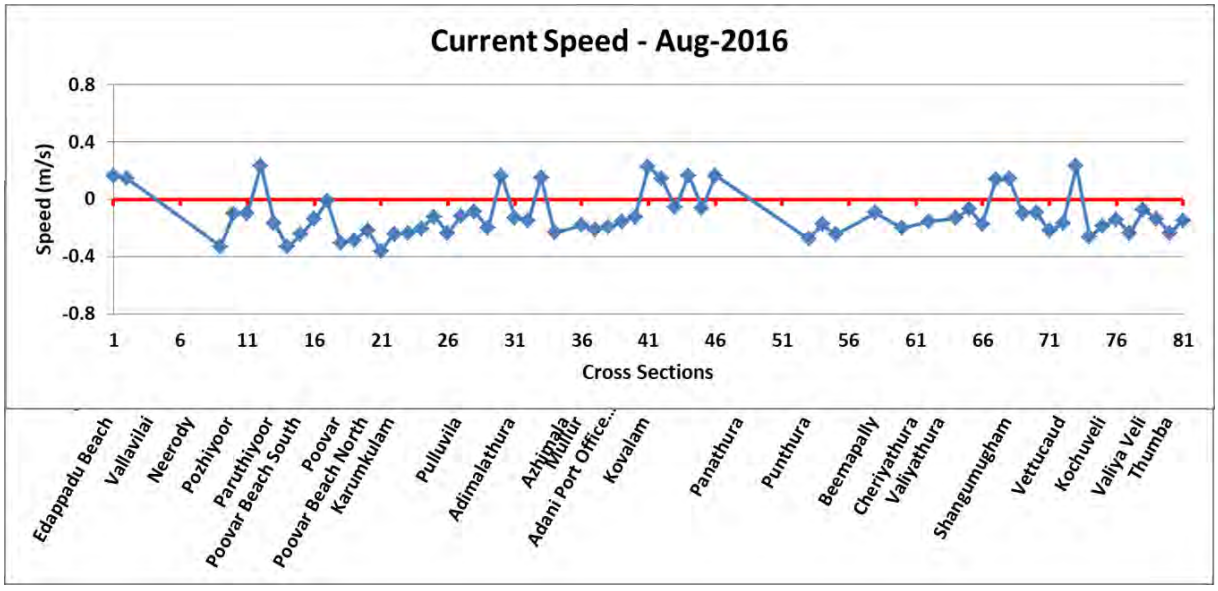


Figure 2-194 Alongshore current speed during August 2016

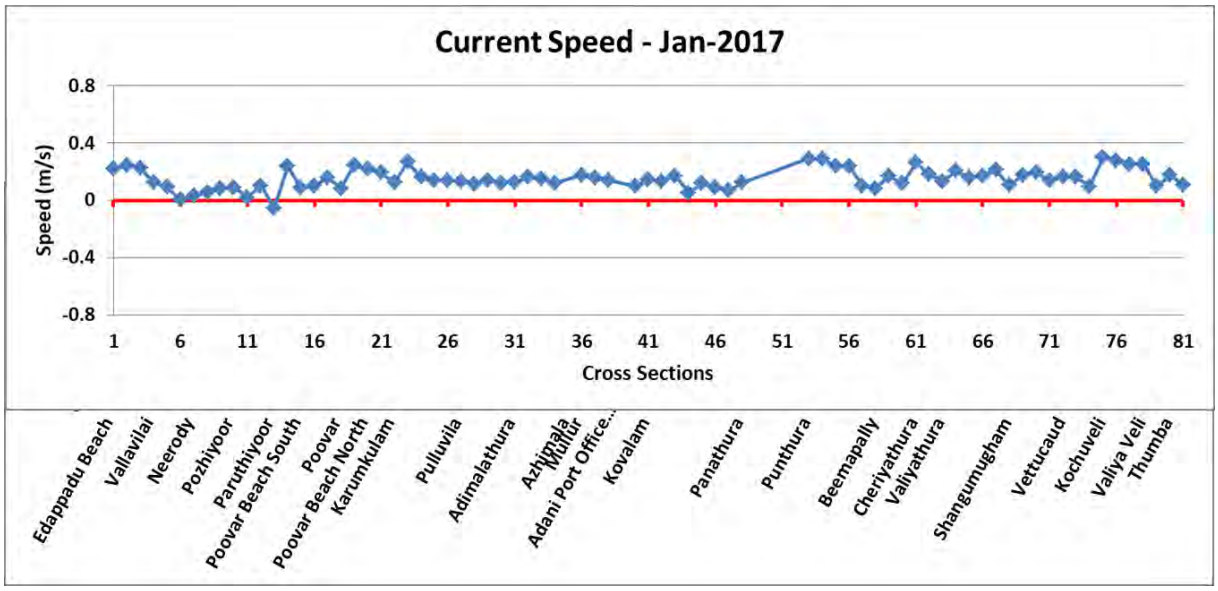


Figure 2-195 Alongshore current speed during January 2017

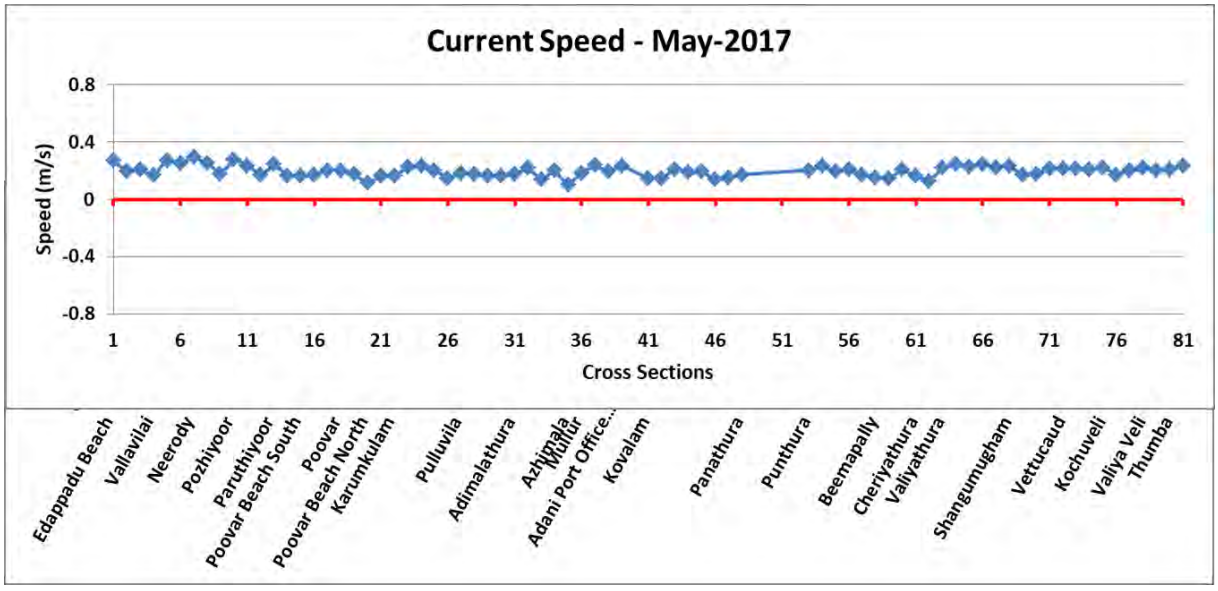


Figure 2-196 Alongshore current speed during May 2017

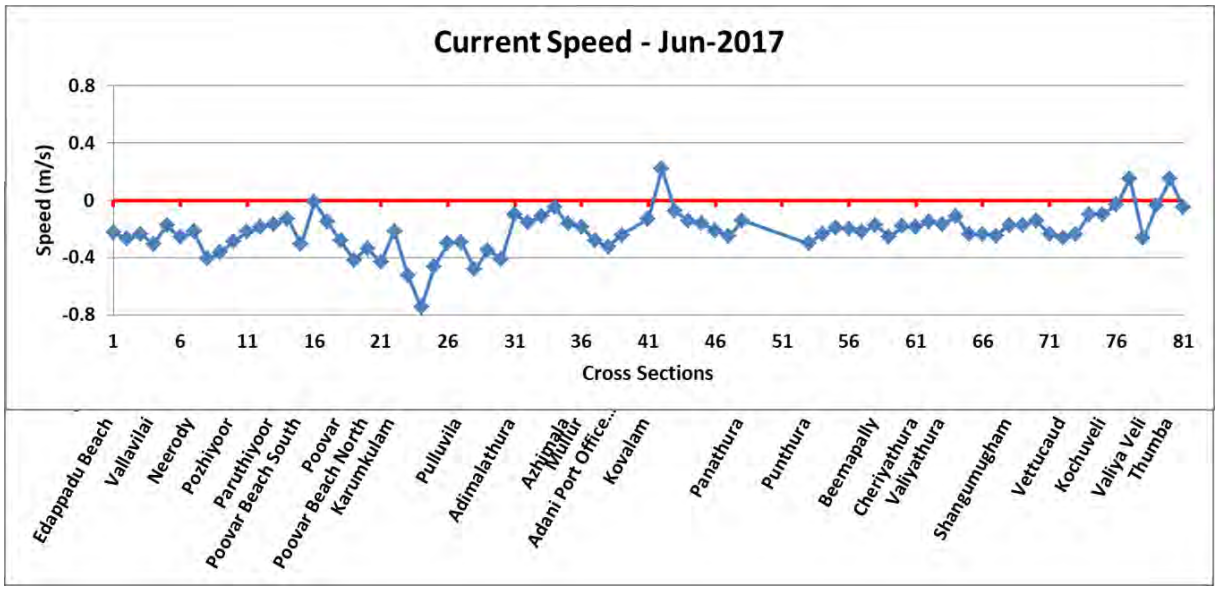


Figure 2-197 Alongshore current speed during June 2017

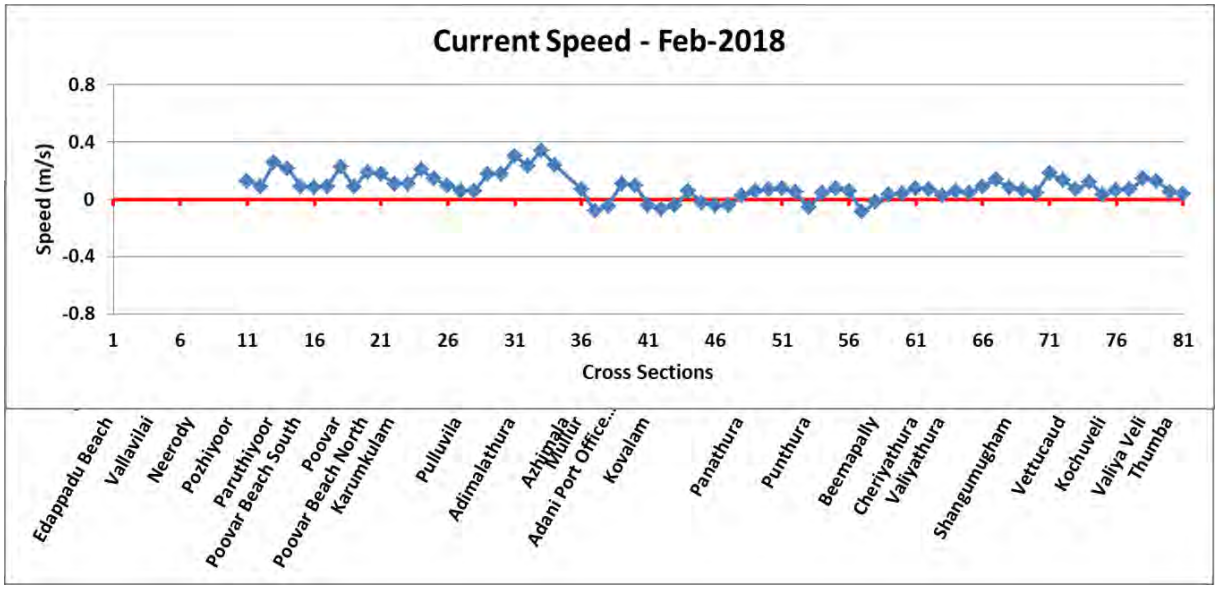


Figure 2-198 Alongshore current speed during February 2018

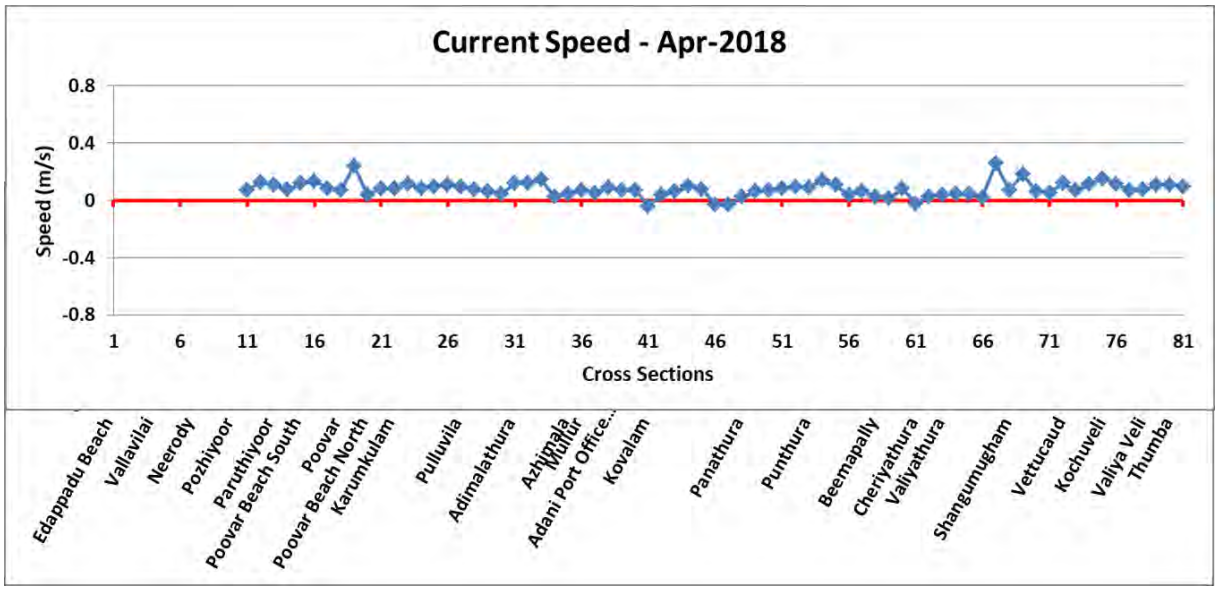


Figure 2-199 Alongshore current speed during April 2018

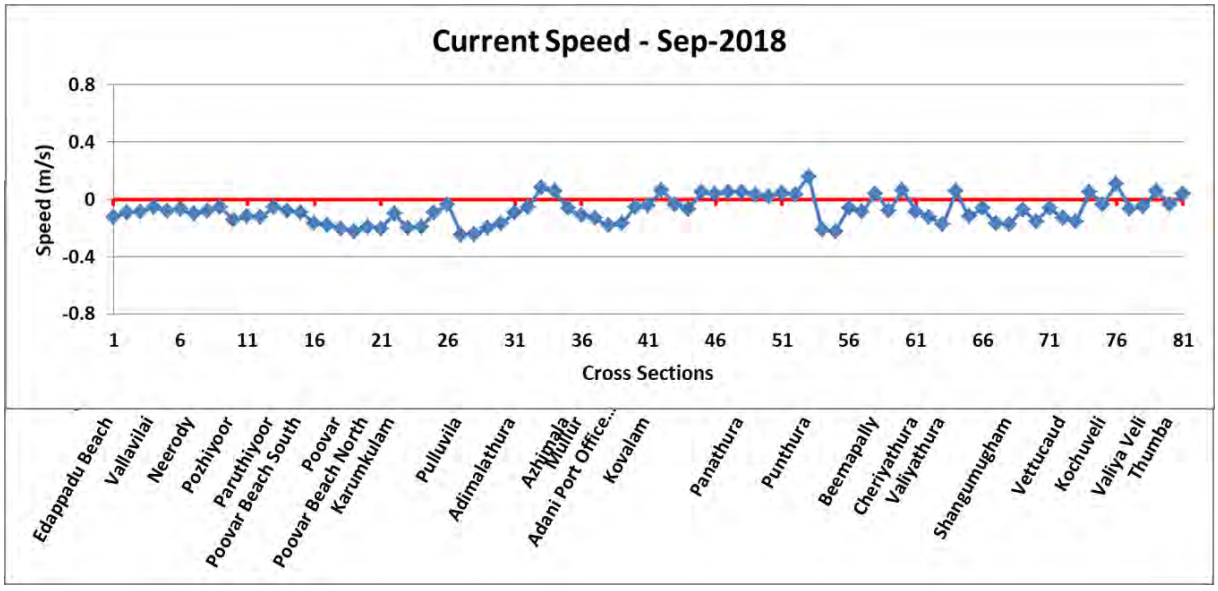


Figure 2-200 Alongshore current speed during September 2018

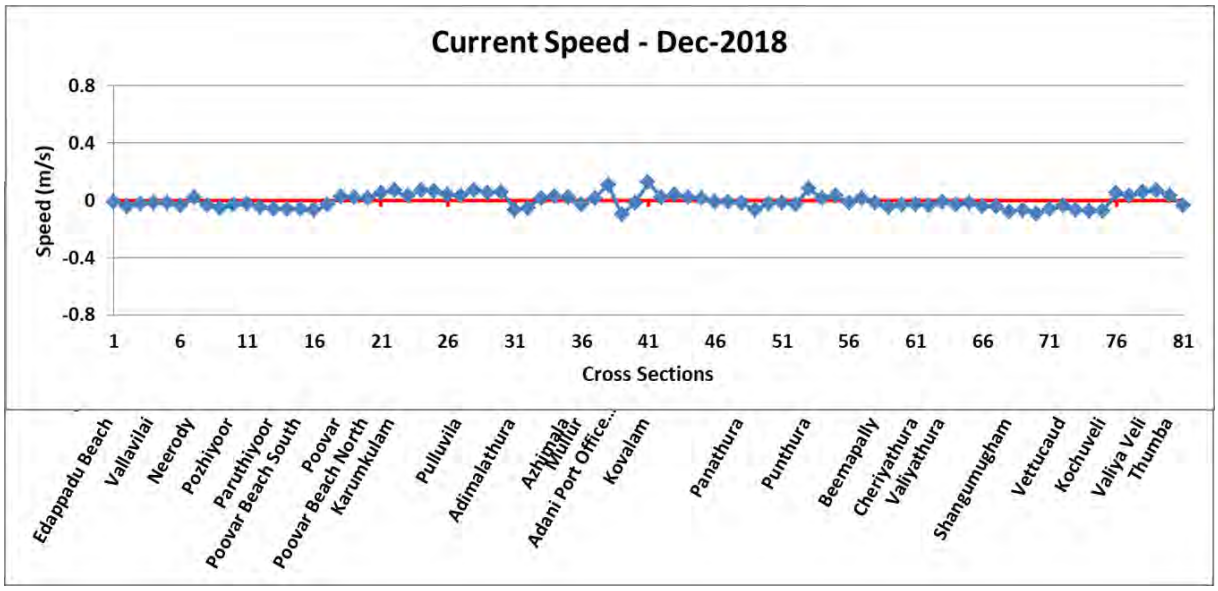


Figure 2-201 Alongshore current speed during December 2018

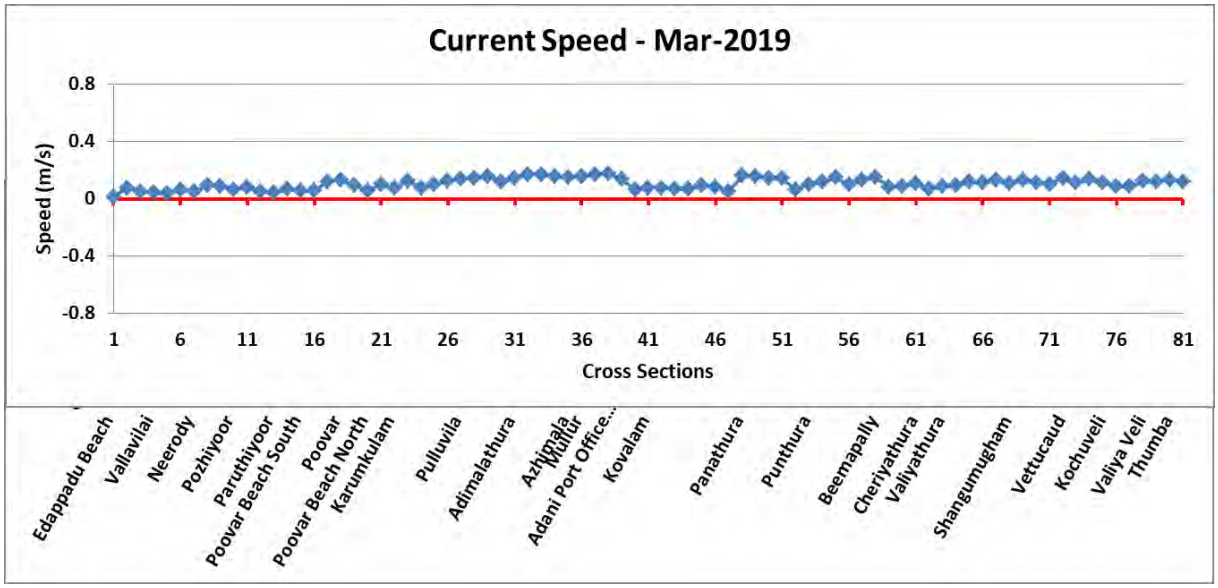


Figure 2-202 Alongshore current speed during March 2019

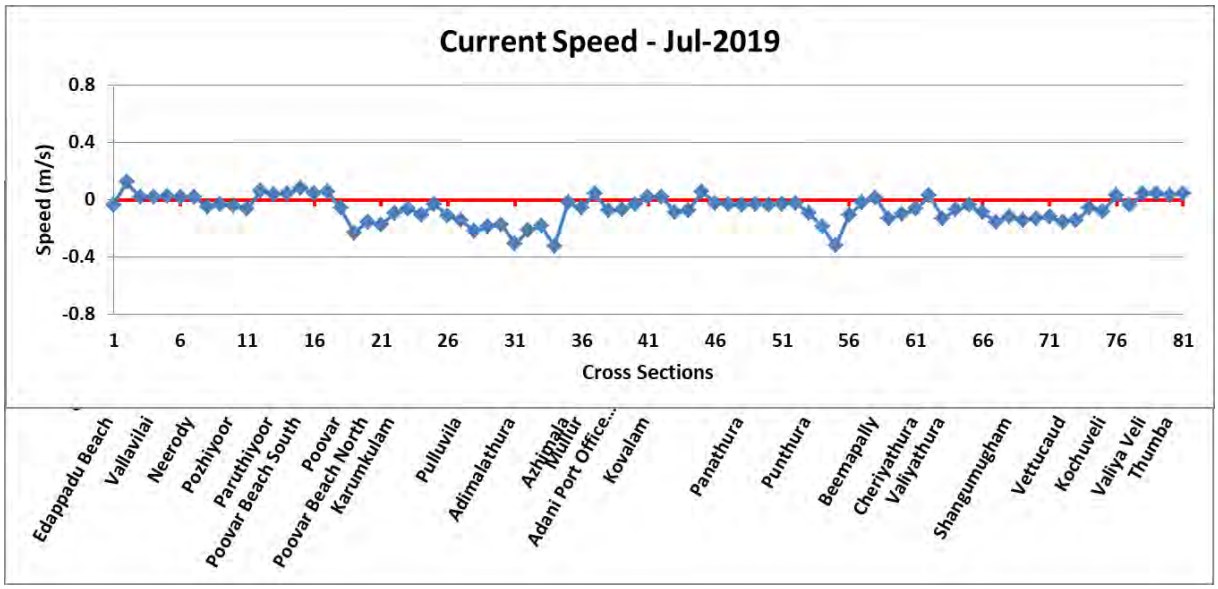


Figure 2-203 Alongshore current speed during July 2019

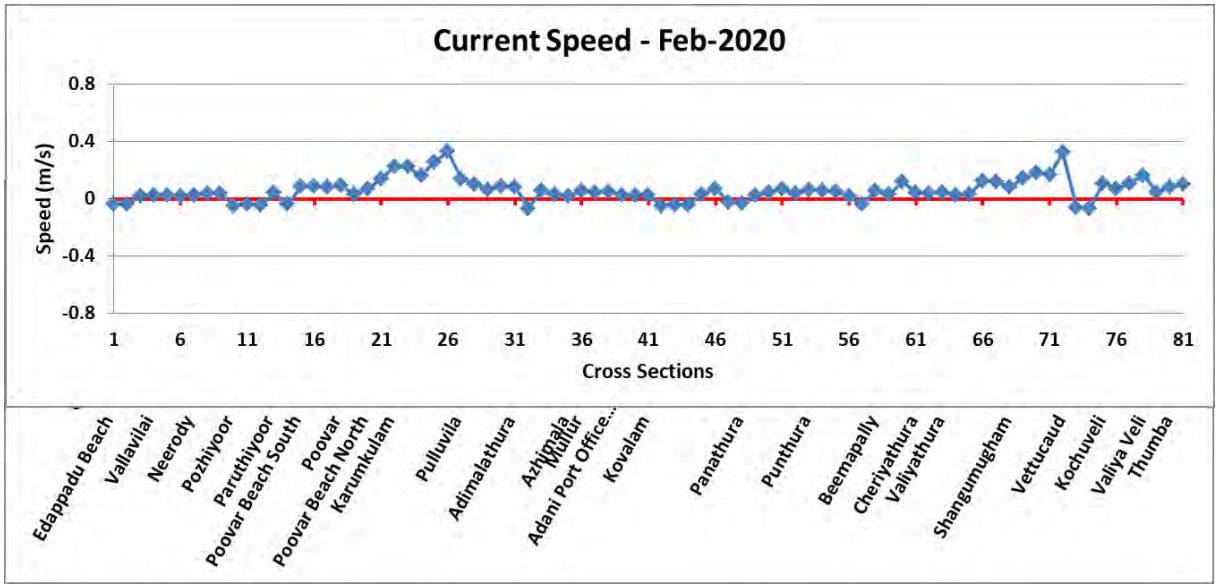


Figure 2-204 Alongshore current speed during February 2020

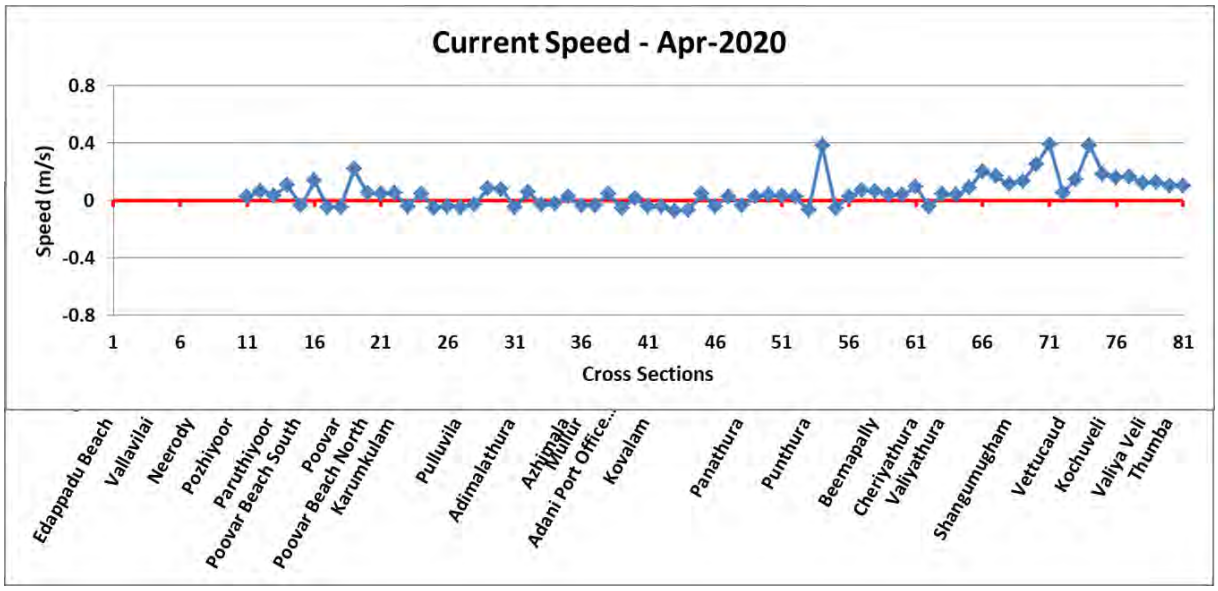


Figure 2-205 Alongshore current speed during April 2020

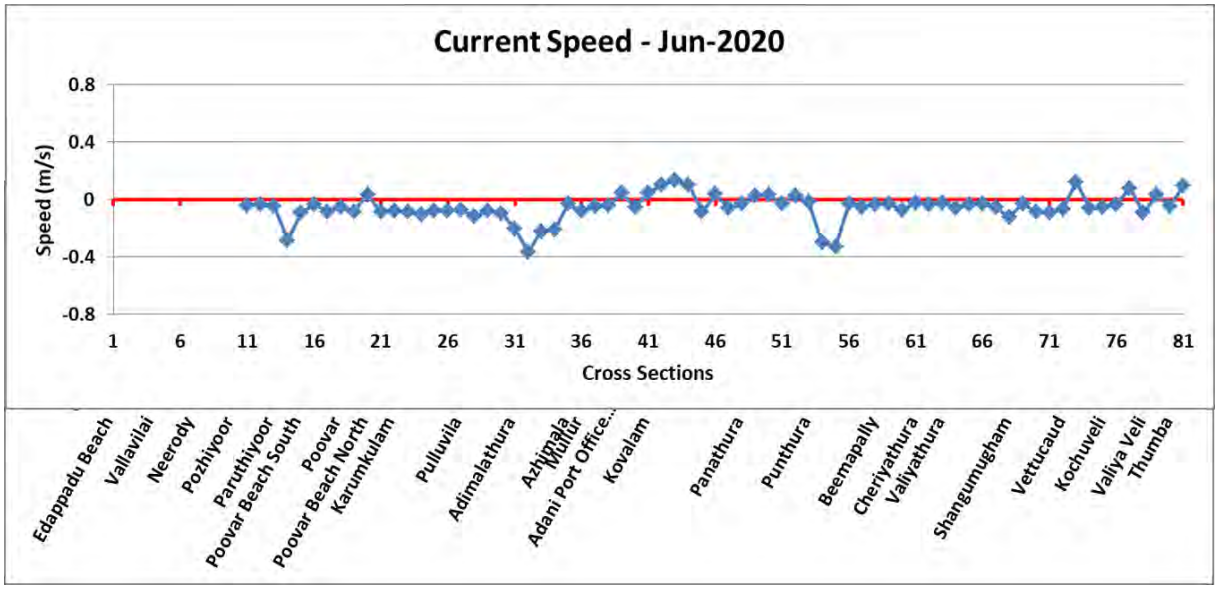


Figure 2-206 Alongshore current speed during June 2020

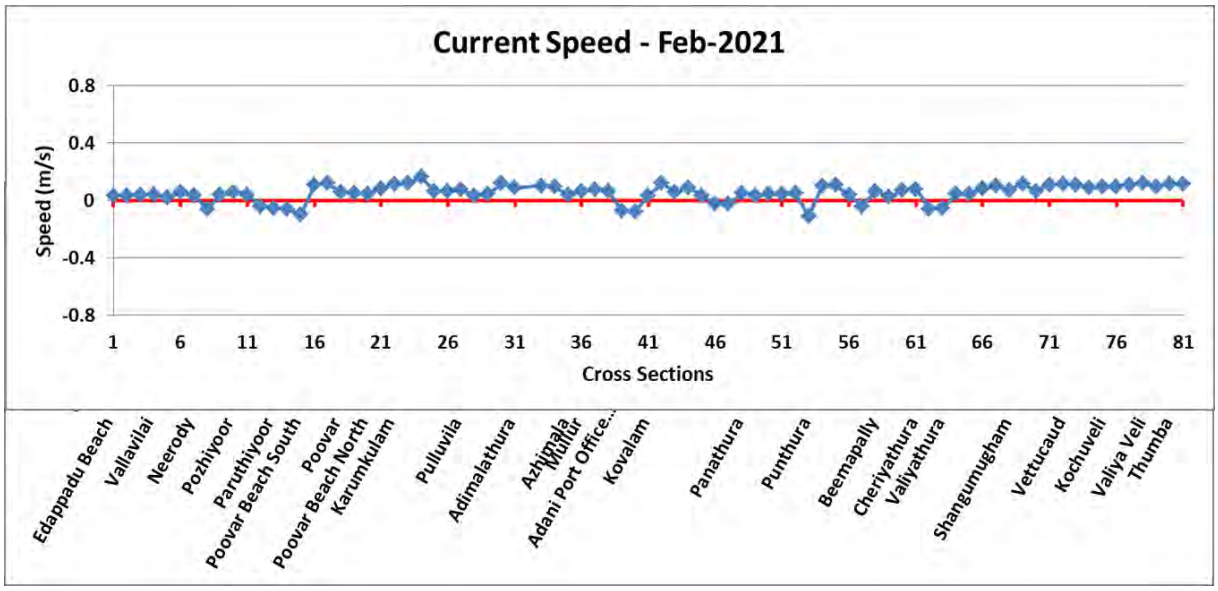


Figure 2-207 Alongshore current speed during February 2021

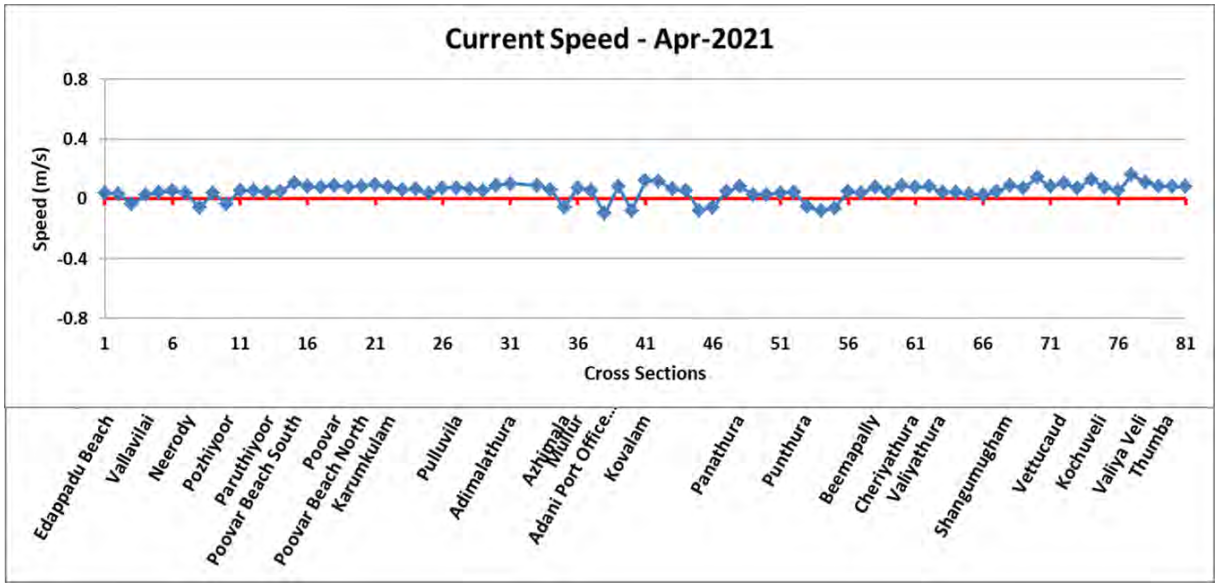


Figure 2-208 Alongshore current speed during April 2021

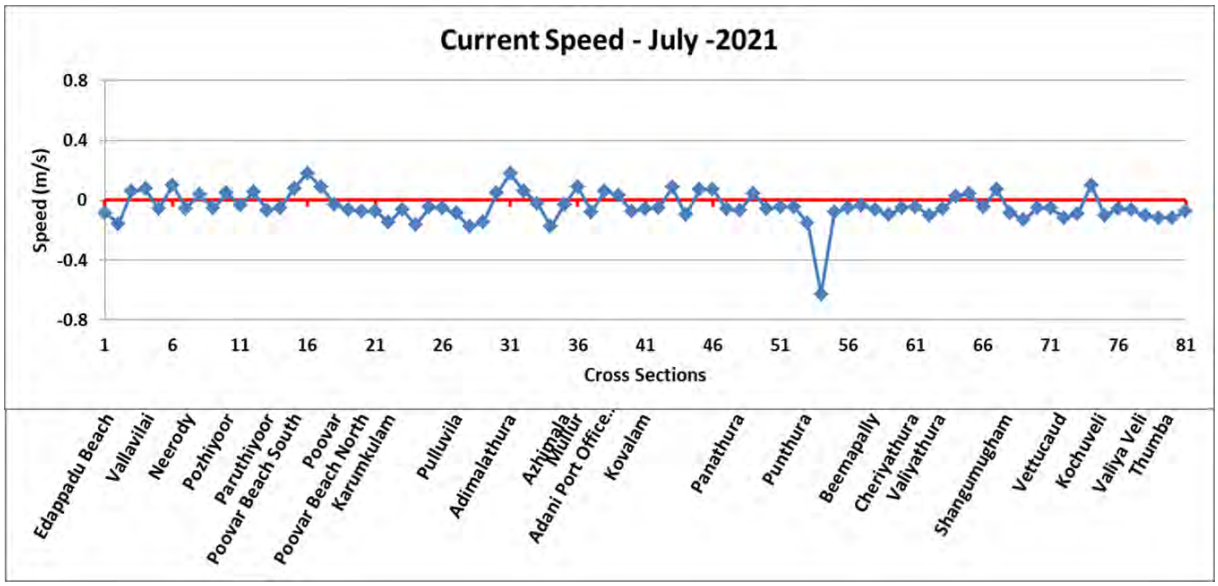


Figure 2-209 Alongshore current speed during July 2021

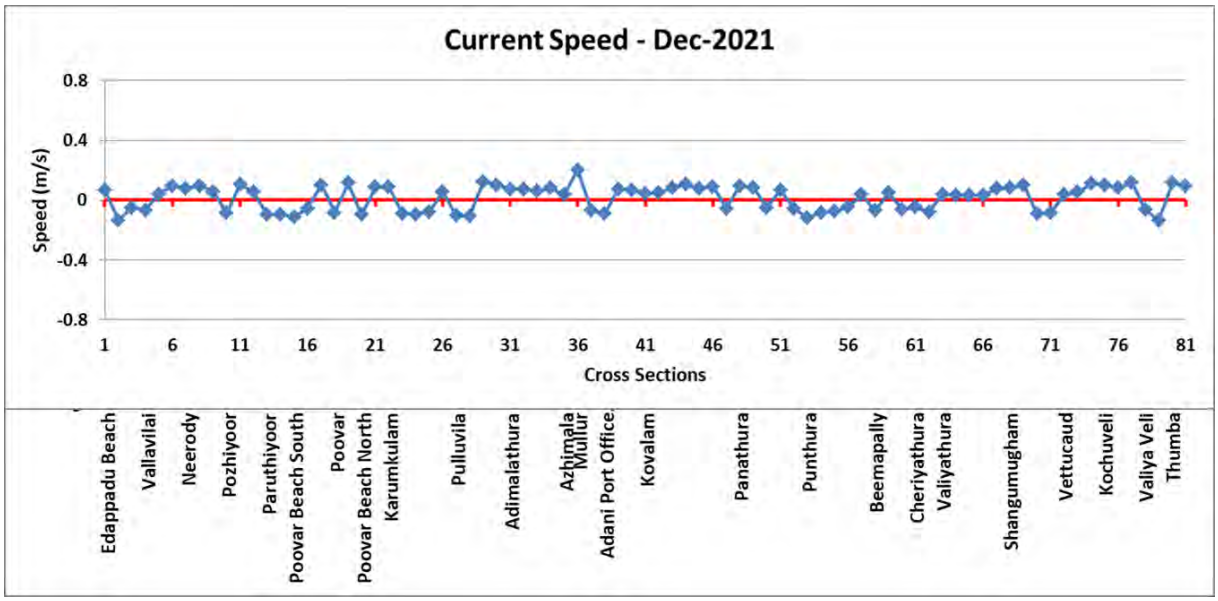


Figure 2-210 Alongshore current speed during December 2021

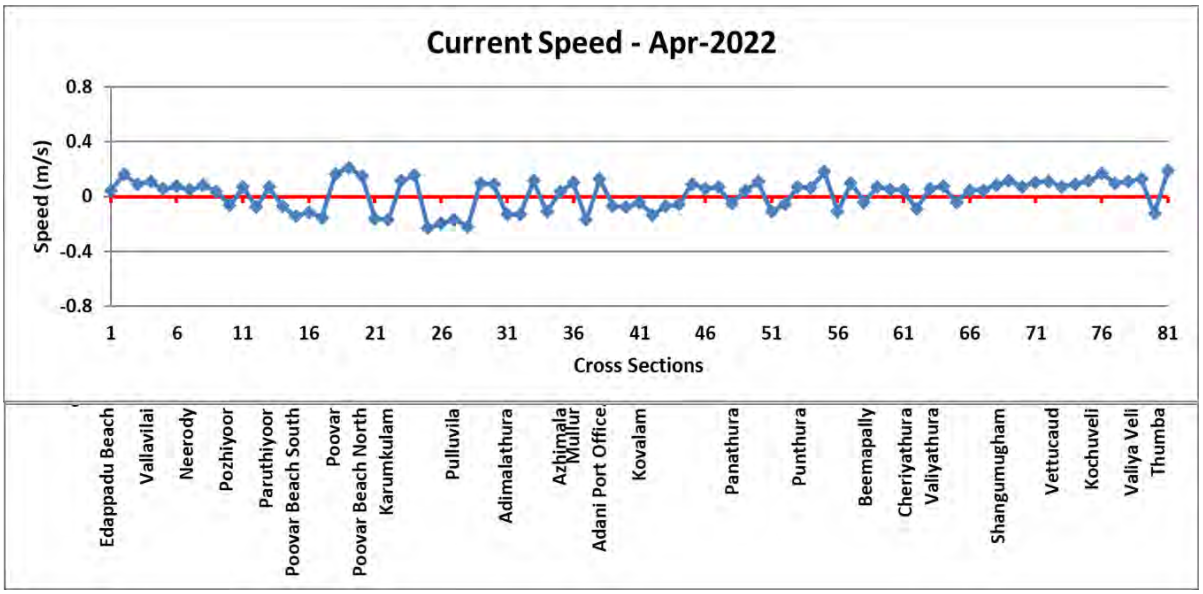


Figure 2-211 Alongshore current speed during April 2022

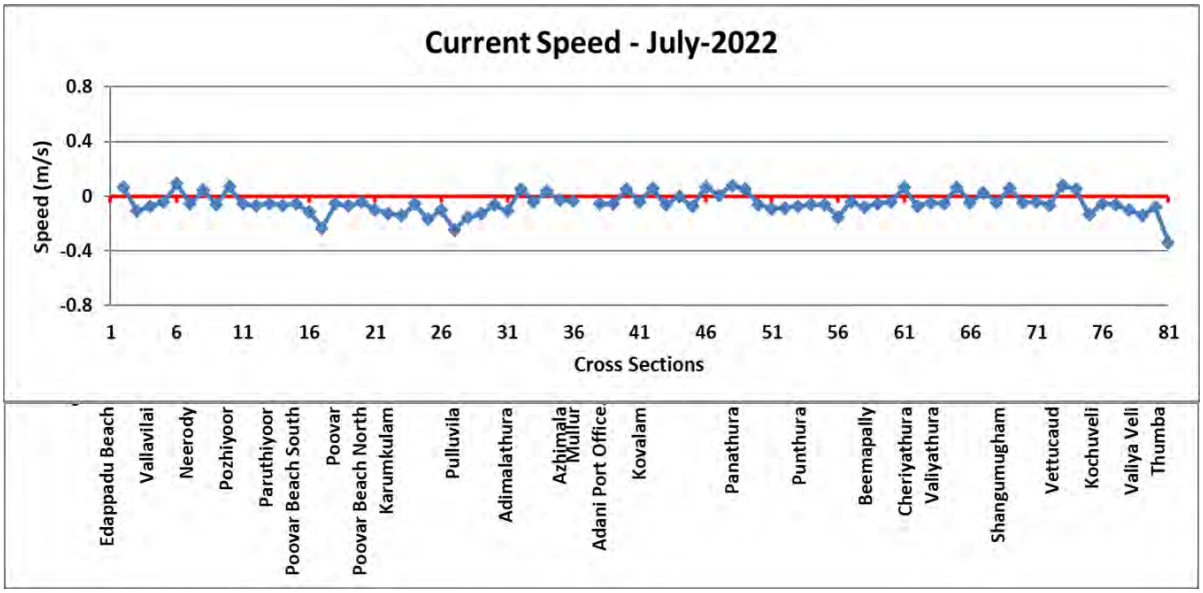


Figure 2-212 Alongshore current speed during July 2022

Figure 2-213 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 2-213.

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

The time series for selected sections on North and South side of proposed port are shown from Figure 2-214 to Figure 2-245.

Legend of Leo observation plots at selected CSP

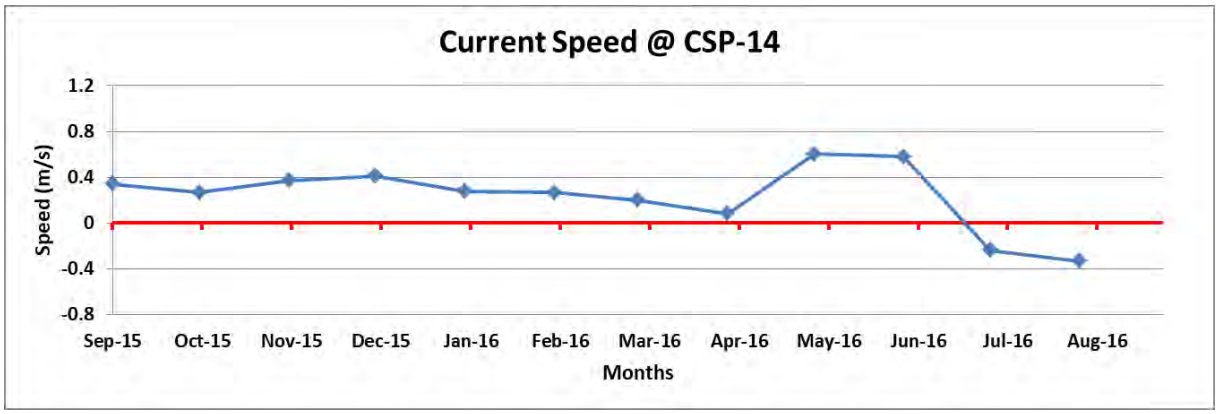


Figure 2-214 Time series of current speed at Paruthiyoor (September 2015 – August 2016)

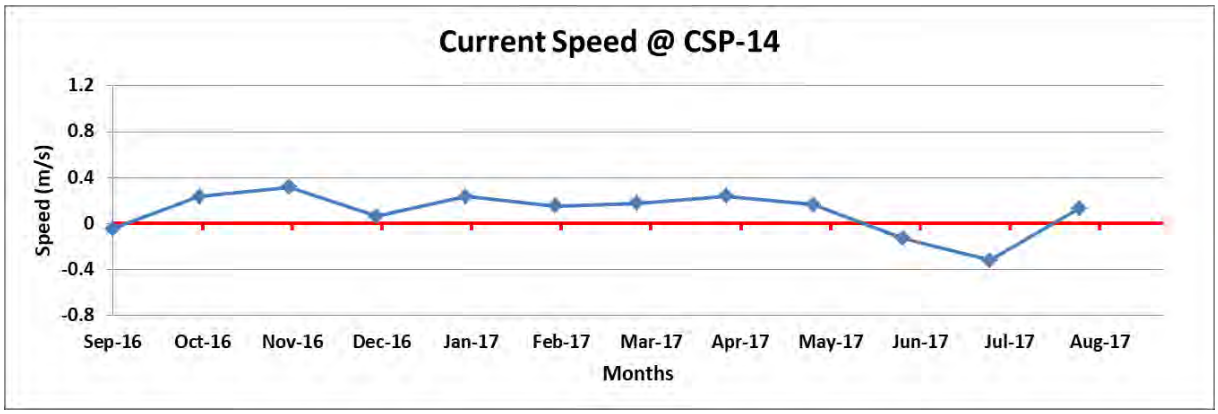


Figure 2-215 Time series of current speed at Paruthiyoor (September 2016 –August 2017)

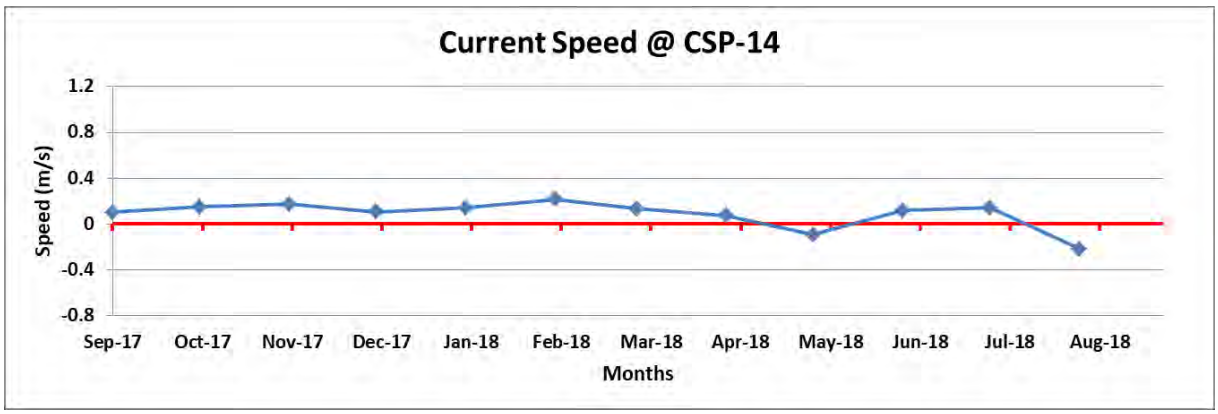


Figure 2-216 Time series of current speed at Paruthiyoor (September 2017 –August 2018)

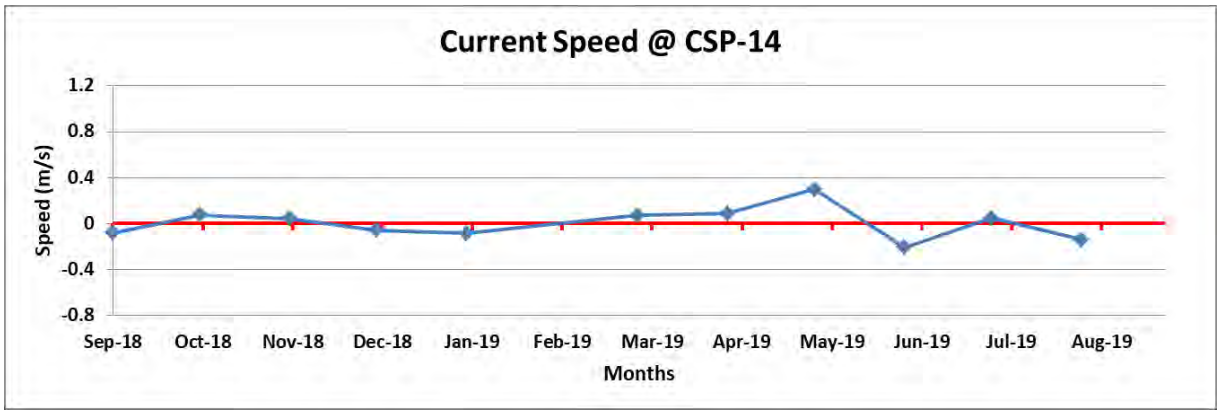


Figure 2-217 Time series of current speed at Paruthiyoor (September 2018 –August 2019)

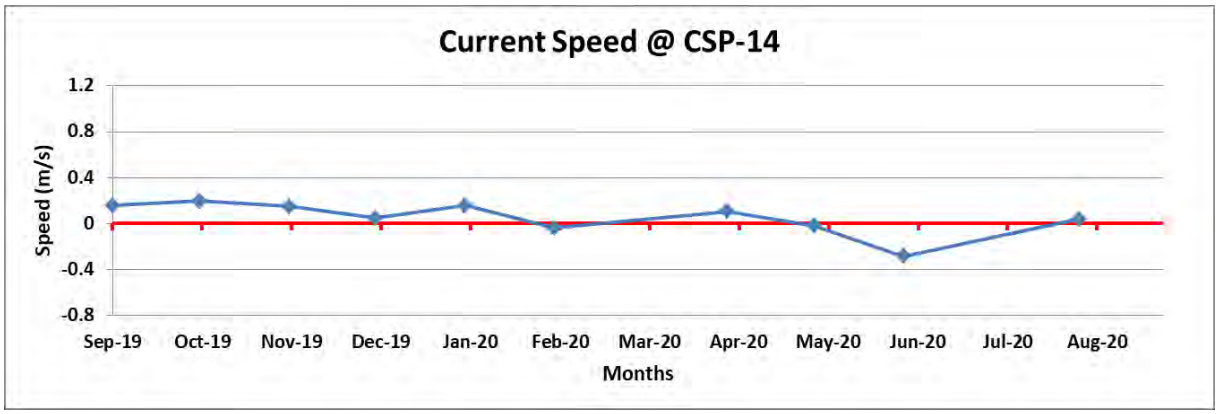


Figure 2-218 Time series of current speed at Paruthiyoor (September 2019 –August 2020)

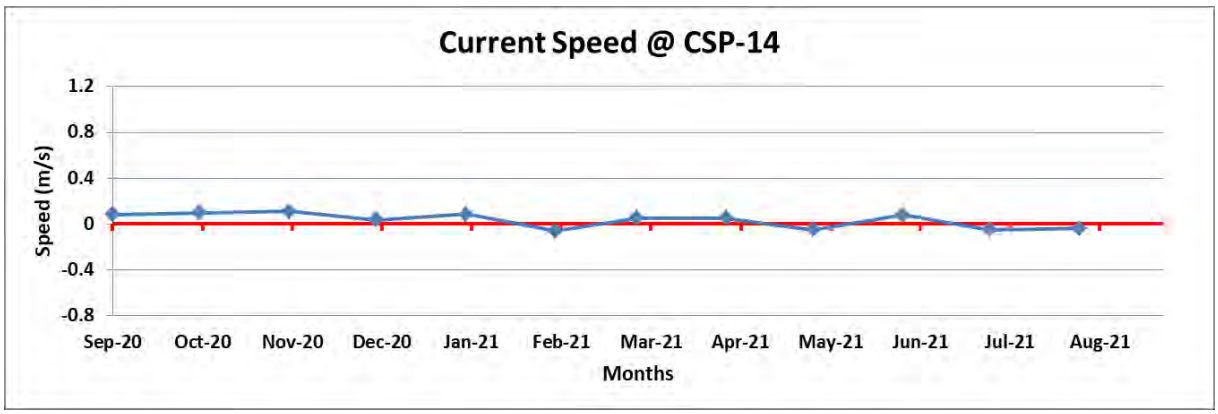


Figure 2-219 Time series of current speed at Paruthiyoor (September 2020 –August 2021)

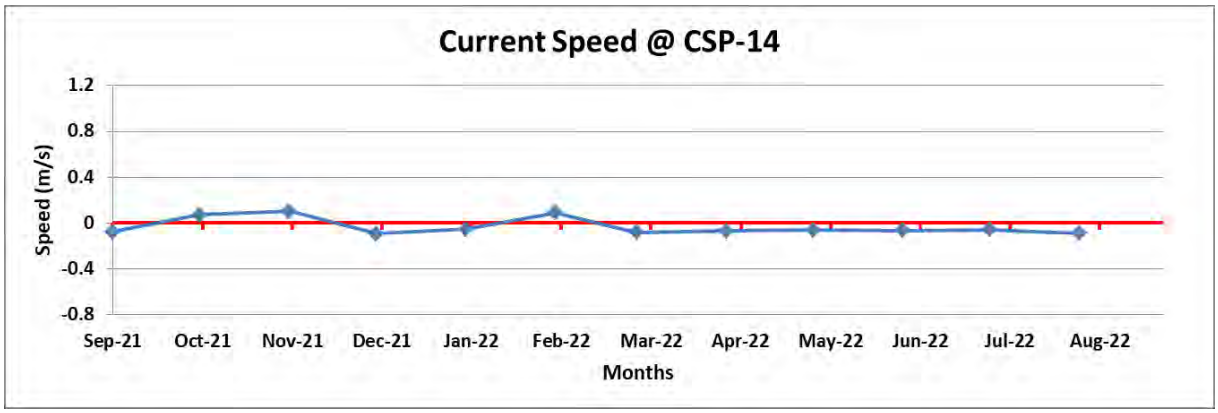


Figure 2-220 Time series of current speed at Paruthiyoor (September 2021 –August 2022)

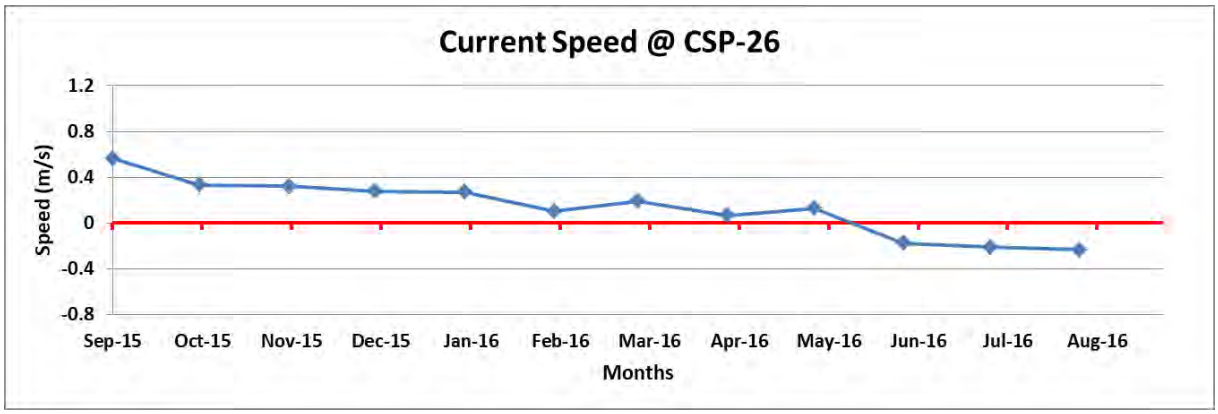


Figure 2-221 Time series of current speed at Karumkulam (September 2015 –August 2016)

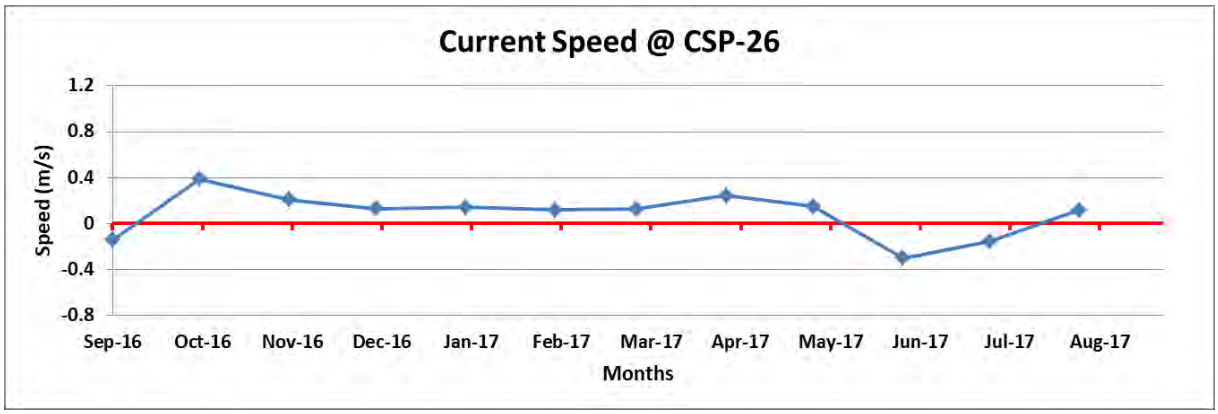


Figure 2-222 Time series of current speed at Karumkulam (September 2016 –August 2017)

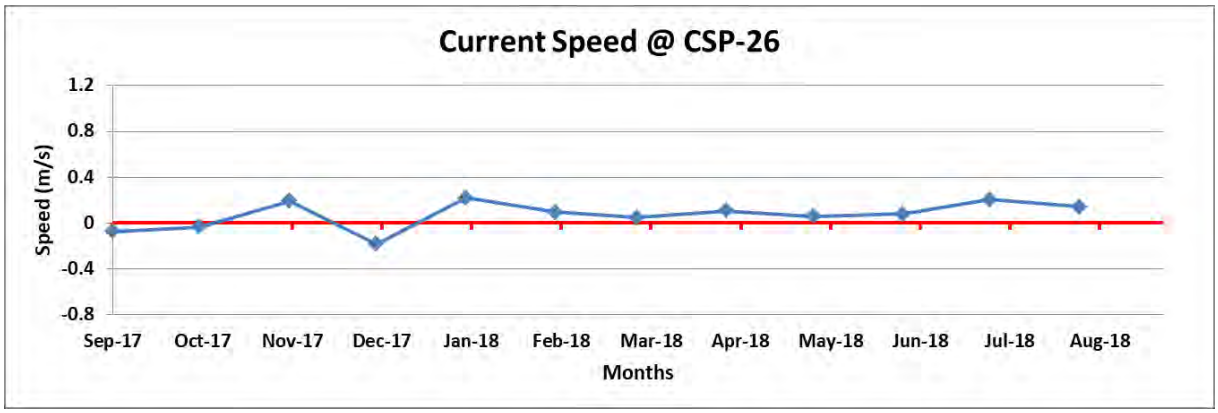


Figure 2-223 Time series of current speed at Karumkulam (September 2017 –August 2018)

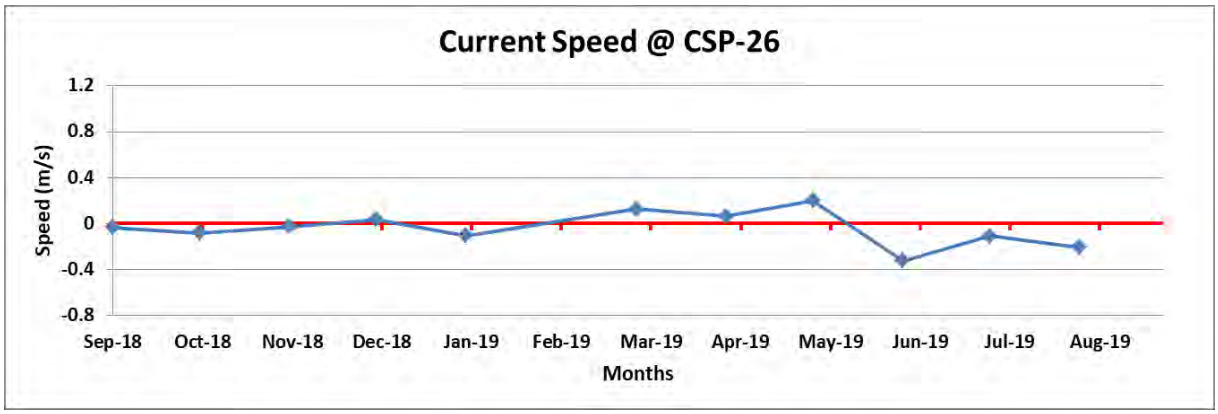


Figure 2-224 Time series of current speed at Karumkulam (September 2018 –August 2019)

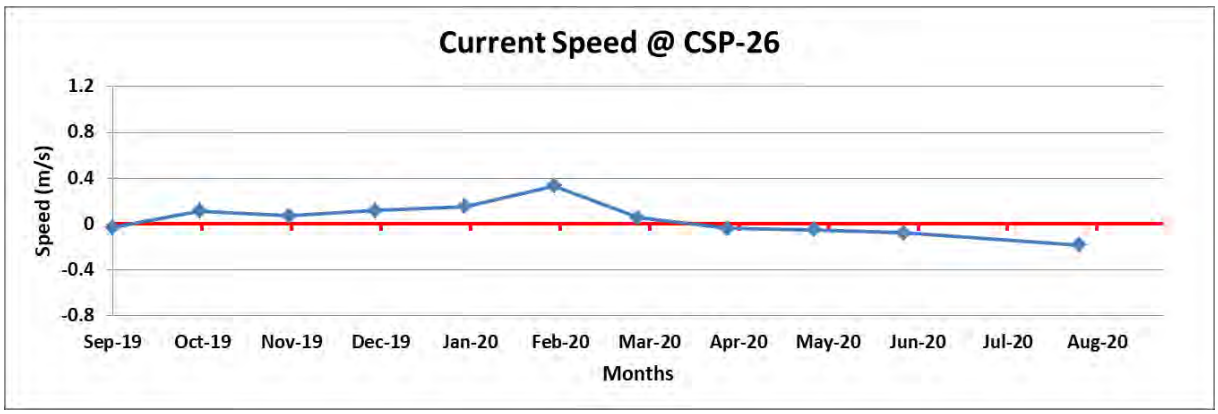


Figure 2-225 Time series of current speed at Karumkulam (September 2019 –August 2020)

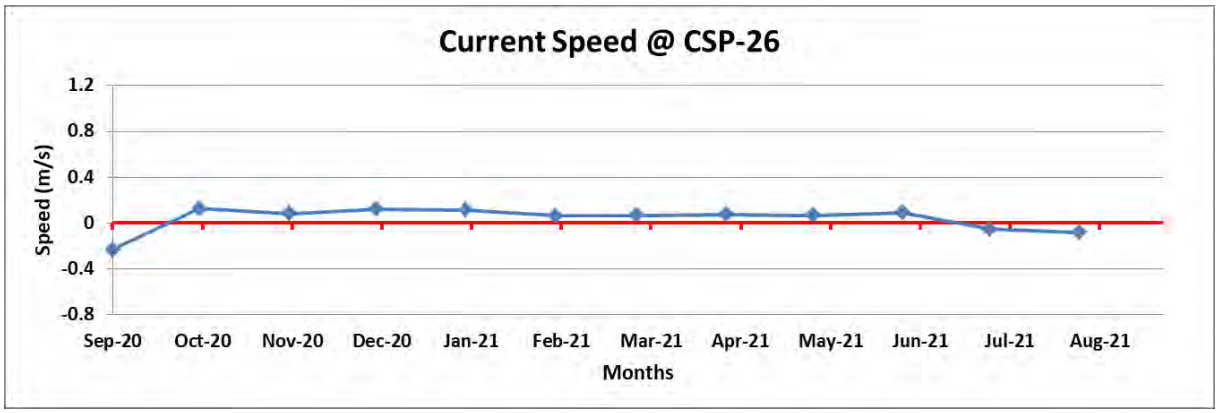


Figure 2-226 Time series of current speed at Karumkulam (September 2020 –August 2021)

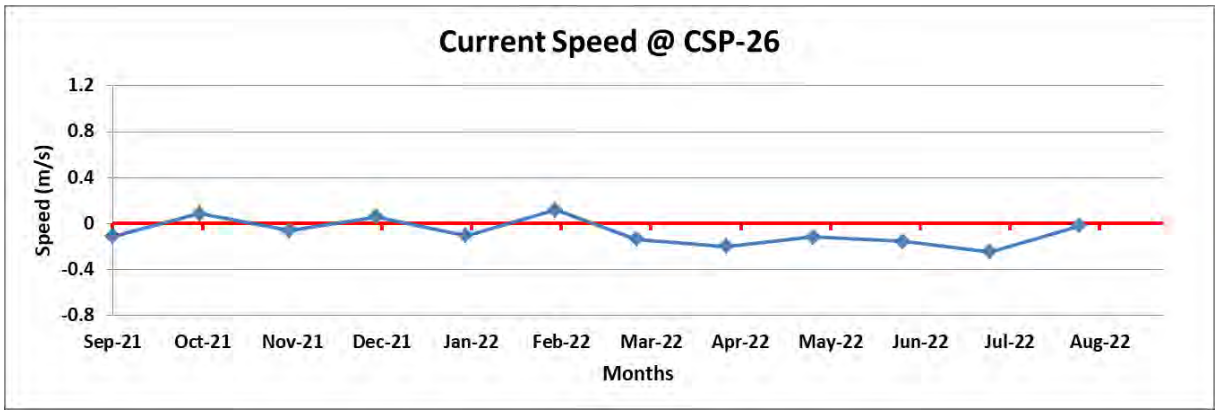


Figure 2-227 Time series of current speed at Karumkulam (September 2021 –August 2022)

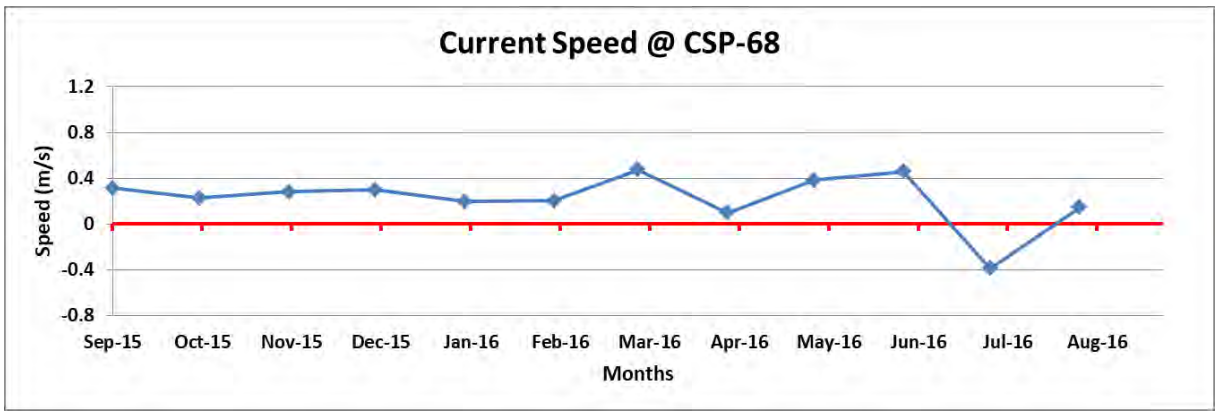


Figure 2-228 Time series of current speed at Shagumugham (September 2015 –August 2016)

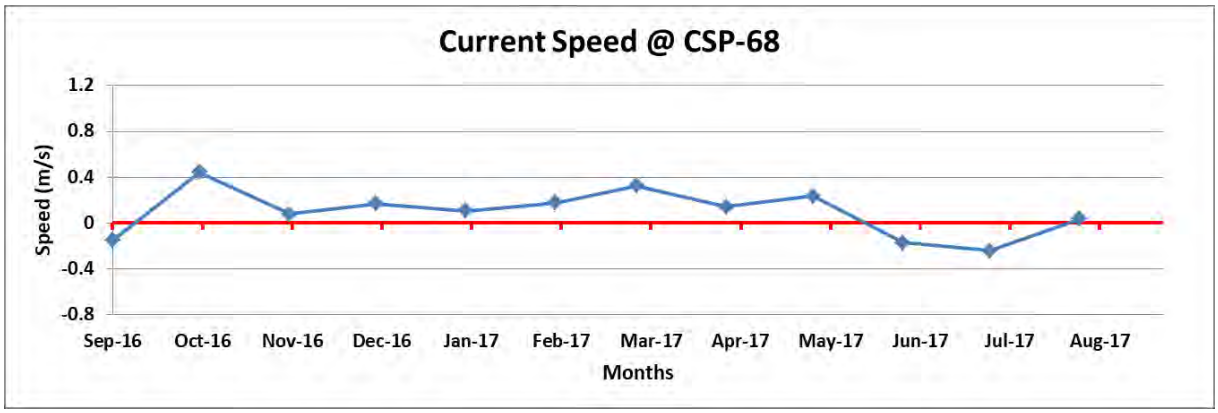


Figure 2-229 Time series of current speed at Shagumugham (September 2016 –August 2017)

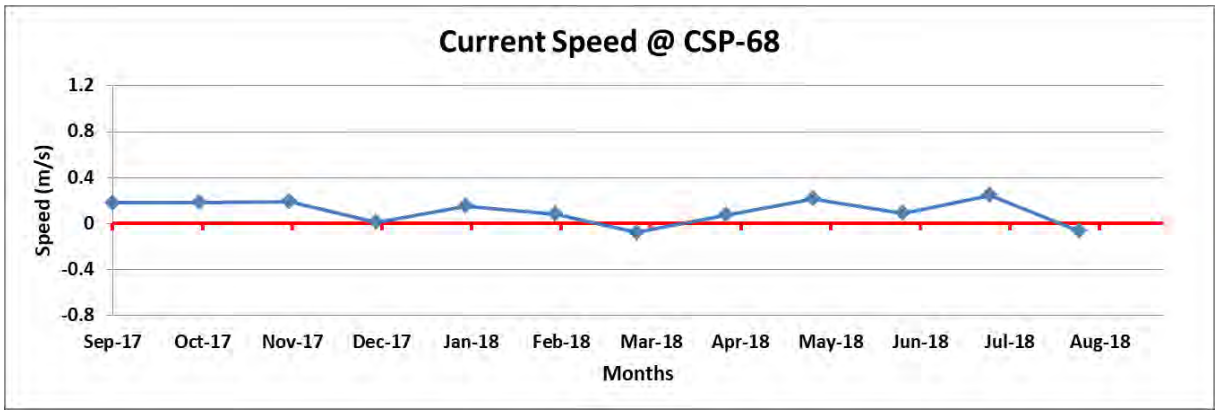


Figure 2-230 Time series of current speed at Shagumugham (September 2017 –August 2018)

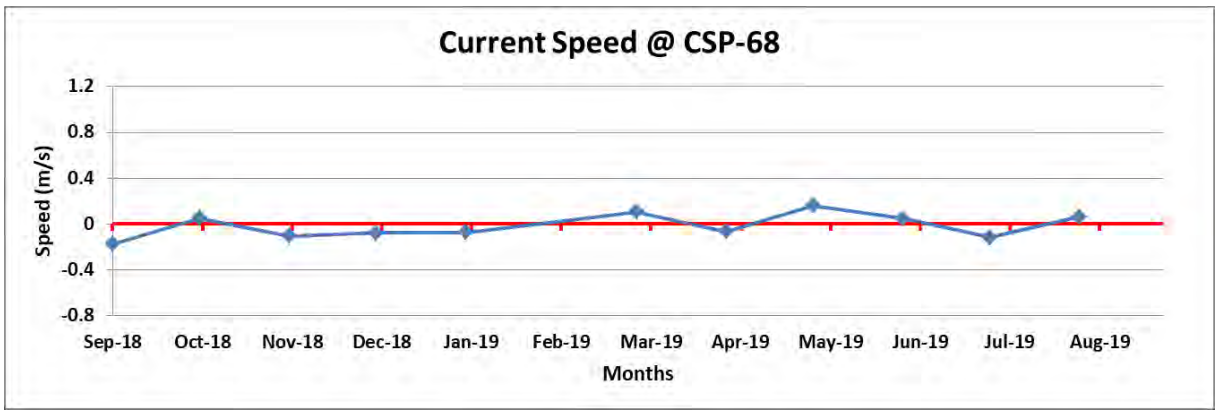


Figure 2-231 Time series of current speed at Shagumugham (September 2018 –August 2019)

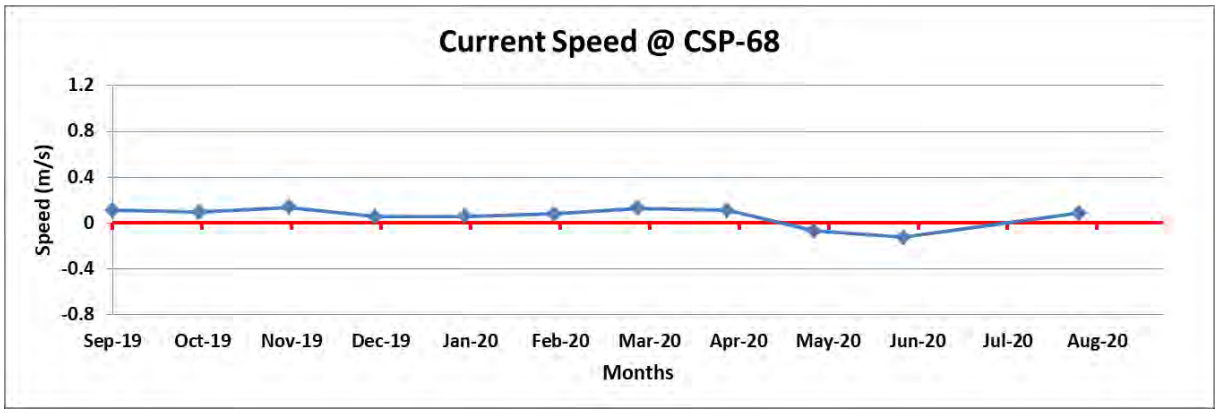


Figure 2-232 Time series of current speed at Shagumugham (September 2019 –August 2020)

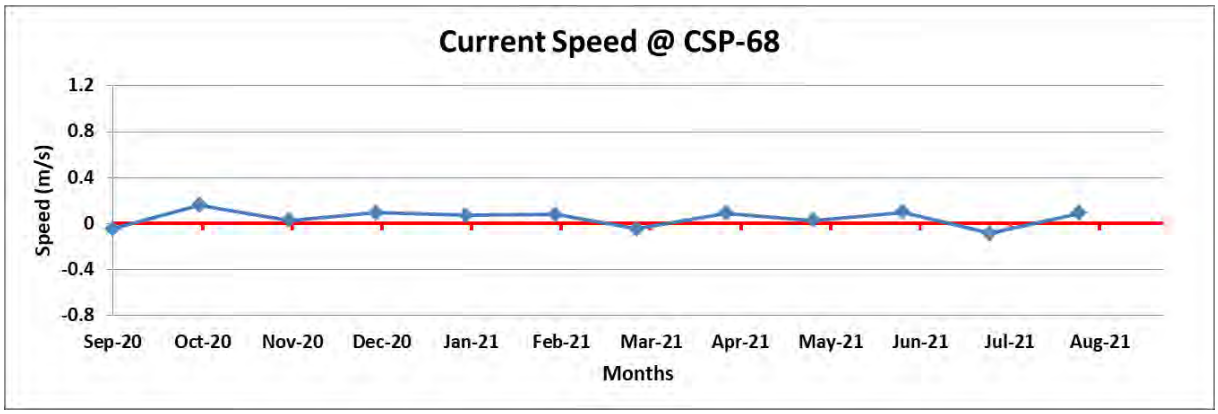


Figure 2-233 Time series of current speed at Shagumugham (September 2020 –August 2021)

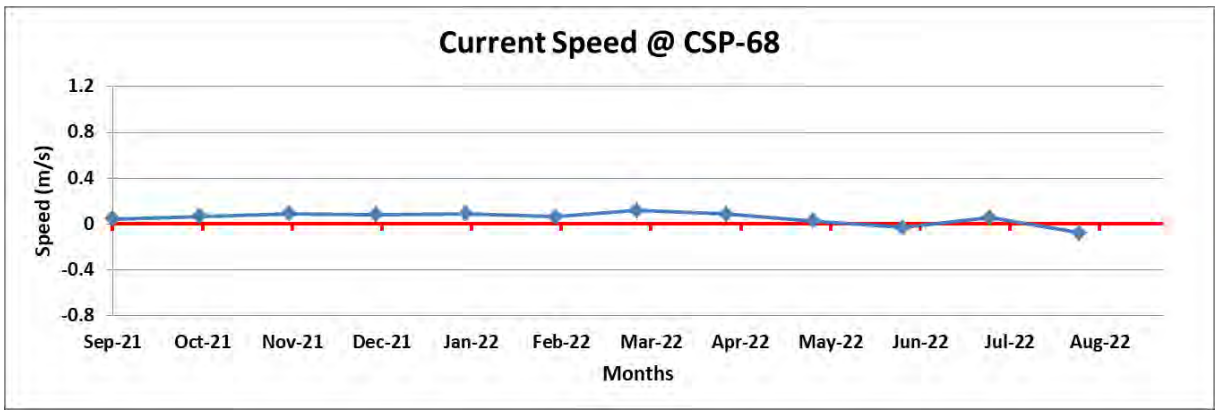


Figure 2-234 Time series of current speed at Shagumugham (September 2021 –August 2022)

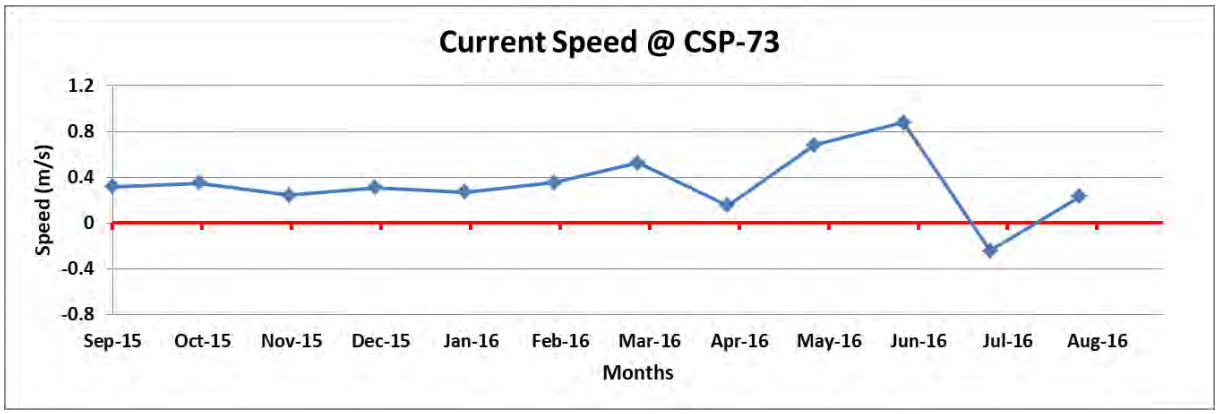


Figure 2-235 Time series of current speed at Vettucaud (September 2015 –August 2016)

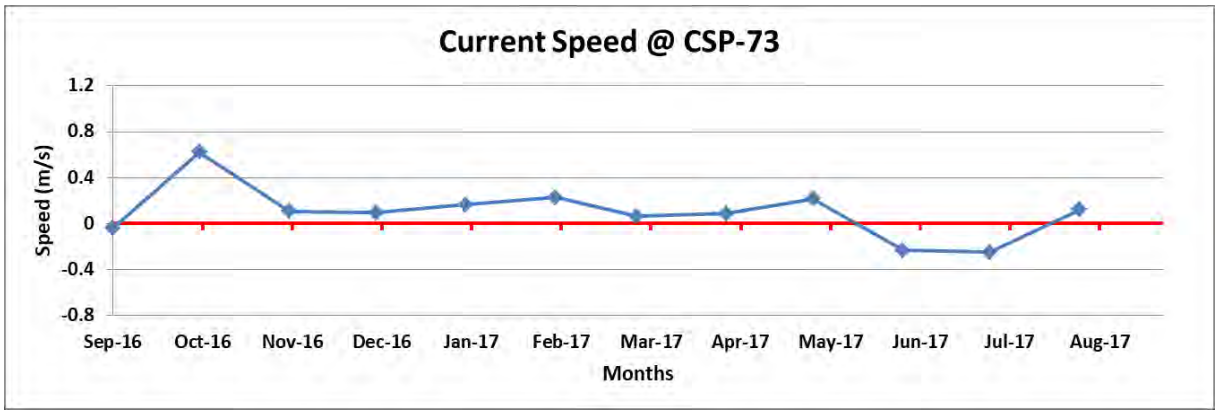


Figure 2-236 Time series of current speed at Vettucaud (September 2016 –August 2017)

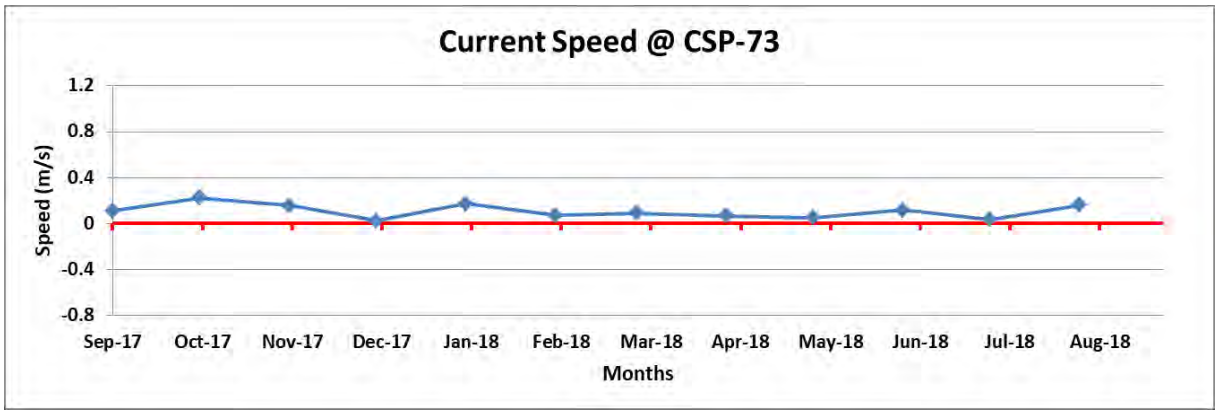


Figure 2-237 Time series of current speed at Vettucaud (September 2017 –August 2018)

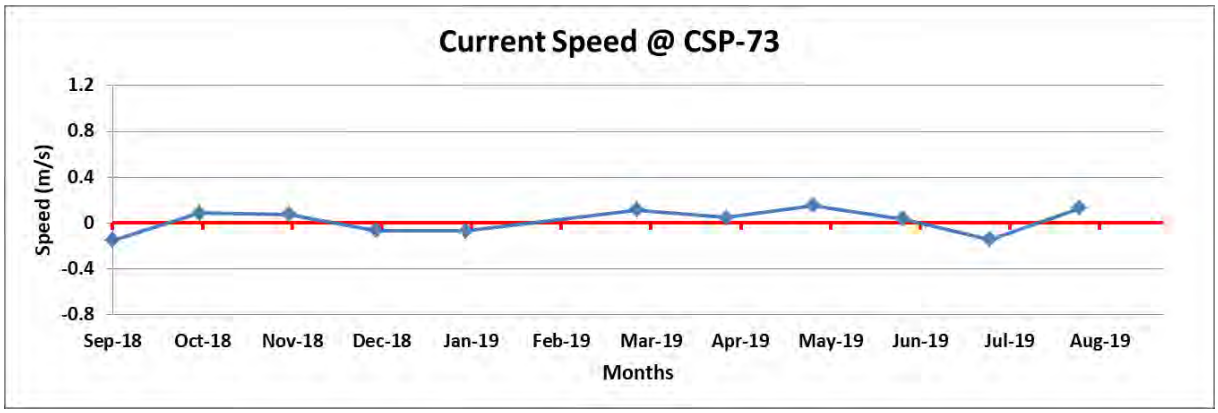


Figure 2-238 Time series of current speed at Vettucaud (September 2018 –August 2019)

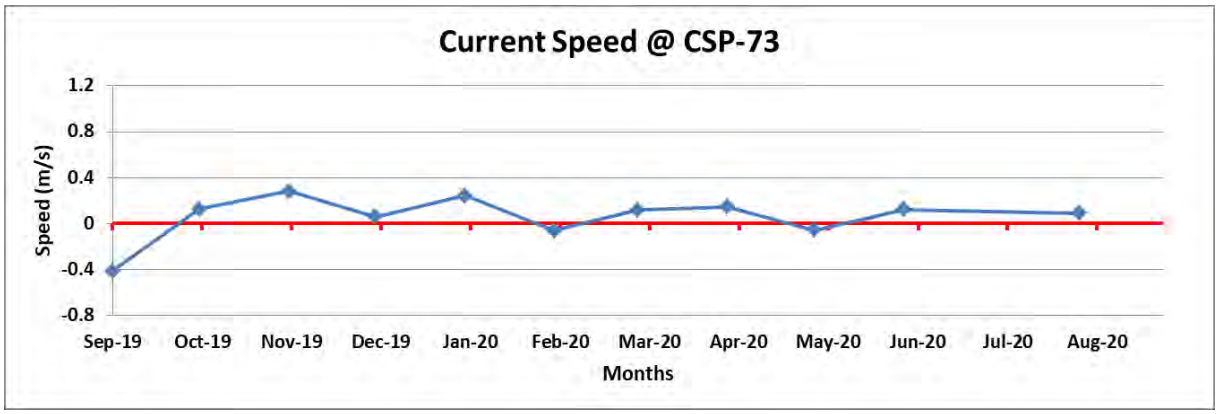


Figure 2-239 Time series of current speed at Vettucaud (September 2019 –August 2020)

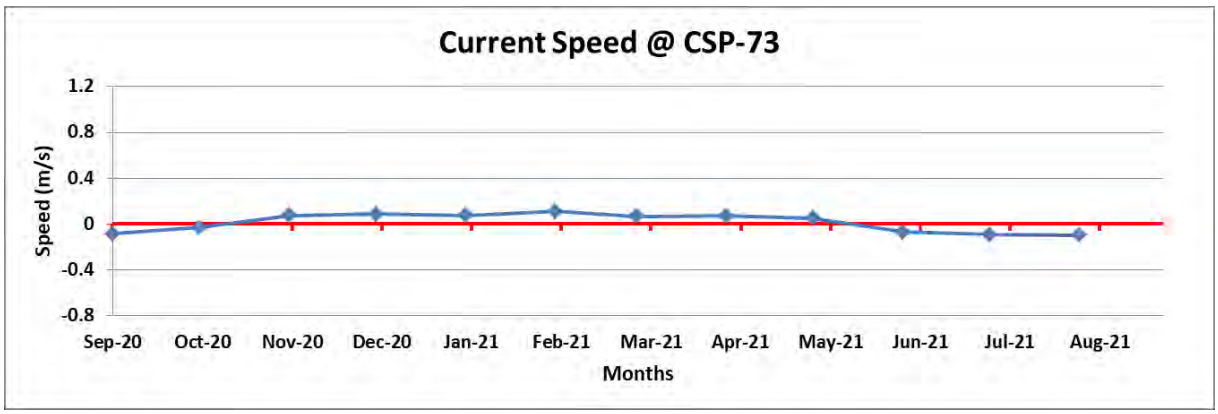


Figure 2-240 Time series of current speed at Vettucaud (September 2020 –August 2021)

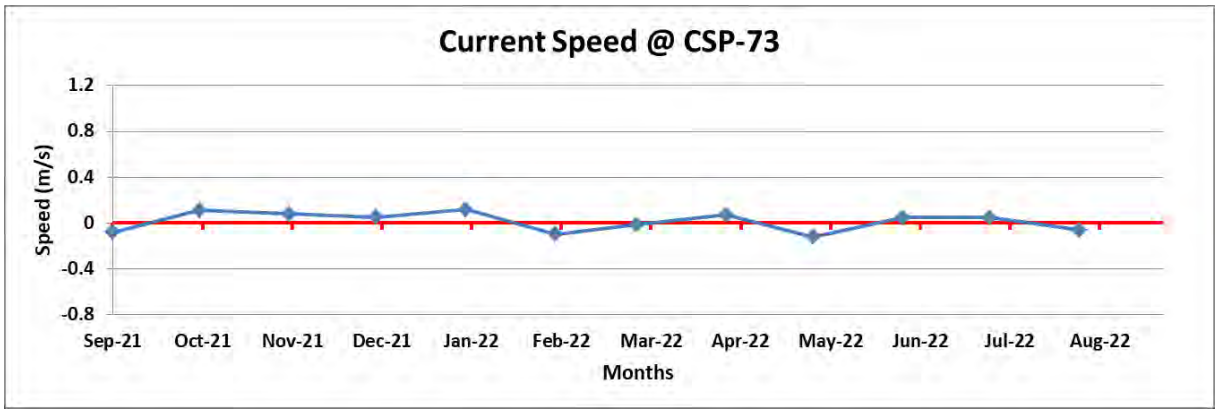
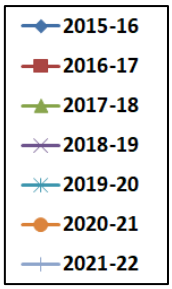


Figure 2-241 Time series of current speed at Vettucaud (September 2021 –August 2022)



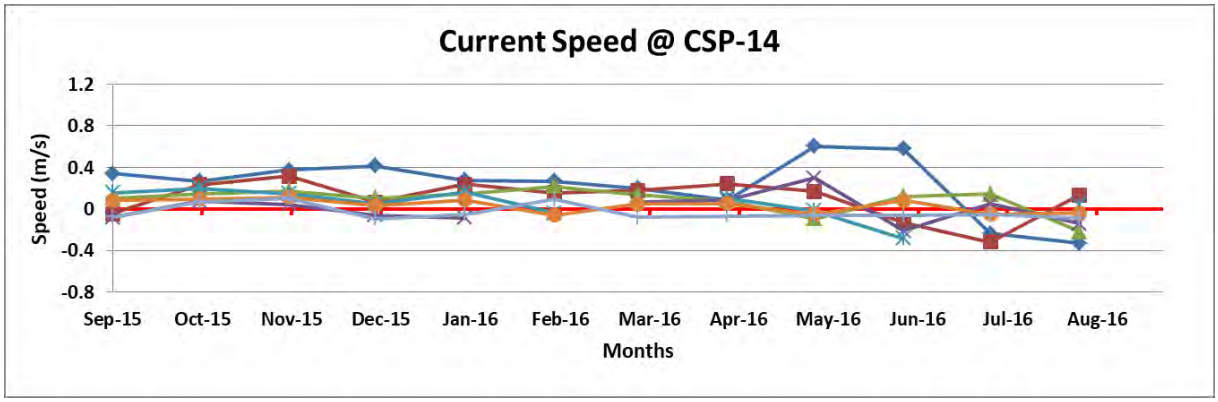


Figure 2-242 Time series of current speed at Paruthiyoor (September 2015 –August 2022)

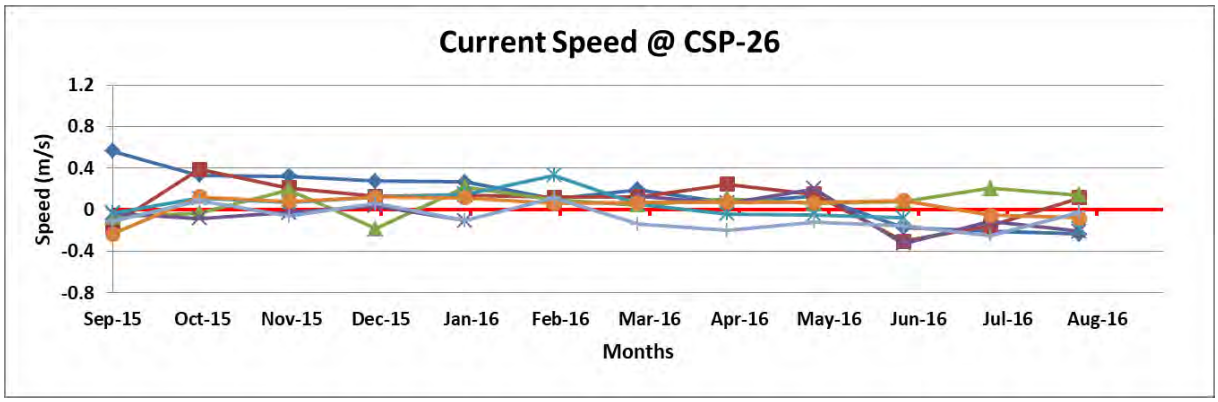


Figure 2-243 Time series of current speed at Karumkulam (September 2015 –August 2022)

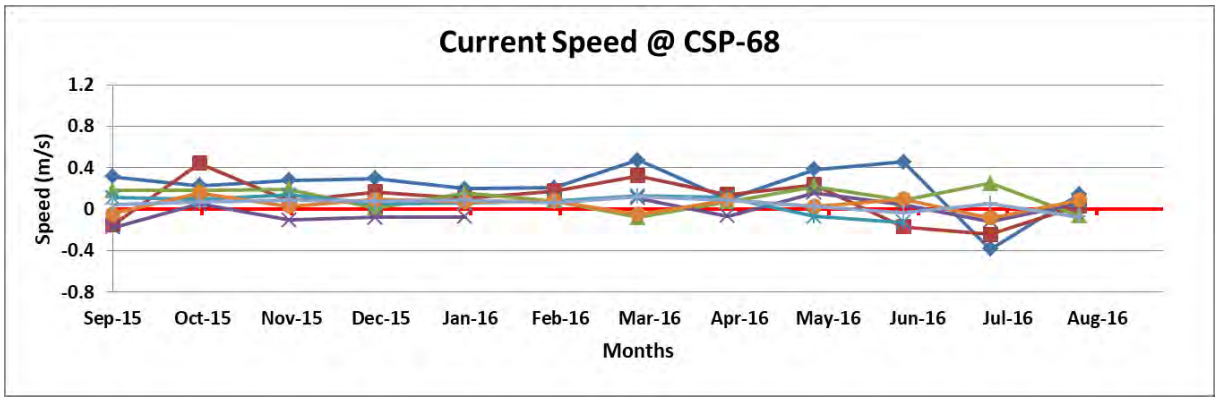


Figure 2-244 Time series of current speed at Shagumugham (September 2015 –August 2022)

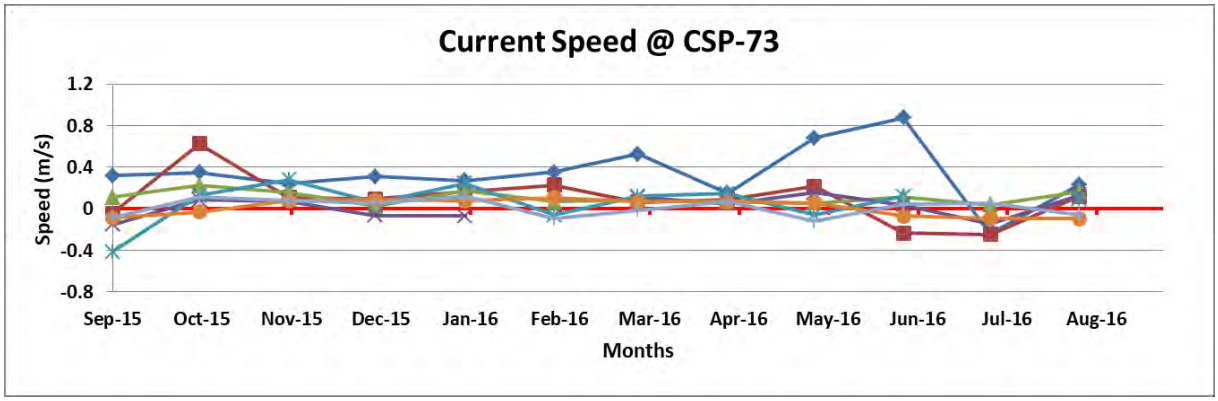


Figure 2-245 Time series of current speed at Vettucaud (September 2015 –August 2022)

3 Model Studies

3.1 Wave Transformation

Near shore wave transformation is carried out to assess the wave climate near the port construction site using the available offshore wave data. The offshore wave data obtained from ECMWF is transformed to near shore region and wave parameters such as wave height, wave direction and wave period is extracted at the point at which wave observations were carried out using the WRB. The simulated wave data is then compared with the observed wave data.

3.1.1 SWAN of Delft Hydraulics

SWAN (Simulating Waves Near shore) is a third-generation wave model for obtaining realistic estimates of wave parameters in coastal areas, lakes and estuaries from given wind, bottom and current conditions. However, SWAN can be used on any scale relevant for wind-generated surface gravity waves. The model is based on the wave action balance equation with sources and sinks. The main goal of the SWAN model is to solve the spectral action balance equation without any a prior restrictions on the spectrum for the evolution of wave growth. The action balance equation, read as (e.g., Mei, 1983; Komen et al., 1994):

$$\frac{\partial N}{\partial t} + \nabla_{\vec{x}} \cdot \left[\left(\overrightarrow{c_g} + \vec{U} \right) N \right] + \frac{\partial c_\sigma N}{\partial \sigma} + \frac{\partial c_\sigma N}{\partial \theta} = \frac{S_{tot}}{\sigma}$$

The left-hand side is the kinematic part of this equation. The second term denotes the propagation of wave energy in two-dimensional geographical $\vec{x}$-space, with the group velocity

$$\overrightarrow{c_g} = \partial\sigma / \partial \vec{k}$$

following from the dispersion relation $\sigma^2 = g|\vec{k}| \tanh(|\vec{k}|d)$ where $\vec{k}$ is the wave number vector and *d* the water depth. The third term represents the effect of shifting of the radian frequency due to variations in depth and mean currents. The fourth term represents depth-induced and current-induced refraction. The quantities c_σ and c_θ are the propagation velocities in spectral space (σ, θ). The right-hand side contains S_{tot}, which is the source/sink term that represents all physical processes which generate, dissipate, or redistribute wave energy. Thus, this equation represents the effects of spatial propagation, refraction, shoaling, generation, dissipation and nonlinear wave-wave interactions.

Wind generated waves have irregular wave heights and periods, caused by the irregular nature of wind. Due to this irregular nature, the sea surface is continually varying, which means that a deterministic approach to describe the sea surface is not feasible. On the other hand, statistical properties of the surface, like average wave height, wave periods and directions, appear to vary slowly in time and space, compared to typical wave periods and wave lengths. The surface elevation of waves in the ocean, at any location and any time, can be seen as the sum of a large number of harmonic waves, each of which has been generated by turbulent wind in different places and times. They are therefore statistically independent in their origin. According to linear wave theory, they remain independent during their journey across the ocean. Under these conditions, the sea surface elevation on a time scale of one hundred characteristic wave periods is sufficiently well described as a stationary, Gaussian process. The sea surface elevation in one point as a function of time can be described as

$$\eta(t) = \sum_{i}^{\cdot} a_i \cos(\sigma_i t + a_i)$$

with η the sea surface elevation, a_i the amplitude of the i^{th} wave component, σ_i the relative radian or circular frequency of the i^{th} wave component in the presence of the ambient current (equals the absolute radian frequency ω when no ambient current is present) and α_i the random phase of the i^{th} wave component. This is called the random-phase model. In the presence of the ambient current, it is assumed that it is uniform with respect to the vertical co-ordinate and the changes in the mean flow within a wave length are so small that they affect only negligibly the dispersion relation. The absolute radian frequency ω then equals the sum of the relative radian frequency σ and the multiplication of the wave number and ambient current velocity vectors:

$$\omega = \sigma + \vec{k}.\vec{u}$$

which is the usual Doppler shift. For linear waves, the relative frequency is given by

$$\sigma^2 = gk \tanh(kd)$$

Where g is the acceleration of gravity and d is the water depth.

3.1.2 Model Domain

Using the inputs of bathymetry data discussed in Section 2.6, the model bathymetry was prepared. The bathymetry covered a large area of around 100X90km^2, ensuring the proper propagation of the incident waves from all the possible directions. The model bathymetry is shown in Figure 3-1.

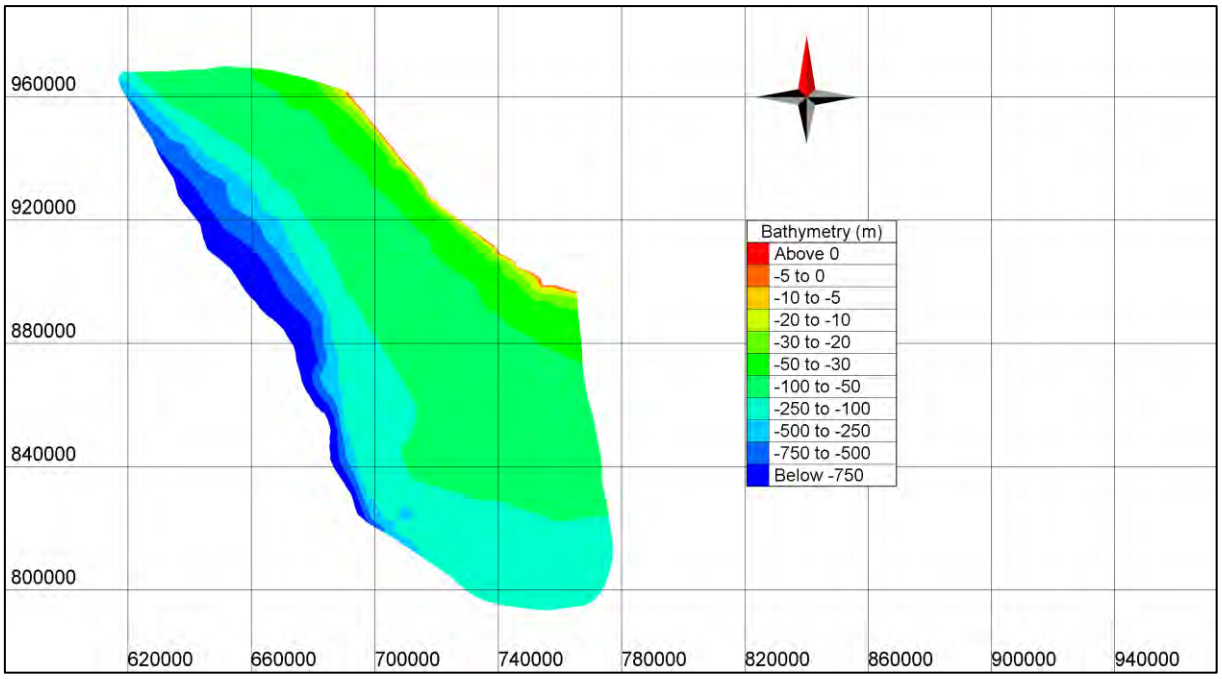


Figure 3-1 Model bathymetry

3.1.3 Model simulations and results

Offshore wave data at 08°00' 00" N, 76°00'00" E were obtained from NCEP. The time frame of data matches with that of the observed wave data collection period. The major wave

parameters like significant wave height, wave direction and time period are thus obtained from NCEP. A typical result from the wave transformation simulations is shown in Figure 3-2.

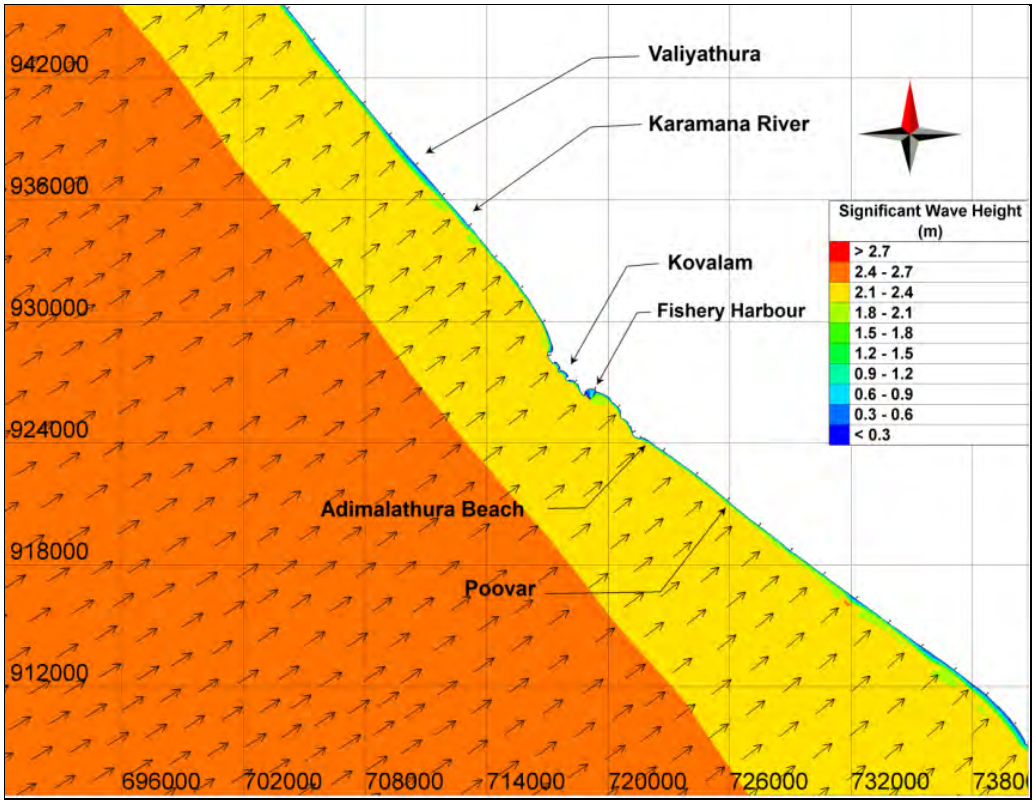


Figure 3-2 Wave transformation for H_s = 2.8m, T_p = 7.8s, Direction - WSW (247.5^0)

The modelled near shore wave data were extracted at the point (08° 21' 42.3"N, 76° 59' 33.9"E, depth -23.2m CD) where the wave observation was carried out. The comparison of modelled wave data and the observed wave data is plotted and shown from Figure 3-3 to Figure 3-5.

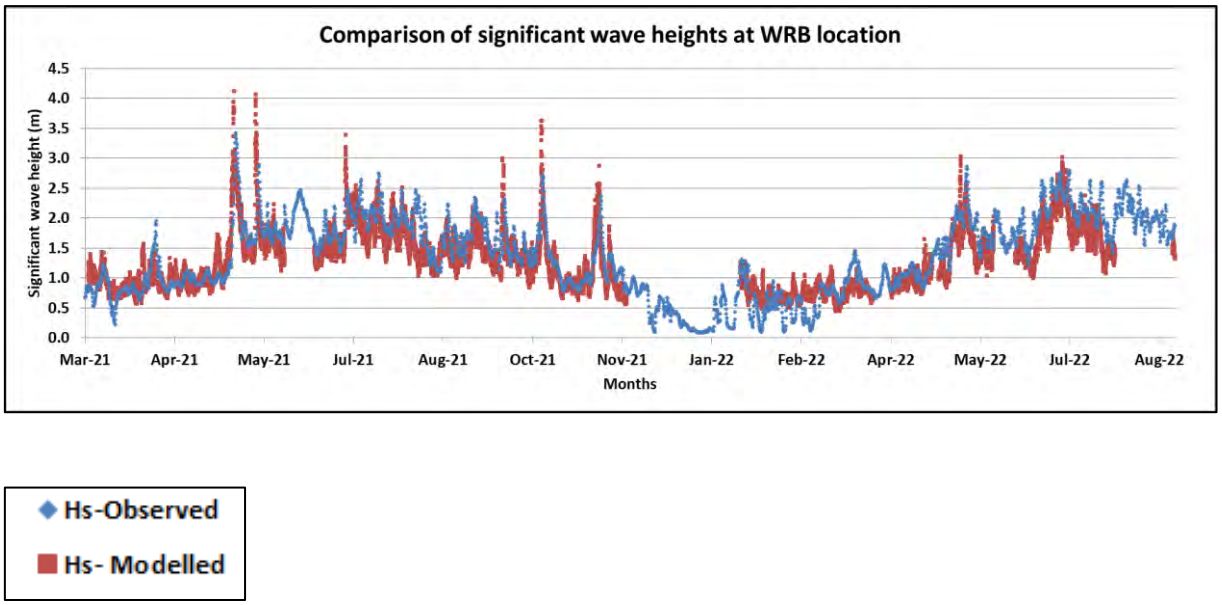


Figure 3-3 Comparison of significant wave heights (March 2021 to August 2022)

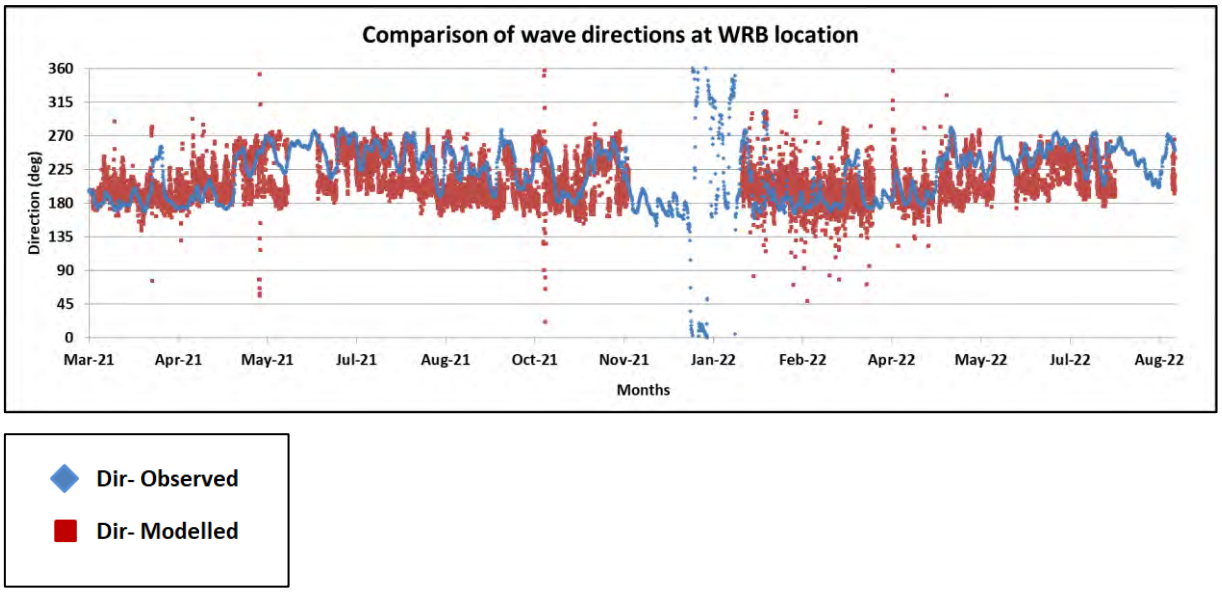


Figure 3-4 Comparison of wave directions (March 2021 to August 2022)

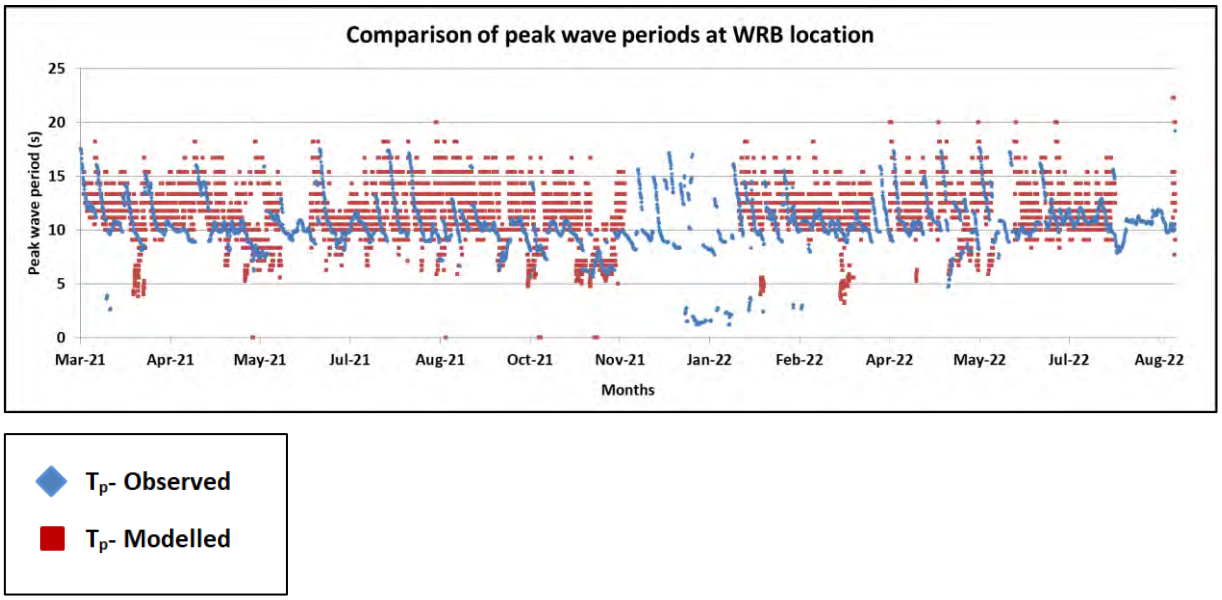


Figure 3-5 Comparison of peak wave periods (March 2021 to August 2022)

From the plots it can be observed that the wave parameters obtained from modelled wave data and observed wave data are in the same band. All the three parameters such as significant wave height, peak wave period and wave direction (True North) shows plausible comparison.

3.2 Assessment of hydrodynamics

3.2.1 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.

3.2.2 Model setup using TELEMAC-2D

In this study, the model domain is updated as per the latest August 2022 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 30m) to resolve the proposed schemes and velocities properly. The mesh near the target location can be viewed in Figure 3-6. The model bathymetry was prepared using the available primary and secondary data and is shown in Figure 3-7. The latest length of breakwater, as on August 2022, is included in the model for hydrodynamic modelling.

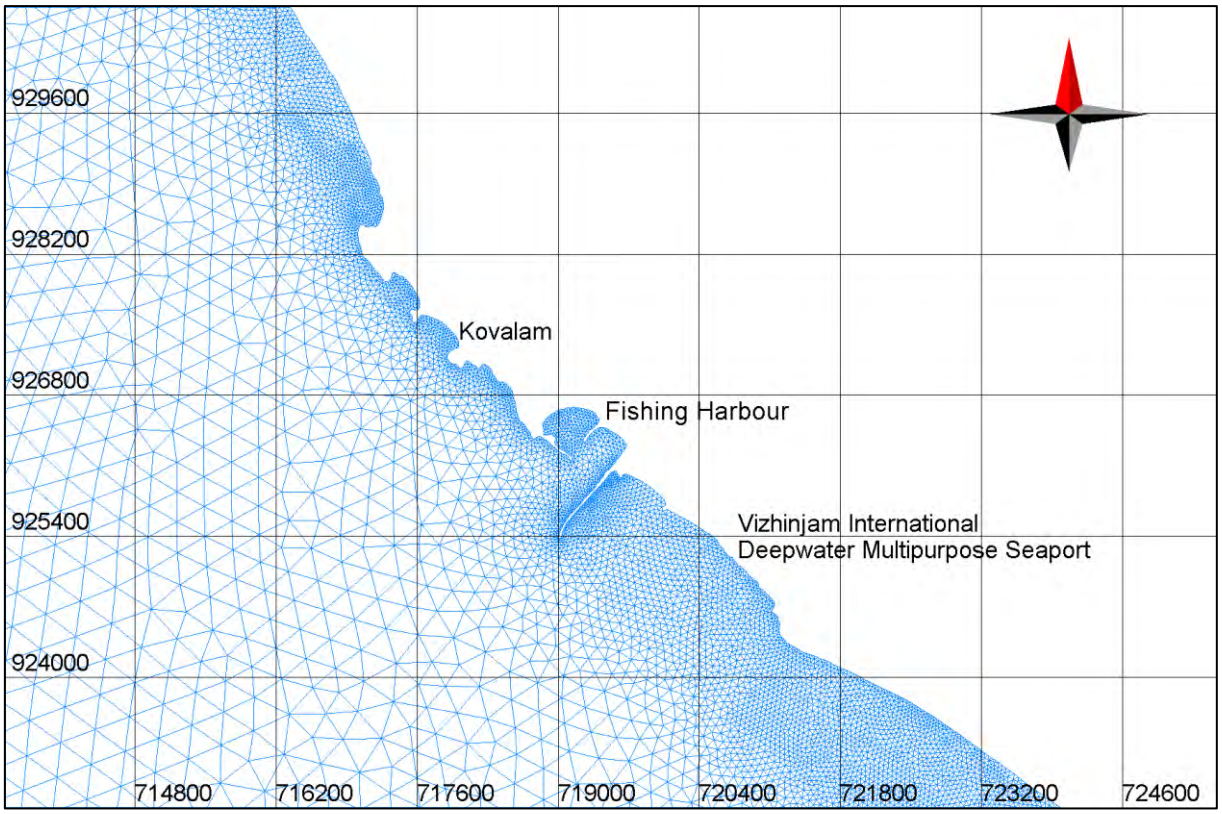


Figure 3-6 Fine mesh near project location

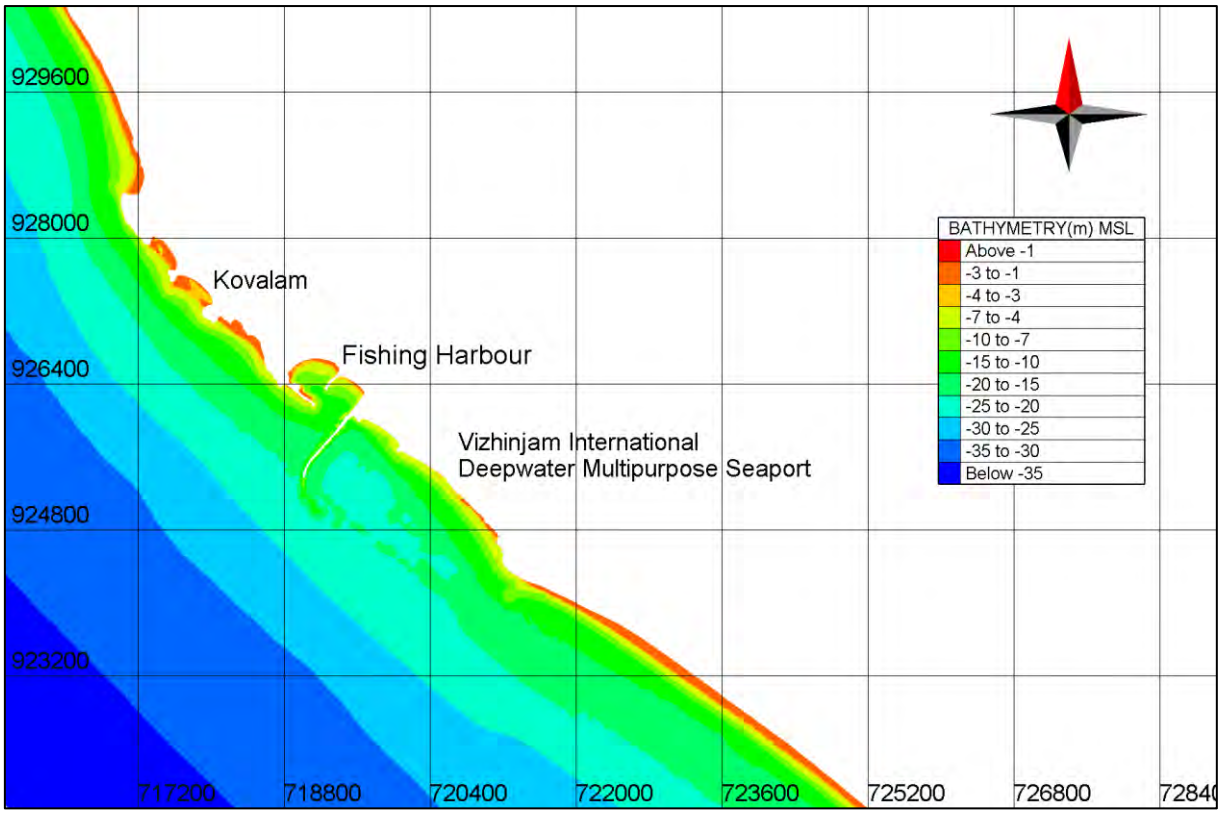


Figure 3-7 Latest bathymetry with respect to MSL

3.2.2.1 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 3-8.

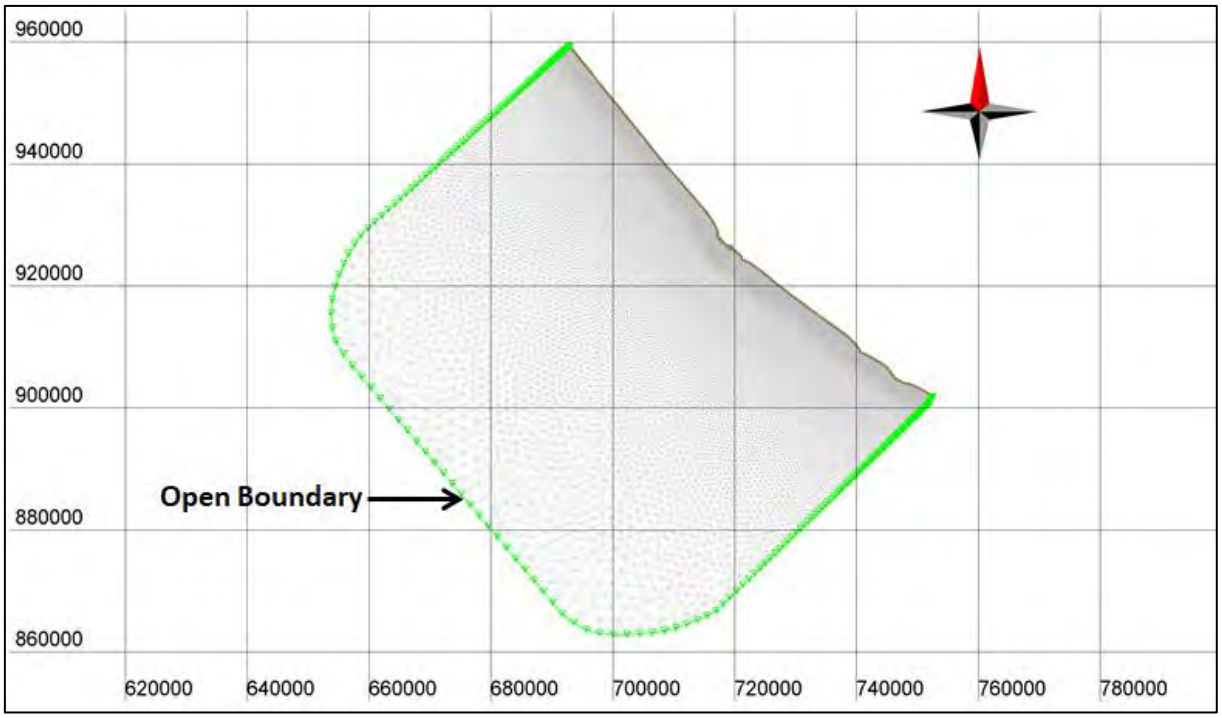


Figure 3-8 Open boundary conditions – HD model

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.

3.2.2.2 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 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 3-9 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.

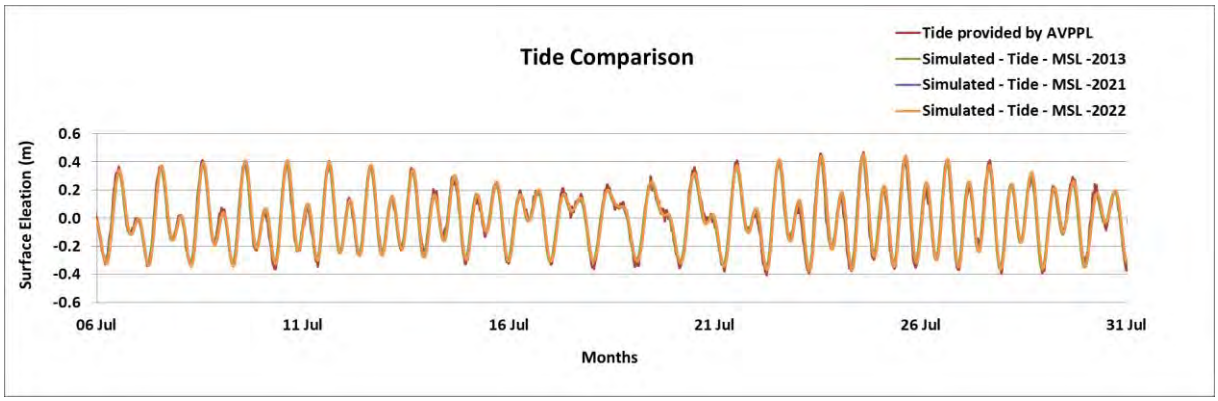
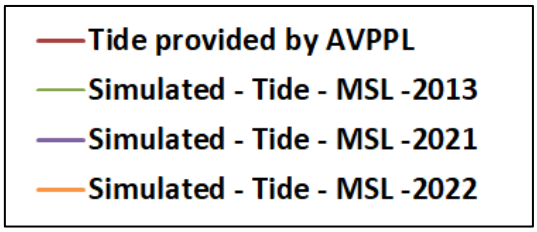


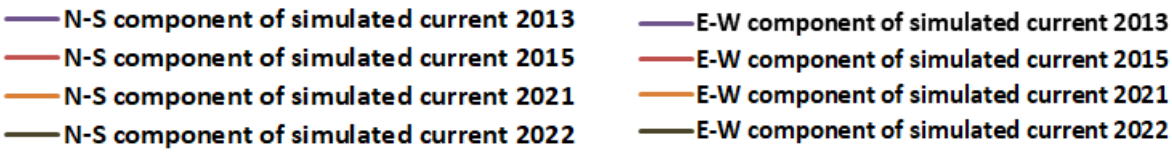
Figure 3-9 Comparison of simulated tide with AVPPL data 2013 (SW Monsoon)



Legend of Tide comparison plot

Figure 3-12 to Figure 3-17 shows the comparison of N-S and E-W components of simulated currents (2013, 2015, 2021 and 2022) 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 3-11) the current speeds have reduced and it can be noticed from N-S components plots presented below. Figure 3-18 and Figure 3-19 shows typical plots from the simulation.



Legend of current comparison plots at CM locations

Figure 3-10 Current meter locations (2013)

Figure 3-11 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
CM3	24.0		719013 E	924545 N

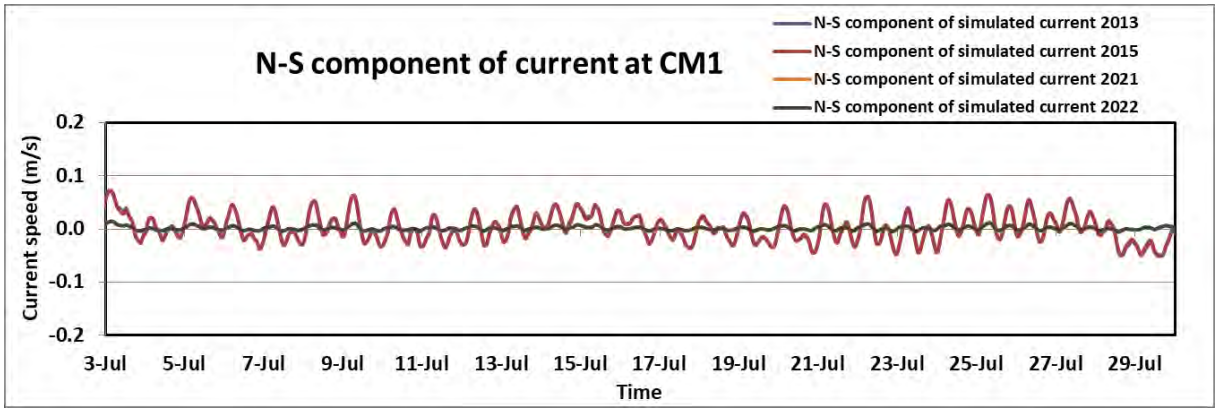


Figure 3-12 Comparison of N-S component of current at CM1 during SW-monsoon

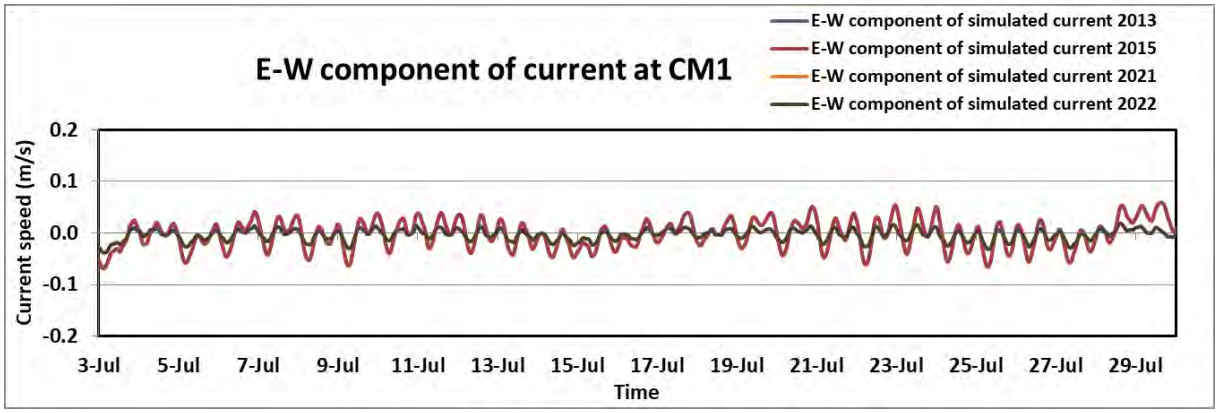


Figure 3-13 Comparison of E-W component of current at CM1 during SW-monsoon

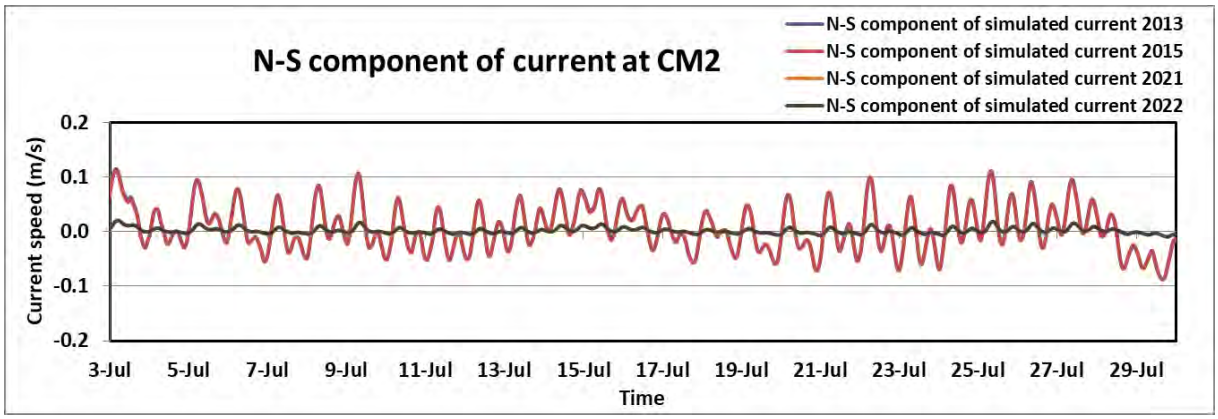


Figure 3-14 Comparison of N-S component of current at CM2 during SW-monsoon

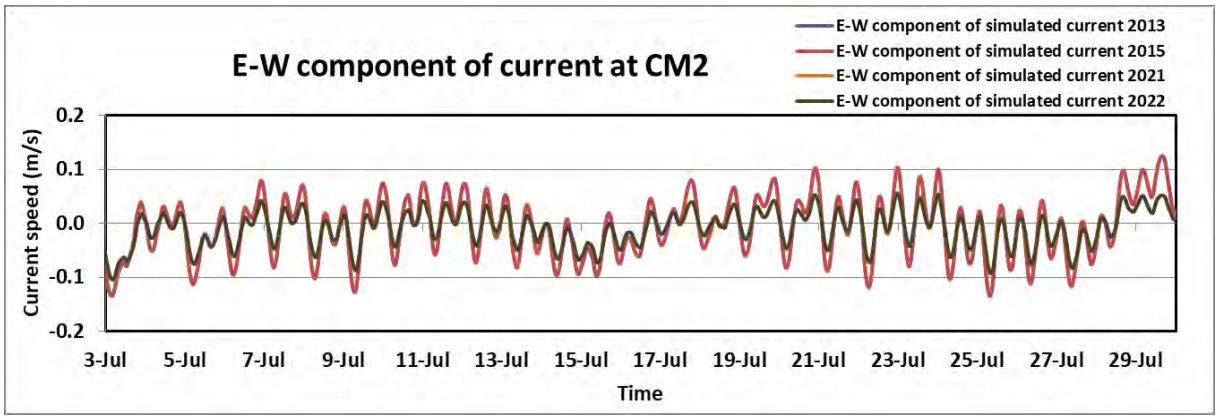


Figure 3-15 Comparison of E-W component of current at CM2 during SW-monsoon

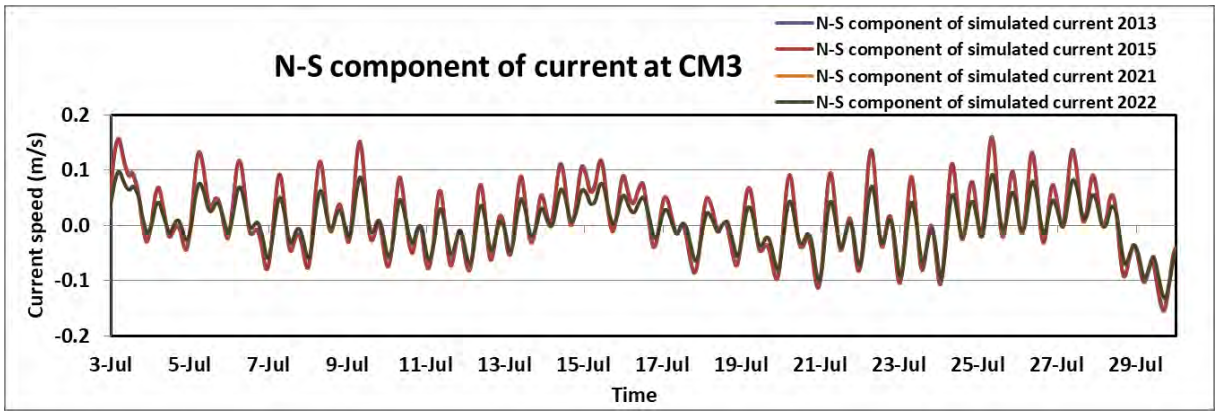


Figure 3-16 Comparison of N-S component of current at CM3 during SW-monsoon

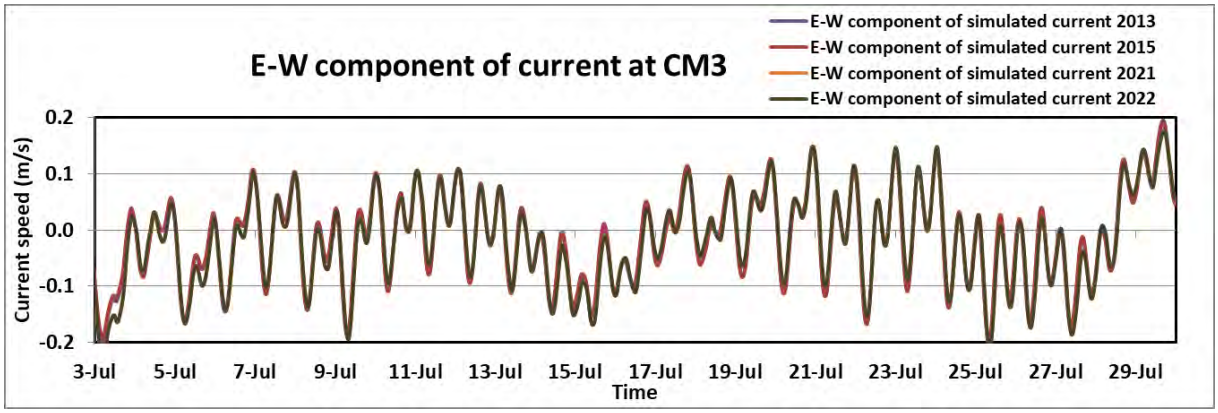


Figure 3-17 Comparison of E-W component of current at CM3 during SW-monsoon

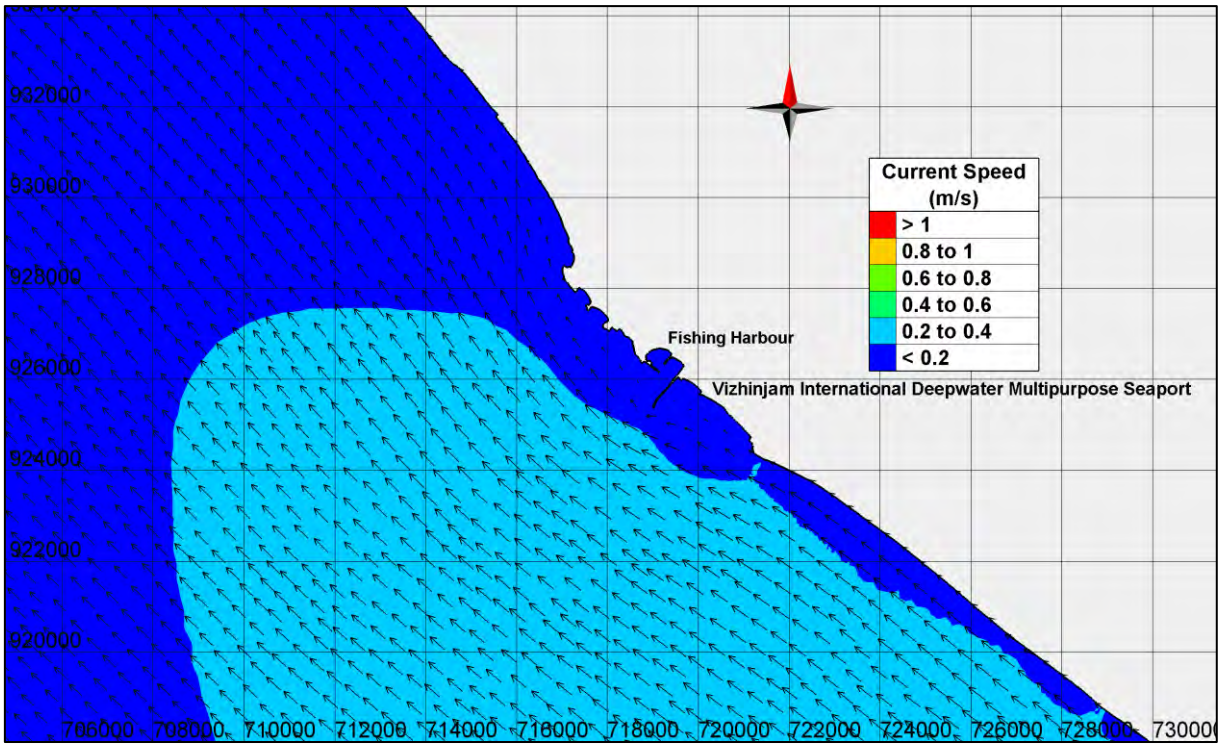


Figure 3-18 Current pattern showing north-westerly flow (typical during monsoon) for pre-monsoon bathymetry

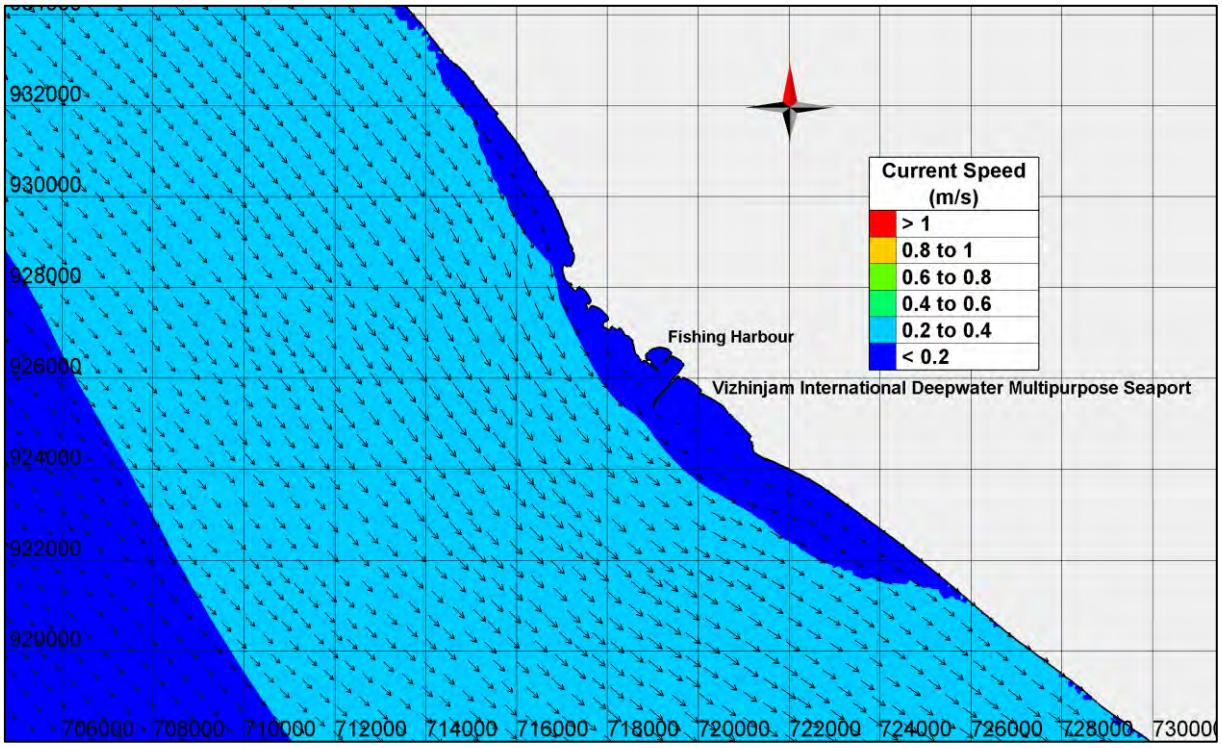


Figure 3-19 Current pattern showing south-easterly flow (typical during monsoon) for pre-monsoon bathymetry

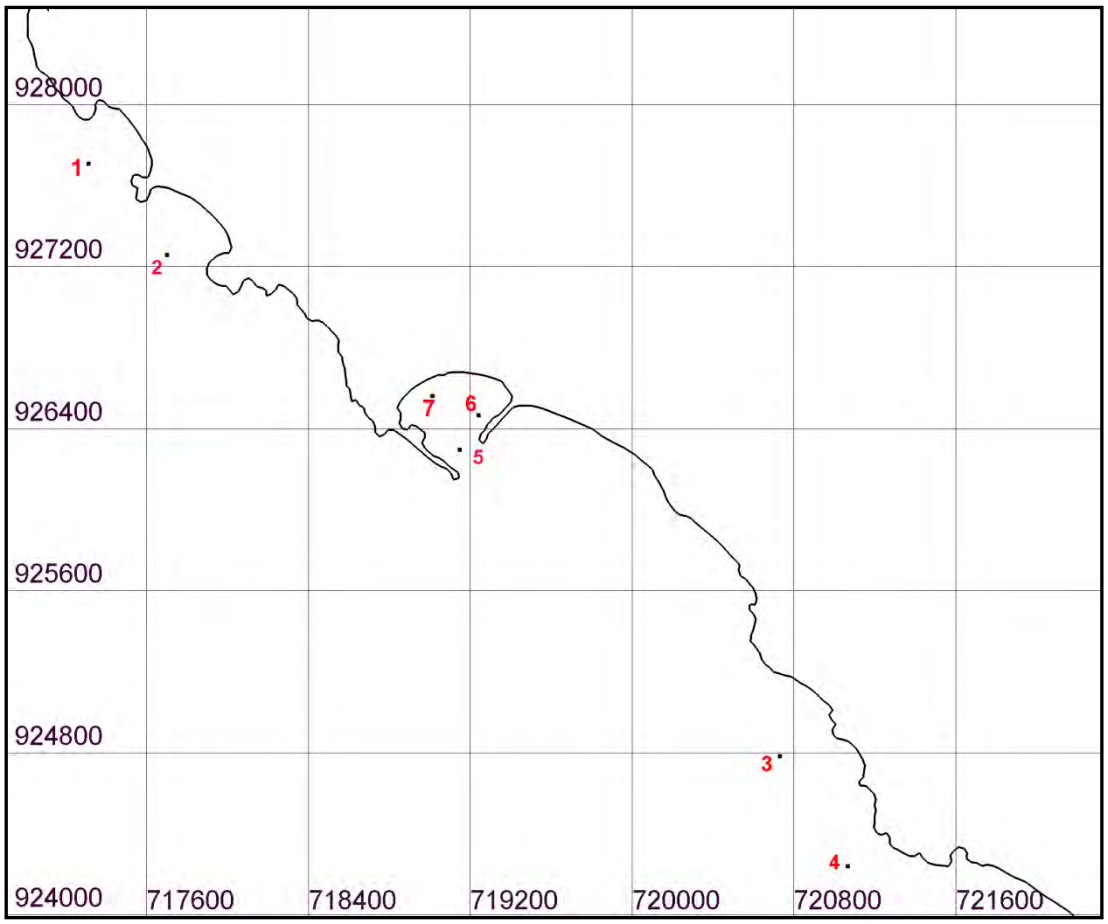
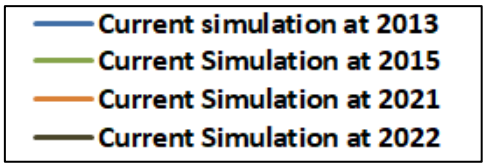


Figure 3-20 Current comparison points location (near shoreline)

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 3-20. The current comparison plots were shown in Figure 3-21 to Figure 3-27. 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.



Legend of current comparison plots at points

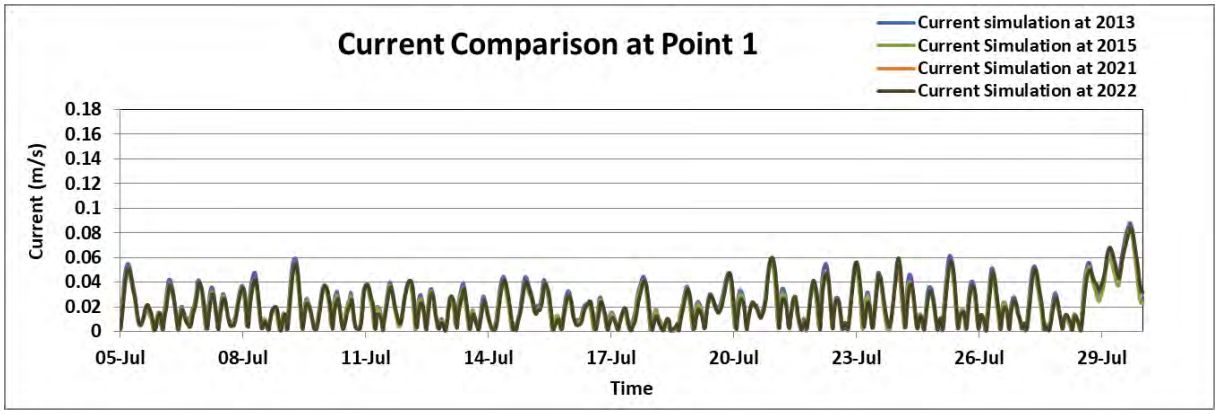


Figure 3-21 Current comparison at point 1

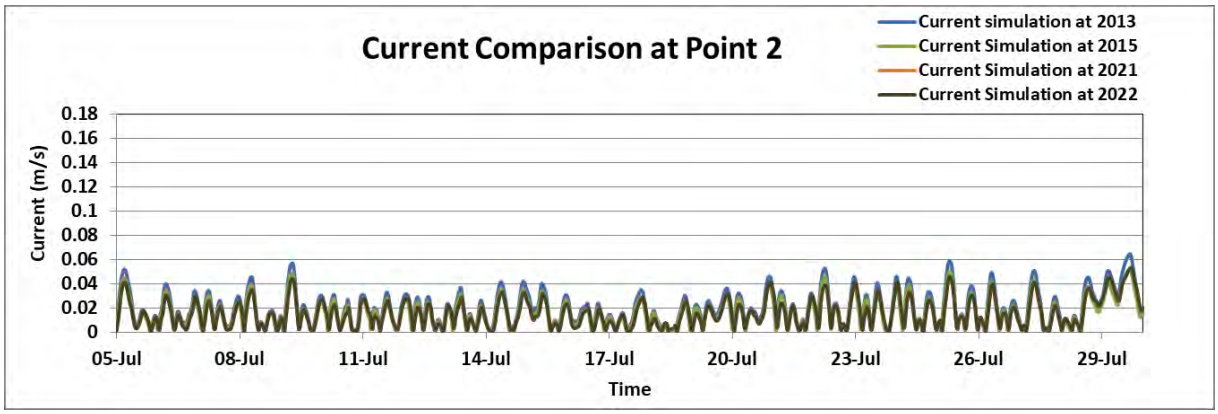


Figure 3-22 Current comparison at point 2

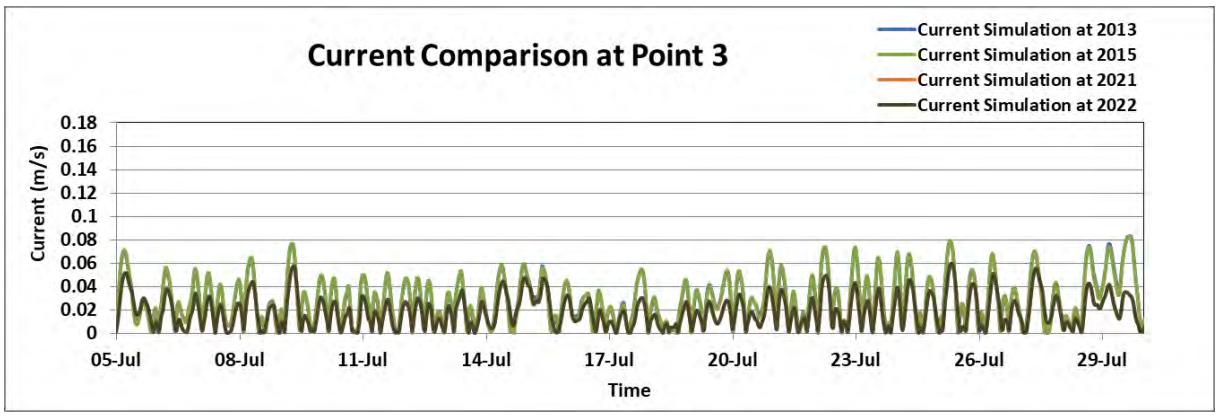


Figure 3-23 Current comparison at point 3

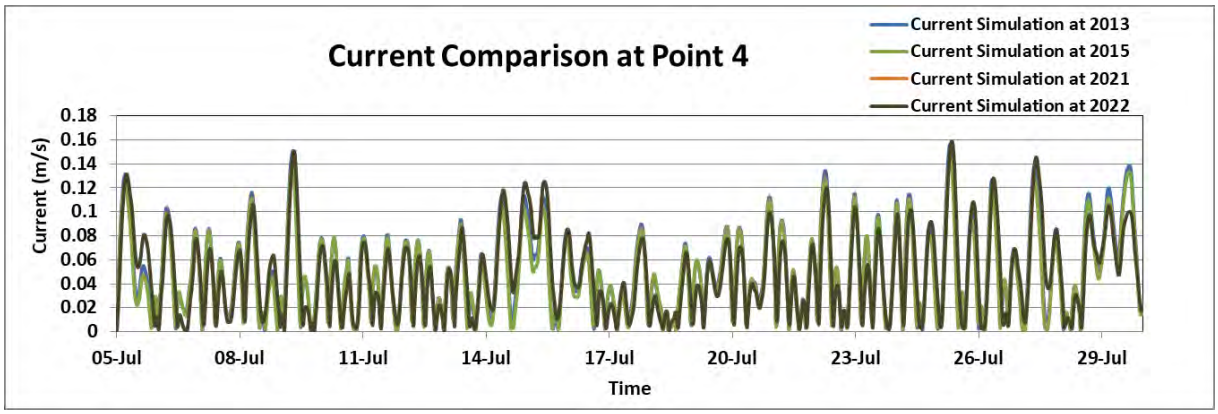
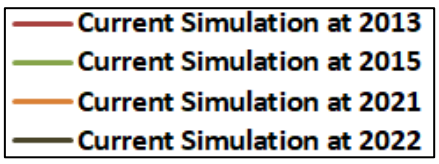


Figure 3-24 Current comparison at point 4



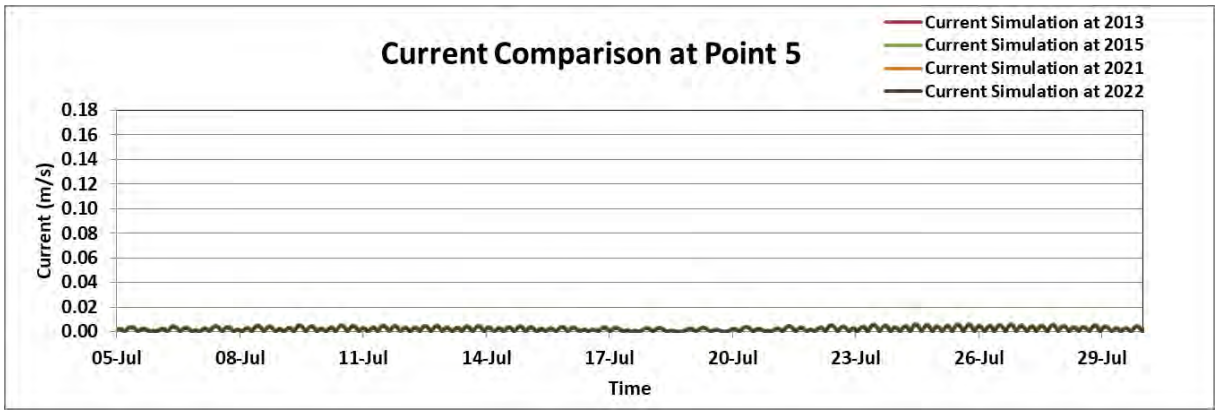


Figure 3-25 Current comparison at point 5

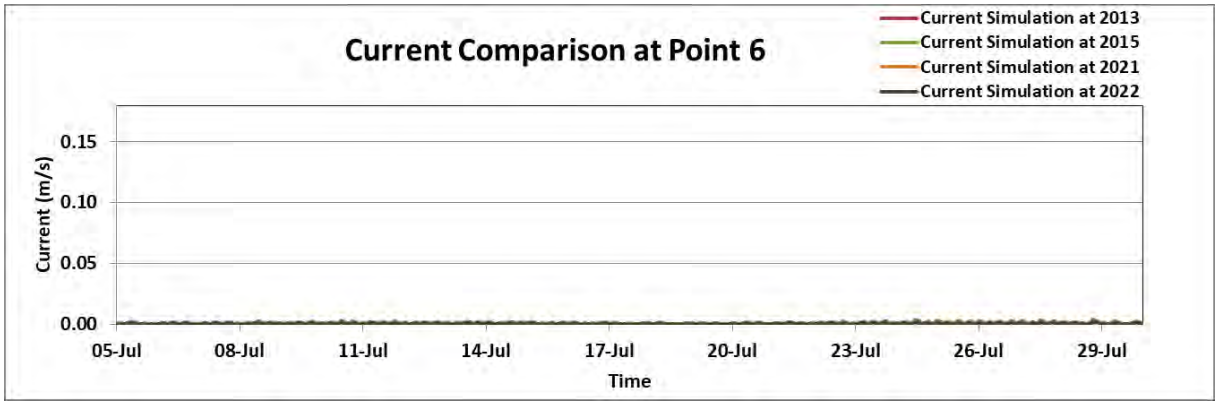


Figure 3-26 Current comparison at point 6

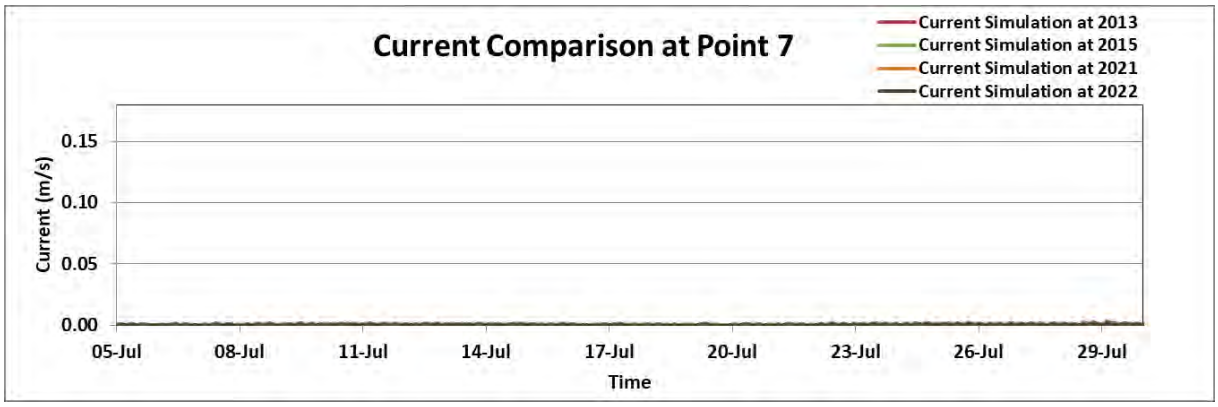


Figure 3-27 Current comparison at point 7

Also, model was setup using latest surveyed bathymetry as on date i.e. Pre monsoon 2021, Post Monsoon 2021 and Pre monsoon 2022. 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 3-7.

Comparison between the simulated and observed tide and currents were done. Figure 3-28, Figure 3-29 and Figure 3-30 show 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.

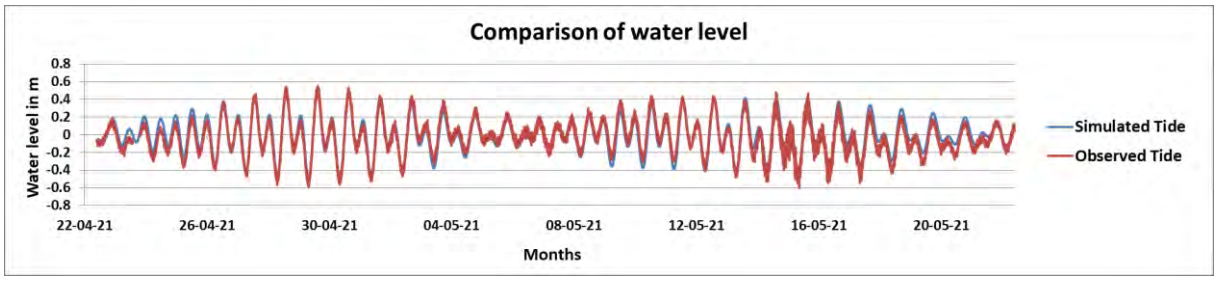


Figure 3-28 Comparison of simulated tide with observed tide (Pre Monsoon 2021)

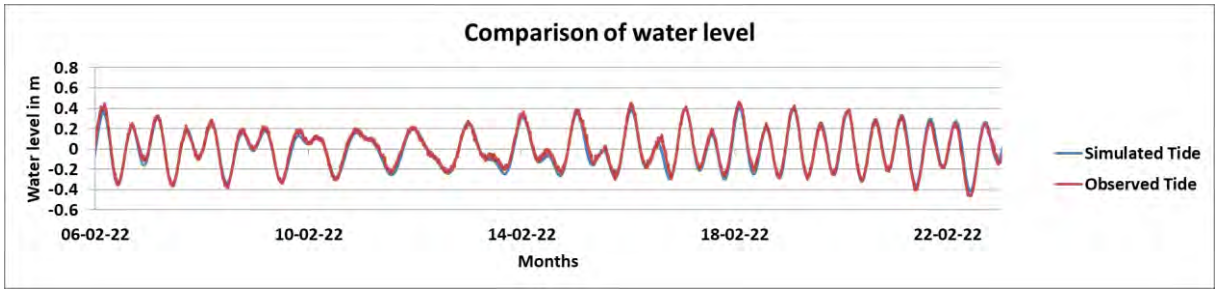


Figure 3-29 Comparison of simulated tide with observed tide (Post Monsoon 2021)

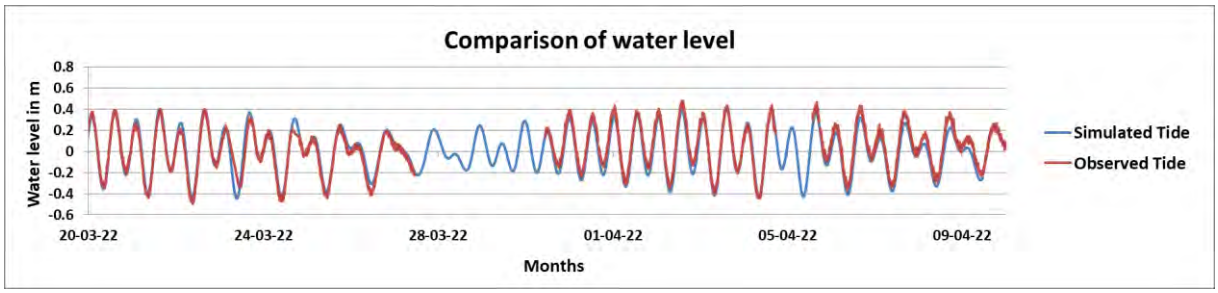


Figure 3-30 Comparison of simulated tide with observed tide (Pre Monsoon 2022)

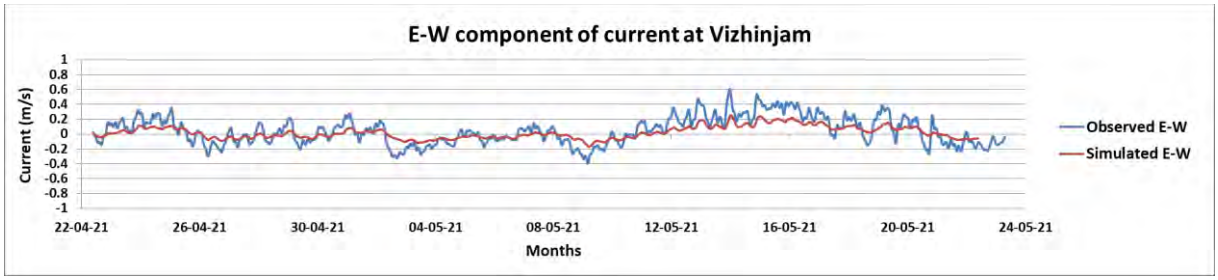


Figure 3-31 Comparison of E-W component of current at Vizhinjam (Pre Monsoon 2021)

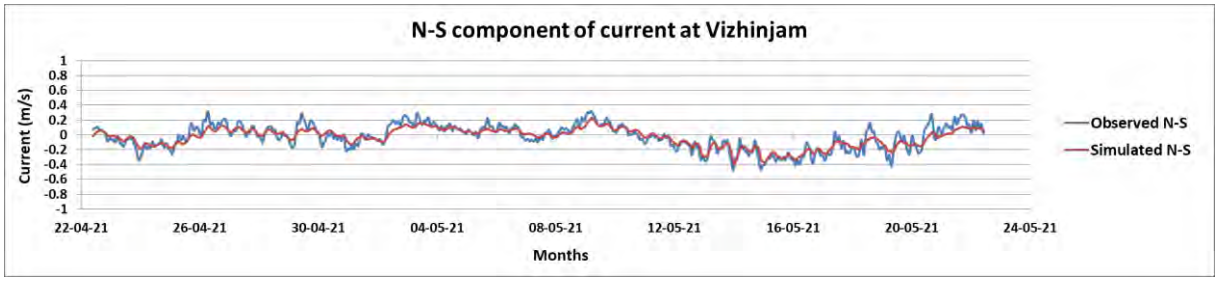


Figure 3-32 Comparison of N-S component of current at Vizhinjam (Pre Monsoon 2021)

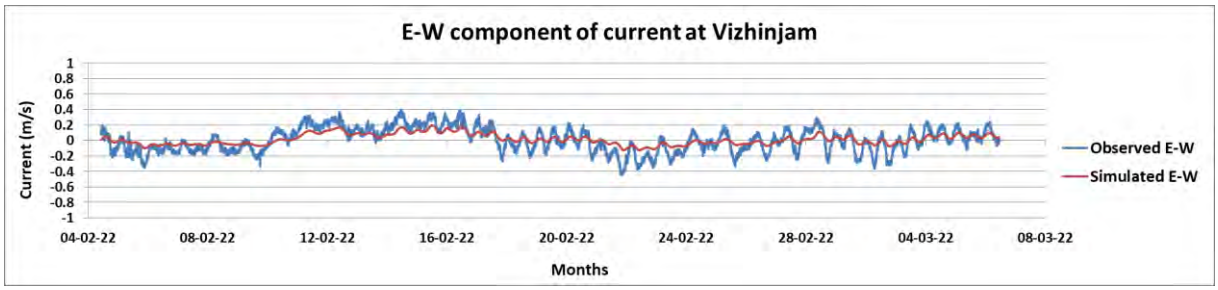


Figure 3-33 Comparison of E-W component of current at Vizhinjam (Post Monsoon 2021)

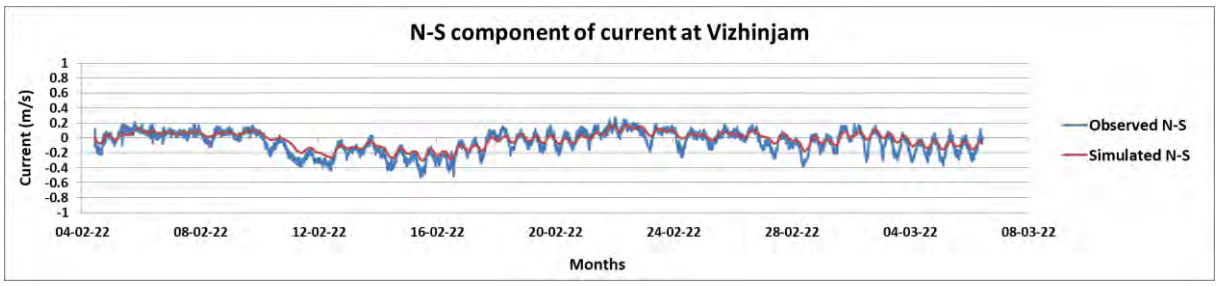


Figure 3-34 Comparison of N-S component of current at Vizhinjam (Post Monsoon 2021)

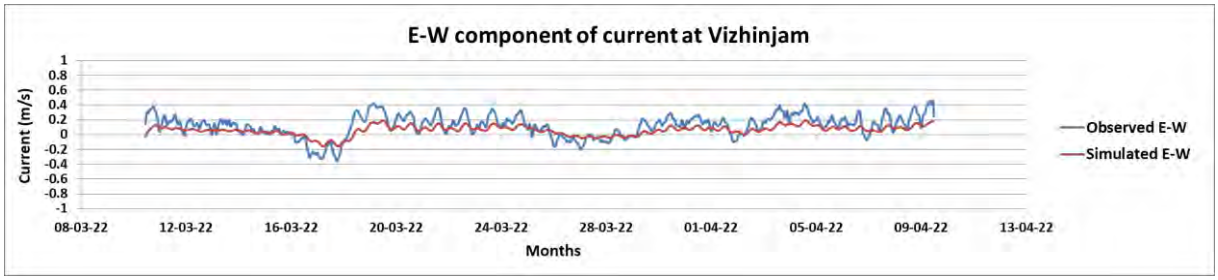


Figure 3-35 Comparison of E-W component of current at Vizhinjam (Pre Monsoon 2022)

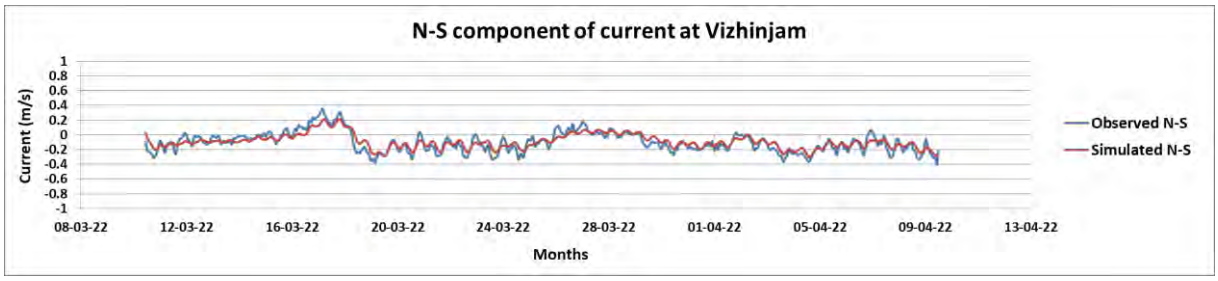


Figure 3-36 Comparison of N-S component of current at Vizhinjam (Pre Monsoon 2022)

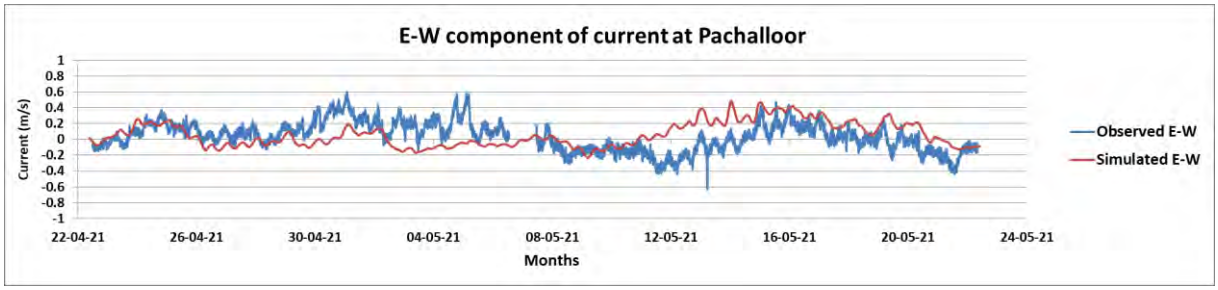


Figure 3-37 Comparison of E-W component of current at Pachalloor (Pre Monsoon 2021)

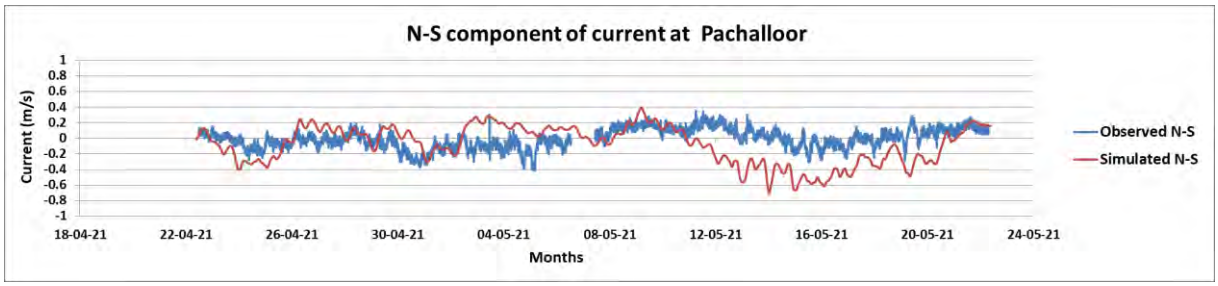


Figure 3-38 Comparison of N-S component of current at Pachalloor (Pre Monsoon 2021)

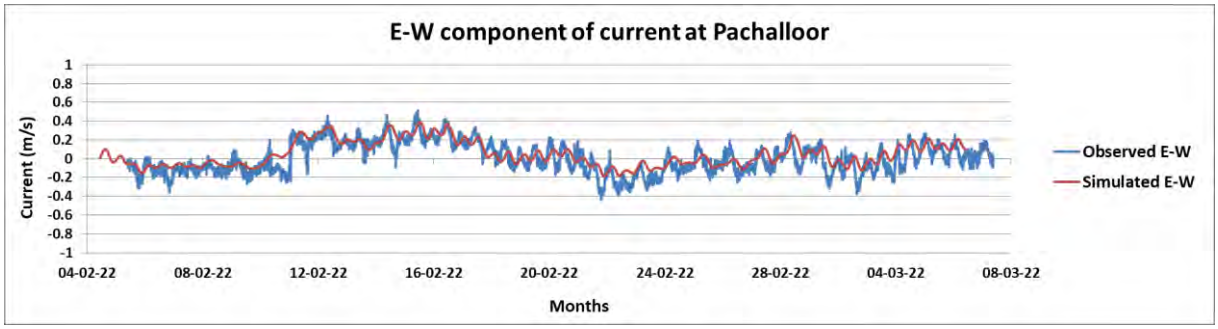


Figure 3-39 Comparison of E-W component of current at Pachalloor (Post Monsoon 2021)

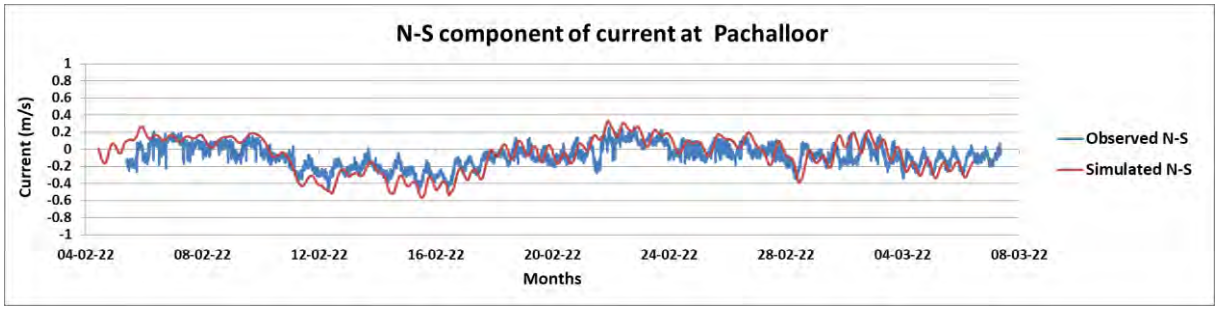


Figure 3-40 Comparison of N-S component of current at Pachalloor (Post Monsoon 2021)

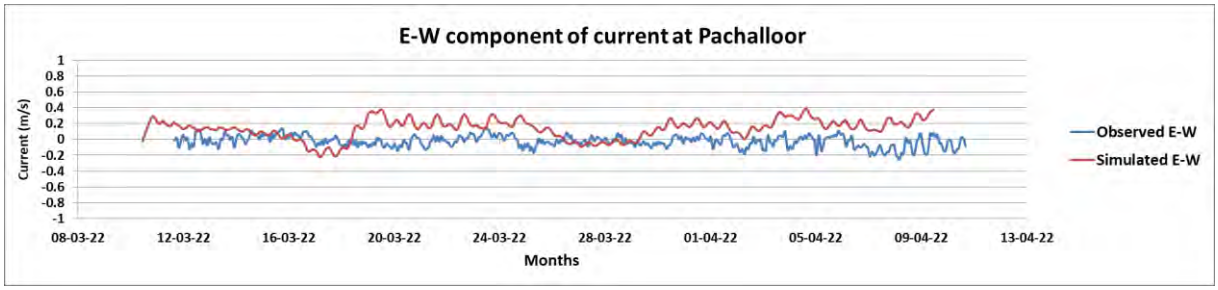


Figure 3-41 Comparison of E-W component of current at Pachalloor (Pre Monsoon 2022)

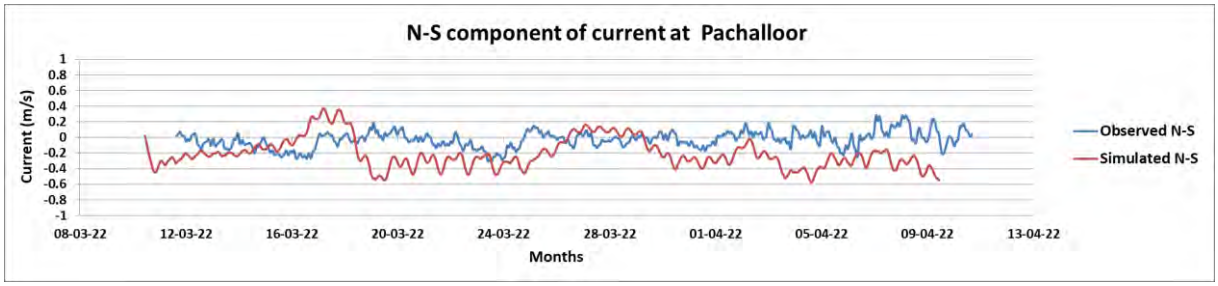


Figure 3-42 Comparison of N-S component of current at Pachalloor (Pre Monsoon 2022)

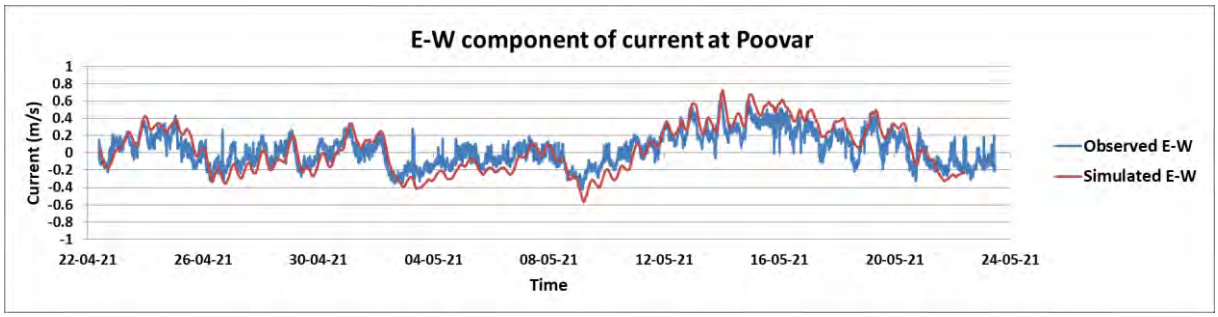


Figure 3-43 Comparison of E-W component of current at Poovar (Pre Monsoon 2021)

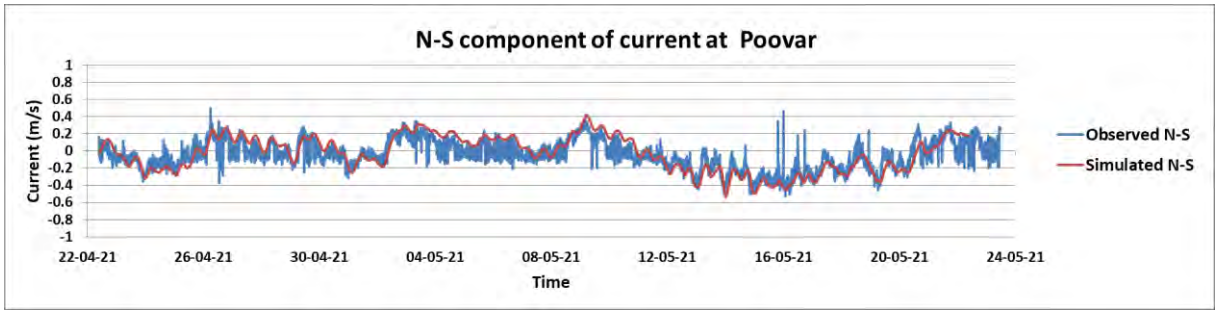


Figure 3-44 Comparison of N-S component of current at Poovar (Pre Monsoon 2021)

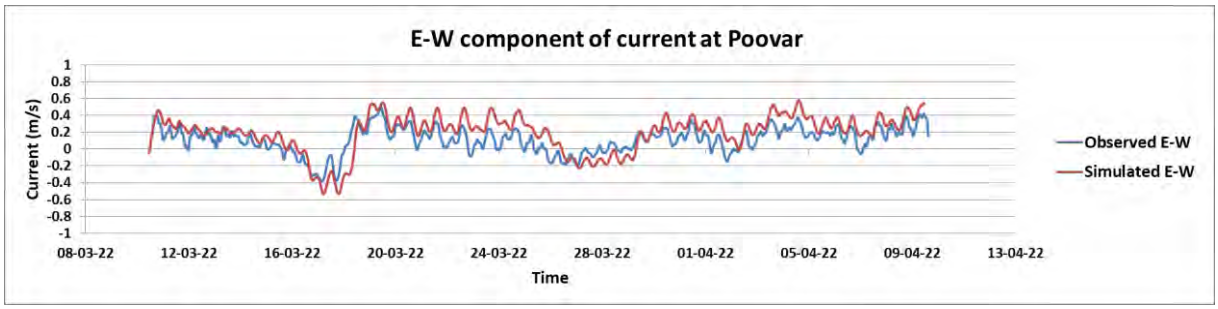


Figure 3-45 Comparison of E-W component of current at Poovar (Pre Monsoon 2022)

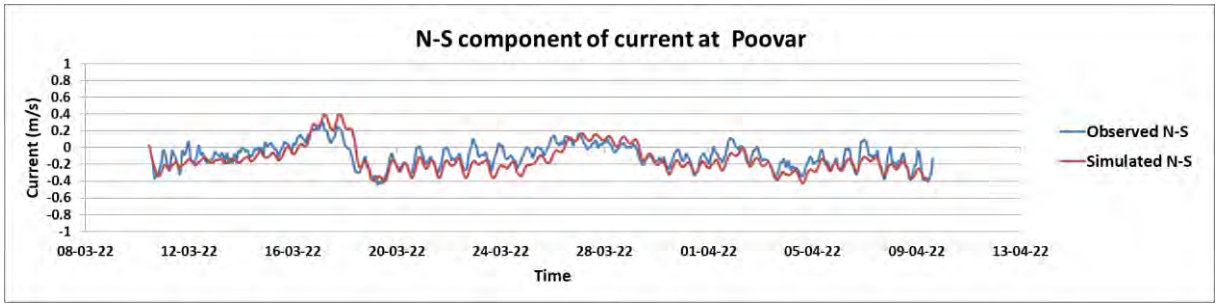


Figure 3-46 Comparison of N-S component of current at Poovar (Pre Monsoon 2022)

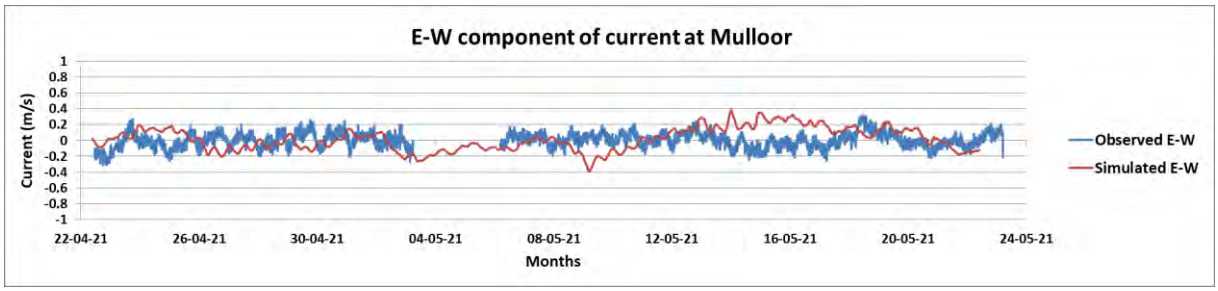


Figure 3-47 Comparison of E-W component of current at Mulloor (Pre Monsoon 2021)

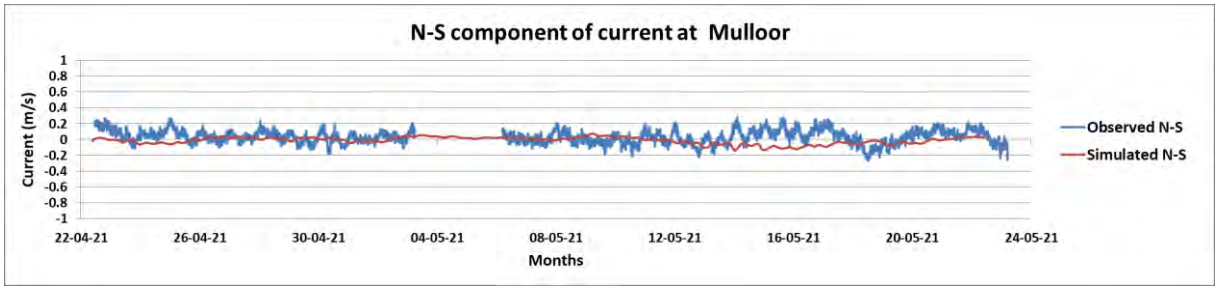


Figure 3-48 Comparison of N-S component of current at Mulloor (Pre Monsoon 2021)

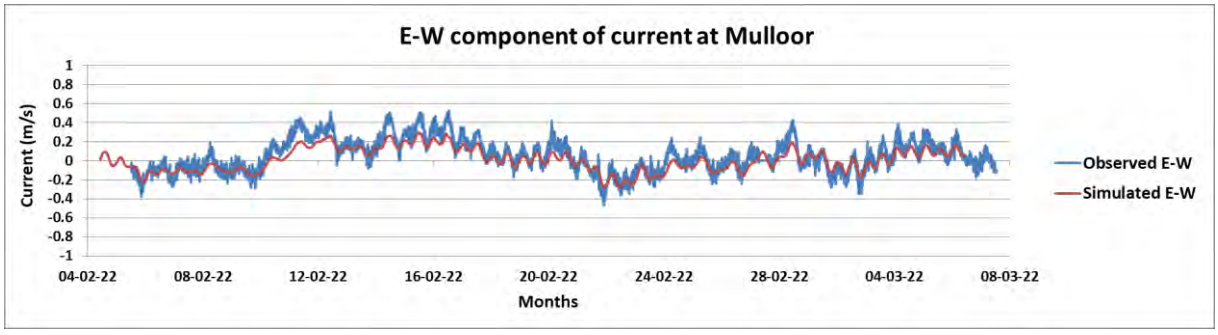


Figure 3-49 Comparison of E-W component of current at Mulloor (Post Monsoon 2021)

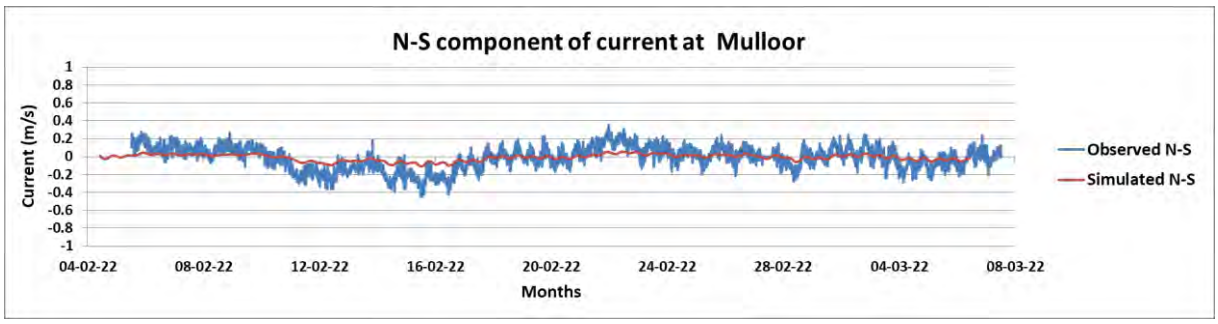


Figure 3-50 Comparison of N-S component of current at Mulloor (Post Monsoon 2021)

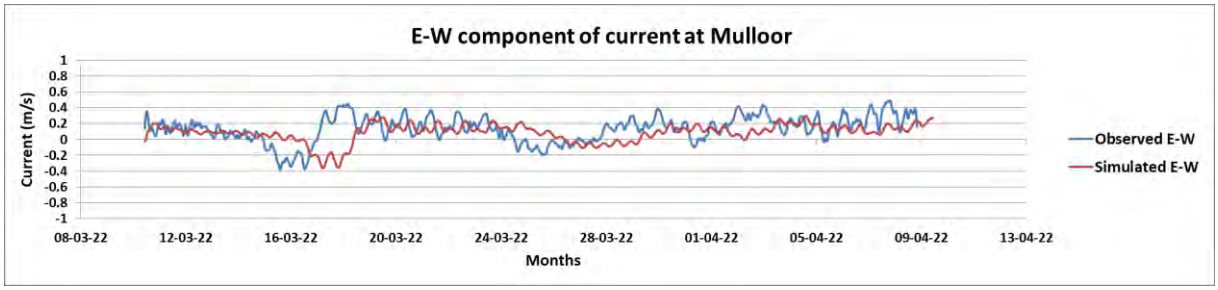


Figure 3-51 Comparison of E-W component of current at Mulloor (Pre Monsoon 2022)

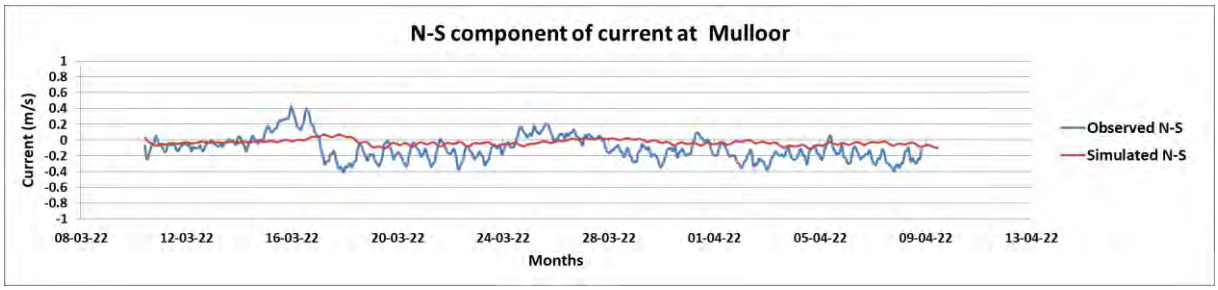


Figure 3-52 Comparison of N-S component of current at Mulloor (Pre Monsoon 2022)

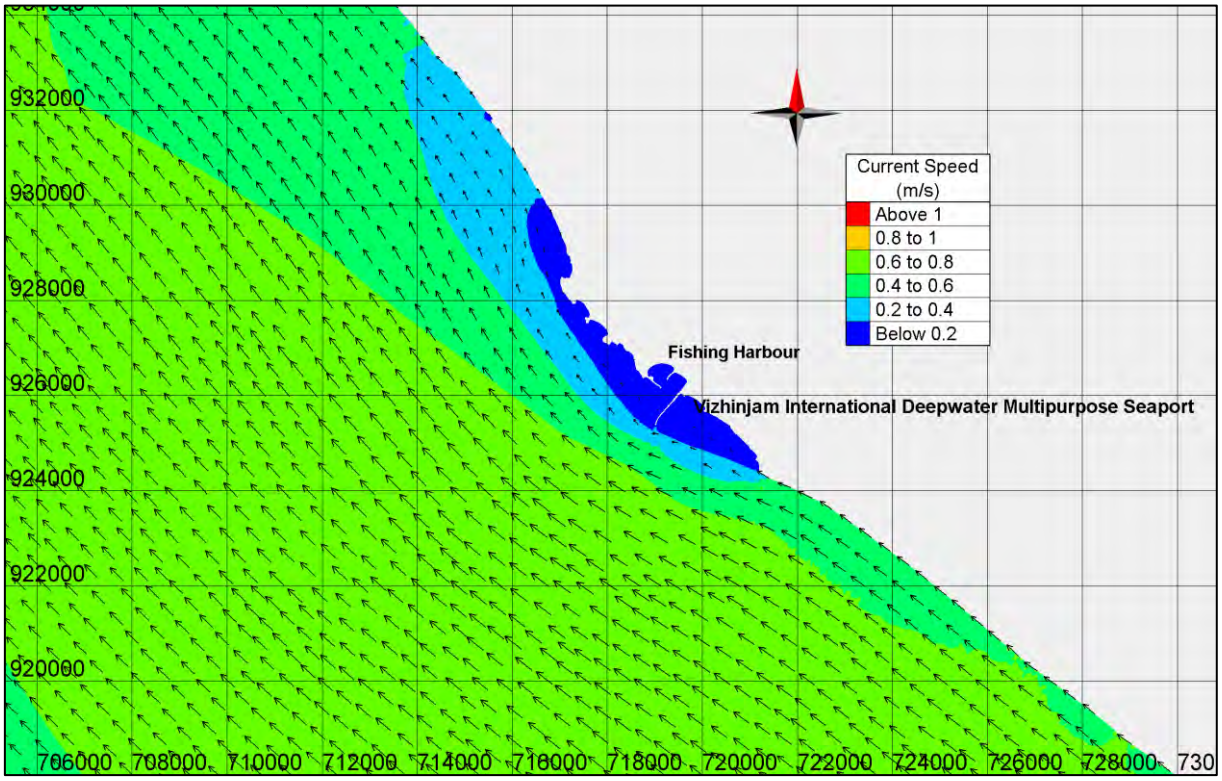


Figure 3-53 Typical plot of current pattern showing north-westerly flow

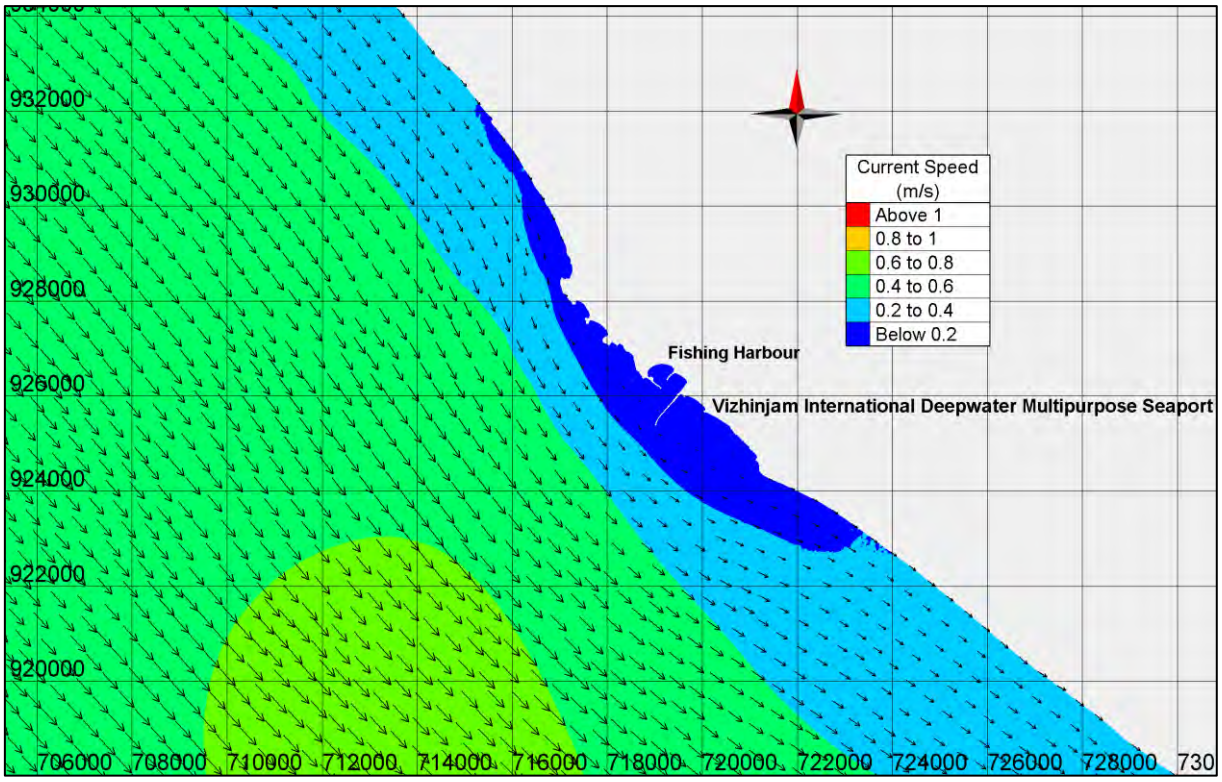


Figure 3-54 Typical plot of current pattern showing south-easterly flow

Figure 3-33 to Figure 3-52 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 3-53 and Figure 3-54 shows typical plots from simulation. This shows that the model can replicate the actual scenario well.

3.3 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 3-55. 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 3-56. This change in orientation will have effect on long shore sediment transport and its behaviour.

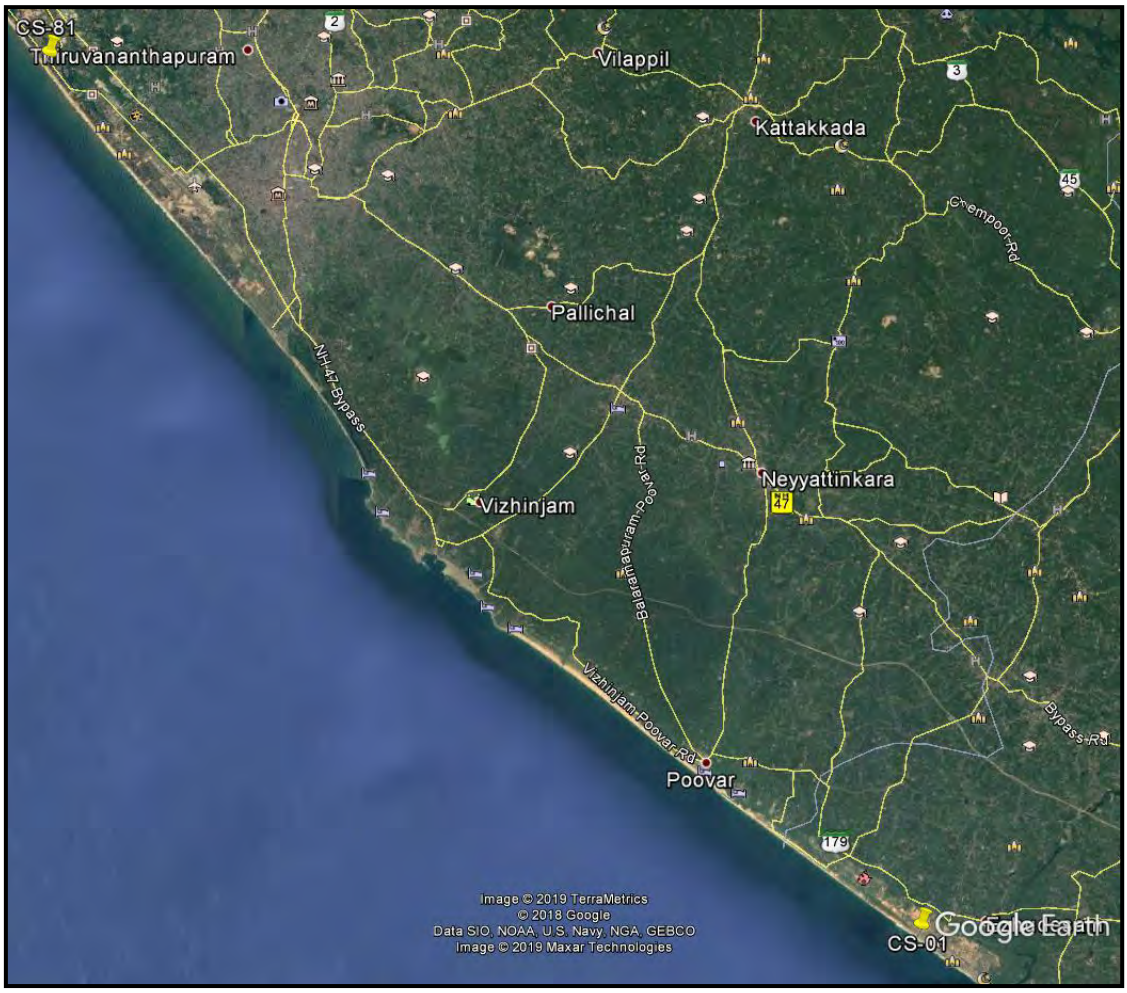
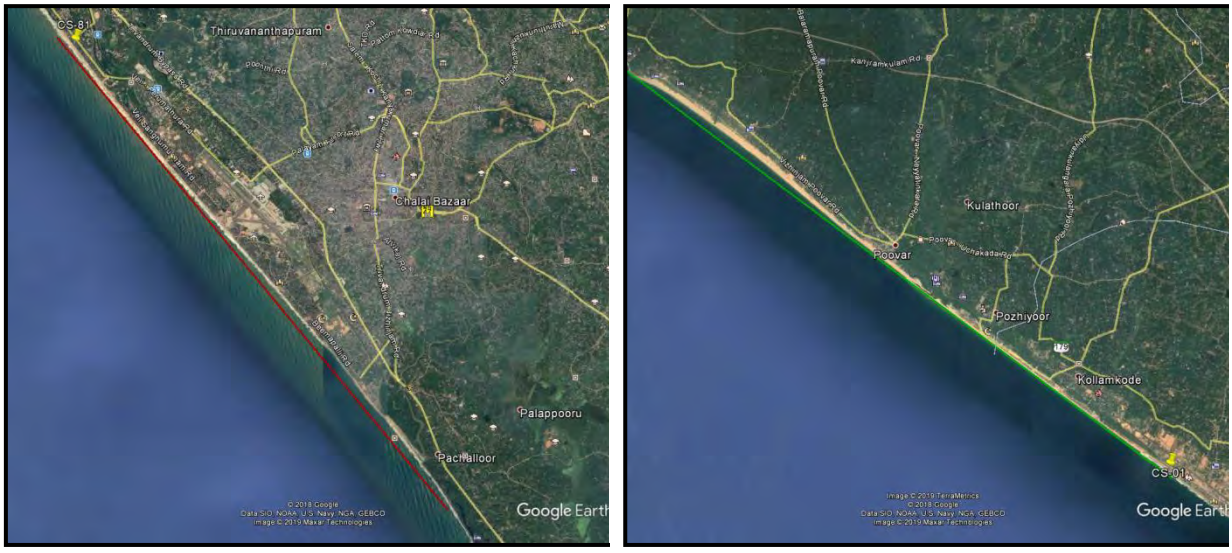


Figure 3-55 Study area



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

Figure 3-56 Coast orientations

3.3.1 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 0.16 to 0.18 M m^3/yr (Northwards) and -0.15 to -0.16 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 Analysis of Beach Volume

An analysis was done to calculate the sediment volume from the available beach profile data. This section provides the details of the analysis carried out for the volume analysis.

The cross shore profiles comprise of beach profiles and sea bed profiles collected at every 0.5 km interval along 40 locations to the north of the port, 40 locations to the south of the port and 1 location near port, representing the elevations with respect to chart datum. One limitation with the cross profiles used in this project is that there is a data gap in between the beach profile and the sea bed profiles owing to the intertidal zone where data collection is tricky. To overcome this limitation to certain extent, LNTIEL used interpolation technique of finding difference between profile and average profiles and filled data gaps. The resulting profiles were used to compute the beach volume.

The beach profile volume and sea bed profile volume combined together represents the net volume (m^3/m alongshore). The Feb 2015 (start of survey) profile is considered as baseline to estimate the volume changes.

From the analysis it was noted that the volumes on beach and sea side mirror each other in the erosion and accretion. However, these are not exact opposite in quantities due to which the net volume is either erosion or accretion. The reasons could be the limitation in calculation of beach profile volume as survey data does not cover active/dynamic beach width entirely at all the locations and limitation in calculation of sea bed profile volume as lack of extension of profile deeper up to the depth of closure. Other reason could be due to longshore sediment transport. In such a case, general tendency observed shall be both beach side and sea side shall show same trend i.e. either accretion or erosion which is not in this case. So, it can be due to combination of above limitations.

From the volume analysis it was found that near the port, the net volume change is minimal, and it remains so for stretches near the port location. Only net volume change seems to be higher in stretches of Valiyathura, Shangumugham and beyond towards Northern Kerala. Therefore, since around the port and upto a significant distance (at least 10km to the north of the port) the net volume change is minimal, the port cannot have effects on what is happening in Valiyathura, Shangumugham and beyond otherwise the effects would have shown in the nearby regions as well.

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

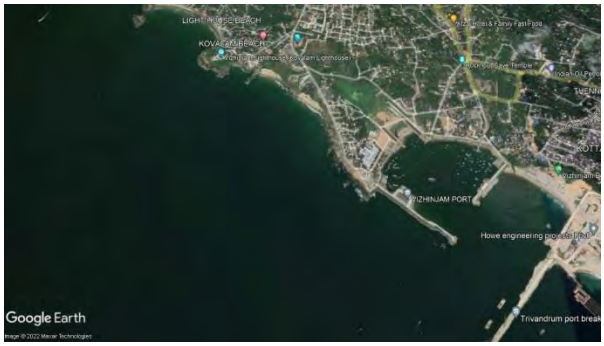
5.1 Introduction

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.

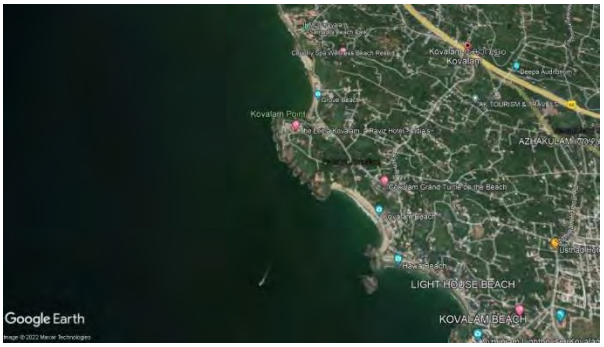
Alongshore sediment transport takes place when waves approach obliquely to the shore and eventually break. The wave breaking releases energy which brings sediment into suspension and alongshore littoral currents transports the sediment. Sediment transport is a cyclic process in which sediments are transported 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.

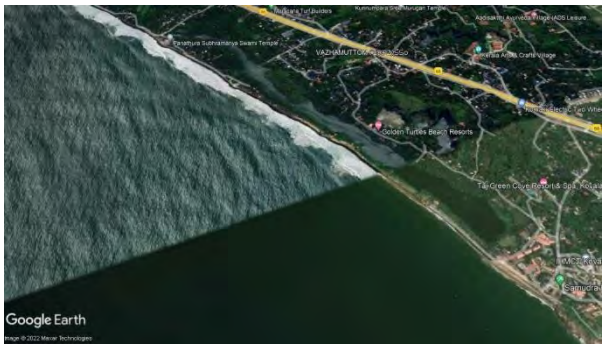
Coastal structure such as a groyne or a breakwater when introduced into the sea interrupts wave-induced littoral sediment transport in the direction of flow. The obstruction of sediment transport leads to sediment built-up up-drift and erosion down-drift due to deficit in sediment supply due to the obstruction.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



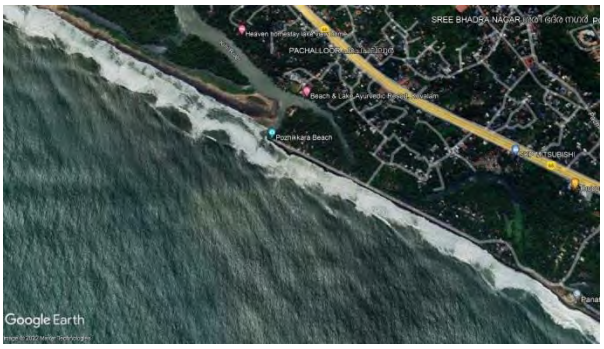
a) 0 - 2 km towards North



b) 2 - 4 km towards North



c) 4 - 6 km towards North



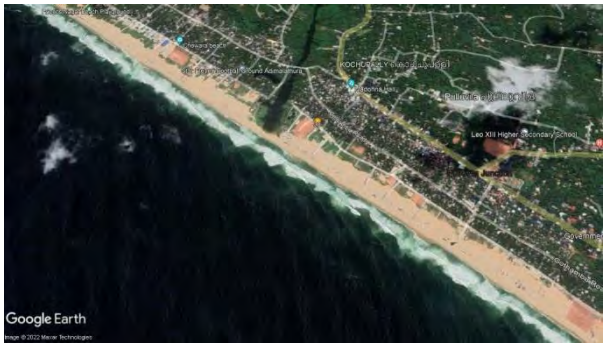
d) 6 - 8 km towards North

e) 8 - 10 km towards North

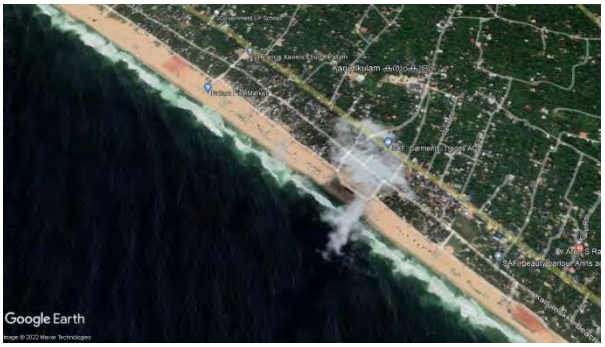
Figure 5-1 Shoreline towards the north of port

a) 0 – 2 km South

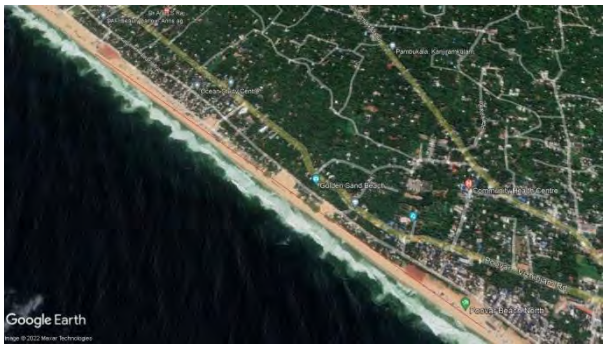
b) 2 – 4 km South



c) 4 – 6 km South



d) 6 – 8 km South



e) 8 – 10 km South

Figure 5-2 Shoreline towards the south of port

Figure 5-3 Groyne fields north of the port

5.2 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.

5.2.1 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.

5.2.2 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 30m×30m was used for the simulation of shoreline evolution using GENESIS.

5.3 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

Figure 5-4 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 5-5 to Figure 5-7 (scaled up five times for better visualization.

5.3.1 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 5-5, Figure 5-6, and Figure 5-7 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 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.

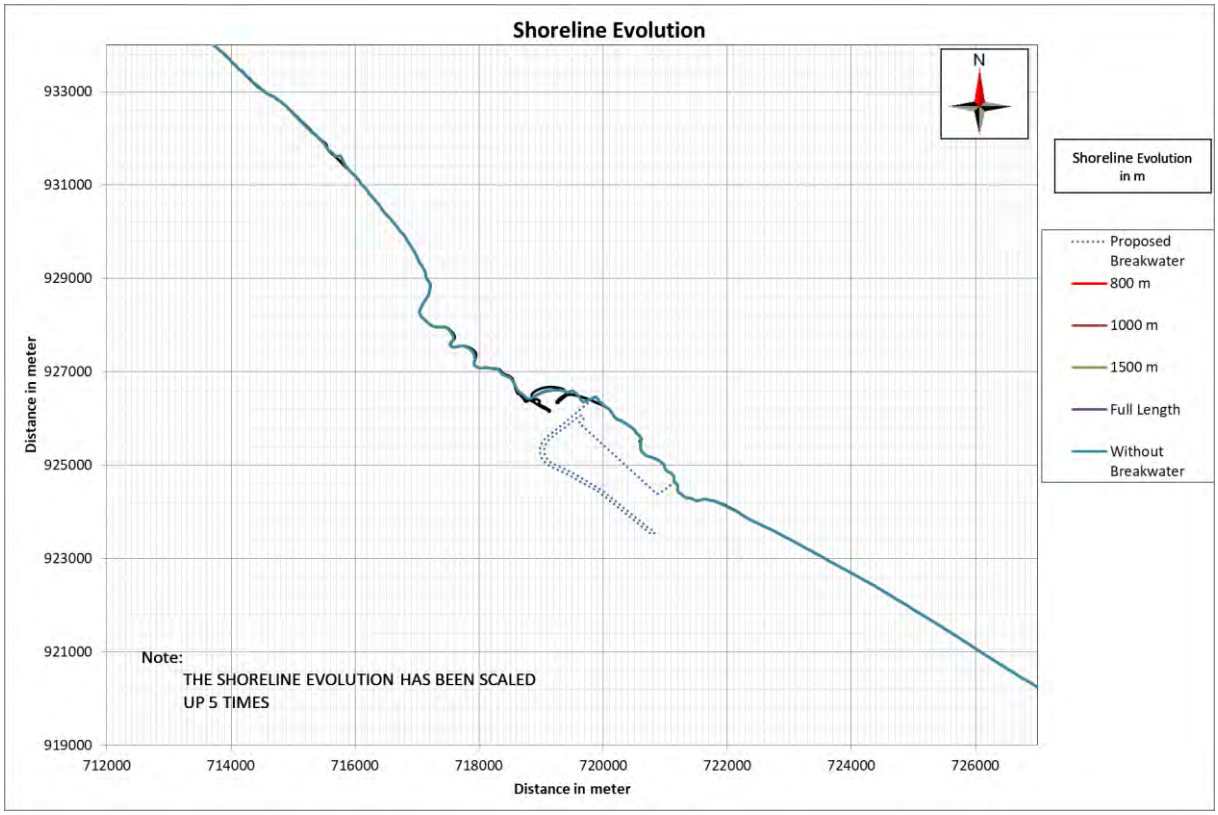


Figure 5-5 Predicted shoreline evolution during 1st year

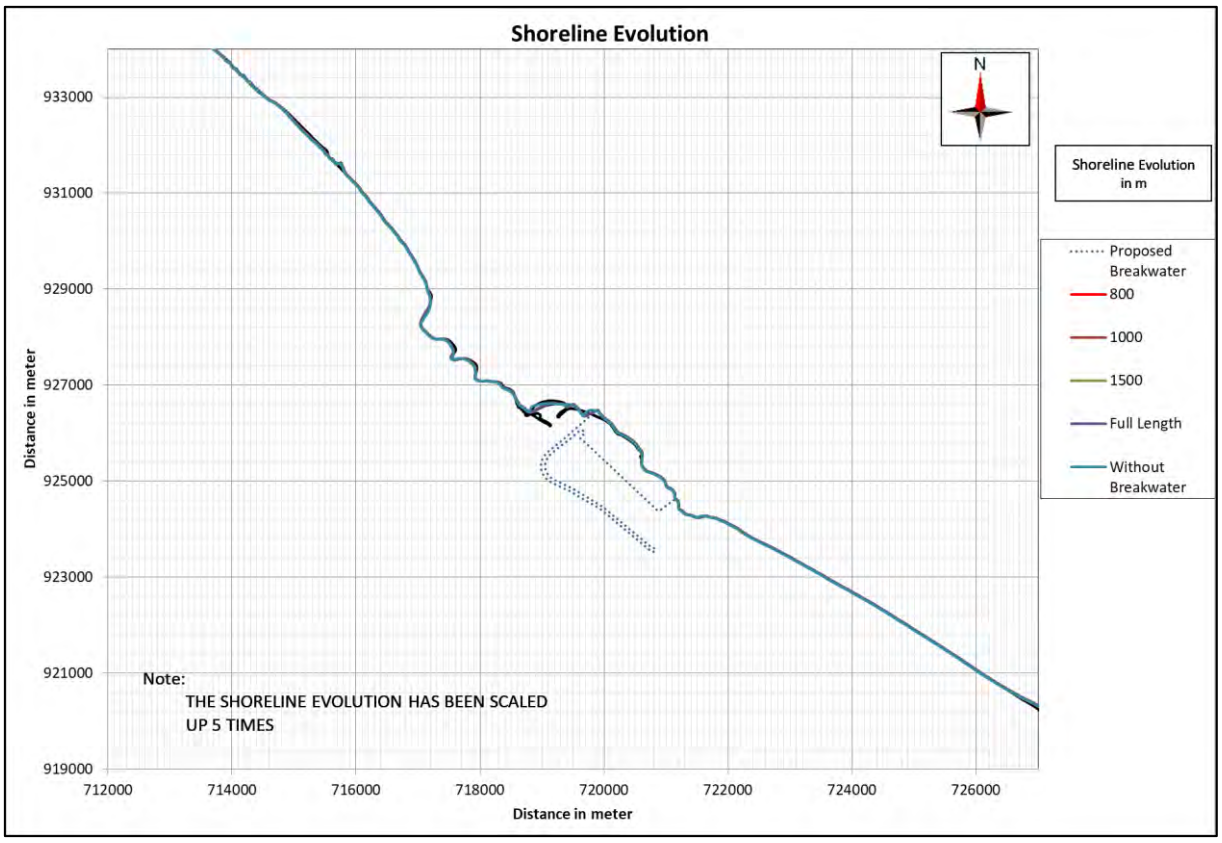


Figure 5-6 Predicted shoreline evolution during 5th year

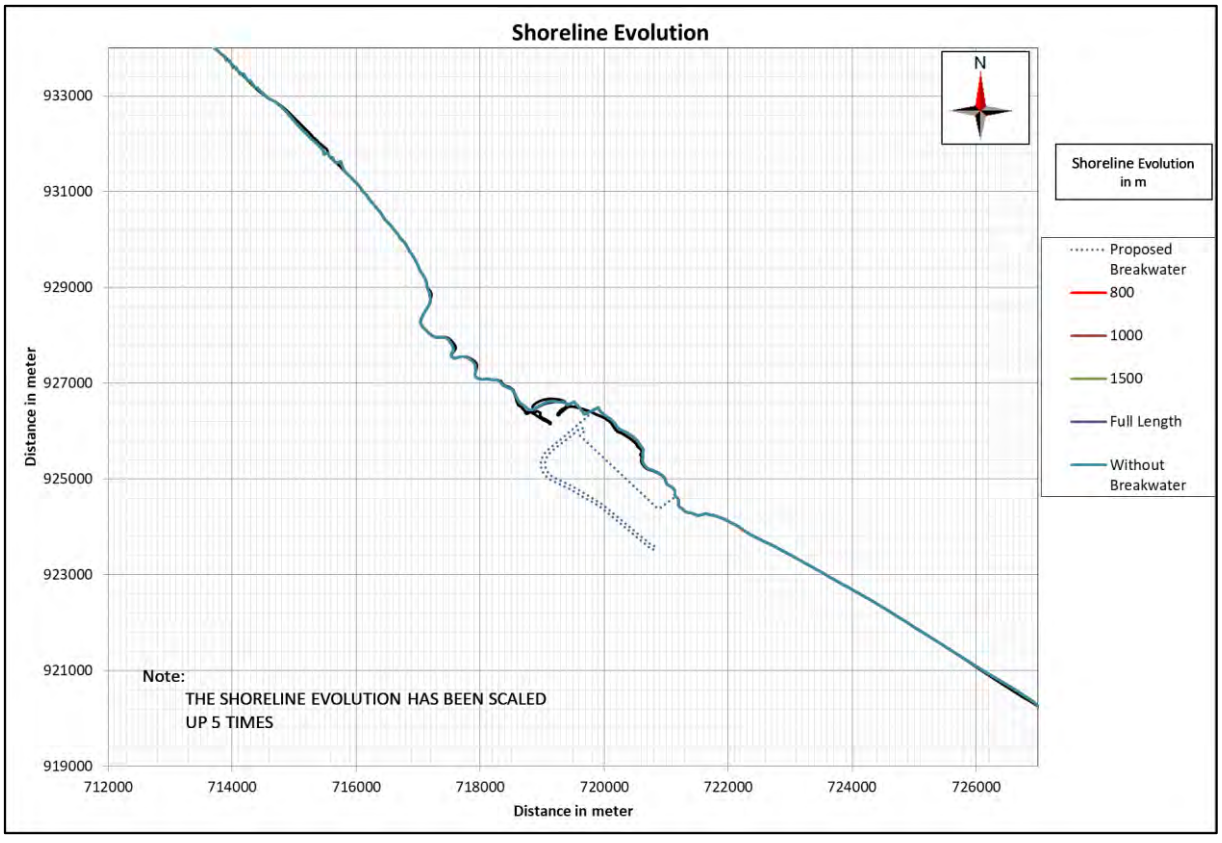


Figure 5-7 Predicted shoreline evolution during 10th year

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.

6 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 7 transect lines perpendicular to the shore; four on the North of port, two on the South of port and one near the port. Cross sections of bathymetries from Pre monsoon 2015 to Pre monsoon 2022 were compared.
- The observed wave data provided by AVPPL for the period of March 2021 to August 2022 is analysed and compared with the observed wave data for February 2018 to August 2021. 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 pre-monsoon, monsoon and post-monsoon of 2021 and Pre-monsoon 2022 at four locations: Pachalloor, 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 0.8 m/s. However, occasionally maximum current speed observed during all the seasons is in the range of 0.9 to 1.0 m/s.
- Continuous monitoring of turbidity using buoys has been carried out during March 2021 to September 2022 in three locations. It is perceptible from time series plots that the turbidity fluctuates all year round, though the values were lower than 4 NTU for almost all the time showing that the water is clear.
- 81 locations at 0.5 km interval were opted to collect beach sediments for each season.
- Further LNTIEL extracted (+) 2 m contour from cross shore profile data. The time series plot of (+) 2 m contour over seven 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 seven-year data are shown at Neerody, Pozhiyoor, Karumkulam, Panathura, Beemapally and Vettucaud locations.
- 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. So 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) Near Shore Wave Transformation

- Offshore wave data from March 2021 to August 2022 was obtained from ECMWF and near shore wave transformation was carried out with the latest bathymetry using SWAN model.
- The wave parameters are extracted from the swan model at the point of Wave rider buoy deployment location and compared with the observed wave data
- From observations, it was evident that the simulated and observed wave data were almost identical indicating good correlation.

b) 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, 2020 and 2021) 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)

c) 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 6 years data (Feb 2015 – Feb 2022, Feb-Feb is considered since most beach profiles have built up, even though the scope of this report is Feb 2021-Sep 2022). The northerly and southerly (annual average) long shore sediment movement in south stretch is in the range of 0.16 to 0.18 M m^3/yr (Northwards) and -0.15 to -0.16 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).

d) Analysis of beach volume

- An analysis was done to calculate the sediment volume from the available beach profile data. LNTIEL used average profiles and filled data gaps using an interpolation technique to carry out the analysis.
- The beach profile volume and seabed profile volume combined represents the net volume (m^3/m alongshore). The Feb 2015 (start of survey) profile is considered as baseline to estimate the volume changes.
- From the volume analysis it was found that near the port, the net volume change is minimal and it remains so for stretches near the port location. Only net volume change seems to be higher in stretches of Valiyathura, Shangumugham and beyond towards Northern Kerala. Therefore since around the port and upto a significant distance (at least 10km to the north of the port) the net volume change is minimal, the port cannot have effects on what is happening in Valiyathura, Shangumugham and beyond otherwise the effects would have shown in the nearby regions as well

e) 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. 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

LNTIEL carried out data analysis and model studies for the aforementioned project and it was found that wave activity has increased in this location in past three years post Ockhi Cyclone. From the model studies it was found that the bathymetry of the port location has no effect on the current patterns and the current patterns have remained fairly the same. The port has no effect on the erosion and accretion at Valiyathura & Shangumugham, hence concluded from all the analyses.

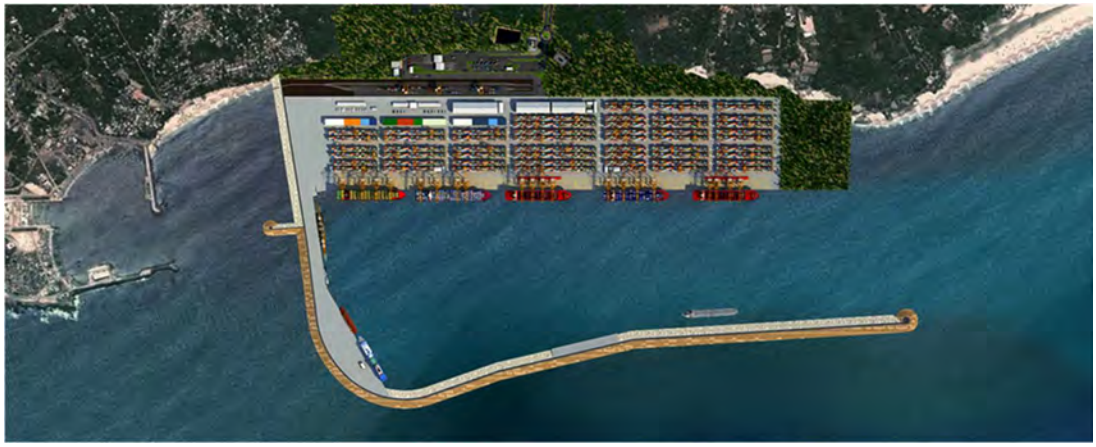
Annexure III

Environment Monitoring Report

(April 2022 to September 2022)

HALF-YEARLY ENVIRONMENT MONITORING REPORT

FOR THE PERIOD APRIL 2022 TO SEPTEMBER 2022



ADANI VIZHINJAM PORT PVT. LTD.
Vizhinjam, Kerala

Report No.: SEAAL/EMR-AVPPL-2223HY-I

Report Date: 25th October, 2022

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-683 501 to M/s Adani Vizhinjam Port Pvt Limited, Thiruvananthapuram-695 014

HYR-A	Table of Contents

HYR-1	Introduction

Standard^S 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 the industries and for the budding scientists.

Standard^S has been established in 2013 in 2500sq.ft area in a complex located at K.J Tower, (above SBI Eloor branch), Pathalam, Udyogamandal P.O, Ernakulam District – 683 501. It has been equipped with sophisticated instruments such GC-MS, AAS, UV Spectrophotometer, Flame Photometer and other Supporting Instruments with required accuracy & precision.

Standard^S is guided and lead by highly qualified scientists with rich experiences. Its technical personnel are well trained and competent and dedicated.

Testing Laboratory of Standard^S 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. 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.

Standard^S gives Technical Consultancy in the field of Water & Waste Water 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.

Standard^S had been engaged by Adani Vizhinjam Port Pvt. Ltd. (AVPPL) for the performing Environmental Monitoring as per the Plan mentioned in EIA and EC. AVPPL issued Service Order Reference No. 5702002993 dated 30.07.2021 which mentions the matrix, parameters and frequency of environmental monitoring and this service contract starts in August 2021. Standard^S 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).

Standard^{S} 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 serves 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 2022 to September 2022.

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 item as per the list and visits the sampling site.

The team identifies the appropriate monitoring location as per the agreement and keep 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 collect the samples and preserves them safely and securely in an appropriate 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 back 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

Manager. The Technical Personnel conforms 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 conforming 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. 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 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 Management Review Meeting.

HYR-3	Ambient Air Quality Monitoring

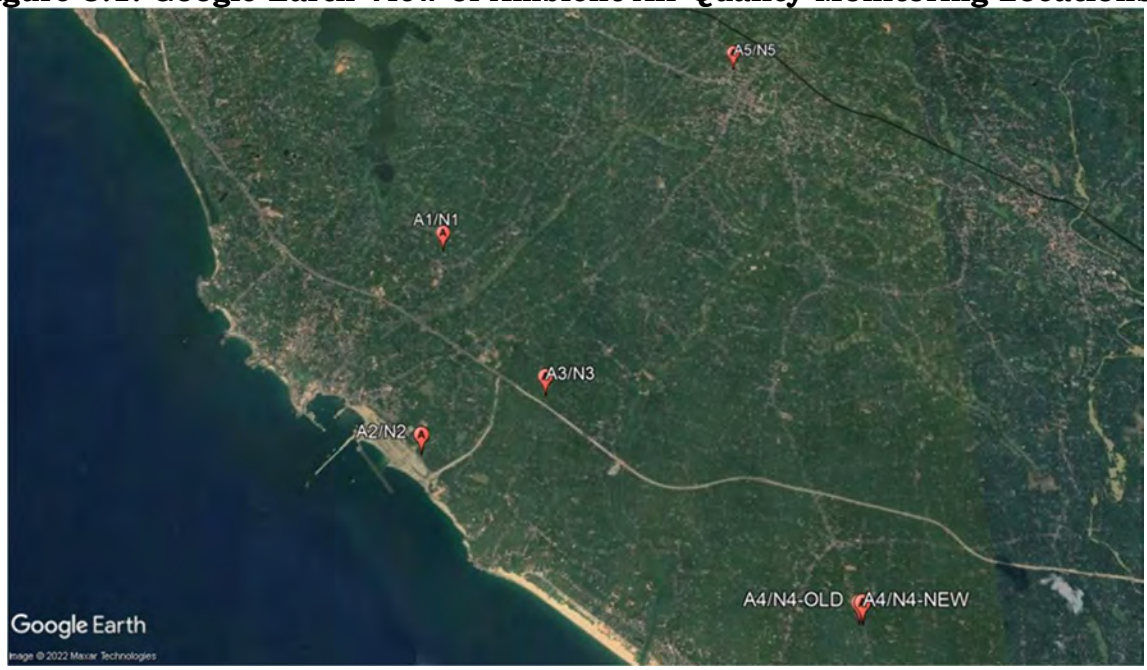
HYR-3.1. Ambient Air Quality Monitoring location details:

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: Venganoor, Port Site, Proposed Port Estate Area, Chani and Balarampuram from April 2022 to September 2022.

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°21'01.98"N & 8°21'02.11"N	77°03'15.11"E & 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 50 Appendix-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 2022 to September 2022:

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
04-04-2022	58.6	30.2	2.35	4.08	BDL	BDL
07-04-2022	60.2	32.4	2.46	3.96	BDL	BDL
11-04-2022	63.2	33.5	3.01	4.25	BDL	BDL
14-04-2022	56.1	29.3	2.11	3.78	BDL	BDL
18-04-2022	48.5	26.1	BDL	2.48	BDL	BDL
21-04-2022	51.6	27.8	2.75	3.91	BDL	BDL
25-04-2022	59.4	30.1	BDL	2.46	BDL	BDL
28-04-2022	52.6	27.3	2.16	3.25	BDL	BDL
02-05-2022	52.9	20.2	2.18	3.76	BDL	BDL
05-05-2022	33.6	18.4	2.63	3.85	BDL	BDL
09-05-2022	66.9	35.60	3.32	4.26	BDL	BDL
12-05-2022	34.9	19.4	2.26	3.85	BDL	BDL
16-05-2022	29.9	16.2	BDL	2.5	BDL	BDL
19-05-2022	45.1	22.7	2.01	3.63	BDL	BDL
23-05-2022	43.9	24.5	BDL	2.16	BDL	BDL
26-05-2022	44.2	28.3	2.36	3.69	BDL	BDL
30-05-2022	22.8	12.6	2.08	3.42	BDL	BDL
02-06-2022	60.2	32.4	2.63	4.15	BDL	BDL
06-06-2022	48.9	25.6	2.77	4.36	BDL	BDL
09-06-2022	58.4	30.7	2.85	4.82	BDL	BDL
13-06-2022	46.2	24.7	2.36	4.08	BDL	BDL
16-06-2022	38.4	20.7	2.01	2.96	BDL	BDL
20-06-2022	56.1	29.4	2.88	4.02	BDL	BDL
23-06-2022	38.6	22.7	2.08	2.74	BDL	BDL
27-06-2022	47.9	29.4	2.13	3.96	BDL	BDL
30-06-2022	35.1	18.6	2.47	4.36	BDL	BDL
04-07-2022	48.5	25.6	2.25	3.85	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
07-07-2022	55.4	29.3	2.46	4.18	BDL	BDL
11-07-2022	42.8	23.7	3.16	5.01	BDL	BDL
14-07-2022	52.3	28.4	3.08	5.16	BDL	BDL
18-07-2022	46.7	25.1	2.26	3.25	BDL	BDL
21-07-2022	48.2	26.5	2.18	4.95	BDL	BDL
25-07-2022	46.3	24.8	2.3	4.22	BDL	BDL
28-07-2022	46.2	25.1	2.19	3.96	BDL	BDL
01-08-2022	52.4	27.8	2.57	3.98	BDL	BDL
04-08-2022	56.8	29.6	3.2	4.87	BDL	BDL
08-08-2022	52.4	27.6	2.44	3.78	BDL	BDL
11-08-2022	53.2	27.5	2.84	4.84	BDL	BDL
15-08-2022	45.7	23.8	2.14	3.20	BDL	BDL
18-08-2022	43.2	22.5	2.27	3.94	BDL	BDL
22-08-2022	48.3	25.3	2.36	3.65	BDL	BDL
25-08-2022	38.7	20.6	2.02	3.67	BDL	BDL
29-08-2022	48.6	25.2	2.87	4.99	BDL	BDL
01-09-2022	49.1	23.5	2.24	3.16	BDL	BDL
05-09-2022	45.3	26.7	2.17	3.57	BDL	BDL
09-09-2022	47.6	25.1	2.32	3.91	BDL	BDL
12-09-2022	55.7	23.9	2.99	4.53	BDL	BDL
15-09-2022	42.9	24.3	2.13	3.96	BDL	BDL
19-09-2022	46.3	27.2	2.31	3.88	BDL	BDL
22-09-2022	51.4	21.6	3.29	3.47	BDL	BDL
26-09-2022	52.8	24.8	3.14	4.59	BDL	BDL
29-09-2022	43.2	23.3	2.36	4.12	BDL	BDL
NAAQS 2009 Limits	**100**	**60**	**80**	**80**	**4**	**-**

***BDL: Below Detectable Limit**

Table 3.5: Location – Port Site (A2)

Port 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
04-04-2022	60.4	33.5	3.89	4.28	BDL	BDL
07-04-2022	74.6	39.2	4.76	7.15	BDL	BDL
11-04-2022	68.7	35.6	5.08	7.86	BDL	BDL
14-04-2022	70.6	38.7	4.16	6.32	BDL	BDL
18-04-2022	78.4	40.5	3.38	4.18	BDL	BDL
21-04-2022	60.1	32.8	2.96	3.89	BDL	BDL
25-04-2022	65.4	34.2	3.17	4.19	BDL	BDL
28-04-2022	60.3	32.8	3.46	4.85	BDL	BDL
02-05-2022	63.5	32.6	3.26	5.02	BDL	BDL
05-05-2022	72.5	38.2	4.15	7.36	BDL	BDL
09-05-2022	66.9	36.8	4.78	7.396	BDL	BDL
12-05-2022	73.5	38.4	3.76	4.69	BDL	BDL
16-05-2022	64.2	29.1	2.69	4.08	BDL	BDL
19-05-2022	59.3	26.9	3.12	4.15	BDL	BDL
23-05-2022	58.9	26.3	2.89	4.08	BDL	BDL
26-05-2022	61.6	32.8	2.67	4.85	BDL	BDL
30-05-2022	51.2	27.6	2.44	4.36	BDL	BDL
02-06-2022	52.3	29.5	2.65	4.12	BDL	BDL
06-06-2022	64.2	34.2	3.78	6.55	BDL	BDL
09-06-2022	57.6	29.7	3.22	5.89	BDL	BDL
13-06-2022	62.3	34.2	3.15	4.78	BDL	BDL
16-06-2022	58.7	30.1	3.08	6.56	BDL	BDL
20-06-2022	58.6	25.8	3.63	6.03	BDL	BDL
23-06-2022	52.7	23.6	2.45	5.27	BDL	BDL
27-06-2022	50.3	27.5	3.18	5.78	BDL	BDL
30-06-2022	54.6	24.8	3.02	3.98	BDL	BDL
04-07-2022	53.2	28.4	2.56	3.92	BDL	BDL
07-07-2022	67.2	35.7	3.33	4.63	BDL	BDL
11-07-2022	51.3	27.2	2.85	4.10	BDL	BDL
14-07-2022	68.5	35.6	2.76	5.12	BDL	BDL

Port 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
18-07-2022	50.8	26.8	2.45	4.85	BDL	BDL
21-07-2022	52.4	28.4	3.11	4.30	BDL	BDL
25-07-2022	56.7	30.6	2.96	4.33	BDL	BDL
28-07-2022	59.3	32.1	3.15	4.08	BDL	BDL
01-08-2022	58.5	30.2	2.22	3.98	BDL	BDL
04-08-2022	72.8	36.9	3.78	5.98	BDL	BDL
08-08-2022	58.1	29.7	3.27	5.70	BDL	BDL
11-08-2022	58.4	30.2	3.98	5.25	BDL	BDL
15-08-2022	48.8	26.4	3.26	5.14	BDL	BDL
18-08-2022	47.3	23.8	3.08	4.83	BDL	BDL
22-08-2022	51.7	30.4	2.72	4.65	BDL	BDL
25-08-2022	57.3	31.7	2.82	4.23	BDL	BDL
29-08-2022	59.2	30.5	3.45	4.87	BDL	BDL
01-09-2022	53.5	24.7	2.86	4.21	BDL	BDL
05-09-2022	56.2	33.6	2.91	4.32	BDL	BDL
09-09-2022	49.6	31.2	2.87	4.59	BDL	BDL
12-09-2022	54.6	26.7	2.69	4.17	BDL	BDL
15-09-2022	51.7	29.5	3.11	3.67	BDL	BDL
19-09-2022	49.4	27.4	3.24	4.25	BDL	BDL
22-09-2022	53.8	31.6	3.41	4.81	BDL	BDL
26-09-2022	56.3	34.1	3.37	4.94	BDL	BDL
29-09-2022	51.8	23.6	2.93	4.33	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
04-04-2022	45.6	23.4	2.56	3.82	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
07-04-2022	52.3	27.8	3.12	4.6	BDL	BDL
11-04-2022	50.1	26.4	2.52	3.75	BDL	BDL
14-04-2022	58.6	31.2	3.21	4.16	BDL	BDL
18-04-2022	52.4	27.6	2.78	3.86	BDL	BDL
21-04-2022	49.6	26.7	2.42	4.16	BDL	BDL
25-04-2022	60.3	32.6	3.18	4.02	BDL	BDL
28-04-2022	54.1	29.4	2.46	3.96	BDL	BDL
02-05-2022	48.3	26.10	2.99	4.16	BDL	BDL
05-05-2022	44.4	23.50	2.44	3.96	BDL	BDL
09-05-2022	41.9	22.30	2.12	3.42	BDL	BDL
12-05-2022	45.4	29.1	2.85	3.79	BDL	BDL
16-05-2022	36.2	20.8	2.63	4.02	BDL	BDL
19-05-2022	54.4	28.9	3.01	4.36	BDL	BDL
23-05-2022	29.9	15.9	3.42	4.25	BDL	BDL
26-05-2022	41.3	27.2	2.76	4.06	BDL	BDL
30-05-2022	60.2	32.2	2.02	2.8	BDL	BDL
02-06-2022	42.6	22.5	2.13	3.78	BDL	BDL
06-06-2022	40.1	21.2	2.96	4.57	BDL	BDL
09-06-2022	35.4	19.6	2.47	3.86	BDL	BDL
13-06-2022	52.1	27.9	2.11	3.42	BDL	BDL
16-06-2022	45.6	24.3	2.4	4.22	BDL	BDL
20-06-2022	48.1	26.5	2.16	3.79	BDL	BDL
23-06-2022	36.4	20.3	3.78	5.1	BDL	BDL
27-06-2022	39.6	17.6	2.1	3.94	BDL	BDL
30-06-2022	50.2	27.5	2.36	3.69	BDL	BDL
04-07-2022	43.9	22.4	2.31	3.68	BDL	BDL
07-07-2022	46.8	24.6	2.46	4.12	BDL	BDL
11-07-2022	37.7	21.8	2.55	3.76	BDL	BDL
14-07-2022	45.3	24.1	2.63	4.09	BDL	BDL
18-07-2022	50.2	26.4	2.96	4.13	BDL	BDL
21-07-2022	55.6	28.9	2.92	4.85	BDL	BDL
25-07-2022	42.3	22.3	2.49	3.85	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
28-07-2022	42.2	23.7	2.25	3.45	BDL	BDL
01-08-2022	53.7	27.6	2.35	3.88	BDL	BDL
04-08-2022	47.5	24.2	3.12	4.76	BDL	BDL
08-08-2022	42.8	22.4	2.74	4.02	BDL	BDL
11-08-2022	58.3	27.9	2.32	3.89	BDL	BDL
15-08-2022	55.8	28.2	2.11	3.94	BDL	BDL
18-08-2022	56.2	29.4	2.63	3.87	BDL	BDL
22-08-2022	44.2	23.5	3.85	5.33	BDL	BDL
25-08-2022	42.5	22.4	2.01	3.25	BDL	BDL
29-08-2022	58.7	30.6	2.52	3.74	BDL	BDL
01-09-2022	42.4	23.3	2.66	3.35	BDL	BDL
05-09-2022	49.3	25.7	2.82	3.94	BDL	BDL
09-09-2022	46.2	26.2	2.97	3.69	BDL	BDL
12-09-2022	51.7	30.6	2.64	4.43	BDL	BDL
15-09-2022	49.6	23.7	2.43	4.11	BDL	BDL
19-09-2022	47.3	24.8	2.21	4.32	BDL	BDL
22-09-2022	51.8	33.1	3.36	4.71	BDL	BDL
26-09-2022	46.3	26.6	2.22	3.93	BDL	BDL
29-09-2022	53.6	31.6	2.87	3.87	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
04-04-2022	52.3	28.6	2.45	3.96	BDL	BDL
07-04-2022	58.9	30.7	2.29	3.19	BDL	BDL
11-04-2022	49.5	25.8	2.78	3.57	BDL	BDL
14-04-2022	57.4	29.6	3.19	4.26	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
18-04-2022	62.7	32.7	3.16	4.11	BDL	BDL
21-04-2022	49.7	26.2	2.79	3.96	BDL	BDL
25-04-2022	61.4	33.6	3.08	5.26	BDL	BDL
28-04-2022	50.8	27.8	2.62	4.01	BDL	BDL
02-05-2022	52.3	28.4	2.63	4.11	BDL	BDL
05-05-2022	58.9	30.2	2.08	3.46	BDL	BDL
09-05-2022	49.5	26.7	2.44	4.08	BDL	BDL
12-05-2022	57.4	30.5	3.26	4.63	BDL	BDL
16-05-2022	62.7	33.8	2.96	3.99	BDL	BDL
19-05-2022	49.7	26.8	2.78	4.05	BDL	BDL
23-05-2022	61.4	32.4	3.63	4.92	BDL	BDL
26-05-2022	50.8	26.1	2.89	4.11	BDL	BDL
30-05-2022	46.9	23.2	2.45	3.88	BDL	BDL
02-06-2022	48.6	25.2	2.58	4.69	BDL	BDL
06-06-2022	50.1	27.9	2.15	3.94	BDL	BDL
09-06-2022	58.9	32.1	2.21	3.75	BDL	BDL
13-06-2022	52.6	28.7	2.87	4.32	BDL	BDL
16-06-2022	51.7	27.4	2.28	4.06	BDL	BDL
20-06-2022	57.9	29.6	2.63	4.75	BDL	BDL
23-06-2022	48.9	25.2	3.78	5.24	BDL	BDL
27-06-2022	44.6	24.8	2.12	3.66	BDL	BDL
30-06-2022	56.3	30.4	2.89	4.52	BDL	BDL
04-07-2022	47.5	20.4	2.35	4.18	BDL	BDL
07-07-2022	57.2	30.2	2.28	3.78	BDL	BDL
11-07-2022	52.5	28.5	2.15	3.63	BDL	BDL
14-07-2022	57.3	30.6	2.89	4.11	BDL	BDL
18-07-2022	48.6	25.2	2.46	3.78	BDL	BDL
21-07-2022	53.2	28.5	2.96	4.95	BDL	BDL
25-07-2022	48.2	21.8	3.15	5.01	BDL	BDL
28-07-2022	50.3	27.2	2.44	5.22	BDL	BDL
01-08-2022	52.4	27.1	2.37	4.83	BDL	BDL
04-08-2022	62.6	32.7	2.16	4.22	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
08-08-2022	50.3	26.4	2.02	3.45	BDL	BDL
11-08-2022	58.9	30.2	2.62	4.12	BDL	BDL
15-08-2022	48.2	25.4	2.46	3.98	BDL	BDL
18-08-2022	62.4	32.7	2.72	4.18	BDL	BDL
22-08-2022	55.6	28.5	3.13	5.34	BDL	BDL
25-08-2022	49.8	25.1	2.10	3.98	BDL	BDL
29-08-2022	61.9	31.4	2.64	4.32	BDL	BDL
01-09-2022	55.6	23.6	2.54	4.16	BDL	BDL
05-09-2022	51.6	29.4	2.31	4.34	BDL	BDL
09-09-2022	54.5	29.1	2.89	3.77	BDL	BDL
12-09-2022	49.6	22.7	2.67	3.81	BDL	BDL
15-09-2022	53.9	23.8	2.88	3.25	BDL	BDL
19-09-2022	55.2	21.5	2.36	3.61	BDL	BDL
22-09-2022	54.1	25.6	2.24	4.39	BDL	BDL
26-09-2022	44.7	26.1	2.46	4.23	BDL	BDL
29-09-2022	51.9	29.3	2.59	3.56	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
04-04-2022	72.2	37.8	2.78	3.89	BDL	BDL
07-04-2022	38.6	21.6	2.05	3.46	BDL	BDL
11-04-2022	49.6	25.1	2.89	4.12	BDL	BDL
14-04-2022	61.5	32.6	2.45	3.96	BDL	BDL
18-04-2022	50.6	26.7	3.16	4.85	BDL	BDL
21-04-2022	40.7	22.4	2.06	3.13	BDL	BDL
25-04-2022	62.1	32.6	2.95	4.08	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
28-04-2022	52.1	27.5	2.01	3.02	BDL	BDL
02-05-2022	54.3	30.50	2.42	3.79	BDL	BDL
05-05-2022	44.8	27.9	2.11	3.84	BDL	BDL
09-05-2022	46.7	23.80	2.65	4.01	BDL	BDL
12-05-2022	53.8	28.40	2.29	3.61	BDL	BDL
16-05-2022	40.3	22.7	3.7	5.11	BDL	BDL
19-05-2022	60.1	34.4	3.25	4.12	BDL	BDL
23-05-2022	46.3	21.9	2.26	3.86	BDL	BDL
26-05-2022	36.7	20.5	2.11	3.26	BDL	BDL
30-05-2022	28.7	17.96	2.07	3.02	BDL	BDL
02-06-2022	48.5	25.6	2.12	3.46	BDL	BDL
06-06-2022	50.6	28.6	2.08	3.5	BDL	BDL
09-06-2022	42.5	24.3	2.44	4.12	BDL	BDL
13-06-2022	47.6	24.6	2.99	4.65	BDL	BDL
16-06-2022	48.9	24.3	3.28	5.35	BDL	BDL
20-06-2022	54.2	29.5	2.56	4.1	BDL	BDL
23-06-2022	40.1	22.1	2.45	4.06	BDL	BDL
27-06-2022	45.6	25.8	2.06	3.79	BDL	BDL
30-06-2022	35.6	20.5	2.65	3.94	BDL	BDL
04-07-2022	51.9	26.3	2.36	3.78	BDL	BDL
07-07-2022	56.8	29.1	2.18	3.62	BDL	BDL
11-07-2022	46.5	20.3	2.55	4.01	BDL	BDL
14-07-2022	48.6	21.5	3.45	4.95	BDL	BDL
18-07-2022	42.1	22.7	3.02	4.16	BDL	BDL
21-07-2022	50.3	26.9	2.26	3.89	BDL	BDL
25-07-2022	51.6	27.6	2.44	4.13	BDL	BDL
28-07-2022	48.2	25.3	2.15	3.55	BDL	BDL
01-08-2022	53.5	27.1	2.34	3.89	BDL	BDL
04-08-2022	45.8	23.7	2.66	3.92	BDL	BDL
08-08-2022	53.8	27.5	2.21	3.87	BDL	BDL
11-08-2022	56.2	29.4	3.45	5.12	BDL	BDL
15-08-2022	42.6	22.8	3.17	5.48	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
18-08-2022	44.8	23.4	2.11	3.94	BDL	BDL
22-08-2022	51.3	26.3	2.65	4.37	BDL	BDL
25-08-2022	55.4	28.8	2.45	4.08	BDL	BDL
29-08-2022	43.8	22.3	2.33	3.66	BDL	BDL
01-09-2022	46.7	24.2	2.56	3.67	BDL	BDL
05-09-2022	49.5	26.3	2.41	3.82	BDL	BDL
09-09-2022	59.4	30.4	3.27	4.92	BDL	BDL
12-09-2022	50.5	27.6	2.98	4.58	BDL	BDL
15-09-2022	47.1	23.7	2.56	4.31	BDL	BDL
19-09-2022	53.8	21.2	2.76	5.26	BDL	BDL
22-09-2022	54.9	28.3	2.31	4.83	BDL	BDL
26-09-2022	51.3	23.5	2.69	4.75	BDL	BDL
29-09-2022	47.4	24.9	2.25	3.42	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 2022 to September 2022)

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 PM10, µg/ m^3	100	Apr-22	63.2	56.3	48.5	78.4	67.3	60.1	60.3	52.9	45.6	62.7	55.3	49.5	72.2	53.4	38.6
		May-22	66.9	41.6	22.8	73.5	63.5	51.2	60.2	44.7	29.9	62.7	54.4	46.9	60.1	45.7	28.7
		Jun-22	60.2	47.8	35.1	64.2	56.8	50.3	52.1	43.3	35.4	58.9	52.2	44.6	54.2	46.0	35.6
		Jul-22	55.4	48.8	42.8	68.5	57.5	50.8	55.6	46.4	37.7	57.3	51.9	47.5	56.8	49.9	42.1
		Aug-22	56.8	48.4	38.7	72.8	56.7	47.3	58.7	50.8	42.5	62.6	56.2	48.2	56.2	49.2	42.6
		Sep-22	55.7	48.3	42.9	56.3	53.0	49.4	53.6	48.7	42.4	55.6	52.3	44.7	59.4	51.2	46.7
		HY	**66.9**	**48.5**	**22.8**	**78.4**	**59.1**	**47.3**	**60.3**	**47.8**	**29.9**	**62.7**	**53.7**	**44.6**	**72.2**	**49.2**	**28.7**
Particulate matter (size less than 2.5µm) or PM 2.5, µg/ m^3	60	Apr-22	33.5	29.6	26.1	40.5	35.9	32.8	32.6	28.1	23.4	33.6	29.4	25.8	37.8	28.3	21.6
		May-22	35.6	22.0	12.6	38.4	32.1	26.3	32.2	25.1	15.9	33.8	28.7	23.2	34.4	25.3	18.0
		Jun-22	32.4	26.0	18.6	34.2	28.8	23.6	27.9	23.0	17.6	32.1	27.9	24.8	29.5	25.0	20.5
		Jul-22	29.3	26.3	18.6	35.7	30.6	26.8	28.9	24.6	21.8	30.6	26.6	20.4	29.1	25.2	20.3
		Aug-22	29.6	25.3	20.6	36.9	30.0	23.8	30.6	26.1	22.4	32.7	29.1	25.1	29.4	25.5	22.3
		Sep-22	27.2	24.5	21.6	34.1	29.2	23.6	33.1	27.3	23.3	29.4	25.7	21.5	30.4	25.6	21.2
		HY	**35.6**	**25.6**	**12.6**	**40.5**	**31.1**	**23.6**	**33.1**	**25.7**	**15.9**	**33.8**	**27.9**	**20.4**	**37.8**	**25.8**	**18.0**
Sulphur dioxide (SO_2), µg/m^3	80	Apr-22	3.01	2.47	BDL	5.08	3.86	BDL	3.21	2.78	BDL	3.19	2.80	BDL	3.16	2.54	BDL
		May-22	3.32	2.41	BDL	4.78	3.31	2.44	3.42	2.69	BDL	3.63	2.79	BDL	3.70	2.54	BDL
		Jun-22	2.88	2.46	BDL	3.78	3.13	2.45	3.78	2.50	2.10	3.78	2.61	BDL	3.28	2.50	BDL
		Jul-22	3.16	2.49	BDL	3.33	2.82	2.22	2.96	2.55	2.25	3.15	2.56	BDL	3.45	2.54	BDL
		Aug-22	3.20	2.52	BDL	3.98	3.30	2.72	3.85	2.66	2.01	3.13	2.48	2.02	3.45	2.63	BDL
		Sep-22	3.29	2.55	BDL	3.41	3.04	2.69	3.36	2.69	2.21	2.89	2.55	2.24	3.27	2.64	2.25
		HY	**3.32**	**2.48**	**BDL**	**5.08**	**3.24**	**BDL**	**3.85**	**2.64**	**BDL**	**3.78**	**2.63**	**BDL**	**3.70**	**2.57**	**BDL**
	80	Apr-22	4.25	3.52	2.46	7.86	5.34	3.89	4.60	4.04	3.75	5.26	4.04	3.19	4.85	3.81	3.02

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
Oxides of Nitrogen (NO_x), µg/m^3		May-22	4.26	3.46	2.16	7.40	5.11	4.08	4.36	3.87	2.8	4.92	4.14	3.46	5.11	3.85	3.02
		Jun-22	4.82	3.94	2.74	6.56	5.44	3.98	5.10	4.04	3.42	5.24	4.33	3.66	5.35	4.11	3.46
		Jul-22	5.16	4.28	3.25	5.12	4.37	3.92	4.85	3.98	3.45	5.22	4.39	3.63	4.95	4.00	3.55
		Aug-22	4.99	4.12	3.2	5.98	5.08	4.23	5.33	4.10	3.25	5.34	4.20	3.45	5.48	4.31	3.66
		Sep-22	4.59	3.91	3.16	4.94	4.37	3.67	4.71	4.04	3.35	4.39	3.90	3.25	5.26	4.40	3.42
		HY	**5.16**	**3.87**	**2.16**	**7.86**	**4.95**	**3.67**	**5.33**	**4.01**	**2.80**	**5.34**	**4.17**	**3.19**	**5.48**	**4.08**	**3.02**
Carbon Monoxide (CO), mg/m^3	4	Oct-21	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Nov-21	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Dec-21	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Jan-22	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Feb-22	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Mar-22	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		HY	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**
Hydrocarbon (HC), ppm	-	Oct-21	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Nov-21	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Dec-21	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Jan-22	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Feb-22	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		Mar-22	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--	--	BDL	--
		HY	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**	**--**	**BDL**	**--**

HY: Half Yearly

HYR-3.6. Graphical representation of Half-Yearly Results (April 2022 to September 2022)

Figure 3.2: Respirable Particulate Matter (PM10)

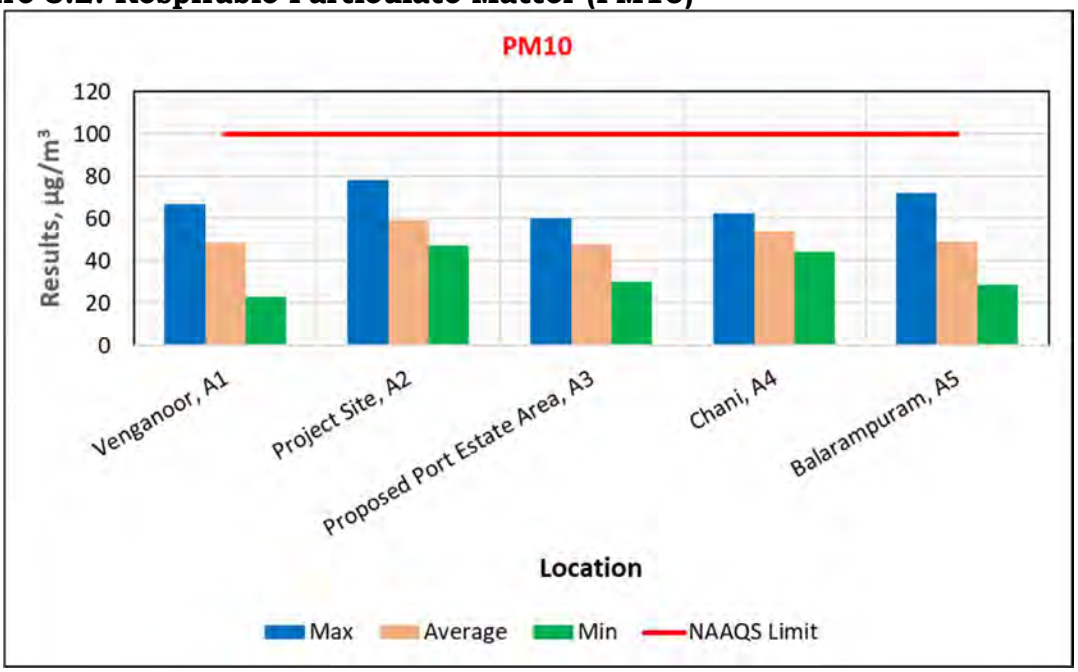


Figure 3.3: Fine Particulate matter (PM2.5)

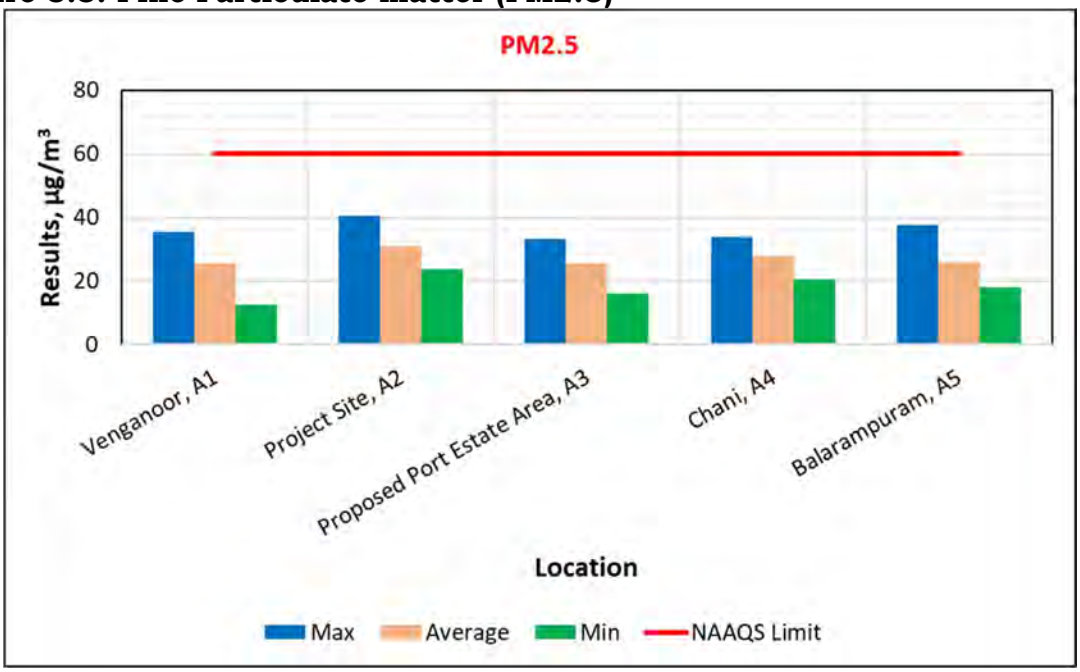


Figure 3.4: Sulphur Dioxide as SO_2

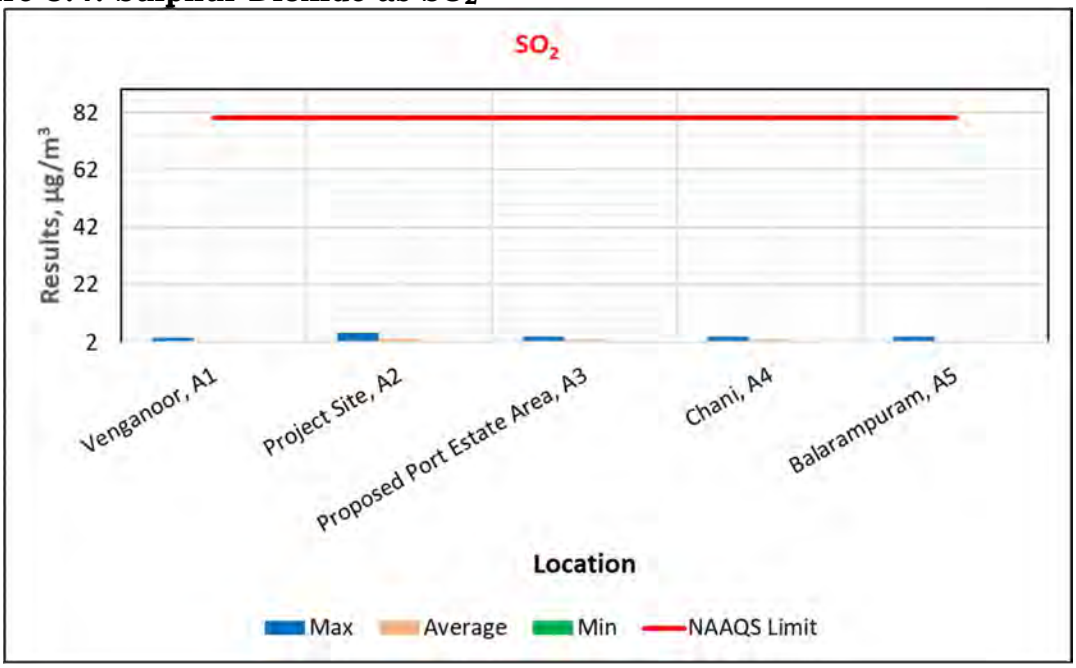
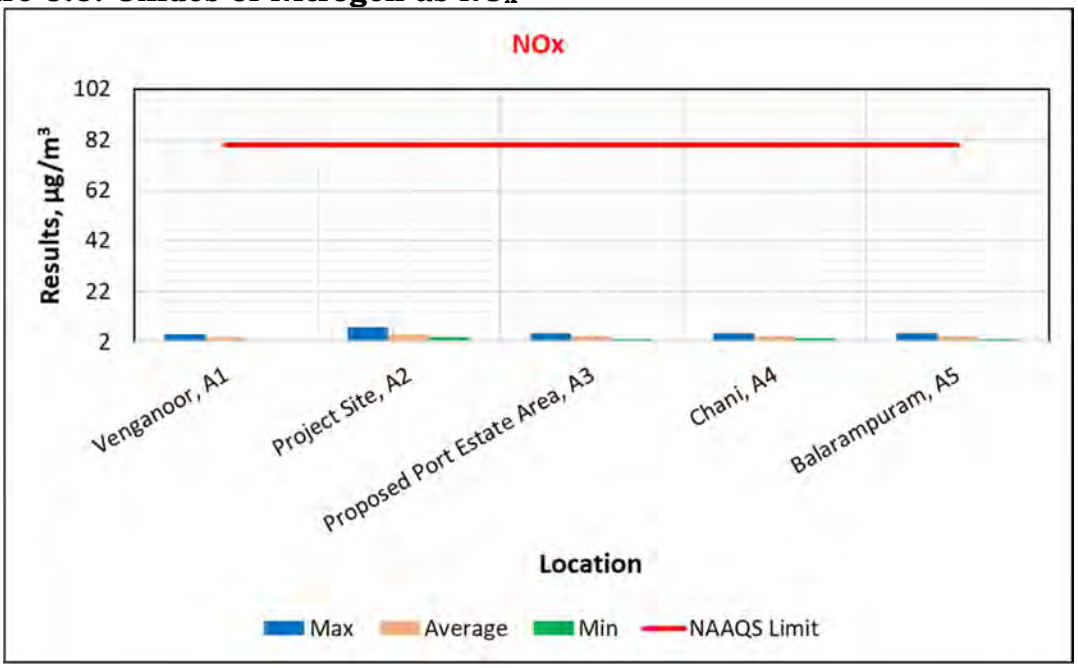


Figure 3.5: Oxides of Nitrogen as NO_x



HYR-3.7. Summary - Ambient Air Quality

During the period of April 2022 to September 2022, following is the summary of ambient air quality results:

a) At the location **Venganoor**:
- PM_{10} was observed in the range between 22.8-66.9 µg/m^3 with an average of 48.5 µg/m^3
- $PM_{2.5}$ was observed in the range between 12.6-35.6 µg/m^3 with an average of 25.6 µg/m^3
- SO_2 was observed in the range between BDL-3.32 µg/m^3 with an average of 2.48 µg/m^3
- NO_2 was observed in the range between 2.16 – 5.16 µg/m^3 with an average of 3.87 µg/m^3
- CO & HC were observed below detectable limits

b) At the location **Port Site**:
- PM_{10} was observed in the range between 47.3-78.4 µg/m^3 with an average of 59.1 µg/m^3
- $PM_{2.5}$ was observed in the range between 23.6-40.5 µg/m^3 with an average of 31.16 µg/m^3
- SO_2 was observed in the range between BDL-5.08 µg/m^3 with an average of 3.24 µg/m^3
- NO_2 was observed in the range between 3.67– 7.86 µg/m^3 with an average of 4.95 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 29.9-60.3 µg/m^3 with an average of 47.8 µg/m^3
- $PM_{2.5}$ was observed in the range between 15.9-33.1 µg/m^3 with an average of 25.7 µg/m^3

- SO_2 was observed in the range between BDL-3.85 µg/m^3 with an average of 2.64 µg/m^3
- NO_2 was observed in the range between 2.80 – 5.33 µg/m^3 with an average of 4.01 µg/m^3
- CO & HC were observed below detectable limits

d) At the location **Chani**:

- PM_{10} was observed in the range between 44.6-62.7 µg/m^3 with an average of 53.7 µg/m^3
- $PM_{2.5}$ was observed in the range between 20.4-33.8 µg/m^3 with an average of 27.9 µg/m^3
- SO_2 was observed in the range between BDL-3.78 µg/m^3 with an average of 2.63 µg/m^3
- NO_2 was observed in the range between 3.19 – 5.34 µg/m^3 with an average of 4.17 µg/m^3
- CO & HC were observed below detectable limits

e) At the location **Balarampuram**:

- PM_{10} was observed in the range between 28.7-72.2 µg/m^3 with an average of 49.2 µg/m^3
- $PM_{2.5}$ was observed in the range between 18.0-37.8 µg/m^3 with an average of 25.8 µg/m^3
- SO_2 was observed in the range between BDL-3.70 µg/m^3 with an average of 2.57 µg/m^3
- NO_2 was observed in the range between 3.02 – 5.48 µg/m^3 with an average of 4.08 µg/m^3
- CO & HC were observed below detectable limits

f) Overall Comparison of Results from **all Locations**:

- PM_{10} was observed a maximum of 78.4 µg/m^3 at Port Site and a minimum of 22.8 µg/m^3 at Venganoor. The overall average of all locations is 51.7 µg/m^3

- $PM_{2.5}$ was observed a maximum of 40.5 µg/m³ at Port Site and a minimum of 12.6 µg/m³ at Venganoor. The overall average of all locations is 27.2 µg/m³
- SO_2 was observed a maximum of 5.08 µg/m³ at Port Site and a minimum of BDL at all locations. The overall average of all locations is 2.71 µg/m³

- NO_2 was observed a maximum of 7.86 µg/m³ at Port Site and a minimum of 2.16 µg/m³ at Venganoor. The overall average of all locations is 4.22 µg/m³

- CO & HC were 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 2022 to September 2022).

Table 3.10: Overall Summary of Results from all Locations

Parameter	Unit	NAAQS 2009 Limits	Max	Avg.	Min
PM10	µg/m³	100	78.4	51.7	22.8
PM 2.5	µg/m³	60	40.5	27.2	12.6
SO2	µg/m³	80	5.08	2.71	BDL
NOx	µg/m³	80	7.86	4.22	2.16
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 2022 to September 2022 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°21'01.98"N & 8°21'02.11"N	77°03'15.11"E & 77°03'16.59"E
Balarampuram	N5	Commercial	8°25'43.73"N	77°02'39.99"E

Figure 4.1: 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 the 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 2022 to September 2022.

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-22	01-04-2022	56.3	45.4	40.9	37.4	54.5	42.2
	16-04-2022	55.2	44.1	39.8	36.9	53.3	42.9
May-22	03-05-2022	54.8	41.7	39.3	35.7	51.6	40.4
	17-05-2022	53.9	40.1	38.4	35.2	50.7	39.6
Jun-22	03-06-2022	58.3	43.1	40.8	34.1	51.6	38.9
	17-06-2022	56.9	39.2	38.3	34.6	49.2	38.7
Jul-22	05-07-2022	65.7	48.4	41.3	32.7	54.1	40.6
	19-07-2022	62.5	44.1	39.8	31.9	51.6	40.0
Aug-22	02-08-2022	64.7	46.7	39.8	34.2	53.9	40.4

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)					
	16-08-2022	60.5	44.5	40.3	35.9	54.6	41.2
Sep-22	02-09-2022	66.2	43.8	40.2	31.6	50.3	40.6
	16-09-2022	68.4	47.1	42.2	32.9	53.7	42.3
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-22	02-04-2022	69.9	59.6	49.8	46.4	65.9	55.4
	15-04-2022	73.2	58.5	52.4	45.1	67.4	53.9
May-22	04-05-2022	73.4	62.5	51.2	46.3	68.1	59.3
	18-05-2022	71.2	59.6	49.6	44.9	66.3	55.7
Jun-22	04-06-2022	79.2	63.8	55.6	47.4	63.9	55.7
	18-06-2022	74.5	61.8	51.9	47.3	62.0	54.8
Jul-22	06-07-2022	83.2	59.3	51.6	42.1	64.8	51.6
	20-07-2022	78.4	57.6	50.7	44.3	62.7	48
Aug-22	03-08-2022	79.4	57.6	52.5	43.8	64.8	53.3
	17-08-2022	67.7	53.6	49.7	43.5	56.6	46.9
Sep-22	03-09-2022	73.7	54.3	47.4	41.6	56.5	51.3
	17-09-2022	71.6	54.7	48.1	42.7	57.9	53.6
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-22	05-04-2022	56.9	41.7	39.7	36.5	51.6	40.3
	19-04-2022	53.2	40.3	36.1	30.8	49.2	38.8
May-22	06-05-2022	55.8	43.4	38.6	35.6	50.9	41.5
	20-05-2022	54.1	41.8	37.6	34.8	50.1	39.6
Jun-22	07-06-2022	57.6	45.4	37.8	32.8	53.7	41.8
	21-06-2022	55.1	43.7	39.3	33.5	53.8	40.7
Jul-22	08-07-2022	59.8	47.4	38.2	32.1	51.3	41.0
	22-07-2022	62.7	46.5	37.1	32.8	53.4	42.6
Aug-22	05-08-2022	59.6	45.8	39.7	34.9	53.8	42.4
	19-08-2022	58.4	45.0	38.9	33.3	52.7	41.6
Sep-22	06-09-2022	57.9	43.6	35.2	31.7	52.3	39.1
	20-09-2022	57.1	44.2	36.4	32.8	53.6	42.0
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-22	06-04-2022	55.9	42.6	38.4	35.7	52.5	40.8
	20-04-2022	56.9	44.4	40.9	37.3	54.1	42.2
May-22	10-05-2022	57.9	42.1	38.7	36.2	53.8	41.6
	24-05-2022	56.1	43.7	37.4	35.8	52.3	40.9
Jun-22	08-06-2022	56.4	44.1	40.6	35.9	52.1	40.3
	22-06-2022	57.6	44.2	39.2	34.6	51.7	39.8
Jul-22	12-07-2022	63.9	48.6	38.5	34.9	54.7	44.0

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)					
	26-07-2022	61.3	47.7	38.6	32.9	53.5	41.3
Aug-22	09-08-2022	58.0	43.9	38.6	34.3	52.3	40.6
	23-08-2022	57.7	43.4	38.4	33.6	52.0	40.1
Sep-22	10-09-2022	55.6	42.5	34.7	31.6	51.9	36.0
	24-09-2022	58.3	45.1	39.7	34.4	52.7	39.0
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-22	08-04-2022	64.1	49.3	44.1	38.2	58.7	47.3
	22-04-2022	62.5	48.2	42.7	37.9	55.9	45.6
May-22	11-05-2022	65.2	52.4	42.2	40.3	61.3	47.5
	25-05-2022	64.6	50.8	42.9	39.3	59.4	46.2
Jun-22	10-06-2022	63.5	51.7	44.9	39.1	55.4	45.7
	24-06-2022	61.7	49.3	43.7	38.5	55.1	45.3
Jul-22	13-07-2022	67.3	53.4	42.5	38.6	61.2	49.7
	27-07-2022	64.2	51.8	41.2	37.6	59.4	46.8
Aug-22	10-08-2022	60.8	44.7	40.4	36.1	54.9	41.3
	24-08-2022	61.1	45.6	41.6	37.1	55.1	42.2
Sep-22	13-09-2022	63.9	48.1	43.5	39.5	55.8	45.4
	27-09-2022	62.3	47.2	43.9	36.4	53.2	43.1
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 2022 to September 2022)

Table 4.8: Half Yearly Average Results

Parameter		Venganoor (N1)	Proposed Port Estate Area (N2)	Chani (N3)	Port Site (N4)	Balarampuram (N5)
		Residential	Residential	Residential	Industrial	Commercial
		Day Time (Limit: 55) Night Time (Limit: 45)			Day Time (Limit: 75) Night Time (Limit: 70)	Day Time (Limit: 65) Night Time (Limit: 55)
L_{max} Day time dB (A)	Max	68.4	62.7	63.9	83.2	67.3
	Min	53.9	53.2	55.6	67.7	44.7
	Avg.	60.3	57.4	58.0	74.6	56.4
L_{max} Night time dB (A)	Max	48.4	47.4	48.6	63.8	53.4
	Min	39.2	40.3	42.1	53.6	44.7
	Avg.	44.0	44.1	44.4	58.6	49.4
L_{min} Day time dB (A)	Max	42.2	39.7	40.9	55.6	44.9
	Min	38.3	35.2	34.7	47.4	40.4
	Avg.	40.1	37.9	38.6	50.9	42.8
L_{min} Night time dB (A)	Max	37.4	36.5	37.3	47.4	40.3
	Min	31.6	30.8	31.6	41.6	36.1
	Avg.	34.4	33.5	34.8	44.6	38.2
Leq Day time dB (A)	Max	54.6	53.8	54.7	68.1	61.3
	Min	49.2	49.2	51.7	56.5	53.2
	Avg.	52.4	52.2	52.8	63.1	57.1
Leq Night time dB (A)	Max	42.9	42.6	44.0	59.3	49.7
	Min	38.7	38.8	36.0	46.9	41.3
	Avg.	40.7	41.0	40.6	53.3	45.5

HYR-4.6. Graphical Representation of Half Yearly Results (April 2022 to September 2022)

Figure 4.2: Residential Area Noise Level

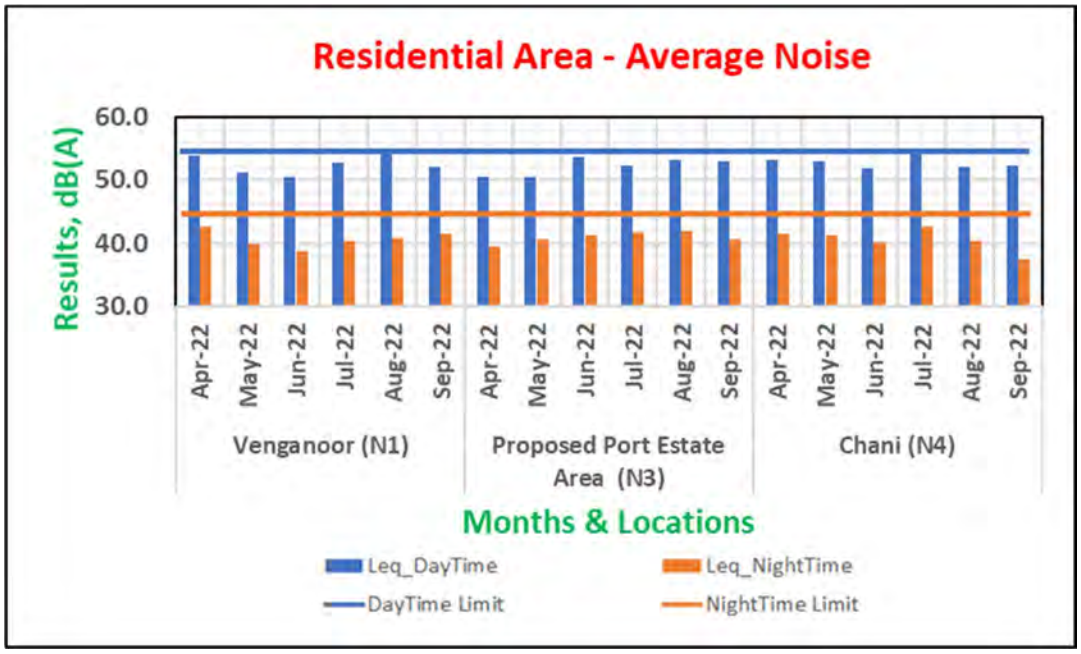


Figure 4.3: Industrial Area Noise Level

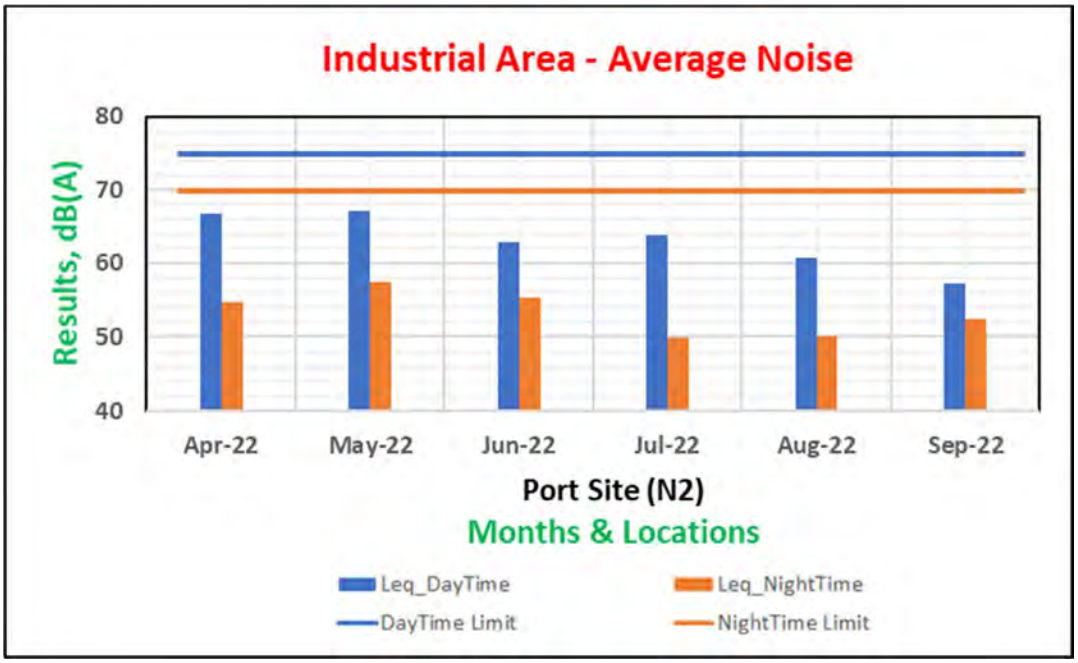
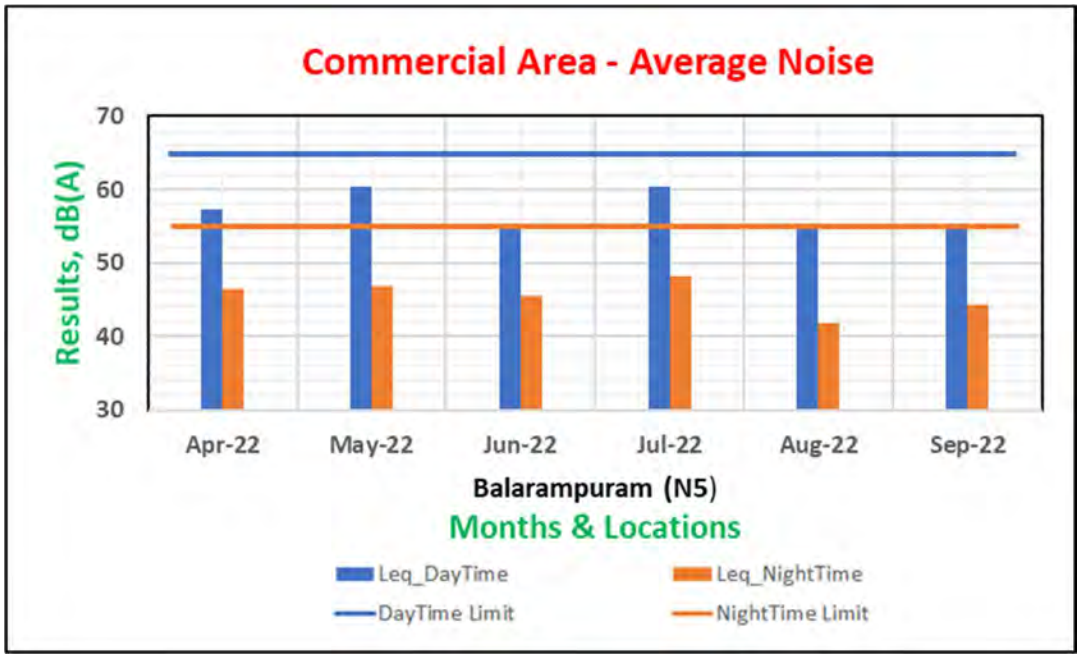


Figure 4.4: Commercial Area Noise Level



HYR-4.7. Summary - Ambient Noise Monitoring

During the period from April 2022 to September 2022, the following is the average noise level observed.

Parameter		Venganoor (N1)	Proposed Port Estate Area (N2)	Chani (N3)	Port Site (N4)	Balarampuram (N5)
		Residential	Residential	Residential	Industrial	Commercial
		Day Time (Limit: 55) Night Time (Limit: 45)			Day Time (Limit: 75) Night Time (Limit: 70)	Day Time (Limit: 65) Night Time (Limit: 55)
Leq Day time dB (A)	Avg	52.4	52.2	52.8	63.1	57.1
Leq Night time dB (A)	Avg	40.7	41.0	40.6	53.3	45.5

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 at all locations on all monitoring days during the monitoring months (from April 2022 to September 2022).

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 2022 to September 2022 was 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 : 1984 RA 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 38:1989 RA 2019
8.	Biochemical Oxygen Demand (3 days, 27°C)	mg/L	2	IS 3025 Part 44:1993 RA 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.	Phytoplanktons	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
4.	Aluminium (as Al)	mg/kg	5	USEPA 7000B : 2017

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
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 2022 to September 2022.

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-22	High tide	26.7	26.7	25.8	26.3	25.4	26.2
			Low tide	27.4	27.1	27.3	27.4	27.1	26.8
		May-22	High tide	24.5	24.8	26.2	25.2	26.3	24.3
			Low tide	27.3	27.5	26.4	26.5	27.1	27.5
		Jun-22	High tide	26.7	26.9	27.5	27.2	27.8	27.2
			Low tide	28.6	28.3	28.7	28.0	28.2	27.7
		Jul-22	High tide	24.5	23.6	24.7	23.3	23.4	24.6
			Low tide	20.4	20.3	20.4	20.6	20.6	20.4
		Aug-22	High tide	23.8	24.2	24.8	23.5	25.7	24.3
			Low tide	23.7	23.5	24.6	23.7	24.3	25.4
		Sep-22	High tide	23.5	24.1	23.5	23.1	23.7	23.7
			Low tide	26.5	26.1	24.5	24.6	25.5	26.2
2	Colour (Hazen)	Apr-22	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
		May-22	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
		Jun-22	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
		Jul-22	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
		Aug-22	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-22	High tide	1	1	1	1	1	1
			Low tide	1	1	1	1	1	1
3	pH Value	Apr-22	High tide	8.11	7.95	8.16	8.14	8.05	8.13
			Low tide	8.13	8.08	8.11	8.02	8.11	8.07
		May-22	High tide	7.90	7.95	7.86	7.88	7.80	8.01
			Low tide	7.92	7.94	7.84	7.90	7.79	7.89
		Jun-22	High tide	7.61	7.40	7.65	7.59	7.49	7.51
			Low tide	7.57	7.46	7.53	7.63	7.54	7.57
		Jul-22	High tide	7.87	7.84	7.90	7.90	7.76	7.92
			Low tide	7.78	7.78	7.86	7.83	7.82	7.80
		Aug-22	High tide	7.65	7.84	7.70	7.80	7.88	7.81
			Low tide	7.63	7.88	7.86	7.85	7.92	7.85
		Sep-22	High tide	7.80	7.65	7.55	7.70	7.60	7.62
			Low tide	7.25	7.85	7.84	7.82	7.74	7.68
4	Turbidity (N.T.U.)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	0.10	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-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
5	Electrical Conductivity (at 25°C) (µmho/cm)	Apr-22	High tide	62210	62190	62150	62330	62140	62690
			Low tide	63000	62710	62170	62810	62320	62990
		May-22	High tide	60180	60340	59980	60040	60240	61010
			Low tide	60690	60620	60500	60280	61000	61090
		Jun-22	High tide	59200	59100	58250	59360	59140	59210
			Low tide	59350	59300	58450	59550	59440	59450
		Jul-22	High tide	60550	61460	61310	61950	61110	60950
			Low tide	61000	61660	61840	60870	61210	61220
		Aug-22	High tide	62220	62410	62210	62090	62180	62420
			Low tide	62445	62985	62780	62140	62455	62910
		Sep-22	High tide	60980	61050	61510	61165	61220	61270
			Low tide	61200	61565	61830	61170	61460	61870
6	Total Suspended Solids (mg/L)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	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-22	High tide	40430	40420	40390	40510	40385	40740
			Low tide	40940	40755	40400	40820	40500	40940
		May-22	High tide	39940	39620	39360	39580	39940	40130
			Low tide	40230	39890	39810	40020	40150	40190
		Jun-22	High tide	38820	38550	38650	38720	38580	38620
			Low tide	38910	38680	38780	38840	38775	38780
		Jul-22	High tide	38147	38786	38625	39660	38500	38398
			Low tide	38430	38846	38959	40240	38562	38610
		Aug-22	High tide	40435	40560	40425	40350	40410	40555
			Low tide	40582	40930	40795	40380	40590	40872
		Sep-22	High tide	39600	39600	39970	39740	39780	39810
			Low tide	39710	40010	40170	39760	39920	40200
8	Dissolved Oxygen (mg/L)	Apr-22	High tide	6.9	6.8	6.9	6.9	6.8	6.8
			Low tide	6.9	7.1	7.1	7.0	6.9	7.1
		May-22	High tide	6.9	7.1	6.8	7.0	7.1	7.0
			Low tide	7.1	7.1	6.9	7.2	7.3	7.1
		Jun-22	High tide	6.8	6.8	6.9	6.9	7.0	6.8
			Low tide	7.2	6.9	7.1	6.9	7.2	6.9
		Jul-22	High tide	6.9	7.0	7.1	6.8	6.9	6.9
			Low tide	7.1	7.2	7.1	7.1	7.1	7.1
		Aug-22	High tide	6.9	6.9	7.1	6.8	6.8	6.9
			Low tide	7.1	7.2	7.1	6.9	6.9	7.2
		Sep-22	High tide	6.9	6.9	6.9	6.9	6.7	7.0
			Low tide	7.2	7.1	7.2	7.2	6.9	7.1

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)
9	Biochemical Oxygen Demand (3 days, 27°C) (mg/L)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	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-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
11		Apr-22	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)
	Nitrite (as NO_2) (mg/L)		Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	0.13	0.13	0.09	0.02	0.02	0.04
			Low tide	0.31	0.23	0.40	0.02	0.04	0.04
		Jun-22	High tide	0.03	BDL	BDL	0.02	BDL	0.06
			Low tide	0.04	BDL	BDL	0.05	0.43	0.09
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	0.04	0.02	BDL	0.09	0.02	BDL
			Low tide	0.06	0.09	BDL	0.10	0.04	0.08
		Sep-22	High tide	BDL	0.05	BDL	0.05	BDL	0.04
			Low tide	0.06	0.10	BDL	0.11	0.07	0.10
12	Nitrate (as NO_3) (mg/L)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
13		Apr-22	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)
	Phenolic Compounds (as C_6H_5OH) (mg/L)	May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	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-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
15	Total Nitrogen (as N)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	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-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
16	Total Phosphorous (as P) (mg/L)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
17	Reactive Phosphorous (mg/L)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	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-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
18	Polycyclic Aromatic Hydrocarbon (mg/L)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
19	Salinity (ppt)	Apr-22	High tide	34.055	34.042	34.018	34.129	34.012	34.351
			Low tide	34.542	34.363	34.030	34.425	34.123	34.536
		May-22	High tide	34.086	34.124	33.958	33.996	34.124	34.616
			Low tide	34.411	34.609	34.002	34.149	34.609	34.667
		Jun-22	High tide	33.655	33.590	33.688	33.759	33.616	33.662

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	33.753	33.720	33.818	33.883	33.811	33.818
		Jul-22	High tide	33.894	34.469	34.374	34.778	34.247	34.146
			Low tide	34.178	34.595	34.709	34.096	34.311	34.317
		Aug-22	High tide	34.236	34.802	34.680	34.607	34.272	34.708
			Low tide	34.323	34.852	34.827	34.628	34.434	34.917
		Sep-22	High tide	34.072	34.117	34.406	34.189	34.224	34.255
			Low tide	34.211	34.441	34.608	34.192	34.375	34.634
20	Total Chlorophyll (mg/m^3)	Apr-22	High tide	0.6	0.6	0.6	0.5	0.4	0.7
			Low tide	0.7	0.9	0.8	0.7	0.7	0.8
		May-22	High tide	0.6	0.5	0.5	0.4	0.6	0.5
			Low tide	0.7	0.6	0.5	0.6	0.8	0.8
		Jun-22	High tide	0.5	0.6	0.4	0.6	0.4	0.6
			Low tide	0.8	0.8	0.6	0.7	0.5	0.7
		Jul-22	High tide	0.6	0.4	0.4	0.5	0.5	0.5
			Low tide	0.7	0.6	0.6	0.8	0.8	0.6
		Aug-22	High tide	0.5	0.4	0.5	0.4	0.5	0.5
			Low tide	0.8	0.5	0.6	0.6	0.6	0.8
		Sep-22	High tide	0.4	0.4	0.4	0.6	0.4	0.6
			Low tide	0.5	0.5	0.8	0.7	0.5	0.9
21	Total Coliforms (MPN Index/100 mL)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	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-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
22	Faecal Coliforms (MPN Index/100 mL)	Apr-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		May-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jun-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Jul-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Aug-22	High tide	BDL	BDL	BDL	BDL	BDL	BDL
			Low tide	BDL	BDL	BDL	BDL	BDL	BDL
		Sep-22	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

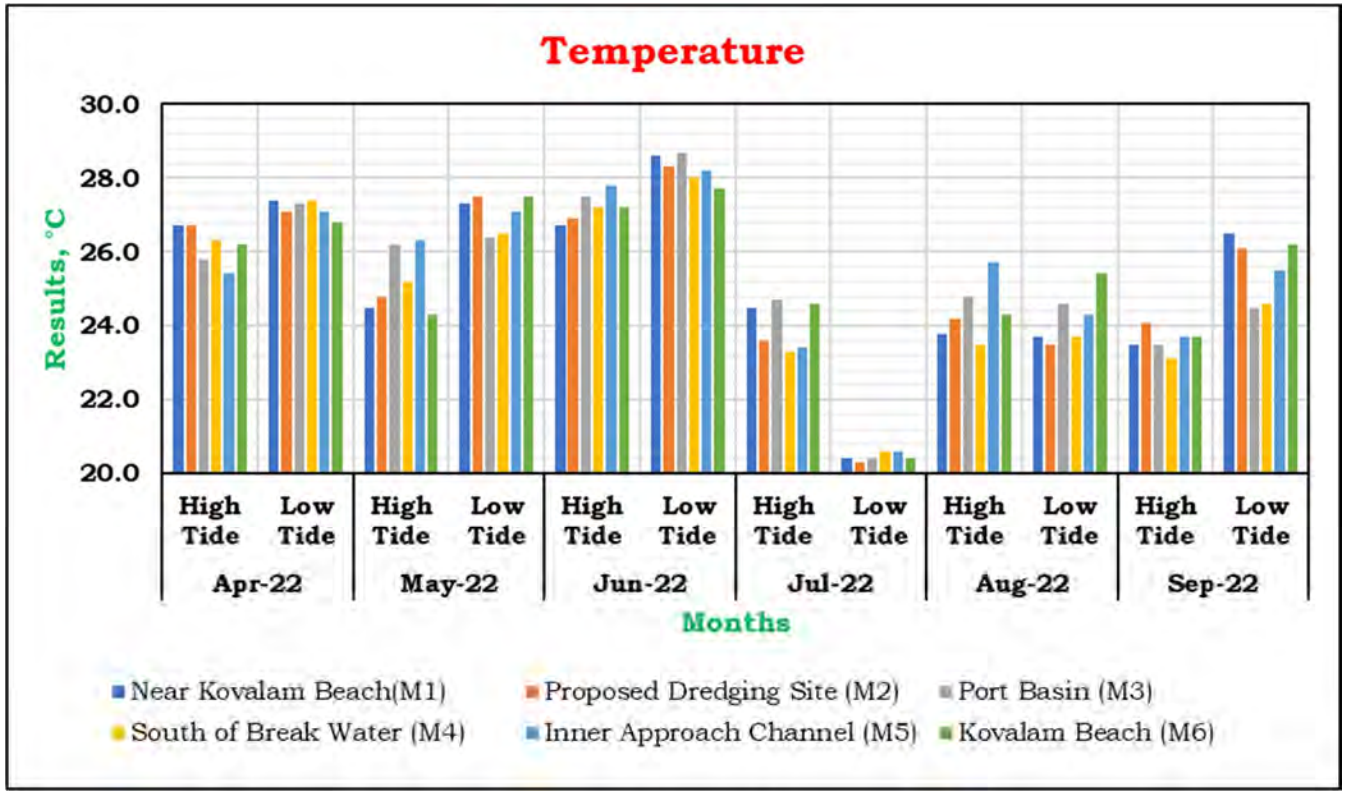


Figure 5.3: Marine Water Analysis for pH

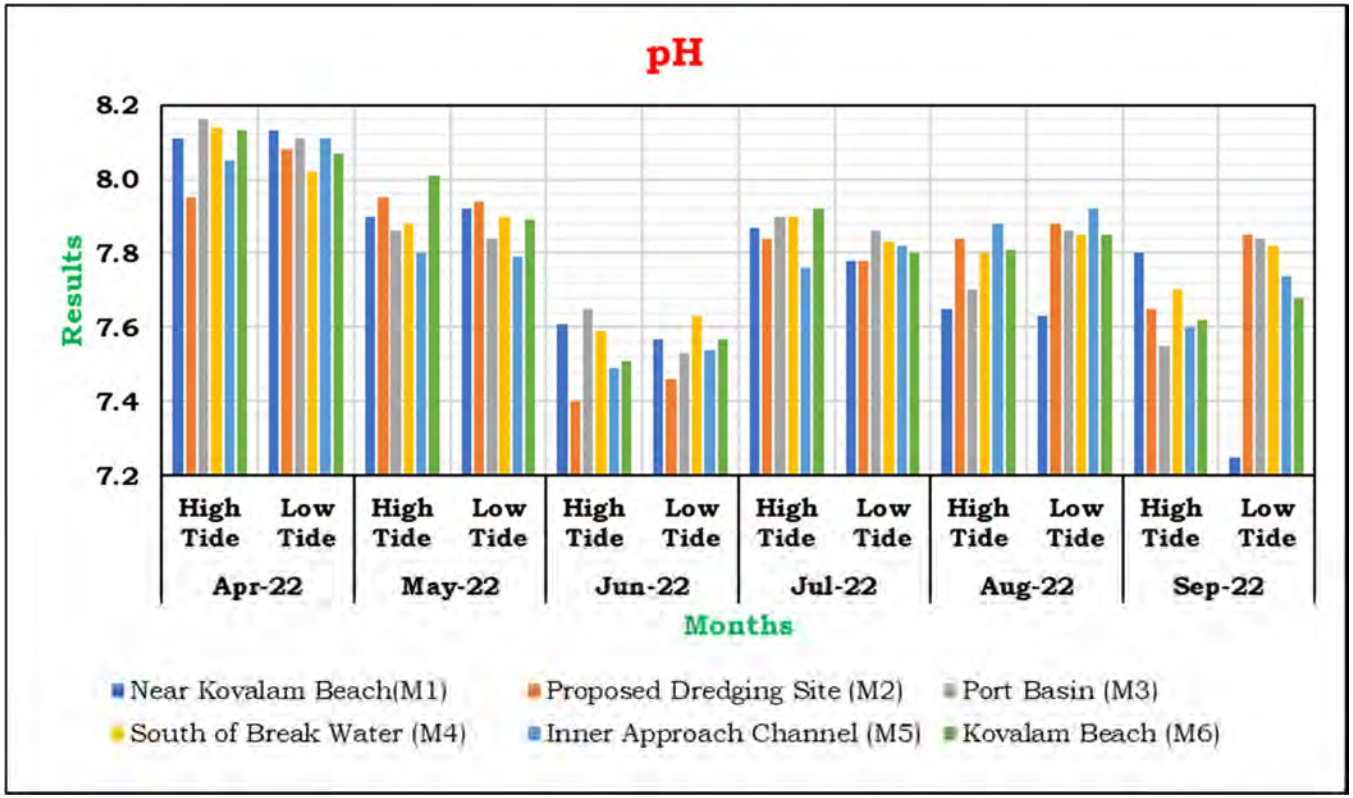


Figure 5.4: Marine Water Analysis for Electrical Conductivity

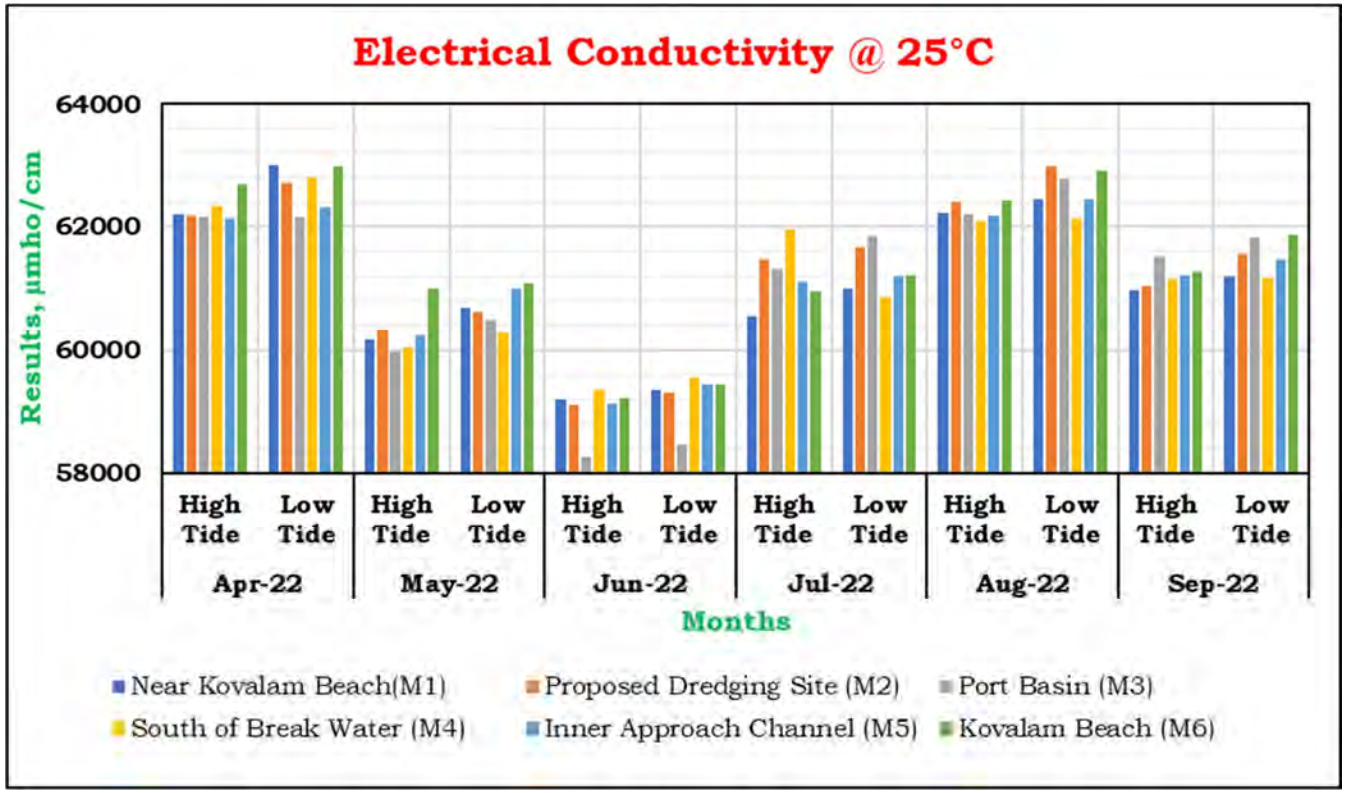


Figure 5.5: Marine Water Analysis for Total Dissolved Solids

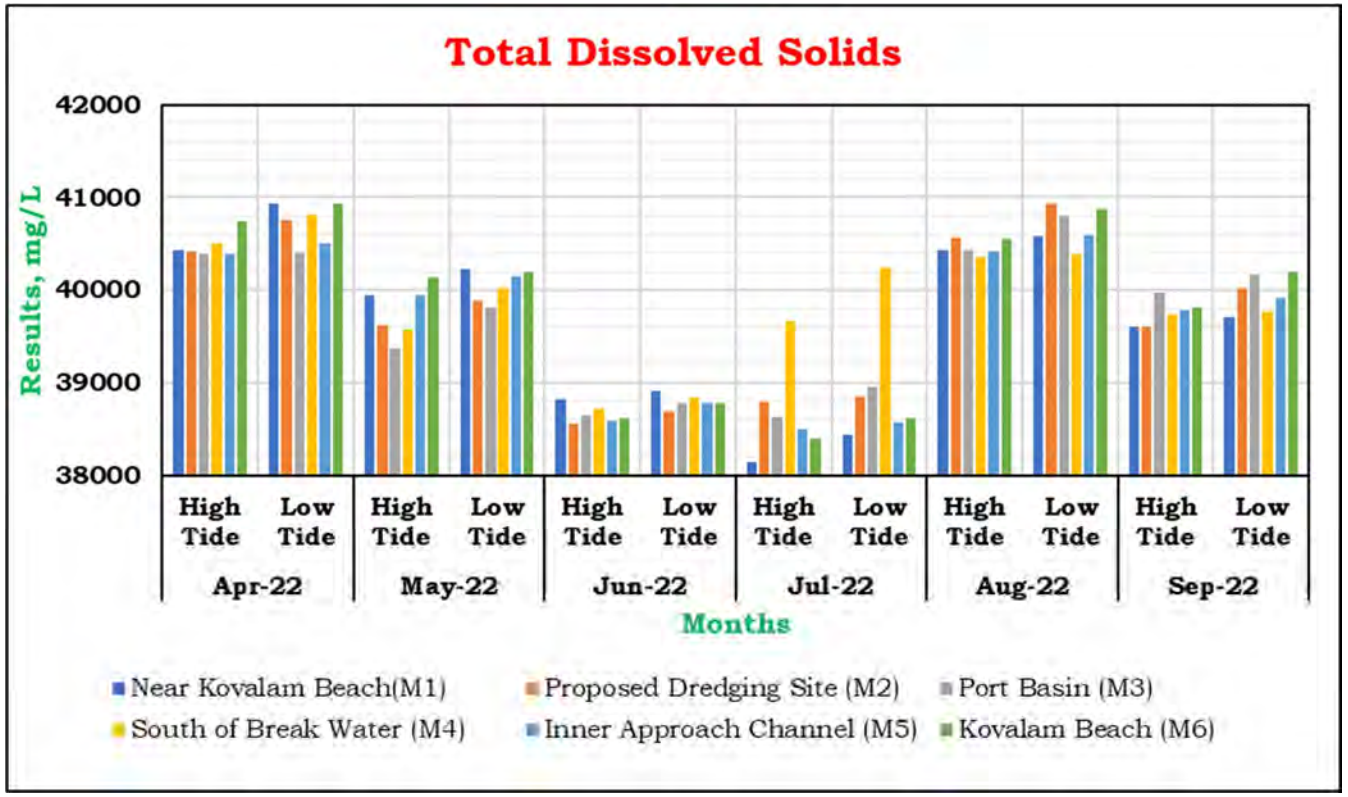


Figure 5.6: Marine Water Analysis for Dissolved Oxygen

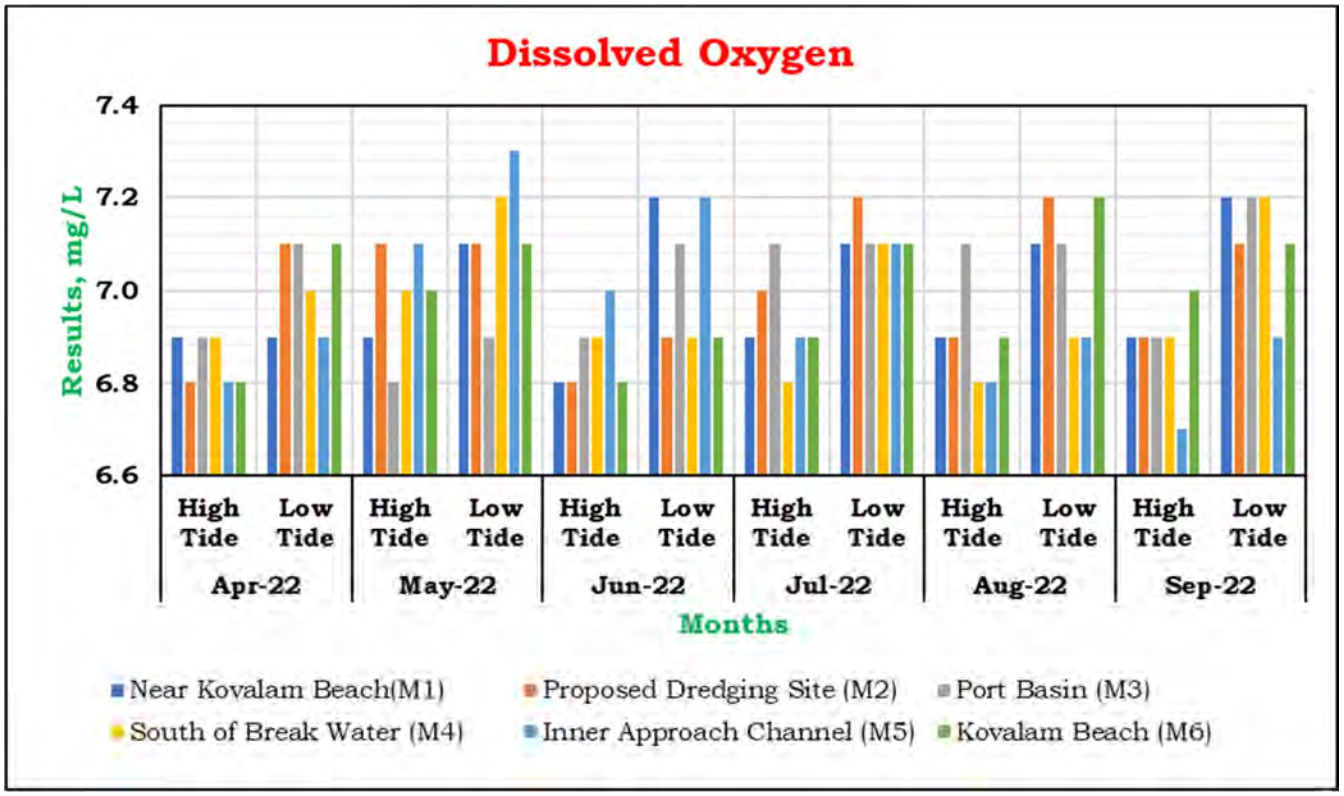


Figure 5.7: Marine Water Analysis for Nitrite as NO_2

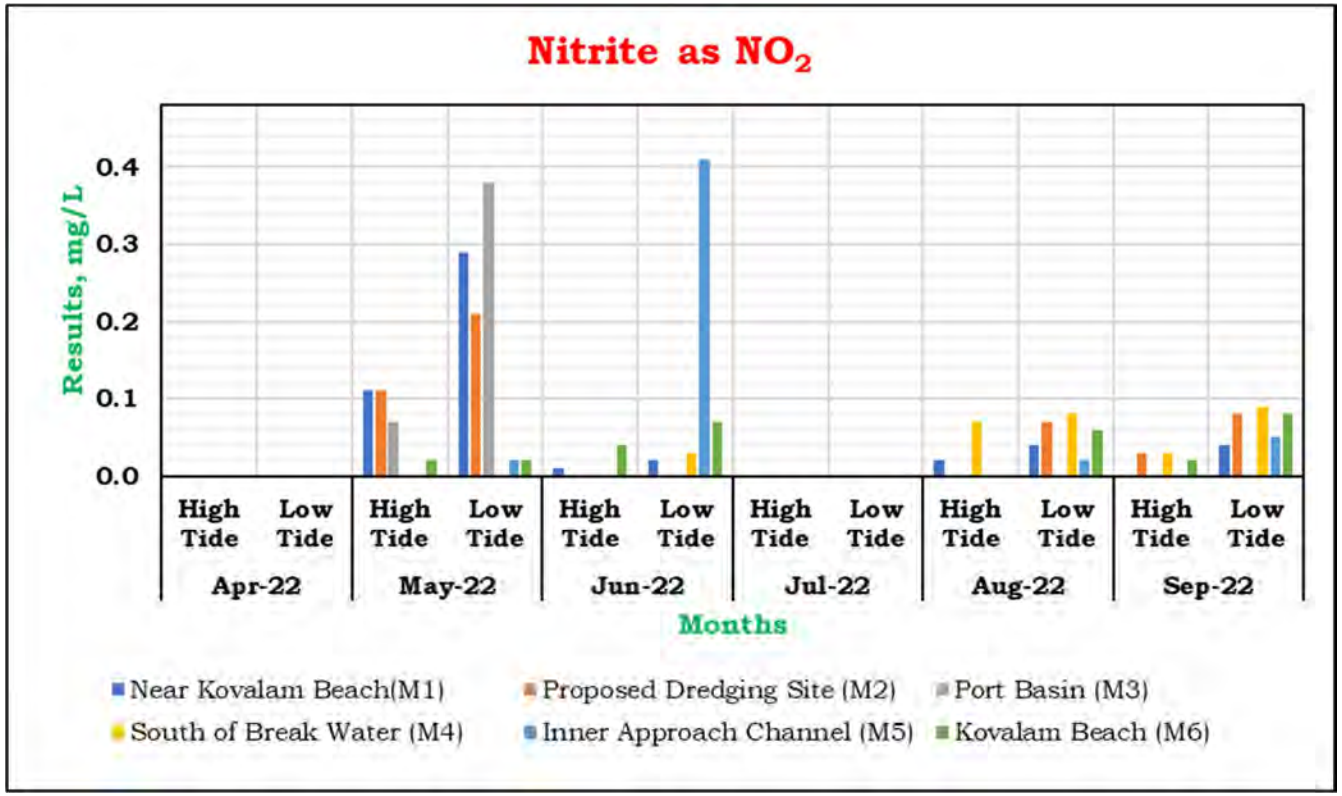


Figure 5.8: Marine Water Analysis for Salinity

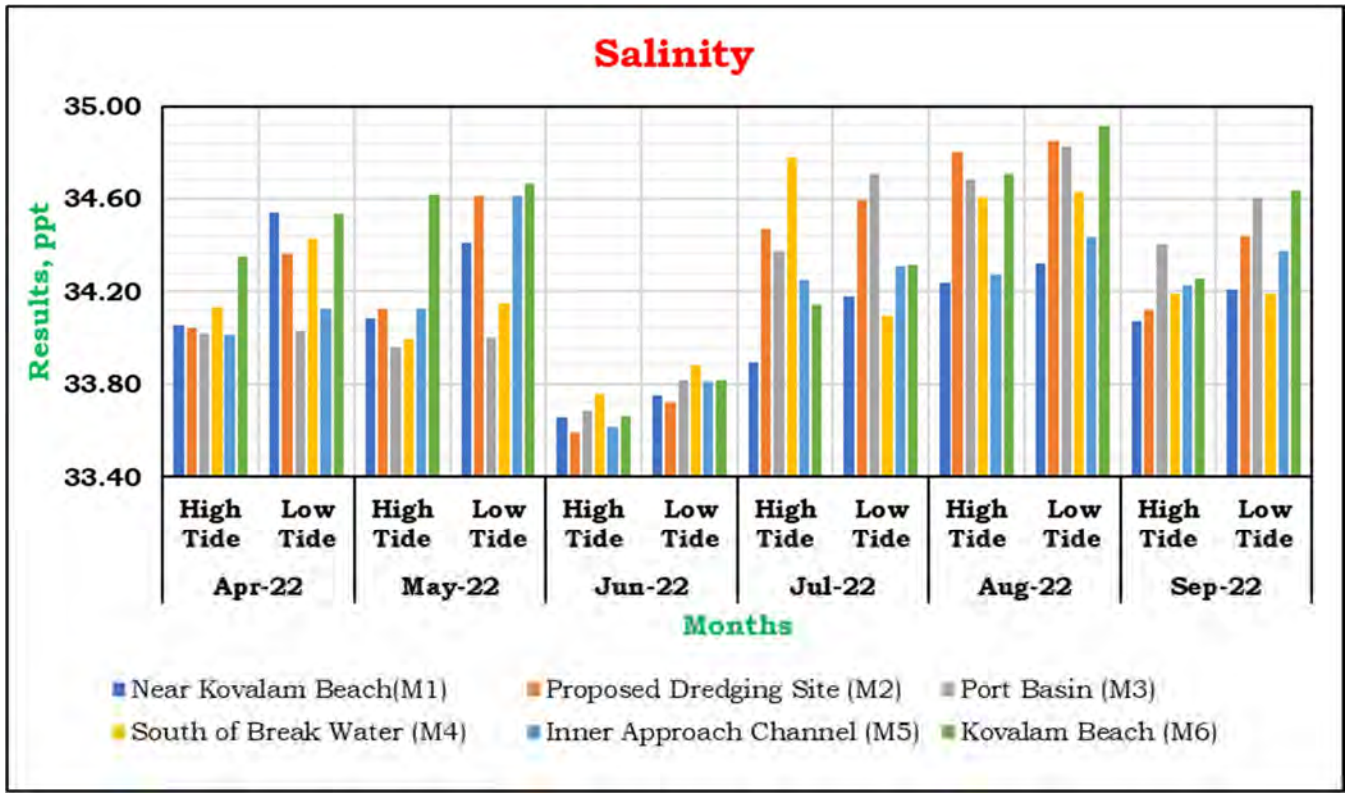
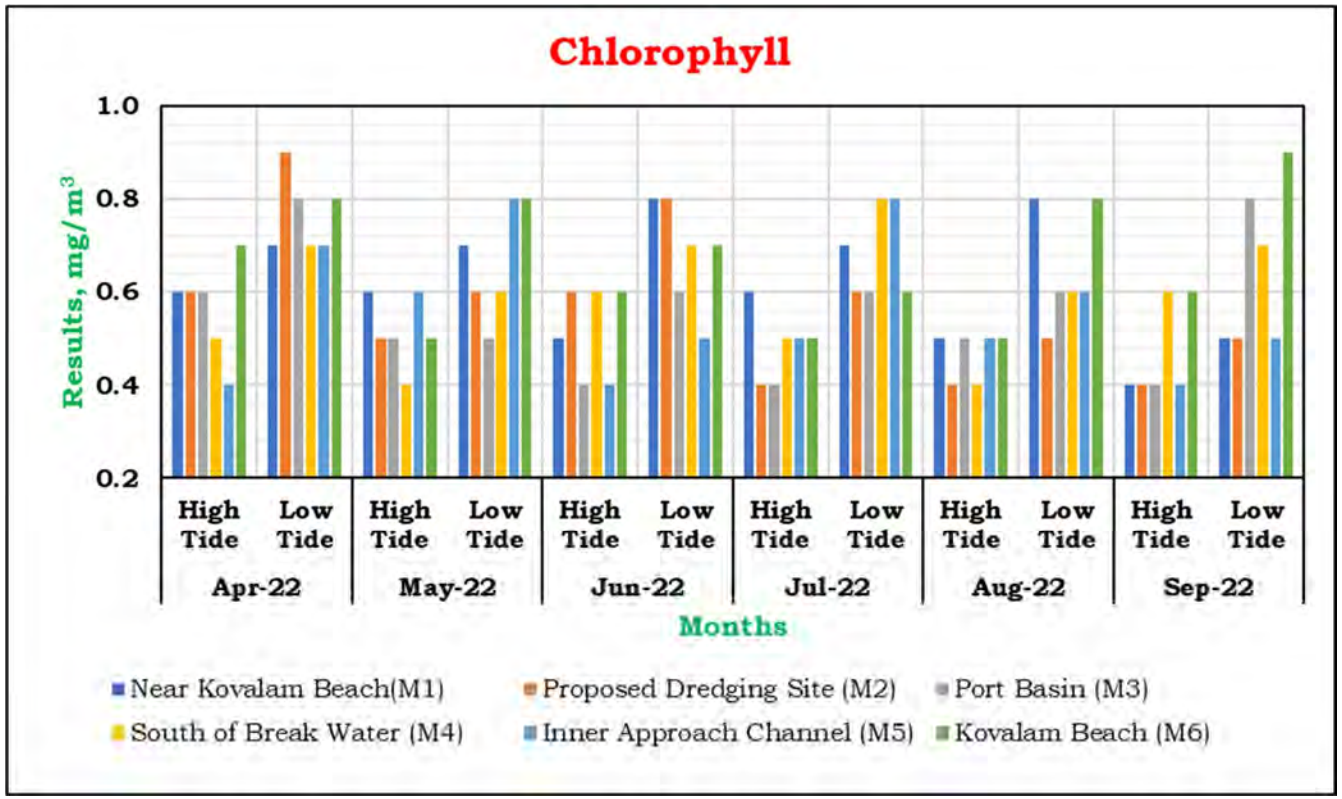


Figure 5.9: Marine Water Analysis for Chlorophyll



HYR-5.6. Summary - Marine water analysis:

During the months from April 2022 to September 2022, 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 20.4 to 28.6 °C
- No visible colour was observed
- pH was observed in the range from 7.25 to 8.13
- Electrical Conductivity (at 25°C) was observed in the range from 59200 to 63000 µmho/cm
- Total Dissolved Solids were observed in the range from 38147 to 40940 mg/L
- Dissolved Oxygen was observed in the range from 6.8 to 7.2 mg/L
- Nitrite (as NO_2) was observed in the range from 0.03 to 0.31 mg/L
- Salinity was observed in the range from 33.655 to 34.542 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.8 mg/m^3
- Turbidity, Total Suspended Solids, Biological Oxygen Demand, Floating materials, Phenolic Compounds (as C_6H_5OH), Nitrate (as NO_3), Ammonical Nitrogen (as NH_3-N), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous (as P), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below detectable limits.

b) At the location **Proposed Dredging Site** (low tide & high tide),

- Temperature was observed in the range from 20.3 to 28.3°C
- No visible colour was observed
- pH was observed in the range from 7.40 to 8.08
- Electrical Conductivity (at 25°C) was observed in the range from 59100 to 62985 µmho/cm
- Total Dissolved Solids were observed in the range from 38550 to 40930 mg/L
- Dissolved Oxygen was observed in the range from 6.8 to 7.2 mg/L

- Nitrite (as NO_2) was observed in the range from 0.02 to 0.23 mg/L
- Salinity was observed in the range from 33.590 to 34.852 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.9 mg/m^3
- Turbidity, Total Suspended Solids, Biological Oxygen Demand, Floating materials, Phenolic Compounds (as C_6H_5OH), Nitrate (as NO_3), Ammonical Nitrogen (as NH_3-N), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous (as P), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below detectable limits.

c) At the location **Port basin** (low tide & high tide),

- Temperature was observed in the range from 20.4 to 28.7°C
- No visible colour was observed
- pH was observed in the range from 7.53 to 8.16
- Electrical Conductivity (at 25°C) was observed in the range from 58250 to 62780 µmho/cm
- Total Dissolved Solids were observed in the range from 38625 to 40795 mg/L
- Dissolved Oxygen was observed in the range from 6.8 to 7.2 mg/L
- Nitrite (as NO_2) was observed in the range from 0.09 to 0.40 mg/L
- Salinity was observed in the range from 33.688 to 34.827 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.8 mg/m^3
- Turbidity, Total Suspended Solids, Biochemical Oxygen Demand (3 days, 27°C), Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous (as P), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below detectable limits.

d) At the location **South of Break Water** (low tide & high tide),

- Temperature was observed in the range from 20.6 to 28.0°C
- No visible colour was observed
- pH was observed in the range from 7.59 to 8.14

- Electrical Conductivity (at 25°C) was observed in the range from 59360 to 62810 µmho/cm
- Total Dissolved Solids were observed in the range from 38720 to 40820 mg/L
- Dissolved Oxygen was observed in the range from 6.8 to 7.2 mg/L
- Nitrite (as NO_2) was observed in the range from 0.02 to 0.11 mg/L
- Salinity was observed in the range from 33.759 to 34.778 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.8 mg/m^3
- Turbidity, Total Suspended Solids, Biochemical Oxygen Demand (3 days, 27°C), Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous (as P), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below detectable limits.

e) At the location **Inner Approach Channel** (low tide & high tide),

- Temperature was observed in the range from 20.6 to 38.2°C
- No visible colour was observed
- pH was observed in the range from 7.49 to 8.11
- Turbidity was observed from BDL to 0.1 N.T.U.
- Electrical Conductivity (at 25°C) was observed in the range from 59140 to 62455 µmho/cm
- Total Dissolved Solids were observed in the range from 38500 to 40590 mg/L
- Dissolved Oxygen was observed in the range from 6.7 to 7.3mg/L
- Nitrite (as NO_2) was observed in the range from 0.02 to 0.43 mg/L
- Salinity was observed in the range from 33.616 to 34.609 ppt
- Total Chlorophyll was observed in the range from 0.4 to 0.8 mg/m^3
- Total Suspended Solids, Biochemical Oxygen Demand (3 days, 27°C), Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous (as P), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below detectable limits.

f) At the location **Kovalam Beach** (low tide & high tide),

- Temperature was observed in the range from 20.4 to 27.7 °C
- No visible colour was observed
- pH was observed in the range from 7.51 to 8.13
- Electrical Conductivity (at 25°C) was observed in the range from 59210 to 62990 µmho/cm
- Total Dissolved Solids were observed in the range from 38398 to 40940 mg/L
- Dissolved Oxygen was observed in the range from 6.8 to 7.2 mg/L
- Nitrite (as NO_2) was observed in the range from 0.04 to 0.1 mg/L
- Salinity was observed in the range from 33.662 to 34.917 ppt
- Total Chlorophyll was observed in the range from 0.5 to 0.9 mg/m^3
- Turbidity, Total Suspended Solids, Biochemical Oxygen Demand (3 days, 27°C), Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Nitrate (as NO_3), Total Nitrogen (as N), Total Phosphorous (as P), Reactive Phosphorous (as P), Polycyclic Aromatic Hydrocarbon, Total Coliforms and Faecal Coliforms were observed below detectable limits.

HYR-5.7. Maximum Values observed - Marine water analysis:

During the period from April 2022 to September 2022, 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)	28.6	28.3	28.7	28.0	28.2	27.7
2	Colour	1	1	1	1	1	1
3	pH Value	8.13	8.08	8.16	8.14	8.11	8.13
4	Turbidity (N.T.U.)	BDL	BDL	BDL	BDL	0.1	BDL
5	Electrical Conductivity (at 25°C) (µmho/cm)	63000	62985	62780	62810	62455	62990
6	Total Suspended Solids (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
7	Total Dissolved Solids (mg/L)	40940	40930	40795	40820	40590	40940
8	Dissolved Oxygen (mg/L)	7.2	7.2	7.2	7.2	7.3	7.2
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)	0.31	0.23	0.40	0.11	0.43	0.10
12	Nitrate (as NO_3) (mg/L)	BDL	BDL	BDL	BDL	BDL	BDL
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

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)
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)	34.542	34.852	34.827	34.778	34.609	34.917
20	Total Chlorophyll (mg/m^3)	0.8	0.9	0.8	0.8	0.8	0.9
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

Summary – Comparison of Results of **All Locations**,

- Maximum value of Temperature was 28.7 °C observed at Port Basin.
- Maximum value of pH was 8.16 observed at Port Basin.
- Maximum value of Turbidity was 0.1 NTU observed at Inner Approach Channel.
- Maximum value of Electrical Conductivity (at 25°C) was 63000 µmho/cm observed at Near Kovalam Beach.
- Maximum value of Total Dissolved Solids was 40940 mg/L observed at Near Kovalam Beach & Kovalam Beach.
- Maximum value of Dissolved Oxygen was 7.3 mg/L observed at Inner Approach Channel.
- Maximum value of Nitrite (as NO_2) was 0.43 mg/L observed at Inner Approach Channel.
- Maximum value of Salinity was 34.917 ppt observed at Kovalam Beach.

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-22	Sandy	Sandy	Sandy	Sandy	Sandy	Sandy
			May-22	Sandy	Sandy	Sandy	Sandy	Sandy	Sandy
			Jun-22	Sandy	Sandy	Sandy	Sandy	Sandy	Sandy
			Jul-22	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
			Aug-22	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
			Sep-22	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
2	Organic Matter	%	Apr-22	0.38	0.45	3.56	0.22	0.22	0.19
			May-22	0.42	0.38	2.12	0.28	0.3	0.22
			Jun-22	0.38	0.42	2.45	0.38	0.4	0.29
			Jul-22	0.19	0.13	0.98	0.14	0.91	0.32
			Aug-22	0.48	0.55	1.31	0.64	0.85	0.22
			Sep-22	0.57	0.41	1.85	0.52	0.60	0.29
3	Total Phosphorus (as P)	mg/kg	Apr-22	249	130	578	119	123	104
			May-22	42.5	110	685	65.2	206	78.6
			Jun-22	65.2	245	550	115	356	158
			Jul-22	150	156	186	63.5	69.4	111
			Aug-22	110	165	258	78.9	47.6	98.7
			Sep-22	145	210	195	92.5	68.4	150
4	Aluminium (as Al)	mg/kg	Apr-22	3029	2098	2106	1893	1975	2204

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)
			May-22	2165	1995	2465	1065	2216	3213
			Jun-22	3255	1090	5545	2160	1145	7546
			Jul-22	1495	838	3311	1371	978	4198
			Aug-22	1948	805	3057	1982	1391	5589
			Sep-22	2116	1025	1698	1423	892	5589
5	Chromium (as Cr)	mg/kg	Apr-22	BDL	BDL	BDL	BDL	BDL	BDL
			May-22	BDL	BDL	BDL	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL	BDL	BDL	BDL
6	Copper (as Cu)	mg/kg	Apr-22	BDL	BDL	BDL	BDL	BDL	BDL
			May-22	BDL	BDL	BDL	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL	BDL	BDL	BDL
7	Iron (as Fe)	mg/kg	Apr-22	7273	8047	9732	3424	5200	7602
			May-22	11925	7065	12654	2065	8564	5986
			Jun-22	10256	5469	10469	3546	6642	2245
			Jul-22	4036	3743	7135	1082	2715	1595
			Aug-22	4857	3095	8058	1763	2958	1857
			Sep-22	5279	2168	5046	2456	4125	1048
8	Lead (as Pb)	mg/kg	Apr-22	BDL	BDL	BDL	BDL	BDL	BDL
			May-22	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)
			Jun-22	BDL	BDL	BDL	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL	BDL	BDL	BDL
9	Manganese (as Mn)	mg/kg	Apr-22	3.98	3.64	4.15	4.85	2.70	4.11
			May-22	5.2	2.69	4.26	3.815	4.05	3.86
			Jun-22	4.08	3.65	2.59	4.56	2.85	1.89
			Jul-22	2.11	2.02	2.59	3.21	1.96	1.45
			Aug-22	3.33	4.40	1.95	2.57	3.84	1.22
			Sep-22	2.13	3.25	1.12	1.86	4.65	2.40
10	Mercury (as Hg)	mg/kg	Apr-22	BDL	BDL	BDL	BDL	BDL	BDL
			May-22	BDL	BDL	BDL	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL	BDL	BDL	BDL
11	Zinc (as Zn)	mg/kg	Apr-22	2.95	3.9	7.40	4.26	6.12	5.77
			May-22	1.88	4.2	5.80	2.65	4.98	4.59
			Jun-22	2.1	1.89	3.65	1.26	2.45	7.80
			Jul-22	1.69	1.02	2.11	1.03	1.26	4.12
			Aug-22	1.46	2.34	2.57	1.95	3.76	5.96
			Sep-22	2.11	1.95	3.56	1.80	3.46	3.22
12	Nickel (as Ni)	mg/kg	Apr-22	BDL	BDL	BDL	BDL	BDL	BDL
			May-22	BDL	BDL	BDL	BDL	BDL	BDL
			Jun-22	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)
			Jul-22	BDL	BDL	BDL	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL	BDL	BDL	BDL
Benthic Organism									
13	Micro Benthic Organism	No./m^2	Apr-22	78600	67400	66800	63500	64800	64300
			May-22	84600	69700	63700	62800	61200	65400
			Jun-22	86200	68300	64800	63400	63100	64200
			Jul-22	92600	82400	70300	70600	68400	58700
			Aug-22	79800	67600	60800	62600	61200	63800
			Sep-22	53200	59100	76600	58000	64000	62000
14	Macro Benthic Organism	No./m^2	Apr-22	61200	65800	49100	57800	63100	52800
			May-22	69400	61800	43900	58300	60100	53500
			Jun-22	67700	60500	45200	59600	61800	50100
			Jul-22	74500	74600	52400	62200	52600	46200
			Aug-22	72000	59400	39600	60800	59200	52600
			Sep-22	44600	38300	42200	46000	52000	48600
15	**Total Benthos**	**No./m^2**	**Apr-22**	**139800**	**133200**	**115900**	**121300**	**127900**	**117100**
			May-22	**154000**	**131500**	**107600**	**121100**	**121300**	**118900**
			Jun-22	**153900**	**128800**	**110000**	**123000**	**124900**	**114300**
			Jul-22	**167100**	**157000**	**122700**	**132800**	**121000**	**104900**
			Aug-22	**151800**	**127000**	**100400**	**123400**	**120400**	**116400**
			Sep-22	**97800**	**97400**	**118800**	**104000**	**116000**	**110600**

HYR-5.9. Graphical representation of Results for Sediment analysis

Figure 5.10: Sediment Analysis for Organic Matter

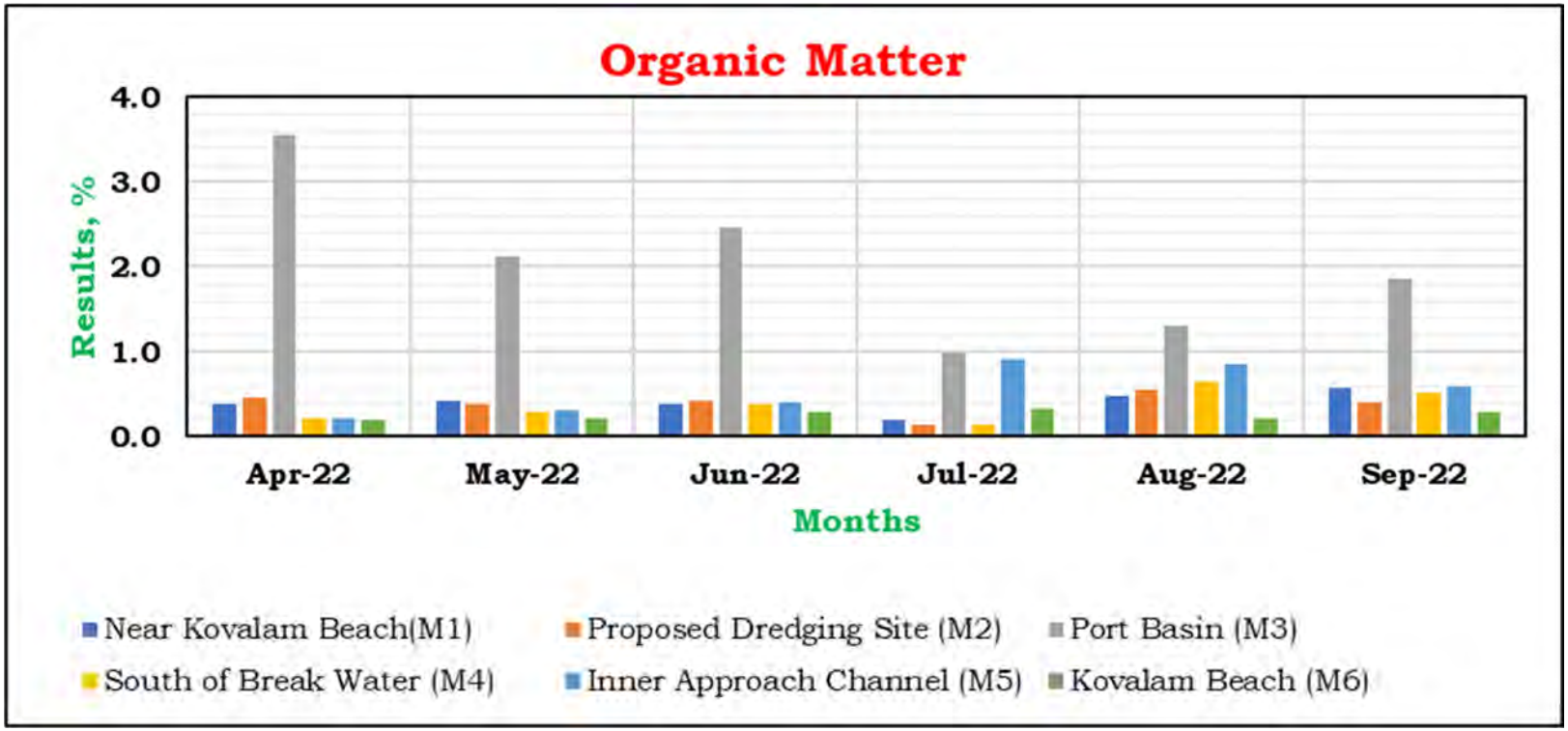


Figure 5.11: Sediment Analysis for Total Phosphorous as P

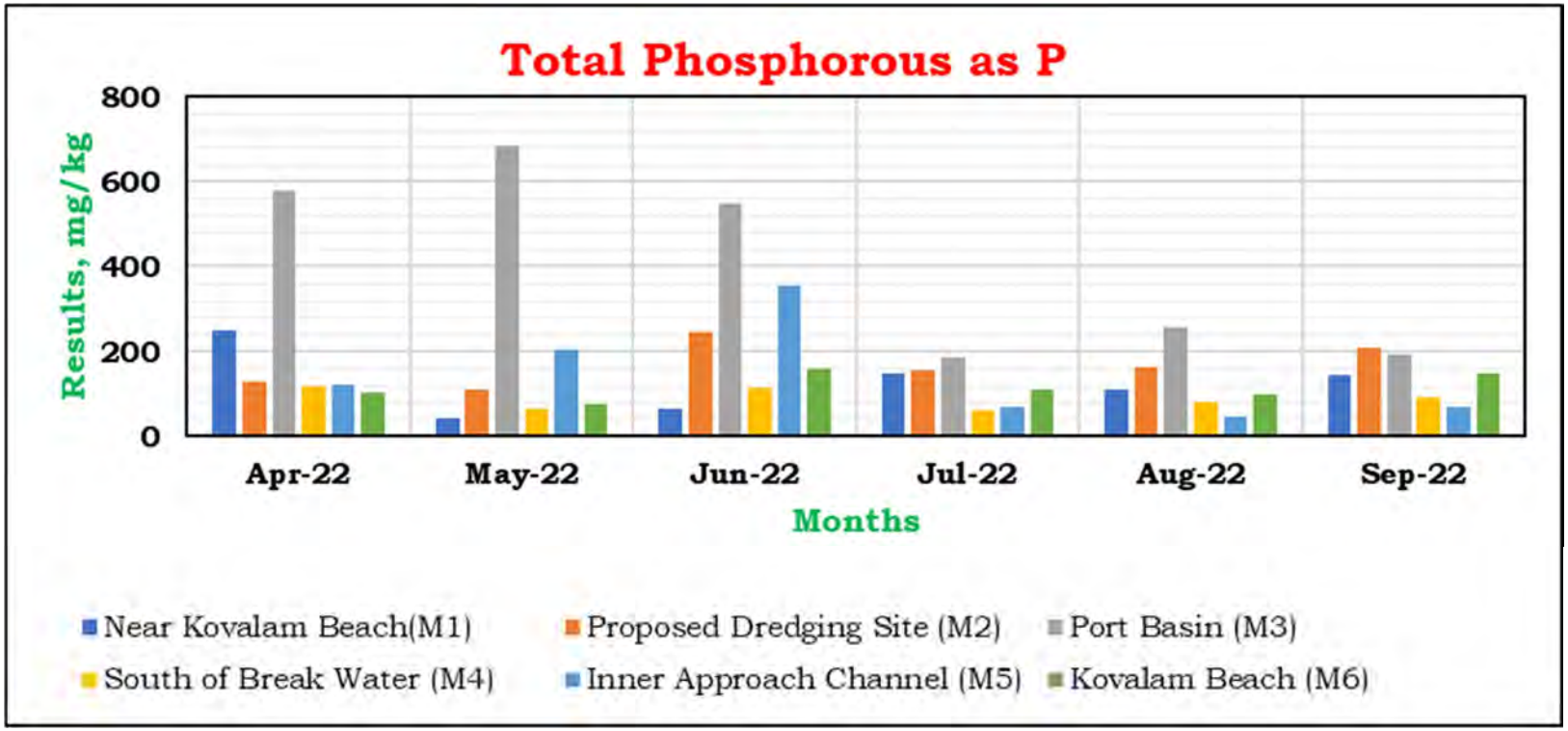


Figure 5.12: Sediment Analysis for Aluminium as Al

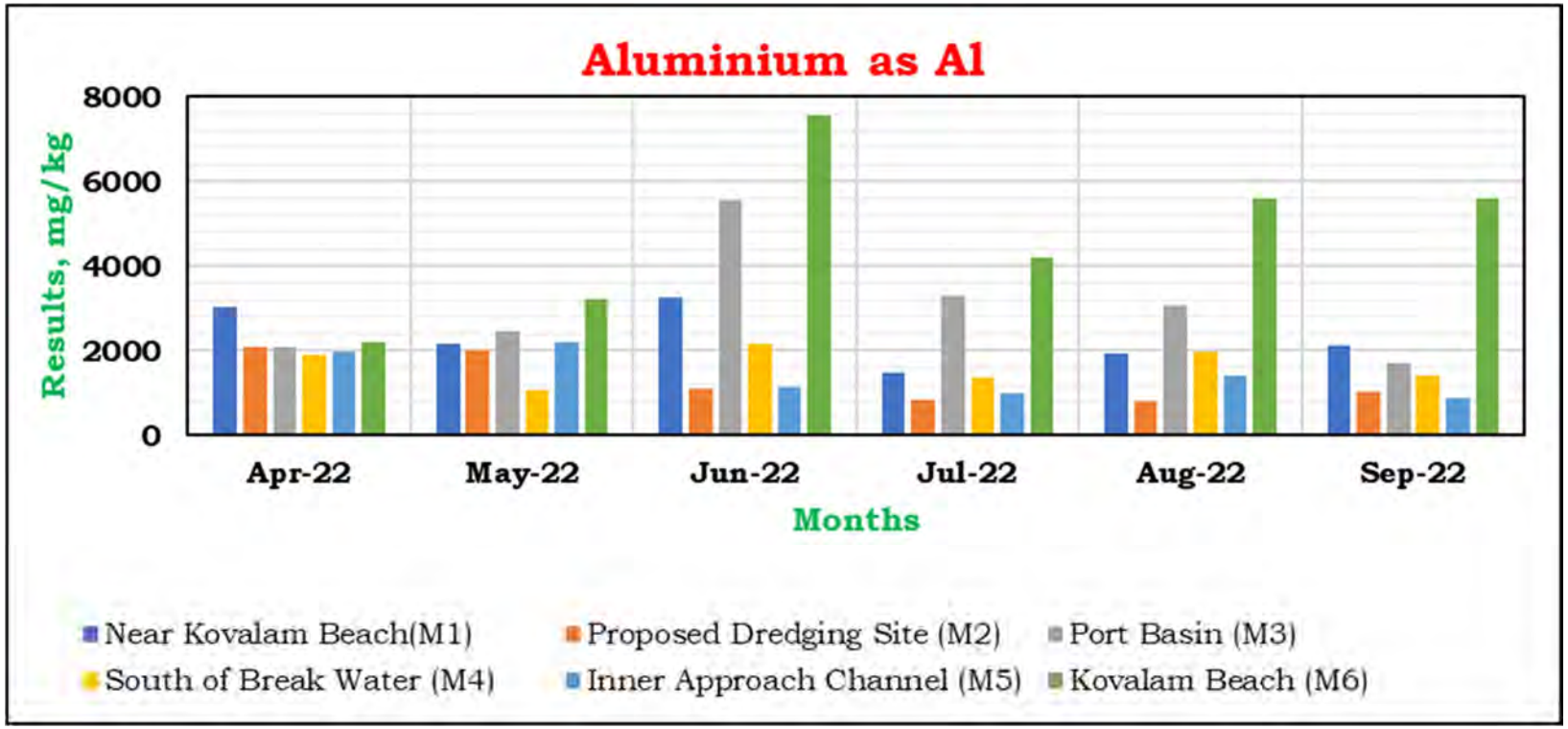


Figure 5.13: Sediment Analysis for Iron as Fe

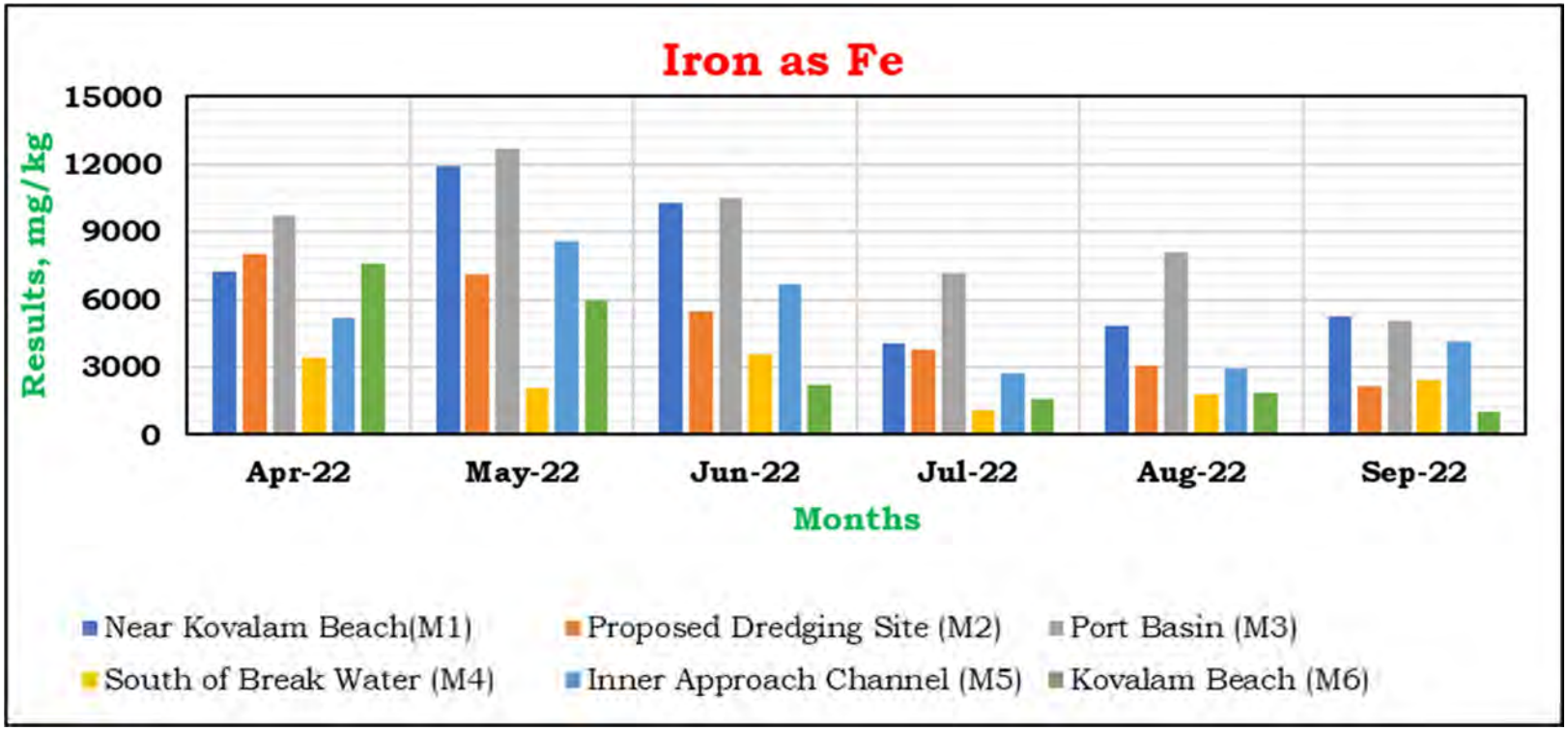


Figure 5.14: Sediment Analysis for Manganese as Mn

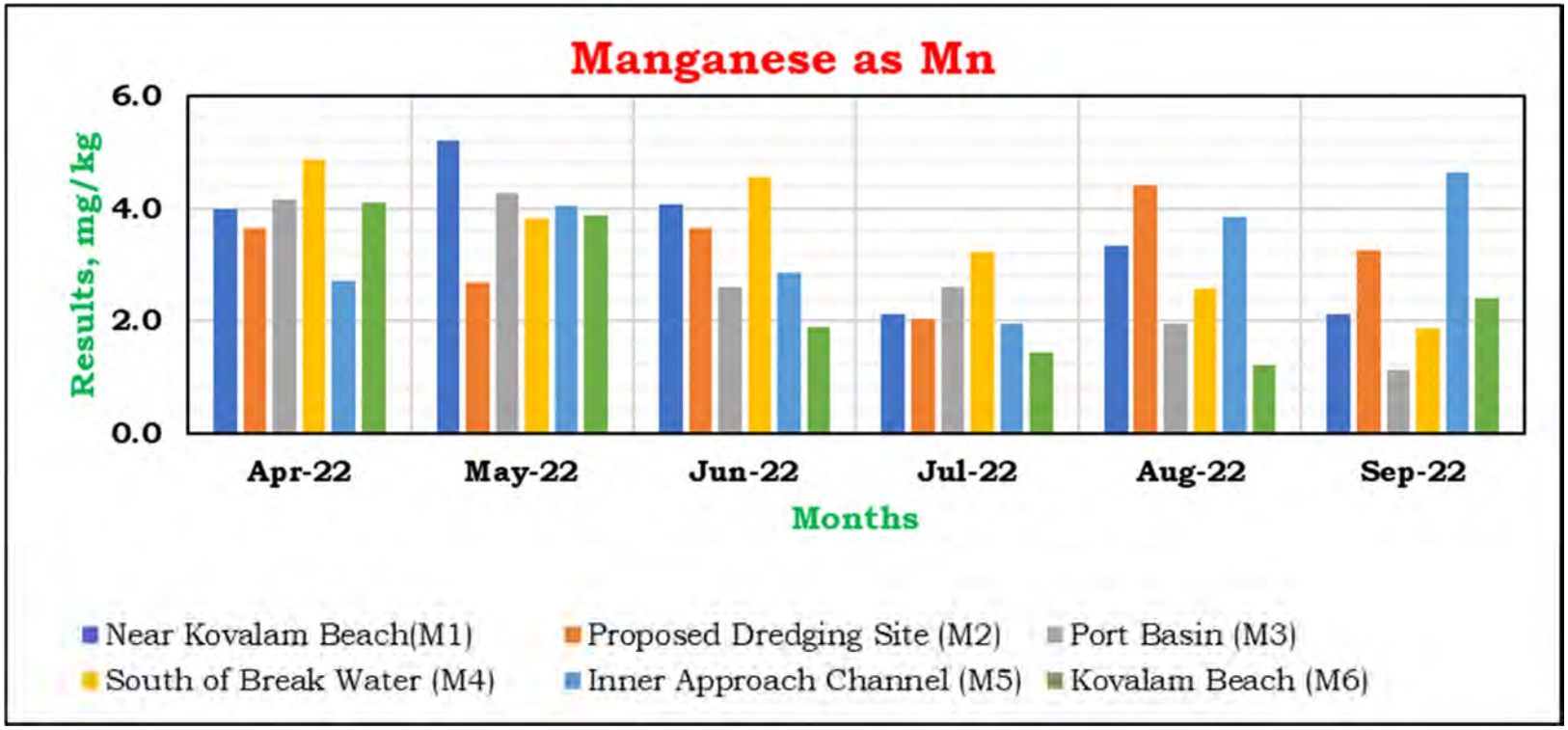


Figure 5.15: Sediment Analysis for Zinc as Zn

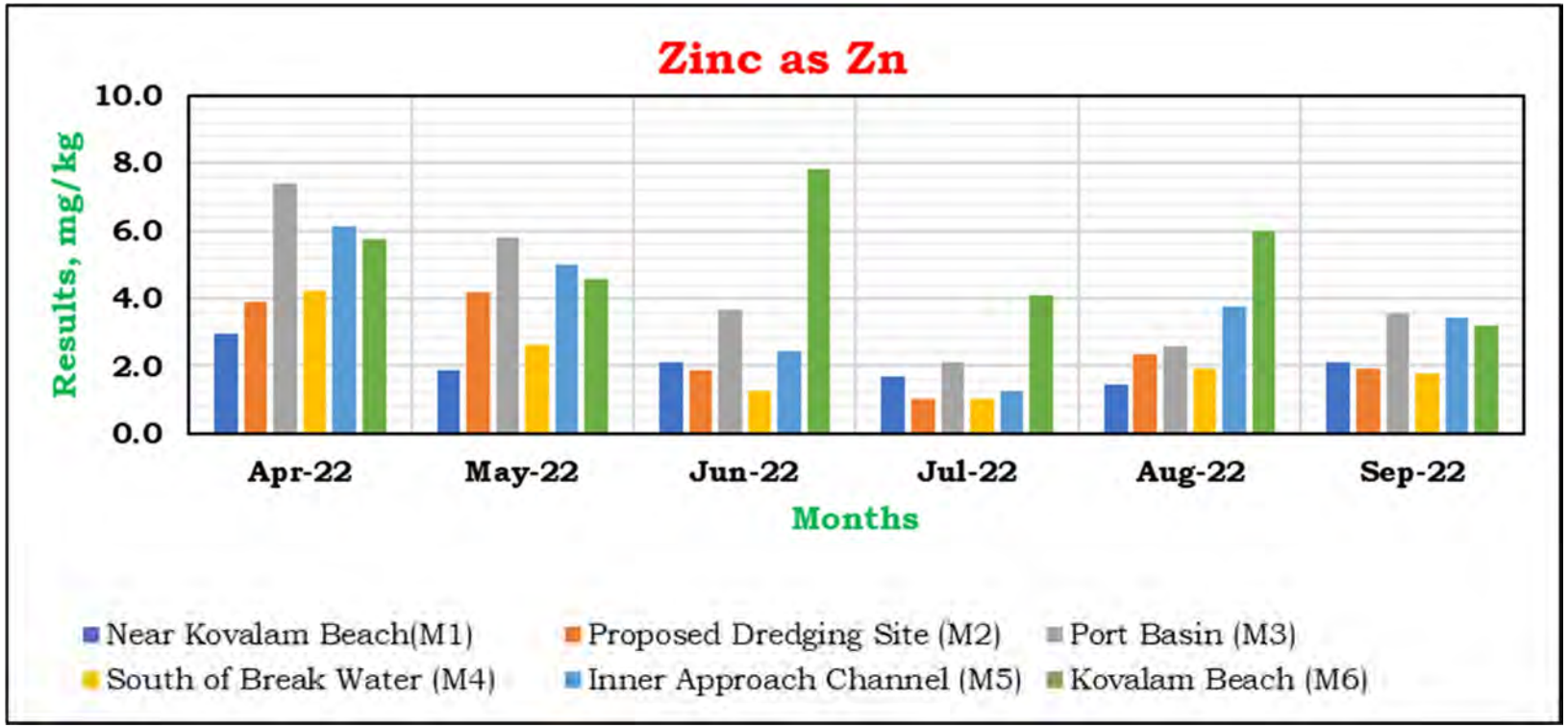
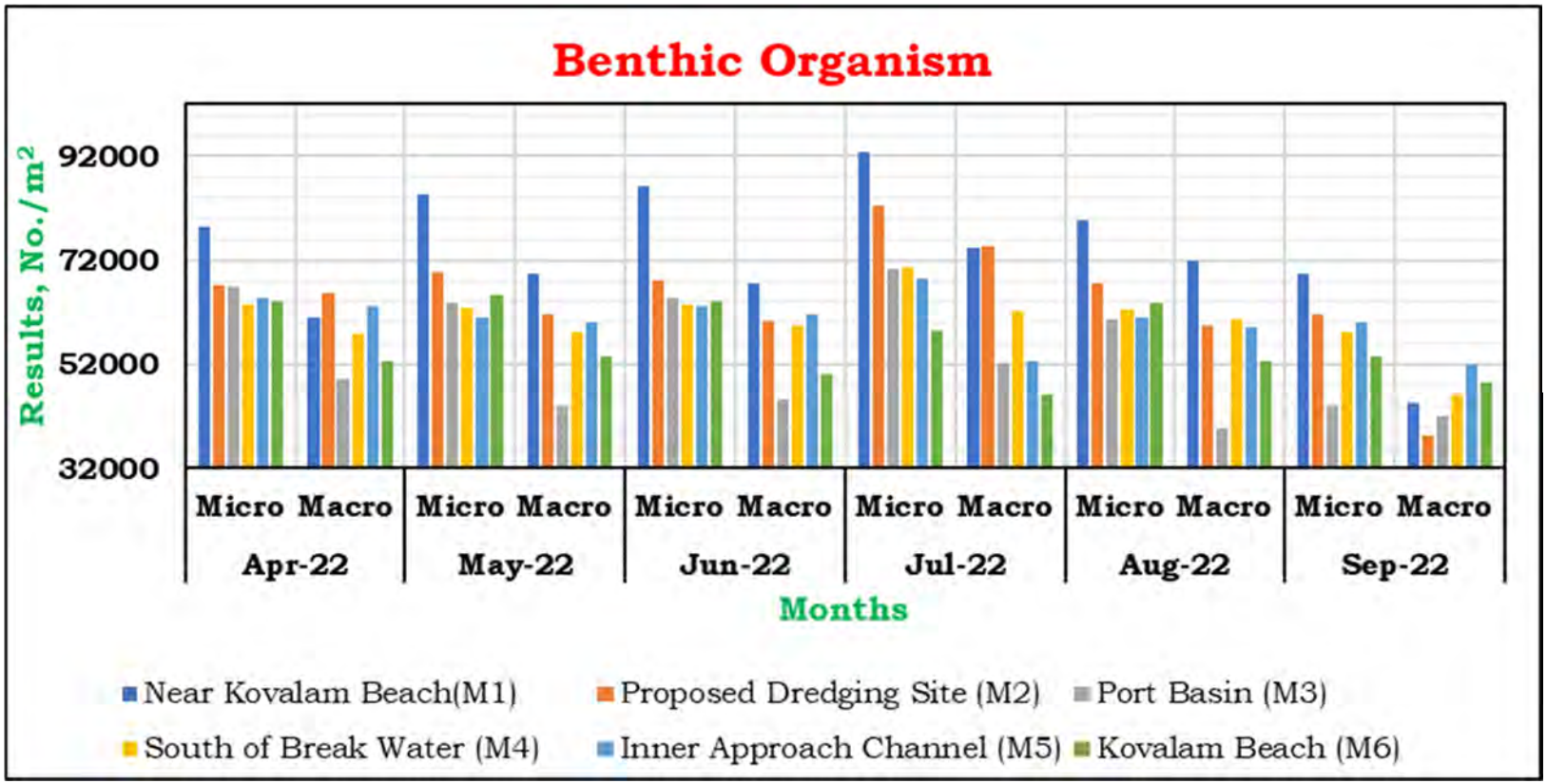


Figure 5.16: Sediment Analysis for Benthic Organism



HYR-5.10. Summary - Sediment Analysis:

During the months from April 2022 to September 2022, 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 0.19 to 0.57%
- Total Phosphorus (as P) was observed in the range from 43.0 to 249mg/kg
- Aluminium (as Al) was observed in the range from 1495 to 3255 mg/kg
- Iron (as Fe) was observed in the range from 4036 to 11925 mg/kg
- Manganese (as Mn) was observed in the range from 2.11 to 5.20 mg/kg
- Zinc (as Zn) was observed in the range from 1.46 to 2.95 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below detectable limits
- Micro benthic organisms were observed in the range from 53200 to 92600/m^2
- Macro benthic organisms were observed in the range from 44600 to 74500/m^2

b) At the location **Proposed Dredging Site**,

- The observed texture was sandy
- Organic matter was observed in the range from 0.13 to 0.55%
- Total Phosphorus (as P) was observed in the range from 110 to 245 mg/kg
- Aluminium (as Al) was observed in the range from 805 to 2098 mg/kg
- Iron (as Fe) was observed in the range from 2168 to 8047 mg/kg
- Manganese (as Mn) was observed in the range from 2.02 to 4.40 mg/kg
- Zinc (as Zn) was observed in the range from 1.02 to 4.20 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below detectable limits
- Micro benthic organisms were observed in the range from 59100 to 82400/m^2

- Macro benthic organisms were observed in the range from 38300 to 74600/m^2

c) At the location **Port Basin**,

- The observed texture was sandy to sandy loam
- Organic matter was observed in the range from 0.98 to 3.56%
- Total Phosphorus (as P) was observed in the range from 186 to 685 mg/kg
- Aluminium (as Al) was observed in the range from 1698 to 5545 mg/kg
- Iron (as Fe) was observed in the range from 5046 to 12654 mg/kg
- Manganese (as Mn) was observed in the range from 1.12 to 4.26 mg/kg
- Zinc (as Zn) was observed in the range from 2.11 to 7.40 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below detectable limits
- Micro benthic organisms were observed in the range from 60800 to 76600/m^2
- Macro benthic organisms were observed in the range from 39600 to 52400/m^2

d) At the location **South of Break Water**,

- The observed texture was sandy
- Organic matter was observed in the range from 0.14 to 0.64%
- Total Phosphorus (as P) was observed in the range from 64 to 119 mg/kg
- Aluminium (as Al) was observed in the range from 1065 to 2160 mg/kg
- Iron (as Fe) was observed in the range from 1082 to 3546 mg/kg
- Manganese (as Mn) was observed in the range from 1.86 to 4.85 mg/kg
- Zinc (as Zn) was observed in the range from 1.03 to 4.26 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below detectable limits
- Micro benthic organisms were observed in the range from 58000 to 70600/m^2
- Macro benthic organisms were observed in the range from 46000 to 62200/m^2

e) At the location **Inner Approach Channel**,

- The observed texture was sandy

- Organic matter was observed in the range from 0.22 to 0.91%
- Total Phosphorus (as P) was observed in the range from 48 to 356 mg/kg
- Aluminium (as Al) was observed in the range from 892 to 2216 mg/kg
- Iron (as Fe) was observed in the range from 2715 to 8564 mg/kg
- Manganese (as Mn) was observed in the range from 1.96 to 4.65 mg/kg
- Zinc (as Zn) was observed in the range from 1.26 to 6.12 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below detectable limits
- Micro benthic organisms were observed in the range from 61200 to 68400/m^2
- Macro benthic organisms were observed in the range from 52000 to 63100/m^2

f) At the location **Kovalam Beach**,

- The observed texture was sandy
- Organic matter was observed in the range from 0.19 to 0.32%
- Total Phosphorus (as P) was observed in the range from 79 to 158 mg/kg
- Aluminium (as Al) was observed in the range from 2204 to 7546 mg/kg
- Iron (as Fe) was observed in the range from 1048 to 7602 mg/kg
- Manganese (as Mn) was observed in the range from 1.22 to 4.11 mg/kg
- Zinc (as Zn) was observed in the range from 3.22 to 7.8 mg/kg
- Chromium (as Cr), Copper (as Cu), Lead (as Pb), Mercury (as Hg) and Nickel (as Ni) were observed below detectable limits
- Micro benthic organisms were observed in the range from 58700 to 65400/m^2
- Macro benthic organisms were observed in the range from 46200 to 53500/m^2

g) Summary – Comparison of Results of **All Locations**,

- Maximum value of Organic matter observed was 3.56 % at Port Basin
- Maximum value of Total Phosphorus (as P) observed was 685 mg/kg at Port Basin
- Maximum value of Aluminium (as Al) observed was 7546 mg/kg at Kovalam Beach

- Maximum value of Iron (as Fe) observed was 12654 mg/kg at Port Basin
- Maximum value of Manganese (as Mn) observed was 5.2 mg/kg at Near Kovalam Beach
- Maximum value of Zinc (as Zn) observed was 7.8 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 92600/m^2 at Near Kovalam Beach
- Maximum value of Macro benthic organisms observed was 74600/m^2 at Proposed Dredging Site.

HYR-5.11. Marine Water Analysis for Phytoplankton and Zooplankton

Table 5.6: 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-22	67413	74040	67490	67509	64964	49031
	May-22	69538	74739	69194	67133	63963	48369
	Jun-22	70903	76360	77819	70417	64220	54250
	Jul-22	79890	69337	72424	49608	79133	83331
	Aug-22	71630	56690	60626	67083	56048	45568
	Sep-22	62806	54942	59028	54764	64370	42646
Total Zooplankton No/100 mL	Apr-22	8155	8547	9086	11474	8388	11635
	May-22	8900	9094	8986	11043	8900	11010
	Jun-22	9416	9771	9058	11650	9860	11723
	Jul-22	10355	8537	10015	11598	10243	11498
	Aug-22	7964	6440	9442	8606	7205	8930
	Sep-22	7082	5778	8674	7698	6262	6728

HYR-5.12. Graphical representation of Results for Marine Phytoplankton and Zooplankton

Figure 5.17: Marine Water Analysis for Total Phytoplankton

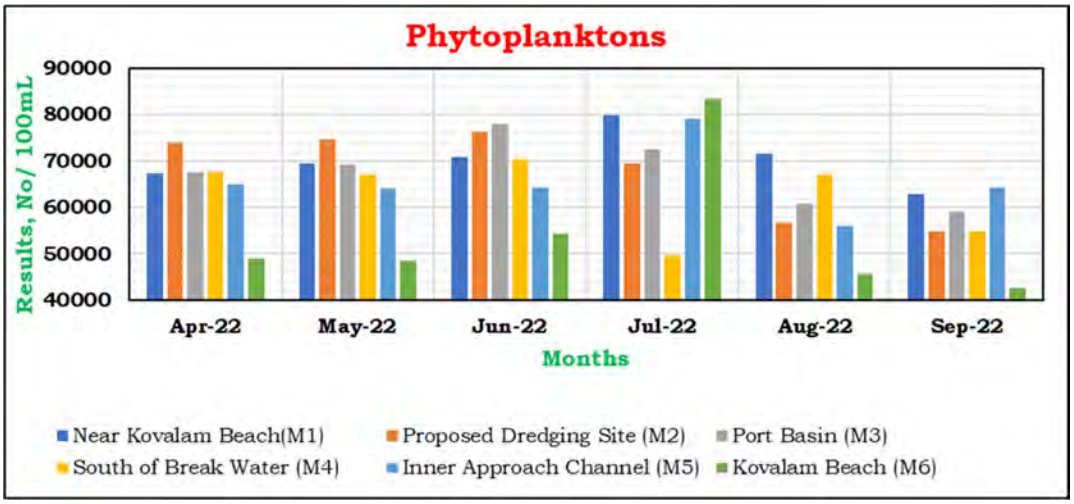
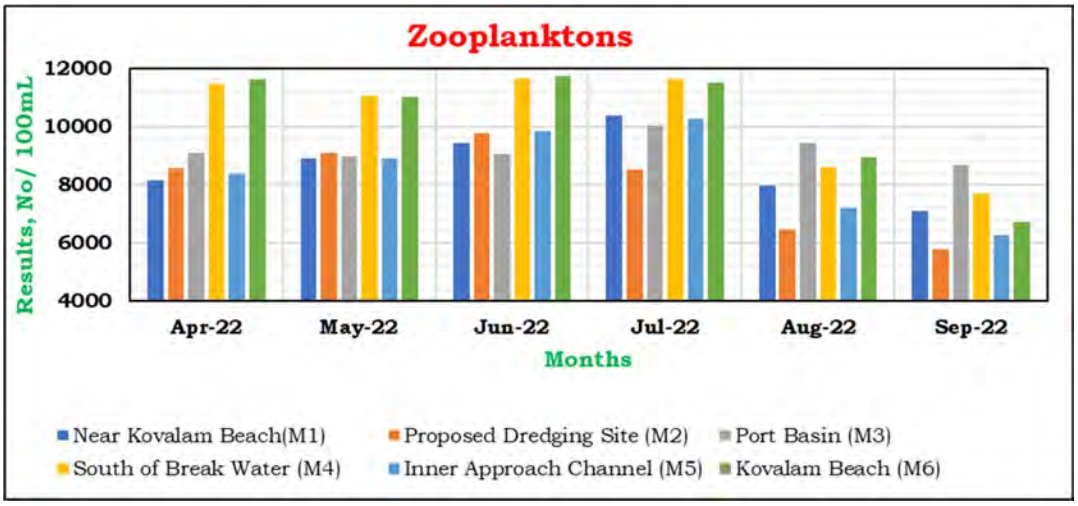


Figure 5.18: Marine Water Analysis for Total Zooplankton



HYR-5.13. Summary-Marine Water Analysis for Phytoplankton and Zooplankton

During the months from April 2022 to September 2022, following is the summary of Marine Water Analysis for Phytoplankton and Zooplankton:

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	62806	54942	59028	49608	56048	42646
	To	79890	76360	77819	70417	79133	83331
Total Zooplankton No/100 mL	From	7082	5778	8674	7698	6262	6728
	To	10355	9771	10015	11650	10243	11723

Summary – Comparison of Results of **All Locations**,

- Maximum value of Total Phytoplankton observed was 79890 No/100 mL at Near Kovalam Beach
- Maximum value of Total Zooplankton observed was 11723 No/100 mL at Kovalam Beach.

HYR-6	Ground Water Analysis

HYR-6.1. Ground Water Location Details:

This section describes the sampling location, methodology adopted for analysis and analysis results of Ground water during the period from April 2022 to September 2022. Ground water sampling was carried out at three locations: Port Site, PAF Area and Proposed Port Estate Area

Table 6.1: Coordinates of Ground Water Location

Location	Legend	Latitude	Longitude
Port 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°22'24.60"N	77°00'11.16"E

Figure 6.1: Google earth views of Ground Water Sampling Locations

HYR-6.2. Methodology of Sampling and Analysis:

Table 6.2: 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 38:1989 RA 2019
8.	Biochemical Oxygen Demand (3 days, 27°C)	mg/L	2	IS 3025 Part 44:1993 RA 2019
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 :2005 RA 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 : 1986 RA 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

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
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***			
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

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
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.	Faecal Coliforms	MPN/100 ml	2	IS 1622: 1981

HYR-6.3. Ground Water Analysis Results for the period from April 2022 to September 2022:

Table 6.3: 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-22	1	1	1
				May-22	1	1	1
				Jun-22	1	1	1
				Jul-22	1	1	1
				Aug-22	1	1	1
				Sep-22	1	1	1
2.	Odour	-	Agreeable	Apr-22	Agreeable	Agreeable	Agreeable
				May-22	Agreeable	Agreeable	Agreeable
				Jun-22	Agreeable	Agreeable	Agreeable
				Jul-22	Agreeable	Agreeable	Agreeable
				Aug-22	Agreeable	Agreeable	Agreeable
				Sep-22	Agreeable	Agreeable	Agreeable
3.	pH Value	-	6.5 to 8.5	Apr-22	6.61	7.34	6.62
				May-22	6.84	7.18	6.74
				Jun-22	7.98	6.68	6.76
				Jul-22	7.08	6.57	6.51
				Aug-22	7.04	6.62	6.56
				Sep-22	6.98	6.52	6.59
4.	Turbidity	N.T.U.	Max. 1	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
5.	Total Dissolved Solids	mg/L	Max. 500	Apr-22	166	122	546
				May-22	140	74	460

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-22	235	104	385
				Jul-22	242	112	310
				Aug-22	302	108	285
				Sep-22	295	102	265
General Parameters concerning substances undesirable in excessive amounts							
6.	Aluminium (as Al)	mg/L	Max. 0.03	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
7.	Ammonia (as NH_3-N)	mg/L	Max.0.5	Apr-22	0.33	0.25	0.32
				May-22	BDL	BDL	BDL
				Jun-22	0.2	0.34	0.26
				Jul-22	0.18	BDL	BDL
				Aug-22	0.20	BDL	0.09
				Sep-22	BDL	BDL	BDL
8.	Anionic Detergents (as MBAS) Calculated as LAS mol.wt. 288.38	mg/L	Max. 0.2	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
9.	Barium (as Ba)	mg/L	Max. 0.7	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
10.	Boron (as B)	mg/L	Max. 0.5	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
11.	Calcium (as Ca)	mg/L	Max. 75	Apr-22	8.80	5.60	14.4
				May-22	8.80	5.60	12.0
				Jun-22	23.2	8.60	8.80
				Jul-22	28.0	8.80	8.80
				Aug-22	30.4	8.00	9.60
				Sep-22	24.5	6.40	8.76
12.	Chloramines (as Cl_2)	mg/L	Max. 4.0	Apr-22	BDL	BDL	BDL
				May-22	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-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
13.	Chloride (as Cl)	mg/L	Max.250	Apr-22	35.9	24.9	193
				May-22	37.6	16.8	180
				Jun-22	87.9	40.9	175
				Jul-22	78.5	45.3	129
				Aug-22	89.9	33.9	126
				Sep-22	76.0	21.0	120
14.	Copper (as Cu)	mg/L	Max.0.05	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
15.	Fluoride (as F)	mg/L	Max. 1	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
16.	Iron (as Fe)	mg/L	Max.0.3	Apr-22	0.20	0.19	0.27
				May-22	0.15	0.14	0.12
				Jun-22	0.12	0.21	0.19
				Jul-22	0.16	0.19	0.11
				Aug-22	BDL	0.18	BDL
				Sep-22	BDL	0.12	BDL
17.	Magnesium (as Mg)	mg/L	Max. 30	Apr-22	1.49	3.47	19.3
				May-22	3.89	1.20	18.0
				Jun-22	2.43	2.92	16.1
				Jul-22	5.96	2.92	12.4
				Aug-22	7.79	2.44	10.7
				Sep-22	9.93	2.98	10.9
18.	Manganese (as Mn)	mg/L	Max.0.1	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
19.	Mineral Oil	mg/L	Max.0.5	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	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-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
20.	Nitrate (as NO_3)	mg/L	Max.45	Apr-22	BDL	BDL	24.4
				May-22	BDL	BDL	30.1
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
21.	Phenolic Compounds (as C6H5OH)	mg/L	Max. 0.001	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
22.	Selenium (as Se)	mg/L	Max. 0.01	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
23.	Silver (as Ag)	mg/L	Max. 0.1	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
24.	Sulphate (as SO_4)	mg/L	Max. 200	Apr-22	3.83	6.81	36.3
				May-22	3.45	5.56	31.3
				Jun-22	17.6	15.3	22.0
				Jul-22	16.3	13.4	32.6
				Aug-22	20.1	9.60	44.2
				Sep-22	20.2	10.5	42.1
25.	Sulphide (as H_2S)	mg/L	Max. 0.05	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
26.	Total Alkalinity (as $CaCO_3$)	mg/L	Max.200	Apr-22	18.1	30.1	18.1
				May-22	29.8	11.9	16.9
				Jun-22	68.3	22.1	6.03
				Jul-22	69.6	15.9	10.9

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-22	95.5	15.9	5.97
				Sep-22	90.4	12.1	6.03
27.	Total Hardness (as $CaCO_3$)	mg/L	Max. 200	Apr-22	28.6	28.6	116
				May-22	38.0	18.0	104
				Jun-22	68.0	34.0	88.0
				Jul-22	68.0	34.7	73.4
				Aug-22	108	30.0	68.0
				Sep-22	102	28.6	69.4
28.	Zinc (as Zn)	mg/L	Max. 5	Apr-22	0.082	0.100	0.110
				May-22	BDL	BDL	0.065
				Jun-22	BDL	BDL	0.038
				Jul-22	BDL	BDL	0.027
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
Parameters Concerning Toxic Substances							
29.	Cadmium (as Cd)	mg/L	Max. 0.003	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
30.	Cyanide (as CN)	mg/L	Max.0.05	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
31.	Lead (as Pb)	mg/L	Max. 0.01	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
32.	Mercury (as Hg)	mg/L	Max. 0.001	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
33.	Molybdenum (as Mo)	mg/L	Max. 0.07	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	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-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
34.	Nickel (as Ni)	mg/L	Max.0.02	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
35. Pesticide Residues							
i.	Alachlor	µg/L	20	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
ii.	Atrazine	µg/L	2	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
iii.	Aldrin/Dieldrin	µg/L	0.03	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
iv.	Alpha HCH	µg/L	0.01	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
v.	Beta HCH	µg/L	0.04	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
vi.	Butachlor	µg/L	125	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	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-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
vii.	Chlorpyrifos	µg/L	30	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
viii.	Delta HCH	µg/L	0.04	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
ix.	2,4D chlorophenoxyacetic acid	µg/L	30	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
x.	DDT (o,p & p,p-Isomers of DDT, DDE, DDD)	µg/L	1	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
xi.	Endosulfan (α,β & Sulphate)	µg/L	0.4	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
xii.	Ethion	µg/L	3	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
xiii.	γ HCH (Lindane)	µg/L	2	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	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
				Sep-22	BDL	BDL	BDL
xiv.	Isoproturon	µg/L	9	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
xv.	Malathion	µg/L	190	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
xvi.	Methyl Parathion	µg/L	0.3	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
xvii.	Monocrotophos	µg/L	1	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
xviii.	Phorate	µg/L	2	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
36.	Polychlorinated Biphenyls (PCB)	mg/L	Max.0.0005	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
37.	Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	Max.0.0001	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	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
38.	Total Arsenic (as As)	mg/L	Max. 0.01	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
39.	Total Chromium (as Cr)	mg/L	Max. 0.05	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
40.Trihalomethanes							
a)	Bromoform	mg/L	Max. 0.1	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
b)	Dibromochloromethane	mg/L	Max. 0.1	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
c)	Bromodichloroethane	mg/L	Max. 0.06	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
d)	Chloroform	mg/L	Max. 0.2	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL
Bacteriological Analysis							
41.	E.coli	MPN Index /100 ml	Not Detectable	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	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
				Sep-22	BDL	BDL	BDL
42.	Total Coliforms	MPN Index /100 ml	Not Detectable	Apr-22	BDL	BDL	BDL
				May-22	BDL	BDL	BDL
				Jun-22	BDL	BDL	BDL
				Jul-22	BDL	BDL	BDL
				Aug-22	BDL	BDL	BDL
				Sep-22	BDL	BDL	BDL

HYR-6.4. Graphical representation of Results for Ground Water Analysis:

Figure 6.2: Ground Water Analysis for pH

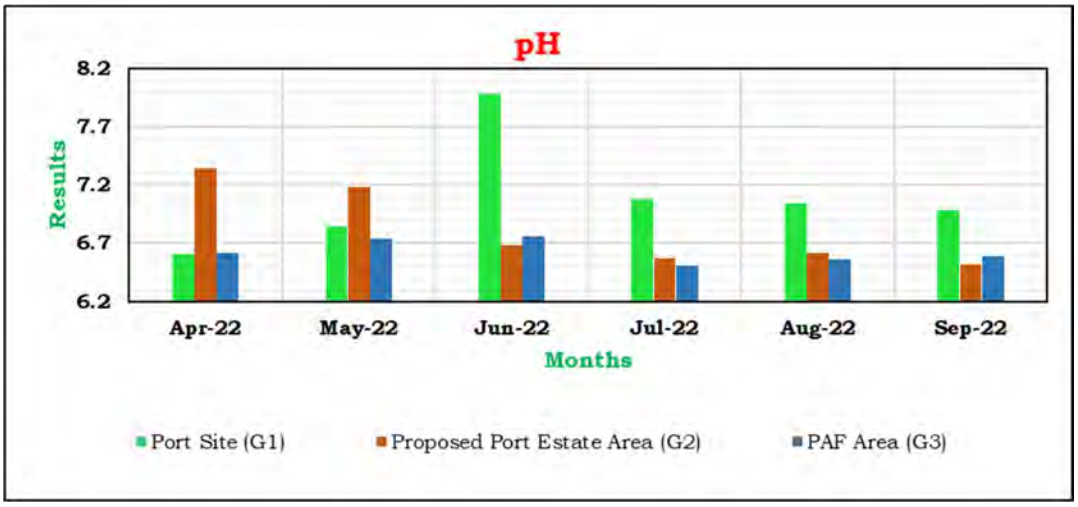


Figure 6.3: Ground Water Analysis for Total Dissolved Solids

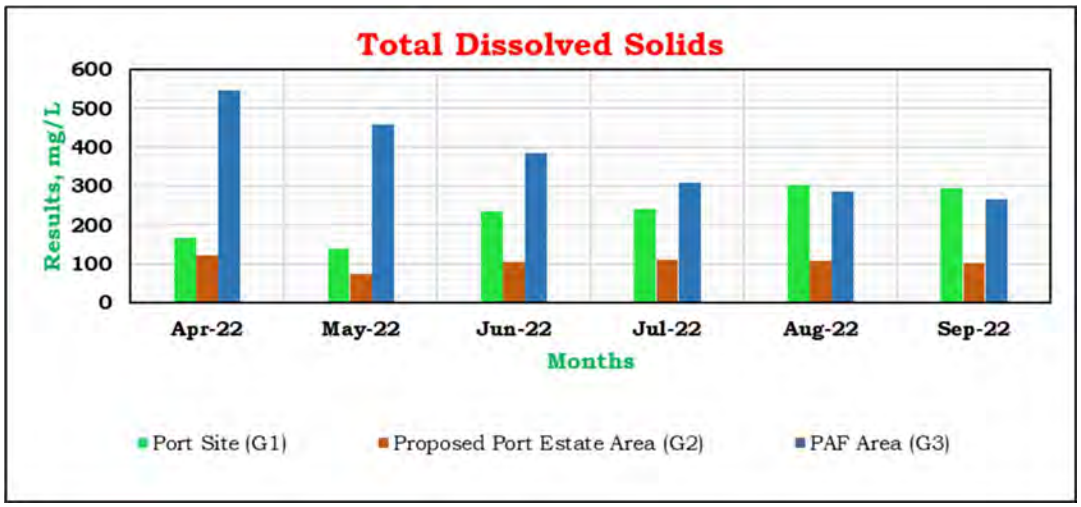


Figure 6.4: Ground Water Analysis for Chloride

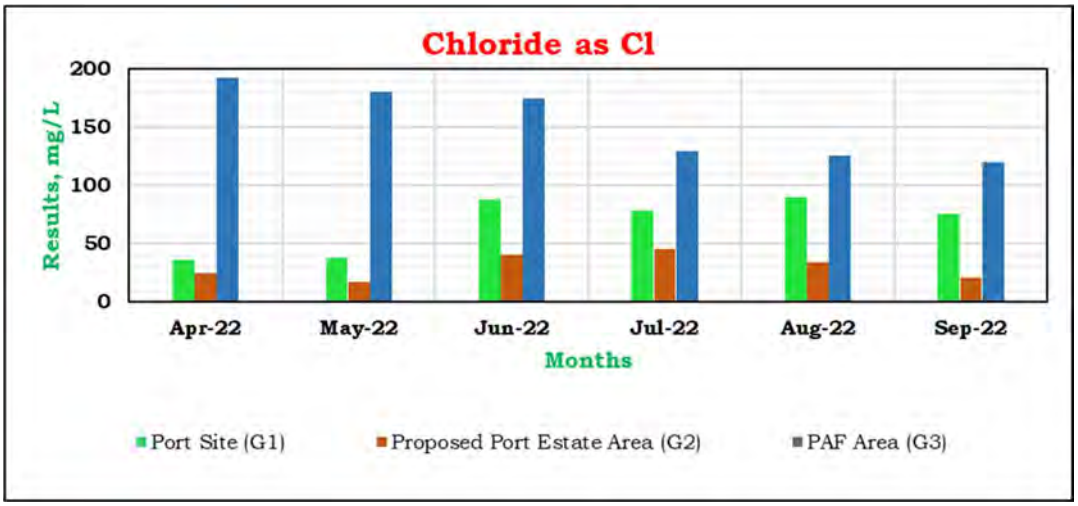


Figure 6.5: Ground Water Analysis for Sulphate as SO_4

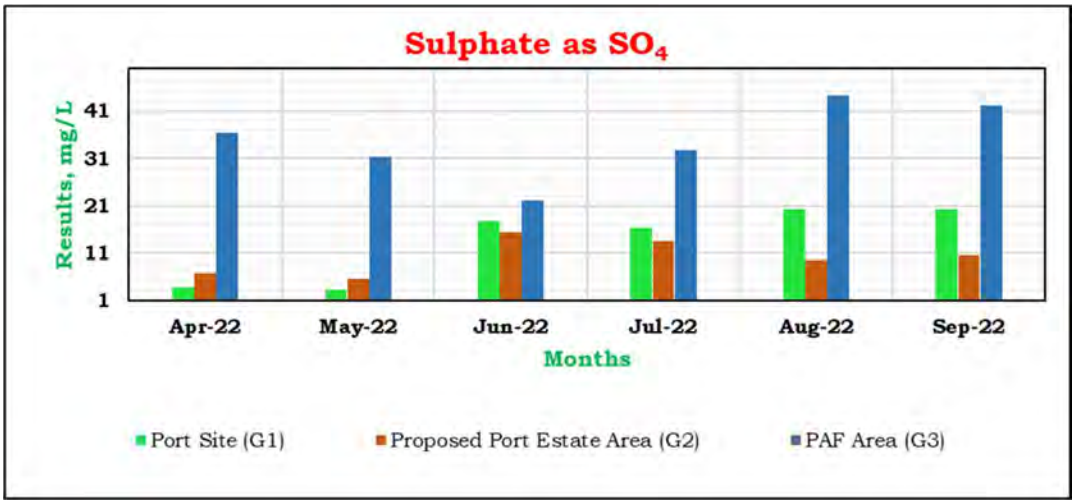


Figure 6.6: Ground Water Analysis for Calcium as Ca

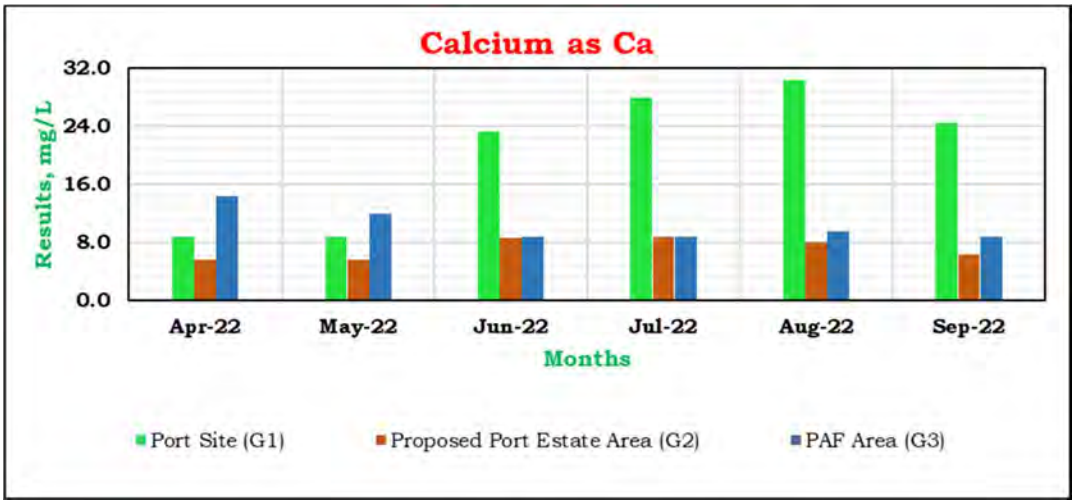


Figure 6.7: Ground Water Analysis for Magnesium as Mg

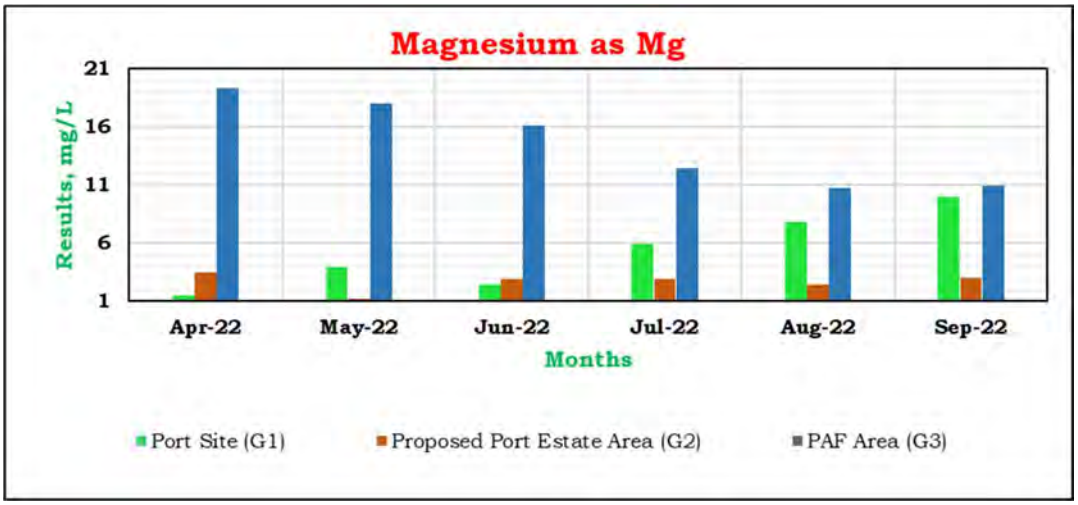


Figure 6.8: Ground Water Analysis for Iron as Fe

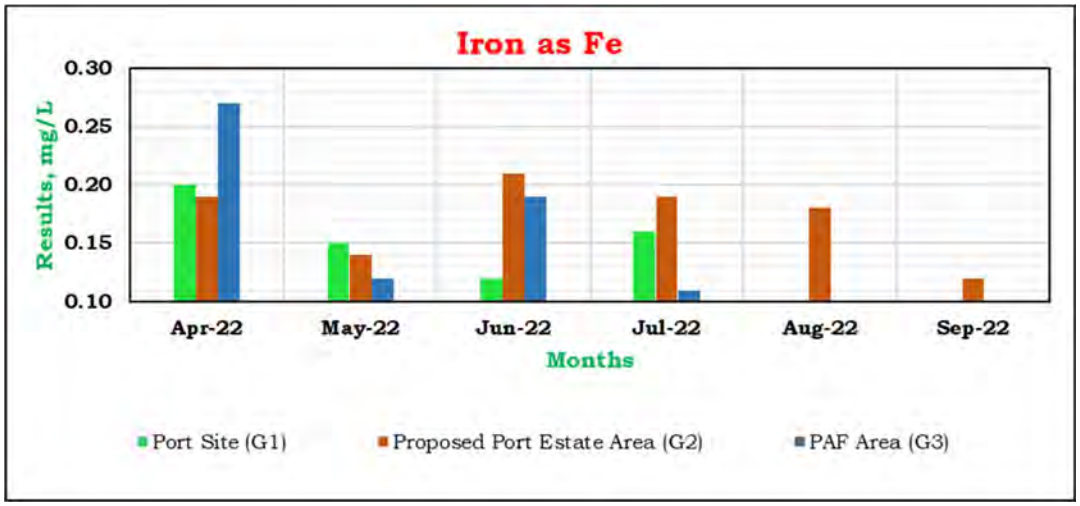


Figure 6.9: Ground Water Analysis for Total Alkalinity as $CaCO_3$

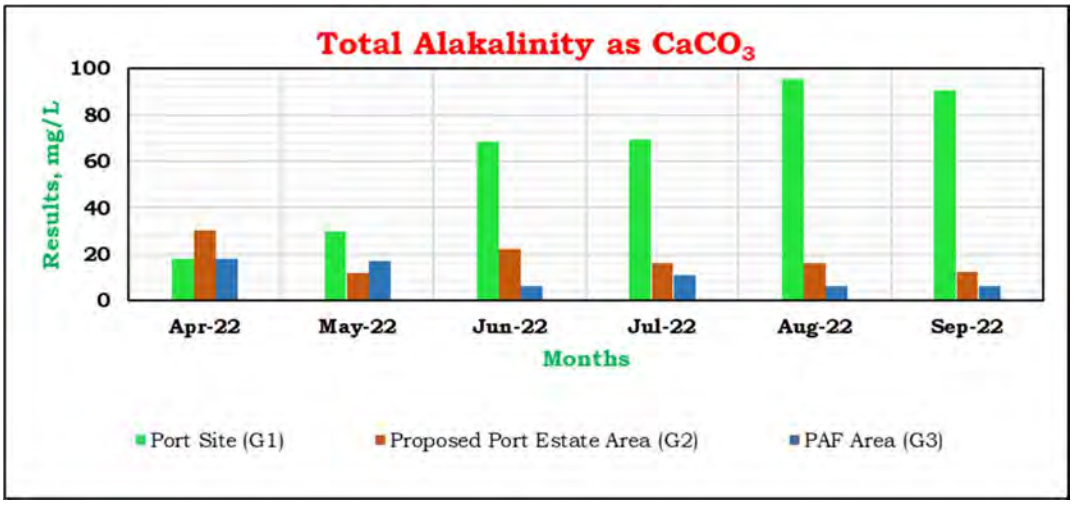


Figure 6.10: Ground Water Analysis for Total Hardness as $CaCO_3$

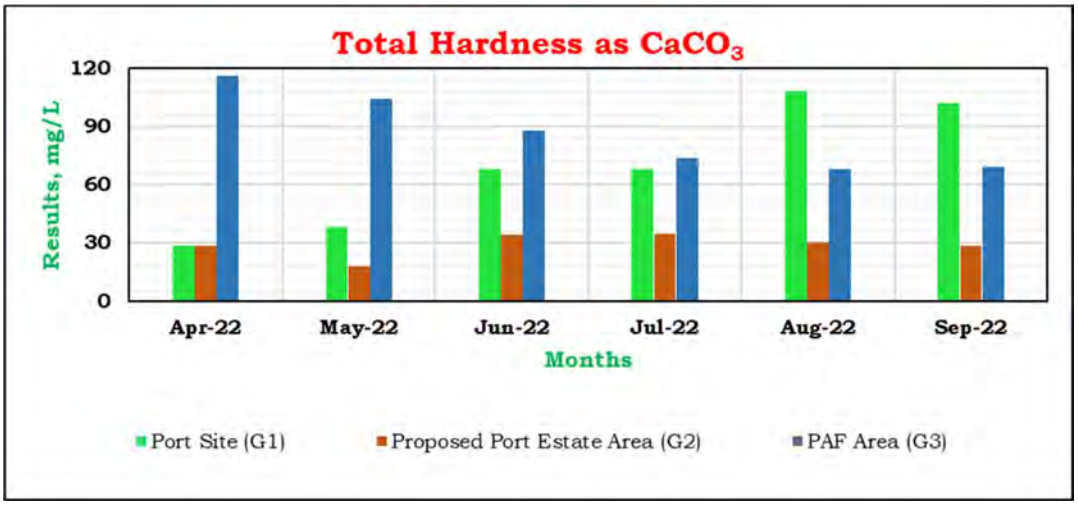


Figure 6.11: Ground Water Analysis for Zinc as Zn

HYR-6.5. Summary- Ground Water Analysis

During the period from April 2022 to September 2022, 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 from 6.61 to 7.98
- Total Dissolved Solids were observed in the range from 140 to 302 mg/L
- Ammonia (as NH_3-N) was observed from BDL to 0.33 mg/L
- Calcium (as Ca) was observed in the range from 8.8 to 30.4 mg/L
- Chloride (as Cl) was observed in the range from 35.9 to 89.9 mg/L
- Iron (as Fe) was observed in the range from BDL to 0.20 mg/L
- Magnesium (as Mg) was observed in the range from 1.49 to 9.93 mg/L
- Sulphate (as SO_4) was observed in the range from 3.45 to 20.2 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 18.1 to 95.5 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 28.6 to 108 mg/L
- Zinc (as Zn) was observed in the range from BDL to 0.082 mg/L
- Turbidity, Manganese (as Mn), Nitrate (as NO_3), Aluminium (as Al), 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), 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 6.52 to 7.34
- Total Dissolved Solids were observed in the range from 74 to 122 mg/L
- Ammonia (as NH_3-N) was observed from BDL to 0.34 mg/L
- Calcium (as Ca) was observed in the range from 5.6 to 8.8 mg/L
- Chloride (as Cl) was observed in the range from 16.8 to 45.3 mg/L
- Iron (as Fe) was observed in the range from 0.12 to 0.21 mg/L
- Magnesium (as Mg) was observed in the range from 1.20 to 3.47 mg/L
- Sulphate (as SO_4) was observed in the range from 5.56 to 15.3 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 11.9 to 30.1 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 18.0 to 34.7 mg/L
- Zinc (as Zn) was observed in the range from BDL to 0.10 mg/L
- Turbidity, Aluminium (as Al), Manganese (as Mn), Nitrate (as NO_3), Fluoride (as F), Anionic Detergents, Barium (as Ba), Boron (as B), Chloramines (as Cl_2), Copper (as Cu), Mineral Oil, Phenolic Compounds(as C_6H_5OH), Selenium (as Se), Silver (as Ag), 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 6.51 to 6.76
- Total Dissolved Solids were observed in the range from 265 to 546 mg/L
- Ammonia (as NH_3-N) was observed from BDL to 0.32 mg/L
- Calcium (as Ca) was observed in the range from 8.76 to 14.4 mg/L
- Chloride (as Cl) was observed in the range from 120 to 193 mg/L
- Iron (as Fe) was observed in the range from BDL to 0.27 mg/L
- Magnesium (as Mg) was observed in the range from 10.7 to 19.3 mg/L
- Nitrate (as NO_3) was observed in the range from BDL to 30.1 mg/L
- Sulphate (as SO_4) was observed in the range from 22.0 to 44.2 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 5.97 to 18.1 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 68.0 to 116 mg/L
- Zinc (as Zn) was observed in the range from BDL to 0.11 mg/L
- Turbidity, Aluminium (as Al), Fluoride (as F), Anionic Detergents, Barium (as Ba), Boron (as B) Chloramines (as Cl_2), Copper (as Cu), Manganese (as Mn), Mineral Oil, Phenolic Compounds(as C_6H_5OH), Selenium (as Se), Silver (as Ag), 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.

The obtained results were compared the requirements of the acceptable limits as per IS 10500:2012. The results were well within the limits for three locations during the monitoring months (from April 2022 to September 2022). The water from these locations are not used for drinking purposes.

HYR-7.1. Surface Water Location Details:

This section describes the sampling location and analysis results of Surface water during the period from April 2022 to September 2022. Surface water sampling was carried out at three locations: Poovar West Canal, Vizhinjam Branch Canal and Vellayani Lake.

Table 7.1: 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°25'32.27"N	76°59'35.29"E

Figure 7.1: Google earth views of Surface Water Sampling Locations

HYR-7.2. Surface Water Analysis Results for the period from April 2022 to September 2022:

Table 7.2: 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-22	1	1	1
			May-22	1	1	1
			Jun-22	1	1	1
			Jul-22	1	1	1
			Aug-22	1	1	1
			Sep-22	1	1	1
2.	Odour	-	Apr-22	Agreeable	Agreeable	Agreeable
			May-22	Agreeable	Agreeable	Agreeable
			Jun-22	Agreeable	Agreeable	Agreeable
			Jul-22	Agreeable	Agreeable	Agreeable
			Aug-22	Agreeable	Agreeable	Agreeable
			Sep-22	Agreeable	Agreeable	Agreeable
3.	pH Value	-	Apr-22	6.85	7.44	6.70
			May-22	7.13	7.49	7.05
			Jun-22	7.03	7.36	6.79
			Jul-22	7.02	7.25	6.81
			Aug-22	7.10	7.31	6.94
			Sep-22	7.10	7.25	7.20
4.	Turbidity	N.T.U.	Apr-22	1.9	2.1	1.1
			May-22	4.2	BDL	BDL
			Jun-22	0.1	1.0	5.2
			Jul-22	1.0	1.0	1.2
			Aug-22	0.1	1.0	1.7
			Sep-22	0.1	1.0	BDL
5.	Electrical Conductivity (at 25°C)	µmho/cm	Apr-22	2153	399	250
			May-22	1498	312	261
			Jun-22	839	426	251
			Jul-22	967	304	232
			Aug-22	840	418	240
			Sep-22	1310	410	250
6.	Total Dissolved Solids	mg/L	Apr-22	1184	200	138
			May-22	970	187	144
			Jun-22	420	234	138
			Jul-22	426	152	116
			Aug-22	420	208	120
			Sep-22	609	208	125
Chemical Parameters						

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
7.	Dissolved Oxygen	mg/L	Apr-22	6.8	6.9	6.8
			May-22	6.9	7.1	7.2
			Jun-22	6.9	7.2	6.9
			Jul-22	6.8	6.9	7.1
			Aug-22	7.1	6.8	6.9
			Sep-22	6.7	6.9	7.0
8.	Biochemical Oxygen Demand (3 days, 27°C)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
9.	Oil & Grease	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
10.	Free Ammonia	mg/L	Apr-22	0.40	0.36	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
11.	Anionic Detergents (as MBAS) Calculated as LAS mol.wt. 288.38	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
12.	Barium (as Ba)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
13.	Boron (as B)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
14.	Calcium (as Ca)	mg/L	Apr-22	14.4	8.00	4.80
			May-22	17.6	10.4	7.20

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Jun-22	11.2	12.0	6.40
			Jul-22	9.60	12.0	8.80
			Aug-22	16.0	13.6	8.80
			Sep-22	16.0	12.0	8.00
15.	Chloride (as Cl)	mg/L	Apr-22	475	56.9	34.9
			May-22	374	45.5	42.5
			Jun-22	183	78.9	43.9
			Jul-22	205	42.3	34.2
			Aug-22	192	42.9	32.9
			Sep-22	335	43.0	36.0
16.	Copper (as Cu)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
17.	Fluoride (as F)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
18.	Iron (as Fe)	mg/L	Apr-22	0.770	0.590	0.760
			May-22	1.50	0.320	0.500
			Jun-22	0.280	0.570	1.28
			Jul-22	0.440	0.350	0.530
			Aug-22	0.160	0.190	0.760
			Sep-22	0.230	0.140	BDL
19.	Magnesium (as Mg)	mg/L	Apr-22	30.8	5.96	2.98
			May-22	22.4	4.87	2.43
			Jun-22	13.6	6.33	3.90
			Jul-22	11.9	2.92	1.49
			Aug-22	8.76	1.95	2.92
			Sep-22	24.2	2.48	2.98
20.	Manganese (as Mn)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
21.	Mineral Oil	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
22.	Nitrate (as NO_3)	mg/L	Apr-22	3.15	BDL	BDL
			May-22	8.55	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
23.	Phenolic Compounds (as C_6H_5OH)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
24.	Selenium (as Se)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
25.	Silver (as Ag)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
26.	Sulphate (as SO_4)	mg/L	Apr-22	46.9	8.54	5.06
			May-22	35.6	5.47	4.33
			Jun-22	21.6	10.8	9.82
			Jul-22	25.8	5.47	4.46
			Aug-22	20.6	10.8	9.82
			Sep-22	45.4	9.52	8.26
27.	Total Phosphate (as PO_4)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	0.22	0.16
			Jun-22	0.17	0.21	0.21
			Jul-22	0.19	0.39	0.22
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
28.	Total Alkalinity (as $CaCO_3$)	mg/L	Apr-22	22.1	34.2	24.1
			May-22	27.8	33.8	23.9
			Jun-22	24.1	38.2	22.1
			Jul-22	18.9	31.8	21.9
			Aug-22	13.9	35.8	23.9
			Sep-22	16.1	38.2	30.1

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
29.	Total Hardness (as $CaCO_3$)	mg/L	Apr-22	163	44.9	24.5
			May-22	136	46.0	28.0
			Jun-22	84.0	56.0	32.0
			Jul-22	73.4	42.8	28.6
			Aug-22	76.0	42.0	34.0
			Sep-22	122	40.8	32.6
30.	Calcium Hardness (as $CaCO_3$)	mg/L	Apr-22	36.7	20.4	12.2
			May-22	44.0	26.0	18.0
			Jun-22	28.0	30.0	16.0
			Jul-22	24.5	30.6	22.4
			Aug-22	40.0	34.0	22.0
			Sep-22	40.0	34.0	20.4
31.	Zinc (as Zn)	mg/L	Apr-22	0.049	BDL	BDL
			May-22	0.035	BDL	BDL
			Jun-22	0.028	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	0.032	BDL	BDL
			Sep-22	0.047	BDL	BDL
32.	Sodium (as Na)	mg/L	Apr-22	293	30.2	19.0
			May-22	238	36.0	27.0
			Jun-22	80.8	37.1	20.7
			Jul-22	97.9	21.4	16.1
			Aug-22	93.4	25.5	17.3
			Sep-22	148	22.8	15.8
33.	Potassium (as K)	mg/L	Apr-22	9.98	4.61	2.94
			May-22	7.73	3.98	2.72
			Jun-22	5.79	5.24	3.89
			Jul-22	6.05	4.45	4.14
			Aug-22	5.18	4.2	4.45
			Sep-22	11.0	3.35	3.34
34.	Sodium Adsorption Ratio	-	Apr-22	9.99	1.97	1.68
			May-22	8.87	2.31	2.22
			Jun-22	3.83	2.16	1.59
			Jul-22	4.98	1.43	1.32
			Aug-22	4.66	1.71	1.29
			Sep-22	4.38	1.21	1.21
35.	Cadmium (as Cd)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
36.	Cyanide (as CN)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
37.	Lead (as Pb)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
38.	Mercury (as Hg)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
39. Pesticide Residues						
i.	Alachlor	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
ii.	Atrazine	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
iii.	Aldrin/Dieldrin	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
iv.	Alpha HCH	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
v.	Beta HCH	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
vi.	Butachlor	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
vii.	Chlorpyrifos	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
viii.	Delta HCH	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
ix.	2,4D chlorophenoxyaceti c acid	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
x.	DDT (o,p & p,p-Isomers of DDT, DDE, DDD)	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
xi.	Endosulfan (α,β & Sulphate)	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
xii.	Ethion	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
			Sep-22	BDL	BDL	BDL
xiii.	γ HCH (Lindane)	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
xiv.	Isoproturon	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
xv.	Malathion	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
xvi.	Methyl Parathion	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
xvii.	Monocrotophos	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
xviii.	Phorate	µg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
40.	Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
41.		mg/L	Apr-22	BDL	BDL	BDL

Sl. No.	Parameters	Unit	Month	Poovar West Canal (S1)	Vizhinjam Branch Canal (S2)	Vellayani Lake (S3)
	Total Arsenic (as As)		May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
42.	Total Chromium (as Cr)	mg/L	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
Biological Analysis						
43.	Total Coliforms	MPN Index/100 ml	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL
44.	Faecal Coliforms	MPN Index/100 ml	Apr-22	BDL	BDL	BDL
			May-22	BDL	BDL	BDL
			Jun-22	BDL	BDL	BDL
			Jul-22	BDL	BDL	BDL
			Aug-22	BDL	BDL	BDL
			Sep-22	BDL	BDL	BDL

HYR-7.3. Graphical representation of Results for Surface Water Analysis:

Figure 7.2: Surface Water Analysis for pH value

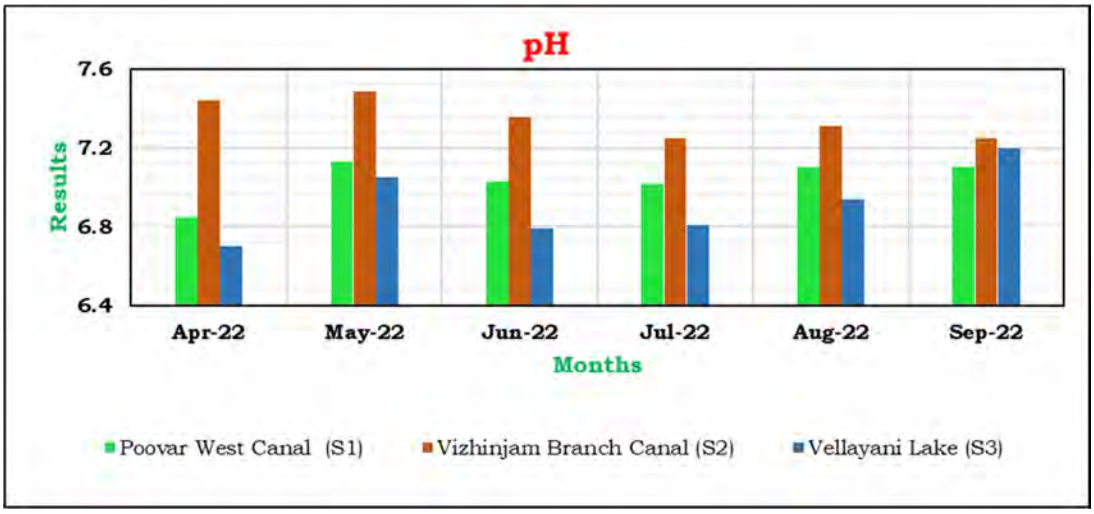


Figure 7.3: Surface Water Analysis for Turbidity

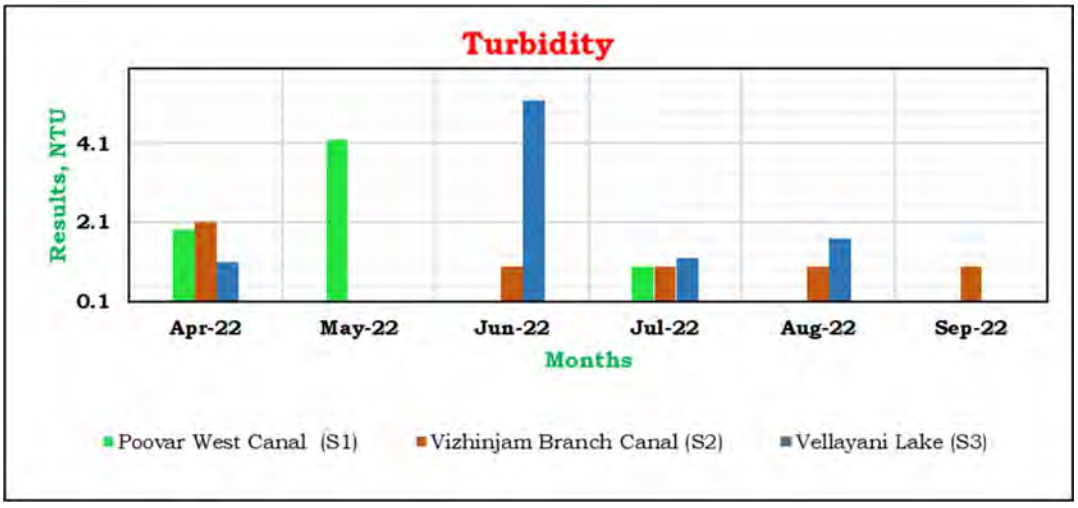


Figure 7.4: Surface Water Analysis for Electrical Conductivity @ 25 °C

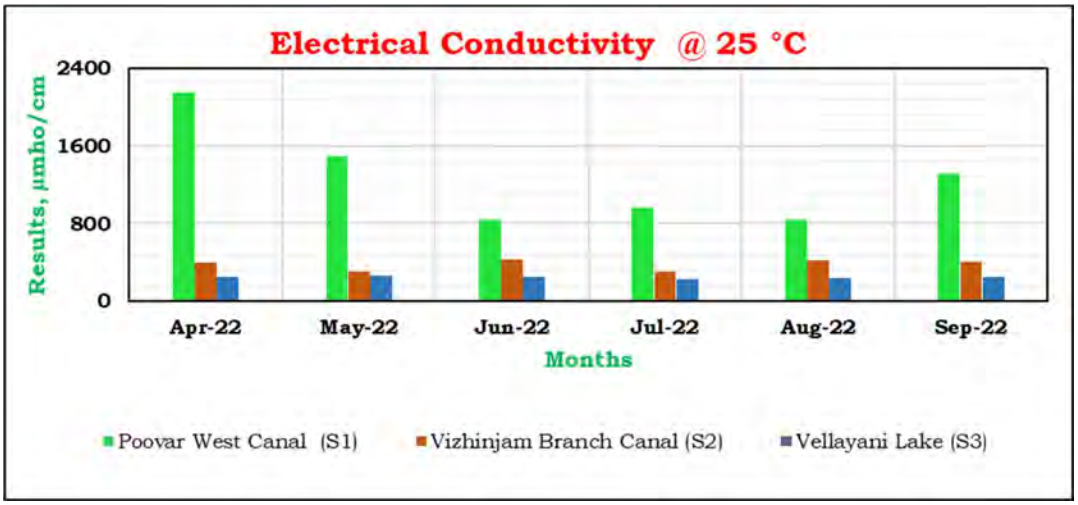


Figure 7.5: Surface Water Analysis for Total Dissolved Solids

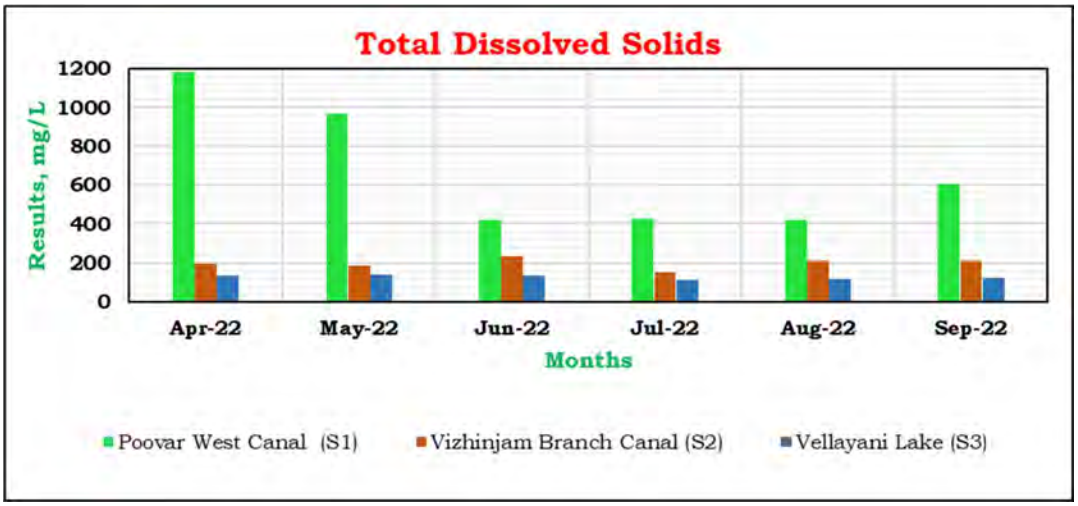


Figure 7.6: Surface Water Analysis for Dissolved Oxygen

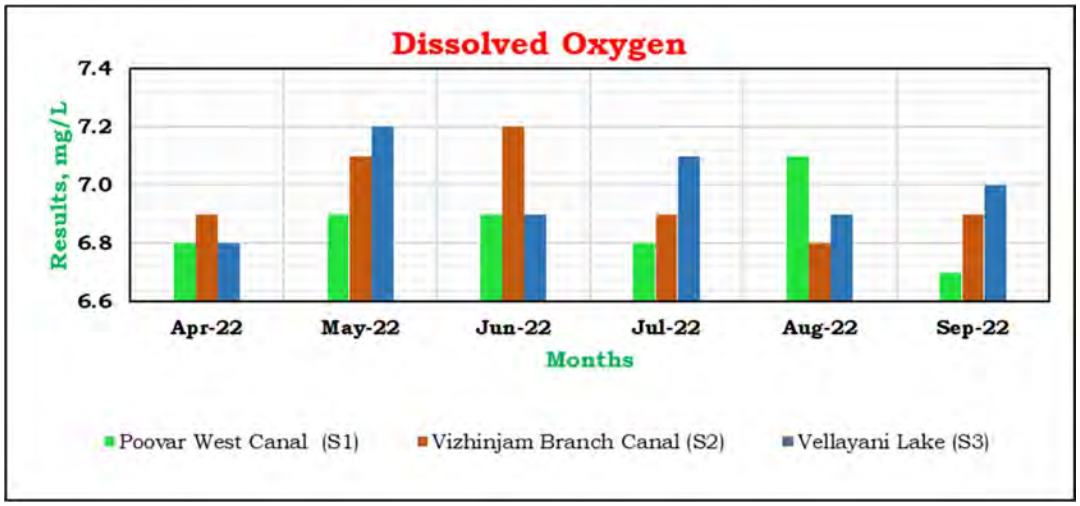


Figure 7.7: Surface Water Analysis for Chloride as Cl

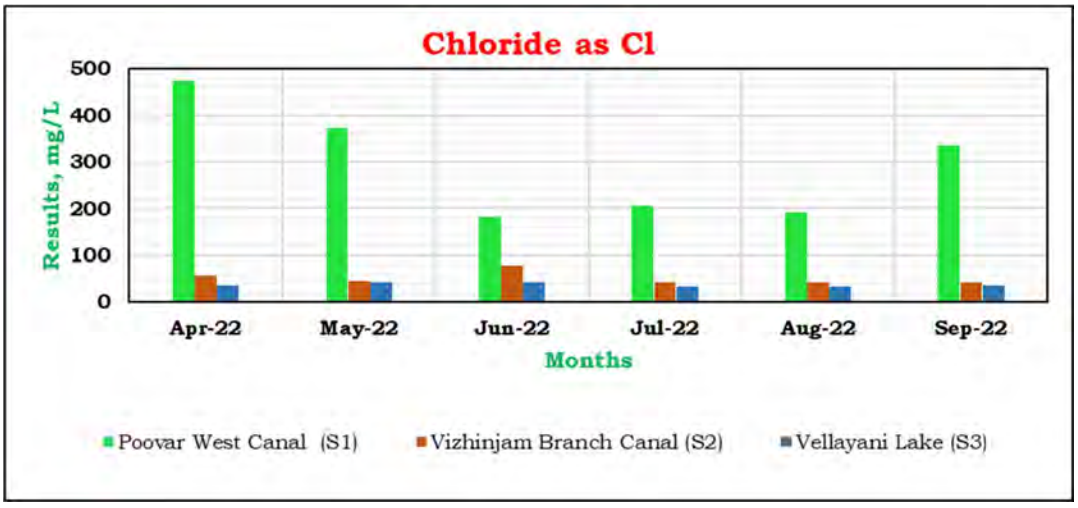


Figure 7.8: Surface Water Analysis for Sulphate as SO_4

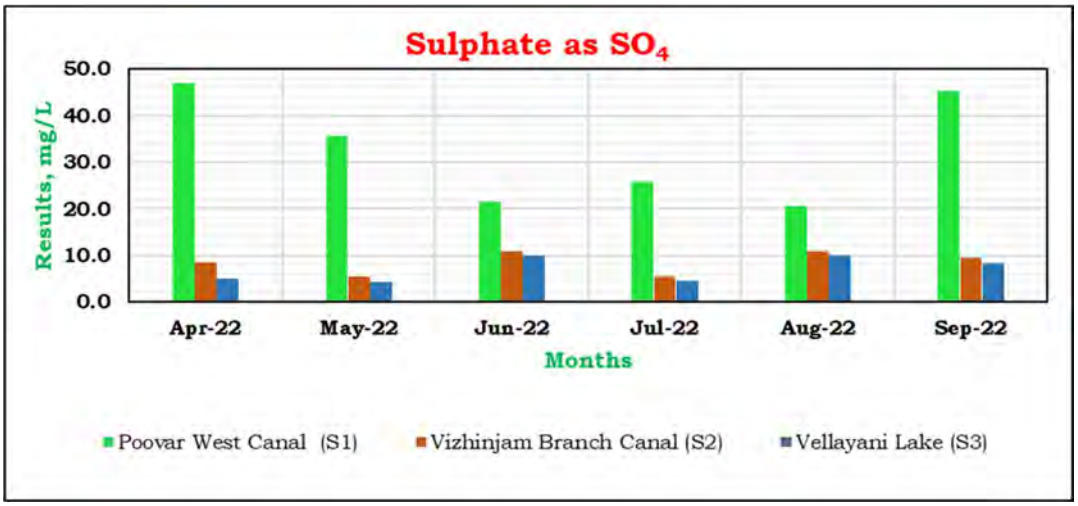


Figure 7.9: Surface Water Analysis for Calcium as Ca

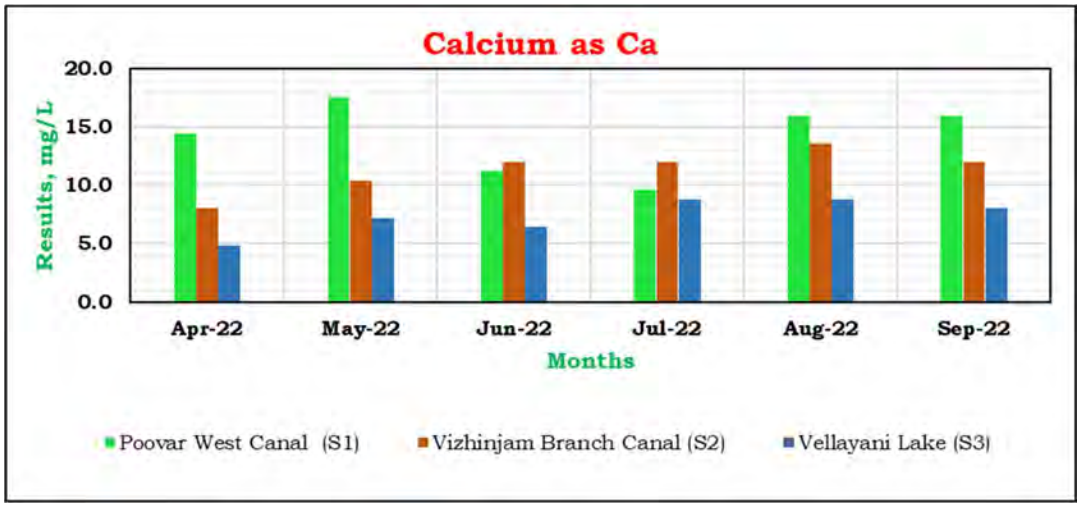


Figure 7.10: Surface Water Analysis for Magnesium as Mg

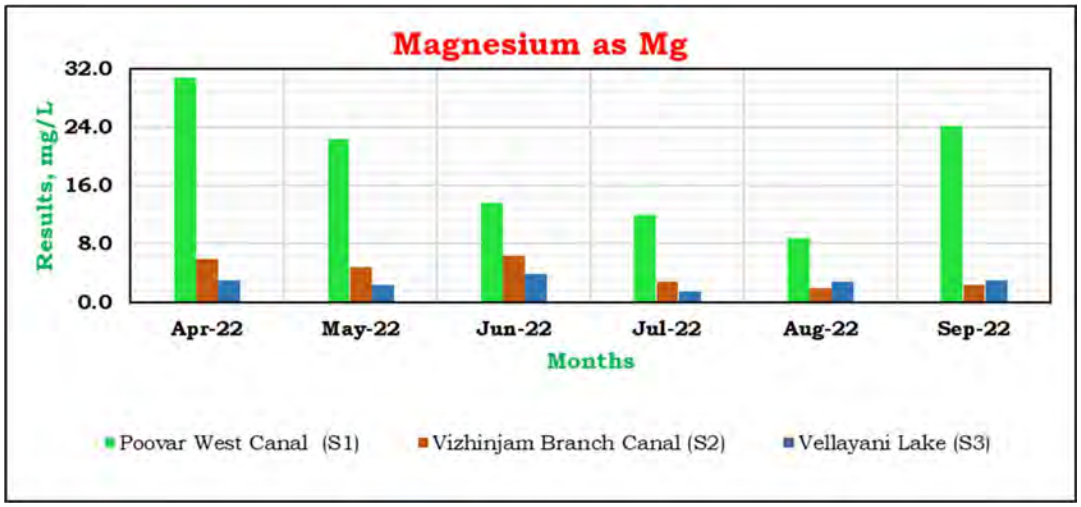


Figure 7.11: Surface Water Analysis for Iron as Fe

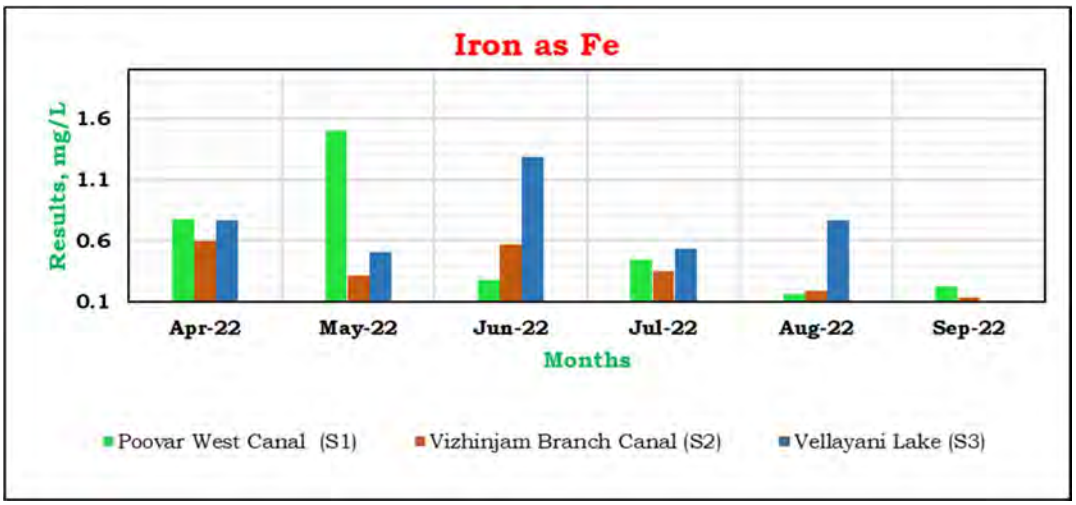


Figure 7.12: Surface Water Analysis for Zinc as Zn

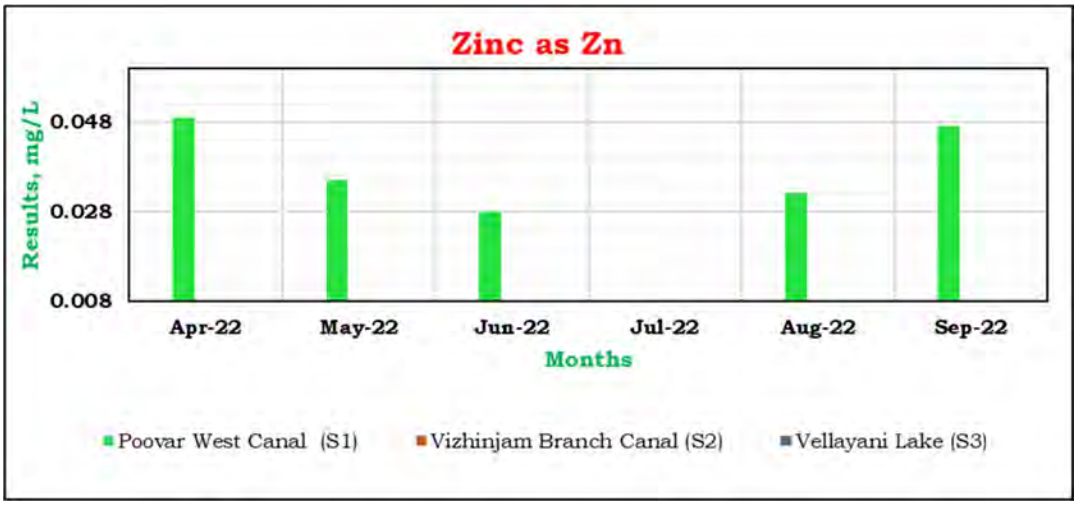


Figure 7.13: Surface Water Analysis for Total Phosphorous as P

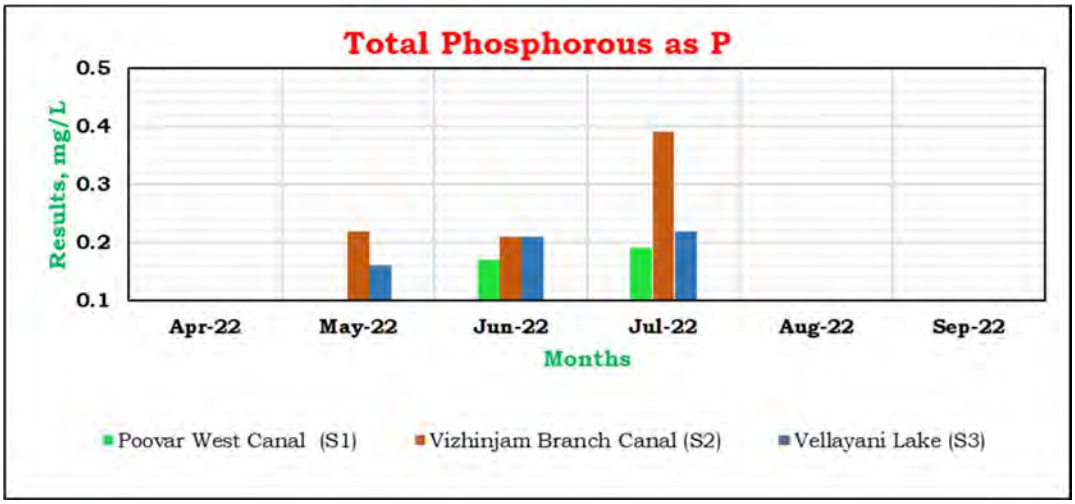


Figure 7.14: Surface Water Analysis for Total Alkalinity as $CaCO_3$

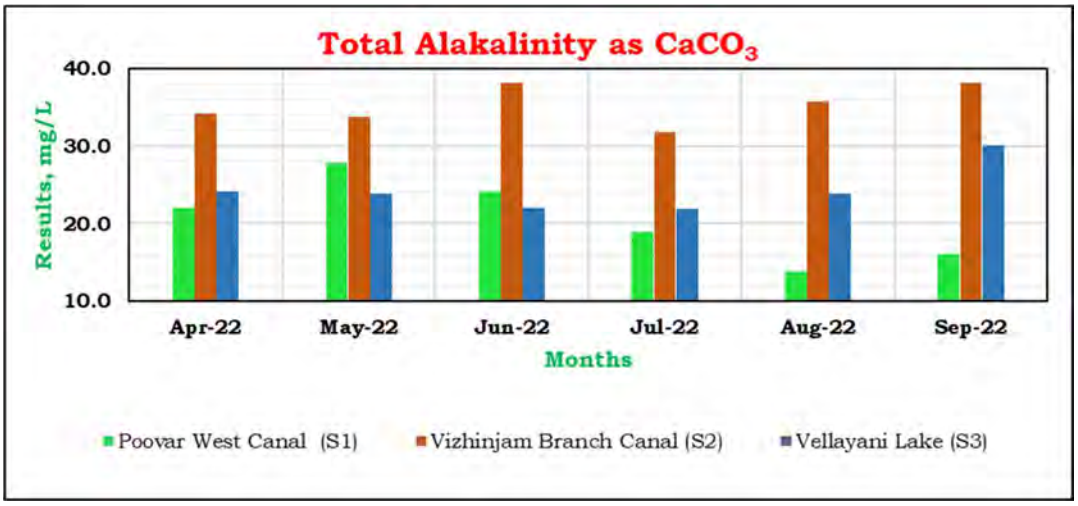


Figure 7.15: Surface Water Analysis for Total Hardness as $CaCO_3$

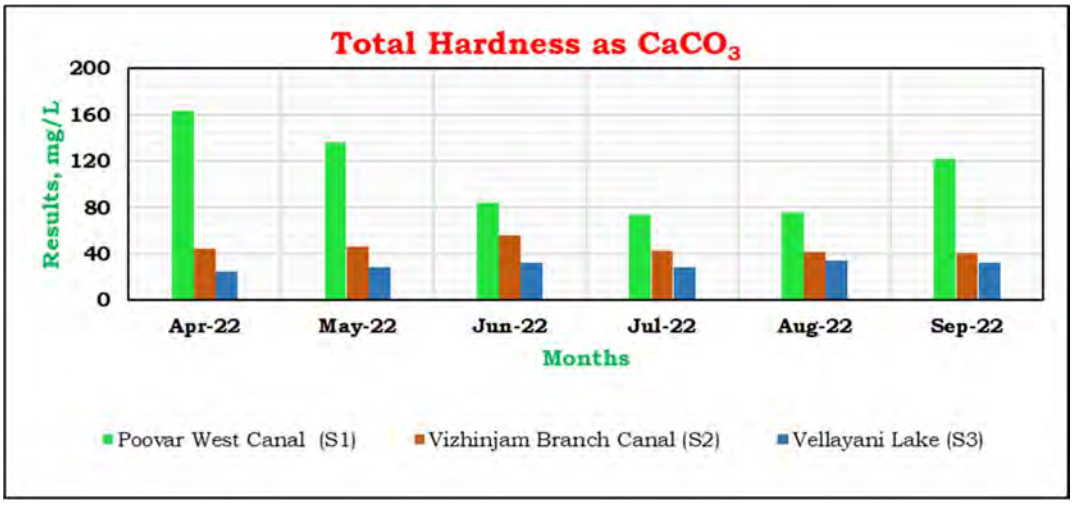


Figure 7.16: Surface Water Analysis for Calcium Hardness as $CaCO_3$

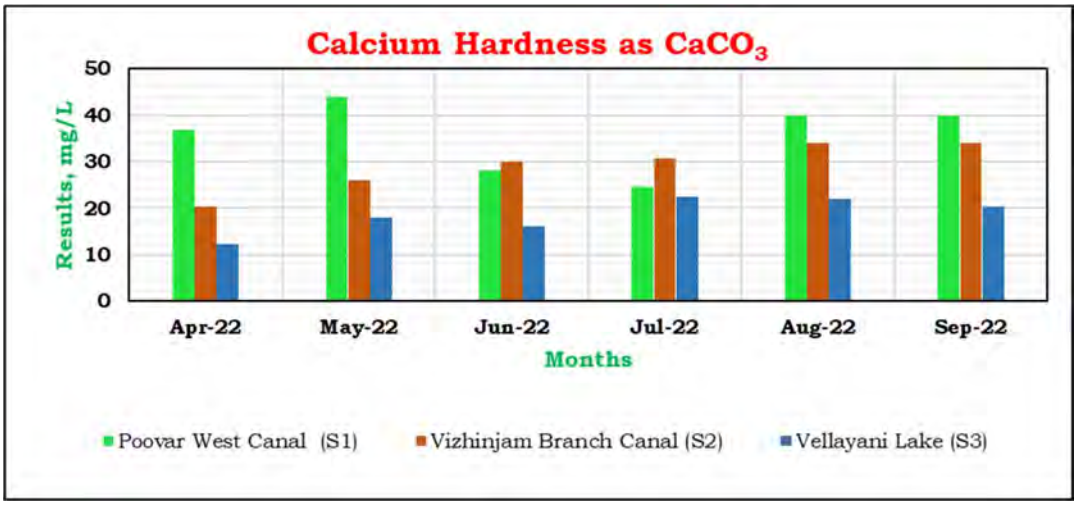


Figure 7.17: Surface Water Analysis for Sodium as Na

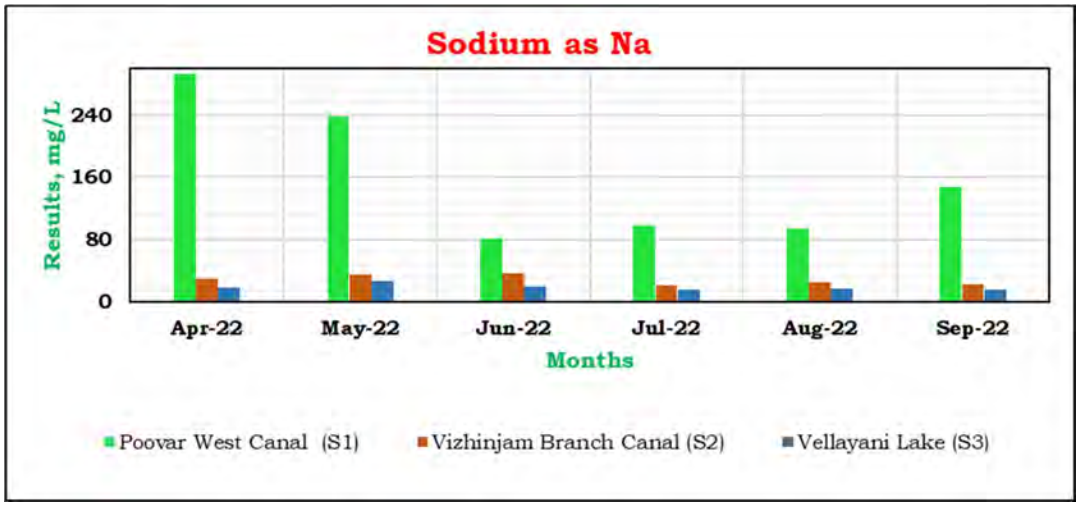


Figure 7.18: Surface Water Analysis for Potassium as K

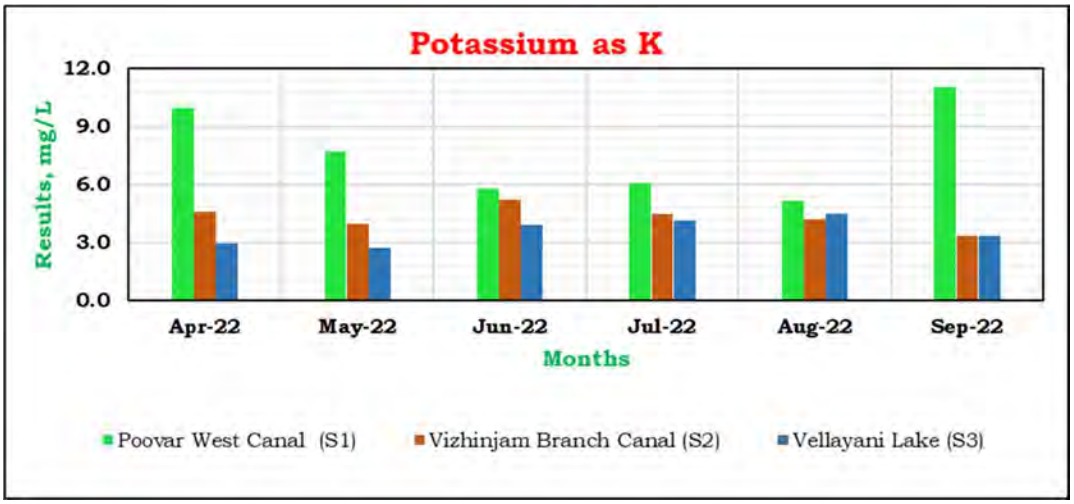
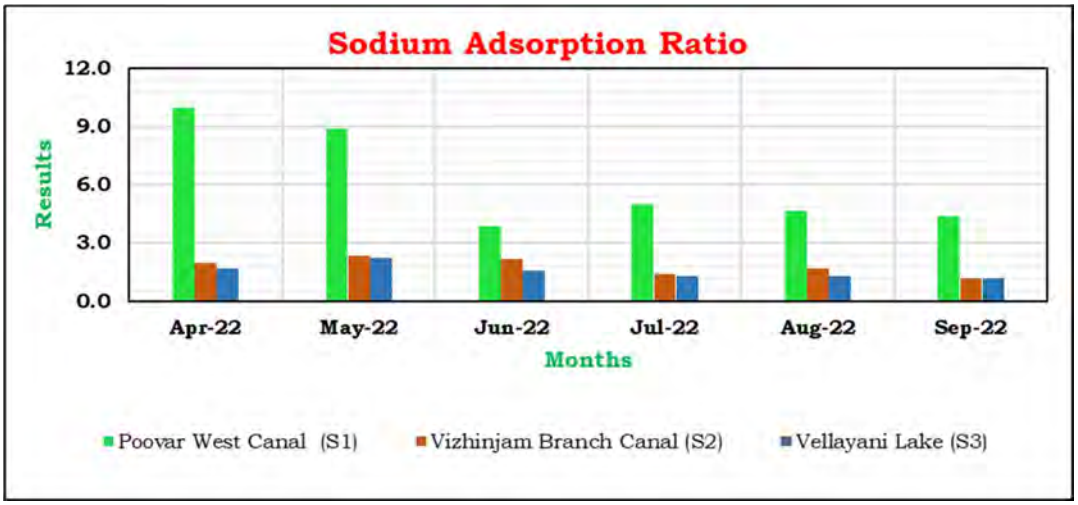


Figure 7.19: Surface Water Analysis for Sodium Adsorption Ratio



HYR-7.4. Summary of Surface water

During the period from April 2022 to September 2022, 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 6.85 to 7.13
- Turbidity was observed in the range from 0.1 to 4.2 N.T.U.
- Total Dissolved Solids were observed in the range from 420 to 1184 mg/L
- Electrical Conductivity was observed in the range from 839 to 2153 µmho/cm
- Dissolved Oxygen was observed in the range from 6.8 to 7.1 mg/L
- Free Ammonia was observed in the range from BDL to 0.40 mg/L
- Calcium (as Ca) was observed in the range from 9.6 to 17.6 mg/L
- Chloride (as Cl) was observed in the range from 183 to 475 mg/L
- Iron (as Fe) was observed in the range from 0.16 to 1.50 mg/L
- Magnesium (as Mg) was observed in the range from 8.76 to 30.8 mg/L
- Nitrate (as NO_3) was observed in the range from BDL to 8.55 mg/L
- Sulphate (as SO_4) was observed in the range from 20.6 to 46.9 mg/L
- Total Phosphate (as PO_4) was observed in the range from BDL to 0.19 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 13.9 to 27.8 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 73.4 to 163 mg/L
- Calcium Hardness (as $CaCO_3$) was observed in the range from 24.5 to 44.0 mg/L
- Sodium (as Na) was observed in the range from 80.8 to 293 mg/L
- Potassium (as K) was observed in the range from 5.18 to 9.98 mg/L
- Sodium Absorption Ratio was observed in the range from 3.83 to 9.99
- Zinc (as Zn) was observed in the range from BDL to 0.049 mg/L
- Manganese (as Mn), Fluoride, 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 7.25 to 7.49
- Turbidity was observed in the range from BDL to 2.1 N.T.U.
- Total Dissolved Solids were observed in the range from 152 to 234 mg/L
- Electrical Conductivity was observed in the range from 304 to 426 µmho/cm
- Dissolved Oxygen was observed in the range from 6.8 to 7.2 mg/L
- Free Ammonia was observed in the range from BDL to 0.36 mg/L
- Calcium (as Ca) was observed in the range from 8.0 to 13.6 mg/L
- Chloride (as Cl) was observed in the range from 42.3 to 78.9 mg/L
- Iron (as Fe) was observed in the range from 0.14 to 0.59 mg/L
- Magnesium (as Mg) was observed in the range from 1.95 to 6.33 mg/L
- Sulphate (as SO_4) was observed in the range from 5.47 to 10.8 mg/L
- Total Phosphate (as PO_4) was observed in the range from BDL to 0.39 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 31.8 to 38.2 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 40.8 to 56.0 mg/L
- Calcium Hardness (as $CaCO_3$) was observed in the range from 20.4 to 34.0 mg/L
- Sodium (as Na) was observed in the range from 21.4 to 37.1 mg/L
- Potassium (as K) was observed in the range from 3.35 to 5.24 mg/L
- Sodium Absorption Ratio was observed in the range from 1.21 to 2.31
- Biochemical Oxygen Demand (3 days, 27°C), Nitrate (as NO_3), 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), Zinc (as Zn), 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 6.70 to 7.20
- Turbidity was observed in the range from BDL to 1.7 N.T.U.
- Total Dissolved Solids were observed in the range from 116 to 144 mg/L
- Electrical Conductivity was observed in the range from 232 to 261 µmho/cm
- Dissolved Oxygen was observed in the range from 6.8 to 7.2 mg/L
- Calcium (as Ca) was observed in the range from 4.8 to 8.8 mg/L
- Chloride (as Cl) was observed in the range from 32.9 to 43.9 mg/L
- Iron (as Fe) was observed in the range from BDL to 1.28 mg/L
- Magnesium (as Mg) was observed in the range from 1.49 to 3.90 mg/L
- Sulphate (as SO_4) was observed in the range from 4.33 to 9.82 mg/L
- Total Phosphate (as PO_4) was observed in the range from BDL to 0.22 mg/L
- Total Alkalinity (as $CaCO_3$) was observed in the range from 21.9 to 30.1 mg/L
- Total Hardness (as $CaCO_3$) was observed in the range from 24.5 to 34.0 mg/L
- Calcium Hardness (as $CaCO_3$) was observed in the range from 12.2 to 22.4 mg/L
- Sodium (as Na) was observed in the range from 16.1 to 27.0 mg/L
- Potassium (as K) was observed in the range from 2.72 to 4.45 mg/L
- Sodium Absorption Ratio was observed in the range from 1.211 to 2.22
- Free Ammonia, Manganese (as Mn), 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), 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), Zinc (as Zn), 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

End of Report

Annexure IV

CSR Activities by AVPPL

(April 2022 to September 2022)

CSR REPORT VIZHINJAM

APRIL 2022 - SEPTEMBER 2022

Adani Vizhinjam Port Pvt. Ltd, 2nd Floor

3rd Floor, Aspinwall House, Kawdiar Road, Kuravankonam,

Trivandrum-695003

CSR REPORT VIZHINJAM FOR THE PERIOD APRIL 2022 - SEPTEMBER -2022

Adani Foundation, the CSR arm of Adani Group is 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 Adani Foundation has done many activities in the following heads during the reporting period (April 2022- September 2022).

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. Special Coaching Support for NTSE Aspirants 2021-22 with Smart Class-the way to Success
3. Intensive Exam preparation programme (Evening Class) at Kottappuram
4. Poets and Men of Literature Meet –
   - 4.1. Literature Magazine
   - 4.2. Two days Summer Camps- Venal Thumbi – "Summer Butterflies" in two batches
   - 4.3. Follow up of Venal Thumbi- 'Summer Butterflies' Camp – Cartoon & Bird watching group
5. Aptitude Assessment Test, Career orientation program and Disbursement of merit Scholarships
6. Teacher's Day Celebration
7. Training Support to the Student's Police Cadet unit, HSS for girls Venganoor

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 providing 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. Special Coaching Support for NTSE Aspirants 2021-22

Special coaching support for NTSE aspirants at St. Mary's Higher Secondary School, Vizhinjam was provided during the period. 25 students, 12 from 10th class for appearing the examination this year and 13 from 9th class for appearing next year had been participated the training. AF was entrusted a special team – 'SMART CLASS –the way Success' for providing the training. This intensive coaching programme was provided for 2 hours every day before or after the usual school classes. Due to the wide spread of COVID cases the examination postponed by the government and yet to decided

1.3. Intensive Exam preparation programme (Evening Class) at Kottappuram

AVPPL-AF under its CSR conducted Evening school for the students of fishing community at Kottappuram St. Mary's School for the last two years and it was a great success. This helped the fishing community students to stay-back in the schools and prepare for SSLC and Plus two exams, leading to better results.

As requested by church authorities and the PTA of St. Mary's Higher Secondary School, Vizhinjam Adani Foundation has been initiated "Evening School" programme this year also. This has been conducted by understanding their backwardness in education due to broken families, poor facilities in their house/huts, alcoholic parents, and other socio- economic backwardness. The programme was provided at 3 locations namely St. Mary's Higher Secondary School, Vizhinjam, St. Alphonsa Shrine, Thulavila and Ursuline Primary School, Kottappuram under the leadership of Vizhinjam Parish. Teachers Forum under the Education Ministry of Vizhinjam Parish, PTA

Committee and Adani Foundation were monitored the programme. 5 special teachers for SSLC students and 3 for plus two students were deputed as mentor teachers from Teachers Forum. The classes had been conducted on every day 6 pm to 9 pm at three locations. Special classes were organized on difficult subjects like English, Maths, chemistry, and Physics.

A total of 105 students including 74 SSLC and 31 Plus two have been benefited the programme. Refreshments were also provided for the students as part of the programme. As a result of the programme all the students except one passed the SSLC Examination and all the 31 Plus two students also passed the examination.

1.4. Poets and Men of Literature Meet

Magazine

A collection of the creatives of literature meet participants were collated and designed as a publication named "Salabhangal- Butterflies". The Final proof reading and designs were completed. Progressing the Techno-commercial procedures to print the same during the period.

'Venal Thumbi- Summer Butterflies" – 2 days Summer Camps in two batches

'Venal Thumbi', summer camp was organized by Adani Foundation in collaboration with Kerala State Library Council & C V Smarka Grandsala, Mukkola, Vizhinjam. The camp was organized during the summer month of May in two phases 17th 18th and 19th 20th 2022. The main intention behind the program was to impart personal traits among children like Leadership quality, artistic talent, organizing capacity, life skills etc.

The first phase started during the morning of 17th May 2022. The inauguration was attended by eminent scholars from the field of education

and literature. The camp was inaugurated by Shri. M. Mahesh Kumar (Member of District Library Council) the personalities who attended the inaugural session briefed about the role of children in nation building and importance of utilizing the innate skills for the benefit of the society.

The First session was handled by Shri. Retnakaran (Poet and men of literature, Literature meet –Adani Foundation & Retd. Principal DIET). He narrated a story having a moral that success comes only through hardships, thus explaining the biography of three famous Leaders. This was followed by session handles Shri. Sebastian Britto, Program Manager Adani Foundation he took an inspiring session on life skills through games. Shri.Prasanth Vempayam, Public Relations Department, Govt of Kerala handled by Origami-, the art of folding objects out of paper to create both two dimensional and three-dimensional subjects. The children attended the session with keen interest on learning a new item of their interest.

The children were taught on the way of writing and telling a story. This session was handled by Mr. Hari Charutha, famous Cartoonist and Children Story Writer. This was followed by a session on Bird Watching handled by Mr. Ajay Kiran Indian Birder. He spoke at length regarding various birds and its habitats. Mr. Akhilan Chrukodu talked to children on various facets of Poem writing and reading. An outing was also organized to Vizhinjam Cave temple & Vizhinjam Sea Port.

The Same Sequence of activities followed on second session 19th and 20th day also.

The Valedictory function of "Venal Thumbi summer Camp was attended by Writer Shri. Satheesh Kidarakuzhi, the other officials of CSR and poets and men of literature of Literature Meet. The highlight of the meeting was the awards being issued for the 'Best camper', 'Best team & Best Camp Diary writer'. Mr. Satheesh Kidarakuzhi the renowned writer issued trophies and certificates to the winners & participants. As the follow up of the programme 4 semi groups were formed according to the aptitude of the participating, bird watching group, cartoon group, public speaking group and theater group. Cartoon and birdwatching groups are monitored by the respective teachers, Mr. Hari Chautha, famous for cartoon and Mr. Kiran, Indian birder. The training programme for other two groups will conduct in coming months.

Best Group

Best Camper and Report

Best Camper

Best Report

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 last month, two groups a cartoon group and a bird watching group have been formed for follow up trainings. The bird watching group has been monitoring by famous birder, Mr. Kiran, who was the Resource Person for the summer camp. Another group for training is Cartoon, it 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 suggestion for improvement. resource materials and other learning tools is also providing. Two WhatsApp groups have been formed for the purpose. Great response is getting from the part of the students. Two more groups are decided to start in the coming months is for practicing public speaking and street theater.

1.5. Aptitude Assessment Test & Career orientation program

Adani Foundation has rewarded scholarship for 122 meritorious students staying within the five wards of Vizhinjam during the period. The selected students received scholarship amount 20,000 for a period of two years. The aim of the programme is to support the students from weaker sections to meet the requirement for their higher education.

As part of the merit scholarship programme an aptitude assessment test was conducted on June 11th, 2022, with the support of Lifology (Career Guidance Institution) for fifty students among the selected. The career Assessment test has covered the following three areas. **1**. FACE- which threw light on core personality of students in four elements. Fact, Action, Concept, and Emotion. **2**. MTI-Marston's type indicator to assess attitude.3.MIO –To know the intelligence inclination.

Individual counseling and briefing of Career Assessment Test report

On June 25th, 2022, Individual counseling and briefing of Career Assessment Test was conducted. The session was handled by Mr. Rahul, Coordinator, Lifology. 50 selected students and their parents were participated in the programme. Based on the career assessment test, one to one briefing provided to each student on the personalized assessment report on Linguistic, Logical, Musical and Visual, Kinesthetic, Interpersonal, Intrapersonal, Natural and Metaphysical Intelligence. Six Suitable career options were also provided for each student as part of the assessment.

The list of participating 50 students who were appeared in the career assessment test and career counselling session is attached as Annexure – 1

The list of remaining 72 meritorious students attached as annexure -2

1.6. Teachers Day Celebration

Teacher's day was celebrated on September 5th, birthday of Dr. S. Radhakrishnan the second president of India. As a mark of respect, eminent teachers of Vizhinjam Mr. Rajamani & Mr. Retnakaran were felicitated with memento of Dr. Shasi Tharoor's Book (Malayalam Version) "India Aradharathri Muthal Aara Noottanduvare" besides the two teachers, their family members and officials of Adani Foundation were participated in the simple function organized at their residences.

1.7. Training Support to the Student's Police Cadet unit, HSS for girls Venganoor

Adani Foundation supported the Student's Police Cadet (SPC) unit, HSS for Girls, Venganoor for organizing a 3-day training programme for their members during Onam Holidays. During the training on 3rd September 2022, two sessions were also handled by the representatives of Adani Foundation. The first session was on "Core Life Skills, which was handled by Mr. Sebastian Britto, Program Manager, CSR. He explained the 10 core life skills and its importance in life. The SPC units are acting as a student body to manage and maintain discipline and to resolve issues within the school campus. They are working with technical assistance of Local police station. The life skills are important to held them to improve the personality at the same time sticking to the original syllabus they must study during the course at School.

The second session was on Brain Storming and mental ability test, the session was handled by Mr. George Zen Livelihood Coordinator CSR.

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, Fruit Orchard & Landscape maintenance at Port site
5. Cancer Care Support
6. Patient care support programme
7. Convergence of Govt. Schemes
8. Special Events – days of importance

2.1. Service of Mobile Health Care Unit (MHCU)

Summary for the period

- During the reporting period, the Vizhinjam MHU has visited 10 sites weekly and has provided 9742 treatments out of which 2316 were male and 7426 were female.
- Total 909 New registrations were received during the reporting period.
- 7 Regular health camps were done during the period.
- 11 awareness sessions on different subjects were also done for the period.
- The team had done 34 home visits for the period.
- 456 Gluco check-ups and 87 HB tests were done during the period
- Distributed masks for all the beneficiaries at all the sites.

- Celebrated the World health day on 7th April and conducted a general health camp and awareness session on Chronic disease at Harbour
- Celebrated the World hypertension day on 17th May and conducted an awareness session on hypertension and checked BP of all the people who were present.
- on 15th June, World Elder Abuse Awareness Day was conducted an awareness session for the community and done walkathon with students Police cadets of Venganoor Girl's Higher Secondary school
- On 12th August the world youth day was celebrated at Christ College Vizhinjam and given awareness to them on the theme of "a secular world for all ages" and the message was given by the National head of Adani foundation Dr. Anil Balakrishnan.
- Poster making competitions were conducted for the Christ college students as the part of World youth Day.
- A Signature campaign is also done at college in the theme of "Intergeneration Solidarity"

Detailed Report

Site wise patient break-up for the period from April - September 2022

Sl. No	Site/Halt Point	April		May		June		July		August		Sept		Total	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	New Church	53	146	33	109	41	148	50	146	25	102	45	132	**247**	**783**
2	Kadaykkulam Resident's Association	43	109	34	103	38	103	62	94	40	82	34	81	**251**	**572**
3	Karayadivila	38	174	42	194	46	160	47	164	58	232	38	141	**269**	**1065**
4	Kanjiramvilla	18	74	34	110	21	84	26	81	35	138	12	55	**146**	**542**
5	Nehru Memorial Library, Theruvu	40	124	40	124	53	175	43	135	59	183	31	96	**266**	**837**
6	SNDP Hall, Kovalam	51	120	41	129	51	160	39	103	51	152	32	96	**265**	**760**
7	Gateway Resident's Association Hall	43	146	25	124	40	169	31	86	44	135	37	98	**220**	**758**
8	Township Colony	33	106	32	111	31	136	18	93	18	95	13	88	**145**	**629**
9	Marian Nagar, Kottappuram	48	98	49	105	43	119	61	127	49	113	43	109	**293**	**671**
10	ICDS HArbour	29	109	26	96	21	89	41	162	15	85	18	74	**150**	**615**
11	Health Camp	9	27	20	59	8	24	20	45	7	39			**64**	**194**
Total		**405**	**1233**	**376**	**1264**	**393**	**1367**	**438**	**1236**	**401**	**1356**	**303**	**970**	**2316**	**7426**
		1638		**1640**		**1760**		**1674**		**1757**		**1273**		**9742**	

Blood glucose test done for the period from April 2022- September 2022

Month	Total Tests			Total Positive cases of Blood Sugar		
	Male	Female	Total	Male	Female	Total
April	9	36	45	3	13	16
May	12	30	42	2	19	21
June	39	76	115	15	34	49
July	60	60	120	29	41	70
August	38	60	98	11	29	40
Sept	16	20	36	6	9	15
Total	**174**	**282**	**456**	**66**	**145**	**211**

HB test done for the period from April 2022- September 2022

Month	Total Tests			Total Positive cases of HB Tests		
	Male	Female	Total	Male	Female	Total
April	6	17	23	1	4	5
May	6	10	16	0	3	3
June	4	8	12	0	5	5
July	2	18	20	0	7	7
August	3	14	17	0	4	4
Sept	0	0	0	0	0	0
Total	**21**	**67**	**88**	**1**	**23**	**24**

Details of awareness programmes during the period

SN	Category	Topic	Venue	Date of the camp	Total
1	Awareness	Chronic diseases	Harbour	7/4/2022	36
2	Awareness	Hypertension	Idivizhunnavilla	7/5/2022	42
3	Awareness	Hypertension	Kanjiramavilla	17/5/2022	41
4	Awareness	Diabeties	Sarvashakthipuram	21/5/2022	37
5	Awareness & Walkathon	Elder Abuse	Venganoor Girls School	15/6/2022	112
6	Awareness	Elder abuse	Kanjiramavilla	15/6/2022	60
7	Awareness	Diabetes	Adimalathura	6/8/2022	46
8	Awareness	Hypertension	Adimalathura	6/8/2022	48
9	Awareness	Secular world for all ages	Christ college Vizhinjam	12/8/2022	61
10	Awareness	Lifestyle disease	Venganoor	2/7/2022	37
11	Awareness	Lifestyle disease	Ambalathinmoola	16/7/2022	28
Total					**548**

Case study - 1

PUSHPAROSE, AGE: 69, Female, Charathadi Puraidam Pulluvilla P O

This is Pushparose, 69-year-old and she is from Charathadi Pulluvilla village, she is staying at a house of her cousin, she has four children and all they left her alone and since she is having lifestyle diseases and she is not ok to stay alone at some rented house. One of her cousins took her to her home and she is staying at

Adimalathura village now. She was taking medicines from the Pulluvilla Primary Health Centre medicines for BP, Diabetes, and asthma, Using the inhaler also.

Vizhinjam MHU Involvement was very well necessary in her life, We met her at a Medical camp at Ambalathinmoola, Adimalathura, and she was not having medicines for two months, and when we found the reason we could understand that she is not given care by her children and she is staying in a cousin's house, and cousin is going for selling fish and she can't take Pushpa rose to hospital because the hospital is so far from her village, and really she was so sad that even she is unable to use the inhaler for her breathing problem.

By understanding her problems, we have checked her BP and sugar level and given medicines and the inhaler for one month and arranged the ASHA worker and the community volunteer for further medicines to contact with us and we assured our services at her doorstep.

She was so much happy for that, and she is happy now with our services

Case study: 2. Suhaira Beevi, Age: 67, Leksham Veedu colony, Kovalam P.O, Vizhinjam

Suhaira is 67 years old, and she is residing at Leksham veedu colony, Kovalam along with her sister who is not married still, Suhaira and her sister staying at the first floor of her daughter's house in a small room. She is a good lady always with positive thoughts. And she is having medicines for Diabetes and Blood pressure. Her husband passed away recently due to age problems. They both are receiving their elderly pensions.

From the beginning she is receiving the medical consultation and medicines through the HelpAge India's team home visit and really, she is happy for that. She always watching the news and she is aware of the politics of India and Kerala state. She spends her pension money for her expenses. And she collects the ration from the ration store provided by the government for the livelihood. And in the lock down period also she didn't struggle for her daily medicines, and she received her medicines with extra happiness because she never had an idea of immunity kit. She was happy for that, and she is well known for the hygiene, and she was very much happy to talk about these to her neighbors.

And for the vaccine she was very much afraid, but she was happy when she knew the facts of vaccine from MHU and she received the help from the MHU for taking the vaccine, and she received her two-dose of vaccine and she very much happy for that and she is also thankful for the help from the MHU.

2.2. SUPOSHAN (SDG No.2 and SDG No4)

SuPoshan is the health care initiative of Adani Foundation aiming to curb malnutrition and anemia among children below 5 years of age and women in reproductive age. After the wind-up process of SuPoshan activities in Vizhinjam for 3 years, it was decided to extend SuPoshan project to Kottukal Gram Panchayat as the second phase of Vizhinjam international seaport expansion is progressing to that area. The programme was launched at Kottukal Panchayath on February 25th, 2022 and started the activities from March 2022 onwards. Following are the major activities conducted under SuPoshan during the reporting period.

a) **Community reach-out**

Breakup of Community Engagement program

Sl. No	Programme	March	April	May	June	July	August	Sept	Total
1	Household visits	1103	2235	1995	1230	1499	1338	1003	10403
2	Family based counseling	73	215	176	85	140	180	58	927
3	Anganwadi Visits	92	38	74	71	67	87	87	516
4	Focus Group Discussions	0	0	0	0	18	10	41	69
5	Village Level	0	0	0	0	0	7	15	22

	Events								
6	Anthropometric Measurements	327	261	328	73	500	933	122	2544
Total		**1595**	**2749**	**2573**	**1459**	**2224**	**2555**	**1326**	**14481**

During the period, SuPoshan activities reached to 14481 families in the nineteen wards of CSR intervention with focus on creating awareness on malnutrition and anemia.

Household Survey

The effective intervention of SuPoshan project needs basic and accurate data, for that the selected Sanginis have started the collection of household level data. The data will help to understand the living conditions, project area and socio-economic status of the people. The survey includes basic details of household and head of the family, details of children under 5 years of age, pregnant women, lactating women, and details of reproductive age group women such as adolescent girls and women under 45 years of age. During the reporting period, Sanginis done household surveys in 5356 houses across 19 wards of Kottukal Panchayath.

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 gives counselling not only to the beneficiaries but also to the family as they are the supporting factor in the overall development of the targeted people. During the period, sanginis gave 927 counselings which include pregnant women, lactating mothers, Parents of SAM, MAM, parents of underweight & overweight children.

Anganwadi visits

SuPoshan programme is completely targeted to the development of children under 5 years and women of reproductive age. In community, anganwadis play a vital role in the holistic development of these beneficiaries. As part of programme, Sanginis conducted 516 visits to 38 anganwadis in the project area.

Anthropometric Measurements

During the period, SuPoshan Sanginis have done growth monitoring in 2544 children. Sanginies have identified 4 SAM Children and 11 MAM children from the screening. Sanginis gave counselling and awareness to the parents on Healthy Eating Habits, using green leafy vegetables in children's food menu, Avoiding junk foods and proper growth monitoring.

Focused Group Discussions

Focus group discussions are completely focused on the targeted populations such as adolescent girls, mothers, and pregnant & lactating mothers. During the period, Sanginis coordinated 69 Focus Group Discussions. Special training and awareness notes were given to Sanginis during Monthly Sangini Trainings for conducting FGDs.

Village Level Events

During the period Sanginis coordinated 22 Village events on recipe competition, awareness rally on breastfeeding, Oath taking ceremony by husbands and family members. This month aims to highlight the huge benefits that breastfeeding can bring to the health and welfare of babies and benefits to maternal health, focusing on good nutrition, poverty reduction, and food security. Village level meeting with Mothers, husbands, mothers-in-law, and other family members gave huge positive response in the field.

Observance of days of importance/ Special Events

Menstrual Hygiene Day

Vizhinjam site celebrated Menstrual Hygiene Day on May 28th, 2022.The theme for this year was "Making Menstruation: A Normal Fact of Life by 2030". Vizhinjam site arranged an awareness session and poster competition for the adolescent girls in five wards of Vizhinjam. The session was handled by Mrs. Nowshi, JPHN, Family Health Centre, Mukkola at CSR Office, Mukkola. The class enlighted on topics like what is Menstruation, Taboos associated with

menstruation, Why Menstrual hygiene is important, Importance of Menstrual Hygiene Day, Hygiene practices during menstruation, Health issues during menstruation, Importance of using cotton pads, Proper disposal of Pads. The total Participants were 33 adolescent children and Pregnant and lactating women. On the day, afternoon Sanginis from Kottukal Panchayath took awareness session for Adolescent girls on menstruation, Safe disposal of sanitary pads.

Pravesanolsavam - Anganwadi Reopening

Pravesanolsavam is a festival to mark the commencement of classes as well as the announcement of various projects for the development of the education sector. As per tradition, a 'Pravesanolsavam' (academic enrollment festival) conducted across the state during June. After Covid Situation, Anganwadis reopened in the state for the academic year on May 30th, 2022. All Sanginis supported Anganwadi Workers and helpers in welcoming children in their respective Anganwadi for the grant reopening.

World Environment Day

Vizhinjam site celebrated World Environment Day on June 5th, 2022.The theme for this year was "Only One Earth". Vizhinjam site celebrated World Environment Day at Kottukal Panchayath. On June 4th, 200 Saplings were distributed by Mr. Sebastian Britto, Program Manager, Adani Foundation to Sanginis. On June 4th, 2022, 200 saplings include Moringa, Apple Cherry, Guava, Magnolia Champaca, Rambutan, Pepper, Star fruit, Indian Blackberry, Annona reticulata and Amla. Sanginis planted saplings in 32 Anganwadis and houses of SAM, MAM, Pregnant, Lactating women, and adolescent girls. On June 6th, Sanginis done cleaning drive at 27 Anganwadis. Anganwadi workers, helpers and children participated in the program.

International Day of Yoga

The International Day of Yoga aims to raise awareness worldwide of the many benefits of practicing yoga. Vizhinjam site celebrated International Day of Yoga on June 21st, 2022.The theme of this day was "Yoga for Humanity". A yoga session was arranged in CSR Office, Mukkola by Mrs. Raji, Yoga Trainer for community volunteers and Sanginis. The trainer also thrown light on the benefits of practicing yoga and how yoga helps in maintain a healthy lifestyle.

Observance of World Breastfeeding Week

World Breastfeeding Week 2022 focused on strengthening the capacity of actors that must protect, promote, and support breastfeeding across different levels of society. This year theme for the week was "Step up for Breastfeeding: Educate and Support". Target audiences including governments, health systems, workplaces and communities will be informed, educated, and empowered to strengthen their capacity to provide and sustain breastfeeding-friendly environments for families in the post pandemic world. Breastfeeding is key to sustainable development strategies post-pandemic, as it improves nutrition, ensures food security, and reduces inequalities between and within countries. The theme is aligned with the thematic area 1 of the WBW-SDG 2030 campaign which highlights the links between breastfeeding and good nutrition, food security and reduction of inequalities. Vizhinjam site celebrated World Breastfeeding Week in the following way:

Sl. No	Date	Type of Activity	No. of participants	Type of Participants	Topics Covered	Villages Covered
1	01.08.2022	Organized rally with Women in reproductive age and children in village for awareness around WBW	40	Adolescent Girls & Lactating Mothers	Assuring the importance of breastfeeding	2
2	02.08.2022	Lactating mothers' group FGD	31	Lactating mothers' & Mothers	Importance of breastfeeding, Promotion of breastmilk rather than	1

					formula or animal milk	
3	03.08.2022	Oath Taking ceremony & FGD with mothers of 6 months to 2 years children	31	mothers of 6 months to 2 years children, husbands, and mothers-in-law	Oath Taking ceremony & FGD with mothers of 6 months to 2 years children - importance of continued Breastfeeding till 2 years - initiation of complementary feeding after completion of 6 months - promoting awareness regarding milk substitute	1
4	04.08.2022	Focused group discussion on building awareness among men's group on importance of breastfeeding & oath taking by husbands in supporting breastfeeding	28	Husbands and Mothers of children under 5 years	importance of continued Breastfeeding till 2 years, Support from family members to mothers	2
5	05.08.2022	Cooking competition amongst 1000 days beneficiaries with local ingredients at AWC	35	Mothers of children under 5 years Pregnant and Lactating Mothers	Kerala Traditional Snacks Recipes with Amrutham Powder (a healthy nutrimix powder for children and RPA women given from AWC)	1
6	05.08.2022	Cooking demonstration – 'dhatri mata	3	Pregnant and Lactating	Locally available vegetables and	1

		ki paustik thali' promoting healthy food for lactating women		Mothers	grains	
7	05.08.2022	Cooking demonstration – 'Garbhavati mata ki paustik thali' promoting healthy food for lactating women	6	Pregnant and Lactating Mothers	Locally available vegetables and grains	1
Total			**174**			

Celebration of National Nutrition Month (Poshan Maah 2022)

The Ministry of Women and Child Development celebrated the fifth Rashtriya Poshan Maah 2022 from September 1 to September 30, 2022, as part of the national POSHAN Abhiyaan, a Central government initiative which aims to strengthen the efforts to end hunger and malnutrition. This year the theme of Poshan Maah 2022 was "Maahila aur Swasthya and Bacha aur Shiksha". Vizhinjam site celebrated National Nutrition Month in the following ways:

Sl. No	Type of Activity	No. of Activities	No. of Participants	Type of Participants	No. of Village Covered	Topics Covered

1	Launch of National Nutrition Month	1	30	Mothers, ASHA, Anganwadi worker, CDPO and ICDS Supervisor	5	Importance of Poshan Maah, Healthy Recipes through locally available resources and vegetables
2	Poshan Rally	10	177	Mothers & Adolescent Children	9	Anemia and Importance of Poshan
3	Focus Group Discussions	41	642	Mothers, Adolescent Children and Pregnant & Lactating Mothers	19	Importance of Poshan Maah, Anemia, Healthy Eating Patterns
4	Family Counselling	58	58	Pregnant & Lactating Mothers, Parents of 6 months to 2 5Years, Parents of 2 Years to 5 Years, Adolescent Children	19	My Plate Concept, Timely and age-appropriate Food
5	Cooking Demo	16	16	Pregnant & Lactating Mothers, Parents of 6 months to 2 Years, Parents of 2 Years to 5 Years, Adolescent Children	19	Recipes using locally available Vegetables
6	WASH Practices	10	52	Pregnant & Lactating Mothers, Parents of 6 months to 2 Years, Parents of 2 Years to 5 Years, Adolescent Children	9	Handwashing Demo & Promotion of Hygiene Practices
Total		**136**	**2559**			

Formation of Anganwadi level Adolescent Clubs

Adolescence is the phase of life between childhood and adulthood, from ages 10 to 19. It is a unique stage of human development and an important time for laying the foundations of good health. Adolescents experience rapid physical, cognitive and psychosocial growth. This affects how they feel, think, make decisions, and interact with the world around them. To grow and develop in good health, adolescents need information, including age-appropriate comprehensive sexuality education; opportunities to develop life skills; health services that are acceptable, equitable, appropriate, and effective; and safe and supportive environments. They also need opportunities to meaningfully participate in the design and delivery of interventions to improve and maintain their health. Expanding such opportunities is key to responding to adolescents' specific needs and rights. SuPoshan aim in the holistic development of Adolescent children especially girls and aims to form adolescent clubs in each anganwadi areas of Kottukal Panchayath. During the period Sanginies formed 5 adolescent clubs in Kottukal Gram Panchayat.

Sangini Weekly Meeting

Weekly meetings are the effective tool for evaluating the progress and to finalize the way forward. SuPoshan team has been conducting review meetings weekly to understand and evaluate the work sanginis do in field. Meeting discussed about the monthly sangini training, household survey, Growth Monitoring, Anganwadi visits, how to do smart work and effective planning, Data entry of household

survey SuPoshan Web App and other SuPoshan related activities. Meeting also discussed the challenges and problems faced in the field.

Apart from that monthly trainings on various topics have also been given to Sanginies for the effective implementation of the project

2.3. Safe to Eat Vegetables for All Homes (SEVAH) - 1000 Household homestead vegetable garden

The kitchen Garden initiative of AF progressing commendably with 760 households during the period. Of the implemented kitchen garden groups 90% of the families received more than average production during the first cycle period.

Household production for the period were as follows (Samples Collected 20 houses each from five wards)

Sl No	Item	April	May	June	July	Aug	Sept
		Quantity (Kg)					
1	Toamto	08.00	05.00	03.00	04.00	05.00	03.00
2	Chilli	05.00	03.00	02.00	05.00	02.00	02.00
3	Cauliflower	02.00	0	0			
4	Cabbage	01.00	0	0			

5	Bhindi	05.00	08.00	03.00	03.00	03.00	05.00
6	Brinjal (Round & Long)	10.00	06.00	05.00	08.00	04.00	07.00
7	Cluster Beans	07.00	04.00	05.00		03.00	04.20
8	Amaranthus			02.00		02.00	03.00
	Yard long Beans			04.00	02.50		
	Salad Cucumber					02.00	
Total		**38.00**	**26.00**	**24.00**	**22.50**	**21.00**	**24.20**

As a Second phase of kitchen Garden seeds are purchased from Vegetable and Fruit Promotion Council of Kerala (VFPCK) using the seed money obtained from savings of the SEVA group. As per the request of the members of various groups a total of 350 packets were purchased from VFPCK and distributed to the members.

A vast majority of the kitchen garden members receive regular supply of seedlings of seeds from local Krishi Bhavan hence they are satisfied regarding the supply. Only that kitchen garden beneficiary who doesn't have access to seeds will be provided with new seed packets.

SEVAH Account Utilization

SEVAH account, which is a contribution of kitchen Garden Beneficiaries, has the total seed money of Rs. 35,000/- as on date after detecting all the payments spend for a purchase of kitchen garden inputs. There are cases of input supply from Govt sources like Krishi Bhavan and Trivandrum Corporation. The inputs are supplied through SEVAH in areas were govt assistance has not reached.

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.

The following activities were done at Farm school during the reporting period

- Extended vegetable Cultivation 43.5 cents to the front side of Farm school

- Orientation Training @ Farm School (Training Continuing)

Sl No	Ward	No of Participants
1.	Mulloor	104
2	Venganoor	54
3	Harbour	53
4	Kottappuram	56
5	Trainers Training	29
Total		**296**

The training process explaining the training modules and training schedule were communicated to nearly 296 beneficiaries is from these beneficiaries

A. Farmer Interest Group (FIG) will be formulated for participating in the training program as well as for undertaking the same as a Agri business activity.

B. The training process is continuing with the target population 400.

Sales counter and ornamental garden at Farm School

The sales counter is operational with sales of organic vegetables and fruits produced at the farm school.

Miowaky- Crowd Forest

AF planted a model Mioway forest at Farm School during the period. A total no of 70 Planting materials of various medicinal and fruit plants were planted in an area of 3 cents. It is proposed that four plants occupied an area of 1 sqm. Thus, a total of 130 plants from 70 items are included in this total area of 3 cents. Of the total 250 plants planted in 3 cents 80 % recorded more than average growth. It is expected that in an interval of 6 months the plants will assume a height of 3 to 4 feet.

Fruit orchard @ GIS –Substation

The activities for the maintenance of Fruit Orchard @ GIS –Substation is on full swing during the period. The total survival percentage of all the planted comes to 100%.

The ornamental garden set in front also shows good growth. A total of 62 cents were covered using 200 numbers of fruit plants ranging from Mango, Jackfruit, Rambootan, Sapota, Gemun, Pomegranate, Ambla, Guava & Papaya.

Due to high weed growth weedicide of non-selective nature were applied throughout GIS substation. A very good result was obtained that almost all weeds were made to dry in a period of one week. A total of 40 Laboure's is saved through this technology. All other fruit plants have developed good canopy and items like sapota, Pomegranate and papaya started producing fruits.

2.5. Landscaping Maintenance @ Vizhinjam Port

The landscaping maintenance at port site is entrusted with Vanitha Karsheeka Karma Sena, one of the livelihood groups formed as part of CSR activities. The maintenance activity is in full swing during the period

The activities include: -

- Weeding operations
- Application of fertilizers
- Pruning of Grown-up plants
- Application of plant protection chemicals

Landscaping at high mast circle was initiated during the period, which is a part of phase 1 activity which covers a total area of 7000 sqft. The Layout consist of two concentric rings one of 800 sqft and remaining 6000 sqft.




2.6. Cancer Care Support - providing nutritious Food supplements & Medicines to the poor cancer patients

Cancer care food support has continued during the period. A total no of 80 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 consoling and for providing further mental strength.

Follow Up treatment of Cancer Detection Camp

A cancer detection Camp was organized at the Parish Hall of Vizhinjam in association with Abhayam Charitable Society on 25.03.2022. Among the total 112 screened, 23 were detected as suspicious cases, further referred to Regional Cancer Centre, Trivandrum. The Follow-up treatment support for the detected patients has been ensured from Regional Cancer center, Trivandrum. During the period twenty-one were taken to RCC for further checkups as follows

Sl No	Name	Age	Ward	Phone No	Test	Remark
1	Jyothi	49	Venganoor	9995927687	Mamogram	Checkup done and no issues detected
2	Arogyamma	42	Kottappuram	7510841434	Mamogram	Checkup done and no issues detected. Repeat checkup after

						one year
3	Saritha	33	Mulloor	6238154093	Breast Ultrasound	Checkup done and no issues detected
4	Ambili	31	Mulloor	Nil	Breast Ultrasound	Checkup done and no issues detected
5	Christy	36	Kottappuram	7558028863	Leukoplakia-Biopsy	Checkup Done and no problems. Repeat checkup after six months.
6	Alex Mary	40	Kottappuram	9747203625	Pap smear	Checkup done and no issues detected
7	Asha Rani	36	Mulloor	8086583936	Pap smear	Checkup Done and waiting for the result
8	Deepa	33	Venganoor	9207879731	Pap smear	Checkup Done and waiting for the result
9	Praseetha	40	Vizhinjam	9778385845	Breast Ultrasound, Pap Smear	Checkup done and no issues detected
10	Usha	48	Mulloor	Nil	Abdominal ultrasound	Checkup done and no issues detected
11	Kochuthresya	47	Kottappuram	9895981760	Pap smear	checkup Done and waiting for the result
12	Saina	42	Mulloor	9400370075	Breast Ultrasound	Checkup done and no issues detected
13	Agnes	43	Kottappuram	9567188134	Leukoplakia Lower lip	Checkup done and no issues detected
14	Suni	38	Vizhinjam	8590040601	Abdominal ultrasound	Checkup done and no issues detected
15	Mariya Das	60	Kottappuram	9995290443	Leukoplakia-Biospsy	Refer to Dental Hospital
16	Vrinda	30	Mulloor	7907791022	Leukoplakia-Biospsy	Checkup done and no issues detected
17	Jasmine Rose	53	Vizhinjam	8330868430	lesion in scalp	Refer Medical College Hospital
18	Elizabeth	54	Kottappuram	8714221415	Pap smear	Consulted a doctor check

						being done, Cancer First Stage detected. Treatment Started
19	Ancy	29	Kottappuram	9778348659	Pap smear	Checkup Done and no problem. Prescribed Medicines
20	Treesa	47	Kottappuram	8089729150	Pap smear	Checkup Done and no problems. Prescribed Medicines
21	Vijaya	28	Kottappuram	9072867830	Pap smear	Checkup Done and no problems. Prescribed Medicines

Cancer Detection Camps

Two cancer detection camps were conducted during the period. The first one was organized at the Sree Bhadra –Mathapadana Shala of Mulloor in association with Hindu Nadar Samajam Society on **15.07.2022**. The camp was Inaugurated by the Smt. Omana Amma, Ward councilor Mulloor. 63 people were screened, and 8 suspicious cases were referred to Regional Cancer Centre, Trivandrum. The Cancer Screening was conducted in association with the Community Oncology Department of RCC Headed by Dr. Jayakrishnan & Dr. Kalavathy. The Follow-up treatment support for the referred people has been ensured from Regional Cancer center, Trivandrum.

Following is the list of referral patients to RCC from the camp

Sl No	Name	Age	Ward	Phone No	Test suggested
1	Tintu	37	Mulloor	8590348110	Breast Ultrasound
2	Vijayakumari	60	Mulloor	9995780009	Breast Ultrasound
3	Raji	37	Mulloor	9995780009	Breast Ultrasound
4	Raji	24	Kottappuram	8137828140	USG Scan
5	Preethipeter	38	Vizhinjam	9895678496	USG Scan
6	Ramani	59	Mulloor	8943028511	Mamogram
7	Sudharma	58	Mulloor	8593019463	Mamogram
8	Mary Beena	46	Mulloor	8547037215	Mamogram

Another cancer detection Camp was organized at the Parish Hall –of Kottappuram in association with Abhayam Charitable Society on **12.08.2022**. Cancer Detection camp Inaugurated by the Kottappuram Church Secretary the meeting was presided over by Mr. Pushparajan Church Secretary and Mr. Arogyam Abhayam President. 75 people were screened, and 12 suspicious cases referred to Regional Cancer Centre, Trivandrum. The Cancer Screening was conducted in association with the Community Oncology Department of RCC Headed by Dr. Kalavathy. The Follow-up treatment support for the identified patients has been ensured from Regional Cancer center, Trivandrum.

List of referral Patients from Cancer Detection Camps

Sl. No	Name	Age	Ward	Phone No	Test	Remark
1	Mariya Das	63	Kottappuram	9567752242	USS Thyroid	Appointment @ RCC
2	Paniyadima	44	Kottappuram	9446568252	Leukoplakia-Biopsy	Appointment @ RCC
3	Cilly	46	Kottappuram	99400718292	Pap smear	Appointment @ RCC
4	Mary	44	Kottappuram	9946538442	USS Breast	Appointment @ RCC
5	Devadasi	45	Kottappuram	9746219475	USS Breast	Appointment @ RCC
6	Seena Zavier	46	Kottappuram	8089051323	Uterus	After 4 months
7	Telma	36	Kottappuram	8921411213	USS Breast	After 3 months
8	Densiya	28	Vizhinjam	7306837622	USS Thyroid	Appointment @ RCC
9	Kochu Thresya	48	Kottappuram	7306837622	USS Breast	Appointment @ RCC
10	Rajam	56	Vizhinjam		Breast Cancer	Appointment @ RCC
11	Selvi	42	Vizhinjam	8714022531	USS Breast	After 2 months
12	Frasisca	56	Vizhinjam	9495660897	Pap smear	Appointment @ RCC

2.7. Patient care support programme/Benevolent support programme

As part of the patient care support programme community volunteers have been visiting the houses of bedridden patients and providing nutritious food, medicine, and mental support to the patients. During the period volunteers and CSR team had conducted 44 visits

2.8. Clean Campaign

The cleaning campaign promoted by AF is progressing commendably during the period. One of the livelihood groups, promoted under the CSR of AVPPL/AF- Karsheeka Karma Sena is coordinating the campaign. Most of the 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, engaged 648 women-days for the campaign

Pre- Monsoon - Clean Campaign

In View of onset of mansoon season followed by summer in June 2022 a month-long awareness campaign on cleanliness, hygiene, and precautions to prevent the communicable diseases in rainy season in the entire communities of Vizhinjam had been conducted jointly by Adani Foundation and Trivandrum Municipal Corporation on 25th May 2022. The program was formally inaugurated by Mr. Paniyadima, Ward Councillor Kottappuram, Thiruvanathapuram Corporation. Junior Health Inspector Mrs. Raji, Vanitha Karshika Karmasena members and CSR team participated. One of the livelihood groups, promoted under the CSR of AVPPL/AF- Karshika Karma Sena was coordinated the campaign. As part of the campaign 253 women days were engaged during the period

2.9. Community Awareness Programme

Adani Foundation has started the community awareness programme in the five wards of Vizhinjam. One of the volunteer's groups, promoted under the CSR of AVPPL/AF- Karsheeka Karma Sena is coordinating the programme. Most of the members who are actively participating in the community awareness are from Community Volunteers. It is important for all members of community to have awareness on Rainy season Diseases, Personal cleanliness, and cleanliness of the Surroundings and ensure proper community monitoring for its effectiveness. During the period 233 community awareness sessions were conducted in which 3611 people participated.

2.10. Special Events/ Days of importance

De-Weeding Drive of Water Hyacinth @ Vellayani Lake

Adani foundation CSR of AVPPL , together with Venganoor Grama Panchayath, Neerthadakam -a local organization for Ecco - restoration has kicked off a massive de-weeding drive for the Vellayani lake. The programme was attended by staff of various departments of Adani -Vizhinjam Port, group of volunteers, gram panchayath officials, residence association, environmental organizations activists, sports clubs, art clubs, freshwater fish farmers, Kudumbhasree members and residents of the panchayat participated in this august programme on manual de-weeding of water Hyacinth on 27th April 2022

This was a preview on the upcoming mechanized de-weeding, aims to de-weed the lake, which is infested with water hyacinth. Mechanized clearing mode is proposed to start from next week and lasting for the next 30 days. The de -weeded area today comes under the Venganoor grama panchayath.

The de weeding programme was introduced as an Employee Volunteering Programme (EVP) of Adani group, budgeted under of Grama panchayath programme, namely "*telineerozhukum navakeralam* "Namely (clean water for new Kerala).

The programme was inaugurated by Gram panchayath president Sri. Sreekumar in the presence of senior officials of AVPPL, Mr. Eethirajan Ramachandran, the Project Director, Sri. Sushil Nair, the Corporate Affairs Head, Dr Anil Balakrishnan, CSR head South India, Mr. Rohit Nair, Security head, Mr. Hebin, Environment head and Mr. Vipin Sekkuri, HR head.

The de-weeding initiative as EVP, was joined by 80 staff members, working at various departments of Adani vizhinjam port including Adani foundation. A total of 200 volunteers participated in the programme, belonging to the organizations concerning Vellayani lake from various walks of life.

It was mentioned that mechanized de weeding of hyacinth will be initiated in the coming week under the leadership of Gram panchayath and other stakeholder organizations. The major share of the funding for working capital will be done by Adani Foundation.

Technology sharing for conversion of Hyacinth into compost and biogas will be utilized by seeking the technology transfer details from Kerala Agriculture University or institutions who had process patency for the same. A model proposal will be vetted out of this.






World Environment Day 2022

World environment Day with its current year theme – "**Only one earth**" commemorated by AVPPL on June 5th, by inauguration of Miyawaki Forest @ Farm School Campus, (venue for Farm learning), Vizhinjam, planted by Adani Foundation, CSR of Adani Vizhinjam port. The inauguration was done by CEO, Adani Vizhinjam Port Private Ltd Mr. Rajesh Jha by opening the Miyawaki corridor by cutting a ribbon and planting an amla Plant. The Miyawaki Forest is planted an area of 3 cents with medicinal and fruit plants, planted in very close proximity with 4 plants /m^2. Inaugurating the function CEO mentioned the utility of Miyawaki forest in Kerala due to high population density that it can be establish in small holdings even at the backyard of a home. At the time when the whole world is reeling under the vagaries of climate change Miyawaki forest is an answer to create a microclimate and for carbon sequestration, a reason for temperature increase he commented.

The function was attended by AVPPL Project Director Shri. Ethirajan Ramachandran, Corporate Head Shri. Sushil Nair, Shri. Jitendran Kinattinkara, Environment Head Shri. Hebin, Techno Commercial Head Mr. Vaddi Venkata Ramana, Security Head Shri. Rohit Nair, Employees of AVPPL, CSR officials, and other community leaders.

The Above event was followed by a cleaning drive in an around with vizhinjam port work site. This event had participation from all staffs of AVPPL, CSR and community Leaders. Waste in the form of non-degradable plastic and other metal debris were removed from the work site vicinity.

Speaking at the function @port Shri. Adolf Jerome Community representative spoke about the impact made at the community level through various social development activities of Adani foundation. The officials of Adani Vizhinjam AVPPL ensured a series of regular clearing drive to remove plastics from seabeds and more opportunity for community to learn about agriculture and organic farming through farm school @ Mukkola.

International Yoga Day

International Yoga Day was celebrated on 21st June 2022 to popularize and practice the essence of yoga among all the community people. A programme for the occasion was organized @ CSR office Mukkola. Yoga Trainer explained various steps to start a yoga practice. This includes

1. Learn how to breathe-Pranayama

2.Start with a brief Meditation-For Positive Thinking

3. Basic and Beginning level yoga Postures

4. End with Shavasana (Relaxation Posture).

The programme was attended by 30 students and community people. The progamme ended by 12 Pm

2.11. Convergence of Govt. Schemes

The convergence of Govt. Grant-in-aids schemes in CSR activities 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 below 18yrs old. Information regarding Kerala Entrance KEAM, NEET -2022, Reliance Jio Mart Customer service officer-Grocery, Social Security Mission Financial Support for Disabled Students, application to Kerala Kendriya –Vidyalaya- for the admission of kids who have lost their parents due to Covid Pandemic, Old Age welfare Schemes of Social Security Mission, Ente-keralam-Mega-Exhibition, Federal Bank-Recruitment, application to Project HOPEA- remedial education for juvenile people in police custody for minor and major offenses points to their unfortunate past of drifting away from the socialization process of education after failing the Class X and XII exams, Notification For the post of Gramin Dak Sevaks in Kerala Circle, Ente Thozhil Ente Abhimanam' (My Job My Pride) job fair campaign organized by Govt. of Kerala and SUPRA PACIFIC- Recruitments, Change of APL card to BPL, Social Security Mission Mustering for the submission of Income Certificate, Remarriage schemes of widows, schemes, Life Project 2020 List declaration website, Pradhan Manthri Kissan Sammunnadhi, Scholarship for students with Disabilities, Widows Protection Scheme-Abhaya Kiranam, ASDC

Course, Fisherman-Women group Small Scale Enterprises Scheme ,Pradhan Mantri Surakshit Matritva Abhiyan, Rashtriya Bal Swasthya Karyakram,Janani Shisu Suraksha Karyakram, Janani Suraksha Yogana,TB Elimination, Rashtriya Kishor Swasthya Karyakram, Human Resource Employment and Development Centre Courses, Parinayam -Social Justice Department, Theeramythri ***programme*** is the flagship ***programme*** of SAF that encourages, facilitates and handholds fisherwomen to engage in gainful alternate self-employment, widow's welfare pension scheme, Padavukal- providing a safe and better living environment to destitute and homeless widows, Thejomaya – After Care Home, She Pad, a scheme to distribute free sanitary napkins to girl students from classes VI to XII in government and aided private schools affiliated to the state school board, 'Swasraya' provides financial assistance to single mothers which will enable them to find self-employment, Marthu Jyothi scheme- financial assistance will be provided to the differently abled mothers until the child turns 2 years, Kanal project has been formulated by Women and Child Development Department of Kerala with an aim to end all domestic and dowry abuse, to empower women and to create awareness among the entire population, HSCAP Plus One Admission 2022 application, Rsidental Medical entrance Coaching for fishermen children, Swadhar Greh scheme targeting the women victims of difficult circumstances who are in need of institutional support for rehabilitation so that they could lead their life with dignity. *Kerala* Police *Nizhal programme* to safe travel in night, Entrepreneur Support Scheme, Education Financial Assistance, Fish vending Kiosk, 'Snehayanam' which provides electric auto rickshaws free of cost to mothers of persons with disabilities, vaccine booster scheme, Vidhya Jyothi Project-Engineering & Management Subjects, Prathyasha is an innovative programme launched as a joint venture amid Individuals, Corporate and Kerala Social Security Mission, ASEP-N Nursing Program, Norkka-Vanithamithra, ESAF-Customer Executive-Swanthanam-Kudumbasree Project for Joint Liability Groups, ITI admissions, Security Guard-Qatar at Dubai, Young Kerala Internship Programme, Inspire Award-Innovation in science pursuit for Inspired Research Scheme is one of the flagship programmes of Department of Science & Technology, Different Types of Projects in Agriculture Department, NULM-Residential Courses -Kudumbashree, Soldiers Children's Scholarships funds were circulated during the period.

2. SUSTAINABLE LIVELIHOOD DEVELOPMENT (SLD)

SUSTAINABLE LIVELIHOOD DEVELOPMENT (SLD)

The projects under SLD includes

1. Competitive Exam Preparation
2. Digital Literacy – E learning
3. Skill Development Programme &
4. Livelihood Development Programme

3.1 "Coaching for success" – Competitive Exam Coaching Programme

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 training sessions are conducting at Farm School building near ASDC Centre. Subject wise classes for syllabus-based examinations are focusing with regular daily mock tests.

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 has 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 conducting 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 are conducted in regular weekends and the results will be announced through the groups.

The training sessions are mainly focused 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 weekly basis through the social media groups.

Achievements by CEP Candidates:

1) As a result of intensive coaching, 78 candidates passed in the Preliminary Examination for the 10th & 12th Level had attended the Main Examination in the January & February months
2) Rank List were published for the Lower Division Clerk examination under the various departments in various districts. One of our candidates Ms. Gopika R Murali achieved 332nd rank in the Malappuram District Lower Division Clerk examination. On the International Youth Day celebration ASDC Vizhinjam team along with Adani Foundation team honor her with a memento for this desirous achievement. She also finds her place in the

short list for the Women Civil Police Officer under the Kerala Police Department.

3) 2 of our other candidates, Mr. Jayasankar and Mr. Jobin got selection and find their place in the Civil Police Officer Main List (Malappuram & Trivandrum) under the Kerala Police Department. They have started physical training for Physical Test for the next level selection.

3.2 Digital Literacy E-Learning Programme

The Digital Literacy training has been progressing in community areas during the period and training were provided to 254 people. The programme covers internet banking, social media, mobile banking, Digi locker, MS office, cyber security, barcode etc.... The programme helped in making the people to 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.




Orientation Training on ERP & LMS

From this year onwards, ASDC started new ERP system for the admission and other activity process and some updates were done in the LMS Learning System

also. Conducted an orientation session for the Digital Literacy voucher-based trainers on the ERP and LMS updates. They came across the modules like Inquiries, Admission, Batch, Attendance, Success Stories etc. in ERP. The session was handled by Mr. Anurag M J, Centre Manager in the presence of Mr. Sebastian Britto, Programme Manager, CSR AF and Mr. George Zen, Project Officer, CSR AF on 4th and 5th May 2022.



Certificate

After completing 16 modules wise assessment the beneficiaries can easily download the E-Certificates from the LMS.


Mobilization

Mobilization has been conducting at community levels with the help of community volunteers and CSR team by Digital Literacy resource persons for further batches. 7 such meetings were conducted during the period.


3.3. SKILL DEVELOPMENT PROGRAMME

Entrepreneurial Skilling Programmes

As the result of entrepreneurial skilling programme two livelihood groups were formed and running the units at Viz Mart, Vizhinjam.

Home Nursing - SPANDHANAM – Patient Care Unit

The beneficiaries of Patient Care training programme formed a group with name "SPANDANAM Patient Care Unit" with 7 members. This group was registered as the Charitable Trust in Registration Department, Trivandrum.

They are conducting weekly meetings for discussing and validating the progress, reach of their group and finding out the new opportunities. 6 members are working in different home-based openings and earning money for their family.

Data Entry Operator (Batch 1) – SWAP DATA SERVICES – Livelihood Group

Data Entry Operator batch beneficiaries formed a group and started a livelihood programme named as SWAP DATA SERVICES at Viz Mart. They are running the Centre with a rented Photostat machine and two PC systems and providing services to the localities. They started working as a collection point of DTDC Courier services and collecting couriers from the nearby offices and sites.

Employability Skilling Programmes

The following five different domain courses have been conducting at the transit campus during the period. All the batches were started only after successfully conducting the Induction Programme.

Sl. No.	Course Name	Eligibility	Duration	Certification	Venue of Classes	Participants	
						Previous Year	Current Year
1	General Duty Assistant-GDA	10th	420 hrs	ASDC & ASAP	ASDC Building, Mukkola		53
2	Beauty Therapist - BT	8th	390 hrs	ASDC & ASAP	CSR Office, Mukkola	19	20
3	Data Entry Operator - DEO	10th	440 hrs	ASDC & ASAP	ASDC Building, Mukkola	30	53
4	Retail Sales Associate – RSA	10th	320 hrs	ASDC & ASAP	ASDC Building, Mukkola	22	13
5	Self Employed	10th	340 hrs	ASDC & ASAP	VizMart, Vizhinjam	38	37

	Tailor						
Total						**109**	**176**

During the reporting period ASDC completed training for 109 candidates who were started their training from previous financial year and the training for another 176 students for the current financial year is progressing

General Duty Assistant (On-the-Job-Training) (Batch 1 & 2)

In this FY 2022-23, new 2 GDA batches were started with 26 and 27 beneficiaries respectively. Theory and Practical sessions are providing through our centre. 42 trainees were completed the On-the-Job Training at Jubilee memorial Hospital, Trivandrum started from 18th July to 17th August 2022. All the trainees attended the LMS assessment, and the batch was ended on 20th September 2022. Many of the trainees were placed in some hospitals, patient care centers and placement activities of the rest are going on.



Placement Details

From the previous year batches 14 GDA trainees were placed in different Hospitals and Patient Care centers in Trivandrum. Placements activities for the rest of trainees are going on.

Sl. No	Course Name	Name of Trainee	Job Role	Organization Name	Salary
1	General Duty Assistant	Stefin S	Patient Care Assistant	Season Two Senior Living	18,000/-
2	General Duty Assistant	Sophy B	Patient Care Assistant	KIMS, Hospital, Trivandrum	12,000/-
3	General Duty	Viji J	Patient Care	All Is Well	18,000/-

	Assistant		Assistant	Patient Care Centre	
4	General Duty Assistant	Saritha R P	Patient Care Assistant	Home Care	13,000/-
5	General Duty Assistant	Soniya	Patient Care Assistant	Season Two Senior Living	18,000/-
6	General Duty Assistant	Neena A	Patient Care Assistant	Season Two Senior Living	18,000/-
7	General Duty Assistant	Sheeja J	Patient Care Assistant	Season Two Senior Living	18,000/-
8	General Duty Assistant	Marykutty S	Patient Care Assistant	Season Two Senior Living	18,000/-
9	General Duty Assistant	Sneha L	Patient Care Assistant	All Is Well Patient Care Centre	18,000/-
10	General Duty Assistant	Jeleena M S	Patient Care Assistant	Season Two Senior Living	18,000/-
11	General Duty Assistant	Shyni S	Patient Care Assistant	Season Two Senior Living	18,000/-
12	General Duty Assistant	Sanju Santhosh	Patient Care Assistant	Season Two Senior Living	18,000/-
13	General Duty Assistant	Praveena Das	Patient Care Assistant	Spandhanam Patient Care	18000/-
14	General Duty Assistant	Tintu N	Patient Care Assistant	Life Care Health Services	25000/-

From the recently completed batches, below listed 23 trainees were placed in the month of September 2022.

Sr. No.	Month	Course	Full Name	Date of Joining	Employer Name	Monthly Current CTC OR Earning
1	September	General Duty Assistant	Aishwarya	05--09-2022	Season two senior Living	18000
2	September	General Duty Assistant	Samson Francis	05--09-2022	Season two senior Living	18000
3	September	General Duty Assistant	Aneesh E	05--09-2022	Season two senior Living	18000
4	September	General Duty Assistant	Princy P J	05--09-2022	Season two senior Living	18000
5	September	General Duty	Clinton Manikyam	05--09-2022	Season two senior Living	18000

		Assistant				
6	September	General Duty Assistant	Shyni C	05--09-2022	Season two senior Living	18000
7	September	General Duty Assistant	Joy J	05--09-2022	Season two senior Living	18000
8	September	General Duty Assistant	Ludhiya M	05--09-2022	Season two senior Living	18000
9	September	General Duty Assistant	Jyothika J	10--09-2022	Lifecare Health Services	24000
10	September	General Duty Assistant	Doniya Mol	10--09-2022	Lifecare Health Services	24000
11	September	General Duty Assistant	Meharin H	10--09-2022	Lifecare Health Services	12000
12	September	General Duty Assistant	Gayathri K V	10--09-2022	Lifecare Health Services	12000
13	September	General Duty Assistant	Sherin M	10--09-2022	Lifecare Health Services	12000
14	September	General Duty Assistant	Anu D	10--09-2022	Lifecare Health Services	24000
15	September	General Duty Assistant	Deepa D N	10--09-2022	Lifecare Health Services	12000
16	September	General Duty Assistant	Steleena D	10--09-2022	Lifecare Health Services	24000
17	September	General Duty Assistant	Raji P R	10--09-2022	Lifecare Health Services	12000
18	September	General Duty Assistant	Varghees S	10--09-2022	Lifecare Health Services	12000
19	September	General Duty Assistant	Christudasan S	10--09-2022	Lifecare Health Services	24000
20	September	General Duty Assistant	Jincy T	10--09-2022	Lifecare Health Services	12000
21	September	General Duty Assistant	Joby J	10--09-2022	Lifecare Health Services	24000

22	September	General Duty Assistant	Sneha S	09--09-2022	All is Well Home care Solutions	18000
23	September	General Duty Assistant	Shalu J	09--09-2022	All is Well Home care Solutions	18000

5. Beauty Therapist (Batch 1)

After completing the training for 19 candidates from the previous year, a new batch of 20 trainees has started at the Centre from 11th July 2022 onwards for beauty therapist.

Guest Session on Keratin Treatment

A Guest Session was conducted for the Beauty Therapist trainees on Keratin Treatment and its methods on 25th April 2022 handled by Mr. Narendra Reddy, experienced Beautician Trainer. In that session, he introduced some cosmetic products used for the Keratin Treatment and did some samples demonstration in front of the trainees for better understanding.

Another guest session was arranged for the ongoing BT batch trainees on 27th September 2022 at centre. Ms. Jenis Jose, experienced beautician handled the session about Human Body massaging methods.

Placement Details

In this reporting period, placed 10 BT trainees from the completed batch in different parlors and related organizations. The details of the placed BT trainees are follows,

Sl. No.	Course Name	Trainee Name	Date of Joining	Employer Name	Salary
1	Beauty Therapist	Aani A	18-06-2022	Soniya Beauty Parlour	5000/-
2	Beauty Therapist	Shanija N S	22-06-2022	Smitha Alby Makeover Studio	4000/-
3	Beauty Therapist	Sreethu A	17-06-2022	Orchid Beauty Parlour	4500/-
4	Beauty Therapist	Josheela G	17-06-2022	Orchid Beauty Parlour	4500/-
5	Beauty Therapist	Renju F	22-06-2022	Smitha Alby Makeover Studio	4000/-
6	Beauty Therapist	Indhu S	21-06-2022	lips & lashes Beauty Parlour	4000/-
7	Beauty Therapist	Umakrishnan	21-06-2022	Style Lady Beauty Parlour	4500/-
8	Beauty Therapist	Princy P A	20-06-2022	Nadiya beauty Parlour	5500/-
9	Beauty Therapist	Mariyam L	20-06-2022	Thejus Beauty Parlour	5000/-
10	Beauty Therapist	Sibily J	20-06-2022	Fairness Beauty Parlour	7000/-

2. Data Entry Operator (Batch 1 & 2)

After completing the training for 30 from the previous year, started new batch of 53 started from 14th July 2022 as 2 batches with 25 & 28 trainees respectively in each batch.

Guest Session on MS Office

Conducted guest lecture session for the Data Entry Operator trainees about MS Office, handled by Mr. Prasanth, Research Scholar, Trivandrum. The session was conducted through online on 23rd April 2022. He very well explained about the features and did a demo presentation on how it can be used in effective way for documentation. Some feature like mail merge, Animation, Formulas, Pivot Table etc. were also briefed in the session.

Guest Session on Cyber Security

Conducted another guest Session on 30th August 2022 as online. The session about "Cyber Security" was handled by Ms. Rajana P R, Freelance Software Developer, Thrissur with 30 participants. The discussed topics are listed as below,

- Detailed session about cyber space (Introduction, Different levels, Advantages & Disadvantages of cyberspace).
- Detailed session about Internet (Introduction, History, Internet service provider, Applications).
- About Cybercrime.
- Introduction of Cyber Security.
- Detailed session about Web browser, Antivirus, Email security, Security password, Two Step Authentication, Smart phone security, Information Security Awareness for family, IT act.

Trainees were interested to listen about the Cyber Security topic, now a days it is disusing in terms of a Diploma programme. The session was very interactive, and she cleared the doubts shotted by the trainees.

DDEO trainees placed from previous batches

Sl. No	Name of the	Course Name	Employer Details	Salary

	Trainees			
1	Ashwini	Domestic Data Entry Operator	Devi Medicals	6,000/-
2	Viji	Domestic Data Entry Operator	Devi Medicals	6,000/-
3	Anjitha A	Domestic Data Entry Operator	JothidevDiabeties Hospital & Research Centre	8000/-
4	Sunitha Johnson	Domestic Data Entry Operator	JothidevDiabeties Hospital & Research Centre	8000/-
5	Aswathy U V	Domestic Data Entry Operator	JothidevDiabeties Hospital & Research Centre	8000/-
6	Arunima A	Domestic Data Entry Operator	JothidevDiabeties Hospital & Research Centre	8000/-
7	Reshma S B	Data Entry Operator	Jayalekshmi Silks	12,350/-

3. Retail Sales Associate

After successfully completing the training for 22 candidates from previous year, started a new batch with 13 beneficiaries on 11th July 2022.

As part of effective practical training, our Retail Sales Associate trainees visited Viz Mart- Mini Shopping Centre at Vizhinjam for practicing the practical procedures. Trainees got the opportunity to interact directly with the real customers, Product demonstration and many other activities related to sales. Mr. George Zen P T, Livelihood Project Officer, Vizhinjam gave all the guidance and support. The livelihood group members in Viz Mart also gave support and they conveyed good feedback about the trainees.



Guest Session on Sales Promotion Techniques

For Retail Sales Associate trainees, a guest session about "Sales Promotion Techniques" was conducted on 18th April 2022 at centre. The session was handled by Mr. Prasanth, Research Scholar, Trivandrum. He briefed about the responsibility of the sales in a company as well as how they can be achieved using some techniques.

Guest Lecture on Marketing & Sales

Another Guest Lecture for Retail Sales Associate batch trainees was conducted on 20th July 2022 at VizMart. The session was handled by Mr. Biju, Marketing Head, Kunnil Hyper Market, Trivandrum. Kunnil Hyper Market group is one of the growing networks having 15 and more shops in and around Trivandrum city. Mr. Biju discussed about the marketing and sales methodologies required for the growth of shop. He gave some activities like Product data collection, Product Arrangements, Listing of higher selling items etc. for the trainees. All the activities were completed by the trainees, and he invited our trainees and trainer to visit one of his Hyper Market in Kaniyapuram as part of Industrial Visit.

Placement Details

During the reporting period, the following placements were done,

Sl. No.	Course Name	Trainee Name	Date of Joining	Employer Name	Salary
1	Retail Sales Associate	Sajan J N	01-06-2022	JothidevDiabeties Hospital & Research Center	8000/-
2	Retail Sales Associate	Ajay A P	01-06-2022	JothidevDiabeties Hospital & Research Center	8000/-
3	Retail Sales Associate	Stephy Stephen	01-06-2022	JothidevDiabeties Hospital & Research Center	8000/-
4	Retail Sales Associate	Preethi P A	01-06-2022	JothidevDiabeties Hospital & Research Center	8000/-
5	Retail Sales Associate	Jibi V	01-06-2022	JothidevDiabeties Hospital & Research Center	8000/-
6	Retail Sales Associate	Lekshmi Vijayan V S	01-06-2022	JothidevDiabeties Hospital & Research Center	8000/-
7	Retail Sales Associate	Anupama Chandran L C	01-06-2022	JothidevDiabeties Hospital & Research Center	8000/-
8	Retail Sales Associate	Ameena A	13-07-2022	Jayalekshmi Skills	12,300/-
9	Retail Sales	Aisha Louis	13-07-2022	Jayalekshmi Skills	12,300/-

	Associate				

4. Self Employed Tailoring (SET)

After successfully completed the training for 38 candidates from the previous year, progressing the training for 37 candidates in two batches.

Apart from regular training a Guest Session was conducted on 7th April 2022.The session was on "Embroidery Works" and handled by Ms. Haripriya, 10-year experience in Embroidery works. She introduced the tools used for the works and did share some models of the same. She explained how the embroidery works can be done and how it would be profitable as self-employment.



Another guest session was conducted on 2nd May 2022. The session was handled by Mr. Soman, Experienced tailor in Vizhinjam. The session was on men shirts and pants stitching.



Third gust session was on 27th September 2022. The session was handled by Ms. Priya Hari, having 10 years of experience in stitching field and 5 years of experience in training. Now she is handling training sessions for some state government schemes related to different projects. The topics handled by the Guest Lecturer are as follows,

- ✓ Running Stitching.
- ✓ Chain & Double Chain Stitching.
- ✓ Cross & Double Cross Stitching.
- ✓ Flying & Double Flying Stitching.
- ✓ Fish Bone Stitching.
- ✓ French Knot Stitching.



Farewell Celebration

Self Employed Tailor batch trainees arranged a farewell celebration as part of the course completion. The celebration was arranged by the trainees and trainer at VizMart on 19th May 2022. ASDC Vizhinjam team members and CSR team members were also participated in the occasion and wishes them all the success. Trainees shared their experiences and growth level in tailoring with all the members. All the trainees shared their thanks and happiness to ASDC and AF for the programme. Mr. Sebastian Britto, Programme Manager, CSR, Mr. Rakesh, Senior Project Officer, CSR, Mr. George Zen, Project Officer, CSR and Mr. Stephen Vinod, Project Officer CSR attended the session and motivated them to use their skill to start livelihood.



Placement Details

Almost all the Self-Employed Tailor trainees were opted self-employment as the livelihood. All the support for becoming self-employment is provided by our CSR and ASDC team. Completed Udhyam Aadhar registration of all the 38 trainees.

Placement Sheet - July					
Candidate Registration Fields					Placement Details
Sr. No.	Centre	Month	Course	Full Name	Employer Name
1	Vizhinjam	July	Self Employed Tailor	Shiji T	Self Employed
2	Vizhinjam	July	Self Employed Tailor	Archana B R	Self Employed
3	Vizhinjam	July	Self Employed Tailor	Sheeba Biju	Self Employed
4	Vizhinjam	July	Self Employed Tailor	Nisha Francis	Self Employed
5	Vizhinjam	July	Self Employed Tailor	Yamuna V V Nair	Self Employed
6	Vizhinjam	July	Self Employed Tailor	Jayalekshmi L	Self Employed
7	Vizhinjam	July	Self Employed Tailor	Sobha Kumari S	Self Employed
8	Vizhinjam	July	Self Employed Tailor	Paniyamma E	Self Employed
9	Vizhinjam	July	Self Employed Tailor	Saritha Kumari S S	Self Employed
10	Vizhinjam	July	Self Employed Tailor	Basundhara V Raj	Self Employed
11	Vizhinjam	July	Self Employed Tailor	Aiswarya J R	Self Employed
12	Vizhinjam	July	Self Employed Tailor	Shynu M K	Self Employed
13	Vizhinjam	July	Self Employed Tailor	Litta K	Self Employed
14	Vizhinjam	July	Self Employed Tailor	Mumthaz S	Self Employed
15	Vizhinjam	July	Self Employed Tailor	Lekshmi Vikraman V	Self Employed

16	Vizhinjam	July	Self Employed Tailor	Soumya A	Self Employed
17	Vizhinjam	July	Self Employed Tailor	Rajani S	Self Employed
18	Vizhinjam	July	Self Employed Tailor	Chithra A Raj	Self Employed
19	Vizhinjam	July	Self Employed Tailor	Ancy S J	Self Employed
20	Vizhinjam	July	Self Employed Tailor	Shereena Pinto F	Self Employed
21	Vizhinjam	July	Self Employed Tailor	Sibil	Self Employed
22	Vizhinjam	July	Self Employed Tailor	Gopika D G	Self Employed
23	Vizhinjam	July	Self Employed Tailor	Mariathresia	Self Employed
24	Vizhinjam	July	Self Employed Tailor	Raji W	Self Employed
25	Vizhinjam	July	Self Employed Tailor	Aseeba V	Self Employed
26	Vizhinjam	August	Self Employed Tailor	Soumya S	Self Employed
27	Vizhinjam	August	Self Employed Tailor	Syama S L	Self Employed
28	Vizhinjam	August	Self Employed Tailor	Roshmi A	Self Employed
29	Vizhinjam	August	Self Employed Tailor	Deepa Jacob	Self Employed

Language & Soft Skill Training

Soft Skill portions like Communication skills, Language skills are providing to the domain trainees as per the SOP. M. Kavitha is handling the soft skill portions for the ongoing domain batches.

General Activities

Monthly Learning Programme

As part of monthly learning programme, Adani Skill Development Centre HO team conducted a session about "Commandments of NLP", handled by Mr. Amithkumar Thakker, Operations Head, Adani Skill Development Centre on 30th April 2022. He made an interaction session with the participants. Discussion was made on the challenges faced by the team members regarding the marketing activity as well as the communication.

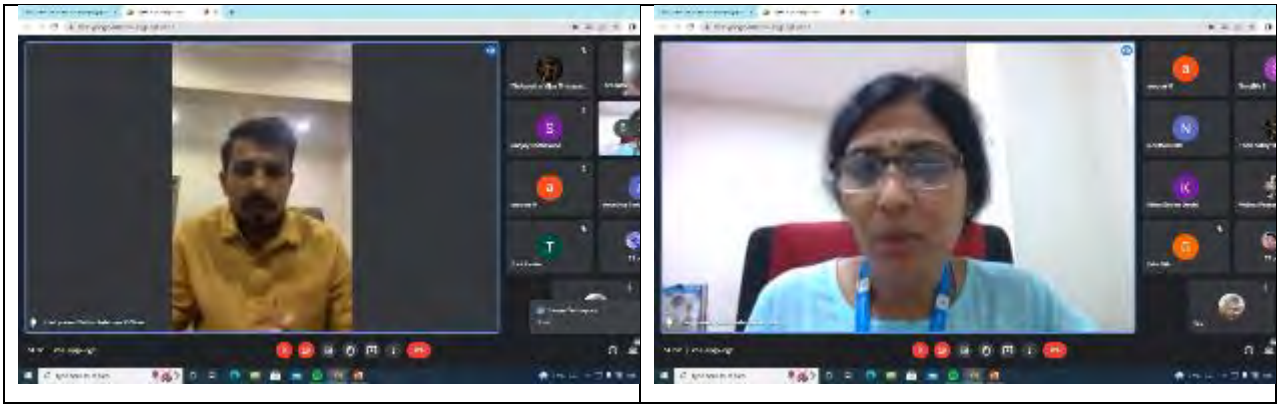
The second monthly learning session was on 21st May 2022 through online platform. The session was about "Summer Tips – Health Related", handled by Dr. Siddharth Darji and Dr. Urmik Chuhan from Adani Health Service Group. Health related tips which people need to consider in this summer season were discussed in the session.

Another monthly learning session was on 23rd June 2022 through online platform. The session was about "Marketing Tools and Techniques", handled by Mr. Cecil Augustine, Associate Vice President, and Head Retail – Adani Solar. He explained about the techniques which we easily implement for the marketing activity.

Employer Engagement Programme

As part of the placement activity, ASDC Vizhinjam conducted an Employer Engagement Programme on 10th May 2022. The session was conducted in association with Mr. Prasad, PRO and Managing Director, Jyothidev's Diabetics Hospital, Trivandrum. Trainees from our RSA, GDA and DDEO batches were participated in the online session. Employer team shared the available openings in the organization and its related information. Total 22 trainees (DDEO-8, RSA-11

& GDA-3) showed interest for attending first level interview on 24th and 25th May 2022. Out of these 15 trainees (DDEO-7, RSA-7 & GDA-1) were shortlisted for the next level interview.



Lakh Admission Achievement

Adani Skill Development has achieved one Lakh admission in different skill courses all around India. As part of the celebration, we captured a photo showing the achievement number format. Trainees from the existing batches were participated in the same.

Guest Session on Industrial Safety

Employees must know about the safety measures what they need to follow and how to manage an emergency safety situation in an organization. As part of the detail understanding, arranged two Guest Session on "Industrial Safety Measures" for the GDA and BT trainees on 31st May 2022 for the RSA and DDEO trainees on 3rd June 2022. The sessions were handled by Mr. Shaji Joseph, Safety Officer, HOWE India Pvt Ltd., Adani Vizhinjam Port and Mr. Vipin, Junior HR, Adani Vizhinjam Port. Mr. Shaji Joseph explained the general safety measures of an organization with the help of a presentation. He also gone through the precautions and emergency toll

free number system for the information sharing. He gave a brief idea about the Types of Fire Extinguisher and how to use that in some situations.

Achievement - Imperial English ToT Certification

Our Language and Soft Skill trainer Ms. Kavitha T R successfully completed the BRITISH TESOL training programme of Imperial English UK and Secured Professional Level Certificate on 11th July 2022. As of now, she is doing the evaluation of assessment for the applicants. Reading, Writing, Grammar, Listening and Speaking are the four sessions in the assessment schedule. Based on the evaluation of the assessment, they are recommended to the levels of training programme.s

Teacher's Day Celebration

ASDC Vizhinjam Centre celebrated this year Teacher's Day on 5th September 2022 by sharing the happiness and highlighting the efforts taken by our Centre trainers in terms of training and related activities. ASDC Vizhinjam Project Officer Mr. Anurag M J, felicitated the trainers by giving a gift. Trainers were motivated and feel happy in that occasion.

Participation in ASDC Review Meet (South Zone)

ASDC Vizhinjam team members started the journey to Krishnapatnam on 14th September for attending the Review Meeting South Zone. Mr. Sreejith S, Placement Manager, Ms. Mini Jose, Beauty Therapist Trainer, Ms. Kavitha T R, Language & Soft Skill Trainer and Ms. Neethu V Nath, Data Entry Operator Trainer attended the meeting.

The review meeting of Adani Skill Development Southern Region was held on 15th September 2022.It was hosted by ASDC Krishnapatnam. 36 participants from three centers attended the Review meeting at Seminar Hall.

HO Team Visit @ ASAP CSP Lakkidi

ASDC HO team, Mr. Amitkumar Thakker - Operations Head, Ms. Payal Joshi - HR Manager, Mr. Dhruv Trivedi - MIS Manager, Mr. Danish Qureshi – Zonal Head South along with Dr. T M George – Technical Advisor CSP Vizhinjam and Mr. Anurag M J – Project Officer visited ASAP CSP Lakkidi on 19th September 2022. The purpose of the visit was to study about the CSP Infrastructure facilities, Courses running, Training Methods, Lab Facilities, Placement Tie-ups, and production unit process.

i. HO Team Visit @ CSP Vizhinjam

ASDC HO Team, Dr. Anil Balakrishnan, Dr T M George, Mr. Anurag M J and Mr. Sreejith visited CSP building construction site and discussed with Mr. Anoop (ASAP Construction Team) & Mr. Sijeesh (PM, CSP Vizhinjam). Mr. Anoop explained all about the construction status and briefed the whole building plan to the ASDC Team.

Points Discussed:

1) **Completion of the Building:** As per the expectation by the ASAP team, Mr. Anoop informed that the construction of the training centre building would be completed by the month of November 2022. Also, the residential building will be completed by the month of December 2022.
2) **Availability of the Classrooms:** Jatin sir suggested that 4 classrooms, the server rooms, library room, activity room, Meeting room and the precision room can be partitioned as per the classroom need. Most of the classrooms can be used as the hybrid mode.

3) **Suggestions from ASDC to ASAP for serious consideration:**

- install 32-amp power plug points in all the classrooms and lab rooms for using high voltage equipment/ peripherals.
- Share the AutoCAD file of the whole building structure with ASDC team.
- CCTV cameras are to be installed from ASAP side inside all the rooms and corridors by the ASAP team.
- to handover all the electrical, plumbing equipment and other peripheral details used in the building with ASDC team for future reference and maintenance.
- possibility of using unbreakable glass for the windows in the building.

- About the fire & safety plan, ASAP team informed that all the labs and common areas are to be installed with fire extinguishers.
- availability of water for the training centre and residential building, ASAP will move forward with the application in the name of ASAP once the building number is issued by the authority.
- to dig a bore well inside the campus for ground water facility.
- application for the Electricity supply from the Kerala State Electricity Board will be submitted through ASAP.
- to do the single name branding instead of using ASDC and ASAP separately. Also, the places for hosting the ASDC Flag, ASAP Flag and National Flag were spotted in the same occasion.


ii. HO Team @ Transit Campus

HO team visited our transit campus after the CSP visit. Team interacted with the Vizhinjam team members and with the trainees also. They collected feedbacks from each domain batch trainees and checked the register documents also. They showed their happiness in the performance of our trainees and also the training methods we are following for the Competitive Exam Preparation batch and Self-Employed Tailor batch. Ms. Payal Joshi, congratulated Ms. Gopika R Murali – 332nd Rank Holder in Lower Division Clerk examination conducted by Kerala Public Service Commission.


Community Skill Park, Vizhinjam

Community Skill Park (CSP) building construction is 85% completed inside Vizhinjam Port area in association with Additional Skill Acquisition Programme (ASAP). 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 planning to start High End Port related courses accordingly to the anticipated vacancies in abroad as well as in the top organizations. ASAP is planning to handover the building by the end of September once the building is commissioned.

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.

ASAP team had shared the draft of agreement to sign between ASDC as Operating Partner and ASAP Kerala. The same was forwarded to HO for further review purpose.

3.4. Sport Support

Adani Foundation has been supporting Kovalam FC, a professional football club in Vizhinjam since 2018. Nutritious food supplements for the emerging players are the main support. Adani Foundation was one of the sponsors of Ravis Cup football competition which was organized by Kovalam FC. Dr. Anil Balakrishnan, Head CSR, Southern Region, inaugurated the first match in the series.

Distribution of Awards – Kovalam FC

As part of their success in international Scour league match held at Neelgiri College of Arts and Science, the management of Kovalam FC decided to distribute awards for the players. Representing Adani Foundation Mr. Rohit S. Nair, Head Security AVPPL and Mr. Vipin Sekkuri, Head HR, AVVPL were invited for the distribution of awards. Cash awards of Rs. 10,000/- to 20,000/- were distributed to 20 top performing players on 28.06.2022 at Arimanoor campus of Kovalam FC

3.5. LIVELIHOOD UPDATES

Status of existing livelihood groups

Sl No	Group	Type of Business/ Status up to March 2020	Business Status during the Period
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... • The turnover during the period was Rs. 4,35,800/- • Supplied contract cleaning cum housekeeping staff to CSR, ASDC, POB, Driver's toilet block at port and ITD Company. • Cleaning and disinfection work were done at 2 locations and 3 houses
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. 4,200/- • The turnover during the period was Rs. 29,149/-
3	Thripti Poultry Unit	• Hi-tech poultry with 14 cages capacity of 630	• Ongoing • Average monthly earning per

	(7 Members)	chicken for 7-member group • The total revenue for the group for the financial year is Rs. 4,41,000/-	family Rs. 4,350/-. • The turnover during the period was Rs 26,212/-
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 • The turnover during the period was Rs. 6,54,434/-
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. • The turnover during the period was Rs. 71,400/-
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. • The turnover during the period was Rs.93,592/-
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 • Selling fertilizer, growbags, etc. also progressing. • The turnover during the period was Rs.4,13,613/-
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 • The turnover during the period was Rs. 37,225/- • The shifting of laundry unit is progressing
9	Data Plus (3 Members)	• Data entry Photostat, projects, designing and online jobs	• Digital Literacy programme and competitive Exam coaching programme have

		• The group has made a turnover of Rs.7,40.000 for the financial year	been successfully supported by the group • The merit scholarship for meritorious students routed through the group • The turnover during the period was Rs. 64,486/-
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. 2300- 2500/- • The turnover during the period was Rs. 2,43,567/-
11	You Me & Tea Café (3 members)	• Canteen unit, traditional Kerala Foods. • Made a turnover of Rs. 7,50,000/-in 7 months	• Concentrated in parcel service and port related orders • Progressing the monthly turnover averages daily turnover reached to 2,700-3,500. • The turnover during the period was Rs. 5,67,454/- • Worker's canteen is entrusted with the group
12	SRM Stitching & Garments unit (3 Members)	• Spot stitching and garments • The group has made a turnover of Rs. 2,14,000/- in six-month time	• Express stitching and selling of lady's garments are the services • The turnover during the period was Rs. 41,048/- • 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 • Established new tie up with Kunnil Supermarket • The turnover during the period was Rs.3,36,855/-
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 • The turnover during the period was Rs. 1,02,243/-

15	SPANDHANAM 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 • Four members got placed in home-based patient care. • The turnover during the period was Rs.1,17,300/-
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
20	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 • The turnover during the period was Rs.2,23,365/-

VIZMART

Viz Mart, the consotium of livelihood groups and the selling counter progressing well during the period. All the pending rent with Trivandrum Corporation is cleared during the period, Rs. 2,80,146 was paid on 17.06.2022.

The running of workers canteen at the port site is entrusted with Viz Mart. CEO Mr. Rajesh Jha was inaugurated the canteen during the period. Three staff were engaged in the canteen

Viz mart in tieup with Kunnil Super martket started a mini supper market during the period. Viz mart has purchased a three wheeler for the transit of goods and services during the period

The maintenance of first phase land scaping at port premises is taken care by Vanitha Karsheeka Karma Sena, one of the livelihood groups. The Viz Mart selling counter at Farm School premises is also progressing well during the period. The maintenance of toilet block and container cabin for drivers at port site and the housekeeping of POB and ITD company are taken care by M/s. Clean 4 U. Vanitha Karsheeka Karma Sena started a new nursery at the premises of Farm School. The shifting of laundry unit to farm school premises is progressing.

Onam kit to AVPPL

As every year this year also, Onam was celebrated with great adorn connection. As received orders from Adani Vizhinjam Port Pvt. Ltd, Viz Mart prepared and handed over a total number of 500 Grocery and vegetable kits to distribute for workers at Kadavila and Kumil quarries of AVPPL. The packing for the kit distribution was started on 1st of September 2022. The kit consists of 18 grocery items and one vegetable kit. The kit was delivered on 5th of September 2022.

Vegetable mart at Viz Mart for Onam

In collaboration with Civil Supplies Corporation, Govt. of Kerala a vegetable outlet was organized at Viz Mart premises. This vegetable mart was exclusively for Onam. The special mart was operated from September 3rd to 7th. The Mart was operated by M/S. Vanitha Karsheeka Karma Sena, one of the livelihood groups formed as part of the CSR activities. This was to facilitate the sales of the Local Vegetable from nearby areas and farm school to the public of Vizhinjam during Onam season. The special mart was inaugurated by the local MLA, Adv. M.

Vincent in the presence of senior officials of Civil Supplies Corporation, Adani Foundation, and livelihood group members.

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.

Sl No	Name	Type of Business	Income for the period
1	Sulekha	Street Shop (Food Counter)	73687
2	Peter	Cobbler	36663
3	Baby	Petty Shop (Grocery & Snacks Items)	54487
4	Sheeja Suresh	Grocery Shop	177874
5	Sindhu	Tailoring Shop	54830
6	Nirmala	Fish Vending	20000
7	Jepsi	Fish Vending	1,93,880
8	Gulastic Amma	Fish Vending	2,62,952

4. COMMUNITY INFRASTRUCUTRE DEVELOPMENT

4.1. Pilot project on clean drinking water for Vizhinjam

Availability of clean drinking water in Vizhinjam persists even after it was made into Corporation in 2010. Provide pure drinking water AVPPL/AF was decided to install five clean drinking ware plants in the nearby five divisions of Vizhinjam having 2000L/hour capacity each on a pilot basis. The total cost of the project is Rs. 52.5 lakhs of which the equipment cost of Rs. 30 lakhs from the CSR of Tata Chemicals whereas the infra and installation cost of Rs. 22.5 lakhs are from CSR of AVPPL/AF. The future maintenance will be the responsibility of community beneficiaries. The infra work and the installation for the water kiosk completed at

3 locations. Work order was given to M/s. Rudrasha Constructions for remaining two locations.

Inauguration at Sai gram, Kottappuram

Tata Swachh Jal-water Filter Unit developed by Ncourage Foundation of Tata and installed by Adani Foundation was inaugurated at Sai Gram Vayalinkara, Kottappuram. The unit can filter 2000 liters of water in one hour. The inauguration was done by Mr. Franklin, a local leader by cutting the ribbon. The key to the kiosk was handed over to Mr. Franklin by Mr. Sebastian Britto, Program Manager CSR Vizhinjam. A 10-member committee was instituted locally for the smooth Function of Swach Jal Unit and its maintenance.

4.2. Community Health Centre, Vizhinjam

The construction work of Community Health Center at Vizhinjam has been resumed after the COVID restrictions. 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 to the Harbour Engineering Department on 03.10.2018. Initiated the process to transfer the second installment of Rs. 1.18 crores to HED. Most electrical works, plumbing works and cement mortar plastering for terrace area are completed. The works that are presently being carried out/done are as follows:

- The setting up of framework for the false ceiling is progressing.
- The tiling work for 5 toilets completed.
- The tiles for the floor area are transported and stacked at site.
- Level difference of nearly 6cm measured in various parts of floor area. Hence Plain cement concrete was laid on the floor to achieve uniform thickness.
- Water pipes and required number of fire detectors and water sprinklers being set up in the roof area and over walls by the Fire and Safety Department.
- The work of various workstations as per the hospital norms is also progressing

4.3. 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
- Progressing the Rock mining work to construct the Core wall (Break water) to block sand iteration at the southern side of the exiting Fishing Harbour
- Progressing the preliminary works to Install Silt breakers
- The construction of footbridge completed.
- The construction of 1 silt trap completed. The second sit trap work is in progress.
- The sidewall construction is progressing.
- The silt removal completed for a depth of 1 m. There is significant increase in the flow of water.



4.4. Maintenance of Karimpozhikkara Road

This road was in a state of complete dilapidated stage. This was the mainstream pathway for most of the fisherman folk inhabiting of this area for their daily livelihood needs, education and hospital needs. Intermittent potholes and excavated roads later becoming huge gutters, made the journey tough for the community to traverse for their daily bread and other needs. Many had Sur-come to serious injuries during their travel course. It was after a serious of discussion, studies, and requests that Adani foundation decided to extend the financial support realizing genuine need.

4.5. Maintenance of Harbour toilet

As per the decision of District Collector's meeting held on 06.06.2022 in connection with trawling ban, AVPPL has directed to do the renovation of available washroom facilities at fishing harbor. This toilet block was renovated earlier during 2017 under CSR, but due to non-maintained by Harbour Engineering Department the premises were unhygienic due to septage and plastic waste accumulation. The toilet block has 5 toilets each for males and females of Harbour community. The access to the toilet block was covered by grass and shrubs resulting in mosquito breeding environment. The inside of toilets was not regularly sanitized after public use. The water pipes, washbasins were under repair condition, hence required urgent renovation.

As per the direction of District Collector the work was started, and the priority was to pump out septage waste. This was done by the support of Municipal Corporation. Septic tank and premises were manually cleaned and cleared off vegetation.

Completed the internal and external plastering repair works for male toilet unit and female toilet units and completed the painting of units. The inside of toilet units was thoroughly cleaned using disinfectants and plumbing accessories were replaced as per requirement. The doors of toilets were properly hatched and provided with new locks. The entrance and exit doors made of grill work were painted rust free.

After the renovation of amenities and surrounding area hygienically, handed over the toilet block for future public use.

4.6. Other major projects under progress

Sl N	Project	
1	Model Anaganwadi,	• 1500 Sqft Montessori model Anganwadi at Govt. Vizhinjam LP School compound. • The plan and the location approved by social

	Vizhinjam (Nr. Police Station)	welfare department • Land permission received from Social Welfare department. • As the Land Contour mapping yet to receive from Social Welfare department, it is decided to prepare a detailed architectural drawing by our consultant • As per the plan, estimate and BoQ received 7 quotations for the work, but the rates quoted are much higher side. So additional approval for fund may be required
2	MRF	• As per the request received from Trivandrum Municipal Corporation it is decided to construct an MRF at harbor ward. Land for the same will be allotted by 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 include • 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 under preparation to demystify the role of all the stakeholders • NFA approved and transferred Rs. 44.77 lakhs to VISL as half share
3	Kottukal School	• A roof top classroom in the existing building • As per the structural certificate plan and estimate are prepared • As per the plan, estimate and BoQ received 7 quotations for the work, but the rates quoted are much higher side. So additional approval for fund may be required

4	Library Uchakkada	• A two-story building in the existing foundation • BoQ, plan and estimate are prepared • As per the plan, estimate and BoQ received 7 quotations for the work, but the rates quoted are much higher side. So additional approval for fund may be required

5. OTHERS

5.1. Celebration of Special Days

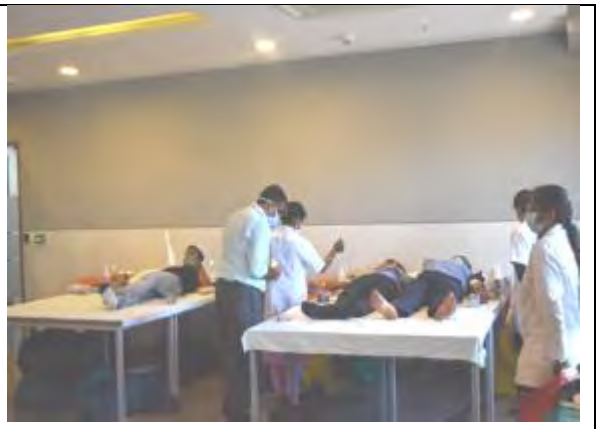
Chairman's 60th Birthday Celebration

The 60th Birthday of Shri. Gautham Santhilal Adani who is the chairman of Adani Group, was celebrated @ Vizhinjam as in the case of other ports and business locations. A video shoot was done @ Vizhinjam to include all the important social development activities and ongoing port construction. The program depicts the greetings expressed by various community men and women to Gautham Sir on his 60th birthday celebration.

Among the video rushes includes the traditional cultural items like Kerala Thiruvathira, Greeting Song sung by Kumari Asthami P Pradip, Release of Nitrogen Balloon of Heart Shape. The number 60 (SYMBOLIFING 60TH BBIRTHDAY) was written by human gathering in the form of '6' & '0'. Both men and women staff participated in the occasion wearing traditional dress Mundu and shirt for men and Kerala Saree for Women. A cake was cut and distributed among the participating staff and community members. The CEO expressed gratitude to all those who participate. The programme ended with distribution of sweets.

Blood Donation Camp (24.06.2022)

A blood donation camp was organized by AVPPL and Adani Foundation in association with Sree Chitra Thirunal Institute for Medical Sciences and Technology Trivandrum came to site along with the staff of Hospital. The Staff of AVPPL, HOWE, Adani Foundation and security personals attended the camp



Inauguration of Gas Insulated Substation @ Mukkola

The 220 kb substation @ Mukkola was inaugurated on 30th June 2022 by Honorable Port Minister Ahamed Devarkovil in the presence of Honorable Minister for Education. Mr. Sivankutty and Honorable Minister for transport Mr. Antony Raju. The meeting was attended by Adv. M.Vincent, MLA for Kovalam, Mr. K. Gopalakrishnan, MD, VISL, and Mr. Rajesh Kumar Jha, CEO AVPPL. The meeting has the presence of more than 600 community members and officials. The mobilization of community people was done by CSR team, and it was highly appreciated.

International Youth Day Celebration

AVPPL/AF Vizhinjam celebrated International Youth Day on 12th August 2022 with a lot of activities. In the morning session, we had arranged a poster making event for all skill domain batch candidates. Trainees actively participated and made different posters in their own concepts. It was a nice experience for them.

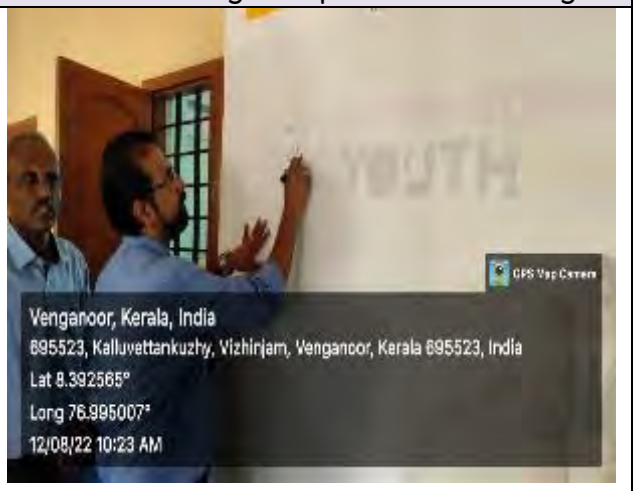
In the afternoon session, we had arranged a Career Guidance Seminar. It was arranged for the trainees of our domain batches. It was led by the National Employment Service, Neyyattinkara, Kerala. Nearly 83 trainees participated in the programme. It lasted for around 2.5 hours. The purpose of the seminar was to bring career guidance to the trainees to their job role. The session was led by Mr. Sanil Kumar, Faculty CDC Neyyattinkara and Mr. Manoj Kumar, IT Officer, Career Development Center, Neyyattinkara. They discussed about the importance of

career planning, personal development, attitude, importance of time management, general skills, how to deal others in the workplace etc. It was a useful session.

After the programme, there was a general meeting. It commenced with a warm welcome speech by Mr. Anurag, Center Head, ASDC. The chief guest of this event was Mrs. Divya, a Malayalam novelist. She was felicitated by Mr. Rakesh, the senior Project Officer, CSR Vizhinjam. She had given the Youth Day Message to the trainees. Dr. Anil Balakrishnan, CSR Head, Southern Region Congratulated one of our CEP trainees Miss Gopika. R. Murali, who is the rank holder of Lower Division Clerk, Malappuram District. She was honored with a memento. Dr. Anil Balakrishnan emphasized the importance of career planning and setting up personal goals in life. Mr. George Zen, Project Officer, CSR talked to the trainees and entertained them. After the Vote of thanks by Miss. Aparna the programme came to an end.

As Part of the International youth day Celebrations conducted another programme at Christ College Vizhinjam in association with English literary club, NSS unit of the College and MHCU. The programme was inaugurated by Dr. Anil Balakrishnan, National Head SLD, Adani Foundation and presided over by Dr. Joseph, Principal Christ College. A signature campaign was also organized as part of the programme to create awareness on the theme "A secular world for all

ages". A poster and collage making competition was conducted prior to the youth day on 8th August 2022 for the students at Christ College and the prizes were distributed on 12th August 2022 during the programme.

<table>
<tr><th colspan="2">World Youth Day</th></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Message by college Pricipal Christ college</td><td>Poster making competition at college</td></tr>
<tr><td>  </td><td> 
</td></tr>
<tr><td>Prize distribution for the winners</td><td>Signature campaign by Dr. Anil balakrishnan</td></tr>
</table>

Birthday celebrations of Hon'ble Chairperson, Adani Foundation

The Birthday of our Honorable chairperson was celebrated on August 29 by cutting of cake and distributed among staff members and to community leaders of Vizhinjam. Addressing the occasion Dr. Anil Balakrishnan CSR Head mentions chairperson as a philanthropist and committed citizen. All the growth happened to the Foundation are the result of the leadership quality the chairperson as

exhibited right from the beginning till date. Other staff members and community leaders spoke and express their birthday wishes.

Onam Celebration

Onam was celebrated at CSR office and Viz Mart. Onam sadhyas (Feast) were arranged at Viz Mart as well as at CSR office for the livelihood group members and CSR staff respectively. The staff members recalled their memories of onam and wished each other for a splendid and prosperous year ahead. A pookkalam (Floral arrangement) was also done by CSR staff at CSR office. Light cultural events were also organized.

5.2. **Community grievances**

Reporting the progress of Vizhinjam Port to community stakeholder

As per the environmental audit compliance, the progress of Port activities has been circulated to the community groups during the period to 4479 people through various community groups like Competitive Exam Coaching students, Open House students, Literature Group students, Digital Literacy Resource Persons, Digital Literacy Community Group, Phoenix – Widows Group, Children's Group, SuPoshan Group, Swachhagraha group, Community Volunteers, Livelihood Group Kottukal Panchayat, Community Awareness.

Press Converge

കേരളകൗമുദി

വെള്ളായണി കായൽ ശുചീകരണത്തിൽ പങ്കെടുത്ത അദാനി ഫൗണ്ടേഷൻ പ്രവർത്തകർ

വെള്ളായണി കായൽ ശുചീകരണത്തിന് അദാനി ഫൗണ്ടേഷനും

വിഴിഞ്ഞം: അദാനി വിഴിഞ്ഞം തുറമുഖത്തിന്റെ സാമൂഹ്യ പ്രതിബദ്ധതാ പദ്ധതിയുടെ ഭാഗമായി അദാനി ഫൗണ്ടേഷൻ, വെങ്ങാനൂർ ഗ്രാമ പഞ്ചായത്ത്, വിവിധ സാമൂഹ്യ സംഘടനകൾ എന്നിവരുടെ നേതൃത്വത്തിൽ വെള്ളായണി കായലിൽ ശുചീകരണ പ്രവർത്തനങ്ങൾക്ക് തുടക്കം കുറിച്ചു. നീക്കം ചെയ്യുന്ന കുളവാഴയിൽ നിന്ന് വെള്ളായണി കാർഷിക കോളേജ് സാങ്കേതിക സഹകരണത്തോടെ ജൈവ വളമാക്കൽ, ബയോഗ്യാസ് നിർമ്മാണ മാതൃകാ പദ്ധതി എന്നിവ നടപ്പിലാക്കുമെന്നും അദാനി ഫൗണ്ടേഷൻ അധികൃതർ പറഞ്ഞു. ഗ്രാമ പഞ്ചായത്ത് പ്രസിഡന്റ് ആർ.എസ്. ശ്രീകുമാർ ഉദ്ഘാടനം ചെയ്തു. പ്രോജക്ട് ഡയറക്ടർ എത്തിരാജൻ രാമചന്ദ്രൻ, കോർപ്പറേറ്റ് അഫയേഴ്സ് വിഭാഗം മേധാവി സുശീൽ നായർ, അദാനി ഫൗണ്ടേഷൻ ദക്ഷിണ മേഖല വിഭാഗം മേധാവി ഡോ. അനിൽ ബാലകൃഷ്ണൻ, സുരക്ഷാ വിഭാഗം മേധാവി രോഹിത് നായർ, എൻവയൺമെന്റ് വിഭാഗം മേധാവി ഹെബിൻ, എച്ച്.ആർ വിഭാഗം മേധാവി വിപിൻ ശേഖരി എന്നിവർ ശുചീകരണത്തിന് നേതൃത്വം നൽകി.

KERALA KAUMUDI EPAPER

വെള്ളായണി കായൽ ശുചീകരണ പ്രവർത്തനങ്ങൾക്ക് തുടക്കമായി

വെള്ളായണി കായൽ ശുചീകരണത്തിന് അദാനി ഗ്രൂപ്പും

EXPRESS READ

Marian Nagar Road opened to public

T'Puram: Giving a huge sigh of relief to the residents, the Marian Nagar Road — a crucial road which interlinks Kottappuram with Mariam Nagar in Vizhinjam — has been renovated and opened to the public. The dilapidated road with huge gutters had turned into a death trap for the local residents owing to lack of maintenance. Several accidents have occured on the stretch — which is the only mainstream pathway for fishermen. The road was renovated under the CSR initiative of the Adani Foundation. Kottapuram ward councillor Panladima J, in a statement issued here, said that several fishermen, who travelled during early morning hours, had encountered accidents in the stretch because of the poorly maintained road. "It is one of the thickly populated areas where fishermen reside. Sick people find it very difficult to even go to the hospital because of the dilapidated road. I took it up with the Adani Foundation and they helped to renovate the road," said Panladima.

കേരള കൗമുദി **അദാനി ഫൗണ്ടേഷൻ മിയാവാക്കി വനം നിർമ്മിക്കുന്നു** 	**അദാനി ഫൗണ്ടേഷന്റെ നേതൃത്വത്തിൽ മിയോവാക്കി വനരൂപീകരണത്തിന് തുടക്കമായി** 
കേരള കൗമുദി  *ലോക വയോജന പീഡന വിരുദ്ധ ബോധവത്കരണ ദിനത്തിൽ നടന്ന ബോധവത്കരണ റാലി* **ലോക വയോജന പീഡന വിരുദ്ധ ബോധവത്കരണ ദിനം ആഘോഷിച്ചു** വിഴിഞ്ഞം: ലോക വയോജന പീഡന വിരുദ്ധ ബോധവത്കരണ ദിനത്തിൽ ഹെൽപേജ് ഇന്ത്യയും, അദാനി ഫൗണ്ടേഷനും ചേർന്ന് വയോജന സമ്മേളനവും, ബോധവത്കരണ ക്ലാസും, ഹെൽപേജ് ഇന്ത്യ പഠന റിപ്പോർട്ട് പ്രകാശനവും നടത്തി. വിഴിഞ്ഞം എസ്.ഐ ജോൺ ബ്രിട്ടോ ഉദ്ഘാടനം ചെയ്തു. അദാനി ഗ്രൂപ്പിന്റെ സാമൂഹ്യ പ്രതിബദ്ധത വിഭാഗമായ അദാനി ഫൗണ്ടേഷൻ സതേൺ റീജിയണൽ ഹെഡ് ഡോ. അനിൽ ബാലകൃഷ്ണൻ മുഖ്യപ്രഭാഷണം നടത്തി. അദാനി ഫൗണ്ടേഷൻ പ്രോഗ്രാം മാനേജർ സെബാസ്റ്റ്യൻ ബ്രിട്ടോ, ഹെൽപേജ് ഇന്ത്യ കോ-ഓർഡിനേറ്റർ രാജൻ ജോൺ എന്നിവർ സംസാരിച്ചു. എച്ച്.എസ്.എസ് ഫോർ ഗേൾസ് വെങ്ങാനൂർ സ്കൂളിലെ എസ്.പി.സി കുട്ടികളുമായി ചേർന്ന് ബോധവത്കരണ ക്ലാസും റാലിയും നടത്തി. ഹെൽപേജ് ഇന്ത്യ ഡോ. വിഷ്ണു. സീനിയർ പ്രോജക്ട് ഓഫീസർ രാകേഷ്, പ്രോജക്ട് ഓഫീസർ ജോർജ് സെൻ പി.ടി, സ്റ്റീഫൻ വിനോദ് എന്നിവർ നേതൃത്വം നൽകി. KERALA KAUMUDI EPAPER Clipping Kerala Kaumudi · Trivandrum	18 **മലയാള മനോരമ** **വയോജന പീഡന വിരുദ്ധ ദിനാഘോഷം**

കേരള കൗമുദി
Trivandrum 20 Jun 2022

നീലഗിരി ഇന്റർ നാഷണൽ ടൂർണമെന്റിൽ ചാമ്പ്യൻപട്ടം സ്വന്തമാക്കുകയും കേരള പ്രീമിയർ ലീഗിലും ജില്ലാ ഒളിമ്പിക് ഗെയിംസിലും മികച്ച പ്രകടനം പുറത്തെടുക്കുകയും ചെയ്ത കോവളം എഫ്.സി താരങ്ങൾക്ക് ക്ലബ് അധികൃതർ കാഷ് അവാർഡ് നൽകുന്നു. ചടങ്ങിൽ വിഴിഞ്ഞം തുറമുഖ സെക്യൂരിറ്റി ഹെഡ് രോഹിത് എസ്. നായർ, എച്ച്. ആർ. ഹെഡ് വിപിൻ സെക്കുറി, സി.എസ്.ആർ ഹെഡ് സെബാസ്റ്റ്യൻ, മദ്രാസ് റെജിമെന്റ് കോച്ച് സേവ്യർ, മുൻ താരവും കോവളം എഫ്.സി മാനേജരുമായ ഇഗ്നേഷ്യസ്, കോച്ച് എബിൻ റോസ് എന്നിവർ സംസാരിച്ചു.

കേരള കൗമുദി

പോഷണ മാസാചരണം

കോവളം : പോഷണ മാസാചരണത്തോടനുബന്ധിച്ച് അദാനി ഗ്രൂപ്പിന്റെ സാമൂഹ്യ പ്രതിബദ്ധതയുടെ ഭാഗമായി അദാനി ഫൗണ്ടേഷൻ ദേശീയ തലത്തിൽ നടപ്പിലാക്കിവരുന്ന 'സുപോഷൺ' പദ്ധതിക്ക് തുടക്കമായി. പദ്ധതിയോടനുബന്ധിച്ച് കോട്ടുകാൽ ഗ്രാമപഞ്ചായത്തിൽ 4 ആഴ്ച നീണ്ടുനിന്ന പരിപാടികളിൽ കൗമാര പെൺകുട്ടികൾ, മുലയൂട്ടുന്ന അമ്മമാർ, 5 വയസിനു താഴെയുള്ള കുട്ടികളുടെ അമ്മമാർ എന്നിവർ പങ്കെടുത്ത വിളംബര റാലി, ബോധവത്കരണ ക്ലാസുകൾ, പോഷകാഹാര പ്രദർശനം, പാചക മത്സരം, ഹോളി കൗൺസലിംഗ്, കൈകഴുകലിന്റെ പ്രാധാന്യം, കുക്കിംഗ് ഡെമോ എന്നിവയും നടന്നു. അദാനി ഫൗണ്ടേഷൻ പ്രോഗ്രാം മാനേജർ സെബാസ്റ്റ്യൻ ബ്രിട്ടോ, സീനിയർ പ്രോജക്ട് ഓഫീസർ രാകേഷ്, പ്രോജക്ട് ഓഫീസർ ജോർജ് സെൻ.പി.ടി, സ്റ്റീഫൻ വിനോദ്, അനുരാഗ്, മായ, കുമാരി തിര, ലീന, രാധ എന്നിവർ നേതൃത്വം നൽകി.

ലോക പരിസ്ഥിതി ദിനം ആഘോഷിച്ചു

Annexure -1

List if 50 selected merit scholarship students

Student Name	Father's Name	Address	Address Line 2
SANDHRA D R	RAJESH C	AMBADI VENGANOOR	VENGANOOR P.O
AJAYALEKSHMI A J	AJITHKUMAR B	VALANVILA VEEDU MULLOOR	MULLOOR P.O
SOORYA GAYATHRI C A	K C CHANDRAHASAN	SREEVIHAR KIDARAKUZHI	VENGANOOR P.O
SHAMILA S	HUSSAIN KHAN	CHENNNA VILAKAM	VIZHINJAM P.O
KARTHIKA J P	JAYAKUMAR T	CHIRATHALA VILAKAM VEEDU	VENNIYOOR VENGANOOR P.O
FATHIMA FARHANA S	SHAJAHAN	SUBAH MANZIL HARBOUR ROAD	VIZHINJAM P.O
SAFA S	HAMSA	HOUSE NO 390 TOWNSHIP COLONY	HARBUR ROAD VIZHINJAM P.O
ARATHI SS	SHIBU N	S S NIVAS MANALI	VENGANOOR P . O
NOUSHABA YASMIN Z	NOUSHAD M	TOWNSHIP COLONY, HOUSE NO.79	VIZHINJAM P.O
SAHIRA A	SAKEER HUSSAIN	MUNDAPLAVILA LEKSHAM VEEDU	VIZHINJAM P.O
SUJITHA B S	BIJU L D	B S BHAVAN, SARVASAKTHIPURAM	VENGANOOR. P. O
SOORYALAKSHMI C M	CHANDRAN G	G T SOORYALAYAM, PANAVILA	MULLOOR P.O
ASWANI A G	ANILKUMAR D	AJAYA VILASAM, VENGANOOR	VENGANOOR. P. O
ABHIRAMI G S	GOPAKUMAR V	GOPA SADANAM, ASARIVILAKAM	VENGANOOR. P. O
THASNI T	THANGAL KUNJU	S M N MANZIL BEHIND CORPORATION OFFICE	VIZHINJAM P.O
ARSHA S P	SUDHEER S S	SOMATHILAKAM VEEDU NELLIVILA	KADAIKULAM MULLOOR P. O
SHEREEFA B	ABDUAL KALAM A R	VATTAVILA SHUHAIB MANZIL	HARBUR ROAD VIZHINJAM P.O
NANDHINI N K	NAGARAJAN K	THEKKE PLANKALAVILA VEEDU	VIZHINJAM STREET VIZHINJAM P.O
ANEETA JOHN	JOY J	JOY JHON VILAS	KOTTAPPURAM P.O
ANUBALA A P	ANILKUMAR S	PANAYARAKUZHI VEEDU PULLOORKONAM	VIZHINJAM P.O
MEHARUNISA J	MAITHEENADAIMA	CHARUVILA PUTHEN VEEDDU PULLOORKONAM	VIZHINJAM P.O
JISHNU M	MOHANAN T	MULLUVILA VEEDU MULLOOR	MULLOOR P.O
ADITHYAN M	MURALI R	MIDHUN NIVAS MULLUVILA	MULLOOR P.O
JYOTHIKA K J	JOY	NARAYANI BHAVAN VALIYAVILA	VENGANOOR P.O
ASWANI A	JOBAI	KADAIKULAM COLONY KARUMPOZHIKKARA	KOTTAPPURAM P.O
ANNIEMOL K R	KUNJUMON	KADAIKULAM COLONY KOTTAPURAM	KOTTAPPURAM P.O
ATHIRA R S	SHAJI D	KUZHIYAN VILA NALUKETTUVEEDU	KIDARKUZHI KIDARAKUZHI P.O
NAZRIN NAVAS N	NAVAS S	NAZRIN MANZIL KAMUKINKUZHI KOVALAM	KOVALAM P.O
ANEESHA A	BIJU	NEAR NEW CHURCH KOTTAPPURM	KOTTAPPURAM P.O

MUHAMMED HASHIM M	MAHEEN KANNU A	HOUSE NO 207 TOWNSHIP COLONY	VIZHINJAMP.O
ARATHI KRISHNA C S	SURESH KUMAR K	AMAL BHAVAN NELLIVILA	KADAIKULAM MULLOOR P. O
SAJNA S	BADAR SAMAN	IBRAHIM MANZIL PANAYARAKUZHI	PULLOORKONAM VIZHINJAM P.O
AKASH ROY S	ROY T P	VALIYA VALENVILA VEEDU	PAYARUMOODU KOTTUKAL P.O
RIJO S R	SELVAN	RIJO BHAVAN MARIYAN NAGAR	KADAIKULAM KOTTAPPURAM P. O
AATHIRA GANESAN S	GANESAN	ASWATHY BHAVAN PRESS ROAD	VENGANOOR VENGANOOR P.O
SIVENDU B	SELVARAJAN S	SIVASAILAM VIRALIVILA	KADAIKULAM MULLOOR P. O
JEFRIN JHON	JHONSON	KANJIRAMVILA LAKSHAM VEEDU	MUKKOLA MULLOOR P.O
KEERTHANA L	MAHESH M	VADAKKINKARA KANNARUMUDUMBIL	PUTHEN VEEDU AZHAKULAM VIZHINJAM P.O
RIJOSH LOPEZ	SHAJI LOPEZ	THOPPUVILA VEEDU THENOORKONAM	KOTTAPPURAM P.O
SHEREEFA MUHAMMED	MUHAMMED KANNU U	MUHAMMED MANZIL HOUSE NO 120	TOWNSHIP COLONY VIZHINJAM P.O
ABHIRAMI R	AJITH KUMAR K	VADAKKEKUNNATHU VEEDU MULLOOR	MULLOOR P.O
JERIN JOY	JOY J	LEELAARJUNA BAHAVN KINARUVETTUVILA	KIDARKUZHI KIDARAKUZHI P.O
ANUSREE ANIL M	ANIL KUMAR K	ANIL BHAVAN CHARUVILA THENOORKONAM	KOTTAPPURAM P.O
ADITHYA D	BINU	VIRALIVILAVEEDU KADAIKULAM	VIZHINJAM MULLOOR P.O
RISVANA H	SIDHIQUE	TOWNSHIP COLONY, HOUSE NO.23	VIZHINJAM VIZHINJAM P.O
RAIHANA H	MUHAMMED RAFI	CHARUVILA VEEDDU MADATHILKONAM	HOUSE NO:10 VIZHINJAM P.O
ABITHA B S	BINU	POROTTUKIZHAKKUMKARA VEEDU	PANAGODE VENGANOOR P.O
AATHIRA T	THADAYOUS	KADAIKULAM, NELLIVILA	MULLOOR P.O
NIMI M S	SANTHOSH	CHARUVILA COLONY	KOTTAPPURAM P.O VIZHINJAM
SANEESH S	SANIL KUMAR S	PERUMPA ROAD MELEPUTHEN VEEDU AYANIMOODU	VEDIVECHANCOIL P.O VENGANOOR

Annexure -2

List of selected scholarship students for the year 2021-23

SL NO	NAME	Address	WARD
1	MANU J P	OSAVILA COLONY KOTTAPPURAM	KOTTAPPURAM
2	LIDHINA S	KADAIKULAM COLONY	KOTTAPPURAM
3	ALINAMOL A	KADAIKULAM COLONY	KOTTAPPURAM
4	JEFRIN S	SINI HOUSE KADAIKULAM COLONY	KOTTAPPURAM
5	AKSA S XAVIER	Mary Bhavan Thennoorkonam	KOTTAPPURAM
6	ANEESHA P	THULAVILA KOTTAPPURAM	KOTTAPPURAM
7	LIZ JOY	LOVE LAND VIZHINJAM	KOTTAPPURAM
8	SUNEESH KUMAR	THULAVILA KOTTAPPURAM	KOTTAPPURAM
9	SHARANYA R	VARUVILAKAM VIZHINJAM	KOTTAPPURAM
10	ANCY K R	KADAIKULAM COLONY VIZHINJAM	KOTTAPPURAM
11	JESNA R	CHARUVILA COLONY KOTTAPPURAM	KOTTAPPURAM
12	MANEESH P	CHARUVILA COLONY KOTTAPPURAM	KOTTAPPURAM
13	PHEBA Y	THULAVILA HOUSE KOTTAPPURAM	KOTTAPPURAM
14	MIMI P	KUZHIVILA PURAYIDOM	KOTTAPPURAM
15	STEPHANIYA A S	KUZHIPALLAM MUKKOLA	KOTTAPPURAM
16	JYOTHISHMA S	NEAR NEW CHURCH KOTTAPPURAM	KOTTAPPURAM
17	SNEHA W	SNEHA HOUSE NEAR NEW CHURCH	KOTTAPPURAM
18	SERGY C VOISE	SANGAMAM COTTAGE	KOTTAPPURAM
19	ATHIRA XAVIER	LAILA HOUSE KOTTAPPURAM	KOTTAPPURAM
20	SANIYA ALEX	SAFIN HOUSE CHIRAICODE KOTTAPPURAM	KOTTAPPURAM
21	NAMITHA RAJ G	THULAVILA HOUSE VIZHINJAM	KOTTAPPURAM
22	ROSHINI P	VADAYAR PURAYIDAM VIZHINJAM	KOTTAPPURAM
23	ARATHI A	NELLIVILA KADAIKULAM MULLOOR	KOTTAPPURAM
24	LINTA B	VADAYAR PURAYIDAM VIZHINJAM	KOTTAPPURAM
25	JASMINE M	TC 62/362 (5) OSSAVIlA COLONY	KOTTAPPURAM
26	ALFA MARY J	SEELI HOUSE THULAVILA	KOTTAPPURAM
27	ASHNA A	THULAVILA HOUSE VIZHINJAM	KOTTAPPURAM
28	VINEESH V	KADAIKULAM COLONY KOTTAPPURAM	KOTTAPPURAM
29	HANNA LISA	OSSAVILA COLONY KOTTAPPURAM P O	KOTTAPPURAM
30	JEBINAXAR M	MUKKOLA KUZHIPALLAM	KOTTAPPURAM
31	SINDHU DAS	KADAIKULAM COLONY KOTTAPPURAM	KOTTAPPURAM
32	SHAMSHIDA J	KUTTIYALIVILA HARBOUR ROAD	HARBOUR
33	AROMA SARMA R	LAL SADANAM AVADUTHURA	HARBOUR
34	SAFARULLA M	TOWNSHIP COLONY HOUSE No 300	HARBOUR
35	NISAMUDHEEN N	THAZHEVEETTUVILAKAM VIZHINJAM	HARBOUR
36	SUMAYYA S	MUHAMMED MANZIL VALIYAVILA	HARBOUR
37	MUHAMMED JASIM	TOWNSHIP COLONY HOUSE No 243	HARBOUR
38	RAMEEZ ALI A	HOUSE NO 336 TOWNSHIP COLONY	HARBOUR
39	AFSANA A	FAISAL MANZIL VIZHINJAM	HARBOUR
40	MUHAMMED ISMAIL A	TOWNSHIP COLONY HOUSE NO 115	HARBOUR
41	SHAHINA SHAJI H S	MELVILAKAM HARBOUR ROAD	HARBOUR
42	NASARUDEEN N	HOUSE NO 545 PULLOORKONAM	VIZHINJAM

43	IRFANA R	MYLANCHIKALLU VEEDU PUTHEN VILA	VIZHINJAM
44	ASNA S S	CHIPPITHOTTU VILA VEEDU VIZHINJAM	VIZHINJAM
45	NAFILA MOL M S	PARAVILA PULLOORKONAM	VIZHINJAM
46	NAJITHA N	ADNAN MANZIL PUTHANVILA	VIZHINJAM
47	AKASH AYYAPPAN	THIRUVONAM VIZHINJAM STREET	VIZHINJAM
48	DARSAN K R	SEETHA BHAVAN VIZHINJAM STREET	VIZHINJAM
49	ANISHMA M N	SEETHA BHAVAN VIZHINJAM STREET	VIZHINJAM
50	RASHID KHAN S	KHAN MANZIL KAITHAVILKATHUKUZHI	VIZHINJAM
51	AISWARYA LAKSHMI U S	UDAYA NIVAS VIZHINJAM STREET	VIZHINJAM
52	ANJANA S M	CHERIYA KUZHIYAMVILA VEEDU	MULLOOR
53	ANJALI ANTONY	SHALOM BHAVAN CHEMAVILAKAM PURAYIDAM	MULLOOR
54	AHALYA C R ISSAC	CHRIST HOME KIDARAKUZHI	MULLOOR
55	JITHU J JAYAN	VAZHAVILA VEEDU THALACODE	MULLOOR
56	APPU A L	ACHU NIVAS MELEKUNNATH	MULLOOR
57	ADITHYA B	POTTAVILA PUTHEN VEEDU	MULLOOR
58	SANDRA C S	VALLAYAMNINNAVILA THEKKARIKATHU	MULLOOR
59	ABHIRAMI CHANDRAN	PANAVILACODU VADAKKETHATTU VEEDU	MULLOOR
60	VAISHNAVI U M	KANJIRAMNINNAVILA VEEDU	MULLOOR
61	ABHIJITH MS	MANIKANDA SADANAM THANNININNAVILA	MULLOOR
62	SAJIN S R	SUNILBHAVAN KUZHIYAMVILA	MULLOOR
63	DEVAYANI B H	DEVU BHAVAN SREE NEELAKESHI BUILDING	VENGANOOR
64	PAVITHRA D	SHAYMAVILA PUTHEN VEEDU	VENGANOOR
65	NIHA FATHIMA S S	FAZIL MANZIL KIDARAKUZHI	VENGANOOR
66	ATHUL S JAYAN	MUDUPARAVILA THOTTARIKATHU VEEDU	VENGANOOR
67	JEENA Y	KUNJUVEEDU PURAYIDAM	VENGANOOR
68	ARAVIND S S	CHANDAVILA VEEDU KIDARAKUZHI	VENGANOOR
69	PRAVEEN J	QUEEN MARY HOUSE KARIKAATU KALLUVILA	VENGANOOR
70	SIJIN SABOOL	TC 59/2009 (2) BETHEL KARIKKATTU KALLUVILA	VENGANOOR
71	BISMI N	A F MANZIL PIRAVILAKAM NEAR L P S	VENGANOOR
72	DRISHYA T S	FLEMING NIVAS KARIKKATTUVILA THENOORKONAM	VENGANOOR

Annexure V

Compliance to Conditions of KCZMA Recommendation

Annexure V

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
(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 State Pollution Control Board vide Consent No. PCB/HO/TVM/ICE-R/02/2018, dated 19.07.2018 valid up to 31.07.2023. • Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 7.12.2015. • 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 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 IX**. All work plans are executed

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		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 Kerala State Pollution Control Board 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.
(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 wastes are not discharged into the backwater area/sea.	**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. Currently no effluent is generated. Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner is being planned and will be implemented in line with CRZ Notification along with the commissioning of the project.
(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.	**Being Complied** NGT Expert committee and Shoreline monitoring cell visited the site visited the site on 19.04.2022 during the compliance period. All necessary facilities/support was extended to the officials during the compliance review/site visit; and the same will be provided during any future planned inspection of the project site. All necessary support will be extended to officials of

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		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. • 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 2022: • No dredging or reclamation was carried out during the compliance period from April 2022 to September 2022. During previous compliance periods, the dredged material amounting to 2.90 Mm^3 has been utilized for reclamation. • Berth Construction: Piling (617 nos.) and casting of pile muffs (617 nos.) have been completed. • Breakwater construction is in progress • Boundary wall work along available front has been completed at various locations; remaining construction work is, on hold due to local issues or not handed over to AVPPL due to disputes. • Following buildings construction work are completed: Gas Insulated Substation (GIS) substation, Substation building (Inside port), Port Operations Building (POB), Port Canteen, Toilet Block-2, Training Room and Custom Check Building, RMU buildings-yard, RMU buildings-berth, Workshop Building, Gate Complex • Following construction work is in progress: Driver Rest Room, DG Shed Building, Water Tank & Pump House, Security Building, Port User Building (PUB) Building, Parking Shed for fire tenders, Storm Water Drain, Yard Development, Approach Road,

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2022 to September 2022		
S. No.	**Conditions**	**Compliance Status as on 30.09.2022**
		Paver Blocks, Electrical Works Contractors could not carry out any activities at the project site since 16.08.2022 due to protests by the Latin Archdiocese and others. As on the end of the compliance period, the situation has not subsided and construction has been affected due to the ongoing agitation by the local people. Work shall resume once the site situation is conducive for construction activities.
(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) which is having validity up till 02.01.2025.
(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 environment protection measures as per the EIA report. Till date, an amount of Rs. 23.48 Crores has been spent on environmental protection measures. The activity wise fund break up and expenditure is enclosed as **Annexure VIII**.
(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 VI

Compliance of the Commitments made during Public Hearing

Annexure VI

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
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. 101.86 Crores was sanctioned by GoK, instead of Rs. 8.55 crores; as suggested earlier in the EIA stage. Till date an amount of Rs. 99.94 crores have been disbursed till 30.09.2022 for a total number of 2640 Livelihood Affected Persons (LAPs) whose verification was complete in all respects; this includes boat owners to whom kerosene is supplied free of cost as well during the port construction period. Verification of the documents of few balance LAPs is in progress. *(Source: VISL)* There are 5 identified EMP areas: Port Site, Road/Rail Corridor, Warehouse Area, PAF (Project Annex Facility) and Backup Areas. Recommendations of the construction stage EMP for these areas are being implemented and strict adherence to EMP compliance with all relevant rules and regulations is being done. Status of construction stage EMP in matrix format is enclosed as **Annexure VII**.
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 procured land has been disbursed along with R&R package. Same policy will be followed for the remaining extent of land acquisition also viz-a-viz applicable. *(Source: VISL)*
4	Additional fish landing centre will be constructed	**Being Complied** Based on Central Water and Power Research Station (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

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
		forward to build the additional fish landing centre to facilitate the local fishermen. Design and estimates are being prepared by Harbour Engineering Department (HED) and once those are finalised and submitted to Vizhinjam International Seaport Limited (VISL), the extension of the seaward breakwater of the old fishing harbour and new fish landing centre would be taken up by GoK. *(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 have formed a high-level committee for finalising the master plan of the old fishing harbour in consultation with all 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
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 for a stretch of 40 km (20 km on both sides of the project site) is being done and reports are being regularly submitted to MoEF&CC as a part of the HYCR. 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 Observations • Tide Observations • Weather Observations • Water Sampling

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
		• Turbidity Regular shoreline monitoring has been carried out during the compliance period till 15.08.2022. SAC could not conduct shoreline monitoring and field data collection along the coastal areas and at the port site since 16.08.2022 due to protests by the Latin Archdiocese and others. As on the end of the compliance period, the situation has not subsided and the shoreline monitoring has been affected due to the ongoing agitation by the local people. Shoreline Monitoring Report by SAC for the period April 2022 to September 2022 is enclosed as **Annexure I**. SAC shall resume the full scope of shoreline monitoring once the safe and secure working condition at site is ensured. L&T IEL had prepared Mathematical Modelling Reports based on 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 As per the instructions of the NGT Appointed Shoreline Monitoring Cell vide Minutes of Meeting dated 19.04.2022, *The reporting period of NIOT shall be half yearly verified with LNTIEL analysis period and shall match with EC compliance reporting period*. Therefore, as a part of data synchronization with the HYCR Period (October – March and April – September), Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data from March 2021 to

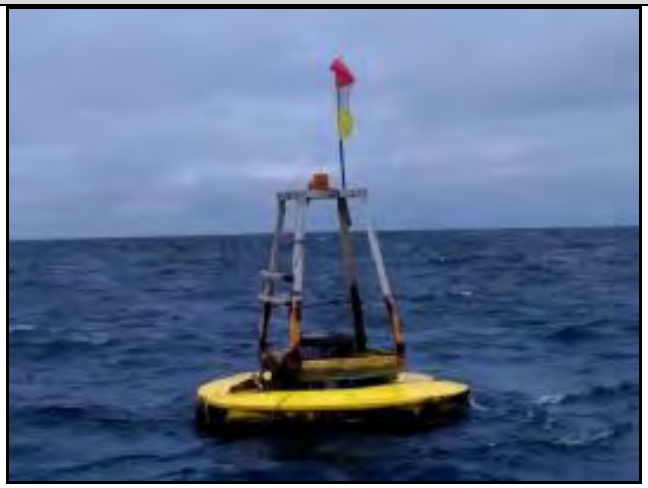
Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
		September 2022 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. Hereafter, the data period for the mathematical modelling reports will be October to September. The mathematical modelling report for the period March 2021 to September 2022 vetted by NIOT is given as **Annexure II**. From all the data analyses and model studies carried out by L&T IEL, it has been concluded that there was minimal variation on shoreline, beach morphology and water quality compared to the previous years and that the port construction has not caused any unnatural changes to these parameters in the vicinity of the port.
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. 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 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. *(Source: VISL)*

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
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 and hydrogeological studies have also been completed. EC amendments in this regard had been submitted to MoEF&CC. The Expert Appraisal Committee (EAC) during their 308th meeting considered this amendment on 15.09.2022. As per the MoM, EAC had observed that the proposed changes should be considered as scope change rather than amendment. The scope change and other observations/clarifications sought by the committee are under preparation for further submission for the EC proposal. *(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 626 persons (employees, staff and construction workers) engaged at site for different construction activities during the compliance period, 323 people are from Kerala and out of them 134 are from nearby wards of the project site. Manpower details for the month of September 2022 were not captured due to the ongoing agitation by Latin Archdiocese and others since 16.08.2022.
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	**Being Complied** Adequate budgetary provision has been kept for waste management as part of EMP as well as

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
	the SWMP.	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 IV**).
17	Upgradation of PHC at Vizhinjam will be carried out	**Being Complied** The construction work of Community Health Center at Vizhinjam has been resumed after the COVID restrictions. The project cost is Rs. 779 Lakhs where the Government component of Rs. 482 lakhs and CSR component of Rs. 297 lakhs from Adani Foundation. Adani Foundation handed over the first instalment of Rs. 118 Lakhs to the Harbour Engineering Department (HED) on 03.10.2018 and have initiated the process to transfer the second instalment of Rs. 118 Lakhs to HED. Most electrical works, plumbing works and cement mortar plastering for terrace area are completed.  **Community Health Centre, Vizhinjam**
19	Appropriate compensation will be given to the resort	**Being Complied** Resort owners evicted have been compensated

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
	owners as per the regulatory advice of KCZMA and MoEF since the resorts are seen to be located in No Development Zone (NDZ) as per CRZ Notification 2011	for land and not for the structures since they were in violation of CRZ notification. Remaining land of 2.865 Ha to be acquired by Land Acquisition (LA) process for which notification has been published and action initiated by the District Collector Thiruvananthapuram. *(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** This is one of the objectives 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 and hydrogeological studies have also been completed. EC amendments in this regard had been submitted to MoEF&CC. The Expert Appraisal Committee (EAC) during their 308th meeting considered this amendment on 15.09.2022. As per the MoM, EAC had observed that the proposed changes should be considered as scope change rather than amendment. The other observations/ clarifications requested by the committee are under preparation for the EC proposal. 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. Inland Waterways connectivity is being ensured to the rest of Kerala by Irrigation Department of the GoK by developing inland navigation channels. *(Source: VISL)*
21	Waste Management, Water	**Being Complied**

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
	Treatment plants, etc. will be part of an operational EMP	Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner is being planned and will be implemented in line with CRZ Notification along with the commissioning of the project.
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** No dredging was carried out during the compliance period from April 2022 to September 2022. The dredged material till 30.09.2022 amounting to 2.90 Mm^3 has been utilized for reclamation of 36 Ha area. The dredged material has been used for reclamation. Turbidity buoys at 3 locations identified by NIOT had been deployed in the month of November 2019 and continuous monitoring was carried out to assess the real time turbidity. The turbidity details for the compliance period are given in **Annexure I**. On 30.08.2022, it was noticed that Turbidity Buoy 2 was found marked with a red, white and yellow flag (placed by some of the fishermen who are protesting the development of Vizhinjam Port). On 12.09.2022, the shoreline monitoring team informed that the flagged Turbidity Buoy 2 was missing from its deployed location and hence data collection from this buoy could not be carried out since. A report has been filed on this behalf at the local police and coastal police stations.

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
		 **Flagged Turbidity Buoy-2**
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 IX**. 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 addressed as per the EIA report	**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 compensation amount totalling to Rs. 12.35 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)*

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
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 IV**. Status of construction stage EMP in matrix format is enclosed as **Annexure VII**.
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 2022 to September 2022 is enclosed as **Annexure III**. 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 2021 to March 2022 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA via email dated 28.05.2022 (a copy of the email is enclosed as **Annexure XVI**).
28	Special care will be taken to minimise the tree felling in the backup area and to plan the development in tune with the topography.	**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 compensatory afforestation of approximately 15,540 trees on 12.05 Ha land; as

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
		identified by social Forest Department in Sainik School, Trivandrum (at an aerial distance of 24 km from the Vizhinjam Port project site). Rs. 80.50 Lakhs has been spent towards Phase-I of the compensatory afforestation at Sainik School. The plantation is in third year of development.
31	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	**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 effect has been issued on 31.05.2018 and compensation has been disbursed to 600 eligible fishermen amounting to a total of Rs. 35.13 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** The final Integrated Area Development Plan prepared through CEPT University, Ahmadabad in consultation with Town Planning, Tourism, Industry and other line departments was reviewed by the expert committee constituted by GoK. Tourism management plan would be discussed with tourism department for a way forward. *(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	**Being Complied** Details of CSR activities carried out during the compliance period are given in **Annexure IV**.

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
	through well designed area development plan will arrest the formation of slums and the like.	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. *(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 VII** 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 local residents will not be affected.
46	Reconstruction of Roads in the nearby area- Adequate	**Being Complied** Being complied on a routine basis through HED;

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S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
	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	the maintenance agency for the fishing harbour and the coastal road network.
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 at imparting skill courses to students for improving their employability. No Objection Certificate (NoC) has been granted to ASAP to proceed with the construction of a Community Skill Park (CSP) in an area of 1.5 acres of land at Vizhinjam. It will operate on a PPP model wherein 25,000 sq. ft. building with facilities for students' hostel are being constructed by GoK under ASAP with ADB assistance, whereas the operation of the centre with logistics and other high-end courses is vested with Adani Skill Development Centre. CSP building construction is 85% completed inside Vizhinjam Port area 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. Adani is planning to start High End Port related courses accordingly to the anticipated vacancies abroad as well as in the top organizations. ASAP is planning to handover the building by the end of December 2022 once the building is commissioned. Preference is being given to local people based on Skill & competency during the construction stage. Out of an average of 626 persons (employees, staff and construction workers) engaged at site for different construction activities during the compliance period, 323 people are from Kerala and out of them 134 are from nearby wards of the project site. Work at

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2022**
		site was suspended since 16.08.2022 due to the strike and ongoing agitation by Latin Archdiocese and fishermen.
51	Only prohibited area for fishing is inside the breakwater. However fishing will be restricted along ship channel and port limits subject to safety norms and operational requirements.	**Will be Complied** 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 covering the Kovalam-Vizhinjam-Poovar tourism corridor.

Annexure VII

Status of Environment Management Plan

Annexure VII

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 30.09.2022**
1	Capital dredging	Marine water quality Marine ecology	○ Check turbidity levels with baseline levels as reference during entire monitoring programme ○ Preparation of Dredge/reclamation Management plan ○ Discharge of waste into sea will be prohibited ○ Oil Spill control measures will be adopted ○ Ensure that slop tanks will be provided to barges/ workboats for collection of liquid/ solid waste ○ Marine environmental monitoring as per environmental monitoring programme	**Being Compiled** ○ No dredging was carried out during the compliance period from April 2022 to September 2022. During previous compliance periods, the dredged material amounting to 2.90 Mm^3 has been utilized for reclamation. ○ Turbidity buoys at 3 locations identified by NIOT are carrying out real time turbidity measurement. ○ Dredging Management plan has been prepared ○ Discharge of waste into sea is prohibited and not being carried out ○ 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. Considering that the procurement of pollution response equipment will be in line with the

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 30.09.2022**
				development of the port, the final OSDCP will be submitted to ICG for approval prior to commissioning of the port; when the pollution response equipment are in place. In the meantime, a Shipboard Emergency Plan is in place along with procedures for reporting oil pollution incidents, a listing of authorities to be notified; a detailed description of actions to be taken by the vessel's crew to reduce or control an oil discharge, and procedures for co-coordinating shipboard activities with national and local authorities. ○ Slop tanks will be provided to barges for collection of liquid/ solid waste ○ 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. ○ Six monthly monitoring reports are regularly submitted to regulatory authorities as a part of Half Yearly Environmental & CRZ clearance Compliance Reports (HYCRs).
2	Material transport and	Air Quality	○ Most of the Breakwater stones will be transported from the quarries to the nearest harbour.	**Being Complied** ○ Rock placing for breakwater construction is being undertaken using the stones brought through barges

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 30.09.2022**
	construction activities		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 equipment etc.	from nearby harbours (Kollam and Muthulapuzhi). 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 30.09.2022**
			○ Provide enclosures on all sides of construction site ○ Movement of material will be mostly during non-peak hours. ○ On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic ○ Water sprinkling will be carried out to suppress fugitive dust ○ Environmental awareness program will be provided to the personnel involved in developmental works ○ Use of tarpaulin covers and speed regulations for vehicles engaged in transportation	
		Noise	○ Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB ○ Procurement of machinery / construction equipment will be done in accordance with	**Being Complied** ○ Noise levels are being monitored every fortnight and are found to be well within the permissible limits within the project area. ○ Contractors are also monitoring the Noise level in their work area and results are within the stipulated limits. ○ Protective gear like earplugs, muffs are provided to workers exposed to noise level beyond threshold limits.

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 30.09.2022**
			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 Acoustic Barriers and Enclosures shall be set up wherever necessary for noisy equipment. o No pilling activity carried out during the compliance period from April 2022 to September 2022. o No dredging activity carried out during the compliance period from April 2022 to September 2022.

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 30.09.2022**
			○ Ambient noise levels will be monitored at regular intervals	
		Disturbance to Natural Drainage pattern	○ Port development is mostly on reclaimed land ○ Rainwater/surface water harvesting pond included in design ○ Existing drainage near port boundary (backup area) will be integrated with port storm water drainage & management plan ○ 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** ○ 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. ○ 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. ○ Provision for installing Sewage Treatment Plant (STP) facility of adequate capacity in phased manner is being planned and will be implemented in line with CRZ Notification along with the commissioning of the project. ○ Drains/streams passing through the warehouse area are not closed/diverted.
		Vegetation and Strain on existing	○ Port development is planned mostly on reclaimed land;	**Being Complied** ○ Care is taken to limit the felling of trees to the bare

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 30.09.2022**
		infrastructure	○ Land use at backup area, PAF Zone and warehouse area will be mostly coconut plantation and low mixed plantation ○ Adequate green belt will be developed in port and its associated (backup area, PAF, warehouse and road & rail connectivity). ○ Temporary workers camp with self-sufficient infrastructure facilities.	minimum. Due permission is taken for trees being cut down as a result of the port development from concerned department (Forest Department). ○ AVPPL, in collaboration with Forest department, have carried out compensatory afforestation of approximately 15,540 trees on 12.05 Ha land; as identified by social Forest Department in Sainik School, Trivandrum (at an aerial distance of 24 km from the Vizhinjam Port project site). The plantation is now in its Third Year. Rs. 80.50 Lakhs has been spent towards Phase-I of the compensatory afforestation at Sainik School. ○ Plantation of saplings along the road margins, road medians and port boundary are being carried out as part of the master plan development/greenbelt development plan. ○ Presently, during the present compliance period, the contractors have demobilized and there are no workers residing in the labour camps. It is ensured that labourers who are staying outside the labour camps are provided with necessary infrastructure facilities.
		Existing Traffic	○ NH-47 bypass under construction around 2.0 km from the proposed Port site and the Transportation	**Being Complied** ○ Presently, 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

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 30.09.2022**
			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	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. 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 Rock placing for breakwater construction is being carried out using the stones brought through barges from nearby harbours (Kollam and Muthulapuzhi). 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 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-

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 30.09.2022**
				IA.III. The Expert Appraisal Committee (EAC) during their 308th meeting considered this amendment on 15.09.2022. As per the MoM, EAC had observed that the proposed changes should be considered as scope change rather than amendment. The scope change and other observations/clarifications sought by the committee are under preparation for further submission for the EC proposal. *(Source: VISL)*
3.	Land Reclamation	Existing Water Resources like Groundwater and surface water	○ Land to be reclaimed will be separated from adjoining land by creating containment bund. ○ Return sea water will be sent back to sea through appropriate channels.	**Being Complied** ○ No dredging was carried out during the compliance period from April 2022 to September 2022. During previous compliance periods, the dredged material amounting to 2.90 Mm^3 has been utilized for reclamation. ○ The dredged material has been used for reclamation. ○ During dredging return sea water is sent back to sea through appropriate channels. ○ The existing drains are maintained for unhindered disposal of surface drainage water.
4.	Solid Waste Management	Soil quality	○ Construction waste will be used within port site for filling of low lying areas. ○ Composted bio-degradable waste will be used as manure in greenbelt.	**Being Complied** ○ Construction waste is used within port site for filling of low lying areas in line to C&D Waste Management Rules 2016, as amended. ○ Contractors working at the site have been made responsible for management of Solid Waste during

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 30.09.2022**
			○ Other recyclable wastes will be sold. ○ 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. ○ General refuse generated on-site will be collected in waste skips and separated from construction waste. ○ Burning of refuse at construction sites will be prohibited. ○ All control measure will be taken to avoid the contamination of groundwater during construction phase	construction stage. They are complying with the provisions pertaining to management of Solid Waste in line to Solid Waste Management Rules 2016, as amended. ○ 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. ○ General refuse waste is being stored separately and sent to approved recyclers and/or sold. ○ No burning of refuse at construction sites is being done. ○ 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	○ Adequate safety measures as per OSHA standards will be adopted ○ Construction site will be secured by fencing with controlled/limited entry points. ○ Hazardous materials such as lubricants, paints, compressed	**Being Complied** ○ Adequate safety measures as per OSHA standards are adopted as and when necessary as per the HSE Plan. ○ Construction site is being secured by fencing wherever possible with controlled/limited entry points. Boundary wall construction is ongoing at available fronts. ○ Medical facilities including first aid are available for attending to injured workers. Ambulance is also available

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 30.09.2022**
			gases, and varnishes etc., will be stored as per the prescribed/approved safety norms. ○ Medical facilities including first aid will be available for attending to injured workers. ○ Handling and storage as per statutory guidelines. ○ Positive isolation procedures will be adhered ○ Hazardous wastes will be disposed through approved KSPCB/CPCB vendors.	at site for shifting the injured to the nearby hospitals. ○ Handling and storage of Hazardous Materials is being done as per statutory guidelines. ○ Hazardous waste is disposed through approved KSPCB/CPCB vendors.
6.	Water Resources	Water scarcity / Pollution	○ Water requirement during the construction is expected to be around 0.10 MLD ○ Water will be sourced from Vellayani lake ○ Avoid/minimise the loss during conveyance ○ Optimized utilization of the water ○ Care will be taken to prevent the runoff from the construction site	**Being Complied** ○ 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 30.09.2022**
			to the nearby natural streams, if any	○ The water for construction purposes for the port is being sourced from the open market/private suppliers. On an average about 14 KLD water is being consumed for construction related activities during the compliance period (April 2022 to September 2022). ○ Care is being taken to prevent the runoff from the construction site to the nearby natural streams.
7.	Fishing	Fishermen and fishing villages	○ Signboards will be placed at the construction activities in order to make fishermen aware of the ongoing construction activities ○ Necessary marker buoys will be installed ○ Interactions will be initiated with the fishing community before commencement of construction works	**Being Complied** ○ Signboards have been placed for demarcation of construction area. ○ Navigational buoys/marker buoys are placed in the marine area for fishing boats to maintain a safe distance from the areas of breakwater construction. ○ 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. ○ 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	○ Tourism activity is observed at Kovalam located about 2.0 km	**Being Complied** ○ 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 30.09.2022**
			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. ○ A cruise terminal and related facilities is part and parcel of the project. This is to largely compensate the losses made ○ For all acquired properties and land adequate compensation will be provided based on legally valid documents	impacted by the construction of the port. ○ 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. ○ 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 covering the Kovalam-Vizhinjam-Poovar tourism corridor ○ 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 to be acquired by Land Acquisition (LA) process for which notification has been published and action initiated by the District Collector, Thiruvananthapuram. *(Source: VISL)*
9	Breakwater	Change in shoreline	○ Shoreline monitoring shall be carried out ○ Suitable Shoreline protection measures will be implemented based on the observations	**Being Complied** ○ 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:

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 30.09.2022**
				○ 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 Observations ○ Tide Observations ○ Weather Observations ○ Water Sampling ○ Turbidity Measurements ○ 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). ○ Several mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC. These mathematical modelling reports have affirmed that the shoreline change is in line with prediction in the EIA study. As per these reports, from all the data analyses and model studies carried out by L&T IEL, it can be concluded that there was minimal variation on

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 30.09.2022**
				shoreline, beach morphology and water quality compared to the previous years and that the port construction has not caused any unnatural changes to these parameters in the vicinity of the port.
10	Effect on existing fishing harbour	Movement of fishing boats	○ 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 construction of the port. Further minor accretion happening within the fishing harbour will be arrested ○ Traffic of Marine vessel/ fishing boats will be planned without affecting each other ○ Adoption of fishing harbour to manage it to perform as per International standard ○ A new fishing harbour provided under CSR initiatives because of	**Being Complied** ○ 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. ○ During operation phase traffic of Marine vessel/fishing boats will be planned without affecting each other as per the applicable laws. ○ Based on studies on tranquillity Central Water and Power Research Station (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 to facilitate the local fishermen. Design and estimates are being prepared by HED and once those are finalised and submitted to VISL, the extension of the seaward breakwater of the old fishing harbour and new fish landing centre would be taken up by GoK. *(Source: VISL)*

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 30.09.2022**
			additional tranquillity creator. ○ Loss of livelihood will be either taken care of in the new port premises or adequately compensated mostly in the form of employment	○ In consultation with the fishermen, enhanced livelihood compensation of Rs. 101.86 Crores was sanctioned by GoK, instead of Rs. 8.55 crores; as suggested earlier in the EIA stage. Till 30.09.2022 an amount of Rs. 99.94 crores have been disbursed for a total number of 2640 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. Verification of documents of a few remaining LAPs is in progress. *(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** ○ NIOT has been engaged to give technical advice on aspects related to shoreline monitoring & shoreline evolution. ○ 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. ○ Wave, current and tide data are being monitored a 40 km stretch. ○ L&T IEL had prepared Mathematical Modelling Reports based on Shoreline Monitoring data; which were vetted by NIOT.

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 30.09.2022**
				○ Several mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC. These mathematical modelling reports have affirmed that the shoreline change is in line with prediction in the EIA study. As per these reports, from all the data analyses and model studies carried out by L&T IEL, it can be concluded that there was minimal variation on shoreline, beach morphology and water quality compared to the previous years and that the port construction has not caused any unnatural changes to these parameters in the vicinity of the port.

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 30.09.2022**
1	Environmental Management and Monitoring Facility Equipment for EMP (Meters, Vehicles and Buildings)	○ This will include institutional requirements, training, environmental management and monitoring. Provision for purchasing required equipment.	**Noted for Compliance** ○ An Environment Management Cell has been established to look after day to day affairs like Monitoring, Training ○ 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 IX**. ○ 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. ○ Necessary equipment will be purchased; adequate provisions have been made in the budget for the same. ○ Third party environmental monitoring has commenced since August 2016 and the monitoring results are satisfactory.
2	Altered Road	○ Retaining walls and gabions should be provided	**Noted for Compliance** ○ AVPPL had awarded the work to Kerala State Remote

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 30.09.2022**
	embankment		Sensing and Environment Centre (KSREC) to undertake study on Groundwater impact due to construction of port approach road. ○ 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.
3	Dust	○ Water should be sprayed during the construction phase, at mixing sites, and temporary roads. ○ 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. ○ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load.	**Being Compiled** ○ Regular Water Sprinkling is done on the approach road by water tankers. ○ Water spraying is carried out at regular intervals after compaction ○ Tarpaulin cover is used in vehicles delivering materials.
4	Air Pollution	○ Vehicles and machinery are to be maintained so that emissions conform to National and State standards. ○ All vehicles and machineries should obtain Pollution Under Control Certificates (PUC).	**Being Complied** ○ 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 Standards (NAAQS) ○ It is ensured that all vehicles entering port have Pollution

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 30.09.2022**
			Under Control (PUC) Certificate.
5	Noise	○ Machinery and vehicles will be maintained to keep their noise to a minimum. ○ Construction of noise barriers of an average length of 100m and eight feet height wherever necessary. ○ Proper maintenance of the rail track and rail wagon, by frequent lubrication to avoid frictional noise. ○ Regular monitoring shall be carried out as per the Environmental Monitoring Plan.	**Being Compiled** ○ All the machinery and vehicles are maintained to keep the noise at minimum ○ Noise monitoring is being done since August 2016, and the readings are within the limits at port site ○ 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	○ Impacted ponds can be enhanced by constructing bridged structures like Gabions to avoid plugging of springs. ○ Mitigation/Compensation shall be affected for the completely impacted ponds. ○ 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 excavated to compensate the loss of effective pond area.	**Will be complied** ○ 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. ○ 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. ○ 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

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 30.09.2022**
			been approved by Southern Railway. Geophysical and geomorphological 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 meeting considered this amendment on 15.09.2022. As per the MoM, EAC had observed that the proposed changes should be considered as scope change rather than amendment. The scope change and other observations/clarifications sought by the committee are under preparation for further submission for the EC proposal. *(Source: VISL)*
7	Flood Impacts and Cross Drainage Structures	○ Formation level should be raised according to the design and the cross drainage structures suitably planned for the flood events.	**Being Complied** ○ 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	○ 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. ○ 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	**Will be Complied** ○ 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. ○ 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 30.09.2022**
		systems in conformity to the Contractors visual integration and management plan and EMP.	
9	Contamination from Wastes	○ All justifiable measures will be taken to prevent the wastewater produced during construction from entering directly into rivers and irrigation systems.	**Being Complied** ○ Measures are being taken up to prevent the wastewater produced during construction from entering directly into rivers and irrigation systems. ○ 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. ○ No waste water is disposed into the water bodies.
10	Borrow pits	○ 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	○ 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	○ On slopes and other suitable places along the two proposed corridors, trees and grass should be planted. ○ On sections with filling and deep cutting their slopes should be covered by sod, or planted with grass, etc. ○ If existing irrigation and drainage system, ponds are damaged, they will be suitably	**Will be Complied** ○ 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 recommendations and AVPPL is in the process of constructing the approach road to port. ○ Suitable mitigation measures as suggested in the KSREC report will be adopted during construction.

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 30.09.2022**
		repaired. o Retaining walls and gabions shall be suitably provided.	
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 AVPPL, in collaboration with Forest department, have carried out compensatory afforestation of approximately 15,540 trees on 12.05 Ha land; as identified by social Forest Department in Sainik School, Trivandrum (at an aerial distance of 24 km from the Vizhinjam Port project site). The plantation is now in its Third Year. Rs. 80.50 Lakhs has been spent towards Phase-I of the compensatory afforestation at Sainik School. o Plantation of saplings along the road margins, road junctions and road medians are being carried out as part of the master plan development/greenbelt development plan.

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 30.09.2022**
16	Vegetation clearance	○ Tree clearing within the ROW should be avoided beyond that which is directly required for construction activities and/ or to reduce accidents. ○ Especially in plantation and house garden areas both along road and rail alignment.	**Being Complied** ○ 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).
17	Fauna	○ Construction workers should protect natural resources and animals. Hunting of birds and other local animals is prohibited.	**Being Complied** ○ Regular awareness sessions are conducted for the construction workers regarding importance of natural resources and animals. ○ Hunting of birds & other local animals is strictly prohibited
18	Traffic Jams and congestion	○ 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** ○ 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	○ 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** ○ All the workers are provided with Personal Protective Equipment's (PPE) and it is ensured that they wear it all the time ○ 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	○ 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** ○ Construction materials/waste are being disposed properly; so as not to block or pollute streams or ponds.

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 30.09.2022**
21	Cultural Remains	○ Construction should be stopped until authorised department assess the remains to preserve Archaeological relics and cultural structures like Temples, mosques and churches. ○ Archaeologists will supervise the excavation to avoid any damage in the relics.	**Will be Complied** ○ 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 30.09.2022**
1	Material transport and construction activities	Air Quality/Dust	○ To reduce impacts from exhausts, emission control norms will be enforced / adhered. ○ All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards. ○ Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt. ○ Providing adequately sized construction yard for storage of construction materials, equipment, tools, earthmoving equipment, etc. ○ Provide enclosures on all sides of construction site ○ Movement of material will be mostly during non-peak hours. ○ On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic ○ Water should be sprayed during the construction phase, at mixing sites, and temporary roads. ○ In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried	**Complied** ○ Monthly Environment Monitoring is being carried out and all the parameters are within the stipulated limit ○ It is ensured that all vehicles entering the area have a valid PUC certification ○ It is ensured that all the vehicles entering the site are following speed limit ○ Tarpaulin cover is used in vehicles ○ Water sprinkling is carried out to arrest dust generation. ○ 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 30.09.2022**
			out at regular intervals to prevent dust. ○ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ○ Environmental awareness program will be provided to the personnel involved in developmental works. ○ Use of tarpaulin covers and speed regulations for vehicles engaged in transportation.	
		Noise	○ Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB. ○ Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A). ○ Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used ○ Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors. ○ Noise attenuation will be practiced for noisy equipment by employing suitable techniques	**Complied** ○ Ambient Noise is being monitored fortnightly for Day & Night time and results are within the prescribed limit. ○ Construction equipment machinery procurement is done in accordance with specifications conforming prescribed standard. ○ 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 30.09.2022**
			such as acoustic controls, insulation and vibration dampers. ○ High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimize noise impacts. ○ Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. ○ Ambient noise levels will be monitored at regular intervals	
2	Construction of Buildings, Roads, Sheds, etc.	Vegetation and Strain on existing infrastructure	○ 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** ○ 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). ○ AVPPL, in collaboration with Forest department, have carried out compensatory afforestation of approximately 15,540 trees on 12.05 Ha land; as identified by social Forest Department in Sainik School, Trivandrum (at an aerial distance of 24 km from the Vizhinjam Port project site). The

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 30.09.2022**
				plantation is now in its Third Year. Rs. 80.50 Lakhs has been spent towards Phase-I of the compensatory afforestation at Sainik School.
		Water Environment	○ The streams 1 and 2 will be made to avoid entering the warehouse area by diverging them into the Karichal River. ○ 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. ○ Another option is to divert the stream through the boundary ○ An application has been filed with the irrigation department for permission.	**Will be Complied** ○ Will be appropriately planned in consultation with the concerned departments
			○ 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.	**Will be Complied** ○ Will be appropriately planned in consultation with the concerned departments

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 30.09.2022**
			○ Filling of low lying areas (if required) shall be done	
			○ Construction waste such as cement, paint, and 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.	**Will be Complied**
		Disturbance to Natural Drainage pattern	○ 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. ○ 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. ○ 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	**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 30.09.2022**
			conformity EMP.	
		Existing Traffic	○ Transportation of construction materials will be carried out during non- peak hours. ○ Regularization of truck movement. ○ Existing roads shall be strengthened and shall be used for the construction material transportation.	**Will be Complied**
3	Solid Waste Management	Soil quality	○ Construction waste will be used within warehouse site for filling of low lying areas. ○ Composted bio-degradable waste will be used as manure in greenbelt. Other recyclable wastes will be sold. ○ Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. ○ General refuse generated on-site will be collected in waste skips and separated from construction waste. ○ 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 30.09.2022**
1	Material transport and construction activities	Air Quality/Dust	○ To reduce impacts from exhausts, emission control norms will be enforced / adhered. ○ All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards. ○ Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt. ○ Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc. ○ Provide enclosures on all sides of construction site ○ Movement of material will be mostly during non-peak hours. ○ On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic ○ Water should be sprayed during the construction phase, at mixing sites, and temporary roads ○ 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** ○ Monthly Ambient Air Monitoring is being carried out and all the parameters are within the stipulated limits. ○ It is ensured that all vehicles entering the area have a valid PUC certification ○ Vehicles entering the site are following speed limit. ○ Tarpaulin cover is used for vehicles transporting the construction material ○ Water sprinkling is carried out on the temporary roads by contractors ○ 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 30.09.2022**
			○ Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. ○ Environmental awareness program will be provided to the personnel involved in developmental works. ○ Use of tarpaulin covers and speed regulations for vehicles engaged in transportation.	
		Noise	○ Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB. ○ Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A). ○ Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used ○ Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors. ○ Noise attenuation will be practiced for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. ○ High noise generating activities such as piling	**Complied** ○ Ambient Noise is being monitored fortnightly for Day & Night time and results are within the prescribed limits. ○ Construction equipment machinery procurement is done in accordance with specifications conforming prescribed standard. ○ 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 30.09.2022**
			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 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 compensatory afforestation of approximately 15,540 trees on 12.05 Ha land; as identified by social Forest Department in Sainik School, Trivandrum (at an aerial distance of 24 km from the Vizhinjam Port project site). The plantation is now in its Third Year. Rs. 80.50 Lakhs has been spent towards Phase-I of the compensatory afforestation at Sainik School.

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 30.09.2022**
				○ Land acquisition has been completed by following due process.
		Existing Traffic	○ Transportation of construction materials will be carried out during non-peak hours. ○ Regularization of truck movement. ○ The existing roads shall be strengthened and shall be used for the construction material transportation.	**Being Complied** ○ Transportation of construction materials is being carried out taking into account the non-peak traffic timing and local restrictions during festivals, strikes, etc. ○ Traffic monitoring & regularization is being carried out for maximum efficiency. ○ Existing roads are being used for transportation of construction material.
		Solid Waste	○ Construction waste will be used within port site for filling of low lying areas. ○ Composted bio-degradable waste will be used as manure in greenbelt. Other recyclable wastes will be sold. ○ Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. ○ General refuse generated on-site will be collected in waste skips and separated from construction waste. ○ Burning of refuse at construction sites will be prohibited.	**Being Complied** ○ Construction waste is used within port site for filling of low lying areas in line to C&D Waste Management Rules 2016, as amended. ○ No burning of refuse at construction sites is being done. ○ 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 30.09.2022**
1	Material transport and construction activities	Air Quality	○ To reduce impacts from exhausts, emission control norms will be enforced / adhered. ○ All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards ○ Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt ○ Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc. ○ Provide enclosures on all sides of construction site ○ Movement of material will be mostly during non-peak hours. ○ On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic ○ Water sprinkling will be carried out to suppress fugitive dust ○ Environmental awareness program will be provided to the personnel involved in developmental works ○ Use of tarpaulin covers and speed regulations for vehicles engaged in transportation	**Being Complied** ○ 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 ○ It is ensured that all vehicles entering the port have PUCs ○ Water sprinkling is being carried out at regular intervals over the temporary road during transportation of materials. ○ All the trucks transporting material are covered by tarpaulin cover. ○ Signage's for speed control are placed within the port area ○ Adequate storage for construction material is provided within the port area on reclaimed land ○ 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 30.09.2022**
		Noise	○ Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB ○ Procurement of machinery/construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A) ○ Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used ○ Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors ○ Noise attenuation will be practiced for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers ○ High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimise noise impacts ○ Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. ○ Ambient noise levels will be monitored at regular intervals	**Being Compiled** ○ All the machinery and vehicles are maintained to keep the noise at minimum ○ 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. ○ Personnel exposed to noise levels beyond threshold limits are provided with protective gear. ○ No pilling activity carried out during the compliance period from April 2022 to September 2022. ○ No dredging activity carried out during the compliance period from April 2022 to September 2022.

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 30.09.2022**
2	Construction Activities	Water Environment	○ Formation level should be raised according to the design and the cross drainage structures suitably planned for the flood events. ○ All justifiable measures will be taken to prevent the wastewater produced during construction from entering directly into the water bodies.	**Being Compiled** ○ 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. ○ 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. ○ No waste water is disposed into the water bodies.
		Land Environment	○ On slopes and other suitable places along the two proposed corridors, trees and grass should be planted. ○ On sections with filling and deep cutting their slopes should be covered by sod, or planted with grass, etc. ○ If existing irrigation and drainage system, ponds are damaged, they will be suitably repaired. ○ Retaining walls and gabions shall be suitably provided.	**Being Complied** ○ Plantation of saplings along the port boundary are planned as part of the master plan development/greenbelt development plan. ○ Retaining walls or gabions are suitably provided.
			○ Arable land should not be used for topsoil borrowing. ○ Topsoil will be kept and reused after excavation is over.	**Will be Complied** ○ Topsoil is not being used for borrowing. ○ 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 30.09.2022**
			○ Any surplus to be used on productive agricultural land.	and will be utilized for greenbelt development as per the greenbelt development plan.
			○ Construction vehicles should operate within the Backup Areas avoiding damage to soil and vegetation.	**Being Complied** ○ Construction vehicles are being operated only alongside the road and port boundaries; thereby avoiding damage to soil and vegetation.
			○ Areas of trees cleared will be replaced according to Compensatory Afforestation Policy under the Forest Conservation Act - 1980. ○ Landscaping shall be done at major junctions.	Refer point No.15 of Environment Management Plan – Road/Rail Corridors
			○ 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** ○ 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 VIII

EMP Expenditure

adani	Adani Vizhinjam Port Private Ltd	From : April 2022 To : September 2022
Vizhinjam International Deepwater Multipurpose Seaport EMP Expenditure		

EMP Expenditure: **Annexure VIII**

S. No.	Environmental Management Plan	Commitment in EIA	Oct 2016 to Mar 2017	Apr 2017 to Sep 2017	Oct 2017 to Mar 2018	Apr 2018 to Sep 2018	Oct 2018 to Mar 2019	Apr 2019 to Sep 2019	Oct 2019 to Mar 2020	Apr 2020 to Sep 2020	Oct 2020 to Mar 2021	Apr 2021 to Sep 2021	Oct 2021 to Mar 2022	Apr 2022 to Sep 2022	Total Till date
		(in Rs. Crores)													
1	Cost of Contractors EMP for all planned EMP implementation measures (Action plan report)	1	0.08	0.08	0.12	0.47	0.32	-	-	-	-	-	-	-	1.07
2	Cost of Capacity building-Training and Institutional strengthening (Training workshop)	0.2	-	-	-	0.003	-	0.01	-	0.025	-	-	-	0.012	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	-	-	-	0.8	-	-	-	-	-	-	-	-	0.8
4	Air quality monitoring at sensitive locations	0.252	0.27	0.28	0.72	0.21	0.27	0.30	0.29	0.152	0.298	0.27	0.298	0.217	3.575
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	1.059	1.08	1.36	1.68	1.65	1.02	1.52	1.295	1.363	1.84	1.035	1.196	16.098
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	-	-	-	-	-	-	-	-	-	-	0.312	0.66	0.972

adani	Adani Vizhinjam Port Private Ltd	From : April 2022 To : September 2022

Vizhinjam International Deepwater Multipurpose Seaport
EMP Expenditure

S. No.	Environmental Management Plan	Commitment in EIA	Oct 2016 to Mar 2017	Apr 2017 to Sep 2017	Oct 2017 to Mar 2018	Apr 2018 to Sep 2018	Oct 2018 to Mar 2019	Apr 2019 to Sep 2019	Oct 2019 to Mar 2020	Apr 2020 to Sep 2020	Oct 2020 to Mar 2021	Apr 2021 to Sep 2021	Oct 2021 to Mar 2022	Apr 2022 to Sep 2022	Total Till date
		(in Rs. Crores)													
11	Solid waste management (sector wise)-Collection disposal system	2.5	-	-	-	-	-	0.01	-	-	-	-	0.04	0.005	0.055
12	Storm water Management	5	-	-	0.05	-	-	-	-	-	-	-	-	-	0.05
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
15	Dust Sweeper (2 Nos.)	0.6	-	-	-	-	-	-	-	-	-	-	-	-	0
16	Air Pollution Control (Four water tankers for wetting of road surface and springing system)	1	-	-	0.21	0.03	0.03	0.03	0.15	0.1	0.135	-	0.125	-	0.81
17	Water and waste water treatment plants	4	-	-	-	-	-	-	-	-	-	-	-	-	0
18	Battery of toilets with bimonthly maintenance provision	1	-	-	-	-	-	-	-	-	-	-	-	-	0
19	Desilting and strengthen of Streams	0.5	-	-	-	-	-	-	-	-	-	-	-	-	0
20	Enhancement of water bodies (ponds along road & rail)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	0
21	Enhancement of religious structures (Temple)	0.05	-	-	-	-	-	-	-	-	-	-	-	-	0
22	Cultural property rehabilitation cost for sacred grove	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0
	TOTAL	**39.937**	**1.409**	**1.44**	**2.46**	**3.193**	**2.27**	**1.37**	**1.96**	**1.572**	**1.796**	**2.11**	**1.81**	**2.09**	**23.48**

Annexure IX

Environment Health, Safety & CSR Organizational Structure

Annexure IX

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	25 Years	MSW, Phd.	Adani Foundation
4.	Hebin C	Head – Environment	15 Years	MS, Oceanography & Coastal Area Studies	AVPPL
5.	Jesse Benjamin Fullonton	Assistant Manager - Environment	11 Years	BSc. Chemical Tech; Msc. Env. Tech	AVPPL
6.	Kanwar P Malik	Head - Horticulture	17 Years	BSc - Agriculture	AVPPL
7.	Arumugam S	Assistant Manager - Safety, Environment and Health	3 Years	M.Tech – Industrial Safety Engineering	AVPPL
8.	Sebastian Britto. A. G	Programme Manager	26 Years	MA, Economics	Adani Foundation
9.	Rakesh R. S	Sr. Project Officer	25Years	MBA, Bsc Agriculture	Adani Foundation
10.	Stephen Vinod	Project Officer	22 Years	BA, Economics	Adani Foundation
11.	George Zen	Consultant – Livelihood	37 Years	BA, Sociology	Adani Foundation
12.	Maya G	Project Officer Community	13 Years	BA, IT-TTC	Adani Foundation

S. No.	Name	Designation	Experience	Qualification	Organization
		Health			
13.	Meera Mariyam Skariah	Asst. SuPoshan Officer	5 Years	MSW	Adani Foundation
14.	Radha S	Engineer	8 Years	MTech	Adani Vizhinjam Port Pvt. Ltd
15.	Limna B	Senior Assistant	15 Years	Pre-degree, ITI	Adani Vizhinjam Port Pvt. Ltd
16.	Anurag MJ	Project Officer	9 Years	MSc. Computer Science	Adani Skill Development Centre
17.	Sreejith	Placement Manager	9 Years	MBA (Marketing)	Adani Skill Development Centre
18.	Kavitha TR	Trainer – Language & Soft Skill	14 Years	MA, B.Ed. (Eng.), SET, CTET, MA Sociology	Adani Skill Development Centre
19.	Neethu V Nath	Trainer – Domestic Data Entry Operator	4 Years	MTech (Computer Science)	Adani Skill Development Centre
20.	Mini Jose	Trainer – Beauty Therapist	12 Years	S.S.L.C, Diploma in Fashion Technology, Diploma in Beauty Therapy,	Adani Skill Development Centre
21.	Shaji Joseph	Safety Executive	13 Years	Diploma in mechanical & Diploma in fire and safety	HOWE

Annexure X

EC for Aryanadu Quarry

ENVIRONMENTAL CLEARANCE

PARIVESH (Pro-Active and Responsive Facilitation by Interactive, and Virtuous Environmental Single-Window Hub)

Government of India
Ministry of Environment, Forest and Climate Change
(Issued by the State Environment Impact Assessment Authority(SEIAA), Kerala)

To,

The CEO
M/S. ADANI VIZHINJAM PORT PRIVATE LIMITED
Vipanchika Tower, Thycaud, Thiruvananthapuram -695014

Subject: Grant of Environmental Clearance (EC) to the proposed Project Activity under the provision of EIA Notification 2006-regarding

Sir/Madam,

This is in reference to your application for Environmental Clearance (EC) in respect of project submitted to the SEIAA vide proposal number SIA/KL/MIN/136067/2020 dated 17 Feb 2020. The particulars of the environmental clearance granted to the project are as below.

1.	**EC Identification No.**	**EC22B001KL114048**
2.	**File No.**	1587/EC1/2020/SEIAA
3.	**Project Type**	New
4.	**Category**	B2
5.	**Project/Activity including Schedule No.**	1(a) Mining of minerals
6.	**Name of Project**	Granite Building Stone Quarry of M/s. Adani Vizhinjam Port Private Limited
7.	**Name of Company/Organization**	M/S. ADANI VIZHINJAM PORT PRIVATE LIMITED
8.	**Location of Project**	Kerala
9.	**TOR Date**	N/A

The project details along with terms and conditions are appended herewith from page no 2 onwards.

Date: 23/07/2022

(e-signed)
Dr. Venu V IAS
Member Secretary
SEIAA - (Kerala)

Note: A valid environmental clearance shall be one that has EC identification number & E-Sign generated from PARIVESH.Please quote identification number in all future correspondence.

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सत्यमेव जयते

PROCEEDINGS OF THE STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY – KERALA, THIRUVANANTHAPURAM

(Present : Dr.H.Nagesh Prabhu IFS (Retd), Chairman, Shri.K.Krishna Panicker, Member, Dr.V.Venu IAS, Member Secretary)

Sub: SEIAA - Environmental Clearance for the Granite Building Stone Quarry of Shri. Rajesh Kumar Jha, Managing Director & CEO, M/s Adani Vizhinjam Port Limited, 2nd Floor, Vipanchika Tower, Thiruvanathapuram – 695014 - Granted – Orders issued.

State Level Environment Impact Assessment Authority, Kerala

Proposal No. SIA/KL/MIN/136067/2020 File No. 1587/EC1/2020/ SEIAA

Ref: 1.Application received on 13.01.2020 from Shri. Rajesh Kumar Jha, Managing Director & CEO, M/s Adani Vizhinjam Port Limited

2. Minutes of the 128th SEAC meeting held on 23rd to 24rd May, 2022
3. Minutes of the 115th SEIAA meeting held on 30th June, 2022
4. G.O(Rt.) No.29/2019/Envt dt.12.04.2019.

ENVIRONMENTAL CLEARANCE NO. 80/Q/2022

Shri. Rajesh Kumar Jha, Managing Director & CEO, M/s Adani Vizhinjam Port Limited, 2nd Floor, Vipanchika Tower, Thiruvanathapuram – 695014, submitted an application for Environmental Clearance via PARIVESH on 13.01.2020 for the Granite Building Stone Quarry for an area of 1.9274 Ha. in Block. No:47, Re - Survey. Nos. 133/4, 133/16, & 139/6 (Government land), in Aryanadu Village, Nedumangad Taluk, Thiruvananthapuram District, Kerala. The project details are as follows:

SL.No.	Particulars	Details
1	Name of the Project	Granite Building Stone Quarry Project of M/s Adani Vizhinjam Port Limited
2	Proposed Activity	Mining of Granite Building Stone
3	Name of the Sector & Schedule No. (in the EIA Notification, 2006)	Non Coal mining, Activity 1(a), Category B2
4	Name & Address of the Project Proponent	Shri. Rajesh Kumar Jha, Managing Director & CEO, M/s Adani Vizhinjam Port Limited, 2nd Floor, Vipanchika Tower, Thiruvanathapuram – 695014
5	Project Location	
	a) Block. No Re-Survey Nos:	47 133/4, 133/16, & 139/6 (Government land)
	b) Village	Aryanadu
	c) Taluk	Nedumangad
	d) District	Thiruvananthapuram
6	Geo Co-ordinates	Latitude 08°35'14.749"N to 08°35'20.030"N Longitude 77°05'58.877"E to 77°06'08.083"E
7	Extent (in Hectare)	1.9274
8	Project Cost	Rs.600 Lakhs
9	Capacity of the Mining Lease	1,99,900.00 TPA
10	Date of Field Inspection	07.05.2022

CER Details

CER (Recurring)				
Sl.No.	**Location Name**	**1st Year**	**2nd Year**	**Total**
1	Primary Health Centre, Aryanadu	5,00,000	-	**5,00,000**
2	Sub- Health Centre, Vallimangalam	-	3,75,000	**3,75,000**
3	Government Lower Primary School, Eanchapuri	. 3,25,000	-	**3,25,000**
	Total	**₹ 8,25,000**	**₹ 3,75,000**	**₹ 12,00,000**

2. In the 128th SEAC meeting held on 23rd to 24rd May, 2022, the Committee verified the documents submitted by the proponent and found them satisfactory. The Committee noted that the nearest built structure is at a distance of 51m. The Committee discussed the field inspection report and recommended EC for the project life of 6 years subject to the following Specific Conditions in addition to the General Conditions.

a. Proposal may be processed only after production of the proof of application to NBWL for Wildlife Clearance and EC may be issued only after getting the Wildlife Clearance.
b. Boundary Pillars should be fixed permanently with immediate effect.
c. Garland drain should be provided covering the entire project area, siltation pond of appropriate volume should be provided at the lowest portion of the project area and outflow channel should be laid to the natural stream nearby. Silt-traps should be provided intermittently in garland drain and outflow channel. Garland drain, silt-traps, siltation ponds and outflow channel should be desilted periodically to prevent any obstruction to the drainage system.
d. Blasting (NONEL) should be done only with a drill hole of 32mm diameter and depth 1.5m loaded with a maximum of 375 gm of explosive in each hole of the array with a burden of 1.5m and spacing of 1m since there are 9 houses within the distance varying from 50-100m and 39 houses within 200m. An affidavit to this should be submitted by the Proponent.

e. If the proponent desires to adopt blasting (NONEL) using a drill hole of diameter 115mm and depth 6.5m with burden ranging from 2.00 to 2.50 m and spacing of 2.50 to 3.00 m loaded with a higher quantity of explosives to the tune of about 20 – 25 kgs of explosives, as proposed in the Mine Plan, special permission from the SEIAA should be obtained after conducting a vibration impact study on various built structures within 200m from the project boundary by engaging a National Institute such as National Institute of Rock Mechanics and inference thereupon.
f. Impact of vibration due to blasting on the nearest houses and built structures should be monitored in terms of Peak Particle Velocity and amplitude for a maximum charge per delay and included in the Half Yearly Compliance Report.
g. Retaining wall of appropriate height should be provided at the overburden dumping site
h. CER Plan should be implemented within the first 2 yearsand it should be operated and maintained till the mine closure plan is implemented
i. Planting of trees for the development of green belt should be done before the commencement of mining and green belt should be nurtured and maintained during the entire project period till the mine closure plan is implemented
j. Prior to the commencement of mining, temporary barrior should be provided wherever green belt cannot be developed due to the presence of barren rock
k. Prior to the commencement of mining, temporary wall should be provided at the boundary adjacent to the houses and road
l. Compensatory afforestation should be initiated prior to the commencement of mining in available land as tree planting is not feasible along some portion of the buffer zone
m. An affidavit should be submitted indicating the land with geocoordinates where compensatory afforestation is proposed
n. Transportation of mined material should not be done during the peak hours in the forenoon (8.30am to 10.30am) and afternoon (3.30pm to 5 pm).
o. Haulage road should be maintained well with frequent sprinkling

3. In the 115th SEIAA meeting held on 30th June, 2022, the Authority decided to issue Environmental Clearance initially for a period of 5 years for the quantity mentioned in the approved Mining Plan and to extend the EC period to cover Project Life of 6 years, from the

date of issuance of original EC, subject to the review by SEAC at the end of five years, to verify whether the Project Proponent has violated any of the EC conditions and thereby caused any damage to the Environment in the project region by violating EC conditions.

The EC is subject to General Conditions and the following Additional Specific Conditions.

1. *The proponent shall carry out quarrying as per the approved Mining Plan and the proponent should strictly follow the Kerala Minor Mineral Concession Rules 2015 and amendments thereby.*
2. *The EC shall be valid from the date of execution of lease/permit from the Department of Mining and Geology. The copy of the lease order should be provided to the SEIAA before commencing the mining activity.*
3. *Since the quarry site is located within a distance of 10km from Peppara Wild Life Sanctuary, as per OM dated 8.8.2019 of MoEF&CC, Clearance from Standing Committee of the National Board for Wildlife is mandatory for mining activity. Hence the Project Proponent is directed to obtain Clearance from Standing Committee of the National Board for Wildlife before starting any activity at the site.*
4. *Authority makes it amply clear that EC issued does not necessarily imply that Wildlife clearance shall be granted to the Project Proponent and that the proposal for Wildlife clearance will be considered by the respective Authorities on its merit and decision taken accordingly. The investment made in the project if any based on this EC in anticipation of clearance from Wildlife angle shall be entirely at the cost and risk of the Project Proponent and MoEF&CC and SEIAA shall not be responsible in this regard in any manner.*
5. *Boundary Pillars should be fixed permanently with immediate effect.*
6. *Garland drain should be provided covering the entire project area, siltation pond of appropriate volume should be provided at the lowest portion of the project area and outflow channel should be laid to the natural stream nearby. Silt-traps should be provided intermittently in garland drain and outflow channel. Garland drain, silt-traps, siltation ponds and outflow channel should be desilted periodically to prevent any obstruction to the drainage system.*

7. *Blasting (NONEL) should be done only with a drill hole of 32mm diameter and depth 1.5m loaded with a maximum of 375 gm of explosive in each hole of the array with a burden of 1.5m and spacing of 1m since there are 9 houses within the distance varying from 50-100m and 39 houses within 200m. An affidavit to this should be submitted by the Proponent.*

8. *A vibration impact study on various built structures within 200m from the project boundary shall be carried out by engaging a National Institute of repute such as National Institute of Rock Mechanics* and their recommendations must be implemented. A copy of the same shall be made available to Dept of Mining and Geology for future reference.

9. *Impact of vibration due to blasting on the nearest houses and built structures should be monitored in terms of Peak Particle Velocity and amplitude for a maximum charge per delay and included in the Half Yearly Compliance Report.*

10. *Retaining wall of appropriate height should be provided at the overburden dumping site.*

11. *CER Plan should be implemented within the first 2 years and it should be operated and maintained till the mine closure plan is implemented.*

12. *Planting of trees for the development of green belt should be done before the commencement of mining and green belt should be nurtured and maintained during the entire project period till the mine closure plan is implemented*

13. *Prior to the commencement of mining, temporary barrier should be provided wherever green belt cannot be developed due to the presence of barren rock*

14. *Prior to the commencement of mining, temporary wall should be provided at the boundary adjacent to the houses and road*

15. *Compensatory afforestation should be initiated prior to the commencement of mining in available land as tree planting is not feasible along some portion of the buffer zone*

16. *An affidavit should be submitted indicating the land with geocoordinates where compensatory afforestation is proposed*

17. *Mining activities including loading of mined materials should not be carried out between sun set and sunrise*

18. *Transportation of mined material should not be done during the peak hours in the forenoon (8.30am to 10.30am) and afternoon (3.30pm to 5 pm).*

19. *Haulage road should be maintained well with frequent sprinkling*

20. *As per OM no F.No.22-65/2017-IA.III dated 30th September 2020, under Corporate Environmental Responsibility (CER) the Project Proponent shall prepare an Environment Management Plan (EMP) as directed by SEAC during appraisal, covering the issues to address the environmental problems in the project region, indicating both physical and financial targets year wise. The EMP shall be implemented in consultation with local self Govt. Institutions. The indicated cost for CER shall be 2% of the project cost depending upon the nature of activities proposed. The follow up action on implementation of CER shall be included in the Half Yearly Compliance Report which will be subjected to field inspection at regular intervals. A copy of the approved EMP shall be made available to the concerned Panchayat for information and implementation support.*

21. *In the wake of occurrence of large scale landslides in the state, as per the information provided by the Department of Mining & Geology, it is directed to use only NONEL (Non Electrical) technology for blasting to reduce the vibration of the ground, which is one of the causative factors that triggers landslides, formation of cracks in the surrounding buildings and disturbance to human and wildlife.*

22. *As per the directions contained in the OM F.No.22-34/2018-IA.III dated 16th January 2020 issued by MoEF&CC, in obedience to the directions of the Hon'ble Supreme Court the Project Proponent shall, undertake re-grassing the mining area and any other area which may have been disturbed due to his mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc. The compliance of this direction shall be included in the Half Yearly Compliance Report which will be monitored by SEAC at regular intervals.*

23. *A copy of the EC shall be marked to IGF (WL), MoEF&CC, PCCF and Chief wild life Warden, Kerala, SEAC, District collector, Thiruvananthapuram and Director Mining and Geology, Department of Industries GOK, besides others for information and necessary further action.*

24. *The violation of EC condition may lead to cancellation of EC and action under The Environment (Protection) Act 1986.*

4. Environmental Clearance as per the EIA Notification, 2006 is hereby accorded for the Granite Building Stone Quarry for an area of 1.9274 Ha. in Block. No:47, Re - Survey. Nos. 133/4, 133/16, & 139/6 (Government land), in Aryanadu Village, Nedumangad Taluk, Thiruvananthapuram District, Kerala. of Shri. Rajesh Kumar Jha, Managing Director & CEO, M/s Adani Vizhinjam Port Limited, 2nd Floor, Vipanchika Tower, Thiruvanathapuram – 695014, initially for a period of 5 years for the quantity mentioned in the approved Mining Plan from the date of execution of valid permit / lease from the Mining & Geology Department and to be extended to cover Project life of 6 years, from the date of issuance of original EC, subject to the review by SEAC at the end of five years, to verify whether the Project Proponent has violated any of the EC conditions and thereby caused any damage to the environment in the project region by violating EC conditions, subject to the Specific Conditions in Para 3 above, and all the environmental impact mitigation and management measures undertaken by the Project Proponent in the Form I, EMP, PFR and Mining Plan submitted to SEIAA. The assurances and clarifications given by the proponent will be deemed to be a part of this Proceedings as if incorporated herein. Also the General Conditions for projects stipulated for mining (items 1 to 57), mentioned below will be applicable and have to be strictly adhered to.

5. The Environmental Clearance issued will also be subject to full and effective implementation of all the undertakings given in the Application Form, mitigation measures as assured in the Environment Management Plan and the mining features including Progressive Mine Closure Plan as submitted with the application. The above undertakings and the conditions and the undertakings in (Mining), (Blasting), (Mines Drainage), (Stacking of Mineral rejects and Disposal of waste), (Environment Management Plan) & (Progressive Mine Closure Plan) of the Mining Plan as submitted will be deemed to be part of this Proceedings as conditions as undertaken by the proponent, as if incorporated herein.

6. Validity of the Environmental Clearance will be initially for a period of **Five (5) years** from the date of execution of valid mine lease/permit from Mining & Geology Department as per SO 1807(E) dated 12.04.2022 of MoEF & CC, subject to earlier review of EC in case of

violation or non-compliance of conditions or genuine complaints from residents within the security area of the quarry. The validity shall extend to cover Project Life of 6 years, from the date of issuance of original EC, subject to the review by SEAC at the end of every five years, to verify whether the Project Proponent has violated any EC conditions and thereby caused any damage to the environment in the project region by violating EC conditions.

7. Compliance of the conditions herein will be monitored by the State Environment Impact Assessment Authority or its authorised offices and also by the Regional Office of the Ministry of Environment, Forest & Climate Change, Govt. of India, Bangalore. Necessary assistance for entry and inspection should be provided by the Project Proponent and those who are engaged or entrusted by him to the staff for inspection or monitoring. Instances of violation if any shall be reported to the District Collector, Thiruvanathapuram

8. The Half Yearly Compliance Report (HYCRs) with its contents, covering letter, compliance report and environmental monitoring data have to be uploaded in the PARIVESH portal and the website of the Project Proponent. The HYCR with the name of the project, EC No and date & the period of submission should be sent to the Regional Office of MoEF & CC & to SEIAA by email only at email ID rosz.bng-mefcc@gov.in & seacseiaakerala@gmail.com, respectively. Hardcopy of HYCRs shall not be acceptable.

9. The given address for correspondence with the authorised signatory of the project is Shri. Rajesh Kumar Jha, Managing Director & CEO, M/s Adani Vizhinjam Port Limited, 2nd Floor, Vipanchika Tower, Thiruvanathapuram – 695014.

GENERAL CONDITIONS

1. The proponent should provide notarized affidavit (indicating the number and date of Environmental Clearance proceedings) that all the conditions stipulated in the EC shall be scrupulously followed.
2. All the statutory clearances should be obtained, as applicable, by the project proponent from the respective competent authorities including that for blasting and storage of explosives. Copies of all statutory clearances shall be submitted along with First Half Yearly Compliance Report.
3. The project proponent should advertise in news papers that the project has

been accorded Environmental Clearance and copies of clearance letters are available in the Office of State Environment Impact Assessment Authority (SEIAA) and on the website of the Authority at www.seiaakerala.in. The advertisement should be in at least two local newspapers widely circulated in the region, one of which shall be in the vernacular language. The advertisement should be made within 10 days from the date of receipt of the Environmental Clearance letter and a copy of the same signed in all pages should be forwarded to the office of this Authority as confirmation.

4. The proponent shall send a copy of the EC to concerned Grama Panchayat/ District Panchayat/ Municipality/Corporation/Urban Local Body and also to the Local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal. The Environmental Clearance shall also be uploaded on the website of the company.

5. The lease area shall be fenced with barbed wire to a minimum height of 4ft around, before starting mining. All the boundary indicators (boards, markings, etc) shall be conspicuous and maintained at all times.

6. The details of Environmental Clearance should be prominently displayed in a metallic board of 3 ft x 3 ft with green background and yellow letters of Times New Roman font size of not less than 40. Sign board with extent of lease area and boundaries shall be depicted at the entrance of the quarry, visible to the public.

7. Explosives should be stored in magazines in isolated place specified and approved by the Explosives Department. Mats to reduce fly rock blasts to a maximum of 10 PPV should be provided.

8. Warning alarms indicating the time of blasting (to be done at specific timings) has to be arranged stipulated by Explosive Department.

9. Access roads to the quarry shall be black topped to contain dust emissions that may arise during transportation of materials. The transportation of minerals should be done in covered trucks to contain dust emissions.

10. A separate Environmental Management Cell (EMC) with suitable qualified personnel should be set-up under the chairmanship of a Senior Executive, who will report directly to the Head of the Organization. The Cell should

have representative of Biodiversity Management Committee of the Panchayath and a representative of NGO, if any active in the area. The EMC should meet at least once in six months and review the activities and minutes should be a part of the compliance report.

11. Quarrying has to be carried out as per approved mining plan with the suggestions from SEAC incorporated and following KMMC rules 2015 and the Amendments thereby.

12. The quarrying operation shall be restricted between 7 AM and 5PM

13. Rain Water Harvesting facility should be installed as per the prevailing provisions of KMBR/KPBR, unless otherwise specified. Maximum possible solar energy generation and utilization shall be ensured as an essential part of the project.

14. Maximum depth of mining shall be as per the mining plan and as per specific direction of SEAC after field inspection. The maximum depth of mining should not be deeper than the local ground water table. No mining operations should be carried out at places having a slope greater than 45°.

15. The height of any bench shall not exceed five meters and breadth shall not be less than the height.

16. The Project proponent shall ensure that no perennial or intermittent natural water course and/or water resources are obstructed due to any mining operations. Necessary safeguard measures to protect the first order streams, if any, originating from the mine lease shall be taken.

17. A minimum buffer distance specified as per existing rules and statutory orders shall be maintained from the boundary of the quarry to the nearest dwelling unit or other structures, and from forest boundaries or any other ecologically sensitive and archeologically important areas or the specific distance specified by SEIAA in EC as per the recommendations of SEAC depending on specific local conditions.

18. The proponent should plant seedlings at least 5 times of the loss of trees that has occurred while clearing the land for the project and follow planting measures as suggested by SEAC. Suitable avenue trees should be planted along the sides of the approach road and internal roads and open parking

areas, if any. Preference should be given to endemic native and fruit bearing species. Planting in buffer areas should be taken up beforehand. Proper upkeep and maintenance of planted seedlings shall be ensured by the project proponent.

19. The proponent should ensure that the vegetation in the buffer is retained, maintained and strengthened with additions of native broad leaved plants.

20. Eco-restoration including the closure of mine as per the progressive closure plan and final closure plan shall be done at the cost of the project proponent. This eco-restoration should follow scientific standards available for restoration, full recovery of the original vegetation and improving the resilience of different ecosystems. Overburden materials should be managed within the site and used for reclamation of mined pit as per mine closure plan / specific conditions.

21. At least 10 percent out of the total excavated pit area should be retained as water storage areas and the remaining area should be reclaimed with stacked dumping and overburden and planted with suitable indigenous plant species, if no other specific condition on reclamation of pit is stipulated in the E.C. Monitoring and management of rehabilitated areas should continue until the vegetation becomes self-sustaining.

22. Control measures on noise and vibration prescribed by KSPCB should be implemented. Quarrying activities should be limited to day time as per KSPCB guidelines/specific conditions.

23. Periodical monitoring of the vibration at specified location (preferably at a distance of 50 m and 100 m) to be conducted and records kept for inspection. This could also form a part of the compliance reports.

24. Speed of trucks entering or leaving the mine site is to be limited to moderate speed of 25 kmph to prevent undue noise from empty trucks.

25. Acoustic enclosures should be provided to reduce sound amplifications in addition to the provisions of green belt and hollow brick envelop for crushers so that the noise level is kept within prescribed standard limit indicated by CPCB/KSPCB.

26. Blasting should be done in a controlled manner using NONEL technique as

specified by the regulations of Petroleum and explosive safety organization (GOI) or any other concerned authorized agency. A licensed person should supervise/ control the blasting operations.

27. Measures should be taken for maintaining noise levels below 85 dBA in the work environment.

28. Project proponent should obtain necessary prior permission of the competent authorities for drawing requisite quantity of surface water and ground water for the project.

29. Regular monitoring of flow rates and water quality upstream and downstream of the springs and perennial nallahs flowing in and around the mine lease area shall be carried out and reported in the six monthly compliance reports to SEIAA.

30. Catch drains and siltation ponds of appropriate size shall be constructed around the mine working, mineral and OB dumps, to prevent run off of water and flow of sediments directly into the river and other water bodies. The water so collected should be utilized for watering the mine area, roads, and for green belt development etc. The drains shall be regularly desilted and maintained properly, particularly after monsoon.

31. Regular monitoring of ground water level and quality shall be carried out around the mine area during mining operation. If any stage ,if it is observed that ground water table is getting depleted due to the mining activity; necessary corrective measures shall be carried out.

32. Garland drains and silt traps are to be provided in the slopes around the core area to channelize storm water. De-silting of Garland canal and silt traps have to be attended on a daily basis. A labour has to be specifically assigned for the purpose. The proponent shall ensure the quality of the discharging storm water as per the General Effluent Discharge Standards of CPCB.

33. In the case of any change(s) in the scope of the project, extent, quantity, process of mining technology involved or in any way affecting the environmental parameters/impacts as assessed, based on which the E.C was issued, the project would require a fresh appraisal by this Authority, for which the proponent shall apply and get the approval of this Authority. In

the case of transfer of ECs, the matter shall be intimated and get the approval from the Authority as per the existing norms.

34. The stipulations by Statutory Authorities under different Acts and Notifications should be complied with, including 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.

35. The top soil, if any, shall be temporarily stored at earmarked place (s) and used for land reclamation and plantation. The over burden (OB) generated during the mining operations shall be stacked at earmarked dump site(s) only. The maximum height of the dumps shall not exceed 8m and width 20m and overall slope of the dumps shall be maintained at $45^{0.}$ The OB dumps should be scientifically vegetated with suitable native species to prevent erosion and surface run off. At critical points, use of geo textile shall be undertaken for stabilization of the dump. Protective wall or gabions should be made around the dump to prevent erosion / flow of sediments during rains. The entire excavated area shall be backfilled.

36. All the mining equipment used in Mining like backhoe loaders and excavators cause pollution and hence shall be serviced regularly & maintained for their efficient functioning and for reducing pollution. Disposal of spent oil from diesel engines should be as specified under relevant Rules/ Regulations.

37. All vehicles used for transportation and within the mines shall have 'PUC' certificate from authorized pollution checking centre. Washing of all vehicles shall be inside the lease area. .

38. Effective safeguard measures such as regular water sprinkling shall be carried out in critical areas prone to air pollution such as haul road, loading and unloading points and transfer points and having high levels of PM_{10} and $PM_{2.5}$. Monitoring of Ambient Air Quality to be carried out based on the Notification 2009, as amended from time to time by the Central Pollution Control Board.

39. Fugitive dust emissions from all the sources should be controlled regularly.

Water spraying arrangement at project site, parking area, on haul roads, loading and unloading and at transport points should be provided and properly maintained.

40. Corporate Environmental Responsibilities (CER) as prescribed by SEIAA/SEAC should be carried out leading to Environmental stability of the Project region. The activities carried out under CER should be a part of the half yearly compliance report. The certificates from the beneficiaries, if the CER part is completed should also be submitted to the State Environment Impact Assessment Authority (SEIAA) along with year wise expenditure .

41. The project proponent is responsible for implementing all the provisions of labour laws applicable from time to time to quarrying /Mining operations. The workers on the site should be provided with on-site accommodation or facilities at a suitable boarding place, protective equipment such as ear muffs, helmet, etc.

42. The proponent has to provide insurance protection to the workers in the case of existing mining or provide the affidavit in case of fresh lease before execution of mining lease.

43. Occupational health surveillance program of the workers should be undertaken periodically to observe any contractions due to exposure to dust and take corrective measures, if needed. The report of health surveillance programme should be included in the half yearly compliance reports.

44. The pits in the abandoned quarries and in the mined area shall be used for activities like water harvesting, aqua culture etc. in an eco friendly manner.

45. If Government land is partly or fully used for mining, the area shall be returned at the end of lease period after mine closure with separate demarcation with suitable survey marks.

46. Any accident occurring in the mined out area after the lease period due to negligence in carrying out safety measures and non-closure , will lead to suspension of all EC obtained for mining by the Proponent.

47. In case of transfer of EC the matter shall be intimated and approval from the Authority shall be obtained as per the existing norms.

48. The proponent shall submit Half Yearly Compliance Reports (1stof June &

1st of December) on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) and upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall be simultaneously sent to the respective Regional Office of Ministry of Environment, Forests and Climate Change, Govt. of India and also to the Office of State Environment Impact Assessment Authority (SEIAA). The proponent has to submit Environmental statement in form V of Environment (Protection) Rules 1986 to SPCB on 31st March every year.

49. The project authorities should extend full cooperation to the officer (s) from the Regional Office of MOEF & CC located at Bangalore/SEAC/SPCB/CPCB/dept of Mining and Geology, while monitoring compliance of the stipulated conditions, by furnishing the requisite data/information/monitoring reports.

50. The above conditions shall prevail notwithstanding anything to the contrary, in consistent, or simplified, contained in any other permit, license on consent given by any other authority for the same project.

51. The Authority reserves the right to add additional safeguard measures subsequently, if found necessary, and to take action including revoking of the Environment Clearance under the provisions of the Environment (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner.

52. The EC given will be withdrawn at any time if the area is declared high hazardous by the SDMA.

53. The Environmental Clearance will be subject to the final order of the courts on any pending litigation related to the land or project, in any court of law.

54. Any appeal against this Environmental 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.

55. Concealing the factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in

withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.

56. The SEIAA may revoke or suspend the order, for non implementation of any of the specific or any of the above conditions. The SEIAA reserves the right to alter/modify the above conditions or stipulate any further condition in the interest of environmental protection.

57. As per regulation no. 106(2) of metalliferous mines regulation under Mine act, the height of any bench shall not exceed six meters and breadth shall not be less than the height.

Sd/-
Administrator, SEIAA
For Member Secretary, SEIAA

To,

Shri. Rajesh Kumar Jha,
Managing Director & CEO,
M/s Adani Vizhinjam Port Limited,
2nd Floor, Vipanchika Tower,
Thiruvanathapuram – 695014

Copy to,

1. MoEF Regional Office, Southern Zone, Kendriya Sadan, 4th Floor, E&F Wing, II Block, Koramangala, Bangalore-560034.(through e-mail: rosz.bng-mefcc@gov.in)
2. The Additional Chief Secretary to Government, Environment Department, Government of Kerala
3. The Director, Directorate of Environment & Climate Change, 4th Floor KSRTC Bus Terminal, Thampanoor, Thiruvananthapuram, Kerala 695001.
4. The District Collector, Thiruvanathapuram
5. The Director, Mining & Geology, Thiruvananthapuram -4.
6. The Member Secretary, Kerala State Pollution Control Board
7. The District Geologist, Thiruvanathapuram
8. The Tahsildhar, Nedumangad Taluk, Thiruvananthapuram District
9. The Secretary, Aryanadu Panchayath, Thiruvananthapuram
10. The Chairman, SEIAA.
11. Website.
12. S/f
13. O/c

Annexure XI

CTO for Aryanadu Quarry

FILE NO : KSPCB/TV/ICO/10005098/2022
Date of issue : 25-07-2022

KERALA STATE POLLUTION CONTROL BOARD

CONSENT TO

OPERATE/AUTHORISATION/REGISTRATION

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. : 10005098
Dated : 15-06-2022

To

Adani Vizhinjam Port Pvt Ltd
Aryanadu, Nedumangad, Thiruvananthapuram

Consent No. : KSPCB/TV/ICO/10005098/2022
Valid Upto : 15-03-2027

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**	15-03-2027
2	Name and Address of the establishment	Adani Vizhinjam Port Pvt Ltd Aryanadu, Nedumangad, Thiruvananthapuram
3	Occupier Details	CEO AVPPL Adani Vizhinjam Port Pvt LTD Mulloor Post, Vizhinjam, Thiruvananthapuram, kerala - 695521
4	Local Body	Aryanad Panchayat
5	Survey Number	133/4, 133/16, 139/6
6	Village	Aryanadu
7	Taluk	Nedumangad
8	District	THIRUVANANTHAPURAM
9	Capital Investment(Rs in Lakhs)	601.5
10	Scale	Medium
11	Category	RED
12	Annual fee(Rs) Total Fee remitted(Rs)	55000.0 275000.0
13	Activity	Building Stone (Qty for 5 Years)-4,85,390 T
14	Machinery details	Rock Quarrying

GENERAL CONDITIONS

2.1 Quarrying is restricted to the land bearing Survey nos.133/4, 133/16, & 139/6 (Government land),

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 Any change in the particulars furnished in the references and/or in the identity of the occupier / authorized agent shall be intimated to the Board within a week.

2.4 It is the responsibility of occupier to ensure that quarrying activities are restricted to only area shown in the attached drawing and at a distance more than 50 m from the nearby residential buildings, places of worship, public buildings, public road having vehicular traffic, river or lake, railway line and bridges.

2.5 After excavation at the site is completed, the land may be reclaimed or used for rain water harvesting with protective barriers/any other suitable purpose like aquaculture approved by the authority.

2.6 All the necessary control measures provided should be maintained properly to ensure that the system is adequate to control the air and water pollution caused by the functioning of the unit within the limit.

2.7 Regular wetting of the roads in the premises of the quarry and approach roads near the quarry shall be done for avoiding excessive dust emission within and outside the boundary of the unit.

2.8 Boundary of quarrying area shall be fenced and demarcated.

2.9 Fugitive emission from the quarry premises and road leading to quarry shall be suppressed using water sprinkling.

2.10 The suspended particulate matter (SPM) at boundary of the premises of the quarry shall not exceed the following limit applicable to that area as per the National Ambient Air Quality Standards. a) The PM 10 in ambient air at the boundary shall not exceed 100 microg/m3 b) The PM 2.5 in ambient air at 1m outside the boundary shall not exceed 60 microg/m3.

2.11 The sound level measured at 1.0 m outside the boundary shall not exceed the limit as per the Ambient Air Quality Standards in respect of Noise.

2.12 The operation of the unit shall be commenced/done only after obtaining clearances from all concerned authorities.

2.13 The quarry shall be operated only from 6am to 6pm.

2.14 For renewal of the consent in case of continuance of operation of the industry, application in the prescribed form shall be submitted through the web portal of the Board http://krocmms.nic.infor renewing the Consent on or before two month in advance to expiry date. Late application will be accepted with 10% (for application before expiry date) & 50% of yearly fee as late fee for application after due date.

2.15 This consent is granted subject to the Environmental Clearance No: 80/Q/2022 dated 23/07/2022 issued by State Environmental Impact Assessment Authority(SEIAA), Thiruvananthapuram and other documents furnished by the applicant. If any document is found false, the consent issued will be cancelled/ revoked.

2.16 Validity of this consent is subject to the order/judgment of Hon'ble Supreme Court in or the Hon’ble NGT in the connected matters.

2.17. The consent issued from the Board will be valid only during the period when statutory or necessary clearances from other concerned authorities are valid. The consent issued from the Board is only with respect to the powers vested under the Water Act, 1974, Air Act, 1981 and Rules there under. The operation of the unit shall be commenced only after obtaining clearances from all concerned authorities.

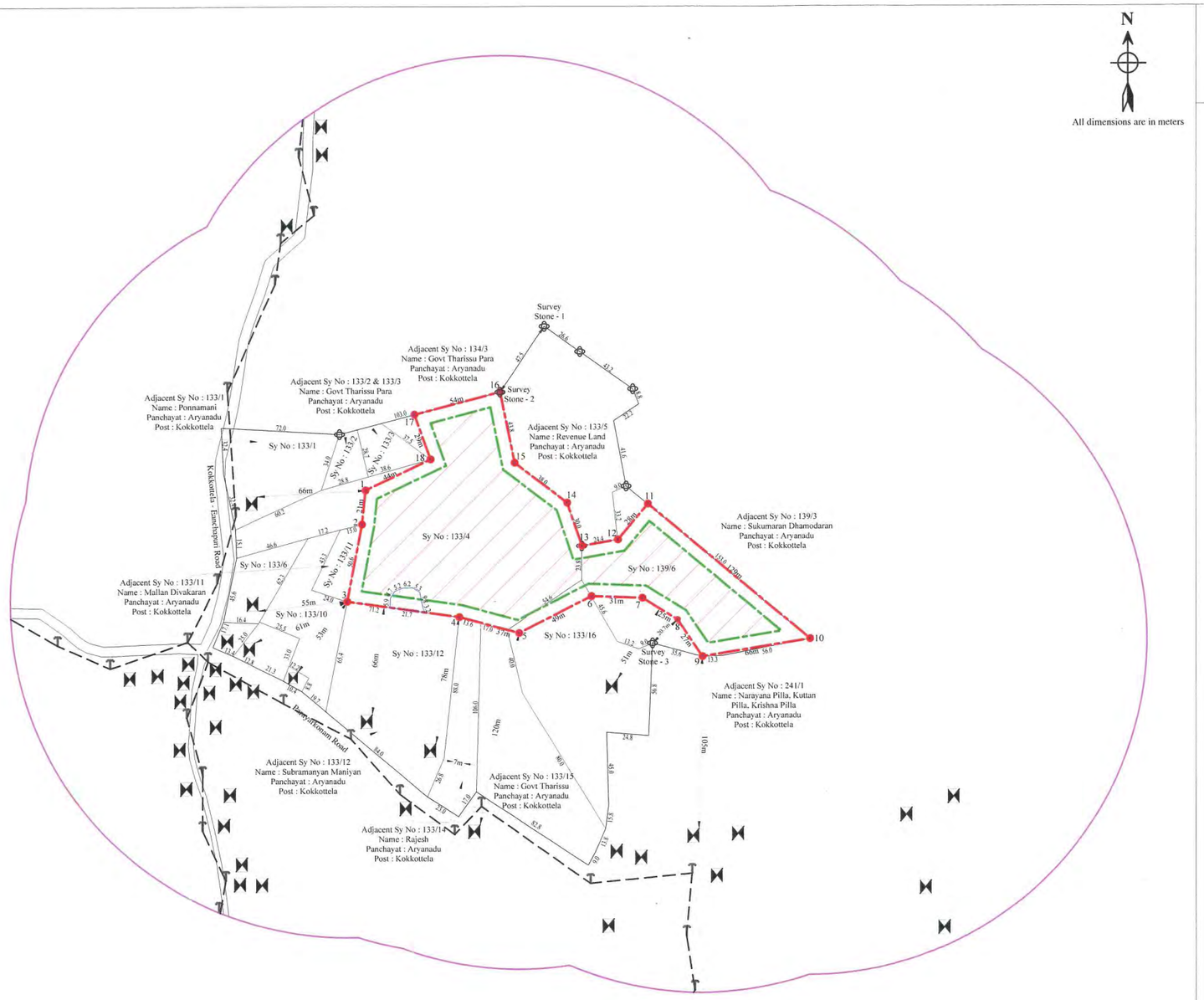
SIGNATURE OF ISSUING AUTHORITY

ENVIRONMENTAL ENGINEER

mmrd 388/22

Annexure - 5

200m SURVEY MAP



Village : Aryanadu
Taluk : Nedumangad
District : Thiruvananthapuram
State : Kerala

Block No : 47

Sy No : 133/4, 133/16 & 139/6

SURVEY MAP

INDEX

- Village Road
- Private Road 7mts
- Houses
- Survey Stone
- Old Pit
- Electric Pole
- Electric Line
- 200m Buffer

MINING LEASE AREA	: 1.3607 Ha
7.5m BUFFER ZONE AREA	: 0.5667 Ha
TOTAL MINING LEASE APPLICATION AREA	: 1.9274 Ha

GPS READINGS OF GROUND CONTROL POINTS
MAP DATUM - WGS84

Ground Control Points	Name	Latitude	Longitude
G C P - 1	Survey Stone 1	N-08°35'21.327"	E-77°06'02.836"
G C P - 2	Survey Stone 2	N-08°35'20.030"	E-77°06'01.948"
G C P - 3	Survey Stone 3	N-08°35'15.022"	E-77°06'04.947"

GPS READINGS OF BOUNDARY PILLARS
MAP DATUM - WGS84

Boundary Pillars	Latitude	Longitude
1	N-08°35'18.095"	E-77°05'59.260"
2	N-08°35'17.418"	E-77°05'59.184"
3	N-08°35'15.887"	E-77°05'58.877"
4	N-08°35'15.566"	E-77°06'01.109"
5	N-08°35'15.240"	E-77°06'02.289"
6	N-08°35'15.961"	E-77°06'03.733"
7	N-08°35'15.919"	E-77°06'04.744"
8	N-08°35'15.484"	E-77°06'05.440"
9	N-08°35'14.749"	E-77°06'05.934"
10	N-08°35'15.084"	E-77°06'08.083"
11	N-08°35'17.788"	E-77°06'04.867"
12	N-08°35'17.084"	E-77°06'04.269"
13	N-08°35'16.964"	E-77°06'03.554"
14	N-08°35'17.821"	E-77°06'03.267"
15	N-08°35'18.624"	E-77°06'02.221"
16	N-08°35'20.030"	E-77°06'01.948"
17	N-08°35'19.594"	E-77°06'00.243"
18	N-08°35'18.703"	E-77°06'00.557"

Land Index of Mining Lease Area

Sl.No	Doc No.	Thandapper No	Re-Survey Block No	Sy.No	Village Name	Name of the owner	Area of possession in Ha.	Area for mining in Ha.	Area for Buffer Zone in Ha.	Total Applied Area in Ha.	Area Already Under Quarrying in Ha.
1	NOC No B7-14936/18	Govt Para	47	133/4	Aryanadu	Govt Tharissu	1.5740	1.0218	0.2976	1.3194	0.0234
2		Govt Para	47	133/16	Aryanadu	Govt Tharissu	0.6960	0.0065	0.0370	0.0435	0.0000
3		Govt Para	47	139/6	Aryanadu	Govt Tharissu	0.7920	0.3324	0.2321	0.5645	0.0000
						Total	3.0620	1.3607	0.5667	1.9274	0.0234

VILLAGE OFFICER ARYANAD

Kumari Jayasree T.R
13/07/2022

Submitted before Mining & Geology Department

APPLICANT : -

M/s Adani Vizhinjam Port Private Limited,
2nd Floor, Vipanchika Tower,
Thycaud,
Thiruvananthapuram
Pin : 695014

Authorized Signatory

Annexure XII

EC for Koodal Quarry

ENVIRONMENTAL CLEARANCE

PARIVESH (Pro-Active and Responsive Facilitation by Interactive, and Virtuous Environmental Single-Window Hub)

Government of India
Ministry of Environment, Forest and Climate Change
(Issued by the State Environment Impact Assessment Authority(SEIAA), Kerala)

To,

The Proprietor

M/S. ADANI VIZHINJAM PORT PVT. LTD

M/s ADANI VIZHINJAM PORT PVT.LTD.,2ND FLOOR,VIPANCHIKA TOWER,THYCAUD,THIRUVANANTHAPURAM,KERALA -695014

Subject: Grant of Environmental Clearance (EC) to the proposed Project Activity under the provision of EIA Notification 2006-regarding

Sir/Madam,

This is in reference to your application for Environmental Clearance (EC) in respect of project submitted to the SEIAA vide proposal number SIA/KL/MIN/61070/2019 dated 17 Apr 2021. The particulars of the environmental clearance granted to the project are as below.

1.	**EC Identification No.**	**EC22B001KL191807**
2.	**File No.**	1441/EC1/2019/SEIAA
3.	**Project Type**	New
4.	**Category**	B1
5.	**Project/Activity including Schedule No.**	1(a) Mining of minerals
6.	**Name of Project**	Koodal (341/6) Granite Building Stone Quarry of M/s Adani Vizhinjam Port Pvt Ltd
7.	**Name of Company/Organization**	M/S. ADANI VIZHINJAM PORT PVT. LTD
8.	**Location of Project**	Kerala
9.	**TOR Date**	04 Aug 2020

The project details along with terms and conditions are appended herewith from page no 2 onwards.

Date: 02/08/2022

(e-signed)
Dr. Venu V IAS
Member Secretary
SEIAA - (Kerala)

Note: A valid environmental clearance shall be one that has EC identification number & E-Sign generated from PARIVESH.Please quote identification number in all future correspondence.

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सत्यमेव जयते

PROCEEDINGS OF THE STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY – KERALA, THIRUVANANTHAPURAM

(Present : Dr.H.Nagesh Prabhu IFS (Retd), Chairman, Shri.K.Krishna Panicker, Member, Dr.V.Venu IAS, Member Secretary)

Sub: SEIAA - Environmental Clearance for the Granite Building Stone Quarry of Sri. Rajesh Kumar Jha, Chief Executive Officer & Authorized Signatory, M/s. Adani Vizhinjam Port Pvt Ltd, 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram District - Granted – Orders issued.

State Level Environment Impact Assessment Authority, Kerala

Proposal No. SIA/KL/MIN/ 61070/2019 **File No. 1441/EC1/2019/SEIAA**

Ref: 1.Application received on 23.02.2021 from Sri. Rajesh Kumar Jha, Chief Executive Officer & Authorized Signatory, M/s. Adani Vizhinjam Port Pvt Ltd

2. Minutes of the 128th SEAC meeting held on 23rd to 24th May, 2022
3. Minutes of the 115th SEIAA meeting held on 30th June, 2022
4. G.O(Rt.) No.29/2019/Envt dt.12.04.2019.

ENVIRONMENTAL CLEARANCE NO. 88/Q/2022

Sri. Rajesh Kumar Jha, Chief Executive Officer & Authorized Signatory, M/s. Adani Vizhinjam Port Pvt Ltd, 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram District – 695014, submitted an application for Environmental Clearance via PARIVESH on 23.02.2021 for the Granite Building Stone Quarry for an area for an area of 4.8556 Ha in Re-Survey No. 341/6 (pt) in Koodal Village, Konni Taluk, Pathanamthitta District, Kerala. The project details are as follows:

SL.No.	Particulars	Details
1	Name of the Project	Granite Building Stone Quarry Project of M/s Adani Vizhinjam Port Limited
2	Proposed Activity	Mining of Granite Building Stone
3	Name of the Sector & Schedule No. (in the EIA Notification, 2006)	Non Coal mining, Activity 1(a), Category B2
4	Name & Address of the Project Proponent	Sri. Rajesh Kumar Jha, Chief Executive Officer & Authorized Signatory, M/s. Adani Vizhinjam Port Pvt Ltd, 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram District – 695014
5	Project Location	
	a) Block No. Re-Survey Nos:	30 341/6 (pt)
	b) Village	Koodal
	c) Taluk	Konni
	d) District	Pathanamthitta
6	Geo Co-ordinates	Latitude 9°08'54.81"N to 9°09'04.73"N Longitude 76°52'13.29"E to 76°52'25.10"E
7	Extent (in Hectare)	4.8556
8	Expected Project Cost	6.51 Crore
9	Capacity of the Mining Lease	1355780 MT
10	Date of Field Inspection	06.05.2022

CER Details

Sl.No.	Items		Funds to be allocated (in INR)
1	Drinking water facility for the labourers		1,00,000
2	Sanitary arrangement		1,00,000
3	Safety kit		2,00,000
4	Dust control		50,000
5	Afforestation etc.		2,50,000
6	Promotion of Rainwater Harvesting Programmes	3,50,000	13,02,000
	Promotion of renewable Energy	3,52,000	
	Promotion of Health care units	4,00,000	
	Improvement of Social Aspects such as road, street light, plantations	2,50,000	
	Total		**Rs. 20,02,000**

2. In the 128th SEAC meeting held on 23rd to 24th May, 2022, the Committee examined the documents submitted by the proponent and found them satisfactory. The Committee noted that the nearest built structure is at a distance of 56.1m. The Committee discussed the field inspection report and recommended EC with Project Life of 5 years subject to the following Specific Conditions in addition to the General Conditions.

a) The Boundary Pillars should be changed to concrete poles and the number of the boundary pillars as given in the approved Mine Plan and coordinates should be marked in paint. The photograph of the all the Boundary Pillars should be submitted prior to commencement of mining.

b) Though the quantity of overburden is less, the proponent should maintain distance criteria as per existing norms from the nearby houses and other built structures

such as the Inchappara- Athirunkal road to the boundary of overburden dumpsite and the boundary of the project site. An affidavit and a map showing the location should be submitted prior to the issuance of EC.

c) A proper retaining wall/ gabion wall should be constructed to prevent topsoil and overburden runoff during rains.

d) A check dam should be constructed for storage of water and recharge of low-lying areas. The structures should be constructed as per the existing distance norms.

e) The garland canal, silt traps, siltation ponds and outflow channel should be desilted and cleaned periodically and geotagged photographs of the same should be submitted along with half-yearly compliance report.

f) The turbidity of outflowing water along with other parameters as per the environmental monitoring plan should be monitored during different seasons and included in the half-yearly report.

g) Impact of vibration due to blasting on the nearest houses and built structures should be monitored in terms of Peak Particle Velocity and amplitude for a maximum charge per delay and included in the Half Yearly Compliance Report.

h) The buffer zone should be enriched with more indigenous plants as specified in the biodiversity assessment report. The same plants should be used for the compensatory afforestation and green belt development. Details of indigenous trees planted during the first three months from the date of issuance of EC should be submitted along with a plan for the remaining period.

i) Transportation of mined material should not be done during the peak hours in the forenoon (8.30am to 10.30am) and afternoon (3.30pm to 5 pm).

j) Regular ground water monitoring of the well located 97 m away on the south side of the quarry (9° 8'53.93"N, 76°52'16.24"E) should be conducted and the data should be incorporated in the half yearly report along with geo-tagged photograph.

k) The natural canals including Erattathodu flowing through the adjacent areas should be properly protected and maintained

3. In the 115th SEIAA meeting held on 30th June, 2022, the Authority decided to issue Environmental Clearance for the project life of 5 years for the quantity mentioned in the

approved Mining Plan subject to the following Specific Conditions in addition to the General Conditions.

The issuance of EC is subject to the proper submission of all necessary documents and affidavits as instructed by SEAC in its 128th meeting to the satisfaction of SEIAA.

1. *The proponent shall carry out quarrying as per the approved Mining Plan and the proponent should strictly follow the Kerala Minor Mineral Concession Rules 2015 and amendments thereby.*
2. *The EC shall be valid from the date of execution of permit/lease from the Department of Mining and Geology. The copy of the lease order should be provided to the SEIAA before commencing the mining activity.*
3. *The drilling and blasting parameters that Blasting (NONEL) will be done only with drill hole of 32mm diameter and depth 1.5m loaded with a maximum of 375 gm of explosive in each hole of the array with a burden of 1.5m and spacing of 1m as agreed in the affidavit.*
4. *The Boundary Pillars should be changed to concrete poles and the number of the boundary pillars as given in the approved Mine Plan and coordinates should be marked in paint before the onset of mining. The photograph of the all the Boundary Pillars should be submitted along with the documents regarding the publicity of EC and other mandatory documents to be produced before SEIAA as per General Condition.*
5. *The proponent should maintain distance criteria as per existing norms from the nearby houses and other built structures such as the Inchappara- Athirunkal road to the boundary of overburden dumpsite and the boundary of the project site, as assured in the affidavit.*
6. *The proponent should comply with all the assurances given during the Public Consultation process as assured in the affidavit.*
7. *A proper retaining wall/ gabion wall should be constructed to prevent topsoil and overburden runoff during rains.*
8. *A check dam should be constructed for storage of water and recharge of low-lying areas. The structures should be constructed as per the existing distance norms.*

9. *The garland canal, silt traps, siltation ponds and outflow channel should be desilted and cleaned periodically and geotagged photographs of the same should be submitted along with Half-Yearly Compliance Report.*

10. *The turbidity of outflowing water along with other parameters as per the environmental monitoring plan should be monitored during different seasons and included in the Half-Yearly Compliance Report.*

11. *Impact of vibration due to blasting on the nearest houses and built structures should be monitored in terms of Peak Particle Velocity and amplitude for a maximum charge per delay and included in the Half Yearly Compliance Report.*

12. *The buffer zone should be enriched with more indigenous plants as specified in the biodiversity assessment report. The same plants should be used for the compensatory afforestation and green belt development. Details of indigenous trees planted during the first three months from the date of issuance of EC should be submitted along with a plan for the remaining period.*

13. *Transportation of mined material should not be done during the peak hours in the forenoon (8.30am to 10.30am) and afternoon (3.30pm to 5 pm). As there are working quarries adjacent to the proposed project site,* the time of blasting must be scheduled in such a way that it will not cause any damage/disturbance to the life and property in the nearby area. To this effect, an agreement with the owners of the present working quarries adjacent to proposed project, must be signed to streamline the blasting and transportation.

14. *Mining activities including loading of mined materials should not be carried out between sun set and sunrise .*

15. *The natural canals including Erattathodu flowing through the adjacent areas should be properly protected and maintained*

16. *As per OM no F.No.22-65/2017-IA.III dated 30th September 2020, under Corporate Environmental Responsibility (CER) the project Proponent shall prepare an Environment Management Plan (EMP) as directed by SEAC during appraisal, covering the issues to address the environmental problems in the project region, indicating both physical and financial targets year wise. The EMP shall be*

implemented in consultation with local self Govt. Institutions. The indicated cost for CER shall be 2% of the project cost depending upon the nature of activities proposed. The follow up action on implementation of CER shall be included in the Half Yearly Compliance Report which will be subjected to field inspection at regular intervals. A copy of the approved EMP shall be made available to the concerned Panchayat for information and implementation support.

17. *In the wake of occurrence of large scale landslides in the state, as per the information provided by the Department of Mining & Geology, it is directed to use only NONEL (Non Electrical) technology for blasting to reduce the vibration of the ground, which is one of the causative factors that triggers landslides, formation of cracks in the surrounding buildings and disturbance to human and wildlife.*

18. *As per the directions contained in the OM F.No.22-34/2018-IA.III dated 16th January 2020 issued by MoEF&CC, in obedience to the directions of the Hon'ble Supreme Court the Project Proponent shall, undertake re-grassing the mining area and any other area which may have been disturbed due to his mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc. The compliance of this direction shall be included in the Half Yearly Compliance Report which will be monitored by SEAC at regular intervals.*

19. *The violation of EC condition may lead to cancellation of EC and action under The Environment (Protection) Act 1986.*

4. Environmental Clearance as per the EIA Notification, 2006 is hereby accorded for the Granite Building Stone Quarry for an area for an area of 4.8556 Ha in Re-Survey No. 341/6 (pt) in Koodal Village, Konni Taluk, Pathanamthitta District, Kerala of Sri. Rajesh Kumar Jha, Chief Executive Officer & Authorized Signatory, M/s. Adani Vizhinjam Port Pvt Ltd, 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram District – 695014, for the quantity mentioned in the approved Mining Plan, for 5 years from the date of execution of valid lease / permit from the Mining & Geology Department, subject to the Specific Conditions in Para 3 above, and all the environmental impact mitigation and management measures undertaken by the Project Proponent in the Form I, EMP, PFR and Mining plan submitted to SEIAA. The assurances and clarifications

given by the proponent will be deemed to be a part of this Proceedings as if incorporated herein. Also the General Conditions for projects stipulated for mining (items 1 to 57), mentioned below will be applicable and have to be strictly adhered to.

5. The Environmental Clearance issued will also be subject to full and effective implementation of all the undertakings given in the Application Form, mitigation measures as assured in the Environment Management Plan and the mining features including Progressive Mine Closure Plan as submitted with the application.The above undertakings and the conditions and the undertakings in (Mining), (Blasting), (Mines Drainage), (Stacking of Mineral rejects and Disposal of waste), (Environment Management Plan) & (Progressive Mine Closure Plan) of the Mining Plan as submitted will be deemed to be part of this Proceedings as conditions as undertaken by the proponent, as if incorporated herein.

6. Validity of the Environmental Clearance will be for a period of **Five (5) years** from the date of execution of the mining lease/permit from the Mining & Geology Department as per SO 1807(E) dated 12.04.2022 of MoEF & CC, subject to inspection by SEIAA on annual basis and compliance of the conditions, subject to earlier review of EC in case of violation or non-compliance of conditions or genuine complaints from residents within the security area of the quarry.

7. Compliance of the conditions herein will be monitored by the State Environment Impact Assessment Authority or its authorised offices and also by the Regional Office of the Ministry of Environment, Forest & Climate Change, Govt. of India, Bangalore. Necessary assistance for entry and inspection should be provided by the Project Proponent and those who are engaged or entrusted by him to the staff for inspection or monitoring. Instances of violation if any shall be reported to the District Collector, Pathanamthitta

8. The Half Yearly Compliance Report (HYCRs) with its contents, covering letter, compliance report and environmental monitoring data have to be uploaded in the PARIVESH portal and the website of the Project Proponent. The HYCR with the name of the project, EC No and date & the period of submission should be sent to the Regional Office of MoEF & CC & to SEIAA by email only at email ID rosz.bng-mefcc@gov.in & seacseiaakerala@gmail.com, respectively. Hardcopy of HYCRs shall not be acceptable.

9. The given address for correspondence with the authorised signatory of the project is

Sri. Rajesh Kumar Jha, Chief Executive Officer & Authorized Signatory, M/s. Adani Vizhinjam Port Pvt Ltd, 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram District – 695014

GENERAL CONDITIONS

1. The proponent should provide notarized affidavit (indicating the number and date of Environmental Clearance proceedings) that all the conditions stipulated in the EC shall be scrupulously followed.
2. All the statutory clearances should be obtained, as applicable, by the project proponent from the respective competent authorities including that for blasting and storage of explosives. Copies of all statutory clearances shall be submitted along with First Half Yearly Compliance Report.
3. The project proponent should advertise in news papers that the project has been accorded Environmental Clearance and copies of clearance letters are available in the Office of State Environment Impact Assessment Authority (SEIAA) and on the website of the Authority at www.seiaakerala.in. The advertisement should be in at least two local newspapers widely circulated in the region, one of which shall be in the vernacular language. The advertisement should be made within 10 days from the date of receipt of the Environmental Clearance letter and a copy of the same signed in all pages should be forwarded to the office of this Authority as confirmation.
4. The proponent shall send a copy of the EC to concerned Grama Panchayat/ District Panchayat/ Municipality/Corporation/Urban Local Body and also to the Local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal. The Environmental Clearance shall also be uploaded on the website of the company.
5. The lease area shall be fenced with barbed wire to a minimum height of 4ft around, before starting mining. All the boundary indicators (boards, markings, etc) shall be conspicuous and maintained at all times.
6. The details of Environmental Clearance should be prominently displayed in a metallic board of 3 ft x 3 ft with green background and yellow letters of

Times New Roman font size of not less than 40. Sign board with extent of lease area and boundaries shall be depicted at the entrance of the quarry, visible to the public.

7. Explosives should be stored in magazines in isolated place specified and approved by the Explosives Department. Mats to reduce fly rock blasts to a maximum of 10 PPV should be provided.

8. Warning alarms indicating the time of blasting (to be done at specific timings) has to be arranged stipulated by Explosive Department.

9. Access roads to the quarry shall be black topped to contain dust emissions that may arise during transportation of materials. The transportation of minerals should be done in covered trucks to contain dust emissions.

10. A separate Environmental Management Cell (EMC) with suitable qualified personnel should be set-up under the chairmanship of a Senior Executive, who will report directly to the Head of the Organization. The Cell should have representative of Biodiversity Management Committee of the Panchayath and a representative of NGO, if any active in the area. The EMC should meet at least once in six months and review the activities and minutes should be a part of the compliance report.

11. Quarrying has to be carried out as per approved mining plan with the suggestions from SEAC incorporated and following KMMC rules 2015 and the Amendments thereby.

12. The quarrying operation shall be restricted between 7 AM and 5PM

13. Rain Water Harvesting facility should be installed as per the prevailing provisions of KMBR/KPBR, unless otherwise specified. Maximum possible solar energy generation and utilization shall be ensured as an essential part of the project.

14. Maximum depth of mining shall be as per the mining plan and as per specific direction of SEAC after field inspection. The maximum depth of mining should not be deeper than the local ground water table. No mining operations should be carried out at places having a slope greater than 45°.

15. The height of any bench shall not exceed five meters and breadth shall not be less than the height.

16. The Project proponent shall ensure that no perennial or intermittent natural water course and/or water resources are obstructed due to any mining operations. Necessary safeguard measures to protect the first order streams, if any, originating from the mine lease shall be taken.

17. A minimum buffer distance specified as per existing rules and statutory orders shall be maintained from the boundary of the quarry to the nearest dwelling unit or other structures, and from forest boundaries or any other ecologically sensitive and archeologically important areas or the specific distance specified by SEIAA in EC as per the recommendations of SEAC depending on specific local conditions.

18. The proponent should plant seedlings at least 5 times of the loss of trees that has occurred while clearing the land for the project and follow planting measures as suggested by SEAC. Suitable avenue trees should be planted along the sides of the approach road and internal roads and open parking areas, if any. Preference should be given to endemic native and fruit bearing species. Planting in buffer areas should be taken up beforehand. Proper upkeep and maintenance of planted seedlings shall be ensured by the project proponent.

19. The proponent should ensure that the vegetation in the buffer is retained, maintained and strengthened with additions of native broad leaved plants.

20. Eco-restoration including the closure of mine as per the progressive closure plan and final closure plan shall be done at the cost of the project proponent. This eco-restoration should follow scientific standards available for restoration, full recovery of the original vegetation and improving the resilience of different ecosystems. Overburden materials should be managed within the site and used for reclamation of mined pit as per mine closure plan / specific conditions.

21. At least 10 percent out of the total excavated pit area should be retained as water storage areas and the remaining area should be reclaimed with stacked dumping and overburden and planted with suitable indigenous plant species, if no other specific condition on reclamation of pit is stipulated in the E.C. Monitoring and management of rehabilitated areas should continue until the

vegetation becomes self-sustaining.

22. Control measures on noise and vibration prescribed by KSPCB should be implemented. Quarrying activities should be limited to day time as per KSPCB guidelines/specific conditions.

23. Periodical monitoring of the vibration at specified location (preferably at a distance of 50 m and 100 m) to be conducted and records kept for inspection. This could also form a part of the compliance reports.

24. Speed of trucks entering or leaving the mine site is to be limited to moderate speed of 25 kmph to prevent undue noise from empty trucks.

25. Acoustic enclosures should be provided to reduce sound amplifications in addition to the provisions of green belt and hollow brick envelop for crushers so that the noise level is kept within prescribed standard limit indicated by CPCB/KSPCB.

26. Blasting should be done in a controlled manner using NONEL technique as specified by the regulations of Petroleum and explosive safety organization (GOI) or any other concerned authorized agency. A licensed person should supervise/ control the blasting operations.

27. Measures should be taken for maintaining noise levels below 85 dBA in the work environment.

28. Project proponent should obtain necessary prior permission of the competent authorities for drawing requisite quantity of surface water and ground water for the project.

29. Regular monitoring of flow rates and water quality upstream and downstream of the springs and perennial nallahs flowing in and around the mine lease area shall be carried out and reported in the six monthly compliance reports to SEIAA.

30. Catch drains and siltation ponds of appropriate size shall be constructed around the mine working, mineral and OB dumps, to prevent run off of water and flow of sediments directly into the river and other water bodies. The water so collected should be utilized for watering the mine area, roads, and for green belt development etc. The drains shall be regularly desilted and maintained properly, particularly after monsoon.

31. Regular monitoring of ground water level and quality shall be carried out around the mine area during mining operation. If any stage ,if it is observed that ground water table is getting depleted due to the mining activity; necessary corrective measures shall be carried out.

32. Garland drains and silt traps are to be provided in the slopes around the core area to channelize storm water. De-silting of Garland canal and silt traps have to be attended on a daily basis. A labour has to be specifically assigned for the purpose. The proponent shall ensure the quality of the discharging storm water as per the General Effluent Discharge Standards of CPCB.

33. In the case of any change(s) in the scope of the project, extent, quantity, process of mining technology involved or in any way affecting the environmental parameters/impacts as assessed, based on which the E.C was issued, the project would require a fresh appraisal by this Authority, for which the proponent shall apply and get the approval of this Authority. In the case of transfer of ECs, the matter shall be intimated and get the approval from the Authority as per the existing norms.

34. The stipulations by Statutory Authorities under different Acts and Notifications should be complied with, including 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.

35. The top soil, if any, shall be temporarily stored at earmarked place (s) and used for land reclamation and plantation. The over burden (OB) generated during the mining operations shall be stacked at earmarked dump site(s) only. The maximum height of the dumps shall not exceed 8m and width 20m and overall slope of the dumps shall be maintained at $45^{0.}$ The OB dumps should be scientifically vegetated with suitable native species to prevent erosion and surface run off. At critical points, use of geo textile shall be undertaken for stabilization of the dump. Protective wall or gabions should be made around the dump to prevent erosion / flow of sediments during rains. The entire excavated area shall be backfilled.

36. All the mining equipment used in Mining like backhoe loaders and

excavators cause pollution and hence shall be serviced regularly & maintained for their efficient functioning and for reducing pollution. Disposal of spent oil from diesel engines should be as specified under relevant Rules/ Regulations.

37. All vehicles used for transportation and within the mines shall have 'PUC' certificate from authorized pollution checking centre. Washing of all vehicles shall be inside the lease area. .

38. Effective safeguard measures such as regular water sprinkling shall be carried out in critical areas prone to air pollution such as haul road, loading and unloading points and transfer points and having high levels of PM_{10} and $PM_{2.5}$. Monitoring of Ambient Air Quality to be carried out based on the Notification 2009, as amended from time to time by the Central Pollution Control Board.

39. Fugitive dust emissions from all the sources should be controlled regularly. Water spraying arrangement at project site, parking area, on haul roads, loading and unloading and at transport points should be provided and properly maintained.

40. Corporate Environmental Responsibilities (CER) as prescribed by SEIAA/SEAC should be carried out leading to Environmental stability of the Project region. The activities carried out under CER should be a part of the half yearly compliance report. The certificates from the beneficiaries, if the CER part is completed should also be submitted to the State Environment Impact Assessment Authority (SEIAA) along with year wise expenditure .

41. The project proponent is responsible for implementing all the provisions of labour laws applicable from time to time to quarrying /Mining operations. The workers on the site should be provided with on-site accommodation or facilities at a suitable boarding place, protective equipment such as ear muffs, helmet, etc.

42. The proponent has to provide insurance protection to the workers in the case of existing mining or provide the affidavit in case of fresh lease before execution of mining lease.

43. Occupational health surveillance program of the workers should be

undertaken periodically to observe any contractions due to exposure to dust and take corrective measures, if needed. The report of health surveillance programme should be included in the half yearly compliance reports.

44. The pits in the abandoned quarries and in the mined area shall be used for activities like water harvesting, aqua culture etc. in an eco friendly manner.

45. If Government land is partly or fully used for mining, the area shall be returned at the end of lease period after mine closure with separate demarcation with suitable survey marks.

46. Any accident occurring in the mined out area after the lease period due to negligence in carrying out safety measures and non-closure , will lead to suspension of all EC obtained for mining by the Proponent.

47. In case of transfer of EC the matter shall be intimated and approval from the Authority shall be obtained as per the existing norms.

48. The proponent shall submit Half Yearly Compliance Reports (1st of June & 1st of December) on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) and upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall be simultaneously sent to the respective Regional Office of Ministry of Environment, Forests and Climate Change, Govt. of India and also to the Office of State Environment Impact Assessment Authority (SEIAA). The proponent has to submit Environmental statement in form V of Environment (Protection) Rules 1986 to SPCB on 31st March every year.

49. The project authorities should extend full cooperation to the officer (s) from the Regional Office of MOEF & CC located at Bangalore/SEAC/SPCB/CPCB/dept of Mining and Geology, while monitoring compliance of the stipulated conditions, by furnishing the requisite data/information/monitoring reports.

50. The above conditions shall prevail notwithstanding anything to the contrary, in consistent, or simplified, contained in any other permit, license on consent given by any other authority for the same project.

51. The Authority reserves the right to add additional safeguard measures subsequently, if found necessary, and to take action including revoking of the Environment Clearance under the provisions of the Environment (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner.

52. The EC given will be withdrawn at any time if the area is declared high hazardous by the SDMA.

53. The Environmental Clearance will be subject to the final order of the courts on any pending litigation related to the land or project, in any court of law.

54. Any appeal against this Environmental 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.

55. Concealing the factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.

56. The SEIAA may revoke or suspend the order, for non implementation of any of the specific or any of the above conditions. The SEIAA reserves the right to alter/modify the above conditions or stipulate any further condition in the interest of environmental protection.

57. As per regulation no. 106(2) of metalliferous mines regulation under Mine act, the height of any bench shall not exceed six meters and breadth shall not be less than the height.

Sd/-

Administrator, SEIAA
For Member Secretary, SEIAA

To,

Sri. Rajesh Kumar Jha,
Chief Executive Officer & Authorized Signatory,
M/s. Adani Vizhinjam Port Pvt Ltd,
2nd Floor, Vipanchika Tower,
Thycaud, Thiruvananthapuram District – 695014

Copy to,

1. MoEF Regional Office, Southern Zone, Kendriya Sadan, 4th Floor, E&F Wing, II Block, Koramangala, Bangalore-560034.(through e-mail: rosz.bng-mefcc@gov.in)
2. The Additional Chief Secretary to Government, Environment Department, Government of Kerala
3. The Director, Directorate of Environment & Climate Change, 4th Floor KSRTC Bus Terminal, Thampanoor, Thiruvananthapuram, Kerala 695001.
4. The District Collector,Pathanamthitta
5. The Director, Mining & Geology, Thiruvananthapuram -4.
6. The Member Secretary, Kerala State Pollution Control Board
7. The District Geologist, Pathanamthitta
8. The Tahsildhar, Konni Taluk, Pathanamthitta District
9. The Secretary, Kalanjoor Panchayath, Pathanamthitta
10. The Chairman, SEIAA.
11. Website.
12. S/f
13. O/c

Annexure XIII

CTO for Koodal Quarry

FILE NO : KSPCB/PT/ICO/10005066/2022
Date of issue : 02-08-2022

KERALA STATE POLLUTION CONTROL BOARD

CONSENT TO

OPERATE/AUTHORISATION/REGISTRATION

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. : 10005066
Dated : 15-06-2022

To

Adani Vizhinjam Port Pvt Ltd
Inchapara, Koodal Village, Konni Taluk, Pathanamthitta, Kerala

Consent No. : KSPCB/PT/ICO/10005066/2022
Valid Upto : 01-08-2025

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**	01-08-2025
2	Name and Address of the establishment	Adani Vizhinjam Port Pvt Ltd Inchapara, Koodal Village, Konni Taluk, Pathanamthitta, Kerala
3	Occupier Details	CEO AVPPL Adani Vizhinjam Port Pvt LTD Mulloor Post, Vizhinjam, Thiruvananthapuram, kerala - 695521
4	Local Body	Kalanjoor Panchayat
5	Survey Number	341/6
6	Village	Koodal
7	Taluk	Konni
8	District	PATHANAMTHITTA
9	Capital Investment(Rs in Lakhs)	652.5
10	Scale	Medium
11	Category	RED
12	Annual fee(Rs) Total Fee remitted(Rs)	55000.0 275000.0
13	Activity	Building Stone- avg.production/day (I yr)-353 MT - avg.production /day (II yr)-1945 MT - avg.production /day (III yr)-1945 MT (Extent- 4.8556 Ha)
14	Machinery details	1. Excavators (160Hp X3 NOs & , 275Hp X 2nos) 2. Compressor with Wagon drill (110HP x1) 3. Rock Breakers (4.57KJ) 4. Tractor mounded with Jackhammer (40HP x 5 Nos) 5. DG sets (5 kVA x 2 nos.)

SPECIFIC CONDITIONS

1. This Consent is issued based on the Judgement dated 25-10-21 of the Honourable Supreme Court of India in CA no. 6273 of 2021 and connected matters, order dated 14-12-2021 of the Honourable Supreme Court in MA no. 1904 of 2021, Judgement dated 10-11-2021 of the Honourable High Court of Kerala in WP(C) 2773 of 2021 and Judgement dated 10-12-2021 of the Honourable High Court of Kerala in WP(C) 27178 of 2021.

2. This Consent is issued subject to any order passed by the Honourable Supreme Court ,Honourable National Green Tribunal, Honourable High Court of Kerala in connected matters.

3. Quarrying shall be done only within the area marked in the location plan .No change, deviation or alteration that may affect the environment, extent and location of quarry shall made. Any change in particulars furnished in the application/the identity of the occupier/ authorized agent is to be intimated to the Board forthwith.

4. The applicant shall put up sign board near the main entrance of the plant to display consent number& validity.

5. Suitable species of trees and curtain plants shall be planted and maintained within and along the periphery of the premises, forming a green belt to improve the environment.

6. Fencing shall be provided around the boundary of quarry and shall be maintained properly.

7. After completion of excavation at any site, the abandoned quarry shall be utilized for rain water harvesting with protective barriers/ any other suitable approved purpose or may be reclaimed as per specification.

8. PM 10 in ambient air at the boundary of quarry shall not exceed 100 microgram /cu.m.PM2.5 in ambient air at the boundary shall not exceed 60 microgram /cu.m.

9. The Sound level (Leq) at 1m outside the boundary of the site shall not exceed the ambient noise standards applicable to the adjoining areas.

10. The consent unless withdrawn earlier and subject to condition no. 1 & 2 shall be valid up to 01/08/2025. For renewal of consent, application may be submitted online 2 months in advance of expiry of validity date.

11. The consent issued from the Board shall be valid only for a period when all other statutory or necessary clearances from other concerned authorities are valid.

12. The applicant shall comply with the instructions that the Board may issue from time to time regarding the prevention and control of Air, Water, Land and Sound Pollution.

SIGNATURE OF ISSUING AUTHORITY

ENVIRONMENTAL ENGINEER

SURVEY MAP

BLOCK NO	-	30
RE-SURVEY NO.	-	341/6part
LEASE AREA	-	4.8556 Hectares

DISTRICT	-	PATHANAMTHITTA
TALUK	-	KONNI
VILLAGE	-	KOODAL
PANCHAYATH	-	KALANJOOR

APPLICANT

M/s. Adani Vizhinjam Port Pvt. Ltd., 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram, Kerala State-695 014.

LEGENDS

	AREA APPLIED FOR LEASE
	PANCHAYATH ROAD
	APPROACH ROAD (10m width)
	SEASONAL DRAINAGE (THODU)
	F.M.B SURVEY LINE
	F.M.B SUB-DIVISION LINE
	200m BOUNDARY LINE
	HOUSE / BUILDING / SHED
	SURVEY STONE
	ROCK MARK
	ELECTRIC POST
	OLD MINING AREA
	BOUNDARY PILLAR

SCALE- 1:3000
ALL DIMENSIONS ARE IN METERS

GCP POINTS

PT.ID	Latitude	Longitude
GCP-1	9°8'54.7605'N	76°52'19.8362'E
GCP-2	9°8'55.233'N	76°52'28.207'E
GCP-3	9°9'4.742'N	76°52'26.299'E

KNOWN POINT

SL.No	Latitude	Longitude
1	9°8'55.012'N	76°52'37.612'E
2	9°8'54.7605'N	76°52'19.8362'E
3	9°8'54.593'N	76°52'16.404'E

OLD PIT AREA

SL.NO	AREA (GROUND)
PIT-1	0.1096 Hect.
PIT-2	0.4184 Hect.
PIT-3	0.6986Hect.
Total	**1.2266 Hect.**

THIS SURVEY MAP IS PREPARED BASED ON FMB

PROPERTY DETAILS

SL.NO	DOC.NO.	THANDAPER NO.	RE-SY. BLOCK NO.	RE - SY. NO.	TOTAL AREA (IN HECTARES)	AREA ALREADY UNDER QUARRYING (IN HECTARES)	AREA APPLIED FOR LEASE (IN HECTARES)	OWNER NAME
1	NOC ISSUED BY REVENUE DEPARTMENT (C7-186960/18, dated-15/2/19)		30	341/6	6.3200	1.2266	4.8556	GOVT. LAND (PARA POR AMPOKE)
		TOTAL			**6.3200**	**1.2266**	**4.8556**	

THIS SURVEY MAP IS PREPARED TO PRODUCE IN THE DEPARTMENT OF MINING AND GEOLOGY / SEIAA, KERALA.

Countersigned
05/9/2021

TAHSILDAR
KONNI

താലൂക്ക് സർവ്വേയർ
കോന്നി

7/9/2021

APPROVED LOCATION PLAN

ENVIRONMENTAL ENGINEER

Annexure XIV

EC for Kadavilla-2&3 Quarry

ENVIRONMENTAL CLEARANCE

PARIVESH

(Pro-Active and Responsive Facilitation by Interactive, and Virtuous Environmental Single-Window Hub)

Government of India
Ministry of Environment, Forest and Climate Change
(Issued by the State Environment Impact Assessment Authority(SEIAA), Kerala)

To,

The CEO
ADANI VIZHINJAM PORT PVT LTD
2nd Floor, Vipanchika Tower, Thycaud Thiruvananthapuram -695014

Subject: Grant of Environmental Clearance (EC) to the proposed Project Activity under the provision of EIA Notification 2006-regarding

Sir/Madam,

This is in reference to your application for Environmental Clearance (EC) in respect of project submitted to the SEIAA vide proposal number SIA/KL/MIN/58473/2019 dated 26 Mar 2021. The particulars of the environmental clearance granted to the project are as below.

1.	**EC Identification No.**	**EC22B001KL194879**
2.	**File No.**	1405/EC2/2019/SEIAA
3.	**Project Type**	New
4.	**Category**	B1
5.	**Project/Activity including Schedule No.**	1(a) Mining of minerals
6.	**Name of Project**	Proposed Building Stone Quarry in Re - Sy. Block No. 37, Re – Sy No. 554/1, 554/5 & 554/6 of Nagaroor village (Kadavilla), Chirayinkeezh Taluk, Thiruvananthapuram district of Kerala state
7.	**Name of Company/Organization**	ADANI VIZHINJAM PORT PVT LTD
8.	**Location of Project**	Kerala
9.	**TOR Date**	22 Aug 2019

The project details along with terms and conditions are appended herewith from page no 2 onwards.

(e-signed)
Dr. Venu V IAS
Member Secretary
SEIAA - (Kerala)

Date: 16/08/2022

Note: A valid environmental clearance shall be one that has EC identification number & E-Sign generated from PARIVESH.Please quote identification number in all future correspondence.

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सत्यमेव जयते

PROCEEDINGS OF THE STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY – KERALA, THIRUVANANTHAPURAM

(Present : Dr.H.Nagesh Prabhu IFS (Retd), Chairman, Shri.K.Krishna Panicker, Member, Dr.V.Venu IAS, Member Secretary)

Sub: SEIAA - Environmental Clearance for the Granite Building Stone Quarry Project of Sri. Rajesh Kumar Jha, CEO – Authorized signatory, M/s Adani Vizhinjam Port Pvt, Ltd. (AVPPL), 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram - 695 014 - Granted – Orders issued.

State Level Environment Impact Assessment Authority, Kerala

Proposal No. SIA/KL/MIN/58473/2019 **File No. 1405/EC2/2019/SEIAA**

Ref: 1.Application received on 21.11.2020 from Sri. Rajesh Kumar Jha, CEO, M/s Adani Vizhinjam Port Pvt Ltd.

2. Minutes of the 128th SEAC meeting held on 23rd to 24th May, 2022
3. Minutes of the 115th SEIAA meeting held on 30th June, 2022
4. G.O(Rt.) No.29/2019/Envt dt.12.04.2019.

ENVIRONMENTAL CLEARANCE NO. 92/Q/2022

Sri. Rajesh Kumar Jha, CEO – Authorized Signatory, M/s Adani Vizhinjam Port Pvt Ltd. (AVPPL), 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram - 695014, submitted an application for Environmental Clearance via PARIVESH on 21.11.2020 for the Granite Building Stone Quarry Project for an area of 2.4706 Ha, in Block No. 37, Re. Sy No. 554/1, 554/5 & 554/6 of Government (Poraomboke) land in Nagaroor Village (Kadavilla),

Chirayinkeezh Taluk, Thiruvananthapuram District, Kerala. The project details are as follows:

SL.No.	Particulars	Details
1	Name of the Project	Granite Building Stone Quarry Project of M/s Adani Vizhinjam Port Limited
2	Proposed Activity	Mining of Granite Building Stone
3	Name of the Sector & Schedule No. (in the EIA Notification, 2006)	Non Coal mining, Activity 1(a), Category B2
4	Name & Address of the Project Proponent	Sri. Rajesh Kumar Jha, CEO – Authorized signatory, M/s Adani Vizhinjam Port Pvt Ltd. (AVPPL), 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram – 695014
5	Project Location	
	a) Block. No Re-Survey Nos:	37 554/1, 554/5 & 554/6, Government (Poraomboke) land
	b) Village	Nagaroor Village (Kadavilla)
	c) Taluk	Chirayinkeezhu
	d) District	Thiruvananthapuram
6	Geo Co-ordinates	Latitude 08º43’ 41.70” N to 08º43’ 51.74” N Longitude 76º50’ 21.24” E to 76º 50’ 27.59” E
7	Extent (in Hectare)	2.4706
8	Project Cost	Rs.300 Lakhs
9	Production Capacity	2,30,000 TPA

10	Water Requirement Source	25 KLD (0.5 KLD for domestic, 1.0 KLD for plantation & 23.5 KLD for dust suppression) Open well & Quarry pit
11	Date of Field Inspection	07.05.2022

CER Details

Sl.No.	Activity	Initial cost (Lakh Rs.	Recurring expenses proposed/annum (Lakh Rs.)
Environmental Monitoring			
1	Environmental monitoring (Air, water, Noise, soil and etc.)	-	3.50
Pollution control measures			
2	Air Pollution Control Measures (4 trip/day * 200 days* Rs.700/trip	-	5.60
3	Plantation	2.00	1.00
4	Water Pollution Control Measures such as gully checks, rubble walls, garland drains within the quarry, etc.	6.00	2.00
5	Preventive and corrective maintenance of plant and machinery to reduce noise pollution and consumption of non- renewable resources (2.5% of the plant & machinery cost).	-	1.50
6	Occupational Health & Safety (provision of first aid room, shelter, providing PPEs)	3.00	2.50
Sub- Total		**11.00**	**16.10**
CER Activities related to Concerns raised during the Public Consultation in physical terms			
7	Considering a requirement form the Local People during the Public Hearing, CER activity with respect to cost towards water supply to	-	5.00

	Thannikonam and Kadavilla will be taken up.		
8	Considering a requirement from the Local People during the Public hearing, CER activity with respect to cost towards Maintenance of Roads: From Thannikonam Village to Kadavilla Junction and other nearby roads will be taken up.	-	8.00
9	Special Medical Checkup and general checkup camps in nearby villages: Nagaroor, Kadavilla, Vanchiyoor will be taken up	-	2.00
Sub- Total		**-**	**15.00**
Total		**Rs. 11.00 Lakhs**	**Rs. 31.10 lakhs**

2. In the 128th SEAC meeting held on 23rd to 24th May, 2022, the Committee examined the documents submitted by the proponent and found them satisfactory. The nearest built structure is at a distance of 55.3m. The Committee discussed the field inspection report and recommended for EC for a period of 5 years subject to the following Specific Conditions in addition to the General Conditions

a. The proponent should upload the District Survey Report, Form 1M and Annexures of the Mine Plan, produced during the field inspection, prior to issuance of the EC.
b. Garland drain should be provided covering the entire project area along with intermittent silt traps and siltation pond of appropriate volume and outflow channel. The entire drain should be desilted periodically for preventing any obstruction to the drainage system.
c. Blasting (NONEL) should be done only with drill hole of 32mm diameter and depth 1.5m loaded with a maximum of 375 gm of explosive in each hole of the array with a burden of 1.5m and spacing of 1m. An affidavit to this should be submitted by the Proponent.
d. If the proponent desires to adopt blasting (NONEL) using drill hole of diameter 115mm and depth 6.5m with burden ranging from 2.00 to 2.50 m and spacing of 2.50 to 3.00 m loaded with higher quantity of explosives to the tune of about 20 – 25 kgs of explosives, as proposed in the Mine Plan, special permission from the SEIAA

should be obtained after conducting a vibration impact study on various built structures within 200m from the project boundary by engaging a National Institute such as National Institute of Rock Mechanics and inference thereupon.

e. Impact of vibration due to blasting on the nearest houses and built structures should be monitored in terms of Peak Particle Velocity and amplitude for a maximum charge per delay and included in the Half Yearly Compliance Report.
f. Retaining wall of appropriate height should be provided at the overburden dumping site
g. CER Plan should be implemented within the first 18 months and it should be operated and maintained till the mine closure plan is implemented
h. Planting of trees for the development of green belt should be done prior to the commencement of mining and green belt should be nurtured and maintained during the entire project period
i. Temporary wall should be provided wherever green belt cannot be developed due to the presence of barren rock
j. Temporary wall should be provided at the boundary adjacent to the Temple and Thrisoolam structure
k. Compensatory afforestation should be initiated before the commencement of mining in available land as tree planting is not feasible along some portion of the buffer zone
l. Transportation of mined material should not be done during the peak hours in the forenoon (8.30am to 10.30am) and afternoon (3.30pm to 5 pm).
m. Adequate number of toilets and waste management facility should be provided at the site
n. Haulage road should be maintained well with frequent sprinkling
o. The proponent should submit an affidavit stating that all the assurances given during the Public Consultation process will be complied with including the drinking water.

3. In the 115th SEIAA meeting held on 30th June, 2022, the Authority decided to issue Environmental Clearance for the project life of 5 years for the quantity mentioned in the approved Mining Plan after the Project Proponent uploads the District Survey Report, Form 1M and Annexures of the Mine Plan, produced during the field inspection and submission of all necessary documents and affidavits as instructed by SEAC in its 128th meeting to the

satisfaction of SEIAA. The EC is subject to the following Specific Conditions in addition to the General Conditions.

1. *The proponent shall carry out quarrying as per the approved Mining Plan and the proponent should strictly follow the Kerala Minor Mineral Concession Rules 2015 and amendments thereby.*
2. *The EC shall be valid from the date of execution of permit/lease from the Department of Mining and Geology. The copy of the lease order should be provided to the SEIAA before commencing the mining activity.*
3. *Simultaneous blasting in Kadavila I and Kadavila II quarries must be avoided and time schedule must be adopted for blasting.*
4. *Garland drain should be provided covering the entire project area along with intermittent silt traps and siltation pond of appropriate volume and outflow channel. The entire drain should be desilted periodically for preventing any obstruction to the drainage system.*
5. *The proponent should adhere to the affidavit regarding the drilling and blasting parameters that Blasting (NONEL) will be done only with drill hole of 32mm diameter and depth 1.5m loaded with a maximum of 375 gm of explosive in each hole of the array with a burden of 1.5m and spacing of 1m.*
6. *A vibration impact study on various built structures within 200m from the project boundary shall be conducted by engaging a National Institute such as National Institute of Rock Mechanics* and their recommendations must be implemented. *A copy of the study report should be made available to Dept. of Mining and Geology for their record and future reference.*
7. *Impact of vibration due to blasting on the nearest houses and built structures should be monitored in terms of Peak Particle Velocity and amplitude for a maximum charge per delay and included in the Half Yearly Compliance Report.*
8. *Retaining wall of appropriate height should be provided at the overburden dumping site*

9. *CER Plan should be implemented within the first 18 months and it should be operated and maintained till the mine closure plan is implemented*
10. *Planting of trees for the development of green belt should be done prior to the commencement of mining and green belt should be nurtured and maintained during the entire project period*
11. *Temporary wall should be provided wherever green belt cannot be developed due to the presence of barren rock*
12. *Temporary wall should be provided at the boundary adjacent to the Temple and Thrisoolam structure*
13. *Compensatory afforestation should be initiated before the commencement of mining in available land as tree planting is not feasible along some portion of the buffer zone*
14. *Transportation of mined material should not be done during the peak hours in the forenoon (8.30am to 10.30am) and afternoon (3.30pm to 5 pm).*
15. *Mining activities including loading of mined materials should not be carried out between sun set and sunrise.*
16. *Adequate number of toilets and waste management facility should be provided at the site*
17. *Haulage road should be maintained well with frequent sprinkling*
18. *The proponent should adhere to the affidavit stating that all the assurances given during the Public Consultation process will be complied with including the drinking water supply.*
19. *As per OM no F.No.22-65/2017-IA.III dated 30th September 2020, under Corporate Environmental Responsibility (CER) the project Proponent shall prepare an Environment Management Plan (EMP) as directed by SEAC during appraisal, covering the issues to address the environmental problems in the project region, indicating both physical and financial targets year wise. The EMP shall be implemented in consultation with local self Govt. Institutions. The indicated cost for CER shall be 2% of the project cost depending upon the nature of activities proposed. The follow up action on implementation of CER shall be included in the Half Yearly Compliance Report which will be subjected to field inspection at regular*

intervals. A copy of the approved EMP shall be made available to the concerned Panchayat for information and implementation support.

20. *In the wake of occurrence of large scale landslides in the state, as per the information provided by the Department of Mining & Geology, it is directed to use only NONEL (Non Electrical) technology for blasting to reduce the vibration of the ground, which is one of the causative factors that triggers landslides, formation of cracks in the surrounding buildings and disturbance to human and wildlife.*

21. *As per the directions contained in the OM F.No.22-34/2018-IA.III dated 16th January 2020 issued by MoEF&CC, in obedience to the directions of the Hon'ble Supreme Court the Project Proponent shall, undertake re-grassing the mining area and any other area which may have been disturbed due to his mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc. The compliance of this direction shall be included in the Half Yearly Compliance Report which will be monitored by SEAC at regular intervals.*

22. *The violation of EC condition may lead to cancellation of EC and action under The Environment (Protection) Act 1986.*

4. The proponent submitted the affidavit and other required documents as instructed by SEIAA.

5. Environmental Clearance as per the EIA Notification, 2006 is hereby accorded for the Granite Building Stone Quarry Project of Sri. Rajesh Kumar Jha, CEO – Authorized signatory, M/s Adani Vizhinjam Port Pvt Ltd. (AVPPL), 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram – 695014, for an area of 2.4706 Ha, in Block No. 37, Re. Sy No. 554/1, 554/5 & 554/6 of Government (Poramboke) land in Nagaroor Village (Kadavilla), Chirayinkeezh Taluk, Thiruvananthapuram District, Kerala, for the Project Life of 5 years for the quantity mentioned in the approved Mining Plan from the date of execution of valid permit / lease from the Mining & Geology Department, subject to the Specific Conditions in Para 3 above, and all the environmental impact mitigation and management measures undertaken by the Project Proponent in the Form I, EMP, PFR and Mining plan submitted to SEIAA. The assurances

and clarifications given by the proponent will be deemed to be a part of this Proceedings as if incorporated herein. Also the General Conditions for projects stipulated for mining (items 1 to 57), mentioned below will be applicable and have to be strictly adhered to.

6. The Environmental Clearance issued will also be subject to full and effective implementation of all the undertakings given in the Application Form, mitigation measures as assured in the Environment Management Plan and the mining features including Progressive Mine Closure Plan as submitted with the application. The above undertakings and the conditions and the undertakings in (Mining), (Blasting), (Mines Drainage), (Stacking of Mineral rejects and Disposal of waste), (Environment Management Plan) & (Progressive Mine Closure Plan) of the Mining Plan as submitted will be deemed to be part of this Proceedings as conditions as undertaken by the proponent, as if incorporated herein.

7. Validity of the Environmental Clearance will be for a period of **Five (5) years** from the date of execution of valid mine lease/permit from Mining & Geology Department as per SO 1807(E) dated 12.04.2022 of MoEF & CC, subject to earlier review of EC in case of violation or non-compliance of conditions or genuine complaints from residents within the security area of the quarry.

8. Compliance of the conditions herein will be monitored by the State Environment Impact Assessment Authority or its authorised offices and also by the Regional Office of the Ministry of Environment, Forest & Climate Change, Govt. of India, Bangalore. Necessary assistance for entry and inspection should be provided by the Project Proponent and those who are engaged or entrusted by him to the staff for inspection or monitoring. Instances of violation if any shall be reported to the District Collector, Thiruvanathapuram

9. The Half Yearly Compliance Report (HYCRs) with its contents, covering letter, compliance report and environmental monitoring data have to be uploaded in the PARIVESH portal and the website of the Project Proponent. The HYCR with the name of the project, EC No and date & the period of submission should be sent to the Regional Office of MoEF & CC & to SEIAA by email only at email ID rosz.bng-mefcc@gov.in & seacseiaakerala@gmail.com, respectively. Hardcopy of HYCRs shall not be acceptable.

10. The given address for correspondence with the authorised signatory of the project is Sri. Rajesh Kumar Jha, CEO – Authorized signatory, M/s Adani Vizhinjam Port Pvt Ltd. (AVPPL), 2nd Floor, Vipanchika Tower, Thycaud, Thiruvananthapuram – 695014.

GENERAL CONDITIONS

1. The proponent should provide notarized affidavit (indicating the number and date of Environmental Clearance proceedings) that all the conditions stipulated in the EC shall be scrupulously followed.
2. All the statutory clearances should be obtained, as applicable, by the project proponent from the respective competent authorities including that for blasting and storage of explosives. Copies of all statutory clearances shall be submitted along with First Half Yearly Compliance Report.
3. The project proponent should advertise in news papers that the project has been accorded Environmental Clearance and copies of clearance letters are available in the Office of State Environment Impact Assessment Authority (SEIAA) and on the website of the Authority at www.seiaakerala.in. The advertisement should be in at least two local newspapers widely circulated in the region, one of which shall be in the vernacular language. The advertisement should be made within 10 days from the date of receipt of the Environmental Clearance letter and a copy of the same signed in all pages should be forwarded to the office of this Authority as confirmation.
4. The proponent shall send a copy of the EC to concerned Grama Panchayat/ District Panchayat/ Municipality/Corporation/Urban Local Body and also to the Local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal. The Environmental Clearance shall also be uploaded on the website of the company.
5. The lease area shall be fenced with barbed wire to a minimum height of 4ft around, before starting mining. All the boundary indicators (boards, markings, etc) shall be conspicuous and maintained at all times.
6. The details of Environmental Clearance should be prominently displayed in a metallic board of 3 ft x 3 ft with green background and yellow letters of

Times New Roman font size of not less than 40. Sign board with extent of lease area and boundaries shall be depicted at the entrance of the quarry, visible to the public.

7. Explosives should be stored in magazines in isolated place specified and approved by the Explosives Department. Mats to reduce fly rock blasts to a maximum of 10 PPV should be provided.

8. Warning alarms indicating the time of blasting (to be done at specific timings) has to be arranged stipulated by Explosive Department.

9. Access roads to the quarry shall be black topped to contain dust emissions that may arise during transportation of materials. The transportation of minerals should be done in covered trucks to contain dust emissions.

10. A separate Environmental Management Cell (EMC) with suitable qualified personnel should be set-up under the chairmanship of a Senior Executive, who will report directly to the Head of the Organization. The Cell should have representative of Biodiversity Management Committee of the Panchayath and a representative of NGO, if any active in the area. The EMC should meet at least once in six months and review the activities and minutes should be a part of the compliance report.

11. Quarrying has to be carried out as per approved mining plan with the suggestions from SEAC incorporated and following KMMC rules 2015 and the Amendments thereby.

12. The quarrying operation shall be restricted between 7 AM and 5PM

13. Rain Water Harvesting facility should be installed as per the prevailing provisions of KMBR/KPBR, unless otherwise specified. Maximum possible solar energy generation and utilization shall be ensured as an essential part of the project.

14. Maximum depth of mining shall be as per the mining plan and as per specific direction of SEAC after field inspection. The maximum depth of mining should not be deeper than the local ground water table. No mining operations should be carried out at places having a slope greater than 45°.

15. The height of any bench shall not exceed five meters and breadth shall not be less than the height.

16. The Project proponent shall ensure that no perennial or intermittent natural water course and/or water resources are obstructed due to any mining operations. Necessary safeguard measures to protect the first order streams, if any, originating from the mine lease shall be taken.

17. A minimum buffer distance specified as per existing rules and statutory orders shall be maintained from the boundary of the quarry to the nearest dwelling unit or other structures, and from forest boundaries or any other ecologically sensitive and archeologically important areas or the specific distance specified by SEIAA in EC as per the recommendations of SEAC depending on specific local conditions.

18. The proponent should plant seedlings at least 5 times of the loss of trees that has occurred while clearing the land for the project and follow planting measures as suggested by SEAC. Suitable avenue trees should be planted along the sides of the approach road and internal roads and open parking areas, if any. Preference should be given to endemic native and fruit bearing species. Planting in buffer areas should be taken up beforehand. Proper upkeep and maintenance of planted seedlings shall be ensured by the project proponent.

19. The proponent should ensure that the vegetation in the buffer is retained, maintained and strengthened with additions of native broad leaved plants.

20. Eco-restoration including the closure of mine as per the progressive closure plan and final closure plan shall be done at the cost of the project proponent. This eco-restoration should follow scientific standards available for restoration, full recovery of the original vegetation and improving the resilience of different ecosystems. Overburden materials should be managed within the site and used for reclamation of mined pit as per mine closure plan / specific conditions.

21. At least 10 percent out of the total excavated pit area should be retained as water storage areas and the remaining area should be reclaimed with stacked dumping and overburden and planted with suitable indigenous plant species, if no other specific condition on reclamation of pit is stipulated in the E.C. Monitoring and management of rehabilitated areas should continue until the

vegetation becomes self-sustaining.

22. Control measures on noise and vibration prescribed by KSPCB should be implemented. Quarrying activities should be limited to day time as per KSPCB guidelines/specific conditions.

23. Periodical monitoring of the vibration at specified location (preferably at a distance of 50 m and 100 m) to be conducted and records kept for inspection. This could also form a part of the compliance reports.

24. Speed of trucks entering or leaving the mine site is to be limited to moderate speed of 25 kmph to prevent undue noise from empty trucks.

25. Acoustic enclosures should be provided to reduce sound amplifications in addition to the provisions of green belt and hollow brick envelop for crushers so that the noise level is kept within prescribed standard limit indicated by CPCB/KSPCB.

26. Blasting should be done in a controlled manner using NONEL technique as specified by the regulations of Petroleum and explosive safety organization (GOI) or any other concerned authorized agency. A licensed person should supervise/ control the blasting operations.

27. Measures should be taken for maintaining noise levels below 85 dBA in the work environment.

28. Project proponent should obtain necessary prior permission of the competent authorities for drawing requisite quantity of surface water and ground water for the project.

29. Regular monitoring of flow rates and water quality upstream and downstream of the springs and perennial nallahs flowing in and around the mine lease area shall be carried out and reported in the six monthly compliance reports to SEIAA.

30. Catch drains and siltation ponds of appropriate size shall be constructed around the mine working, mineral and OB dumps, to prevent run off of water and flow of sediments directly into the river and other water bodies. The water so collected should be utilized for watering the mine area, roads, and for green belt development etc. The drains shall be regularly desilted and maintained properly, particularly after monsoon.

31. Regular monitoring of ground water level and quality shall be carried out around the mine area during mining operation. If any stage ,if it is observed that ground water table is getting depleted due to the mining activity; necessary corrective measures shall be carried out.

32. Garland drains and silt traps are to be provided in the slopes around the core area to channelize storm water. De-silting of Garland canal and silt traps have to be attended on a daily basis. A labour has to be specifically assigned for the purpose. The proponent shall ensure the quality of the discharging storm water as per the General Effluent Discharge Standards of CPCB.

33. In the case of any change(s) in the scope of the project, extent, quantity, process of mining technology involved or in any way affecting the environmental parameters/impacts as assessed, based on which the E.C was issued, the project would require a fresh appraisal by this Authority, for which the proponent shall apply and get the approval of this Authority. In the case of transfer of ECs, the matter shall be intimated and get the approval from the Authority as per the existing norms.

34. The stipulations by Statutory Authorities under different Acts and Notifications should be complied with, including 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.

35. The top soil, if any, shall be temporarily stored at earmarked place (s) and used for land reclamation and plantation. The over burden (OB) generated during the mining operations shall be stacked at earmarked dump site(s) only. The maximum height of the dumps shall not exceed 8m and width 20m and overall slope of the dumps shall be maintained at $45^{0.}$ The OB dumps should be scientifically vegetated with suitable native species to prevent erosion and surface run off. At critical points, use of geo textile shall be undertaken for stabilization of the dump. Protective wall or gabions should be made around the dump to prevent erosion / flow of sediments during rains. The entire excavated area shall be backfilled.

36. All the mining equipment used in Mining like backhoe loaders and

excavators cause pollution and hence shall be serviced regularly & maintained for their efficient functioning and for reducing pollution. Disposal of spent oil from diesel engines should be as specified under relevant Rules/ Regulations.

37. All vehicles used for transportation and within the mines shall have 'PUC' certificate from authorized pollution checking centre. Washing of all vehicles shall be inside the lease area. .

38. Effective safeguard measures such as regular water sprinkling shall be carried out in critical areas prone to air pollution such as haul road, loading and unloading points and transfer points and having high levels of PM_{10} and $PM_{2.5}$. Monitoring of Ambient Air Quality to be carried out based on the Notification 2009, as amended from time to time by the Central Pollution Control Board.

39. Fugitive dust emissions from all the sources should be controlled regularly. Water spraying arrangement at project site, parking area, on haul roads, loading and unloading and at transport points should be provided and properly maintained.

40. Corporate Environmental Responsibilities (CER) as prescribed by SEIAA/SEAC should be carried out leading to Environmental stability of the Project region. The activities carried out under CER should be a part of the half yearly compliance report. The certificates from the beneficiaries, if the CER part is completed should also be submitted to the State Environment Impact Assessment Authority (SEIAA) along with year wise expenditure .

41. The project proponent is responsible for implementing all the provisions of labour laws applicable from time to time to quarrying /Mining operations. The workers on the site should be provided with on-site accommodation or facilities at a suitable boarding place, protective equipment such as ear muffs, helmet, etc.

42. The proponent has to provide insurance protection to the workers in the case of existing mining or provide the affidavit in case of fresh lease before execution of mining lease.

43. Occupational health surveillance program of the workers should be

undertaken periodically to observe any contractions due to exposure to dust and take corrective measures, if needed. The report of health surveillance programme should be included in the half yearly compliance reports.

44. The pits in the abandoned quarries and in the mined area shall be used for activities like water harvesting, aqua culture etc. in an eco friendly manner.

45. If Government land is partly or fully used for mining, the area shall be returned at the end of lease period after mine closure with separate demarcation with suitable survey marks.

46. Any accident occurring in the mined out area after the lease period due to negligence in carrying out safety measures and non-closure , will lead to suspension of all EC obtained for mining by the Proponent.

47. In case of transfer of EC the matter shall be intimated and approval from the Authority shall be obtained as per the existing norms.

48. The proponent shall submit Half Yearly Compliance Reports (1st of June & 1st of December) on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) and upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall be simultaneously sent to the respective Regional Office of Ministry of Environment, Forests and Climate Change, Govt. of India and also to the Office of State Environment Impact Assessment Authority (SEIAA). The proponent has to submit Environmental statement in form V of Environment (Protection) Rules 1986 to SPCB on 31st March every year.

49. The project authorities should extend full cooperation to the officer (s) from the Regional Office of MOEF & CC located at Bangalore/SEAC/SPCB/CPCB/dept of Mining and Geology, while monitoring compliance of the stipulated conditions, by furnishing the requisite data/information/monitoring reports.

50. The above conditions shall prevail notwithstanding anything to the contrary, in consistent, or simplified, contained in any other permit, license on consent given by any other authority for the same project.

51. The Authority reserves the right to add additional safeguard measures subsequently, if found necessary, and to take action including revoking of the Environment Clearance under the provisions of the Environment (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner.

52. The EC given will be withdrawn at any time if the area is declared high hazardous by the SDMA.

53. The Environmental Clearance will be subject to the final order of the courts on any pending litigation related to the land or project, in any court of law.

54. Any appeal against this Environmental 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.

55. Concealing the factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.

56. The SEIAA may revoke or suspend the order, for non implementation of any of the specific or any of the above conditions. The SEIAA reserves the right to alter/modify the above conditions or stipulate any further condition in the interest of environmental protection.

57. As per regulation no. 106(2) of metalliferous mines regulation under Mine act, the height of any bench shall not exceed six meters and breadth shall not be less than the height.

Sd/-

Administrator, SEIAA
For Member Secretary, SEIAA

To,

Sri. Rajesh Kumar Jha,
CEO – Authorized signatory,
M/s Adani Vizhinjam Port Pvt Ltd. (AVPPL),
2nd Floor, Vipanchika Tower,
Thycaud, Thiruvananthapuram - 695014

Copy to,

1. MoEF Regional Office, Southern Zone, Kendriya Sadan, 4th Floor, E&F Wing, II Block, Koramangala, Bangalore-560034.(through e-mail: rosz.bng-mefcc@gov.in)
2. The Additional Chief Secretary to Government, Environment Department, Government of Kerala
3. The Director, Directorate of Environment & Climate Change, 4th Floor KSRTC Bus Terminal, Thampanoor, Thiruvananthapuram, Kerala 695001.
4. The District Collector, Thiruvanathapuram
5. The Director, Mining & Geology, Thiruvananthapuram -4.
6. The Member Secretary, Kerala State Pollution Control Board
7. The District Geologist, Thiruvanathapuram
8. The Tahsildhar, Chirayinkeezh Taluk, Thiruvananthapuram District
9. The Secretary, Nagaroor Panchayath, Thiruvananthapuram
10. The Chairman, SEIAA.
11. Website.
12. S/f
13. O/c

Annexure XV

CTO for Kadavilla-2&3 Quarry

FILE NO : KSPCB/TV/ICO/10005087/2022
Date of issue : 27-08-2022

KERALA STATE POLLUTION CONTROL BOARD

CONSENT TO

OPERATE/AUTHORISATION/REGISTRATION

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. : 10005087
Dated : 15-06-2022

To

Adani Vizhinjam Port Pvt Ltd
Kadavila 2 & 3 Stone Quarry, Nagaroor Village, Chirayinkeezhu, Thiruvananthapuram

Consent No. : KSPCB/TV/ICO/10005087/2022
Valid Upto : 31-05-2025

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**	31-05-2025
2	Name and Address of the establishment	Adani Vizhinjam Port Pvt Ltd Kadavila 2 & 3 Stone Quarry, Nagaroor Village, Chirayinkeezhu, Thiruvananthapuram
3	Occupier Details	CEO AVPPL Adani Vizhinjam Port Pvt LTD Mulloor Post, Vizhinjam, Thiruvananthapuram, kerala - 695521
4	Local Body	Nagaroor Panchayat
5	Survey Number	554/1, 554/5, 554/6
6	Village	Nagaroor
7	Taluk	Chirayinkeezhu
8	District	THIRUVANANTHAPURAM
9	Capital Investment(Rs in Lakhs)	301.5
10	Scale	Small
11	Category	RED
12	Annual fee(Rs) Total Fee remitted(Rs)	35000.0 175250.0
13	Activity	GRANITE BUILDING STONE QUARRY-2,30,000 TPA (as per EC No. 92/Q/2022)
14	Machinery details	

GENERAL CONDITIONS

2.1 Quarrying is restricted to the land bearing Survey nos. 554/1, 554/5, 554/6.

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 Any change in the particulars furnished in the references and/or in the identity of the occupier / authorized agent shall be intimated to the Board within a week.

2.4 It is the responsibility of occupier to ensure that quarrying activities are restricted to only area shown in the attached drawing and at a distance more than 200 m from the nearby residential buildings, places of worship, public buildings, public road having vehicular traffic, river or lake, railway line and bridges.

2.5 After excavation at the site is completed, the land may be reclaimed or used for rain water harvesting with protective barriers/any other suitable purpose like aquaculture approved by the authority.

2.6 All the necessary control measures provided should be maintained properly to ensure that the system is adequate to control the air and water pollution caused by the functioning of the unit within the limit.

2.7 Regular wetting of the roads in the premises of the quarry and approach roads near the quarry shall be done for avoiding excessive dust emission within and outside the boundary of the unit.

2.8 Boundary of quarrying area shall be fenced and demarcated.

2.9 Fugitive emission from the quarry premises and road leading to quarry shall be suppressed using water sprinkling.

2.10 The suspended particulate matter (SPM) at boundary of the premises of the quarry shall not exceed the following limit applicable to that area as per the National Ambient Air Quality Standards. a) The PM 10 in ambient air at the boundary shall not exceed 100 microg/m3 b) The PM 2.5 in ambient air at 1m outside the boundary shall not exceed 60 microg/m3.

2.11 The sound level measured at 1.0 m outside the boundary shall not exceed the limit as per the Ambient Air Quality Standards in respect of Noise.

2.12 The operation of the unit shall be commenced/done only after obtaining clearances from all concerned authorities.

2.13 The quarry shall be operated only from 6am to 6pm.

2.14 For renewal of the consent in case of continuance of operation of the industry, application in the prescribed form shall be submitted through the web portal of the Board keralapcbonline.com for renewing the Consent on or before two month in advance to expiry date. Late application will be accepted with 10% (for application before expiry date) & 50% of yearly fee as late fee for application after due date.

2.15 This Consent is granted on the basis of ENVIRONMENTAL CLEARANCE DATED: 16/08/2022 and other documents furnished by the applicant. If any document is found false, the consent issued will be cancelled/ revoked.

2.16 This consent is granted subject to the Environmental Clearance No:92/Q/2022 DATED: 16/08/2022 issued by State Environmental Impact Assessment Authority(SEIAA), Thiruvananthapuram.

SIGNATURE OF ISSUING AUTHORITY

ENVIRONMENTAL ENGINEER

SURVEY MAP-NAGAROOR VILLAGE (PROPOSED QUARRY OF M/s C . E . O ADANI VIZHINJAM PORT Pvt. Ltd

DISTRICT : THIRUVANANTHAPURAM

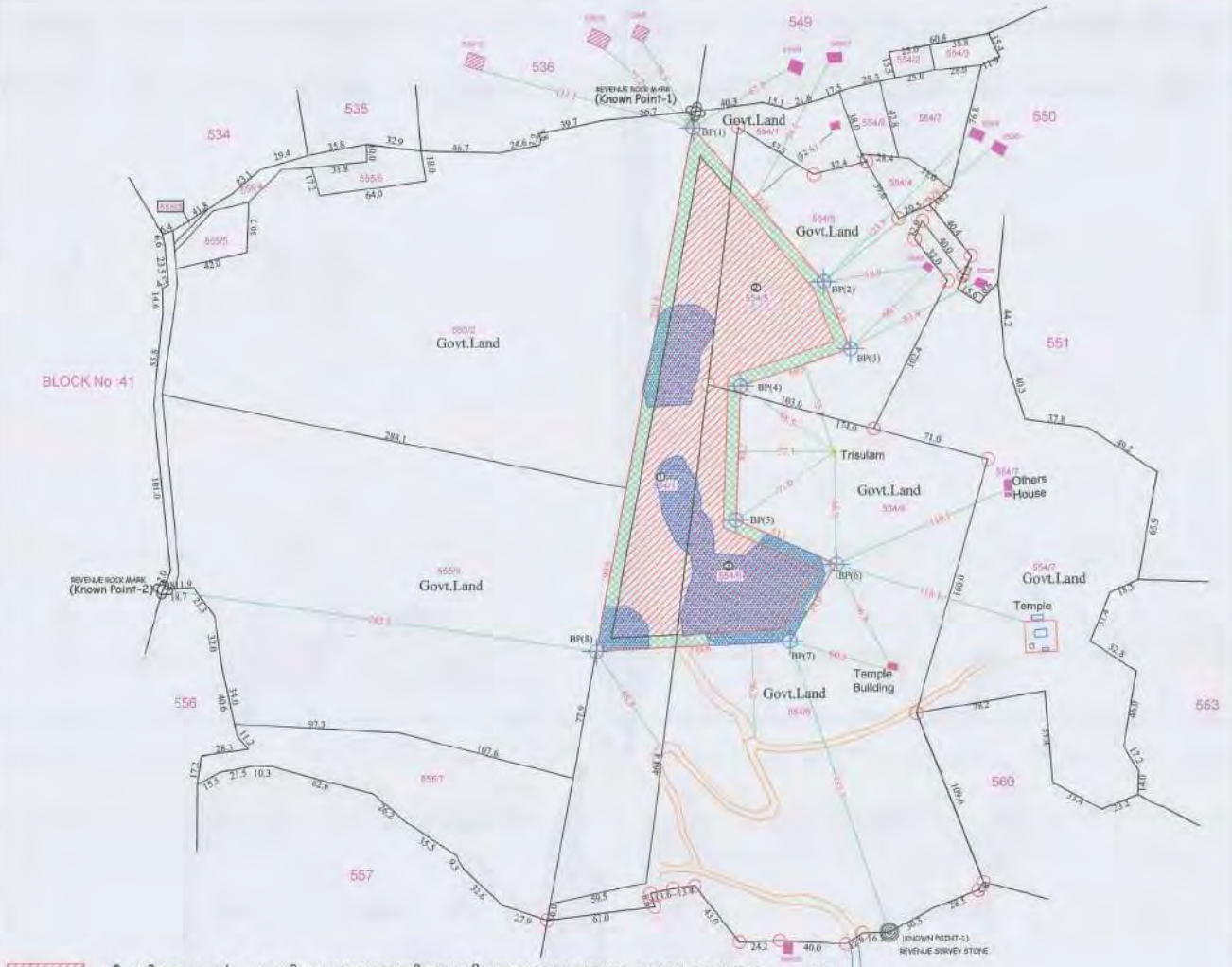
TALUK : CHIRAYINKEEZH

VILLAGE : NAGAROOR

BLOCK No : 37

Re Sy No. : 554/1,5,6

FILE NO : Dg/8671/18



- റീസർവെ 554/1 ,5,6 ൽ ഖനനാനുമതിക്കായി ആവശ്യപ്പെടുന്ന സ്ഥലം 1.8440 Ha
- റീസർവെ 554/1,5,6 ൽ ഖനനാനുമതിക്കായി ആവശ്യപ്പെടുന്ന സ്ഥലത്തിന്റെ ചുറ്റുമുള്ള ബഫർ എരിയ 0.6266 Ha
- റീ സർവ്വെ 554/1,5,6, ൽ ഖനനാനുമതിക്കായി ആവശ്യപ്പെടുന്ന Lease Area =2.4706 Ha
- റീസർവ്വെ 539/6 ഉൾപ്പെട്ടുവരുന്ന പഞ്ചായത്ത് റോഡ്
- N.O.C ലഭിച്ച സ്ഥലത്ത് നിലവിലുള്ള റോഡ്
- ഖനനസ്ഥലത്തിലേക്കുള്ള വഴി
- പരിസര പ്രദേശത്തുള്ള വീട്
- പാറ മാർക്ക് കാണുന്ന സ്റ്റേഷനുകൾ
- BP(1) റീസർവ്വെ 554/1 ,5,6 ൽ ഖനനാനുമതിക്കായി ആവശ്യപ്പെടുന്ന സ്ഥലത്ത് സ്ഥാപിച്ചിട്ടുള്ള സ്റ്റേഷനുകൾ
- N.O.C ലഭിച്ച റീസർവ്വെ 554/1,5,6 എന്നിവയിൽ പുനസ്താപിച്ച കല്ലുകൾ
- ഖനനാനുമതിക്കായി ആവശ്യപ്പെടുന്ന സ്ഥലത്ത് മുമ്പ് പാറ ഖനനം ചെയ്ത സ്ഥലം 0.8000 Ha

Submit before The Mining and Geology Department

GPS READING		
BOUNDARY PILLAR	LATTITUDE	LONGITUDE
BP1	8°43'51.74"N	76°50'21.24"E
BP2	8°43'50.18"N	76°50'24.80"E
BP3	8°43'49.21"N	76°50'25.94"E
BP4	8°43'47.59"N	76°50'24.33"E
BP5	8°43'45.21"N	76°50'25.43"E
BP6	8°43'45.30"N	76°50'27.59"E
BP7	8°43'43.54"N	76°50'27.45"E
BP8	8°43'41.70"N	76°50'24.14"E

PROPERTY DETAILS

Re Sy NO:	N O C AREA	UN USSED AREA	BUFFER AREA	MINING AREA	LEASE AREA
554/1	2.7604 Hectare	1.6229 Hectare	0.2883 Hectare	0.8492 Hectare	1.1375 Hectare
554/5	1.7037 Hectare	1.0914 Hectare	0.1455 Hectare	0.4668 Hectare	0.6123 Hectare
554/6	5.1154 Hectare	4.3946 Hectare	0.1928 Hectare	0.5280 Hectare	0.7208 Hectare
TOTAL =	9.5795 Hectare	7.1089 Hectare	0.6266 Hectare	1.8440 Hectare	2.4706 Hectare

Applicant Designation & Address:

M/s C.E.O ADANI VIZHINJAM PORT Pvt. Ltd.
2nd Floor, Vipanchika Tower,
Thycaud, Thiruvananthapuram.

Office Use :

Scale 1cm =20 m

APPROVED SITE /OUTLET LOCATION DRAWING

Side plan verified (AE1)

ENVIRONMENTAL ENGINEER

OFFICE, CHIRAYINKEEZHU ATTINGAL

TAHSILDAR CHIRAYINKEEZH

NIRMAL KUMAR. G
TAHSILDAR
CHIRAYINKEEZHU

Annexure XVI

Email Submission of HYCR for the Period

October 2021 to March 2022

From:	PRASAD KURIEN
To:	rosz.bng-mefcc@gov.in
Cc:	Ssuresh.cpcb@nic.in; tvpmro@gmail.com; Kushal.vashist@gov.in; kczmasandtd@gmail com; zobangalore.cpcb@nic.in; rosz.bng-mef@nic.in; pamidisuneel; Rajesh Kumar Jha; Hebin Chenthamarakshan; Jesse Benjamin Fullonton; CEO; MD VISL
Subject:	EP12.1/7/2013-14/Ker- Oct-2021- to Mar 2022 - EC Compliance report Reg.
Date:	Saturday, May 28, 2022 11:56:11 AM
Attachments:	EC_F. No. 11-1222011-IA.III dated 03.01.2014-HYCR-Oct2021-Mar2022_21.05.2022.pdf

Dear Sir/Madam,

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 with the same terms and conditions.

Kindly find attached the Half yearly compliance report (HYCR) for the period from October 2021 to March 2022 for records and reference.

Acknowledgement on receipt of the email with contents is highly appreciated.

With Regards,

--
Prasad Kurien
General Manager-Environment
Vizhinjam International Seaport Limited
Thiruvananthapuram

VIZHINJAM INTERNATIONAL SEAPORT LIMITED

(A Government of Kerala Undertaking)

Vizhinjam International Deepwater Multipurpose Seaport

Half Yearly Compliance Report (HYCR) of Conditions of Environmental and CRZ Clearance for the Period April 2022 to September 2022

November 2022