Vizhinjam International Seaport Limited

(A Government of Kerala Undertaking)

VISL/2019-20/HYCR/GME/2/534

27th November,2020

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 2020 to September 2020** – Reg.

Ref: 1) F.No.11-122/2011-IA.III dated 3rd January 2014
2) 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

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).

The Half Yearly Compliance Report (HYCR) of the conditions stipulated in the cited references for the period from **April 2020 to September 2020** 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 2020 to September 2020** 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: (1) **The Director (Monitoring-IA II Division)**, Ministry of Environment, Forest & Climate Change, IndraParyavaranBhavan, JorBagh, New Delhi - 110003
(2) **The Zonal Officer**, Central Pollution Control Board (CPCB), Zonal Office, Bengluru – 560 010.
(3) **The Member Secretary**, Kerala State Pollution Control Board, Pattom P.O., Thiruvananthapuram – 695 004
(4) **The Member Secretary**, KCZMA, 4th Floor, KSRTC Bus Terminal, Thampanoor, Thiruvananthapuram – 695 001
(5) **Shri. Rajesh Jha**, MD& CEO Adani Vizhinjam Port Private Ltd. (AVPPL), Vipanchika Tower, Thycaud P.O., Thiruvananthapuram- 14

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 2020 to September 2020

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 2020

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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
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** 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. Shoreline Monitoring Report for the period April 2020 to September 2020 is enclosed as **Annexure I**. Due to the lockdown imposed by the Government of India (GoI)/Government of Kerala (GoK) as a result of the ongoing COVID-19 pandemic, shoreline monitoring was hampered during the compliance period; particularly in locations which lie in the state of Tamil Nadu where entry was prohibited. Hence, onshore profiles, LEO, photo documentation, etc. could not be carried at these locations. During the month of July 2020, the entire Vizhinjam area was under lockdown hence no data could be collected the month. L&T Infrastructure Engineering Ltd. (L&T IEL) had prepared Mathematical Modelling Reports based on Shoreline Monitoring

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		data; which were vetted by National Institute of Ocean Technology (NIOT). Three mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC; as detailed below: • 1st Mathematical Modelling Report for the period February 2015 to February 2017; submitted along with the HYCR for the period April 2017 to September 2017 • 2nd Mathematical Modelling Report for the period March 2017 to February 2018; submitted along with the HYCR for the period April 2018 to September 2018 • 3rd Mathematical Modelling Report for the period March 2018 to February 2019; submitted along with the HYCR for the period April 2019 to September 2019 These mathematical modelling reports have affirmed that the shoreline change is in line with prediction in the EIA study. In continuation with the same practise Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data from March 2019 to February 2020 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. The mathematical modelling report for the period March 2019 to February 2020 vetted by NIOT is given as **Annexure II**. As per the mathematical modelling report, from all the data analyses and model studies carried out by LNTIEL, 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

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		construction has not caused any unnatural 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 2020 to September 2020. The dredged material till 30.09.2020 amounting to 2.90 Mm^3 has been utilized for reclamation of 36 Ha area.
(iv)	Additional fish landing centre shall be developed as part of the proposed Vizhinjam port for upliftment of fisheries sector.	**Being Complied** The work for construction of the fish landing centre (Rs. 16.00 crores) and the fishery breakwater (Rs. 131.12 crores) has been initiated as part of the funded work component of the concession agreement with AVPPL. The EPC Contractor of the concessionaire is finalising the design for the fishing berth and has mobilised the sub-contractor along with resources for construction of fishery harbour since March 2017. However, fishing boats docked in the proposed area need to be removed before the commencement of work. GoK has initiated discussions with fishermen representatives for removal of the boats to facilitate construction work and these discussions are ongoing. *(Source: VISL)*
(v)	The project shall be executed in such a manner that there is minimum disturbance to fishing activity.	**Being Complied** Following is being practiced to ensure minimum disturbance to fishing activity: • Work is planned in such a way that the movement of fishing boats is not hindered due to project construction. • Signboards have been placed for demarcation of construction area. • For mutual understanding of the developmental activities with the local fishing community an exclusive CSR team has been assigned.

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		• 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. • 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**. • Marine Water Quality is being monitored regularly and results are submitted as part of the compliance reports. No abnormal results were observed during the monitoring period. (**Refer Annexure III**). Marine water monitoring was suspended during the months of April 2020 to July 2020 due to the restrictions of the lockdown imposed as a result of the ongoing COVID-19 pandemic.

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		 **Turbidity Buoy**
(vi)	Steps would be taken to safeguard the interests of the fisheries sector as detailed in the Resettlement Action Plan (RAP), Corporate Social Responsibility (CSR) and in the Integrated Fishing Community Management (IFCMP), namely a component of Rs.7.1 crores as part of the compensation package for the fisheries sector, as livelihood restoration measures for mussel collectors, shore seine fishermen and others. Rs.41.30 crores as part of CSR activities in the fisheries sector under (i) water supply scheme (7.3crores) (ii) new fishing landing centre (16crores) (iii) adoption of existing fishing harbor (5crores) (iv) sea food park (4crores) (iii) skill development centre (4crores) (iv) environmental sanitation (3crores) and (v) solid waste management (2crores).	**Being Complied** In consultation with the fishermen, enhanced livelihood compensation of Rs. 101.86 Crores was sanctioned by GoK, instead of Rs. 7.10 crores; as suggested earlier in the EIA stage. Till date an amount of Rs. 83.32 crores have been disbursed till 30.09.2020 for a total number of 2625 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 balance LAPs is in progress. *(Source: VISL)* The status of the CSR activities envisaged in the fisheries sector is as follows: **Water supply**: A Water Supply Scheme for the local community has been commissioned in April 2013 by VISL by expending an amount of Rs. 7.30 crores. For Operation & Maintenance (O&M) of the same an amount of Rs. 5.28 crores had been spent and from 04.04.2019 onwards, O&M of the scheme is being done by Kerala Water Authority (KWA). *(Source: VISL)* **Fish Landing centre**: The work for construction of the fish landing centre

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		(Rs. 16.00 crores) and the fishery breakwater (Rs. 131.12 crores) has been initiated as part of the funded work component of the concession agreement with AVPPL in the form of a new fishing harbour. AVPPL is unable to start the construction activities since the proposed site is blocked by fishermen with their fishing boats. The proposed area needs to be cleared for the commencement of works. GoK has initiated discussions with fishermen representatives for removal of the boats to facilitate construction work and discussions underway. *(Source: VISL)* **Existing Fishing Harbour**: Tender for modernization of the existing fishing harbour was invited by Harbour Engineering Department (HED) and work awarded. However, the works could not be initiated due to sectoral protests among different fishermen groups. GoK has initiated discussions with protesting groups and discussions underway. *(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 harbour. *(Source: VISL)* **Skill Development:** 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 is a PPP project wherein 25000 sq. ft. building with facilities for students' hostel are being constructed by GoK under ASAP,

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		whereas the operation of the centre with logistics and other high-end courses is vested with Adani Skill Development Centre. Preference is being given to local people based on skill and competency during the construction stage. *(Source: VISL)* **Environmental/Sanitation:** Several cleaning campaigns are being jointly organized with zonal health wing under CSR activities; the cleaning activity is being carried out in the major communities of Vizhinjam especially in coastal belt jointly with the sanitation workers of Municipal Corporation of Thiruvananthapuram. The locations are identified through community interaction and mapping out of the highly sensitive receptacles of waste. Towards that a teams are formed with sanitation workers from Thiruvananthapuram Municipal Corporation, volunteers from CSR team, the members of "clean-4-U" livelihood group promoted under the CSR and the respective community members. **Solid Waste Management:** Adani Foundation installed "Thumboormozhi Aero Bins" in three coastal belt communities Viz Kottappuram Ward, Vizhinjam Ward and Harbour ward as a one-stop solution for the alarming issue of Solid Waste Management. It is on a tri-partite partnership model wherein Adani Foundation bears the one time installation cost for the project; Municipal Corporation ensured the maintenance and monitoring of the project whereas the Ward Councillor together with the Community leaders act as the change agent for a better waste management project.

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		Activities carried out by AVPPL as a part of CSR intervention for education, community health, sustainable livelihood development, community infrastructure development and other community engagement programmes, etc. for the period of April 2020 to September 2020 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 as a consultant 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 completed and all the required clarifications have been provided to Southern Railways and the approval is awaited. Land acquisition process has been initiated. *(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.	**Will be Complied** Resort owners evicted have been compensated for land and not for the structures since they were in violation of CRZ notification. An area of 0.728 Ha has been acquired up to 31.09.2020 under negotiated purchase. 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)*
(ix)	The port shall ensure that all ships under operation follow the MARPOL convention regarding discharge or spillage of any toxic, hazardous or polluting material like ballast water, oily water or sludge, sewage, garbage etc. The emission of	**Will be Complied** Currently project is under construction. This shall be complied during operational phase.

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	NOx & SOx shall remain within permissible limits.	
(x)	CSR activities shall cover villages within 10 km radius of the project.	**Complied** All CSR activities on livelihood development health, sanitation, education etc. are being implemented after receiving formal demands from social controlled institutions; government controlled institution and recognized platforms. As indicated in EIA report, during initial phase of development, CSR activities will be taken for Vizhinjam & nearby villages in 2 km radii. Considering the same during Phase I implementation of the project, CSR activities are presently carried out in 5 wards namely; Mulloor, Kottapuram, Vizhinjam, Harbour and Venganoor. An amount of Rs. 2.57 Crores has been spent for CSR activities mainly in the fields of education, community health, sustainable livelihood development, community infrastructure development, etc. during the compliance period. Details on CSR activities carried out by AVPPL during compliance period (April 2020 to September 2020) 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 (Enclosed as **Annexure V**). Awaiting approval of the same.
(xii)	All the recommendations /conditions stipulated by Kerala Coastal Zone Management Authority (KCZMA) shall be complied with.	**Complied** We 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

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		for the period April 2020 to September 2020 is enclosed as **Annexure VI**.
(xiii)	The responses/ commitments made during public hearing shall be complied with in letter and spirit.	**Complied** We 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 2020 to September 2020 is enclosed as **Annexure VII**.
(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 VIII**.
(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** 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. The Master Plan has been forwarded to Joint Planning Committee (JPC) for further action. *(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

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(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. A 3.00 MLD water supply scheme for the project had been commissioned with the source of water being Vellayani Lake whose raw water will be available for treatment. 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 would be used for port related activities. However, at present, the entire treated water from the scheme is being utilised by the community. Due to this reason, the water for construction purposes for the port is being sourced from the open market/private suppliers. On an average about 166 Litres per day of water is being consumed for construction related activities during the compliance period (April 2020 to September 2020). Due to the impact of the COVID-19 pandemic during the compliance period, construction activities were decelerated and therefore consumption of water is significantly less.
(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.	**Complied** Contractors working at site, under the EPC Contractor M/s. Howe Engineering Projects India Pvt. Ltd. (HEPIPL) have obtained separate consents from KSPCB for handling Hazardous Waste. During this compliance period (April 2020 to

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		September 2020) 26 L of used oil had been generated and it has been stored as per Hazardous Waste Rules at site and will be disposed to authorized (CPCB/KSPCB) waste oil handlers.
(xix)	No hazardous chemicals shall be stored in the Coastal Regulation Zone area.	**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. At present settled sludge is used for filling of low lying area.
(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 to CRZ Notification along with the commissioning of the project in consultation with KSPCB. AVPPL had submitted relevant documents including Location Plan, Process, Design, Capacity, Layout and other details to KSPCB seeking approval from the board as per the CTE obtained for the project. KSPCB had conducted a site visit on 21.08.2019. During the site visit additional details were sought and the same were submitted to KSPCB. Thereafter, KPSCB had called for a meeting and presentation on the proposed STP on 15.11.2019. As per the discussions, it is understood that AVPPL will have to apply for approval online.
(xxii)	No solid waste will be disposed of in the Coastal Regulation Zone area. The solid waste shall be properly collected, segregated and disposed as per	**Being Complied** No solid waste is being disposed in the CRZ area. As mentioned in the EIA, contractors working at the site have been made responsible for management of

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	the provision of Solid Waste (Management and Handling) Rules, 2000.	Solid Waste during construction stage. The contractors are complying with the provisions pertaining to management of Solid Waste and it 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 properly collected and disposed as per the Rules. Project proponent shall install necessary oil spill mitigation measures.	**Being Complied** 12 DG sets are present at site; all 10 are in use and 2 are on standby. These are compliant to CPCB guidelines. 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 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 in consultation with forest department as identified in the EIA will be developed in all possible areas including back-up areas and along the boundary of the project area. A greenbelt development plan has been considered in the Master Plan and adequate budgetary provision has been kept for this purpose. **Compensatory Afforestation**: During the meeting with Hon'ble Minister dated 05.04.2017, it was decided that Forest Department shall identify land for compensatory afforestation in lieu of trees felled at port site areas; at the rate

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		of 1:10. 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.  **Compensatory Afforestation at Sainik School**  **Progress as on 30.09.2020**
(xxvii)	The fund earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes.	**Being Complied** An amount of 40 Crores has been kept solely for EMP implementation as per the commitment in the EIA; and this amount is not diverted for any other purpose. An amount of Rs. 1.572 Crores has been utilized towards EMP implementation measures during compliance period April 2020 to September 2020. Till date, an amount of Rs. 15.67 Crores has been spend on environmental protection measures.

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		The EMP expenditure for the compliance period April 2020 to September 2020 is enclosed as **Annexure IX**.
(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 X**.
(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

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S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
		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. • 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 369 Nos. of workers were engaged in the port construction activities on a daily basis during the compliance period April 2020 to September 2020. Construction workers and Labours are housed in a labour camp near to the project site as well as nearby resorts. Labours are provided with all the necessary infrastructure facilities including water, electricity, fuel, sanitation, etc. and the details of the same were submitted in the HYCR for the period October 2018 to March 2019.
(iii)	Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.	**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**. Surface & Ground water monitoring was suspended in the months of April 2020 and May 2020 due to the restrictions of the lockdown imposed as a result of the ongoing COVID-19 pandemic. There are no significant changes observed

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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
		in the water quality during the compliance period.
(iv)	Borrow sites for each quarry sites for road construction material and dump sites must be identified keeping in view the following: (a) No excavation or dumping on private property is carried out without written consent of the owner. (b) No excavation or dumping shall be allowed on wetlands, forest areas or other ecologically valuable or sensitive locations. (c) Excavation work shall be done in close consultation with the Soil Conservation and Watershed Development Agencies working in the area, and (d) Construction spoils including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump sites for such materials must be secured so that they shall not leach into the ground water.	**Complied** Quarry material is being obtained from approved quarry sites only. The progress of road constructed so far include Hume Pipe laying, construction of retaining wall, drain works, sub grade works and piling in ponds for bridge. 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:

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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
		• Block No.29, Re-Survey No.120/10 in Manickal Village, Nedumangad Taluk, Thiruvananthapuram District, Kerala (Details submitted along with the HYCR for the period October 2019 to March 2020) • Nagaroor Village, Chirayinkeezhu Taluk, Thiruvananthapuram District (Details submitted along with the HYCR for the period April 2019 to September 2019) In case of new quarries, necessary approvals will be obtained from the competent authority.
(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. • STP will be installed in phased manner along with the project in consultation with KSPCB. AVPPL had submitted relevant documents including Location Plan, Process, Design, Capacity, Layout and other details to KSPCB seeking approval from the board as per the CTE obtained for the project. KSPCB had conducted a site visit on 21.08.2019. During the site visit additional details were sought and the same were submitted to KSPCB. Thereafter, KPSCB had called for a meeting and presentation on the proposed STP on 15.11.2019. As per the discussions, it is understood that AVPPL will have to apply for approval online. • Environment Monitoring is being carried out as per Environment Monitoring Plan prescribed in EIA by NABL and MoEF&CC accredited agency; M/s. Ashwamedh Engineers &

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 2020 to September 2020

<table>
<tr><th>S. No.</th><th>Conditions</th><th>Compliance Status as on 30.09.2020</th></tr>
<tr><td></td><td></td><td>Consultant. Summary of the Ambient Air Quality Monitoring (AAQM) for the duration from April 2020 to September 2020 at 5 monitoring locations is mentioned below.
<table>
<tr><th>Parameter</th><th>Unit</th><th>Max</th><th>Min</th><th>Perm. Limit</th></tr>
<tr><td>PM_{10}</td><td>$\mu g/m^3$</td><td>91</td><td>32</td><td>100</td></tr>
<tr><td>$PM_{2.5}$</td><td>$\mu g/m^3$</td><td>30</td><td>10</td><td>60</td></tr>
<tr><td>SO_2</td><td>$\mu g/m^3$</td><td>7.23</td><td>BDL</td><td>80</td></tr>
<tr><td>NO_2</td><td>$\mu g/m^3$</td><td>9.58</td><td>BDL</td><td>80</td></tr>
<tr><td>CO</td><td>mg/m^3</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>--</td></tr>
</table>

Detailed Monitoring Reports for the period April 2020 to September 2020 is attached as Annexure III). Air Quality monitoring was suspended in the months of April 2020 and May 2020 due to the restrictions of the lockdown imposed as a result of the ongoing COVID-19 pandemic.
All the monitored parameters were found within the prescribed limits.
</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:</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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
		• Tarpaulin cover is being used during transportation of construction material • All vehicles coming into the site are under a speed restriction of 20 km/hr • Regular Water Sprinkling is done on the approach road by water tankers. • It is ensured that all vehicles entering the Port have a valid PUC certification • The dumpers have speed governors ensuring adherence to speed limit  **Water Sprinkling in Progress**  **Tarpaulin Cover on Trucks**

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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
		 **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 existing ones, if necessary in the interest of environment and the same shall be complied with.	**Noted for Compliance**
(xi)	The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied to the satisfaction of the Ministry.	**Noted**
(xii)	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment & Forests.	**Noted and Will be Complied** AVPPL is the concessionaire for implementing the project and operating it for the next 40 years, based on concession agreement signed between the GoK &,

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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
		AVPPL on 17.08.2015. 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 of the period from October 2015 to March 2016). The preliminary construction activities commenced at site on 16.11.2015 followed by official inauguration on 05.12.2015. Financing agreement forming part of financial closure was submitted by the concessionaire on 13.05.2016.
(xiv)	Kerala State Pollution Control Board shall display a copy of the clearance letter at the Regional Office, District Industries Center and Collector's Office/Tehsildar's office for 30 days.	**Noted** This condition does not pertain to project proponent. However, it is learnt that KSPCB had complied with the same.
13.	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 2006, including the amendments and rules made thereafter.	**Noted for Compliance**
14.	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and	**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.

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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
	Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.	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 (Submitted along with the compliance report for the period October 2015 to March 2016). • As per the exemption granted by GoK G.O. No. 310/2015/LSGD dated 01.10.2015, AVPPL is not required to obtain any further building permits/permission to construct port related building within the port premises.
15.	The project proponent shall advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Environment Clearance and copies of the clearance letters are available with the Kerala State Pollution Control 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	**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

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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
	and a copy of the same should be forwarded to the Regional office of this Ministry at Bangalore.	
16.	This Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.	**Noted**
17.	Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	**Noted** Three appeals challenging the EC granted to the project (two appeals filed at NGT, Southern Regional Bench, Chennai and one at NGT, Principal Bench, Delhi) and one original application (OA-filed at NGT, Principal Bench Delhi) indirectly challenging the CRZ Notification, 2011 were filed as per the NGT Act, 2010. The appeals filed at Chennai bench were later transferred to the Delhi bench. The Delhi Bench of NGT has upheld the EC granted to the project vide its judgment dated 02.09.2016.
18.	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, ZilaParishad/Municipal Corporation, Urban Local Body and the Local NGO, if any from whom suggestions/representations, if any, 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	**Complied** The copy of the latest HYCR for the period October 2019 to March 2020 including the results of six monthly monitoring data (October 2019 to March 2020) has been

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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
	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.	uploaded on VISL website http://www.vizhinjamport.in and also on APSEZ website https://www.adaniports.com/Downloads. The HYCR for the period October 2019 to March 2020 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA vide email dated 27.05.2020 (a copy of the email is enclosed as **Annexure XI**). Environment Monitoring is being carried out as per the Environment Monitoring Plan prescribed in EIA by Ashwamedh Engineers & Consultant (NABL Accredited & MoEF&CC approved laboratory). Detailed Monitoring reports (Air, Water, Noise, Marine Water, and Sediment) 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.	**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 2019 to March 2020 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA vide email dated 27.05.2020 (a copy of the email is enclosed as **Annexure XI**).
21.	The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by	**Will be Complied** The project is in construction phase. The same shall be complied post commissioning during operational phase.

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 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
	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.	

Enclosures:

Annexure Number	Details of Annexure
Annexure I:	Shoreline Monitoring Report (April 2020 to September 2020)
Annexure II:	Shoreline Mathematical Modelling Report (March 2019 to February 2020)
Annexure III:	Environment Monitoring Report (April 2020 to September 2020)
Annexure IV:	CSR Activities by AVPPL (April 2020 to September 2020)
Annexure V:	Letter to ICG for submission of Final OSDCP
Annexure VI:	Compliance of Conditions of KCZMA Recommendation for EC/CRZ Clearance
Annexure VII:	Compliance of the Response/Commitments made during Public Hearing
Annexure VIII:	Status of Environment Management Plan
Annexure IX:	EMP Expenditure (April 2020 to September 2020)
Annexure X:	Environment Health, Safety & CSR Organizational Structure
Annexure XI:	Submission Email of HYCR for the Period October 2019 to March 2020

Annexure I

Report on Shoreline Monitoring

(April 2020 to March 2019)

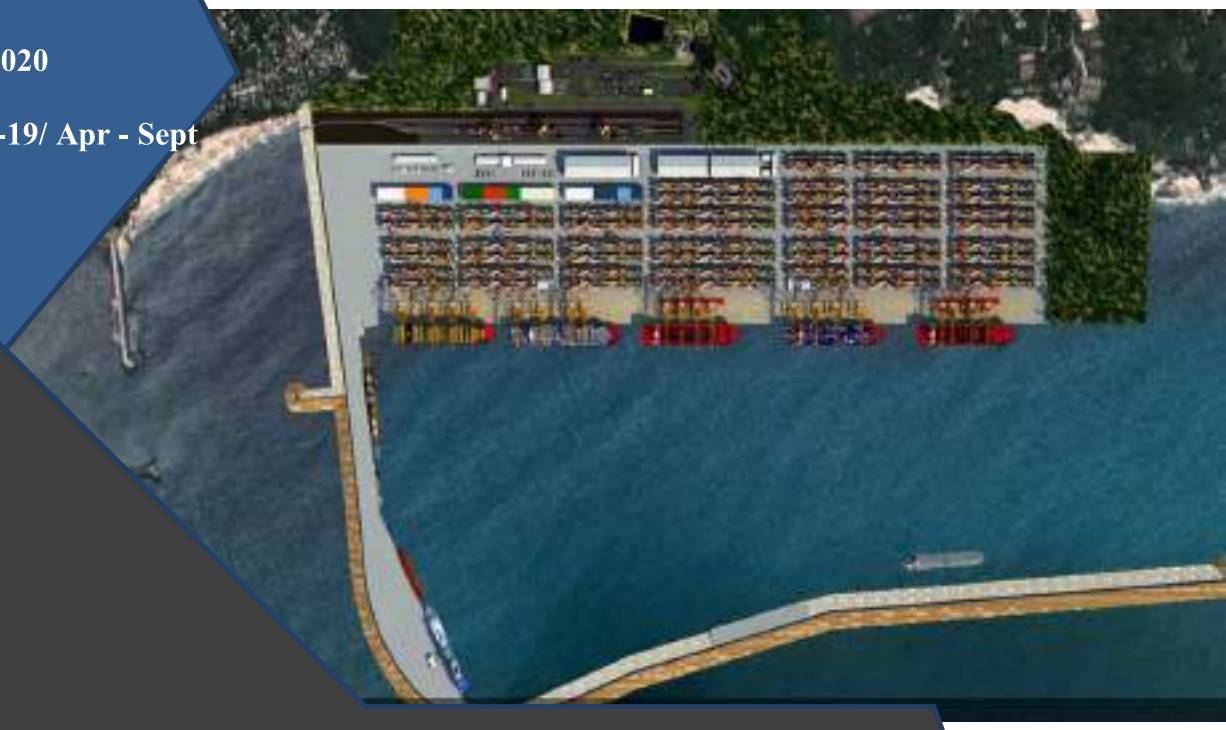
Adani Vizhinjam Port Pvt. Ltd

OCEANOGRAPHIC AND BATHYMETRIC DATA COLLECTION FOR ASSESSMENT OF SHORELINE CHANGES

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

Date: 18th November 2020

SAC Ref #: SAC/P167-19/ Apr - Sept 2020 Rev 1



HALF YEARLY REPORT (APRIL TO SEPTEMBER 2020)

"APPROVAL SHEET"

Prepared by:	*Signed*	*Date*
V Mehta		*18/11/2020*

Checked and Approved by:	*Signed*	*Date*
S Philip		*18/11/2020*

REVISION CONTROL

Date	Rev	Section / Page No.	Remarks	Comment by
06/11/2020	0		Submitted for approval	
18/11/2020	1	Sec 1, Pg 8	Spaces added between paragraphs	AVPPL
		Sec 5.2, Pg 32	Figure 5-5 changed as suggested	AVPPL
		Sec 5.3, Pg 33	Tide gauge marked in Figure 5-6	AVPPL
		Sec 6.2, Pg 49	Added degree unit in Table 6-1	AVPPL
		Sec 6.3, Pg 52	Removed the word 'freak' as suggested, added 'No data' for Location P3 in Table 6-2, added seasons for the observation period	AVPPL
		Sec 6.4, Pg 58	Added degree unit in Tables 6-4 and 6-5	AVPPL
		Sec 6.4, Pg 61 to 63	Provided consolidated tables and histograms for meteorological parameters as suggested	AVPPL
		Sec 6.6, Pg 65	Changed 'severely hampered' to 'suspended entirely' in second paragraph, removed last line	AVPPL
		Sec 6.7, Pg 66	Added 'at any of the locations' in last line	AVPPL
		Sec 6.8, Pg 71	Changed scale of salinity in Figure 6-32 to show correct salinity value	AVPPL

		Sec 6.8, Pg 73	Removed last line as suggested	AVPPL
		Sec 6.9, Pg 73	Removed 'As part of the contract' in first paragraph	AVPPL
		Sec 6.9, Pg 75	Replaced 'Not collected' with "Not Applicable' in Table 6-15	AVPPL
		Sec 6.9, Pg 76	Removed last two lines	AVPPL
		Sec 6.11, Pg 80	Removed turbidity tables for individual months and replaced with a consolidated table as suggested	AVPPL
		Sec 6.11, Pg 81	Specified reason for data gaps in time series of turbidity	AVPPL
		Sec 6.12, Pg 88 and 89	Removed lines and wordings as suggested	AVPPL
		Sec 7, Pg 90	Added reason for hampering of survey activities	AVPPL
		Sec 8, Pg 90	Amended last point in References	AVPPL
		Sec 9, Pg 90	Amended conclusion for significant wave height	AVPPL

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Annexure I – Photo Documentation of CSP Locations

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

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

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

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

① Shankar And Co, hereinafter referred to as SAC, based in Navi Mumbai has been awarded the contract to carry out Shoreline Monitoring – Oceanographic & Bathymetric Data Collection in the vicinity of the proposed site for the development of the Vizhinjam International Deepwater Multipurpose Seaport, vide the service order; SO 5700267194 dated 3rd May 2019 by AVPPL.

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.

As part of the contract, 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 from April to September 2020.

Due to the pandemic situation, access to Tamil Nadu state to carry out all onshore activities were not possible. Hence onshore profiles, LEO, photo documentation etc. could not be carried at these locations. During the month of July 2020, the entire Vizhinjam area was under lockdown hence no data could be collected in this month.

All the 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 (Apr-May), monsoon (June-Sep), and fair-weather period (Dec-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.



Figure 2-1: General Survey Location

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

The CSP lines, which coincide with the Littoral Environment Observation (LEO), beach sampling and photographic documentation, are indicated in Figure 2-2. 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 2-2: 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 (Apr-May), Monsoon (Jun-Sep) and Fair-weather period (Dec-Mar).
- 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.
- 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.
- Analysis and processing of the data and submission of periodic reports in soft & hard copies.

3.1 Location Coordinates

The location co-ordinates provided by the client 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	3.447

A Gill Metpack weather station with rain gauge was installed at the Ayur Bay Resort and the coordinates are provided in the table below:

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 Ayur Bay Resort)	08° 22' 13.53"N	77° 00' 08.78"E	28.456

Since the system was installed at a height of 28.456m above CD a correction factor was applied in the wind speed to reduce the data to 10m above MSL. The corrections were obtained from WMO manual supplied by NIOT. As per section 5.2.2 in the manual, 20% of the speed was deducted to derive the current speeds at 10m above MSL. The data provided is thus referenced to 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.	**Easting**	**Northing**	**Latitude**	**Longitude**
Turbidity Buoy-1	720497.55	923507.87	08° 20' 58.60" N	77° 00' 08.10' E
Turbidity Buoy-2	718843.20	925075.84	08° 21' 49.90" N	76° 59' 14.30' E
Turbidity Buoy-3	718784.75	926000.91	08° 22' 20.01" N	76° 59' 12.54' E

3.3 Beach and Water Sampling

A total of 81 beach samples were collected in two seasons, as part of the contract. The samples were to be analyzed for grain size distribution as per IS 1498. 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
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

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

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

BEACH SAMPLING LOCATIONS		
WGS-84, UTM Projection, CM 75° East, Zone 43, North		
BS-81	8° 31.1988' N	76° 52.6188' E

The water samples (132 from four locations) were collected in two seasons 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 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

3.1 Grab Sampling

A total of 80 grab samples were collected from the offshore area in one season as per the scope of work.

The samples have been numbered as GS-01-01, GS-01-02 to GS-40-01 and GS-40-02. GS-01 represents the sample to be collected from the southernmost part and GS-40 corresponds to the northernmost part. Two samples were to be collected each from the one square kilometre area and these are denoted by the suffix 01 and 02. A Google Earth imagery provided in the figure below gives a clearer picture of the grab sample locations. This is only a representative image.



Figure 3-1: Grab sampling locations

The following table provides the coordinates of the grab sampling locations.

Table 3-7: Grab Sampling Locations

GRAB SAMPLING LOCATIONS WGS-84, UTM Projection, CM 75° East, Zone 43, North		
Location	**Easting**	**Northing**
GS-01-01	734071.045	914222.445
GS-01-02	733461.665	913429.567
GS-02-01	733278.167	914831.826
GS-02-02	732668.787	914038.948
GS-03-01	732485.290	915441.206
GS-03-02	731875.909	914648.328
GS-04-01	731692.412	916050.587
GS-04-02	731083.031	915257.709
GS-05-01	730899.534	916659.967
GS-05-02	730299.277	915860.077
GS-06-01	730108.355	917252.674
GS-06-02	729508.036	916452.703
GS-07-01	729290.883	917848.939

GRAB SAMPLING LOCATIONS		
WGS-84, UTM Projection, CM 75° East, Zone 43, North		
GS-07-02	728680.681	917054.993
GS-08-01	728493.994	918453.101
GS-08-02	727883.769	917659.124
GS-09-01	727706.648	919069.679
GS-09-02	727128.369	918251.504
GS-10-01	726912.515	919677.426
GS-10-02	726303.073	918884.469
GS-11-01	726127.895	920297.552
GS-11-02	725518.168	919504.223
GS-12-01	725357.149	920935.729
GS-12-02	724747.366	920142.327
GS-13-01	724580.923	921566.775
GS-13-02	724008.185	920743.887
GS-14-01	723778.377	922180.998
GS-14-02	723177.347	921381.564
GS-15-01	722980.588	922766.567
GS-15-02	722370.734	921973.073
GS-16-01	722152.725	923330.428
GS-16-02	721539.284	922532.266
GS-17-01	721312.947	923878.786
GS-17-02	720656.451	923024.604
GS-18-01	720580.926	924567.348
GS-18-02	719898.407	923679.308
GS-19-01	719942.911	925378.224
GS-19-02	719349.669	924606.344
GS-20-01	719194.206	926045.079
GS-20-02	718570.376	925233.400
GS-21-01	718274.212	926489.066
GS-21-02	717651.412	925678.728
GS-22-01	717499.545	927122.106
GS-22-02	716879.322	926315.156
GS-23-01	716980.751	928088.139
GS-23-02	716254.351	927143.004
GS-24-01	716482.523	929080.894

GRAB SAMPLING LOCATIONS		
WGS-84, UTM Projection, CM 75° East, Zone 43, North		
GS-24-02	715801.588	928194.915
GS-25-01	716042.519	930149.406
GS-25-02	715315.207	929203.084
GS-26-01	715470.571	931046.243
GS-26-02	714821.993	930202.365
GS-27-01	714854.197	931861.423
GS-27-02	714209.468	931046.405
GS-28-01	714176.846	932644.972
GS-28-02	713555.601	931836.657
GS-29-01	713519.303	933430.440
GS-29-02	712895.295	932618.530
GS-30-01	712871.320	934228.346
GS-30-02	712244.643	933412.963
GS-31-01	712204.017	935001.114
GS-31-02	711585.287	934196.072
GS-32-01	711523.280	935756.403
GS-32-02	710904.066	934950.731
GS-33-01	710838.402	936506.306
GS-33-02	710218.746	935700.058
GS-34-01	710161.990	937267.222
GS-34-02	709537.645	936465.141
GS-35-01	709487.177	938040.487
GS-35-02	708868.618	937225.399
GS-36-01	708828.757	938814.547
GS-36-02	708204.133	938001.834
GS-37-01	708173.034	939602.382
GS-37-02	707548.410	938789.670
GS-38-01	707517.311	940390.218
GS-38-02	706892.687	939577.505
GS-39-01	706861.588	941178.054
GS-39-02	706221.414	940345.110
GS-40-01	706205.865	941965.889
GS-40-02	705581.241	941153.177

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 Samuel



Figure 4-2: Transit vessel MFB Sindhu Yatra Matha



Figure 4-3: Multibeam Survey boat MFB Bethel

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**
Vishtasp Mehta	Project Manager
Unnikrishnan K.U.	Party Chief / Surveyor
Arun P.K.	Party Chief / Survey Engineer
Vishnu Haridas	Land Surveyor
Vaishak K.R.	Trainee Surveyor
Vishnu Haridas	Land 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:

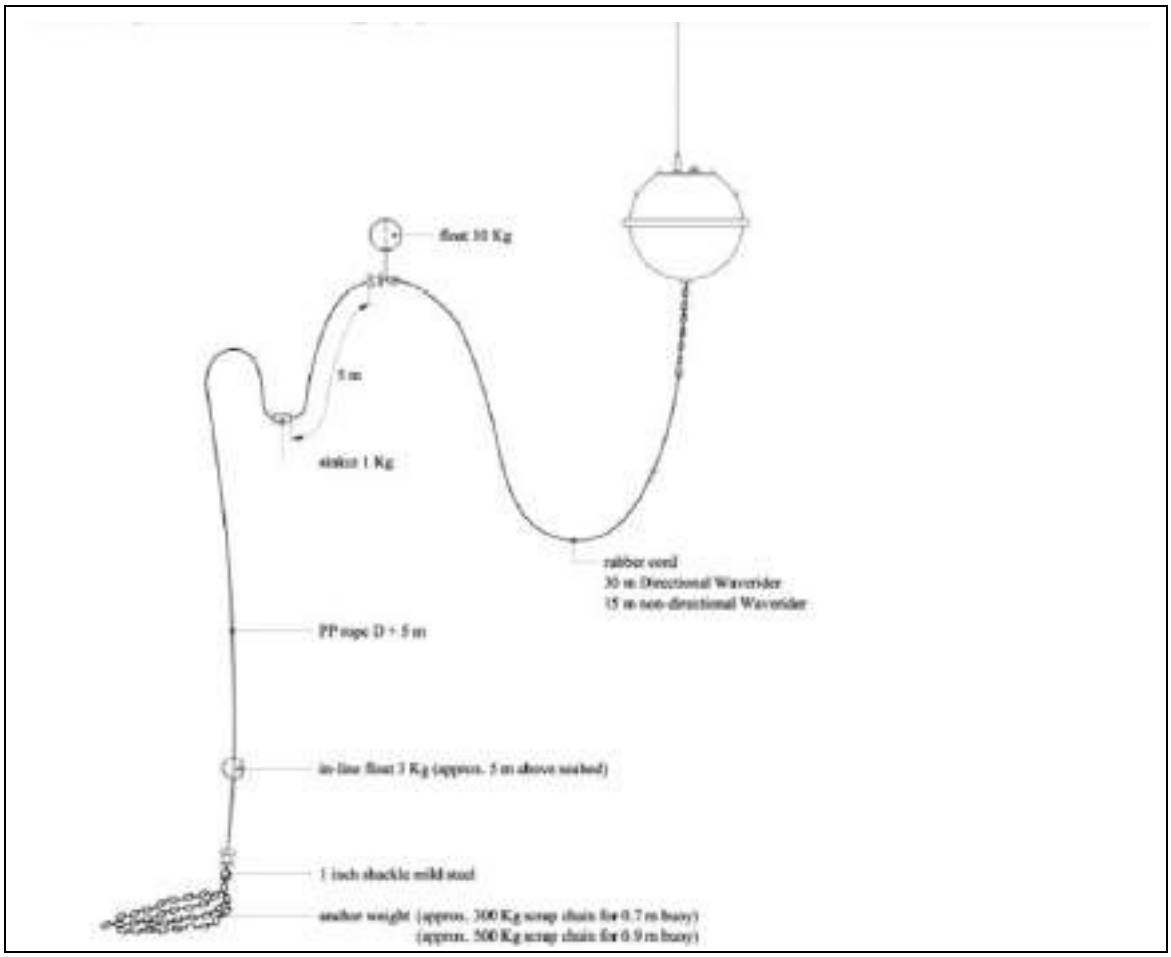

Figure 5-1: WRB Mooring Diagram

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 for different seasons. 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. The following figure shows the ADCP installation in an upward looking mode.



Figure 5-3: ADCP deployment at Vizhinjam by diver



Figure 5-4: ADCP deployed at Mulloor

①



Figure 5-5: ADCP deployed at Pachalloor

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Unfortunately, on 2nd September 2020, the watch keeping boat at Pachalloor location capsized at midnight. The ADCP and boat were both lost in the incident. However, the search of the ADCP was severely hampered due to bad weather conditions and the search is still going on, at different spots nearby to locate the boat and the missing unit.

5.3 Automatic Tide Gauge

An EMCON Automatic Tide Gauge (ATG) was installed near the Coast Guard jetty, inside the fishing harbour for measuring the tides. The tide gauge is a capacitance-based instrument, measuring the water level due to change in capacitance on the surface of sensor. The sensor was installed on a 2.5m 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 10-minute intervals throughout the duration of the project.

A photograph of the tide gauge location is shown below:



Figure 5-6: Tide Gauge

5.4 Automatic Weather Station (AWS)

A Gill Metpack Automatic Weather Station (AWS) was installed atop Ayur Bay Resort at Nellikunnu. 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.

An image of automatic weather station is provided below:



Figure 5-7: AWS on top of Ayur Bay Resort, Nellikunnu (Mulloor)

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 10/20 RTK system with base station and rover. A photograph of the system is provided below:



Figure 5-8: RTK System with base station and rover

5.6 Multibeam Echo Sounder System

A GeoAcoustics Geoswath Plus 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 2020 are given below.

Table 5-1: MBES Calibration results

Parameter	Value	Comments
Latency	0.02s	Seapath 130 Positioning System with beacon corrections.
Port Roll	0.01º	Seapath 130-H MRU accuracy 0.03º in roll
Starboard Roll	-0.05º	Seapath 130-H MRU accuracy 0.03º in roll
Pitch	0.00º	
Yaw	-5.05º	Accuracy better than 0.2°

The calibration values obtained in the month of September 2020 are as follows.

Parameter	Value	Comments
Latency	0.07s	Seapath 130 Positioning System with beacon corrections.
Port Roll	0.08º	Seapath 130-H MRU accuracy 0.03º in roll
Starboard Roll	-0.15º	Seapath 130-H MRU accuracy 0.03º in roll
Pitch	0.00º	
Yaw	-6.15º	Accuracy better than 0.2°

5.7 DGPS Positioning System

Vessel positioning was carried out by the Seapath 130 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 navigation and data acquisition software was used to provide track guidance information to the survey crew and also output the position of the vessel to assist the helmsman in maintaining the selected track guidance line. The VDU displays the selected survey line, the position of the vessel in relation to that line and numerical data to assist the helmsman such as the along-line and off-line distances, vessel speed and course made good, gyro heading, distance and bearing to end of line and water depth. The position of each fix, together with other information such as fix numbers, depths, PDOP and along-line distances were logged to the hard drive.

5.7.1 DGPS Consistency Check

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

After installing the Seapath 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 Seapath/Hypack and the observer's watch, for which local time (GMT+5.30) was used. The Seapath 130 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 details are provided below for selected few DGPS calibrations.



DGPS CONSISTENCY CHECK

Job Number	P167-19	**Project**	AVPPL Shoreline Monitoring
Client	AVPPL	**Vessel**	MFB Bethel
Location	Vizhinjam Harbour	**Date**	21/04/2020

Nav Equipment	**Primary**		**Secondary**	
Item	**Type**	**Serial Number**	**Type**	**Serial Number**
GPS Receiver	Seapath 130	168	-	-
GPS Antenna	Seapath 130	168	-	-
GPS Demodulator	-		-	-

Offsets	**X (m)**	**Y (m)**	**Z (m)**
DGPS Antenna to CRP	0	0	0

1st set of Observations on Points A & B

DGPS Observations on		Date: 21 April 2020	Time: 11:15 hrs	
Observation Points	**Number of Observations**	**Time of Observations**	**Average Easting WGS 84 Spheroid, CM**	**Average Northing WGS 84 Spheroid, CM**
A	180	15 min	719297.31	926431.26
B	180	15 min	719290.12	926424.14
Comments:	**Calculated distance between Point A and Point B**	=	**10.12 m**	
	Computed Bearing (T) between Point A and Point B	=	**45.28°**	
	Measured distance (by tape) between Point A and Point B	=	**10 m**	

2nd set of Observations on Points A & B

DGPS Observations on		Date:	Time:	
Observation Points	**Number of Observations**	**Time of Observations**	**Average Easting WGS 84 Spheroid, CM**	**Average Northing WGS 84 Spheroid, CM**
A	-	-	-	-
B	-	-	-	-
Comments:	**Calculated distance between Point A and Point B**	=	**mtrs**	
	Computed Bearing (T) between Point A and Point B	=		
	Measured distance (by tape) between Point A and Point B	=	**mtrs.**	

Difference observed between 1st set and 2nd set of observations made on points A & B

Observation Points	**Difference in Easting (δE)**	**Difference in Northing (δN)**
A	-	-
B	-	-

Signed			
Position	**Name**	**Signature**	**Date**
Surveyor	Vishnu Haridas		21/04/2020
Party Chief	Unnikrishnan K U		21/04/2020

DOC-SAC DGPS CONSISTENCY CHECK Rev 0

Figure 5-9: DGPS Consistency checks on board M.F.B. Bethel

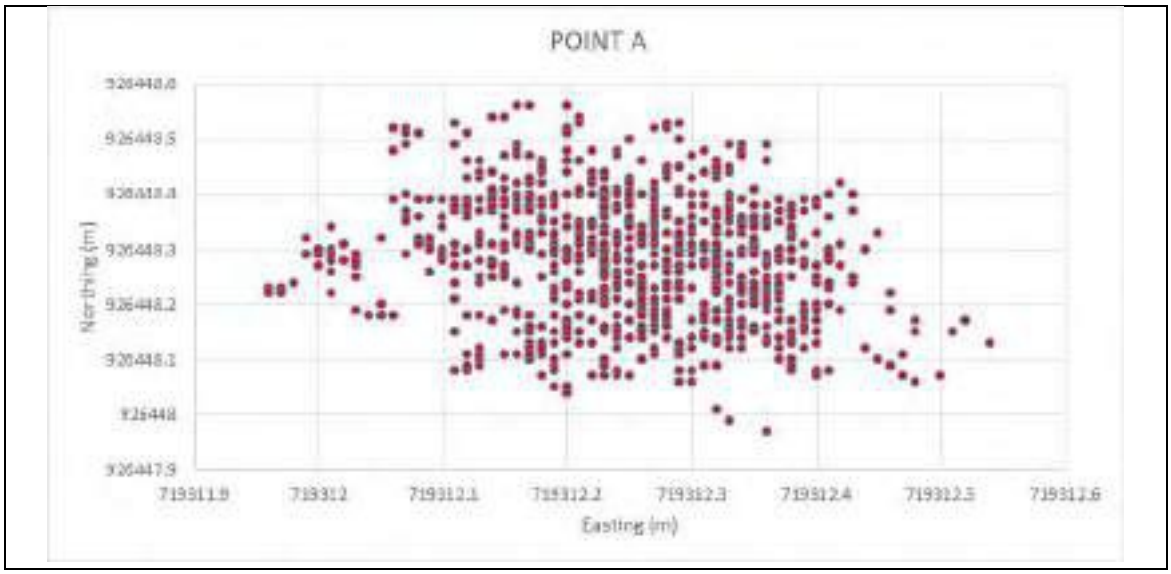


Figure 5-10: Scatter Plot of DGPS calibration on board M.F.B. Bethel

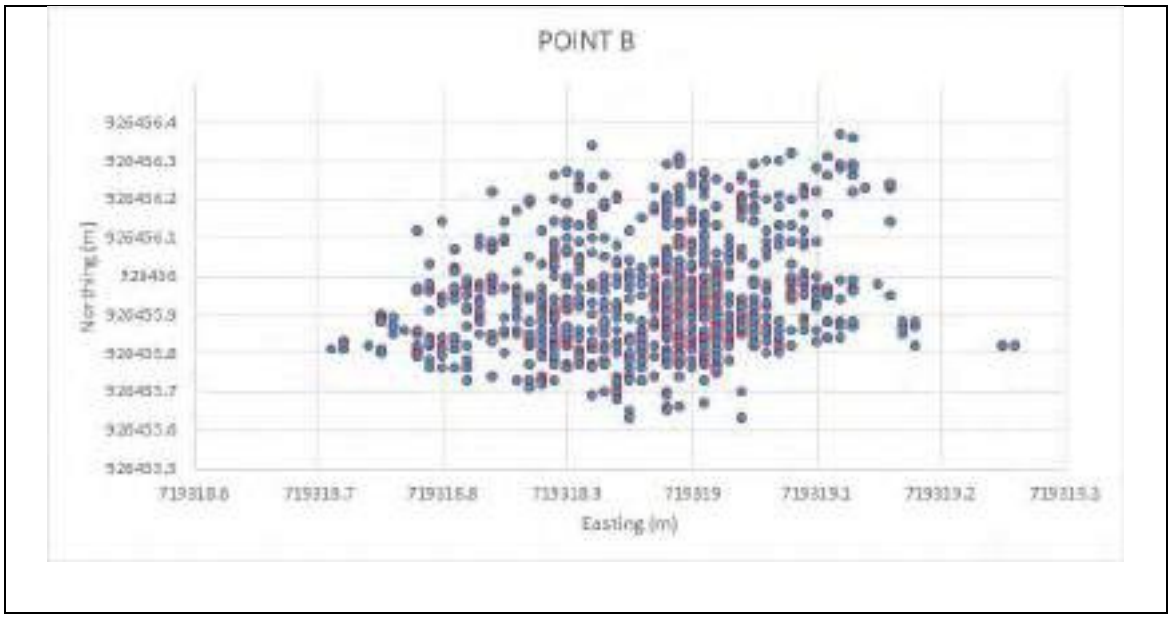


Figure 5-11: Scatter Plot of DGPS calibration on board M.F.B. Bethel

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 details are provided below for selected few gyro calibrations.



GYRO CALIBRATION

(Offset Method) (Quay/Tape)

Job	AVPPL Shoreline Monitoring	Job No	P167-19
Client	AVPPL	Vessel	MFB Bathel
Location	Vizhinjam Fishing Jetty	Date	21-Apr-20
Gyro S/N	130-168		

Quay heading(T)	Baseline length(m)	Gyro Name : SEAPATH	Quayside on:
45.28	8.00	S/No. 130-168	Starboard

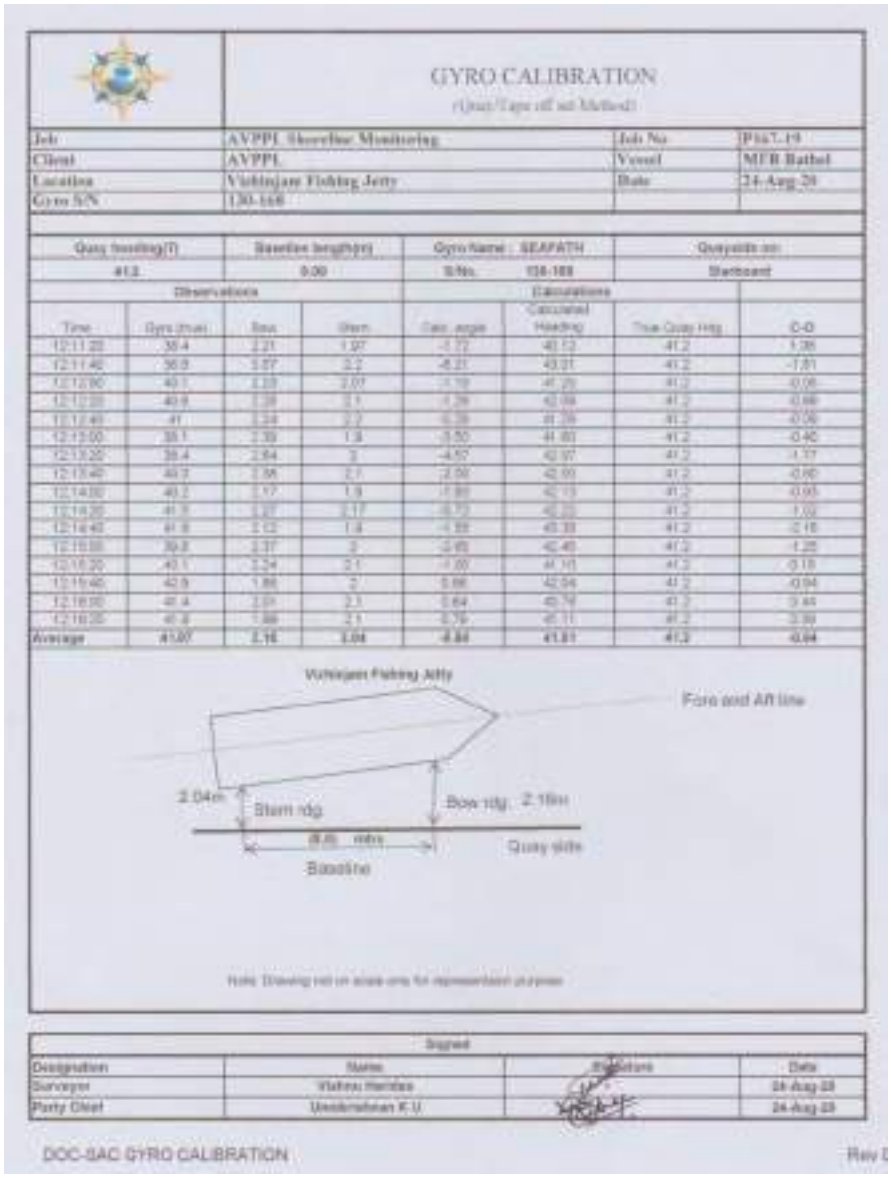
Observations				Calculations			
Time	Gyro (true)	Bow	Stern	Calc. angle	Calculated Heading	True Quay Hdg	C-O
11:35:10	45.2	0.3	0.6	2.15	43.05	45.28	2.23
11:35:20	45.8	0.8	0.5	-2.15	47.99	45.28	-2.67
11:35:30	45.3	0.7	0.6	-0.72	46.02	45.28	-0.74
11:35:40	45.4	0.5	0.8	2.15	43.25	45.28	2.03
11:35:50	45.9	0.7	0.5	-1.43	47.33	45.28	-2.05
11:36:00	45.9	0.6	0.9	2.15	43.65	45.28	1.63
11:36:10	45.3	0.6	0.7	-0.72	46.22	45.28	-0.94
Average	45.56	0.63	0.64	0.20	45.35	45.28	-0.07

Note: Drawing not an scale only for representation purpose

Signed

Designation	Name	Signature	Date
Surveyor	Vishnu Haridas		21-Apr-20
Party Chief	Unnikrishnan K.U		21-Apr-20

DOC-SAC GYRO CALIBRATION Rev 0



GYRO CALIBRATION

Job	AVPPL Shoreline Monitoring	Job No	P161.19
Client	AVPPL	Vessel	MFB Bathel
Location	Vizhinjam Fishing Jetty	Date	24-Aug-20
Gyro S/N	130-168		

Quay heading(T)	Baseline length(m)	Gyro Name : SEAPATH	Quayside on:
41.2	9.00	S/No. 130-168	Starboard

Observations				Calculations			
Time	Gyro (true)	Bow	Stern	Calc. angle	Calculated Heading	True Quay Hdg	O-D
12:11:20	39.4	2.21	1.97	-1.72	40.12	41.2	1.08
12:11:40	36.8	1.97	2.2	-4.21	43.01	41.2	-1.81
12:12:00	40.1	2.19	2.07	-1.19	41.29	41.2	-0.09
12:12:20	40.9	2.28	2.1	-1.29	42.09	41.2	-0.89
12:12:40	41	2.24	2.2	-0.28	41.28	41.2	-0.08
12:13:00	39.1	2.39	1.8	-3.50	41.60	41.2	-0.40
12:13:20	39.4	2.64	2	-4.57	42.97	41.2	-1.77
12:13:40	40.2	2.56	2.1	-2.56	42.76	41.2	-0.96
12:14:00	40.2	2.17	1.9	-1.80	42.13	41.2	-0.93
12:14:20	41.3	2.27	2.17	-0.72	42.02	41.2	1.02
12:14:40	41.3	2.12	1.8	-1.99	43.29	41.2	-2.19
12:15:00	39.8	2.37	2	-2.45	42.45	41.2	-1.25
12:15:20	40.1	2.24	2.1	-1.69	41.79	41.2	-0.59
12:15:40	42.9	1.86	2	5.68	42.54	41.2	-0.94
12:16:00	41.4	2.01	2.1	1.64	45.76	41.2	3.44
12:16:20	41.8	1.88	2.1	3.76	41.11	41.2	3.39
Average	41.07	2.16	2.04	-0.84	41.91	41.2	-0.04

Note: Drawing not on scale only for representation purpose

Signed			
Designation	Name	Signature	Date
Surveyor	Vishnu Haridas		24-Aug-20
Party Chief	Unnikrishnan K.U.		24-Aug-20

DOC-SAC GYRO CALIBRATION Rev 0

Figure 5-12: Gyrocompass Calibrations on board M.F.B. Bethel

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.

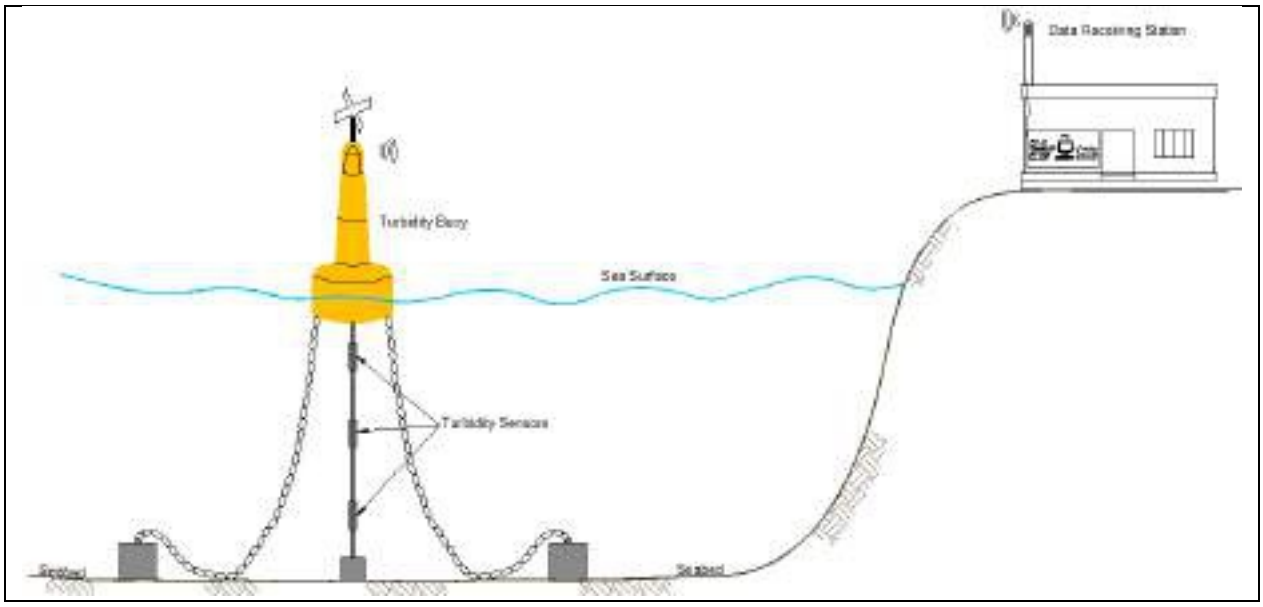


Figure 5-13: Turbidity buoy Mooring Diagram

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 5-14: Turbidity Buoy

6 SURVEY RESULTS

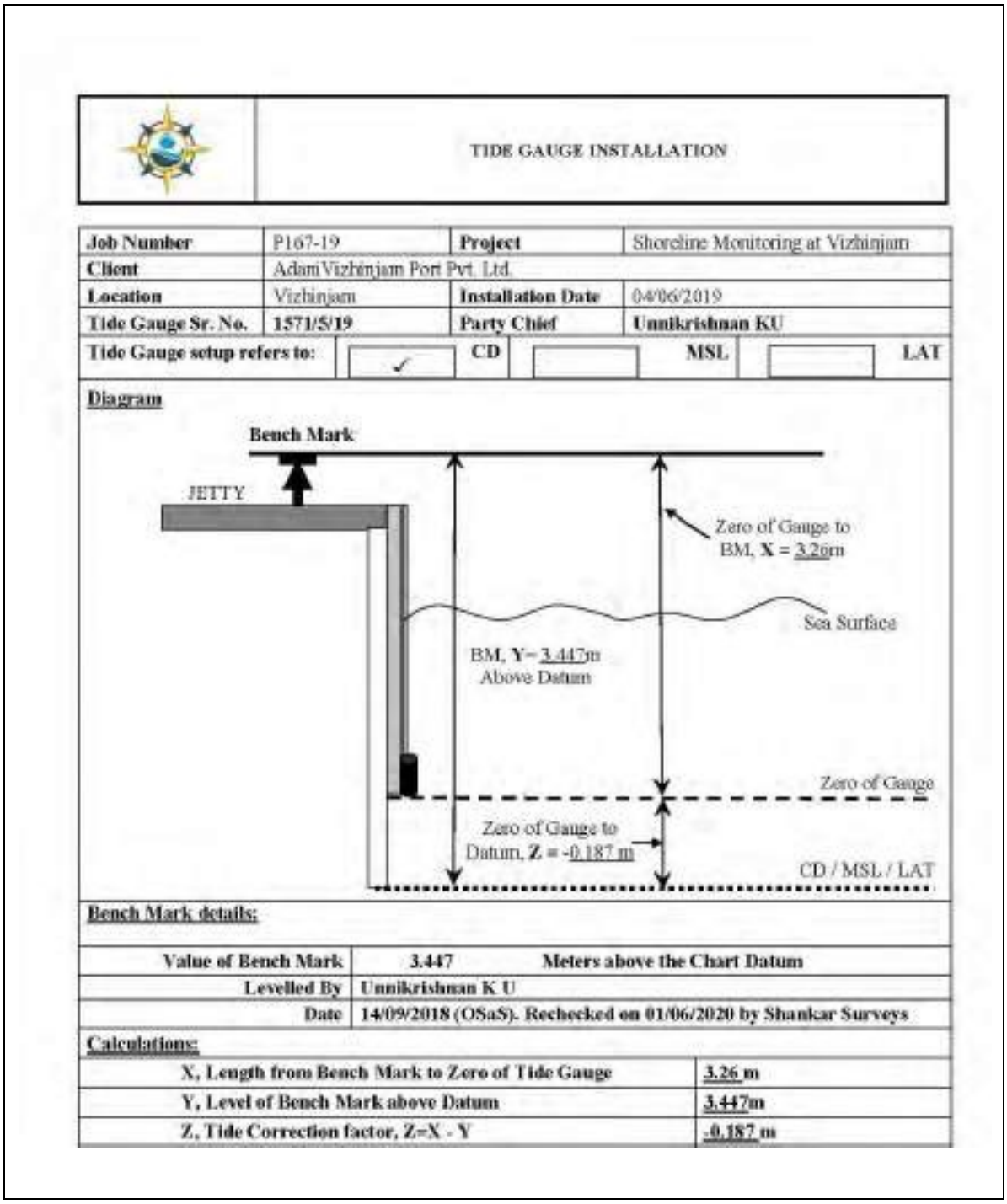
6.1 Tidal Measurements

The tides were observed near the Coast Guard jetty. The tide is referenced to the chart datum, the value of which was provided by VISL. The temporary benchmark (TBM) is marked on the wharf and is 3.447m above chart datum. An image of the TBM is provided below:



Figure 6-1: Location of TBM

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



TIDE GAUGE INSTALLATION

Job Number	P167-19	**Project**	Shoreline Monitoring at Vizhinjam
Client	Adani Vizhinjam Port Pvt. Ltd.		
Location	Vizhinjam	**Installation Date**	04/06/2019
Tide Gauge Sr. No.	1571/5/19	**Party Chief**	Unnikrishnan KU

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

Diagram

Bench Mark details:

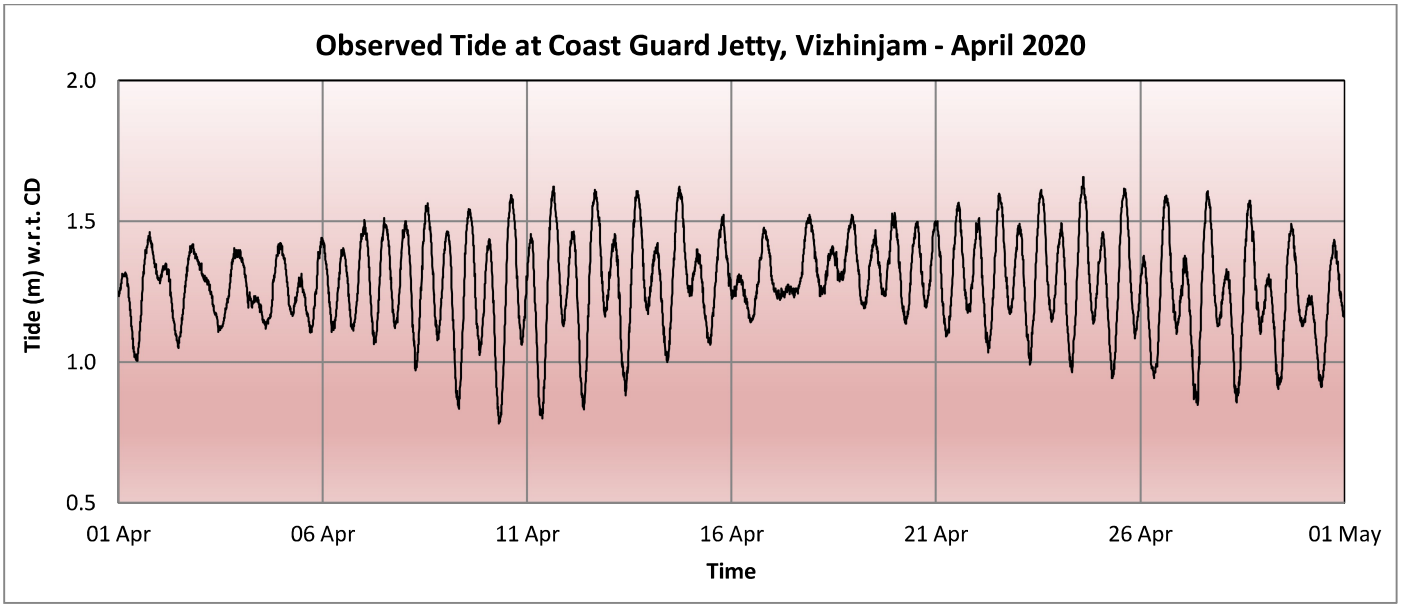
Value of Bench Mark	**3.447 Meters above the Chart Datum**
Levelled By	**Unnikrishnan K U**
Date	**14/09/2018 (OSaS). Rechecked on 01/06/2020 by Shankar Surveys**

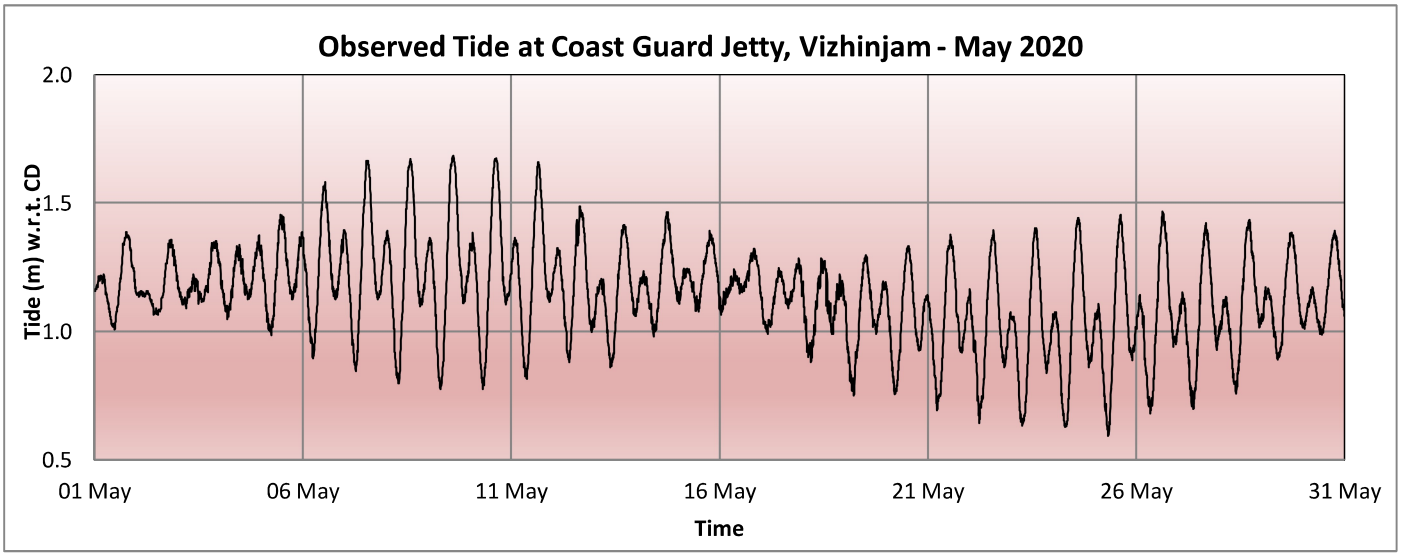
Calculations:

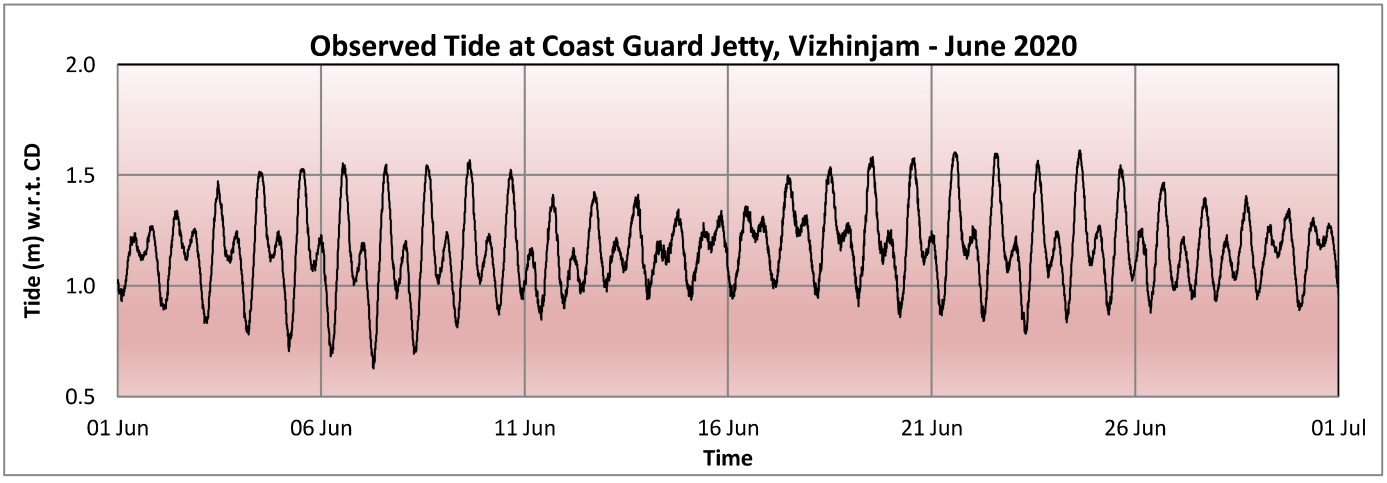
X, Length from Bench Mark to Zero of Tide Gauge	**3.26 m**
Y, Level of Bench Mark above Datum	**3.447m**
Z, Tide Correction factor, Z=X - Y	**-0.187 m**

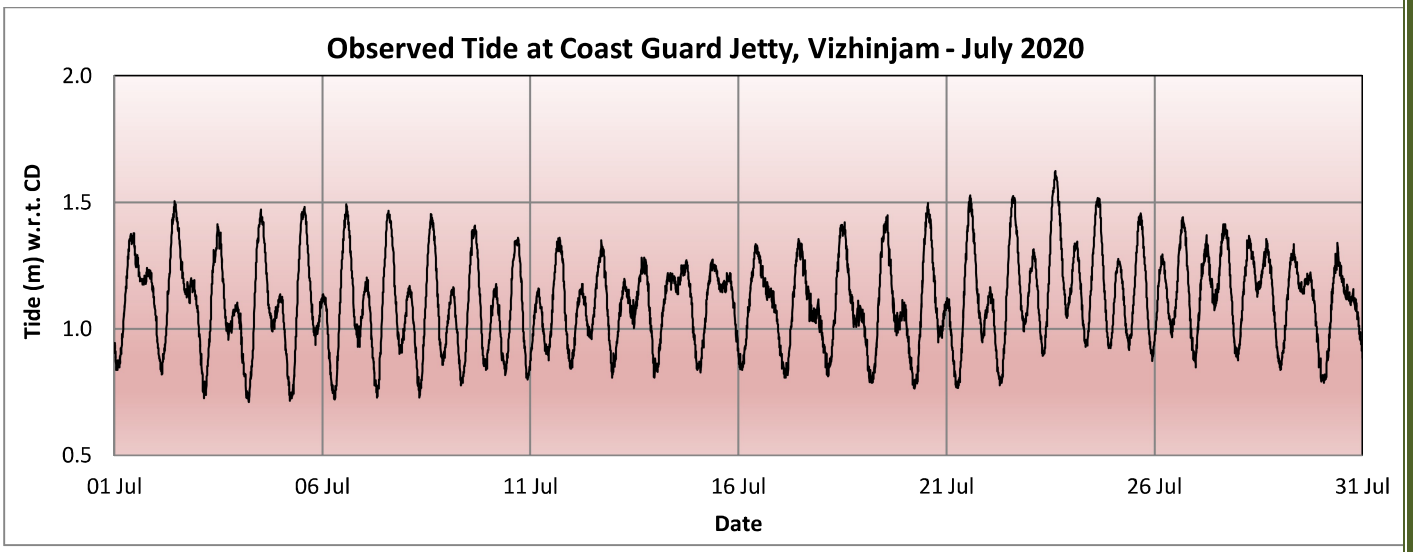
Figure 6-2: Schematic Diagram of Tide Gauge

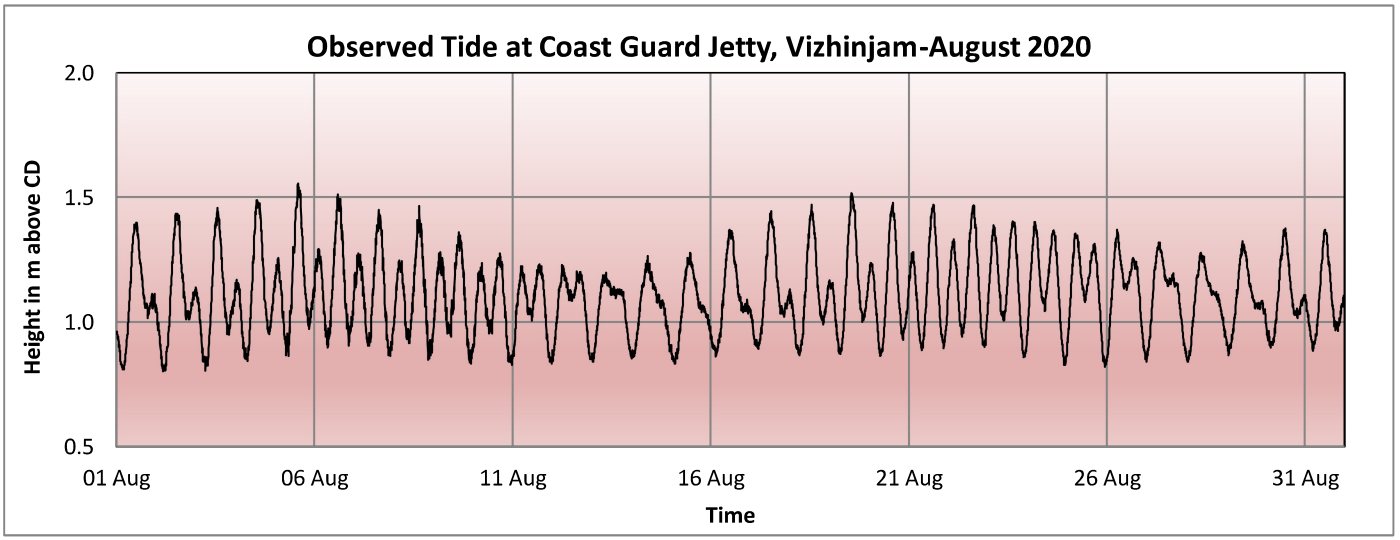
The tides observed are mixed semi-diurnal in nature, with the maximum range being observed in the springs. The representation of tide data collected, in the form of graphs is placed below.


Observed Tide at Coast Guard Jetty, Vizhinjam - April 2020
Tide (m) w.r.t. CD
2.0
1.5
1.0
0.5
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Time


Observed Tide at Coast Guard Jetty, Vizhinjam - May 2020
Tide (m) w.r.t. CD
2.0
1.5
1.0
0.5
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Time


Observed Tide at Coast Guard Jetty, Vizhinjam - June 2020
Tide (m) w.r.t. CD
2.0
1.5
1.0
0.5
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Time





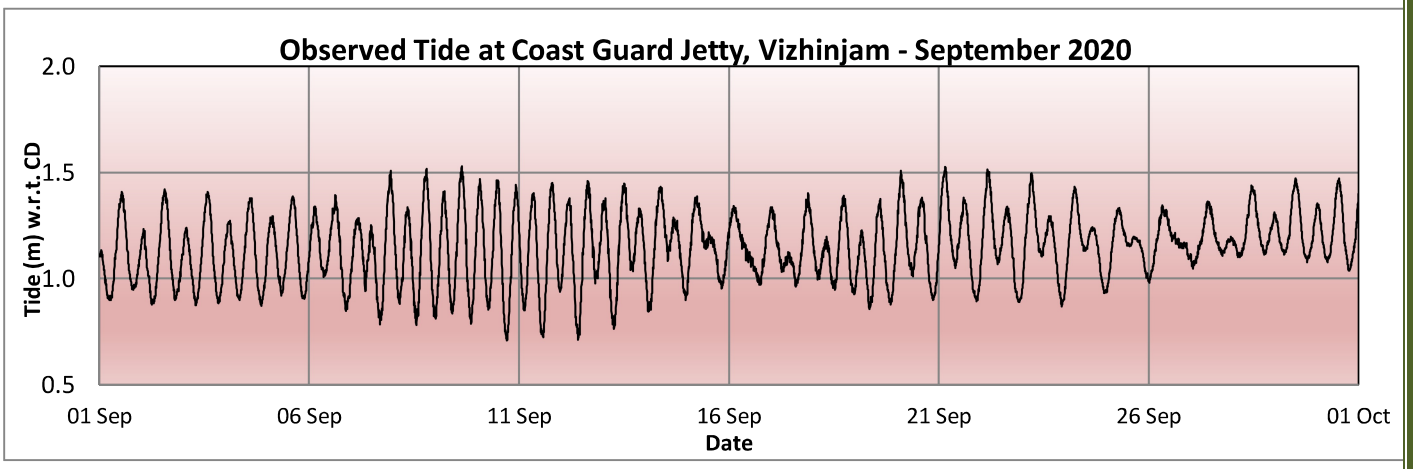


Figure 6-3: Time series of tide

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 2020:

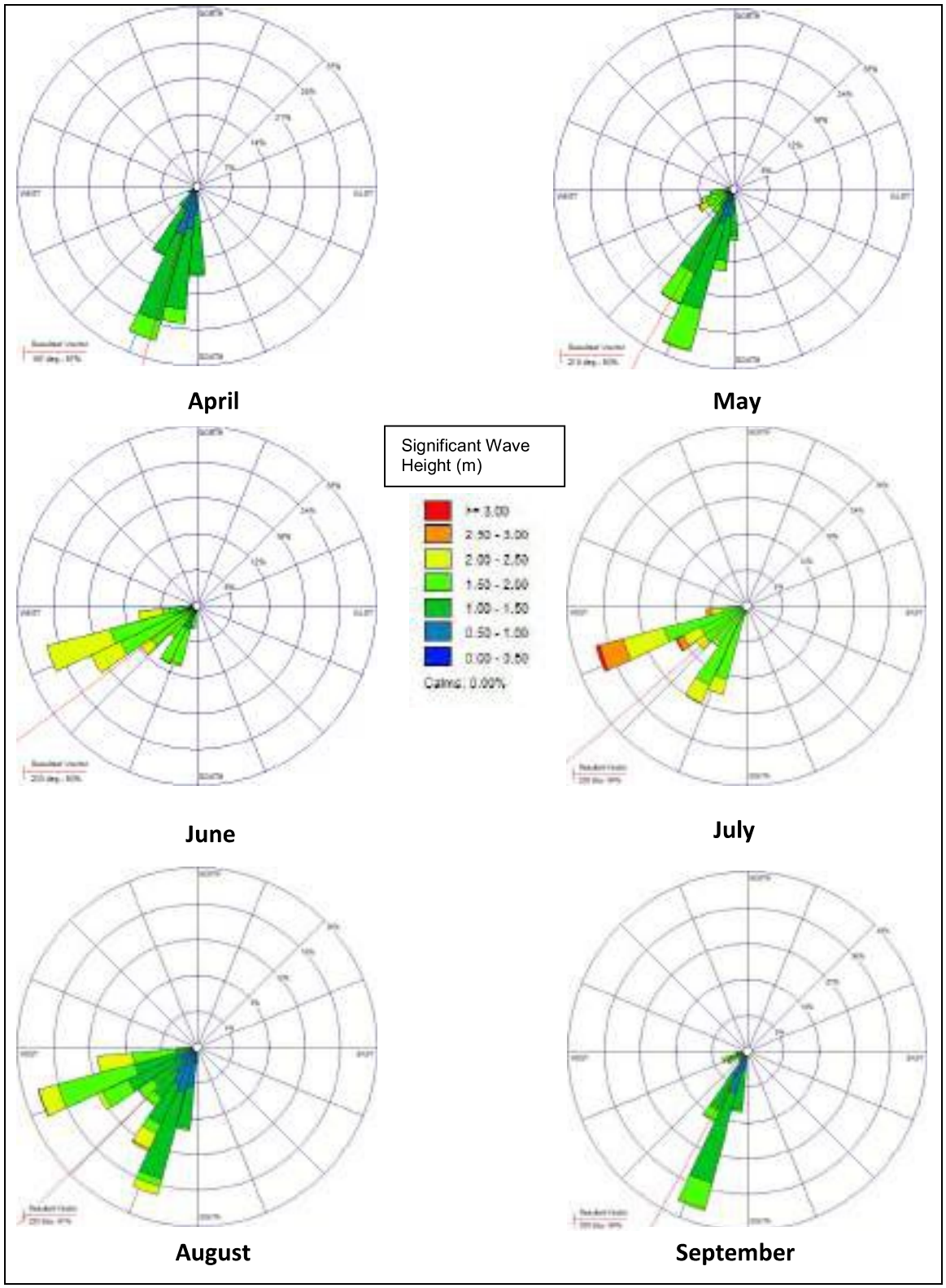


Figure 6-4: Wave Rose (Hs in metre v/s Direction)

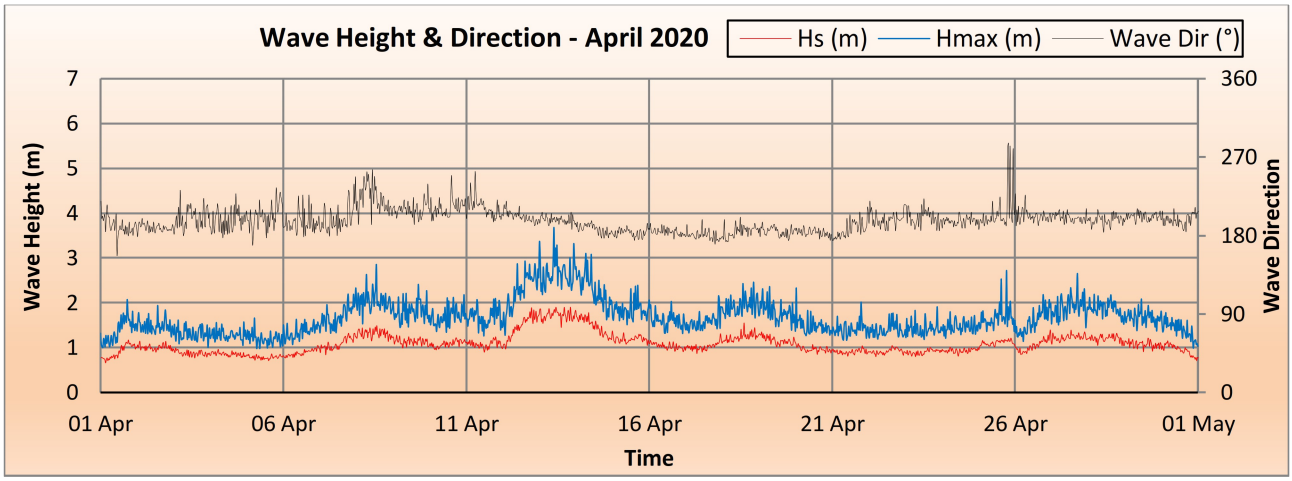
The following table provides the monthly maximum significant wave height (Hs) and wave period (Tp) observed during the seasons.

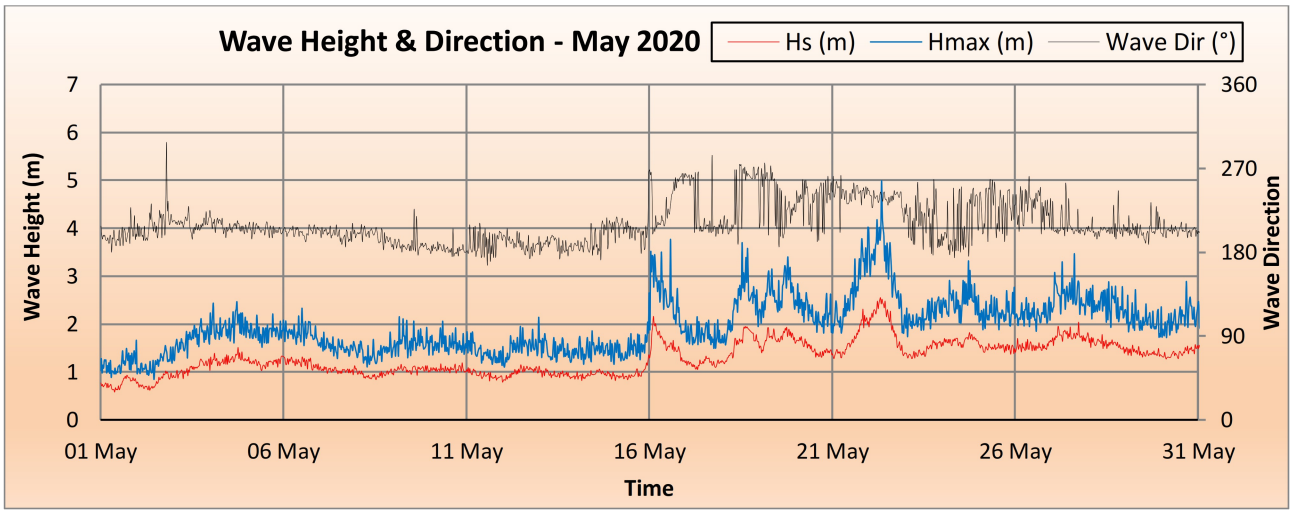
Table 6-1: Monthly maximum Hs and Tp

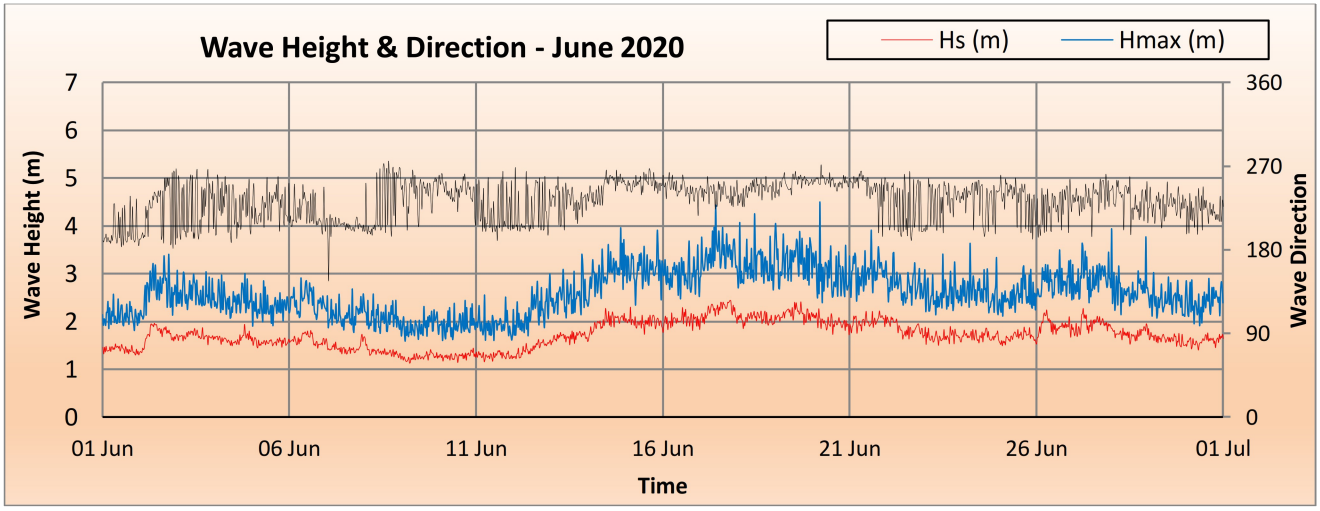
Significant wave height (Hs) in meters and wave period (Tp) in seconds			
Month	**Hs (m)**	**Predominant Direction (°)**	**Tp (sec)**
April 2020	1.9	197	18.18
May 2020	2.55	210	20
June 2020	2.44	233	20
July 2020	3.15	229	20
August 2020	3.03	225	16.67
September 2020	3.98	209	18.18

The above table indicates that during the monsoon period, the wave heights increased and even during September 2020 which is considered the monsoon withdrawal month, due to a meteorological event the wave height increased to about 4m.

The time series of wave data from April to September 2020 is shown below.


Wave Height & Direction - April 2020
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
Time


Wave Height & Direction - May 2020
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
Time


Wave Height & Direction - June 2020
Hs (m)
Hmax (m)
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
Time

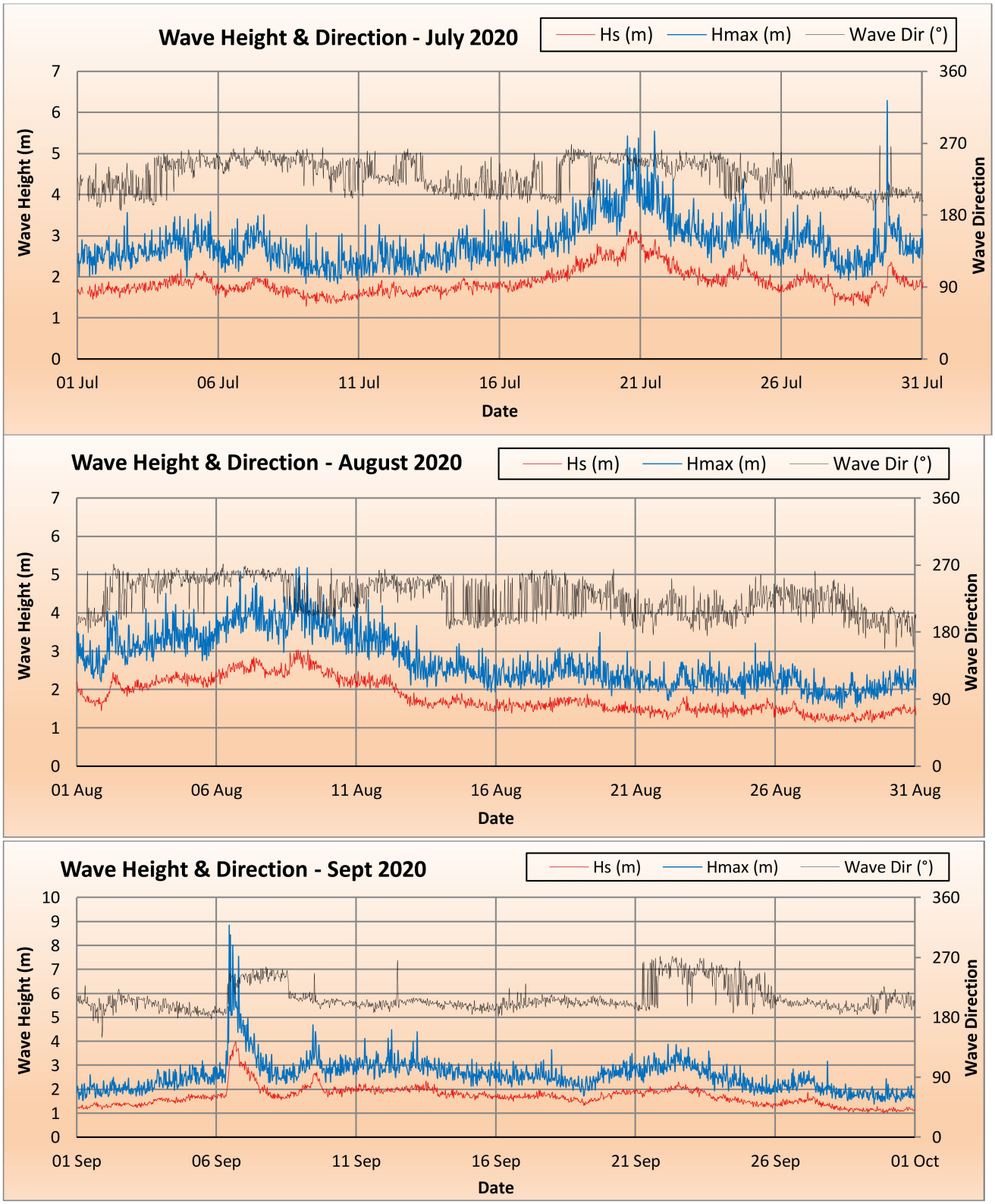


Figure 6-5: Time series of wave parameters

6.3 Current Measurements

Current meters were deployed at four locations during the period April to September 2020, first during May-June and second during August-September 2020; to measure the speed and direction of the current at three different levels, i.e., surface, mid-depth and near bottom. The ADCPs were deployed for a period of 30 days to cover one lunar cycle. Unfortunately, the ADCP deployed at Pachalloor was lost due to an incident on 2nd September 2020, during the second campaign.

The following table gives the deployment details of the ADCPs in the survey area for all the seasons.

Table 6-2: ADCP Mooring Locations

Location	Water Depth (m)	Period of Observation	Latitude	Longitude	Frequency
P1 (Vizhinjam)	22.1	25th April to 26th May 2020	08° 21' 55.4"N	76° 58' 51.6"E	600 kHz
P2 (Poovar)	23.1	25th April to 26th May 2020	08° 17' 35.8"N	77° 04' 03.5"E	600 kHz
P3 (Pachalloor)	21.9	25th April to 26th May 2020	08° 24' 08.6"N	76° 56' 16.1"E	600 kHz
P4 (Mulloor)	22.9	25th April to 26th May 2020	08° 21' 42.3"N	76° 59' 33.9"E	600 kHz
P1 (Vizhinjam)	22.1	17th Aug to 20th Sept 2020	08° 21' 55.4"N	76° 58' 51.9"E	600 kHz
P2 (Poovar)	23.1	17th Aug to 20th Sept 2020	08° 17' 35.8"N	77° 04' 04"E	600 kHz
P3 (Pachalloor)	21.9	No data	08° 24' 08.6"N	76° 56' 11.1"E	600 kHz
P4 (Mulloor)	22.9	17th Aug to 20th Sept 2020	08° 21' 42.3"N	76° 59' 34.5"E	600 kHz

The following table provides the maximum surface currents recorded at each location during the Pre-monsoon and monsoon periods.

Table 6-3: Maximum speed of surface currents

Maximum Surface Current Speed in cm/s				
Season	Location P1 (Vizhinjam)	Location P2 (Poovar)	Location P3 (Pachalloor)	Location P4 (Mulloor)
April – May 2020	70.4	69.3	71.3	75.6
Aug-Sept 2020	116.7	156.7	--	107.4

The current rose plots of surface current speed at Location 1 (Vizhinjam) are shown below.

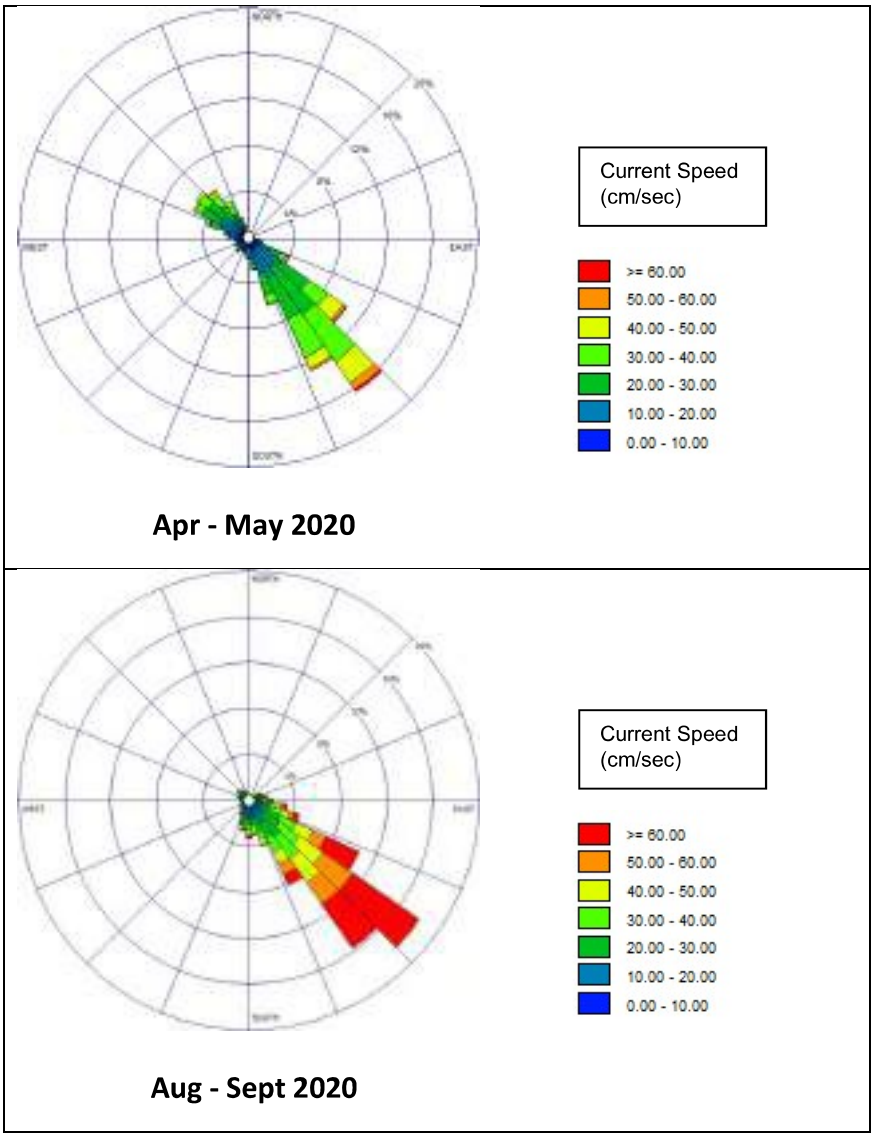


Figure 6-6: Rose Plot (surface speed in cm/sec) – P1 (Vizhinjam)

The rose plots reveal a flow parallel to the shore. During the monsoon period, the flow was predominantly towards the southeast.

The current rose plots of surface current speed at Location 2 (Poovar) are shown below.

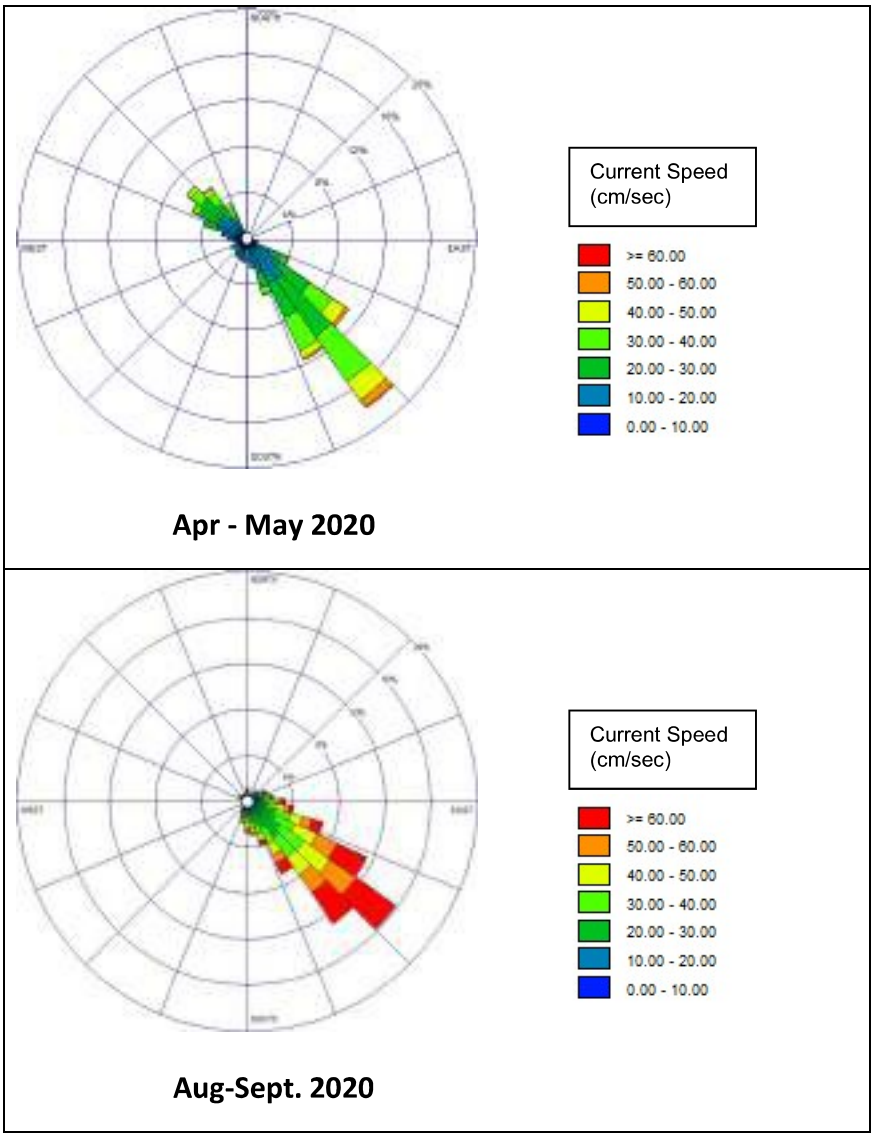


Figure 6-7: Rose Plot (surface speed in cm/sec) – P2 (Poovar)

The rose plots reveal a flow parallel to the shore. During the monsoon period, the flow was predominantly towards the southeast.

The current rose plots of surface current speed at Location 3 (Pachalloor) are shown below.

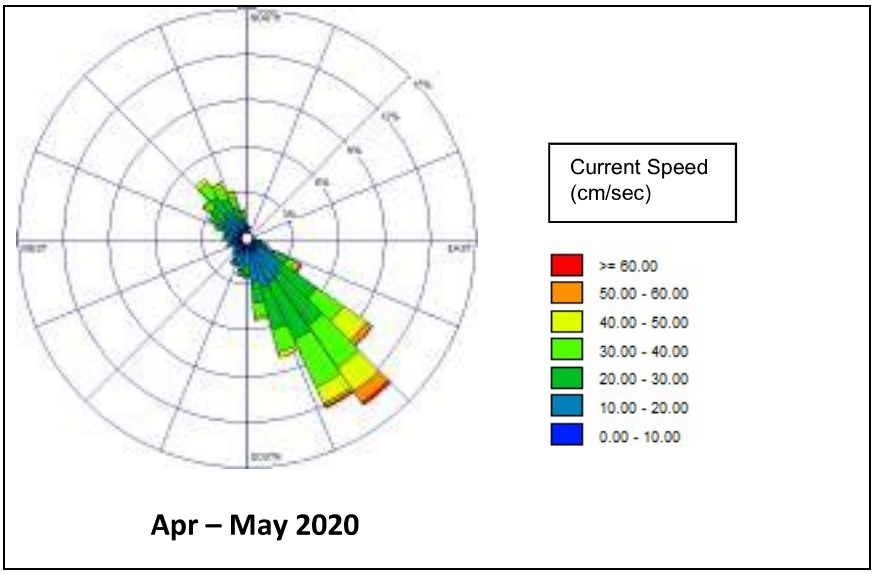
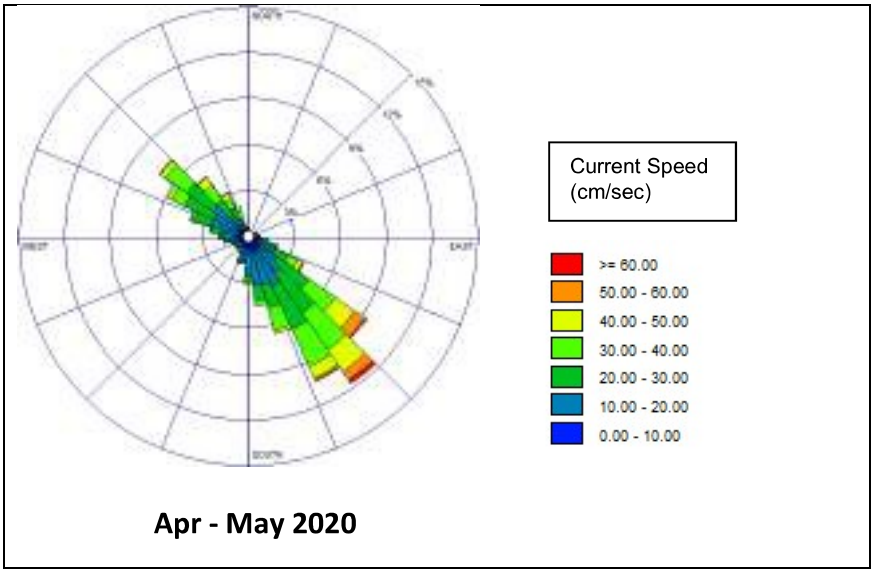


Figure 6-8: Rose Plot (surface speed in cm/sec) – P3 (Pachalloor)

The rose plots reveal a flow parallel to the shore and was predominantly towards the southeast.

The current rose plots of surface current speed at Location 4 (Mulloor) are shown below.



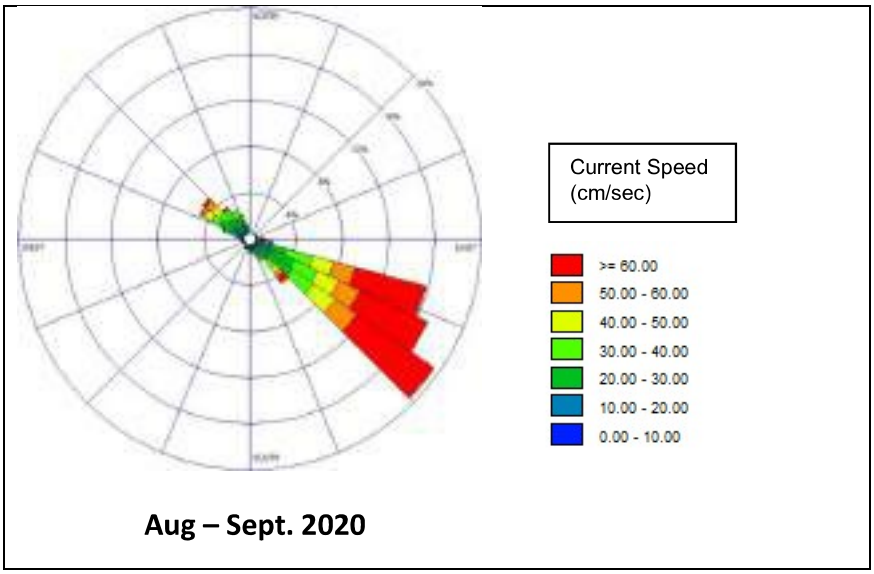


Figure 6-9: Rose Plot (surface speed in cm/sec) – P4 (Mulloor)

The rose plots reveal a flow parallel to the shore and was predominantly towards the southeast.

6.4 Measurement of Meteorological Parameters

The automatic weather station was installed on the roof of Ayur Bay Resort. The wind data for all the months is compiled and presented in the form of rose plots below.

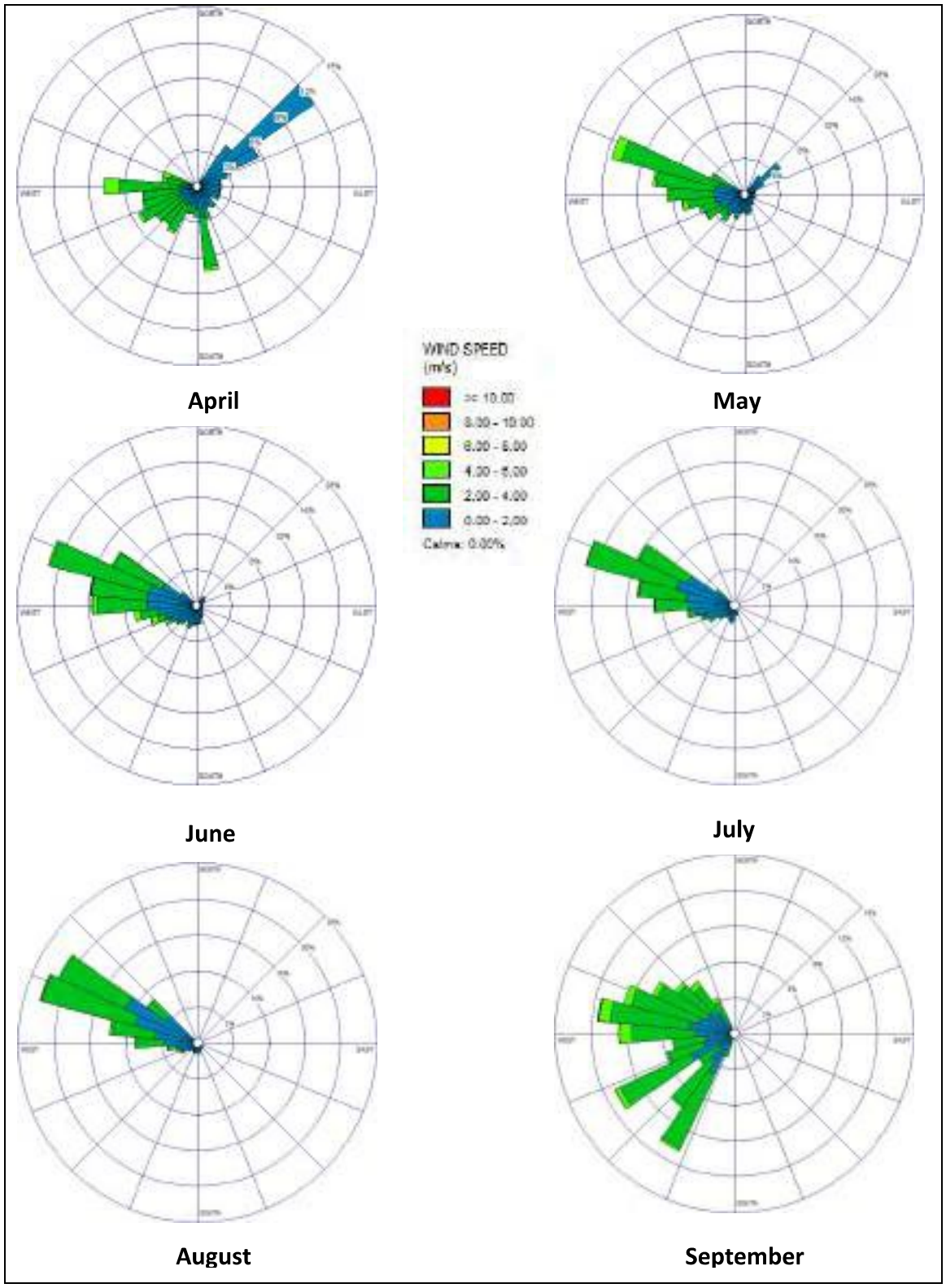


Figure 6-10: Wind rose (Speed in m/s vs direction)

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

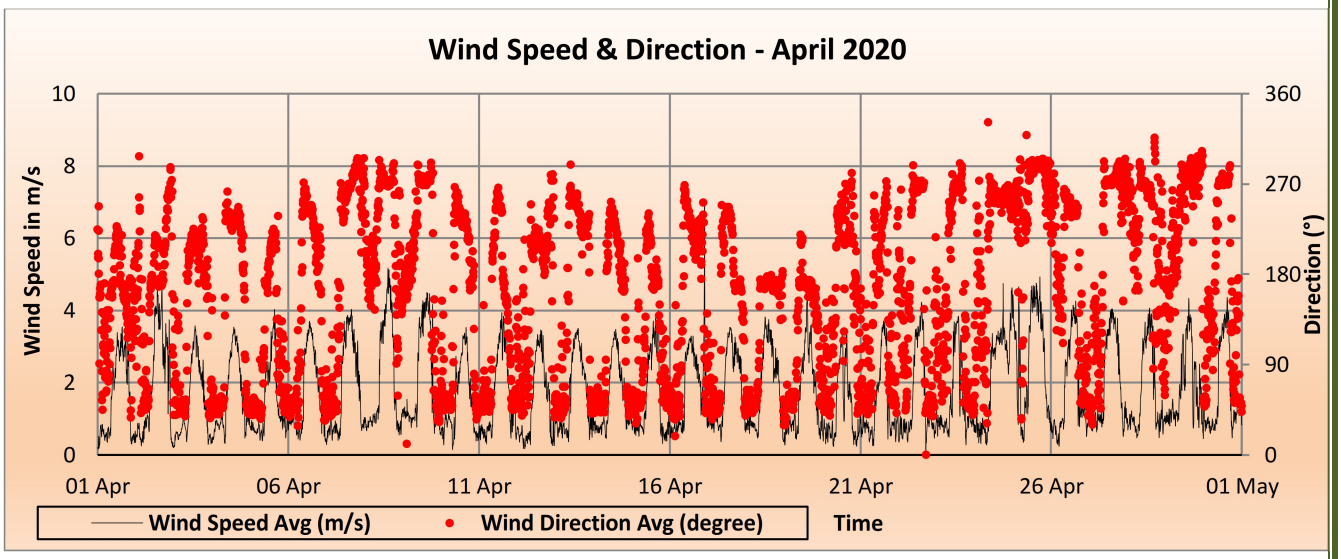
① Table 6-4: Monthly maximum wind speed from seaside

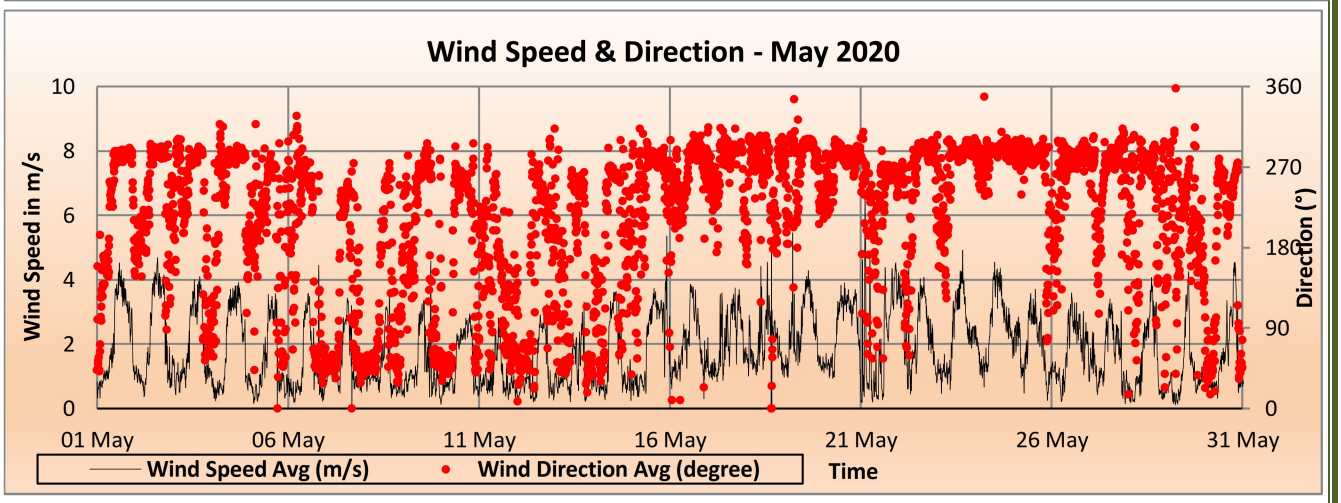
Month	Wind Speed (m/s)	Predominant Direction (°)
April 2020	5.16	247.5
May 2020	6.72	286.2
June 2020	7.13	291.8
July 2020	8.92	278
August 2020	9.91	289.6
September 2020	4.00	238.4

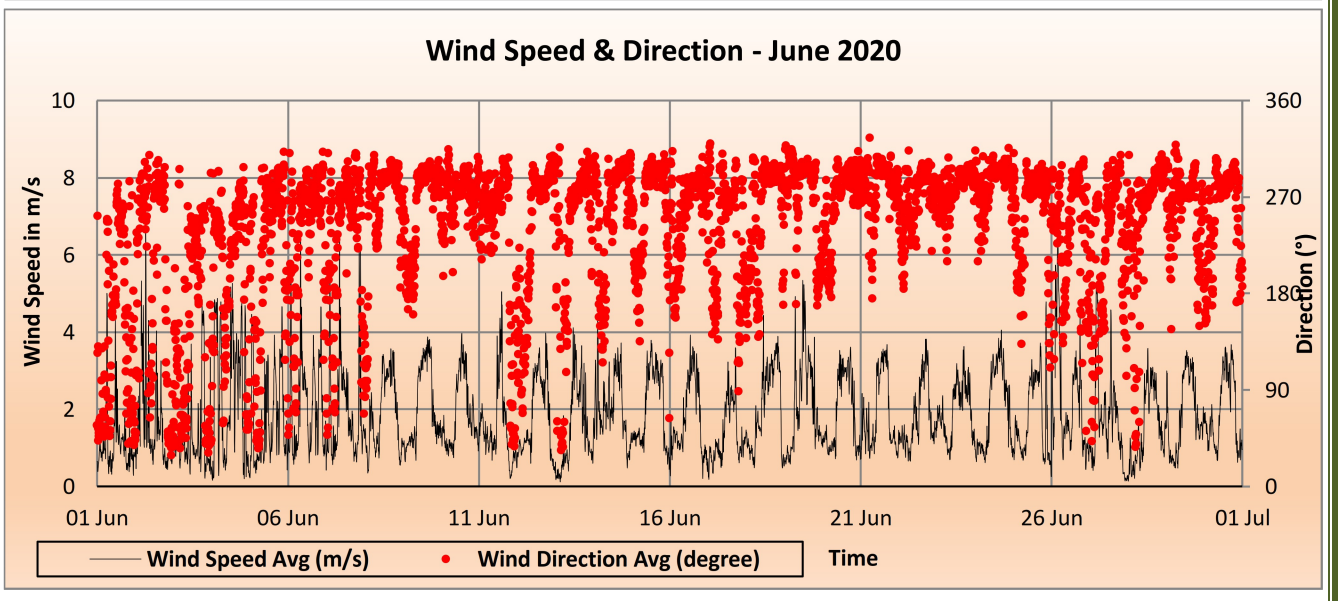
① Table 6-5: Monthly maximum wind speed from landside

Month	Wind Speed (m/s)	Predominant Direction (°)
April 2020	6.93	170.1
May 2020	5.36	157.9
June 2020	4.44	54.4
July 2020	6.53	9.3
August 2020	3.7	152.5
September 2020	3.81	126.6

The time series of wind data from April to September 2020 is shown below.


Wind Speed & Direction - April 2020
Wind Speed in m/s
Direction (°)
10
8
6
4
2
0
360
270
180
90
0
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Time


Wind Speed & Direction - May 2020
Wind Speed in m/s
Direction (°)
10
8
6
4
2
0
360
270
180
90
0
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Time


Wind Speed & Direction - June 2020
Wind Speed in m/s
Direction (°)
10
8
6
4
2
0
360
270
180
90
0
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Time

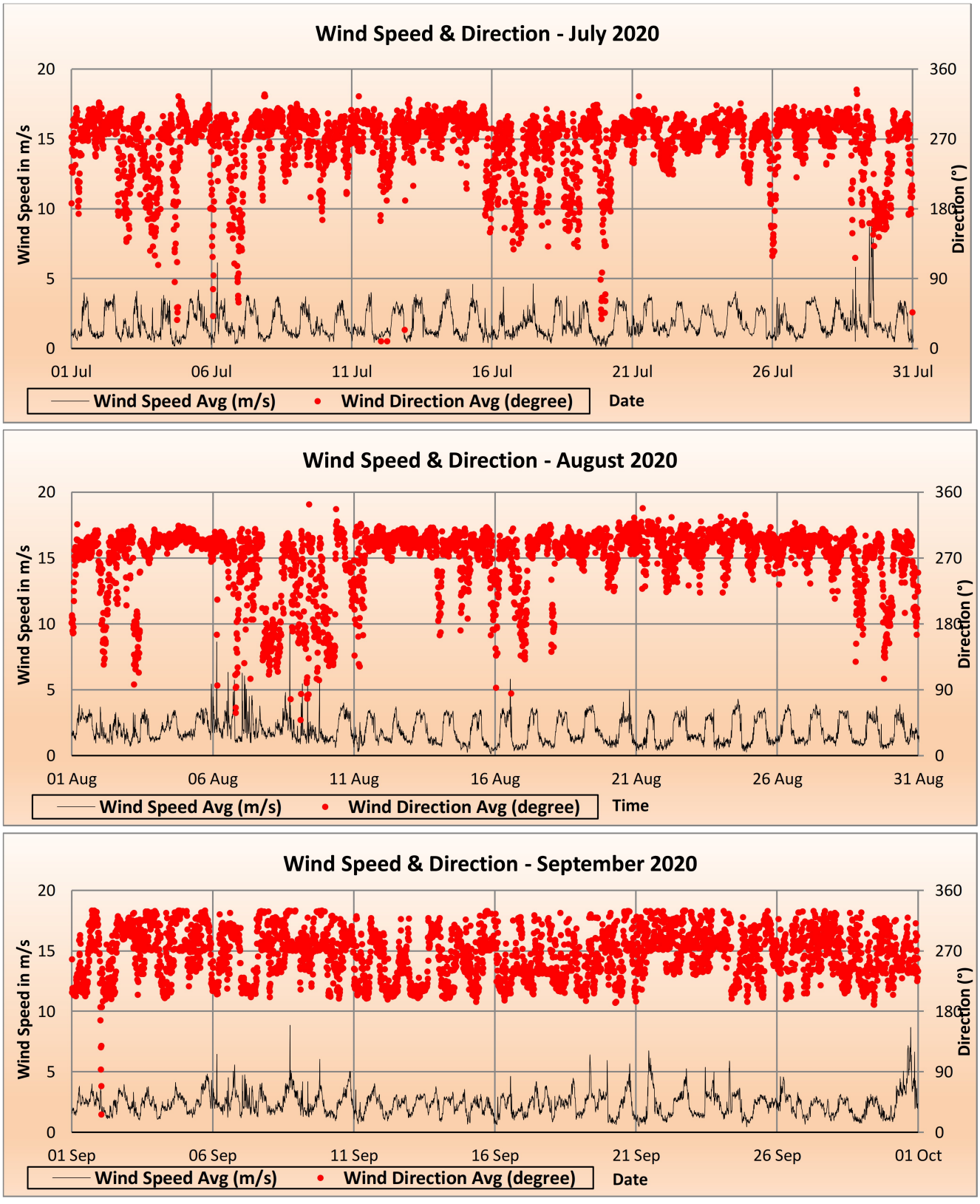


Figure 6-11: Time series of wind data

① The percentage occurrence tables for atmospheric pressure, temperature and relative humidity for the period of April to September 2020 are shown below.

Table 6-6: Frequency distribution of atmospheric pressure

Frequency Distribution	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20
Atm. Pressure (mb)	**Percentage Occurrence**					
<1000	0.00	0.22	0.00	0.00	0.00	1.39
1000-1004	1.25	31.02	34.35	45.79	26.41	62.71
1004-1008	69.41	67.08	61.37	52.69	70.57	35.86
>1008	29.34	1.68	4.28	1.52	3.02	0.05
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 6-7: Frequency distribution of temperature

Frequency Distribution	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20
Temperature (°)	**Percentage Occurrence**					
20-24	0.16	0.52	1.27	2.35	3.73	4.95
24-28	37.83	47.19	70.96	74.03	72.39	72.50
28-32	61.18	50.66	27.77	23.62	23.81	22.55
>32	0.83	1.63	0.00	0.00	0.07	0.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 6-8: Frequency distribution of relative humidity

Frequency Distribution	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20
Rel. Humidity (%)	**Percentage Occurrence**					
50-60	0.23	0.11	0.02	0.00	0.00	0.05
60-70	19.45	2.60	2.43	1.32	0.29	1.34
70-80	40.76	23.92	22.24	28.10	14.92	32.62
>80	39.56	73.37	75.31	70.58	84.79	66.00
Total	**100.00**	**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 2020 are shown below.



Figure 6-12: Histogram of atmospheric pressure



Figure 6-13: Histogram of temperature



Figure 6-14: Histogram of relative humidity

The following table shows the amount of rainfall received during the entire period from April to September 2020.

Table 6-9: Cumulative rainfall

Month	Cumulative Rainfall (mm)
April 2020	49.6
May 2020	319.8
June 2020	372.6
July 2020	380.5
August 2020	146.2
September 2020	226.6

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

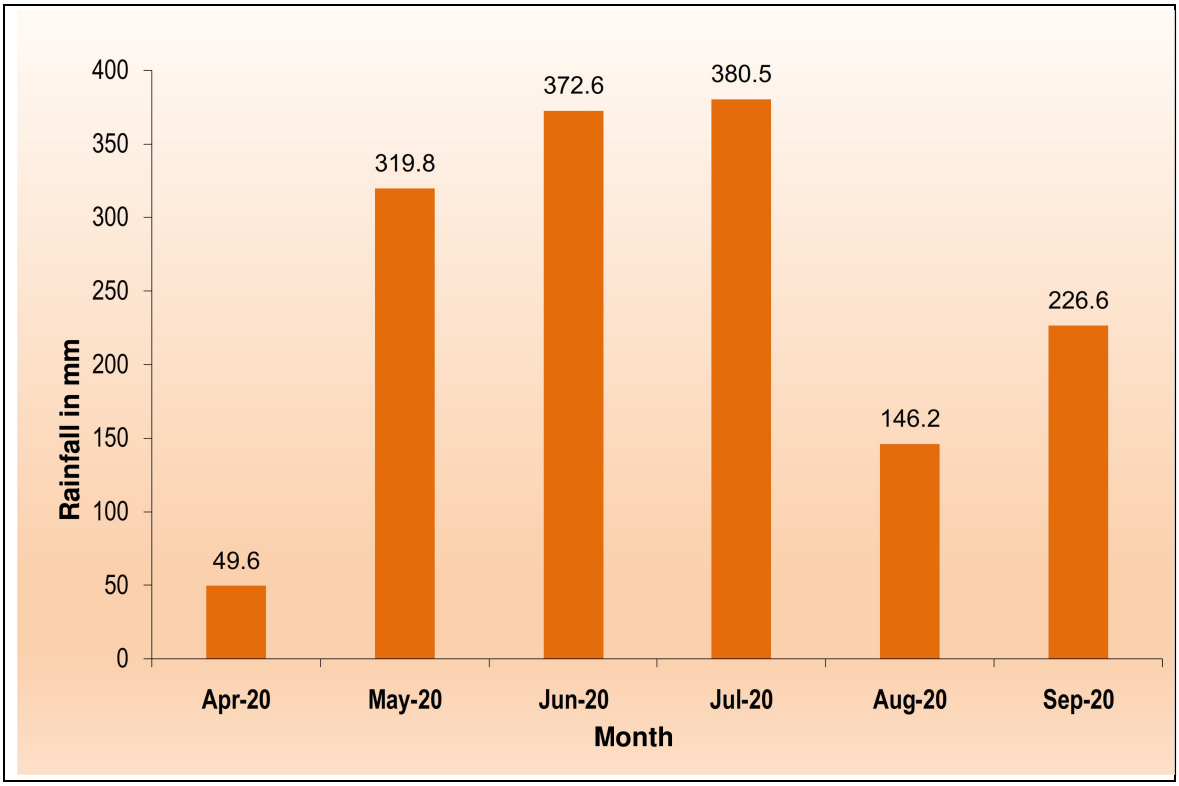


Figure 6-15: Histogram of cumulative rainfall

6.5 Littoral Environment Observations

The LEO was carried out at 71 out of 81 locations in all the months, since the entry was restricted to the 10 locations in Tamil Nadu state due to COVID-19 pandemic. The LEO plate was deployed at all the locations and the same was tracked for about five to ten minutes, as per the site conditions. The initial and final GPS positions were then used to calculate the SOG and COG. The estimated wave height, angle of wave, period and the stretch of breakers were also noted down in the log.

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

Table 6-10: Monthly maximum along shore current

Month	Max Speed (cm/s) / Direction	Line No.	Location
April 2020	39.22 / north	CSP-71	Shankumukham
May 2020	13.94 / south	CSP-34	Adimalathura
June 2020	36.64 / south	CSP-32	Adimalathura
July 2020	Not collected due to lockdown		
August 2020	18.4 / south	CSP-26	Karumkulam
September 2020	23.2 / south	CSP-26	Karumkulam

6.6 Photographic Documentation

Photographic documentation was carried out for all the 71 locations, coinciding with the cross-shore profiling.

① In the month of July 2020, the survey activities were suspended entirely as a result of restriction on personnel movement due to COVID-19 lockdown in the entire Vizhinjam and adjoining area. The photographs for the period from April 2020 to September 2020 are placed at **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. Due to the pandemic situation, onshore profiling from locations CSP1 to CSP10 which were lying in the Tamil Nadu state could not be carried out due to travel restrictions. During the survey period, due to breakers nearshore, the boat could not approach the shore at any of the locations.

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

Table 6-11: CSP Location names

CSP NO.	LANDMARK	LOCATION
CSP-01	CATHOLIC CRISMATIC PRAYER CENTER	EDAPPADU BEACH
CSP-02		
CSP-03		
CSP-04	ST. MARY'S CHURCH	VALLAVILAY
CSP-05		
CSP-06		
CSP-07	ST. NICOLAS' CHURCH	NEERODY
CSP-08		
CSP-09		
CSP-10	SREE BHADRAKALI TEMPLE	POZHIYOOR
CSP-11		
CSP-12		
CSP-13	ST. MATHEW'S CHURCH	PARUTHIYOOR
CSP-14	CHURCH OF CHRIST	
CSP-15	POOVAR ISLAND RESORT	POOVAR BEACH SOUTH
CSP-16		
CSP-17		
CSP-18	POZHIKARA BEACH	POOVAR
CSP-19		
CSP-20	ST. ANTONY'S CHAPEL	POOVAR BEACH NORTH
CSP-21		
CSP-22	ST. ANTONY'S CHURH	KARUMKULAM
CSP-23		
CSP-24		
CSP-25		
CSP-26		
CSP-27	GOTHAMBU ROAD	PULLUVILA
CSP-28		
CSP-29		
CSP-30		
CSP-31	ADIMALATHURA CATHOLIC CHURCH	ADIMALATHURA
CSP-32		
CSP-33		
CSP-34		
CSP-35	AZHIMALA TEMPLE	AZHIMALA
CSP-36	NAGAR BHAGAVATHY TEMPLE	MULLUR
CSP-37		

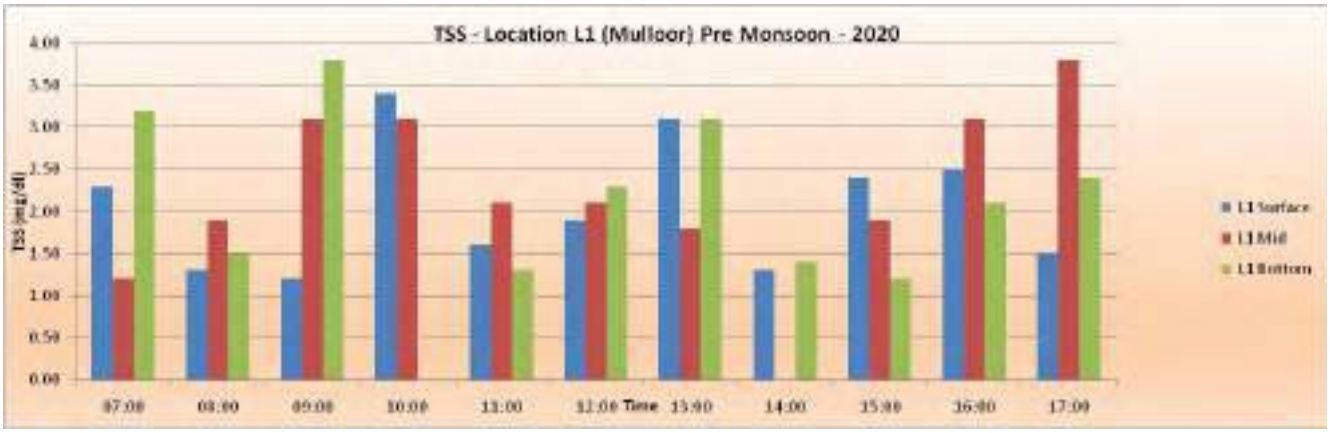
CSP NO.	LANDMARK	LOCATION
CSP-38	ADANI PORT RECLAMATION AREA	ADANI PORT OFFICE VIZHINJAM
CSP-39		
CSP-40		
CSP-41	VIZHINJAM LIGHT HOUSE	KOVALAM
CSP-42		
CSP-43		
CSP-44		
CSP-45		
CSP-46		
CSP-47	SAMUDRA BEACH PARK	KOVALAM
CSP-48	MOSQUE	PANATHURA
CSP-49		
CSP-50	PANATHURA TEMPLE	PANATHURA
CSP-51		
CSP-52		
CSP-53	PUNTHURA FISH MARKET	PUNTHURA
CSP-54		
CSP-55		
CSP-56		
CSP-57		
CSP-58	BEEMA PALLY	BEEMA PALLY
CSP-59		
CSP-60		
CSP-61	CHERIYATHURA SPORTS GROUND	CHERIYATHURA
CSP-62		
CSP-63	VALIYATHURA BRIDGE	VALIYATHURA
CSP-64		
CSP-65		
CSP-66		
CSP-67		
CSP-68	SHANGUMUGHAM BEACH	SHANGUMUGHAM
CSP-69		
CSP-70	ST. PETER'S CHURCH	SHANGUMUGHAM
CSP-71		
CSP-72	VETTUCAUD CHURCH	VETTUCAUD
CSP-73		
CSP-74		
CSP-75	VELI CHILDRENS PARK	KOCHUVELI
CSP-76		
CSP-77		

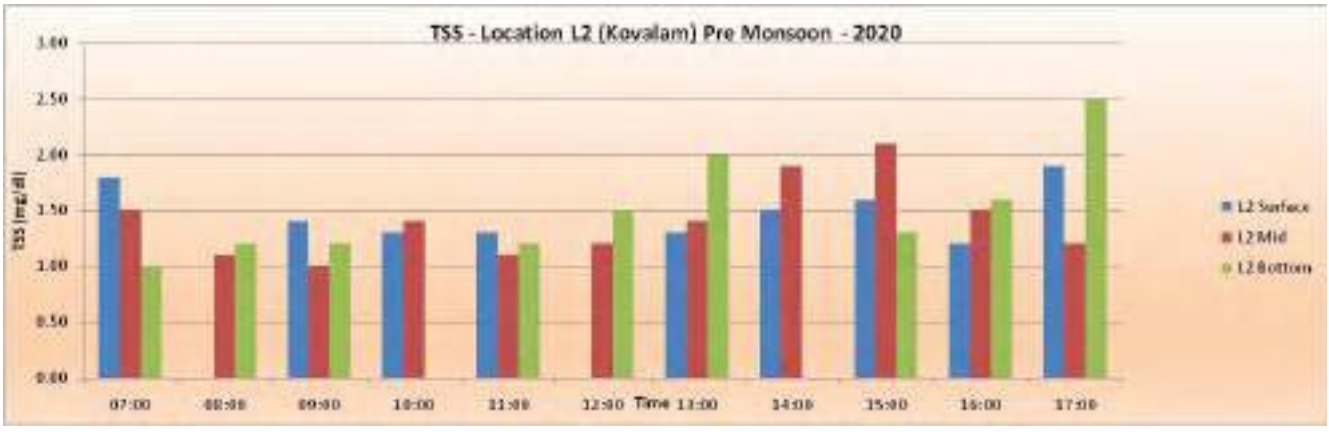
CSP NO.	LANDMARK	LOCATION
CSP-78	ST. THOMAS' CHURCH	VALIYA VELI
CSP-79		
CSP-80	CHRISTIAN BROTHEREN CHURCH	THUMBA
CSP-81		

6.8 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 season. The parameters measured were Total Suspended Solids, Turbidity and Salinity at NABL accredited laboratory in Kochi (Standards Environmental & Analytical Laboratories, Accreditation and Approval: NABL as per ISO 17025:2005).

The time series for Total Suspended Solids (in mg/l) for the above locations are provided below.





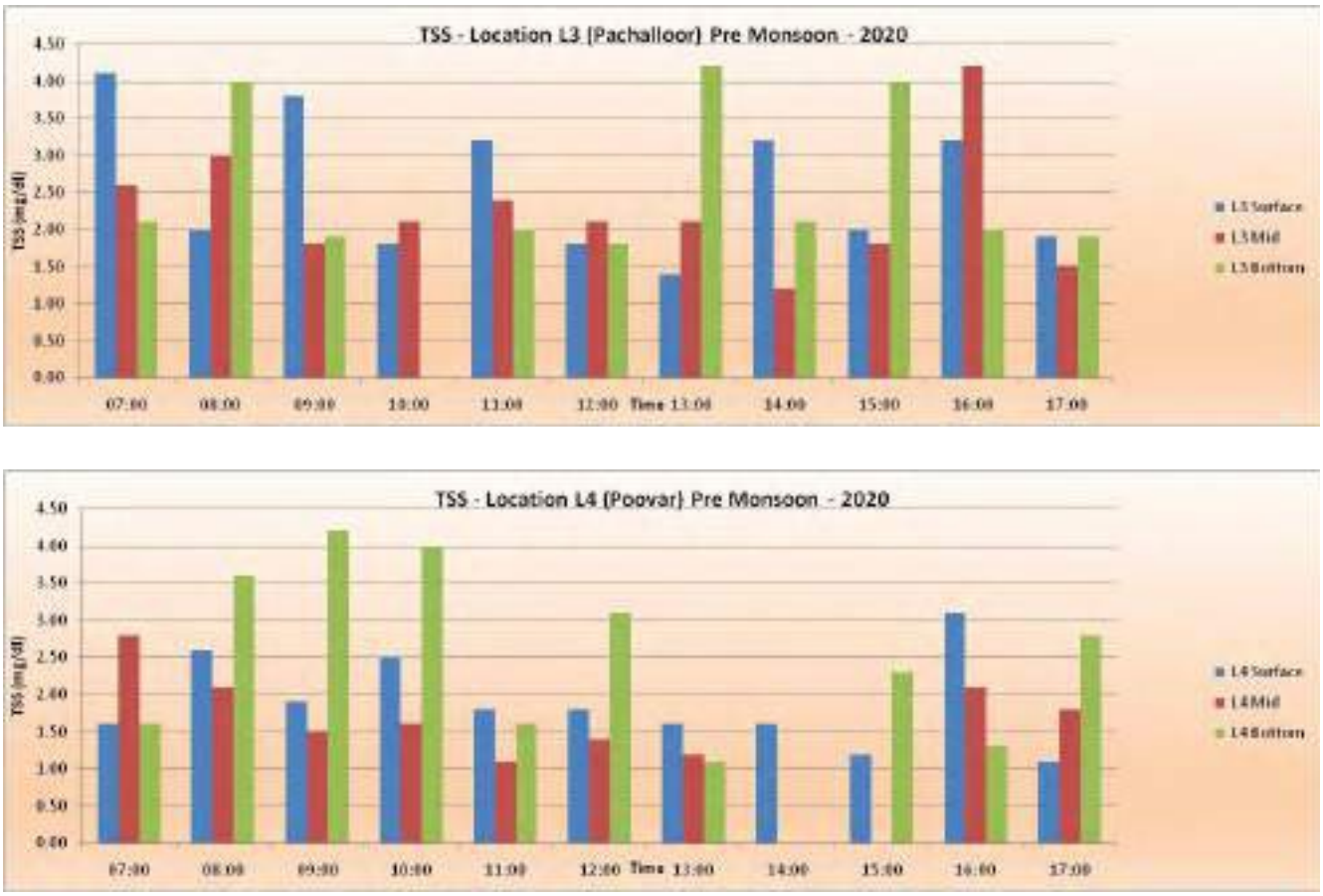


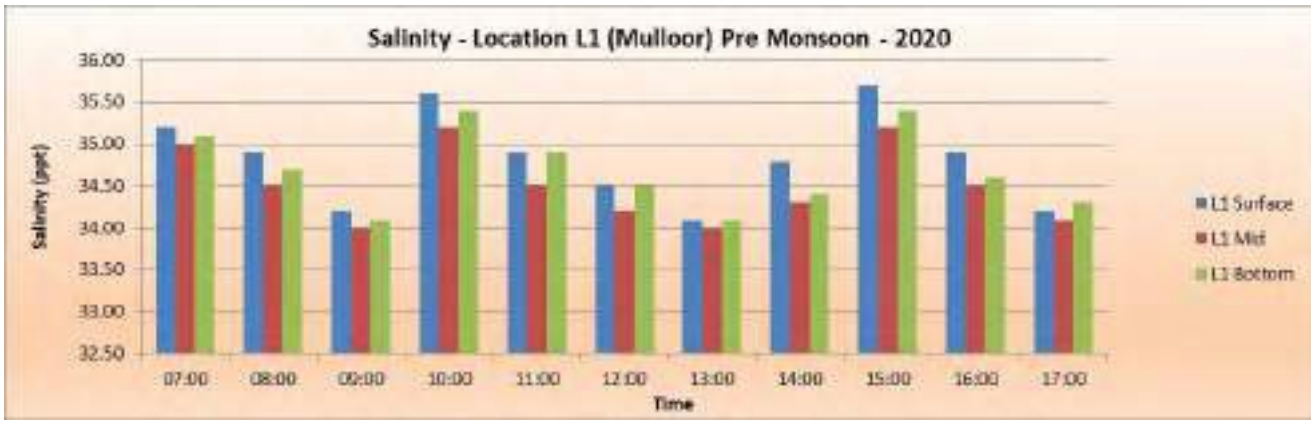
Figure 6-16: Time Series of TSS

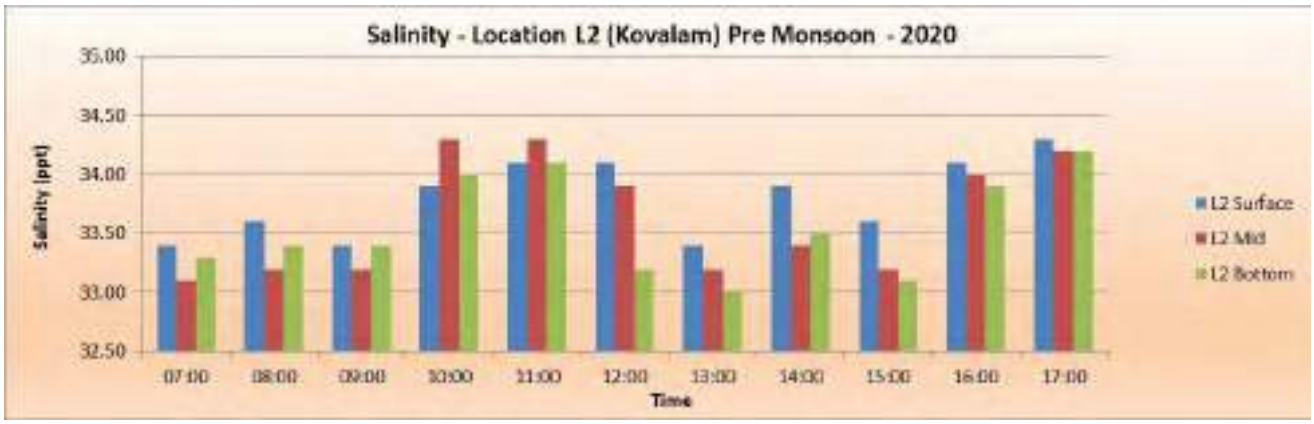
The maximum Total Suspended Solids at all the locations was less than 4.5mg/l at all occasions.

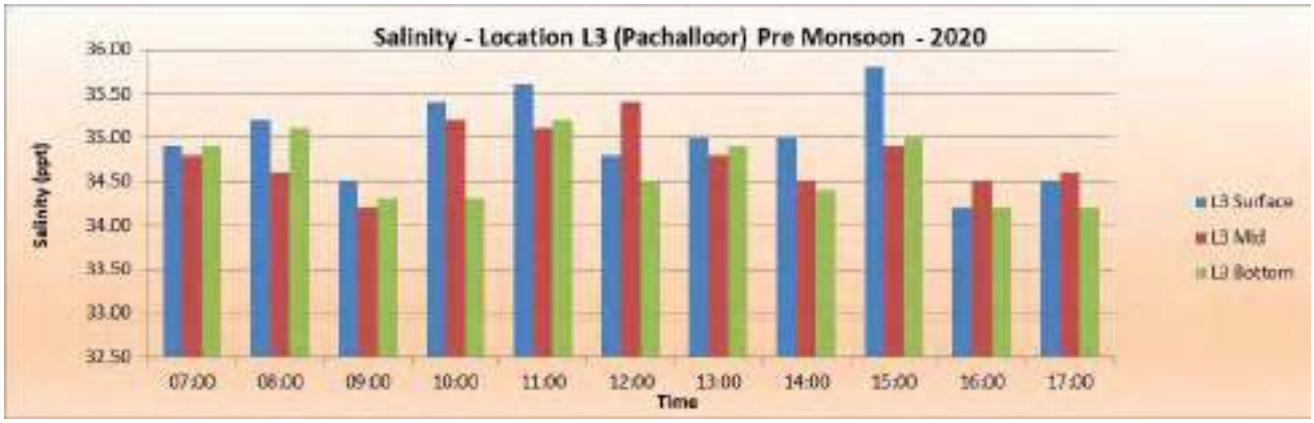
Note: *At times, when the value of Total Suspended Solids dropped to less than 1mg/l, it was Below Detectable Level (BDL) and the exact value could not be measured accurately and thus the column is not shown.*

The time series for salinity at all three levels for all the locations is given as follows.

①


Salinity - Location L1 (Mulloor) Pre Monsoon - 2020
Salinity (ppt)
36.00
35.50
35.00
34.50
34.00
33.50
33.00
32.50
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


Salinity - Location L2 (Kovalam) Pre Monsoon - 2020
Salinity (ppt)
34.50
34.00
33.50
33.00
32.50
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


Salinity - Location L3 (Pachalloor) Pre Monsoon - 2020
Salinity (ppt)
36.00
35.50
35.00
34.50
34.00
33.50
33.00
32.50
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

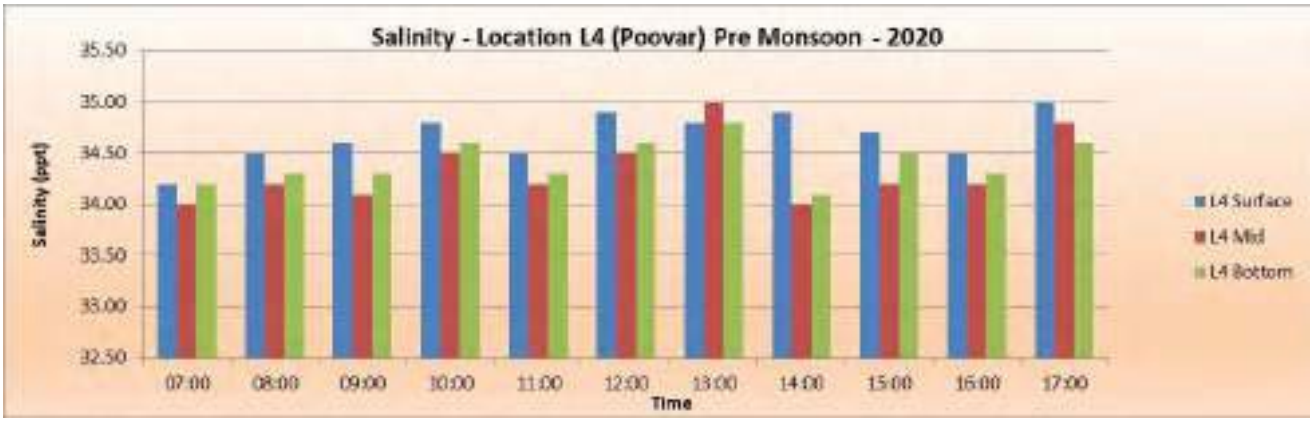
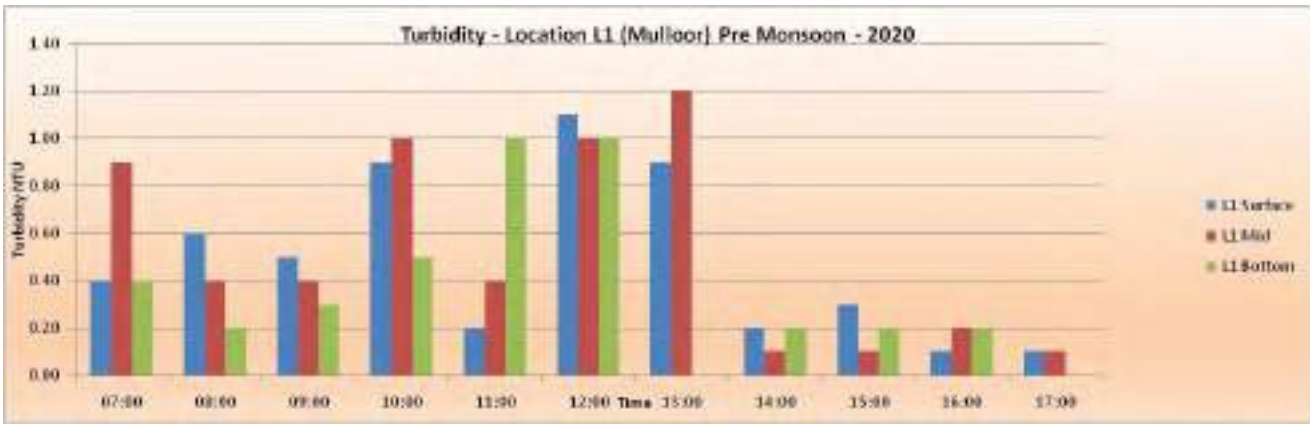
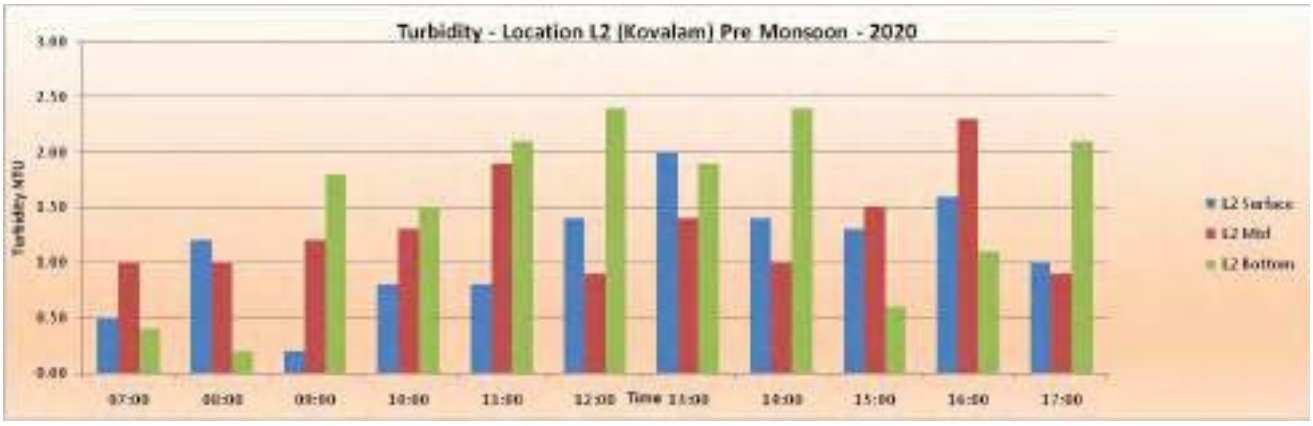


Figure 6-17: Time Series of salinity

The salinity at all locations is seen to be between 33.0 and 35.8 parts per thousand (ppt).

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





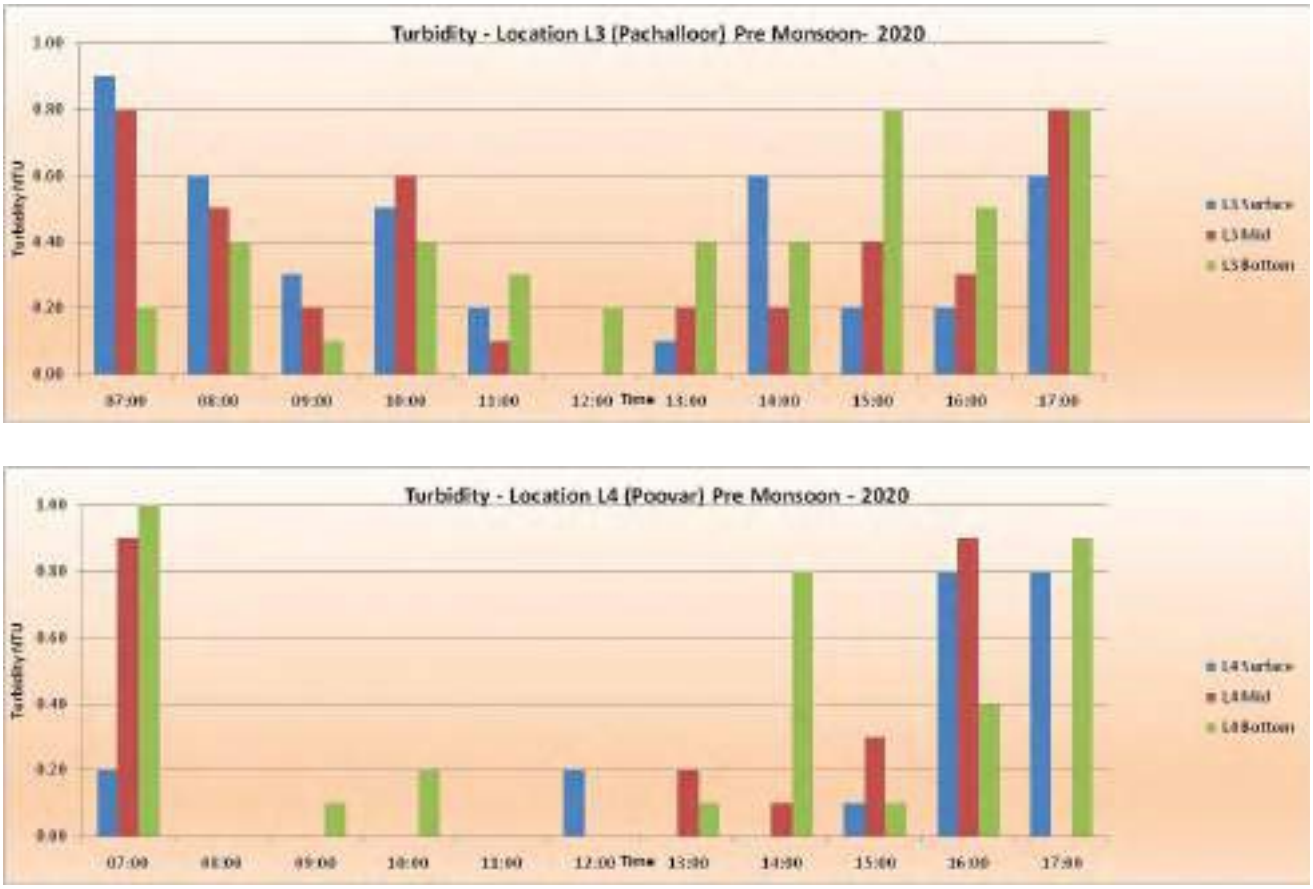


Figure 6-18: Time Series of Turbidity at water sampling locations

The maximum turbidity recorded was 2.4 NTU near the bottom at Location L2 (Kovalam).

Note: *At times, when the value of Turbidity dropped to less than 0.1 NTU, it was Below Detectable Level (BDL) and the exact value could not be measured accurately and thus the column is not shown.*

6.9 Beach Sampling

Beach samples were collected 65 out of the 81 locations in the month of May 2020. The samples BS-1 to BS-10 could not be collected due to restrictions on inter-state travel to Tamil Nadu as a result of the lockdown imposed by the Government of India. BS-49 to BS-52 could not be collected due to non-availability of beach in those locations. The following table shows the D50 value (in mm) of the sediments collected along with the soil classification.

Table 6-12: Beach sample soil classification

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-01	Not collected					
BS-02	Not collected					
BS-03	Not collected					
BS-04	Not collected					
BS-05	Not collected					
BS-06	Not collected					
BS-07	Not collected					
BS-08	Not collected					
BS-09	Not collected					
BS-10	Not collected					
BS-11	Not collected					
BS-12	Not collected					
BS-13	0	100	0	100	0.6467	Medium Sand
BS-14	0	100	0	100	0.6075	Medium Sand
BS-15	0	100	0	100	0.6056	Medium Sand
BS-16	0	100	0	100	0.4683	Medium Sand
BS-17	0	100	0	100	0.4226	Fine Sand
BS-18	0	100	0	100	0.5189	Medium Sand
BS-19	0	100	0	100	0.4185	Fine Sand
BS-20	0	100	0	100	0.3940	Fine Sand
BS-21	0	100	0	100	0.4255	Medium Sand
BS-22	0	100	0	100	0.4599	Medium Sand
BS-23	0	100	0	100	0.4582	Medium Sand
BS-24	0	100	0	100	0.4639	Medium Sand
BS-25	0	100	0	100	0.5069	Medium Sand
BS-26	0	100	0	100	0.4314	Medium Sand
BS-27	0	100	0	100	0.4282	Medium Sand
BS-28	0	100	0	100	0.5781	Medium Sand
BS-29	0	100	0	100	0.4728	Medium Sand
BS-30	0	100	0	100	0.4627	Medium Sand
BS-31	0	100	0	100	0.5593	Medium Sand
BS-32	0	100	0	100	0.5656	Medium Sand
BS-33	0	100	0	100	0.5117	Medium Sand
BS-34	0	100	0	100	0.5222	Medium Sand
BS-35	0	100	0	100	0.5222	Medium Sand
BS-36	0	100	0	100	0.6183	Medium Sand
BS-37	0	100	0	100	0.4203	Fine Sand
BS-38	0	100	0	100	0.5664	Medium Sand
BS-39	0	100	0	100	0.3559	Fine Sand
BS-40	0	100	0	100	0.5953	Medium Sand
BS-41	0	100	0	100	0.1699	Fine Sand
BS-42	0	100	0	100	0.2539	Fine Sand
BS-43	0	100	0	100	0.2304	Fine Sand

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
BS-44	0	100	0	100	0.3538	Fine Sand
BS-45	0	100	0	100	0.3746	Fine Sand
BS-46	0	100	0	100	0.3384	Fine Sand
BS-47	0	100	0	100	0.4320	Medium Sand
BS-48	0	100	0	100	0.3521	
BS-49	Not Applicable					
BS-50	Not Applicable					
BS-51	Not Applicable					
BS-52	Not Applicable					
BS-53	0	100	0	100	0.1829	Fine Sand
BS-54	0	100	0	100	0.3839	Fine Sand
BS-55	0	100	0	100	0.4087	Fine Sand
BS-56	0	100	0	100	0.3991	Fine Sand
BS-57	0	100	0	100	0.4325	Medium Sand
BS-58	0	100	0	100	0.4083	Fine Sand
BS-59	0	100	0	100	0.4857	Medium Sand
BS-60	0	100	0	100	0.4412	Medium Sand
BS-61	0	100	0	100	0.4502	Medium Sand
BS-62	0	100	0	100	0.4557	Medium Sand
BS-63	0	100	0	100	0.5027	Medium Sand
BS-64	0	100	0	100	0.3917	Fine Sand
BS-65	0	100	0	100	0.4445	Medium Sand
BS-66	0	100	0	100	0.4629	Medium Sand
BS-67	0	100	0	100	0.4206	Fine Sand
BS-68	0	100	0	100	0.4525	Medium Sand
BS-69	0	100	0	100	0.4081	Fine Sand
BS-70	0	100	0	100	0.4088	Fine Sand
BS-71	0	100	0	100	0.4013	Fine Sand
BS-72	0	100	0	100	0.3996	Fine Sand
BS-73	0	100	0	100	0.3853	Fine Sand
BS-74	0	100	0	100	0.3915	Fine Sand
BS-75	0	100	0	100	0.3541	Fine Sand
BS-76	0	100	0	100	0.4032	Fine Sand
BS-77	0	100	0	100	0.4067	Fine Sand
BS-78	0	100	0	100	0.3870	Fine Sand
BS-79	0	100	0	100	0.4124	Fine Sand
BS-80	0	100	0	100	0.4287	Medium Sand
BS-81	0	100	0	100	0.4001	Fine Sand

① The classification is based on IS 1498 as provided below:

Fine Sand – 0.425 to 0.075 mm
Medium Sand – 2.000 to 0.425 mm
Coarse Sand – 4.750 to 2.000 mm

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

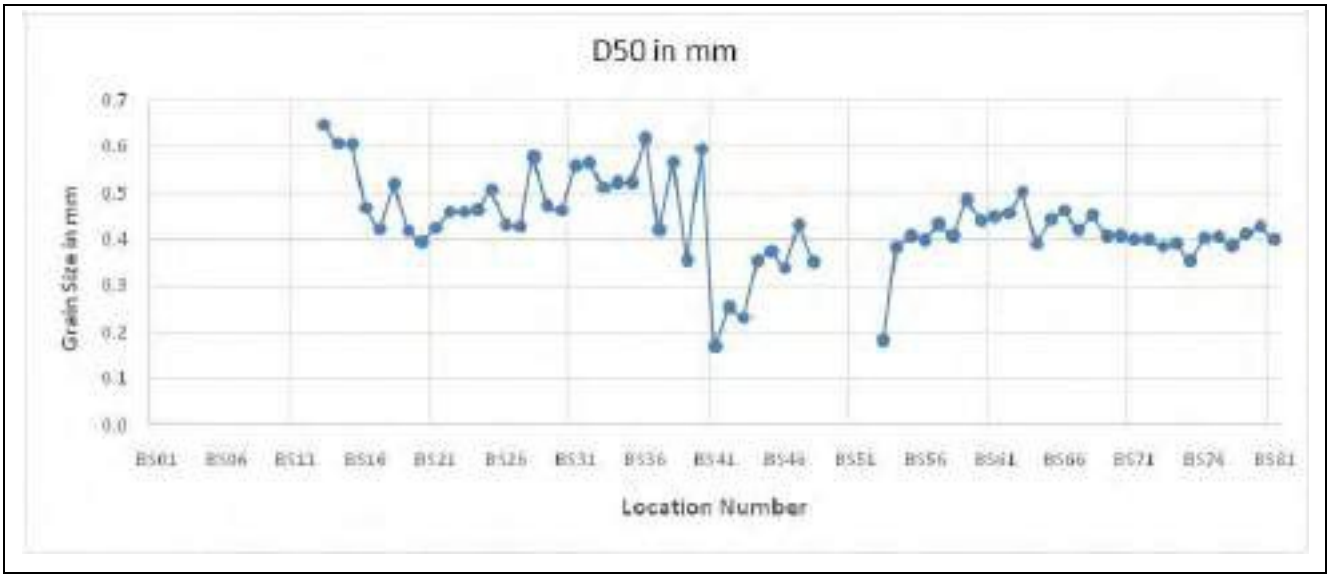


Figure 6-19: Distribution of D50 value of beach samples

① Based on the above, it is inferred that the beach samples at the locations were mostly medium to fine sand.

6.10 Grab Sampling

Marine grab samples were collected from all 80 locations. The following table shows the D50 value (in mm) of the sediments collected along with the soil classification.

Table 6-13: Grab sample soil classification

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
GS-01-01	0	100	0	100	0.3401	Fine Sand
GS-01-02	0	100	0	100	0.5665	Medium Sand
GS-02-01	0	100	0	100	0.2333	Fine Sand
GS-02-02	0	100	0	100	0.1155	Fine Sand
GS-03-01	0	100	0	100	0.4065	Fine Sand
GS-03-02	0	100	0	100	0.4123	Fine Sand
GS-04-01	0	100	0	100	0.5569	Medium Sand
GS-04-02	0	100	0	100	0.2386	Fine Sand
GS-05-01	0	100	0	100	0.2018	Fine Sand
GS-05-02	0	100	0	100	0.5581	Medium Sand
GS-06-01	0	100	0	100	0.2473	Fine Sand
GS-06-02	0	100	0	100	0.1966	Fine Sand
GS-07-01	0	100	0	100	0.2808	Fine Sand
GS-07-02	0	100	0	100	0.4996	Medium Sand
GS-08-01	0	100	0	100	0.3373	Fine Sand
GS-08-02	0	100	0	100	0.2137	Fine Sand
GS-09-01	0	100	0	100	0.2591	Fine Sand
GS-09-02	0	100	0	100	0.1902	Fine Sand
GS-10-01	0	100	0	100	0.3055	Fine Sand
GS-10-02	0	100	0	100	0.3644	Fine Sand
GS-11-01	0	100	0	100	0.4089	Fine Sand
GS-11-02	0	100	0	100	0.2069	Fine Sand
GS-12-01	0	100	0	100	0.5779	Medium Sand
GS-12-02	0	100	0	100	0.3777	Fine Sand
GS-13-01	0	100	0	100	0.2324	Fine Sand
GS-13-02	0	100	0	100	0.4001	Fine Sand
GS-14-01	0	100	0	100	0.1991	Fine Sand
GS-14-02	0	100	0	100	0.4065	Fine Sand
GS-15-01	0	100	0	100	0.3681	Fine Sand
GS-15-02	0	100	0	100	0.1252	Fine Sand
GS-16-01	0	100	0	100	0.4558	Medium Sand
GS-16-02	0	100	0	100	0.1516	Fine Sand
GS-17-01	0	100	0	100	0.4030	Fine Sand
GS-17-02	0	100	0	100	0.4401	Medium Sand
GS-18-01	0	100	0	100	0.3871	Fine Sand
GS-18-02	0	100	0	100	0.4496	Medium Sand
GS-19-01	0	100	0	100	0.1168	Fine Sand

Sample Name	Gravel %	Sand %	Mud%	Total	D50 (mm)	Classification
GS-19-02	0	100	0	100	0.4578	Medium Sand
GS-20-01	0	100	0	100	0.1775	Fine Sand
GS-20-02	0	100	0	100	0.1213	Fine Sand
GS-21-01	0	100	0	100	0.1570	Fine Sand
GS-21-02	0	100	0	100	0.3502	Fine Sand
GS-22-01	0	100	0	100	0.2248	Fine Sand
GS-22-02	0	100	0	100	0.1722	Fine Sand
GS-23-01	0	100	0	100	0.2811	Fine Sand
GS-23-02	0	100	0	100	0.2300	Fine Sand
GS-24-01	0	100	0	100	0.1713	Fine Sand
GS-24-02	0	100	0	100	0.2551	Fine Sand
GS-25-01	0	100	0	100	0.2551	Fine Sand
GS-25-02	0	100	0	100	0.2573	Fine Sand
GS-26-01	0	100	0	100	0.2077	Fine Sand
GS-26-02	0	100	0	100	0.2927	Fine Sand
GS-27-01	0	100	0	100	0.3467	Fine Sand
GS-27-02	0	100	0	100	0.3966	Fine Sand
GS-28-01	0	100	0	100	0.5157	Medium Sand
GS-28-02	0	100	0	100	0.2934	Fine Sand
GS-29-01	0	100	0	100	0.5137	Medium Sand
GS-29-02	0	100	0	100	0.2703	Fine Sand
GS-30-01	0	100	0	100	0.2965	Fine Sand
GS-30-02	0	100	0	100	0.2267	Fine Sand
GS-31-01	0	100	0	100	0.2462	Fine Sand
GS-31-02	0	100	0	100	0.5032	Medium Sand
GS-32-01	0	100	0	100	0.2379	Fine Sand
GS-32-02	0	100	0	100	0.1831	Fine Sand
GS-33-01	0	100	0	100	0.2974	Fine Sand
GS-33-02	0	100	0	100	0.5615	Medium Sand
GS-34-01	0	100	0	100	0.2626	Fine Sand
GS-34-02	0	100	0	100	0.2300	Fine Sand
GS-35-01	0	100	0	100	0.1967	Fine Sand
GS-35-02	0	100	0	100	0.1444	Fine Sand
GS-36-01	0	100	0	100	0.3103	Fine Sand
GS-36-02	0	100	0	100	0.1322	Fine Sand
GS-37-01	0	100	0	100	0.2793	Fine Sand
GS-37-02	0	100	0	100	0.1230	Fine Sand
GS-38-01	0	100	0	100	0.1477	Fine Sand
GS-38-02	0	100	0	100	0.1691	Fine Sand
GS-39-01	0	100	0	100	0.2200	Fine Sand
GS-39-02	0	100	0	100	0.1535	Fine Sand
GS-40-01	0	100	0	100	0.1724	Fine Sand
GS-40-02	0	100	0	100	0.1288	Fine Sand

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

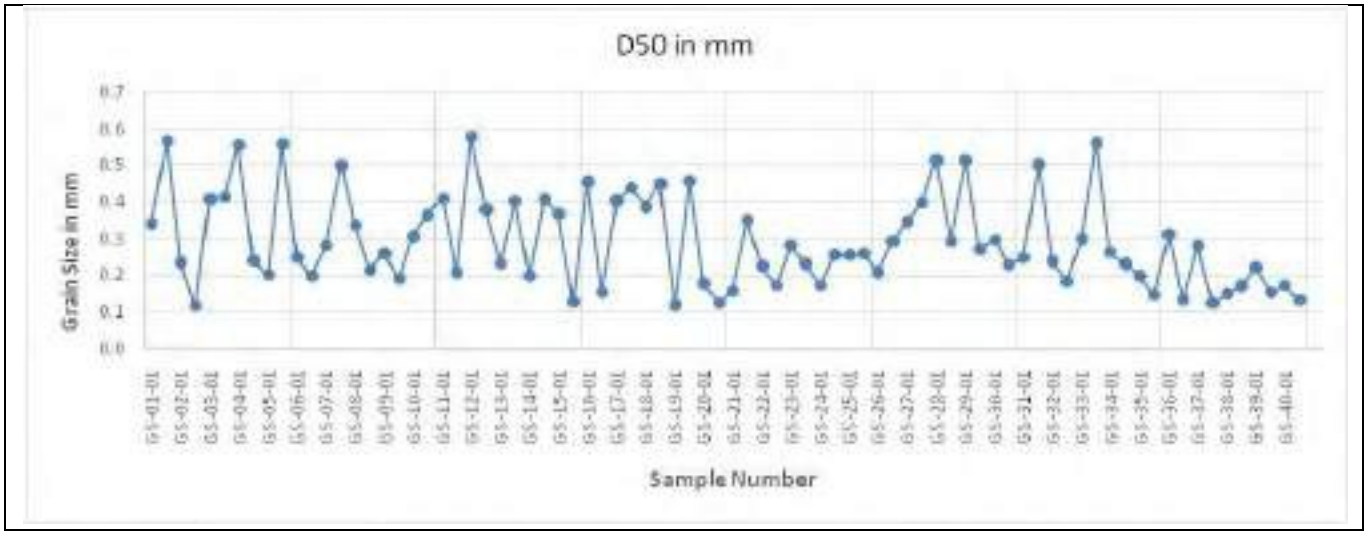


Figure 6-20: Distribution of D50 value of grab samples

Based on the above, it is inferred that the grab samples were mostly fine sand with some locations showing the presence of medium sand.

6.11 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 in the month of May 2020 and the turbidity was measured at three different depths i.e. surface, mid-depth and bottom.

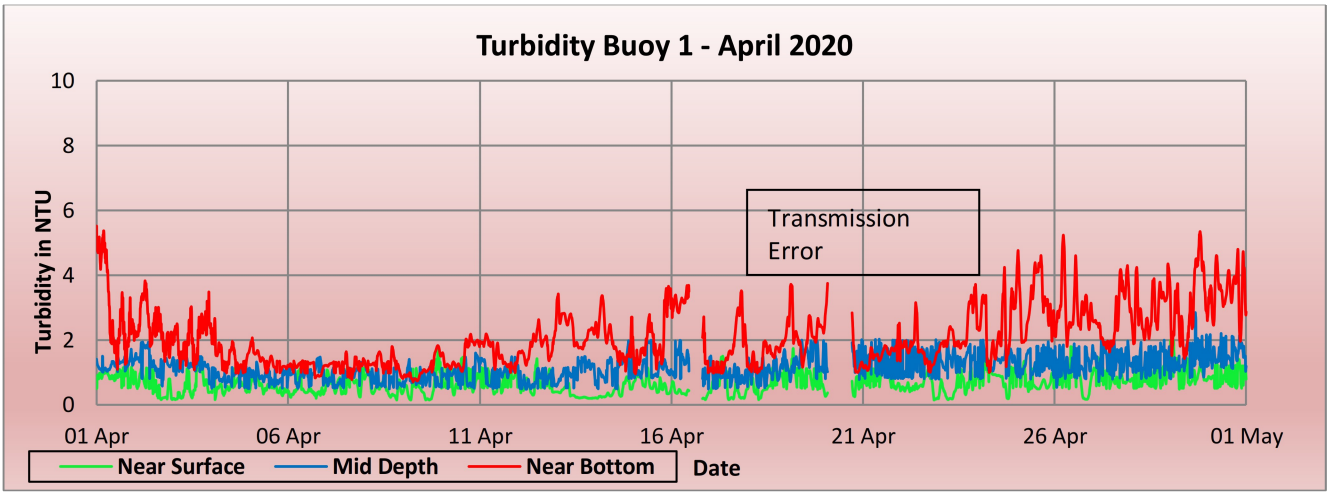
① A summary of the maximum turbidity data (measured in NTU) recorded for the period of April to September 2020 at each turbidity buoy location is placed in the table below.

Table 6-14: Summary of maximum turbidity values in NTU

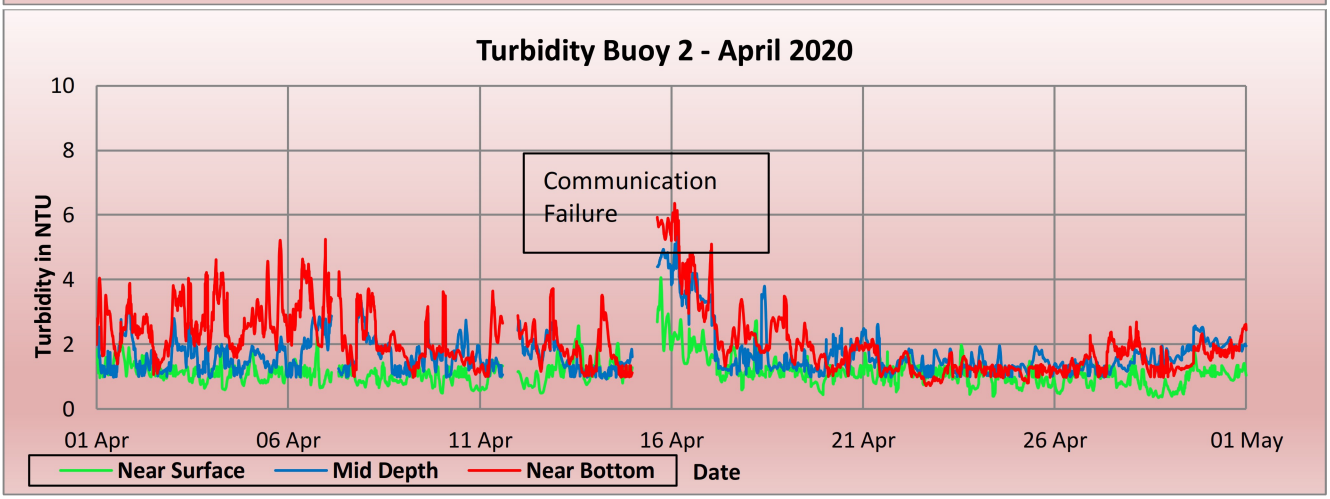
Location	Maximum Turbidity (NTU)	Depth	Month and Year
Turbidity Buoy-1	5.99	Near Bottom	June 2020
Turbidity Buoy-2	6.36	Near Bottom	April 2020
Turbidity Buoy-3	5.95	Near Bottom	May 2020

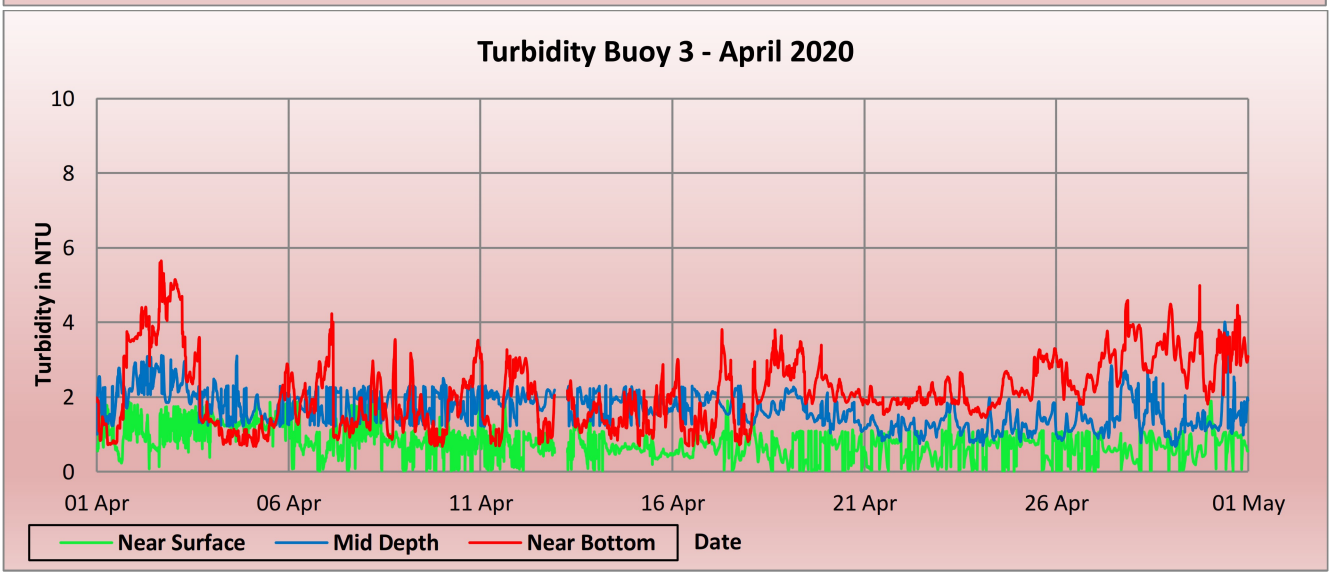
The time series curves of turbidity measurements from May 2020 to September 2020 are shown below.

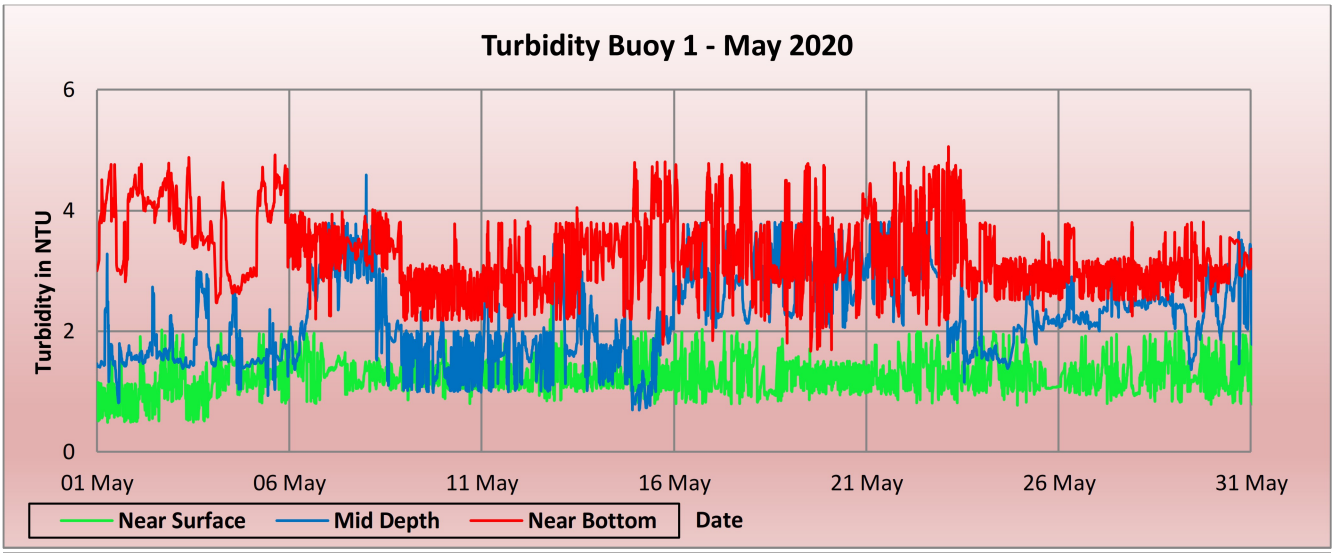
①

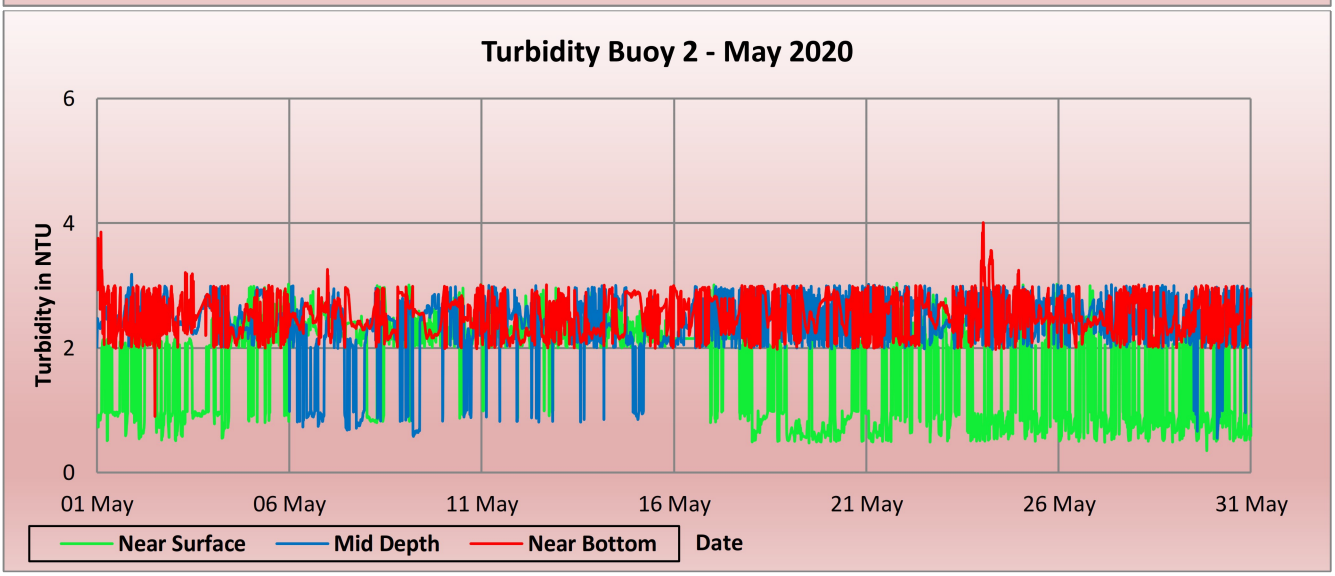

Turbidity Buoy 1 - April 2020
Turbidity in NTU
10
8
6
4
2
0
Transmission Error
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Near Surface
Mid Depth
Near Bottom
Date

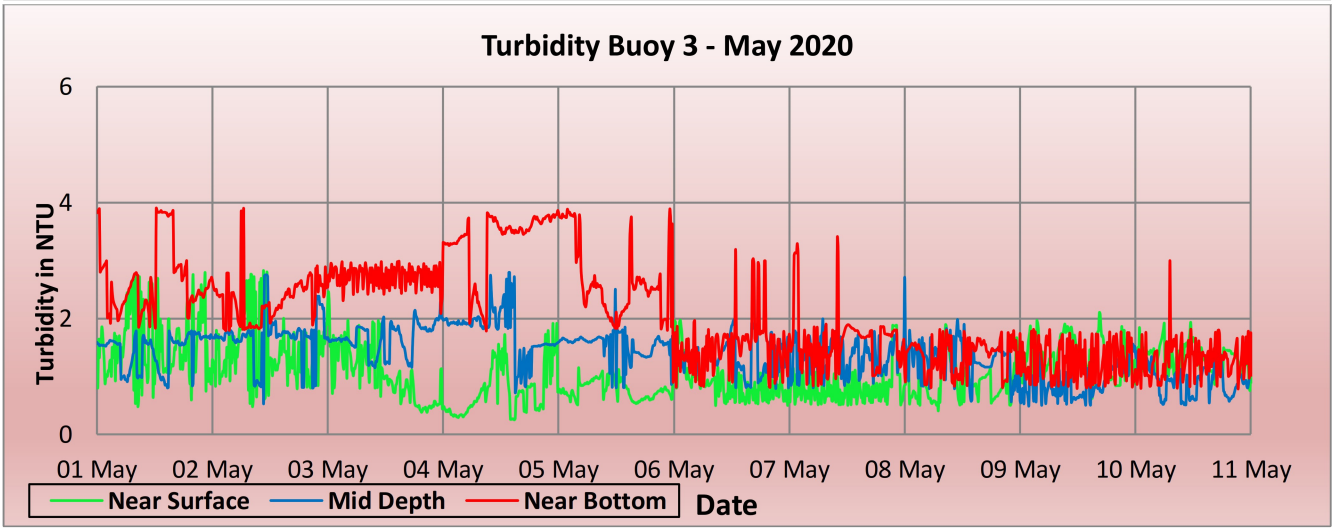
①

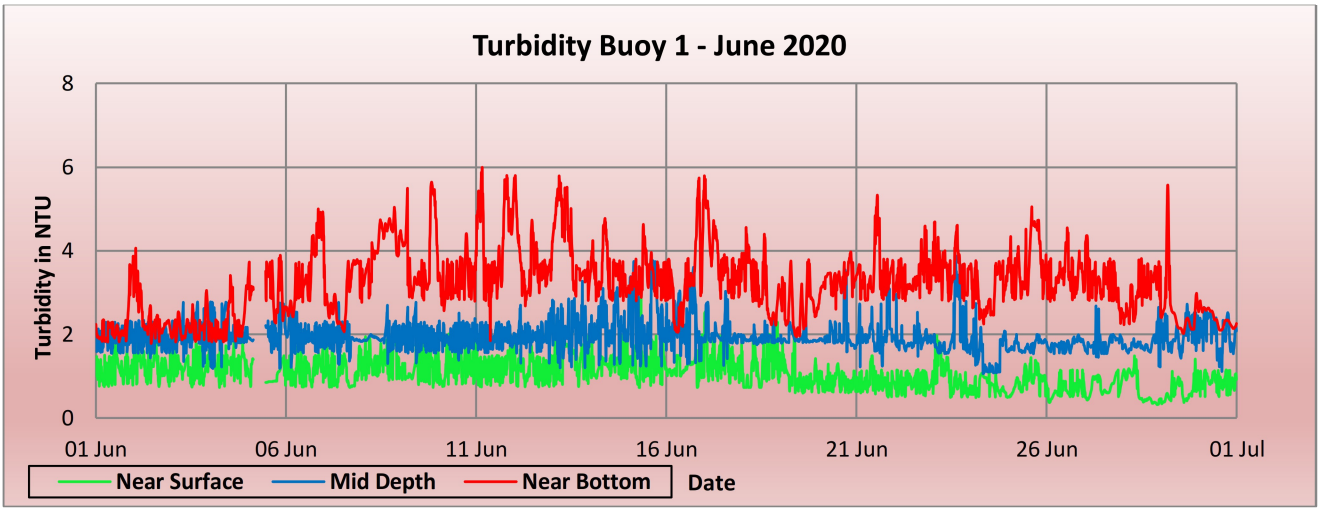

Turbidity Buoy 2 - April 2020
Turbidity in NTU
10
8
6
4
2
0
Communication Failure
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Near Surface
Mid Depth
Near Bottom
Date

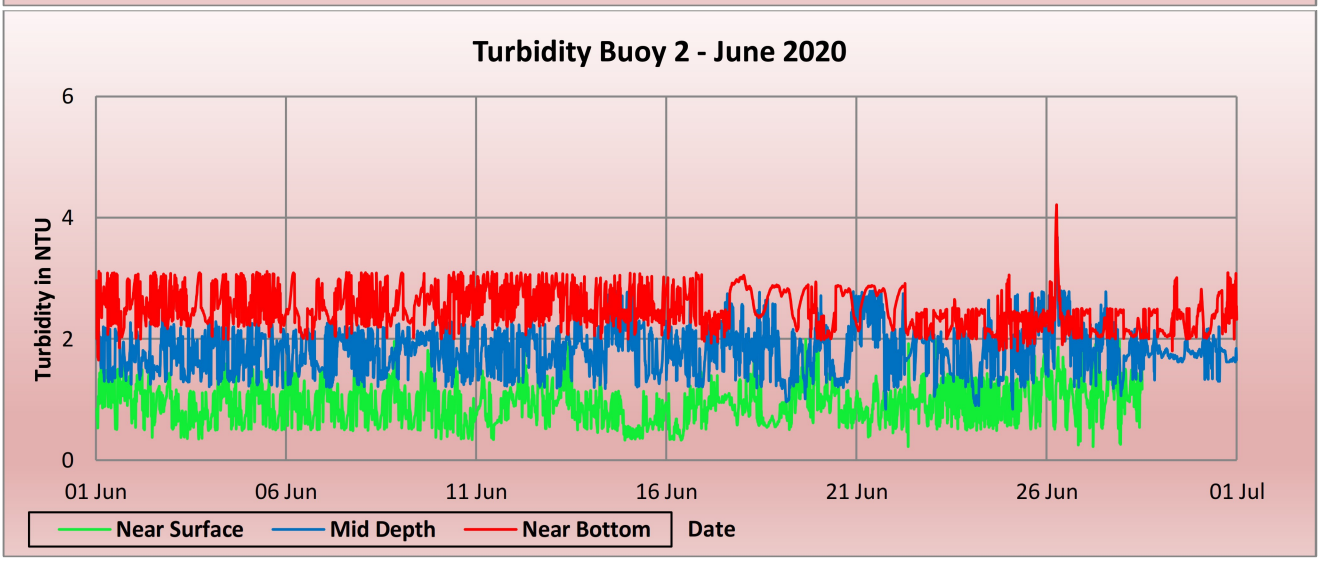

Turbidity Buoy 3 - April 2020
Turbidity in NTU
10
8
6
4
2
0
01 Apr
06 Apr
11 Apr
16 Apr
21 Apr
26 Apr
01 May
Near Surface
Mid Depth
Near Bottom
Date

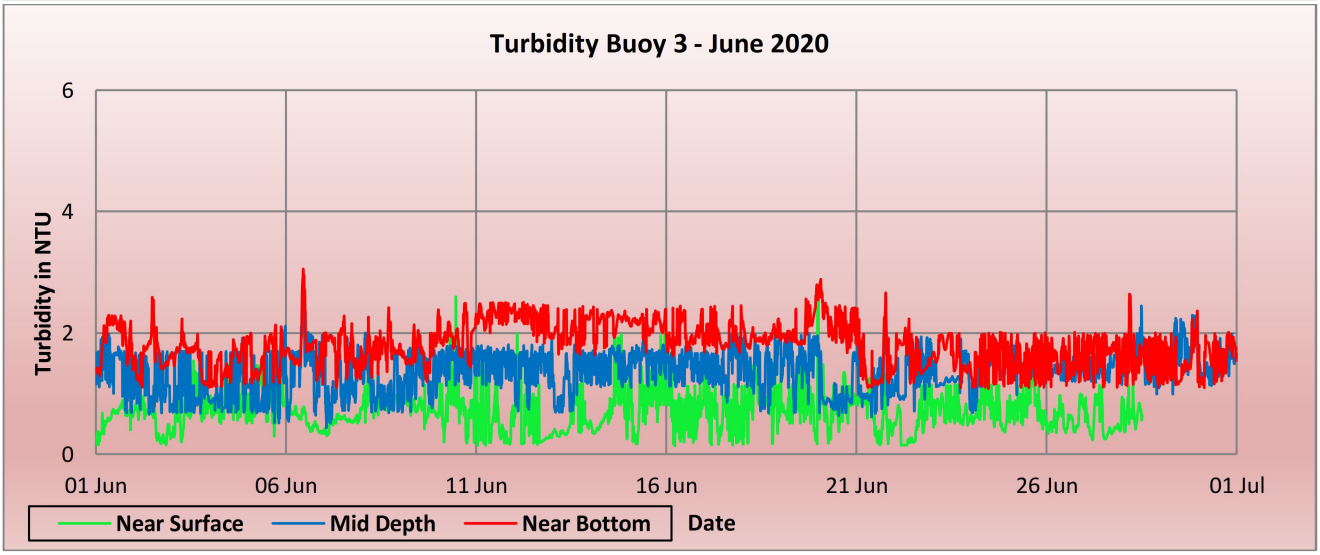

Turbidity Buoy 1 - May 2020
Turbidity in NTU
0
2
4
6
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Near Surface
Mid Depth
Near Bottom
Date

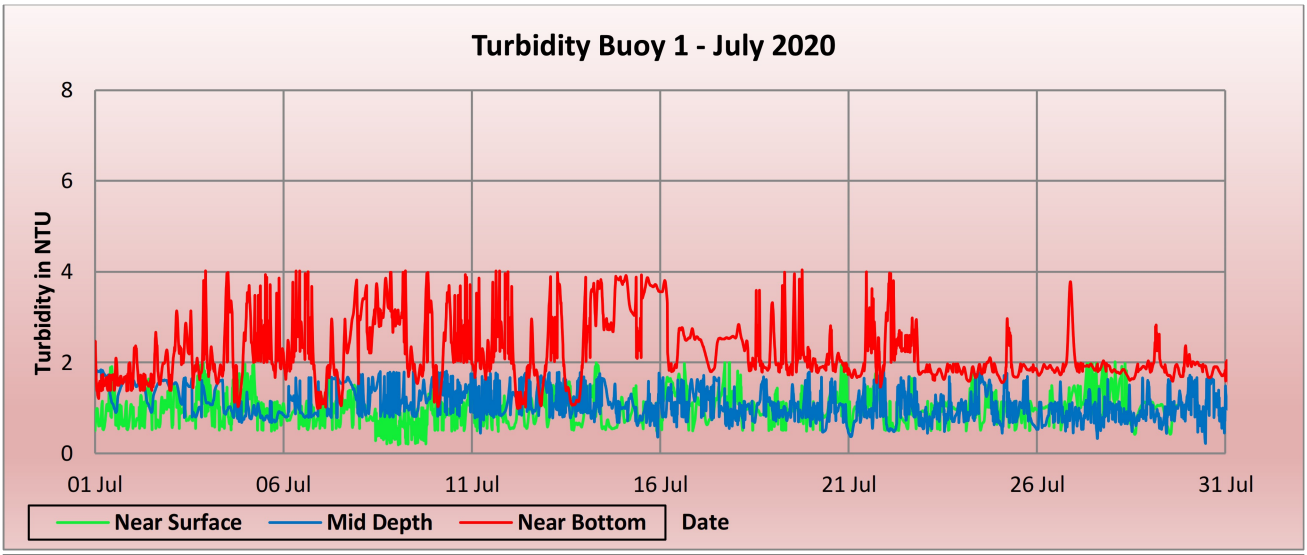

Turbidity Buoy 2 - May 2020
Turbidity in NTU
0
2
4
6
01 May
06 May
11 May
16 May
21 May
26 May
31 May
Near Surface
Mid Depth
Near Bottom
Date

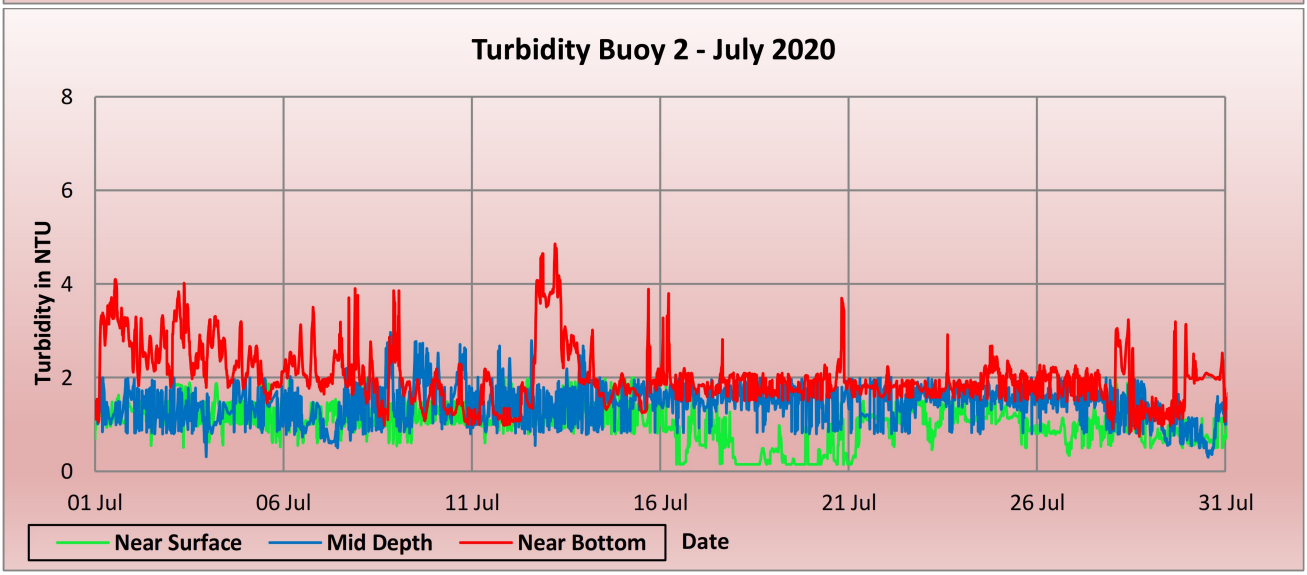

Turbidity Buoy 3 - May 2020
Turbidity in NTU
0
2
4
6
01 May
02 May
03 May
04 May
05 May
06 May
07 May
08 May
09 May
10 May
11 May
Near Surface
Mid Depth
Near Bottom
Date

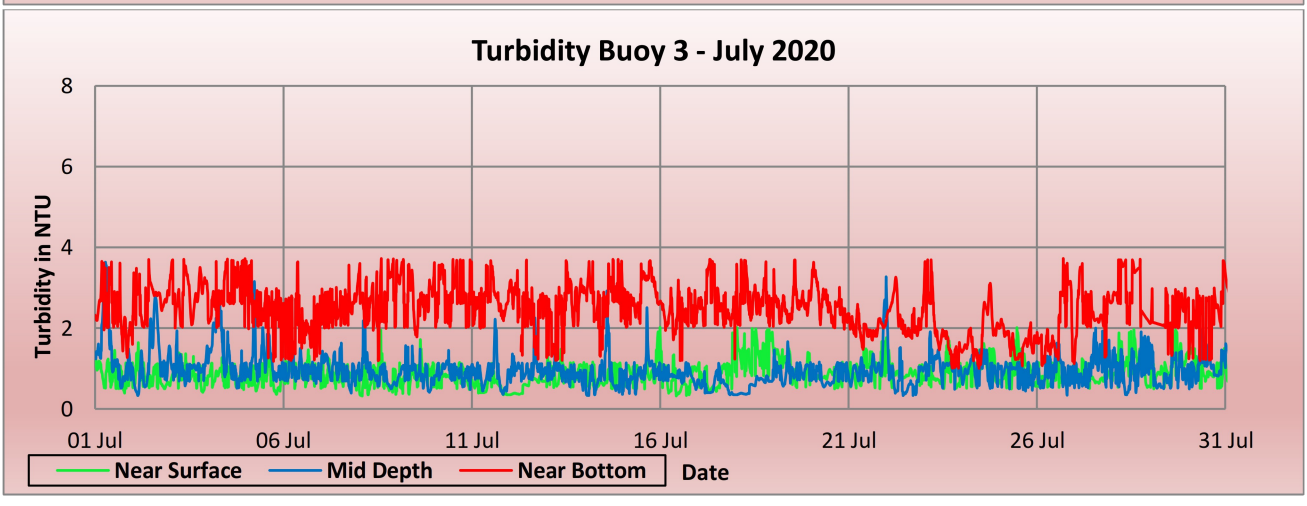

Turbidity Buoy 1 - June 2020
Turbidity in NTU
8
6
4
2
0
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Near Surface
Mid Depth
Near Bottom
Date

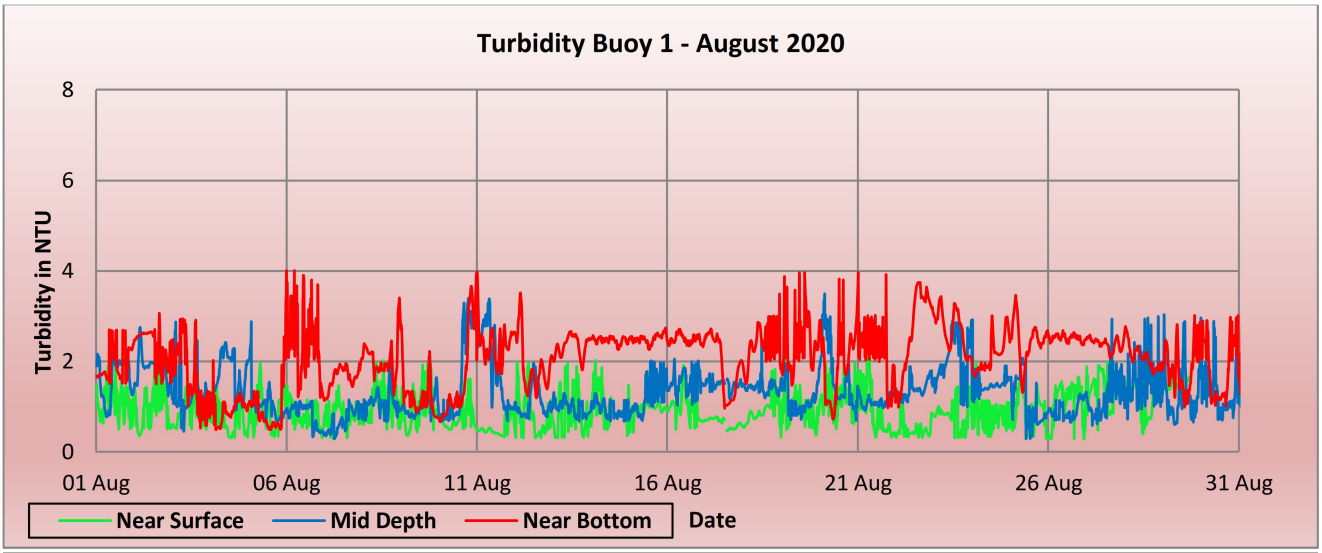

Turbidity Buoy 2 - June 2020
Turbidity in NTU
6
4
2
0
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Near Surface
Mid Depth
Near Bottom
Date

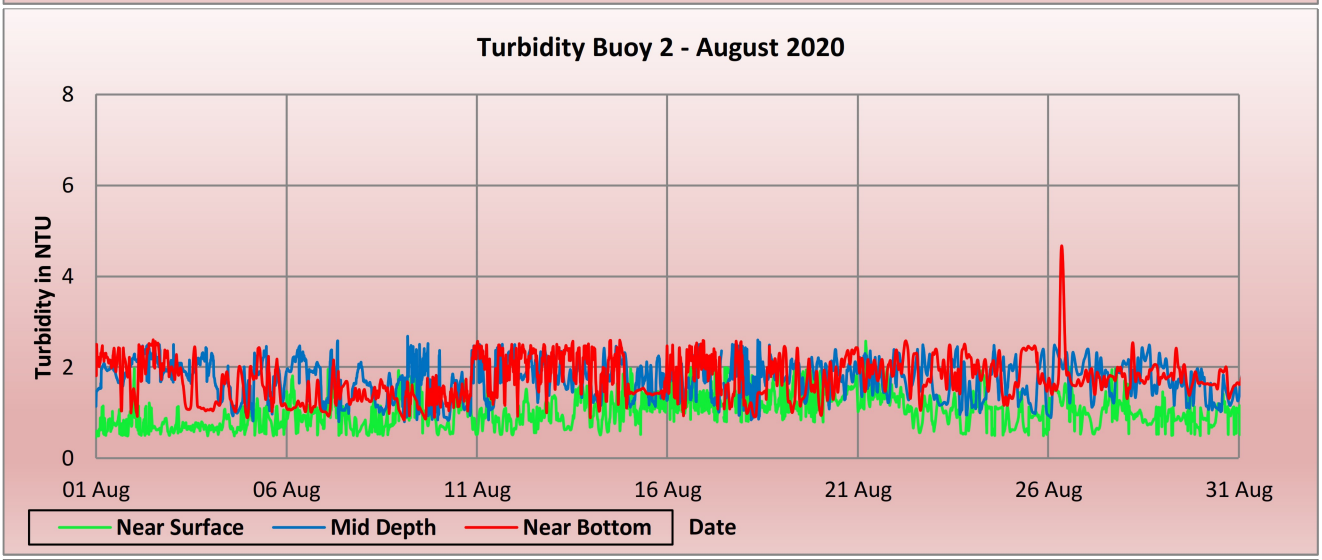

Turbidity Buoy 3 - June 2020
Turbidity in NTU
6
4
2
0
01 Jun
06 Jun
11 Jun
16 Jun
21 Jun
26 Jun
01 Jul
Near Surface
Mid Depth
Near Bottom
Date

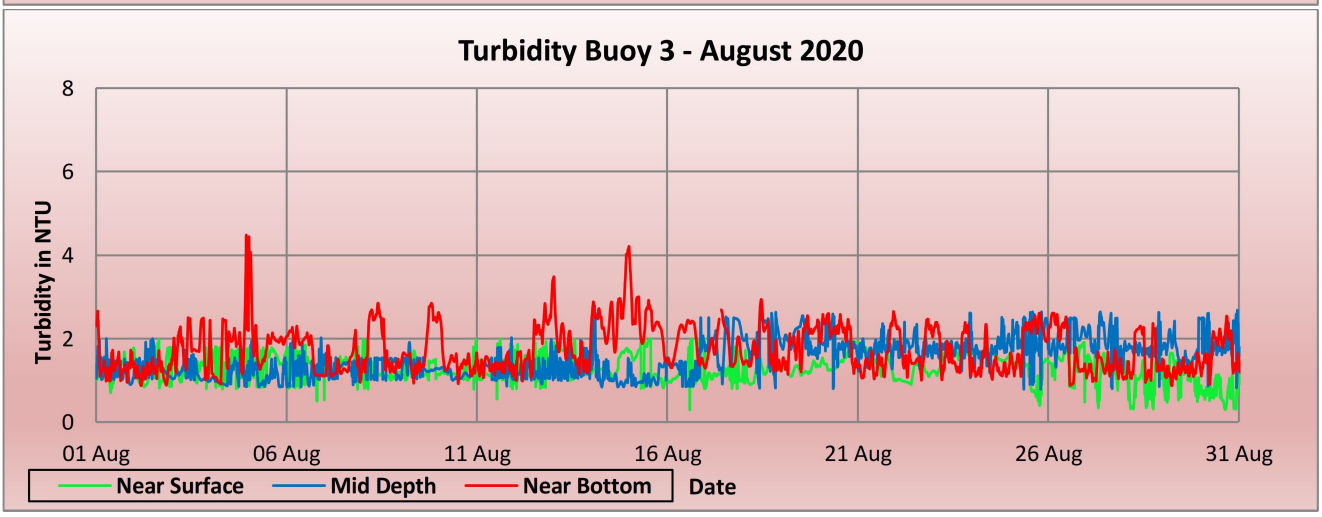

Turbidity Buoy 1 - July 2020
Turbidity in NTU
8
6
4
2
0
01 Jul
06 Jul
11 Jul
16 Jul
21 Jul
26 Jul
31 Jul
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 2 - July 2020
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 2020
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 2020
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 2020
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 3 - August 2020
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

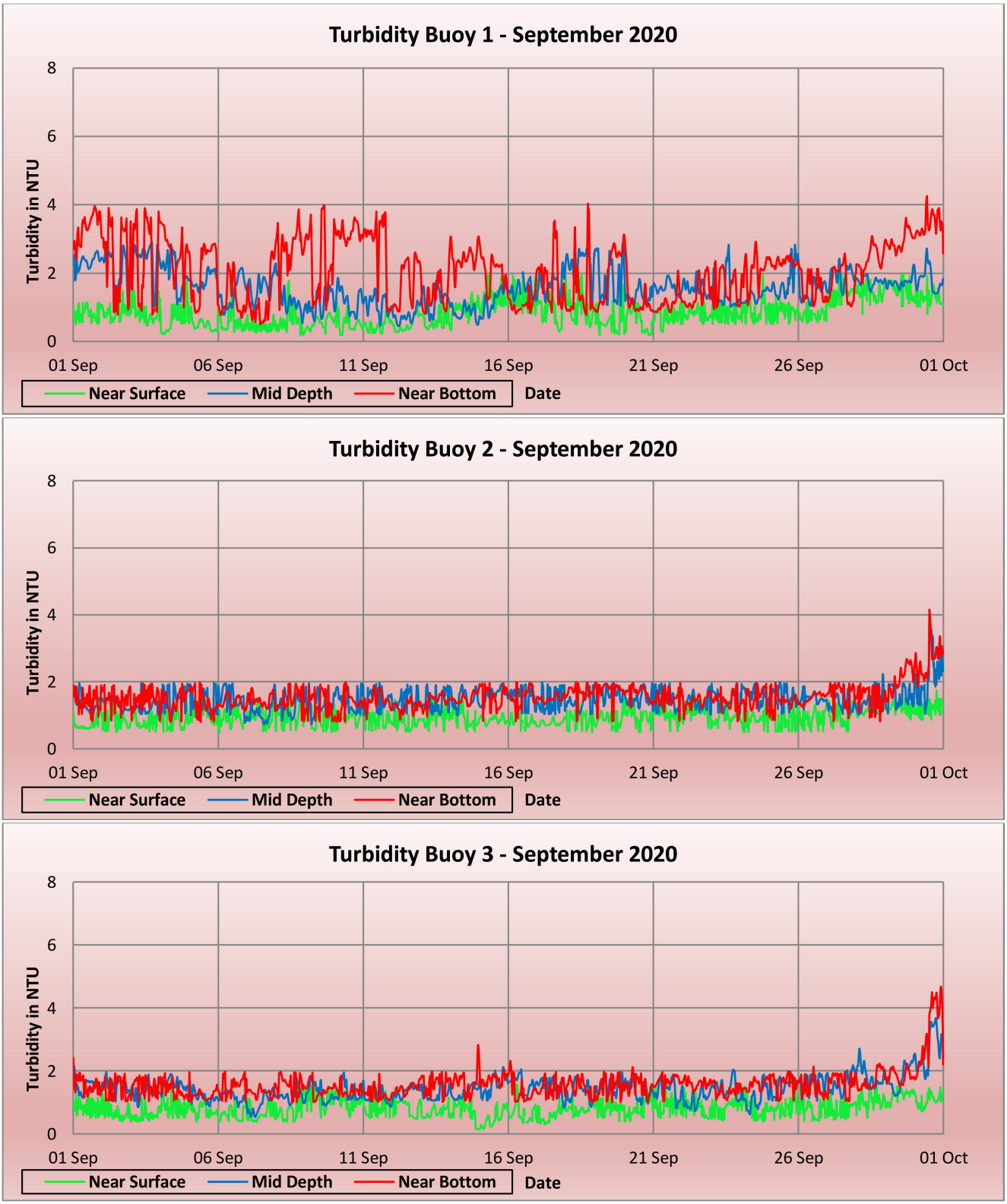


Figure 6-21: Time Series of Turbidity measurements

6.12 Bathymetry

Survey Location

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

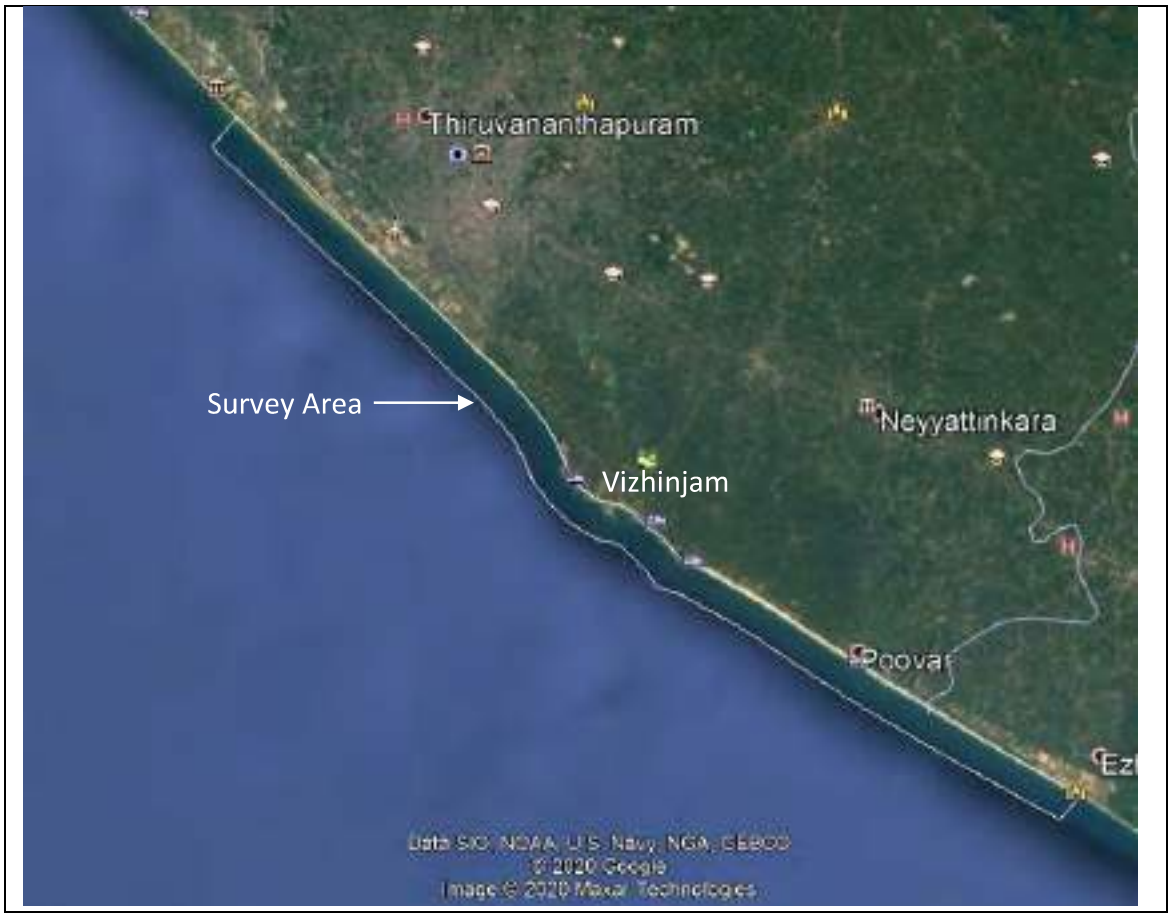


Figure 6-22: Bathymetry area coverage

Line Plan and Survey Methodology

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

Results

① 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 25m below CD in the northwestern part at location 713200.5 mE, 932750.5 mN. The seabed is seen to slope gently towards the southwest.

6.13 River Surveys

The river crossing survey was carried out at 6 river/stream crossings.

① The survey was carried out for 500m length of rivers debouching in the 40 km stretch of the sea. In the major rivers (Poovar, Chovara, Thiruvallam and Veli) survey was carried out using a single beam echo sounder. The other two streams were surveyed using the RTK system. The water depths for the major rivers are the actual water levels recorded using the echo sounder. The boundary of the rivers was fixed using RTK and those (dry) heights are denoted with respect to Chart Datum. The survey was carried out from 11th to 26th September 2020.

The river/stream wise survey findings are given below:

6.13.1 Veli River

① Veli River runs north of the Thiruvananthapuram airport. It is a tourist spot with many tourist boats plying in the river. The maximum depth of 4.4m was observed in the northern part of the river.

6.13.2 Thiruvallam River

① Thiruvallam River lies north of Vizhinjam. This is a confluence of two rivers. The survey was carried out using a shallow draft boat and the depth as recorded is provided without applying any tide. About 7.5m of water was observed in the northern part of the river.

6.13.3 Gangayattumkara Stream

① The stream runs next to the fishing harbour. A considerable amount of rain water is discharged through this stream during the rainy season.

6.13.4 Karimpallickara Stream

① This narrow stream lies between Mulloor and Vizhinjam. The narrowness can be attributed to the construction work which is in progress.

6.13.5 Chovara River

Chovara River lies between Vizhinjam and Poovar river. This river is land-locked during a major part of the year. A maximum depth of 3.3m is observed in the central part of
① the river. The depth provided is the raw depth and no tide is applied to the recorded depth.

6.13.6 Poovar River

Poovar River lies south of Vizhinjam, and is also land-locked during a major part of the year. During the monsoon, the wave action breaks the natural partition, and the river joins with the sea. The river is a tourist spot with numerous resorts situated along the banks, with tourist boats plying in the area.

A maximum water level of 5.4m was recorded toward the north-western portion. Towards south-east of the river, the depths vary from 1 to 2.5m.

7 WEATHER

① During the monsoon, the survey activities were severely hampered as a result of rain and bad weather.

8 REFERENCES

① 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 2020

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. ① The significant wave heights were more than 2m for the months of May to September 2020 and less than 2m for April 2020, with maximum wind speeds blowing from the westerly direction.
3. The current direction was predominantly from southeast in all locations, with surface currents showing more speed than those recorded at mid-depth and near the bottom.
4. The long-shore current speed was recorded in a southerly direction in the monsoon months and in a northerly direction before the monsoon.
5. The salinity was in the range of 33.0 to 35.8 ppt.
6. The Total Suspended Solids were less than 4.5 mg/l in all the locations.
7. The maximum turbidity recorded at the water sampling locations was 2.4 NTU near the bottom of Location L2 (Kovalam) during the pre-monsoon period.
8. At the location of the turbidity buoys, the maximum turbidity recorded at Location 1 was 5.99 NTU near the bottom in the month of June 2020, maximum turbidity measured at Location 2 was 6.36 NTU near the bottom in the month of June 2020

and that recorded at Location 3 was 5.95 NTU near the bottom in the month of May 2020.

9. The beach samples consisted of medium to fine sand.
10. The seabed is seen to slope gently towards the southwest. The maximum depth recorded by multibeam echo sounder is 25m below CD in the northwestern part of the survey area at location 713200.5 mE, 932750.5 mN.
11. In all the rivers, the water depth was found to be more towards the upstream of the rivers.

Annexure I

Photo Documentation at CSP Locations - September 2020



Figure 1- September CSP 11

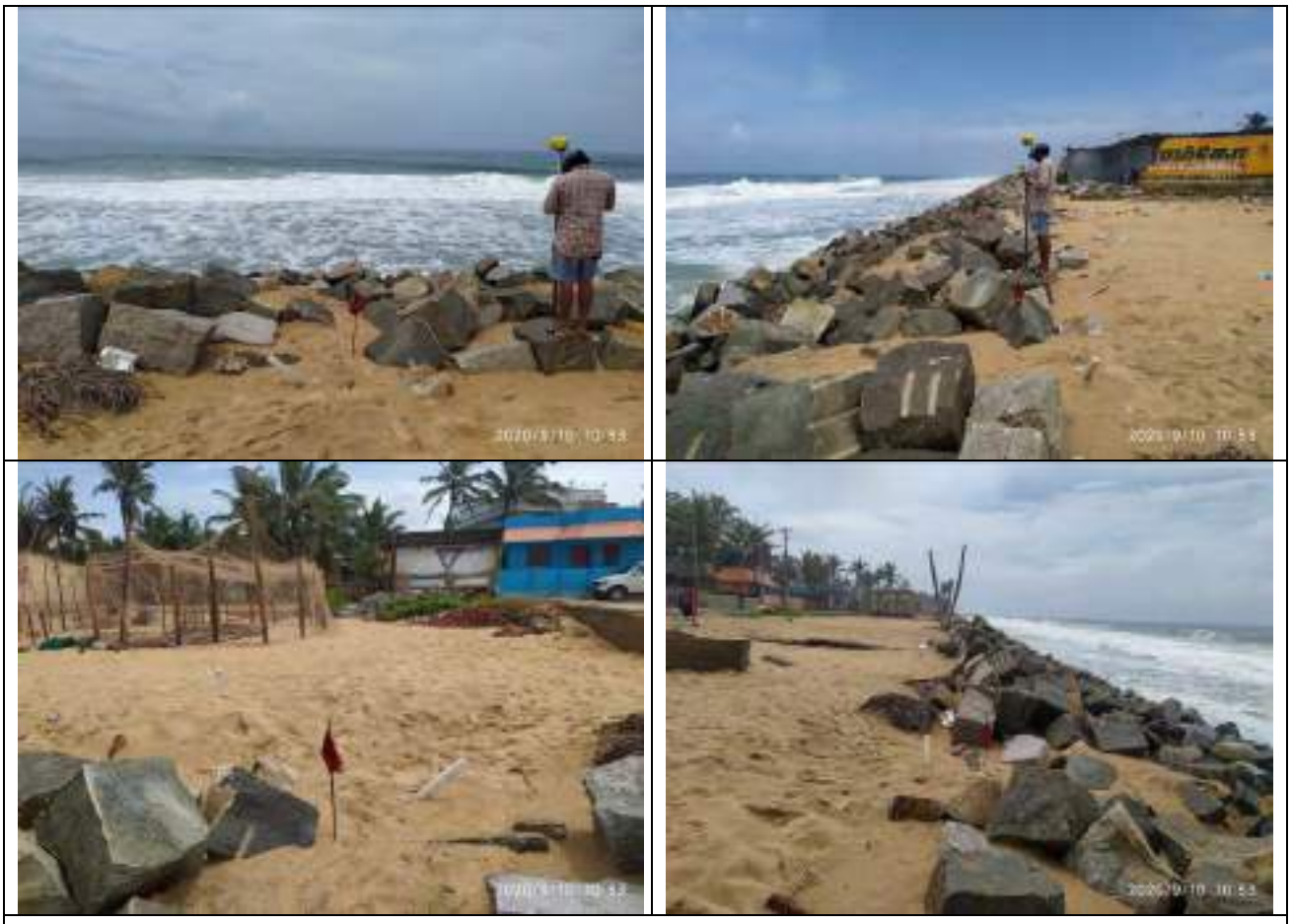


Figure 2- September CSP 12



Figure 3- September CSP 13



Figure 4- September CSP 14



Figure 5- September CSP 15



Figure 6- September CSP 16



Figure 7- September CSP 17



Figure 8- September CSP 18



Figure 9- September CSP 19



Figure 10- September CSP 20



Figure 11- September CSP 21



Figure 12- September CSP 22

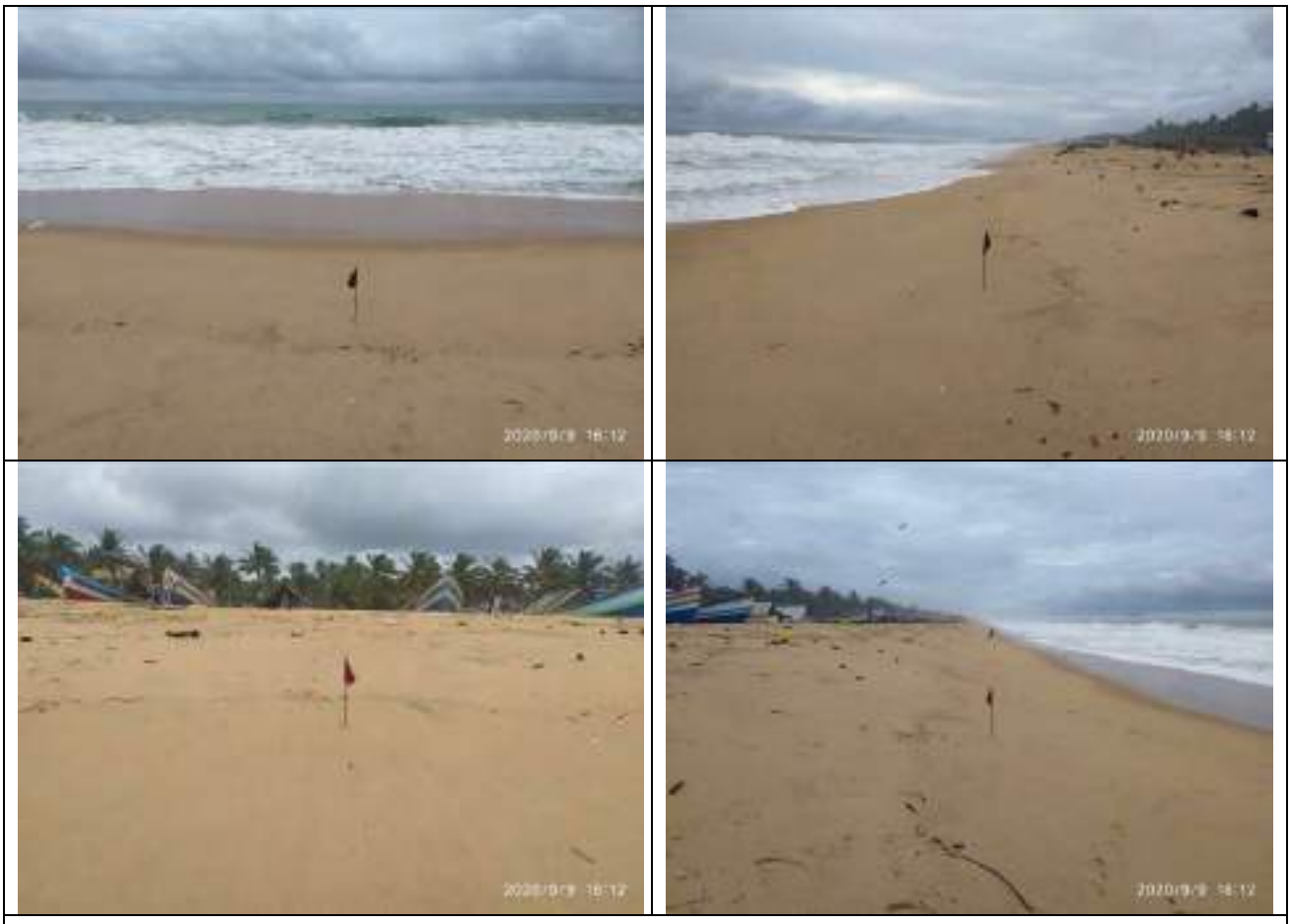


Figure 13- September CSP 23



Figure 14- September CSP 24



Figure 15- September CSP 25



Figure 16- September CSP 26






Figure 17- September CSP 27



Figure 18- September CSP 28

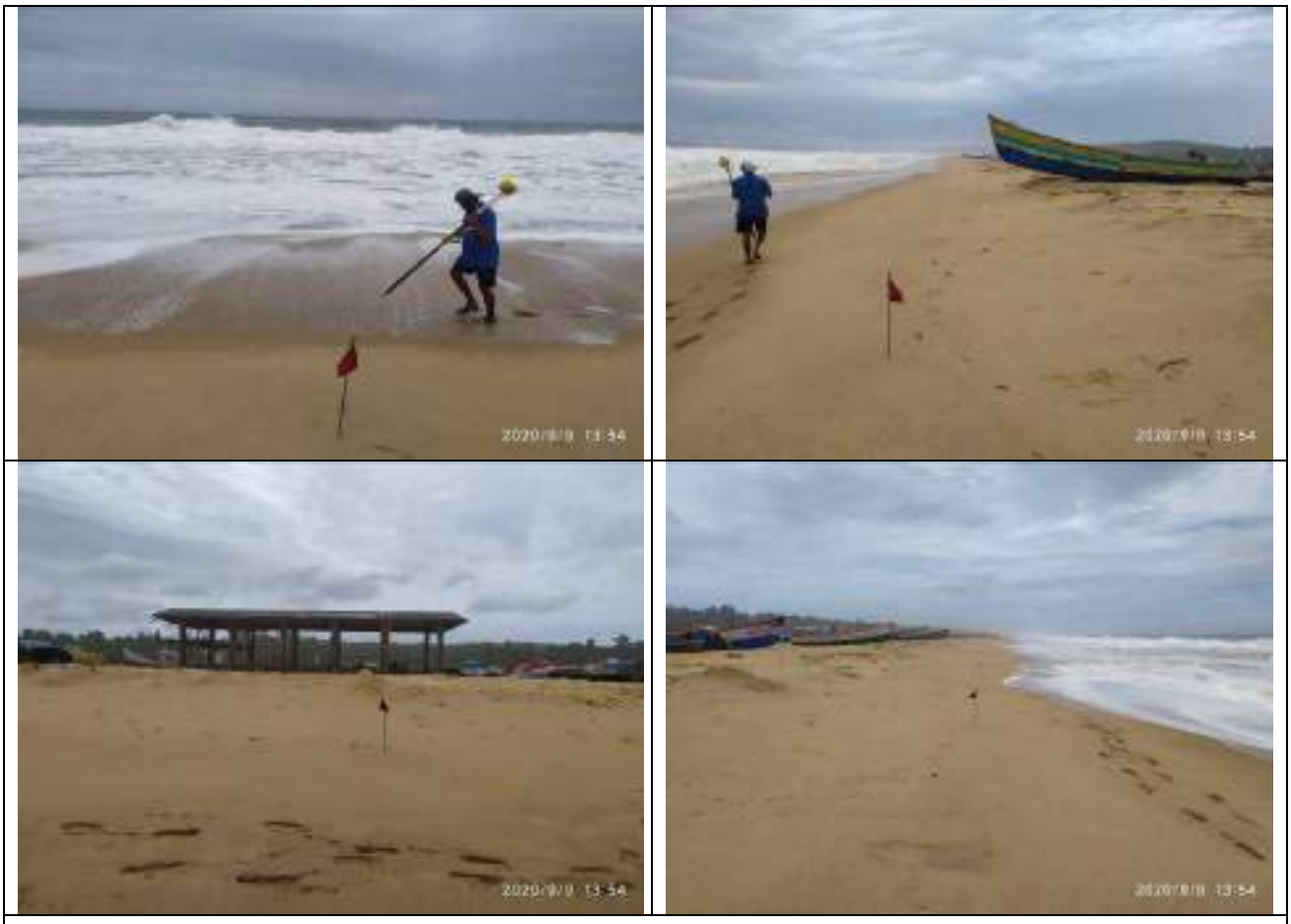


Figure 19- September CSP 29

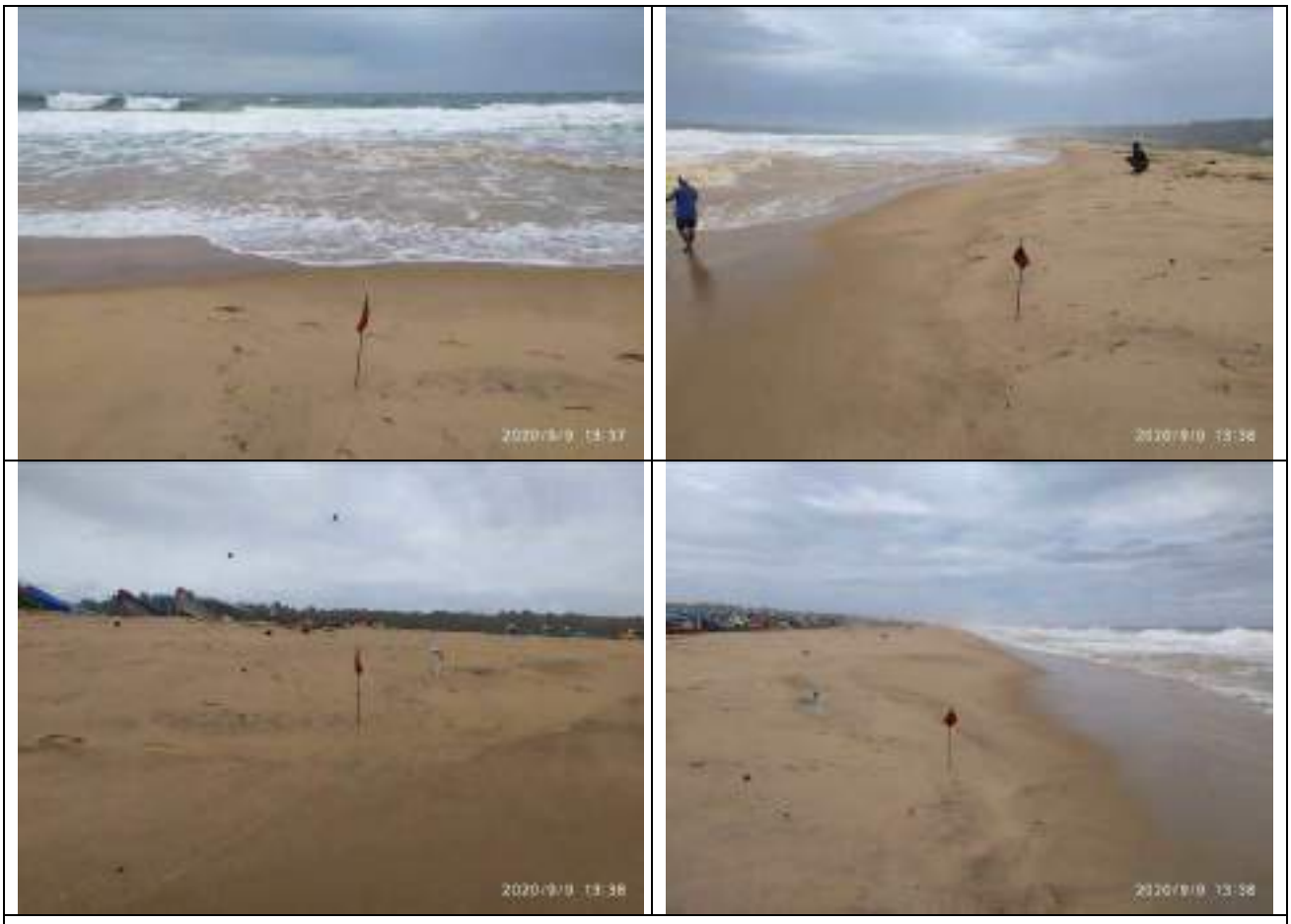


Figure 20- September CSP 30



Figure 21- September CSP 31



Figure 22- September CSP 32

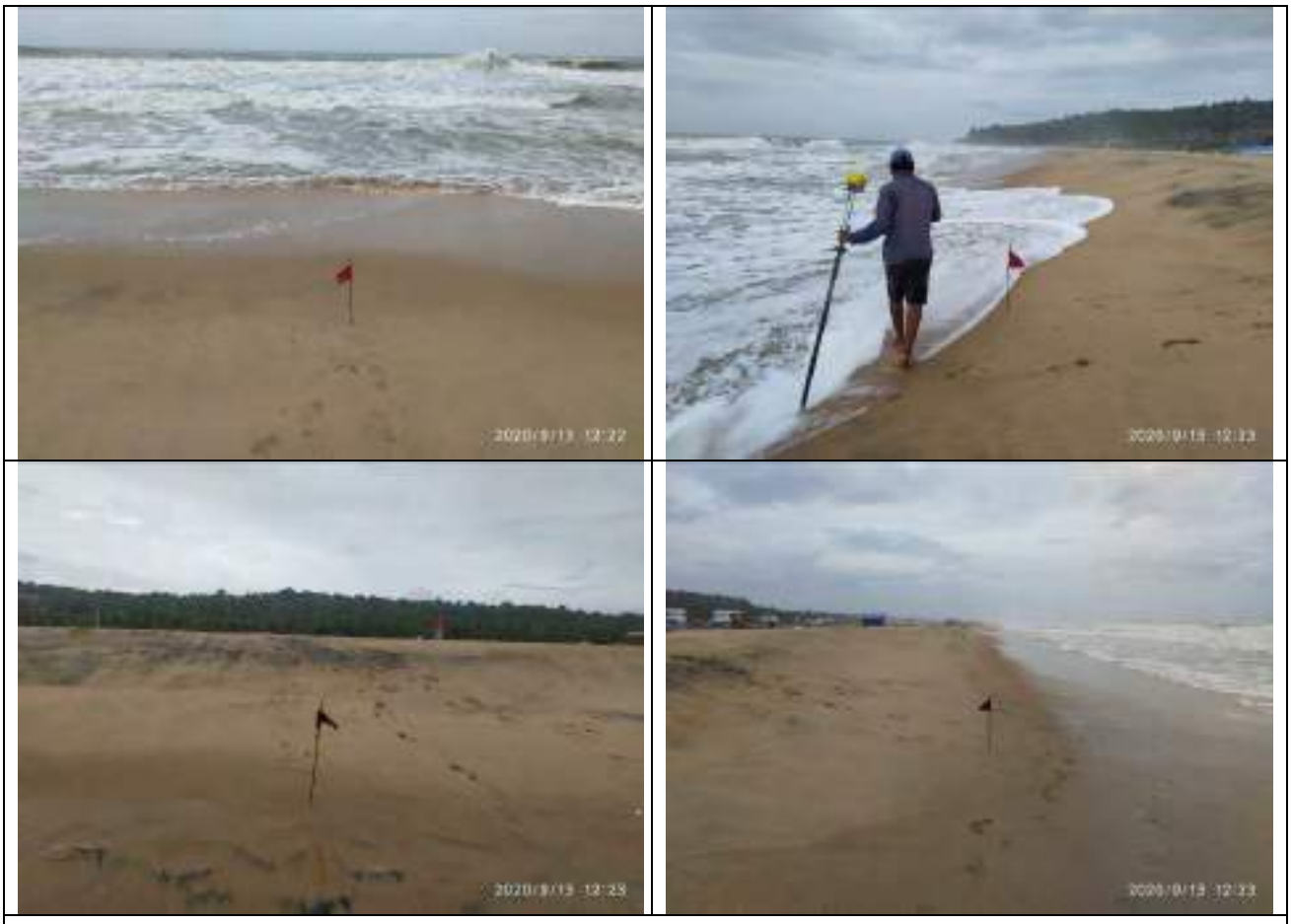


Figure 23- September CSP 33



Figure 24- September CSP 34



Figure 25- September CSP 35



Figure 26- September CSP 36

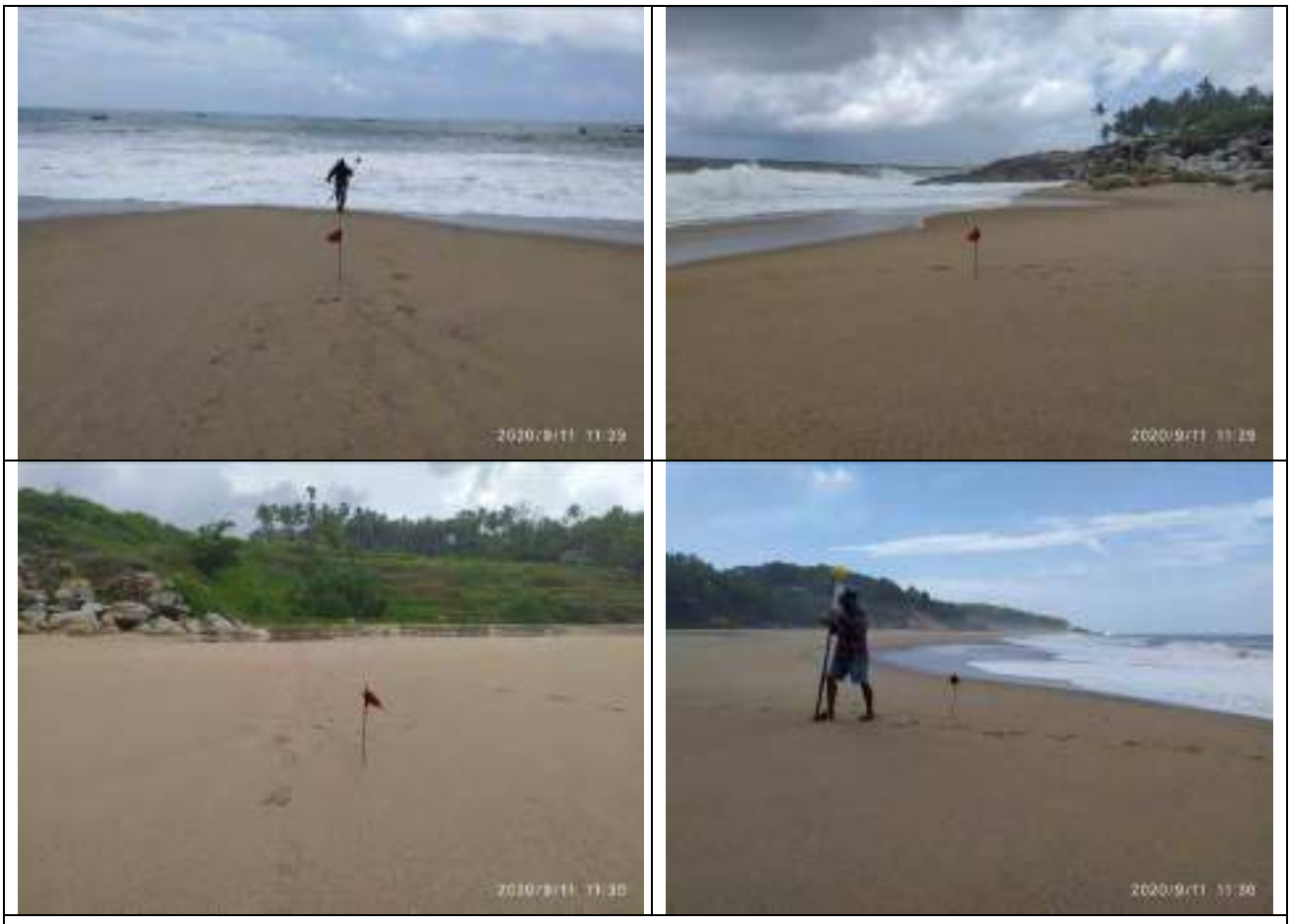


Figure 27- September CSP 37









Figure 28- September CSP 38



Figure 29- September CSP 39



Figure 30- September CSP 40



Figure 31- September CSP 41



Figure 32- September CSP 42



Figure 33- September CSP 43

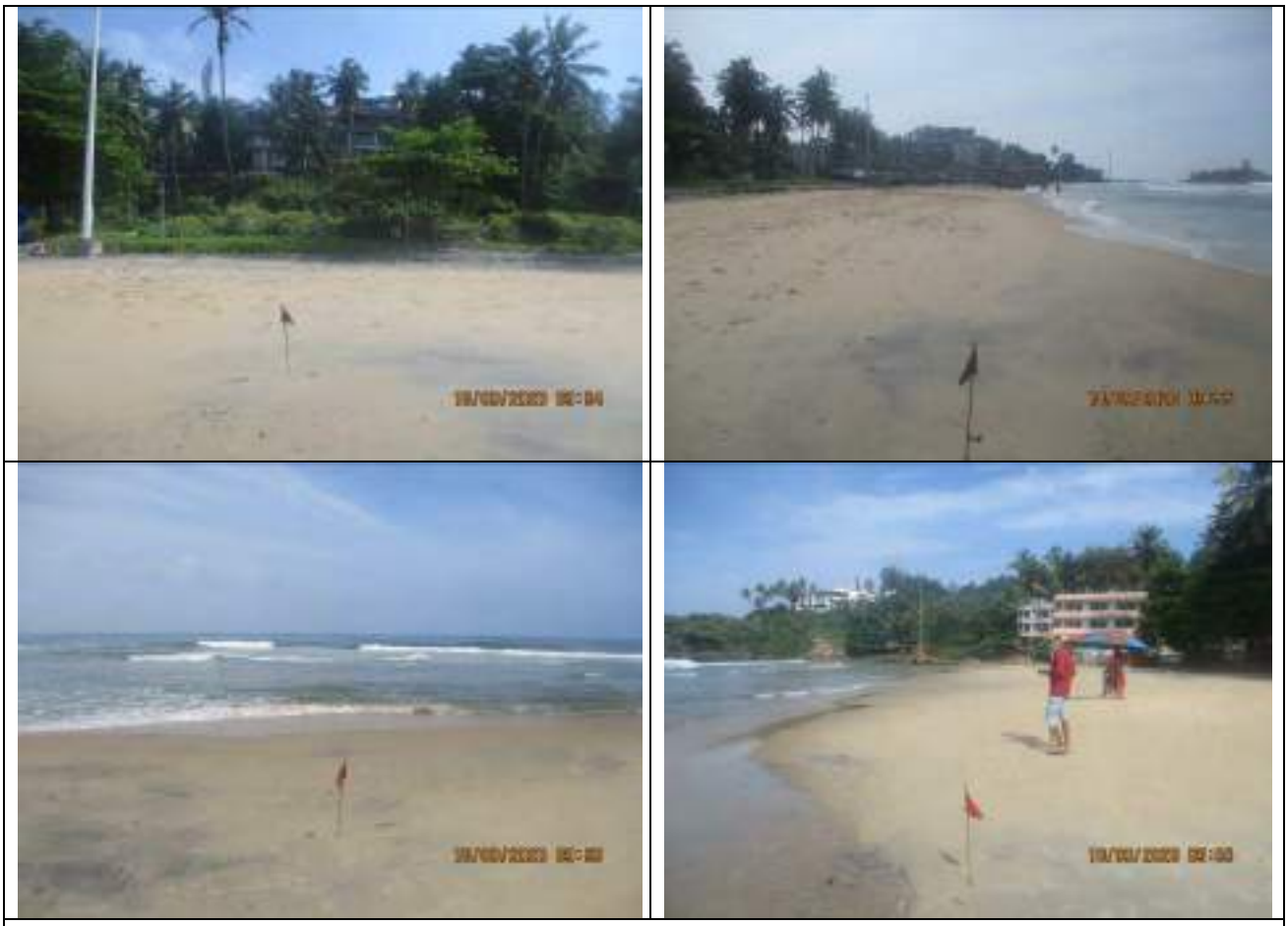


Figure 34- September CSP 44



Figure 35- September CSP 45



Figure 36- September CSP 46



Figure 37- September CSP 47



Figure 38- September CSP 48



Figure 39- September CSP 49



Figure 40- September CSP 50



Figure 41- September CSP 51



Figure 42- September CSP 52



Figure 43- September CSP 53



Figure 44- September CSP 54



Figure 45- September CSP 55



Figure 46- September CSP 56



Figure 47- September CSP 57



Figure 48- September CSP 58



Figure 49- September CSP 59



Figure 50- September CSP 60



Figure 51- September CSP 61



Figure 52- September CSP 62



Figure 53- September CSP 63



Figure 54- September CSP 64



Figure 55- September CSP 65



Figure 56- September CSP 66



Figure 57- September CSP 67



Figure 58- September CSP 68



Figure 59- September CSP 69



Figure 60- September CSP 70



Figure 61- September CSP 71

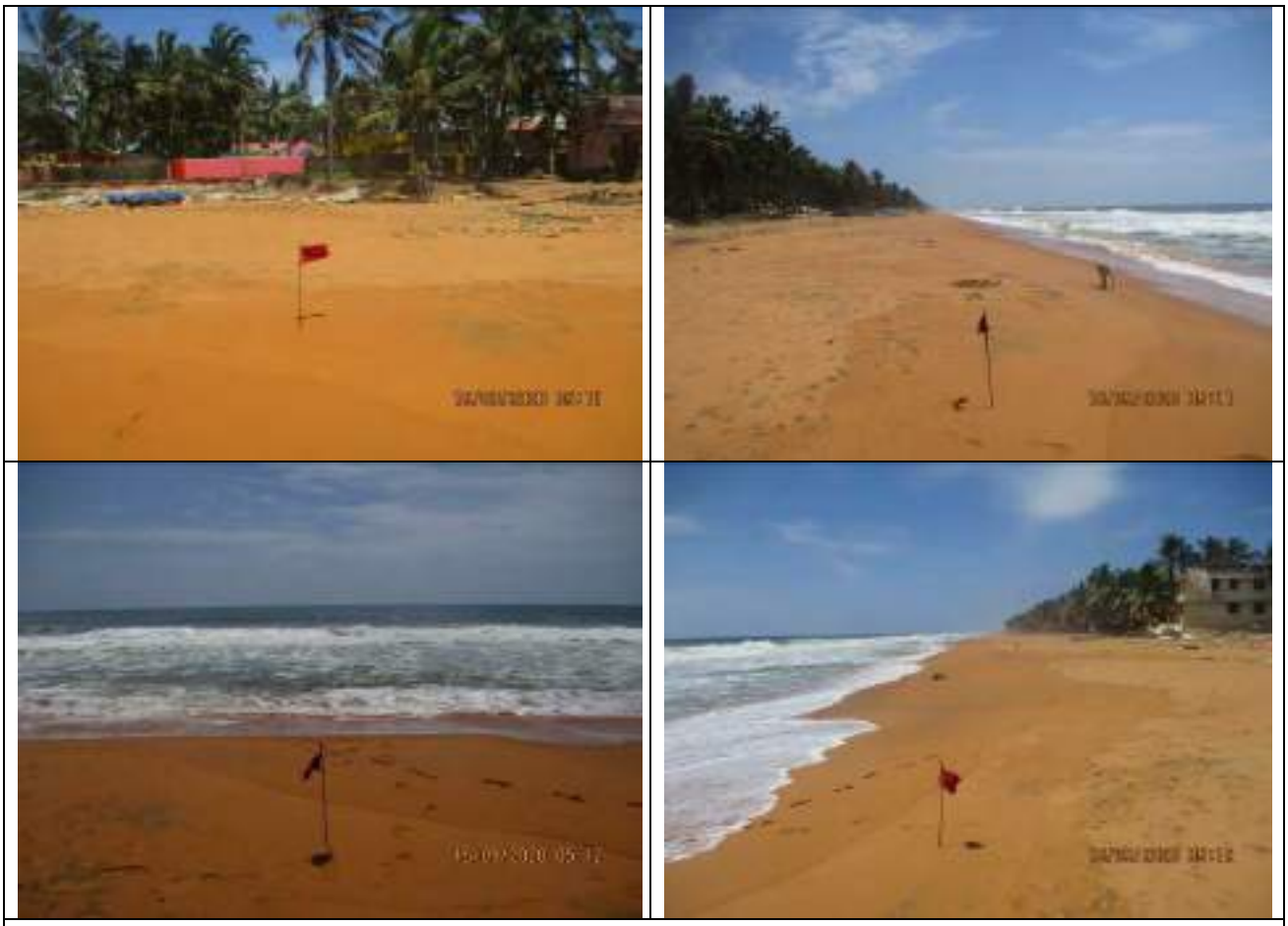


Figure 62- September CSP 72



Figure 63- September CSP 73



Figure 64- September CSP 74



Figure 65- September CSP 75

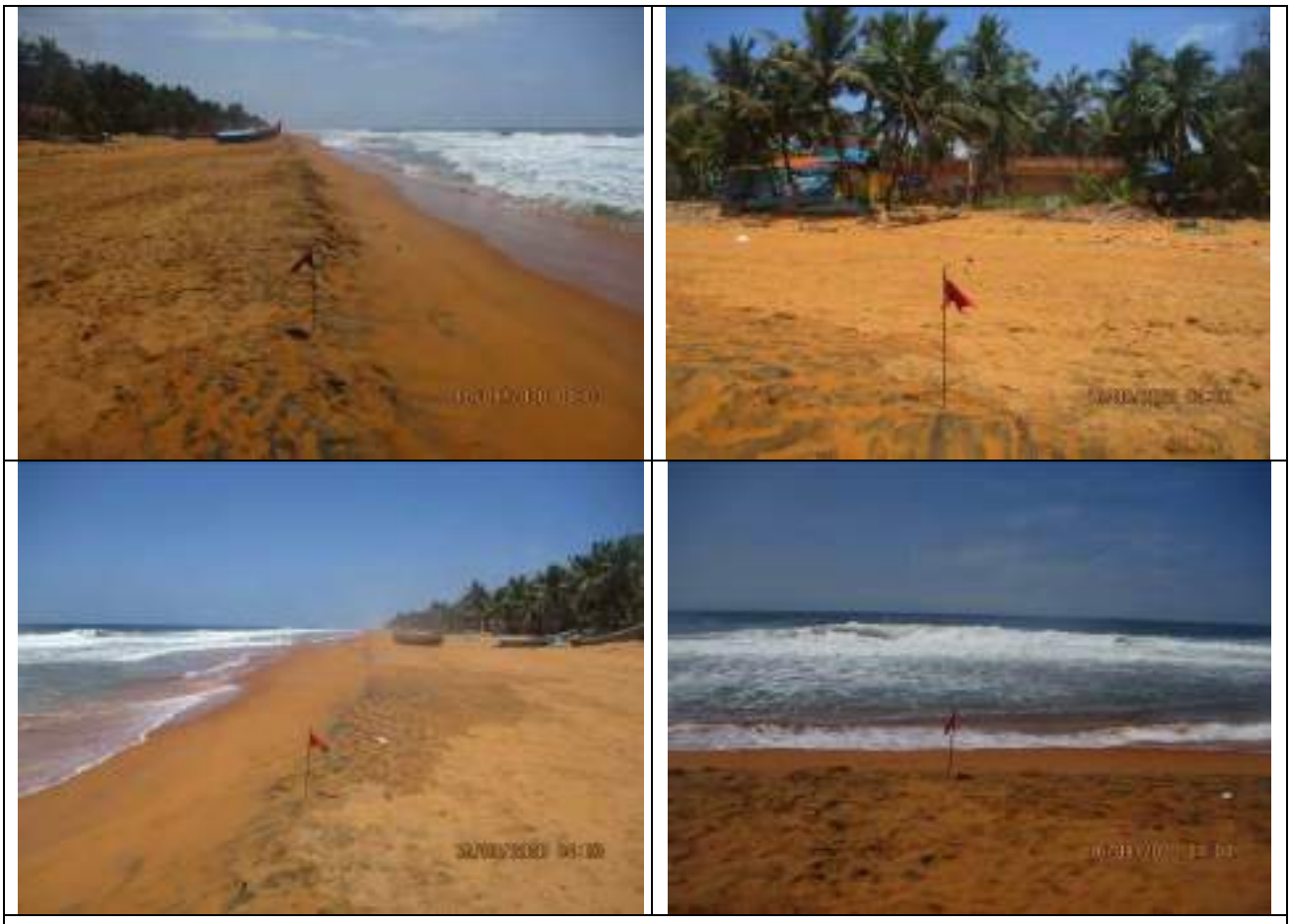


Figure 66- September CSP 76



Figure 67- September CSP 77



Figure 68- September CSP 78



Figure 69- September CSP 79



Figure 70- September CSP 80

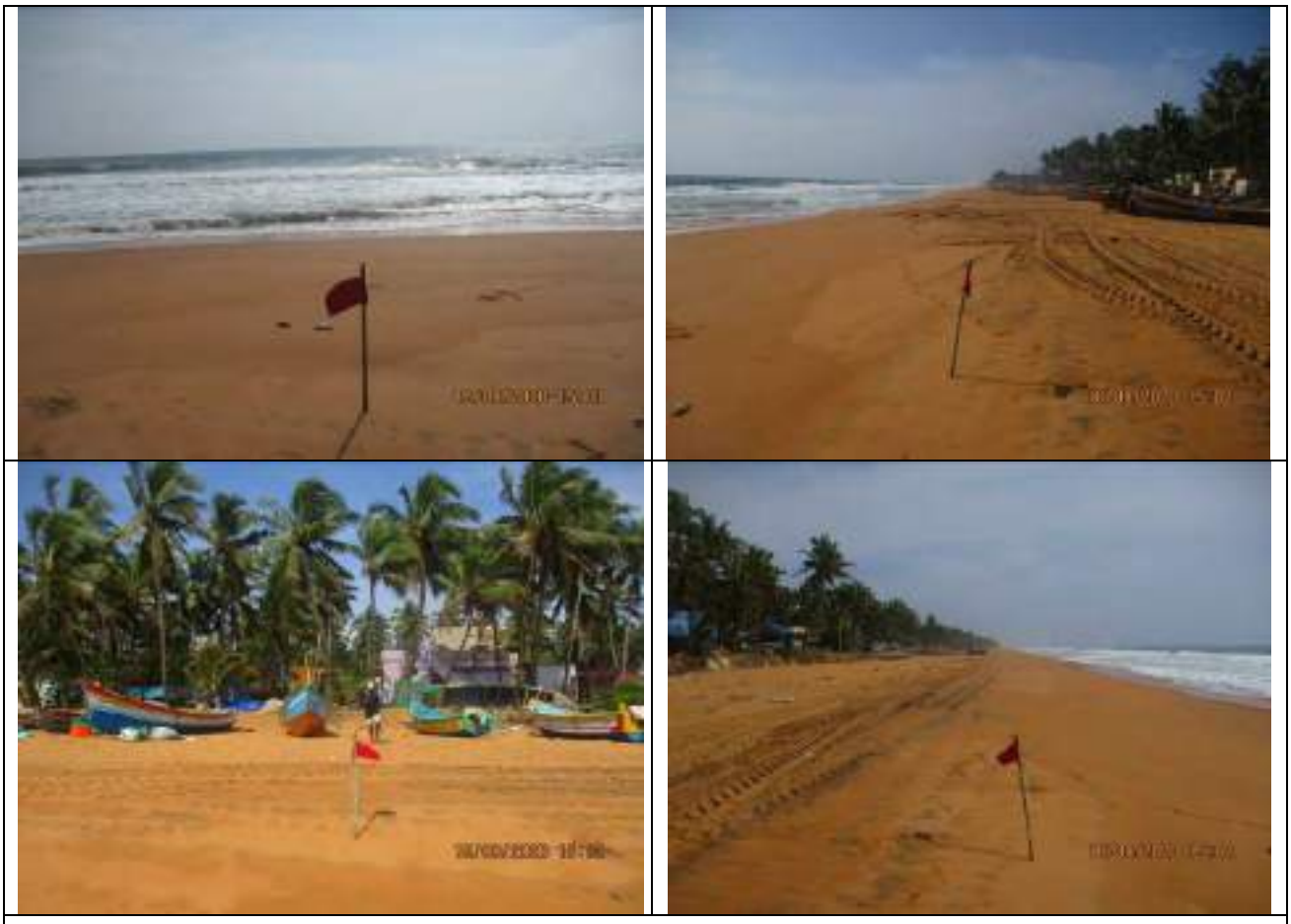


Figure 71- September CSP 81

Annexure II

Shoreline Mathematical Modelling Report

(March 2019 to February 2020)

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 (2019-2020)	**Project No.:** C1201501	
Title: Data Analysis and Model Study Report 2019-20	**Document No.:** RP004	**Rev.:** 0

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Notes:

1.

Revision Details:

Rev.	Date	Details	Prepared Init.	Prepared Sign.	Checked Init.	Checked Sign.	Approved Init.	Approved Sign.
0	30/11/2020	First Submission	PSJ		RRJ		PRJ	

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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
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
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 sea port 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 sea port. VISL has awarded Adani Vizhinjam Port Private Limited (AVPPL) the job of constructing the port. As a part of the project requirements, AVPPL has to 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 2019, LNTIEL submitted a report based on the data received from February 2015 - February 2019. 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 2019 to February 2020. AVPPL entrusted LNTIEL to help them in the 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 was further investigated. In some cases numerical modelling tools would be required to confirm the cause of variation in these parameters. In this report, only those model studies (such as wave transformation and hydrodynamics) are carried out which can indicate if the marine environment is prevailing within expected variations. Accompanying model studies has been carried out depending on the results of these model studies.

With this background, LNTIEL has prepared this report by carrying out the analysis of the data received from March 2019-February 2020 and different model studies to assess the impact of port development.

Following are the summary of the work 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 5 sections perpendicular to the shore; two on the North of port, two on the South of port and one near the port. Cross sections of bathymetries from Pre monsoon 2016 to Post monsoon 2019 were compared. From the analysis, no change in bathymetry is observed even though some localized changes have occurred due to dredging and reclamation. The bathymetry towards the north and south of the port has remained similar since 2015 (the time since continuous measurement was carried out) indicating that the dredging activities in the port area has minimal impact on the bathymetry of the neighbouring areas.
- The observed wave data provided by AVPPL for the period of March 2019 to February 2020 is analysed and compared with the observed wave data for February

2015 to February 2019. Majority of the waves observed at the project location fall in the range of 0.5-1.5 m. From these comparisons, it can be seen that 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 2019 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 0.8 to 0.9 m/s.
- Continuous monitoring of turbidity using buoys has been carried out during March 2019 to February 2020 in three locations. It is perceptible from time series plots that the turbidity fluctuates all year round, though the values were lower than 10 NTU for almost all the time.
- 81 locations at 0.5 km interval were opted to collect beach sediments for each season. The data received by LNTIEL was analysed by plotting each of the profiles and cross shore profiles of different years of particular season were compared. The plots suggest that the shoreline movement of this portion of the coast is following its natural course till Ockhi. After this, the impact of Ockhi cyclone can be evidently noticed. Furthermore the increase in wave heights due to storm events in subsequent years is making the beach recovery more difficult.
- Further LNTIEL extracted (+) 2 m contour from cross shore profile data. The time series plot of (+) 2 m contour over four year data 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 no much accretion was noticed during fair weather 2017 and pre-monsoon 2018. In addition, as a result of monsoon 2018 and 2019 the beach got further eroded compared to previous monsoon seasons.
- LNTIEL extracted -3m, -4m, -6m, and -8m contours from cross shore profile data and time series plots of respective contours over five year data are shown at Neerody, Pozhiyoor, Karumkulam, Panathura, Beemapally and Vettucaud locations.

2) Model Studies

a) Near Shore Wave Transformation

- Offshore wave data from March 2019 to February 2020 was obtained from NCEP 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, 2015, 2016, 2017, 2018 and 2019) 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) Longshore sediment transport

- Longshore 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.
- In order 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 5 years data (Feb 2015 – Feb 2020). 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 so as to carry out the analysis.
- 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.
- It is evident that in the immediate vicinity of the port location (38 to 40) the effect is minimal and major deviations are far away from port location. If these deviations are due to port development then it should be persistent from port location to extreme stations. But it is not the case and shall not be attributed to port development.

From all the data analyses and model studies carried out by LNTIEL, 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

1 Introduction

Government of Kerala is setting up green field modern deep water multipurpose sea port 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 sea port.

In this regard VISL had appointed Royal Haskoning DHV India (RHI) as their technical consultant in April 2010 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, VISL appointed AECOM India Private Limited (AEIPL) to prepare the Detailed Project Report (DPR) for the Development of Vizhinjam Port as part of the EIA studies. 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 in this regard. 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, AVPPL was hired 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 to assess 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 with 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 2019, LNTIEL has produced reports containing analyses for all these years. As a continuation, AVPPL has measured oceanographic data from March 2019 to February 2020 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.

2 Data Analysis

2.1 Project location

The Vizhinjam fishing harbour is located in Thiruvananthapuram district in the Indian state of Kerala. It is situated about 16km south of Thiruvananthapuram. The proposed port location is situated at about 300m from the existing fishing harbour and is shown in Figure 2-2.



Figure 2-1 Google image of site



Figure 2-2 Location of the port (Latest available imagery at the time of report)

2.2 Waves

Long term observation of wave heights at a location is useful as it provides the required data for considering design wave height as well as for the prediction of wave heights at the location.

This section of the report mainly 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 2019 to 29th February 2020. The measured wave height, direction and peak wave period are represented in the form of graphs and are given in Figure 2-3 to Figure 2-5.

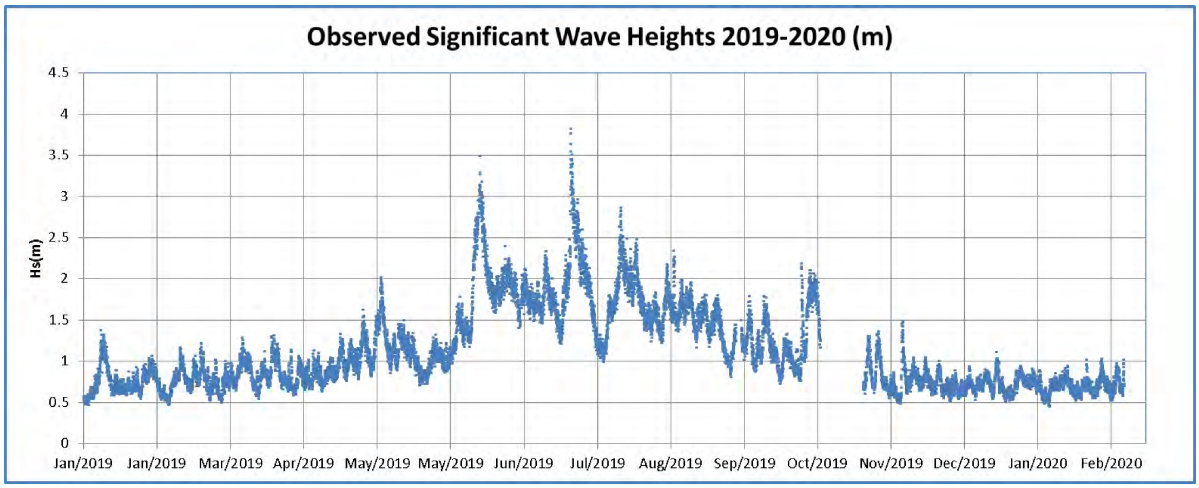


Figure 2-3 Time history plot of wave height for observed wave data

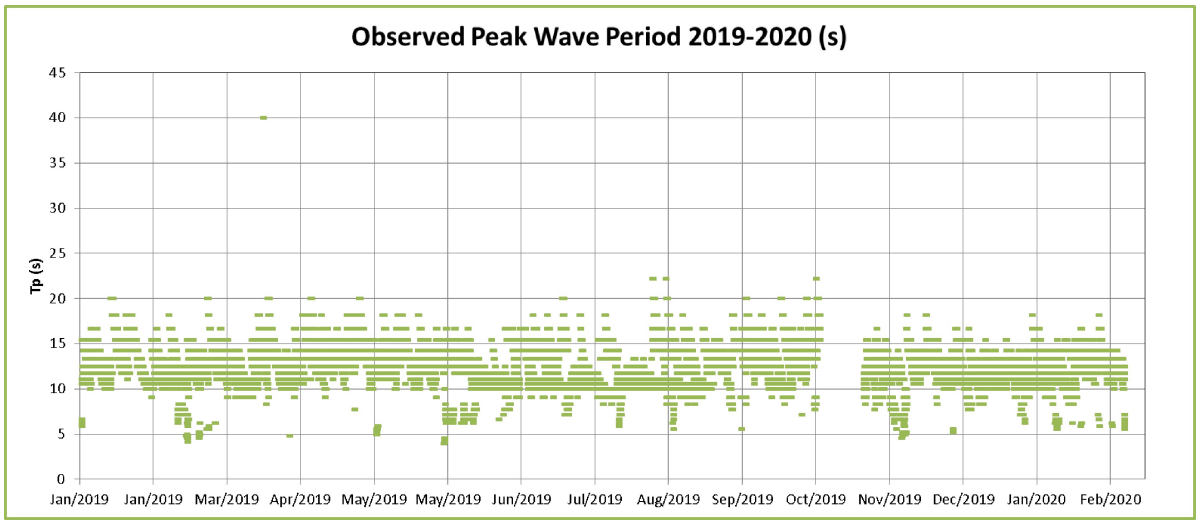


Figure 2-4 Time history plot of peak wave period for observed wave data

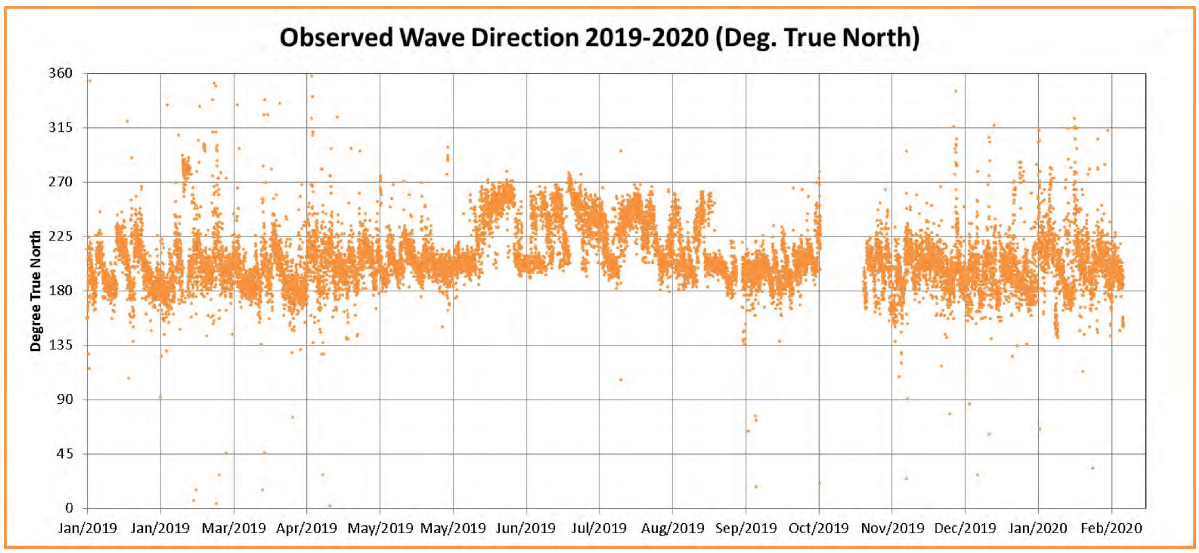


Figure 2-5 Time history plot of wave direction for observed wave data

From the above graphs, we can observe that the wave heights are mostly in the range of 0.5 m – 1.5 m during non-monsoon period and it reaches around 4 m during monsoon period. The parameters were observed to follow the same trend as observed in the previous years.

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 above. It may be noted that in almost all of these events, the cause was either a storm or a depression.

Table 2-1 Storm events observed during Mar 2019 to Feb 2020

S. No.	Date	Reason
1	3rd May 2019	Cyclone Fani

S. No.	Date	Reason
2	8th to 14th June 2019	Cyclone Vayu
3	18th to 21st July 2019	Monsoon
4	8th August 2019	Kerala floods
5	30th September to 1st October 2019	Landside depression
6	21st to 29th October 2019	Cyclone Kyarr
7	29th October to 16th November 2019	Cyclone Maha
8	1st December 2019	Cyclone Pawan

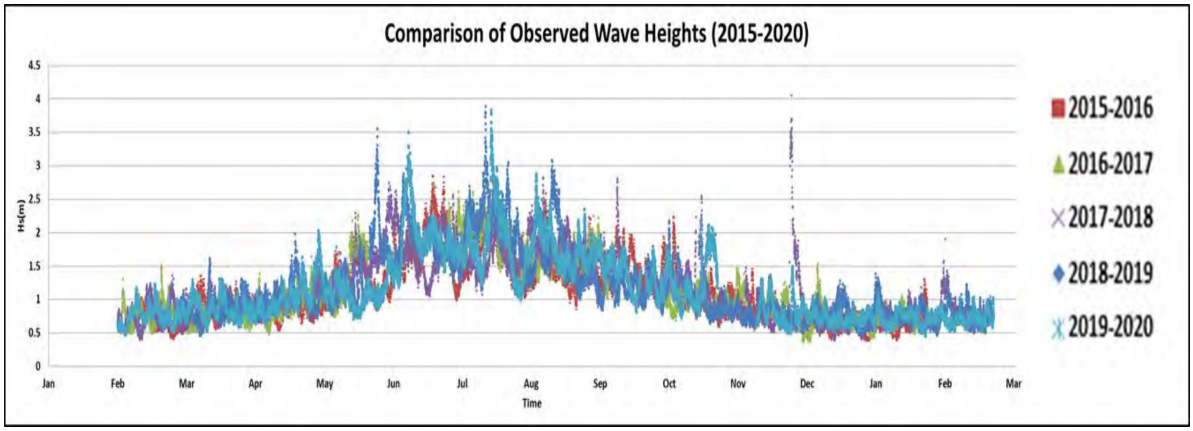


Figure 2-6 Comparison of wave heights (2015-2020)

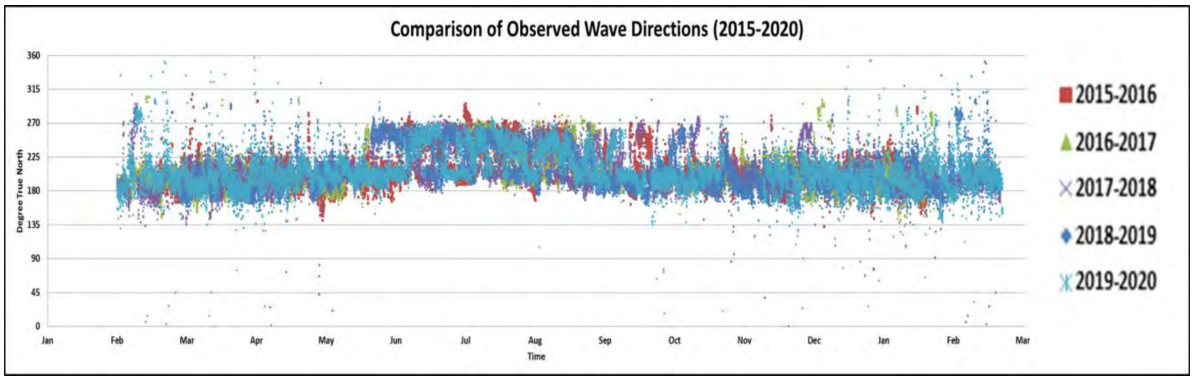


Figure 2-7 Comparison of wave directions (2015-2020)

Wave parameters were measured using WRB during the period of 10th February 2015 to 29th February 2020 by OSAS till June 2019 and later on by Shankar & Co. at the project location. A comparison for percentage exceedance of wave heights observed for the past four years from 2015, 2016, 2017, 2018 and 2019 was carried out and the same is presented in Figure 2-8. From these comparisons, it can be seen that the variability of wave heights and directions are similar for all the years except for storm events.

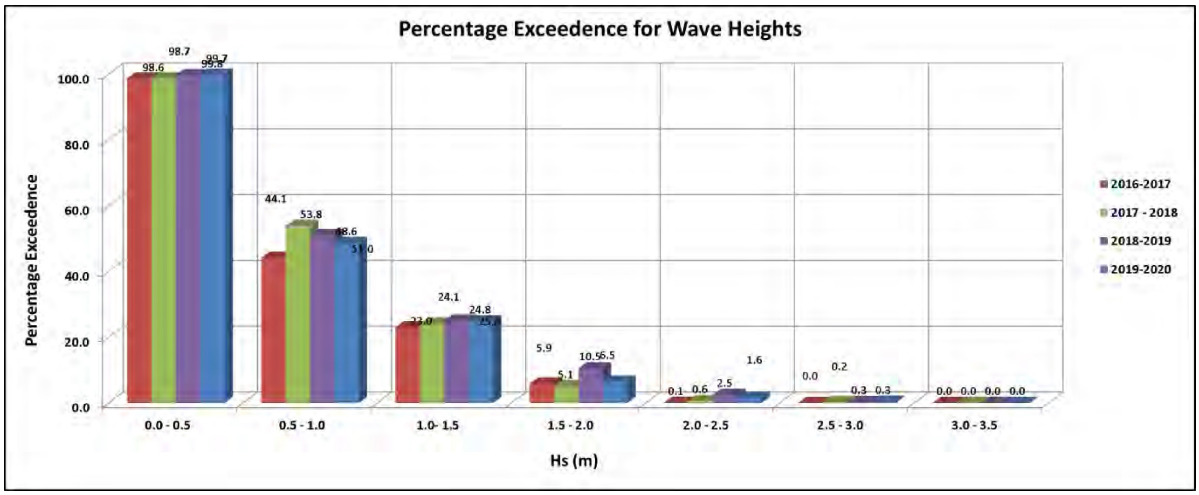


Figure 2-8 Percentage exceedance of wave heights for the observed data

2.3 Tides

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. The quality of the data was analysed for the present study and shifts in the datum used were observed. In addition to these data, in-situ tide measurements using ATG were also available in old reports. Due to this 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 March 2018 to February 2019. These data were reported in the earlier reports by LNTIEL.

Subsequently, OSAS collected data, at 08° 22' 33.68" N, 76° 59' 16.65" E and at a depth of 3.3 m, for the period of March 2019 to June 2019 and Shankar & Co. collected data from July 2019 to February 2020. The measured tide provided by AVPPL is presented in Figure 2-9.

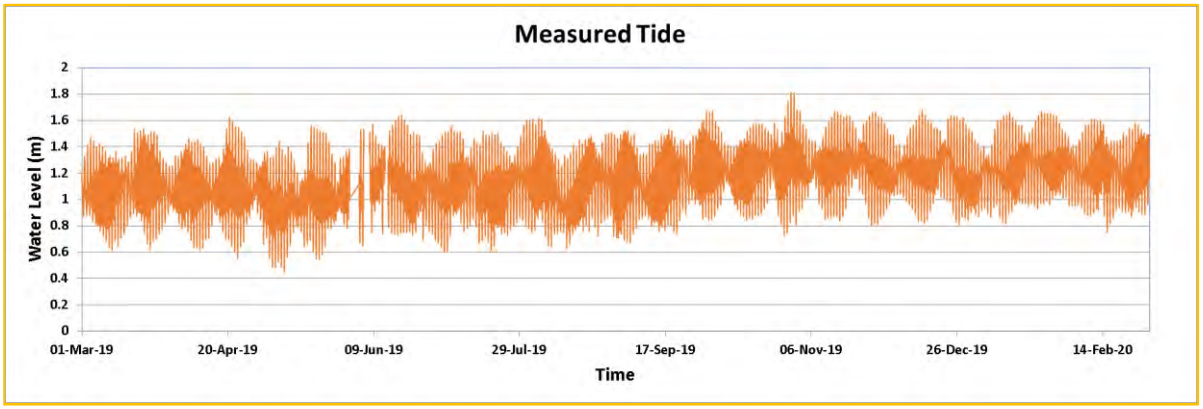


Figure 2-9 Tide data measured during Mar 2019 to Feb 2020

2.4 Currents

OSAS had carried out measurement of current speeds and directions at different depths as given in Table 2-2 at four different locations Pachalloor, Vizhinjam, Mulloor and Poovar as

presented in Figure 2-10. AVPPL provided the current data for one month for each season from March 2019 to February 2020 (Pre-monsoon, Monsoon and Post-monsoon). The data collected for each season are presented in Figure 2-19 and Figure 2-34.

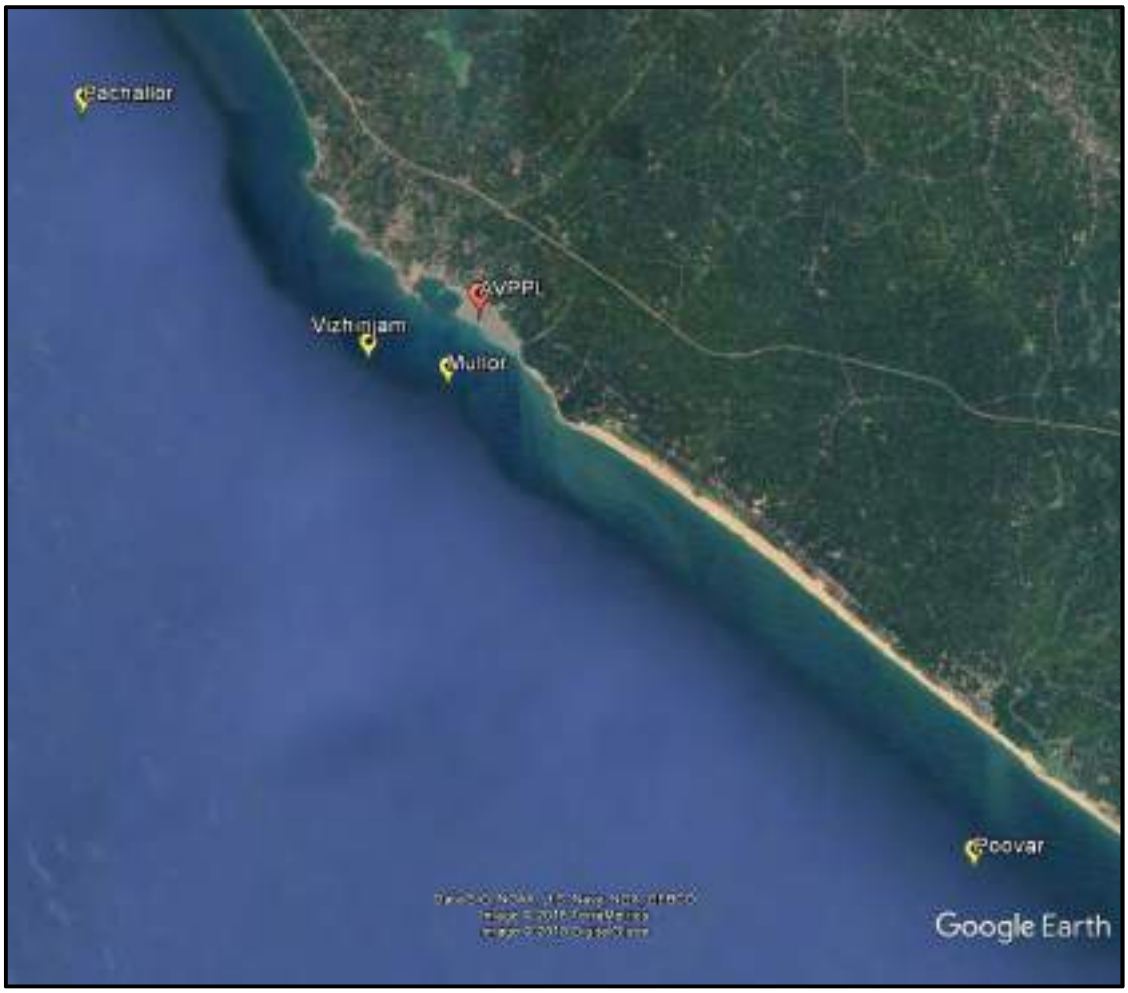


Figure 2-10 Locations from where the current data are collected

Table 2-2 Observed Current Speed and Direction during 2019

Location and Depth (CD,m)	Coordinates		Pre Monsoon		Monsoon		Post Monsoon	
	Northing	Easting	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"	0.1-0.7	NW-SE	0.1-0.85	NW-SE	0.1-0.65	NW-SE
Poovar 23.0	$8^0$17'35.8"	$77^0$04'03.5"	0.1-0.75	NW-SE	0.1-0.85	NW-SE	0.1-0.8	NW-SE
Pachalloor	$8^0$24'08.6"	$76^0$56'16.1"	0.1-0.8	NW-SE	0.1-0.90	NW-SE	0.1-0.8	NW-SE

21.4								
Mulloor 23.2	$8^0$21'42.3"	$76^0$59'33.9"	0.1-0.6	NW-SE	0.1-0.9	NW-SE	0.1-0.65	NW-SE

It can be noticed that the current speed in the region will be in general 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 0.8 to 0.9 m/s. The current speed and the current direction for different seasons at four different locations are shown in Figure 2-19 to Figure 2-34. Start and end times of observed currents in three seasons is as shown in Table 2-3.

Table 2-3 Current observation timeline

Location	Coordinates		Pre Monsoon		Monsoon		Post Monsoon	
	Northing	Easting	Start date	End date	Start date	End date	Start date	End date
Pachalloor	$8^0$24'08.6"	$76^0$56'16.1"	09/05/19	25/05/19	16/08/19	16/09/19	12/01/20	12/02/20
Vizhinjam	$8^0$21'55.4"	$76^0$58'51.6"	23/04/19	25/05/19	16/08/19	16/09/19	11/01/20	12/02/20
Mulloor	$8^0$21'42.3"	$76^0$59'33.9"	23/04/19	25/05/19	16/08/19	16/09/19	11/01/20	12/02/20
Poovar	$8^0$17'35.8"	$77^0$04'03.5"	23/04/19	25/05/19	16/08/19	16/09/19	12/01/20	12/02/20

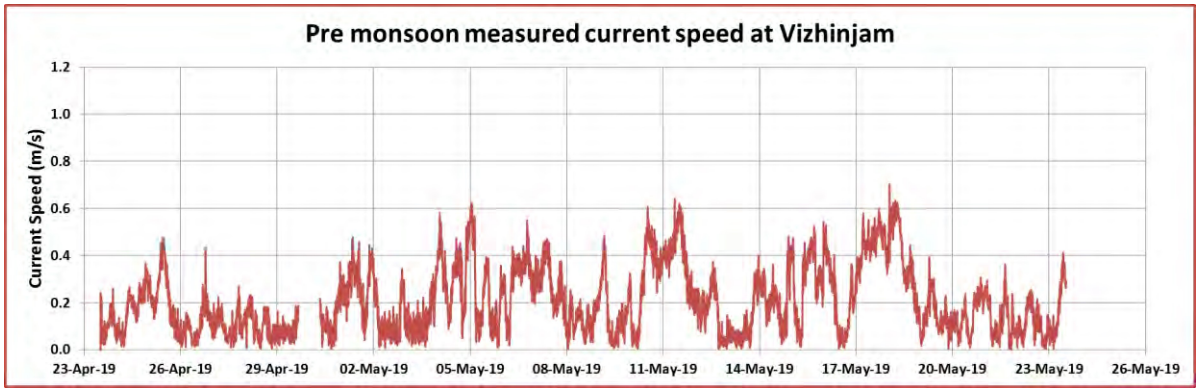


Figure 2-11 Pre-Monsoon measured current speed at Vizhinjam during May 2019

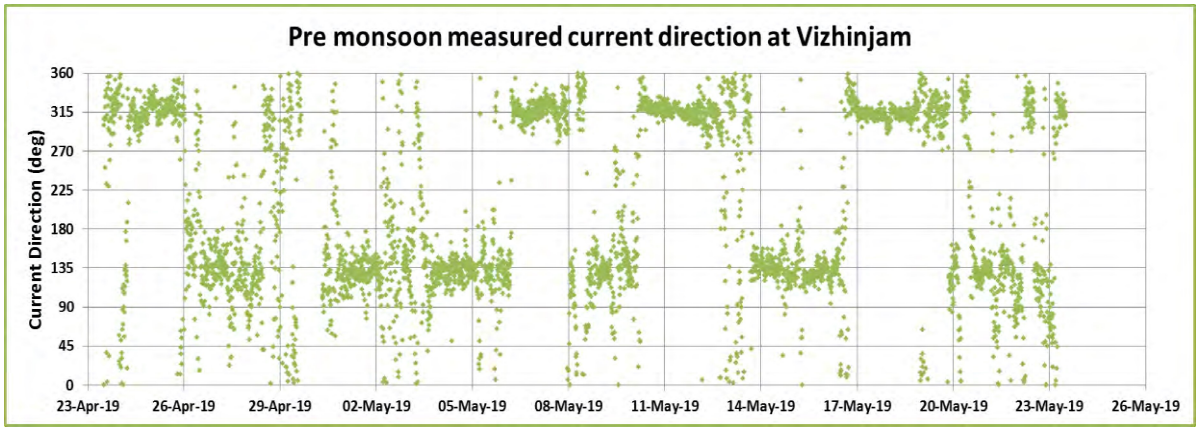


Figure 2-12 Pre-Monsoon measured current direction at Vizhinjam during May 2019

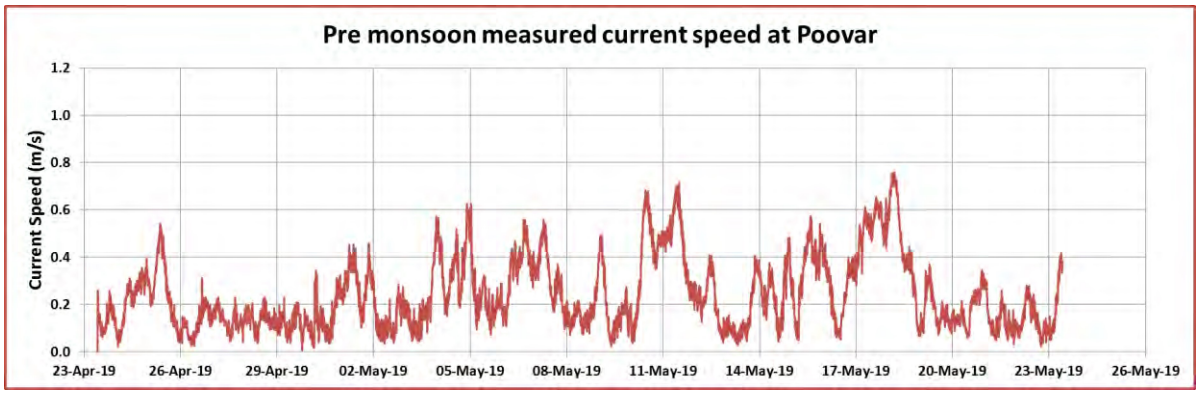


Figure 2-13 Pre-Monsoon measured current speed at Poovar during May 2019

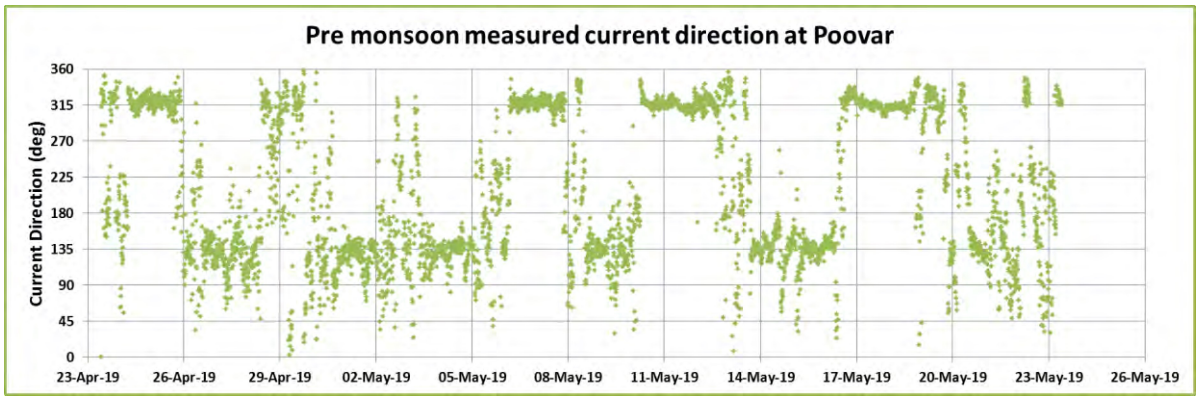


Figure 2-14 Pre-Monsoon measured current direction at Poovar during May 2019

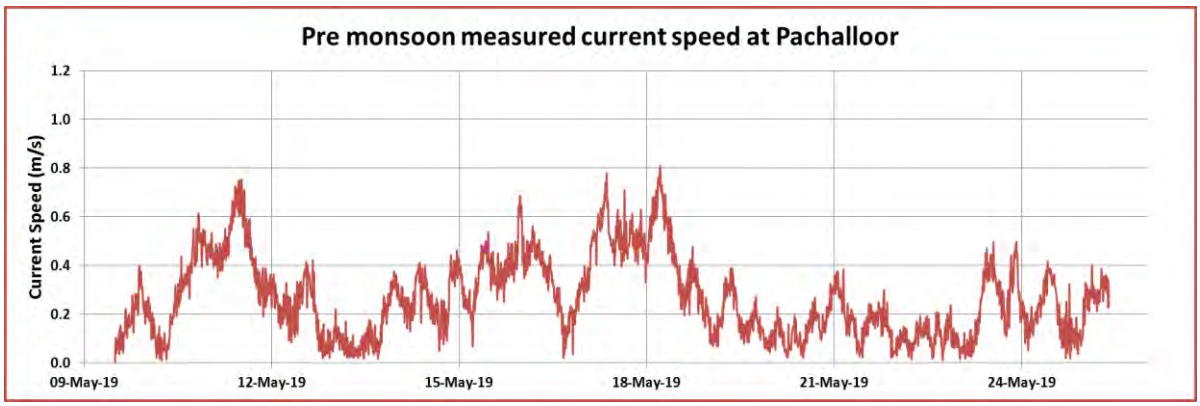


Figure 2-15 Pre-Monsoon measured current speed at Pachalloor during May 2019

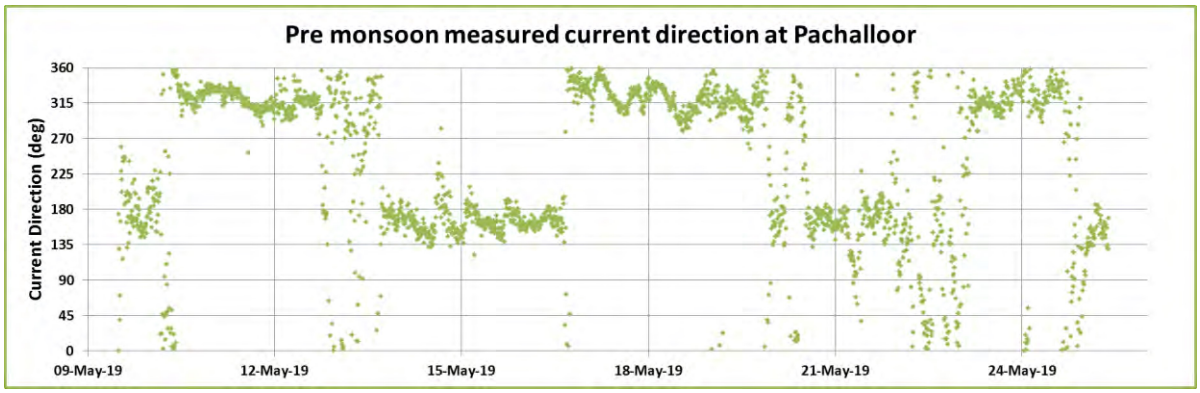


Figure 2-16 Pre-Monsoon measured current direction at Pachalloor during May 2019

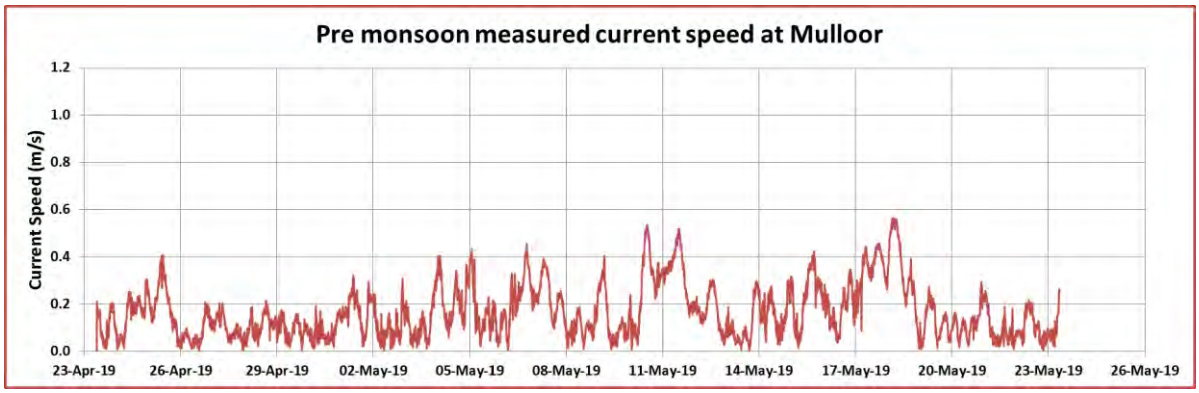


Figure 2-17 Pre-Monsoon measured current speed at Mulloor during May 2019

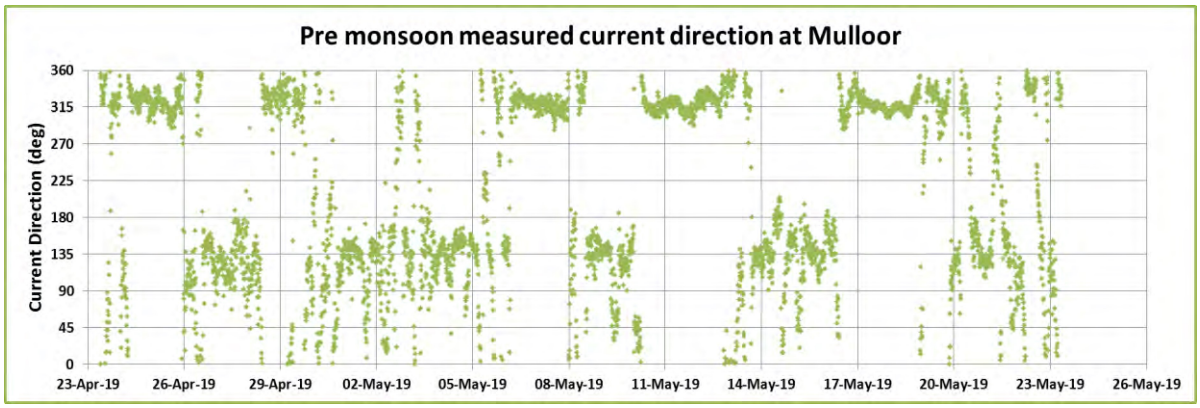


Figure 2-18 Pre-Monsoon measured current direction at Mulloor during May 2019

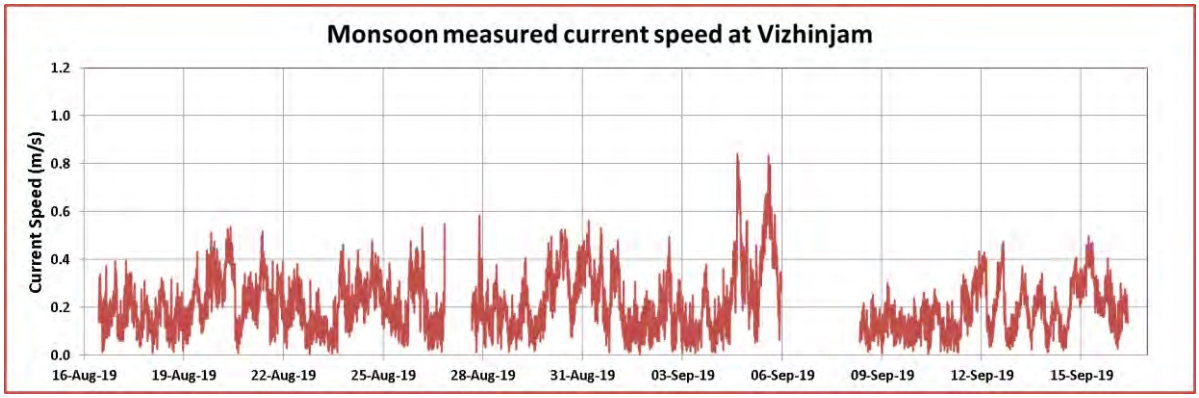


Figure 2-19 Monsoon measured current speed at Vizhinjam during Aug to Sept 2019

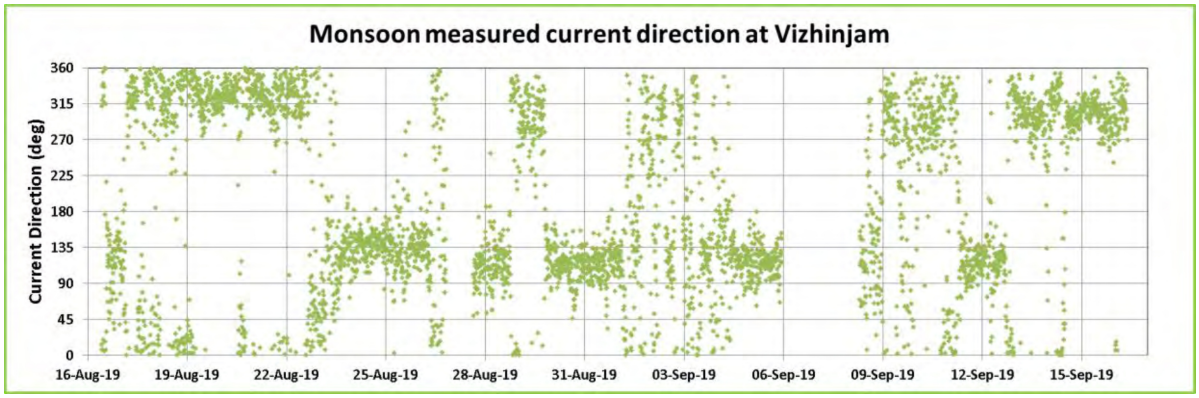


Figure 2-20 Monsoon measured current direction at Vizhinjam during Aug to Sept 2019

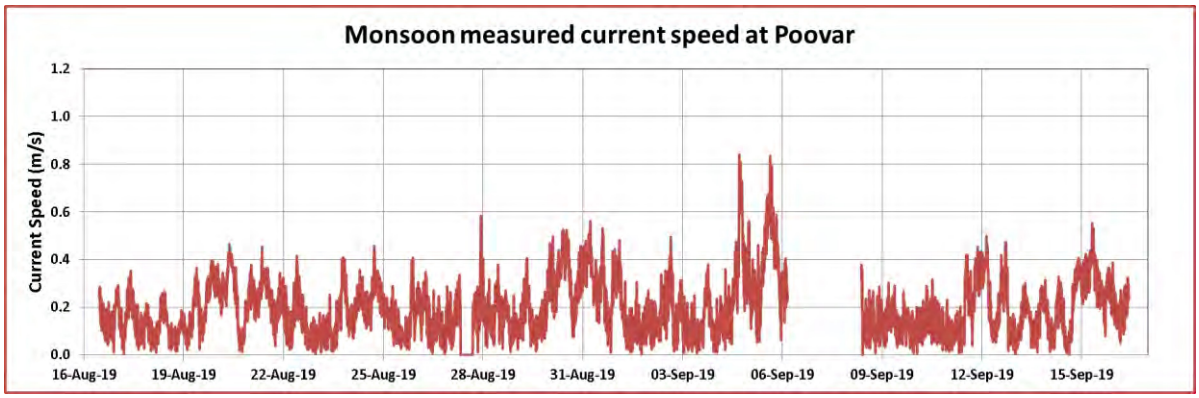


Figure 2-21 Monsoon measured current speed at Poovar during Aug to Sept 2019

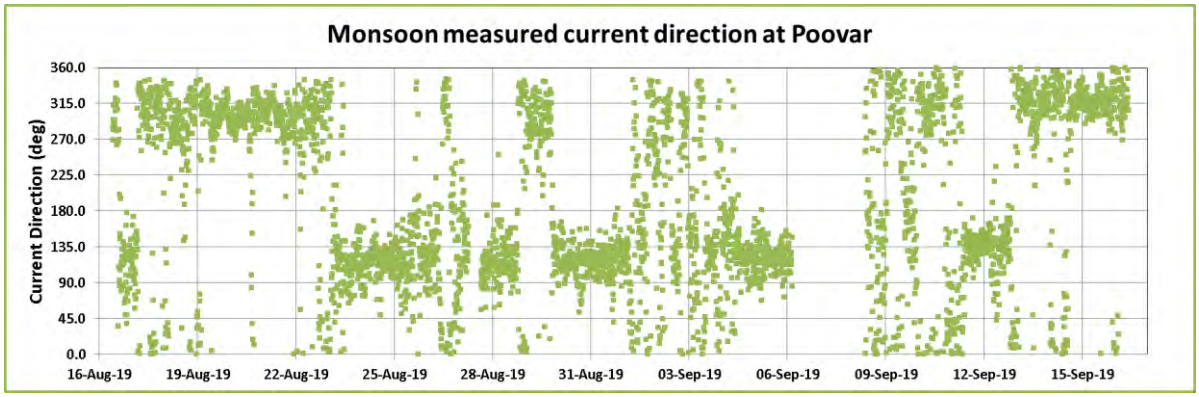


Figure 2-22 Monsoon measured current direction at Poovar during Aug to Sept 2019

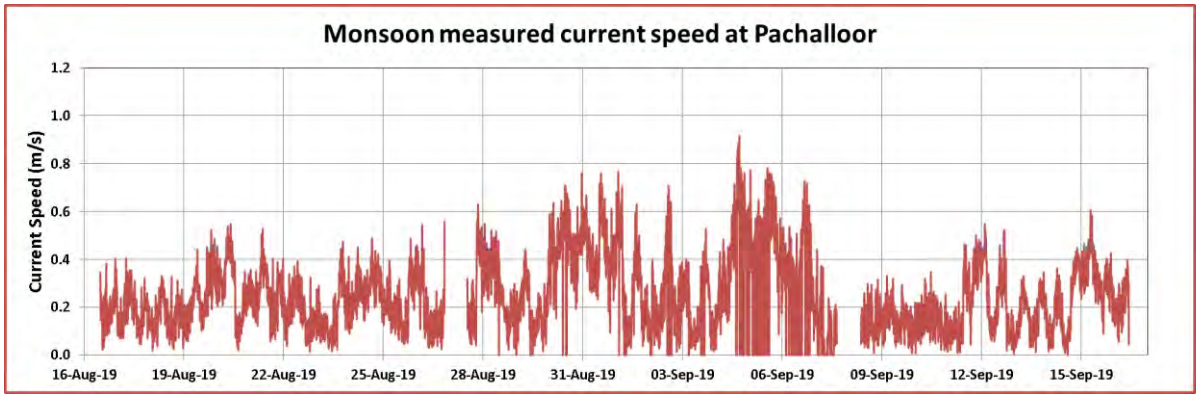


Figure 2-23 Monsoon measured current speed at Pachalloor during Aug to Sept 2019

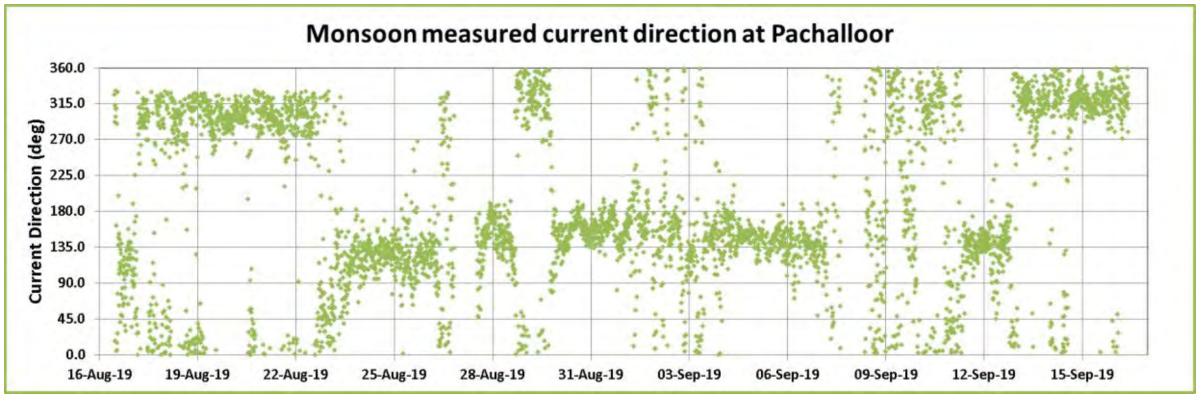


Figure 2-24 Monsoon measured current direction at Pachalloor during Aug to Sept 2019

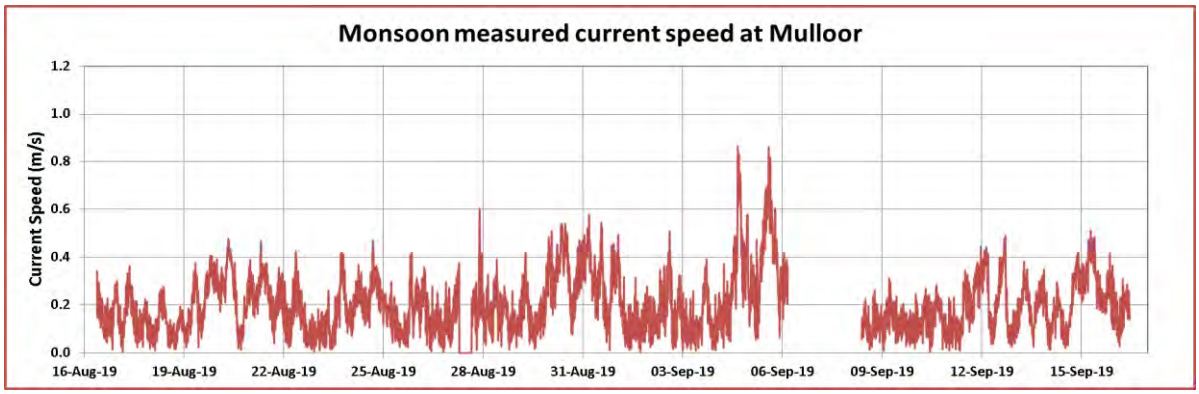


Figure 2-25 Monsoon measured current speed at Mulloor during Aug to Sept 2019

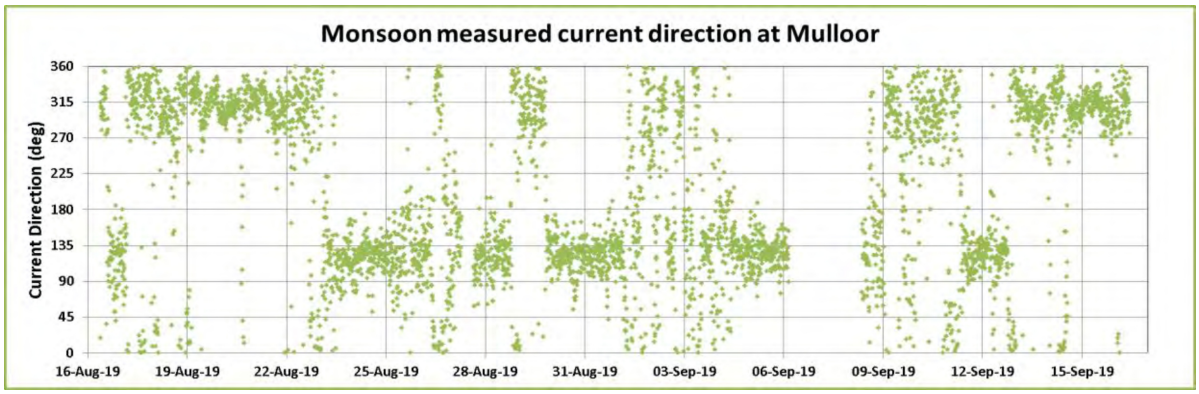


Figure 2-26 Monsoon measured current direction at Mulloor during Aug to Sept 2019

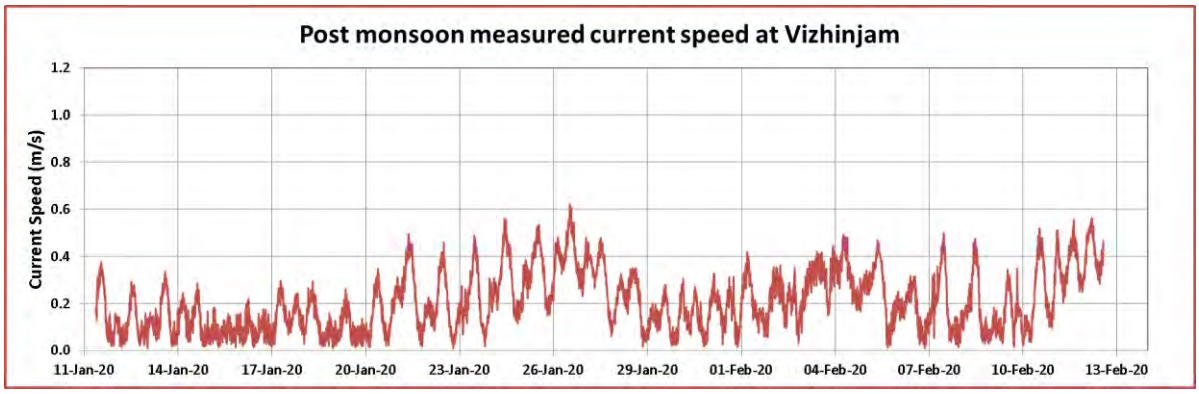


Figure 2-27 Post Monsoon measured current speed at Vizhinjam during Jan to Feb 2020

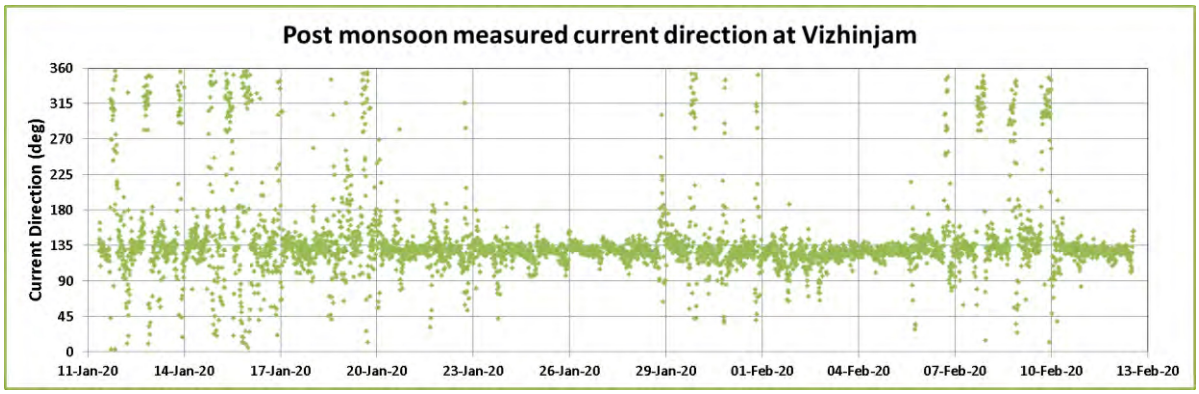


Figure 2-28 Post Monsoon measured current direction at Vizhinjam during Jan to Feb 2020

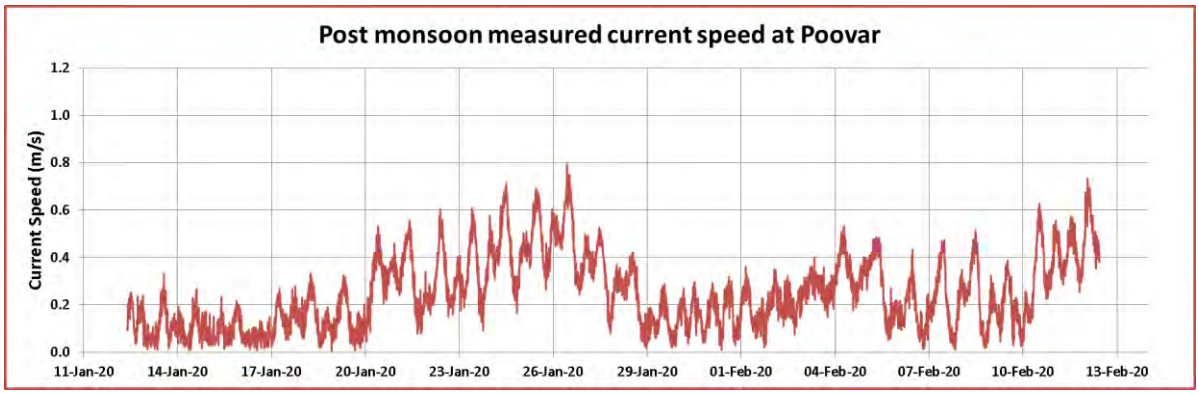


Figure 2-29 Post Monsoon measured current speed at Poovar during Jan to Feb 2020

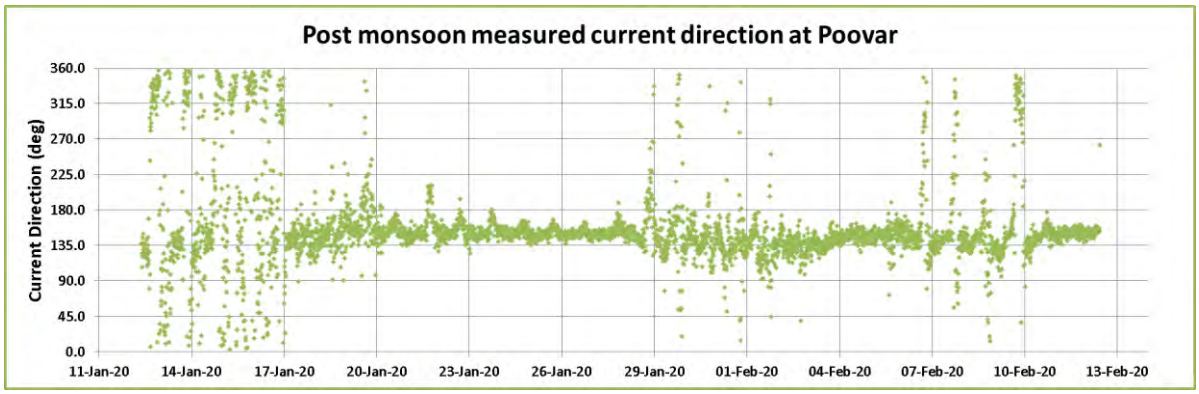


Figure 2-30 Post Monsoon measured current direction at Poovar during Jan to Feb 2020

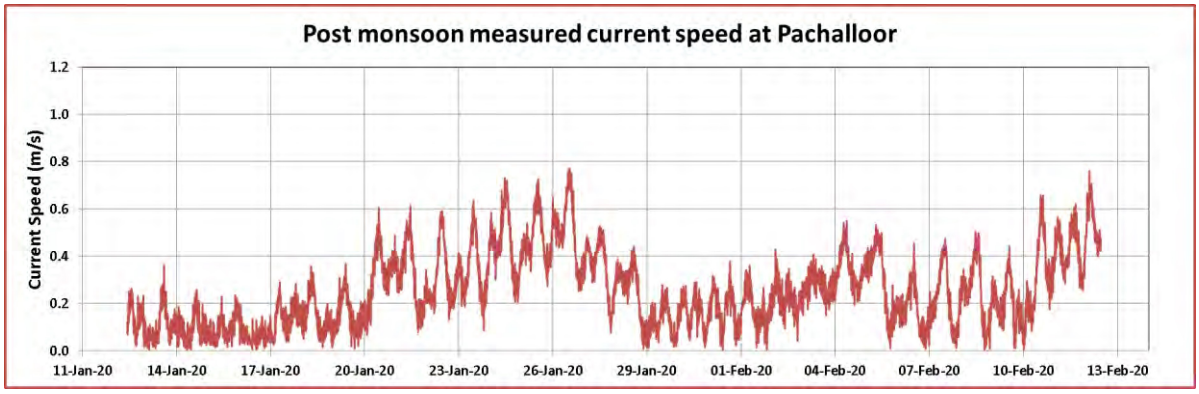


Figure 2-31 Post Monsoon measured current speed at Pachalloor during Jan to Feb 2020

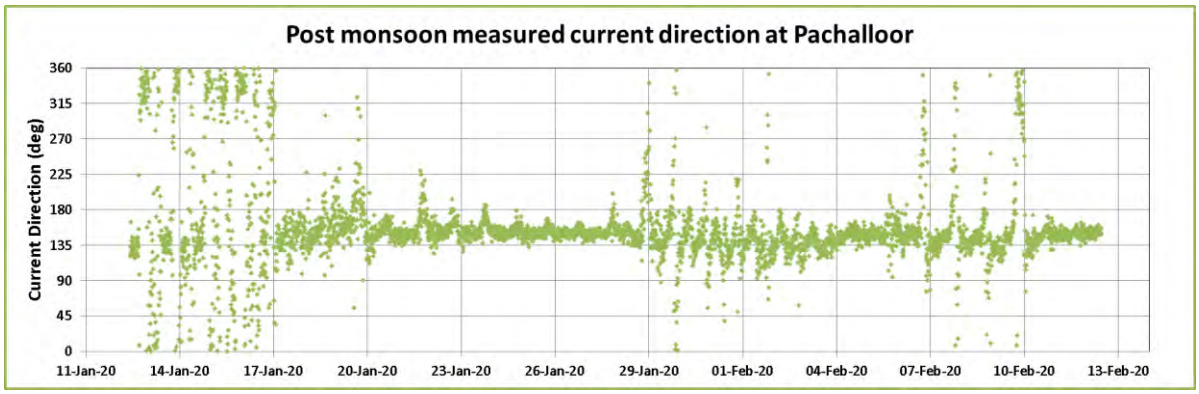


Figure 2-32 Post Monsoon measured current direction at Pachalloor during Jan to Feb 2020

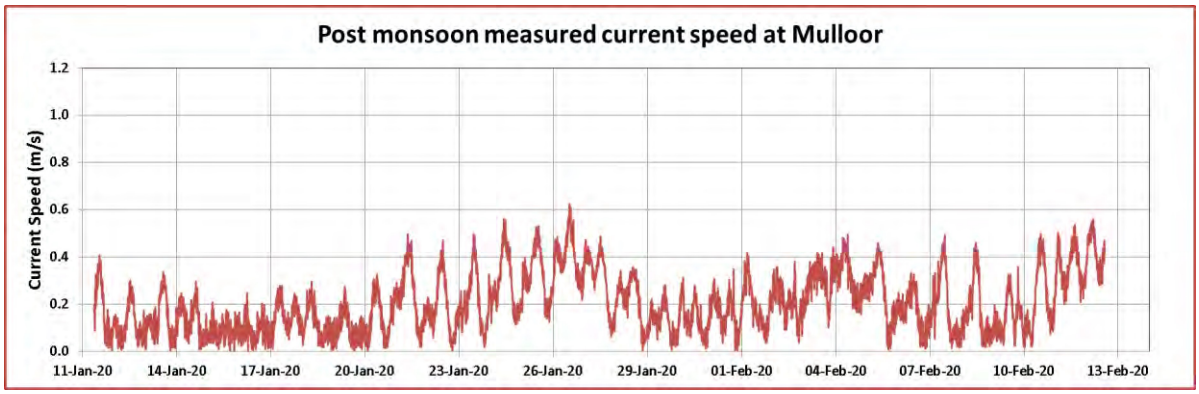


Figure 2-33 Post Monsoon measured current speed at Mulloor during Jan to Feb 2020

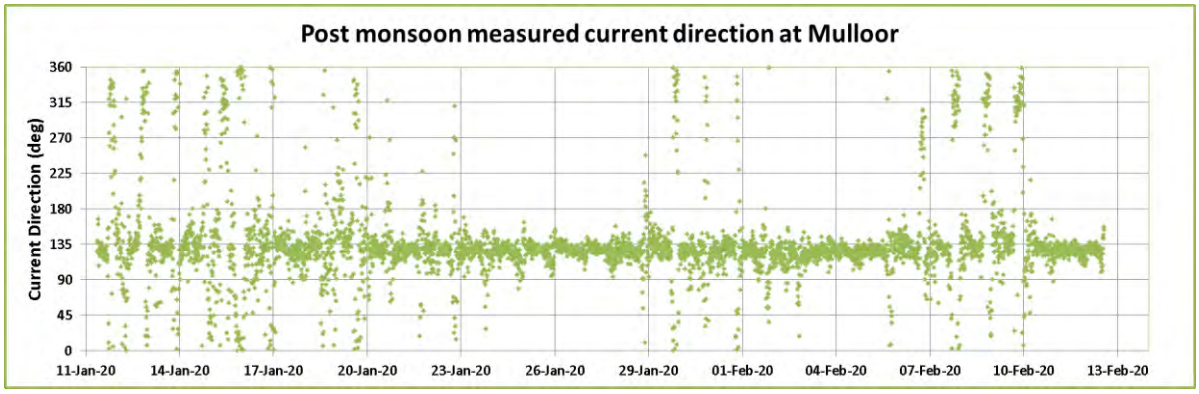


Figure 2-34 Post Monsoon measured current direction at Mulloor during Jan to Feb 2020

2.5 Wind

OSAS had carried out the measurement of wind speed and direction from March 2019 to June 2019 and Shankar & Co. collected data from July 2019 to February 2020 using AWS established at the location as presented in Figure 2-35. The mostly wind speed varies from 3 to 4 m/s and the maximum wind speed measured is 12 m/s. It is observed that the wind speed is in expected range as in previous year. The graph showing the variation of wind speed and wind direction provided by AVPPL is presented in Figure 2-36 and Figure 2-37.



Figure 2-35 Location of AWS

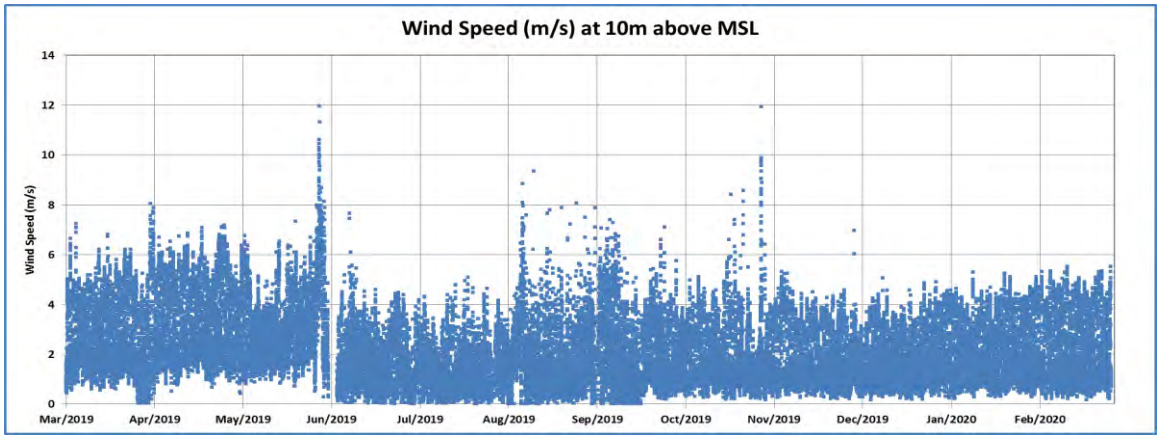


Figure 2-36 Wind speed measured during June 2019 to February 2020

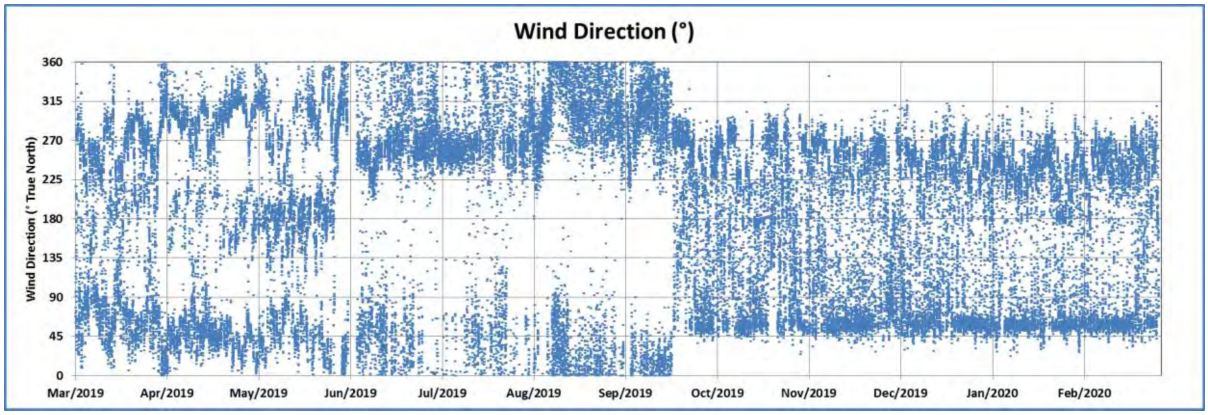


Figure 2-37 Wind direction measured during June 2019 to February 2020

2.6 Turbidity data from monitoring buoys

AVPPL has provided the turbidity data from 1st March 2019 to 29th February 2020 in 10 min intervals collected from three locations near the port area as presented in Figure 2-38 using turbidity monitoring buoys.

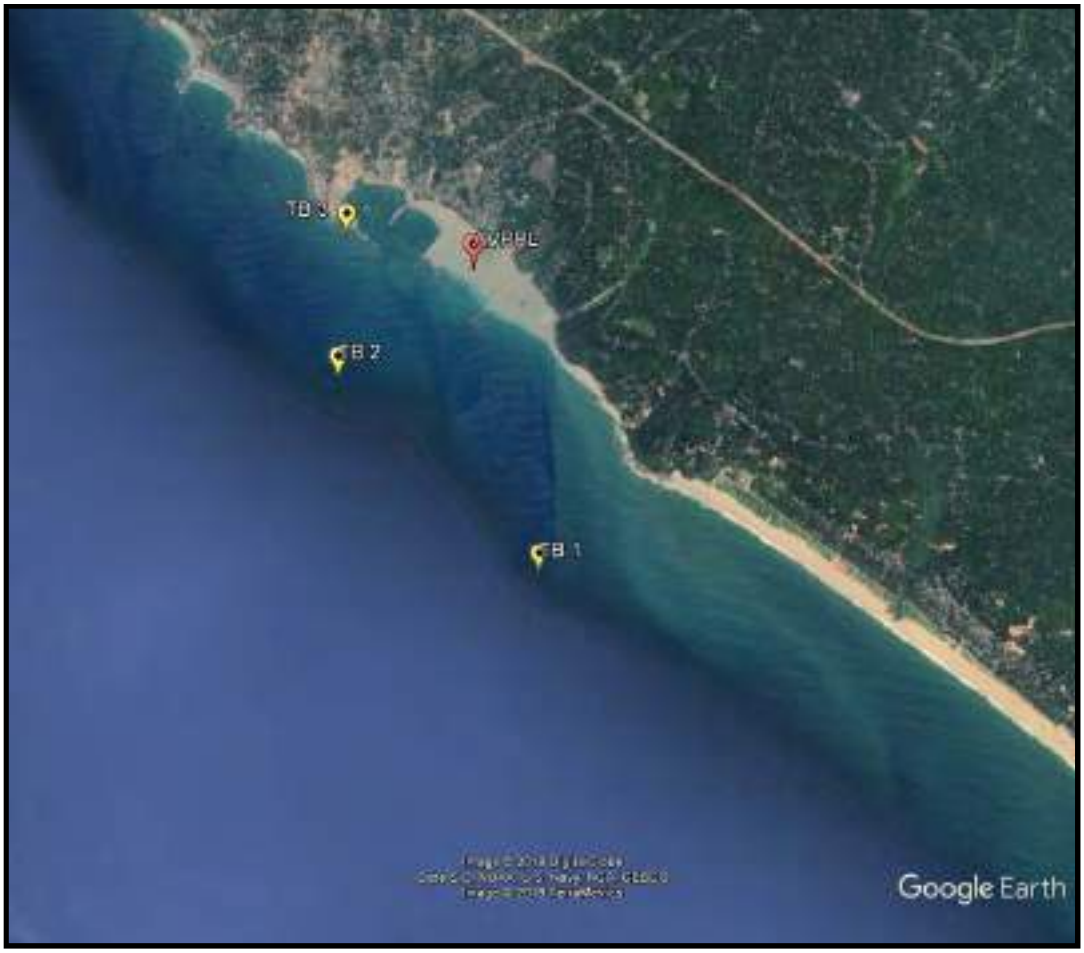


Figure 2-38 Location of Turbidity Buoys

The time series plotted using this turbidity data are presented in Figure 2-39 to Figure 2-41 for all the three locations. It has been informed by the Client that all the three buoys were non-operational from June 2019 to October 2019 due to change in contractor and difficulty in buoy installation during monsoon season. All turbidity values are found below 10 NTU.

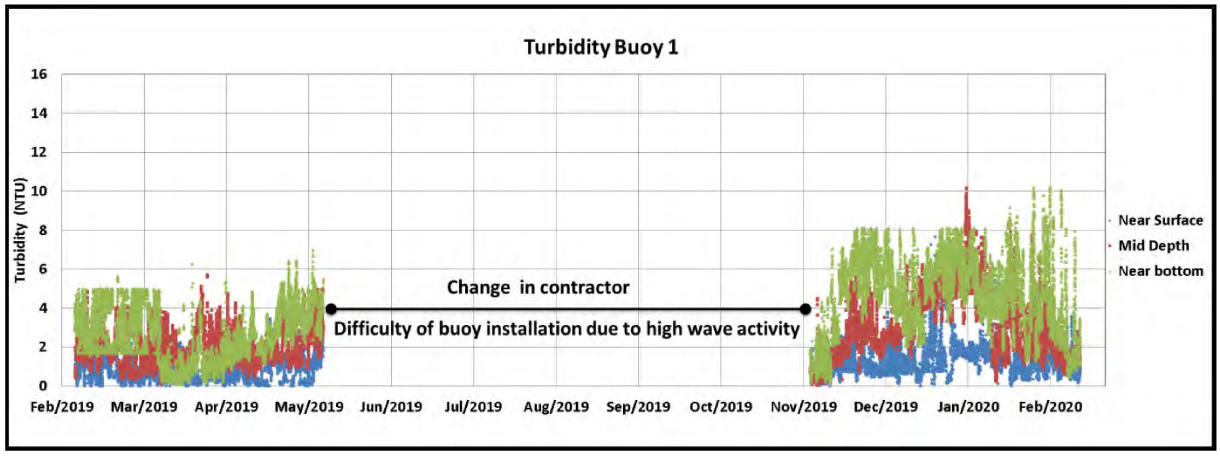


Figure 2-39 Time series plotted with the turbidity data collected from Turbidity Buoy 1

◆ Near Surface

■ Mid Depth

▲ Near bottom

Legend of turbidity buoy time series

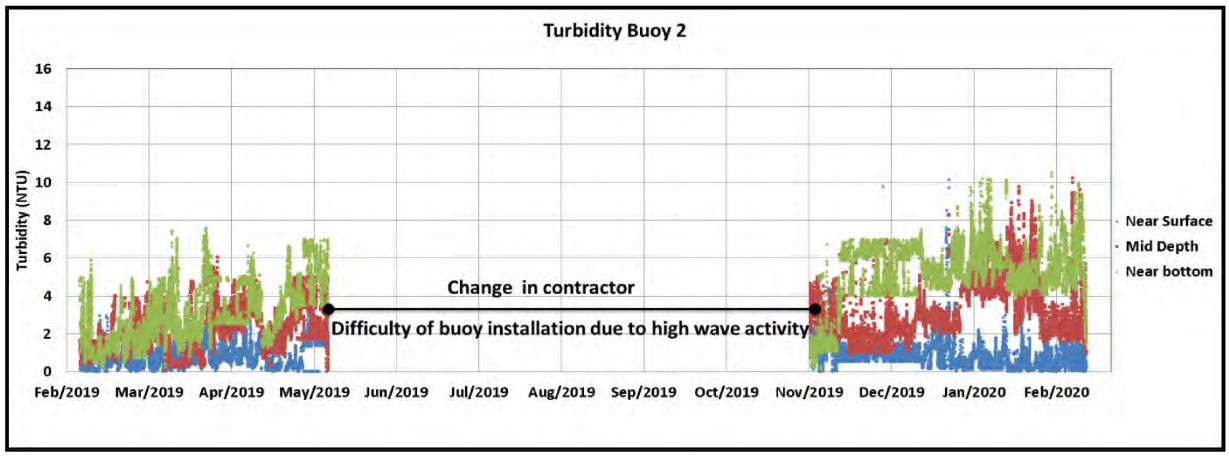


Figure 2-40 Time series plotted with the turbidity data collected from Turbidity Buoy 2

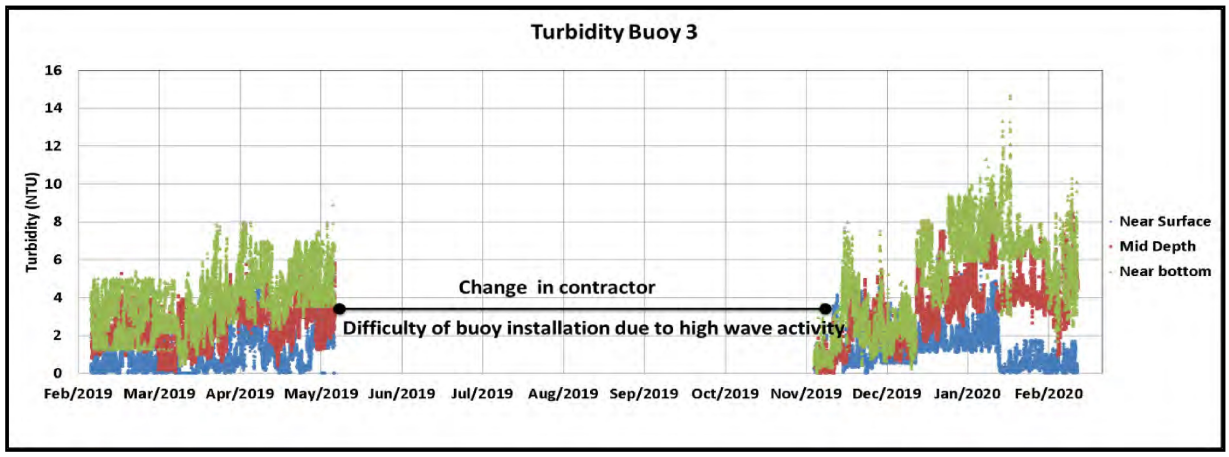


Figure 2-41 Time series plotted with the turbidity data collected from Turbidity Buoy 3

It is perceptible from time series plots that the turbidity fluctuates all year round, though the values were lower than 10 NTU for almost all the time.

2.7 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). From these survey data, the coastal zone has a steep slope until a depth of (-) 15m. Later the depth varies gradually up to deeper portion. 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 2019 and Post Monsoon 2019 are shown in Figure 2-42 and Figure 2-43.

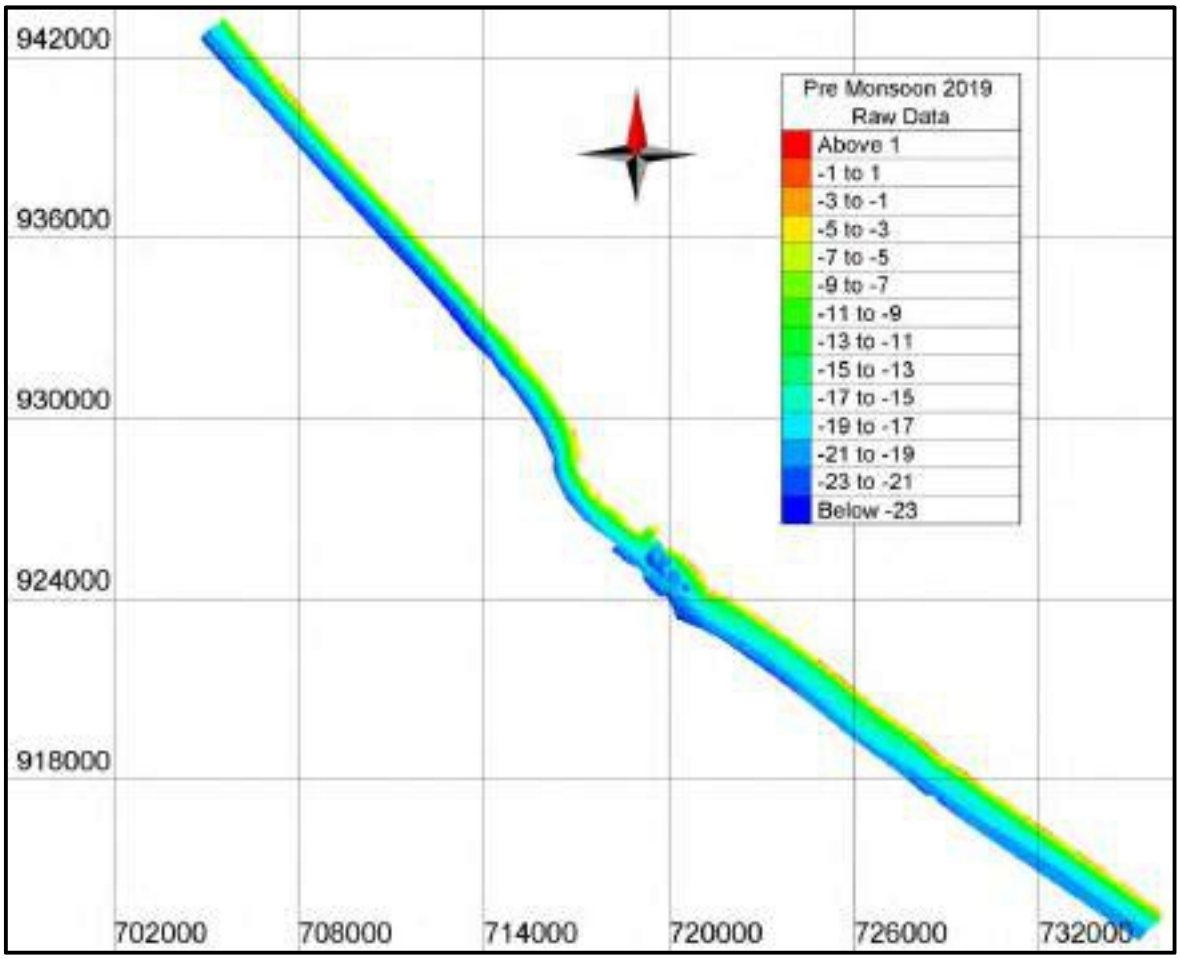


Figure 2-42 Bathymetry survey data using MBES for Pre Monsoon 2019

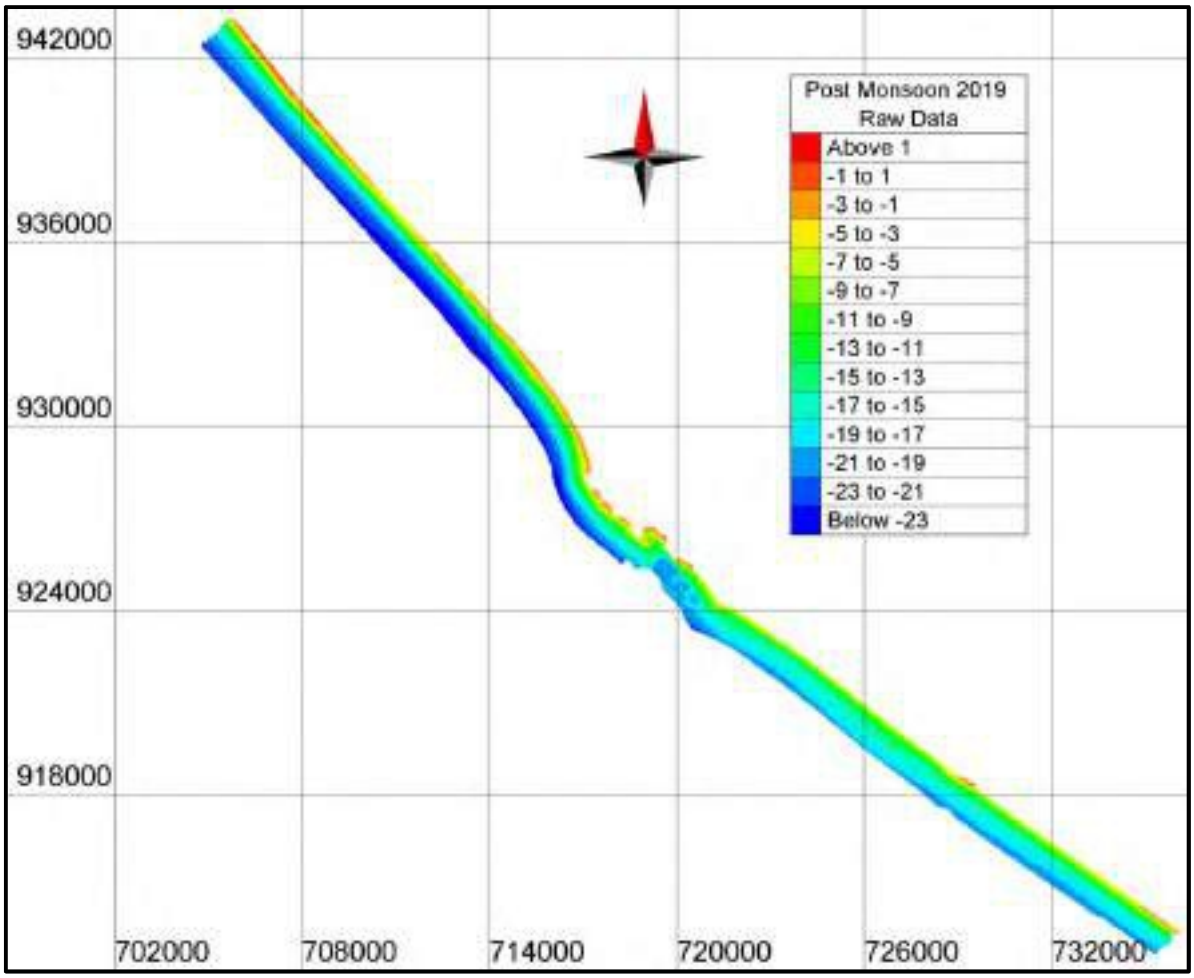


Figure 2-43 Bathymetry survey data using MBES for Post Monsoon 2019

A comparison was made between Pre Monsoon 2018 MBES data and Pre Monsoon 2019 MBES data as shown in Figure 2-44. The same comparison was done for Post monsoon 2018 and Post monsoon 2019 MBES data and shown in Figure 2-45. The comparison in bathymetry between premonsoon 2019 and postmonsoon 2019 are presented in Figure 2-46.

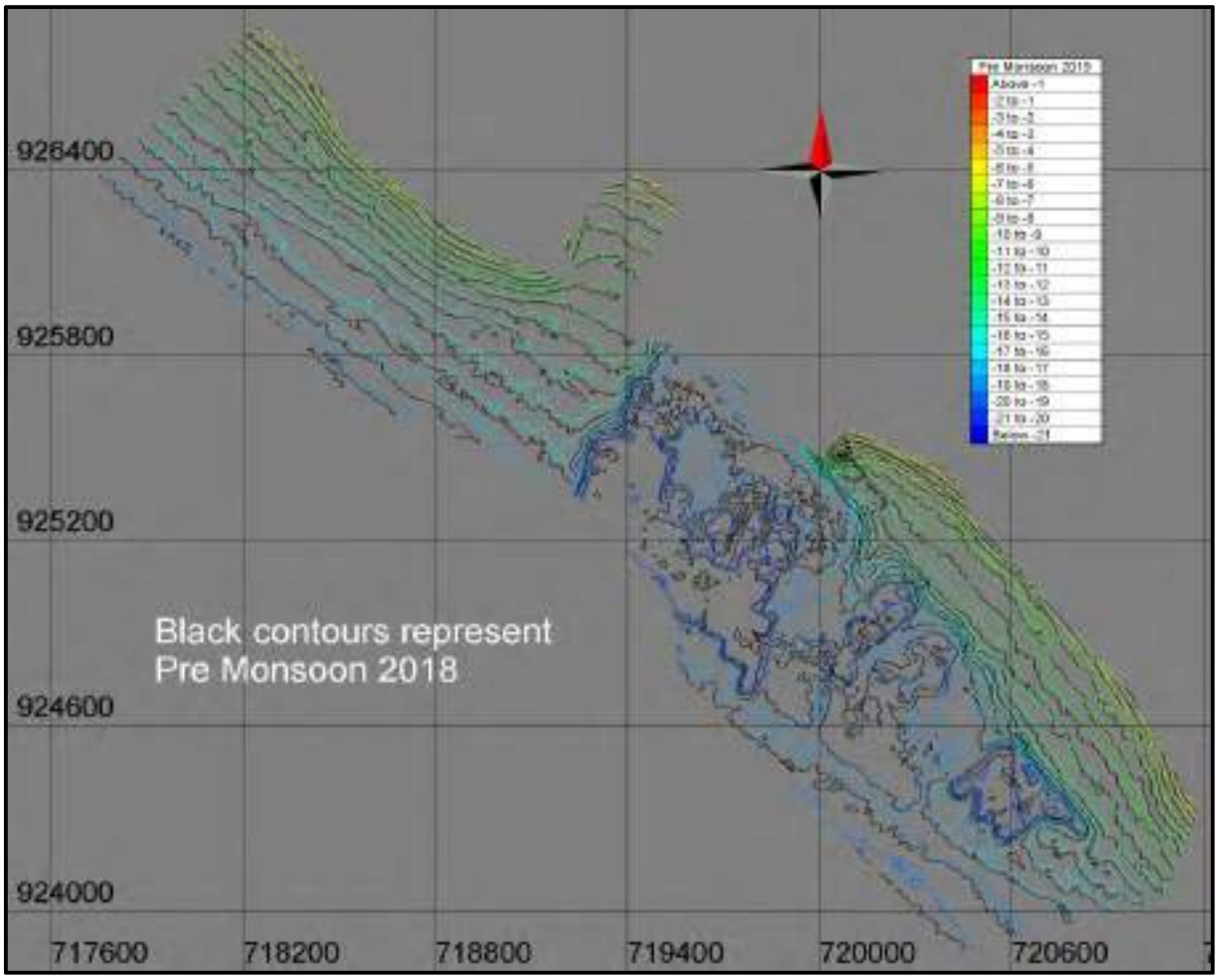


Figure 2-44 Difference in Bathymetry during Pre monsoon 2018 and 2019

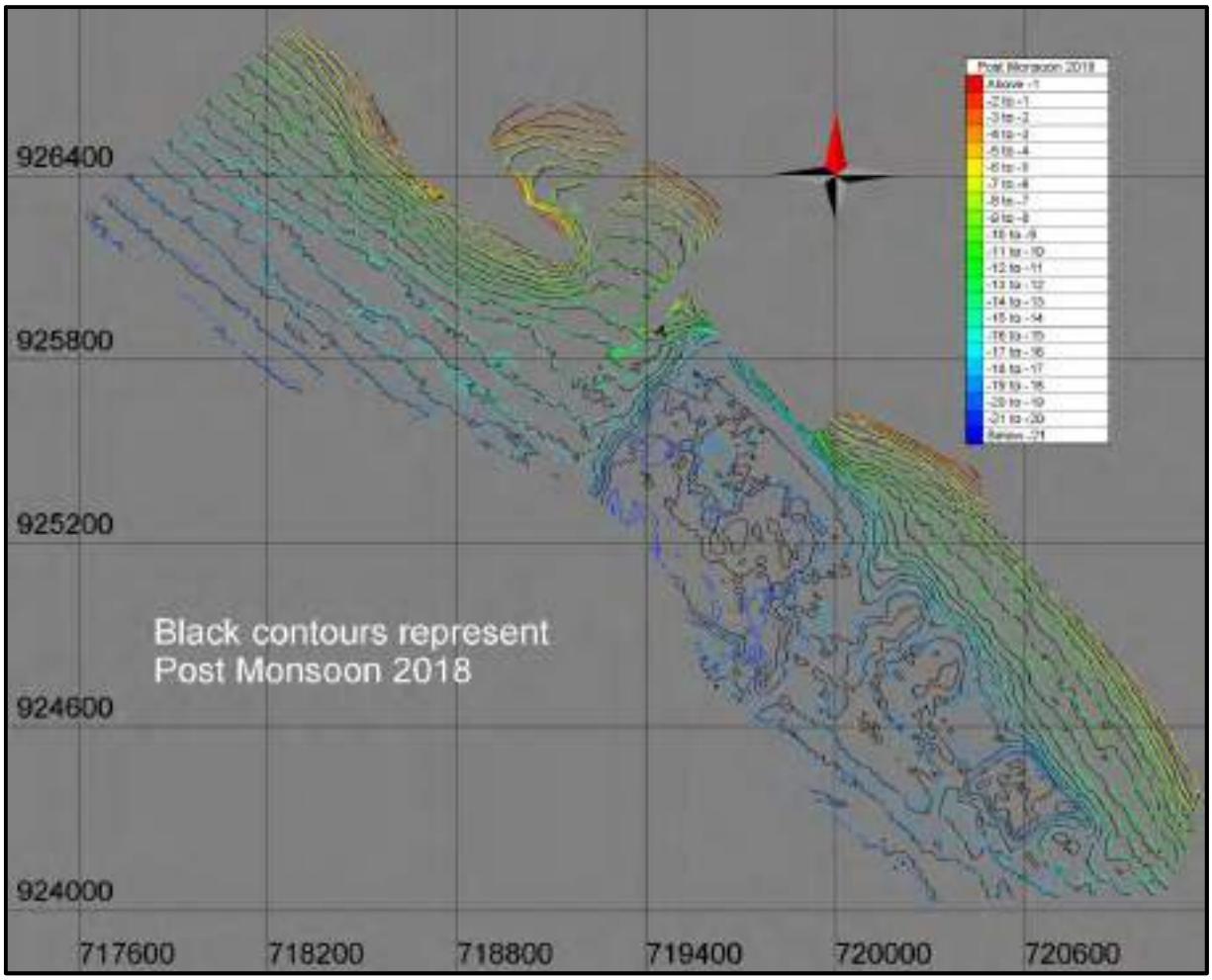


Figure 2-45 Difference in Bathymetry during Post monsoon 2018 and 2019

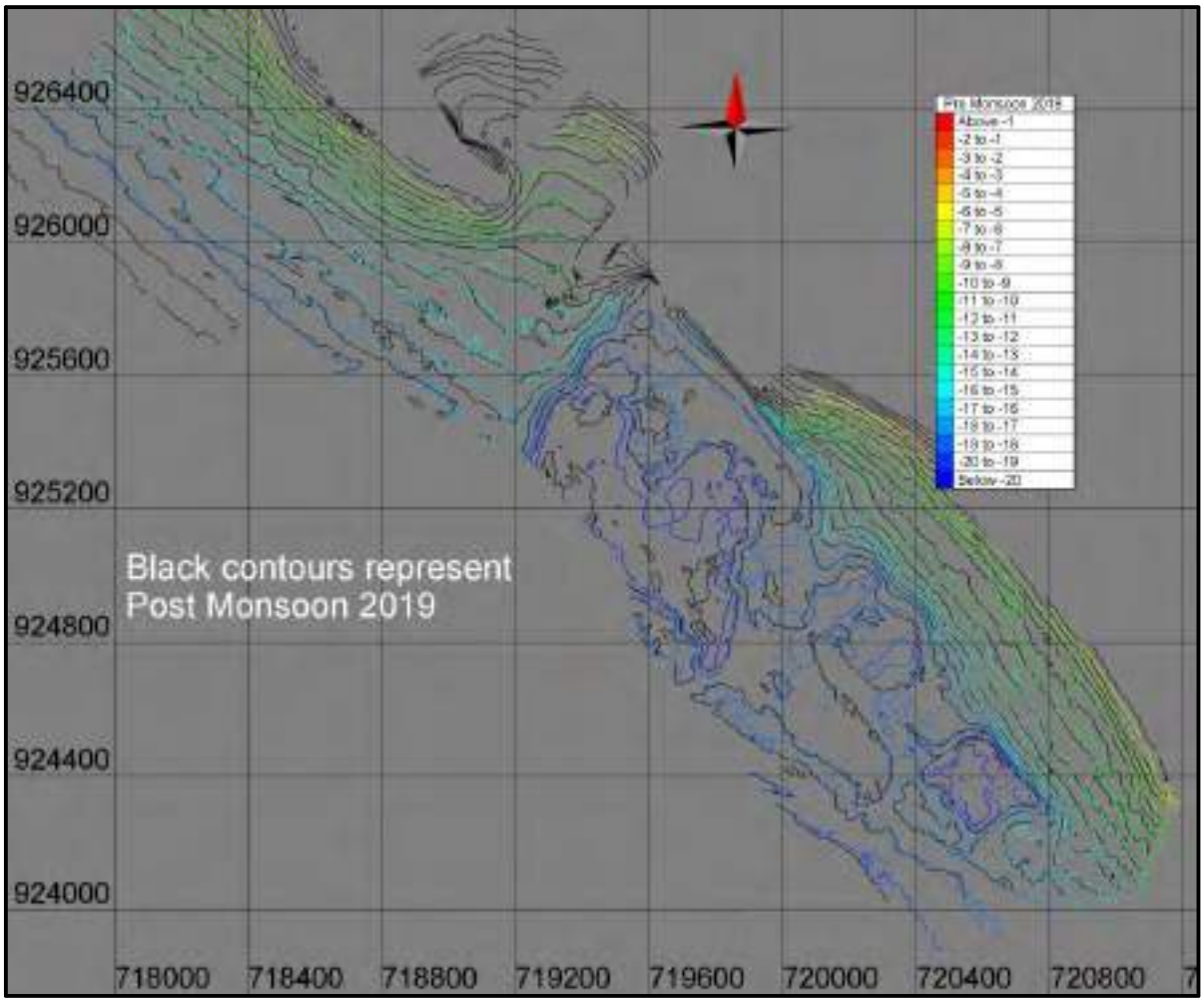


Figure 2-46 Difference in Bathymetry during Pre monsoon and Post monsoon 2019

In addition to the above mentioned analysis, five lines were selected to check the variation in bathymetry profiles for different seasons (Pre monsoon 2016, Post monsoon 2016, Pre monsoon 2017, Post monsoon 2017, Pre monsoon 2018, Post monsoon 2018, Pre monsoon 2019 and Post monsoon 2019). The locations of these sections are as shown in Figure 2-47. 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.

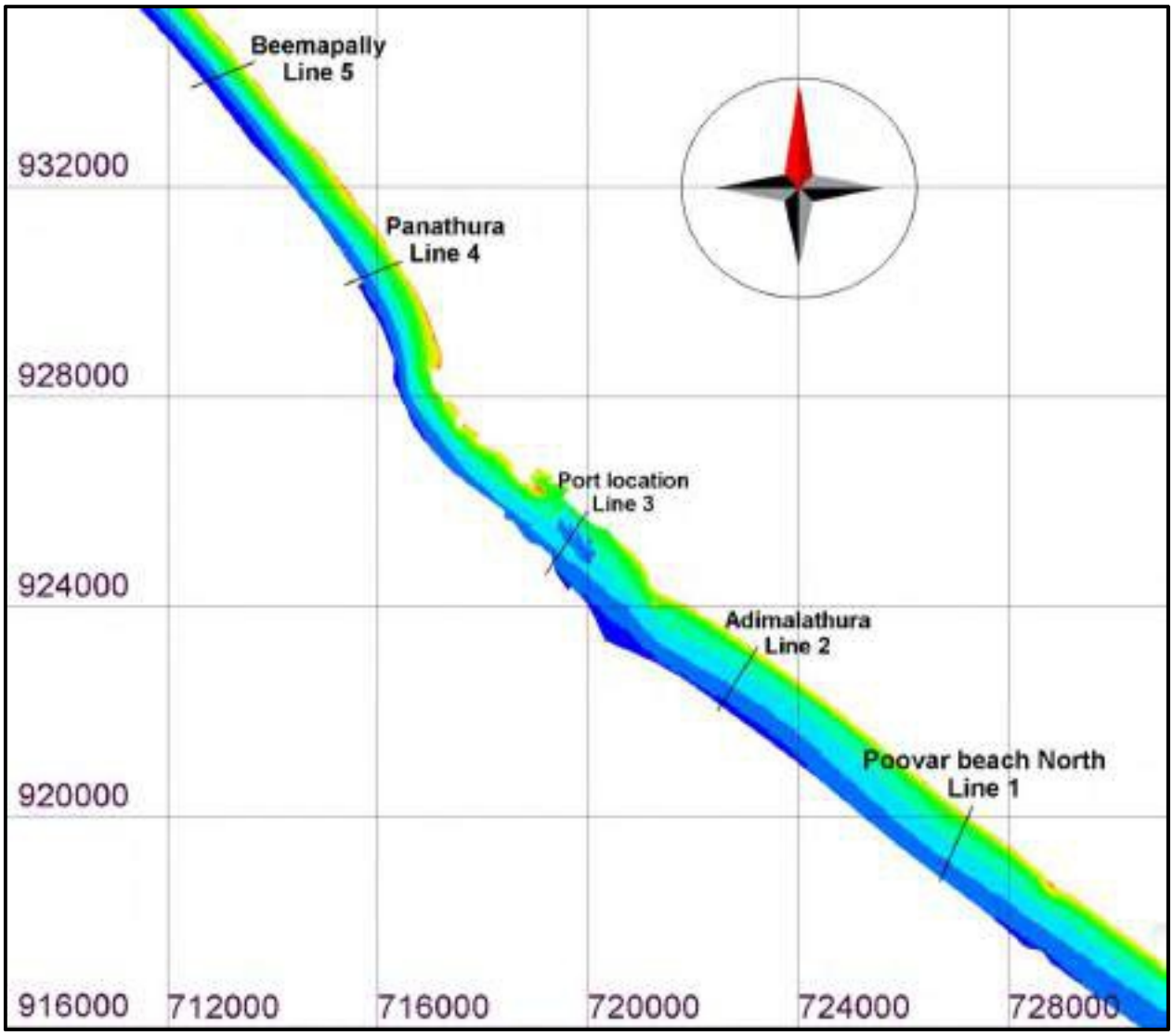


Figure 2-47 Location of the selected cross sections

Figure 2-48 to Figure 2-52 shows the comparison of Pre monsoon and Post monsoon of four years (2016, 2017, 2018 and 2019) bathymetry data along the selected sections. From these plots it was noticed that there was no change in bathymetry over past four years at lines 1, 2, 4 and 5 even though at line 3 (place where dredging was active) change was noticed. This indicates that the dredging activities in the port vicinity have minimal impact on the bathymetry elsewhere in the study region.



Legend of bathymetry comparison plots

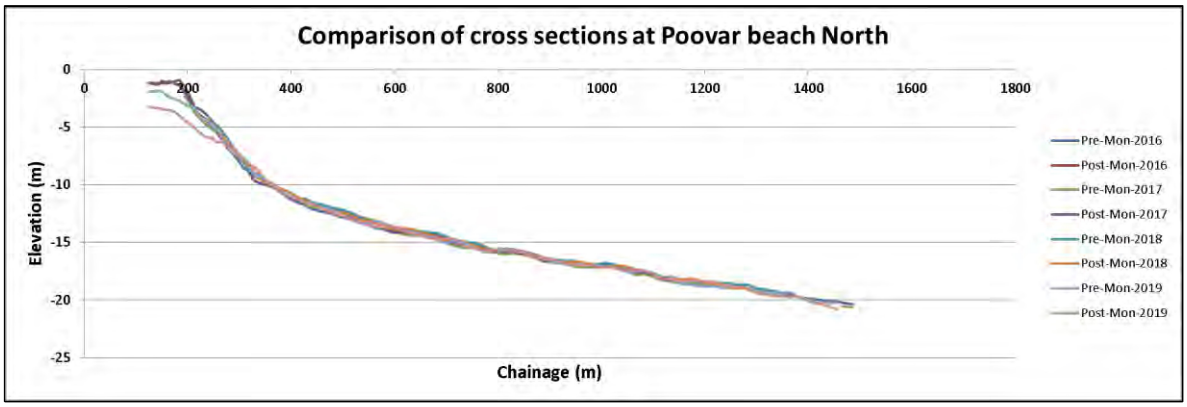


Figure 2-48 Bathymetry-Cross section comparison at Poovar beach North

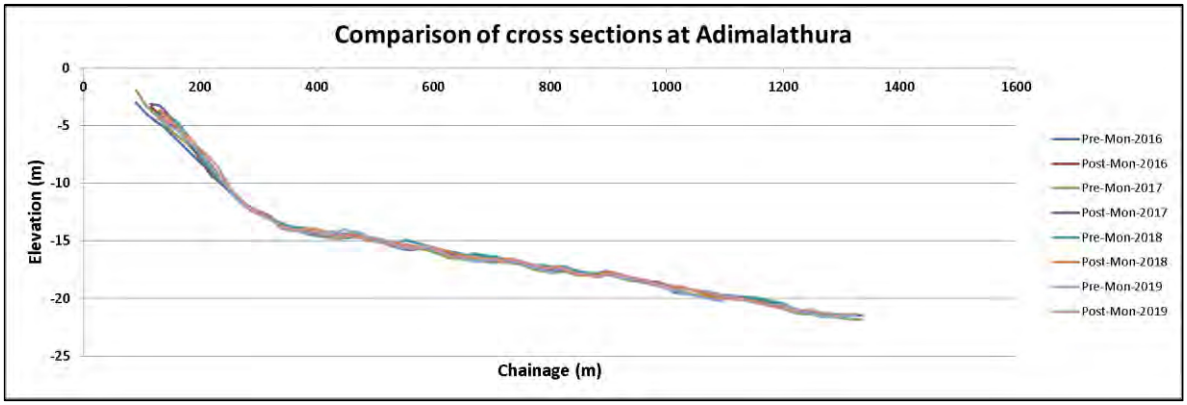


Figure 2-49 Bathymetry-Cross section comparison at Adimalathura

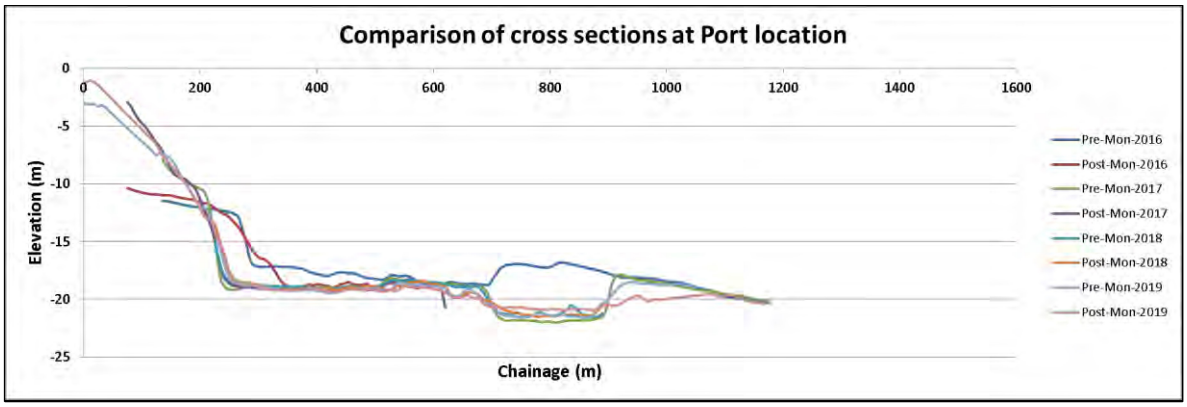


Figure 2-50 Bathymetry-Cross section comparison at Port location

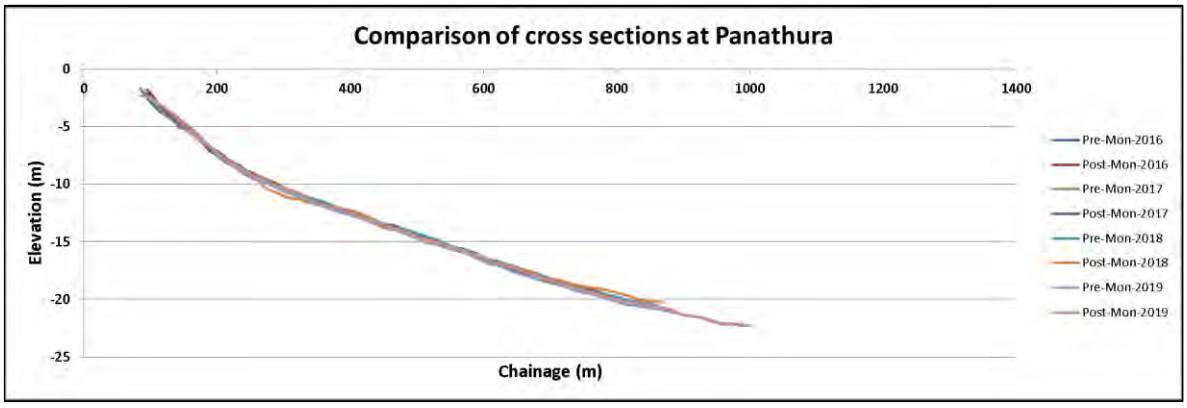


Figure 2-51 Bathymetry-Cross section comparison at Panathura

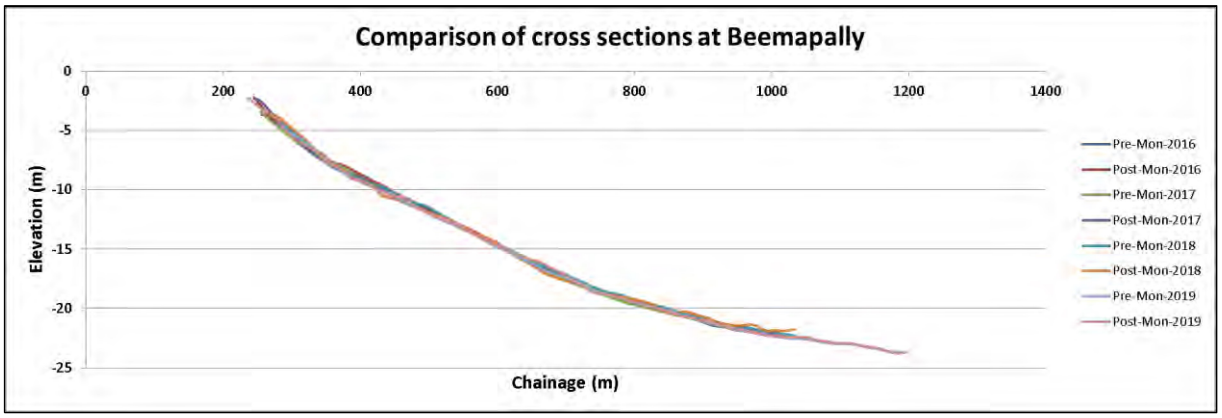


Figure 2-52 Bathymetry-Cross section comparison at Beemapally

2.8 Cross Shore Profile

Cross shore beach profiles were collected by AVPPL at 81 locations covering 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. The survey data are available from February 2015 to February 2020 for these locations. The cross shore profile locations are shown in





Figure 2-53 Cross Shore Profile Locations

AVPPL provided names of 81 locations and respective landmarks for easy identification and discussion. Table 2-4 shows landmarks and corresponding CSP numbers.

Table 2-4 CSP Location Details

CSP NO.	Land Mark	Location
CSP-01	Catholic Crismatic Prayer Center	Edappadu Beach
CSP-02		
CSP-03		
CSP-04	St.Mary's Church	Vallavilai
CSP-05		
CSP-06		
CSP-07	St.Nicolas Church	Neerody
CSP-08		
CSP-09		
CSP-10	Sree Bhadrakali Temple	Pozhiyoor
CSP-11		
CSP-12		
CSP-13	St.Mathew's Church	Paruthiyoor

CSP NO.	Land Mark	Location
CSP-14	Church Of Christ	
CSP-15	Poovar Island Resort	Poovar Beach South
CSP-16		
CSP-17		
CSP-18	Pozhikara Beach	Poovar
CSP-19		
CSP-20	St.Antony's Chapel	Poovar Beach North
CSP-21		
CSP-22	St.Antony's Church	Karumkulam
CSP-23		
CSP-24		
CSP-25		
CSP-26		
CSP-27	Gothambu Road	Pulluvila
CSP-28		
CSP-29		
CSP-30		
CSP-31	Adimalathura Catholic Church	Adimalathura
CSP-32		
CSP-33		
CSP-34		
CSP-35	Azhimala Temple	Azhimala
CSP-36	Nagar Bhagavathy Temple	Mullur
CSP-37		
CSP-38	Adani Reclamation Area	Adani Port Office Vizhinjam
CSP-39		
CSP-40		
CSP-41	Vizhinjam Light House	Kovalam
CSP-42		
CSP-43		
CSP-44		
CSP-45		
CSP-46		
CSP-47	Samudra Beach Park	Kovalam
CSP-48	Mosque	Panathura
CSP-49		
CSP-50	Panathura Temple	Panathura
CSP-51		
CSP-52		
CSP-53	Punthura Fish Market	Punthura
CSP-54		
CSP-55		
CSP-56		
CSP-57		

CSP NO.	Land Mark	Location
CSP-58	Beemapally	Beemapally
CSP-59		
CSP-60		
CSP-61	Cheriyathura Sports Ground	Cheriyathura
CSP-62		
CSP-63	Valiyathura Bridge	Valiyathura
CSP-64		
CSP-65		
CSP-66		
CSP-67		
CSP-68	Shangumugham Beach	Shangumugham
CSP-69		
CSP-70	St.Peters Church	Shangumugham
CSP-71		
CSP-72	Vettucaud Church	Vettucaud
CSP-73		
CSP-74		
CSP-75	Veli Childrens Park	Kochuveli
CSP-76		
CSP-77		
CSP-78	St.Thomas Church	Valiya Veli
CSP-79		
CSP-80	Christian Brotheren Church	Thumba
CSP-81		

2.8.1 Survey Methodology

The survey area was divided into land side and sea side. On the land side, the survey has been 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 has been carried out using Multi Beam Echo Sounder (MBES) up to a depth of 10m till August 2018 and later on survey has been conducted up to a depth of 20m till April 2019 as per the guideline of shoreline committee. In further shoreline committee meeting Dt: 13-03-2019: “Only 4 CSP lines 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 were to be carried up to a depth of 10 m only”. Accordingly, AVPPL selected two lines (CSP 2 & CSP 35) to south of the port and two lines (CSP 64 & CSP 74) to north of the port.

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 at foreshore zone (as shown in Figure 2-54) due to inaccessible depths and rough weather condition during survey period. Data were not available from June 2019 to August 2019.

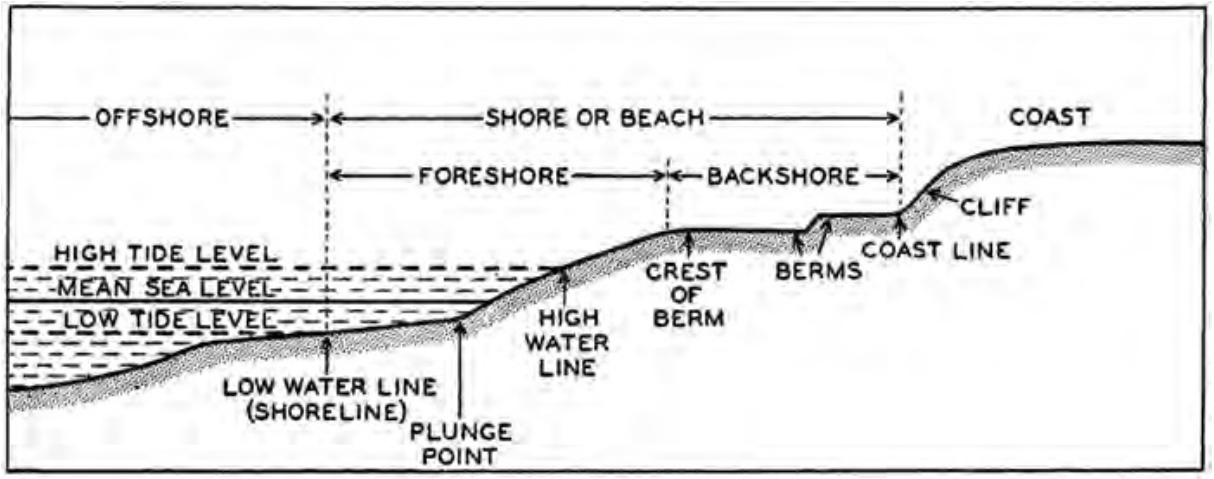


Figure 2-54 Beach profile terminology

2.8.2 Analysis of beach profiles

The data received by LNTIEL was analysed by plotting each of the profiles from March 2019 to February 2020. The aim of this comprehensive exercise was to check the data quality and to compare profiles with surveyed data from different locations which may help in grouping and for different seasons to visualise erosion or accretion. The assessment of the profiles before 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.

As a preliminary step, 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. The monthly profiles of particular season 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 2017 to March 2018, the seasons will be as follows:

Pre-Monsoon 2017 – April 2017 to May 2017

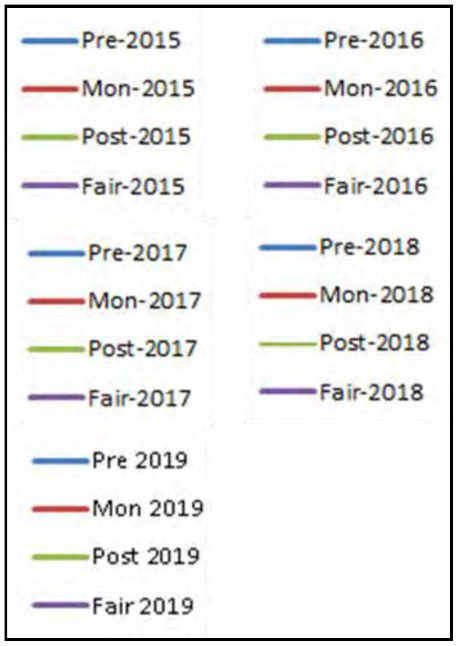
Monsoon 2017 – June 2017 to September 2017

Post-Monsoon 2017 – October 2017 to November 2017

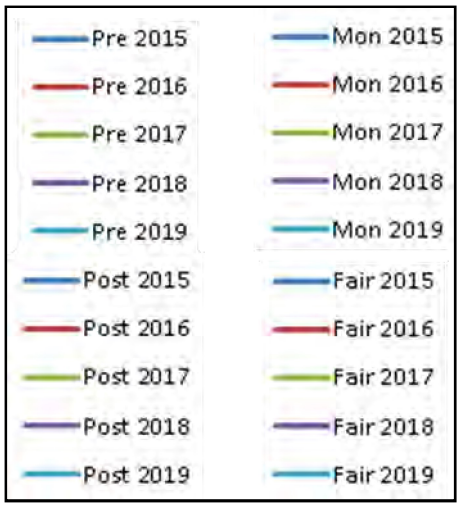
Fair Weather 2017 – December 2017 to March 2018

The main focus was on seasonal variations by comparing different seasons of each year (seasonal comparison) and different years of same season (yearly comparison) at particular location. As there were large numbers of cross shore profiles over a stretch of 40km it was not an easy task to group similar sections into one category. However, LNTIEL observed similar trends for some of the cross sections and opted one cross section from each group and reported. By this way, LNTIEL selected three sections on South of Port (CS-07 – Neerody, CS-12 – Pozhiyoor and CS-26 – Karumkulam) and three sections on North of Port (CS-49 – Panathura, CS-58 – Beemapally and CS-74 – Vettucaud) and shown the comparison in Figure 2-55 to Figure 2-93. In Figure 2-55, Abscissa represents the distance in meter from an arbitrary point which will be same for all profiles at one cross section, Ordinate represents elevation in meter and legend is self-explanatory. First chart shows comparison of profiles of different seasons of a particular year (Seasonal charts) and second chart shows comparison of profiles of different years of a particular season (Yearly charts).

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



Legend of seasonal charts



Legend of yearly charts

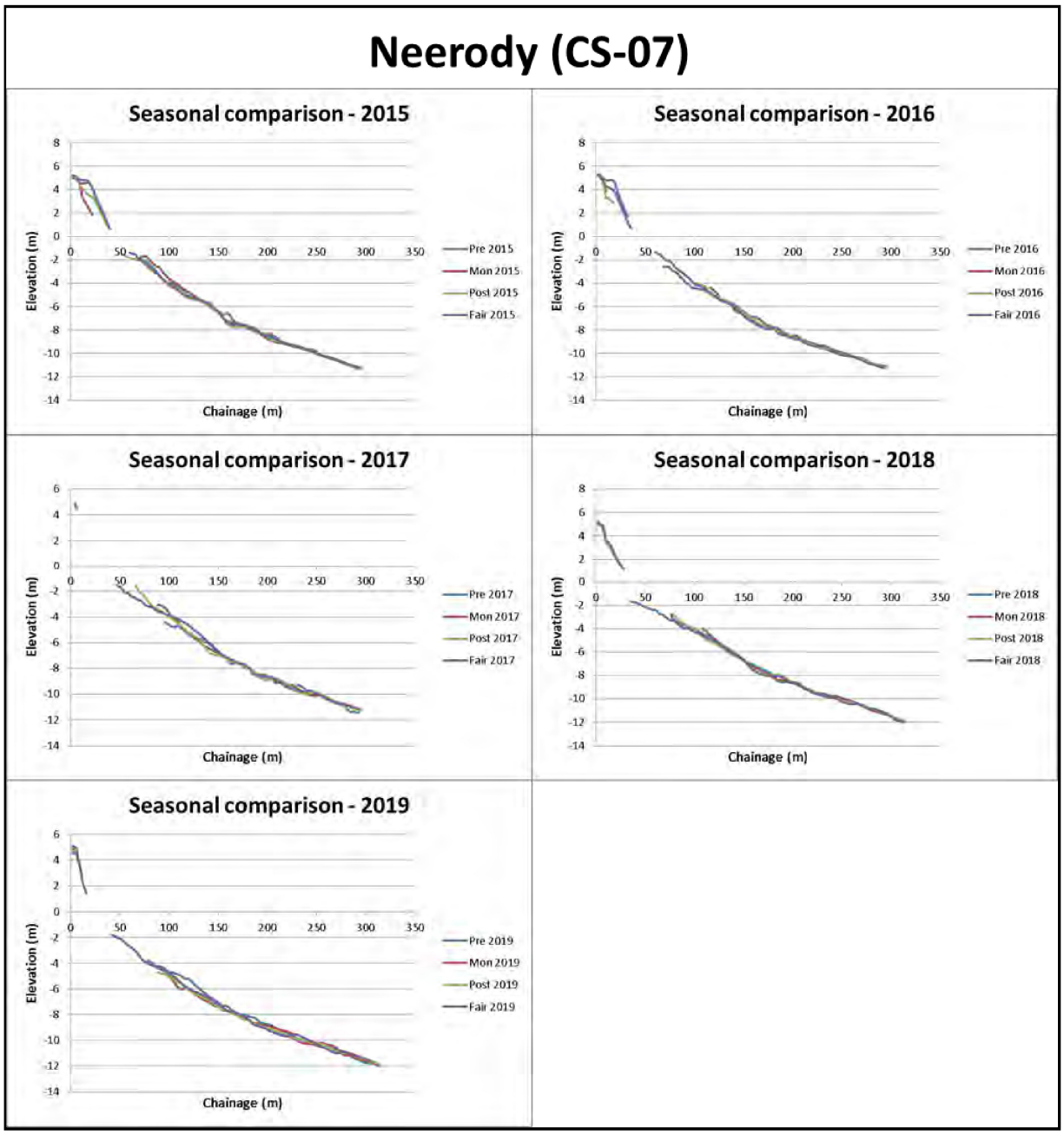


Figure 2-55 Profiles at Neerody (CS 07) – Seasonal comparison

Coastal protection structure known as seawall was present in the stretch of CS 3 to CS 9. Among these sections, CS 7 which is at Neerody location in Tamil Nadu state was chosen to illustrate the seasonal trends over five years. In this stretch, some construction activities (groins) were noticed during fair weather season of 2019. From Figure 2-55, it can be noticed that the seasonal variations are very minimal. However, accretion was observed in foreshore zone during Ockhi (December 2017).

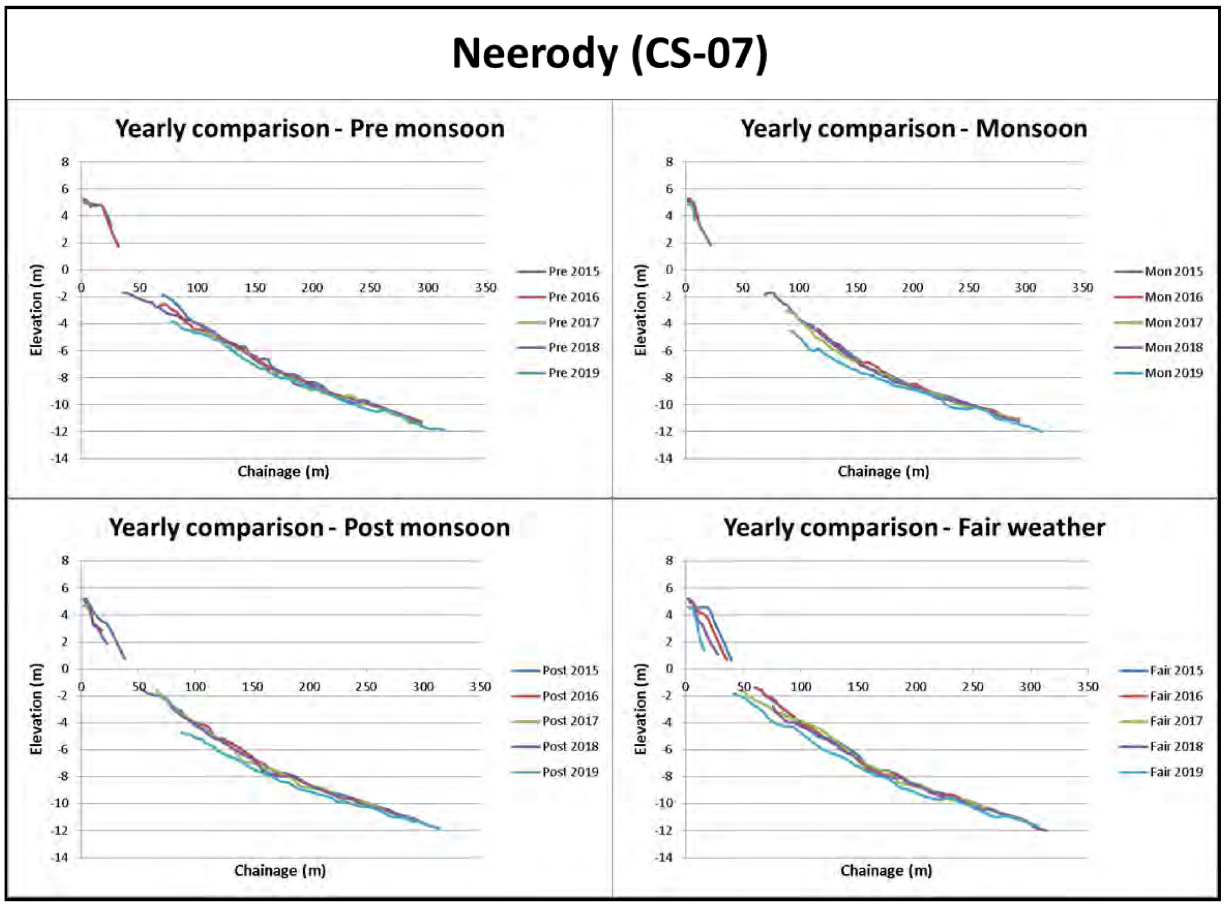


Figure 2-56 Profiles at Neerody (CS 07) – Yearly comparison

LNTIEL extracted -3m, -4m, -6m, and -8m contours from cross shore profile data at Neerody and below plots are time series of respective contours over five year data at CS 07 with similar time scale and shows the seasonal variations of erosion and accretion.

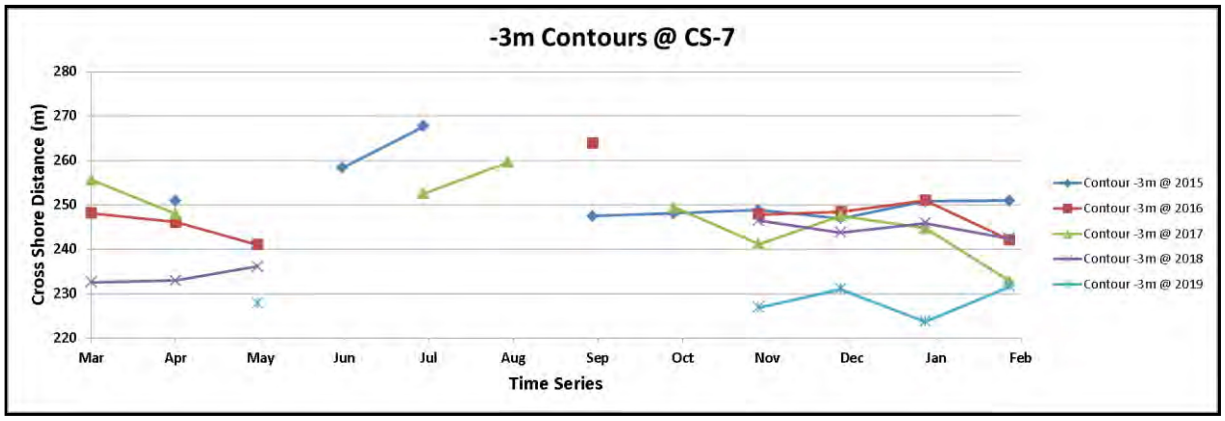


Figure 2-57 Time series of (–) 3 m contour at Neerody (CS 07)

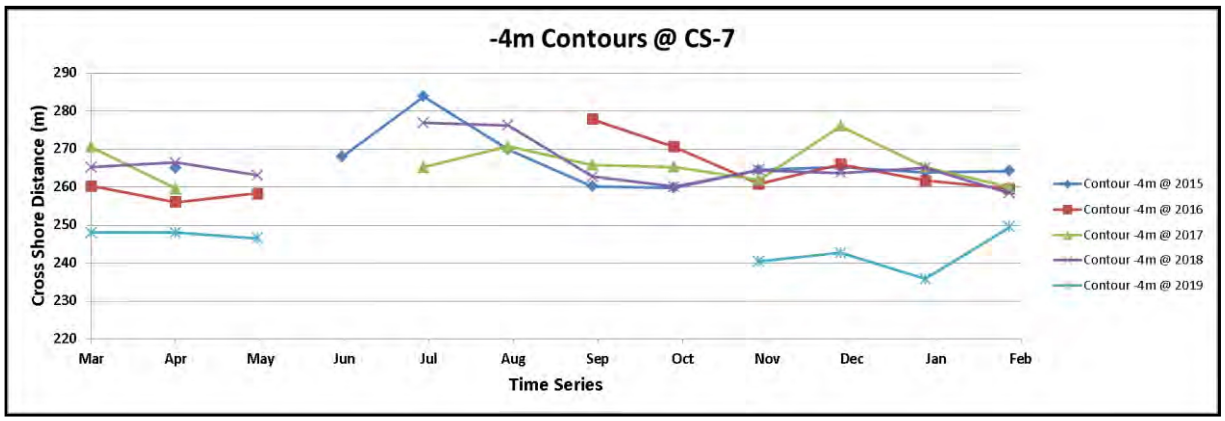


Figure 2-58 Time series of (–) 4 m contour at Neerody (CS 07)

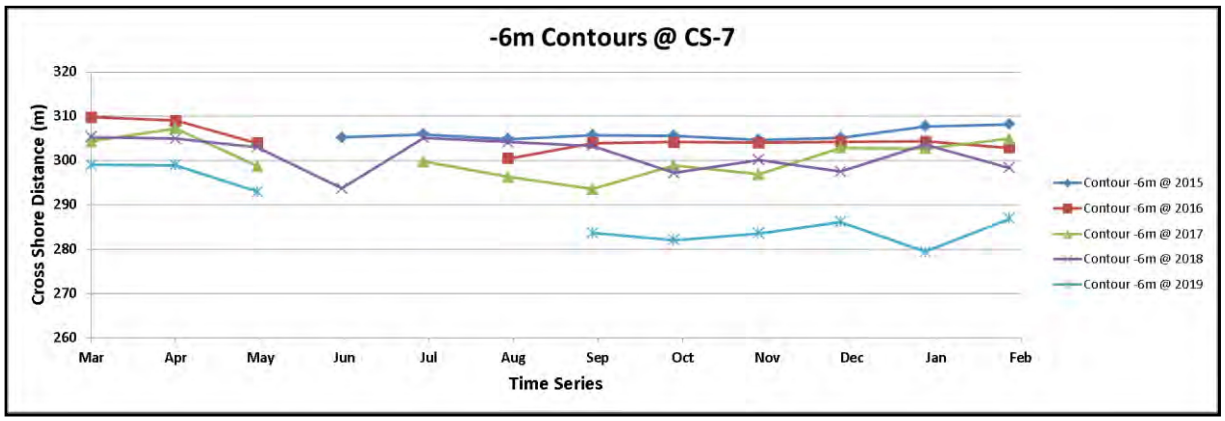


Figure 2-59 Time series of (–) 6 m contour at Neerody (CS 07)

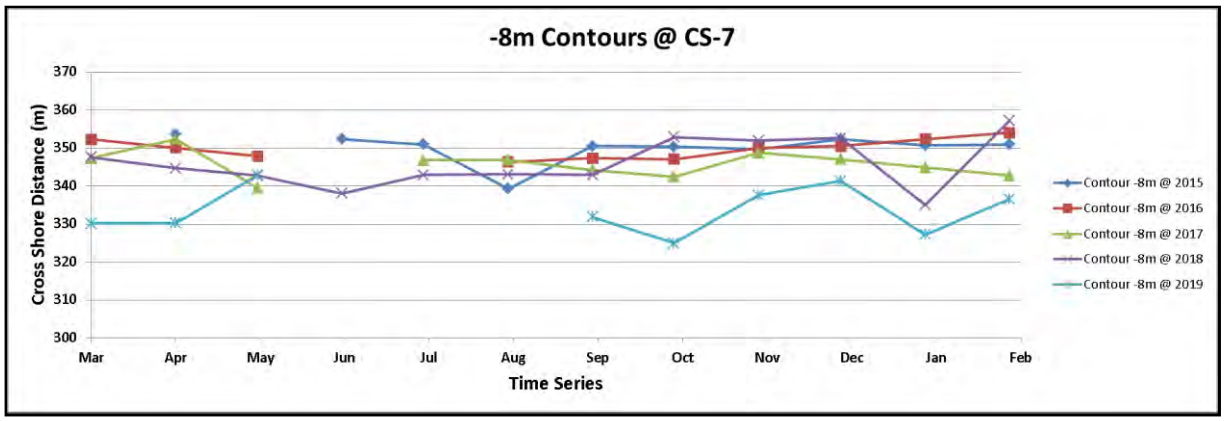


Figure 2-60 Time series of (–) 8 m contour at Neerody (CS 07)

In addition to above, the +2m, -3m, -5m and -8m contours continuous variation of contour distances over the year is provided for better clarity as shown in Figure 2-61.

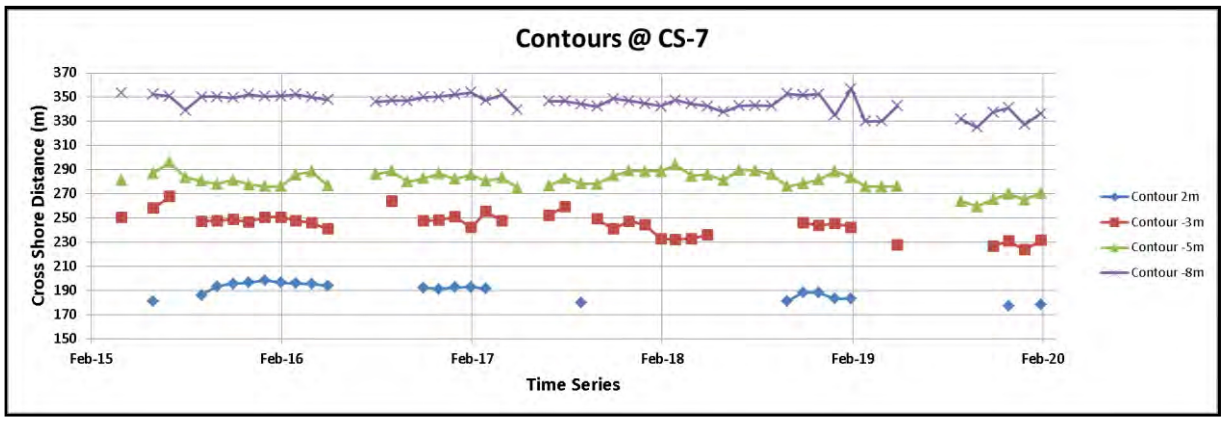


Figure 2-61 Time series of contours at Neerody (CS 07)

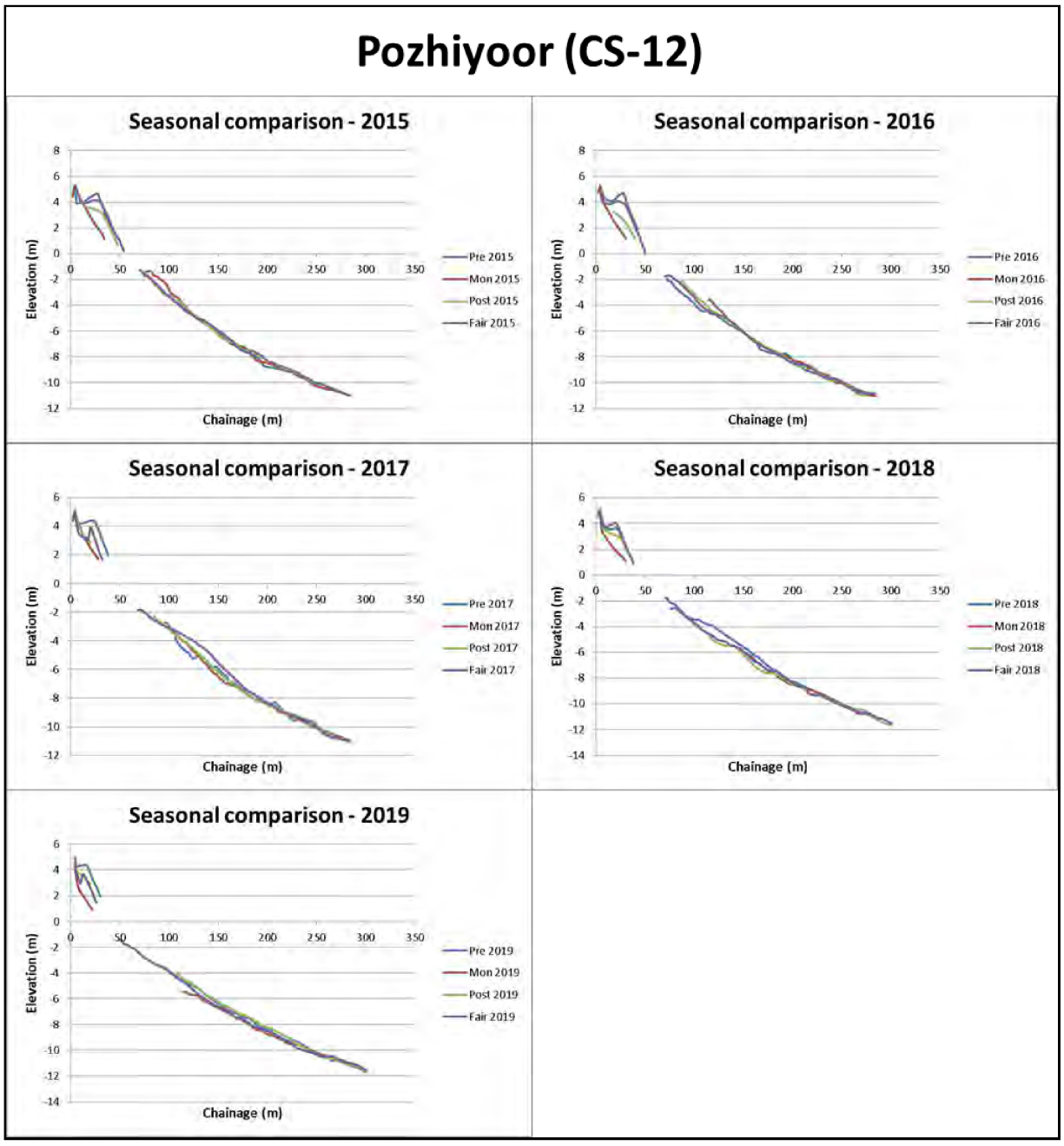


Figure 2-62 Profiles at Pozhiyoor (CS 12) – Seasonal comparison

Beach was present throughout the year in the stretch of CS 10 to CS 14. Among these sections, CS 12 which is at Pozhiyoor location in Kerala state was chosen to illustrate the seasonal trends over five years. From Figure 2-62, it can be noticed that the coast undergoes seasonal variations during 2015 to 2019. Beach was noticed during pre-monsoon seasons. Later on beach got eroded and deposited in offshore region at the time of monsoon seasons. Beach gradually developed during post monsoon seasons and remained stable during 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.

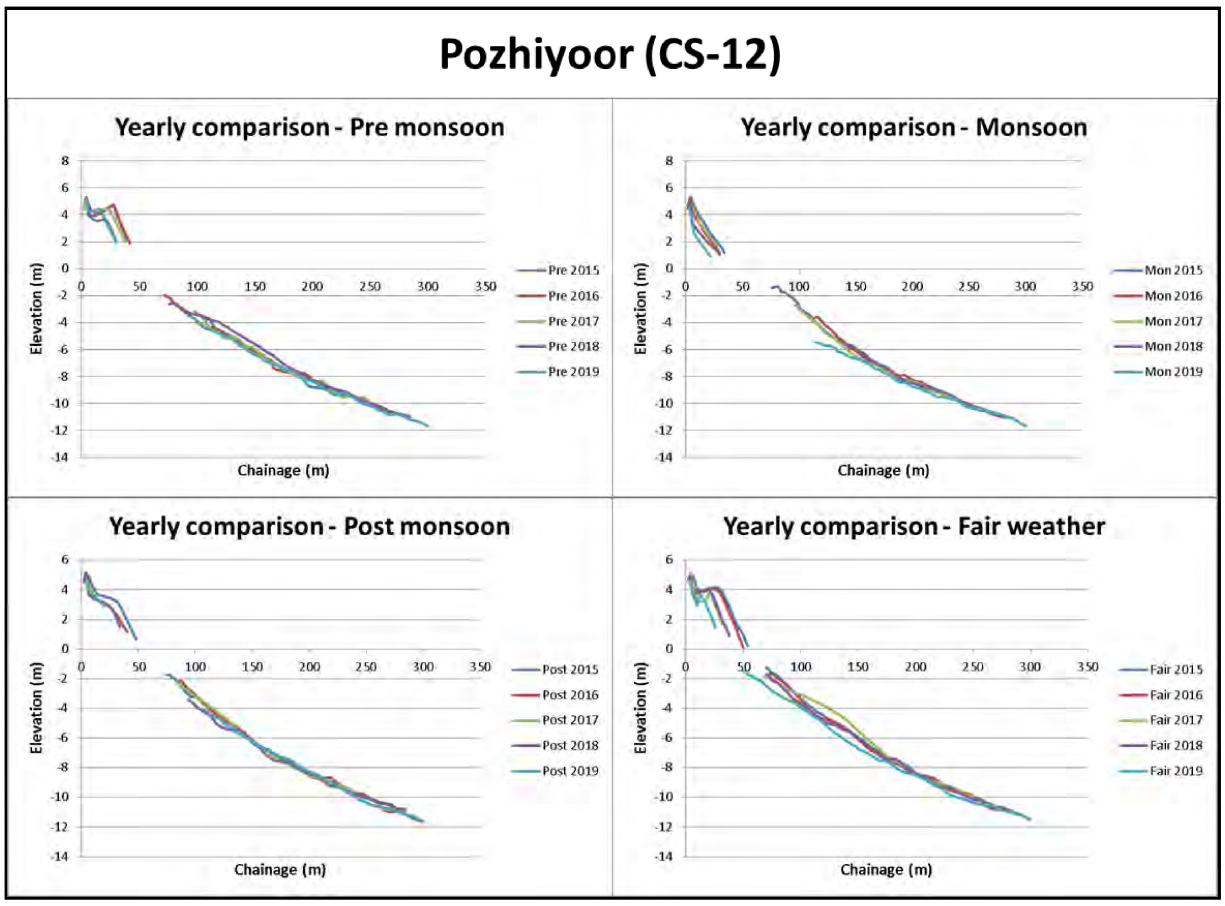


Figure 2-63 Profiles at Pozhiyoor (CS 12) – Yearly comparison

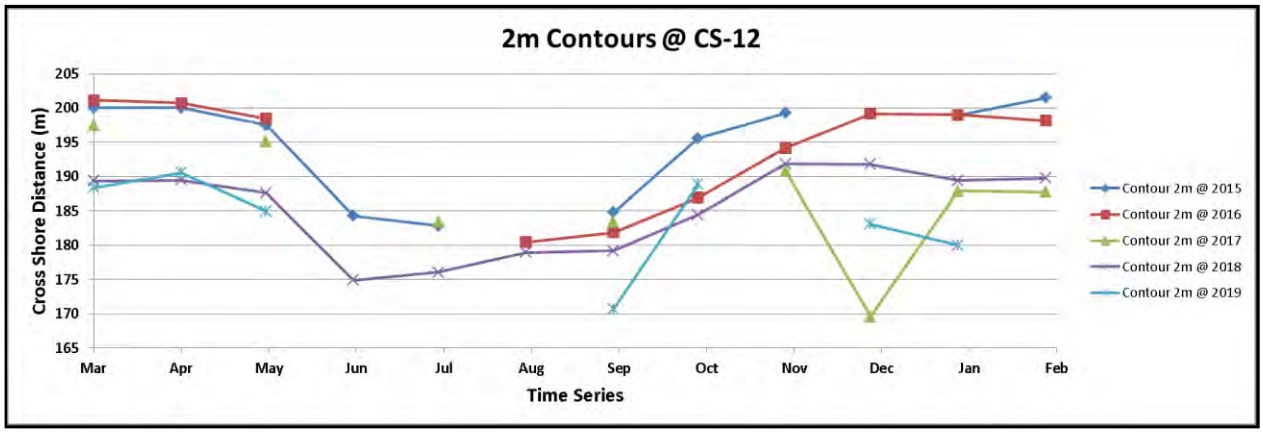
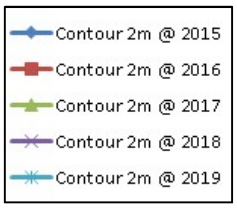


Figure 2-64 Time series of (+) 2 m contour at Pozhiyoor (CS 12)

Further LNTIEL extracted (+) 2 m contour from cross shore profile data at Pozhiyoor. The above plot is time series of (+) 2 m contour over five year data at CS 12 with similar time scale. 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 minimal accretion was noticed during fair weather 2017 and pre-monsoon 2018. In addition, as a result of monsoon 2018 and 2019 the beach got further eroded compared to previous monsoon seasons. The recent storms are proving to be further detrimental to the beach accretion.



Legend of time series of (+) 2 m contour

LNTIEL extracted -3m, -4m, -6m and -8m contours from cross shore profile data at Pozhiyoor and below plots are time series of respective contours over five year data at CS 12 with similar time scale and shows the seasonal variations of erosion and accretion.

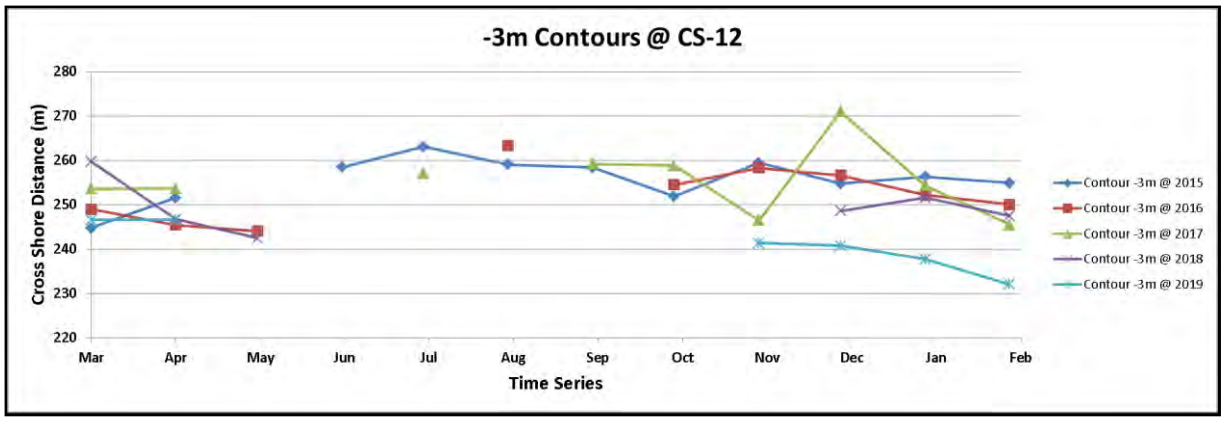


Figure 2-65 Time series of (–) 3 m contour at Pozhiyoor (CS 12)

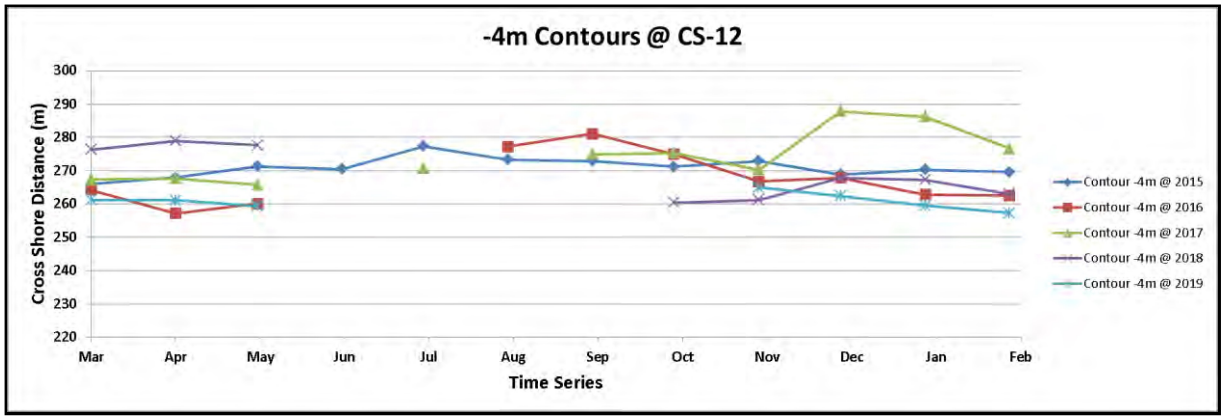


Figure 2-66 Time series of (–) 4 m contour at Pozhiyoor (CS 12)

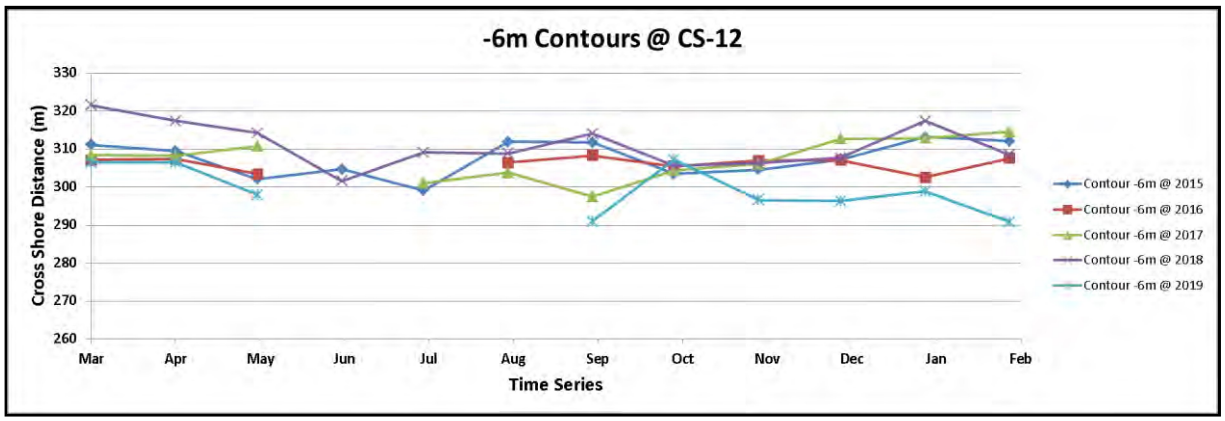


Figure 2-67 Time series of (–) 6 m contour at Pozhiyoor (CS 12)

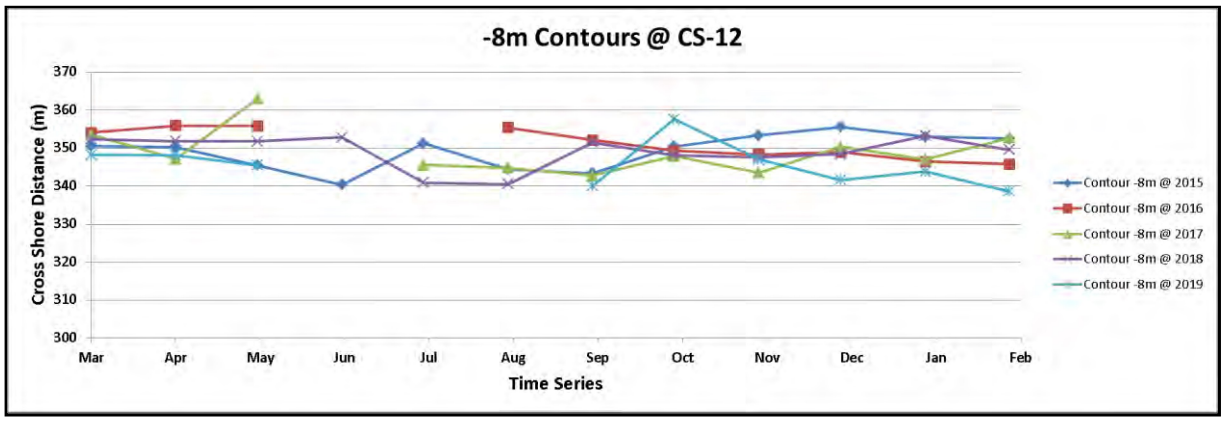


Figure 2-68 Time series of (–) 8 m contour at Pozhiyoor (CS 12)

In addition to above, the +2m, -3m, -5m and -8m contours continuous variation of contour distances over the year is provided for better clarity as shown in Figure 2-69.

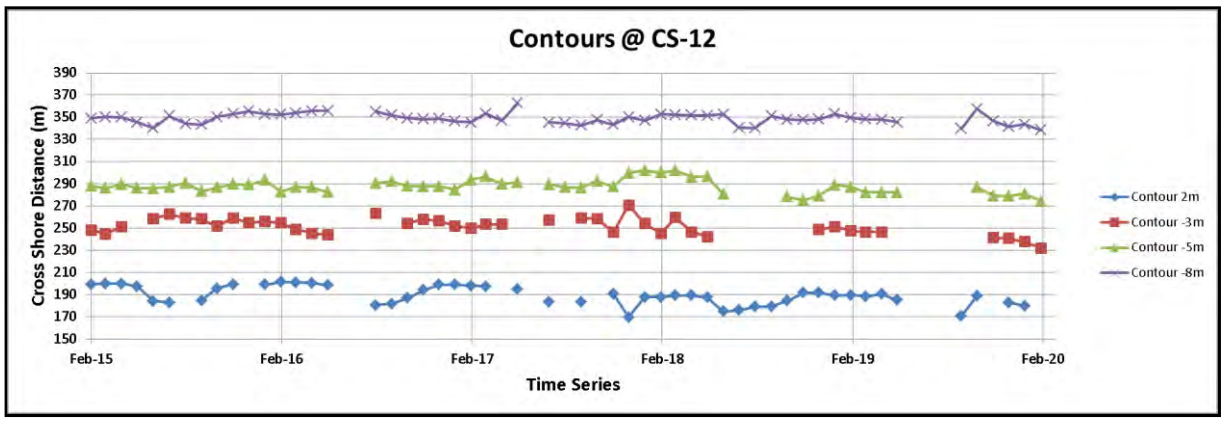


Figure 2-69 Time series of contours at Pozhiyoor (CS 12)

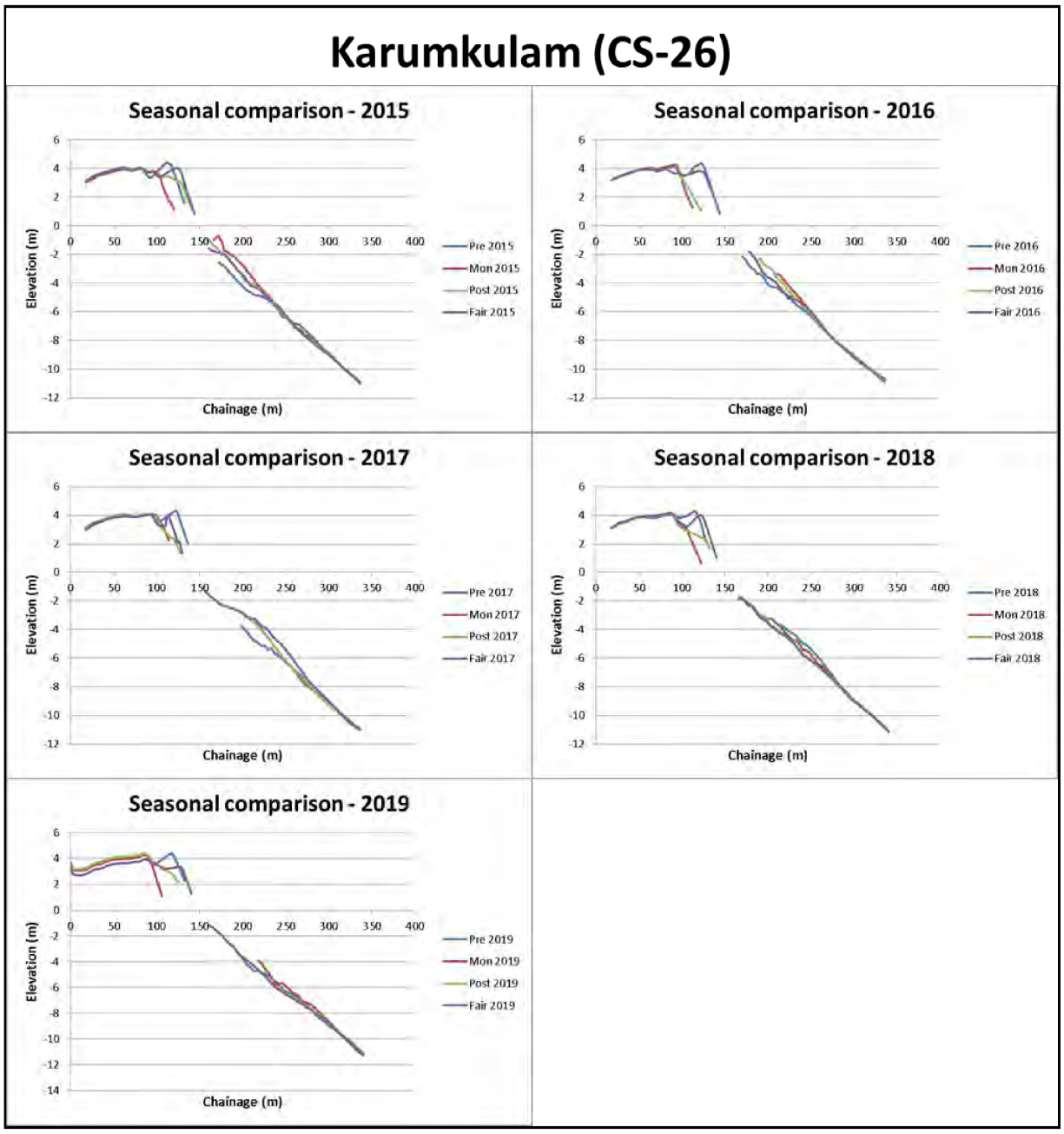


Figure 2-70 Profiles at Karumkulam (CS 26) – Seasonal comparison

Beach was present throughout the year in the stretch of CS 18 to CS 34. Among these sections, CS 26 which is at Karumkulam location in Thiruvananthapuram district of Kerala state was chosen to illustrate the seasonal trends over five years. From Figure 2-70, it can be noticed that the coast undergoes seasonal variations during 2015 to 2019. Beach was noticed during pre-monsoon seasons. Later on beach got eroded and deposited in offshore region at the time of monsoon seasons. Beach gradually developed during post monsoon seasons and remained stable during 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.

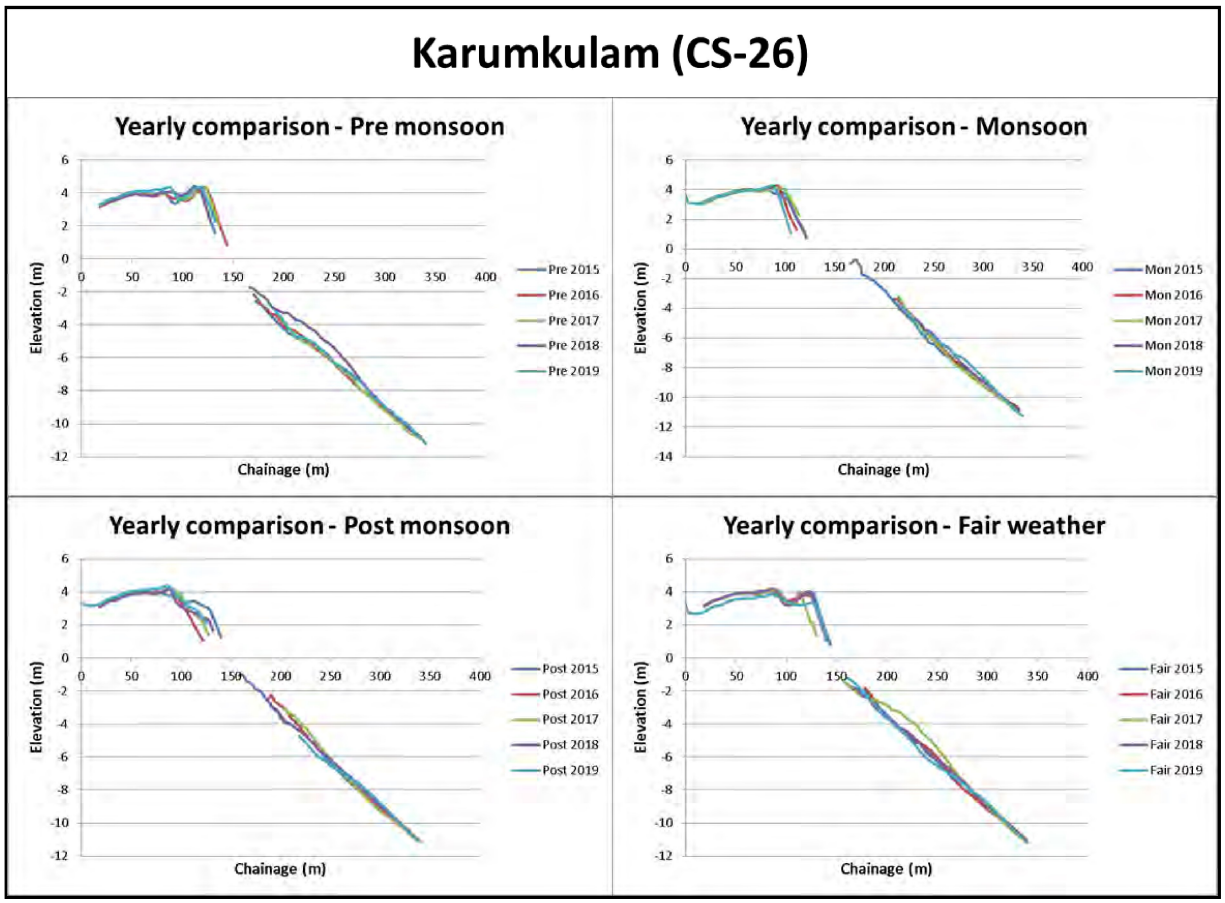


Figure 2-71 Profiles at Karumkulam (CS 26) – Yearly comparison

The plots represent comparison of profiles of particular 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 was undergoing processes to recover from this impact which can be observed from fair weather seasons comparison plot.

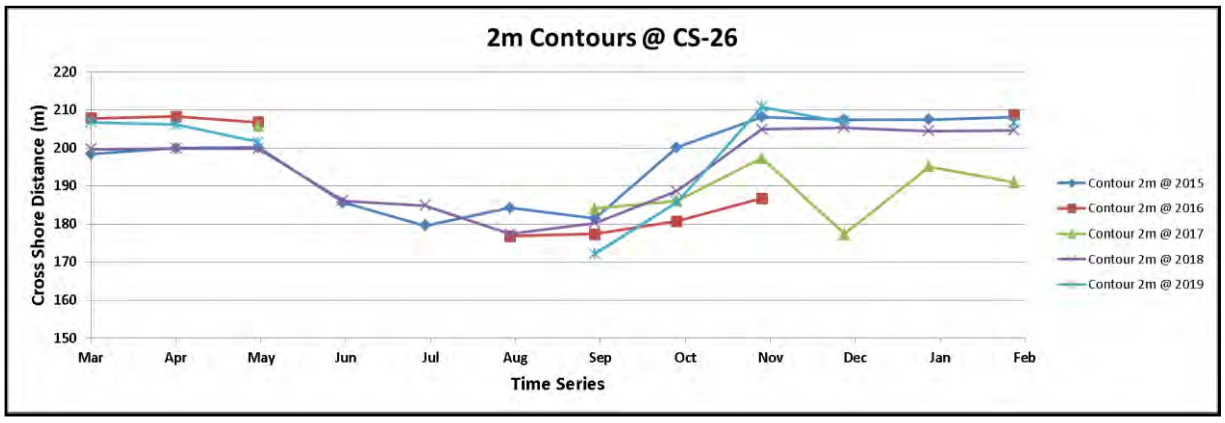


Figure 2-72 Time series of (+) 2 m contour at Karumkulam (CS 26)

Further LNTIEL extracted (+) 2 m contour from cross shore profile data at Karumkulam. The above plot is time series of (+) 2 m contour over five year data at CS 26 with similar time scale. 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 minimal accretion was noticed during fair weather 2017 and pre-monsoon 2018. In addition, as a result of monsoon 2018 and 2019 the beach got further

eroded compared to previous monsoon seasons. The recent storms are proving to be further detrimental to the beach accretion.

LNTIEL extracted -3m, -4m, -6m and -8m contours from cross shore profile data at Karumkulam and below plots are time series of respective contours over five year data at CS 26 with similar time scale and shows the seasonal variations of erosion and accretion.

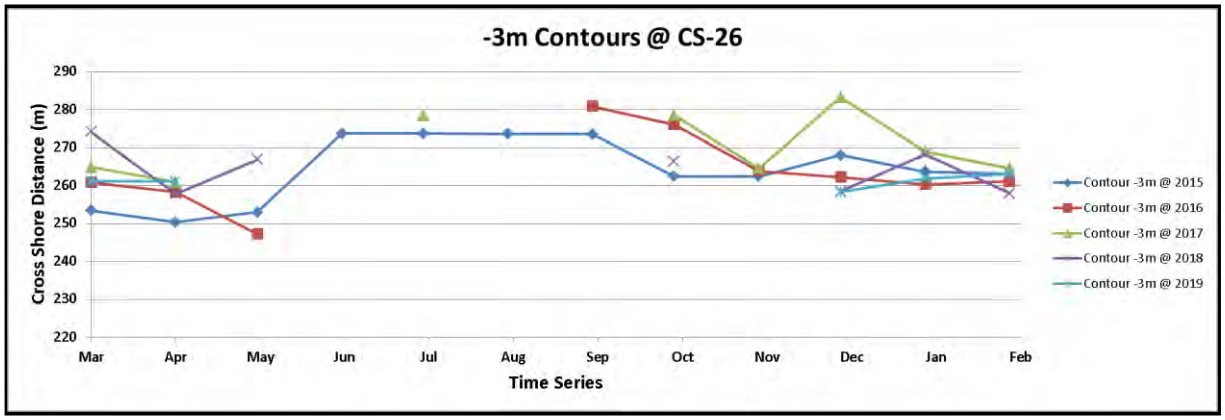


Figure 2-73 Time series of (–) 3 m contour at Karumkulam (CS 26)

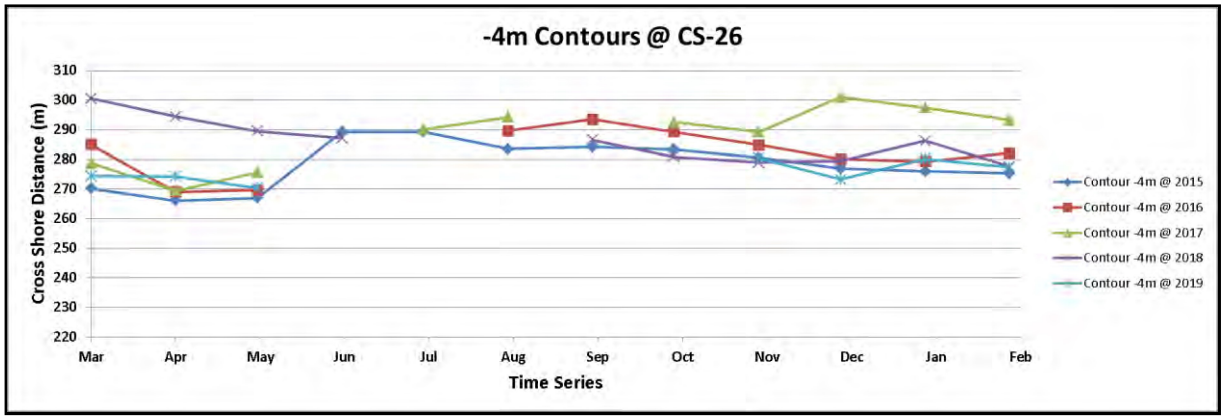


Figure 2-74 Time series of (–) 4 m contour at Karumkulam (CS 26)

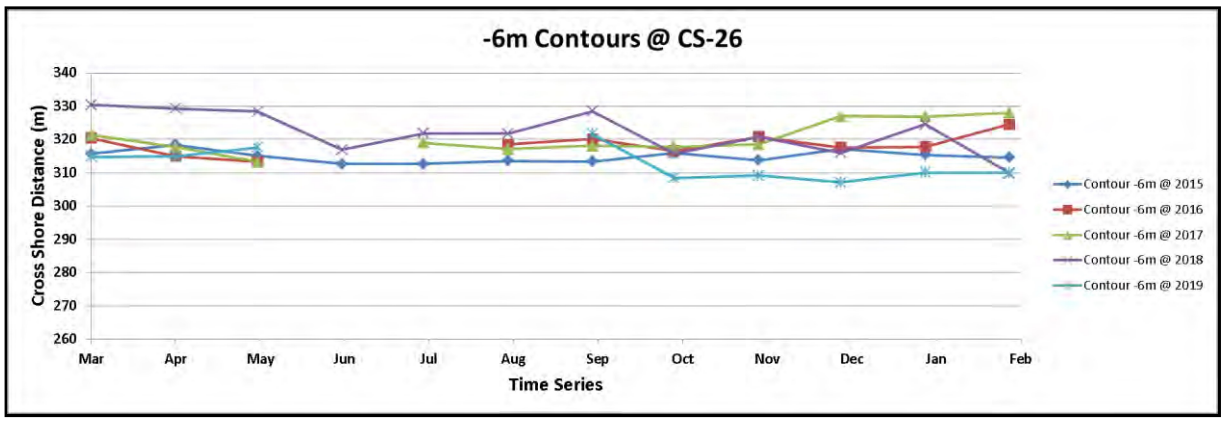


Figure 2-75 Time series of (–) 6 m contour at Karumkulam (CS 26)

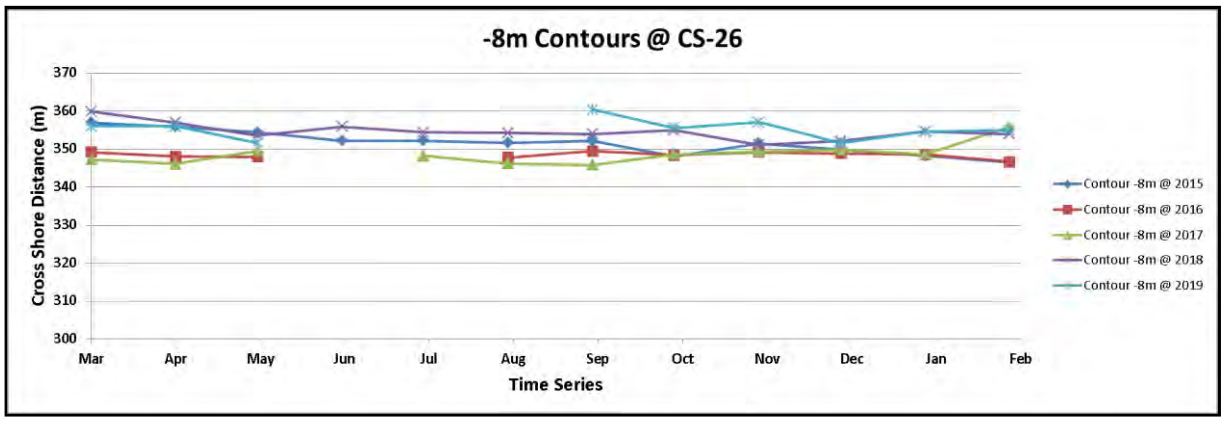


Figure 2-76 Time series of (–) 8 m contour at Karumkulam (CS 26)

In addition to above, the +2m, -3m, -5m and -8m contours continuous variation of contour distances over the year is provided for better clarity as shown in Figure 2-77.

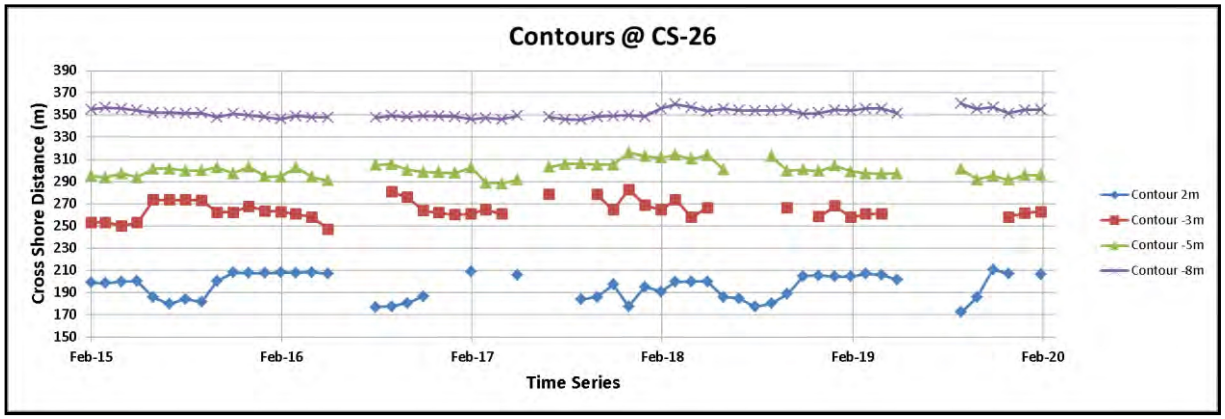


Figure 2-77 Time series of contours at Karumkulam (CS 26)

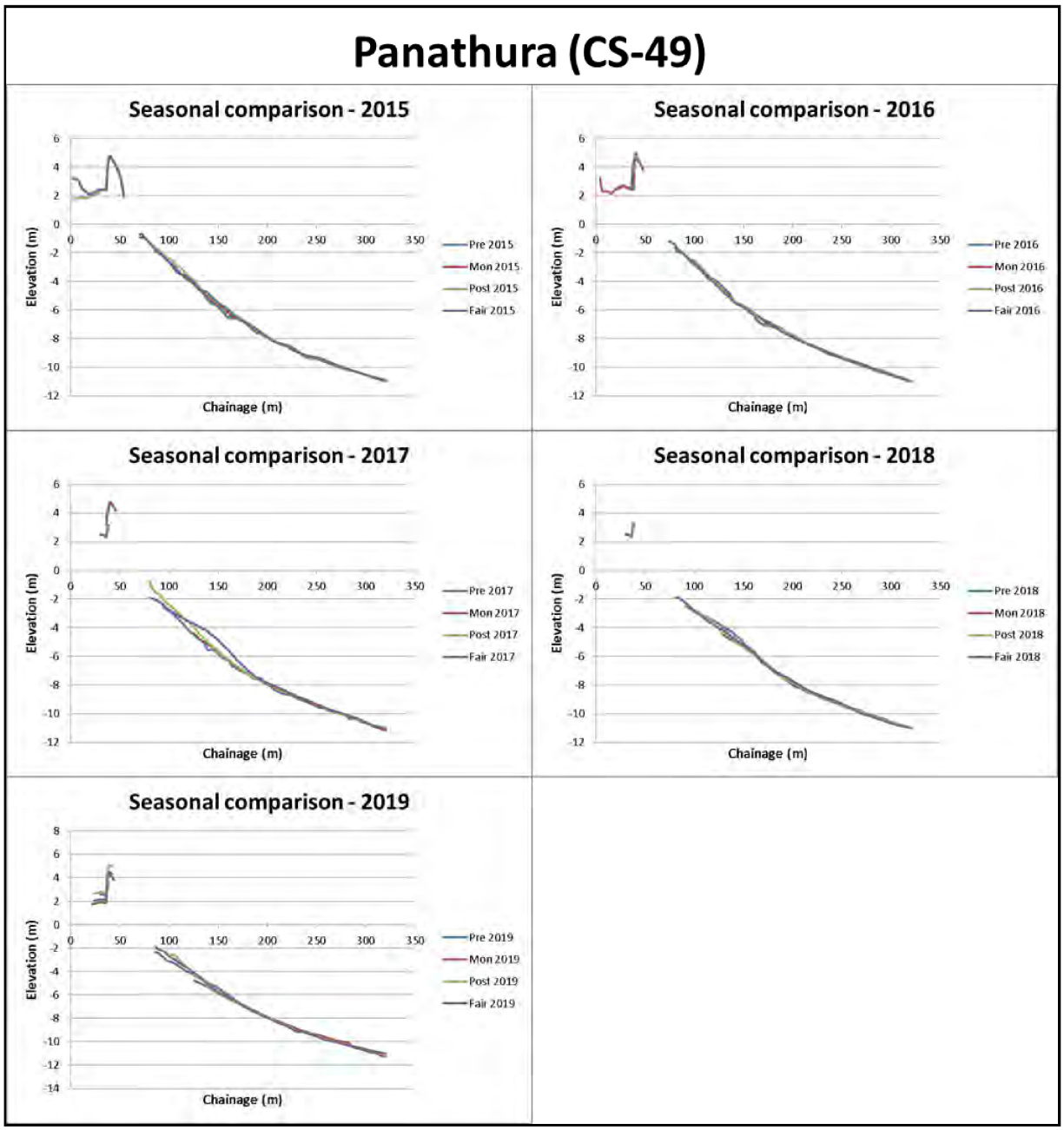


Figure 2-78 Profiles at Panathura (CS 49) – Seasonal comparison

Coastal protection structure known as seawall was present in the stretch of CS 47 to CS 52. Among these sections, CS 49 which is at Panathura location in Thiruvananthapuram district of Kerala state was chosen to illustrate the seasonal trends over five years. From Figure 2-78, it can be noticed that the seasonal variations are very minimal. However, accretion was observed in foreshore zone during Ockhi (December 2017).

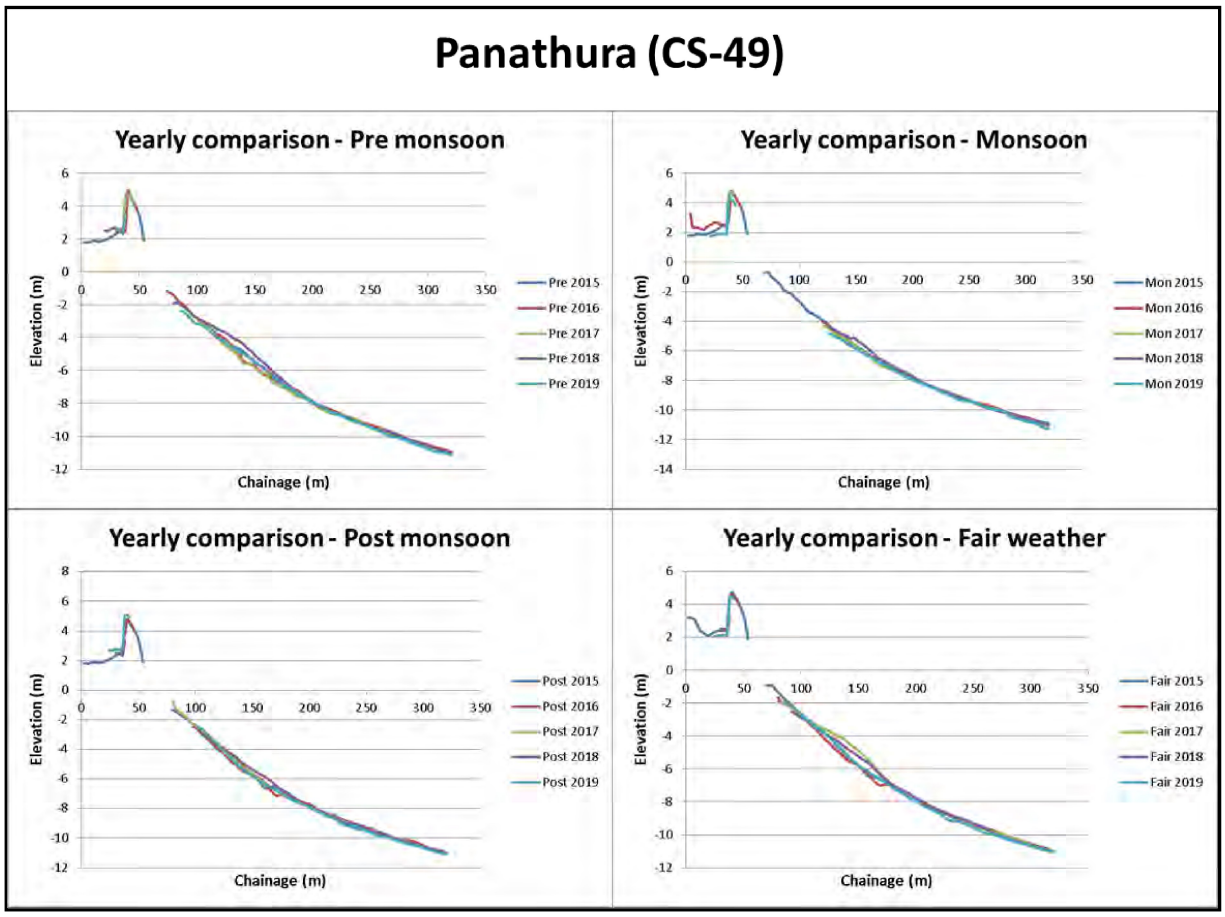


Figure 2-79 Profiles at Panathura (CS 49) – Yearly comparison

The plots represent comparison of profiles of particular season over different years. These plots suggest that there was an accretion in offshore region during fair weather 2017 and pre-monsoon 2018 seasons.

LNTIEL extracted -3m, -4m, -6m and -8m contours from cross shore profile data at Panathura and below plots are time series of respective contours over five year data at CS 49 with similar time scale and shows the seasonal variations of erosion and accretion.

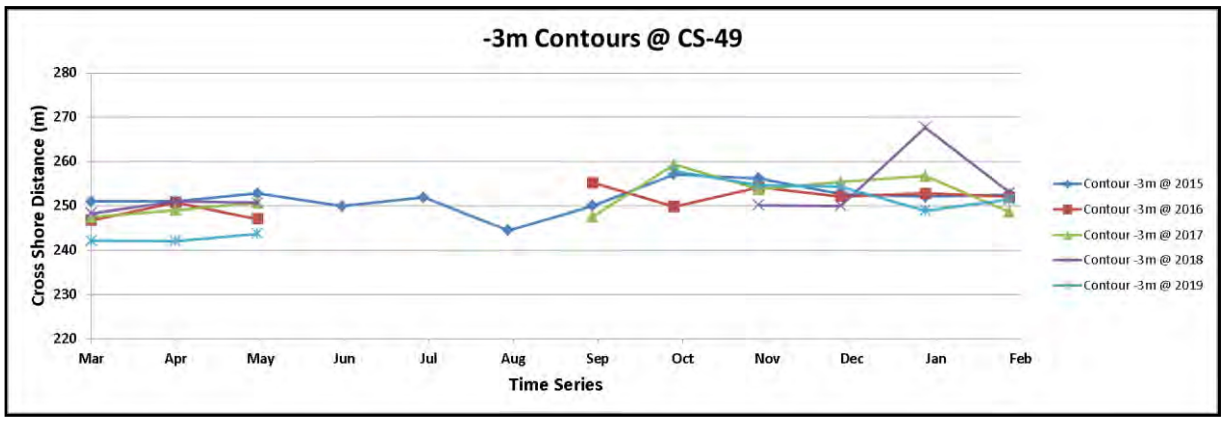


Figure 2-80 Time series of (–) 3 m contour at Panathura (CS 49)

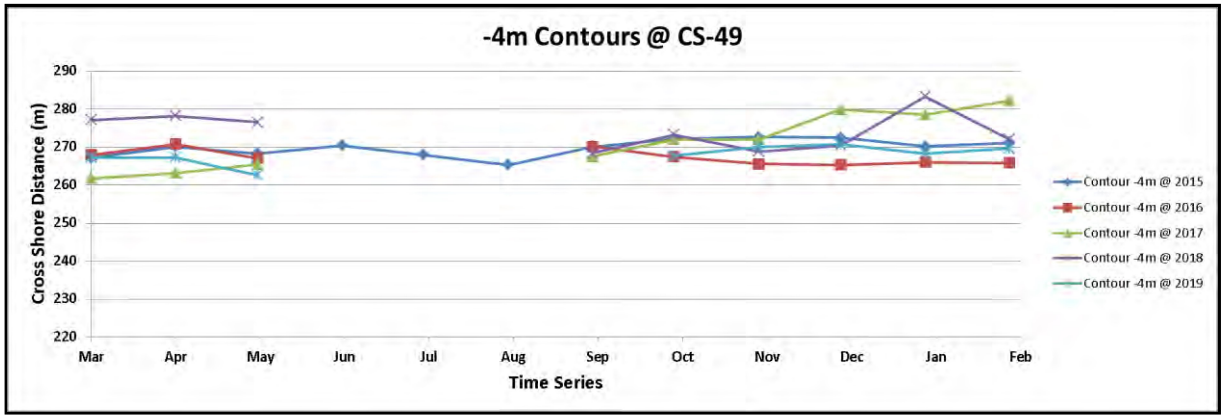


Figure 2-81 Time series of (–) 4 m contour at Panathura (CS 49)

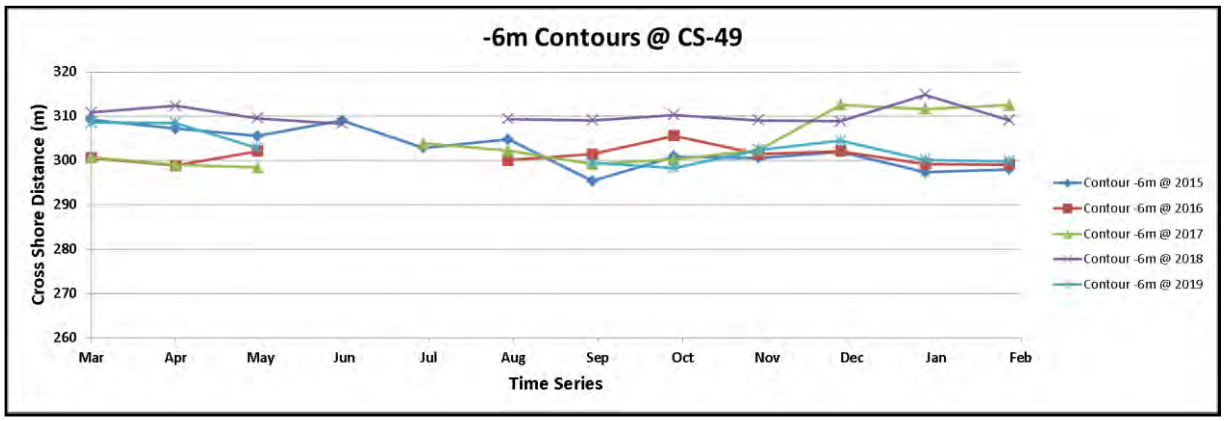


Figure 2-82 Time series of (–) 6 m contour at Panathura (CS 49)

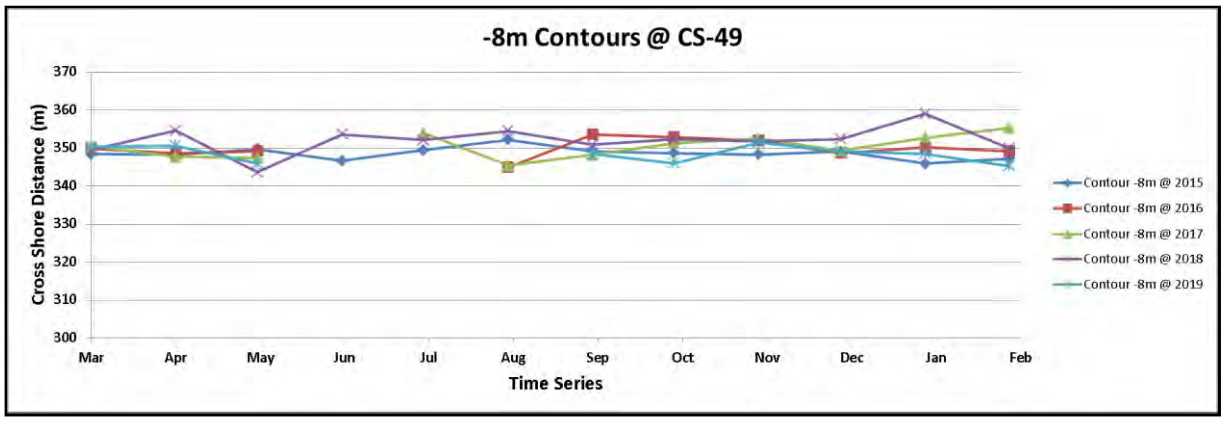


Figure 2-83 Time series of (–) 8 m contour at Panathura (CS 49)

In addition to above, the +2m, -3m, -5m and -8m contours continuous variation of contour distances over the year is provided for better clarity as shown in Figure 2-84.

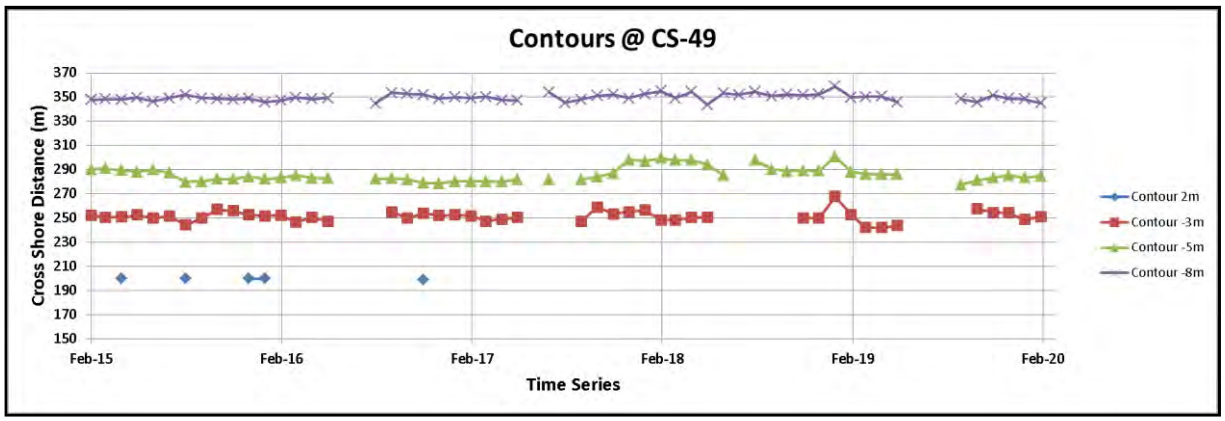


Figure 2-84 Time series of contours at at Panathura (CS 49)

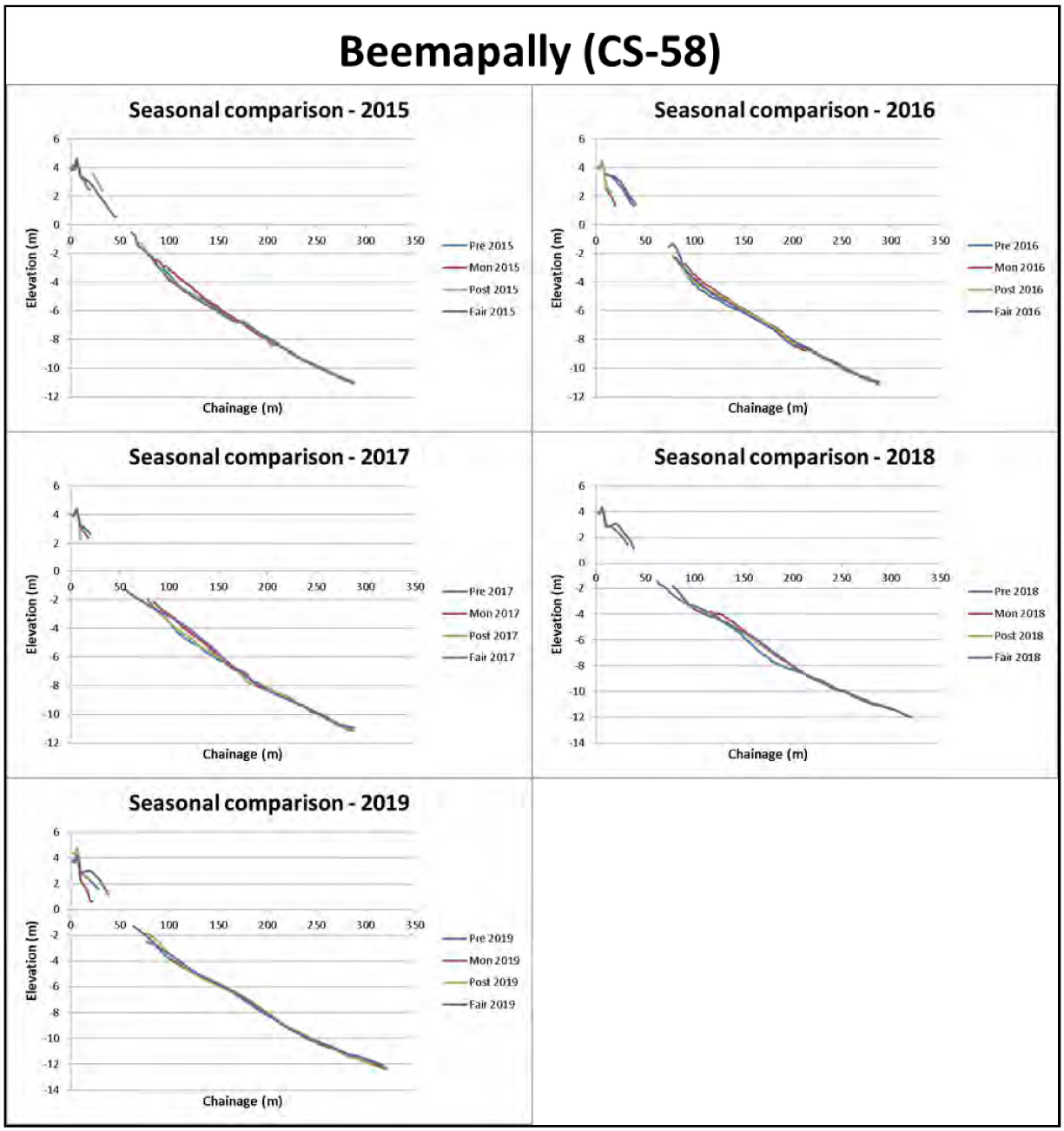


Figure 2-85 Profiles at Beemapally (CS 58) – Seasonal comparison

Coastal protection structure seawall along with groynes was present in the stretch of CS 56 to CS 67. Among these sections, CS 58 which is at Beemapally location in Thiruvananthapuram district of Kerala state was chosen to illustrate the seasonal trends over five years. From Figure 2-85, it can be noticed that the coast undergoes seasonal variations during 2015 to 2019. Beach was noticed during pre-monsoon seasons. Later on beach got eroded and deposited in offshore region at the time of monsoon seasons. Beach gradually developed during post monsoon seasons and remained stable during 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.

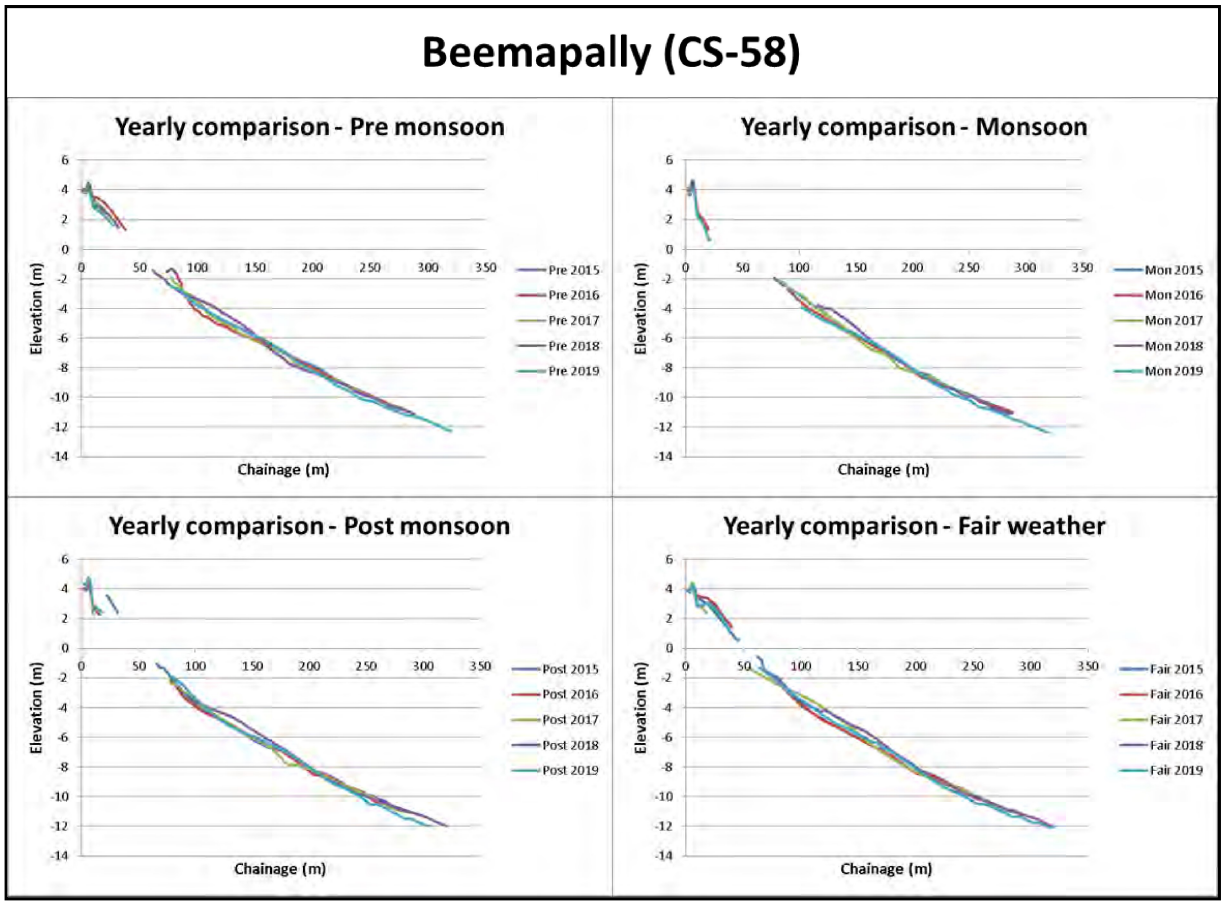


Figure 2-86 Profiles at Beemapally (CS 58) – Yearly comparison

The plots represent comparison of profiles of particular season over different years. These plots suggest that there was an accretion in offshore region after Ockhi cyclone.

LNTIEL extracted -3m, -4m, -6m and -8m contours from cross shore profile data at Beemapally and below plots are time series of respective contours over five year data at CS 58 with similar time scale and shows the seasonal variations of erosion and accretion.

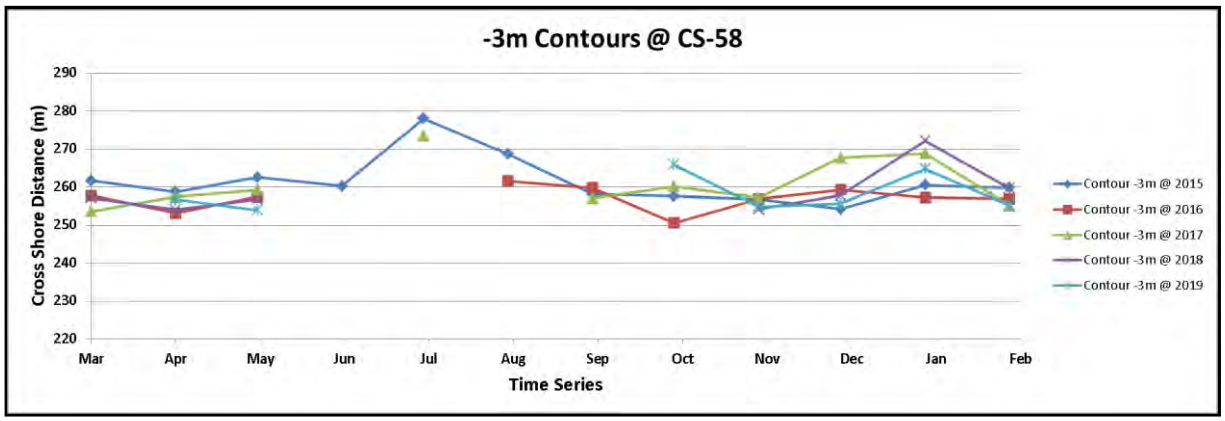


Figure 2-87 Time series of (–) 3 m contour at Beemapally (CS 58)

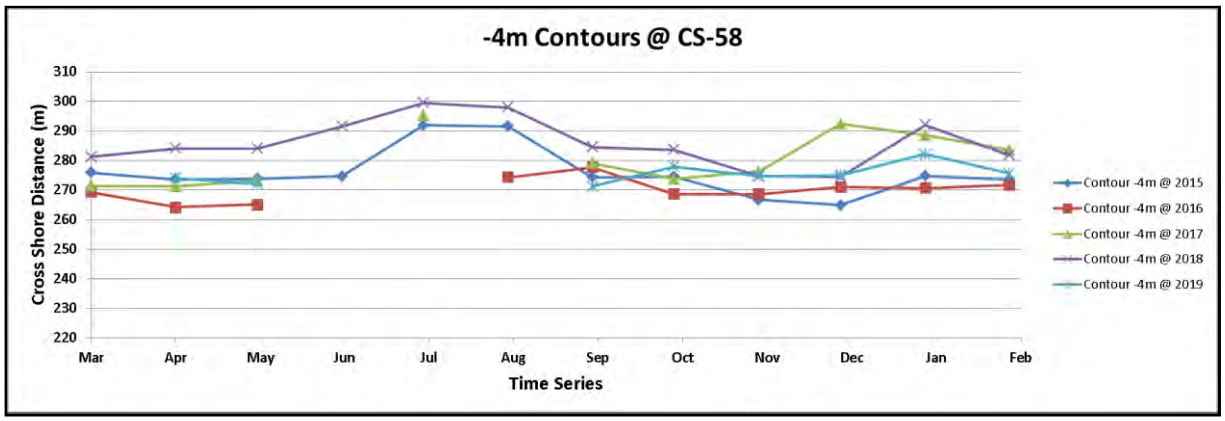


Figure 2-88 Time series of (–) 4 m contour at Beemapally (CS 58)

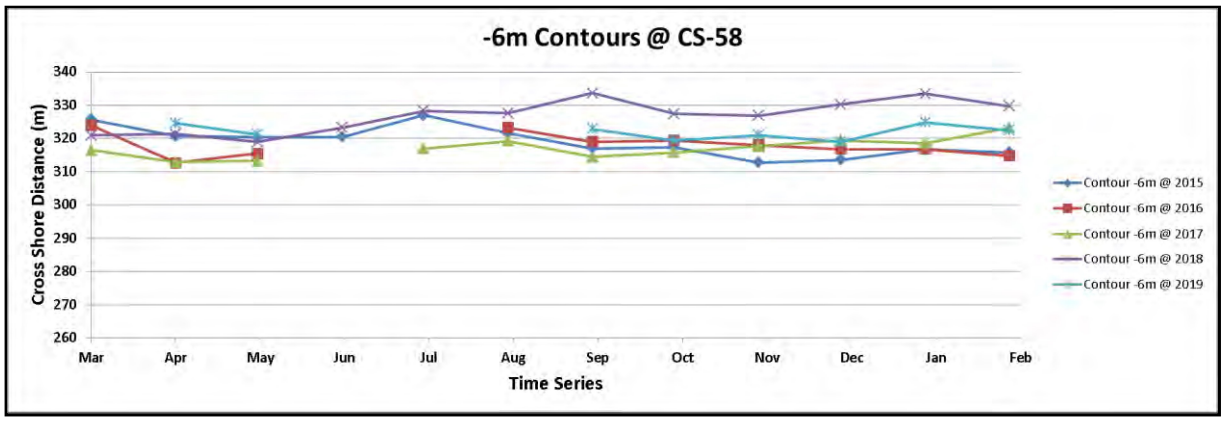


Figure 2-89 Time series of (–) 6 m contour at Beemapally (CS 58)

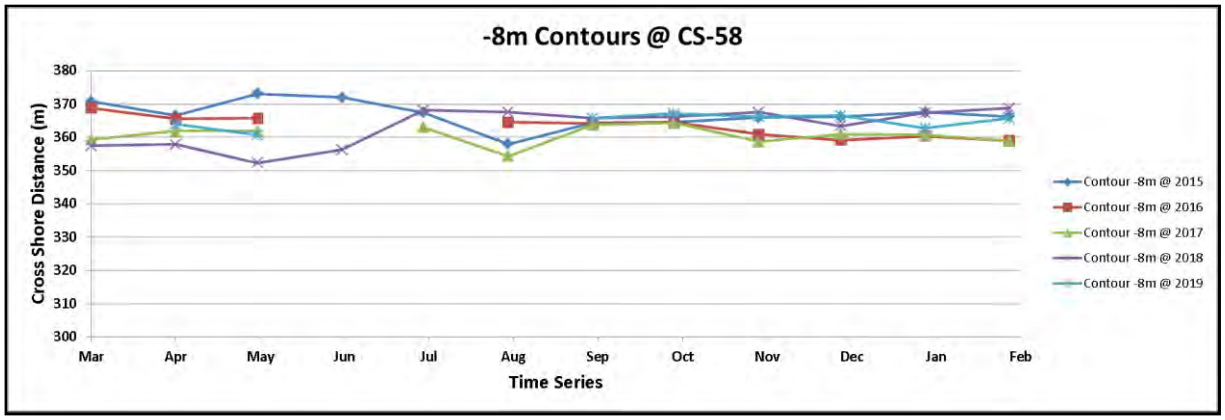


Figure 2-90 Time series of (–) 8 m contour at Beemapally (CS 58)

In addition to above, the +2m, -3m, -5m and -8m contours continuous variation of contour distances over the year is provided for better clarity as shown in Figure 2-91.

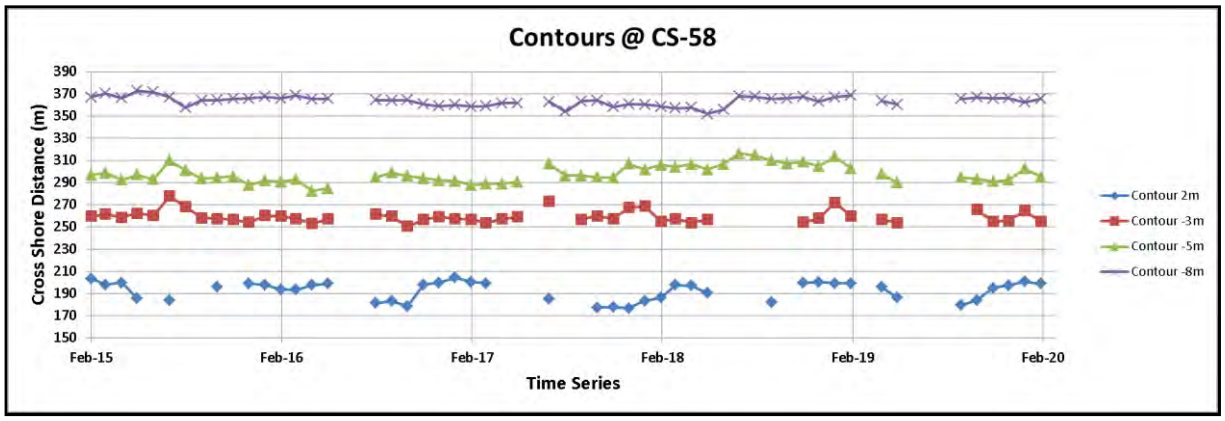


Figure 2-91 Time series of contours at Beemapally (CS 58)

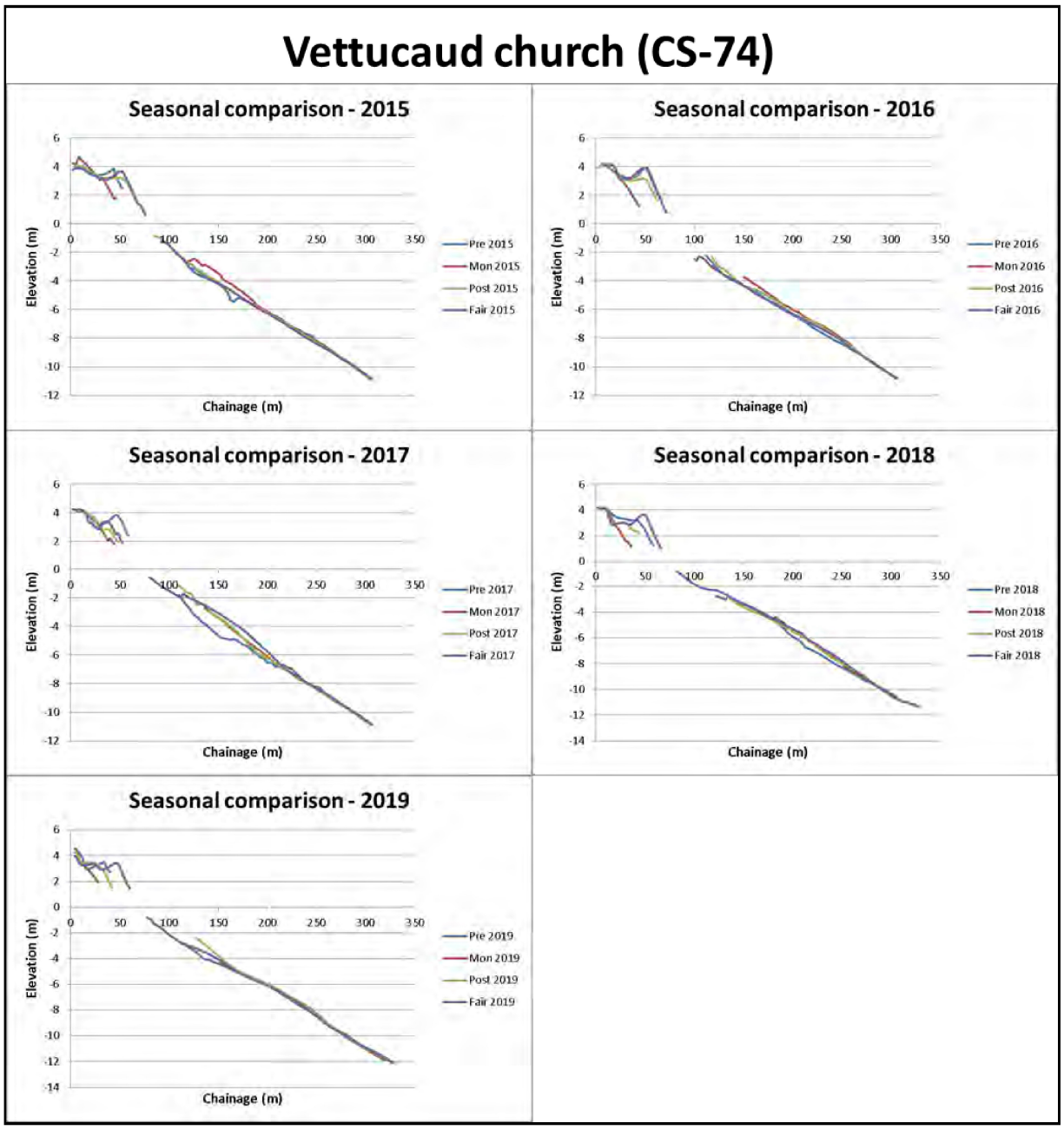


Figure 2-92 Profiles at Vettucaud (CS 74) – Seasonal comparison

Beach was present throughout the year in the stretch of CS 68 to CS 81. Among these sections, CS 74 which is at Vettucaud location in Thiruvananthapuram district of Kerala state was chosen to illustrate the seasonal trends over five years. From Figure 2-92, it can be noticed that the coast undergoes seasonal variations during 2015 to 2019. Beach was noticed during pre-monsoon seasons. Later on beach got eroded and deposited in offshore region at the time of monsoon seasons. Beach was gradually developed during post monsoon seasons and remains stable during fair weather seasons whereas in 2017 the trend got shifted as the coast experienced a very severe cyclonic storm (IMD Classification) named Ockhi during fair weather season resulted in severe erosion all along the coast and accretion was observed in foreshore zone. After Ockhi the erosion was noticed during fair weather 2017 and pre monsoon 2018 seasons on land side and deposition on sea side.

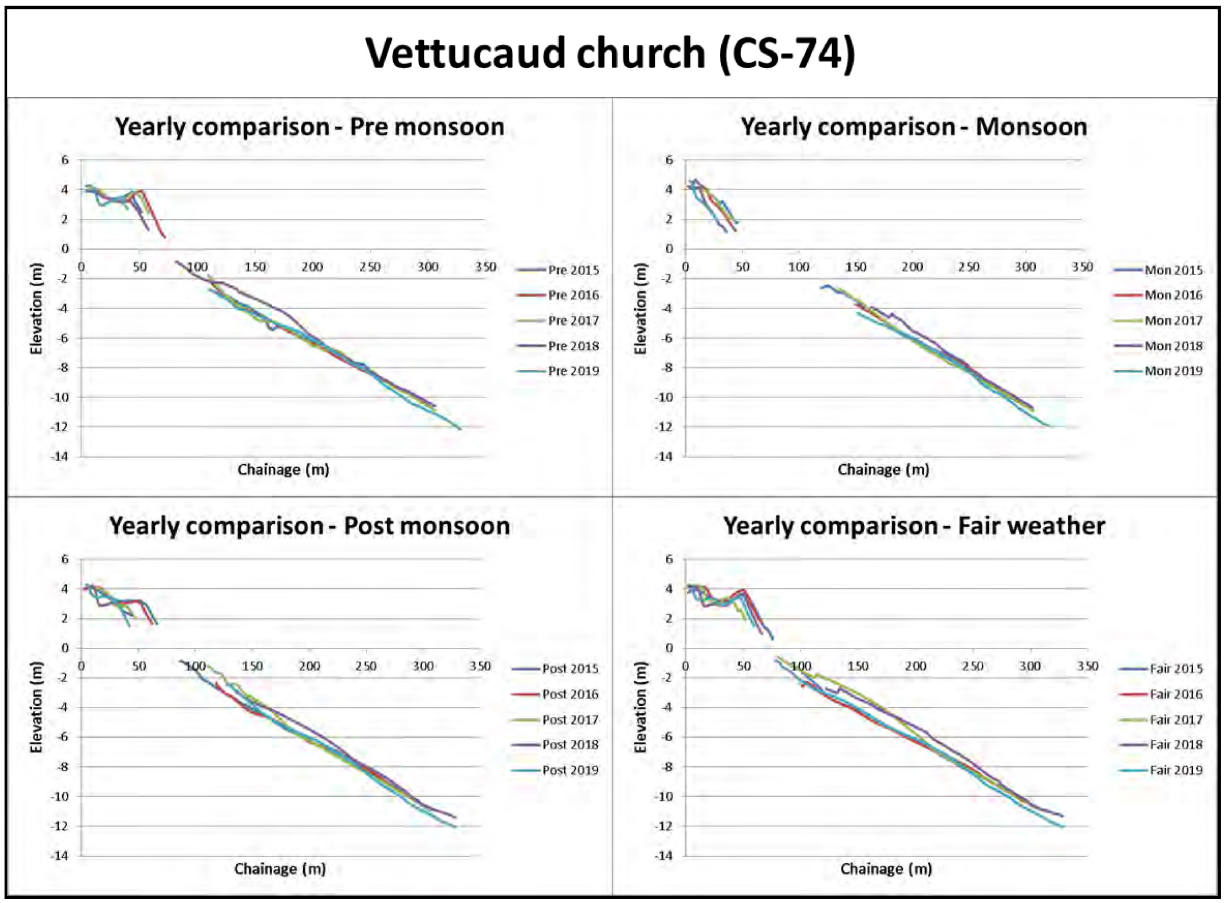


Figure 2-93 Profiles at Vettucaud (CS 74) – Yearly comparison

The plots represent comparison of profiles of particular 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 was undergoing processes to recover from this impact which can be observed from fair weather seasons comparison plot.

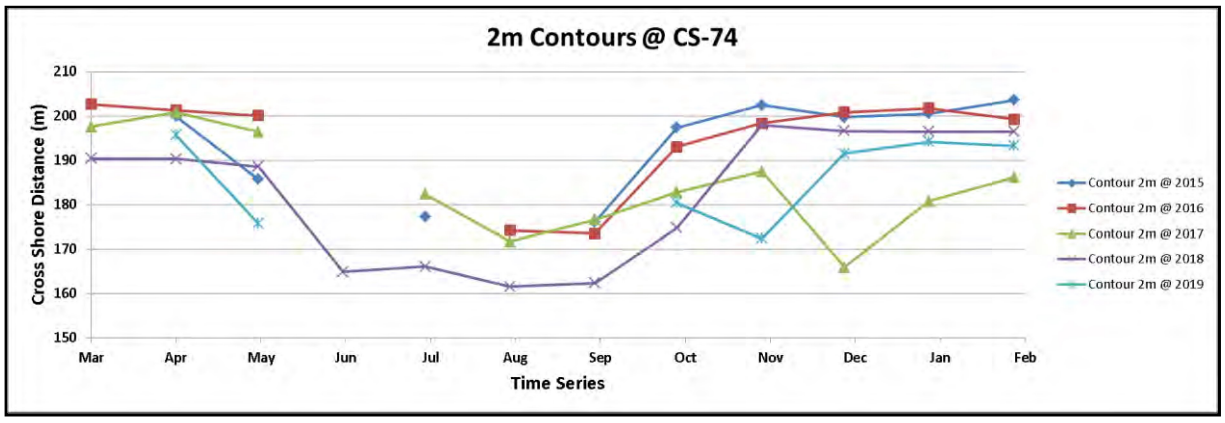


Figure 2-94 Time series of (+) 2 m contour at Vettucaud (CS 74)

Further LNTIEL extracted (+) 2 m contour from cross shore profile data. The above plot is time series of (+) 2 m contour over five year data at CS 74 with similar time scale. 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 no much accretion was noticed during fair weather 2017 and pre-monsoon 2018. In addition, as a result of monsoon 2018 and 2019 the beach got further eroded compared to

previous monsoon seasons. However, the beach was developed after monsoon season with high rates compared to post-monsoon 2017 and fair weather 2017.

LNTIEL extracted -3m, -4m, -6m and -8m contours from cross shore profile data at Vettucaud and below plots are time series of respective contours over five year data at CS 74 with similar time scale and shows the seasonal variations of erosion and accretion.

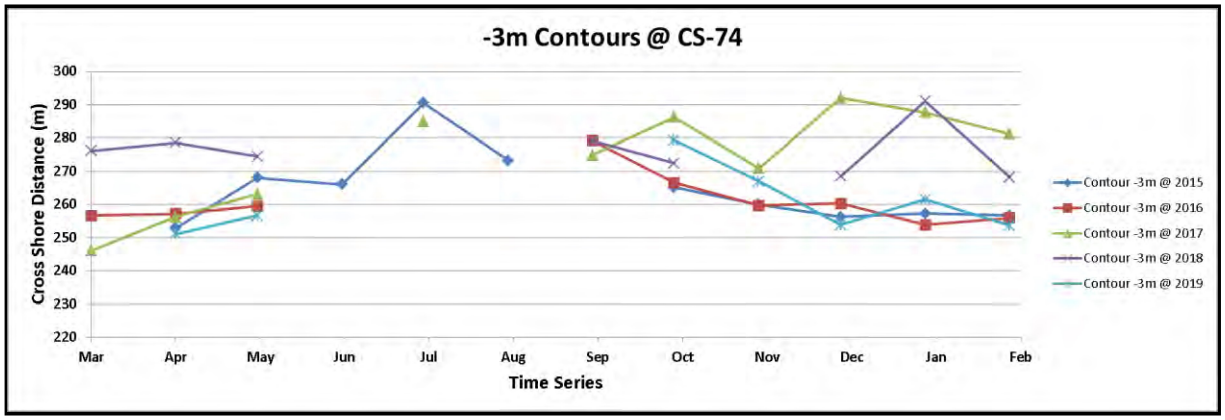


Figure 2-95 Time series of (–) 4 m contour at Vettucaud (CS 74)

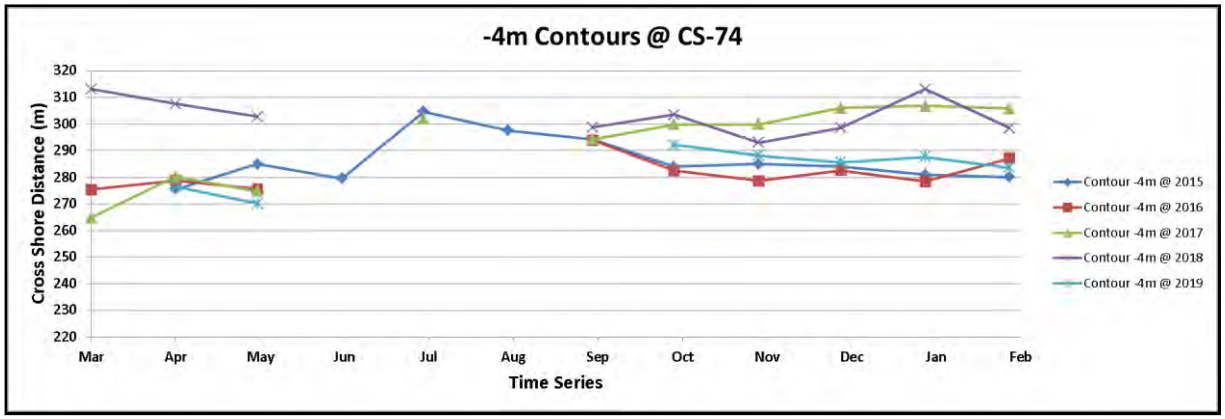


Figure 2-96 Time series of (–) 4 m contour at Vettucaud (CS 74)

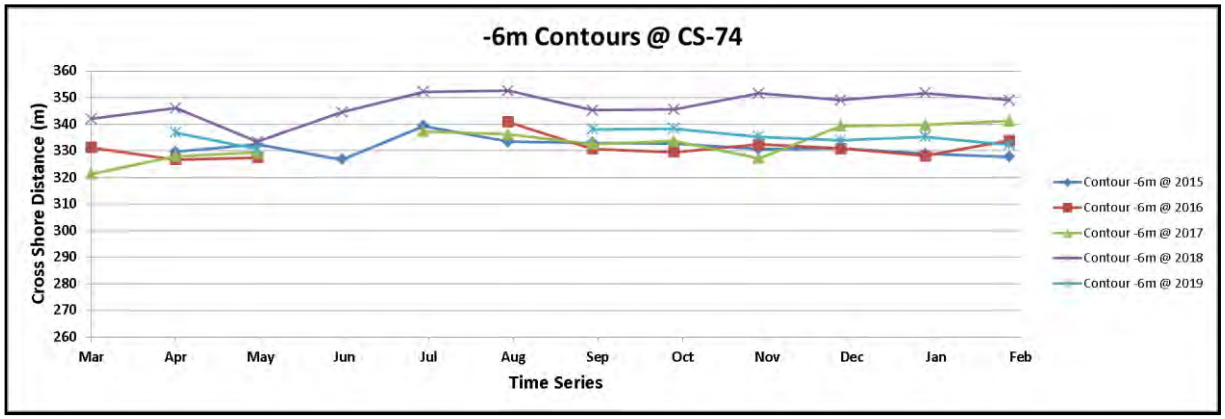


Figure 2-97 Time series of (–) 6 m contour at Vettucaud (CS 74)

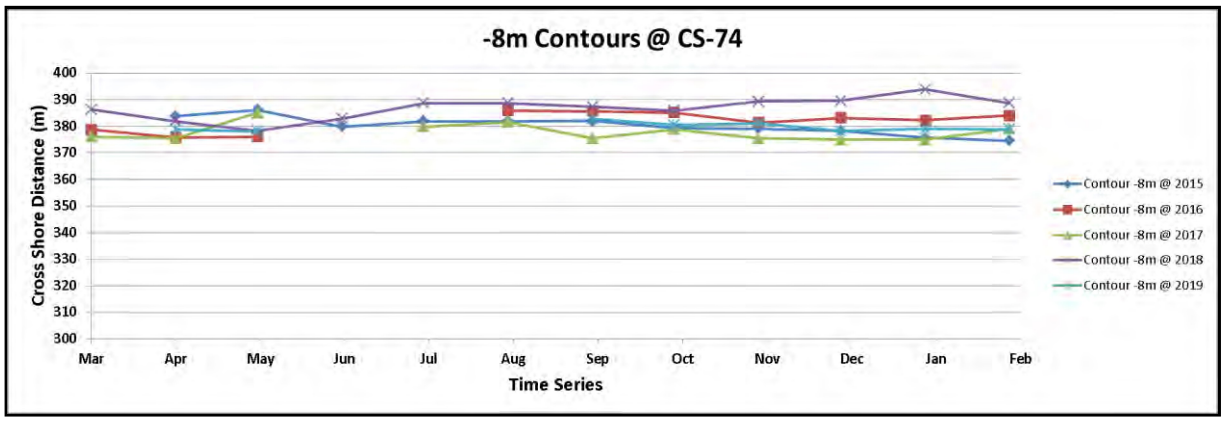


Figure 2-98 Time series of (–) 8 m contour at Vettucaud (CS 74)

In addition to above, the +2m, -3m, -5m and -8m contours continuous variation of contour distances over the year is provided for better clarity as shown in Figure 2-99.

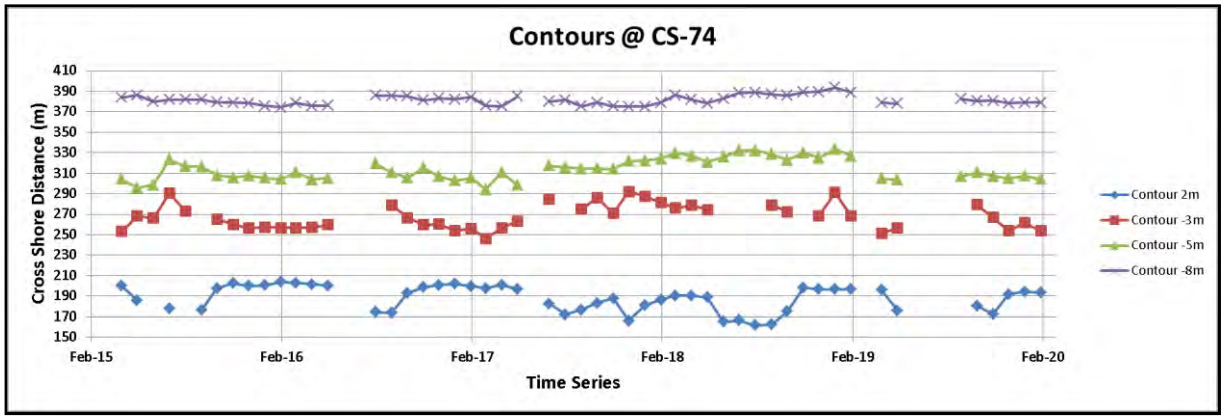


Figure 2-99 Time series of contours at Vettucaud (CS 74)

Fair weather season is the best time to compare the coast 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 long shore scenario of the coast.

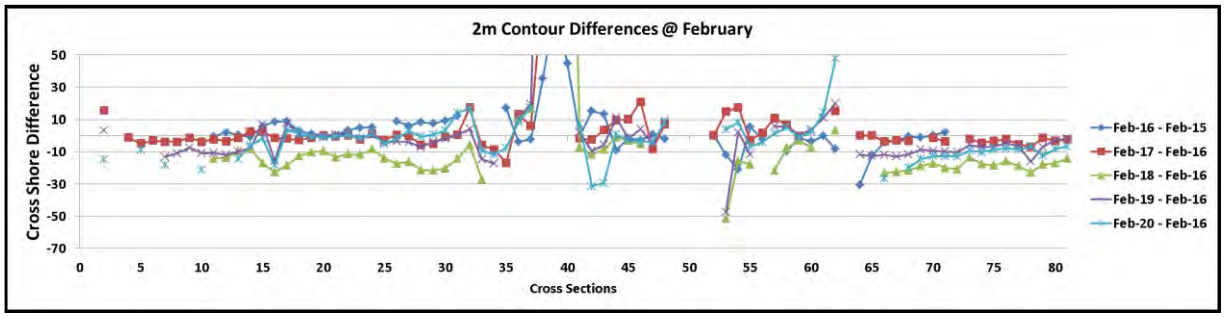


Figure 2-100 Long shore comparison of (+) 2m contour differences during February

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 cross sections which may be due to inaccessibility or protest and these values were not interpolated and left as it is.

Figure 2-100 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 is minimal variation between February 2016 and February 2015 (Blue line), February 2016 is 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 long shore scenario of coast post Ockhi cyclone. It can be seen from this plot that the coast experienced severe erosion. Violet & Cyan lines represent the long shore scenario of coast post Ockhi cyclone. It can be seen that the stretch south of Poovar River mouth was still in transition and stretch north of Poovar River mouth to Adimalathura seems to be recovered from Ockhi cyclone impact. Near Valiyathura bridge there was accretion on south of groyne and erosion on north of groyne which seems to be natural phenomenon due to construction of groyne. The coast from Shangumugham to Thumba is in the process of attaining its stable position.

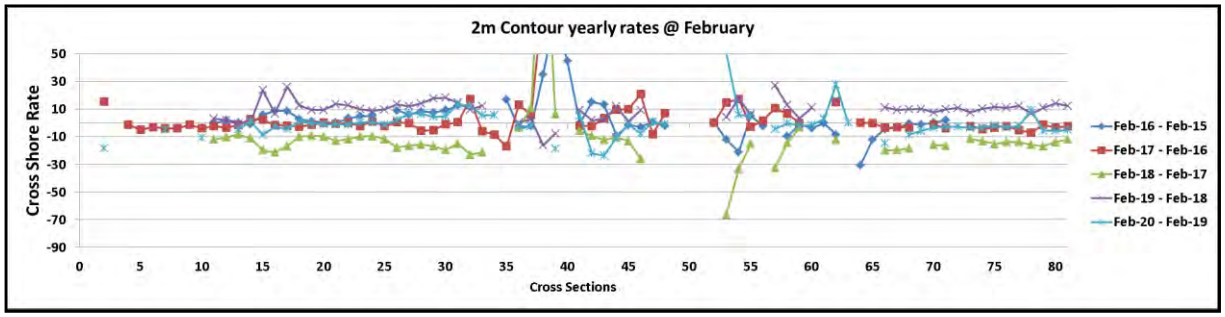


Figure 2-101 Long shore comparison of yearly rates during February

Further to above, LNTIEL analysed the yearly rates during February month. Figure 2-101 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 last year was high along the coast compared to previous years probably because the coast is in the process to attain its stable or equilibrium position. In the period of March 2019 to February 2020 the rate was almost similar to pre Ockhi scenario.

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 NCEP 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

$$\eta(t) = \sum_i a_i \cos(\sigma_i t + a_i)$$

with η the sea surface elevation, a_i the amplitude of the ith wave component, σ_i the relative radian or circular frequency of the ith 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 ith 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 simulations and results

Offshore wave data at 08°00' 00" N, 76°00'00" E were obtained from NCEP for which the time frame 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. In order to reduce the simulation time, the wave records with similar characteristics were made in to bins and then grouped together. Such grouped wave events were then simulated using SWAN to obtain the corresponding near shore wave data.

The modelled near shore wave data were extracted at the point (08° 21' 42.3"N, 76° 59' 33.9"E) where the wave observation were carried out by OSAS. These near shore grouped wave events were again transformed back to the respective time frame and then compared with observed wave data provided by AVPPL. The comparison of modelled wave data and the observed wave data is plotted and shown from Figure 3-1 to Figure 3-3

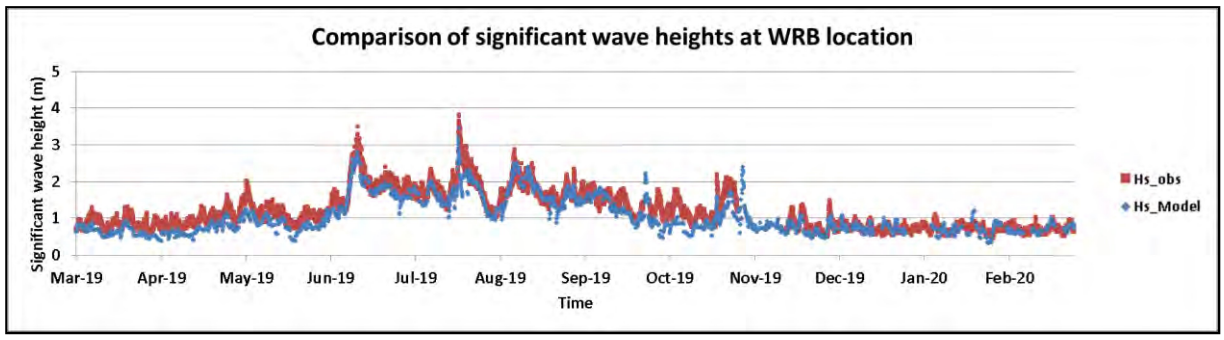


Figure 3-1 Comparison of significant wave heights (March 2019 to February 2020)

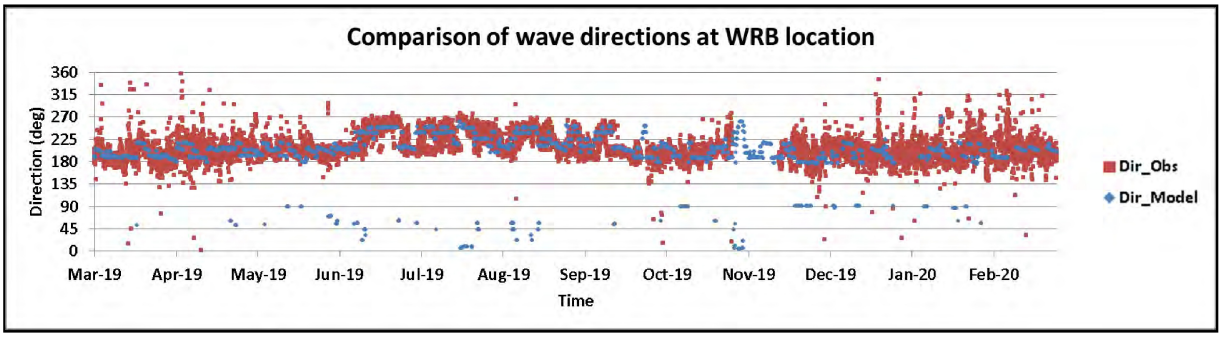


Figure 3-2 Comparison of wave directions (March 2019 to February 2020)

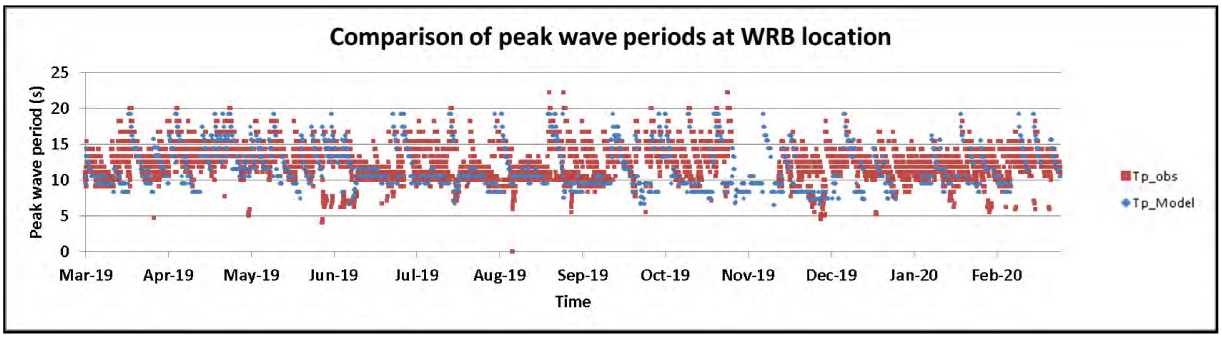


Figure 3-3 Comparison of peak wave periods (March 2019 to February 2020)

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 phenomenon 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 February 2020 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 3-4. The model bathymetry was prepared using the available primary and secondary data and is shown in Figure 3-5.

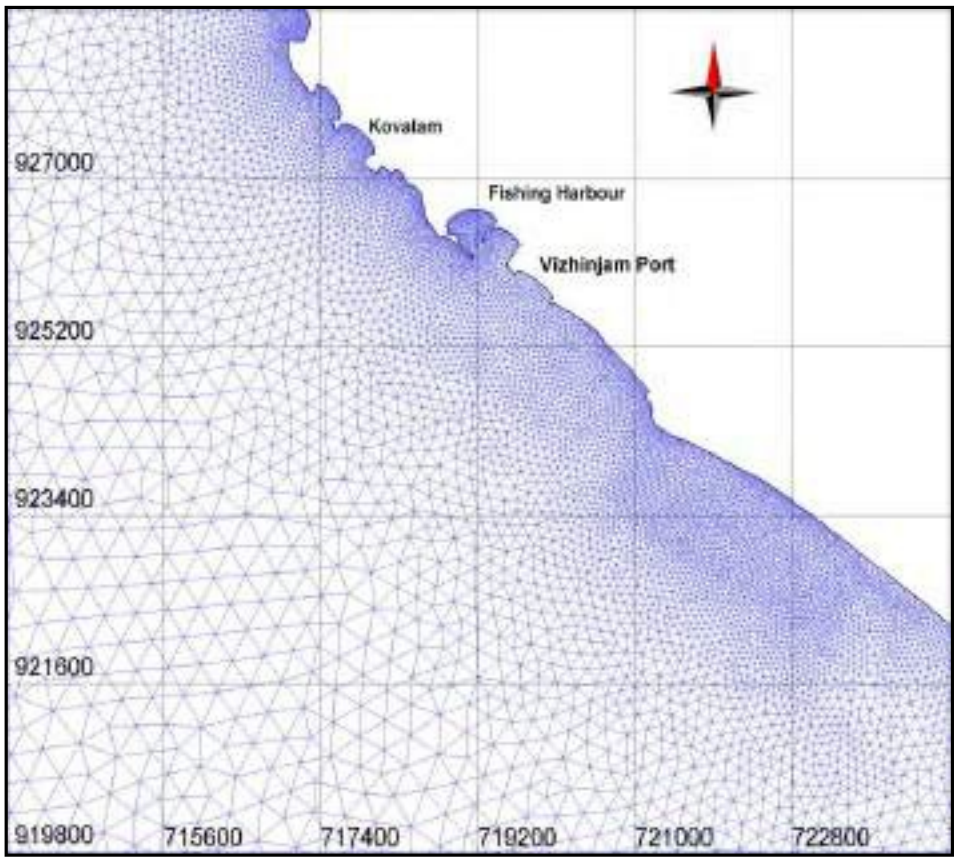


Figure 3-4 Fine mesh near project location

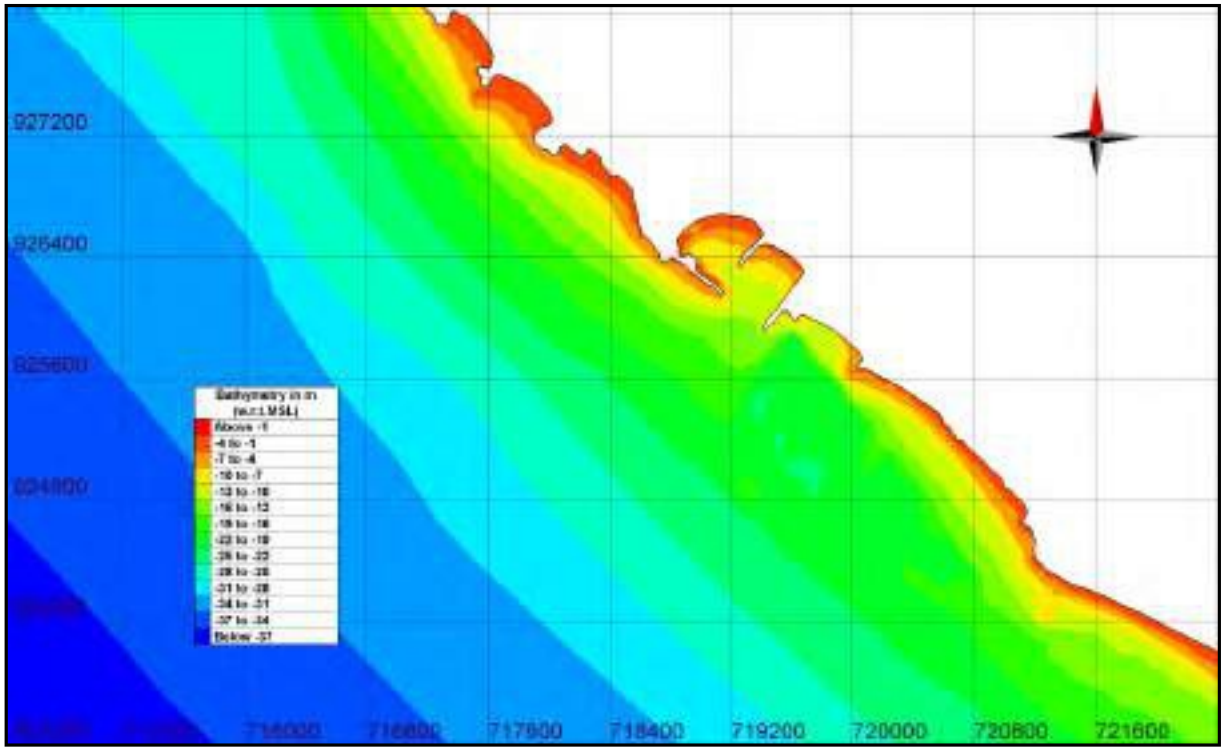


Figure 3-5 Pre-monsoon (2019) bathymetry with respect to MSL

3.2.2.1 Boundary conditions

Tidal levels were applied along the open boundary of the model domain. In order to set up the model, tidal elevations along the open boundary were predicted using OTPS developed by OSU.

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 and 2019 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 3-6 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.

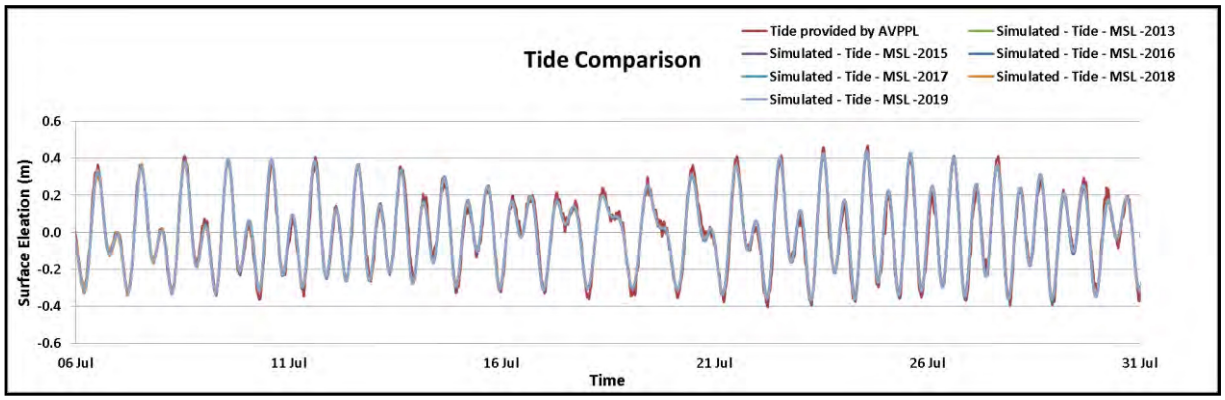
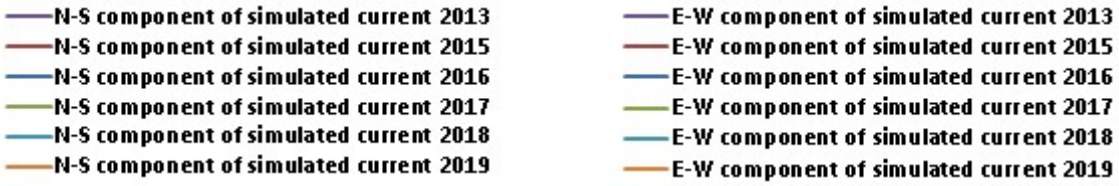


Figure 3-6 Comparison of simulated tide with AVPPL data 2013 (SW Monsoon)



Legend of Tide comparison plot

Figure 3-7 to Figure 3-12 shows the comparison of N-S and E-W components of simulated currents (2013, 2015, 2016, 2017, 2018 and 2019) at the measurement locations put on a similar time scale. As in the case of tides, it can be seen that all the three simulated currents show good correlation with each other. This shows that the effect of the change of bathymetry on the hydrodynamics of the area is negligible. Figure 3-13 and Figure 3-14 shows typical plots from the simulation.



Legend of current comparison plots at CM locations

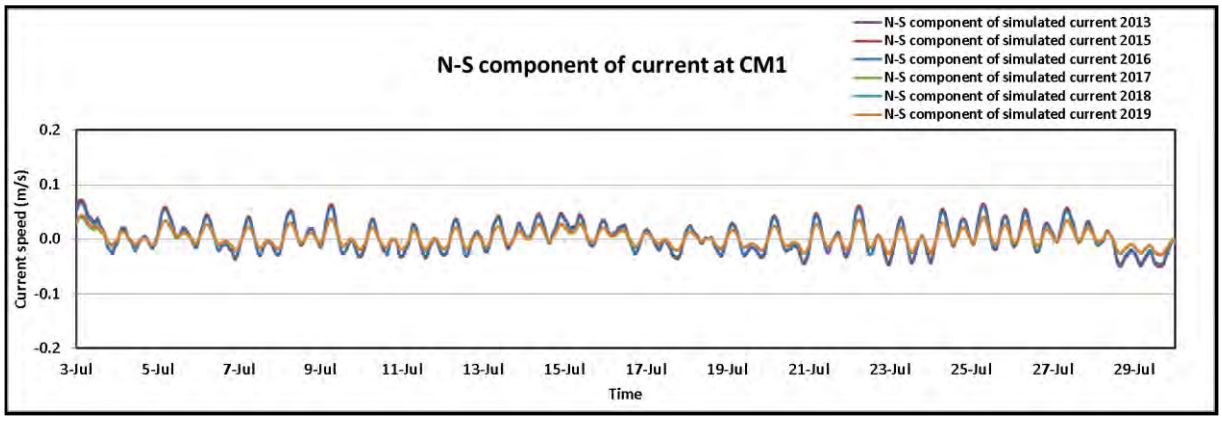


Figure 3-7 Comparison of N-S component of current at CM1 during SW-monsoon

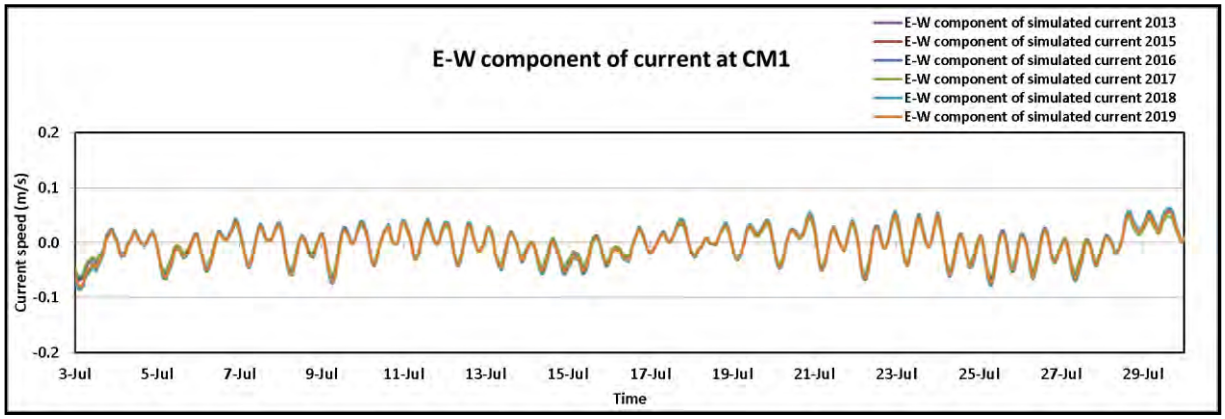


Figure 3-8 Comparison of E-W component of current at CM1 during SW-monsoon

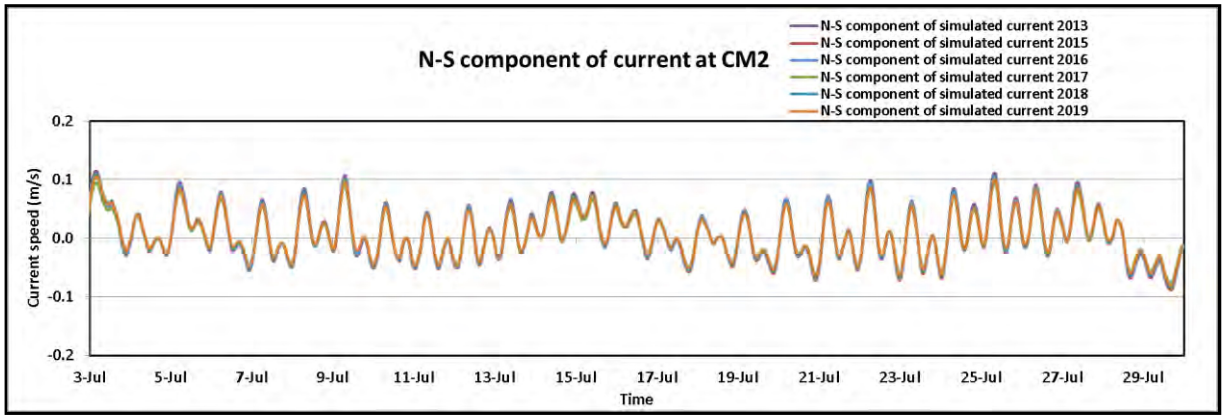


Figure 3-9 Comparison of N-S component of current at CM2 during SW-monsoon

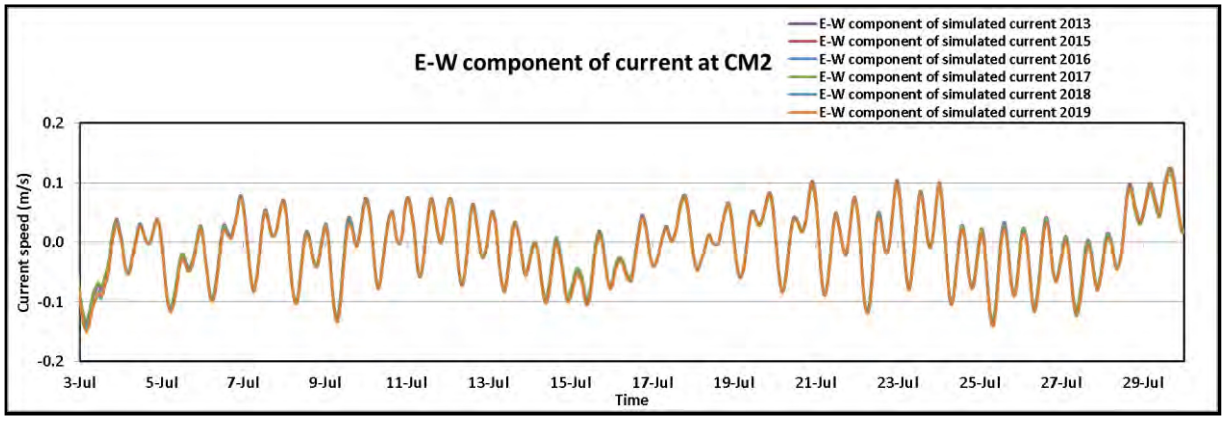


Figure 3-10 Comparison of E-W component of current at CM2 during SW-monsoon

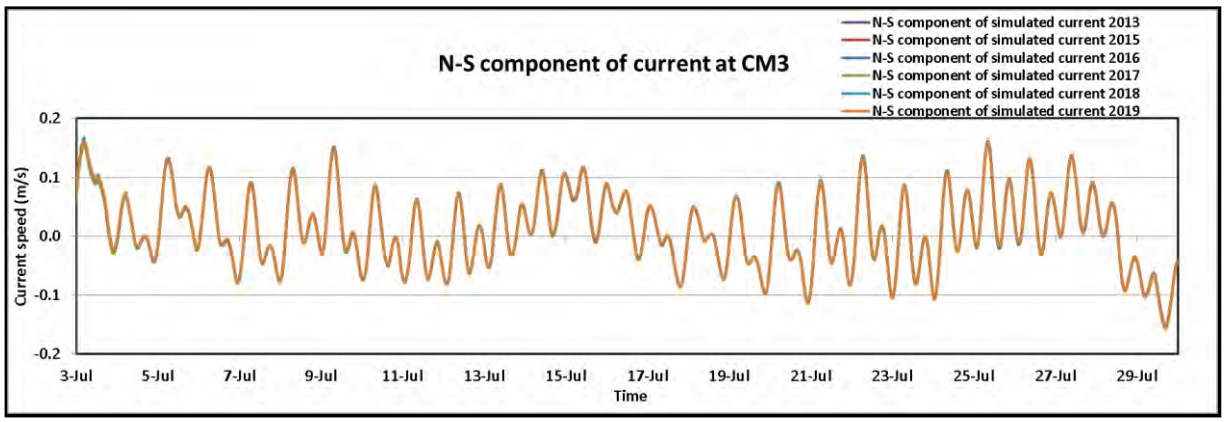


Figure 3-11 Comparison of N-S component of current at CM3 during SW-monsoon

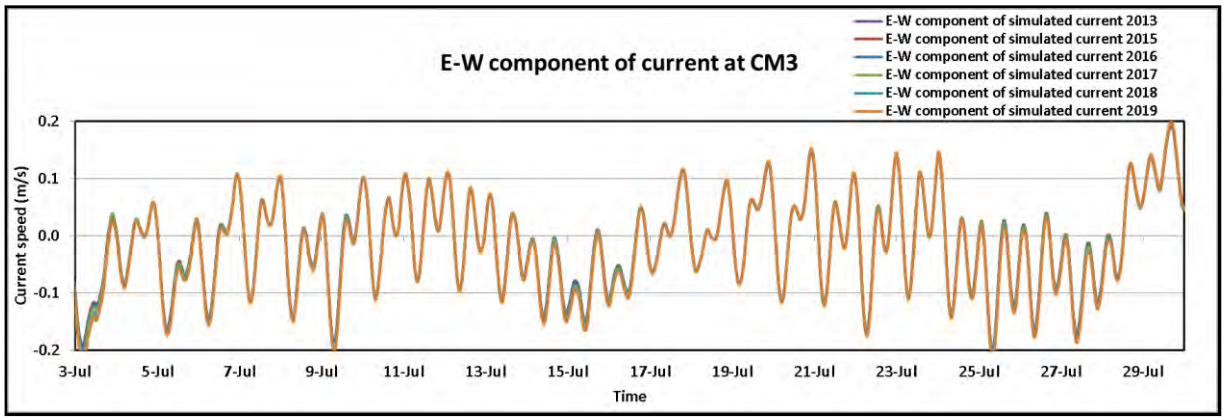


Figure 3-12 Comparison of E-W component of current at CM3 during SW-monsoon

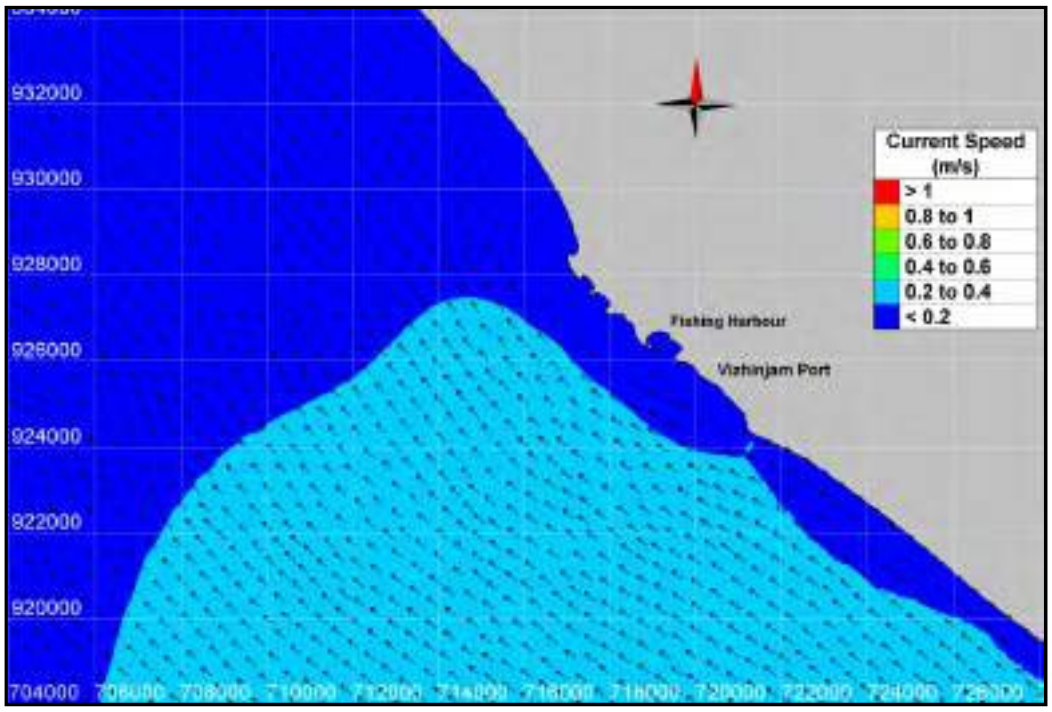


Figure 3-13 Current pattern showing north-westerly flow (typical during monsoon) for pre-monsoon bathymetry during 2019

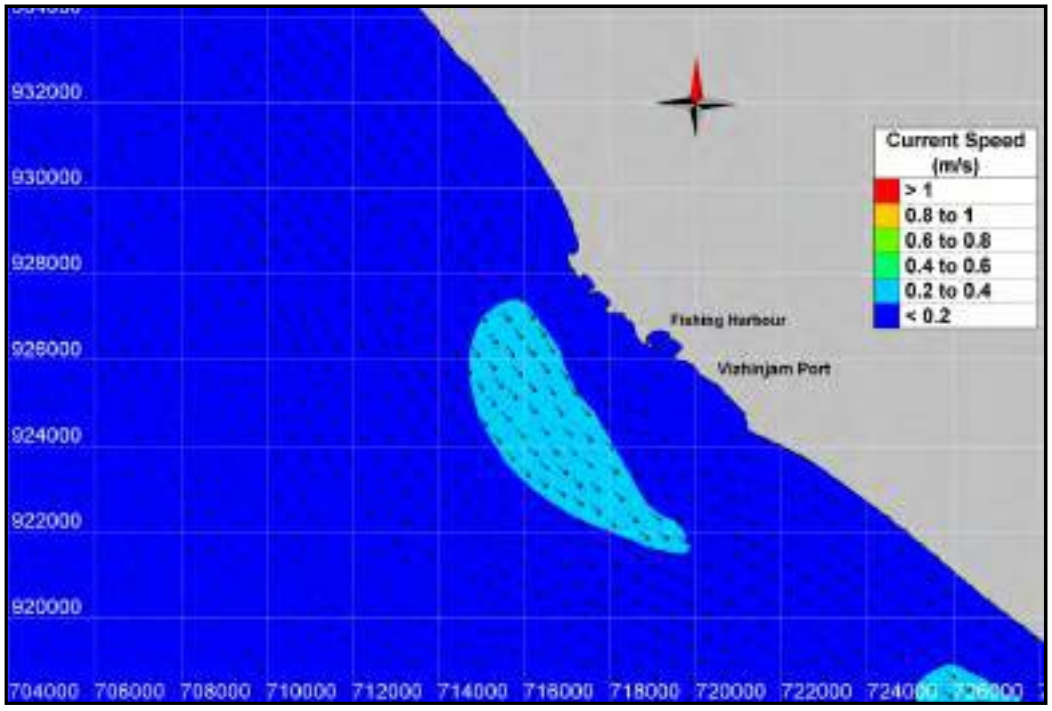


Figure 3-14 Current pattern showing south-easterly flow (typical during monsoon) for pre-monsoon bathymetry during 2019

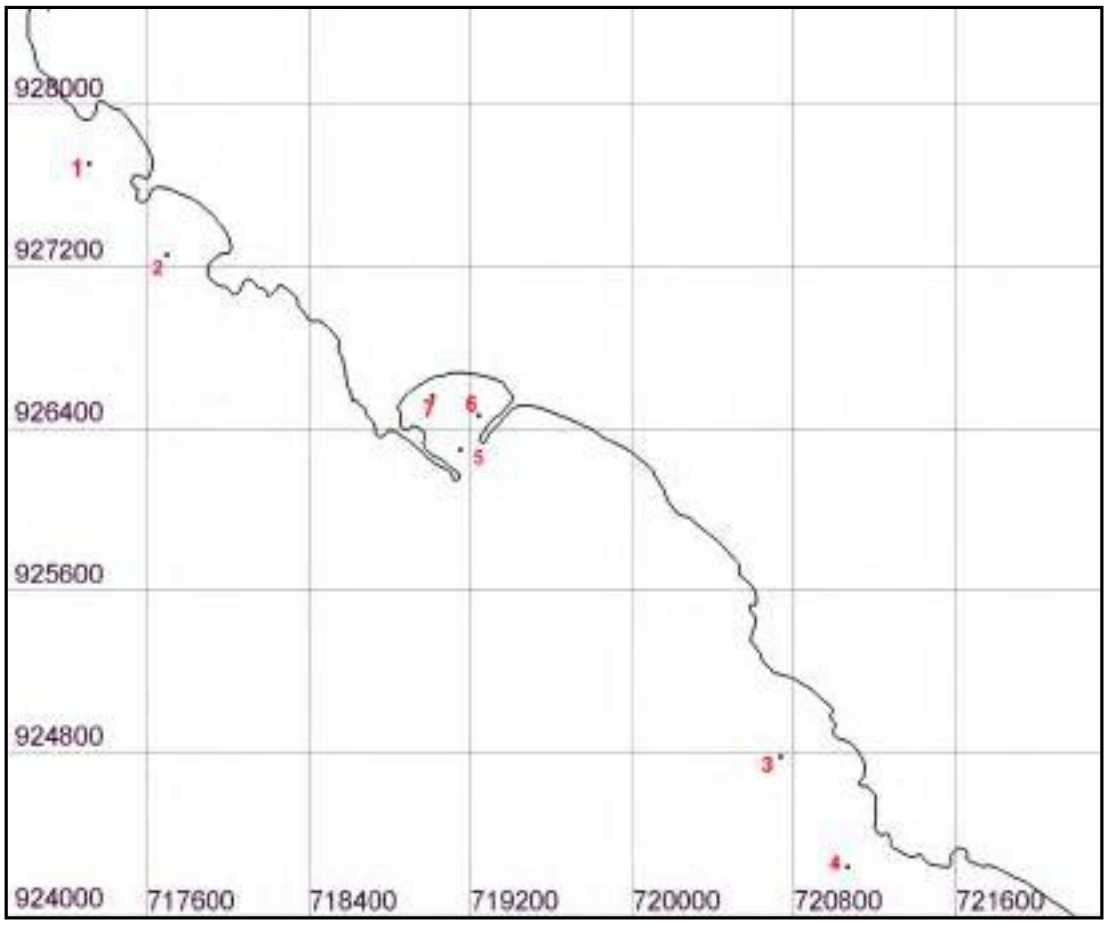


Figure 3-15 Current comparison points location (near shoreline)

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 3-15. The current comparison plots were shown in Figure 3-16 to Figure 3-22. 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

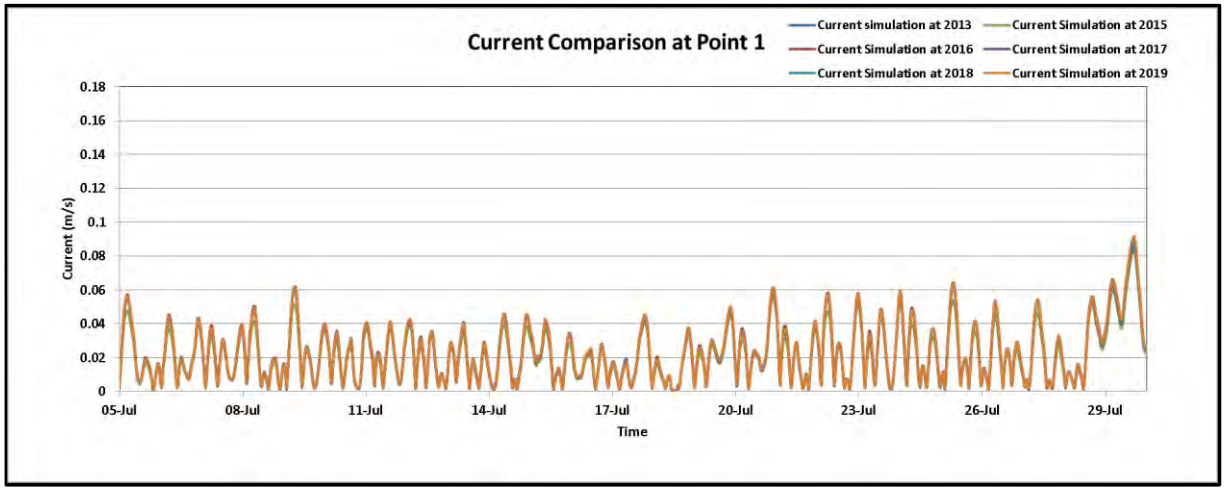


Figure 3-16 Current comparison at point 1

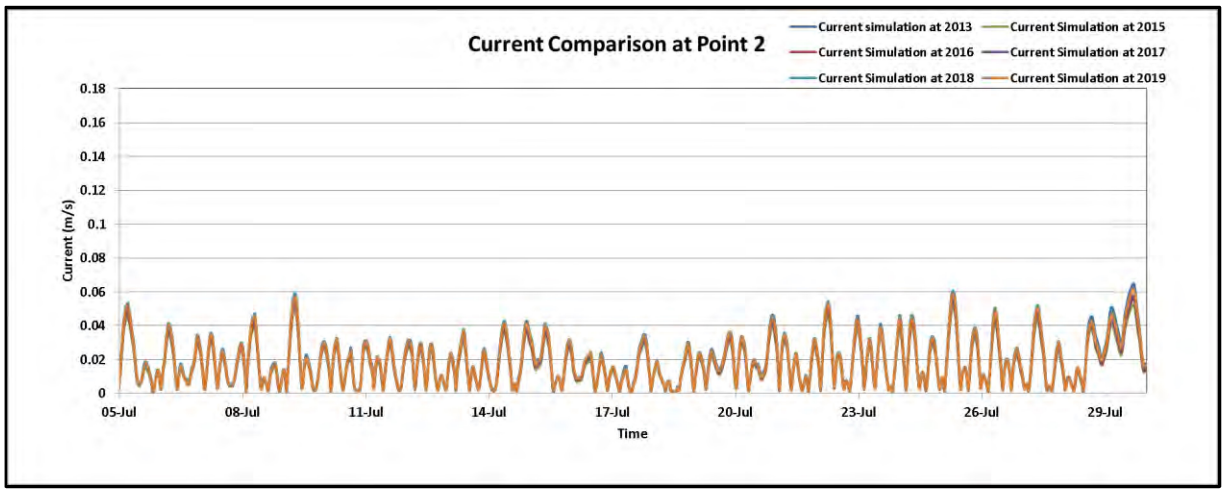


Figure 3-17 Current comparison at point 2

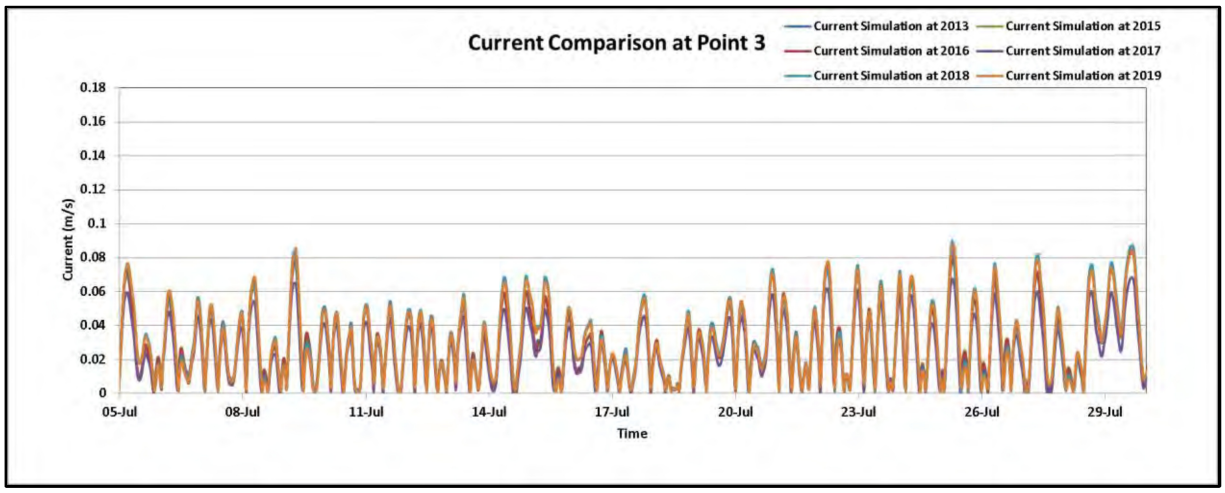


Figure 3-18 Current comparison at point 3

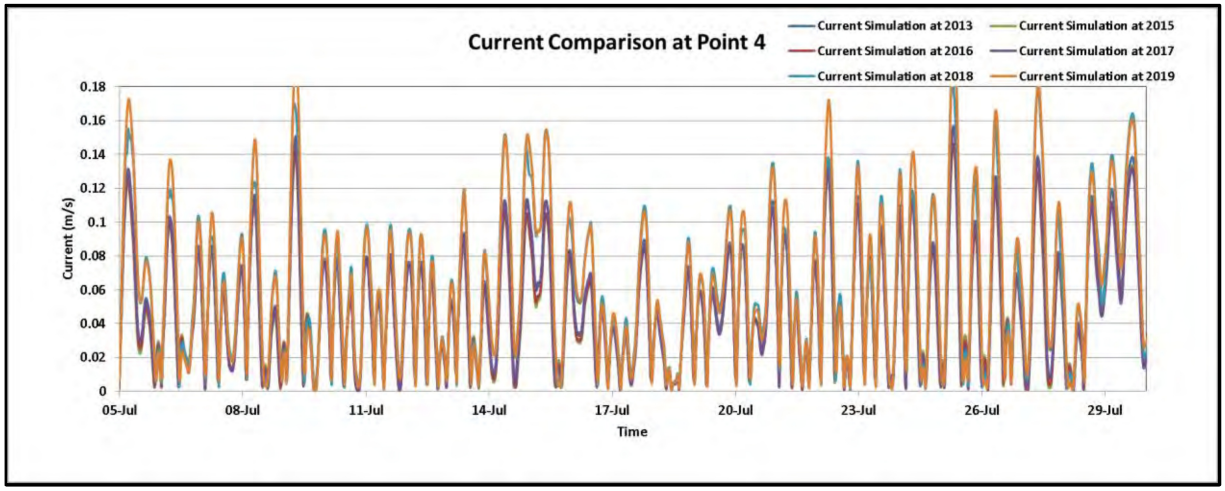


Figure 3-19 Current comparison at point 4

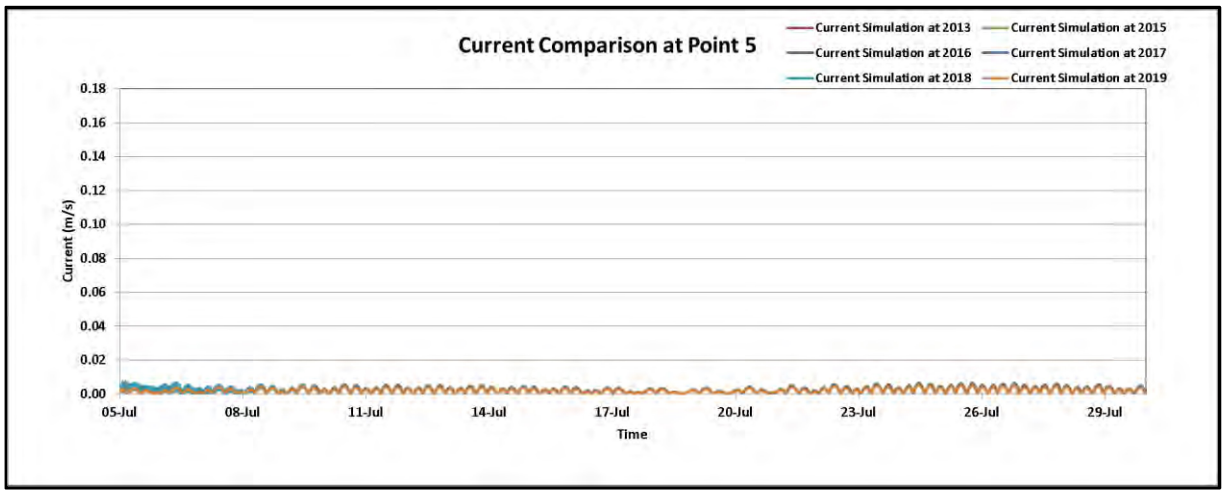


Figure 3-20 Current comparison at point 5

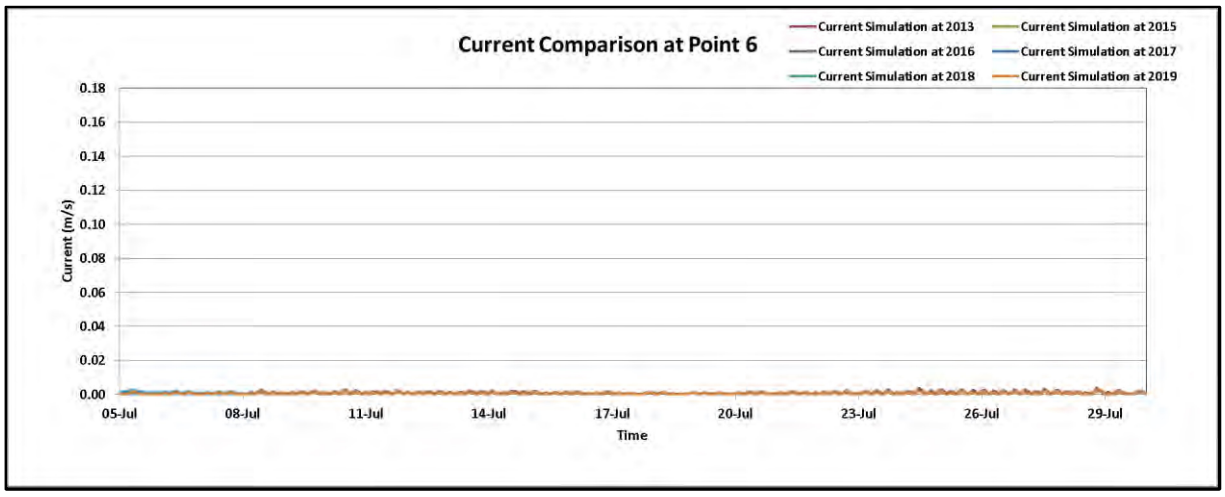


Figure 3-21 Current comparison at point 6

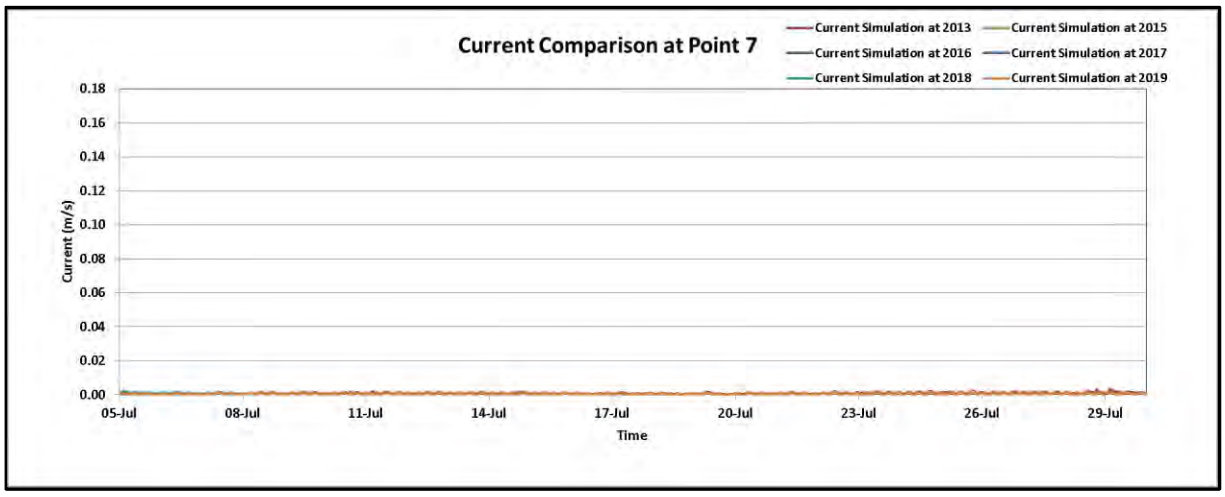


Figure 3-22 Current comparison at point 7

Also, model was setup using latest surveyed bathymetry as on date i.e. Post Monsoon 2019. 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 Figure 3-23.

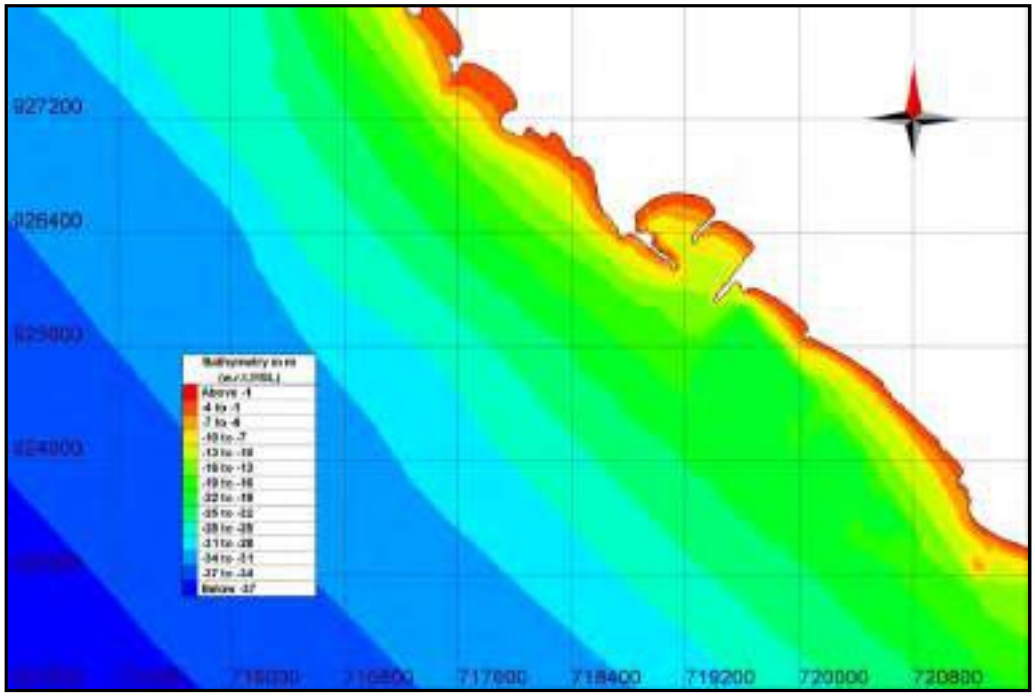


Figure 3-23 Post-Monsoon (2019) bathymetry with respect to MSL

Comparison between the simulated and observed tide and currents were done. Figure 3-24 shows the comparison between the modelled tide and observed tide measurement carried out by AVPPL. From the comparisons it can be seen that there is a good correlation between simulated and observed data which indicates that the change in bathymetry has no effect on the tidal variations.

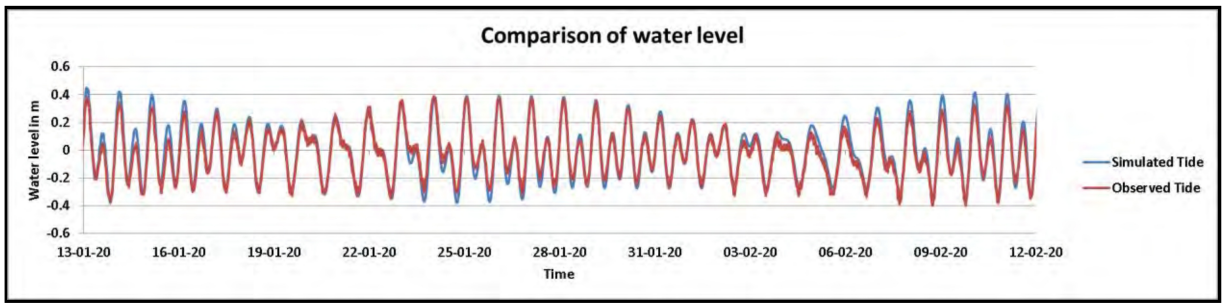


Figure 3-24 Comparison of simulated tide with observed tide (Post Monsoon 2019)

Figure 3-25 to Figure 3-32 represents the comparison of E-W and N-S components of current during Post monsoon 2019 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 at all the locations. Figure 3-33 and Figure 3-34 shows typical plots from simulation.

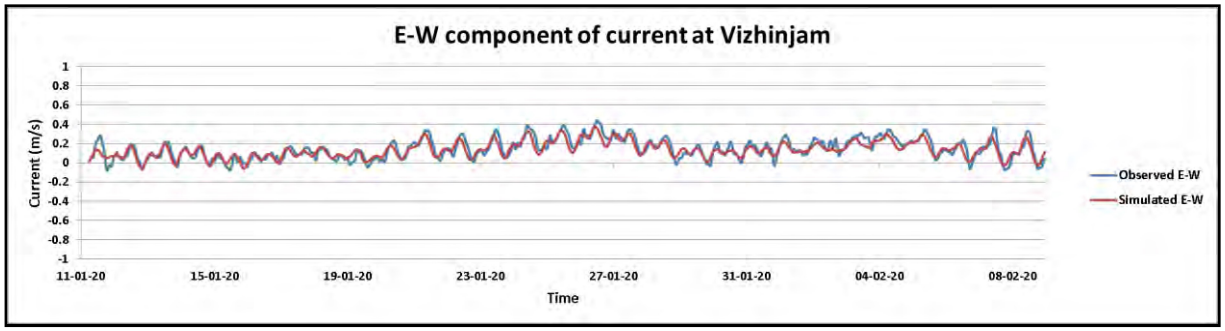


Figure 3-25 Comparison of E-W component of current at Vizhinjam (Post Monsoon 2019)

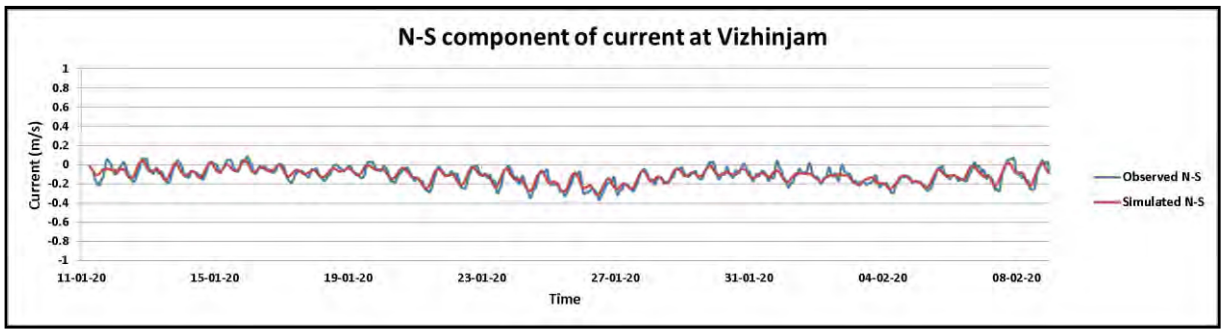


Figure 3-26 Comparison of N-S component of current at Vizhinjam (Post Monsoon 2019)

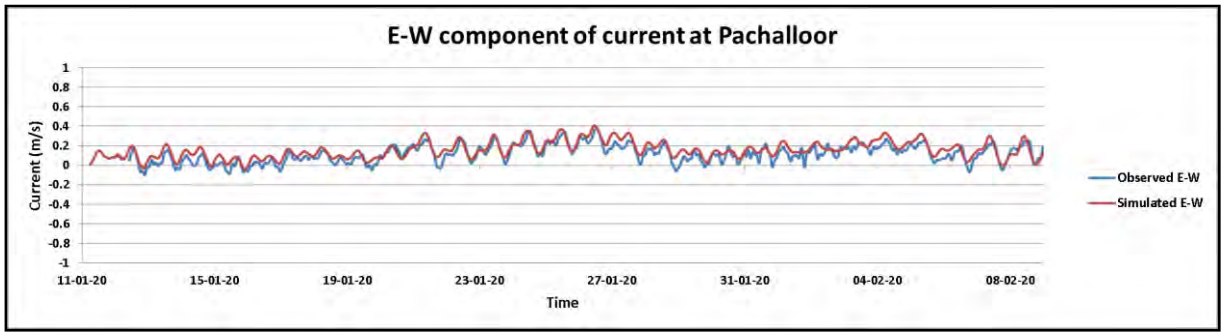


Figure 3-27 Comparison of E-W component of current at Pachalloor (Post Monsoon 2019)

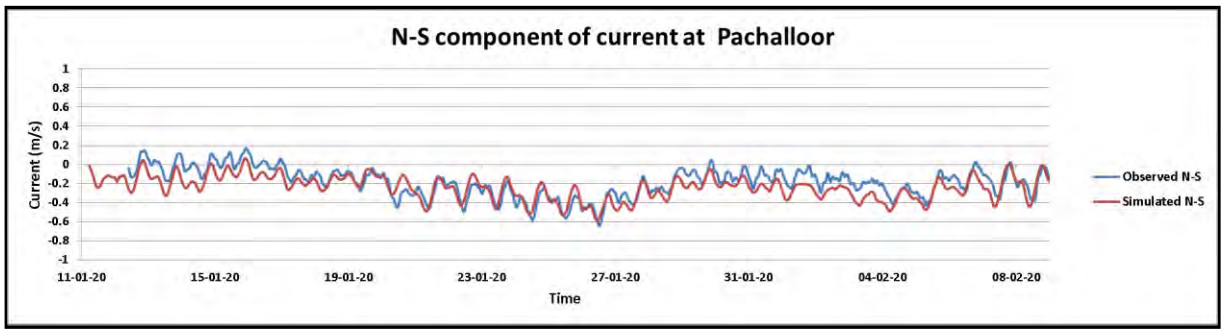


Figure 3-28 Comparison of N-S component of current at Pachalloor (Post Monsoon 2019)

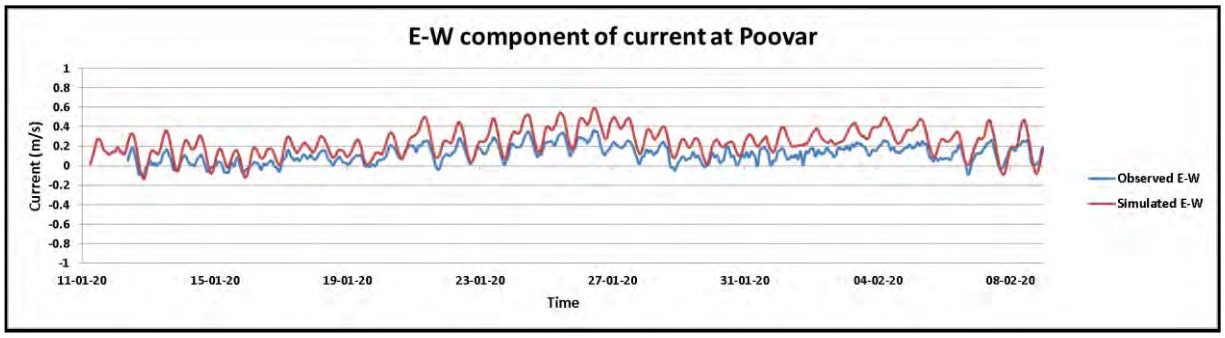


Figure 3-29 Comparison of E-W component of current at Poovar (Post Monsoon 2019)

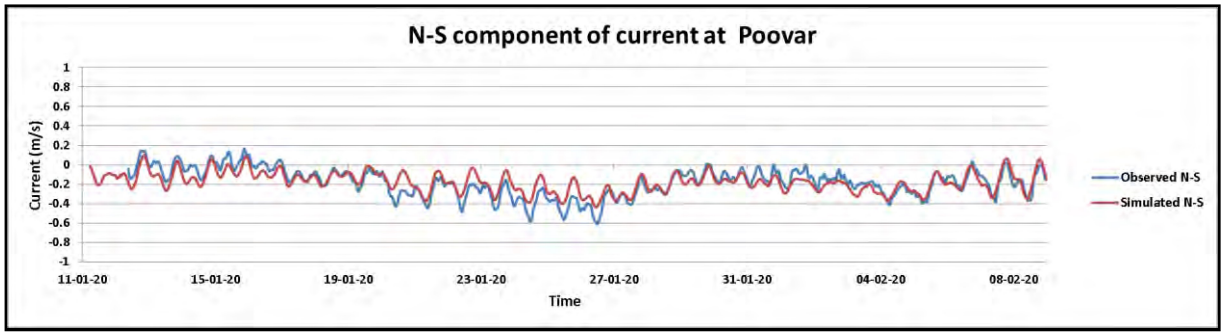


Figure 3-30 Comparison of N-S component of current at Poovar (Post Monsoon 2019)

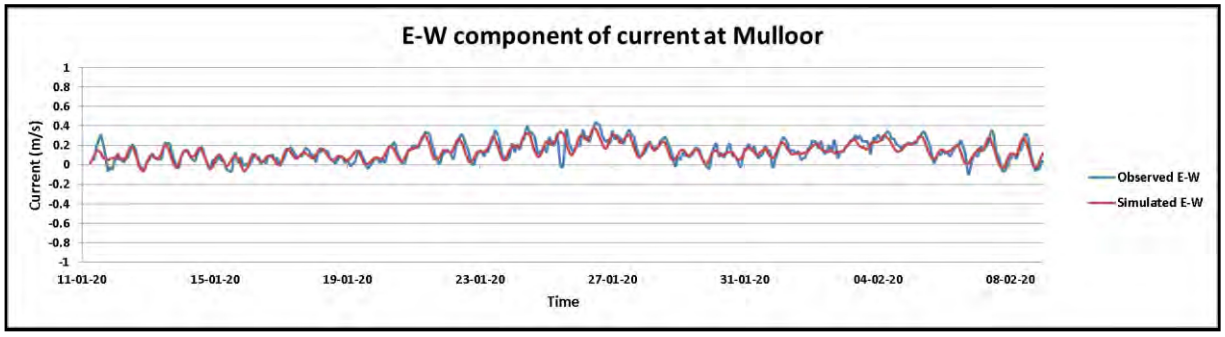


Figure 3-31 Comparison of E-W component of current at Mulloor (Post Monsoon 2019)

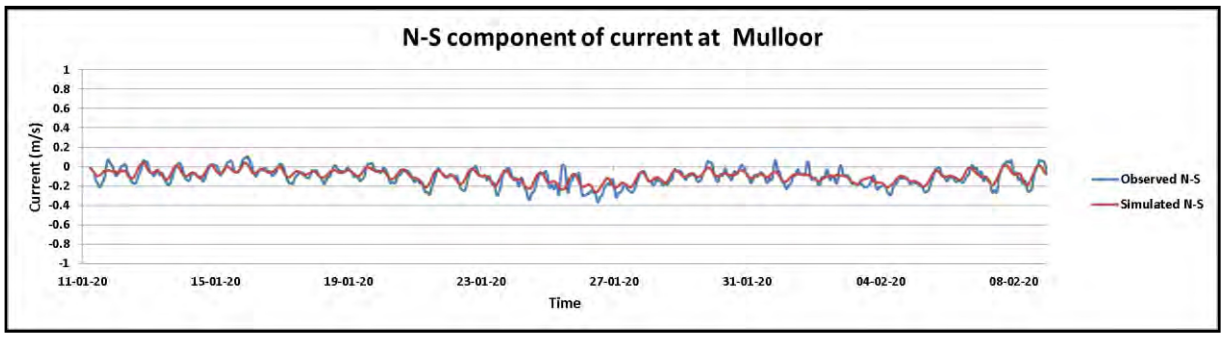


Figure 3-32 Comparison of N-S component of current at Mulloor (Post Monsoon 2019)

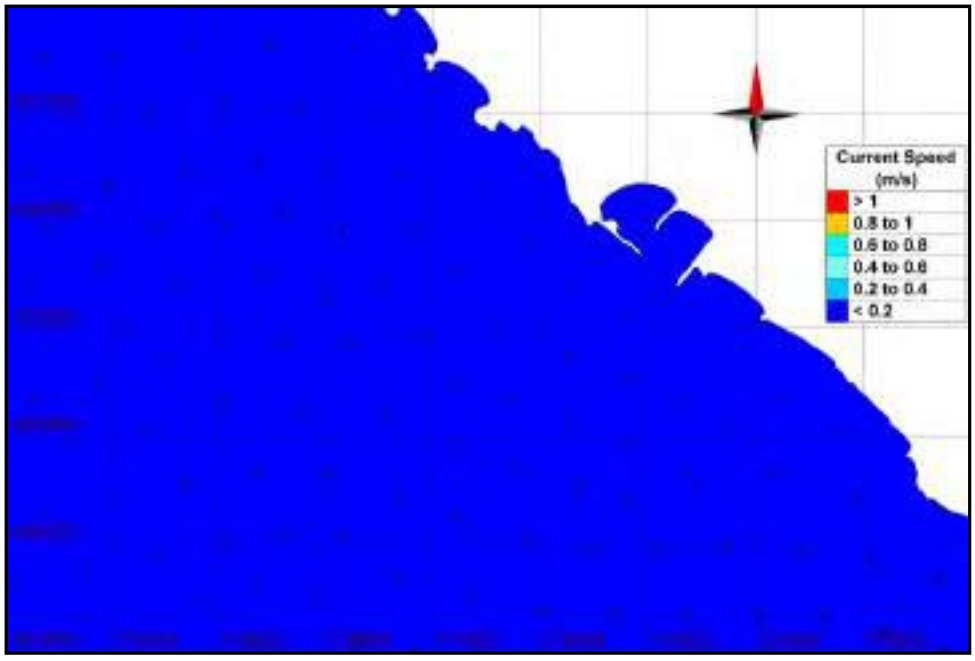


Figure 3-33 Typical plot of current pattern showing north-westerly flow

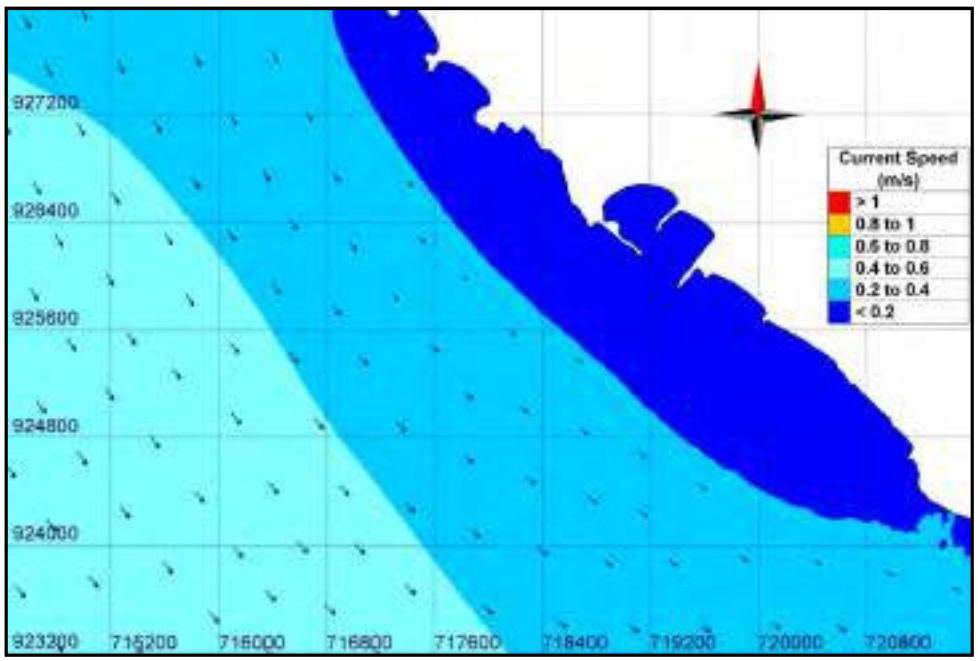


Figure 3-34 Typical plot of current pattern showing south-easterly flow

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 3-35. 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 3-36. This change in orientation will have effect on long shore sediment transport and its behaviour.

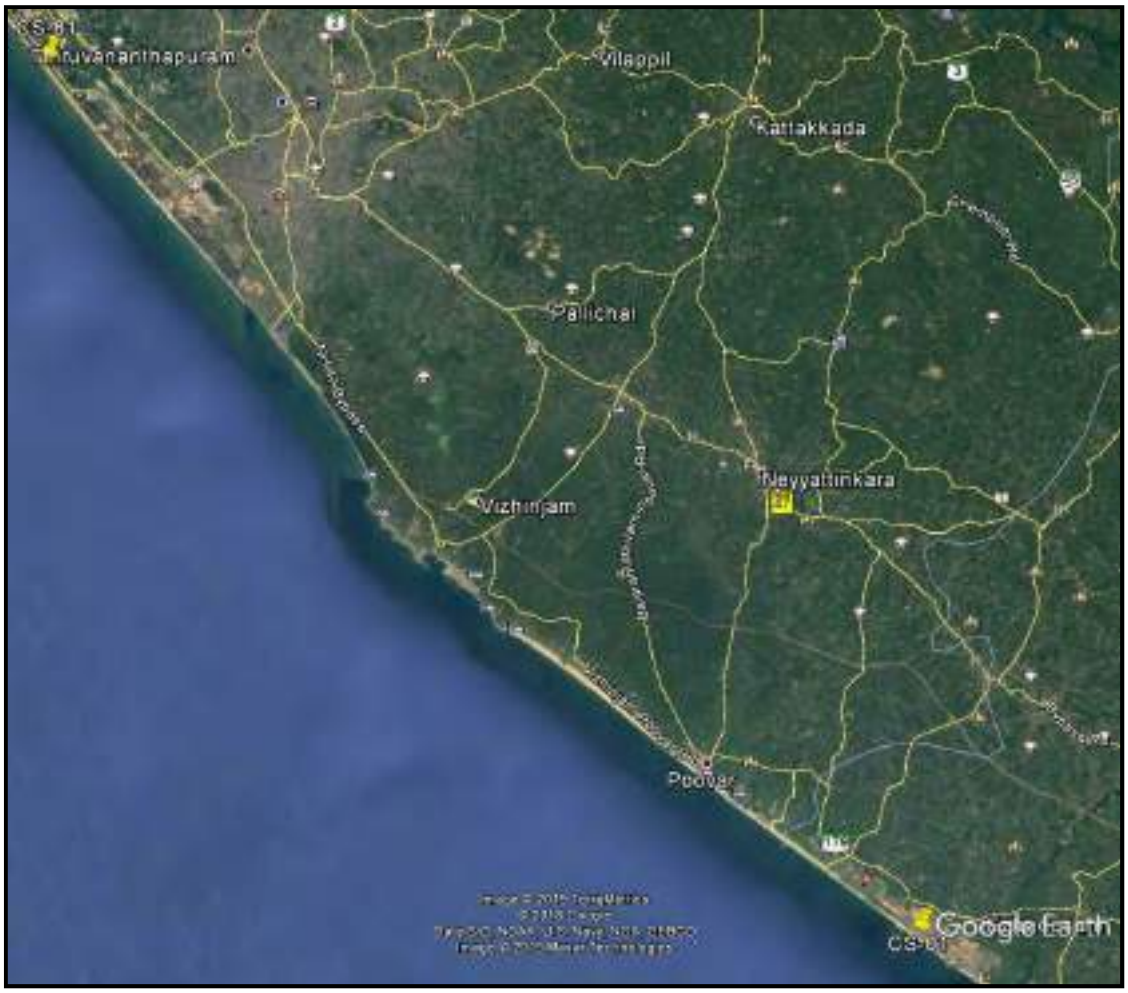
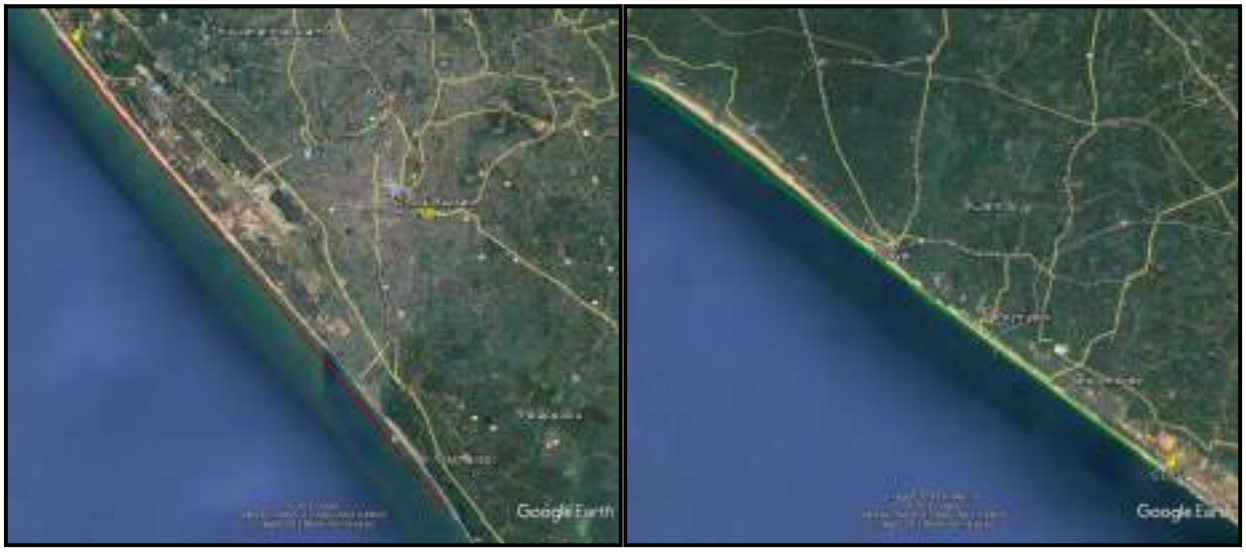


Figure 3-35 Study area



North orientation **South orientation**

Figure 3-36 Coast orientations

3.3.1 Long shore sediment transport due to breaking waves

In order to compute long shore 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.

The cross shore profiles, compared over the same temporal scale, at a section will represent the cumulative effect of longshore and cross shore transport took place in a year. The common profiles were established within common start and end coordinates at each section. The cross sectional area between these common profiles was calculated and the net quantity was found by multiplying these cross sectional areas with long shore distance between adjacent sections (in this case 500m). However, data gap in surf zone of cross shore profiles may have slight deviations in the estimation of net quantity. This net quantity is resultant of longshore transport alone as cumulative effect of onshore to offshore transport or vice versa will be cancelled out by using trapezoidal formula. The observed cross shore profile of February months were chosen to estimate the net quantity of longshore transport took place in a year.

The difference in net long shore transport estimate between two adjacent sections was compared with net quantity obtained from cross shore profiles.

As explained earlier, depending on the coast orientation two average LSTR estimates were calculated based on available 5 years data (Feb 2015 – Feb 2020). 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. LNTIEL used average profiles and filled data gaps using an interpolation technique so as to carry out the analysis. To interpolate LNTIEL carried out averaging of the profiles and the difference between the profiles and the average profiles were used to fill up the gap. 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. Figure 4-1 shows the volume change along the coast during Feb 2020. Abscissa (X – axis) represents the cross sections or stations and ordinate (Y – axis) represents the volume change in m^3/m alongshore. The positive values indicate accretion and negative values indicate erosion. The Brown line on the graph represents beach profile volume, the green line on the graph represents sea bed profile volume and the pink line on the graph represents net volume. It can be 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 shows either erosion or accretion. One of 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. Other reason could be due to longshore sediment transport. The general tendency observed in such a case is both beach side and sea side should show same trend i.e. either accretion or erosion which is not in this case. It can be due to combination of above limitations.

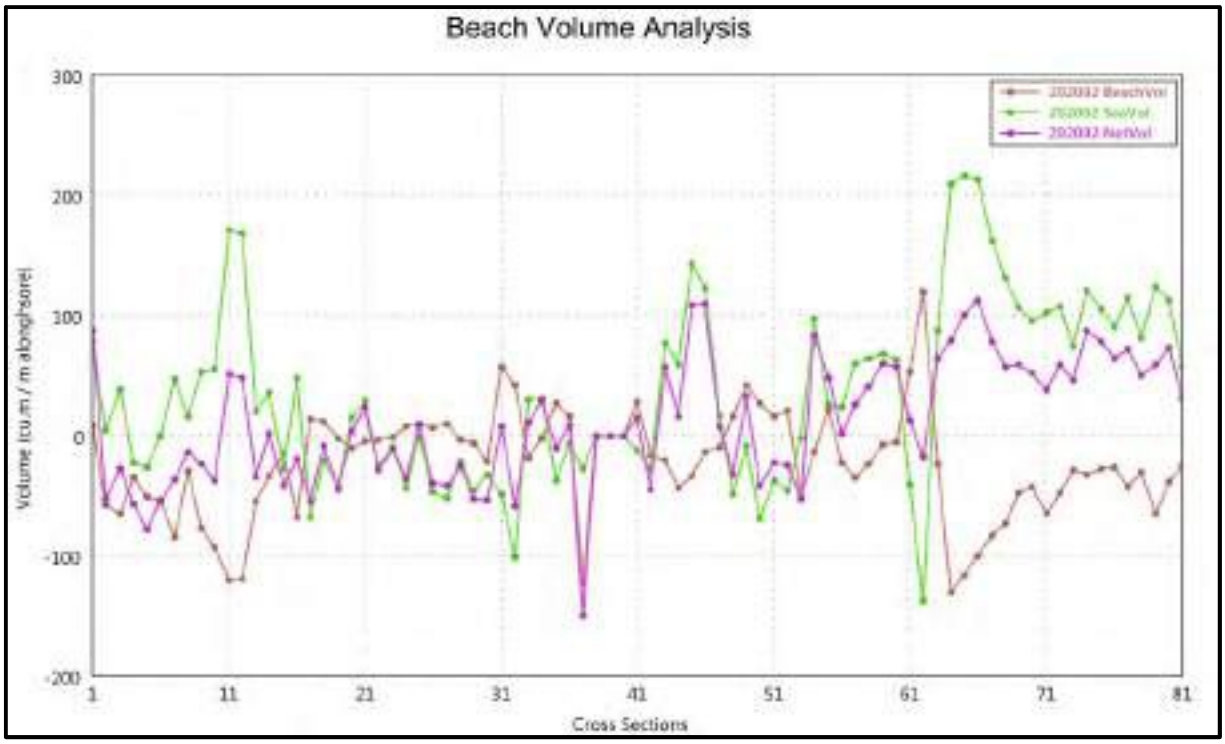


Figure 4-1 Volume change alongshore – Feb 2020

It is evident that in the immediate vicinity of the port location (38 to 40) the effect is minimal and major deviations are far away from port location. If these deviations are due to port development then it should be persistent from port location to extreme stations. But it is not the case and shall not be attributed to port development.

Principal Component Analysis (PCA) is the process of computing the principal components and using them to perform a change of basis on the data, sometimes using only the first few principal components and ignoring the rest. This can be used to decompose the profiles into the basic functions that most efficiently explain the data variance. The first mode explains more variance than any other mode. LNTIEL referred “Field evidence of beach profile evolution toward equilibrium” (Ludka, B. C., R. T. Guza, W. C. O’Reilly, and M. L. Yates – 2015) and done the PCA. Figure 4-2 shows the temporal variation of principal component 1. Most of the sections follow this pattern. This shows the beach profile is oscillating between bar (negative value) and berm (positive value). During Ockhi, the berm formation is disturbed and the beach has not recovered fully. In other terms, the beach profile shows seasonal variation of erosion and accretion.

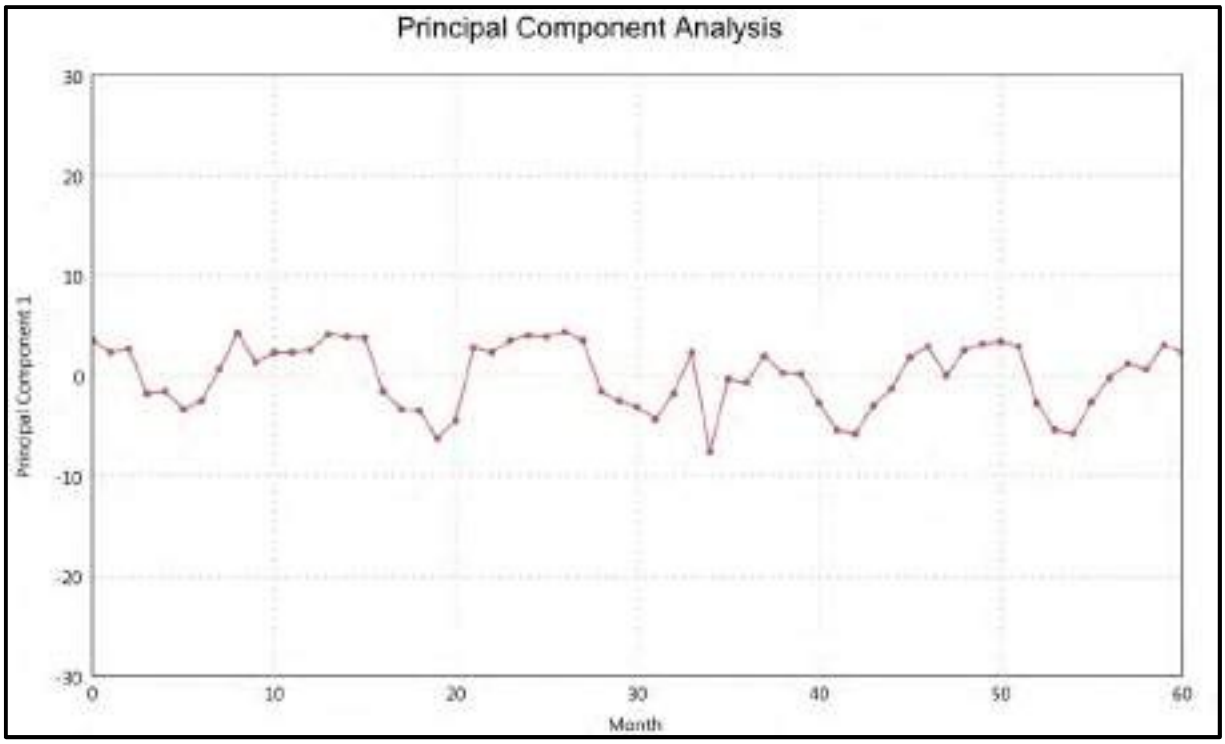


Figure 4-2 Temporal variation of principal component 1

The following graph represents the square of the Hs versus time. The square of the Hs is relatable to the energy of the wave. This shows good correlation with the principal component 1 temporal plot as we can notice the berm formation during calm period and bar formation during rough season.

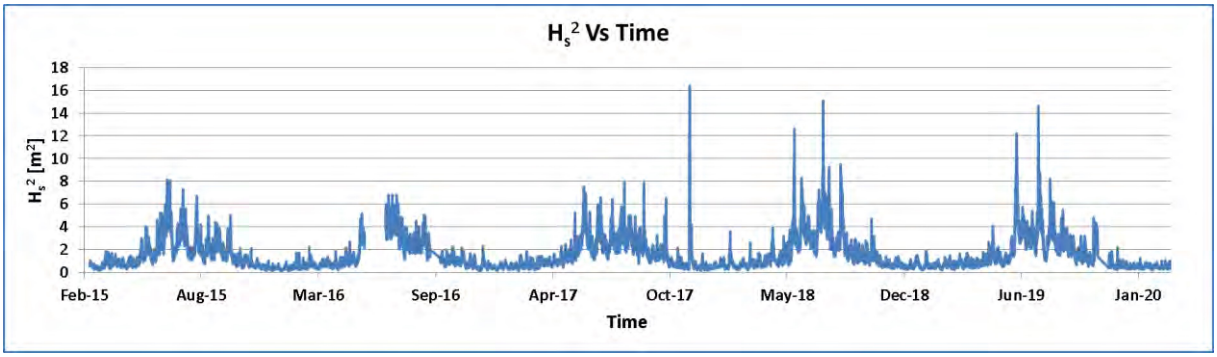


Figure 4-3 H_s^2 versus Time plot

The following graph shows temporal variation of H_s^2 and principal component. It can be noted from this graph that the higher the H_s^2, the lower the principal component and vice versa.

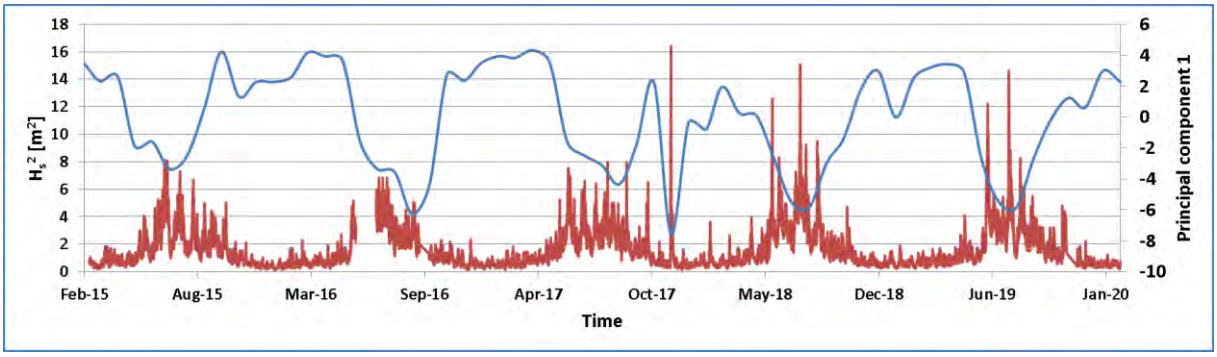


Figure 4-4 Graph showing temporal variation of H_s^2 and principal component 1

5 Conclusion

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

1) Data Analysis

- The bathymetry analysis has been carried out to check whether any changes occurred in the sea water depth due to the impact of upcoming port. Analysis was carried out by considering 5 sections perpendicular to the shore; two on the North of port, two on the South of port and one near the port. Cross sections of bathymetries from Pre monsoon 2016 to Post monsoon 2019 were compared. From the analysis, no change in bathymetry is observed even though some localized changes have occurred due to dredging and reclamation. The bathymetry towards the north and south of the port has remained similar since 2015 (the time since continuous measurement was carried out) indicating that the dredging activities in the port area has minimal impact on the bathymetry of the neighbouring areas.
- The observed wave data provided by AVPPL for the period of March 2019 to February 2020 is analysed and compared with the observed wave data for February 2015 to February 2019. Majority of the waves observed at the project location fall in the range of 0.5-1.5 m. From these comparisons, it can be seen that 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 2019 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 0.8 to 0.9 m/s.
- Continuous monitoring of turbidity using buoys has been carried out during March 2019 to February 2020 in three locations. It is perceptible from time series plots that the turbidity fluctuates all year round, though the values were lower than 10 NTU for almost all the time.
- 81 locations at 0.5 km interval were opted to collect beach sediments for each season. The data received by LNTIEL was analysed by plotting each of the profiles and cross shore profiles of different years of particular season were compared. The plots suggest that the shoreline movement of this portion of the coast is following its natural course till Ockhi. After this, the impact of Ockhi cyclone can be evidently noticed. Furthermore the increase in wave heights due to storm events in subsequent years is making the beach recovery more difficult.
- Further LNTIEL extracted (+) 2 m contour from cross shore profile data. The time series plot of (+) 2 m contour over four year data 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 no much accretion was noticed during fair weather 2017 and pre-monsoon 2018. In addition, as a result of monsoon 2018 and 2019 the beach got further eroded compared to previous monsoon seasons.

- LNTIEL extracted -3m, -4m, -6m and -8m contours from cross shore profile data and time series plots of respective contours over five year data are shown at Neerody, Pozhiyoor, Karumkulam, Panathura, Beemapally and Vettucaud locations.

2) Model Studies

a) Near Shore Wave Transformation

- Offshore wave data from March 2019 to February 2020 was obtained from NCEP 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, 2015, 2016, 2017, 2018 and 2019) 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) Longshore sediment transport

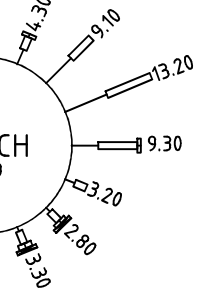
- Longshore sediment transport refers to the cumulative movement of beach and near shore material parallel to the shore by the combined action of tides, wind, waves and the shore-parallel currents produced by them.
- The study area extends from Edappadu Beach (CS 01) in the South to Thumba (CS 81) in 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.
- In order 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 5 years data (Feb 2015 – Feb 2020). 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 so as to carry out the analysis.
- 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.
- It is evident that in the immediate vicinity of the port location (38 to 40) the effect is minimal and major deviations are far away from port location. If these deviations are due to port development then it should be persistent from port location to extreme stations. But it is not the case and shall not be attributed to port development.

From all the data analyses and model studies carried out by LNTIEL, 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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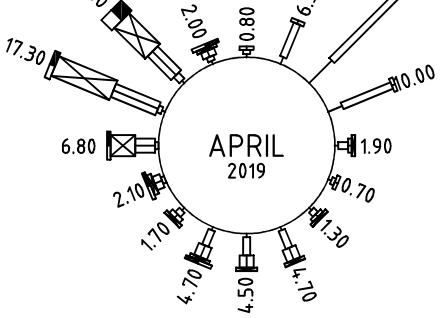
APRIL
2019
17.30
6.80
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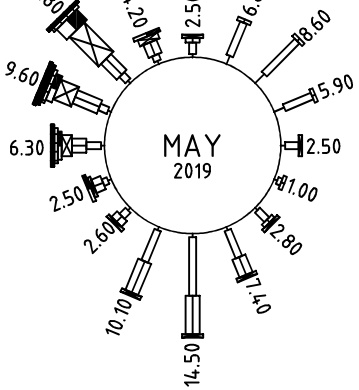
MAY
2019
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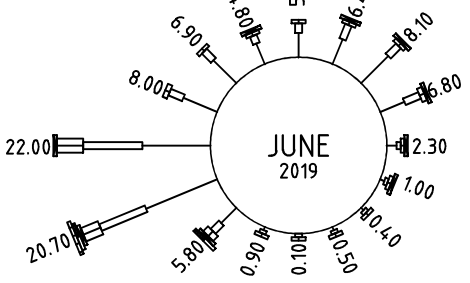
JUNE
2019
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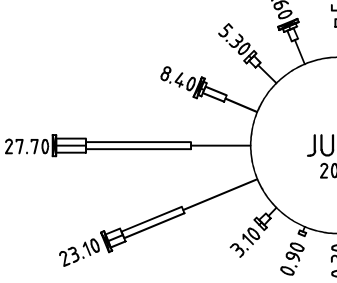
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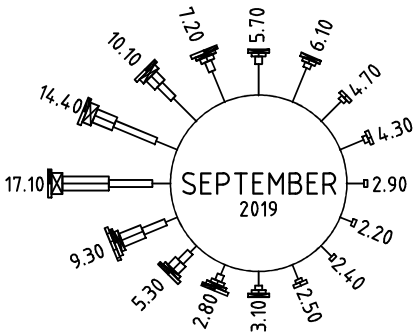
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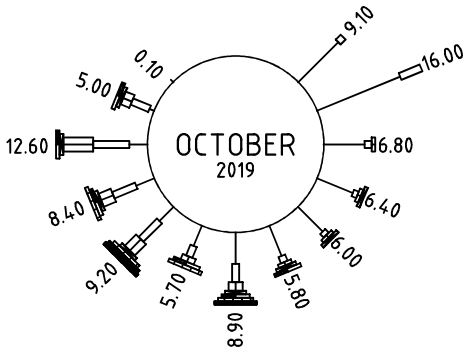
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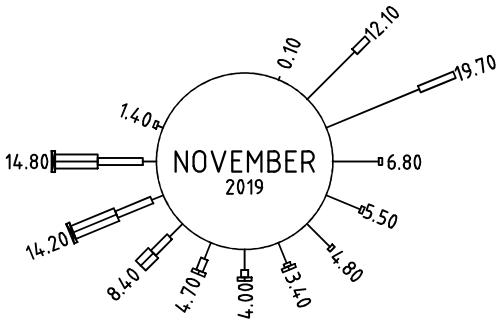
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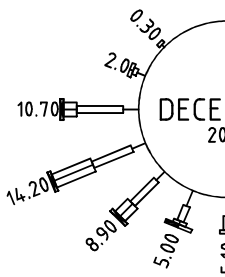
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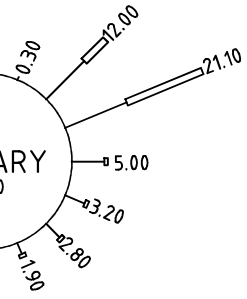
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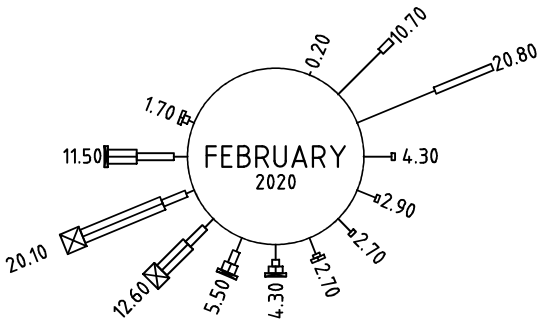
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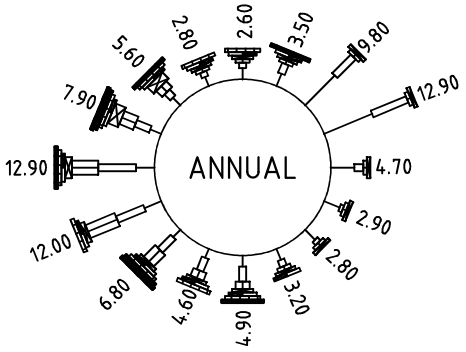
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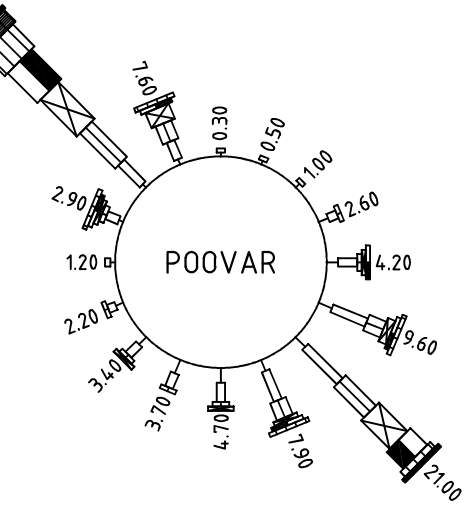

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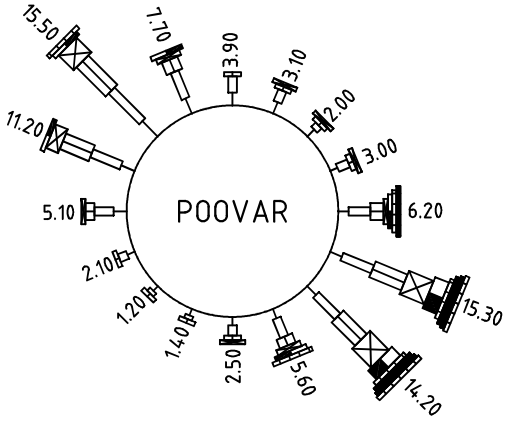

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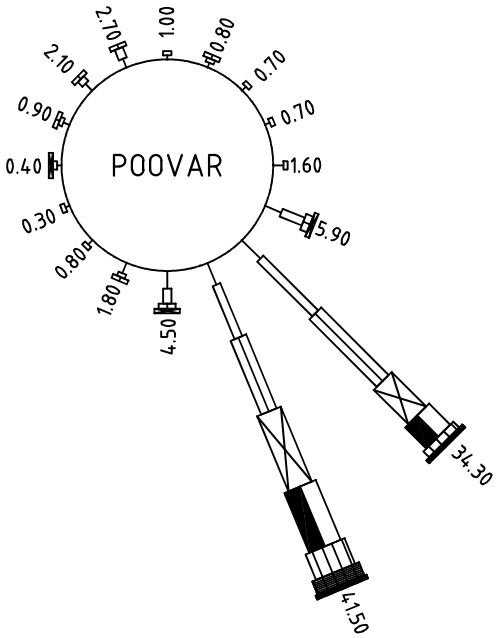

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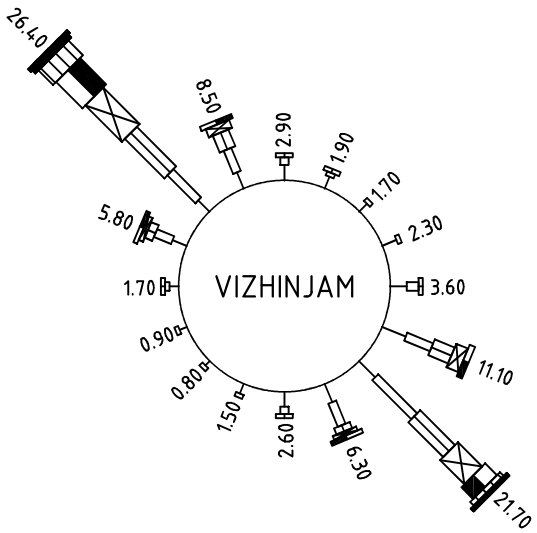

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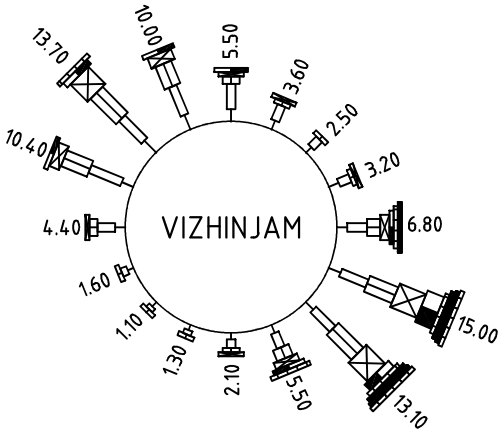

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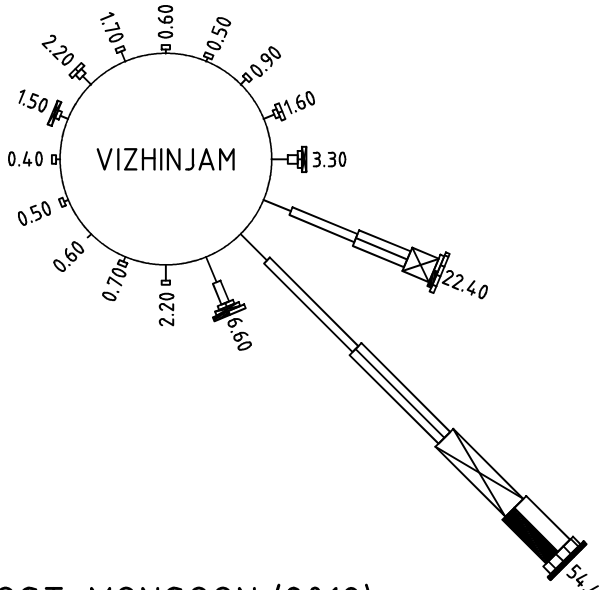

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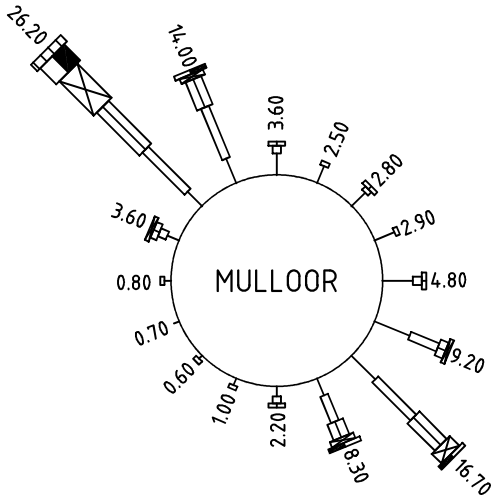

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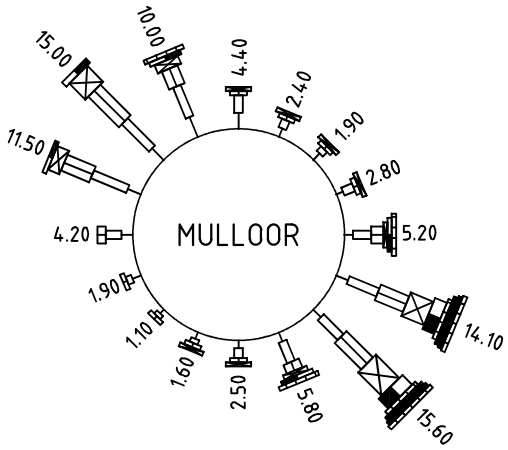

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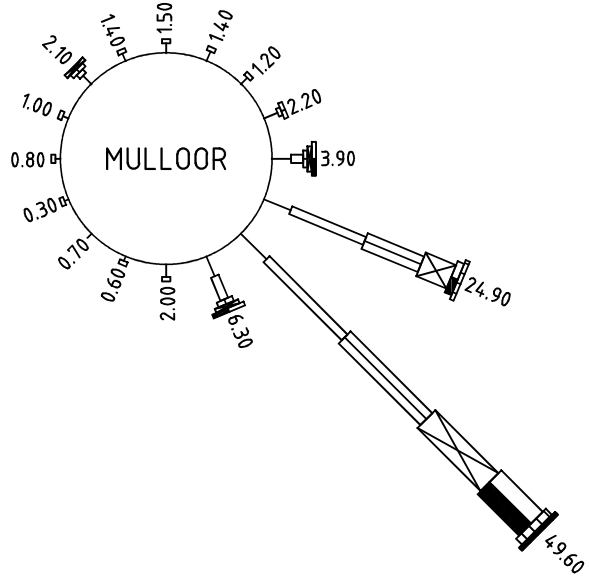

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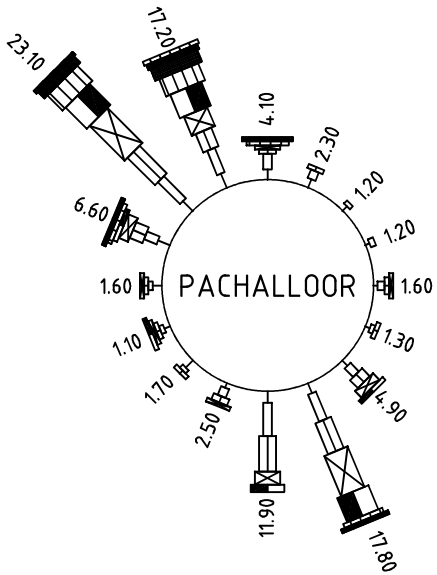

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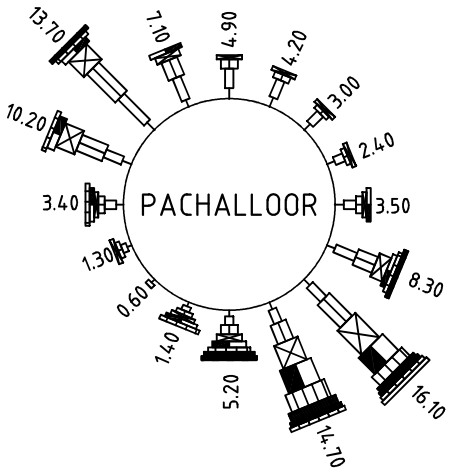

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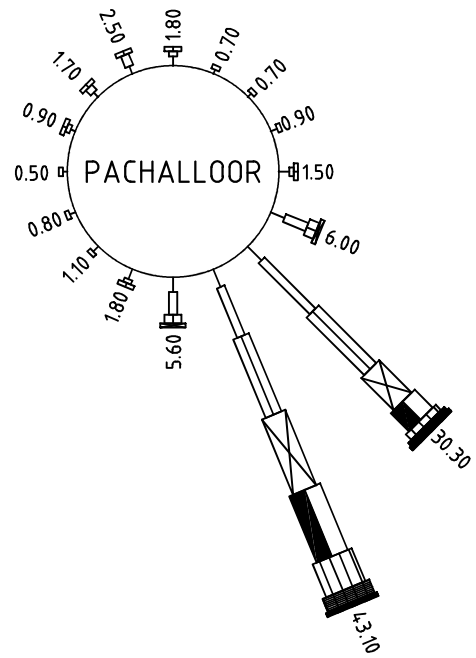

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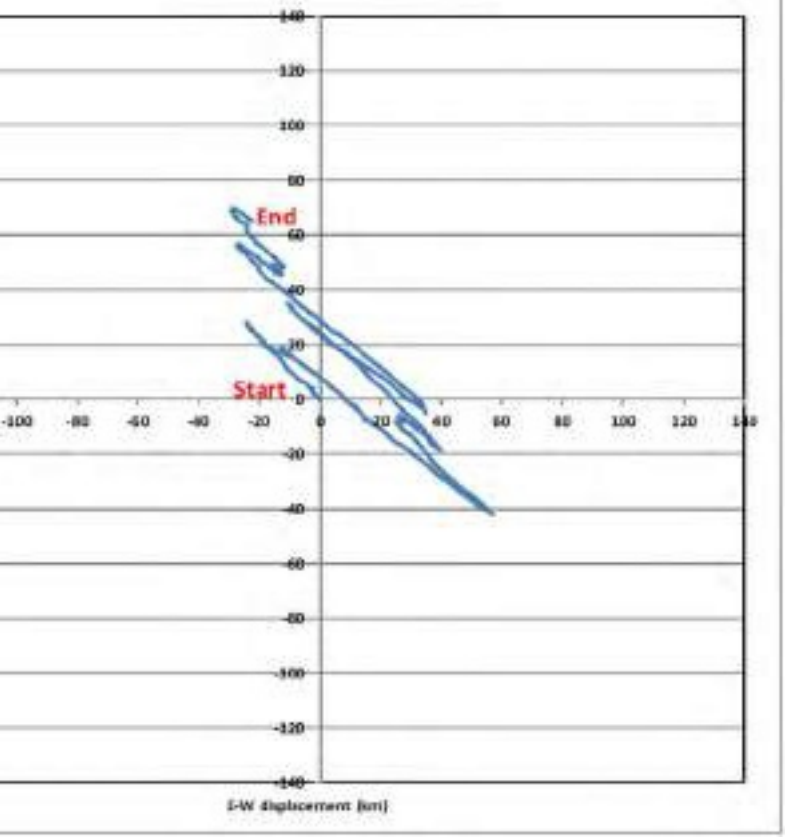

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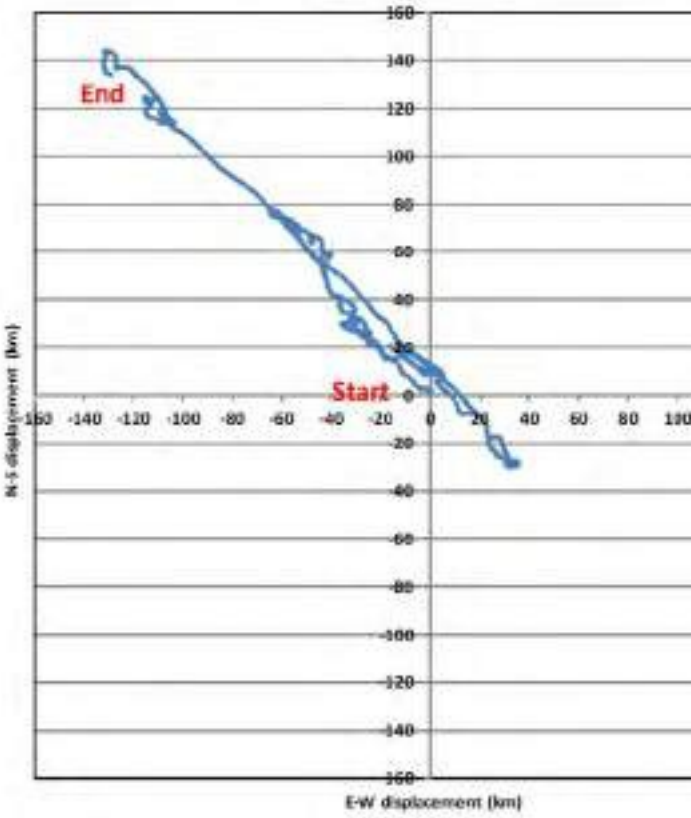

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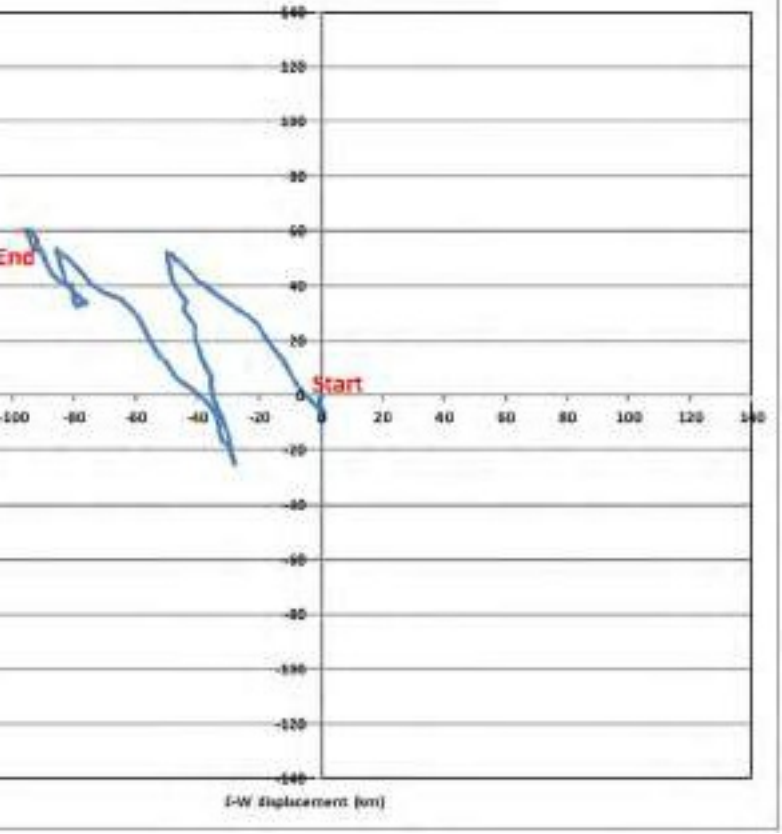

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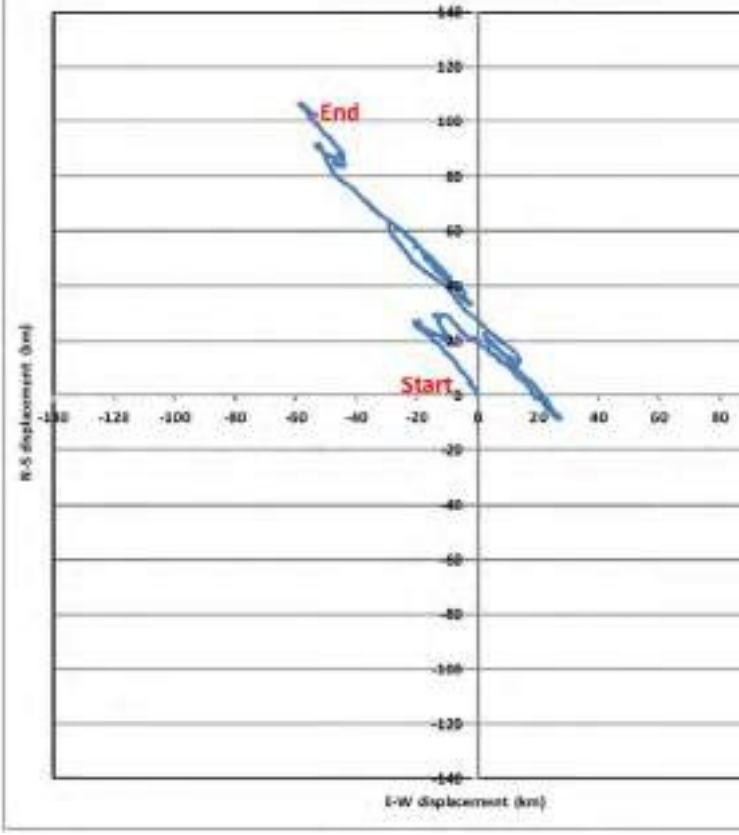

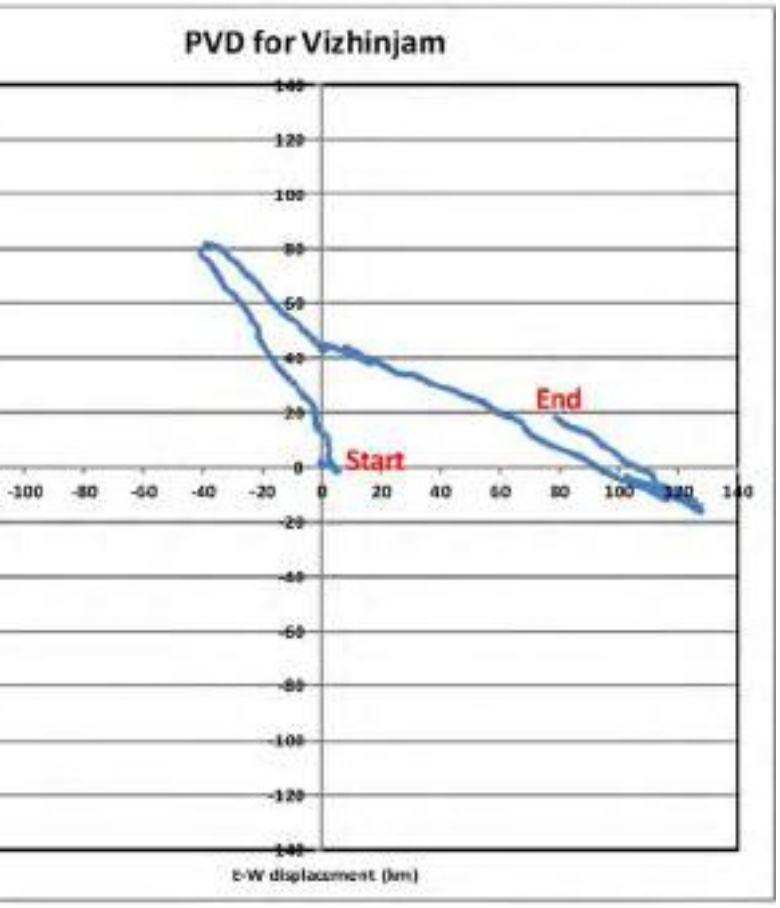
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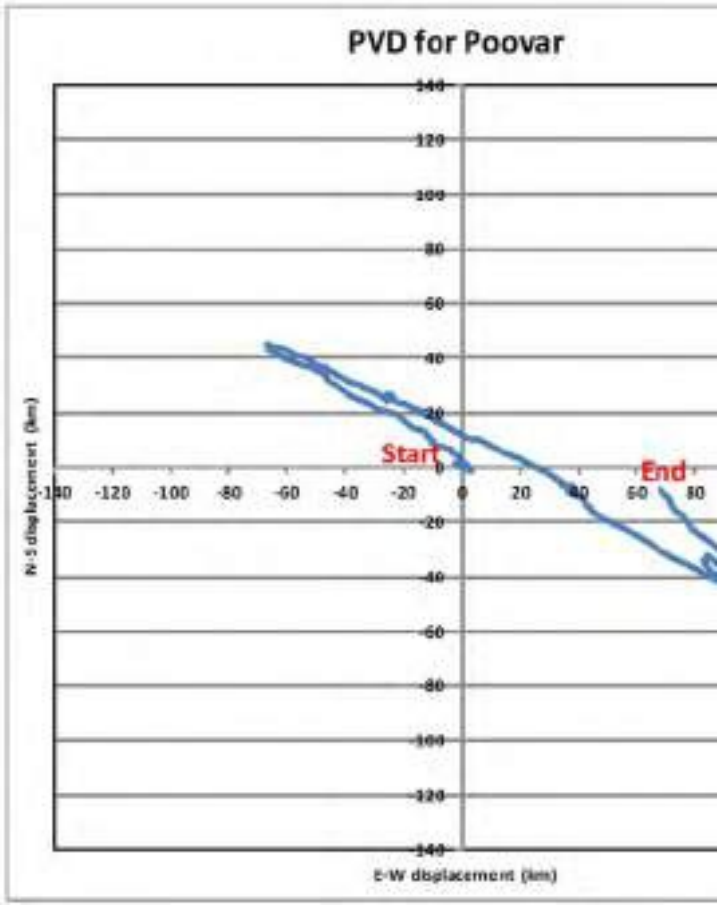
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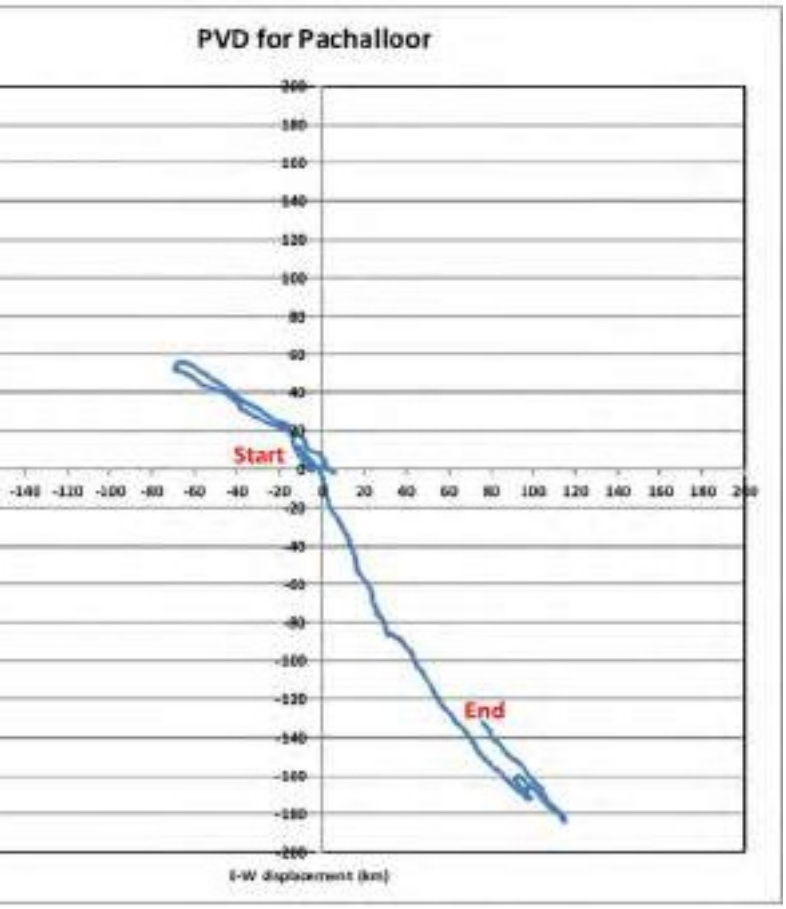
E-W displacement (km)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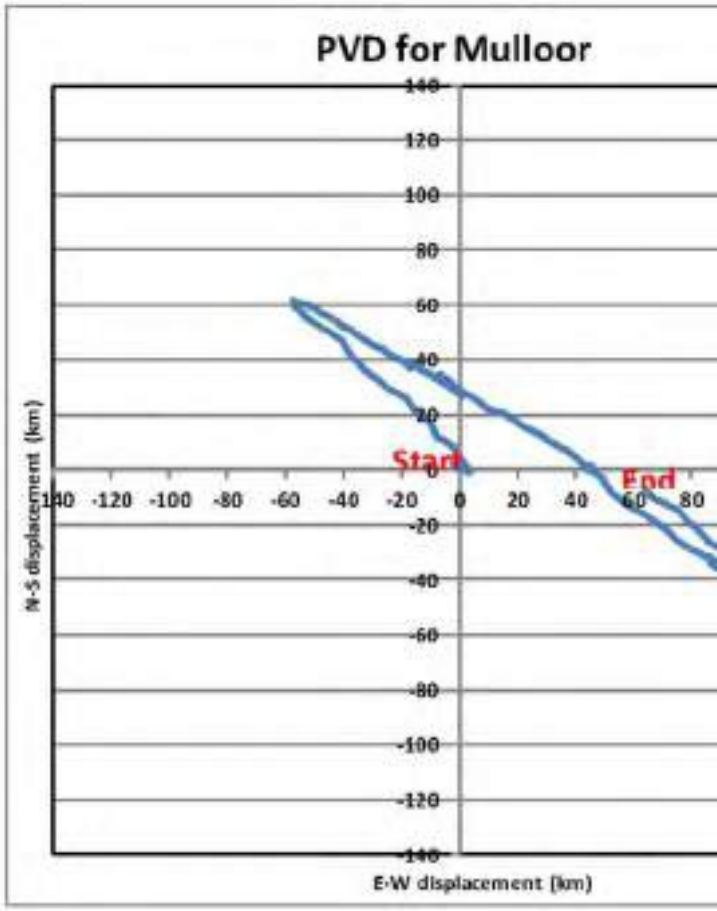
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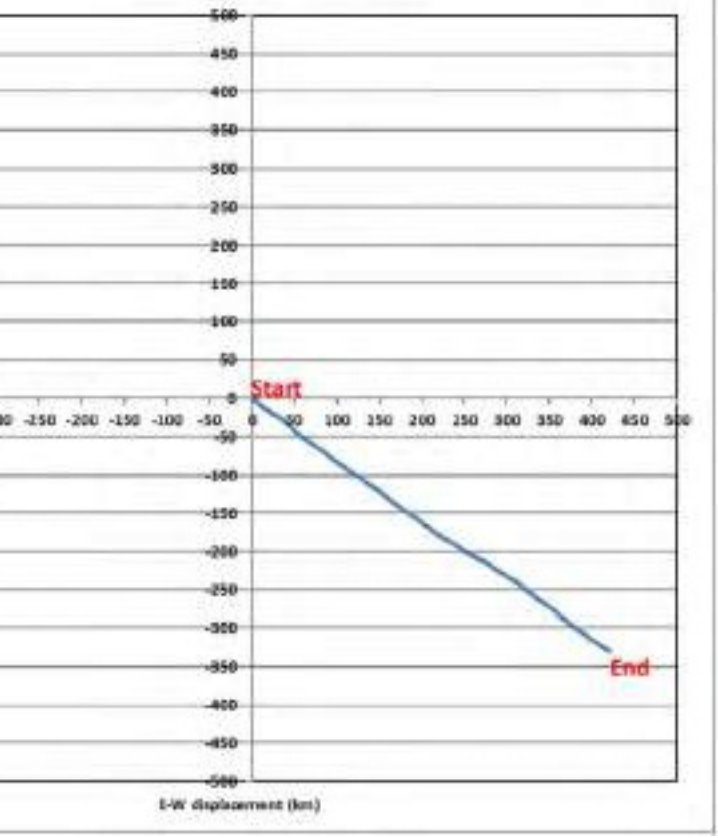
N-S displacement (km)
E-W displacement (km)

PVD for Vizhinjam



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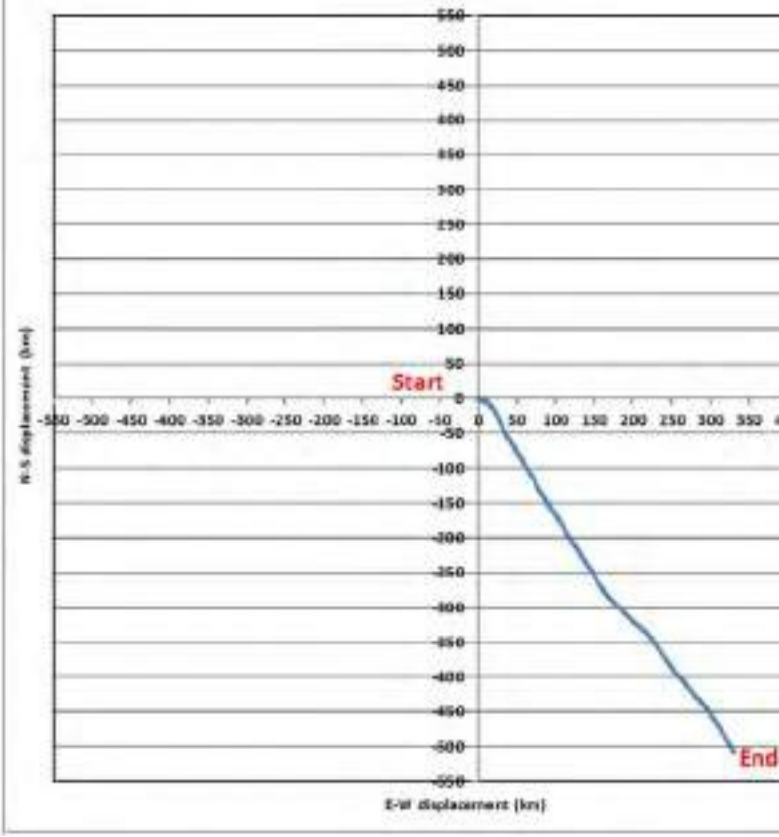

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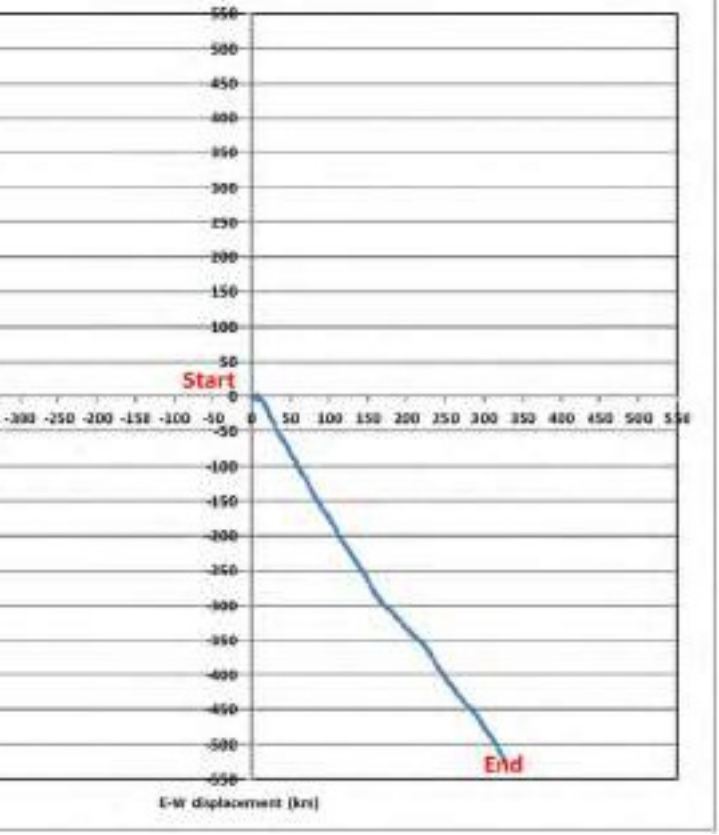

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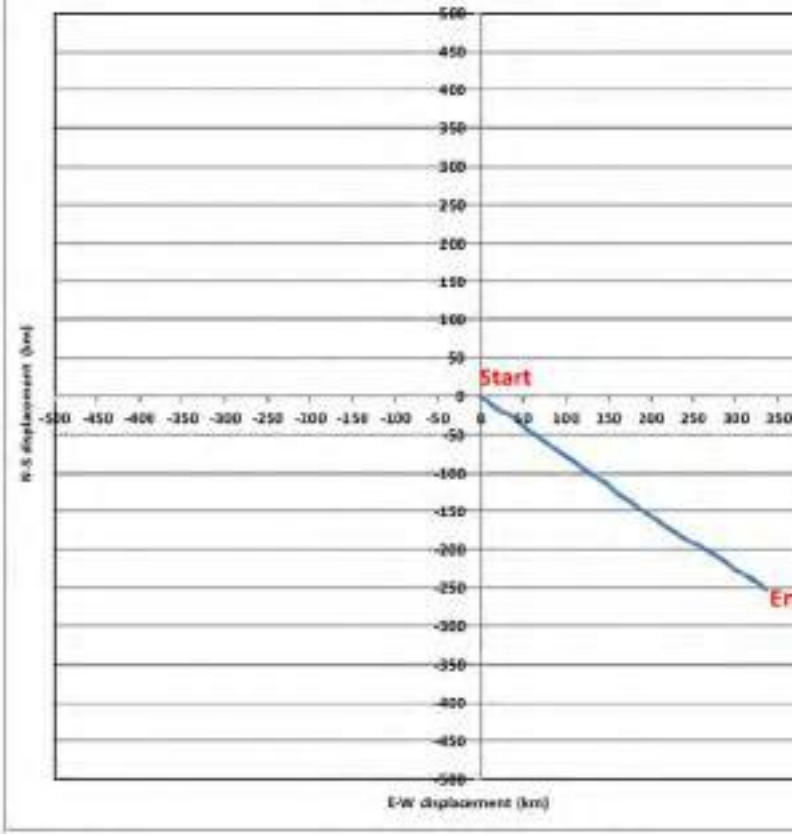


Annexure III

Environment Monitoring Report

(April 2020 to September 2020)

HALF YEARLY ENVIRONMENT MONITORING REPORT

For the period

April 2020 to September 2020



Adani Vizhinjam Port Pvt. Ltd.

Vizhinjam, Kerala

CONTENTS

- Introduction
- QA/QC Procedure
- Ambient Air Quality Monitoring
- Ambient Noise Level Monitoring
- Marine water & Sediment
    - Marine water Analysis Report
    - Sediment Analysis Report
    - Phytoplankton Analysis from Marine Samples
    - Zooplankton Analysis from Marine Samples
- Groundwater Analysis Report
- Surface water Analysis Report

CHAPTER 1

Introduction

Ashwamedh Engineers and Consultants (AEC) was established in May 1986. The company is engaged in providing Environmental pollution testing, Food and agriculture testing and Consultancy Services. Our affiliates are established all over India and overseas. Ashwamedh has steadily achieved growth up to such an extent that it has become India's foremost analytical laboratory with several branch offices. The well-equipped laboratory and office set up of about 28000 sq.ft at Nashik, Maharashtra. The strength of our organization is the years of hard work, dedication and contribution made by our staffs who are experts in their respective fields and they produce innovative ideas for the growth of the organization.

Ashwamedh has made itself capable of testing of water, waste water, air, food, noise monitoring, hazardous and non-hazardous waste testing, fuel and agriculture testing. We have a state-of-art Laboratory set-up for Chemical, Mechanical and Microbiological Analysis at Nashik. Our Laboratory is accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) in accordance with ISO/IEC 17025:2005 in the Chemical, Biological and Mechanical Testing fields (Certificate numbers: T-5509). Our Laboratory is recognized by the Ministry of Environment, Forests & Climate Change (MoEF&CC), Govt. of India (GoI), New Delhi under Environment (Protection) Act, 1986. We are also ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 certified organization.

Our Laboratory is recognized by Bureau of Indian Standard for Packaged Drinking Water and Packaged Natural Mineral Water also recognised by Agricultural and Processed Food Products Export Development Authority (APEDA). Our laboratory is approved by Food Safety & Standards Authority of India (FSSAI) for food testing also approved by Agricultural Marketing (AGMARK) and State Agriculture Department.

AEC was engaged by Adani Vizhinjam Port Pvt. Ltd. (AVPPL) for the Post EIA Environmental Monitoring as per Environmental Monitoring Plan mentioned in EIA and EC. AVPPL issued service order no. 5700273929 dated: 07.08.2019 and S.O. No. 5700288999 dated: 21.08.2020; which mentions the matrix, parameters and frequency of environmental monitoring. AEC carried out said environmental monitoring strictly as per above mention service order. As per the service order 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).

AEC is submitting 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 condition mentioned in service order.

This present report is the consolidated half yearly report over the six month period of April 2020 to September 2020. Due to the lockdown imposed by the Government of India (GoI)/Government of Kerala (GoK) as a result of the ongoing COVID-19 pandemic, environmental monitoring was hampered; particularly during the months of April 2020 to July 2020.

CHAPTER 2

Quality Assurance /Quality Control Procedure

The quality assurance and quality control plan include following elements:

1. Sample collection, preservation and transportation of sample
2. Chain of custody
3. Laboratory Analysis
4. Data evaluation and validation

1. Sample collection, preservation and transportation of sample:

The Team leader ensures that selected members of the study team meet all the selection criteria identified. Prior to the starting of the study, individual team members were put to test in the laboratory for their competency in carrying out typical environmental sampling/monitoring for different parameters as per the requirements of the project.

The team leader has ensured that the selected procedures are documented and the study team members are familiar with the sampling and analytical procedures. Before commencement of work, the team leader has checked for availability of all the items required for sampling at site and in the laboratory. In case of any missing items, suitable alternate arrangements have been made and required materials were procured.

Precautions are taken to protect the samples, the material being sampled, the sampling instruments and containers for samples from contamination. Samples are sufficient in volume and frequency is decided based on scope of work. Samples are collected, packed and transported prior to analysis in a manner that safeguards against change in the particular constituents or properties to be examined.

For the collection of samples appropriate containers are used with respective sample matrix and parameters analysed as per the method reference.

Labelling of samples is done at site only and it includes the name of location, date of sample collection. Sampling sheet is filled at site with required information. The sample is sent along with the sampling sheet to laboratory for further analysis.

For the preservation of sample appropriate preservation techniques with respect to parameters analysed is followed and samples are transported with due care to the laboratory.

2. Chain of Custody:

Firstly, after receiving the samples at the laboratory, assigning Sample ID is a very systematic and methodical way of representing samples identification as Sample ID is a Permanent Identification Number of a sample and it maintains traceability and transparency throughout the process.

It is the format for communication between Sample Receipt Department and the Laboratory. Laboratory also communicates to the Sample Receipt Department. It gives all details of sample except its company name. It includes parameters to be analysed, method reference for each parameter analysed, units in which the analytical results to be expressed, results of each parameter analysed, date at which the analysis was started and date at which the analysis was completed.

After completion of analysis, analytical values duly filled in by respective analyst with the help of test data in respective report format. This draft report is verified and approved by Technical Manager. Final reports are prepared and authorised by Technical Manager and sent to client.

3. Laboratory Analysis:

All physiochemical and biological analysis, as per the scope of work are carried out at our permanent facility at Nashik, Maharashtra. For the sampling and analysis of samples standard reference methods are used.

4. Data evaluation and validation:

For the quality control and validation, laboratory follows the following procedures:

1. Participation in Inter-Laboratory Comparison (ILC) with NABL accredited laboratories.
2. The results obtained from all laboratories are recorded and reviewed for performance by Quality Manager and acceptance criteria is satisfactory ≤ 2.
3. The laboratory also participates in Proficiency testing (PT) programmes conducted by NABL/Central Pollution Control Board (CPCB)/other Proficiency testing (PT) providers depending on the availability of the programme.
4. The results received from nodal laboratory are recorded and reviewed for performance.

5. Replicate testing is done on received samples in a planned manner as per schedule. Replicate testing is done by same/different analysts or using same/different methods.
6. Reviewing the results of replicate testing for performance evaluation is done by Quality Manager.
7. Acceptance criteria in case of replicate/duplicate testing is </20% relative standard deviation.
8. Testing of retained samples is carried out, by allotting a new sample ID and sending it to laboratory for retesting done by same/different analyst or using same/different methods.
9. Reviewing the results of retesting for performance evaluation is done by Quality Manager.
10. Acceptance criteria in case of retesting is </20% relative standard deviation.
11. Correlation of results for different characteristics like TDS/EC ratio. Anion/cation balance, COD/BOD correlation is carried out.
12. The quality control data is analysed and where they are found to be outside predefined criteria, planned action is taken to correct the problem and to prevent incorrect results from being reported.

Table 2.1: Check list format for sampling

Item	Yes or No	If No, reason and Justification for acceptance
Was the sampling point correctly located?	Yes	
Permanent facility available?	Yes	
Was the correct sample used?	Yes	
Were the proper types of sample containers used?	Yes	
Were the replicates or multiple samples taken as required?	Yes	
Were adequate quantities of samples taken?	Yes	
Were the sample containers properly labelled?	Yes	
Were the preservatives added and sample containers sealed as required?	Yes	
Were the sealed sample containers maintained at required storage condition?	Yes	
Checked by: Team In-charge	Yes	

Note: It is not necessary that this form be filled each sample/sampling point. It is sufficient if the deviations if any are recorded in the log books.

Table 2.2: Check list for sample Integrity

Item	Yes or No	If No, reason and Justification for acceptance
Is the chain of custody record attached?	Yes	
Is the chain of custody record filled in properly	Yes	
Is the sample received within the holding time?	Yes	
Is the sample seal on sample containers intact?	Yes	
Is the sample received in proper storage condition?	Yes	
Is the sample quantity adequate for required analysis?	Yes	
Checked By: Team In – charge		

Note: It is not necessary that this form be filled each sample/sampling point. It is sufficient if the deviations if any are recorded in the log books.

Table 2.3: Check list format for analysis

Item	Yes or No	If No, reason and Justification for acceptance
Was the correct method used for the analysis?	Yes	
Were the correct instruments, equipment and apparatus used for the analysis?	Yes	
Was the competence of the analyst deployed for the analysis verified?	Yes	
Were the instruments, equipment and apparatus used pre-calibrated as required?	Yes	
Was the sample correctly and adequately identified and described in the analysis logbook?	Yes	
Were all the raw data properly recorded?	Yes	
Were the correct equations and units used?	Yes	
Checked By: Lab Manager		

Note: It is not necessary that this form be filled each sample/sampling point. It is sufficient if the deviations if any are recorded in the log books.

Table 2.4: Check list format for quality check in the field

Parameters	Comments (Yes/No)	Remarks
Sample bottle labelled?	Yes	
Sample container rinsed with D.D. water?	Yes	
Field equipment blanks are identified	Yes	
Is the preservative has been added after sampling or preserved as per sampling/ Test method?	Yes	
Are proper storage conditions are maintained?	Yes	
The sample quantity is adequate?	Yes	
Is sample properly identified?	Yes	
Is proper type of container used?	Yes	
Checked By: Lab Manager		

Note: It is not necessary that this form be filled each sample/sampling point. It is sufficient if the deviations if any are recorded in the log books.

Table 2.5: Check list format for quality check in the lab

Parameters	Comments (Yes/No)	Remarks
Is the sample details entered into Raw data register?	Yes	
Sample quantity measured?	Yes	
Glassware is calibrated?	Yes	
Balance/equipment is calibrated?	Yes	
Data entered in the analyst work book or not?	Yes	

Note: It is not necessary that this form be filled each sample/sampling point. It is sufficient if the deviations if any are recorded in the log books.

CHAPTER 3

Ambient Air Quality Monitoring

1. Ambient Air Quality Monitoring location details:

This chapter describes the sampling location, methodology adopted for monitoring ambient air quality and analysis of Ambient Air Quality results. The prime objective of the environment monitoring with respect to ambient air quality is to establish the present air quality and its conformity to ambient air quality standards. Ambient Air quality monitoring was carried out at five (5) locations including Venganoor, Proposed Port Estate Area, Port Site, Chani and Balaramapuram during April 2020 to September 2020. Air Quality monitoring was suspended in the months of April 2020 and May 2020 due to the restrictions of the lockdown imposed by the government as a result of the ongoing COVID-19 pandemic.

Table 3.1: Ambient Air Quality Monitoring Locations

Sr. No.	Location	Latitude	Longitude
1.	Venganoor	8^0,23′,55.10″N	77^0,00′,11.30″E
2.	Proposed Port Estate Area	8^0,22′,41.47″N	77^0,01′,02.94″E
3.	Port Site	8^0,22′,13.53″N	77^0,00′,08.78″E
4.	Chani	8^0,20′,56.86″N	77^0,03′,16.19″E
5.	Balaramapuram	8^0,25′,42.67″N	77^0,02′,13.78″E



Figure 3.1: Google earth view of AAQM stations

2. Methodology of Sampling and Analysis:

Table 3.2: Ambient Air Quality Monitoring Methodology

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
1.	Particulate Matter (size less than 10 µm) or PM_{10}	µg/m^3	2	IS 5182 (Part 23): 2006,RA 2017
2.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	µg/m^3	0.4	USEPA CFR 40,Part 50,Appendix L
3.	Sulphur Dioxide (SO_2)	µg/m^3	4.0	IS 5182 (Part 2): 2001,Reaffirmed 2016
4.	Nitrogen Dioxide (NO_2)	µg/m^3	6.5	IS 5182 (Part 6): 2017
5.	Carbon Monoxide (CO)	mg/m^3	0.5	CPCB Guidelines,37/2012-13,page no.16
6.	Hydrocarbon (HC)	ppm	1.0	By portable HC meter

3. National Ambient Air Quality Standards:

Table 3.3: National Ambient Air Quality Standards Dated 16th November 2009

Sr. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air	
			Industrial, Residential, Rural & other areas	Ecologically Sensitive Areas
1.	Sulphur dioxide (SO_2), µg/m^3	Annual	50	20
		24 h	80	80
2.	Nitrogen Dioxide (NO_2), µg/ m^3	Annual	40	30
		24 h	80	80
3.	Particulate matter (size less than 10µm) or PM_{10}, µg/ m^3	Annual	60	60
		24 h	100	100
4.	Particulate matter (size less than 2.5µm) or $PM_{2.5}$, µg/ m^3	Annual	40	40
		24 h	60	60
5.	Carbon Monoxide(CO), µg/m^3	8 h	02	02
		1 h	04	04
6.	Hydrocarbon (HC), ppm	-	-	-

4. **Ambient Air Quality Monitoring Results for the period April 2020 to September 2020:**

Table 3.4: Location - Venganoor

Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03.06.2020	50	11	<4.0	<6.5	<1	<1
06.06.2020	56	15	<4.0	<6.5	<1	<1
08.06.2020	45	13	6.59	8.64	<1	<1
11.06.2020	70	22	4.47	6.68	<1	<1
15.06.2020	80	26	<4.0	<6.5	<1	<1
18.06.2020	64	20	4.70	7.07	<1	<1
22.06.2020	58	16	<4.0	<6.5	<1	<1
25.06.2020	49	10	<4.0	<6.5	<1	<1
29.06.2020	66	18	<4.0	<6.5	<1	<1
02.07.2020	70	20	<4.0	<6.5	<1	<1
06.07.2020	62	18	<4.0	<6.5	<1	<1
09.07.2020	54	14	4.31	7.19	<1	<1
13.07.2020	56	16	6.21	8.49	<1	<1
16.07.2020	62	21	<4.0	<6.5	<1	<1
30.07.2020	51	12	5.36	9.43	<1	<1
03.08.2020	38	10	<4.0	<6.5	<1	<1
06.08.2020	42	11	<4.0	<6.5	<1	<1
10.08.2020	45	13	<4.0	<6.5	<1	<1
13.08.2020	55	16	4.79	7.07	<1	<1
17.08.2020	50	14	<4.0	<6.5	<1	<1
20.08.2020	68	20	5.36	7.07	<1	<1
24.08.2020	70	24	5.36	8.02	<1	<1
27.08.2020	60	17	<4.0	<6.5	<1	<1
31.08.2020	64	18	<4.0	<6.5	<1	<1
03.09.2020	38	10	<4.0	<6.5	<1	<1
07.09.2020	39	16	<4.0	<6.5	<1	<1
10.09.2020	43	12	<4.0	<6.5	<1	<1
14.09.2020	49	18	4.00	7.10	<1	<1
17.09.2020	55	22	<4.0	<6.5	<1	<1
21.09.2020	62	21	4.90	8.00	<1	<1
24.09.2020	58	15	4.90	7.10	<1	<1
28.09.2020	63	19	<4.0	<6.5	<1	<1
NAAQS 2009	**100**	**60**	**80**	**80**	**4**	**-**

Table 3.5: Location - Proposed Port Estate Area

Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03.06.2020	55	15	<4.0	<6.5	<1	<1
06.06.2020	59	16	<4.0	<6.5	<1	<1
08.06.2020	63	17	6.49	7.63	<1	<1
11.06.2020	80	26	5.32	6.96	<1	<1
15.06.2020	76	24	<4.0	<6.5	<1	<1
18.06.2020	58	18	6.02	6.96	<1	<1
22.06.2020	74	22	6.94	7.73	<1	<1
25.06.2020	60	17	<4.0	<6.5	<1	<1
29.06.2020	82	28	6.43	9.58	<1	<1
02.07.2020	50	10	<4.0	<6.5	<1	<1
06.07.2020	70	20	<4.0	<6.5	<1	<1
09.07.2020	58	12	5.28	7.84	<1	<1
13.07.2020	68	20	4.80	8.02	<1	<1
16.07.2020	60	18	<4.0	<6.5	<1	<1
30.07.2020	56	11	5.28	8.31	<1	<1
03.08.2020	40	11	<4.0	<6.5	<1	<1
06.08.2020	48	14	<4.0	<6.5	<1	<1
10.08.2020	51	16	<4.0	<6.5	<1	<1
13.08.2020	55	19	5.64	8.02	<1	<1
17.08.2020	62	22	<4.0	<6.5	<1	<1
20.08.2020	68	24	6.20	8.02	<1	<1
24.08.2020	75	26	5.36	6.60	<1	<1
27.08.2020	70	23	<4.0	<6.5	<1	<1
31.08.2020	76	25	<4.0	<6.5	<1	<1
03.09.2020	40	10	<4.0	<6.5	<1	<1
07.09.2020	32	15	<4.0	<6.5	<1	<1
10.09.2020	39	13	<4.0	<6.5	<1	<1
14.09.2020	48	18	4.00	7.10	<1	<1
17.09.2020	56	20	<4.0	<6.5	<1	<1
21.09.2020	61	21	4.90	8.00	<1	<1
24.09.2020	52	15	4.90	7.10	<1	<1
28.09.2020	68	19	<4.0	<6.5	<1	<1
NAAQS 2009	**100**	**60**	**80**	**80**	**4**	**-**

Table 3.6: Location - Port Site

Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03.06.2020	60	18	<4.0	<6.5	<1	<1
06.06.2020	62	20	<4.0	<6.5	<1	<1
08.06.2020	51	14	5.60	8.57	<1	<1
11.06.2020	86	26	6.41	7.54	<1	<1
15.06.2020	80	25	<4.0	<6.5	<1	<1
18.06.2020	78	22	5.05	6.90	<1	<1
22.06.2020	91	30	4.77	7.57	<1	<1
25.06.2020	58	18	<4.0	<6.5	<1	<1
29.06.2020	77	22	6.30	8.97	<1	<1
02.07.2020	80	23	<4.0	<6.5	<1	<1
06.07.2020	76	22	<4.0	<6.5	<1	<1
09.07.2020	81	25	5.89	8.42	<1	<1
13.07.2020	68	20	4.69	8.33	<1	<1
16.07.2020	66	15	<4.0	<6.5	<1	<1
30.07.2020	75	24	5.52	9.23	<1	<1
03.08.2020	39	12	<4.0	<6.5	<1	<1
06.08.2020	50	14	<4.0	<6.5	<1	<1
10.08.2020	51	15	<4.0	<6.5	<1	<1
13.08.2020	68	20	4.51	6.60	<1	<1
17.08.2020	70	22	<4.0	<6.5	<1	<1
20.08.2020	75	24	5.92	7.54	<1	<1
24.08.2020	69	25	5.64	8.49	<1	<1
27.08.2020	70	26	<4.0	<6.5	<1	<1
31.08.2020	72	24	<4.0	<6.5	<1	<1
03.09.2020	39	12	<4.0	<6.5	<1	<1
07.09.2020	34	15	<4.0	<6.5	<1	<1
10.09.2020	40	13	<4.0	<6.5	<1	<1
14.09.2020	45	18	4.00	7.10	<1	<1
17.09.2020	49	20	<4.0	<6.5	<1	<1
21.09.2020	56	21	4.90	8.00	<1	<1
24.09.2020	51	15	4.90	7.00	<1	<1
28.09.2020	63	19	<4.0	<6.5	<1	<1
NAAQS 2009	**100**	**60**	**80**	**80**	**4**	**-**

Table 3.7: Location - Chani

Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03.06.2020	57	18	<4.0	<6.5	<1	<1
06.06.2020	56	16	<4.0	<6.5	<1	<1
08.06.2020	80	26	6.53	8.96	<1	<1
11.06.2020	78	25	6.77	7.40	<1	<1
15.06.2020	82	30	<4.0	<6.5	<1	<1
18.06.2020	68	22	5.37	7.40	<1	<1
22.06.2020	72	24	7.23	8.57	<1	<1
25.06.2020	60	20	<4.0	<6.5	<1	<1
29.06.2020	81	28	5.83	7.03	<1	<1
02.07.2020	76	22	<4.0	<6.5	<1	<1
06.07.2020	70	20	<4.0	<6.5	<1	<1
09.07.2020	55	14	5.50	8.22	<1	<1
13.07.2020	68	18	4.96	7.80	<1	<1
16.07.2020	60	16	<4.0	<6.5	<1	<1
30.07.2020	55	12	5.08	7.54	<1	<1
03.08.2020	36	10	<4.0	<6.5	<1	<1
06.08.2020	48	13	<4.0	<6.5	<1	<1
10.08.2020	52	15	<4.0	<6.5	<1	<1
13.08.2020	58	20	5.36	8.49	<1	<1
17.08.2020	55	18	<4.0	<6.5	<1	<1
20.08.2020	60	20	5.36	7.07	<1	<1
24.08.2020	62	21	5.08	6.60	<1	<1
27.08.2020	70	23	<4.0	<6.5	<1	<1
31.08.2020	68	22	<4.0	<6.5	<1	<1
03.09.2020	36	10	<4.0	<6.5	<1	<1
07.09.2020	52	15	<4.0	<6.5	<1	<1
10.09.2020	48	13	<4.0	<6.5	<1	<1
14.09.2020	60	18	4.00	7.10	<1	<1
17.09.2020	68	20	<4.0	<6.5	<1	<1
21.09.2020	70	21	5.40	8.00	<1	<1
24.09.2020	58	15	4.90	7.10	<1	<1
28.09.2020	71	19	<4.0	<6.5	<1	<1
NAAQS 2009	**100**	**60**	**80**	**80**	**4**	**-**

Table 3.8: Location - Balaramapuram

Date	Parameters					
	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	HC
	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	ppm
03.06.2020	70	21	<4.0	<6.5	<1	<1
06.06.2020	62	24	<4.0	<6.5	<1	<1
08.06.2020	78	26	5.12	8.14	<1	<1
11.06.2020	70	22	4.81	6.83	<1	<1
15.06.2020	68	20	<4.0	<6.5	<1	<1
18.06.2020	80	26	5.09	7.29	<1	<1
22.06.2020	86	30	4.65	8.58	<1	<1
25.06.2020	60	18	<4.0	<6.5	<1	<1
29.06.2020	72	21	<4.0	<6.5	<1	<1
02.07.2020	78	22	<4.0	<6.5	<1	<1
06.07.2020	65	18	<4.0	<6.5	<1	<1
09.07.2020	70	20	4.64	7.75	<1	<1
13.07.2020	68	16	5.21	9.19	<1	<1
16.07.2020	66	15	<4.0	<6.5	<1	<1
30.07.2020	74	21	4.96	8.30	<1	<1
03.08.2020	38	10	<4.0	<6.5	<1	<1
06.08.2020	52	15	<4.0	<6.5	<1	<1
10.08.2020	48	13	<4.0	<6.5	<1	<1
13.08.2020	60	18	4.23	7.07	<1	<1
17.08.2020	68	20	<4.0	<6.5	<1	<1
20.08.2020	70	21	5.36	7.54	<1	<1
24.08.2020	58	15	4.79	6.60	<1	<1
27.08.2020	71	19	<4.0	<6.5	<1	<1
31.08.2020	66	20	<4.0	<6.5	<1	<1
03.09.2020	34	10	<4.0	<6.5	<1	<1
07.09.2020	42	11	<4.0	<6.5	<1	<1
10.09.2020	45	10	<4.0	<6.5	<1	<1
14.09.2020	52	21	4.10	6.10	<1	<1
17.09.2020	66	18	<4.0	<6.5	<1	<1
21.09.2020	68	18	5.20	7.10	<1	<1
24.09.2020	56	12	4.80	6.80	<1	<1
28.09.2020	51	24	<4.0	<6.5	<1	<1
NAAQS 2009	**100**	**60**	**80**	**80**	**4**	**-**

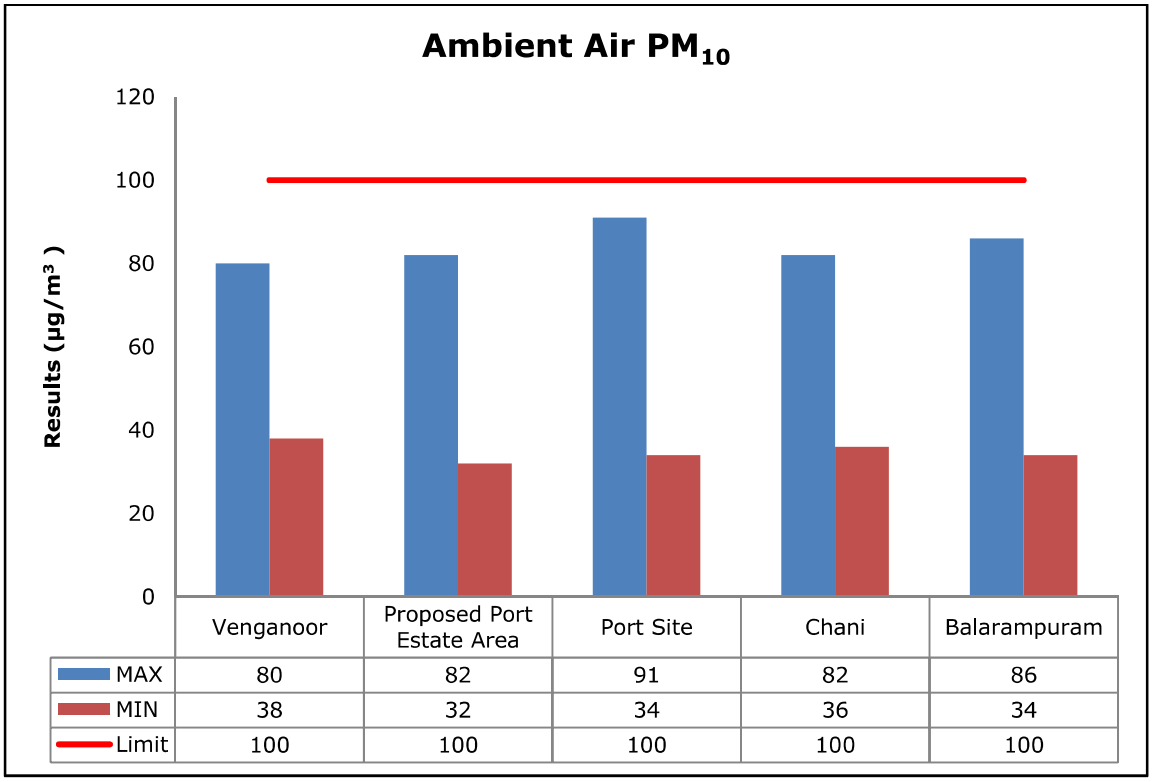
5. Monthly Average Results of Ambient Air Quality Monitoring

Table 3.9: Monthly Average Results

Parameter	NAAQS 2009	Month	Venganoor	Proposed Port Estate Area	Port Site	Chani	Balaramapuram
Particulate matter (size less than 10µm) or PM10, µg/ m^3	100	June-20	60	67	71	70	72
		July-2020	59	60	74	64	70
		Aug-2020	55	61	63	57	59
		Sept-2020	51	50	47	58	52
Particulate matter (size less than 2.5µm) or PM $_{2.5}$, µg/ m^3	60	June-20	17	20	22	23	23
		July-2020	17	15	22	17	19
		Aug-2020	16	20	20	18	17
		Sept-2020	17	16	17	16	16
Sulphur dioxide (SO_2), µg/m^3	80	June-20	5.25	6.24	5.63	6.35	4.92
		July-2020	5.29	5.12	5.37	5.18	4.94
		Aug-2020	5.17	5.73	5.36	5.27	4.79
		Sept-2020	5.17	4.60	4.60	4.77	4.70
Nitrogen Dioxide (NO_2), µg/ m^3	80	June-20	7.46	7.77	7.91	7.87	7.71
		July-2020	8.37	8.06	8.66	7.85	8.41
		Aug-2020	7.39	7.55	7.54	7.39	7.07
		Sept-2020	7.40	7.40	7.37	7.40	6.67
Carbon Monoxide (CO), µg/m^3	4	June-20	<1	<1	<1	<1	<1
		July-2020	<1	<1	<1	<1	<1
		Aug-2020	<1	<1	<1	<1	<1
		Sept-2020	<1	<1	<1	<1	<1
Hydrocarbon (HC), ppm	-	June-20	<1	<1	<1	<1	<1
		July-2020	<1	<1	<1	<1	<1
		Aug-2020	<1	<1	<1	<1	<1
		Sept-2020	<1	<1	<1	<1	<1

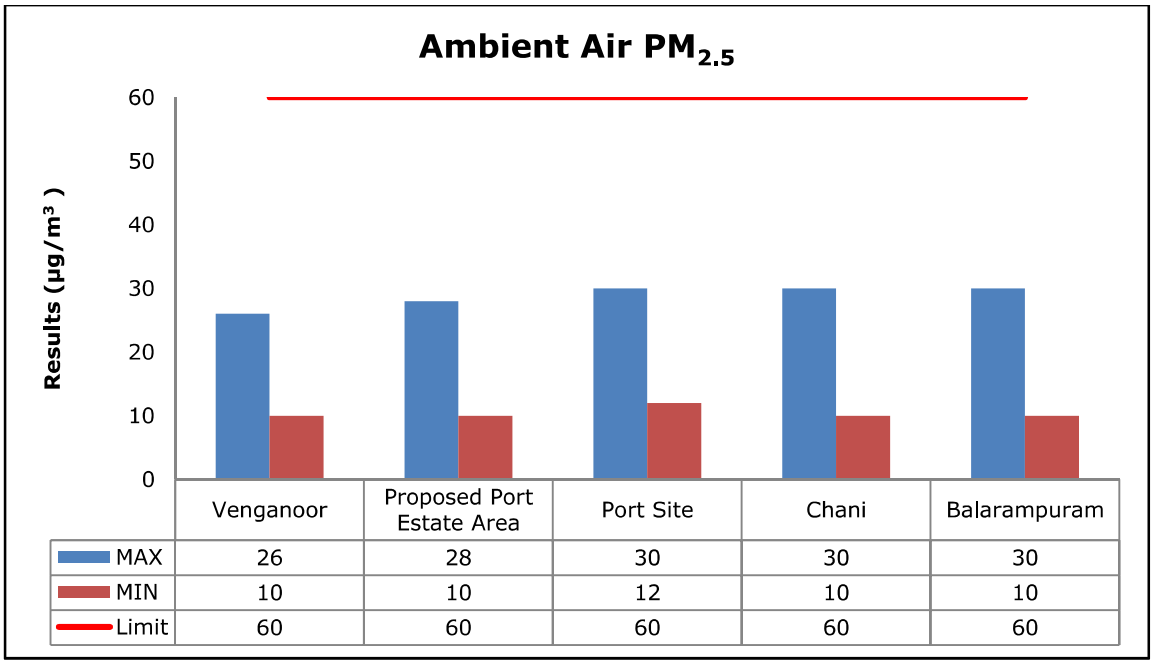
6. Graphical representation of Results

Figure 3.2: Particulate matter (size less than 10µm) (PM_{10})



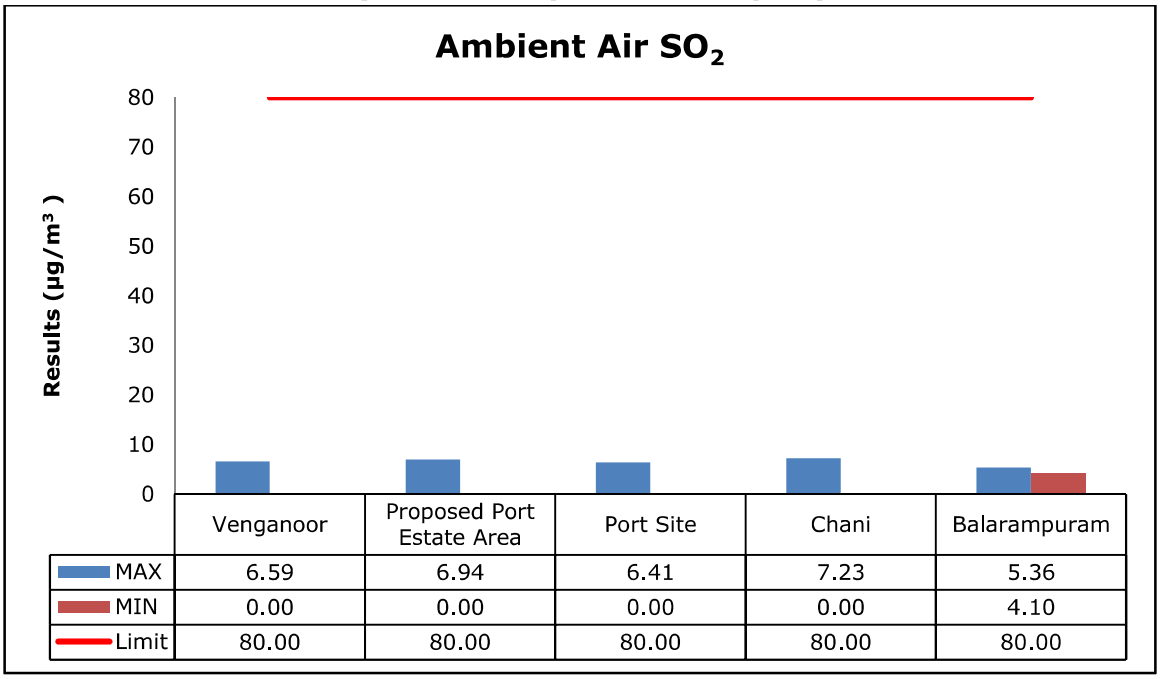
	Venganoor	Proposed Port Estate Area	Port Site	Chani	Balarampuram
MAX	80	82	91	82	86
MIN	38	32	34	36	34
Limit	100	100	100	100	100

Figure 3.3: Particulate matter (size less than 2.5µm) ($PM_{2.5}$)



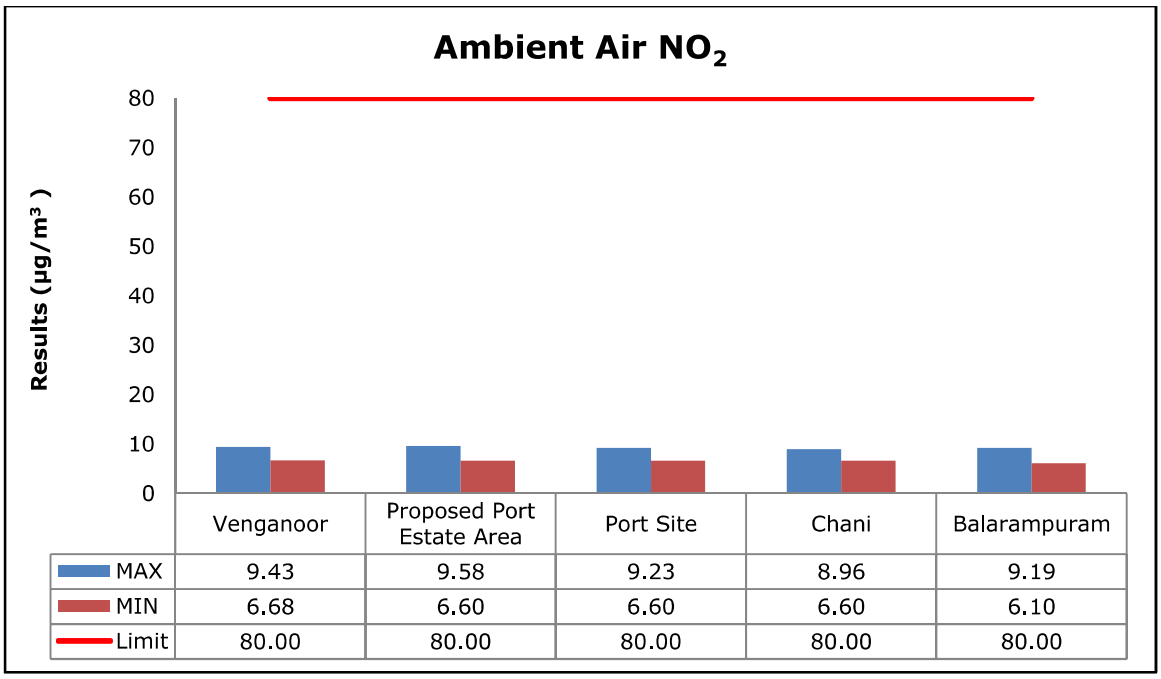
	Venganoor	Proposed Port Estate Area	Port Site	Chani	Balarampuram
MAX	26	28	30	30	30
MIN	10	10	12	10	10
Limit	60	60	60	60	60

Figure 3.4: Sulphur dioxide (SO_2)



	Venganoor	Proposed Port Estate Area	Port Site	Chani	Balarampuram
MAX	6.59	6.94	6.41	7.23	5.36
MIN	0.00	0.00	0.00	0.00	4.10
Limit	80.00	80.00	80.00	80.00	80.00

Figure 3.5: Nitrogen Dioxide (NO_2)



	Venganoor	Proposed Port Estate Area	Port Site	Chani	Balarampuram
MAX	9.43	9.58	9.23	8.96	9.19
MIN	6.68	6.60	6.60	6.60	6.10
Limit	80.00	80.00	80.00	80.00	80.00

7. Summary - Ambient Air Quality

During the period of June 2020 to September 2020, at the location **Venganoor**, the concentration of PM_{10} was observed in the range between 38-80 µg/m^3 with an average of 56 µg/m^3, $PM_{2.5}$ was observed in the range between 10-26 µg/m^3 with an average of 17 µg/m^3, SO_2 was observed in the range between <4.0-6.59 µg/m^3 with an average of 5.08 µg/m^3, NO_2 was observed in the range between <6.5-9.43 µg/m^3 with an average of 7.66 µg/m^3, CO and HC were observed <1 for all four months.

At the location **Proposed Port Colony**, concentration of PM_{10} was observed in the range between 32-82 µg/m^3 with an average of 60 µg/m^3, $PM_{2.5}$was observed in the range between 10-28 µg/m^3 with an average of 18 µg/m^3, SO_2 was observed in the range between <4.0-6.94 µg/m^3 with an average of 5.54 µg/m^3, NO_2 was observed in the range between <6.5-9.58 µg/m^3 with an average of 7.71 µg/m^3, CO and HC were observed <1 for all Four months.

At the location **Port site**, concentration of PM_{10} was observed in the range between 34-91 µg/m^3 with an average of 63 µg/m^3, $PM_{2.5}$ was observed in the range between 12-30µg/m^3 with an average of 20 µg/m^3, SO_2 was observed in the range between <4.0 – 6.41 µg/m^3 with an average of 5.29 µg/m^3, NO_2 was observed in the range between <6.5-9.23 µg/m^3 with an average of 7.88 µg/m^3, CO and HC were observed <1 for all Four months.

At the location **Chani**, concentration of PM_{10} was observed in the range between 36-62 µg/m^3 with an average of 62 µg/m^3, $PM_{2.5}$ was observed in the range between 10-30 g/$m^3$with an average of 19 µg/m^3, SO_2 was observed in the range between <4.0 – 7.23 µg/m^3 with an average of 5.53 µg/m^3, NO_2 was observed in the range between <6.5-8.96 µg/m^3 with an average of 7.66 µg/m^3, CO and HC were observed <1 for all Four months.

At the location **Balaramapuram**, concentration of PM_{10} was observed in the range between 34-86 µg/m^3 with an average of 63 µg/m^3, $PM_{2.5}$was observed in the range between 10-30 µg/m^3 with an average of 19 µg/m^3, SO_2 was observed in the range between <4.0-5.36 µg/m^3 with an average of 4.84 µg/m^3, NO_2 was observed in the range between <6.5–9.19 µg/m^3 with an average of 7.48 µg/m^3,CO and HC were observed <1 for all Four months.

The obtained results were compared with National Ambient Air Quality Standards (NAAQS), 2009. The results were well within the limit on all monitoring days at all 5 locations during the monitoring months (June 2020 to September 2020).

CHAPTER 4

Ambient Noise Monitoring

1. Ambient Noise Monitoring location details

This chapter describes the sampling location, methodology adopted for monitoring ambient noise and analysis of monitored results. Ambient Noise Monitoring during April 2020 to September 2020 was carried out at Venganoor, Proposed Port Estate Area, Port Site, Chani and Balaramapuram. Classification of locations as per the Noise Pollution (Regulation & Control) Rules, 2000 (Rules 3 (1) and 4(1)) are as below. Noise monitoring was suspended in the months of April 2020 and May 2020 due to the restrictions of the lockdown imposed by the government as a result of the ongoing COVID-19 pandemic.

Table 4.1: Ambient Noise Monitoring Stations details

Sr. No.	Location	Area Type	Latitude	Longitude
1.	Port Site	Industrial	8^0,22',13.53"N	77^0,00',08.78"E
2.	Balaramapuram	Commercial	8^0,25',37.60"N	77^0,02',43.80"E
3.	Proposed Port Estate Area	Residential	8^0,22',41.47"N	77^0,01',02.94"E
4.	Chani	Residential	8^0,20',56.86"N	77^0,03',16.19"E
5.	Venganoor	Residential	8^0,23',55.10"N	77^0,00',11.30"E



Figure 4.1: Google earth view of Ambient Noise Monitoring Stations

2. Methodology of Sampling

Ambient Noise Monitoring is being carried out as per CPCB Protocol for Ambient Level Noise Monitoring, July 2015 & AEC/C/SAP/SAM/35 & 36, Issue No.4, Issue date 01.04.2018

3. Ambient Noise Standards

As per the Noise Pollution (Regulation & Control) Rules, 2000 (Rules 3 (1) and 4(1))

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

4. Ambient Noise Monitoring Results for the period April 2020 to September 2020.

Table 4.3 : Location - Port Site (Industrial)

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)					
Jun-20	04.06.2020	94.1	77.9	41.2	42.1	63.5	53.7
	18.06.2020	83.3	78.1	45.8	45.3	60.6	56.3
July-2020	09.07.2020	89.1	73.4	41.8	42.5	61.8	52.3
	13.07.2020	86.4	75.2	37.5	40.6	58.4	48.7
Aug-2020	06.08.2020	92.9	82.8	44.5	41.1	66.1	53.7
	20.08.2020	94.6	82.8	48.3	50.1	63.4	60
Sept-2020	03.09.2020	89.5	83.5	44.5	44.9	61.3	59.8
	24.09.2020	94.5	85.9	54.2	53.7	71	60.1
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**75**	**70**

Table 4.4: Location - Balaramapuram (Commercial)

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)					
June-2020	08.06.2020	83.6	72.9	40.7	41.2	49.4	46.5
	22.06.2020	84.4	72.2	36	35.4	57.8	46.9
July-2020	13.07.2020	86.4	75.2	37.5	40.6	58.4	48.7
	31.07.2020	84.3	83.9	41.3	40.8	53.5	51.4
Aug-2020	10.08.2020	84.1	68.1	34.1	35.1	58.3	41.4
	24.08.2020	90.4	72.1	36.1	36	61.2	47.9
Sept-2020	07.09.2020	84.4	81.6	37.8	36.4	58.4	50.5
	28.09.2020	88.5	72.1	36.6	36.5	61.1	46.8
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**65**	**55**

Table 4.5: Location - Proposed Port Estate Area (Residential)

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)					
June-2020	05.06.2020	74.4	67	34.6	34.5	52	40
	19.06.2020	79.6	69.3	34.6	33.7	55	43.2
July-2020	10.07.2020	81.6	74.2	36.1	36.1	51	44.9
	29.07.2020	77.7	72.7	35	34.9	52.1	43.9
Aug-2020	07.08.2020	82.8	63	35.6	36.8	52.1	42.8
	21.08.2020	79.7	71.3	37.7	37	54.8	43
Sept-2020	04.09.2020	78.9	71.3	37.7	34.9	54.8	44.4
	25.09.2020	83.6	78.7	34.3	35.1	53.4	44.2
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**55**	**45**

Table 4.6: Location - Chani (Residential)

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)					
June-2020	06.06.2020	81	62.6	34.2	35.2	50.4	37.6
	20.06.2020	77.5	68.5	33.9	34.2	53	43.5
July-2020	11.07.2020	78.9	68.6	34.6	35.2	47.5	44.8
	30.07.2020	75.2	69.1	33.9	34.4	49	44
Aug-2020	08.08.2020	76.2	67.8	36	35.1	51.1	42.6
	22.08.2020	73.4	72.3	36.8	34.9	48.8	43.5
Sept-2020	06.09.2020	76	67.5	34	34	49.7	37.9
	27.09.2020	72.7	61.7	33.5	33.7	48.5	36.8
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**55**	**45**

Table 4.7: Location - Venganoor (Residential)

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)					
June-2020	07.06.2020	68.7	60	33.4	33.3	41	36.6
	21.06.2020	74.7	62.1	35	34.2	45.7	37.3
July-2020	12.07.2020	75.9	63.7	35.5	36.4	45.1	40.1
	26.07.2020	71.9	69.7	34.1	35.4	43	40.4
Aug-2020	09.08.2020	74.3	59.5	36.4	31.5	47.2	39
	23.08.2020	70.9	60.4	32.8	33.4	49.4	36.7
Sept-2020	06.09.2020	76	67.5	34	34	49.7	37.9
	27.09.2020	72.7	61.7	33.5	33.7	48.5	36.8
As per the Noise Pollution (Regulation & Control) Rules, 2000 [Rules 3 (1) and 4(1)]						**55**	**45**

5. Half Yearly Average Results of Ambient Noise Monitoring

Table 4.8: Half Yearly Average Results

Parameter		Proposed Port Estate Area	Chani	Venganoor	Port Site	Balaramapuram
		Residential	Residential	Residential	Industrial	Commercial
		Day Time(55) Night Time(45)	Day Time(55) Night Time(45)	Day Time(55) Night Time(45)	Day Time(75) Night Time-(70)	Day Time (65) Night Time(55)
L_{max} Day time dB (A)	Max	83.6	81.0	76.0	94.6	90.4
	Min	74.4	72.7	68.7	83.3	83.6
	Avg	79.8	76.4	73.1	90.6	85.8
L_{max} Night time dB (A)	Max	78.7	72.3	69.7	85.9	83.9
	Min	63.0	61.7	59.5	73.4	68.1
	Avg	70.9	67.3	63.1	80.0	74.8
L_{min} Day time dB (A)	Max	37.7	36.8	36.4	54.2	41.3
	Min	34.3	33.5	32.8	37.5	34.1
	Avg	35.7	34.6	34.3	44.7	37.5
L_{min} Night time dB (A)	Max	37.0	35.2	36.4	53.7	41.2
	Min	3.7	33.7	31.50	40.6	35.1
	Avg	35.4	34.6	34.0	45.0	37.8
Leq Day time dB (A)	Max	55.0	53.0	49.7	71.0	61.2
	Min	51.0	47.5	41.0	58.4	49.4
	Avg	53.2	49.8	46.2	63.3	57.3
Leq Night time dB (A)	Max	44.9	44.8	40.4	60.1	51.4
	Min	40.0	36.8	36.6	48.7	41.4
	Avg	43.3	40.8	38.1	55.6	47.5

6. Graphical representation of Results

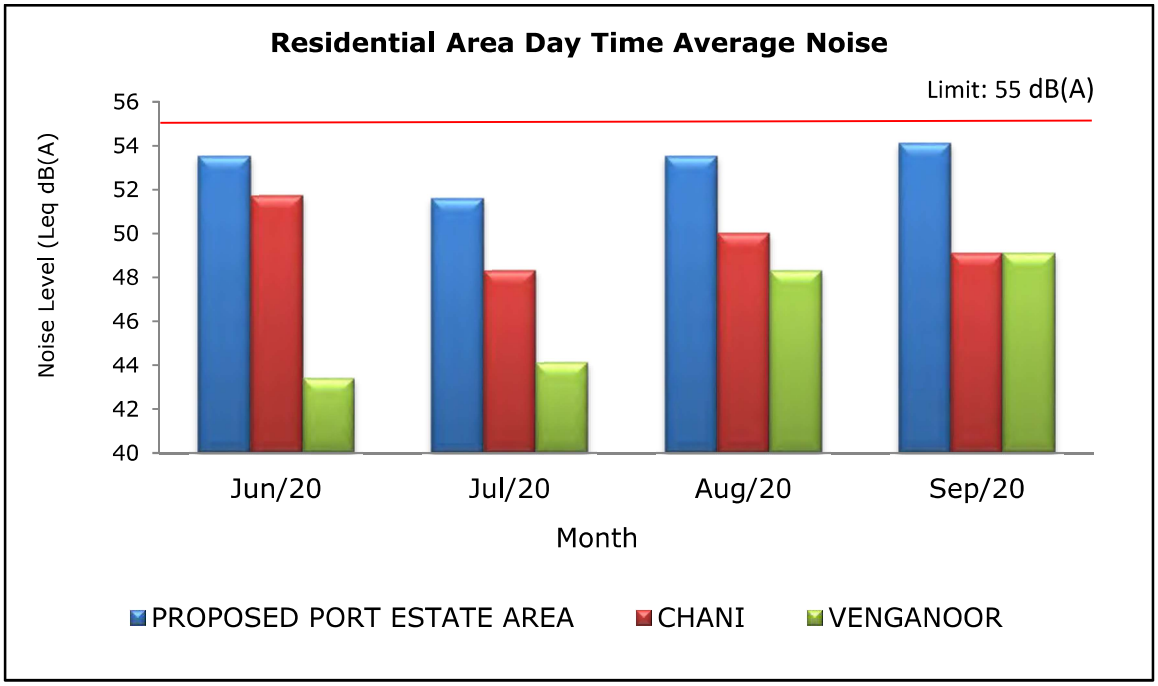


Figure 4.9: Residential Area Noise Level at day time

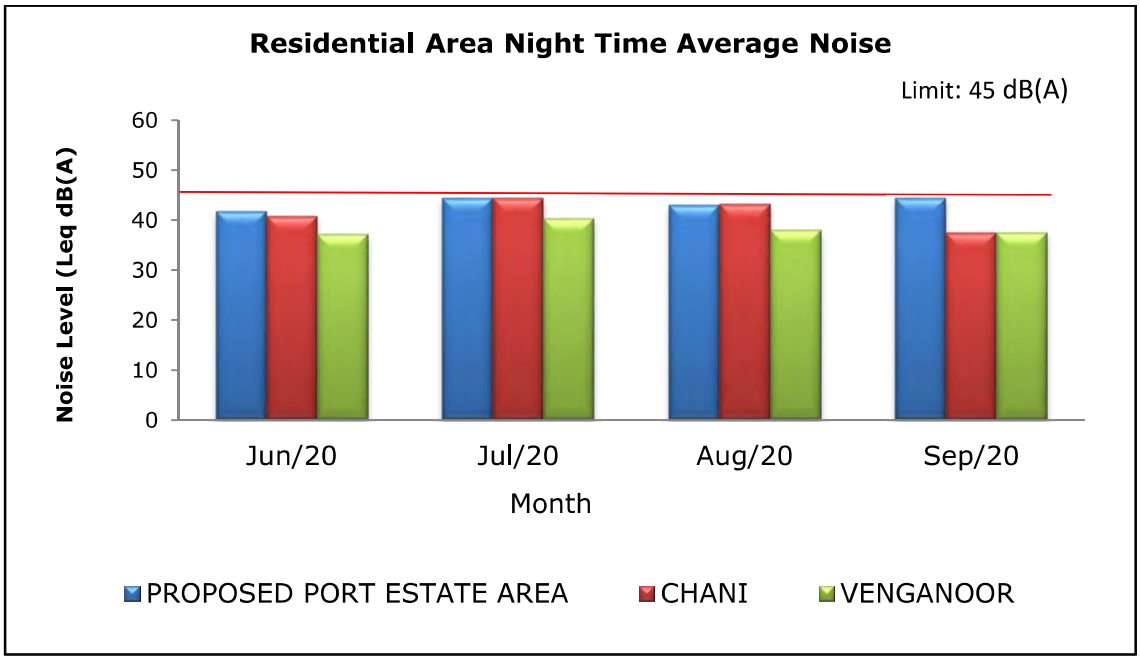


Figure 4.10: Residential Area Noise Level at night time

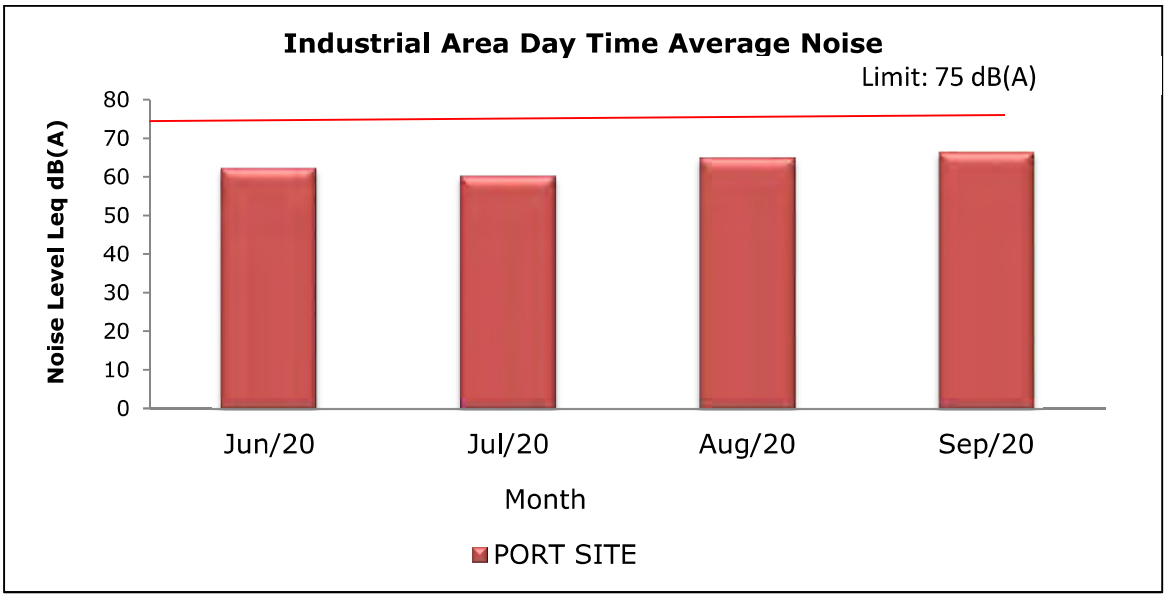


Figure 4.11: Industrial Area Noise Level at day time

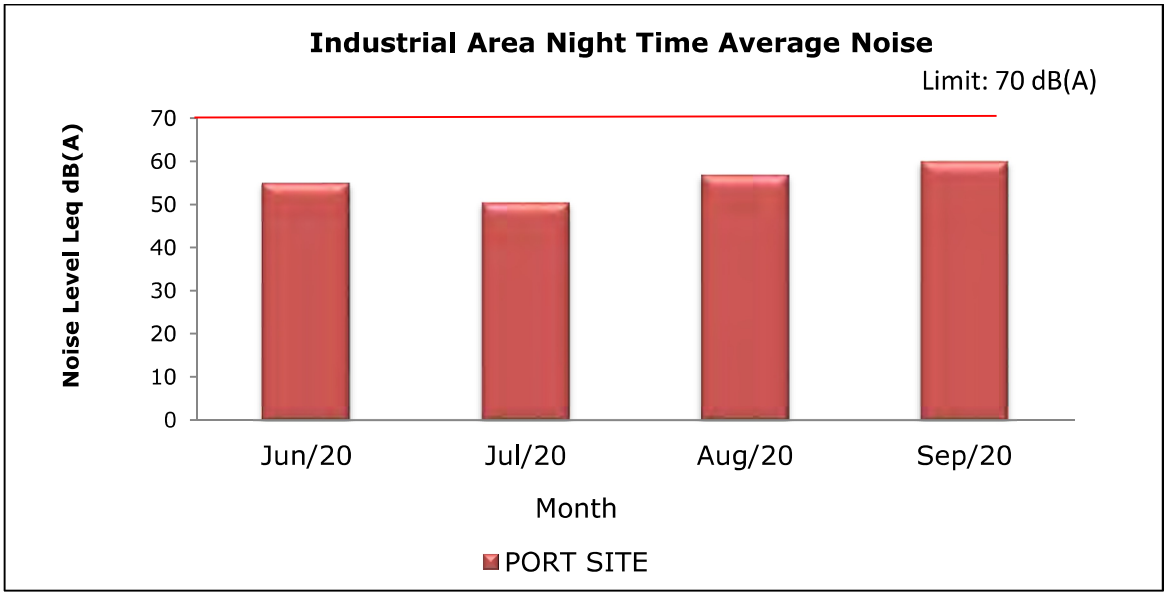


Figure 4.12: Industrial Area Noise Level at night time

Figure 4.13: Commercial Area Noise Level at day time

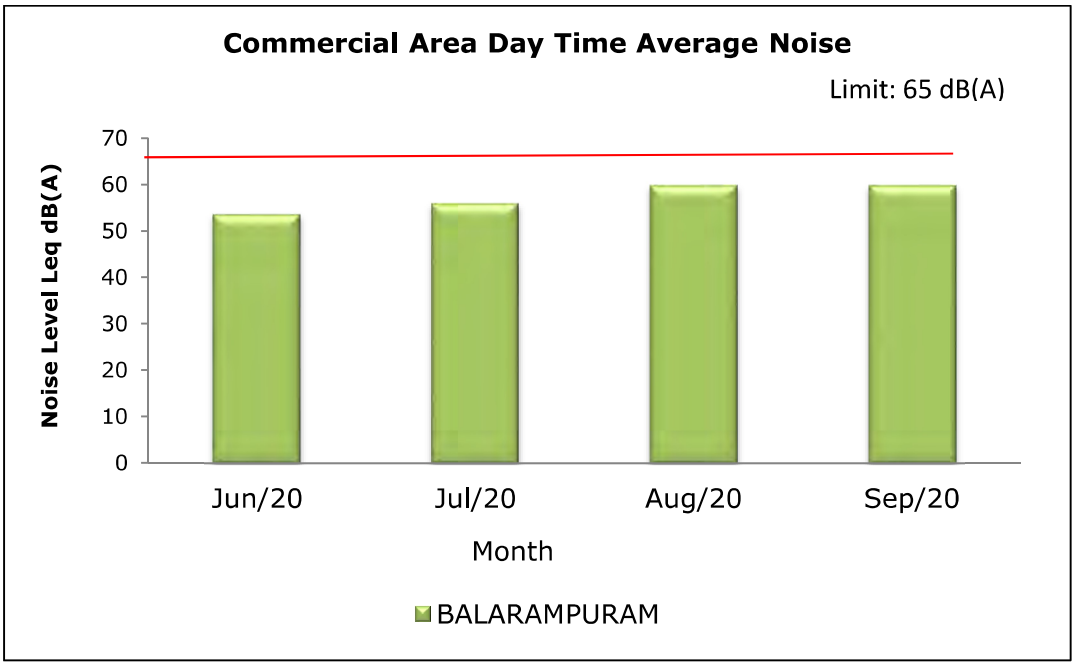
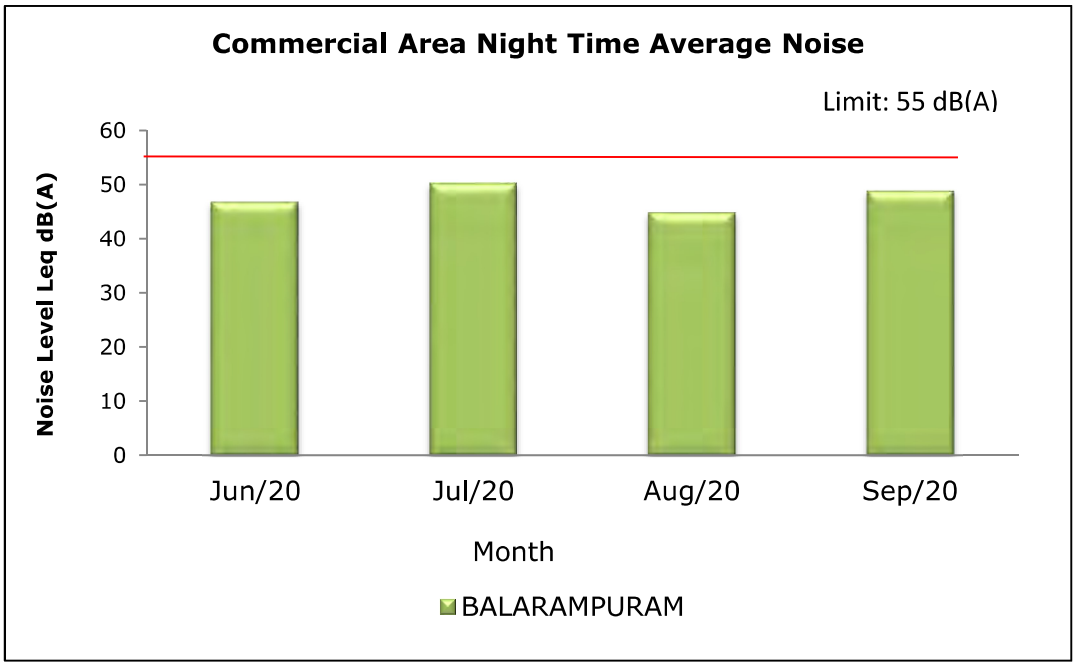


Figure 4.14: Commercial Area Noise Level at night time



7. Summary - Ambient Noise Monitoring

During the period April 2020 to September 2020 average noise level observed at residential areas i.e. at Proposed Port Estate Area, Chani and Venganoor during day time were 53.2 dB(A), 49.8 dB(A) and 46.2 dB(A) respectively and during night time 43.3 dB(A), 40.8 dB(A) and 38.1 dB(A) respectively.

At industrial area i.e. at Port Site area average noise level observed at day time 63.3 dB(A) and at night time 55.6 dB(A).

At commercial area i.e. Balaramapuram area average noise level observed at day time 57.3 dB(A) and at night time 47.5 dB(A).

The results obtained were compared with Noise Pollution (Regulation & Control) Rule, 2000 (Rule 3(1) and 4(1)) and it is observed that noise reading were within limits at all locations on all monitoring days during the monitoring months (June 2020 to September 2020).

CHAPTER 5

Marine water and Sediment Analysis

1. Marine Water and Sediment Sampling location details:

This chapter describes the sampling location, methodology adopted for analysis and the analysis of monitored data for Marine Water and Sediment. Marine monitoring was suspended for the months of April 2020 to July 2020 due to the restrictions of the lockdown imposed by the government as a result of the ongoing COVID-19 pandemic. Sampling and analysis of marine water at high tide and low tide during August 2020 and September 2020 carried out at different locations such as; Near Kovalam Beach, Proposed Dredge Material Disposal Site, South of Break Water, Port Basin, Inner Approach Channel and Kovalam Beach. Classification of locations as per the Noise Pollution (Regulation & Control) Rules, 2000 (Rules 3 (1) and 4(1)) is as below:

Table 5.1: Marine Water and Sediment sampling locations details

Sr. No.	Location	Latitude	Longitude
1.	Near Kovalam Beach	8^0,22′,28.20″N	76^0,58′,48.70″E
2.	Proposed Dredge Material Disposal Site	8^0,21′,54.40″N	76^0,59′,27.90″E
3.	South of Break Water	8^0,22′,03.20″N	76^0,59′,46.50″E
4.	Port Basin	8^0,22′,00.00″N	77^0,00′,03.30″E
5.	Inner Approach Channel	8^0,21′,05.90″N	77^0,00′,40.70″E
6.	Kovalam Beach	8^0,23',03.61″ N	76°,58',37.62" E



Figure 5.1: Google earth view of Marine Water and Sediment Sampling Locations

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	^{0}C	0	IS 3025 (Part 9):1984
2.	pH Value	-	1	IS 3025 (Part 11):1983
3.	Turbidity	N.T.U.	0.1	IS 3025 (Part 10):1984
4.	Electrical Conductivity (at 25°C)	µmho/cm	0.1	IS 3025(Part 14): 1984
5.	Total Suspended Solids	mg/L	5	IS 3025 (Part 17): 1984
6.	Total Dissolved Solids	mg/L	5	IS 3025 (Part 16):1984
7.	Dissolved Oxygen	mg/L	0.05	IS 3025 (Part 38): 1989
8.	Biochemical Oxygen Demand (3 days, 27°C)	mg/L	1	IS 3025 (Part 44): 1993
9.	Floating Materials – Oil, Grease and Scum (Including Petroleum Products)	mg/L	0.005	APHA, 23rd Ed., 2017,5520-B, 5-40 and Clause 6 of IS: 3025 (Part 39): 1991, Amds.2, Sept 2013
10.	Nitrite (as NO_2)	mg/L	0.01	APHA, 23rd Ed., 2017, 4500-NO_2-B,4-124
11.	Nitrate (as NO_3)	mg/L	0.2	APHA, 23rd Ed., 2017, 4500-NO_3 B-4-127
12.	Phenolic Compounds (as C_6H_5OH)	mg/L	0.001	APHA, 23rd Ed., 2017, 5530- B & C, 5-49
13.	Ammonical Nitrogen (as NH_3-N)	mg/L	5	APHA, 23rd Ed., 2017, 4500 NH_3, B & C, 4 -114, 4-116
14.	Total Nitrogen (as N)	mg/L	0.1	APHA, 23rd Ed., 2017, 4500 NH_3, B & C, 4 -114, 4-116
15.	Total Phosphorous (as P)	mg/L	0.1	APHA, 23rd Ed., 2017, 4500 P,E, 4-155
16.	Reactive Phosphorous	mg/L	0.1	APHA, 23rd Ed., 2017, 4500 P,E, 4-155
17.	Polycyclic Aromatic Hydrocarbon	mg/L	0.00007	APHA, 23rd Ed., 2017, 6440, 6-94
18.	Salinity	PPT	0.01	CPCB ADSORBS /8/1983-84
19.	Total Chlorophyll	mg/L	ND	APHA, 23rd Ed.,2017, 10200 H
20.	Total Coliforms	MPN Index /100 ml	1.8	APHA, 23rd Ed., 2017, 9221-B, 9-69
21.	Faecal Coliforms	MPN Index /100ml	1.8	APHA, 23rd Ed., 2017, 9221-E, 9-77

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
22.	Phytoplankton	No./100ml	ND	APHA, 23rd Ed., 2017
23.	Zooplanktons	No./100ml	ND	APHA, 23rd Ed., 2017
Sediment Analysis				
1.	Texture	-	Qualitative	AEC/C/SAP/S-3
2.	Organic Matter	%	0.043	FAO 1976, Sec. III,3, Page no.73
3.	Total Phosphorus (as P)	mg/kg	5	WLII, B-10a,Page no. 16
4.	Aluminium (as Al)	mg/kg	1	USEPA / SW 846/ 6010 C
5.	Chromium (as Cr)	mg/kg	1	USEPA / SW 846/ 6010 C
6.	Copper (as Cu)	mg/kg	0.08	USEPA / SW 846/ 6010 C
7.	Iron (as Fe)	mg/kg	1	USEPA / SW 846/ 6010 C
8.	Lead (as Pb)	mg/kg	0.1	USEPA / SW 846/ 6010 C
9.	Manganese (as Mn)	mg/kg	0.5	USEPA / SW 846/ 6010 C
10.	Mercury (as Hg)	mg/kg	0.01	USEPA / SW 846/ 6010 C
11.	Zinc (as Zn)	mg/kg	0.5	USEPA / SW 846/ 6010 C
12.	Nickel (as Ni)	mg/kg	0.1	USEPA / SW 846/ 6010 C
13.	Benthic Organism	/m^2	ND	APHA, 23rd Ed., 2017
Note: **ND:** Not Detected				

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

Parameter	Unit	# E(P)A Rules, 1986
Faecal Coliforms	/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).		

4. Marine Water Analysis Result for the period April 2020 to September 2020

Table 5.4: Marine Water Analysis Results

Sr. No.	Parameter	Month		Near Kovalam Beach	Proposed Dredge Material Disposal Site	South of Break Water	Port Basin	Inner Approach Channel	Kovalam Beach
1	Temperature (°C)	Aug-20	High tide	High tide	28.6	28.5	28.9	28.6	28.3
			Low tide	Low tide	28.7	28.6	28.8	28.7	28.8
		Sept-20	High tide	High tide	27.6	27.3	28.7	27.5	27.2
			Low tide	Low tide	27.4	27.1	28.5	27.2	27.2
2	Colour and Odour	Aug-20	High tide & Low tide	No visible colour or offensive odour					
		Sept-20	High tide & Low tide	No visible colour or offensive odour					
3	pH Value	Aug-20	High tide	8.34	8.31	8.44	8.41	8.42	8.52
			Low tide	8.28	8.29	8.39	8.3	8.4	8.24
		Sept-20	High tide	7.85	7.85	7.94	8.02	7.84	8.08
			Low tide	8.01	8	8.02	8.04	8.08	8.02
4	Turbidity	Aug-20	High tide	0.68	0.62	0.71	0.8	0.7	0.4

Sr. No.	Parameter	Month		Near Kovalam Beach	Proposed Dredge Material Disposal Site	South of Break Water	Port Basin	Inner Approach Channel	Kovalam Beach
	(N.T.U.)		Low tide	0.59	0.46	0.64	0.5	0.7	0.6
		Sept-20	High tide	1.2	0.8	1.2	1.3	1.1	1
			Low tide	1	1.2	1.3	1.2	0.7	0.9
5	Electrical Conductivity (at 25°C) (µmho/cm)	Aug-20	High tide	38650	38700	33700	37646	37900	35637
			Low tide	35000	36484	35400	33671	34612	35030
		Sept-20	High tide	47500	48000	46500	47100	46800	46700
			Low tide	46300	47500	47900	47300	48300	44400
6	Total Suspended Solids (mg/L)	Aug-20	High tide	7	8	7	8	6	6
			Low tide	8	6	6	7	7	7
		Sept-20	High tide	10	8	8	12	9	8
			Low tide	8	10	12	12	8	10
7	Total Dissolved Solids (mg/L)	Aug-20	High tide	25510	23220	22240	25210	25010	24590
			Low tide	23800	24080	24780	22560	28290	23470
		Sept-20	High tide	26600	26880	26040	26370	26200	26150
			Low tide	25920	26600	26820	26480	27040	28460

Sr. No.	Parameter	Month		Near Kovalam Beach	Proposed Dredge Material Disposal Site	South of Break Water	Port Basin	Inner Approach Channel	Kovalam Beach
8	Dissolved Oxygen (mg/L)	Aug-20	High tide	4.6	4.8	5.1	5	4.9	5.1
			Low tide	4.8	4.8	5.2	5.2	4.9	4.6
		Sept-20	High tide	5.9	5.8	6.2	5.6	6.3	5.8
			Low tide	6.8	6.8	6.8	5.8	5.8	5.6
9	Biochemical Oxygen Demand (3 days, 27°C) (mg/L)	Aug-20	High tide	4	6	4	6	4	5
			Low tide	5	5	5	5	6	5
		Sept-20	High tide	3.1	1.6	1.6	1.5	1	3.2
			Low tide	1.2	1.1	1.1	1.1	5.1	3.1
10	Floating Materials (Oil, Grease and Scum) (Including Petroleum Products) (mg/L)	Aug-20	High tide	<1	<1	<1	<1	<1	<1
			Low tide	<1	<1	<1	<1	<1	<1
		Sept-20	High tide	<1	<1	<1	<1	<1	<1
			Low tide	<1	<1	<1	<1	<1	<1
11	Nitrite (as NO_2) (mg/L)	Aug-20	High tide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
			Low tide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		Sept-20	High tide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Sr. No.	Parameter	Month		Near Kovalam Beach	Proposed Dredge Material Disposal Site	South of Break Water	Port Basin	Inner Approach Channel	Kovalam Beach
			Low tide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Nitrate (as NO_3) (mg/L)	Aug-20	High tide	1.2	1.39	1.29	1.49	1.6	1.5
			Low tide	1.17	2.14	1.12	1.65	1.29	1.4
		Sept-20	High tide	2.43	2.7	2.63	2.9	4.3	2.53
			Low tide	2.72	2.88	2.68	2.56	2.56	2.54
13	Phenolic Compounds (as C_6H_5OH) (mg/L)	Aug-20	High tide	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
			Low tide	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
		Sept-20	High tide	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
			Low tide	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
14	Ammonical Nitrogen (as NH_3-N) (mg/L)	Aug-20	High tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
			Low tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
		Sept-20	High tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
			Low tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
15	Total Nitrogen (as N) (mg/L)	Aug-20	High tide	0.93	0.97	1.06	1.22	1.13	1.23
			Low tide	1.03	1.03	1.25	1.26	1.06	1.1

Sr. No.	Parameter	Month		Near Kovalam Beach	Proposed Dredge Material Disposal Site	South of Break Water	Port Basin	Inner Approach Channel	Kovalam Beach
		Sept-20	High tide	0.98	1.26	1.46	1.42	1.62	1.62
			Low tide	1.38	1.3	1.25	1.12	1.23	1.34
16	Total Phosphorous (as P) (mg/L)	Aug-20	High tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
			Low tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
		Sept-20	High tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
			Low tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
17	Reactive Phosphorous (mg/L)	Aug-20	High tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
			Low tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
		Sept-20	High tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
			Low tide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
18	Polycyclic Aromatic Hydrocarbon (mg/L)	Aug-20	High tide	<0.00007	<0.00007	<0.00007	<0.00007	<0.00007	<0.00007
			Low tide	<0.00007	<0.00007	<0.00007	<0.00007	<0.00007	<0.00007
		Sept-20	High tide	<0.00007	<0.00007	<0.00007	<0.00007	<0.00007	<0.00007
			Low tide	<0.00007	<0.00007	<0.00007	<0.00007	<0.00007	<0.00007
19	Salinity (ppt)	Aug-20	High tide	34.2	34.2	34.2	34.7	35.1	34.3

Sr. No.	Parameter	Month		Near Kovalam Beach	Proposed Dredge Material Disposal Site	South of Break Water	Port Basin	Inner Approach Channel	Kovalam Beach
			Low tide	33.3	34.2	34.3	34.7	34.3	33.4
		Sept-20	High tide	34.3	34.8	34.3	35.3	34.3	34.3
			Low tide	34.4	35.3	34.8	34.3	35.3	34.2
20	Total Chlorophyll (mg/m^3)	Aug-20	High tide	1.2	1.0	0.8	1	1	0.9
			Low tide	0.8	1	0.9	1	0.8	1
		Sept-20	High tide	0.6	0.9	1.4	1.1	0.8	0.8
			Low tide	0.8	1	0.9	1	0.8	1
21	Total Coliforms (MPN Index/100 mL)	Aug-20	High tide	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
			Low tide	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
		Sept-20	High tide	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
			Low tide	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
22	Faecal Coliforms (MPN Index/100 mL)	Aug-20	High tide	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
			Low tide	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
		Sept-20	High tide	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
			Low tide	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8

5. Graphical representation of Results for marine water

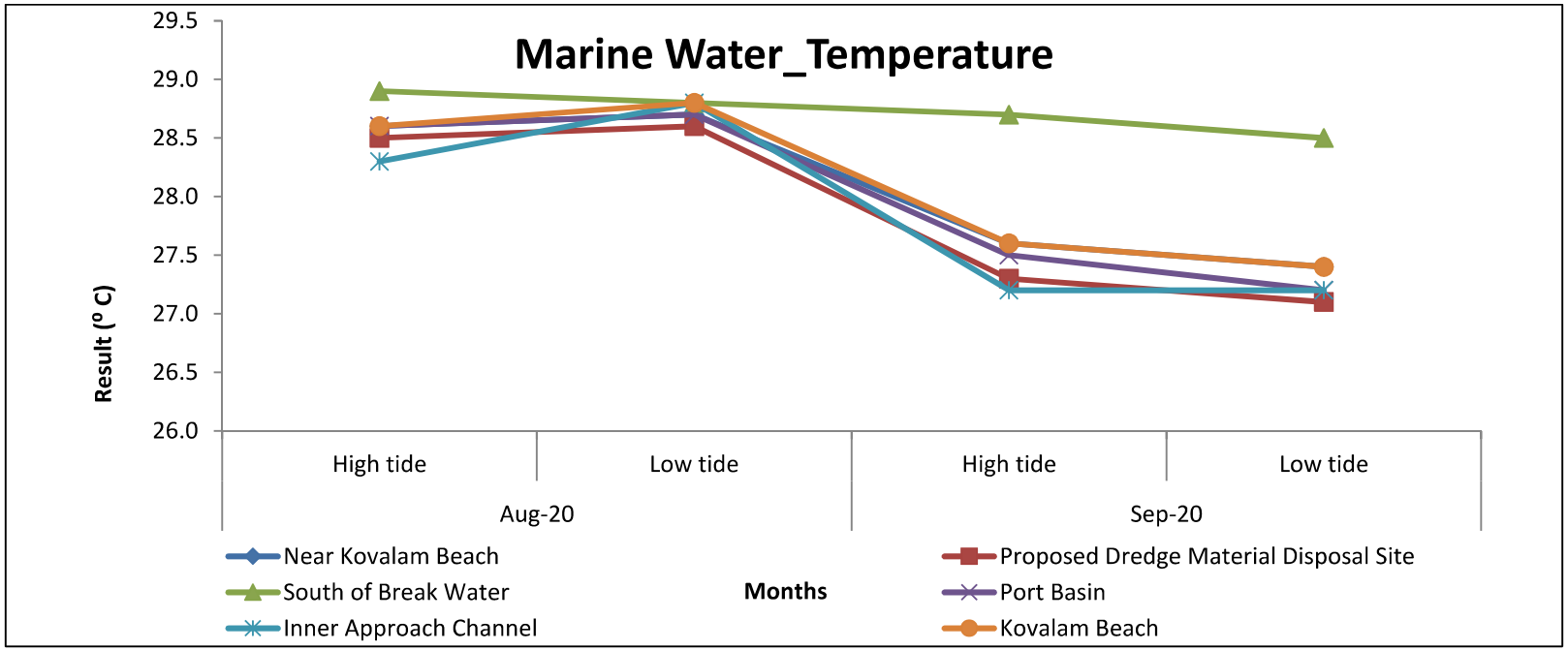


Figure 5.2: Marine Water Analysis for Temperature

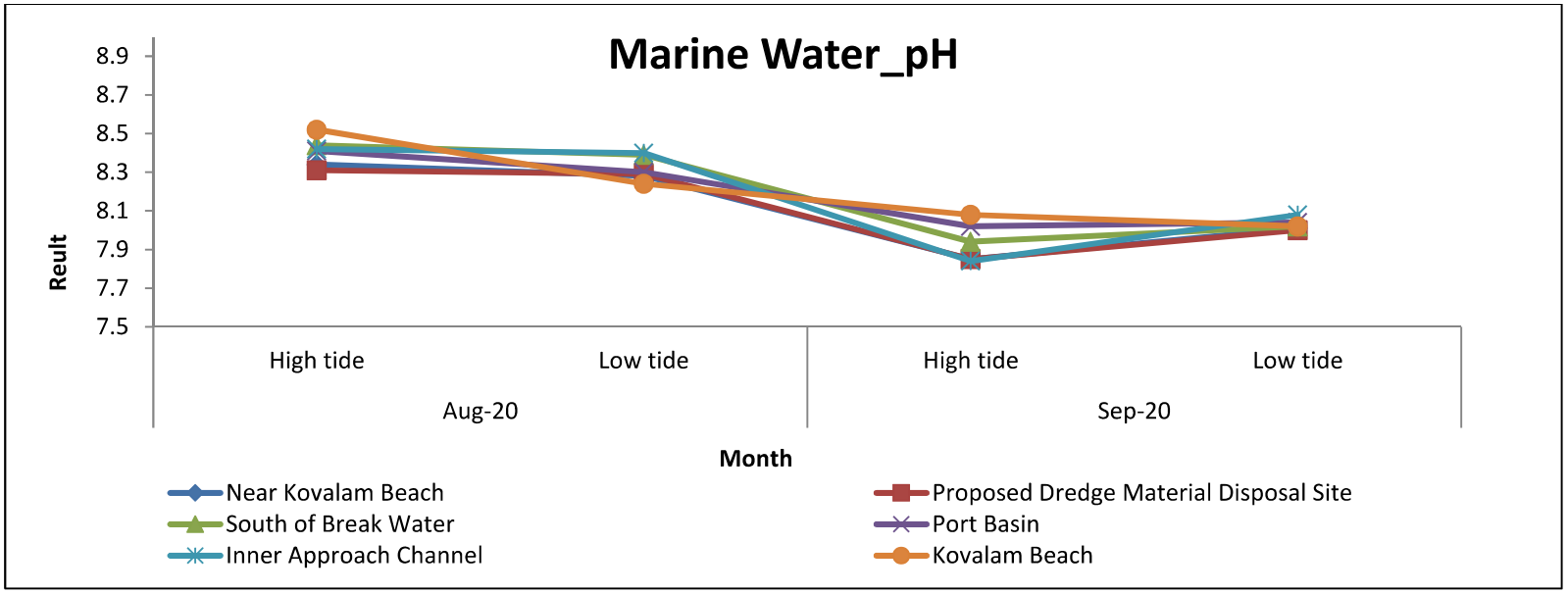


Figure 5.3: Marine Water Analysis for pH

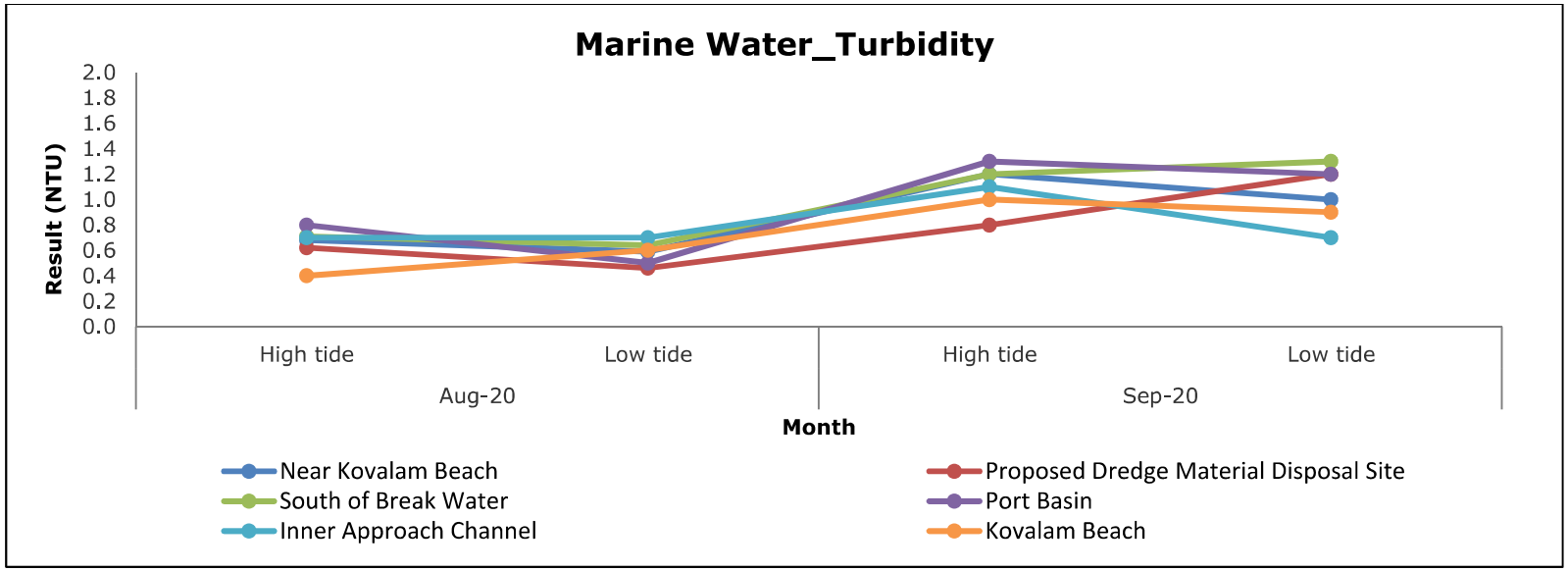


Figure 5.4: Marine Water Analysis for Turbidity

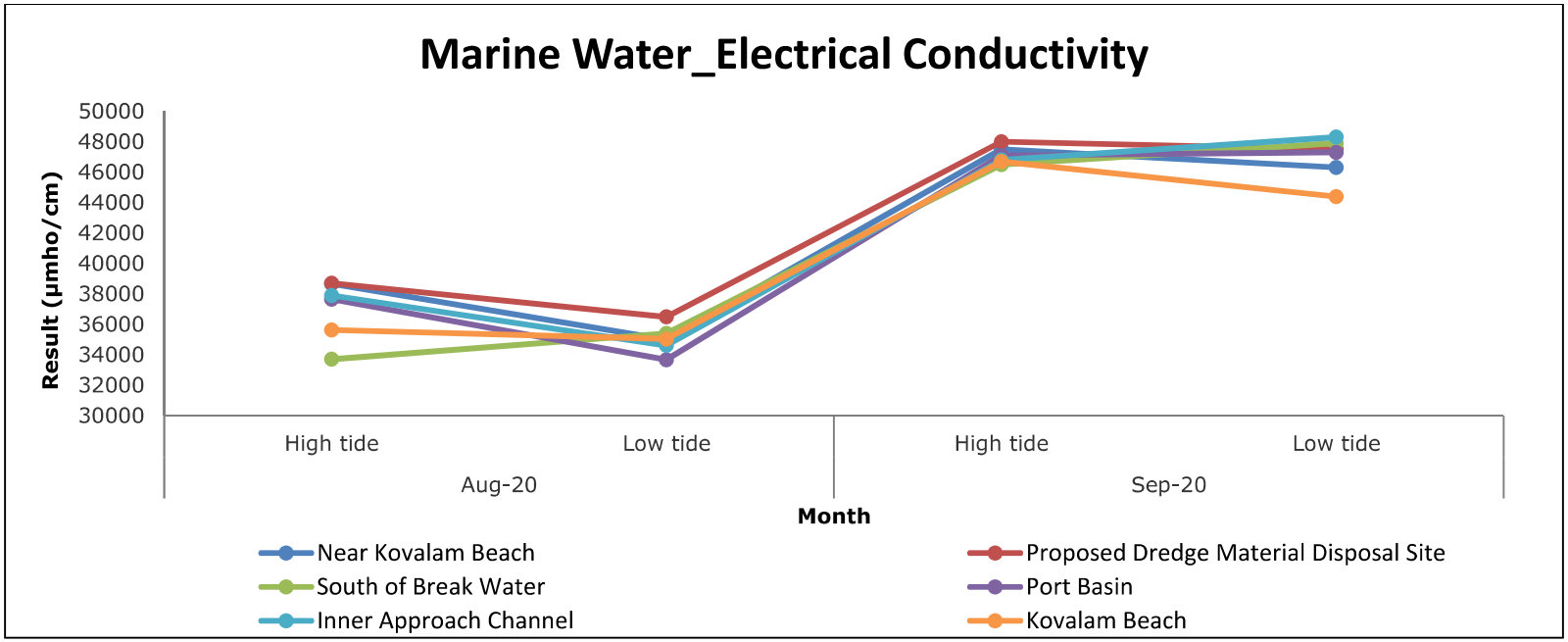


Figure 5.5: Marine Water Analysis for Electrical Conductivity

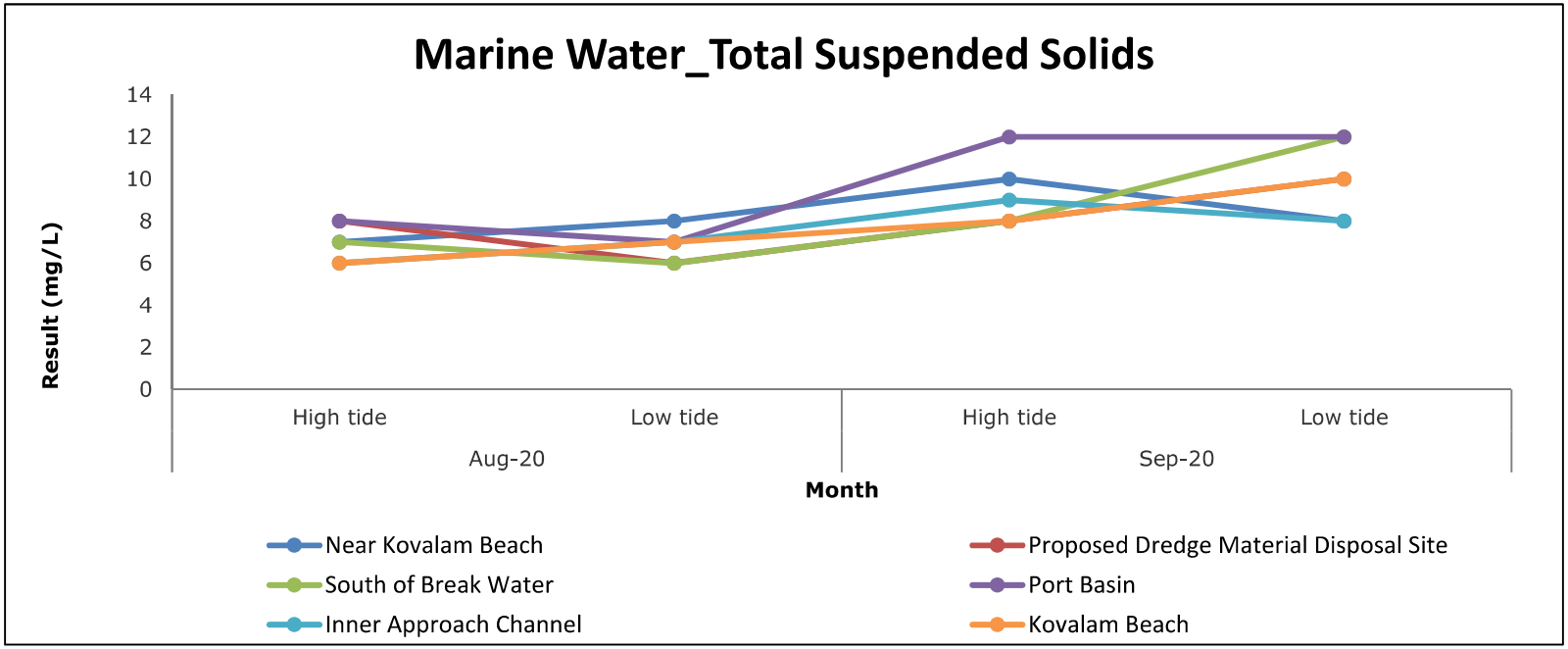


Figure 5.6: Marine Water Analysis for Total Suspended Solids

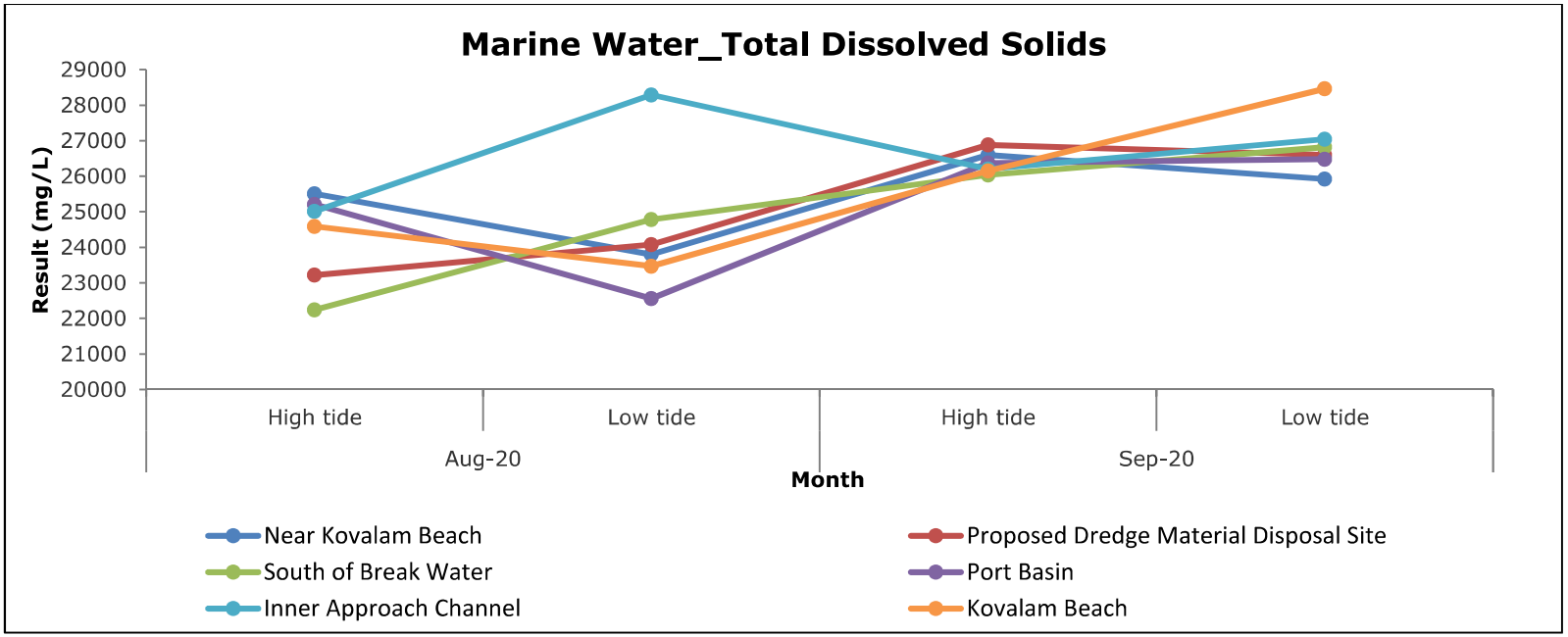


Figure 5.7: Marine Water Analysis for Total Dissolved Solids

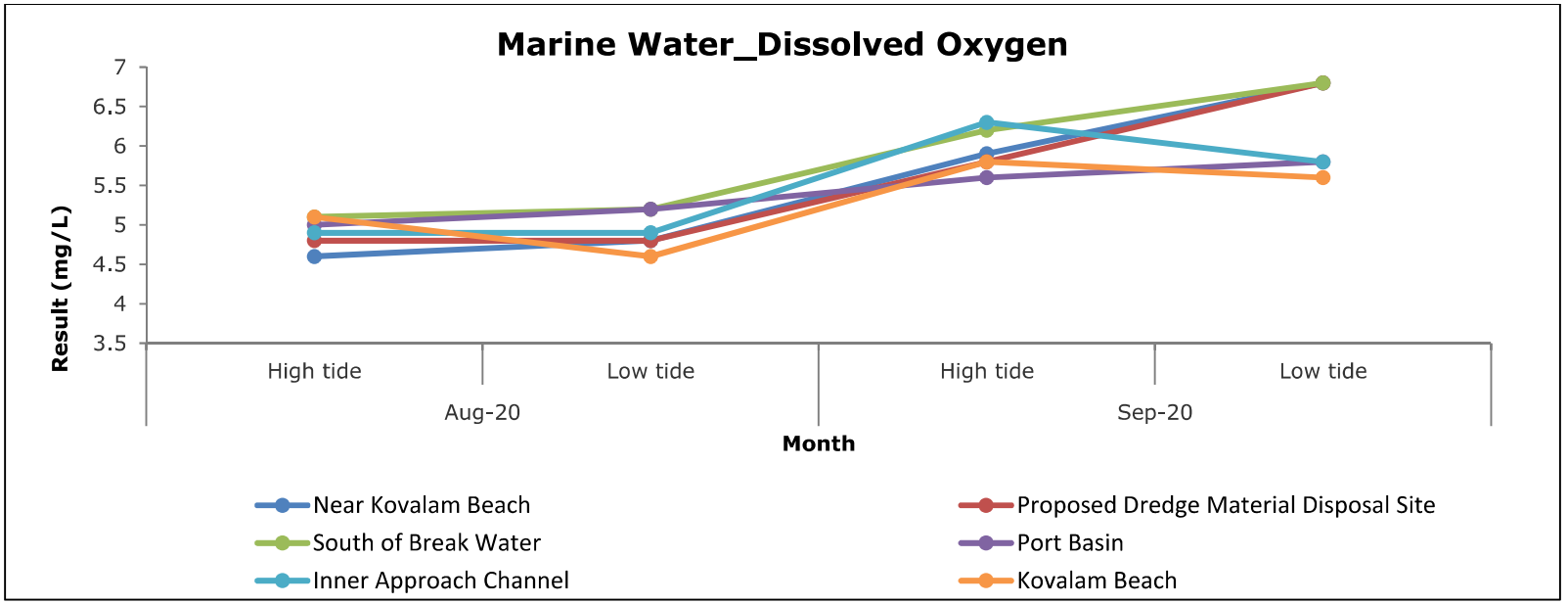


Figure 5.8: Marine Water Analysis for Dissolved Oxygen

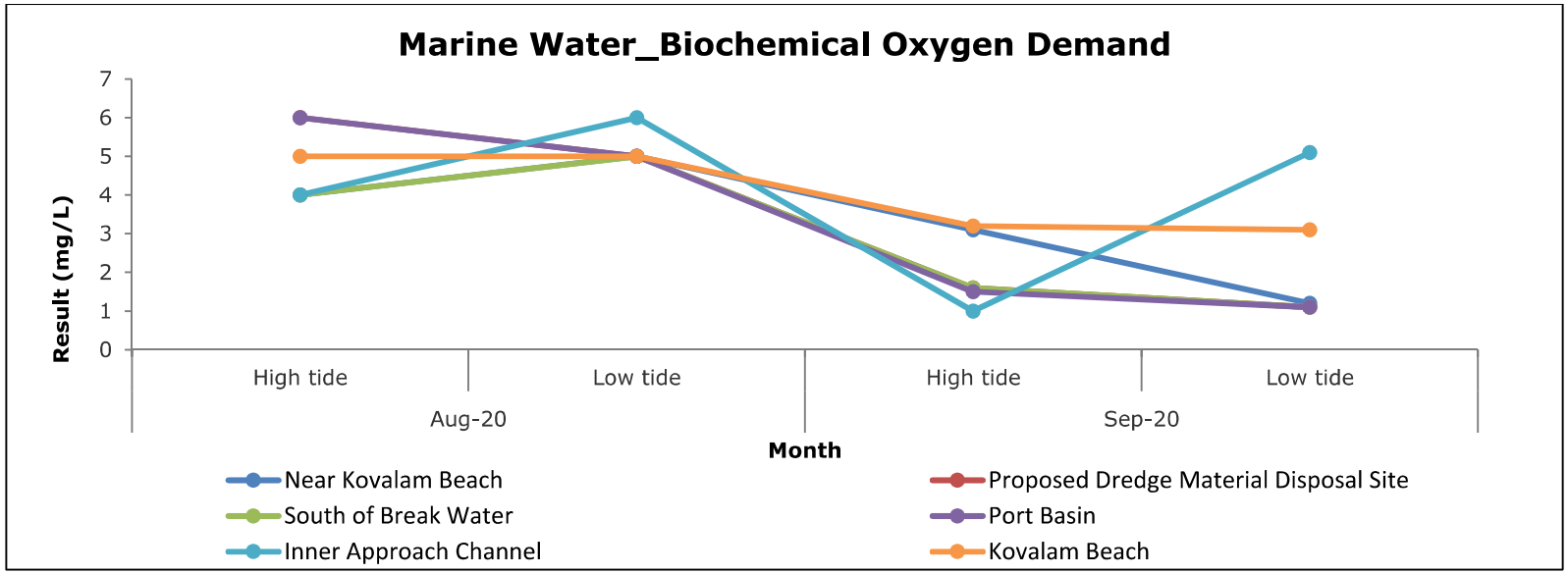


Figure 5.9: Marine Water Analysis for Biochemical Oxygen Demand

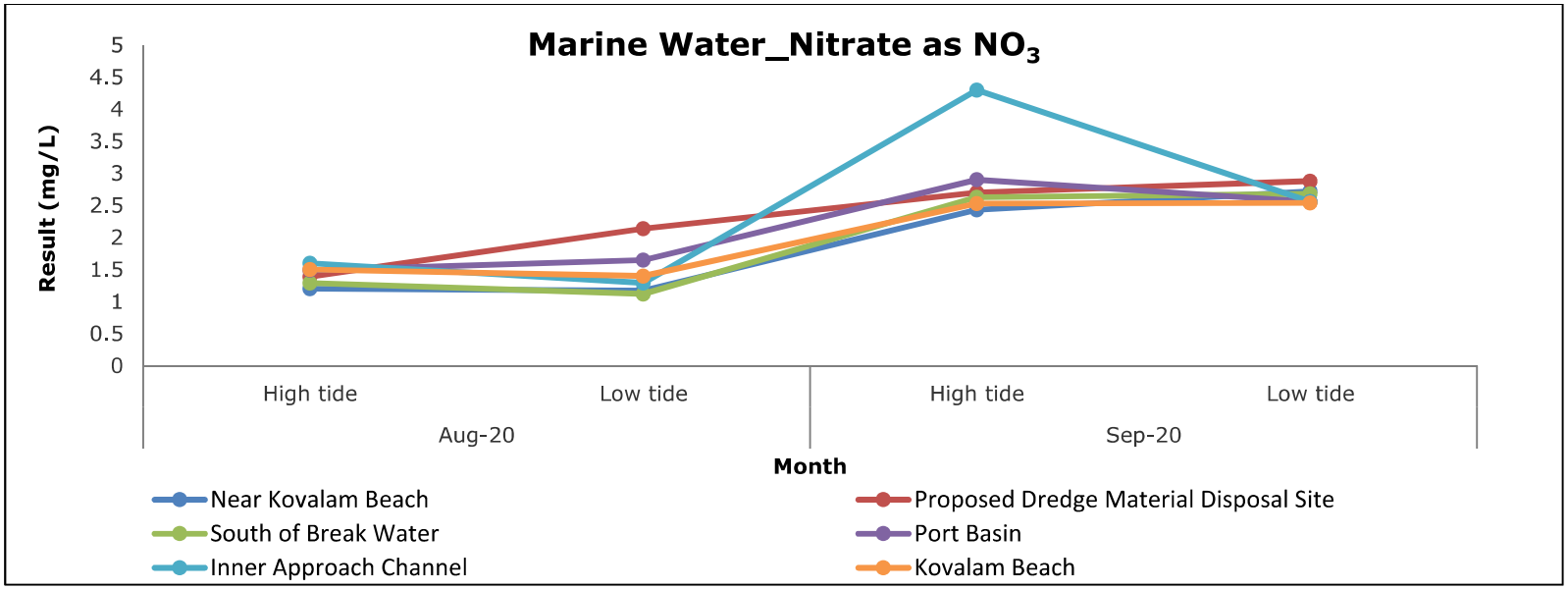


Figure 5.10: Marine Water Analysis for Nitrate as NO_3

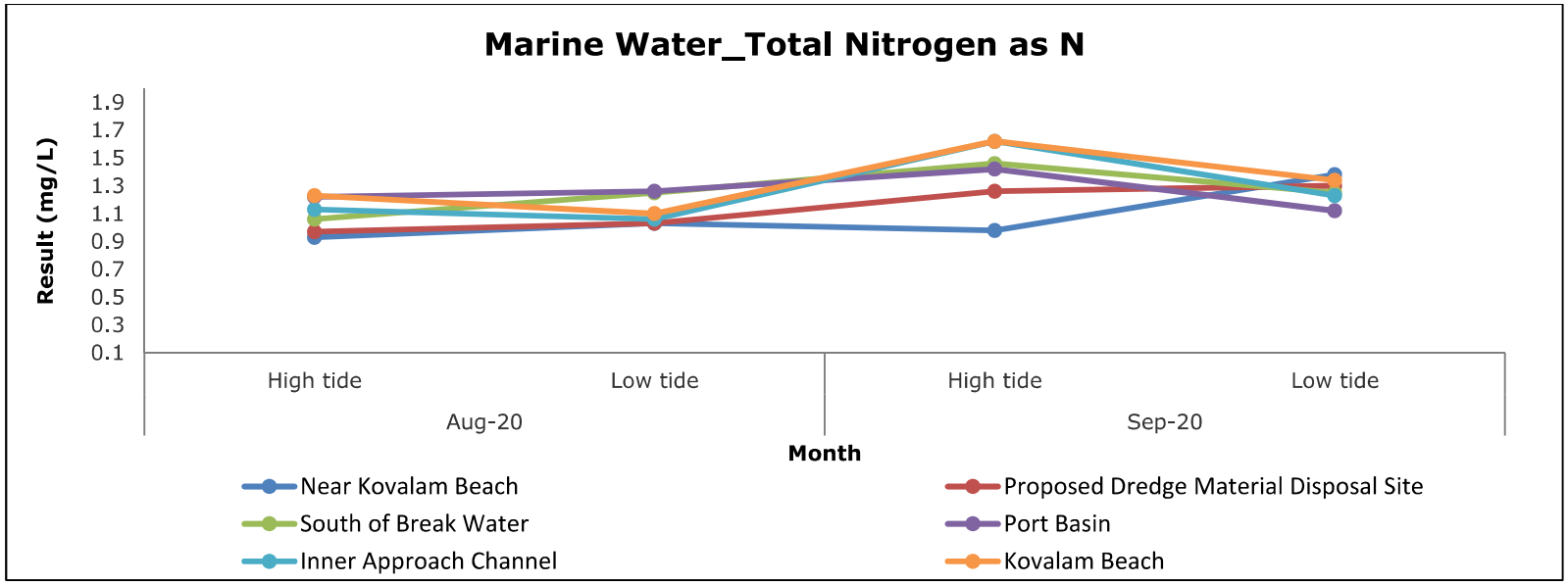


Figure 5.11: Marine Water Analysis for Total Nitrogen as N

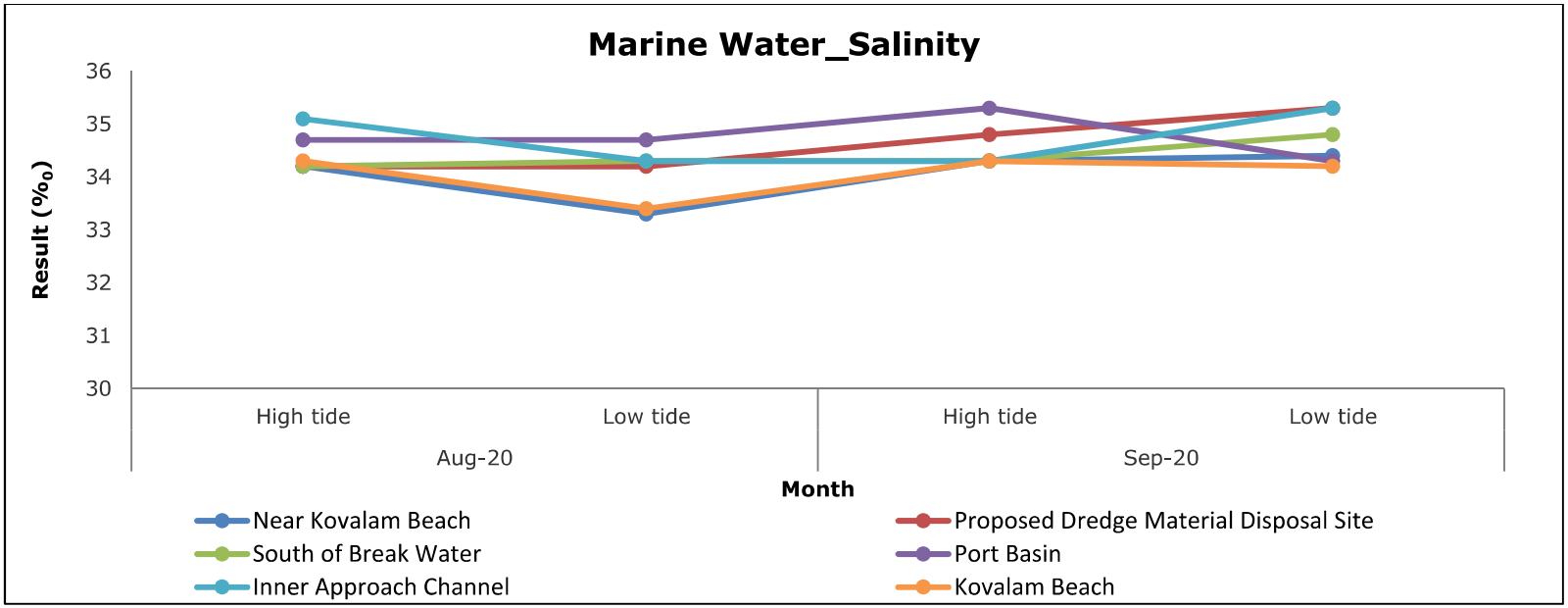


Figure 5.12: Marine Water Analysis for Salinity

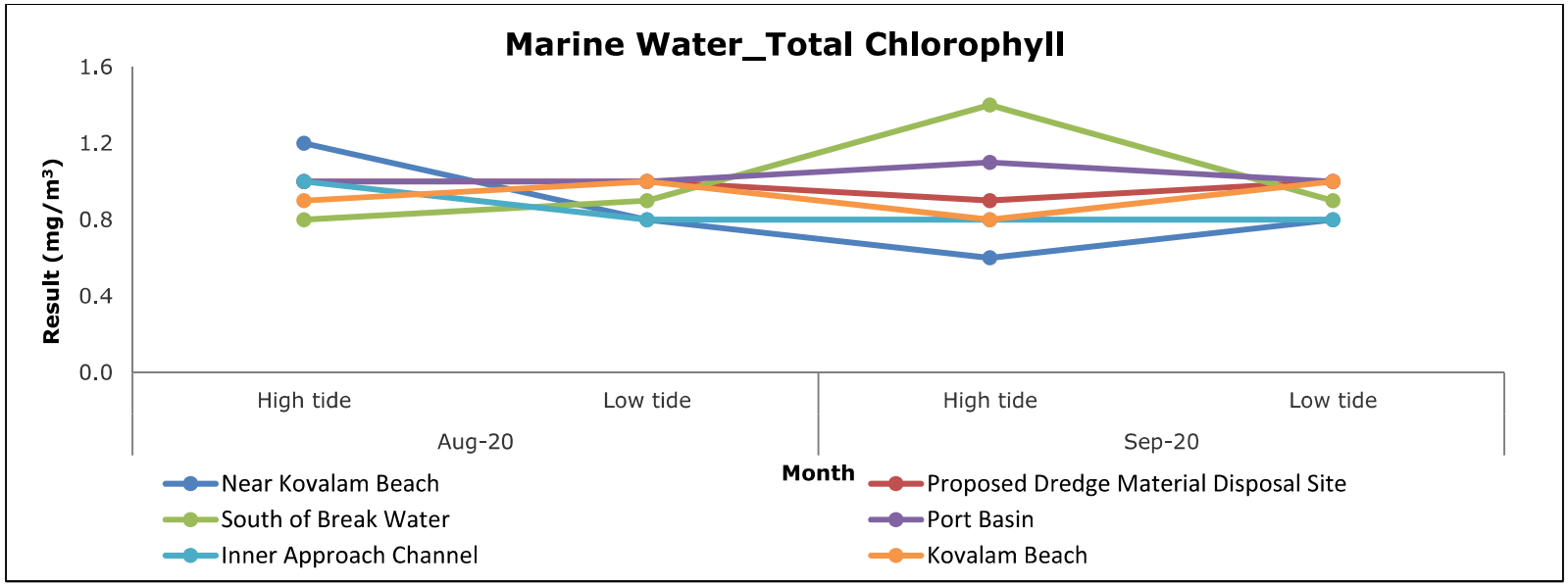


Figure 5.13: Marine Water Analysis for Total Chlorophyll

6. Summary - Marine water analysis:

During the months of August 2020 and September 2020, following is the summary of the marine water analysis:

at the location **Near Kovalam Beach**, the low tide and high tide Temperature was observed in the range between 27.4-28.7, No visible colour or offensive odour was observed, concentration of p^H were observed in the range between 7.85-8.34, Turbidity was observed in the range between 0.59-1.20 N.T.U, Electrical Conductivity (at 25°C) was observed in the range between 35000-47500 µmho/cm, Total Suspended Solid was observed in the range between 7-10 mg/L, Total Dissolved Solids was observed in the range between 23800-26600 mg/L, Dissolved Oxygen was observed in the range between 4.6-6.8 mg/L, Biochemical Oxygen Demand (3 days, 27°C) was observed in the range 1.2-5.0 mg/L, Nitrite (as NO_2) was observed <0.01, Nitrate (as NO_3)was observed in the range between 1.17-2.72 mg/L, Ammonical Nitrogen (as NH_3-N)was observed <0.1, Total Nitrogen (as N)was observed in the range between 0.93-1.38 mg/L. Floating materials, Phenolic Compounds (as C_6H_5OH), Total Phosphorous (as P), Reactive Phosphorous and Polycyclic Aromatic Hydrocarbon were observed below the detection limits. Salinity was observed in the range between 33.3-34.4 PPT, Total Chlorophyll was observed in the range between 0.60-1.20 mg/m^3, Total Coliforms and Faecal Coliforms were observed <1.8 MPN Index/100 mL.

At the location **Proposed Dredge Material Disposal Site**, the low tide and high tide Temperature was observed in the range between 27.1-28.6^{0}C, No visible colour or offensive odour was observed, concentration of p^H were observed in the range between 7.85-8.31, Turbidity was observed in the range between 0.46-1.20 N.T.U, Electrical Conductivity (at 25°C) was observed in the range between 36484-48000 µmho/cm, Total Suspended Solids was observed in the range between 6-10 mg/L, Total Dissolved Solids was observed in the range between 23220-26880 mg/L, Dissolved Oxygen was observed in the range between 4.8-6.8 mg/L, Biochemical Oxygen Demand (3 days, 27°C) was observed in the range between 1.1-6.0 mg/L, Nitrite (as NO_2) was observed <0.01, Nitrate (as NO_3) was observed in the range between 1.39-2.88 mg/L, Ammonical Nitrogen (as NH_3-N)was observed <0.1, Total Nitrogen (as N)was observed in the range between 0.97-1.30 mg/L. Floating materials, Phenolic Compounds (as C_6H_5OH),Total Phosphorous (as P),Reactive Phosphorous and Polycyclic Aromatic Hydrocarbon were observed below the detection limits. Salinity was observed in the range between 34.2-35.3 PPT, Total Chlorophyll was observed in the range between 0.9-1.0 mg/m^3, Total Coliforms and Faecal Coliforms were observed <1.8 MPN Index/100 mL.

At the location **South of Break Water**, the low tide and high tide Temperature was observed in the range between 28.5-28.9 ^{0}C, No visible colour or offensive odour was observed, concentration of p^H were observed in the range between 7.94-8.44, Turbidity was observed in the range between 0.64-1.30 N.T.U, Electrical Conductivity (at 25°C) was observed in the range between 33700-47900 µmho/cm, Total Suspended Solids was observed in the range between 6-12 mg/L, Total Dissolved Solids was observed in the range between 22240-26820 mg/L, Dissolved Oxygen was observed in the range between 5.1-6.8 mg/L, Biochemical Oxygen Demand (3 days, 27°C)was observed in the range between 1.1-5.0 mg/L, Nitrite (as NO_2)was observed <0.01, Nitrate (as NO_3)was observed in the range between 1.12-2.68 mg/L, Ammonical Nitrogen (as NH_3-N) was observed <0.1, Total Nitrogen (as N) was observed in the range between 1.06-1.46 mg/L, Floating materials, Phenolic Compounds (as C_6H_5OH),Total Phosphorous (as P), Reactive Phosphorous and Polycyclic Aromatic Hydrocarbon were observed below the detection limits. Salinity was observed in the range between 34.2-34.8 PPT, Total Chlorophyll was observed in the range between 0.70 – 1.20 mg/m^3, Total Coliforms and Faecal Coliforms were observed <1.8 MPN Index/100 mL.

At the location **Port Basin**, the low tide and high tide Temperature was observed in the range between 27.2-28.7 ^{o}C, No visible colour or offensive odour were observed, concentration of p^H were observed in the range between 8.02-8.41, Turbidity was observed in the range between 0.50-1.30 N.T.U, Electrical Conductivity (at 25°C)was observed in the range between 33671-47300 µmho/cm, Total Suspended Solids was observed in the range between 7-12 mg/L, Total Dissolved Solids was observed in the range between 22560-26480 mg/L, Dissolved Oxygen was observed in the range between 5.0-5.8 mg/L, Biochemical Oxygen Demand (3 days, 27°C) was observed in the range between 1.1-6 mg/L, Nitrite (as NO_2) was observed <0.01, Nitrate (as NO_3) was observed in the range between 1.49-2.90 mg/L, Total Nitrogen (as N) was observed in the range between 1.12-1.42 mg/L, Floating materials, Phenolic Compounds (as C_6H_5OH), Ammonical Nitrogen (as NH_3-N), Total Phosphorous (as P), Reactive Phosphorous and Polycyclic Aromatic Hydrocarbon were observed below the detection limits. Salinity was observed in the range between 34.3-35.3 PPT, Total Chlorophyll was observed in the range between 1.0-1.10 mg/m^3,Total Coliforms were observed in the range between <1.8 -49 MPN Index/100 mL and Faecal Coliforms were observed in the range between <1.8 – 17 MPN Index/100 mL.

At the location **Inner Approach Channel**, the low tide and high tide Temperature was observed in the range between 27.2-28.8^{0}C, No visible colour or offensive odour was

observed, concentration of p^H were observed in the range between 7.84-8.42, Turbidity was observed in the range between 0.70-1.10 N.T.U, Electrical Conductivity (at 25°C)was observed in the range between 34612-48300 µmho/cm, Total Suspended Solids was observed in the range between 6-9 mg/L, Total Dissolved Solids was observed in the range between 25010-28290 mg/L, Dissolved Oxygen was observed in the range between 4.9-6.3 mg/L, Biochemical Oxygen Demand (3 days, 27°C) was observed in the range between 1.0-6.0 mg/L, Nitrite (as NO_2)was observed <0.01, Nitrate (as NO_3)was observed in the range between 1.29-4.30 mg/L, Ammonical Nitrogen (as NH_3-N)was observed <0.1, Total Nitrogen (as N)was observed in the range between 1.06-1.62 mg/L. Floating materials, Phenolic Compounds (as C_6H_5OH), Total Phosphorous (as P), Reactive Phosphorous and Polycyclic Aromatic Hydrocarbon were observed below the detection limits. Salinity was observed in the range between 34.3-35.3 PPT, Total Chlorophyll was observed in the range between 0.8-1.0 mg/m^3, Total Coliforms were observed in the range between <1.8 – 39 MPN Index/100 mL and Faecal Coliforms were observed in the range between <1.8 – 14 MPN Index/100 mL.

At the location **Kovalam Beach**, the low tide and high tide Temperature was observed in the range between 27.4-28.8 ^{0}C, No visible colour or offensive odour was observed, concentration of p^H were observed in the range between 8.02-8.52, Turbidity was observed in the range between 0.40-1.0 N.T.U, Electrical Conductivity (at 25°C) was observed in the range between 35030-46700 µmho/cm, Total Suspended Solids was observed in the range between 6-10 mg/L, Total Dissolved Solids was observed in the range between 23470-28460 mg/L, Dissolved Oxygen was observed in the range between 4.6-5.8 mg/L, Biochemical Oxygen Demand (3 days, 27°C) was observed in the range between 3.1-5.0 mg/L, Nitrite (as NO_2)was observed <0.01, Nitrate (as NO_3)was observed in the range between 1.40-2.54 mg/L, Ammonical Nitrogen (as NH_3-N)was observed <0.1, Total Nitrogen (as N)was observed in the range between 1.10-1.62 mg/L, Floating materials, Phenolic Compounds (as C_6H_5OH), Total Phosphorous (as P), Reactive Phosphorous, Polycyclic Aromatic Hydrocarbon were observed below the detection limits. Salinity was observed in the range between 33.4-34.3 PPT, Total Chlorophyll was observed in the range between <1.8 mg/m^3, Total Coliforms and Faecal Coliforms were observed <1.8 MPN Index/100 mL.

7. Sediment Analysis Results

Table 5.5: Near Kovalam Beach

Parameter	Unit	Aug-20	Sept-20
Texture	-	Sandy	Sandy
Organic Matter	%	3.12	3.48
Total Phosphorus (as P)	mg/kg	14.5	15.1
Aluminium (as Al)	mg/kg	587	873
Chromium (as Cr)	mg/kg	5.79	3.72
Copper (as Cu)	mg/kg	3.50	1.64
Iron (as Fe)	mg/kg	4084	5110
Lead (as Pb)	mg/kg	8.94	5.85
Manganese (as Mn)	mg/kg	7.84	15
Mercury (as Hg)	mg/kg	<0.04	<0.04
Zinc (as Zn)	mg/kg	6.80	7.04
Nickel (as Ni)	mg/kg	5.10	6.92
Benthic Organism			
Micro Benthic Organism	/m^2	89400	90400
Macro Benthic Organism	/m^2	72300	82500
Total	**/m^2**	**161700**	**172900**

Table 5.6: Proposed Dredge Material Disposal Site

Parameter	Unit	Aug-20	Sept-20
Texture	-	Sandy	Sandy
Organic Matter	%	3.51	1.26
Total Phosphorus (as P)	mg/kg	12.1	13.2
Aluminium (as Al)	mg/kg	917	1065
Chromium (as Cr)	mg/kg	4.78	7.26
Copper (as Cu)	mg/kg	3.38	2.24
Iron (as Fe)	mg/kg	4018	6071
Lead (as Pb)	mg/kg	10.5	3.33
Manganese (as Mn)	mg/kg	7.82	17
Mercury (as Hg)	mg/kg	<0.04	<0.04
Zinc (as Zn)	mg/kg	7.29	7.41
Nickel (as Ni)	mg/kg	5.73	4.48
Benthic Organism			
Micro Benthic Organism	/m^2	14800	14500
Macro Benthic Organism	/m^2	94300	95300
Total	**/m^2**	**109100**	**109800**

Table 5.7: South of Breakwater

Parameter	Unit	Aug-20	Sept-20
Texture	-	Sandy	Sandy
Organic Matter	%	2.5	1.22
Total Phosphorus (as P)	mg/kg	22.5	22.0
Aluminium (as Al)	mg/kg	552	720
Chromium (as Cr)	mg/kg	4.85	13.2
Copper (as Cu)	mg/kg	3.96	1.25
Iron (as Fe)	mg/kg	4005	4130
Lead (as Pb)	mg/kg	14.2	7.11
Manganese (as Mn)	mg/kg	7.73	8.88
Mercury (as Hg)	mg/kg	<0.04	<0.04
Zinc (as Zn)	mg/kg	6.54	<2.5
Nickel (as Ni)	mg/kg	6.49	<3
Benthic Organism			
Micro Benthic Organism	/m^2	35100	34000
Macro Benthic Organism	/m^2	22000	25400
Total	**/m^2**	**57100**	**59400**

Table 5.8: Port Basin

Parameter	Unit	Aug-20	Sept-20
Texture	-	Sandy	Sandy
Organic Matter	%	0.81	2.53
Total Phosphorus (as P)	mg/kg	12.5	18.0
Aluminium (as Al)	mg/kg	472	676
Chromium (as Cr)	mg/kg	5.67	11.8
Copper (as Cu)	mg/kg	2.67	1.59
Iron (as Fe)	mg/kg	3951	4233
Lead (as Pb)	mg/kg	12.7	6.59
Manganese (as Mn)	mg/kg	6.07	7.5
Mercury (as Hg)	mg/kg	<0.04	<0.04
Zinc (as Zn)	mg/kg	5.14	<2.5
Nickel (as Ni)	mg/kg	5.71	<3
Benthic Organism			
Micro Benthic Organism	/m^2	74500	73000
Macro Benthic Organism	/m^2	67500	67500
Total	**/m^2**	**142000**	**140500**

Table 5.9: Inner Approach Channel

Parameter	Unit	Aug-20	Sept-20
Texture	-	Sandy	Sandy
Organic Matter	%	0.9	2.59
Total Phosphorus (as P)	mg/kg	13.5	14.8
Aluminium (as Al)	mg/kg	962	490
Chromium (as Cr)	mg/kg	5.53	2.21
Copper (as Cu)	mg/kg	3.34	2.36
Iron (as Fe)	mg/kg	4015	3192
Lead (as Pb)	mg/kg	8.87	4.77
Manganese (as Mn)	mg/kg	7.67	12.3
Mercury (as Hg)	mg/kg	<0.04	<0.04
Zinc (as Zn)	mg/kg	6.44	<2.5
Nickel (as Ni)	mg/kg	7.07	<3
Benthic Organism			
Micro Benthic Organism	/m^2	34000	33600
Macro Benthic Organism	/m^2	9500	8400
Total	**/m^2**	**43500**	**42000**

Table 5.10: Kovalam Beach

Parameter	Unit	Aug-20	Sept-20
Texture	-	Sandy	Sandy
Organic Matter	%	2.81	2.90
Total Phosphorus (as P)	mg/kg	13.5	14.4
Aluminium (as Al)	mg/kg	892	886
Chromium (as Cr)	mg/kg	4.99	3.02
Copper (as Cu)	mg/kg	3.34	2.00
Iron (as Fe)	mg/kg	4036	5069
Lead (as Pb)	mg/kg	8.68	4.63
Manganese (as Mn)	mg/kg	7.68	12.6
Mercury (as Hg)	mg/kg	<0.04	<0.04
Zinc (as Zn)	mg/kg	6.39	5.07
Nickel (as Ni)	mg/kg	3.14	3.02
Benthic Organism			
Micro Benthic Organism	/m^2	89000	92400
Macro Benthic Organism	/m^2	84000	86500
Total	**/m^2**	**173000**	**178900**

8. Graphical representation of Results for sediment analysis

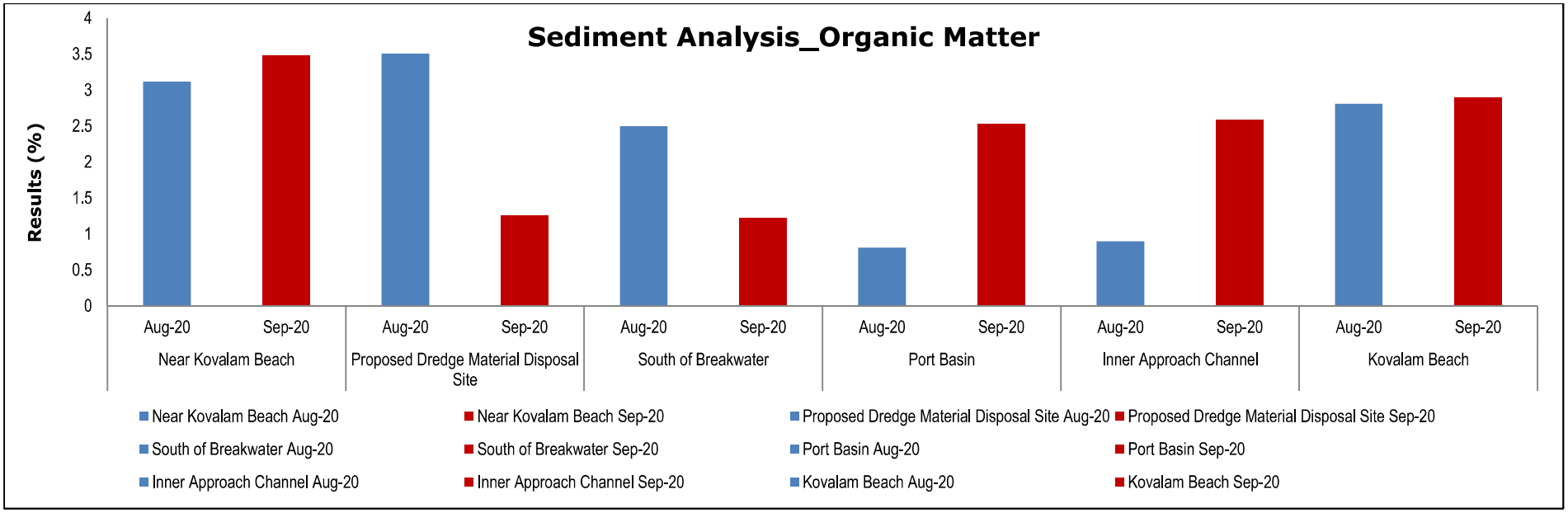


Figure 5.14: Sediment analysis for Organic Matter

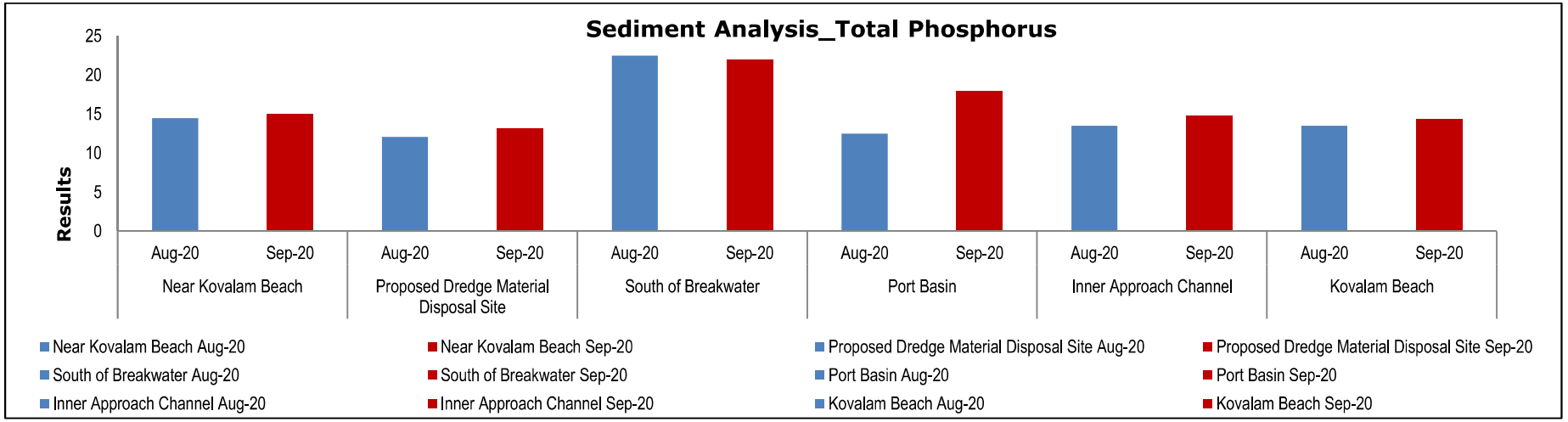


Figure 5.15: Sediment analysis for Total Phosphorus

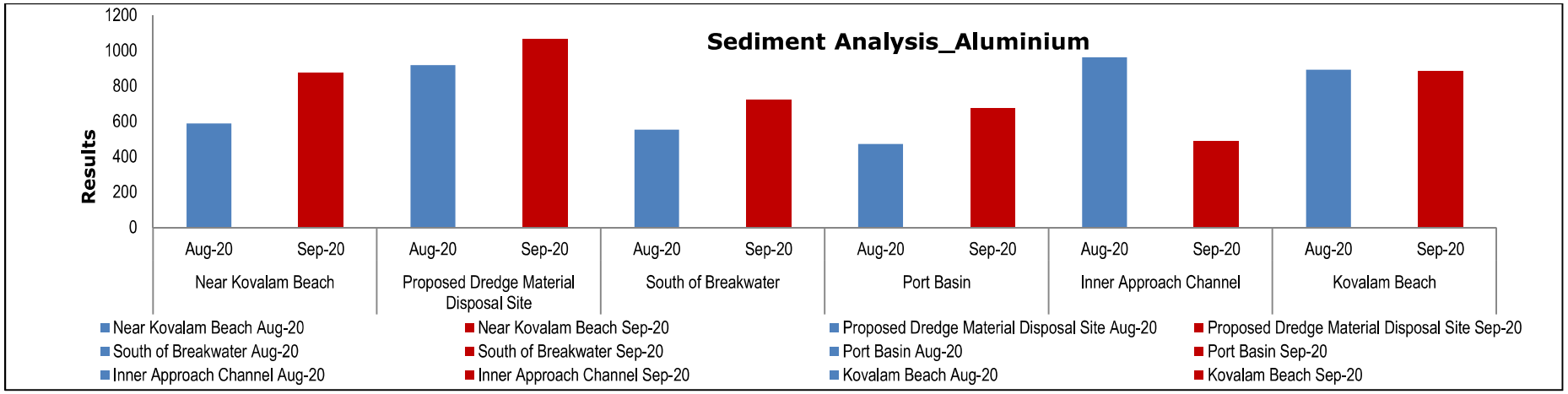


Figure 5.16: Sediment analysis for Aluminium

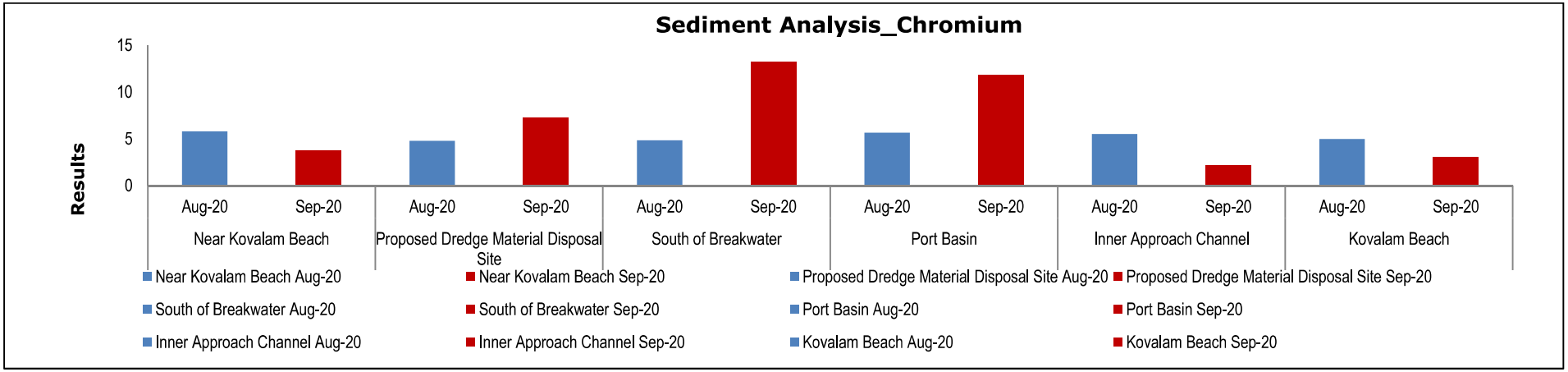


Figure 5.17: Sediment analysis for Chromium

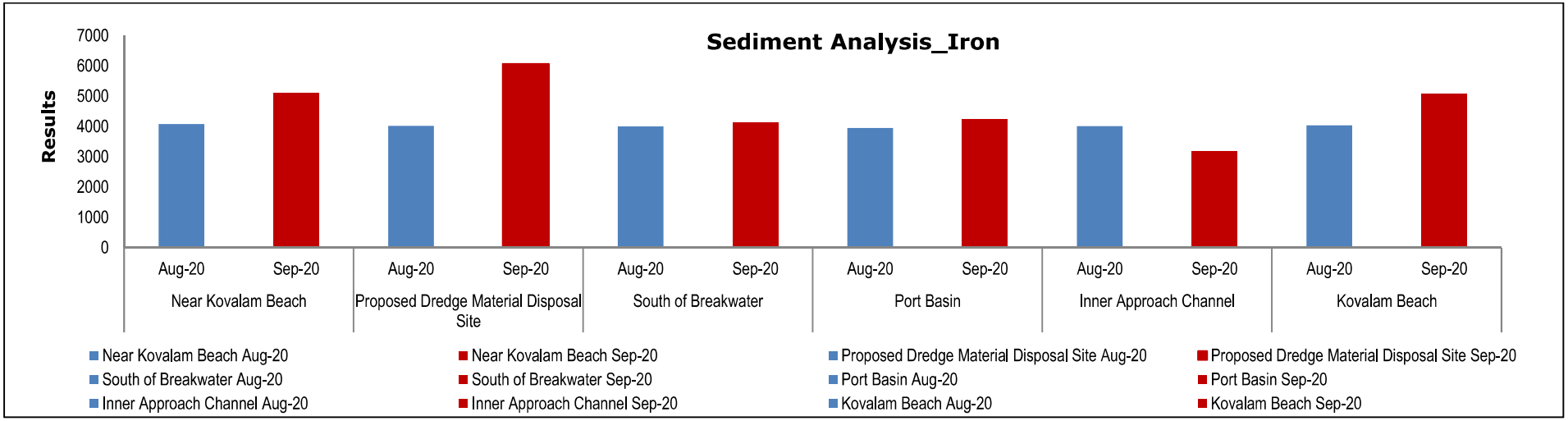


Figure 5.18: Sediment analysis for Iron

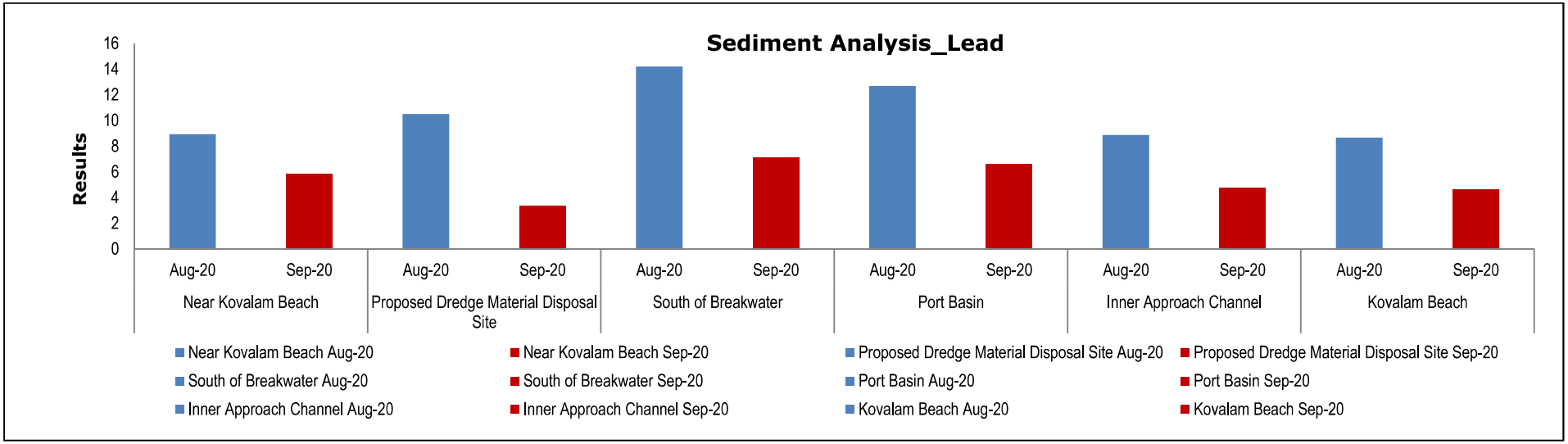


Figure 5.19: Sediment analysis for Lead

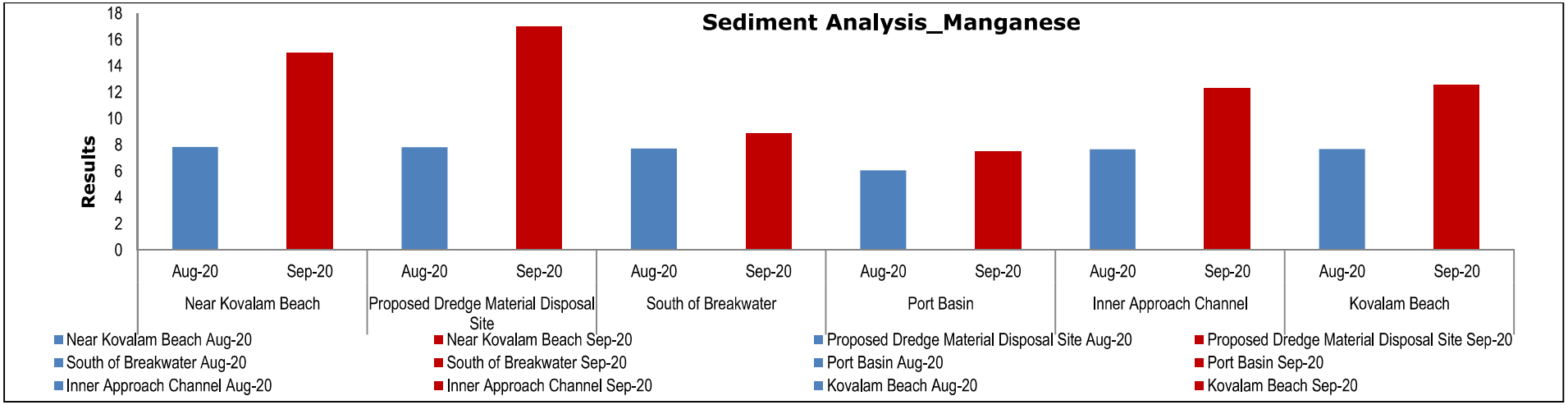


Figure 5.20: Sediment analysis for Manganese

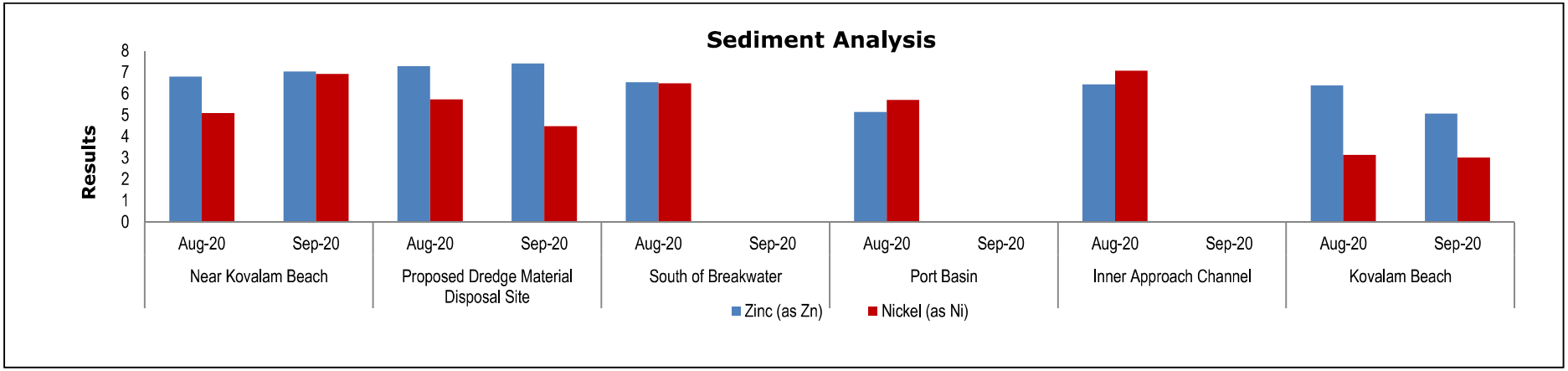


Figure 5.21: Sediment analysis for Zinc and Nickel

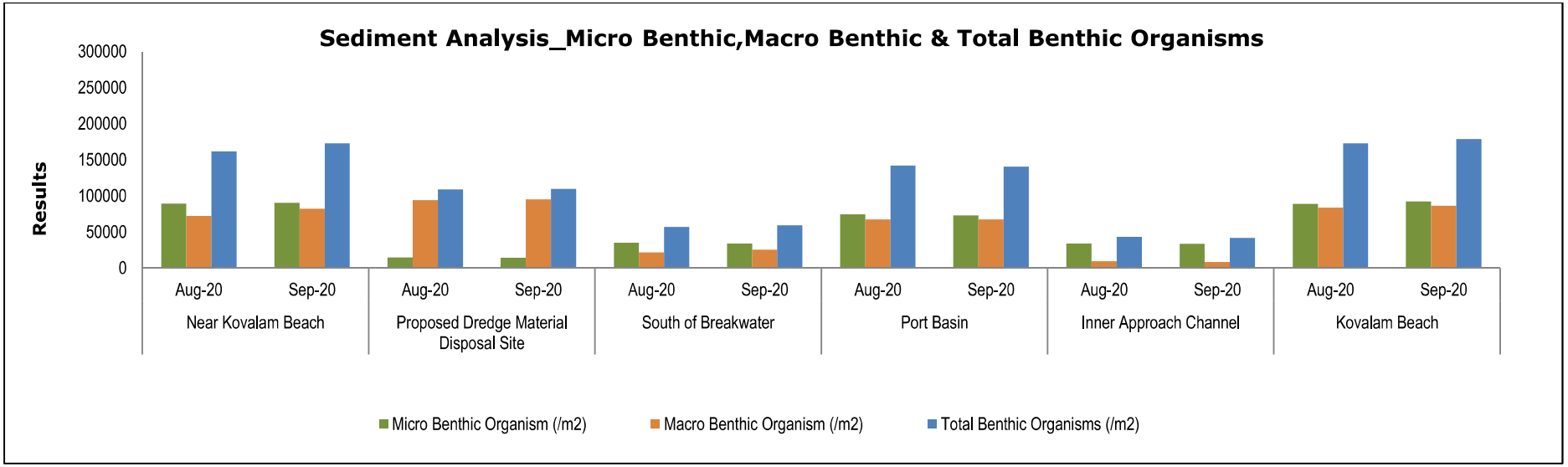


Figure 5.22: Sediment analysis for Benthic Organism

9. Summary- Sediment Analysis:

During the months of August 2020 and September 2020, following is the summary of sediment analysis:

At the location **Near Kovalam Beach**, the observed texture was sandy, Organic matter was observed in the range between 3.12-3.48%, Total Phosphorus (as P) was observed in the range between 14.5-15.1 mg/kg. Aluminium (as Al) was observed in the range between 587-873 mg/kg. Chromium (as Cr) was observed in the range between 3.72-5.79 mg/kg. Copper (as Cu) was observed in the range between 3.72-5.79 mg/kg. Iron (as Fe) was observed in the range between 4084-5110 mg/kg. Lead (as Pb) was observed in the range between 5.85-8.94 mg/kg. Manganese (as Mn) was observed in the range between 7.84-15 mg/kg. Mercury (as Hg) was observed <0.04. Zinc (as Zn) was observed in the range between 6.80-7.04 mg/kg. Nickel (as Ni) was observed in the range between 5.10-6.92 mg/kg. Micro benthic organisms were observed in the range between 89400-90400/m^2 and macro benthic organisms were observed in the range between 72300-82500/m^2.

At the location **Proposed Dredge Material Disposal site**, the observed texture was clay and sandy, Organic matter was observed in the range between 1.26-3.51 %, Total Phosphorus (as P) was observed in the range between 12.1-13.2 mg/kg. Aluminium (as Al) was observed in the range between 917-1065 mg/kg. Chromium (as Cr) was observed in the range between 4.78-7.26 mg/kg. Copper (as Cu) was observed in the range between 2.24-3.38 mg/kg. Iron (as Fe) was observed in the range between 4018-6071 mg/kg. Lead (as Pb) was observed in the range between 3.33-10.5 mg/kg. Manganese (as Mn) was observed in the range between 7.82-17 mg/kg. Mercury (as Hg) was observed <0.04. Zinc (as Zn) was observed in the range between 7.29-7.41 mg/kg. Nickel (as Ni) was observed in the range between 4.48-5.73 mg/kg. Micro benthic organisms were observed in the range between 14500-14800/m^2 and macro benthic organisms were observed in the range between 94300-95300/m^2.

At the location **South of break water**, the observed texture was clay and sandy, Organic matter was observed in the range between 1.22-2.50 %, Total Phosphorus (as P) was observed in the range between 22-22.5 mg/kg. Aluminium (as Al) was observed in the range between 552-720 mg/kg. Chromium (as Cr) was observed in the range between 4.85-13.20 mg/kg. Copper (as Cu) was observed in the range between 1.25-3.96 mg/kg. Iron (as Fe) was observed in the range between 4005-4130 mg/kg. Lead (as Pb) was observed in the range between 7.11-14.2mg/kg. Manganese (as Mn) was observed in the range between 7.73-6.88 mg/kg. Mercury (as Hg) was observed in the

range between <0.04. Zinc (as Zn) was observed in the range between <2.5 – 6.54 mg/kg. Nickel (as Ni) was observed in the range between below <3–6.49 mg/kg. Micro benthic organisms were observed in the range between 34000-35100/m^2 and macro benthic organisms were observed in the range 22000-25400/m^2.

At the location **Port Basin**, the observed texture was sandy, Organic matter was observed in the range between 0.81-2.53 percent, Total Phosphorus (as P) was observed in the range between 12.5-18 mg/kg. Aluminium (as Al) was observed in the range between 472-676 mg/kg. Chromium (as Cr) was observed in the range between 5.67-11.8 mg/kg. Copper (as Cu) was observed in the range between 1.59-2.67 mg/kg. Iron (as Fe) was observed in the range between 3951-4233 mg/kg. Lead (as Pb) was observed in the range between 6.59-12.7 mg/kg. Manganese (as Mn) was observed in the range between 6.07-7.5 mg/kg. Mercury (as Hg) was observed <0.04. Zinc (as Zn) was observed in the range between <2.5 -5.14 mg/kg. Nickel (as Ni) was observed in the range between <3 -5.71 mg/kg. Micro benthic organisms were observed in the range between 73500-74500/m^2 and macro benthic organisms were observed in the range between 67500-67500/m^2.

At the location **Inner Approach Channel**, the observed texture was sandy, Organic matter was observed in the range between 0.90-2.59%, Total Phosphorus (as P) was observed in the range between 13.5-14.6 mg/kg. Aluminium (as Al) was observed in the range between 490-962 mg/kg. Chromium (as Cr) was observed in the range between 2.21-5.53 mg/kg. Copper (as Cu) was observed in the range between 2.36-3.34 mg/kg. Iron (as Fe) was observed in the range between 3192-4015 mg/kg. Lead (as Pb) was observed in the range between 4.77-8.87 mg/kg. Manganese (as Mn) was observed in the range between 7.67-12.3 mg/kg. Mercury (as Hg) was observed <0.04. Zinc (as Zn) was observed in the range between <2.5 -6.44 mg/kg. Nickel (as Ni) was observed in the range between <3 -7.07 mg/kg. Micro benthic organisms were observed in the range between 33600-34000/m^2 and macro benthic organisms were observed in the range between 8400-9500/m^2.

At the location **Kovalam Beach**, the observed texture was sandy, Organic matter was observed in the range between 2.81-2.90%, Total Phosphorus (as P) was observed in the range between 13.5-14.4 mg/kg. Aluminium (as Al) was observed in the range between 886-892 mg/kg. Chromium (as Cr) was observed in the range between 3.02-4.99 mg/kg. Copper (as Cu) was observed in the range between 2– 3.34 mg/kg. Iron (as Fe) was observed in the range between 4036-5069 mg/kg. Lead (as Pb) was observed in the range between 4.63-8.68 mg/kg. Manganese (as Mn) was observed in

the range between 7.68-12.6 mg/kg. Mercury (as Hg) was observed <0.04. Zinc (as Zn) was observed in the range between 5.07-6.39 mg/kg. Nickel (as Ni) was observed in the range between 3.02-3.14 mg/kg. Micro benthic organisms were observed in the range between 89000-92400/m^2 and macro benthic organisms were observed in the range between 84000-86500/m^2.

10.Marine Water Analysis for Phytoplankton and Zooplankton

Table 5.11: Total Phytoplankton and Zooplankton Results

Parameter	Month	Near Kovalam Beach	Proposed Dredge Material Disposal Site	South of Break water	Port Basin	Inner Approach Channel	Kovalam Beach
Total Phytoplankton No/100 mL	Aug-20	4121800	368200	1362800	127100	1476000	4328800
	Sept-20	4244200	401400	1445800	132200	1381700	4433900
Total Zooplankton No/ 100 mL	Aug-20	8882	9270	10557	5833	11147	9578
	Sept-20	8688	8929	10294	5595	10899	9341

11. Graphical representation of Results for Marine Phytoplankton and Zooplankton

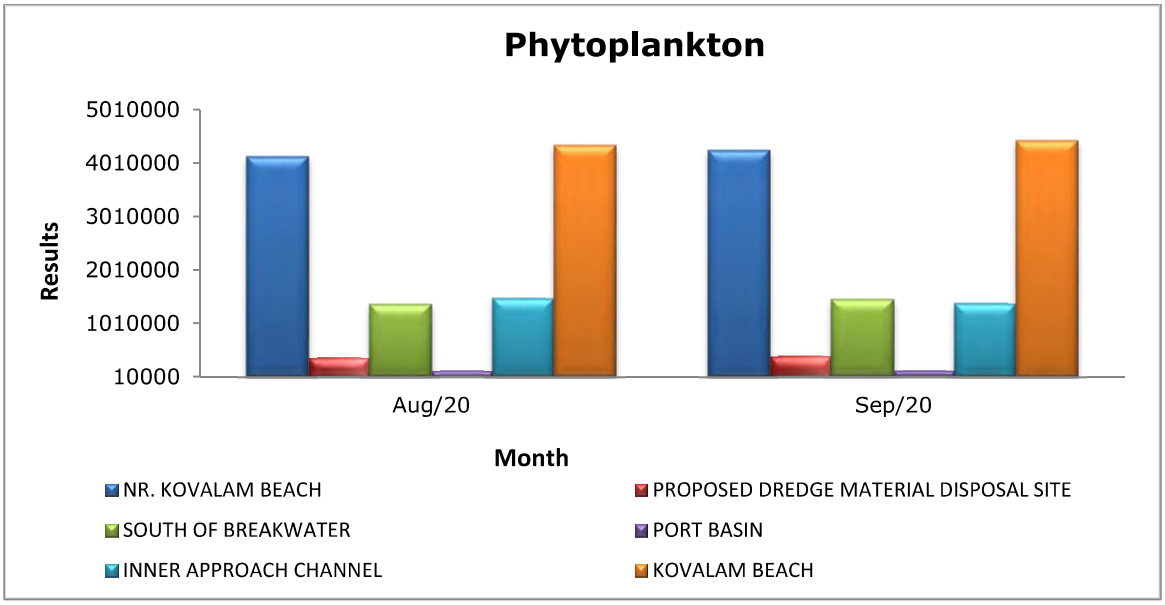


Figure 5.23: Marine Water Analysis for Total Phytoplankton

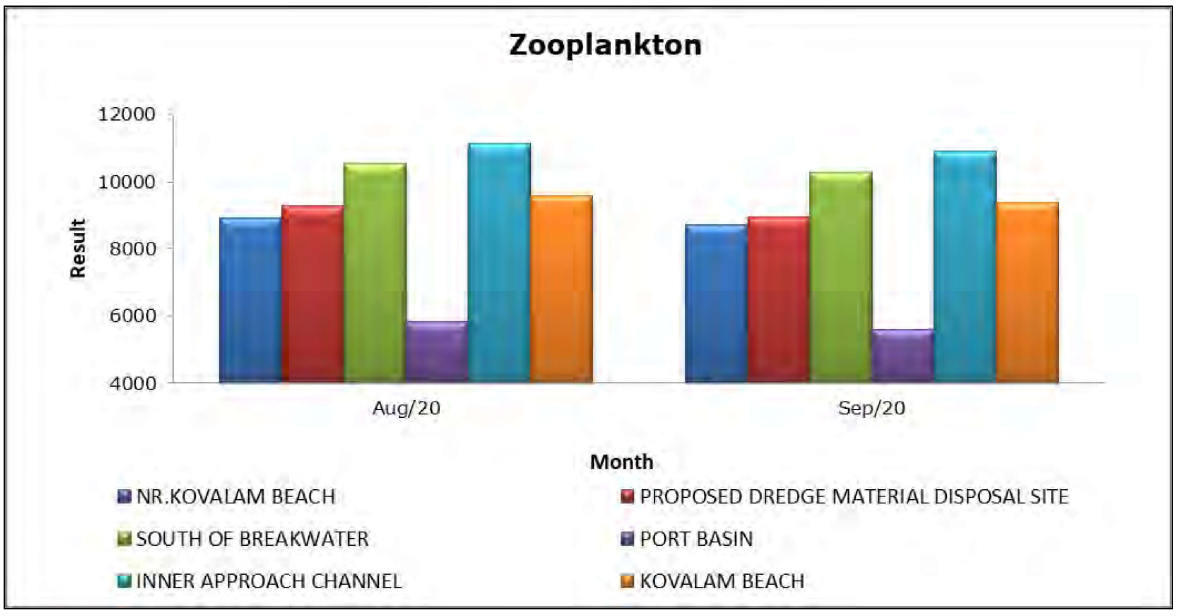


Figure 5.24: Marine Water Analysis for Total Zooplankton

12.Summary-Marine Water Analysis for Phytoplankton and Zooplankton

During the months August 2020 and September 2020, following is the summary of Marine Water Analysis for Phytoplankton and Zooplankton:

At the location **Near Kovalam Beach**, Phytoplankton were observed in the range between 4121800-4244200 No/100 mL and Zooplanktons were observed in the range between 8688-8882 No/100 mL.

At the location **Proposed Dredge Material Disposal site**, Phytoplankton were observed in the range between 368200-401400 No/100 mL and Zooplanktons were observed in the range between 8929-9270 No/100 mL.

At the location **South of Breakwater**, Phytoplankton were observed in the range between 1362800-1445800 No/100 mL and Zooplanktons were observed in the range between 10294-10557 No/100 mL.

At the location **Port Basin**, Phytoplankton were observed in the range between 107300-132200 No/100 mL and Zooplanktons were observed in the range between 5595-5833 No/100 mL.

At the location **Inner Approach Channel**, Phytoplankton were observed in the range between 1476000-1381700 No/100 mL and Zooplanktons was observed in the range between 11147-10899 No/100 mL.

At the location **Kovalam Beach**, Phytoplankton were observed in the range between 4328800-4433900 No/100 mL and Zooplanktons was observed in the range between 9341-9578 No/100 mL.

CHAPTER 6

Water Analysis

1. Ground water and surface water sources details:

This chapter describes the sampling location, methodology adopted for analysis and analysis results of Ground water and Surface water during the period June 2020 to September 2020. Ground water and surface water sampling was suspended in the months of April 2020 and May 2020 due to the restrictions of the lockdown imposed by the government as a result of the ongoing COVID-19 pandemic. Ground water sampling was carried out at three locations including Port Site, PAF Area and Proposed Port Estate Area and surface water sampling was carried out at Poovar West Canal, Vizhinjam Branch Canal and Vellayani Lake.

Table 6.1: Ground Water Location details

Sr. No.	Location	Latitude	Longitude
Ground Water			
1.	Port Site	8°,22'02.10"N	77°,00'17.96"E
2.	PAF Area	8^0,22',14.86"N	77^0,00',9.20"E
3.	Proposed Port Estate Area	8^0,22',24.64"N	77^0,01',46.27"E
Surface Water			
1.	Poovar West Canal	8^0,19',08.18"N	77^0,04',35.30"E
2.	Vizhinjam Branch Canal	8^0,22',49.55"N	76^0,59',35.01"E
3.	Vellayani Lake	8^0,25',30.71"N	76^0,59',37.70"E



Figure 6.1: Google earth views of Ground water and Surface water sources

2. Methodology of Sampling and Analysis:

Table 6.2: Ground Water and Surface Water methodology

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
1.	Colour	Hazen Units	1	IS 3025 (Part 4):1983, RA 2017
2.	Odour	-	Qualitative	IS 3025 (Part 5): 1983, RA 2017
3.	p^H Value	-	1-14	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	0.1	IS 3025(Part 14): 1984
6.	Total Dissolved Solids	mg/L	5	IS 3025 (Part 16): 1984, RA 2017
7.	Dissolved Oxygen	mg/L	0.05	IS 3025 (Part 38): 1989,
8.	Biochemical Oxygen Demand(3 days, 27°C)	mg/L	1	IS 3025 (Part 44): 1993
9.	Oil & Grease	mg/L	1	APHA, 23rd Ed., 2017,5520-B, 5-40
10.	Aluminium (as Al)	mg/L	0.025	IS 3025(Part 55): 2003, RA 2014
11.	Ammonia (as NH_3- N)	mg/L	0.1	APHA, 23rd Ed., 2017, 4500-NH3, B &C, 4-110, 4-112
12.	Anionic Detergents (as MBAS) Calculated as LAS mol. wt. 288.38	mg/L	0.1	APHA, 23rd Ed 2017, 5540-B & C5-53 & 5-55
13.	Barium (as Ba)	mg/L	0.1	IS 3025 (Part 2): 2004, RA 2014/ISO 11885:1996
14.	Boron (as B)	mg/L	0.1	Annex H of IS 13428:2005,RA 2014
15.	Calcium (as Ca)	mg/L	0.4	IS 3025 (Part 40): 1991, RA 2014,
16.	Chloramines (as Cl_2)	mg/L	0.05	APHA, 23rd Ed., 2017, 4500-Cl-G, 4-80
17.	Chloride (as Cl)	mg/L	0.25	IS 3025 (Part 32):1988, RA 2014
18.	Copper (as Cu)	mg/L	0.02	IS 3025 (Part 2): 2004, RA 2014/ISO 11885:1996
19.	Fluoride (as F)	mg/L	0.05	IS 3025 (Part 60):2008, RA 2013
20.	Iron (as Fe)	mg/L	0.06	IS 3025 (Part 2): 2004, RA 2014/ISO 11885:1996
21.	Magnesium (as Mg)	mg/L	0.02	IS 3025 (Part 46):1994, RA 2014, Amds.2
22.	Manganese (as Mn)	mg/L	0.02	IS 3025 (Part 2): 2004, RA 2014 / ISO 11885:1996
23.	Mineral Oil	mg/L	0.005	IS 3025 (Part 39):1991,RA 2014
24.	Nitrate (as NO_3)	mg/L	0.2	APHA, 23rd Ed., 2017, 4500-NO3, B-4-127
25.	Phenolic Compounds (as C_6H_5OH)	mg/L	0.001	APHA, 23rd Ed., 2017, 4500-NO3, B-4-127
26.	Selenium (as Se)	mg/L	0.005	IS 3025 (Part 2): 2004, RA 2014 / ISO 11885:1996
27.	Silver (as Ag)	mg/L	0.005	IS 3025 (Part 2): 2004, RA 2014 / ISO 11885:1996
28.	Sulphate (as SO_4)	mg/L	2	IS 3025 (Part 24): 1986, RA 2014
29.	Sulphide (as H_2S)	mg/L	0.025	IS 3025 (Part 29):1986, RA 2014
30.	Total Phosphate (as PO_4)	mg/L	0.1	APHA, 23rd Ed., 2017,4500 P,E, 4-155
31.	Total Alkalinity (as $CaCO_3$)	mg/L	0.5	IS 3025(Part 23):1986, RA 2014, Amds.2
32.	Total Hardness (as $CaCO_3$)	mg/L	0.5	IS 3025(Part 23):1986, RA 2014, Amds.2
33.	Calcium Hardness (as $CaCO_3$)	mg/L	-	IS 3025(Part 21): 1983
34.	Zinc (as Zn)	mg/L	0.05	IS 3025 (Part 2): 2004, RA 2014/ ISO 11885:1996
35.	Sodium (as Na)	mg/L	0.2	IS 3025 (Part 45):1993
36.	Potassium (as K)	mg/L	0.06	IS 3025(Part 45): 1993

Sr. No.	Parameter	Unit	Detection Limit	Method Reference
37.	Sodium Absorption Ratio	-	-	IS 11624:1986
38.	Cadmium (as Cd)	mg/L	0.002	IS 3025 (Part 2): 2004, RA 2014/ ISO 11885:1996
39.	Cyanide (as CN)	mg/L	0.001	IS 3025(Part 27):1986
40.	Lead (as Pb)	mg/L	0.008	IS 3025 (Part 2): 2004, RA 2014/ ISO 11885:1996
41.	Mercury (as Hg)	mg/L	0.0008	IS 3025 (Part 2): 2004, RA 2014/ ISO 11885:1996
42.	Molybdenum (as Mo)	mg/L	0.002	IS 3025 (Part 2): 2004, RA 2014 / ISO 11885:1996
43.	Nickel (as Ni)	mg/L	0.01	IS 3025 (Part 2): 2004, RA 2014 / ISO 11885:1996
44.	***Pesticide Residues***			
i.	Alachlor	µg/L	0.01	US EPA 525.2,1995
ii.	Atrazine	µg/L	0.01	US EPA 525.2,1995
iii.	Aldrin/Dieldrin	µg/L	0.01	US EPA 525.2,1995
iv.	Alpha HCH	µg/L	0.01	US EPA 525.2,1995
v.	Beta HCH	µg/L	0.01	US EPA 525.2,1995
vi.	Butachlor	µg/L	0.01	US EPA 525.2,1995
vii.	Chlorpyrifos	µg/L	0.05	US EPA 525.2,1995
viii.	Delta HCH	µg/L	0.01	US EPA 525.2,1995
ix.	2,4D chlorophenoxyacetic acid	µg/L	0.07	US EPA 515.1,1995
x.	DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	µg/L	0.01	US EPA 525.2,1995
xi.	Endosulfan (α,β& Sulphate)	µg/L	0.01	US EPA 525.2,1995
xii.	Ethion	µg/L	0.05	US EPA 525.2,1995
xiii.	γ HCH (Lindane)	µg/L	0.01	US EPA 525.2,1995
xiv.	Isoproturon	µg/L	0.07	US EPA 532.2000
xv.	Malathion	µg/L	0.05	US EPA 525.2,1995
xvi.	Methyl Parathion	µg/L	0.05	US EPA 525.2,1995
xvii.	Monocrotophos	µg/L	0.05	US EPA 525.2,1995
xviii.	Phorate	µg/L	0.07	US EPA 8141B ,Rev2,Feb2007
45.	Polychlorinated Biphenyls (PCB)	mg/L	0.00007	Annex M of IS 13428:2005,RA 2014
46.	Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	0.00007	APHA, 23rd Ed., 2017, 6440, 6-94
47.	Total Arsenic (as As)	mg/L	0.005	IS 3025 (Part 2): 2004, RA 2014/ ISO 11885:1996
48.	Total Chromium (as Cr)	mg/L	0.02	IS 3025 (Part 2): 2004, RA 2014 / ISO 11885:1996
49.	**Trihalomethanes**			
a)	Bromoform	mg/L	0.01	AEC/C/SAP/INS/5-16
b)	Dibromochloromethane	mg/L	0.01	AEC/C/SAP/INS/5-16
c)	Bromodichloroethane	mg/L	0.01	AEC/C/SAP/INS/5-16
d)	Chloroform	mg/L	0.01	AEC/C/SAP/INS/5-16
50.	*E. coli*	MPN Index /100 ml	1.8	APHA, 23rd Ed., 2017, 9221-E, G, 9-80
51.	Total Coliforms	MPN Index /100 ml	1.8	APHA, 23rd Ed., 2017, 9221-B, 9-69
52.	Faecal Coliforms	MPN Index /100ml	1.8	APHA, 23rd Ed., 2017, 9221-E, 9-77

3. **Ground Water Analysis Results for the period June 2020 to September 2020:**

Table 6.3: Location - Port Site

Parameter	Unit	Acceptable Limit as per IS 10500: 2012	June-20	July-20	Aug-20	Sept-20
Organoleptic & Physical Parameters						
Colour	Hazen Units	*Max.* 5	1	1	1	1
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
p^H Value	-	6.5 to 8.5	7.22	7.32	6.76	6.63
Turbidity	N.T.U.	*Max.* 1	<0.2	<0.2	<0.2	<0.2
Total Dissolved Solids	mg/L	*Max.* 500	392	390	1	360
General Parameters concerning substances undesirable in excessive amounts						
Aluminum (as Al)	mg/L	*Max.* 0.03	<0.025	<0.025	<0.025	<0.025
Ammonia (as NH_3- N)	mg/L	*Max.*0.5	<0.1	<0.1	<0.1	<0.1
Anionic Detergents (as MBAS) Calculated as LAS mol. wt. 288.38	mg/L	*Max.* 0.2	<0.1	<0.1	<0.1	<0.1
Barium (as Ba)	mg/L	*Max.* 0.7	<0.1	<0.1	<0.1	<0.1
Boron (as B)	mg/L	*Max.* 0.5	<0.1	<0.1	<0.1	<0.1
Calcium (as Ca)	mg/L	*Max.* 75	33.6	27.2	31.3	28.8
Chloramines (as Cl_2)	mg/L	*Max.* 4.0	<0.05	<0.05	<0.05	<0.05
Chloride (as Cl)	mg/L	*Max.*250	119	107	127	122
Copper (as Cu)	mg/L	*Max.*0.05	<0.02	<0.02	<0.02	<0.02
Fluoride (as F)	mg/L	*Max.* 1	0.8	0.4	0.5	0.5
Iron (as Fe)	mg/L	*Max.*0.3	0.078	0.248	0.106	<0.06
Magnesium (as Mg)	mg/L	*Max.* 30	14.6	15.1	17.5	15.5
Manganese (as Mn)	mg/L	*Max.*0.1	0.024	<0.02	<0.02	<0.02
Mineral Oil	mg/L	*Max.*0.5	<0.005	<0.005	<0.005	<0.005
Nitrate (as NO_3)	mg/L	*Max.*45	24.3	13.9	3.38	13.7
Phenolic Compounds (as C_6H_5OH)	mg/L	*Max.* 0.001	<0.001	<0.001	<0.001	<0.001
Selenium (as Se)	mg/L	*Max.* 0.01	<0.005	<0.005	<0.005	<0.005
Silver (as Ag)	mg/L	*Max.* 0.1	<0.005	<0.005	<0.005	<0.005
Sulphate (as SO_4)	mg/L	*Max.* 200	56	49.1	63.7	48.4
Sulphide (as H_2S)	mg/L	*Max.* 0.05	<0.025	<0.025	<0.025	<0.025
Total Alkalinity (as $CaCO_3$)	mg/L	*Max.*200	110	123	130	125
Total Hardness (as $CaCO_3$)	mg/L	*Max.* 200	144	130	150	136
Zinc (as Zn)	mg/L	*Max.* 5	0.283	0.054	<0.05	<0.05
Cadmium (as Cd)	mg/L	*Max.* 0.003	<0.002	<0.002	<0.002	<0.002
Cyanide (as CN)	mg/L	*Max.*0.05	<0.001	<0.001	<0.001	<0.001

Parameter	Unit	Acceptable Limit as per IS 10500: 2012	June-20	July-20	Aug-20	Sept-20
Lead (as Pb)	mg/L	*Max.* 0.01	<0.008	<0.008	<0.008	<0.008
Mercury (as Hg)	mg/L	*Max.* 0.001	<0.0008	<0.0008	<0.0008	<0.0008
Molybdenum (as Mo)	mg/L	*Max.* 0.07	<0.002	<0.002	<0.002	<0.002
Nickel (as Ni)	mg/L	*Max.*0.02	<0.01	<0.01	<0.01	<0.01
Alachlor	µg/L	20	<0.01	<0.01	<0.01	<0.01
Atrazine	µg/L	2	<0.01	<0.01	<0.01	<0.01
Aldrin/Dieldrin	µg/L	0.03	<0.01	<0.01	<0.01	<0.01
Alpha HCH	µg/L	0.01	<0.01	<0.01	<0.01	<0.01
Beta HCH	µg/L	0.04	<0.01	<0.01	<0.01	<0.01
Butachlor	µg/L	125	<0.01	<0.01	<0.01	<0.01
Chlorpyrifos	µg/L	30	<0.05	<0.05	<0.05	<0.05
Delta HCH	µg/L	0.04	<0.01	<0.01	<0.01	<0.01
2,4D chlorophenoxyacetic acid	µg/L	30	<0.07	<0.07	<0.07	<0.07
DDT (o, p & p,p- Isomers of DDT, DDE, DDD)	µg/L	1	<0.01	<0.01	<0.01	<0.01
Endosulfan (a, b & Sulphate)	µg/L	0.4	<0.01	<0.01	<0.01	<0.01
Ethion	µg/L	3	<0.05	<0.05	<0.05	<0.05
γ HCH (Lindane)	µg/L	2	<0.01	<0.01	<0.01	<0.01
Isoproturon	µg/L	9	<0.07	<0.07	<0.07	<0.07
Malathion	µg/L	190	<0.05	<0.05	<0.05	<0.05
Methyl Parathion	µg/L	0.3	<0.05	<0.05	<0.005	<0.005
Monocrotophos	µg/L	1	<0.05	<0.05	<0.005	<0.005
Phorate	µg/L	2	<0.07	<0.07	<0.07	<0.07
Polychlorinated Biphenyls (PCB)	mg/L	*Max.*0.0005	<0.00007	<0.00007	<0.00007	<0.00007
Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	*Max.*0.0001	<0.00007	<0.00007	<0.00007	<0.00007
Total Arsenic (as As)	mg/L	*Max.* 0.01	<0.005	<0.005	<0.005	<0.005
Total Chromium (as Cr)	mg/L	*Max.* 0.05	<0.02	<0.02	<0.02	<0.02
Trihalomethanes						
Bromoform	mg/L	*Max.* 0.1	<0.01	<0.01	<0.01	<0.01
Dibromochloro Methane	mg/L	*Max.* 0.1	<0.01	<0.01	<0.01	<0.01
Bromodichloroethane	mg/L	*Max.* 0.06	<0.01	<0.01	<0.01	<0.01
Chloroform	mg/L	*Max.* 0.2	<0.01	<0.01	<0.01	<0.01
Bacteriological Analysis						
E. coli	MPN Index /100 mL	Not Detectable	<1.8	<1.8	<1.8	<1.8
Total Coliforms	MPN Index	-	350	1600	920	1600

Parameter	Unit	Acceptable Limit as per IS 10500: 2012	June-20	July-20	Aug-20	Sept-20
	/100 mL					

Table 6.4: Location - Proposed Port Estate Area

Parameter	Unit	Acceptable Limit as per IS 10500: 2012	June-20	July-20	Aug-20	Sept-20
Organoleptic & Physical Parameters						
Colour	Hazen Units	*Max.* 5	1	1	1	1
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
p^H Value	-	6.5 to 8.5	7.02	6.81	6.19	6.78
Turbidity	N.T.U	*Max.* 1	<0.2	<0.2	1.90	0.36
Total Dissolved Solids	mg/L	*Max.* 500	186	200	134	128
General Parameters concerning substances undesirable in excessive amounts						
Aluminum (as Al)	mg/L	*Max.* 0.03	<0.025	<0.025	<0.025	<0.025
Ammonia (as NH_3- N)	mg/L	*Max.*0.5	<0.1	<0.1	<0.1	<0.1
Anionic Detergents (as MBAS) Calculated as LAS mol. wt. 288.38	mg/L	*Max.* 0.2	<0.1	<0.1	<0.1	<0.1
Barium (as Ba)	mg/L	*Max.* 0.7	<0.1	<0.1	<0.1	<0.1
Boron (as B)	mg/L	*Max.* 0.5	<0.1	<0.1	<0.1	<0.1
Calcium (as Ca)	mg/L	*Max.* 75	22.4	16.8	9.60	8.02
Chloramines (as Cl_2)	mg/L	*Max.* 4.0	<0.05	<0.05	<0.05	<0.05
Chloride (as Cl)	mg/L	*Max.*250	36	41	39.9	34.5
Copper (as Cu)	mg/L	*Max.*0.05	<0.02	<0.02	<0.02	<0.02
Fluoride (as F)	mg/L	*Max.* 1	0.5	0. 3	0.3	0.3
Iron (as Fe)	mg/L	*Max.*0.3	0.159	0.249	<0.06	0.090
Magnesium (as Mg)	mg/L	*Max.* 30	10.2	8.26	4.4	6.32
Manganese (as Mn)	mg/L	*Max.*0.1	0.029	<0.02	<0.02	<0.02
Mineral Oil	mg/L	*Max.*0.5	<0.005	<0.005	<0.005	<0.005
Nitrate (as NO_3)	mg/L	*Max.*45	16.7	6.4	4.30	10.7
Phenolic Compounds (as C_6H_5OH)	mg/L	*Max.* 0.001	<0.001	<0.001	<0.001	<0.001
Selenium (as Se)	mg/L	*Max.* 0.01	<0.005	<0.005	<0.005	<0.005
Silver (as Ag)	mg/L	*Max.* 0.1	<0.005	<0.005	<0.005	<0.005
Sulphate (as SO_4)	mg/L	*Max.* 200	51.8	24	32.6	28.6
Sulphide (as H_2S)	mg/L	*Max.* 0.05	<0.025	<0.025	<0.025	<0.025
Total Alkalinity (as $CaCO_3$)	mg/L	*Max.*200	70	52.5	25	30
Total Hardness	mg/L	*Max.* 200	98	76	42	46

Parameter	Unit	Acceptable Limit as per IS 10500: 2012	June-20	July-20	Aug-20	Sept-20
(as $CaCO_3$)						
Zinc (as Zn)	mg/L	*Max*. 5	<0.05	<0.05	<0.05	<0.05
Parameters Concerning Toxic Substances						
Cadmium (as Cd)	mg/L	*Max.* 0.003	<0.05	<0.002	<0.002	<0.002
Cyanide (as CN)	mg/L	*Max.*0.05	<0.05	<0.001	<0.001	<0.001
Lead (as Pb)	mg/L	*Max.* 0.01	<0.05	<0.008	<0.008	<0.008
Mercury (as Hg)	mg/L	*Max.* 0.001	<0.05	<0.0008	<0.0008	<0.0008
Molybdenum (as Mo)	mg/L	*Max.* 0.07	<0.05	<0.002	<0.002	<0.002
Nickel (as Ni)	mg/L	*Max.*0.02	<0.05	<0.01	<0.01	<0.01
Pesticide Residues						
Alachlor	µg/L	20	<0.01	<0.01	<0.01	<0.01
Atrazine	µg/L	2	<0.01	<0.01	<0.01	<0.01
Aldrin/Dieldrin	µg/L	0.03	<0.01	<0.01	<0.01	<0.01
Alpha HCH	µg/L	0.01	<0.01	<0.01	<0.01	<0.01
Beta HCH	µg/L	0.04	<0.01	<0.01	<0.01	<0.01
Butachlor	µg/L	125	<0.01	<0.01	<0.01	<0.01
Chlorpyrifos	µg/L	30	<0.05	<0.05	<0.05	<0.05
Delta HCH	µg/L	0.04	<0.01	<0.01	<0.01	<0.01
2,4D chlorophenoxyacetic acid	µg/L	30	<0.07	<0.07	<0.07	<0.07
DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	µg/L	1	<0.01	<0.01	<0.01	<0.01
Endosulfan (a ,b & Sulphate)	µg/L	0.4	<0.01	<0.01	<0.01	<0.01
Ethion	µg/L	3	<0.05	<0.05	<0.05	<0.05
γ HCH (Lindane)	µg/L	2	<0.01	<0.01	<0.01	<0.01
Isoproturon	µg/L	9	<0.07	<0.07	<0.07	<0.07
Malathion	µg/L	190	<0.05	<0.05	<0.05	<0.05
Methyl Parathion	µg/L	0.3	<0.05	<0.05	<0.005	<0.005
Monocrotophos	µg/L	1	<0.05	<0.05	<0.005	<0.005
Phorate	µg/L	2	<0.07	<0.07	<0.07	<0.07
Polychlorinated Biphenyls (PCB)	mg/L	*Max.*0.0005	<0.00007	<0.00007	<0.00007	<0.00007
Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	*Max.*0.0001	<0.00007	<0.00007	<0.00007	<0.00007
Total Arsenic (as As)	mg/L	*Max*. 0.01	<0.005	<0.005	<0.005	<0.005
Total Chromium (as Cr)	mg/L	*Max.* 0.05	<0.02	<0.02	<0.02	<0.02
Bromoform	mg/L	*Max*. 0.1	<0.01	<0.01	<0.01	<0.01
Dibromochloro Methane	mg/L	*Max*. 0.1	<0.01	<0.01	<0.01	<0.01
Bromodichloroethane	mg/L	*Max*. 0.06	<0.01	<0.01	<0.01	<0.01

Parameter	Unit	Acceptable Limit as per IS 10500: 2012	June-20	July-20	Aug-20	Sept-20
Chloroform	mg/L	*Max.* 0.2	<0.01	<0.01	<0.01	<0.01
Bacteriological Analysis						
E. coli	MPN Index /100 mL	Not Detectable	<1.8	<1.8	<1.8	<1.8
Total Coliforms	MPN Index /100 mL	-	220	<1.8	430	350

Table 6.5: Location - PAF Area

Parameter	Unit	Acceptable Limit as per IS 10500: 2012	June-20	July-20	Aug-20	Sept-20
Organoleptic & Physical Parameters						
Colour	Hazen Units	*Max.* 5	1	1	1	1
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
p^H Value	-	6.5 to 8.5	6.67	6.64	6.80	7.53
Turbidity	N.T.U.	*Max.* 1	<0.2	<0.2	3.60	0.21
Total Dissolved Solids	mg/L	*Max.* 500	492	376	380	450
General Parameters concerning substances undesirable in excessive amounts						
Aluminum (as Al)	mg/L	*Max.* 0.03	<0.025	<0.025	<0.025	<0.025
Ammonia (as NH_3-N)	mg/L	*Max.*0.5	<0.1	<0.1	<0.1	<0.1
Anionic Detergents (as MBAS) Calculated as LAS mol. wt. 288.38	mg/L	*Max.* 0.2	<0.1	<0.1	<0.1	<0.1
Barium (as Ba)	mg/L	*Max.* 0.7	<0.1	<0.1	<0.1	<0.1
Boron (as B)	mg/L	*Max.* 0.5	<0.1	<0.1	<0.1	<0.1
Calcium (as Ca)	mg/L	*Max.* 75	31.3	28.9	30.4	30.5
Chloramines (as Cl_2)	mg/L	*Max.* 4.0	<0.05	<0.05	<0.05	<0.05
Chloride (as Cl)	mg/L	*Max.*250	244	107	232	236
Copper (as Cu)	mg/L	*Max.*0.05	<0.02	<0.02	<0.02	<0.02
Fluoride (as F)	mg/L	*Max.* 1	0.8	0.5	0.3	0.3
Iron (as Fe)	mg/L	*Max.*0.3	0.256	0.143	<0.06	<0.06
Magnesium (as Mg)	mg/L	*Max.* 30	18.5	15.6	17	16
Manganese (as Mn)	mg/L	*Max.*0.1	0.087	0.088	<0.02	<0.02
Mineral Oil	mg/L	*Max.*0.5	<0.005	<0.005	<0.005	<0.005
Nitrate (as NO_3)	mg/L	*Max.*45	23.8	21.2	29.5	25.8

Parameter	Unit	Acceptable Limit as per IS 10500: 2012	June-20	July-20	Aug-20	Sept-20
Phenolic Compounds (as C_6H_5OH)	mg/L	*Max.* 0.001	<0.001	<0.001	<0.001	<0.001
Selenium (as Se)	mg/L	*Max.* 0.01	<0.005	0.009	<0.005	<0.005
Silver (as Ag)	mg/L	*Max.* 0.1	<0.005	<0.005	<0.005	<0.005
Sulphate (as SO_4)	mg/L	*Max.* 200	54.5	44.2	45.8	37.4
Sulphide (as H_2S)	mg/L	*Max.* 0.05	<0.025	<0.025	<0.025	<0.025
Total Alkalinity (as $CaCO_3$)	mg/L	*Max.*200	17.5	20	40	10
Total Hardness (as $CaCO_3$)	mg/L	*Max.* 200	154	136	146	142
Zinc (as Zn)	mg/L	*Max.* 5	0.322	0.198	<0.05	<0.05
Parameters Concerning Toxic Substances						
Cadmium (as Cd)	mg/L	*Max.* 0.003	<0.002	<0.002	<0.002	<0.002
Cyanide (as CN)	mg/L	*Max.*0.05	<0.001	<0.001	<0.001	<0.001
Lead (as Pb)	mg/L	*Max.* 0.01	<0.008	<0.008	<0.008	<0.008
Mercury (as Hg)	mg/L	*Max.* 0.001	<0.0008	<0.0008	<0.0008	<0.0008
Molybdenum (as Mo)	mg/L	*Max.* 0.07	<0.002	<0.002	<0.002	<0.002
Nickel (as Ni)	mg/L	*Max.*0.02	<0.01	<0.01	<0.01	<0.01
Pesticide Residues						
Alachlor	µg/L	20	<0.01	<0.01	<0.01	<0.01
Atrazine	µg/L	2	<0.01	<0.01	<0.01	<0.01
Aldrin/Dieldrin	µg/L	0.03	<0.01	<0.01	<0.01	<0.01
Alpha HCH	µg/L	0.01	<0.01	<0.01	<0.01	<0.01
Beta HCH	µg/L	0.04	<0.01	<0.01	<0.01	<0.01
Butachlor	µg/L	125	<0.01	<0.01	<0.01	<0.01
Chlorpyrifos	µg/L	30	<0.05	<0.05	<0.05	<0.05
Delta HCH	µg/L	0.04	<0.01	<0.01	<0.01	<0.01
2,4D chlorophenoxyacetic acid	µg/L	30	<0.07	<0.07	<0.07	<0.07
DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	µg/L	1	<0.01	<0.01	<0.01	<0.01
Endosulfan (a, b & Sulphate)	µg/L	0.4	<0.01	<0.01	<0.01	<0.01
Ethion	µg/L	3	<0.05	<0.05	<0.05	<0.05
γ HCH (Lindane)	µg/L	2	<0.01	<0.01	<0.01	<0.01
Isoproturon	µg/L	9	<0.07	<0.07	<0.07	<0.07
Malathion	µg/L	190	<0.05	<0.05	<0.05	<0.05
Methyl Parathion	µg/L	0.3	<0.05	<0.05	<0.005	<0.005
Monocrotophos	µg/L	1	<0.05	<0.05	<0.005	<0.005
Phorate	µg/L	2	<0.07	<0.07	<0.07	<0.07
Polychlorinated Biphenyls (PCB)	mg/L	*Max.*0.0005	<0.00007	<0.00007	<0.00007	<0.00007
Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	*Max.* 0.0001	<0.00007	<0.00007	<0.00007	<0.00007

Parameter	Unit	Acceptable Limit as per IS 10500: 2012	June-20	July-20	Aug-20	Sept-20
Total Arsenic (as As)	mg/L	*Max*. 0.01	<0.005	<0.005	<0.005	<0.005
Total Chromium (as Cr)	mg/L	*Max.* 0.05	<0.02	<0.02	<0.02	<0.02
Trihalomethanes						
Bromoform	mg/L	*Max*. 0.1	<0.01	<0.01	<0.01	<0.01
Dibromochloro Methane	mg/L	*Max*. 0.1	<0.01	<0.01	<0.01	<0.01
Bromodichloroethane	mg/L	*Max*. 0.06	<0.01	<0.01	<0.01	<0.01
Chloroform	mg/L	*Max*. 0.2	<0.01	<0.01	<0.01	<0.01
Bacteriological Analysis						
E. coli	MPN Index/ 100mL	Not Detectable	<1.8	<1.8	<1.8	<1.8
Total Coliforms	MPN Index/ 100mL	-	<1.8	540	<1.8	150

4. Graphical representation of Results for the period June 2020 to September 2020

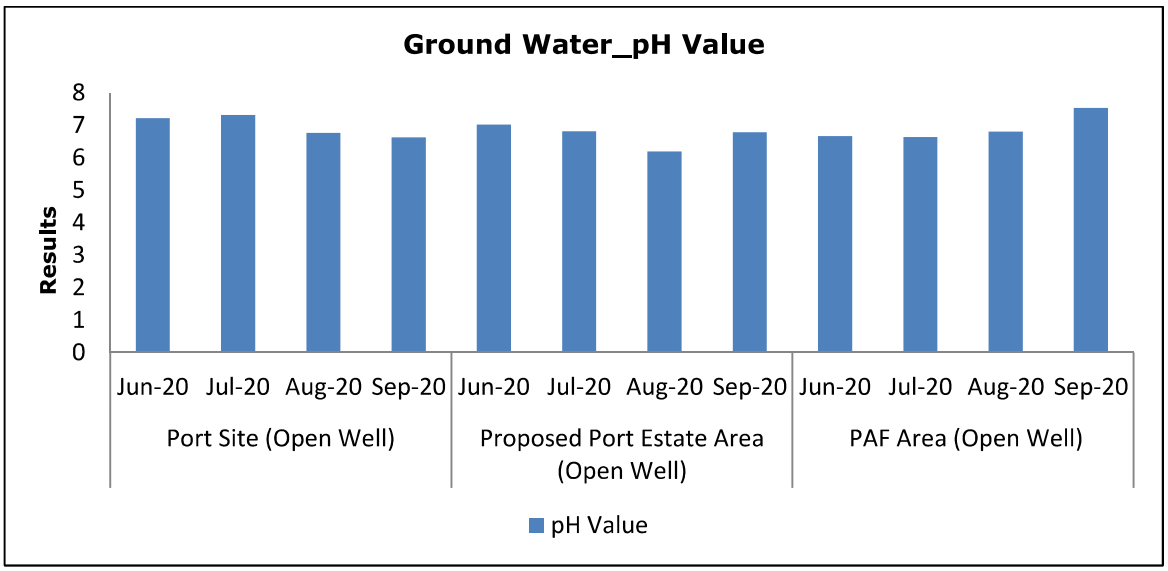


Figure 6.2: Ground Water Analysis for pH

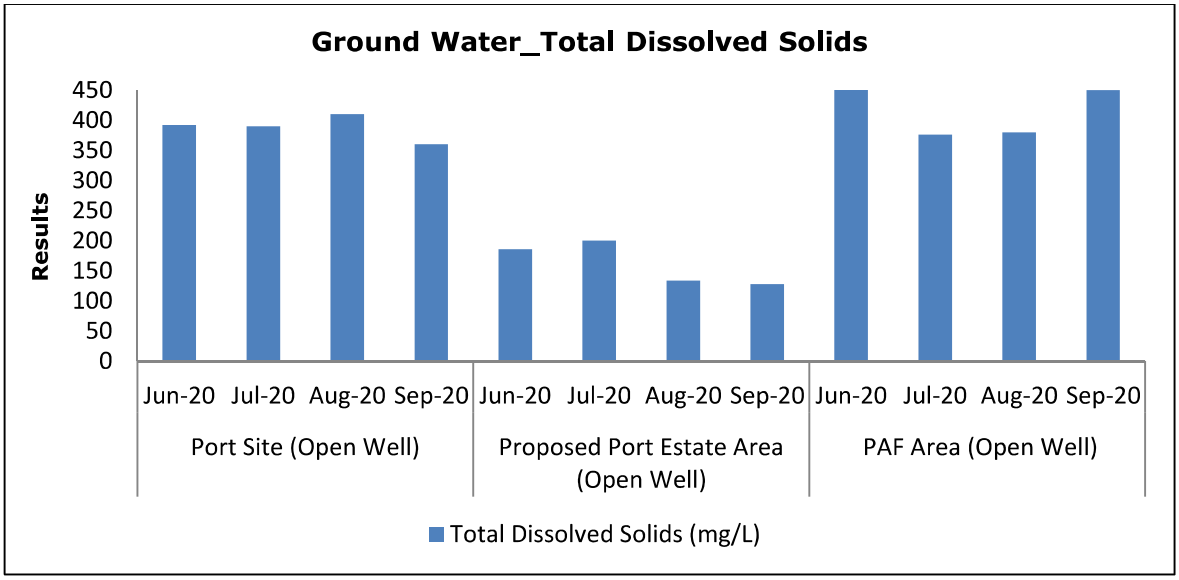


Figure 6.3: Ground Water Analysis for Total Dissolved Solids

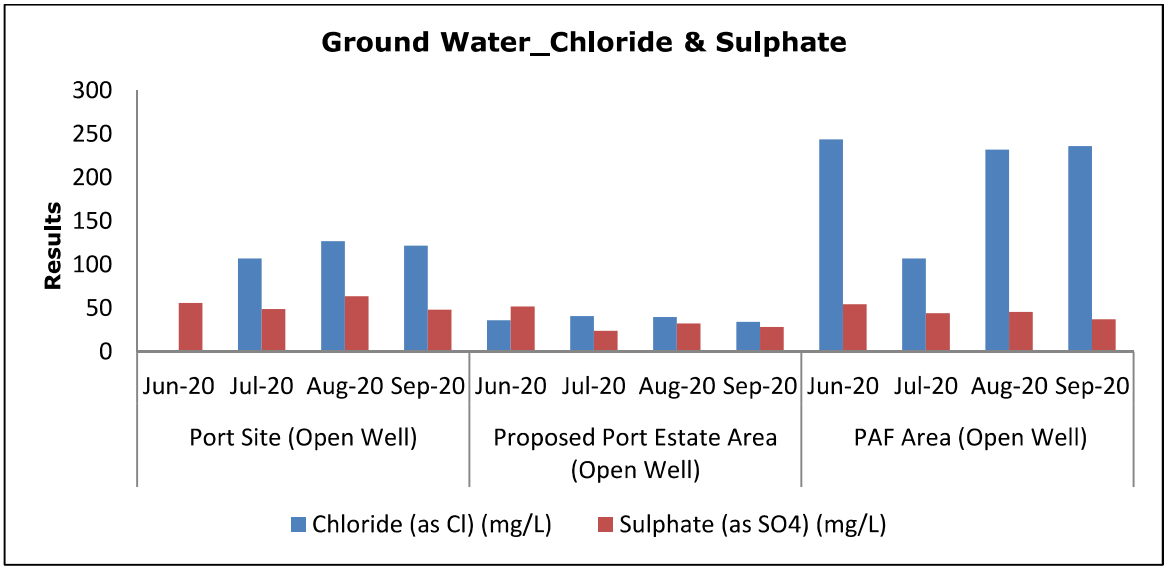


Figure 6.4: Ground Water Analysis for Chloride and Sulphate

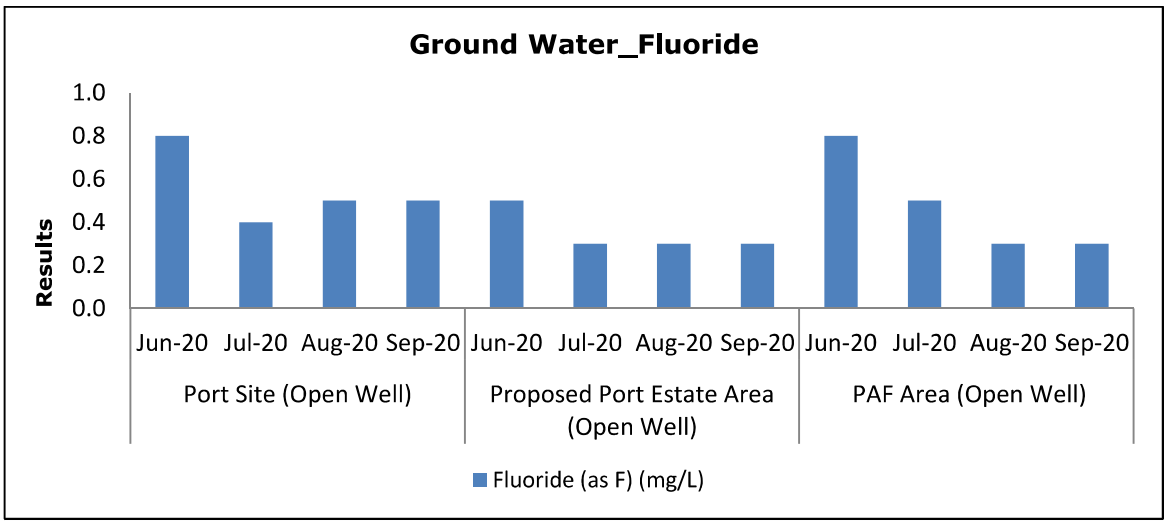


Figure 6.5: Ground Water Analysis for Fluoride

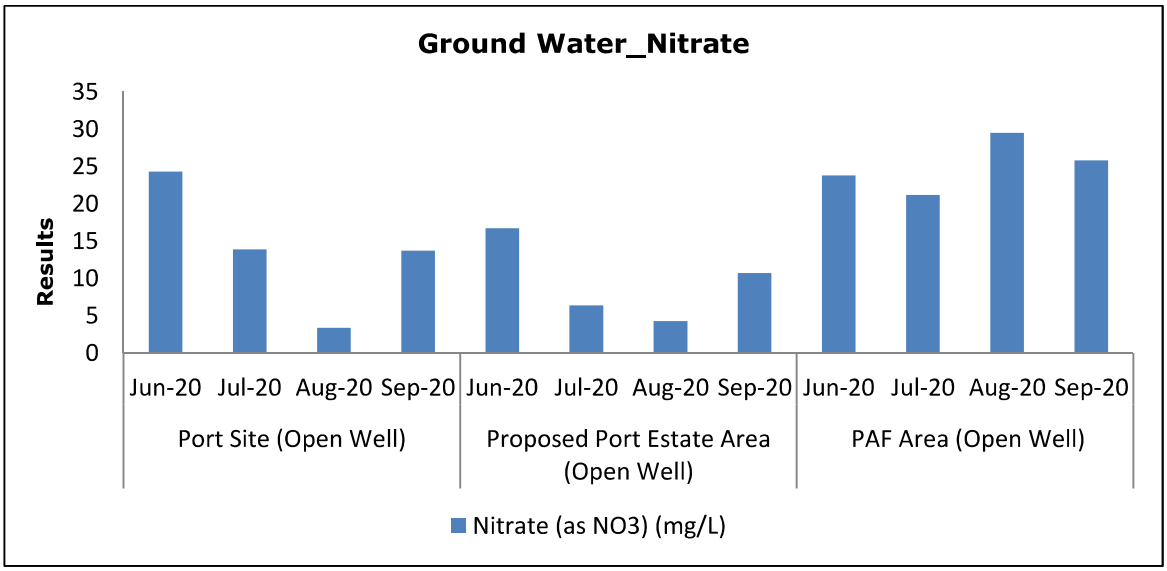


Figure 6.6: Ground Water Analysis for Nitrate

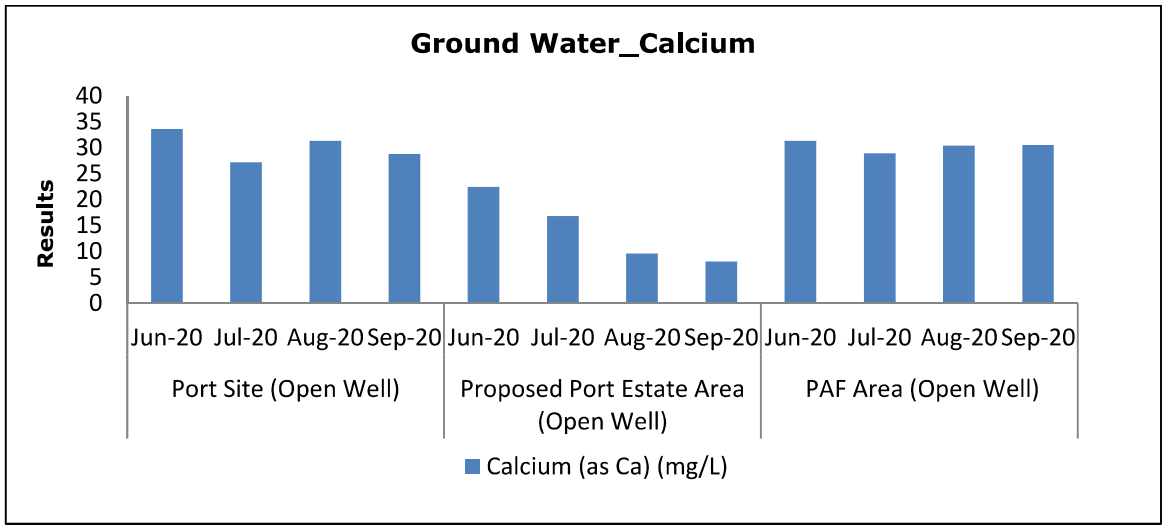


Figure 6.7: Ground Water Analysis for Calcium

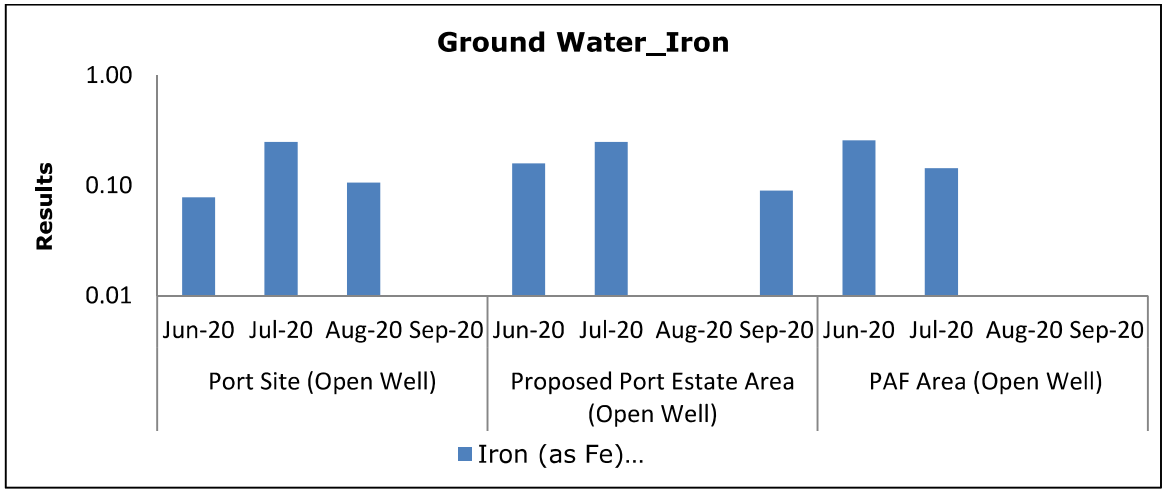


Figure 6.8: Ground Water Analysis for Iron

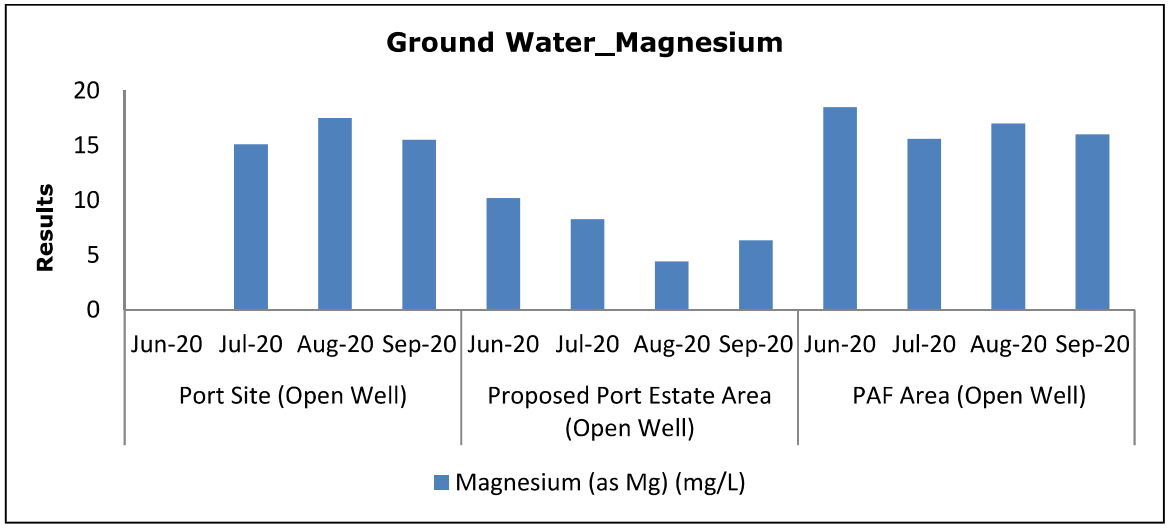


Figure 6.9: Ground Water Analysis for Magnesium

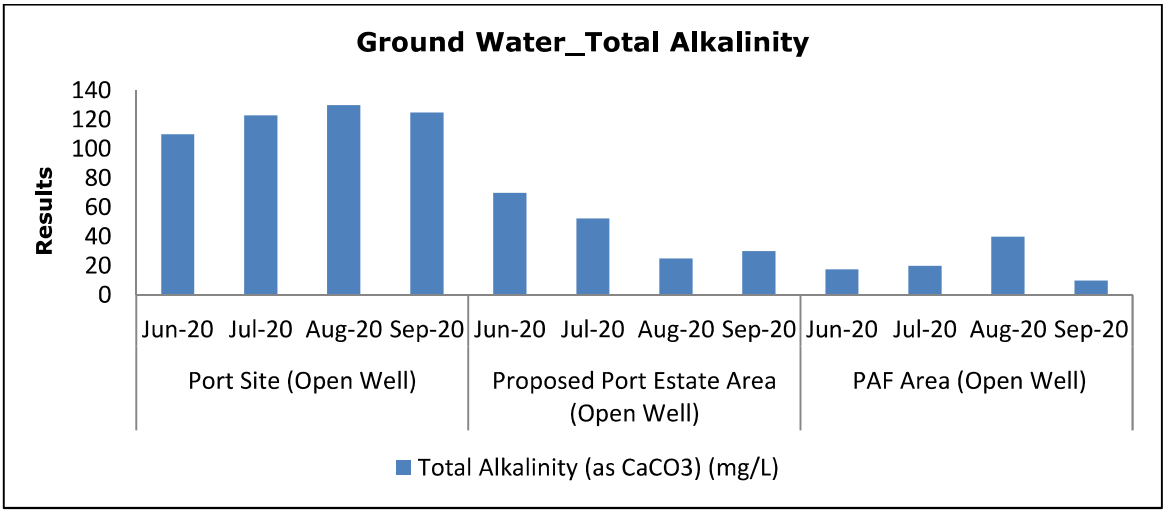


Figure 6.10: Ground Water Analysis for Total Alkalinity

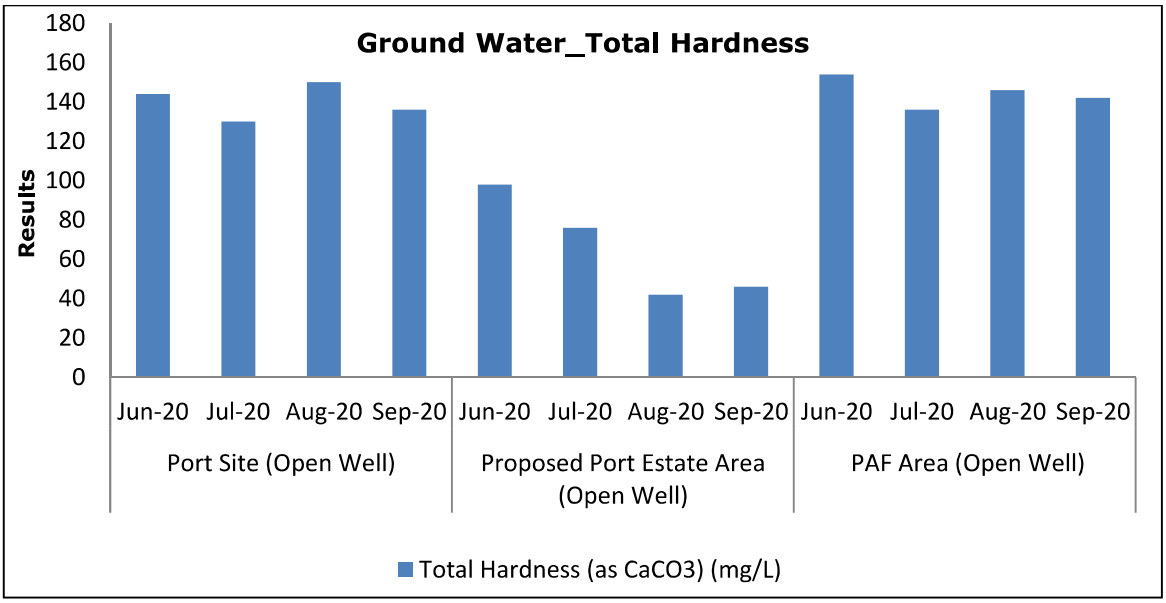


Figure 6.11: Ground Water Analysis for Total Hardness

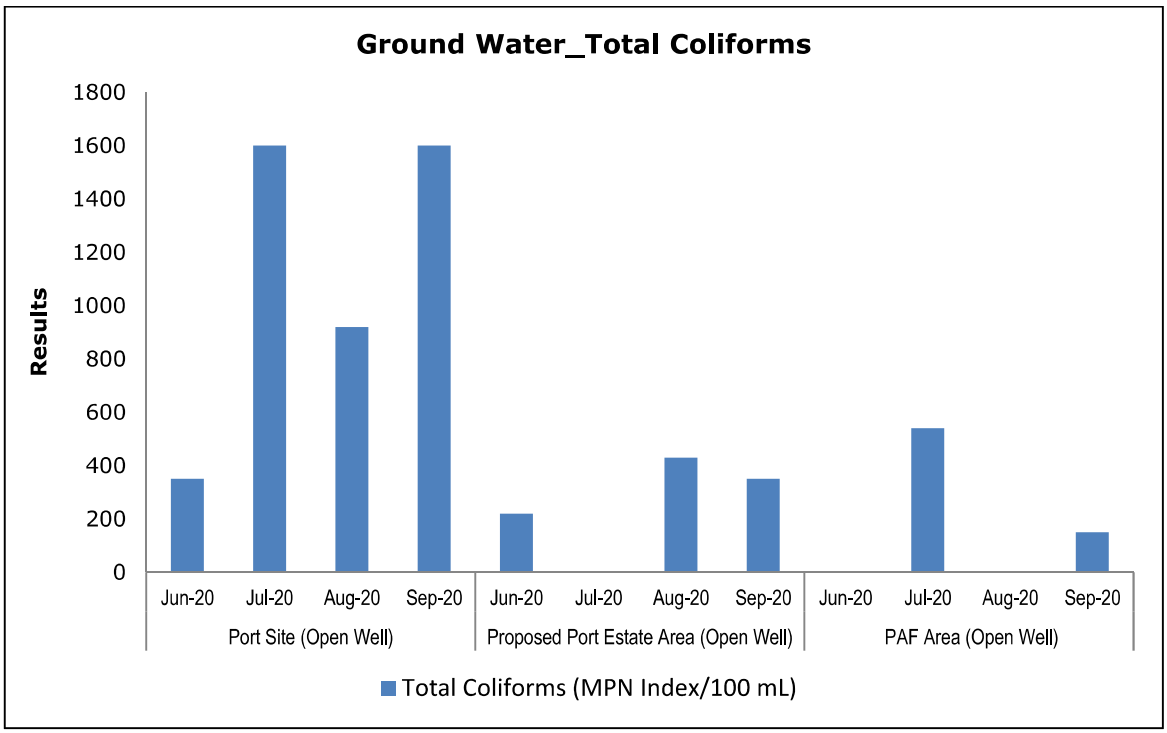


Figure 6.12: Ground Water Analysis for Total Coliforms

5. Summary- Ground Water Analysis

During the period June 2020 to September 2020, following is the summary of groundwater analysis:

At the location **Port Site** (Open Well), the Colour observed was 1 Hazen unit and the odour was agreeable. pH was observed in the range between 6.63-7.32. Turbidity was observed <0.2 NTU. Total Dissolved Solids was observed in the range between 360-410 mg/L. Calcium (as Ca) was observed in the range between 27.2-33.6 mg/L. Chloride (as Cl) was observed in the range between 107-127 mg/L. Fluoride (as F) was observed in the range between 0.4-0.8 mg/L. Iron (as Fe) was observed in the range between 0.078-0.248. Magnesium (as Mg) was observed in the range between 14.6-17.5 mg/L. Nitrate (as NO_3)was observed in the range between 3.38-24.3 mg/L. Sulphate (as SO_4) was observed in the range between 48.4-63.7 mg/L. Total Alkalinity (as $CaCO_3$)was observed in the range between 8110-130 mg/L. Total Hardness (as $CaCO_3$)was observed in the range between 130-150 mg/L. Manganese (as Mn),

Aluminium(as Al), Ammonia (as NH_3-N), Anionic Detergents, Barium (as Ba), Boron, 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), Zinc (as Zn), 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 Detection Limit. Bacteriological parameters such as *E.coli* was observed in the range between <1.8 MPN Index/100 mL and Total Coliforms were observed in the range between 350-1600 MPN Index/100 mL.

At the location **Proposed Port Estate Area** (Open Well), the Colour observed was 1 Hazen unit and the odour was agreeable. pH was observed in the range between 6.19-7.02. Turbidity was observed in the range between 0.36-1.9 NTU. Total Dissolved Solids was observed in the range between 128-200 mg/L. Calcium (as Ca) was observed in the range between 8.02-22.4 mg/L. Chloride (as Cl)was observed in the range between 34.5-41 mg/L. Fluoride (as F)was observed in the range between 0.3-0.5 mg/L. Iron (as Fe) was observed in the range between 0.09-0.249 mg/L. Magnesium (as Mg) was observed in the range between 4.4-10.2 mg/L. Manganese (as Mn)was observed <0.02. Nitrate (as NO_3) was observed in the range between 4.3-16.7 mg/L. Sulphate (as SO_4)was observed in the range between 24-51.8 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 25-75 mg/L. Total Hardness (as $CaCO_3$)was observed in the range between 42-98 mg/L. Aluminium (as Al), Ammonia (as NH_3- N), Anionic Detergents, Barium (as Ba), Boron, Chloramines (as Cl_2), Copper (as Cu), Iron (as Fe), Mineral Oil, Phenolic Compounds(as C_6H_5OH), Selenium (as Se) and Silver (as Ag), Sulphide (as H_2S), Zinc (as Zn), 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 Detection Limit. Bacteriological parameters such as *E.coli* was observed <1.8 MPN Index/100 mL and Total Coliforms were observed in the range between <1.8-430 MPN Index/100 mL.

At the location **Proposed PAF Area** (Open Well), the Colour observed was 1 Hazen unit and the odour was agreeable. pH was observed in the range between 6.64-7.53. Turbidity was observed in the range between <0.2 – 3.6 NTU. Total Dissolved Solids was observed in the range between 376-492 mg/L. Calcium (as Ca) was observed in the range between 28.9-31.3 mg/L. Chloride (as Cl) was observed in the range

between 107-244 mg/L. Fluoride (as F) was observed in the range between 0.3-0.8 mg/L. Iron (as Fe)was observed <0.06-0256. Magnesium (as Mg) was observed in the range between 15.6-18.5 mg/L. Manganese (as Mn) was observed <0.02-0.088. Nitrate (as NO_3) was observed in the range between 21.2-29.5 mg/L. Sulphate (as SO_4) was observed in the range between 37.4-54.5 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 10-40/L. Total Hardness (as $CaCO_3$)was observed in the range between 136-154 mg/L. Aluminium, Ammonia (as NH_3-N), Anionic Detergents and 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) and 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), Polynuclear Aromatic Hydrocarbons (PAH) and Zinc (as Zn)were observed Below Detection Limit. Bacteriological parameters such as *E.coli* was observed <1.8 MPN Index/100 mL and Total Coliforms were observed in the range <1.8-540 MPN Index/100 mL.

6. Surface Water Analysis Results for the period June 2020 to September 2020:

Table 6.6: Location - Poovar West Canal

Parameter	Unit	June-20	July-20	Aug-20	Sept-20
Physical Parameters					
Colour	Hazen Units	1	1	1	1
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable
p^H Value	-	7.09	7.09	6.89	6.71
Turbidity	N.T.U.	<0.2	0.21	0.3	<0.2
Electrical Conductivity (at 25°C)	µmho/cm	178.6	536	610	148
Total Dissolved Solids	mg/L	104	300	348	82
Chemical Parameters					
Dissolved Oxygen	mg/L	6.5	6	6.3	6.3
Biochemical Oxygen Demand (3 days, 27°C)	mg/L	<1	<1	<1	<1
Oil & Grease	mg/L	<1	<1	<1	<1
Free Ammonia	mg/L	<1	<1		<0.1
Anionic Detergents (as MBAS) Calculated as LAS mol. wt. 288.38	mg/L	<0.1	<0.1	<0.1	<0.1
Barium (as Ba)	mg/L	<0.1	<0.1	<0.1	<0.1
Boron (as B)	mg/L	<0.1	<0.1	<0.1	<0.1
Calcium (as Ca)	mg/L	12	16	20	5.61
Chloride (as Cl)	mg/L	37.5	162	174	28.5
Copper (as Cu)	mg/L	<0.02	<0.02	<0.02	<0.02
Fluoride (as F)	mg/L	0.1	0.2	0.1	0.1
Iron (as Fe)	mg/L	0.277	0.160	<0.06	<0.06
Magnesium (as Mg)	mg/L	5.35	7.77	7.78	4.4
Manganese (as Mn)	mg/L	<0.02	<0.02	<0.02	<0.02
Mineral Oil	mg/L	<0.005	<0.005	<0.005	<0.005
Nitrate (as NO_3)	mg/L	3.39	2.97	2.90	2.49
Phenolic Compounds (as C_6H_5OH)	mg/L	<0.001	<0.001	<0.001	<0.001
Selenium (as Se)	mg/L	<0.005	<0.005	<0.005	<0.005
Silver (as Ag)	mg/L	<0.005	<0.005	<0.005	<0.005
Sulphate (as SO_4)	mg/L	10.5	26.6	98.2	<2
Total Phosphate (as PO_4)	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity (as $CaCO_3$)	mg/L	20	41	47.5	12.5
Total Hardness (as $CaCO_3$)	mg/L	52	72	82	32
Calcium Hardness (as $CaCO_3$)	mg/L	30	40	50	14
Zinc (as Zn)	mg/L	<0.05	<0.05	<0.05	<0.05
Sodium (as Na)	mg/L	21.7	12.5	13.5	16.7
Potassium (as K)	mg/L	0.41	1.4	1.5	1.9
Sodium Absorption Ratio	-	1.31	0.64	0.65	1.28

Parameter	Unit	June-20	July-20	Aug-20	Sept-20
Cadmium (as Cd)	mg/L	<0.002	<0.002	<0.002	<0.002
Cyanide (as CN)	mg/L	<0.001	<0.001	<0.001	<0.001
Lead (as Pb)	mg/L	<0.008	<0.008	<0.008	<0.008
Mercury (as Hg)	mg/L	<0.0008	<0.0008	<0.0008	<0.0008
Pesticide Residues					
Alachlor	µg/L	<0.01	<0.01	<0.01	<0.01
Atrazine	µg/L	<0.01	<0.01	<0.01	<0.01
Aldrin/Dieldrin	µg/L	<0.01	<0.01	<0.01	<0.01
Alpha HCH	µg/L	<0.01	<0.01	<0.01	<0.01
Beta HCH	µg/L	<0.01	<0.01	<0.01	<0.01
Butachlor	µg/L	<0.01	<0.01	<0.01	<0.01
Chlorpyrifos	µg/L	<0.05	<0.05	<0.05	<0.05
Delta HCH	µg/L	<0.01	<0.01	<0.01	<0.01
2,4D chlorophenoxyacetic acid	µg/L	<0.07	<0.07	<0.07	<0.07
DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	µg/L	<0.01	<0.01	<0.01	<0.01
Endosulfan (a, b & Sulphate)	µg/L	<0.01	<0.01	<0.01	<0.01
Ethion	µg/L	<0.05	<0.05	<0.05	<0.05
γ HCH (Lindane)	µg/L	<0.01	<0.01	<0.01	<0.01
Isoproturon	µg/L	<0.07	<0.07	<0.07	<0.07
Malathion	µg/L	<0.05	<0.05	<0.05	<0.05
Methyl Parathion	µg/L	<0.05	<0.05	<0.05	<0.05
Monocrotophos	µg/L	<0.05	<0.05	<0.05	<0.05
Phorate	µg/L	<0.07	<0.07	<0.07	<0.07
Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	<0.00007	<0.00007	<0.00007	<0.00007
Total Arsenic (as As)	mg/L	<0.005	<0.005	<0.005	<0.005
Total Chromium (as Cr)	mg/L	<0.02	<0.02	<0.02	<0.02
Biological Analysis					
Total Coliforms	MPN Index/ 100 mL	130	540	110	140
Faecal Coliforms	MPN Index/ 100 mL	13	<1.8	<1.8	<1.8

Table 6.7: Location - Vizhinjam Branch Canal

Parameter	Unit	June-20	July-20	Aug-20	Sept-20
Physical Parameters					
Colour	Hazen Units	1	1	1	1
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable
p^H Value	-	7.32	7.50	7.68	7.12
Turbidity	N.T.U.	<0.2	0.23	0.26	0.22
Electrical Conductivity (at 25°C)	µmho/ cm	218	218	216	248
Total Dissolved Solids	mg/L	122	122	120	138
Chemical Parameters					
Dissolved Oxygen	mg/L	6.7	5.8	5.8	5.9
Biochemical Oxygen Demand (3 days, 27°C)	mg/L	<1	<1	<1	<1
Oil & Grease	mg/L	<1	<1	<1	<1
Free Ammonia	mg/L	<1	<1		<0.1
Anionic Detergents (as MBAS) Calculated as LAS mol.wt. 288.38	mg/L	<0.1	<0.1	<0.1	<0.1
Barium (as Ba)	mg/L	<0.1	<0.1	<0.1	<0.1
Boron (as B)	mg/L	<0.1	<0.1	<0.1	<0.1
Calcium (as Ca)	mg/L	22.4	8.82	10.4	13.6
Chloride (as Cl)	mg/L	36.9	41.5	45	38.5
Copper (as Cu)	mg/L	<0.02	<0.02	<0.02	<0.02
Fluoride (as F)	mg/L	0.6	0.3	0.2	0.3
Iron (as Fe)	mg/L	0.153	0.271	<0.06	0.498
Magnesium (as Mg)	mg/L	1.45	4.37	4.37	6.32
Manganese (as Mn)	mg/L	<0.02	<0.02	<0.02	<0.02
Mineral Oil	mg/L	<0.005	<0.005	<0.005	<0.005
Nitrate (as NO_3)	mg/L	8.59	6.55	4.75	3.1
Phenolic Compounds (as C_6H_5OH)	mg/L	<0.001	<0.001	<0.001	<0.001
Selenium (as Se)	mg/L	<0.005	<0.005	<0.005	<0.005
Silver (as Ag)	mg/L	<0.005	<0.005	<0.005	<0.005
Sulphate (as SO_4)	mg/L	11.3	8.44	6.41	3.72
Total Phosphate (as PO_4)	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity (as $CaCO_3$)	mg/L	32.5	35	35	40
Total Hardness (as $CaCO_3$)	mg/L	62	40	44	60
Calcium Hardness (as $CaCO_3$)	mg/L	56	22	26	34
Zinc (as Zn)	mg/L	<0.05	<0.05	<0.05	<0.05
Sodium (as Na)	mg/L	21.7	22.8	24.1	24
Potassium (as K)	mg/L	0.41	0.74	0.9	2.9
Sodium Absorption Ratio	-	1.20	1.59	1.6	1.35
Cadmium (as Cd)	mg/L	<0.002	<0.002	<0.002	<0.002
Cyanide (as CN)	mg/L	<0.001	<0.001	<0.001	<0.001
Lead (as Pb)	mg/L	<0.008	<0.008	<0.008	<0.008

Parameter	Unit	June-20	July-20	Aug-20	Sept-20
Mercury (as Hg)	mg/L	<0.0008	<0.0008	<0.0008	<0.0008
Pesticide Residues					
Alachlor	µg/L	<0.01	<0.01	<0.01	<0.01
Atrazine	µg/L	<0.01	<0.01	<0.01	<0.01
Aldrin/Dieldrin	µg/L	<0.01	<0.01	<0.01	<0.01
Alpha HCH	µg/L	<0.01	<0.01	<0.01	<0.01
Beta HCH	µg/L	<0.01	<0.01	<0.01	<0.01
Butachlor	µg/L	<0.01	<0.01	<0.01	<0.01
Chlorpyrifos	µg/L	<0.05	<0.05	<0.05	<0.05
Delta HCH	µg/L	<0.01	<0.01	<0.01	<0.01
2,4D chlorophenoxyacetic acid	µg/L	<0.07	<0.07	<0.07	<0.07
DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	µg/L	<0.01	<0.01	<0.01	<0.01
Endosulfan (a, b & Sulphate)	µg/L	<0.01	<0.01	<0.01	<0.01
Ethion	µg/L	<0.05	<0.05	<0.05	<0.05
γ HCH (Lindane)	µg/L	<0.01	<0.01	<0.01	<0.01
Isoproturon	µg/L	<0.07	<0.07	<0.07	<0.07
Malathion	µg/L	<0.05	<0.05	<0.05	<0.05
Methyl Parathion	µg/L	<0.05	<0.05	<0.05	<0.05
Monocrotophos	µg/L	<0.05	<0.05	<0.05	<0.05
Phorate	µg/L	<0.07	<0.07	<0.07	<0.07
Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	<0.00007	<0.00007	<0.00007	<0.00007
Total Arsenic (as As)	mg/L	<0.005	<0.005	<0.005	<0.005
Total Chromium (as Cr)	mg/L	<0.02	<0.02	<0.02	<0.02
Biological Analysis					
Total Coliforms	MPN Index/ 100 mL	130	1600	920	270
Faecal Coliforms	MPN Index/ 100 mL	27	<1.8	110	<1.8

Table 6.8: Location - Vellayani Lake

Parameter	Unit	June-20	July-20	Aug-20	Sept-20
Physical Parameters					
Colour	Hazen Units	1	1	1	1
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable
p^H Value	-	6.92	6.86	6.53	6.68
Turbidity	N.T.U.	<0.2	0.2	2.1	0.24
Electrical Conductivity (at 25°C)	µmho/ cm	154.6	182	180	135
Total Dissolved Solids	mg/L	90	108	112	76
Chemical Parameters					
Dissolved Oxygen	mg/L	5.5	6.4	5.9	6.2
Biochemical Oxygen Demand (3 days, 27°C)	mg/L	2	<1	<1	<1
Oil & Grease	mg/L	<1	<1	<1	<1
Free Ammonia	mg/L	<0.1	<0.1	<0.1	<0.1
Anionic Detergents (as MBAS) Calculated as LAS mol. wt. 288.38	mg/L	<0.1	<0.1	<0.1	<0.1
Barium (as Ba)	mg/L	<0.1	<0.1	<0.1	<0.1
Boron (as B)	mg/L	<0.1	<0.1	<0.1	<0.1
Calcium (as Ca)	mg/L	12	9.61	8.01	8.82
Chloride (as Cl)	mg/L	26.9	37.4	32.5	29
Copper (as Cu)	mg/L	<0.02	<0.02	<0.02	<0.02
Fluoride (as F)	mg/L	0.2	0.1	0.1	0.1
Iron (as Fe)	mg/L	0.280	0.142	<0.06	0.0489
Magnesium (as Mg)	mg/L	3.88	3.88	4.37	3.40
Manganese (as Mn)	mg/L	<0.02	<0.02	<0.02	<0.02
Mineral Oil	mg/L	<0.005	<0.005	<0.005	<0.005
Nitrate (as NO_3)	mg/L	3.19	2.27	2.5	1.88
Phenolic Compounds (as C_6H_5OH)	mg/L	<0.001	<0.001	<0.001	<0.001
Selenium (as Se)	mg/L	<0.005	0.007	<0.005	<0.005
Silver (as Ag)	mg/L	<0.005	<0.005	<0.005	<0.005
Sulphate (as SO_4)	mg/L	8.22	6.41	6.53	<2
Total Phosphate (as PO_4)	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity (as $CaCO_3$)	mg/L	30	35	30	37.5
Total Hardness (as $CaCO_3$)	mg/L	46	40	38	36
Calcium Hardness (as $CaCO_3$)	mg/L	30	24	20	22
Zinc (as Zn)	mg/L	<0.05	<0.05	<0.05	<0.05
Sodium (as Na)	mg/L	15.7	25.6	26	16
Potassium (as K)	mg/L	0.46	0.80	8.2	3.10
Sodium Absorption Ratio	-	1.01	1.79	1.85	1.16
Cadmium (as Cd)	mg/L	<0.002	<0.002	<0.002	<0.002
Cyanide (as CN)	mg/L	<0.001	<0.001	<0.001	<0.001
Lead (as Pb)	mg/L	<0.008	<0.008	<0.008	<0.008

Parameter	Unit	June-20	July-20	Aug-20	Sept-20
Mercury (as Hg)	mg/L	<0.0008	<0.0008	<0.0008	<0.0008
Pesticide Residues					
Alachlor	µg/L	<0.01	<0.01	<0.01	<0.01
Atrazine	µg/L	<0.01	<0.01	<0.01	<0.01
Aldrin/Dieldrin	µg/L	<0.01	<0.01	<0.01	<0.01
Alpha HCH	µg/L	<0.01	<0.01	<0.01	<0.01
Beta HCH	µg/L	<0.01	<0.01	<0.01	<0.01
Butachlor	µg/L	<0.01	<0.01	<0.01	<0.01
Chlorpyrifos	µg/L	<0.05	<0.05	<0.05	<0.05
Delta HCH	µg/L	<0.01	<0.01	<0.01	<0.01
2,4D chlorophenoxyacetic acid	µg/L	<0.07	<0.07	<0.07	<0.07
DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	µg/L	<0.01	<0.01	<0.01	<0.01
Endosulfan (a, b & Sulphate)	µg/L	<0.01	<0.01	<0.01	<0.01
Ethion	µg/L	<0.05	<0.05	<0.05	<0.05
γ HCH (Lindane)	µg/L	<0.01	<0.01	<0.01	<0.01
Isoproturon	µg/L	<0.07	<0.07	<0.07	<0.07
Malathion	µg/L	<0.05	<0.05	<0.05	<0.05
Methyl Parathion	µg/L	<0.05	<0.05	<0.05	<0.05
Monocrotophos	µg/L	<0.05	<0.05	<0.05	<0.05
Phorate	µg/L	<0.07	<0.07	<0.07	<0.07
Polynuclear Aromatic Hydrocarbons (PAH)	mg/L	<0.00007	<0.00007	<0.00007	<0.00007
Total Arsenic (as As)	mg/L	<0.005	<0.005	<0.005	<0.005
Total Chromium (as Cr)	mg/L	<0.02	<0.02	<0.02	<0.02
Biological Analysis					
Total Coliforms	MPN Index/ 100 mL	920	130	110	350
Faecal Coliforms	MPN Index/ 100 mL	23	<1.8	7.8	<1.8

7. Graphical representation of Results for the period June 2020 to September 2020:

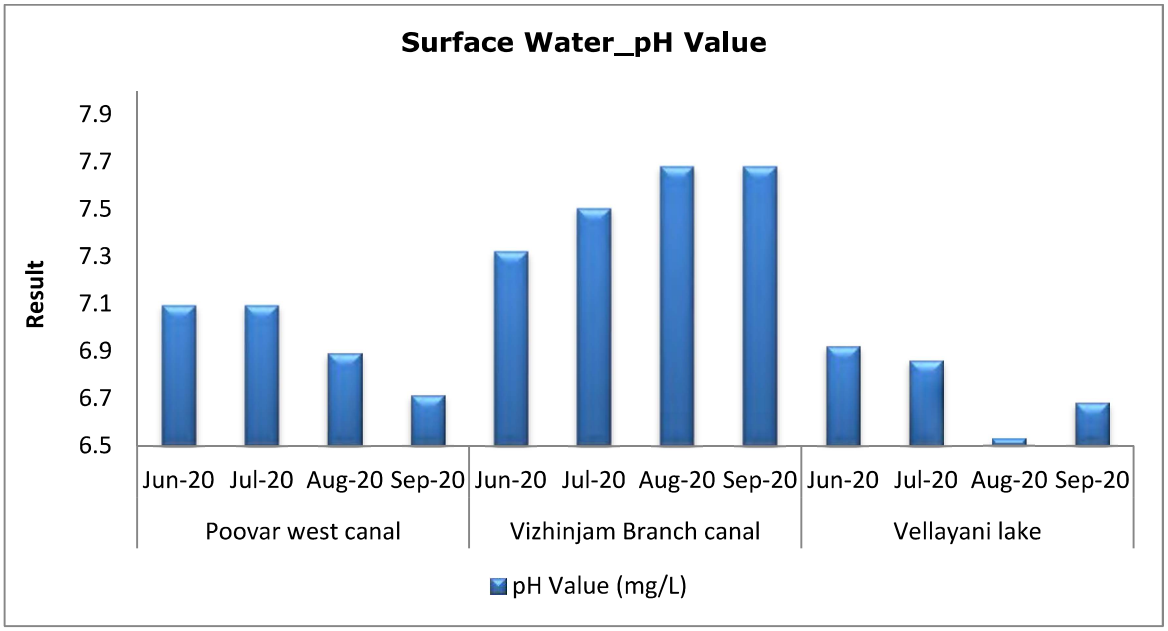


Figure 6.13: Surface Water Analysis for pH value

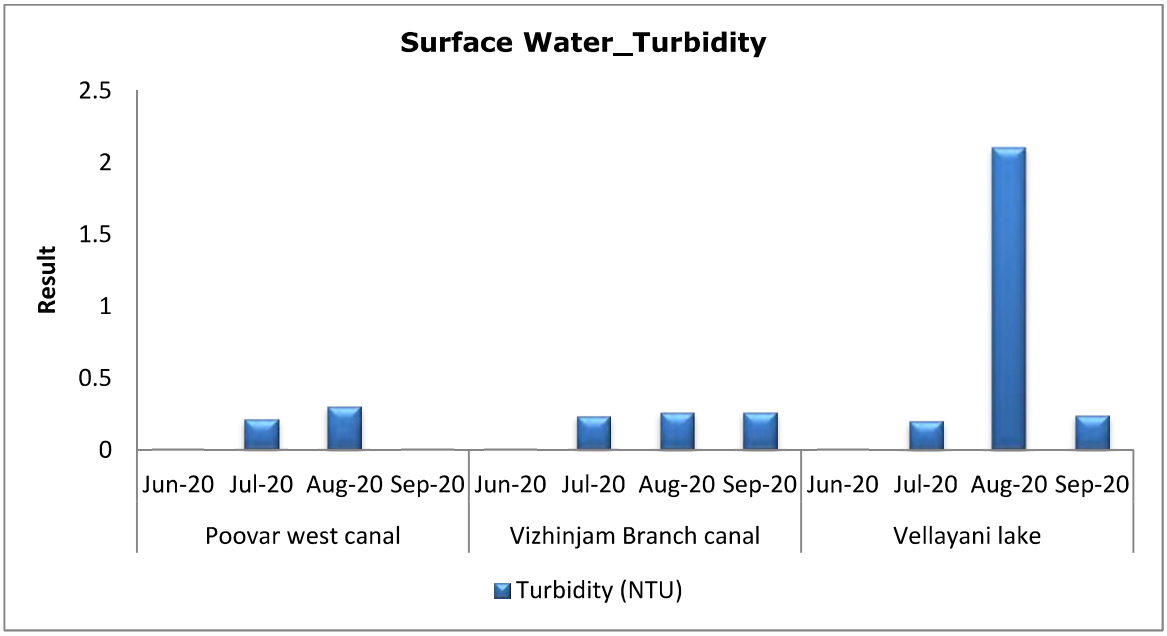


Figure 6.14: Surface Water Analysis for Turbidity

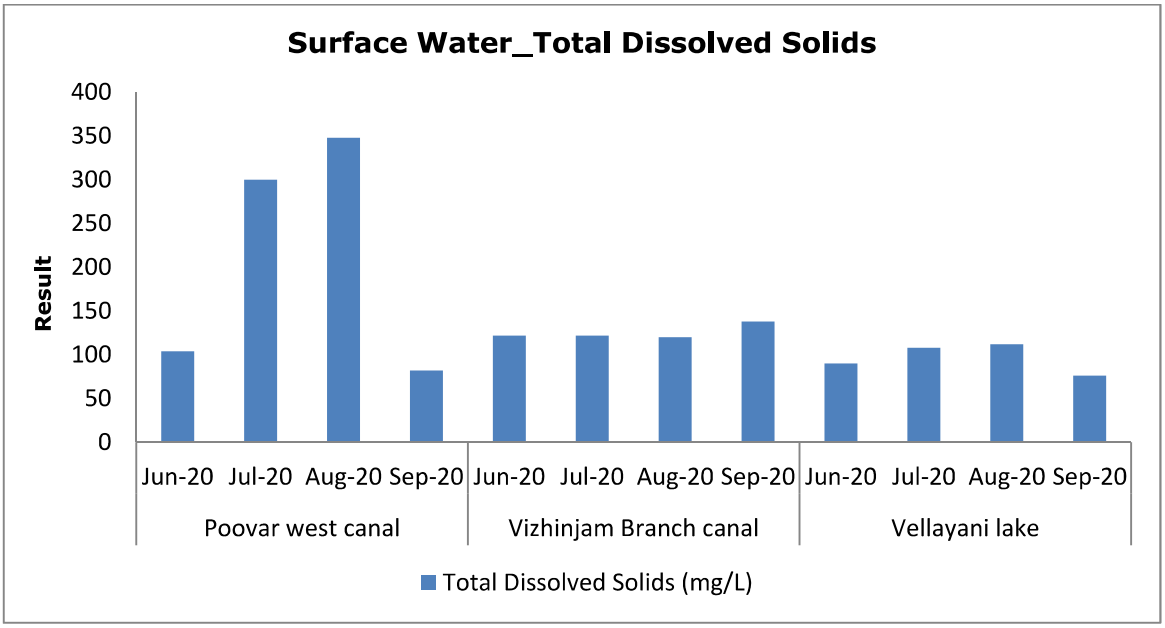


Figure 6.15: Surface Water Analysis for Total Dissolved Solids

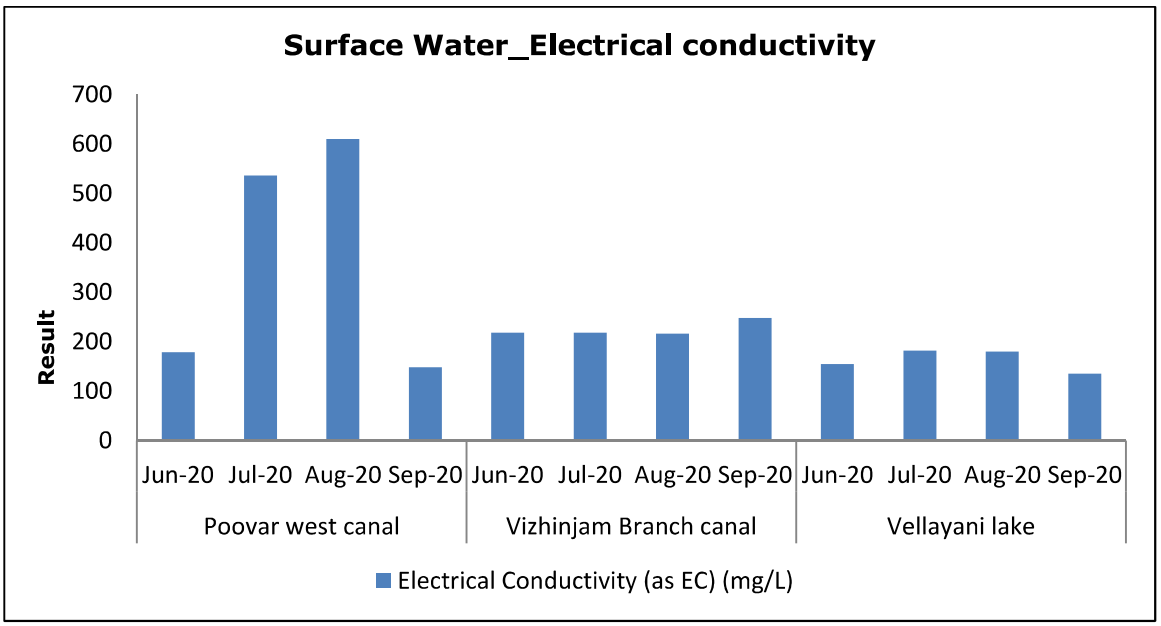


Figure 6.16: Surface Water Analysis for Electrical Conductivity

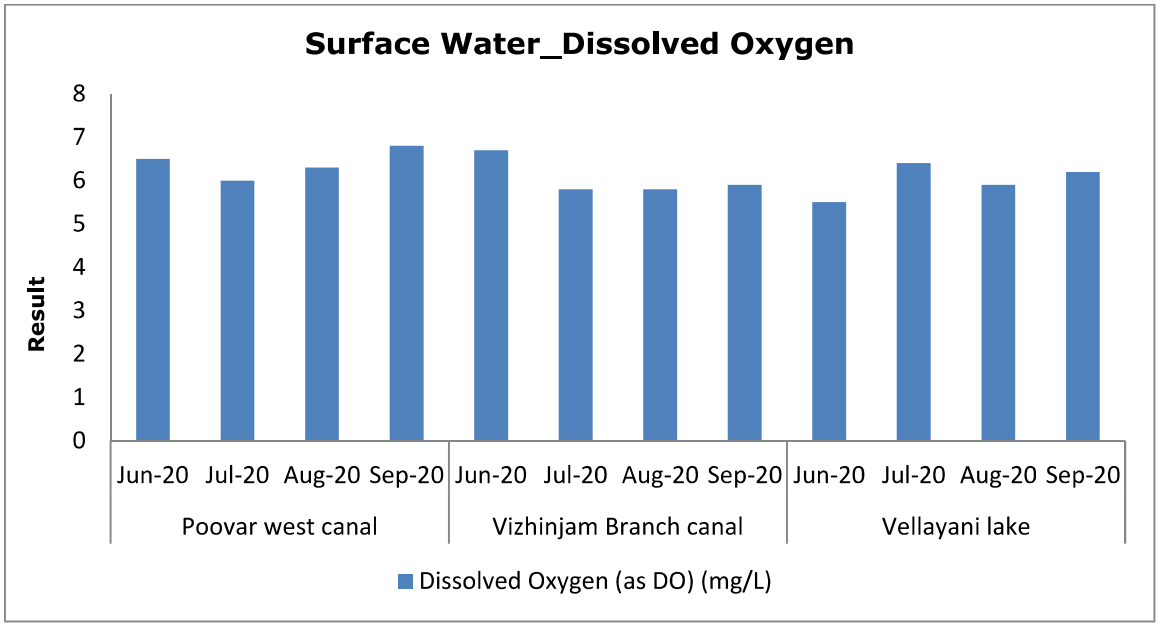


Figure 6.17: Surface Water Analysis for Dissolved oxygen

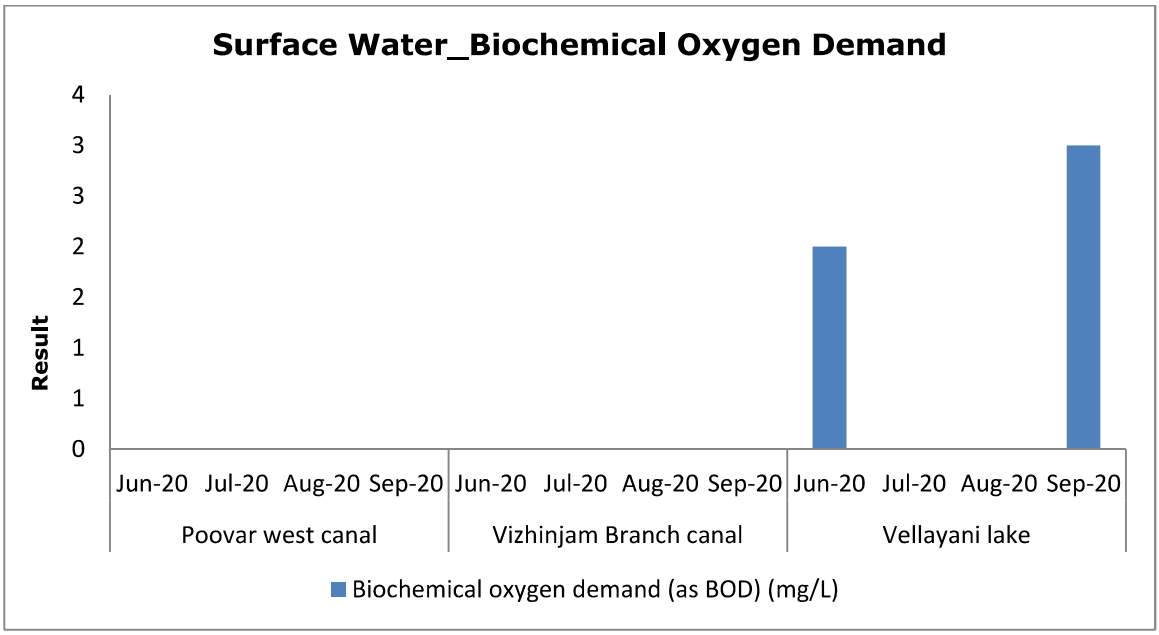


Figure 6.18: Surface Water Analysis for Biochemical Oxygen Demand

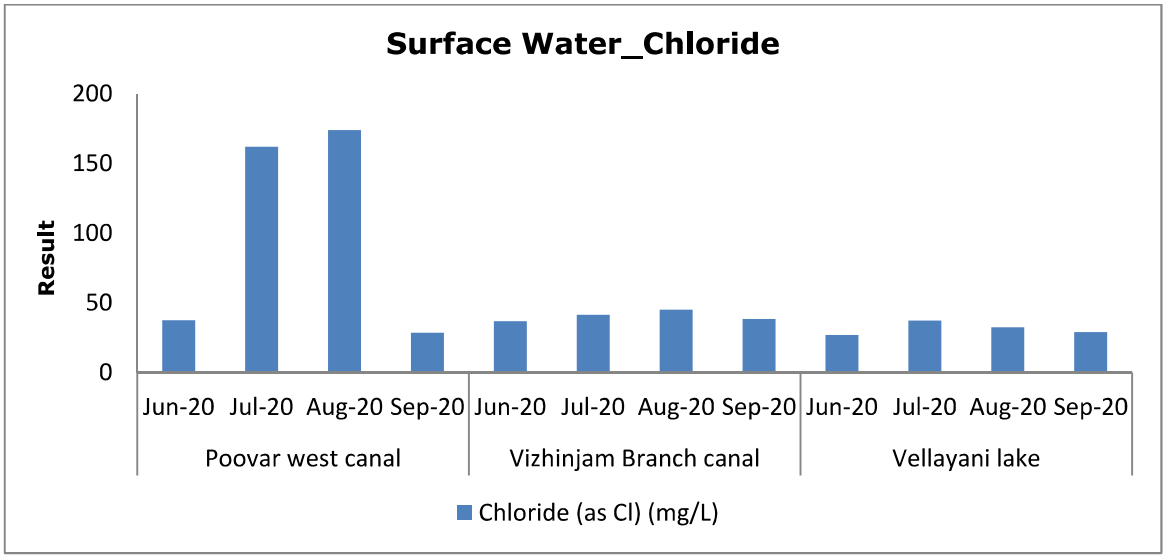


Figure 6.19: Surface Water Analysis for Chloride

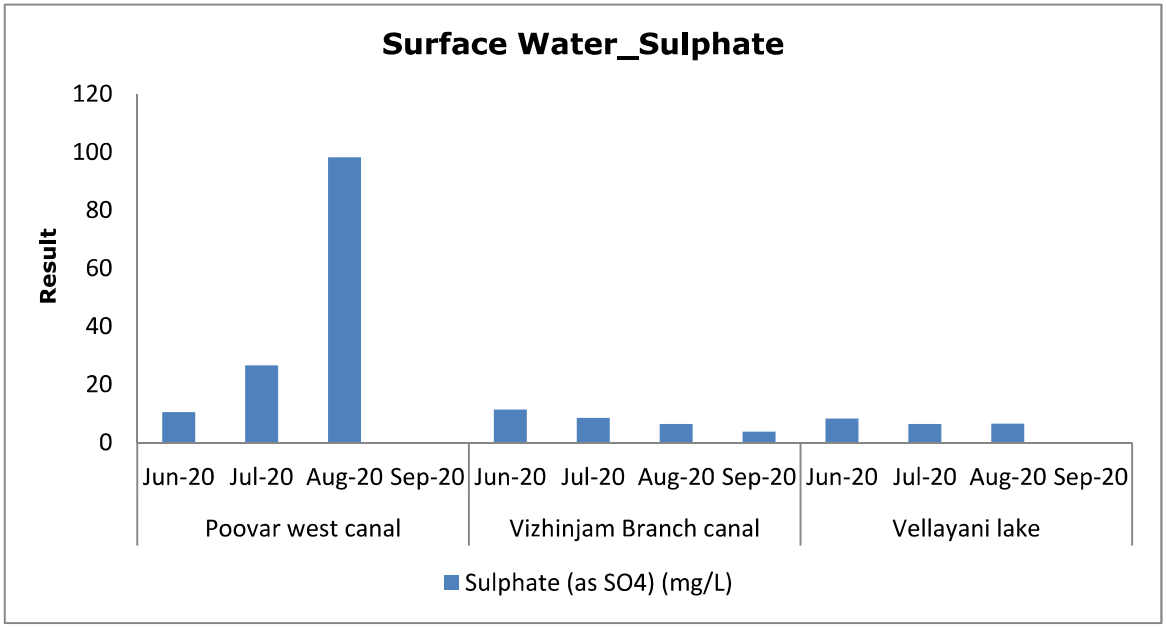


Figure 6.20: Surface Water Analysis for Sulphate

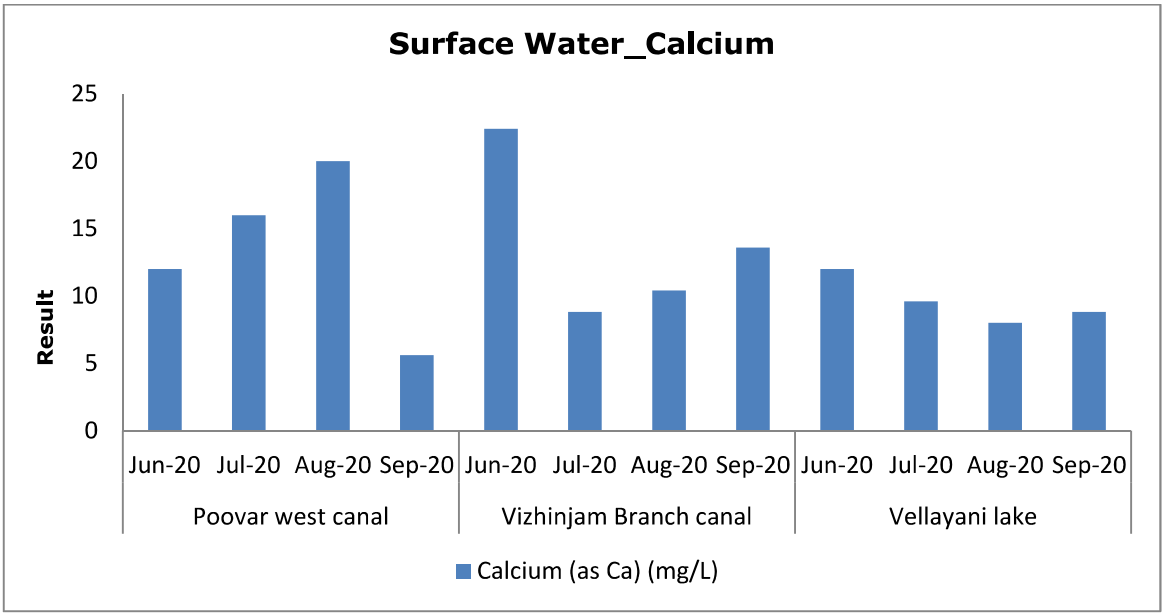


Figure 6.21: Surface Water Analysis for Calcium

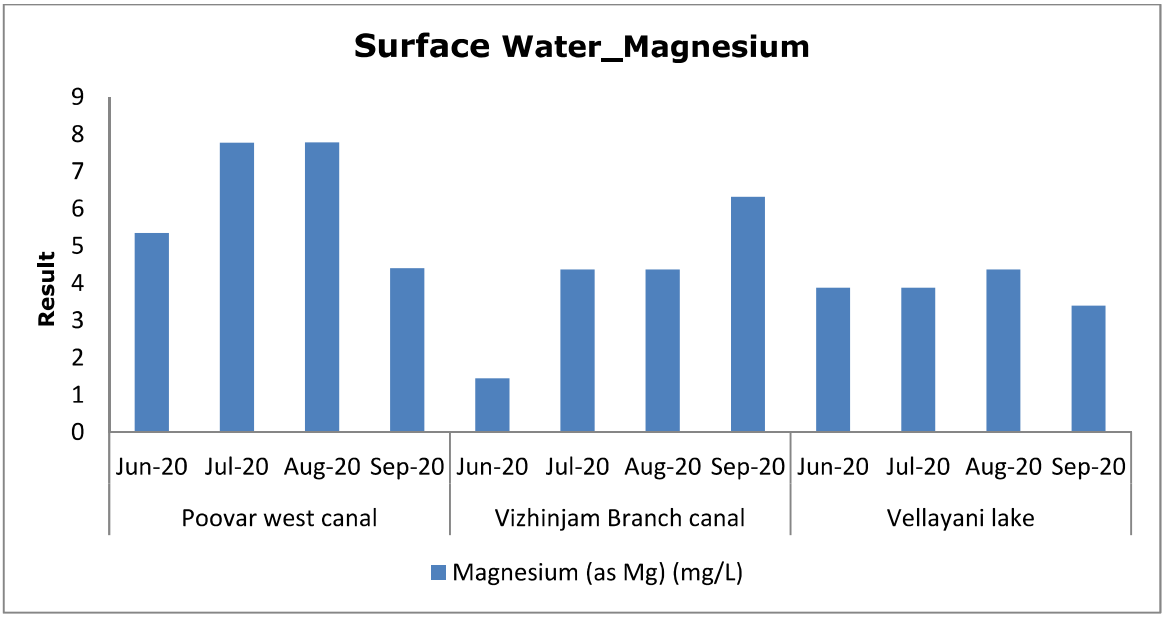


Figure 6.22: Surface Water Analysis for Magnesium

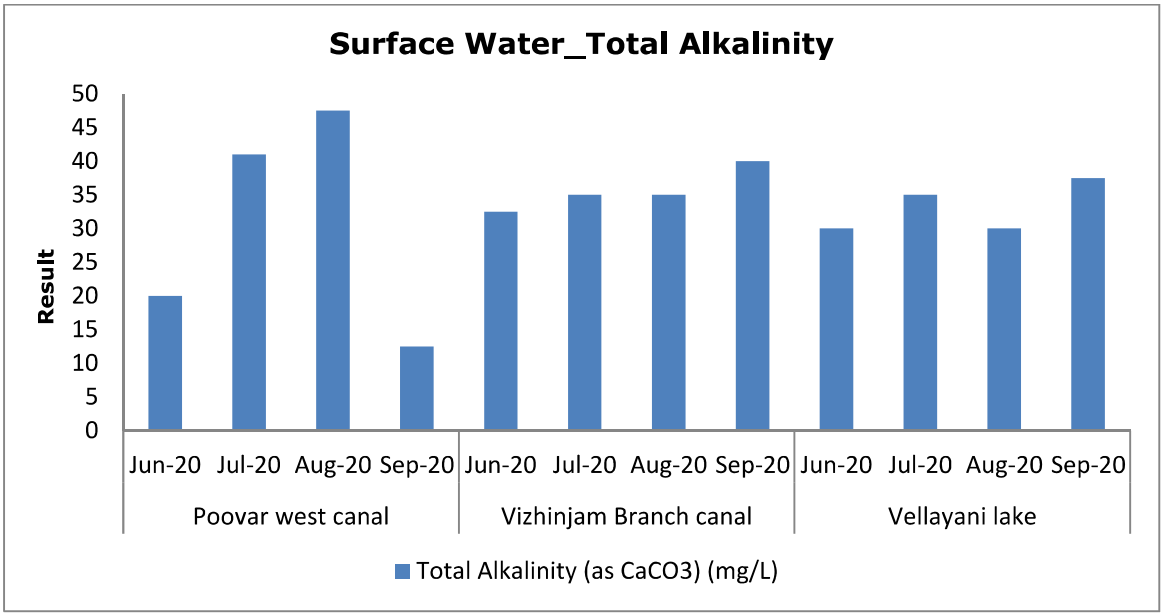


Figure 6.23: Surface Water Analysis for Total Alkalinity

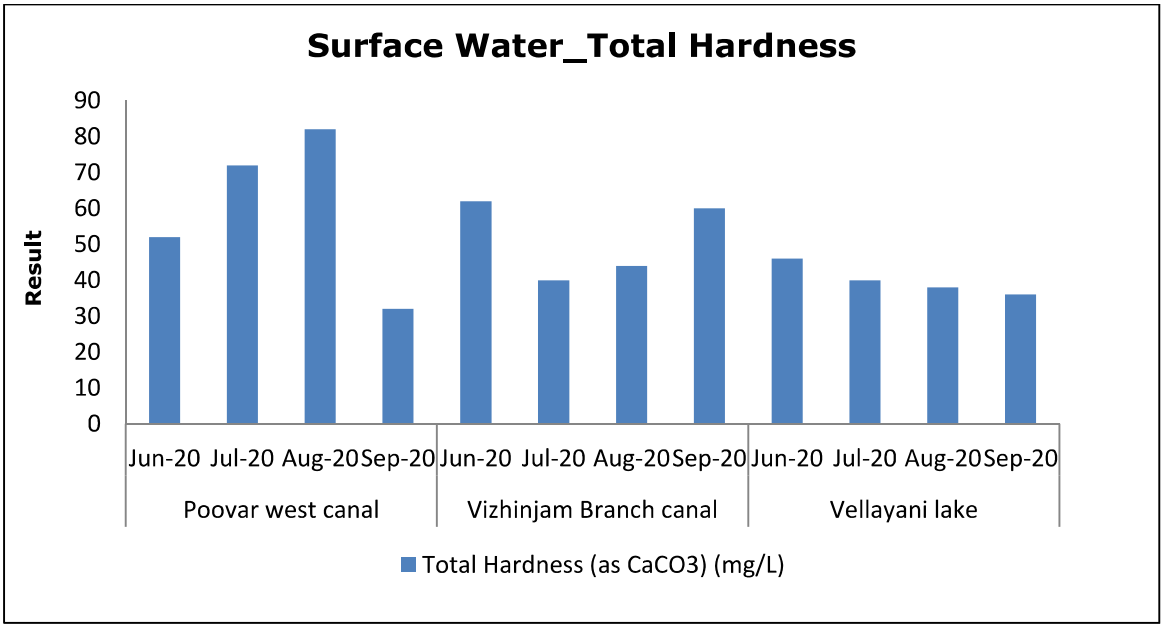


Figure 6.24: Surface Water Analysis for Total Hardness

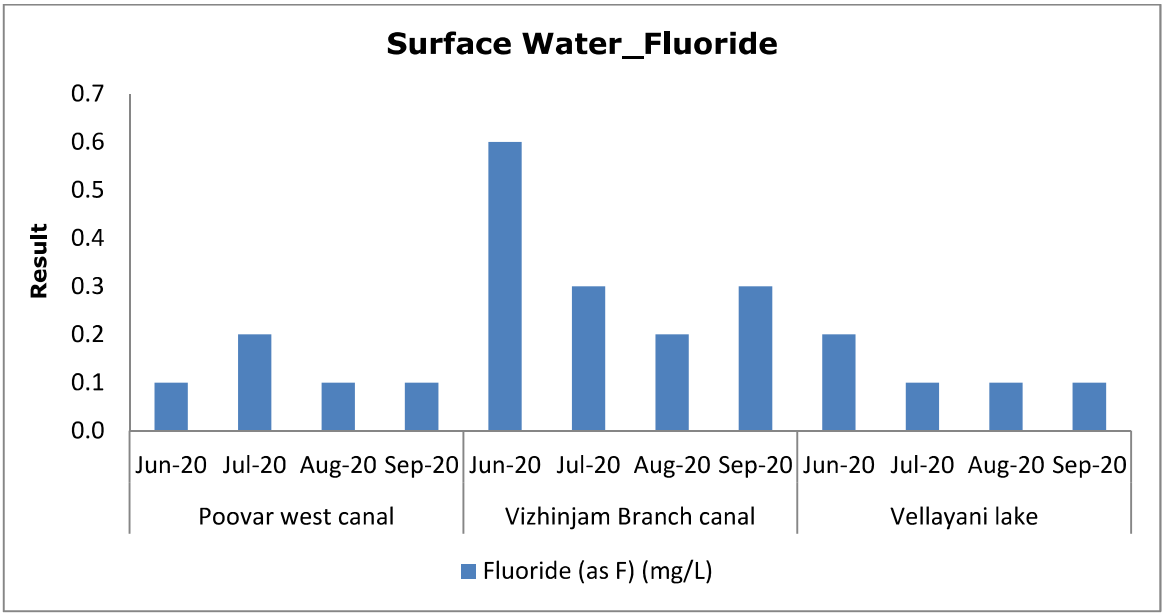


Figure 6.25: Surface Water Analysis for Fluoride

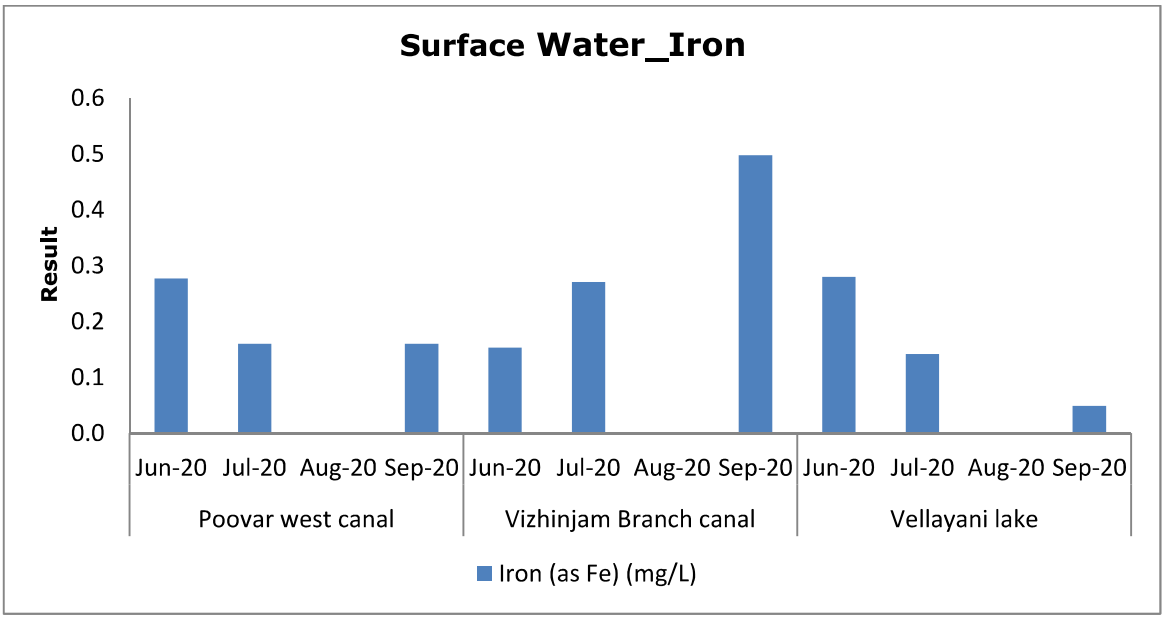


Figure 6.26: Surface Water Analysis for Iron

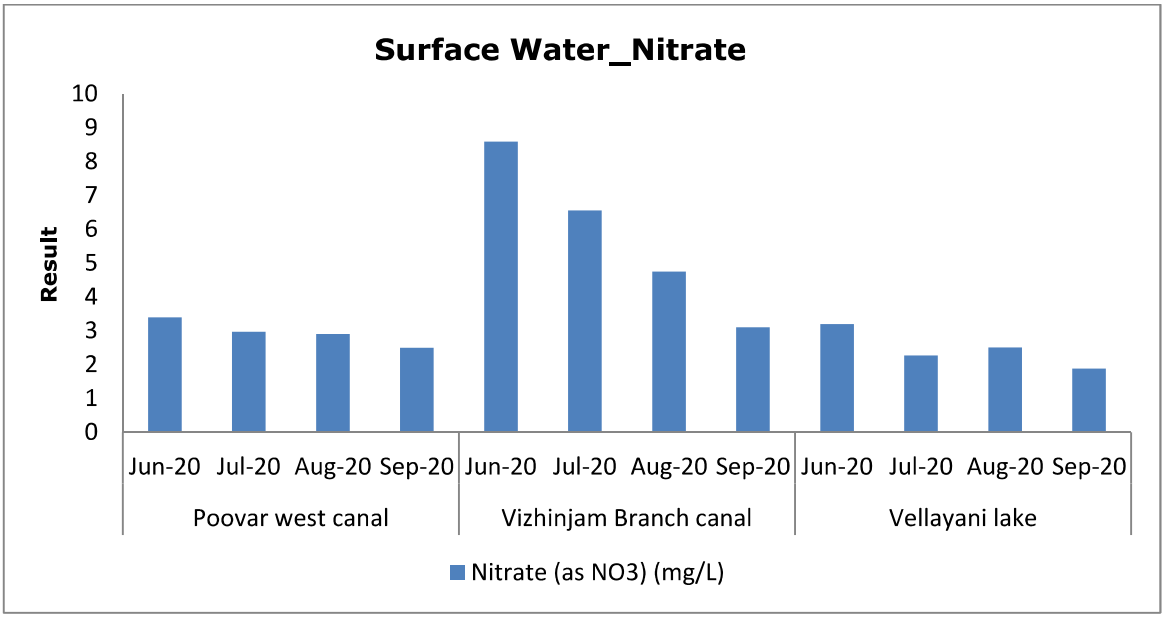


Figure 6.27: Surface Water Analysis for Nitrate

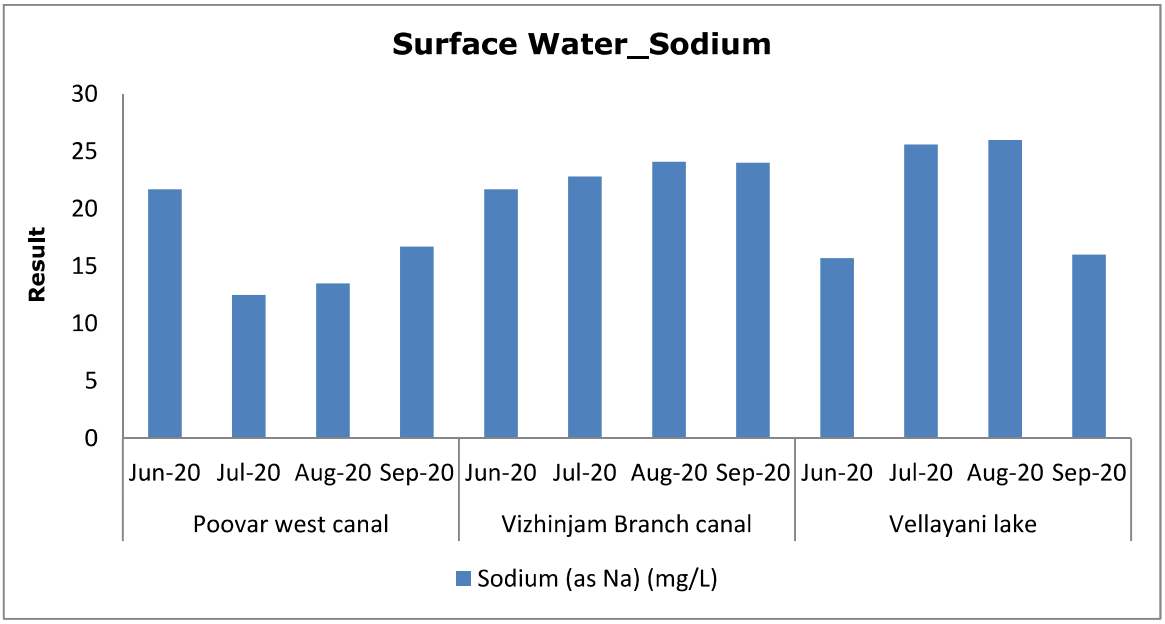


Figure 6.28: Surface Water Analysis for Sodium

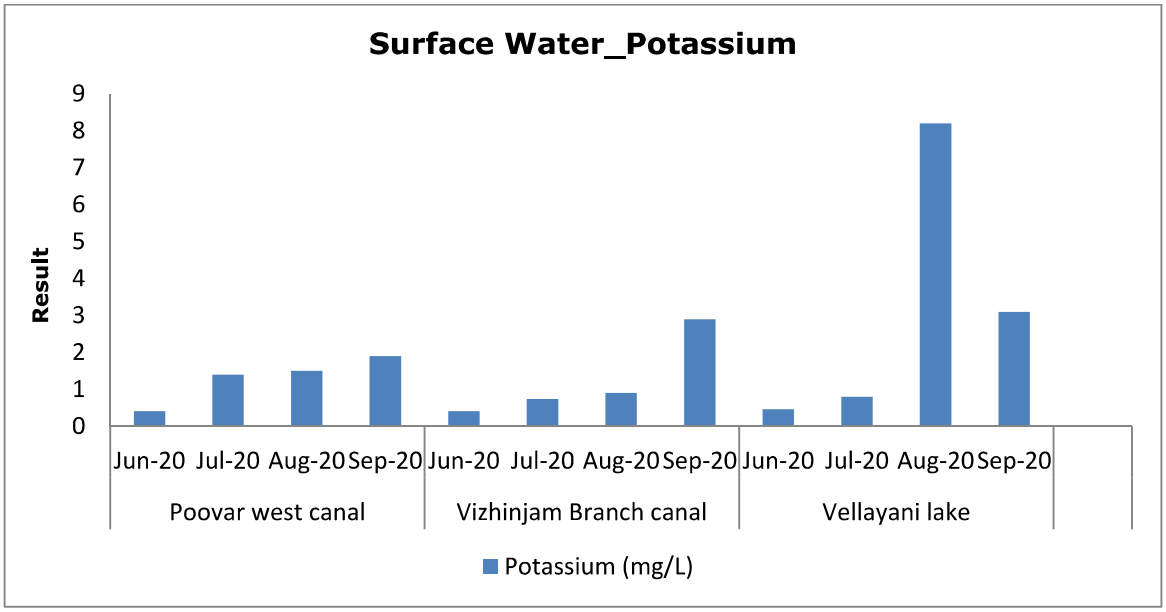


Figure 6.29: Surface Water Analysis for Potassium

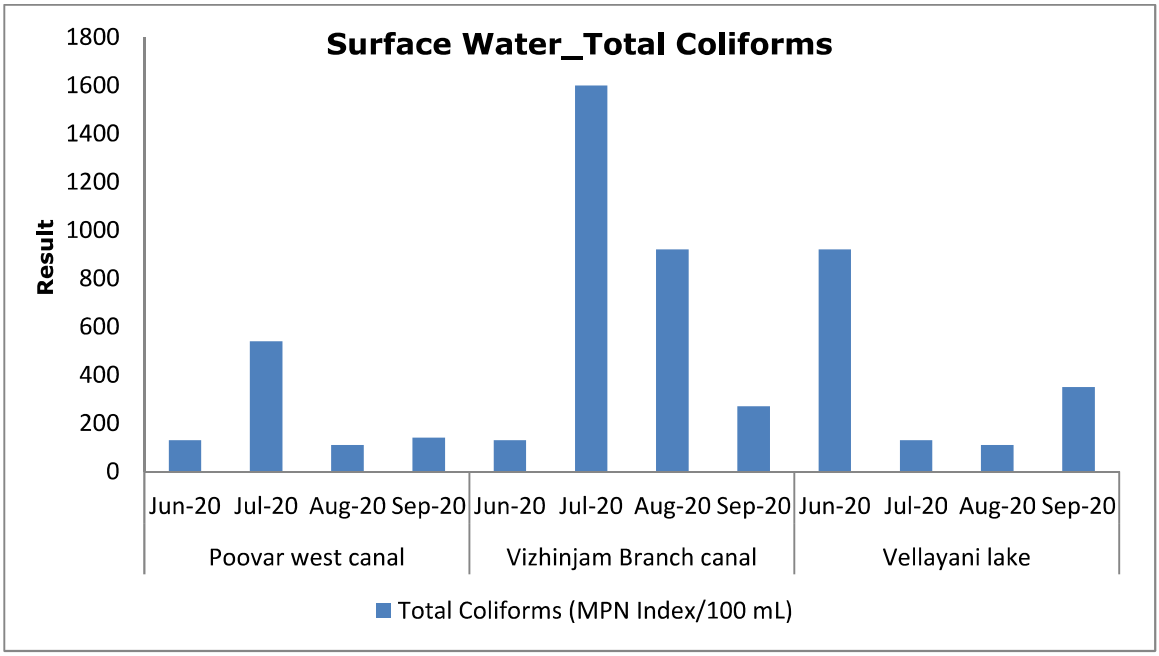


Figure 6.30: Surface Water Analysis for Total Coliforms

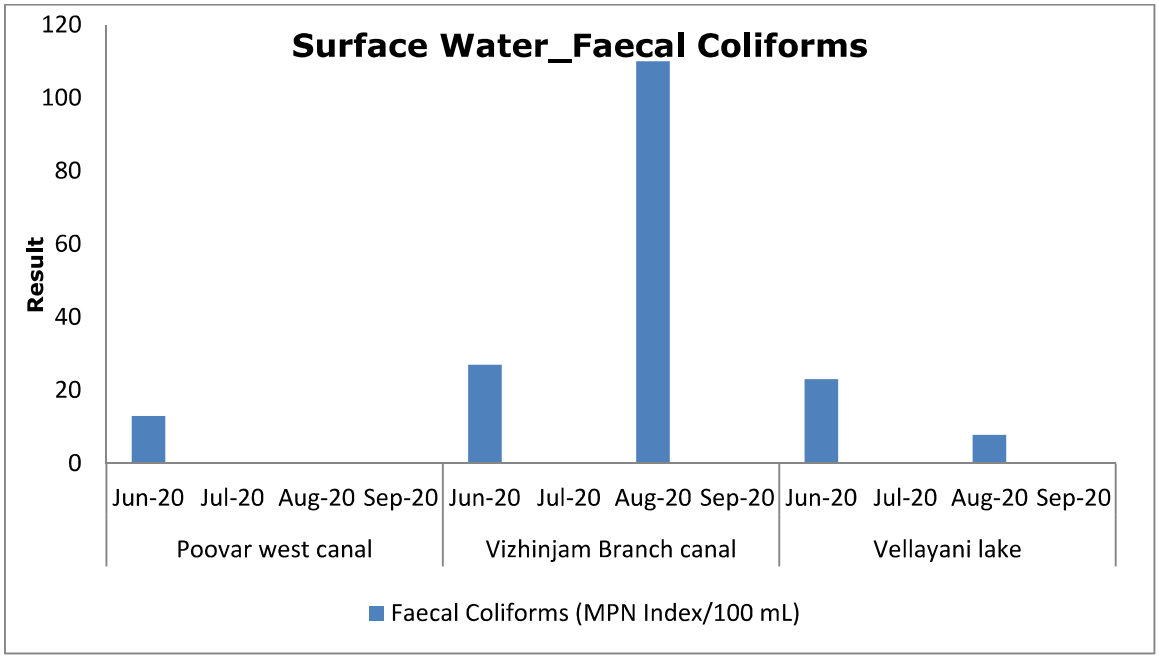


Figure 6.31: Surface Water Analysis for Faecal Coliforms

8. Summary of Surface water

During the period June 2020 to September 2020, following is the summary of surface water analysis:

At the location **Poovar West Canal**, Colour was observed 1 Hazen unit and odour was agreeable. pH was observed in the range between 6.71-7.09. Turbidity was observed in the range between 0.21-0.3 NTU. Total Dissolved Solids was observed in the range between 82-348 mg/L. Electrical Conductivity was observed in the range between 148-610 µmho/cm. Dissolved Oxygen was observed in the range between 6.0-6.8 mg/L. Biochemical Oxygen Demand (3 days, 27°C) was observed <0.1 mg/L. Calcium (as Ca) was observed in the range between 5.6-20 mg/L. Chloride (as Cl) was observed in the range between 28.5-174 mg/L. Fluoride (as F) was observed in the range 0.1-0.2 mg/L. Iron (as Fe) was observed in the range between <0.06 – 0.277 mg/L. Magnesium (as Mg) was observed in the range between 4.4-7.78 mg/L. Manganese (as Mn) was observed <0.02. Nitrate (as NO_3) was observed in the range between 2.5-3.39 mg/L. Sulphate (as SO_4) was observed in the range between <2-98.2 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 12.5-47.5 mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 32-82 mg/L. Calcium Hardness (as $CaCO_3$) was observed in the range between 14-50 mg/L. Sodium (as Na) was observed in the range between 12.5-21.7 mg/L. Potassium (as K) was observed in the range between 0.4-1.9 mg/L. Sodium Absorption Ratio was observed in the range between 0.6-1.31 mg/L. Free Ammonia, Total Phosphate (as PO_4), 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), Zinc (as Zn), 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 detection limit. Bacteriological parameters such as Total Coliforms were observed in the range between 110 to 540 MPN Index/100 mL and Faecal Coliforms were observed in the range between <1.8 to 13 MPN Index/100 mL.

At the location **Vizhinjam Branch Canal**, Colour was observed 1 Hazen unit and odour was agreeable. pH was observed in the range between 7.12-7.68. Turbidity was observed in the range between <0.2– 0.26 NTU. Total Dissolved Solids was

observed in the range between 120-138 mg/L. Electrical Conductivity was observed in the range between 216-248 µmho/cm. Dissolved Oxygen was observed in the range between 5.8-6.7 mg/L. Biochemical Oxygen Demand (3 days, 27°C) was observed <1. Calcium (as Ca) was observed in the range between 8.82-22.4 mg/L. Chloride (as Cl) was observed in the range between 36.9-45 mg/L. Fluoride (as F) was observed in the range between 0.2-0.6 mg/L. Iron (as Fe) was observed in the range between <0.06 – 0.498 mg/L. Magnesium (as Mg) was observed in the range between 1.45-6.32 mg/L. Nitrate (as NO_3) was observed in the range between 3.1-8.59 mg/L. Sulphate (as SO_4) was observed in the range between 3.72-11.3 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 32.5-40 mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 40-62 mg/L. Calcium Hardness (as $CaCO_3$) was observed in the range between 22-56 mg/L. Sodium (as Na)was observed in the range between 21.7-24.1 mg/L. Potassium (as K)was observed in the range between 0.41-2.9 mg/L. Sodium Absorption Ratio was observed in the range between 1.2-1.6. Manganese (as Mn), Oil & Grease, Free Ammonia, Anionic Detergents and Barium (as Ba), Boron (as B), Copper (as Cu), Mineral Oil, Phenolic Compounds (as C_6H_5OH), Selenium (as Se), Silver (as Ag), Total Phosphate (as PO_4), Zinc (as Zn), 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 Detection Limits. Bacteriological parameters such as Total Coliforms were observed in the range between 130 to 1600 MPN Index/100 mL and Faecal Coliforms were observed in the range between <1.8 to 110 MPN Index/100 mL.

At the location **Vellayani Lake**, Colour was observed 1 Hazen unit and odour was agreeable. pH was observed in the range between 6.53-6.92. Turbidity was observed in the range between <0.2 to 2.1 NTU. Total Dissolved Solids was observed in the range between 76-112 mg/L. Electrical Conductivity was observed in the range between 135-182 µmho/cm. Dissolved Oxygen was observed in the range between 5.5-6.4 mg/L. Biochemical Oxygen Demand (3 days, 27°C) was observed in the range between <1-3 mg/L. Calcium (as Ca) was observed in the range between 8.01-12 mg/L. Chloride (as Cl) was observed in the range between 26.9-37.4 mg/L. Fluoride (as F) was observed in the range between 0.1 – 0.2 mg/L. Iron (as Fe) was observed in the range between <0.06– 0.28 mg/L. Magnesium (as Mg) was observed in the range between 3.4-4.37 mg/L. Manganese (as Mn) was observed <0.02. Nitrate (as NO_3) was observed in the range between 1.88-3.19 mg/L. Sulphate (as SO_4) was observed in the range between <2 – 8.22

mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 30-37.5 mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 36-46 mg/L. Calcium Hardness (as $CaCO_3$) was observed in the range between 20-30 mg/L. Sodium (as Na) was observed in the range between 15.7-26 mg/L. Potassium (as K) was observed in the range between 0.46-8.2 mg/L. Sodium Absorption Ratio was observed in the range between 1.01-1.85. Free Ammonia, 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), Zinc (as Zn), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Total Arsenic (as As), Total Chromium (as Cr), Total Phosphate (as PO_4), Pesticide Residues and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detection limit. Bacteriological parameters such as Total Coliforms were observed in the range between 110 to 920 MPN Index/100 mL and Faecal Coliforms were observed in the range between <1.8 to 23 MPN Index/100 m.

Annexure IV

CSR Activities by AVPPL

(April 2020 to September 2020)

CSR REPORT VIZHINJAM

(April 2020- Sept 2020)

Adani Vizhinjam Port Pvt Ltd, 2nd Floor

Vipanchika Tower, Thycaud, Trivandrum-695014

Dated 30.09.2020

We are living in unprecedented times in the face of a global humanitarian crisis. The world is grappled with fear and uncertainties tied to the COVID-19 outbreak and its rampant spread. Being the costal belt of Thiruvananthapuram district including Vizhinjam area was under the critical containment zone, the first half of the current financial year was very much challenging one for CSR activities. Aligned with that most of the CSR activities have been shifted to online mode during the reporting period. In addition to the below mentioned ongoing activities a special COVID related Community Care Support Programme has also been initiated during the period.

1. Education
2. Community Health
3. Sustainable Livelihood Development
4. Community Infrastructure Development
5. Others

1. **EDUCATION:** The important activities carried out under Education vertical during the period are
   i. Monthly Open House & Poets and men of Literature meet
   ii. Green Campaign & Tree planting
   iii. Distribution of Bicycles to the girl children of widows

1.1. Monthly Open House & Poets and men of Literature meet

Monthly open house and Poets & men of literature meet are two important programmes under education vertical. Monthly open house is to encourage meritorious students from fishing community and to provide information on different professional courses and various schemes and options available. Poet and men of literature is to promoting reading habits and creative writing by the student and connecting them to public libraries. Following are major programmes conducted during the period under this head.

Sl. No	Month	Programmes	No .of Participants
1	April	COVID Awareness & Online Tasks	1920
2	May	1. Online training on 'Yes I Can' -(Think Positive) 2. online Competitions on the theme "Time for Nature" in connection with the World environment day including Painting, Short Story writing, Poem writing, Essay writing in 3 categories	100
3	June	1. Self-Awareness & motivation 2. World Environment Day Celebrations – Online competitions on Painting, Poem and story writing	100
4	July	Online Competitions on the theme " To raise awareness about safeguarding sexual and reproductive health needs" in connection with World Population day on 11th June 2020 - Poem writing, Drawing and Essay writing	220
5	Aug	Webinar on the theme "Eye donation & Eye Care" as part of the National Eye Donation Fortnight - to create mass public awareness about the importance of eye donation and to motivate people to pledge their eyes for donation after death. Association with Regional Institute of Ophthalmology, Trivandrum	44
6	Sept.	1. Felicitation of Poets & men of literature on Teachers day 2. National Nutrition Month Celebrations – 2 Webinars and a poster competition	25 100
Total			**2509**

World Environment Day (June 5th 2020)







World Population Day at 11th June 2020

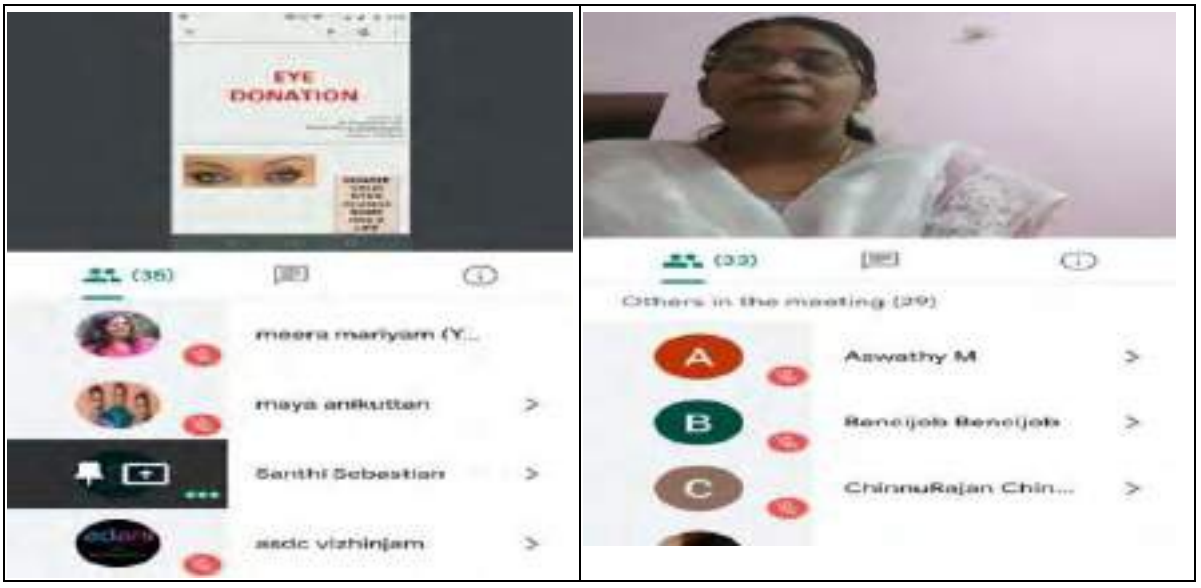
Theme of the day	:	• To raise awareness about safeguarding sexual and reproductive health needs
Online Competition items	:	• Poem writing • Drawing • Essay writing
No of entries received		• 43 entries were received and 12 winners are declared





Webinar on Eye Donation and Eye Care "Give the gift of sight to those in need - 2020"

The National Eye Donation Fortnight is observed from 25th August to 8th September with an aim to create mass public awareness about the importance of eye donation and to motivate people to pledge their eyes for donation after death. On this occasion Adani Foundation, Adani Vizhinjam Port Private Ltd under CSR organized an online webinar in association with Regional Institute of Ophthalmology, Medical College Trivandrum. The theme for the day was "Eye Care and Eye Donation" as part of its community health activities. Mrs. Shanthi. B.T, Eye Donation Counselor, Regional Institute of Ophthalmology Thiruvananthapuram handled the session. The theme for the day was **Give the gift of sight to those in need**. A video was created by the students after the session. 44 students were actively participated in the programme. The participants were reiterated to extend their support to fight against Blindness, one of the major public health problems in the developing countries. According to World Health Organization, corneal diseases (Damage in the tissue covering the front of eye) are among the major causes of vision loss and blindness, after cataract and glaucoma. In most cases, loss of sight can be corrected through "Eye Donation". There are number of reasons as to why people do not donate their eyes: Lack of awareness among the general public is one among them.



Felicitation of Poets & men of literature on Teachers' day

The teacher's day was celebrated on 5th September 2020 at CSR office, Mukkola by honouring the Poets and men of Literature. Eight eminent poets & Teachers who have been voluntarily supporting the programme of Literature meet were honoured by CSR Team.




National Nutrition Month Celebrations

101 students have participated in two webinar series on "Nutrition for healthy growing teenagers", by Mrs. Sajitha, ICDS Supervisor, Nedumangad block, Trivandrum and "Traditional Kerala foods to increase immunity", by Dr Suma Divakar, Head, Department of food and nutrition, College of agriculture, Kerala Agriculture University Trivandrum. A Poster Competition was also conducted for open house and literature students on the importance of nutritious diet.

1.2. GREEN CAMPAING

The green campaign is an initiative to promote planting trees in the community. The initiative was started as part of Van Mahotsav "Tree Festival". The Green Campaign includes activities on green canopy development by planting trees, clean campaign around community habitats and initiatives towards keeping green protocol in offices. As part of the programme 620 fruit bearing trees are planted in private and public lands. The activities have been initiated through 21 adolescent clubs and one literature club formed under CSR at Vizhinjam. The plants included Sitha bhal, Rambutan, Guava, Njaval, Badam, Nelli, Mango seedlings, Jamba, Citrus, Lekshmi Tarur, Povarsshu and curru leaf. The adolescent group selected for the event are entrusted the responsibility

for the growth monitoring of plants. A group leader has been selected from each club for keeping the growth dairy. A plan has been developed to post the growth monitoring photos on a monthly basis, which can be recognized with prizes to the club. An orientation was also conducted for adolescent club members on 26-08-2020 to throw light on the importance of trees, and how trees help in climate change, reducing carbon dioxide. As part of Green Campaign, CSR team along with students groups planted 100 fruit trees in the communities. The plants included Sitha bhal, Rambutan, Guava, Njaval, Badam, Nelli, Mango seedlings, Jamba, Citrus, Lekshmi Tarur, Povarsshu and curry leaf. It is planned to replicate the model to spread the same in public institutions and schools where there are enough spaces are available.





1.3. Distribution of Bicycles to the girl children of widows

Bicycles were distributed to the girl children of widows from BPL studying 5th to 8th standard. This was formally inaugurated by Shri.M.Vincent MLA presided over by ward councilor Smt.Omana on 23.06.2020, the international Widow's Day. There are 92 BPL widows' families having gild children studying from 5th to 8th standard identified in Vizhinjam. Due to COVID restrictions, the first lot of 60 cycles was distributed during the reporting period. The distribution was organized in each ward by keeping COVID protocols.

Sl. No	Ward	Venue	No. of Cycle distributed	Inaugurated by
1	Mulloor	Govt. LPS, Mulloor	8	Adv. M. Vincent, MLA & Smt. C. Omana, Ward Councilor

2	Venganoor	Aswathy Auditorium, Kalluvettakuzhy	7	Mr. Santhosh, Ward Counsellor
3	Vizhinjam	Zonal Office, TVM corporation, Vizhinjam	8	Mr. N.A. Resheed, Ward Counsellor
4	Kottappuram	St. Mary's HSS, Kottappuram	10	Ms. Shyni W, Ward Counsellor and Fr. Justin Judin, Vicar, Vizhinjam
5	Harbour	HALPS, Harbour	7	Smt. Nina Beevi, Ward Counsellor
6	Kottappuram	St. Mary's HSS, Kottappuram	20	Ms. Shyni W, Ward Counsellor and Asst. Vicar, Vizhinjam
Total			**60**	

Distribution of Bicycle at Mulloor ward inaugurated by MLA Shri M.Vincent on 23.06.2020



Distribution at Venganoor ward inaugurated by Shri.Santhosh, ward councilor, 24.06.2020



Distribiution of Bicycle at Kottappuram ward inaugurated by Fr.Justin presided by Kumari Shini, ward councilor,25.06.2020





Distribution of Bicyle at Vizhinjam ward by Mr,Rasheed ward councilor on 26.06.2020





Disribution of Bicycle at Harbour ward by Smt.Nisa Beevi on 27.06.2020







2. COMMUNITY HEALTH

Following are the major activities conducted under Community Health.

1. Service of Mobile Health Care Unit (MHCU)
2. Su-Poshan
3. Promotion of 1000 House Hold kitchen Garden programme

2.1 Service of Mobile Health Care Unit (MHCU)

A mobile health care unit with a doctor, pharmacist and a social worker has been working under the CSR of AVPPL/AF since 2016. A Fiver year agreement is made with Helpage India for the service. They have been visiting 10 sites weekly in the affected areas to provide free checkups, medicines and referral services. A total of 6527 treatments were provided and 649 new registrations were also done in the period.

a. Site wise patient break-up for the period

SN	MHU Sites/Halt Point	April	May	June	July	Aug	Sept.	Total
1	New Church	207	220	243	23	98	153	944
2	Kadaykkulam Resident's Association	153	139	176	24	63	104	659
3	Karayadivila	126	141	163	30	35	125	620
4	Thulavila	93	30	48	6	22	50	249
5	Nehru Memorial Library, Theruvu	193	205	202	66	77	173	916
6	SNDP Hall, Kovalam	88	94	93	44	51	102	472
7	Gateway Resident's Association Hall	105	93	102	42	36	70	448
8	Township Colony	174	181	165	66	52	117	755
9	Marian Nagar, Kottappuram	112	153	112	63	24	85	549
10	Near Aquarium	100	161	189	113	86	136	785
11	Medical camp and other treatments	126	4					130
	Total	**1477**	1421	**1493**	**477**	**544**	**1115**	**6527**

b. Blood glucose test

Total Tests			**Total Positive cases of Blood Sugar**		
Male	**Female**	**Total**	**Male**	**Female**	**Total**
22	**0**	**22**	**7**	**0**	**7**

c. Photo Gallery from the field

Regular MHU activities



Scanning with infrared thermal scanner



Dispencing medicine



Dispencing medicine with social distancing



Medicines through volunteers

d. Case study



Mr. Azees ID card No: 4055

Pattani colony Vizhinjam Trivandrum Kerala

Azees, is a 72 year old man residing at Pattani colony in Vizhinjam, Trivandrum. He is running a petty shop in that Colony to make his livelihood. In his house, his wife, daughter and family stay. The lockdown forced him to close the shop, so his income was stopped and felt very difficult for the livelihood. His son in law is driving a hired auto-rickshaw

but the lockdown has put a break for that income. The free ration provided from ration store made them to stay at home. However, Azees was having doubt whether he receives his regular medicines from the Mobile Health Care unit of Adani Foundation. He contacted the helpline number of MHU to know the availability of medicines. Immediately the Mobile health care unit site volunteers reached his house and provided medicines.

Further, Azees was well aware of the precautions on Covid-19, and the information to wear mask and sanitizers but could not buy it as it needs money. Vizhinjam MHU has provided a Hygiene kit including of Mask, Sanitizer, Hand wash and Soaps. He thanked the MHU team for the total support provide. His eyes were filled with tears of happiness and a hope that there are many to care them.

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

SuPoshan is the healthcare initiative of Adani Foundation aimed to curb malnutrition and anemia among children below 5 years of age and women in reproductive age. Following are the major activities conducted.

Sl. No	Programme	April	May	June	July	Aug	Sept	Total
1	Tele Counselling	120	270	130	111	167	147	945
2	Menstrual Hygiene Day (28.05.2020)	220						220
3	Community Volunteer Support	120	270					390
4	COVID online Awareness	350	150					500
	ORS Week July 23 -29				155			155
5	World Breastfeeding week					252		252
5	National Nutrition Month						548	548
Total		**810**	**690**	**130**	**266**	**419**	**695**	**3010**

a. World Breastfeeding Week-2020

Vizhinjam site celebrated World Breastfeeding Week by conducting online competitions and webinars. Following are the details of the programs:

Date & Event	Event	Number of Participants	Subjects Covered	departments
webinar on "Exclusive Breast feeding "- 01-08-20	Resource Persons : e. Mrs Deepa S, ICDS, Supervisor, Vizhinjam Sector- II f. Mrs Divya Arun, ICDS Supervisor, Vizhinjam Sector-I	A Total of 101 participants;	• Benefits of Breastfeeding • Problems faced by Breastfeeding Mothers & it's remedies • Breast Milk composition • Fore Milk and Hind Milk • Benefits of colostrums	ICDS Department
Essay Competition & Floral Carpet 03-08-20	SuPoshan team	Total no: of participants for competition : 18	Support Breastfeeding for a healthier planet	
webinar on "Benefits of Breastfeeding for mother & child" 04- 08-20	Resource Person: 1. Mrs Rashmi S ,Deputy District Education & Media Officer, District Medical Office, Health Service Department, Trivandrum	Total of 49 participants	• When to start Breastfeeding • Composition of breast milk • How to feed a baby • ABC's of Breastfeeding • Kangaroo care • Risk of artificial Breastfeeding • Steps to be followed to prevent spread of Corona Virus to baby while feeding	Health Department

05-08-20 Slogan Writing Competition	SuPoshan Team	Total Participants of 12	Support Breastfeeding for a healthier planet	
06-08-20 Poetry Competition	SuPoshan Team	Total Participants of 14	Support Breastfeeding for a healthier planet	
07-08-20 Webinar on "Breastfeeding - Emotional bond between mother & child "	Resource Persons: 1. Mrs Thara S, CDPO, Athiyanoor Block, ICDS, Trivandrum & iv. Mrs Latha, ICDS Supervisor, Kottukal Panchayat, ICDS Department, Trivandrum	Total of 46 participants	*Breastfeeding - Infant's Health benefits *Breastfeeding - Mother's health benefits *Advantages & Disadvantages of artificial feeding *Psychological benefits of Breastfeeding	ICDS Department
08-08-20 Poster & slogan writing	SuPoshan Team	Total Participants of 12	Support Breastfeeding for a healthier planet	

b. National Nutrition Month 2020

The details of National Nutrition month celebrations

Date	**Event**	**No of Participants**	**Subjects Covered**
05-09-2020	Vegetables & Millet Carpet	05	• Sangini Suja prepared outline of India with millets, cereals. • Sangini Raji with the help of children made outline of Kerala with Millets & Cereals. • Sangini Chandri made "SuPoshan Vizhinjam" with millets & cereals

10-09-2020	Webinar on "Nutritive requirements for children below 5 years),	42	• First 1000 days, Food to be taken by below 5 year, Digestive foods, Usage of junk foods • Dr Vidya V K, MBBS. DCH, DNB Indian Medical Association (IMA) took session
10-09-2020	Poster Competition	8	• My Plate, Eating Habits 7 Immunity Foods
11-09-2020	Webinar on "Nutrition for healthy growing teenagers"	101	• Adolescent age is important, healthy diet, Disease Prevention, Balanced diet, Good Nutrition, Major Nutrients, Food pyramid • The awareness session was taken by Mrs. Sajitha, ICDS Supervisor, Nedumangad block, Trivandrum
16-09-2020	Webinar on "Traditional Kerala foods to increase immunity".	Total Participants : 63	• Need to bring back traditional foods, Immune boosting, Ayurvedic properties of Spices, Kerala Sadya, Nutraceutical properties of dry ginger, Nutraceutical properties of Amla, Arrow root preparations in Kerala, Nutraceutical properties of jackfruit seed. • Session was taken by Dr Suma Divakar, Head, Department of food and nutrition, College of agriculture, Kerala.
18-09-2020	Webinar on the topic "Nutrition in Adolescence	61	• Classification of Foods, Nutritional requirements, Sources of Nutrition, Deficiency disorders, Eating styles of Adolescents, Nutritional Problems • Session was taken by Dr Sheeja Sreenivas, Chairperson, Women Doctor's Wing, IMA Kochi
22-09-2020	Webinar on the topic "Nutritious weaning foods".	101	• Why starting weaning foods after 6 months, basic principles for feeding young children, Problems related to weaning, foods to avoid before 12 months, disadvantages of processed complementary foods, Preparation & storage of weaning foods, Banana based weaning foods

			• Session was taken by Mrs Sowmya PS, Nutritionist & Research Scholar, Kerala Agricultural University
23-09-2020	Webinar on "Orientation to Kitchen Garden",	35	• Direct sown vegetables, Transplanted vegetables, Protray Nursery, Media for portray nursery, filling of grow bags, multiply trichoderma cow dung, Solid solarisation, Pesticides, Fertilizers • Mrs Manju Thomas & Mrs Bindhu R Mathew Subject Matter Specialist, Horticulture, Mitraniketan, Krishi Vigyan Kendra
25-09-2020	Webinar on "Nutritive value of Moringa & it's Value added products"	Total Partici pants : 73	• Global market for Moringa, difference between Green leaf & Dry leaf, Nutrients in Moringa, Medicinal & Therapeutic properties of Moringa, Essential Amino Acid • Session handled by Dr.Kamalasanan Pillai, Principal Scientist, Centre for Excellence for Moringa, Kanyakumari Kerala Agricultural University, Trivandrum
29-09-2020	Webinar on the topic "Nutritive Value of Honey & it's value added products". Agricultural University.	:47	• Nutritive Value of honey, Chemical composition of honey, Immunity factors of honey, Medicines from honey, Foods from honey, Usage of honey, Value added products from honey like honey drink, cookies ,jam, rice balls, cakes, ice cream, bread, honey roasted nuts bar, honey fruit syrup • Session was taken by Dr Stephen Devaneshan, General Secretary, FIA &. Bee Expert, KVIC Member, Scientific Panel, FSSAI, New Delhi & Former Dean, Faculty of Agriculture, Kerala
29-09-2020	Recipe Competition	12	• Participants prepared different recipes from Moringa leaves and it's drumstick.

c. Exit Plan Action Plan

As Vizhinjam completed 3 years of its implementation of SuPoshan project and hence a plan has been developed for the exit of the project. As per the proposed plan, the exit of the project from Vizhinjam area can be completed by end of March 2020. Further, decided to recommend initiating SuPoshan project to Adimalathura in Kottukal Panchayat. The major points discussed in detail for the exit of SuPoshan project are Conversion of identified malnourished and anemia cases to healthy, Alternative Livelihood for existing Sanginies, Follow Up of achievements gained by SuPoshan Project, Proposal for the extension of SuPoshan Project to New Site.





















2.3 BaLA (Building as Learning Aid)

- Adani foundation supported 12 Anganwadis in Vizhinjam through Building as Leaning Aid (BaLA) by painting Anganwadis as a learning platform at Vizhinjam and completed the work during the period.
- BaLA is an innovative concept towards qualitative enhancement in elementary education through intervention in school building infrastructure. Since buildings are the most expensive physical assets of a school, efforts should be made to derive maximum educational value from them. Thus, BaLA is about exploring uniqueness of three dimensional spaces as a child friendly learning resource for all children.
- The painting helps children to become friendly with environment, handwashing, personal hygiene and alphabets more easily and understandable.
- AF got excellent feedback from anganwadi workers as it help in developing respect for nature and environment, Personal Hygiene, Communication skills, Numeracy skills, Power of observation through pictorial representation.



2.4. 1000 Household homestead vegetable garden-2020-21
(Growing own vegetables in homes, the "New Normal Post Covid 19")

Covid 19 pandemic and the lock down associated with it saw an unprecedented turning in the transport of vegetables and other essentials over the state borders. The price hikes or supply shortages and consequently consumer woes are increasing and hence there is a need to plan self-reliance at household level. Given that context AVPPL/AF has planned to implement 1000 Kitchen garden in the five wards of Vizhinjam under CSR in coming months. It is planned to implement in 4 phases. The first phase is with 260 houses.

A basic data collected for the purpose. Beneficiaries in the near vicinity can be grouped into 20 in a group. For 1000 families a total of 50 groups can be formed in a phased manner in a period of one year. Following are the recommended planting materials for kitchen garden.

Sl no	Seed /cuttings
1	Bhindi
2.	Brinjal long
3	Brinjal round
4	Tomato-lekshmi
5	Cow pea-non trailing
6	Chilli-long
7	Palak
8	Amaranthus
9	Coccinia cuttings

Following table gives the Summary of groups formed for Kitchen Garden in Phase -1

Sl No	Name of Group	Ward	Presently Cultivating		Willingness to Cultivate Kitchen Garden		Place of Cultivation		Willingness to form Groups		Willingness to pay 10 % Contribution		Name of the Mahila Kisan Leader
			Yes	No	Yes	No	Roof Top	Land	Yes	No	Yes	No	
1	Gramam	Vengan oor	20	0	20	0	10	10	20	20	20	0	Sarabin dhu

2	Karshaka Sangam	Mulloor	17	3	20	0	7	13	20	0	20	0	Kavitha
3	Vayal	Harbour	11	9	20	0	8	12	20	0	20	0	Jasmine Rose
4	Pulari	Mulloor	11	9	20	0	14	6	20	0	20	0	Preeja
5	Padam	Kottappuram	14	6	20	0	10	10	20	0	20	0	Mercy
6	Ente Pachakkari	Venganoor	14	6	20	0	8	12	20	0	20	0	Aruna
7	Ente Thottam	Venganoor	19	1	20	0	17	3	20	0	20	0	Maya
8	Healthy Garden	Kottappuram	15	5	20	0	5	15	20	0	20	0	Carmel
9	Kisan	Mulloor	18	2	20	0	15	5	20	0	20	0	Raji
10	Haritha	Harbour	16	4	20	0	14	6	20	0	20	0	Chandri
11	Varnam	Harbour	15	5	20	0	15	5	20	0	20	0	Bindhu Sukesan
12	Krishi Deepa	Venganoor	16	4	20	0	9	11	20	0	20	0	Virjin Mary
13	Green House	Mulloor	14	6	20	0	17	3	20	0	20	0	Suja
14	Heaven On Earth	Mulloor	18	2	20	0	14	6	20	0	20	0	Chandrika
15	Vayalor am	Vengnaoor	14	6	20	0	7	13	20	0	20	0	Anitha

16	Kethar am	Vengn aoor	18	2	20	0	1	19	20	0	20	0	Sindhu
17	Narum azha	Vengna oor	13	7	20	0	3	17	20	0	20	0	Manju
Total			**263**	**77**	**340**	**0**	**174**	**166**	**340**	**0**	**340**	**0**	

3. SUSTAINABLE LIVELIHOOD DEVELOPMENT (SLD)

The projects under SLD included

3.1 Coaching for success – Competitive Exam Coaching programme

3.2 Digital Literacy Programme

3.3 Skill Development Programme &

3.4 Livelihood Development Programme

3.1 "Coaching for success" – Competitive Exam Coaching Programme

Being an urban agglomeration, one of the requirements of youth at Vizhinjam is to prepare them for competitive exams including PSC. As per the request, AF created a platform for selected 100 students every year to prepare in competitive exams, scholarships and government/private jobs at locations. Priority is given to fishing community students. The Soft launch of the programme was done by Dr. Sashi Tharoor, MP. Rregistration of candidates increased from 114 to 623 after the launch.

a. Inauguration of Virtual Training Program "Coaching for success"

Virtual class for the Competitive Exam Preparation candidates was formally inaugurated by **Dr. Shashi Tharoor** (MP Trivandrum) on 12th August 2020 through Google Meet platform. Shri.Rajesh Jha, CEO, AVPPL extended presidential address. Shri M.P Joseph, Former I.A.S & UN Official presented the methods for the preparation of competitive exam. Shri P.N Roy Chaudhary (Executive Director, Adani Foundation) guided for providing all the learning resources for the candidates through online platform. Shri Vasant Gadhavi (Executive Director, ASDC) described the importance of

Competitive Exam Preparation and appreciated the efforts that ASDC Vizhinjam team took for conducting the Competitive Exam Preparation. 250 candidates participated in the virtual inauguration programme. A lot of enquiries from the part of the candidates even from other districts were also raised to join in the virtual training programme.



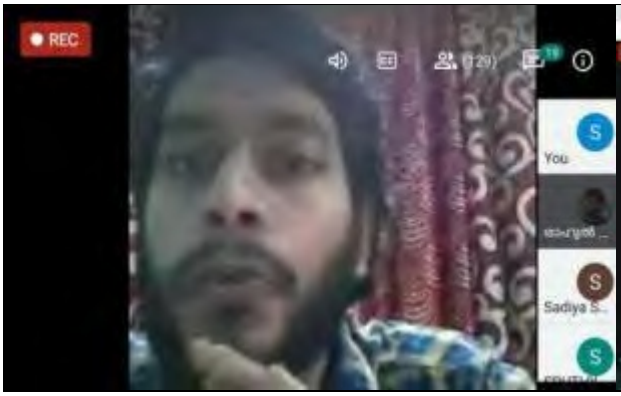




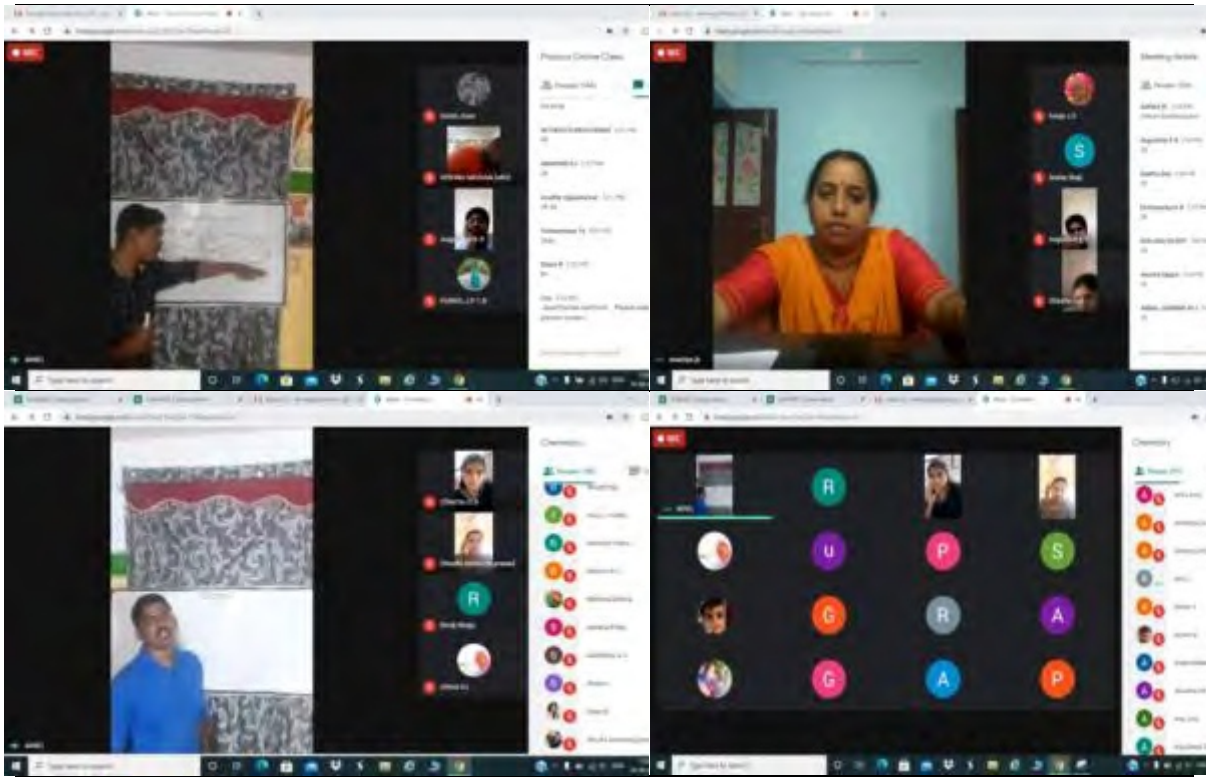


b. Virtual Training Classes

Followed by the inauguration, virtual class for Competitive Exam preparation started except week ends. Training sessions along with daily mock test is also going on with an average of 100 students' participation. Weekly mock test, timetable and study materials are shared through google drive link.

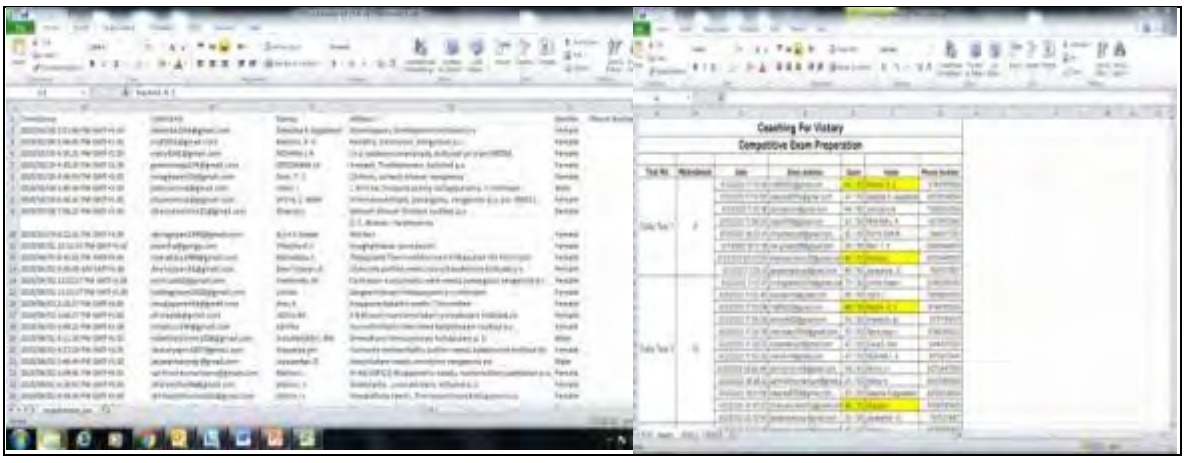






c. E-Learning Activities

In addition to the virtual classes other e-learning activities have been progressing simultaneously. Candidates those who registered have been added in the WhatsApp group for getting them updated. 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 on a regular basis. Daily online test for a score of 50 has been conducting on a regular basis. Coordinator will monitor and record the daily scoresheet of each candidate. The link will shared with the candidates through WhatsApp group. After the successful completion of every day test the top scorers will be announced by the coordinator in the group.



- Different vacancy announcements from Central and State government has also been circulating through online platform
- Necessary support has been provided for students, who are not having proper internet facility or devices for applying various job opportunities.

3.2. Digital Literacy

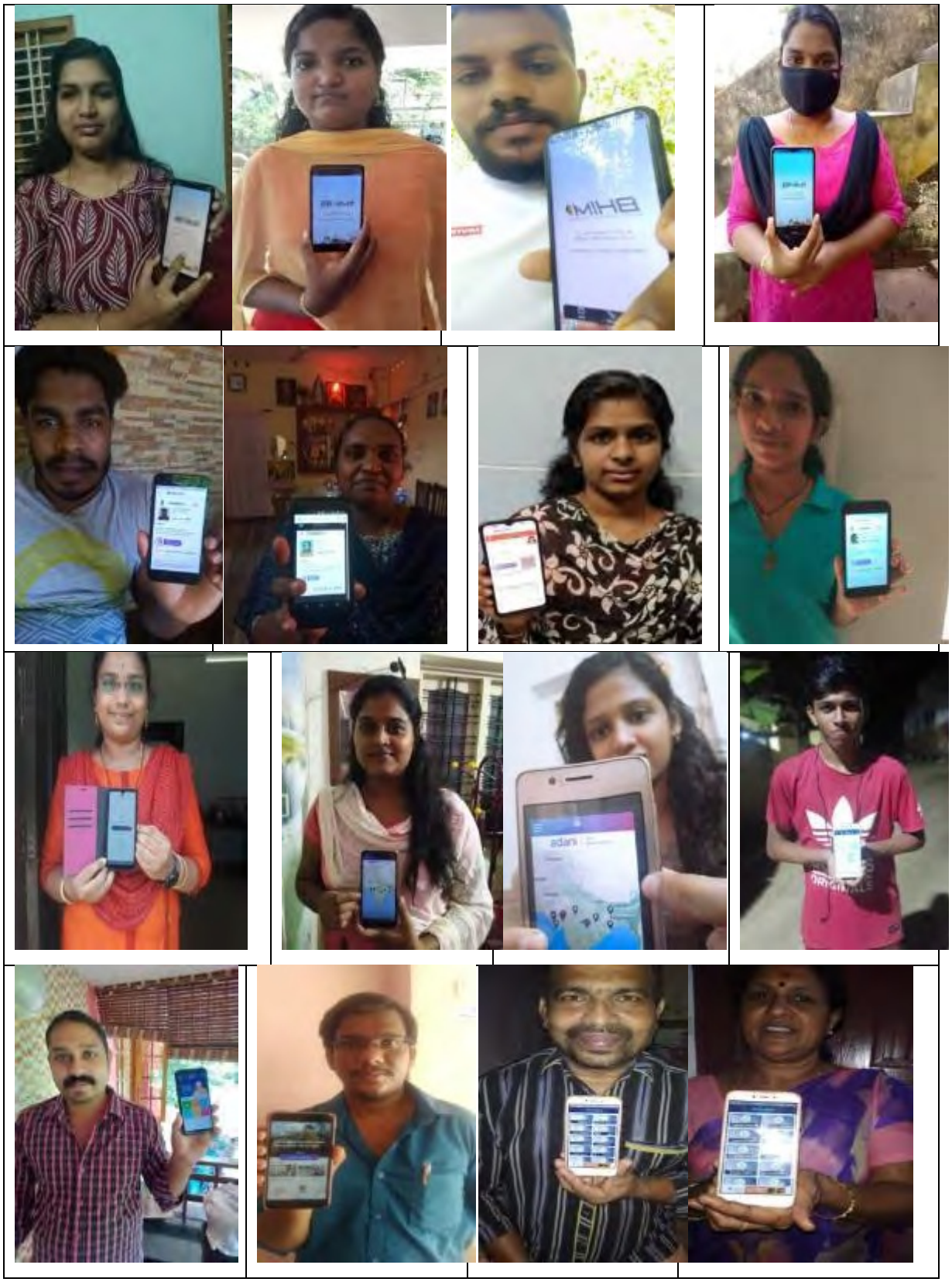
a. E-Learning Programme

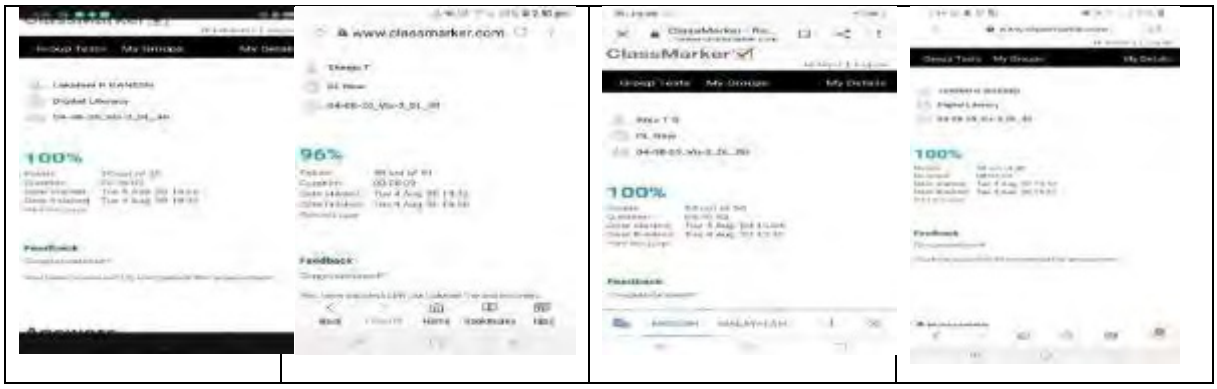
Digital Literacy Programme of Adani Foundation has been showing consistent progress since 2018 and it reached to 3764 people, wherein 1968 are trained in 2019-20. This year the digital literacy has reached to 596 out of the proposed target of 2000. The programme helped in making the people to equip on online transactions, bill payments like KSEB, water bills, school fee payments and e-commerce activities. The significant achievement of Digital literacy is that it helped to connect cash less transactions even at community level wherein 90% of the beneficiaries are women from the community. In this Covid 19 scenario, ASDC Vizhinjam continued the training on Digital Literacy in E-Learning method.

As part of the training programme beneficiaries have been sharing the photos of different Apps installed in their own smartphones. Every beneficiaries installed BHIM App, Saksham App and Digi-Locker. They started doing the necessary transaction activities through online and also used the Digi-Locker facility. The other Apps like MyGov App, GST finder App etc. mentioned in the Digital Literacy Programme were also installed by the beneficiaries.

Digital Literacy beneficiaries are also promoting the use and benefits of SAKSHAM App in the community. All the details about the Saksham Centre as well as the courses run by the Centre across India can be easily viewed by the community people and they can contact the center for the admission process. Daily Module test screenshots were shared by the beneficiaries and their modules scores were recorded by the coordinator. Resources trainers are also taking initiatives for clearing the beneficiary's doubts about the topics through digital platform. They created WhatsApp groups for interacting with the

beneficiaries, like sharing the daily study materials daily module test google form link sharing and also the doubts asked by the beneficiaries were cleared through this platform itself.





b. Digital Literacy impact in this Covid 19 Situation

Mr. Pradeep V a Malayalee Ayurveda therapist, who is currently running a clinic at Andhra Pradesh lost all his documents in flood while he was staying at Mumbai. He has migrated to Andhra Pradesh for finding a new job or to start a new business, he was in need of all the relevant documents. He was unable to reach his native place and apply for duplicates of Aadhar and Pan Card due to lock down situation. When he starts his new clinic at Andhra Pradesh, he was in need to open a current bank account, but due to insufficient documents he couldn't. While he was planning to come back to his native place, unfortunately the lockdown started. He faced a critical situation there without having relevant documents. The only thing was he knows his Aadhar id number. When one of our resource trainer contacted him for joining in our online Digital Literacy programme, at first he denied but the trainer explained the need and facilities that he could get through this programme made his mind changed. He shared his willingness to join the programme. After completing the Digi-Locker module, trainer asked him to download the Digi-Locker app. He was very sad on that because he only knows his Aadhar Id number and thought it was not possible to open the application. Then the trainer explained in detail about the possibility to start the Digi-Locker App. He installed the same and downloaded Aadhar card in digital form. After that he was thinking about his Pan Card, the trainer provided necessary information regarding the availability of Pan Card through Digi-Locker in digital form. After downloading



the pan card he was confused because in Aadhar card photo is displayed but in pan card it is not like physical card and photo is not displayed. Then the trainer explained that the photo is not a matter for Pan Card because the card was digitally verified by the authority and QR code is correctly displayed. Trainer ensured that the Pan Card he downloaded was from the official website and it is acceptable anywhere in India. For online account opening and verification process he shared it with the corresponding bank officials of HDFC bank and it was accepted by them. The very next day itself he opened a current bank account through online process with the help of Aadhar Id and Pan Card downloaded through Digi Locker. He thanked our trainer and became happy for the needy support received which made to change his life through the digital literacy programme.

Aditt A, high school student residing at Trivandrum is studying at Sri Ravi Shankar Vidyamandir Maruthankuzhy, Trivandrum. As we know the school classes are conducting through online on daily basis. Also teachers are giving some activities, home works to engage students in study methods in this lock down situation. In his school, all the important days were celebrated and some extracurricular activities were assigned to the students also. We all had gone through the Kargil Vijaya Diwas on July 26, one of the battles winning moment's anniversary of our Indian Army. On 24th July Friday, he got any activity from his class teacher based on Kargil Vijaya Diwas. He has to register and attend a quiz competition on Kargil Vijaya Diwas in **My Gov App**. Actually, he was not aware about the My Gov App. He shared this activity question with his mom. She was one the beneficiary of ASDC Digital Literacy programme and she already knows the procedure for downloading My Gov App and how to use it. She helped him for downloading and registering in this App. On 25th July Saturday, he downloaded My Gov App and registered in the presence of his mom. After the successful registration he attended the quiz and downloaded the certificate. On 26th July Kargil Diwas, he shared the certificate to his class teacher to post in the school WhatsApp group. He was the first student who did all those process completely and successfully. His teacher appreciates him through a text

message in the group and all the students congratulate him too. Everyone enquired that how he was able to do that activity properly. He shared that, his mom attended the Digital Literacy programme of ASDC and got the knowledge of using and registering in the apps like My Gov, Digi-Locker, GST Finder, SAKSHAM App etc. They also appreciated his mom for attending the programme and congratulated her also. She became happy for helping her son through the participation in ASDC Digital Literacy programme.





3.3. SKILL DEVELOPMENT PROGRAMME

a. Retail Trainee Associate

The last batch of Retail Trainee Associate with 22 students is waiting for the assessment due to COVID restrictions. The batch consists of 2 male and 20 female candidates. Although the assessment is pending all students were given opportunities to attend interviews and 12 candidates were placed in different organizations in Trivandrum district.

b. TRANSIT CAMPUS OF COMMUNITY SKILL PARK at Vizhinjam

The new transit campus of CSP under ASDC at Vizhinjam started functioning during the reporting period. As per the guidelines from ASDC, the skill course are

restructured more of entrepreneurship model for community people. Following are the courses started with candidate not exceeding 10 for each batch. The successfully completing candidate will be provided certificates of NSDC/ASDC.

SL. No.	Course Name	Eligibility	Duration	Venue of Classes	Day & Time	Prospects
1	Home Nursing	10th	100 hrs	ASDC Building, Mukkola	Monday-Friday (10am to 5pm)	Tied with local hospital for after care of patients
2	Assistant Beauty Therapist	8th	280 hrs	CSR Office, Mukkola	Monday-Friday (10am to 5pm)	A business unit for beauty and wellness with mobile facility is planned
3	Data Entry & DTP Training	10th	150 hrs	ASDC Building, Mukkola	Monday-Friday (10am to 5pm)	An E-Seva center at VIZ mart is planned for the candidates

c. Training on Patient Care

Patient Care is a high demanding unorganized health sector in Kerala, where majority of the home nurses are not professionally trained. The need for home nurses is increasing day by day in Trivandrum as well as in Kerala. In Vizhinjam there is no professional home nursing agency so people hire services from Trivandrum city. The professional fee for their service is also unbearable for the middle class. Given that context the training on Patient Care on pilot basis has been completed with seven members on a pilot basis. Due to Covid19 scenario, external assessment for the group is postponed.



These beneficiaries formed a group with name "**SPANDANAM Patient Care Unit".** They opened a new bank account in Vijaya Bank, Vizhinjam.

The group elected Mrs. Jeeva as the group President, Mrs. Beena as the Secretary and Mrs. Bindhu as treasurer. This group was registered as the Charitable Trust in Registration Department, Trivandrum. Notice, Visiting card preparation process is going on.



d. Training on Beautician

Beautician is one of the main freelancing activities that even a house wife from the community can engage. Training started from 25th May 2020 onwards and has been continued during period in virtual platform.





e. Training on Data Entry

The training on Data Entry and DTP operator started from 27th May 2020 onwards and has been continued during the reporting period in virtual platform.





f. Smart Maid

House maid is one of the major livelihood activities which can be promoted for the community people in Vizhinjam area. As part of promoting livelihood initiatives, ASDC Vizhinjam Centre planned to start a new programme on SMART

MAID training. The ASDC team developed syllabus having different modules from Home Nursing, Digital Literacy, Basic beautician and cooking courses for making the trainee smart.

g. General Duty Assistant

ASDC Vizhinjam Centre started the General Duty Assistant skill course with strength of 19 candidates during the period. The sessions have been conducting virtually.

h. SAKSHAM DAY

In this year, ASDC Vizhinjam celebrated the fourth year of "SAKSHAM" by making webinar meet with all sites. Further a promotion video of Saksham four years with the input of Shri. Rajesh Kumar Jha, CEO AVPPL, Dr. Jayakumar, MD, VISL, Mr. Vinod, Head ASAP and Dr.Anil Balakrishnan, unit head CSR which has been shared on YouTube.





3.4 LIVELIHOOD UPDATES

a. Status of existing livelihood groups

Sl No	Group	Type of Business/ Status up to March 2020	Business Status during the Month
1	Clean 4 U (5 Members)	• Hi Tech Cleaning for Flats, Hospitals, Offices, water tank, Vehicle and Public Institutions • Hosted a new web site www.clean4u.info for the customer registration • The turnover during the year was Rs.4,06,000/-	• The clients included offices, hospitals, flats... • Purchased an own four wheeler • Average monthly turnover was close to Rs.1 lakh • Supplied 3 new contract staff for Transit Centre, Gust House and POB

2	Anaswara Poultry Unit (7Members)	• Hitech poultry with 14 cages of 630 chicken for 7 member • The total revenue for the group for the financial year is Rs. 6,09,000/-	• Ongoing • Average monthly earning per family is Rs.3,500/-
3	Thripti Poultry Unit (7 Members)	• Hitech poultry with 14 cages capacity of 630 chicken for 7 member group • The total revenue for the group for the financial year is Rs. 4,41,000/-	• Ongoing • Average monthly earning per family Rs.4000/-
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/-	• Only parcel service • Daily turnover of Rs.8,000 to Rs.10,000 and gets an average profit of Rs.750 per day • Canteen runs in the building of Harbour Engineering Department
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 facemasks have been stitching as part of the CSR activities. • Average monthly turnover is 12,000/-
6	Eco Shop unit (3 members)	Selling of fresh vegetables at VizMart • The turnover of the group for the last six months was Rs. 8,80,000/-	• Procuring vegetables from the local farmers and selling at VizMart. • Working as per COVID protocols • They have been getting Rs. 2500 – Rs. 3500 business daily

7	Vizhinjam Karshika Karmasena (4 Members)	Clearing of vegetation and other agri works Turn over for the last three months was 2,40,000/-	• The clean Campaign including community cleaning and the cleaning of public places are coordinating by the Group. • Clearing of vegetation going on at various locations
8	Prime Events (5 Members)	• Power Laundry Unit and Steam Pressing Team • Consultancy partner for Viz Mart – Livelihood market • The group has made a turnover of Rs.7,60.000 for the financial year	• Steam pressing and hi-tech power laundry progressing • Received a revolving fund from AVPPL for expansion. • Average monthly turnover is Rs. 8,000/-
9	Data Plus (3 Members)	• Data entry Photostat, projects, designing and online jobs • The group has made a turnover of Rs.7,40.000 for the financial year	• Digital Literacy programme has been successfully supported by the group
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 • Average monthly turnover is Rs. 22,000/-
11	You Me & Tea Café (3 members)	• Canteen unit, traditional Kerala Foods • Made a turnover of Rs. 7,30,000/-in 7 months	• Concentrated in parcel service • Progressing the monthly turnover • Average monthly turnover of the group is Rs. 1,50,000/-

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	Started its service after lockdown • Special stitching training is going • Average monthly turnover of the group is Rs. 6500/-
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. 62, 000/- in 3 months.	• New tie up with Paul Raj, whole sale dealer established • Started a new sales counter for Nestle Products and mineral water • Functioning as per COVID protocols. • Monthly turnover is close to Rs. 1,00,000/-
14	Frozen Days (3 Members)	• Fresh juice, ice creams and milk products	• Started a unit at Vizmart from 02-12-2019.
15	Elite Gift and Fancy shop (3 Members)	• Gift items, fancy items, handicrafts, etc. • The group has made a monthly turnover of Rs. 60,000/-. In last 4 months	• Average monthly turnover is close to Rs. 6500/-
16	Happy Days Napkin distribution	Sanitary Napkins distribution in tie up with HLL	• Under progress

b. **VIZMART**

The market outlet for livelihood groups, Viz Mart progressing well during the reporting period. A mobile application has been initiated for collecting online orders from October onwards. Further necessary training, sourcing of products for the groups, branding support, bank linkages, product packaging, linking of resources and market tie-ups have also facilitated under the CSR.



c. Clean 4 U

The clean 4 u livelihood group purchased a four wheeler for expanding their business domain.



4. COMMUNITY INFRASTRUCUTRE DEVELOPMENT

4.1. Public toilet at Kottappuram

The construction of public toilet at Kottappuram has been completed. Electricity, Pipe connections are ready.



4.2. Community Health Centre, Vizhinjam

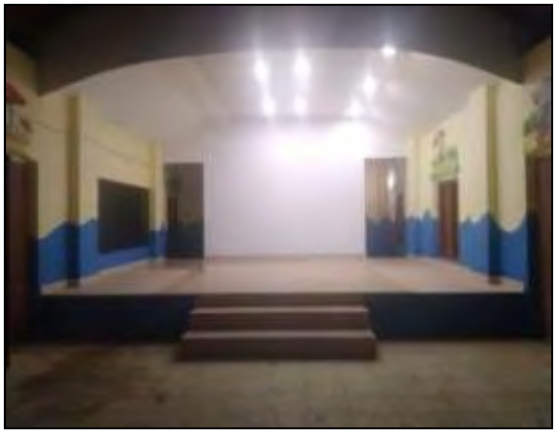
The work of Community Health Center at Vizhinjam has been progressing. The project cost is Rs. 7.79 crores where the Government component of Rs.482 lakhs and CSR component of 297 lakhs from Adani Foundation. Adani Foundation handed over the first installment of Rs.1.18 crores to the Harbour Engineering Department.





4.3. Mudippura Nada LP School, Venganoor

The works on construction of stage platform and washing facility have been completed in Mudippuranada School under CSR. The formal handing over may be conducted immediately after the lockdown.





4.4. HALP School, Harbour Road, Vizhinjam

The works of rain roof and sanitation facilities in HALP School are progressing. The work included side roofing; toilet blocks for boys, washing facility for staff and installation of water pump.




4.5. LPS School, Kidarakkuzhy



In Kidarakkuzhy LP School, the following works are progressing.

- Toilet block for boys & staff.
- Urinals for boys, Soak pit & septic tank at right side of the existing block.

4.6. Old age Home (Ambranchi villa, Andoorkonam, Vizhinjam)

The works of Old age home "Snehasanthram" at Ambranchivila has been completed and waiting to inaugurate due to COVID restrictions. Following are the facilities provided

- Kitchen platforms, Toilet /wash rooms, Washing facility & bathrooms separately (3 nos) completed.
- Beautification works of existing well (Plaster, cleaning colour etc.), Outside area with IPS or paver, Light weight shed b/w two existing building, Racks for storage are completed. Flooring inside the proposed shed and necessary electrification, area lighting, fans etc. have completed




4.7. Other major projects under progress

Sl N	Project	
1	Community Sitting Space with solar lights & small parks • Five numbers of Community Parks at various locations in & nearby villages, finalised • Stopped the work due to COVID-19 restrictions	
2	Model Anaganwadi, Vizhinjam (Nr. Police Station)	• 1500 Sqft Montessori model Anganwadi at Govt. Vizhinjam LP School compound. • The plan and the location approved by social welfare department • Land permission received from Social Welfare department. • Land Contour mapping yet to receive from Social Welfare department

5. OTHERS

5.1. COVID -19 Pandemic emergency response Activities

a. Donation to CM relief fund

Amidst the efforts of Adani Foundation at Vizhinjam for the containment of COVID-19, Adani Ports has contributed Rs.5 Crores to Kerala State Chief Minister's Relief fund to combat COVID-19 pandemic. This has been thanked by the Chief Minster Shri.Pinarayi Vijayan in his press meet held with all print and visual media channels held on 16 April 2020



b. Medical Support (Service of Mobile Health Care Unit (MHCU))



- Arranged awareness on Corona virus at all the sites.
- Distributed 125 hygiene kits for the deserving beneficiaries.
- 200 Masks distributed to patients came without masks.

- The community volunteers haves supported in providing medicines to the houses where it has been found difficult to assemble especially those having age above 65 years.



Doctor helpinng beneficiaries for wearing mask



Medicines distribution through police



Awareness flex for the public



Door to door distribution of hygiene kit



Awareness on corona

c. Awareness sessions by MHCU

SN	Category	Topic	Venue of camp	Date of camp	Total
1	Awareness	Covid-19	Kottappuram	6/4/2020	29

d. Supply of Provision Items for community Kitchen

As government imposed country wide lockdown, the daily wage earners especially the migrant workers, street vendors, beggars and abandoned people find it difficult to get their daily bread. In the month of March Adani Foundation has provided 2100 kg of rice, green grams, sugar and tea was provided to 1642 migrant labours at Vizhinjam. In continuation to that, in the month of April following support were provided for Community Kitchen

- 500 coconuts provided for the community kitchen organized for 1500 people by Government through Trivandrum Corporation and Community Volunteers.
- Provided 1975 kg rice provided for ration distribution through Vizhinjam Police Station and Counsellors to the fishing and deprived families in the wards of Kottappuram, Vizhinjam, Harbour Mulloor and Venganoor for 1000 families.
- Provided 800 kg rice to livelihood members, Volunteers and other associated directly with CSR
- Provided 200 kg of rice for the community Kitchen at Kottukal serving to 500 people from poor families, migrant labours and to the aged people.



e. Enduring Break the Chain Campaign

The initiatives for "Break the Chain" campaign started in the month of February and March 2020 has been continued in April too. This included the following

i. Continued the filling of water and sanitizers to the tanks provided at Thennoorkonam Junction, Vizhinjam junction and close to the Police station. These are the important places where the volunteers have started community kitchen and door to door supply of provisions and medicines.

ii. Distribution of Face Mask: The stitching of face masks has been continued during the reporting period. The face mask is one of the basic requirements to prevent the spread of Corona Virus. State government has made it mandatory to wear masks are mandatory in public places. As the availability of face mask is very limited in this emergency situation and the local shops are lay higher charges, Adani Foundation started stitching of masks through livelihood groups promoted under CSR. Adani Foundation stitched 6700 face masks so far for the officials including Police, Health and security staff, government officials, field staff and general public during the reporting period.

f. Digital Awareness on COVID -through Volunteer Platform

Adani Foundation has been started an online awareness programme through community volunteer platform VIZ "**Angels Army**". Authentic information published by the health department, Govt. of Kerala, National Rural Health Mission, Central Government (My GOV), Ministry of AYUSH, WHO and UNICEF were used for awareness creation. The following topics are covered in the awareness programme.

5.1 Importance of Social Distancing
5.2 Importance of Handwashing
5.3 Use of Face Masks
5.4 Steps to breaking the chain of COVID-19
5.5 Genuine Lockdown rules to be followed
5.6 Importance and role of ArogyaSethu App
5.7 Patient flow Chart infected with COVID-19
5.8 Protect your Kid from COVID-19
5.9 Importance of Cleanliness
5.10 Hygiene

5.11 Importance of Kitchen Garden

5.12 Immunity Boosting

Samples of awareness materials used













The awareness programme has been made interesting by giving "**tasks**" with a title of "**COVID Super Heroes**". Task were got good appreciation from volunteers and community at large, which they have responded in writings, videos, photos and other creatives

Task -1: A small change that you bring in your home and surroundings during lockdown period.

Task -2: Demonstration of Hand washing with soap

Task – 3: Use of Mask/Homemade face masks

Task – 4: Disinfection of house and surrounding

Task – 5: Cleaning of home and surroundings

Task – 6: Craft items/Bottle Art

It is interesting to report 1920 families have participated in the digital awareness programme and 60 entries are received in six tasks.

Some of the entries/creatives received towards various tasks are given below





g. Saga of Neelambari – an alternative Income Generation



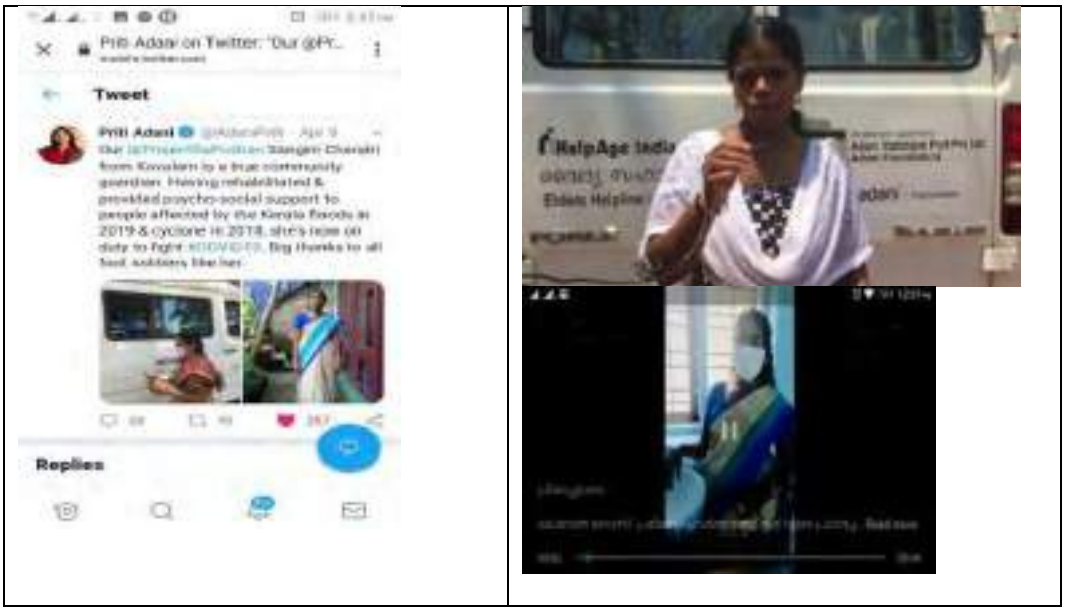
As part of the online awareness tasks given to the participants, one of the tasks was to do a "Small change that you bring in your house and surroundings". Kumari. Neelambari, 5th Standard from Venganoor Higher Secondary School shared a good story that she along with her mother stitched cloth bag during this lock down period as an income generation activity. They stitched almost 600 cloth bags and earned an income of Rs. 6500/- in 10 days' time. Although it was a task, however it helped the family during this lockdown period.

h. COVID Warriors

Adani Foundation has a team of 100 more community volunteers at vizhinjam since 2017. Many volunteers have made wonderful efforts during this COVID season, especially in the lockdown period. Most of the community volunteers, Livelihood group members, SuPoshan Sanginies and Digital Literacy resource parsons were involved with ward level health team to prepare food at community kitchen, distribution of food materials, medicines, door to door break the chain awareness campaigns and provide psychosocial support. Some of the activities taken up by volunteers are

- Corona awareness campaign carried out through volunteers.
- Distributed medicines from MHU to the patients at their houses.
- Supported distribution of masks to patients and community workers.
- Helped to provide food from community to kitchens to the poor households at Vizhinjam. Every day 1500 food packets were distributed from community kitchen.
- Distributed 125 hygiene kits for the deserving beneficiaries through volunteers by identifying bed ridden and other community people in vulnerable conditions,
- Pasted corona precautions poster at main areas of Vizhinjam.

A special mention to be given to SuPoshan Sanginies, as they were engaged in working with community kitchens, distributing essentials at the doorsteps of the elderly and others in need. All sanginis helped MHU team in helping them distributing medicines to the households of each ward. Sangini Anitha and Sangini Chandri engaged in distributing food to the nearby government hospitals with the help of Health Department.



Digital Literacy Resource Persons, RTA students and other Sanginies were actively participated in the digital awareness programme on COVID-19. One of our livelihood group members Mrs. Suraja has visited all households near to her community during this lockdown period and created door to door awareness programme on the use of Sanitizers, importance of handwashing and the right use of face masks. She rescued an old lady abandoned by their children and sent her to an old age home with the support of local police and other local leaders.





i. Cleaning & disinfection after lockdown

After the second phase of lockdown, some relaxations were provided by state Government to start the construction activities and office works. One of our livelihood groups "Clean 4 U" took this an opportunity to bag some cleaning work. They have cleaned and disinfected HOWE office, Port premises, CSR office, ASDC new skill centre and AVPPL City office

j. Online COVID Awareness sessions – ASDC

Based on the guidance and support of ASDC-HO, Vizhinjam team has explored the E-Learning facility for the youth from community at large through Blue Jeans app. Following training programmes are conducted through the online platform.

i. Covid19 awareness session to RTA and Digital Literacy teams.
ii. Covid-19 online training course of World Health Organization.

k. Online awareness training course – World Health Organization

All members of ASDC Vizhinjam have successfully attended the online course and got certified. Digital Literacy trainers also got certified after attending the course and shared the link to their beneficiaries.

- There are 50 more Digital Literacy beneficiaries were also successfully attended WHO course on COVID-19 and got certified.

- ASDC Vizhinjam team members along with CSR members started online awareness creation among community peoples on Covid-19.

Sl. No.	Team	Date & Time	No. of Participants	Remarks
1	Digital Literacy	10.04.2020 10.30 am	13	• Safety measures for preventing the spread of Covid19. • Symptoms of Covid19. • Hand hygiene.
2	RTA Students	12.04.2020 10.30 am	9	
3	Digital Literacy	11.04.2020 10.30 am	13	• Dos and Don'ts of mask users. • Quarantine measures and importance of self-isolations. • Shared DISHA number and official platforms for updates.
4	RTA Students	13.04.2020	9	

I. "Arogya setu" App and Covid19 online awareness course

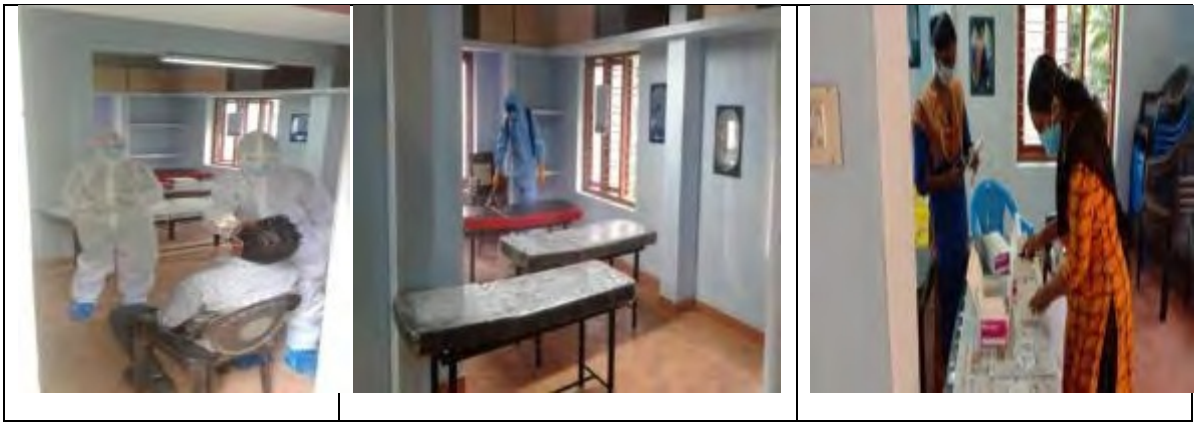
Another major task performed through online platform is to promote "Arogya setu" App developed by Government of India for providing the accurate updates as well as awareness on Covid19 for the citizens.

- During the reporting period 6 ASDC members, 10 Digital Literacy trainers, 250 Digital Literacy beneficiaries and other 35 community persons installed the app.
- Through this app people could find out the Covid19 case near to us and can know how safe they are?



m. Antigen test for COVID

Two antigen tests for COVID were conducted in association with Health department at our CSR office Mukkola on 7th & 12th August 2020. 200 people were screened in the test and identified 17 positive cases.



5.2 International Yoga Day (IYD) 2020 June 21st

- The international yoga day (IYD) of year 2020, under the theme "**Yoga at Home and Yoga with Family** was celebrated on 21st day of June 2020. The classes on yoga were set in strict covid prevention protocols, SMS (Social distancing, Mask and Sanitization. The session was handled by Yogacharyan Mr.Bindu Kumar and Dr.Akhil.

- Beginning with ***Guruvandanam,*** the emphasis was given to *pranayama* and its variance into the technique of ***Kapalbharati*** *and* ***Vrikshasana*** were practiced.

The one and half hour programme on yoga ended with ***Shanti mantra*** *and final* ***Guruvandanam***. Due to covid conditions, the participation was limited to 40 members

- It has been decided to continue the yoga classes from coming Saturday onwards at Adani Mukkola office from 9.00 a.m. to 10.30 a.m.






5.2. World Environment Day, June 05, 2020 - its "TIME #ForNature,

The World Environment Day was celebrated at Vizhinjam under the theme biodiversity "it's TIME ForNature" a concern that is both urgent and existential. The main points were discussed during the celebrations are as follows:

- Change your diet to more environmentally friendly foods
- Leave some green space in your garden
- Avoid buying single use plastics
- Recycle as much as you can
- Plant an urban garden in your backyard
- Minimize use of household chemicals
- Create a compost in your garden
- Explore how to buy locally produced products
-

Following are the important activities carried out jointly by CSR department and Environment department under AVPPL.

- A total of 500 saplings were planted on that day in communities and offices of CSR, ASDC and VIZMART.

a. Environmental day celebration at ASDC

The Theme for the day was presented and there after the team planted Saplings in the premises of ASDC campus.




b. Environment day celebration @Viz Mart, Vizhinjam

- The ASDC and CSR team handed over 1000 environment friendly Cloth Bags to VIZ Mart. Thereafter planted saplings in front of VIZ Mart, the market for selling of livelihood group products.




c. Environmental day celebrations @ CSR office Mukkola

A competition on developing literatures on Environmental theme was conducted among the students of literature group a week back. 66 entries were received online of which 12 were selected by the literature committee and Prizes were distributed to the winners on this environmental day. The celebration witnessed a beautiful song on nature sung by Mr. Adolf Jerome, group song by students and the messages on environmental day. Thereafter samplings were distributed to sanginis and planted a few in the office premises of CSR.






d. Environmental day celebrations @ Community Level by Sanginis

Distributed 200 saplings to the nearby communities through Sanginies, adolescent clubs and the parents of SAM-MAM children.








5.3. World Oceans Day (8th June 2020) – Restoration of Vellayani Lake, an Employee Volunteering Programme.

- The World Ocean day of 8th June, 2020 was memorialized through a novel exertion by the employees of Adani group, through its Employee's Voluntary Programme (EVP) by joining, hands in restoring Vellayani Lake.
- The event was conducted on 9th June 2020 with leading people's organization on Vellayani lake protection namely "*Neerthadaka Paristhidi Samrakshana Samithi" (organization for protection of Lake Ecosystem)*, members of local bodies.
- It was a sheer example of participatory eco restoration where the water hyacinth mat covering the Vellayani lake surface was manually uprooted and removed.
- The leaning work started at 6.00 am and concluded by 10.00 p.m. Of the total 100 members participated, 80 were employees of AVPPL, DREDGING DEPARTMENT, HOWE and SECURITY WING participated coordinated by Adan Foundation.
- Water hyacinth is the major weed of Vellayani Lake, currently causing difficulties to the water ecosystem. The mat forming nature of hyacinth, severely impacts biodiversity by preventing the entry of sunlight and oxygen to the bottom water.
- Moreover, their growth prevents the natural flow of water in irrigation channels and obstructs smooth navigation. Besides water hyacinth, the lake has huge deposits of plastics and related debris.

- This restoration event of June 9, 2020 through our EVP witnessed large level of enthusiasm and positive energy. One thing to be noted is the greater participation and leadership obtained from the women employees for their work accomplishment towards a social cause.
- The solidarity of the whole team could make up in the removal of tons of hyacinths in 3 and a half hour time.
- Adhering to the precautionary measures (SMS- social distancing, Mask usage and Sanitization) to be followed during the Corona pandemic, the volunteers used facemasks, sanitizers and social distancing, when engaged in the cleaning drive.
- Even though the cleaning drive could cover only part of the restoration process, five of the team members continued the cleaning works with local community for another six more days. Further, 250 meter nylon rope was provided for supporting the process of collecting the weeds.










5.4. Benevolent support to Mr. Suresh



Mr. Biju Thomas Mathew, Senior Officer, Stores Techno commercial of AVPPL donated Rs.10,000 for the support Mr. Suresh a bedridden patient from Mulloor during the reporting period. Mr. Suresh, a burst fracture T12 patient with paraplegia bilateral fracture calcaneus. He was the only breadwinner of a family having wife Sheeja, tow girl children and a boy. He was a contract employee of Kerala State Road Transport Corporation (KSRTC) department. As per the Hi-Court order KSRTC dismissed all the contract employees, and hence he lost his work. Once the income has stopped, he started working as daily wage painter with a contractor. During the work he fell down from a rooftop and become totally paralyzed. For the treatment, education and basic needs the family is struggling so hard. The donation was indeed a small support as a relief to the family.

5.5. Vayalinkara – Model Village Plan

A model village development plan is under process for the development of Vayalinkara area. A drainage plan, drinking water pipe line plan and street light plan were prepared and finalized with HOWE. The work has been progressing. A village level committee was constituted to support AF for the monitoring of the construction works. The villagers, especially housewives are also been

joined with the contractors in the construction activities. This has increased the ownership of community in the development of their areas.










5.6. Releasing of New Sports Jersey & nutritious support for Kovalam FC

Kovalam FC, the upcoming football club released their new jersey for the year with the support of Adani Foundation and Federal Bank. The New Jersey was released by Adv.M. Vincent, MLA, Kovalam. The nutritious food supply programme under the CSR of Adani Foundation for the emerging players was also initiated on the day. The nutritious support programme may continue for a period of one year.





5.7. Distribution of Wheel Chairs

As part of the benevolent support program, Adani Foundation provided four wheel chairs to four needy people in Kottappuram and Harbour wards. The wheel chairs were distributed in the presence of ward counsellors Ms. Shinyand Mrs. Nisabi handed from Kottappuram and Harbour wards respectively.









5.8. Widows Engagement Program

Adani Foundation has been decided to implement a widow's engagement plan in the intervention area. As part of the plan, two gatherings were organized during the reporting period on September 19th and 26th participated by 50 widows from 5 wards in the vizhinjam region. It is humble endeavor to raise the social cohesiveness of widowed mothers and raising their social status. Further, support them in linking to various government schemes and programmes. AVPPL/AF has presently provided bicycles to the girl children of windows from the five wards. Some of them have expressed their interest in livelihood programs and clean campaigns. It was decided to hold such meeting on every second Saturday.





5.9. EVP - Food to Old age home

Mr.Jayesh, one of the Staff members from HOWE supported Vizhinjam old age home with one day lunch.



5.10. Covid-19 Pandemic – Community Care Support

(A Community Response Initiative – Tele interaction with Community People)

A new initiative was introduced in connection with COVID-19 pandemic response activities during the reporting period was '**Tele interaction with community People**". CSR team members have been interacted with community people on a daily basis during the lockdown period over phone and extended support in the form of connecting government departments like health department, Trivandrum Corporation, Primary Health Centre, Community health Centre, ASHA workers, DISHA Health Help Line, Police Department, Political and Local leaders etc. Local volunteers are also provided support especially to distributed urgent medicines according to the instructions of CSR team members. The grievances collected during the tele counselling will help us to plan the post covid activities. A total of 477 cases were handled during the period

5.11. Convergence of Govt. Schemes

AVPPL/AF started the procedures to converge Govt. Grant-in-aids schemes in CSR activities. The CSR team have collected the details of various schemes and compiled in an excel sheet for further follow up and reporting. Among that, following schemes are identified to engage with community on an immediate basis.

Sl.No	Schemes
1	Old age Pension & Widow Pension
2	Treatment support for the poor (cancer, kidney failure, heart disease…)
3	Self-employment schemes
4	Grow bags, econ-shop, horticulture
5	Sports items, Sports Coaching classes, distress relief fund
6	Skilling schemes
7	Educational Scholarships

Further the schemes need to validate with concerned department before wide circulation. For this online interactions with following departments were scheduled and initiated.

Sl.No	Date	Department	Resource Person
1	27.07.2020	Fisheries	Mrs. Beena, Deputy Director Fisheries
2	20.08.2020	NABARD	Mr. Ajish Balu, DDM Trivandrum
3	20.08.2020	Agriculture	Mrs. Tushara, Agriculture officer, Vizhinjam
4	20.08.2020	Animal husbandry	Dr. Asha, Veterinary Surgeon, Vizhinjam

It is also decided to start online platforms (WhatsApp) separately as widows group, families of Oldage people group, adolescent group, youth group, women's group, livelihood group, volunteers group, digital literacy group, skills group…etc to share the modalities of the schemes to needy community beneficiaries and for right follow-up. Two such WhatsApp groups named "Phoenix – for Widows and divorced" and 'Shalabhangal- Butterflies for children below 18yrs old" have started. Concerned Information has been sharing to the groups. A monitoring

sheet has also prepared to update the progress of conversion by the respective staff. The details application for various schemes is as follows

Sl.No	Schemes	No. of People			
		July	Aug	Sept	Total
1	Widow's/Divorcee Pension Scheme	16		5	21
2	Snehapoorvam- Education Support Scheme	4		5	9
3	Disability Pension Scheme	1			1
4	LIFE Housing Scheme	3	31		34
Total		**24**	**31**	**10**	**65**

5.12. Independence day Celebration

CSR team celebrated Independence Day with Kovalam FC, a professional football club providing football training to the youth of Vizhinjam.





5.13. Hospital beds to Mukkola PHC

AVPPL/AF supported Primary Health Centre by providing 10 Craft Model semi fowler hospital beds. The new foldable and movable hospital beds were handed over to hospital by Dr. Anil Balakrishnan in the presence of Adv. M. Vincent, MLA for Kovalam and Mrs. C. Omana, Ward Counsellor for Mulloor ward. Presently this hospital is a COVID test center. The beds were provided for the new building constructed by Trivandrum Corporation.





5.14. World Photography Day

AVPPL/AF observed World Photography Day on 19-08-2020 by conducting a webinar and a photography competition.

The webinar was handled by Mr.Vishnu T R, the Youngest Cinematographer in Kerala, India for once debuting his feature by the age of 20 for "Sethu" (Postponed due to COVID19).

The session gave information on different technicalities while taking photos, guidelines for taking good photos and frames of taking good photographs. An online competition was also conducted for the participants thereafter. A total of 42 participants participated under the theme of "Motherhood during COVID-19".The winners were appreciated by giving e-certificates.





		
First prize	**Second Prize**	**Third Prize**

5.15. Distribution of wheel chairs & Onam celebration @ VizMart

CSR team and ASDC team along with Livelihood group members celebrated Onam on 29th August 2020 at VizMart, Vizhinjam. Being the occasion of Onam Team members made a floral design with vegetables. All the team members were in Kerala style dress code and conducted some entertainments at VizMart. More importantly 11 number of Wheel chairs were procured and four were distributed under EVP on that day to kids and aged people who are struggling in their life to have such a support.





List of benevolent – distribution of wheel chairs

Sl No	Name	Age	Ward	Disease	Type of Wheel Chair
1	Rakesh	12	Kottappuram	Muscular Dystrophy affected all 4 limbs. Unable to walk grade 2 power lower limb than upper limb	Electronic Wheel Chair

2	Shobana	55	Venganoor	Left side paralysis of the body after the bike accident.	Wheel Chair
3	Kebeer	60	Harbour	Impairment of locomotion.	Wheel Chair
4	Abinraj	8	Mulloor	Diplopia Siemen, speak less, walk less depended all activities.	Wheel Chair






5.16. Reporting the progress of Vizhinjam Port to community stakeholder.

As per the environmental audit compliance, it has been decided to circulate the progress of Port activities on a monthly basis to maximum community stakeholders. During the reporting month following progress were reported to 590 members through virtual platforms

Project Component (Phase I)	Status
Container Berth (800 mtr long)	Piling & Beams completed for 800 mtr. Slabs will be installed once breakwater work advances
Breakwater(3.1 km long)	620 mtr completed. Rock sourcing and stockpiling is in progress
Fishery berth & harbour	Work will commence in consultation with local fishermen and Government
Port yard and buildings	• Port Operation Building completed. • All other buildings are at advanced stage of completion • Yard construction in progress
Port Access Road (2 Km)	In progress. 2 nos bridge construction in progress
Main Electrical Substation and Port Electrical System	Construction completed. Commissioning will be done soon

Table depicting the details of members informed on Port developmental activities

Sl.No	**Group**	**No .of Families reached**		
		July	**Aug**	**Sept**
1	Competitive Exam Coaching	242	68	112
2	Open House	31	21	28
3	Literature Group	27	24	22
4	Digital Literacy Resource Persons	15	15	15
5	Digital Literacy Community Group	148	198	326
6	Phoenix – Widows Group	46	46	52
7	Children's Group	94	94	97
8	SuPoshan Group	12	12	12
9	Swachhagraha	125	112	117
Total		**740**	**590**	**781**

5.17. Building support to AKG memorial Higher Secondary School

An amount of Rs.1 Crore has been provided under CSR to AKG Memorial Higher Secondary school for the new building planned in the school. The cheque was formally handed over by Shri.Rajesh Jha, CEO AVPPL in the presence of Shri.Sushil Nair, Head Corporation Affairs and Dr.Anil Balakrishnan, Head, CSR. It is one of the reputed schools in Thalasseri Education Division of Pinarayi Panchayat in the district of Kannur. The school has been started functioning since 1977.



The amount is provided for the new international school building of Rs.23 crore proposed for Higher Secondary. Other major contributors for this school are Education Department, NABARD and major companies.

5.18. Community Grievances

a. Cleaning of "Gangayar Canal"

The dredging department of HOWE is cleaning the sand accumulated at the mouth of Gangayar Canal joining sea at Valiyakadappuram every day. The sand accumulation earlier caused flooding of more than 100 houses during rainy season. The support provided by HOWE is saving life of more than 100 families. A proposal for permanent solution as detailed is progressing

- 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 a distance of 500 m &
- A footbridge



b. Drain Cleaning – Vayalinkara before monsoon

As per the request from Vizhinjam parish and the residents of Vayalinkara, AVPPL/AF cleaned a major drain at Mariayan Nagar near Vizhinjam sea port during the reporting period. The Sanitation workers of Trivandrum Municipal Corporation and a team from Vizhinjam Fire station extended their help in removing garbage from the drain










c. Drain Cleaning – Kottappuram before monsoon

The cleaning of major drains at Kottappuram has been started on 25.04.2020. This has been started based on the meeting chaired by Mayor. The work has been entrusted with Health Inspector along with Adani Port. The Ward counsellor of Kottappuram, Health Inspector of Vizhinjam Zone and the sanitation workers from Corporation has led the campaign. The CSR team support along with JCV has been provided form Port for the campaign. .



d. Cleaning of Vegetation

CSR started cleaning the areas close to port where community people complaints about vegetation and attack of reptiles and flies. This group consist of seven women from the local communities who are undertaking the jobs which earlier were done by men. Following areas cleaned during the period

- Karimpallikkara
- Pocket – 4 Near Panavila Temple, Mulloor
- Chappath Punnakilam
- Break water – 1 area &
- Kottappuram
- Devarkulam near Kalingnada Junction













5.20 Media Coverage



കേരള കൗമുദി

മുഴുവൻ തൊഴിലാളികൾക്കും ഭക്ഷ്യധാന്യങ്ങൾ വിതരണം ചെയ്യുന്ന അന്യ സംസ്ഥാന തൊഴിലാളികൾക്ക് വാർഡ് കൗൺസിലർ സി. മോനായുടെയും നിരീക്ഷണം എസ്.ഐ. എസ്.ബി പ്രവീൺകുമാറിന്റെയും നേതൃത്വത്തിൽ ഭക്ഷ്യ ധാന്യ കിറ്റ് വിതരണം ചെയ്യുന്നു

കേരളകൗമുദി വാർത്ത തുണച്ചു

അന്യ സംസ്ഥാന തൊഴിലാളികൾക്ക് ഭക്ഷ്യധാന്യങ്ങളെത്തി

കൊരളം: തെക്കിടവൻപ്രദേശത്തെ പുതിയ കെട്ടിടങ്ങളിൽ താമസിക്കുന്ന അന്യ സംസ്ഥാന തൊഴിലാളികൾക്ക് കേരളകൗമുദി വാർത്ത തുണയായി.

വാടകയ്ക്കു മുഴുവൻ വാർഡിലെ 35ഓളം അന്യ തൊഴിലാളികൾ ഭക്ഷണമില്ലാതെ കഷ്ടപ്പെടുന്ന വാർത്ത കഴിഞ്ഞ ദിവസമാണ് കേരളകൗമുദി പ്രസിദ്ധീകരിച്ചത്. ഇത് ശ്രദ്ധയിൽപ്പെട്ടതോടെ സാമൂഹ്യപ്രവർത്തകനായ സി. മോനായും വിവിധ രാഷ്ട്രീയ പാർട്ടി പ്രവർത്തകരും ചേർന്ന് കുടുംബങ്ങൾക്ക് ഭക്ഷ്യധാന്യങ്ങൾ വിതരണം ചെയ്തു. പണം തീർന്ന് പുറത്തിറങ്ങാൻ പോലുമാകാതെയാണ് ഇവർ പട്ടിണിയിലായത്. എന്നാൽ കൊറോണ ഭീതിയുടെ കാരണം ഇവരെ തിരിഞ്ഞുനോക്കിയില്ലെന്നാണ് ആക്ഷേപമുണ്ട്.

അന്യസംസ്ഥാന തൊഴിലാളി ക്യാമ്പുകളിൽ പരിശോധന ശക്തമാക്കി

തിരുവനന്തപുരം: തലസ്ഥാനത്തെ അന്യ സംസ്ഥാന തൊഴിലാളികൾ താമസിക്കുന്ന സ്ഥലങ്ങളിൽ പരിശോധന ശക്തമാക്കി സിറ്റി പോലീസ് കമ്മീഷണർ നാഗരാജുവിന്റെ നേതൃത്വത്തിലും തൊഴിലാളികൾക്കായി സൗകര്യങ്ങൾ ഒരുക്കിയിരുന്നു.

ഡെപ്യൂട്ടി കമ്മീഷണർമാരുടെ നേതൃത്വത്തിൽ സംഘടിതകൊള്ളസംഘത്തിനായി പരിശോധിച്ചിരുന്ന നാടോടി സംഘത്തിന്റെ ക്യാമ്പ് ഇന്നലെ അസി. കമ്മീഷണറുടെ നേതൃത്വത്തിൽ സന്ദർശിച്ചു. ഇവർക്കാവശ്യമായ ഭക്ഷണം കണ്ടെത്തി കിച്ചണുകൾ വഴി നൽകുവാൻ അസി. കമ്മീഷണർ ജില്ലാ പോലീസ് മേധാവിയുടെ നിർദേശം നൽകി. കഴിഞ്ഞയാഴ്ച തലസ്ഥാനത്തെത്തി ലോക്ക് ഡൗൺ കാരണം നാട്ടിലേക്ക് തിരിച്ചുപോകാനാകാതെ ഉത്തർപ്രദേശ് സ്വദേശികളായ 26 പേരാണ് ഈ സംഘത്തിലുള്ളത്. ഇവർക്കായി ഷെൽട്ടർ ഹോമുകൾ ഏർപ്പെടുത്തിയിരുന്നു

2020 ഏപ്രിൽ 8 ബുധൻ
മലയാള മനോരമ

സമൂഹ അടുക്കള: അദാനി ഫൗണ്ടേഷൻ ഭക്ഷ്യധാനം നൽകി

കോവിഡ് പ്രതിരോധ പ്രവർത്തനങ്ങൾക്ക് സഹായഹസ്തവുമായി അദാനി ഫൗണ്ടേഷൻ





മുഖ്യമന്ത്രിയുടെ ദുരിതാശ്വാസനിധിയിലേക്ക് അദാനി ഗ്രൂപ്പ് അഞ്ചു കോടി രൂപ നൽകി

സഹായവുമായി അദാനി ഫൗണ്ടേഷൻ

കോവളം: നഗരസഭയുടെ വിഴിഞ്ഞത്തെ കമ്മ്യൂണിറ്റി കിച്ചണിലേക്ക് അദാനി ഫൗണ്ടേഷൻ ഭക്ഷ്യധാന്യങ്ങൾ സംഭാവന നൽകി.

കഴിഞ്ഞ ദിവസങ്ങളിൽ കൊട്ടപ്പുറം, മുല്ലൂർ പ്രദേശങ്ങളിലെ അന്യസംസ്ഥാന തൊഴിലാളികളുടെ ക്യാമ്പുകളിലേക്കും അരിയും പലചരക്ക് സാധനങ്ങളും ഫൗണ്ടേഷന്റെ നേതൃത്വത്തിൽ വിതരണം ചെയ്തിരുന്നു.

THE TIMES OF INDIA, AHMEDABAD
THURSDAY, APRIL 9, 2020

UNMASKED

Adani Foundation powers women self-help groups

TIMES NEWS NETWORK





Women self help groups aided by Adani Saksham, a part of Adani Foundation, have been producing N 95 masks for free distribution. So far, Adani Foundation, the CSR arm of Adani Group, has produced and distributed more than 1,72,00 masks in states like Gujarat, Chhattisgarh, Kerala, Tamil Nadu and Jharkhand.

"There has been a commendable effort from women to safeguard the communities, which is the need of the hour. Members of our Adani Saksham Skill Development Centres in Mundra and Trivandrum have been constantly engaged in making masks to ensure a steady supply," said Preeti Adani, chairperson of Adani Foundation.

The organization has also provided 100 ventilators to the Ahmedabad Municipal Corporation followed by PPEs (personal protective equipment). In Ahmedabad, the foundation has distributed masks to policemen on duty and to doctors for nursing staff working with them.

In Gokla, Jharkhand the foundation helped produce 1 lakh masks made by women of self-help group (SHG) Phoolo Jhano Saksham Sakhi Mandal and handed them to the district administration. Adani Foundation also distributed another 17,000 masks in the villages.

At Mundra in Gujarat, more than 12,000 masks made by SHG Saheli have been distributed to police, ICDS department, education department, labourers, drivers and others, said sources. The Adani GAIMS Hospital is well-equipped for handling Covid-19 cases in Kutch, said an Adani group

Tankara women join hands for making, donating masks

TIMES NEWS NETWORK



While the entire government machinery of the country is engaged in its fight against

ദുരിതാശ്വാസത്തിന് അദാനിയുടെ 5 കോടി

തിരുവനന്തപുരം • മുഖ്യമന്ത്രിയുടെ കോവിഡ് 19 ദുരിതാശ്വാസ നിധിയിലേക്ക് അദാനി ഗ്രൂപ്പ് 5 കോടി രൂപ നൽകി. പ്രധാനമന്ത്രിയുടെ ദുരിതാശ്വാസ നിധിയിലേക്ക് 100 കോടി രൂപയും, മഹാരാഷ്ട്ര, ഗുജറാത്ത്, ജാർഖണ്ഡ് മുഖ്യമന്ത്രിമാരുടെ ദുരിതാശ്വാസനിധിയിലേക്കു 1 കോടി രൂപ വീതവും നേരത്തെ സംഭാവന ചെയ്തിരുന്നു. സംസ്ഥാനത്തു സമൂഹ അടുക്കളയ്ക്കും പ്രതിരോധ പ്രവർത്തങ്ങൾക്കും സഹായം നൽകി.

മുഖ്യമന്ത്രിയുടെ ദുരിതാശ്വാസ നിധി: അദാനി ഗ്രൂപ്പ് 5 കോടി നൽകി

തിരുവനന്തപുരം

കോവിഡ്–19 പ്രതിരോധ പ്രവർത്തനങ്ങൾക്കായി മുഖ്യമന്ത്രിയുടെ ദുരിതാശ്വാസ നിധിയിലേക്ക് വിഴിഞ്ഞം തുറമുഖ നിർമാണ കമ്പനിയായ അദാനി ഗ്രൂപ്പ് അഞ്ചു കോടി രൂപ നൽകി. ബ്രേക്ക് ദ ചെയിൻ ക്യാമ്പയിന്റെ ഭാഗമായി പൊതുസ്ഥലങ്ങളിൽ ശുദ്ധജലവും സോപ്പും ലഭ്യമാക്കി കമ്പനി കൈകഴുകൽ പ്രോത്സാഹിപ്പിക്കുന്നുണ്ട്. ആരോഗ്യപ്രവർത്തകർ, സന്നദ്ധപ്രവർത്തകർ, ഉദ്യോഗസ്ഥർ എന്നിവർക്ക് മാസ്ക്കുകൾ, സാനിറ്റൈസർ എന്നിവ വിതരണം ചെയ്യുന്നുണ്ട്. വിഴിഞ്ഞം പദ്ധതി പ്രദേശത്ത് പ്രവർത്തിക്കുന്ന സാമൂഹ്യ അടുക്കളകളിലേക്ക് സാധനങ്ങളും വിതരണം ചെയ്തു.

Adani Ports donates ₹5 cr. to State

THIRUVANANTHAPURAM

Adani Ports has donated ₹5 crore to the State as assistance for the efforts to combat the COVID-19 pandemic. Gautam Adani, president, Adani Foundation, announced the contribution on his Twitter handle. The foundation has also joined hands with the State for the 'Break the Chain' movement at Vizhinjam. The other initiatives include installation of water taps, supply of provisions for community kitchen and distribution of sanitisers and face masks.

Adani Ports & SEZ donate ₹5cr to state govt

'Thiruvananthapuram: In the wake of the ongoing nation-wide lockdown to mitigate the Covid-19 pandemic, Adani Ports and Special Economic Zone contributed Rs.5 crore to the state government "as an initiative to reach out to the masses and unite to combat coronavirus".

Lauding "the gratifying efforts undertaken to curb the vast spread of the virus across the country", group chairman Gautam Adani announced the contribution on his Twitter handle and said the contribution to Kerala government was a step towards the goodness quotient of the conglomerate's motto.

A release from Adani Foundation cited various activities in Kerala initiated by the group to help fight Covid-19 such as joining the 'break the chain' movement in Vizhinjam, installation of water taps in public areas, supply of provisions for community kitchen, distribution of sanitizers and reusable face-masks and campaign to raise awareness about Covid-19 among communities. TNN

Adani Ports donates ₹5 cr to state relief fund

T'Puram: To fight the Covid-19 pandemic, Adani Ports & Special Economic Zone contributed ₹5 crore to the state government. Adani Foundation, the Corporate Social Responsibility (CSR) wing of the Adani Group, had already supported the government's fight against the pandemic by joining the 'Break the Chain' movement in Vizhinjam. Chairman of Adani Group Gautam Adani announced the contribution through his Twitter handle. The firm has been at the forefront of installing water taps in public places, the supply of provisions for community kitchens and making and distribution of sanitisers and reusable facemasks.

വയോധികയെ കുറ്റിക്കാട്ടിൽ ഉപേക്ഷിച്ച മക്കൾക്കെതിരേ കേസ്



വെള്ളായണി കായൽ ശുചീകരണത്തിൽ അദാനി വിഴിഞ്ഞം തുറമുഖവും



അദാനി വിഴിഞ്ഞം തുറമുഖ കമ്പനി ലോക പരിസ്ഥിതി ദിനാഘോഷങ്ങൾ സംഘടിപ്പിച്ചു





കുളവാഴകൾ നീങ്ങും; കുഞ്ഞോളങ്ങളുണരും





വെള്ളായണി കായൽ ശുചീകരിച്ചു



് തടസപ്പെട്ടു; ി നശിച്ചു



വെള്ളായണി കായൽ ശുചീകരിച്ചു

മംഗളം Fri, 12 June 2020
epaper.mangalam.com/c/52698282



പെൺകുട്ടികൾക്ക് സൈക്കിളുകൾ വിതരണം ചെയ്തു

അന്താരാഷ്ട്ര യോഗ ദിനം ആചരിച്ചു



International Widows' Day – Cycle distribution

ത്തിൽ ഉണ്ട്.

ഇന്നലെ 580 സാമ്പിളുകൾ പരിശോധനയ്ക്കായി അയച്ചു. ഇന്നലെ 287 പരിശോധന ഫലങ്ങൾ ലഭിച്ചു. 4 പേർക്ക് രോഗം സ്ഥിരീകരിച്ചു.

തലസ്ഥാനത്ത് ഇന്നലെ രോഗം സ്ഥിരീകരിച്ചവർ

തിരുവനന്തപുരം: 29 വയസുള്ള പുരുഷൻ– കൈമനം, പാപ്പനംകോട് സ്വദേശി– ദമാമിൽ നിന്ന് ജൂൺ 20ന് എത്തി.

33 വയസുള്ള പുരുഷൻ, 27 വയസുള്ള സ്ത്രീ– ഇരുവരും പൗഡിക്കോണം സ്വദേശികൾ– ഡൽഹിയിൽ നിന്ന് ജൂൺ ഏഴിന് എത്തി.

27 വയസുള്ള പുരുഷൻ– പേട്ട സ്വദേശി– കുവൈറ്റിൽ നിന്ന് ജൂൺ 16ന് എത്തി.

സൈക്കിളുകൾ വിതരണം ചെയ്തു

വിഴിഞ്ഞം: അന്താരാഷ്ട്ര വിധവാ ദിനത്തോടനുബന്ധിച്ച് അദാനി ഫൗണ്ടേഷന്റെ നേതൃത്വത്തിൽ വിഴിഞ്ഞം പ്രദേശത്തെ വിധവകളുടെ പെൺമക്കൾക്ക് സൈക്കിളുകൾ വിതരണം ചെയ്തു. അഞ്ചാം ക്ലാസിനും എട്ടാം ക്ലാസിനും ഇടയിൽ പഠിക്കുന്ന പെൺകുട്ടികൾക്ക് കമ്പനിയുടെ സാമൂഹ്യ പ്രതിബദ്ധതാ പദ്ധതിയുടെ ഭാഗമായി നൽകിയ സൈക്കിളുകളുടെ വിതരണോദ്ഘാടനം എം. വിൻസെന്റ് എം.എൽ.എ നിർവഹിച്ചു.

വിഴിഞ്ഞം തുറമുഖം പ്രവർത്തനം ആരംഭിക്കുന്നതിന് മുമ്പ് തന്നെ അതിന്റെ ഗുണഫലങ്ങൾ ജനങ്ങൾക്ക് ലഭ്യമായി തുടങ്ങി എന്നതിന്റെ പ്രകടമായ ഉദാഹരണങ്ങളാണ് മുല്ലൂർ യു.പി സ്കൂൾ, ഹാർബർ എൽ.പി സ്കൂൾ, വിഴിഞ്ഞം പ്രാഥമിക ആരോഗ്യ കേന്ദ്രം എന്നിവയ്ക്കായി നിർമ്മിച്ച് നൽകിയ പുതിയകെട്ടിടങ്ങളും ഇത്തരം ജീവകാരുണ്യ പ്രവർത്തനങ്ങളുമെന്ന് എം. എൽ.എ പറഞ്ഞു. മുല്ലൂരിൽ നടന്ന ചടങ്ങിൽ വാർഡ് കൗൺസിലർ സി. ഓമന അധ്യക്ഷതവഹിച്ചു. അദാനി ഗ്രൂപ്പ് ദക്ഷിണേന്ത്യാ സാമൂഹ്യപ്രതിബദ്ധത വിഭാഗം മേധാവി ഡോ. അനിൽബാലകൃഷ്ണൻ മുഖ്യപ്രഭാഷണം നടത്തി. വിഴിഞ്ഞം പ്രദേശത്തെ 5 സ്കൂൾ വാർഡുകളിലായി 100 പെൺകുട്ടികൾക്കാണ് സൈക്കിളുകൾ വിതരണം ചെയ്യുന്നത്.



• അദാനി ഫൗണ്ടേഷന്റെ നേതൃത്വത്തിൽ വിധവകളുടെ പെൺമക്കൾക്ക് സൈക്കിളുകൾ വിതരണം ചെയ്യുന്ന പദ്ധതിയുടെ ഉദ്ഘാടനം എം.വിൻസെന്റ് എം.എൽ.എ നിർവ്വഹിക്കുന്നു.

മംഗളം Wed, 24 June 2020
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അന്താരാഷ്ട്ര വിധവാ ദിനത്തിൽ വിധവകളുടെ പെൺമക്കൾക്ക് സൈക്കിളുകൾ വിതരണം ചെയ്തു



ലോക യുവജന ദിനത്തിൽ ഓൺലൈൻ മത്സര പരീക്ഷാ പരിശീലനത്തിന് തുടക്കമായി



ഉൾപ്പെടെ 68 പേർ കോറന്റയിനിലാ

പരിശീലനത്തിന് തുടക്കമായി

വിഴിഞ്ഞം: ലോക യുവജന ദിനത്തോടനുബന്ധിച്ച് അദാനി ഗ്രൂപ്പിന്റെ സാമൂഹ്യപ്രതിബദ്ധത പദ്ധതികളുടെ ഭാഗമായി മത്സര പരീക്ഷാ പരിശീലന പരിപാടി തുടങ്ങി. ഓൺലൈനായി നടത്തുന്ന പരിശീലന പരിപാടി ശശി തരൂർ എം.പി. വീഡിയോ കോൺഫറൻസിങ്ങിലൂടെ ഉദ്ഘാടനം ചെയ്തു. തുറമുഖ കമ്പനി ചീഫ് എക്സിക്യൂട്ടീവ് ഓഫീസർ രാജേഷ് ഝാ അധ്യക്ഷതവഹിച്ചു. എം.പി. ജോസഫ്, പി.എൻ. റോയ് ചൗധരി, വസന്ത് ഗദിഎന്നിവർ പ്രസംഗിച്ചു.

മംഗളം Fri, epap



ലോക മുലയൂട്ടൽ വാരം ആഘോഷിച്ചു

വിഴിഞ്ഞം : അദാനി വിഴിഞ്ഞം തുറമുഖ കമ്പനിയുടെ സാമൂഹിക പ്രതിബദ്ധത വിഭാഗമായ അദാനി ഫൗണ്ടേഷൻ ഓഗസ്റ്റ് 1 മുതൽ ഓഗസ്റ്റ് 7 വരെ ലോക മുലയൂട്ടൽ വാരം ആഘോഷിച്ചു .

ആരോഗ്യമുള്ളൊരു തലമുറയ്ക്കായി മുലയൂട്ടൽ പ്രോത്സാഹിപ്പിക്കാം എന്നതായിരുന്നു ഈ വർഷത്തെ വിഷയം.

പോഷണ ശോഷണവും വിളർച്ചയും തടയുന്നതിനായി അദാനി ഫൗണ്ടേഷൻ നടപ്പിലാക്കി വരുന്ന സുപോഷൺ പദ്ധതിയുടെ ഭാഗമായാണ് വാരാഘോഷം സംഘടിപ്പിച്ചത്

കോവിഡ് മഹാമാരിയുടെ പശ്ചാത്തലത്തിൽ ഓൺലൈൻ വെബ്ബിനാറുകളിൽ കൂടി ഈ വർഷത്തെ വിഷയം ആസ്പദം ആക്കി ഗർഭിണിമാരായ സ്ത്രീകൾ , പാലൂട്ടുന്ന അമ്മമാർ എന്നിവർക്ക് ബോധവത്കരണം നൽകുകയും കൗമാരക്കാരായ പെൺകുട്ടികൾക്കും അമ്മമാർക്കുമായി വിവിധ ഓൺലൈൻ മത്സരങ്ങൾ നടത്തുകയും ചെയ്തു.

ആദ്യദിന വെബ്ബിനാർ ഐ സി ഡി സ് , വിഴിഞ്ഞം സെക്ടറിലെ സൂപ്പർവൈസർമാരായ ശ്രീമതി.ദീപ സ് നായർ , ശ്രീമതി. ദിവ്യ എന്നിവർ ചേർന്ന് സമ്പൂർണ മുലയൂട്ടൽ എന്ന വിഷയത്തിൽ ക്ലാസ് നയിച്ചു .

രണ്ടാം വെബിനാറിൽ ശ്രീമതി.രശ്മി എസ് ഡെപ്യൂട്ടി ഡിസ്ട്രിക് എഡ്യുക്കേഷൻ & മാസ്സ് മീഡിയ ഓഫീസർ ,ആരോഗ്യ വകുപ്പ് തിരുവനന്തപുരം മുലയൂട്ടൽ : അമ്മയ്ക്കും കുഞ്ഞിനും ഉള്ള ഗുണങ്ങൾ എന്ന വിഷയത്തിലാണ് ക്ലാസ് നയിച്ചത്.

മൂന്നാം വെബിനാർ മുലയൂട്ടൽ : അമ്മയുടെയും കുഞ്ഞിന്റെയും വൈകാരിക ബന്ധം എന്നതായിരുന്നു. അതിയന്നൂർ സി ഡി പി ഓ ആയ ശ്രീമതി.താരയും കോട്ടുകാൽ പഞ്ചായത്തിലെ ഐ സി ഡി സ് സൂപ്പർവൈസർ ശ്രീമതി.ലതയുമാണ് ഈ ക്ലാസിന് നേതൃത്വം നൽകിയത്. വെബിനാറുകളിൽ 200 ലധികം പേർ പങ്കെടുത്തു.

ഉപന്യാസം,കവിത രചന,ചിത്ര രചന തുടങ്ങിയ ഓൺലൈൻ മത്സരങ്ങളിൽ കൗമാരക്കാരായ പെൺകുട്ടികൾ,അമ്മമാർ,വിഴിഞ്ഞം ഏരിയ അംഗൻവാടി വർക്കറുമാർ,സുപോഷൺ ഫീൽഡ് തല പ്രവർത്തകരായ സംഗിണിമാർ തുടങ്ങിയവർ പങ്കെടുത്തു.

അദാനി ഫൗണ്ടേഷൻ ദക്ഷിണ ഇന്ത്യാ മേധാവി ഡോ.അനിൽ ബാലകൃഷ്ണൻ ,സീനിയർ പ്രൊജക്റ്റ് ഓഫീസർ ശ്രീ.സെബാസ്റ്റിൻ ബ്രിട്ടോ ,പ്രൊജക്റ്റ് ഓഫീസർ കുമാരി.മീര മറിയം സ്കറിയ, ശ്രീമതി. മായ എന്നിവർ പരിപാടികൾക്കു നേതൃത്വം നൽകി.

മുക്കോല പ്രാഥമികാരോഗ്യ കേന്ദ്രത്തിന്റെ പുതിയ ഇരുനില കെട്ടിടം പൂർത്തിയായി



• മുക്കോല പ്രാഥമികാരോഗ്യ കേന്ദ്രത്തിലേക്ക് അദാനി ഫൗണ്ടേഷൻ നൽകുന്ന ആത്യാധുനിക കിടക്കകൾ സിഎസ്ആർ ഹെഡ് ഡോ. അനിൽ ബാലകൃഷ്ണൻ കൈമാറിയപ്പോൾ. എം. വിൻസെന്റ് എംഎൽഎ, വാർഡ് കൗൺസിലർ സിഓമന എന്നിവർ സമീപം

വിഴിഞ്ഞം: നഗരസഭ മുല്ലൂർ വാർഡിൽ മുക്കോല പ്രാഥമികാരോഗ്യകേന്ദ്രത്തിനായി പുതുതായി നിർമ്മിച്ച ഇരുനില കെട്ടിടം പൂർത്തിയായി. ആശുപത്രി സൗകര്യങ്ങൾ കൂടി കെട്ടിടം അധികൃതർക്ക് കൈമാറാൻ കോവിഡ് പ്രോട്ടോക്കോൾ പാലിച്ച് കഴിഞ്ഞ ദിവസം നടന്ന ലളിതമായ ചടങ്ങിൽ എം. വിൻസെന്റ് എംഎൽഎ പറഞ്ഞു. ഈ മാസം 20 മുതൽ പുതിയ കെട്ടിടത്തിൽ ആശുപത്രി സേവനം ലഭ്യമാക്കുമെന്ന് അധികൃതർ അറിയിച്ചു. രോഗിയിൽ കിടത്തി ചികിത്സ ഉൾപ്പെടെ ലഭ്യമാക്കുന്നതിനുള്ള സംവിധാനങ്ങൾ ഒരുക്കിയ ആശുപത്രിയിലേക്ക് ക്രാഫ്റ്റ് മോഡലിലുള്ള 10 സെമി ഫൗളർ കിടക്കകൾ അദാനി ഫൗണ്ടേഷൻ സിഎസ്ആർ ഹെഡ് അനിൽ ബാലകൃഷ്ണൻ കൈമാറി. രോഗികളുടെ ശാരീരിക അവസ്ഥകൾക്ക് അനുസരിച്ച് ക്രമീകരി ക്കാവുന്നതും ആവശ്യാനുസരണം മറ്റിടങ്ങളിലേക്ക് കൊണ്ടു പോകാവുന്ന വിധത്തിലുള്ളതാണ് കിടക്കകൾ. പി എച്ച് സി യുടെ സമീപത്തായി പ്രവർത്തിച്ച് വരുന്ന കൊമിയോ ആശുപത്രിക്ക് കൂടുതൽ സൗകര്യം ലഭ്യമാക്കുന്നതിനായി നിർമ്മിച്ച ഭവനം നിലവിലെ ഉദ്ഘാടനം കോവിഡ് പ്രോട്ടോക്കോൾ പാലിച്ച് കൊണ്ട് വ്യാഴാഴ്ച വൈകിട്ട് നാലിന് മേയർ കെ. ശ്രീകുമാർ വീഡിയോ കോൺഫറൻസ് വഴി നിർവഹിക്കുമെന്ന് വാർഡ് കൗൺസിലർ സിഓമന പറഞ്ഞു.

മംഗളം Mon, 17 August 2020
epaper.mangalam.com/c/54286109



മുക്കോല പ്രാഥമികാരോഗ്യ കേന്ദ്രത്തിലേക്ക് അദാനി ഫൗണ്ടേഷൻ നൽകുന്ന ആത്യാധുനിക കിടക്കകൾ സിഎസ്ആർ ഹെഡ് ഡോ. അനിൽ ബാലകൃഷ്ണൻ കൈമാറിയപ്പോൾ. എം.വിൻസെന്റ് എംഎൽഎ, വാർഡ് കൗൺസിലർ സിഓമന എന്നിവർ സമീപം.

അദാനി തുറമുഖ കമ്പനി മുക്കോല പ്രാഥമികാരോഗ്യ കേന്ദ്രത്തിന് അത്യാധുനിക കിടക്കകൾ നൽകി





മണ്ണാര പരീക്ഷാ പരിശീലന പരിപാടി തുടങ്ങി



അദാനി വിഴിഞ്ഞം തുറമുഖ കമ്പനിയുടെ സാമൂഹ്യ പ്രതിബദ്ധതാ പദ്ധതി പ്രകാരമായി മുക്കോല പ്രാഥമികാരോഗ്യ കേന്ദ്രത്തിന് അത്യാധുനിക കിടക്കകൾ നൽകിയപ്പോൾ. എ.വിൻസന്റ് എംഎൽഎ, കൗൺസിലർ സി.ഓമന, സാമൂഹ്യപ്രതിബദ്ധത വിഭാഗം ദക്ഷിണ ഇന്ത്യാ മേധാവി ഡോ അനിരുദ്ധ് ബാലകൃഷ്ണൻ എന്നിവർ സമീപം.



Port operation building inaugurated at Vizhinjam

TIMES NEWS NETWORK

Thiruvananthapuram: Vizhinjam International Seaport on Wednesday took one step closer to being fully operational. Minister for ports Kadannappally Ramachandran on Wednesday inaugurated the port operation building (POB) of Adani Vizhinjam Ports Private Ltd in a virtual ceremony held here.



The POB will be the nerve centre of port operations with a state-of-the-art control room and amenities such as canteen, medical aid centre and accommodation facility

INT'L SEAPORT

The port operation building is the most important installation of the port. It will be the nerve centre of port operations.

All major operations such as guiding the traffic of ships in the port as well as moving of containers using cranes can be controlled remotely from the control room of the POB.

This is a first-of-its-kind facility in the country. The POB is a four-storey building with a state-of-the-art control room and amenities such as canteen, medical aid centre and even accommodation facility. In fact, it will be the only building in the port area that will have accommodation facility for the staff. All the other buildings will be for industrial purposes only.

According to officials concerned, the POB makes the port here stand apart from its nearest competitors because it enables the Vizhinjam port to be a fully automated one. Even the port in Sri Lanka, which is also a transshipment port like the Vizhinjam port, is not automated as it lacks a facility like POB.

In his inaugural address, Kadannappally Ramachandran said that steps have been taken for the speedy completion of construction of breakwater for the port. KSEB is carrying out works for laying a 220KV power line to the port. The Kerala water authority has already set up a drinking water project with a capacity of 33 lakh litres. Residents too are provided drinking water from this system.

The government has also forwarded a detailed study report on connecting the port with the Thiruvananthapuram-Nagercoil railway line to the Southern Railway authorities. The study was conducted by Konkan Railway Corporation.

Minister for tourism and devaswom Kadakampally Surendran presided over the event. Thiruvananthapuram MP Shashi Tharoor, Kovalam MLA M Vincent, city mayor K Sreekumar, and ports department secretary Sanjay Kaul too attended the inauguration.

Annexure V

Letter to ICG for submission of Final OSDCP

adani

Ports and Logistics

AVPPL/ICG/2020-21/1134

Date: 22nd May 2020

To,
The Commander
(for District Operational and Plans Officer)
No. 4, Coast Guard District (Kerala & Mahe)
Kalvathy Road, Fort Kochi – 682 001

Sub: Facility Level Oil Spill Disaster Contingency Plan for Vizhinjam International Transshipment Deep-Water Multipurpose Seaport – Submission of Plan toward Approval - Reg.

Ref:
1. NOS-DCP, 2015 and Subsequent Circulars Issued by Indian Coast Guard
2. AVPPL/ICG/2019-20/872 dated 2nd September, 2019.
3. ICG Letter No: 739 dated 30th September, 2019.
4. Enclosure to RHQ (W)letter 773/2/ADANI dated 13 February 2020

Dear Sir,

Your kind attention is invited to the references cited above.

In line with the requirement, Facility Level Oil Spill Disaster Contingency Plan duly incorporated with complete comments of DHQ and RHQ shared via reference 2 and 3 is submitting herewith for your kind consideration. We hope our submission is in line with the requirements and request you to kindly approve the plan towards implementation.

Thanking you

Yours faithfully,

Rajesh

Rajesh Jha
Chief Executive Officer

Encl: Facility Level Contingency Plan – 3 Copies

भारतीय तटरक्षक जिला मुख्यालय-4 * रक्षा मंत्रालय * MINISTRY OF DEFENCE * INDIAN COAST GUARD DHQ-4, KOCHI

09/06/2020

Adani Vizhinjam Port Pvt Ltd
2nd Floor, Vipanchika Tower, Thycaud
Thiruvananthapuram,
Kerala-695014

Tel +91 79 2656 5555
Fax +91 79 2555 5500
info@adani.com
www.adani.com
CIN: U61200GJ2015PTC083954

ADANI VIZHINJAM PORT PVT LTD
4752 INWARD Alevink
RECEIPT DATE 09/06/2020

Annexure VI

Compliance of Conditions of KCZMA Recommendation for EC/CRZ Clearance

Annexure VI

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
(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 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 (Submitted along with the compliance report for the period October 2015 to March 2016). • As per the exemption granted by Government of Kerala (GoK) G.O. No. 310/2015/LSGD dated 01/10/2015, AVPPL is not required to obtain any further building permit/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 X**. All work plans are executed after assessing the defined EHS plans. It is also submitted that dredging of lakes or kayals are not envisaged as part of this project.
(iii)	The project proponent must	**Complied**

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
	obtain necessary clearance separately from the Kerala State Pollution Control Board, Health Department and other appropriate Authorities when such implementation programmes are undertaken.	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** As prescribed in EIA during construction stage, the contractors have been made responsible for management of Solid Waste. Necessary arrangement has been made for collection, segregation and disposal of Solid Waste as per Solid Waste Management Rules, 2016, as amended. A dedicated integrated solid waste management facility is planned which will be constructed along with project. • No solid waste is being disposed of in the CRZ area. • Currently no effluent is generated; domestic wastewater generated is treated in STP at labour camps and treated water is used for sprinkling within port area.
(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** There was no visit by officials of KCZMA during the compliance period. All necessary support will be extended to officials of KCZMA during inspection of the project/site visit; at any time. Additionally, AVPPL meet officials of KCZMA regularly from time to time for suggestions and to apprise them of various project related work. Also,

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
		copy of HYCRs are being submitted to KCZMA; the same will be continued in future.
(vii)	The KCZMA may be duly informed of any construction/developmental works/major activities undertaken in the CRZ area of the project	**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 2020: • No dredging was carried out during the compliance period from April 2020 to September 2020. The dredged material till 30.09.2020 amounting to 2.90 Mm^3 has been utilized for reclamation of 36 Ha area. The dredged material has been used 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 has been completed at various locations - Truck terminal 3, Pocket 4 and pocket 4 (Resort Area); remaining construction work is in progress or on hold due to local issues. • Following buildings construction work is in progress: o Gas Insulated Substation (GIS) substation o Substation building (Inside port) o Rail Mounted Unit (RMU) buildings-yard o RMU buildings-berth o Workshop Building

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
		○ Gate Complex ○ Driver Rest Room ○ DG Shed Building ○ Water Tank & Pump House ○ Security Building ○ Port User Building (PUB) Building ○ Port Canteen • Yard development work: ○ Storm Water Drain construction ○ Cantilevered Rail Mounted Gantry (CRMG) beam works are in progress ○ Paver block casting for yard development is in progress. • Port Access Road ○ Laying of Hume Pipe along with Retaining Wall are in progress ○ Drain construction ○ Piling for ponds is in progress. ○ Sub-grade works are in progress Due to outbreak of COVID-19 pandemic, progress of the project works have been hampered since 23.03.2020. Port Operation building was inaugurated by Hon'ble Minster of Ports, Shri Kadannapally Ramachandran in a virtual function on 30.09.2020 in the presence of Hon'ble Minister for Tourism and Devaswom, Shri Kadakampally Surendran, MP Shri Shashi Tharoor, Kovalam MLA Shri M Vincent, Thiruvananthapuram Mayor Shri K Sreekumar and Secretary, Ports.

Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period April 2020 to September 2020		
S. No.	**Conditions**	**Compliance Status as on 30.09.2020**
		 **POB Building**
(viii)	Environmental clearance must be obtained from the Ministry of Environment & Forests.	**Complied** Environment & CRZ Clearance has been obtained from Ministry of Environment & Forest vide MoEF letter dated 03.01.2014 (F.No.11-122/2011-IA.III).
(ix)	An adequate financial provision has to be made for environmental protection measures.	**Complied** A total of Rs. 40 Crore has been set aside for environment protection measures as per the EIA report. Till date, an amount of Rs. 15.67 Crores has been spend on environmental protection measures. The activity wise fund break up and expenditure during the compliance period April 2020 to September 2020 is enclosed as **Annexure IX**.
(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 Environmental & CRZ clearance was submitted by Vizhinjam International Seaport Ltd. (VISL), a Government of Kerala (GoK) undertaking.

Annexure VII

Compliance of the Response/Commitments made during Public Hearing

Annexure VII

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
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 Government of Kerala (GoK), instead of Rs. 7.10 crores suggested earlier in the EIA stage. Till date an amount of Rs. 83.32 crores have been disbursed till 30.09.2020 for a total number of 2625 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 balance LAPs is in progress. *(Source: VISL)* Out of the 5 identified EMP areas, work is ongoing in Port Site, Road/Rail Corridor and in PAF (Project Annex Facility)). 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 VIII**.
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** The work for construction of the fish landing centre (Rs. 16.00 crores) and the fishery breakwater (Rs. 131.12 crores) has been initiated as part of the funded work component of the concession agreement with AVPPL in the form of a new fishing harbour.

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
		The EPC Contractor is finalising the design for the fishing berth. However, AVPPL is unable to start the construction activities since the proposed site is blocked by fishing boats by fishermen. The proposed area needs to be cleared for the commencement of works. GoK has initiated discussions with fishermen representatives for removal of the boats to facilitate construction work and discussions are underway. *(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 Harbour Engineering Department (HED) and work awarded. However, the works could not be initiated due to sectoral protests among different fishermen groups. *(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** 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. Shoreline Monitoring Report for the period April 2020 to September 2020 is enclosed as **Annexure I**. 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). Three mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC; as detailed below: • 1st Mathematical Modelling Report for the period February 2015 to February 2017; submitted along with the HYCR for the period April 2017 to September 2017 • 2nd Mathematical Modelling Report for the period March 2017 to February 2018;

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
		submitted along with the HYCR for the period April 2018 to September 2018 • 3rd Mathematical Modelling Report for the period March 2018 to February 2019; submitted along with the HYCR for the period April 2019 to September 2019 These mathematical modelling reports have affirmed that the shoreline change is in line with what was predicted as part of the EIA study. Appropriate protection measures, if any, shall be taken up within 10 km of the project site is observed based on the Shoreline studies and as per the suggestions of the NGT Expert Committee; as per NGT order. In continuation with the same practise Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data from March 2019 to February 2020 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. The Mathematical modelling report for the period March 2019 to February 2020 vetted by NIOT is given as **Annexure II**. As per the mathematical modelling report, from all the data analyses and model studies carried out by LNTIEL, 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.
8	Water supply provision to the Vizhinjam fishing village	**Complied** Water Supply Scheme for provision to the local people has been commissioned in April 2013 by VISL by expending an amount of Rs. 7.30 crores. For Operation & Maintenance (O&M) of the same an amount of Rs. 5.38 crores had been spent and from 04.04.2019 onwards, Now, O&M of the scheme is being done by Kerala Water Authority (KWA).

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
		(Source: VISL)
10	Railway work will be initiated after Environment Clearance (EC)	**Complied** Konkan Railway Corporation Limited (KRCL) has been engaged as a consultant 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 completed and all the required clarifications have been provided to Southern Railways and the approval is awaited. Land acquisition process has been initiated. *(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 the total persons employed at site for different construction activities during the compliance period, 142 people are from Kerala and out of them 63 are from nearby wards of the project site. Due to the impact of the COVID-19 pandemic during the compliance period, construction activities were decelerated and therefore employment at site were comparatively less.
13	Take all possible measures for judicial use of lighting system as part of the Green Port concept to reduce the carbon footprint	**Will be Complied** Is being considered with appropriate planning.
16	Waste management is included in the EMP and C&D waste management is part of the SWMP.	**Being Complied** Adequate budgetary provision has been kept for waste management as part of EMP as well as CSR. As mentioned in EIA, contractors have been made responsible for management of Waste including waste from labour colony during the construction stage. 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

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
		which will be constructed along with project. Additionally, as a part of CSR activities, AVPPL are taking up following activities with respect to solid waste management: Cleaning of Gangayar Canal, Drain Cleaning of Vayalinkara and Kottappuram, Cleaning of Vegetation at: Karimpallikkara, Near Panavila Temple, Mulloor, Chappath Punnakilam, Break water – 1 area, Kottappuram and Devarkulam near Kalingnada Junction (Refer Section 5.19 of **Annexure IV**).
17	Upgradation of PHC at Vizhinjam will be carried out	**Being Complied** The construction of new building at Community Health Centre, Vizhinjam is progressing. This is part of upgradation of Community Health Centre (CHC), Vizhinjam with a new three-storied building is another project initiated jointly by Government of Kerala and Adani Foundation in 2018. The building consists of basement, ground floor, first floor and second floor. As per G.O. (R)No.842/17/F&PD dated 01.11.2017, the revised estimate for the building comes to Rs. 7.79 Crores with the Government component of Rs. 4.82 Crores and CSR component of Rs. 2.97 Crores from Adani Foundation. Adani Foundation handed over the first instalment of Rs. 1.18 crores to the Harbour Engineering Department (HED) on 03.10.2018. The work is being done by HED with financial support of Adani – CSR is progressing.

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
		 
19	Appropriate compensation will be given to the resort 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	**Being Complied** Resort owners evicted have been compensated for land and not for the structures since they were in violation of CRZ notification. An area of 0.728 Ha has been acquired up to 30.09.2020 under negotiated purchase. 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. Presently, development of dedicated road connectivity approach road (2.0 km) from the port to the NH-47 Bypass is in progress and

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
		Detailed Project Report (DPR) has been completed and all the required clarifications have been provided to Southern Railways for 10.7 km rail connectivity to the present railway line running from Thiruvananthapuram Central station (TVC) to Nagercoil junction (NCJ) of Thiruvananthapuram.
21	Waste Management, Water Treatment plants, etc. will be part of an operational EMP	**Noted for Compliance**
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 2020 to September 2020. The dredged material till 30.09.2020 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**.
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, 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 X**. It is also ensured that contractors working at

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
		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.
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 261 Mussel collectors have collected the compensation amount totalling to Rs. 12.34 Crore. Although they were offered alternate livelihood plan through cage fishing, they opted for one-time settlement citing the risks involved in such fishing. The remaining 10 mussel collectors have not approached VISL for compensation. *(Source: VISL)*
26	VISL will ensure all the project components i.e., including road/rail connectivity are implemented in time. In addition the planned CSR and EMP measures will also be implemented and monitored to ensure the socio-economic development of the region.	**Being Complied** AVPPL had awarded the work to Kerala State Remote Sensing and Environment Centre (KSREC) to undertake study on Groundwater impact due to construction of port approach road. KSREC has submitted the final report with recommendations and AVPPL is in the process of constructing the approach road to port taking into account the recommendation given by the report. Konkan Railway Corporation Limited (KRCL) has been engaged as a consultant 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 completed and all the required clarifications have been provided to Southern Railways and the approval is awaited. Land acquisition process has been initiated. *(Source: VISL)* CSR activities are detailed in **Annexure IV**. Status of construction stage EMP in matrix format is enclosed as **Annexure VIII**.
27	The implementation of the	**Being Complied**

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
	EMP/RAP/CSR will be ensured through the institutional and regulatory mechanism with regular monitoring and periodic compliance reports to the MoEF	Refer point 24 above. Regular monitoring of Environment Parameters are being carried out. Detailed Monitoring Reports for the period April 2020 to September 2020 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, the HYCR for the period October 2019 to March 2020 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA vide email dated 27.05.2020 (a copy of the email is enclosed as **Annexure XI**).
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 the same 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 at its Third Year.
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

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
		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. Verification of the document of balance fishermen is in progress. *(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. The Master Plan has been forwarded to Joint Planning Committee (JPC) for further action. *(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** During the Operation Phase as per the applicable laws.
36	Implementation of CSR measures and planned development of the region through well designed area development plan will arrest the formation of slums and the like.	**Being Complied** Details of CSR activities carried out during the compliance period are given in **Annexure IV**. Refer point 33 above for area development plan.
37	"Inconvenience Allowances" during construction period of three years to the fisherman (As per EIA Report)	**Being Complied** An amount of Rs. 27.18 Crores have been sanctioned by the GoK as inconvenience allowance in the form of kerosene in November 2017. Rs. 12.48 Crore has been given till 30.09.2020 to the disbursal agency identified for the work. *(Source: VISL)*
38	As per the Entitlement Framework, Hardship Allowance	**Complied** Compensation for livelihood loss; Rs 6.08

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
	is suggested in the EIA/EMP for resort workers who lost their job due to acquisition of the resort	Crores out of allocated Rs. 6.11 Crores has been disbursed to 211 out of 211 number of resorts workers and settled completely. *(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 VIII** 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 signed with AVPPL 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	**Noted for Compliance** 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 provisions have been made for the old fishing harbour and its linkage roads as it will be adopted as a part of best practice and beautification process	**Being Complied** Being complied on a routine basis through HED; the maintenance agency for the fishing harbour and the coastal road network.
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	**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

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
	based on their merit. However during construction period the EIA study has suggested to adequately employ local population to the maximum extent possible	construction of a Community Skill Park (CSP) in an area of 1.5 acres of land at Vizhinjam. It is a PPP project wherein 25000 sq. ft. building with facilities for students' hostel are being constructed by GoK under ASAP, whereas the operation of the centre with logistics and other high-end courses is vested with Adani Skill Development Centre. Preference is being given to local people based on skill and competency during the construction stage. *(Source: VISL)* Preference is being given to local people based on Skill & competency during the construction stage. Out of the total persons employed at site for different construction activities, an average of 175 people are from Kerala and out of them 76 are from nearby wards of the project site.
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** During operation phase.
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.	**Being 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	**Noted**

Compliance of the Response/Commitments made during Public Hearing		
S. No.	**Responses/Commitments**	**Status as on 30.09.2020**
	the number of ships being crossed by them daily in the international ship channel.	
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 for Compliance** 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 VIII

Status of Environment Management Plan

Annexure VIII

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 30.09.2020**
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 2020 to September 2020. The dredged material till 30.09.2020 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 are carrying out real time turbidity measurement. ○ Dredging Management plan has been prepared ○ Discharge of waste into sea is prohibited ○ 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 (Enclosed as **Annexure V**). Awaiting approval of the same. ○ 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

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 30.09.2020**
				○ been added from October 2017 after suggestion from NGT committee and the parameters are within permissible limits. ○ Six monthly monitoring reports are regularly submitted to regulatory authorities as a part of Environmental & CRZ clearance compliance.
2	Material transport and construction activities	Air Quality	○ Most of the Breakwater stones will be transported from the quarries to the nearest harbour. From there through Barges it will be transported to project site. This is will avoid substantiate flow of Heavy Vehicles during construction Phase thereby minimizing impact on Air and Noise Quality in the project region. ○ 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	**Being Complied** ○ Rock placing for breakwater construction was initiated using the stones brought through barges from nearby harbours. ○ It is ensured that all vehicles entering the Port have a valid PUC certification ○ Adequate sized construction yard has been provided for storage of construction materials, equipment tools, earthmoving equipment, etc. ○ The dumpers have speed governors ensuring adherence to speed limit ○ Signage for speed control are displayed inside port area ○ Water sprinkling is carried out for supressing dust ○ It is ensured that all trucks transporting material are covered by tarpaulin. ○ 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 30.09.2020**
			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	
		Noise	○ Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control	**Being Complied** ○ Noise levels are being monitored every fortnight and are found to be well within the permissible limits within the project area.

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 30.09.2020**
			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 10pm) to minimise noise impacts ○ Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs,	○ 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 30.09.2020**
			muffs, etc. ○ 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 to CRZ Notification along with the commissioning of the project in consultation with KSPCB. AVPPL had submitted relevant documents

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 30.09.2020**
				including Location Plan, Process, Design, Capacity, Layout and other details to KSPCB seeking approval from the board as per the CTE obtained for the project. KSPCB had conducted a site visit on 21.08.2019. During the site visit additional details were sought and the same were submitted to KSPCB. Thereafter, KPSCB had called for a meeting and presentation on the proposed STP on 15.11.2019. As per the discussions, it is understood that AVPPL will have to apply for approval online. ○ No work has started in warehouse area and drains/streams passing through the area are not closed/ diverted.
		Vegetation and Strain on existing infrastructure	○ Port development is planned mostly on reclaimed land; ○ 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.	**Being Complied** ○ Care is taken to limit the felling of trees to the bare minimum. Plantation of saplings along the road margins, road medians and port boundary are planned as part of the master plan development. ○ Temporary Worker camp has been provided with all necessary infrastructure facilities (Water, Electricity, Sanitation, Fuel, etc.)
		Existing Traffic	○ NH-47 bypass under construction	**Being Complied**

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 30.09.2020**
			around 2.0 km from the proposed Port site and the Transportation of construction materials will be carried out during non- peak hours. Hence a dedicated road of 45 M RoW is proposed to connect site with NH Bypass ○ Regularization of truck movement ○ Majority of rock for breakwater construction will be transported through sea route via barges from nearby quarry sites ○ A dedicated rail network of approximately 15 km is proposed from port to Nemom railway station	○ Traffic monitoring & regularization is being carried out for maximum efficiency. ○ Trial run of rock placing for breakwater construction was initiated using the stones brought through barges from nearby harbours. ○ Konkan Railway Corporation Limited (KRCL) has been engaged as a consultant 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 completed and all the required clarifications have been provided to Southern Railways and the approval is awaited. Land acquisition process has been initiated. *(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 2020 to September 2020. The dredged material till 30.09.2020 amounting to 2.90 Mm^3 has been utilized for reclamation of 36 Ha area. The dredged material has been used for reclamation. ○ During dredging return sea water is sent back to sea through appropriate channels.

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 30.09.2020**
				○ 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. ○ 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	**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. ○ 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	**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

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 30.09.2020**
			points. ○ Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms. ○ Construction site will be secured by fencing with controlled/ limited entry points ○ 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.	wherever possible with controlled/limited entry points. ○ Medical facilities including first aid are available for attending to injured workers. Ambulance is also available at site for shifting the injured to the nearby hospitals. ○ Handling and storage is 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	**Being Complied** ○ A 3.00 MLD water supply scheme for the project had been commissioned with the source of water being Vellayani Lake whose raw water will be available for treatment. The net availability of treated water from this supply scheme is 2.49 MLD

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 30.09.2020**
			○ Avoid/minimise the loss during conveyance ○ Optimized utilization of the water ○ Care will be taken to prevent the runoff from the construction site to the nearby natural streams, if any	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 would be used for port related activities. However, at present, the entire treated water from the scheme is being utilised by the community. Due to this reason, the water for construction purposes for the port is being sourced from the open market/private suppliers. ○ On an average about 166 Litres per day of water is being consumed for construction related activities.
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. ○ 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. ○ AVVPL 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.

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 30.09.2020**
8.	Tourism	Effect on tourism	○ Tourism activity is observed at Kovalam located about 2.0 km 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	**Being Complied** ○ The tourism activity in the nearby Kovalam area is not 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. An area of 0.728 Ha has been acquired up to 30.09.2020 under negotiated purchase. 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.

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 30.09.2020**
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 arrangement consists of: ○ Cross Shore Beach Profiling perpendicular to the shoreline 20 KM on either side of the port at 500 m intervals which includes bathymetry survey up to CD -10 and landside survey up to HTL + 100 m and photographic documentation of morphological changes, seasonal beach sediment sampling and analysis at 81 locations, bathymetry survey of 40 km x 15 km twice in a year, monthly monitoring of littoral zone, seabed sediment sampling per sq.km in 80 sq.km, current measurement with ADCP at four locations for 3 seasons, tide measurement, continuous wave measurement by wave rider buoy, water sampling and analysis, continuous turbidity monitoring at 3 locations, bathymetry and cross section survey of 6 rivers debouching into the sea in 40 Km stretch study area, continuous weather monitoring by Automatic Weather Station.

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 30.09.2020**
				○ 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). ○ Three mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC; as detailed below: ○ 1st Mathematical Modelling Report for the period February 2015 to February 2017; submitted along with the HYCR for the period April 2017 to September 2017 ○ 2nd Mathematical Modelling Report for the period March 2017 to February 2018; submitted along with the HYCR for the period April 2018 to September 2018 ○ 3rd Mathematical Modelling Report for the period March 2018 to February 2019; submitted along with the HYCR for the period April 2019 to September 2019 These mathematical modelling reports have affirmed that the shoreline change is in line with what was predicted as part of the EIA study. In continuation with the same practice Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data from March 2019 to February 2020 to L&T IEL for mathematical modelling to

Status of Environment Management Plan-Port Site-Construction Stage Potential Impacts and Mitigation Measures of Various Project Activities				
S. No.	**Activity**	**Relevant Environmental Components likely to be impacted**	**Proposed Mitigation Measures**	**Status as on 30.09.2020**
				assess the impact on shoreline under the guidance of NIOT. The Mathematical modelling report for the period March 2019 to February 2020 vetted by NIOT is given as **Annexure II**. As per the mathematical modelling report, from all the data analyses and model studies carried out by LNTIEL, 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.
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	**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. ○ The work for construction of the fish landing centre (Rs. 16.00 crores) and the fishery breakwater (Rs. 131.12 crores) has been initiated as part of the funded work component of the concession agreement with AVPPL in the form 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 30.09.2020**
			○ Adoption of fishing harbour to manage it to perform as per International standard ○ A new fishing harbour provided under CSR initiatives because of 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	a new fishing harbour. The EPC Contractor is finalising the design for the fishing berth. However, AVPPL is unable to start the construction activities since the proposed site is blocked by fishermen with their fishing boats. The proposed area needs to be cleared for the commencement of works. GoK has initiated discussions with fishermen representatives for removal of the boats to facilitate construction work and discussions underway. *(Source: VISL)* ○ In consultation with the fishermen, enhanced livelihood compensation of Rs. 101.86 Cr was sanctioned by Government of Kerala (GoK), instead of Rs. 7.10 crores suggested earlier in the EIA stage. Out of this amount, Rs. 83.32 crores have been disbursed till 30.09.2020 for a total number of 2625 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 balance LAPs is in progress. *(Source: VISL)*
11	Shoreline	erosion/accretion	Final shoreline Impact management plan	**Being Complied** ○ NIOT has been engaged to give technical advice

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 30.09.2020**
	changes		will be prepared in consultation with agencies like CESS/INCOIS, NGO and local bodies and will implemented.	on aspects related to shoreline monitoring & shoreline evolution. o Comprehensive Shoreline Monitoring is being carried out under the technical Guidance of NIOT and six monthly monitoring reports are being submitted regularly as part of EC & CRZ Compliance. o Wave, current and tide data are being monitored a 40 km stretch. o L&T Infrastructure Engineering Ltd. (L&T IEL) had prepared Mathematical Modelling Reports based on Shoreline Monitoring data; which were vetted by National Institute of Ocean Technology (NIOT). o Three mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC; as detailed below: o 1st Mathematical Modelling Report for the period February 2015 to February 2017; submitted along with the HYCR for the period April 2017 to September 2017 o 2nd Mathematical Modelling Report for the period March 2017 to February 2018; submitted along with the HYCR for the period April 2018 to September 2018 o 3rd Mathematical Modelling Report for the period March 2018 to February 2019;

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 30.09.2020**
				submitted along with the HYCR for the period April 2019 to September 2019 These mathematical modelling reports have affirmed that the shoreline change is in line with what was predicted as part of the EIA study. In continuation with the same practice Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data from March 2019 to February 2020 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. The Mathematical modelling report for the period March 2019 to February 2020 vetted by NIOT is given as **Annexure II**.

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 30.09.2020**
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 XI**. ○ 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

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 30.09.2020**
			budget for the same. o Third party environmental monitoring has commenced since August 2016 and the monitoring results are satisfactory.
2	Altered Road embankment	Retaining walls and gabions should be provided	**Noted for Compliance** o AVPPL had awarded the work to Kerala State Remote Sensing and Environment Centre (KSREC) to undertake study on Groundwater impact due to construction of port approach road. o Kerala State Remote Sensing and Environment Centre (KSREC) have studied the impact due to construction of port approach road. o Recommendations of KSREC are being implemented and suitable mitigation measures as suggested in the KSREC report are being adopted during construction.
3	Dust	o Water should be sprayed during the construction phase, at mixing sites, and temporary roads. o In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to prevent dust. o Vehicles delivering materials should be covered to reduce spills and dust blowing off the load.	**Being Compiled** o Regular Water Sprinkling is done on the approach road by water tankers. o Water spraying is carried out at regular intervals after compaction o Tarpaulin cover is used in vehicles delivering materials.
4	Air Pollution	o Vehicles and machinery are to be maintained so that emissions conform to National and State	**Being Complied** o Ambient air quality monitoring is carried out at 5

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 30.09.2020**
		standards. ○ All vehicles and machineries should obtain Pollution Under Control Certificates (PUC).	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 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	**Will be complied** ○ AVPPL had awarded the work to Kerala State Remote Sensing and Environment Center (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

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 30.09.2020**
		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.	KSREC report will be adopted during construction. ○ Konkan Railway Corporation Limited (KRCL) has been engaged as a consultant 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 completed and all the required clarifications have been provided to Southern Railways and the approval is awaited. Land acquisition process has been initiated. *(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**
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 systems in conformity to the Contractors visual integration and management plan and EMP.	**Will be Complied** ○ AVPPL had awarded the work to Kerala State Remote Sensing and Environment Center (KSREC) to undertake study on Groundwater impact due to construction of port approach road and also suggest mitigation measures. ○ For impacted 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 30.09.2020**
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. STPs are set by contractors for treating the wastewater generated during construction and at the labour camps. The treated wastewater is used for sprinkling purpose to suppress dust emission.
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 repaired. ○ Retaining walls and gabions shall be suitably provided.	**Will be Complied** ○ AVPPL had awarded the work to Kerala State Remote Sensing and Environment Centre (KSREC) to undertake study on Groundwater impact due to construction of port approach road. 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.
13	Loss of agricultural topsoil	○ Arable land should not be used for topsoil borrowing.	**Being Complied** ○ Arable land is not being used for topsoil borrowing

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 30.09.2020**
		○ Topsoil will be kept and reused after excavation is over. ○ Any surplus to be used on productive agricultural land.	○ The topsoil excavated is being stored and will be reused during development of greenbelt.
14	Compaction of Soil and Damage to Vegetation	Construction vehicles should operate within the Corridor of Impact avoiding damage to soil and vegetation.	**Will be Complied**
15	Loss of trees and Avenue Planting	○ 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.	**Being Compiled** ○ AVPPL, in collaboration with Forest department, have carried out compensatory afforestation in 12.05 Ha land as identified by social Forest Department in Sainik School, Trivandrum (at an aerial distance of 24 km from project site). The plantation is now at its Third Year.
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.	**Will be complied** ○ Special care is taken to minimize the tree felling to the extent possible, but in line with the technical requirements of the project. Due prior permission is taken for tree felling from Forest Department.
17	Fauna	Construction workers should protect natural resources and animals. Hunting of birds and other local animals is prohibited.	**Being Complied** ○ Construction workers are housed in labour camp near the project site and are provided with all the basic amenities such as drinking water, proper sanitation, canteen etc. Regular awareness sessions are conducted for the construction workers regarding importance of natural resources and

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 30.09.2020**
			animals. o 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** o All the workers are provided with Personal Protective Equipment's (PPE) and it is ensured that they wear it all the time o Also all the contractors working at site have a dedicated health and safety person to oversee the work carried out.
20	Pollution of Streams parallel or along the alignments	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.
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 (boundary wall construction) 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 30.09.2020**
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. ○ Vehicles delivering materials should be covered to	**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 (boundary wall construction) 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 30.09.2020**
			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 and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimize noise impacts.	**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 (boundary wall construction) 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 30.09.2020**
			○ 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.	**Will be Complied** AVPPL, in collaboration with Forest department, have carried out compensatory afforestation in 12.05 Ha land as identified by social Forest Department in Sainik School, Trivandrum (at an aerial distance of 24 km from project site). The plantation is now at its Third Year.
		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	**Will be Complied** No work is carried out in the area. Will be appropriately planned in consultation with the concerned departments

Environment Management Plan – Warehouse Area* (Construction Phase) *Minimal work (boundary wall construction) 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 30.09.2020**
			○ An application has been filed with the irrigation department for permission.	
			○ 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. ○ Filling of low lying areas (if required) shall be done	**Will be Complied** Will be appropriately planned in consultation with the concerned departments
			○ 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	**Will be Complied**

Environment Management Plan – Warehouse Area* (Construction Phase) *Minimal work (boundary wall construction) 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 30.09.2020**
			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 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 30.09.2020**
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. ○ Vehicles delivering materials should be covered to	**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 ○ Vehicles entering the site have 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 30.09.2020**
			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 and drilling will be scheduled at daytime (6.00 am	**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)

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 30.09.2020**
			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	
2	Construction of Buildings, Roads, Parking features, 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. ○ 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.	**Will be Complied** AVPPL, in collaboration with Forest department, have carried out compensatory afforestation in 12.05 Ha land as identified by social Forest Department in Sainik School, Trivandrum (at an aerial distance of 24 km from project site). The plantation is now at its Third Year.
		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.	**Will be Complied**
		Solid Waste	○ Construction waste will be used within port site for filling of low lying areas.	**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 30.09.2020**
			○ 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.	

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 30.09.2020**
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 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 the port have Pollution Under Control Certificate (PUC) ○ Water sprinkling was carried out at regular interval over the temporary road during transportation of cut material. ○ 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 was 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 30.09.2020**
		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 Noise monitoring is being carried since August 2016, and the readings are within the limits at port site ○ At present only building work has commenced in limited way and barriers will be installed where ever necessary in future ○ Regular monitoring of ambient Noise is carried out since August 2016 as per the Environmental Monitoring Plan prescribed in EIA

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 30.09.2020**
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** ○ The contractors working at site have obtained separate consent from KSPCB for their batching plant and they have constructed settling pond for wash water generated. ○ No wash water is disposed into the water bodies. ○ STPs are set by contractors for treating the wastewater generated during construction and at the labour camps. The treated wastewater is used for sprinkling purpose to suppress dust emission.
		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.	**Will be Complied**
			○ Arable land should not be used for topsoil	**Will be Complied**

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 30.09.2020**
			borrowing. ○ Topsoil will be kept and reused after excavation is over. ○ Any surplus to be used on productive agricultural land.	
			○ 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 to the extent possible considering the technical requirements

Annexure IX

EMP Expenditure

(April 2020 to September 2020)

adani	Adani Vizhinjam Port Private Ltd	From : April 2020 To : September 2020
Vizhinjam International Deepwater Multipurpose Seaport EMP Expenditure		

Annexure IX

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	Total Cumulative 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	0.038
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	0.3	0.29	0.152	2.492
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	10.664
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

adani	Adani Vizhinjam Port Private Ltd	From : April 2020 To : September 2020

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	Total Cumulative till Date
		(in Rs. Crores)									
11	Solid waste management (sector wise)-Collection disposal system	2.5	-	-	-	-	-	0.01	-	-	0.01
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	0.55
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**	**15.674**

Annexure X

Environment Health, Safety & CSR Organizational Structure

Annexure X

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.	Anil Balakrishnan	Head – CSR	23 Years	MSW, Phd.	AVPPL
3.	Y D Manmohan	Environment Specialist	30 Years	BE – Civil Engg ME Env. Engg.	STUP
4.	Sebastian Britto	Project Officer	21 Years	MA, Economics	AVPPL
5.	Stephen Vinod	Community Mobilizer	13 Years	BA, Economics	AVPPL
6.	George Zen	Community Mobilizer	32 Years	BA, Sociology	AVPPL
7.	Meera Mariyam Skariah	Community Mobilizer	3 Years	MSW	AVPPL
8.	Hebin C	Head – Environment	13 Years	MS, Oceanography & Coastal Area Studies	AVPPL
9.	Jesse Benjamin Fullonton	Assistant Manager - Environment	9 Years	BSc. Chemical Tech; Msc. Env. Tech	AVPPL
10.	Kanwar P Malik	Head - Horticulture	15 Years	BSc - Agriculture	AVPPL
11.	Arumugam S	Assistant Manager - Safety, Environment and Health	2 Years	M.Tech – Industrial Safety Engineering	AVPPL
12.	Shaji Joseph	Safety Executive	13 Years	Diploma in mechanical & Diploma in fire and safety	HOWE

Annexure XI

Submission Email of HYCR for the Period

October 2019 to March 2020

Jesse Benjamin Fullonton

From: PRASAD KURIEN <prasad.kurien@vizhinjamport.in>
Sent: Wednesday, 27 May, 2020 04:32 PM
To: rosz.bng-mefcc@gov.in
Cc: Ssuresh.cpcb@nic.in; tvpmro@gmail.com; rosz.bng-mef@nic.in; Kushal.vashist@gov.in; zobangalore.cpcb@nic.in; MS KCZMA; Rajesh Kumar Jha; Hebin Chenthamarakshan; Jesse Benjamin Fullonton; Manoranjan Tripathy; MD & CEO
Subject: EP12.1/7/2013-14/Ker - Oct 2019 -Mar 2020
Attachments: EC_F. No. 11-1222011-IA.III-HYCR-Oct19-Mar 2020.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).

Kindly find attached the Half yearly compliance report (HYCR) for the period from Oct 2019 to Mar 2020 for records and reference.

Acknowledgement on receipt of the email with contents is highly appreciated.

With best 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 of Conditions of Environmental and CRZ Clearance for the Period April 2020 to September 2020

November 2020