# Vizhinjam International Seaport Limited
(A Government of Kerala Undertaking)

VISL/53/2021/GM1 (E) 24th May 2021

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 **October 2020 to March 2021** – Reg.

Ref: 1) File No. 11-122/2011-IA.III dated 3rd January 2014
2) Letter No. 1285/A3/13/KCZMA/S&TD dated 24th August 2013
3) File No: EP/12.1/7/2013-14/Ker 829 dated 20th August 2019
4)F.No.11-122/2011-IA.III Proposal No. IA/KL/MIS/178082/2020 dated 29-12-2020

Dear Sir,

This has reference to the Environmental & CRZ Clearance (EC) issued on 3rd January 2014 (vide reference cited 1) by the Ministry of Environment, Forest & Climate Change (MoEF&CC) for the proposed Vizhinjam International Multipurpose Deepwater Seaport at Vizhinjam in Thiruvananthapuram District of Kerala State based on the recommendation of KCZMA (vide the reference cited 2). Subsequently, the validity of EC was extended by MoEF&CC dated 29th December 2020 (vide reference cited 4).

The Half Yearly Compliance Report (HYCR) of the conditions stipulated in the cited references for the period from **October 2020 to March 2021** 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 **October 2020 to March 2021** is being submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA via email.

**Yours Sincerely**
**For Vizhinjam International Seaport Ltd**

**Managing Director & CEO**
Encl: As Stated Above

Copy to: MD & CEO Adani Vizhinjam Port Private Ltd. (AVPPL), 2nd Floor, Vipanchika Tower, Near Govt. Guest House, 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 October 2020 to March 2021

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)

**May 2021**

| Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| **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**<br>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.<br><br>The CTE was renewed vide Consent No. PCB/HO/TVM/ICE-R/02/2018 dated 19.07.2018 valid up to 31.07.2023.<br><br>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**<br>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 October 2020 to March 2021 is enclosed as **Annexure I**.<br><br>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).<br><br>Four mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC; as detailed below: |

| Data Period | Submitted With HYCR for the Period |
|---|---|
| Feb 2015 to Feb 2017 | Apr 2017 to Sep 2017 |
| Mar 2017 to Feb 2018 | Apr 2018 to Sep 2018 |

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| | | <table><tr><td>Mar 2018 to Feb 2019</td><td>Apr 2019 to Sep 2019</td></tr><tr><td>Mar 2019 to Feb 2020</td><td>Apr 2020 to Sep 2020</td></tr></table><br>These mathematical modelling reports have affirmed that the shoreline change is in line with prediction in the EIA study. As per the latest mathematical modelling report, from all the data analyses and model studies carried out by L&T IEL, it can be concluded that there was minimal variation on shoreline, beach morphology and water quality compared to the previous years and that the port construction has not caused any unnatural changes to these parameters in the vicinity of the port.<br><br>In continuation with the same practise Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data from March 2020 to February 2021 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. |
| (iii) | The capital dredged material (7.6 $Mm^3$) shall be utilized for reclamation of berths. | **Being Complied**<br>No dredging or reclamation was carried out during the compliance period from October 2020 to March 2021. The dredged material till 31.03.2021 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**<br>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.<br><br>The EPC Contractor 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 |

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| | | proposed area need to be removed before the commencement of work. Government of Kerala (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**<br>Following is being practiced to ensure minimum disturbance to fishing activity:<br>• Work is planned in such a way that the movement of fishing boats is not hindered due to project construction.<br>• Signboards have been placed for demarcation of construction area and marker buoys are placed in the marine area for fishing boats to maintain a safe distance from the areas of breakwater construction.<br>• For mutual understanding of the developmental activities with the local fishing community an exclusive CSR team has been assigned.<br>• 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.<br>• 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.<br>• 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**.<br>• Marine Water Quality is being monitored regularly and results are submitted as part of the compliance reports. No abnormal |

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| | | results were observed during the monitoring period. (**Refer Annexure II**).<br>  <br>**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 | **Being Complied**<br>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. 94.15 crores have been disbursed till 31.03.2021 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 few balance LAPs is in progress. *(Source: VISL)*<br><br>The status of the CSR activities envisaged in the fisheries sector is as follows:<br>**Water supply**: A Water Supply Scheme for the local community has been commissioned in April 2013 by VISL by expending an amount of Rs. 8.10 crores. For Operation & Maintenance (O&M) of the same an amount of Rs. 5.28 crores has been spent till date. From 04.04.2019 onwards, O&M of the scheme is being done by Kerala Water Authority (KWA). *(Source: VISL)* |

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| | (3crores) and (v) solid waste management (2crores). | **Fish Landing centre**: 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. 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)*<br>**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. *(Source: VISL)*<br>**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)*<br>**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, whereas the operation of the centre with logistics and other high-end courses is vested with Adani Skill Development Centre. Preference is being |

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| | | given to local people based on skill and competency during the construction stage. Tender for fixing transaction advisor has been invited. *(Source: VISL)*<br>**Environmental/Sanitation:** Adani Foundation has started a clean campaign programme in the community to have awareness on personal cleanliness, cleanliness of the surroundings and ensure proper community monitoring for its effectiveness; with strict COVID protocol. One of the livelihood groups, promoted under the CSR of AVPPL/Adani Foundation - Karsheeka Karma Sena is coordinating the campaign. Most of the members who are actively participating in the cleaning campaign are from widow's category as part of our Widow's engagement programme.<br>  <br>**Cleaning Campaign**<br><br>**Gangayar Canal:** As the community people reported the sand accumulation at Gangayar causing flooding and which has directly affected more than 100 houses during rainy season, AVPPL/Adani Foundation has been regularly removing sand from the mouth of Ganagayar to ensure proper water flow to sea. The dredging department of HOWE is doing the work at the mouth of Gangayar River |

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| | | joining sea at Valiyakadappuram every day. The proposed maintenance to ensure proper water flow and desilting of Gangayar initiated during the month of December 2020. The work has been entrusted to Minor Irrigation Department under the supervision of Harbour Engineering Department (HED). The project cost of Rs. 89 lakhs for the same has been shared equally by AVPPL and VISL. But as the tenders for the work shown an additional expense of Rs. 30 lakhs Minor Irrigation Department official request VISL/AVPPL to allot the same in the Monitoring committee meeting held on 19.02.2021. The proposal included the following:<br>• Desilting of waste up to 1 km from the mouth of the canal<br>• Core wall (Break water) to block sand iteration at the southern side of the exiting Fishing Harbour<br>• Installation of three Silt breakers at a distance of 500 m & a footbridge<br><br>  <br>**Ensuring proper water flow at Gangayar Canal**<br><br>**Solid Waste Management:** Adani Foundation, in association with Trivandrum Municipal Corporation, has installed 26 "Thumboormozhi Aero Bins" in the communities of Kottappuram, Vizhinjam and |

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<tr><td></td><td></td><td>Harbour divisions as a one-stop solution for the alarming issue of Solid Waste Management. Municipal Corporation employed 9 sanitation workers for the day to day management of bins. The following table depict the location of bins and quantum of waste handled through this bins<br><br>
<table>
<tr><th>S. No.</th><th>Location of Bins</th><th>No. of Bins</th><th>No of families Served</th><th>Quantum of Waste /day</th></tr>
<tr><td>1</td><td>Vizhinjam Market</td><td>8</td><td>850</td><td>220 Kg</td></tr>
<tr><td>2</td><td>Harbour Mathippuram</td><td>10</td><td>1000</td><td>300 Kg</td></tr>
<tr><td>3</td><td>Kottappuram – Charuvila</td><td>3</td><td>250</td><td>100 kg</td></tr>
<tr><td>4</td><td>Puloorkonam, Vizhinjam</td><td>5</td><td>500</td><td>150 Kg</td></tr>
<tr><td colspan="2">Total</td><td>26</td><td>2600</td><td>770 kg</td></tr>
</table>
<br>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 October 2020 to March 2021 is given in Annexure III.</td></tr>
<tr><td>(vii)</td><td>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.</td><td>Will be Complied<br>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 submitted to Southern Railway for its approval. All the required clarifications have been provided to Southern Railways and the approval is expected shortly. (Source: VISL)</td></tr>
<tr><td>(viii)</td><td>Compensation packages in accordance with the Central/State Government</td><td>Will be Complied<br>Resort owners evicted have been compensated for land and not for the</td></tr>
</table>

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| | norms shall be given to all the authorized-cum-affected (having valid clearances as applicable) resort owners. | structures since they were in violation of CRZ notification. An area of 0.728 Ha has been acquired up to 31.03.2021 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 NOx & SOx shall remain within permissible limits. | **Will be Complied**<br>Currently project is under construction. This shall be complied during operational phase. |
| (x) | CSR activities shall cover villages within 10 km radius of the project. | **Complied**<br>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. 2.56 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 (October 2020 to March 2021) are enclosed as **Annexure III**. |

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| (xi) | Oil Contingency Management Plan shall be put in place. | **Will be Complied**<br>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.<br><br>After final review by PRT (West), ICG has made specific remarks on the compliance of OSDCP prepared in line with NOS-DCP guidelines; directing AVPPL to submit the OSDCP for approval only after pollution response equipment are in place.<br><br>Considering that the procurement of pollution response equipment will be in line with the development of the port, the final OSDCP will be submitted to ICG for approval prior to commissioning of the port; when the pollution response equipment are in place. |
| (xii) | All the recommendations /conditions stipulated by Kerala Coastal Zone Management Authority (KCZMA) shall be complied with. | **Complied**<br>AVPPL are complying with all the recommendations/conditions of KCZMA. Copies of the HYCRs are also being sent to KCZMA. Compliance to the recommendations/conditions of KCZMA for the period October 2020 to March 2021 is enclosed as **Annexure IV**. |
| (xiii) | The responses/ commitments made during public hearing shall be complied with in letter and spirit. | **Complied**<br>AVPPL are complying with the responses/commitments made during public hearing (as applicable). Status of the same is being submitted regularly with HYCRs to all the authorities concerned. The compliance status of the commitments made during Public Hearing & actions on the same during the compliance period October 2020 to March 2021 is enclosed as **Annexure V**. |
| (xiv) | All the recommendation of the EMP shall be complied | **Being Complied** |

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| | 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. | 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 VI**. |
| (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**<br>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 will be 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**<br>All the relevant details pertaining to EIA, ToR, EAC meetings, Public Hearing, etc. related to the project have been placed on VISL website http://www.vizhinjamport.in/eia-30-5-13.php |
| (xvii) | There shall be no withdrawal of groundwater in Coastal Regulation Zone Area, for this project. In case any groundwater is proposed to be withdrawn from outside the CRZ area, specific prior permission from the concerned State/Central Groundwater Board shall be obtained in this regard. | **Noted**<br>There will not be any withdrawal of groundwater in CRZ Area.<br><br>In case of requirement of groundwater withdrawal outside CRZ area, specific prior permission will be obtained from State/Central Groundwater Board.<br><br>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 |

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| | | 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.<br><br>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 100KLD water is being consumed for construction related activities during the compliance period (October 2020 to March 2021). |
| (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**<br>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 (October 2020 to March 2021) 35 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**<br>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**<br>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**<br>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. |

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| | | 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 the provision of Solid Waste (Management and Handling) Rules, 2000. | **Being Complied**<br>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 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**<br>12 DG sets are present at site; 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**<br>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 | **Will be Complied**<br>The project is in construction phase and the same shall be complied during operational phase. |

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| | traffic control guidelines shall be framed. | |
| (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**<br>**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 in line with the establishment of the project. A greenbelt development plan has been considered in the Master Plan and adequate budgetary provision has been kept for this purpose.<br><br>**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 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. Rs. 80.50 Lakhs has been spent towards Phase-I of the compensatory afforestation at Sainik School.<br><br>  <br>**Progress at Sainik School as on 31.03.2021** |

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|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | | Additionally, as during the course of development of port more trees are being cut, AVPPL had applied for necessary permissions from Forest Dept. for cutting of trees. Thereafter, GoK and Forest Dept. have further identified land of area 35 Ha for Phase-2 of compensatory afforestation in lieu of trees felled for development of Vizhinjam port project. Phase-2 of the scheme has been approved by GoK vide Government Order No. G.O(Rt)No.183/2018/F&WLD dated 26.06.2020 (**Annexure VII**). Govt. has accorded Administrative sanction of Rs. 2.61 Crores for the scheme for Phase-2.<br><br>AVPPL, in collaboration with Forest department, have completed nursery works in 11 Ha of area at Kerala University Campus, Karyavattom (at an aerial distance of 23 km from the Vizhinjam Port project site) and have begun planting operations.<br><br>  <br>**Nursery Works at Kerala University**<br>  <br>**Compensatory Afforestation at Kerala University Campus** |

| 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 October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | |  <br>**Progress at Kerala University as on 31.03.2021** |
| (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**<br>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.<br><br>An amount of Rs. 1.796 Crores has been utilized towards EMP implementation measures during compliance period October 2020 to March 2021. Till date, an amount of Rs. 17.47 Crores has been spent on environmental protection measures. The EMP expenditure for the compliance period October 2020 to March 2021 is enclosed as **Annexure VIII**. |
| (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**<br>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. |

| 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 October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | | Organizational Structure for Environment, Health, and Safety & CSR for construction phase is enclosed as **Annexure IX**. |
| (xxix) | Staff Colony should be located beyond CRZ area. | **Will be Complied**<br>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**<br>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:<br>• 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.<br>• Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 7.12.2015.<br>• CTE for consumer pump inside the Vizhinjam port premises was obtained on 07.03.2021 (Consent No.: PCB/TVM-DO/NTA/PTP/15/2021) for the period of 5 years valid up to 28.02.2026 (enclosed as **Annexure X**).<br>• 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 | **Complied**<br>On an average 307 Nos. of employees, staff and construction workers are engaged in the |

| Half Yearly Compliance Report (HYCR) on Conditions Stipulated in Environmental & CRZ Clearance (EC) F.No.11-122/2011-IA.III dated 03.01.2014 for the Period October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | and sanitation must be ensured for construction workers during the construction phase of the project to avoid any damage to the environment. | port construction activities on a daily basis during the compliance period October 2020 to March 2021.<br><br>Construction workers and Labours were housed in labour camps near to the project site as well as nearby resorts. Labourers were 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.<br><br>Presently, during the present compliance period, the contractors have demobilized and there are no workers residing in the labour camps. It is ensured that labourers who are staying outside the labour camps are provided with necessary infrastructure facilities. |
| (iii) | Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality. | **Complied**<br>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 II**. There are no significant changes observed in the water quality during the compliance period. |
| (iv) | Borrow sites for each quarry sites for road construction material and dump sites must be identified keeping in view the following:<br>(a) No excavation or dumping on private property is carried out without written consent of the owner.<br>(b) No excavation or dumping shall be allowed on wetlands, forest areas or other ecologically | **Complied**<br>Quarry material is being obtained from approved quarry sites only.<br><br>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.<br><br>Earth cutting generated from road corridor construction at present are dumped in truck terminal area.<br>• No excavation has been carried out in private property. |

| 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 October 2020 to March 2021 | | |
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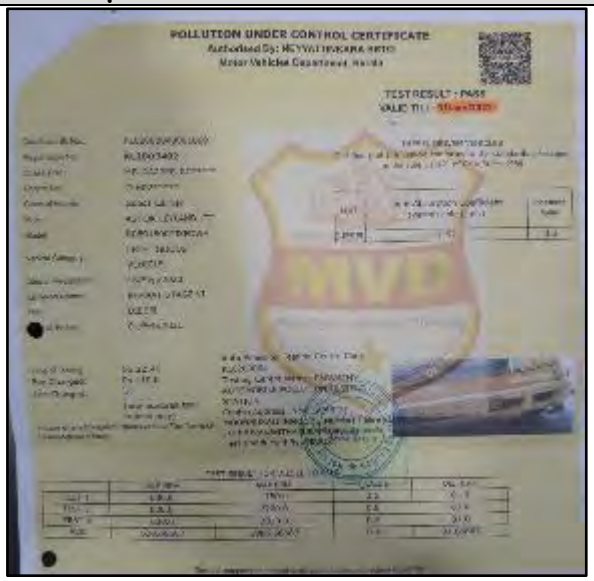
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | valuable or sensitive locations.<br>(c) Excavation work shall be done in close consultation with the Soil Conservation and Watershed Development Agencies working in the area, and<br>(d) Construction spoils including bituminous 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. | • No excavation or dumping has been carried out in wetlands, forest area or other ecologically valuable or sensitive locations.<br>• 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.<br>• 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**<br>The construction material was obtained from approved quarries only.<br><br>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:<br>• 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)<br>• Nagaroor Village, Chirayinkeezhu Taluk, Thiruvananthapuram District (Details submitted along with the HYCR for the period April 2019 to September 2019)<br><br>In case of new quarries, necessary approvals will be obtained from the competent |

| 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 October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | | authority. Apart from these, the concessionaire is also sourcing rocks from the following private quarry owners in Kerala:<br>• Vismaya Rocks Pvt. Ltd. Quarry at Kummil Village, Kottarakara Taluk, Kollam District, Kerala<br>• Tasna Mines Quarry at Mancode Village, Kottarakara Taluk, Kollam District, Kerala<br><br>The concessionaire is also sourcing rocks from several private quarry operators in Tamil Nadu. It is ensured that all private quarry owners have necessary approvals and permits from competent authorities. |
| (vi) | The project authorities shall make necessary arrangements for disposal of solid wastes and for the treatment of effluents by providing a proper wastewater treatment plant outside the CRZ area. The quality of treated effluents, solid wastes and noise level etc. must conform to the standards laid down by the competent authorities including the Central/State Pollution Control Board and the Union Ministry of Environment and Forests under the Environment (Protection) Act, 1986, whichever are more stringent. | **Being Complied**<br>• No solid waste is being disposed of in the CRZ area.<br>• Solid waste is handled as per the Solid Waste Management Rules, 2016 as amended.<br>• 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.<br>• 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 & Consultant. Summary of the Ambient Air Quality Monitoring (AAQM) for the duration from October 2020 to |

**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 October 2020 to March 2021**

| S. No. | Conditions | Compliance Status as on 31.03.2021 |
|---|---|---|
| | | March 2021 at 5 monitoring locations is mentioned below.<br><br>**Parameter** / **Unit** / **Max** / **Avg.** / **Min** / **Perm. Limit**<br>$PM_{10}$ / $\mu g/m^3$ / 92 / 56 / 30 / 100<br>$PM_{2.5}$ / $\mu g/m^3$ / 51 / 21 / 8 / 60<br>$SO_2$ / $\mu g/m^3$ / 9.60 / 5.10 / BDL / 80<br>$NO_2$ / $\mu g/m^3$ / 15.10 / 7.87 / BDL / 80<br>CO / $mg/m^3$ / BDL / BDL / BDL / 4<br>HC / ppm / BDL / BDL / BDL / --<br><br>• Detailed Monitoring Reports for the period October 2020 to March 2021 is attached as **Annexure II**).<br>• All the monitored parameters were found within the prescribed limits. |
| (vii) | The proponent shall obtain the requisite consents for discharge of effluents and emissions under the Water (Prevention and control of Pollution) Act, 1974 and the Air (Prevention and control of Pollution) Act, 1981 from the Kerala State Pollution Control Board before commissioning of the project and a copy of each of these shall be sent to this Ministry. | **Will be Complied**<br>CTO under the Water (Prevention and control of Pollution) Act, 1974 and the Air (Prevention and control of Pollution) Act, 1981 will be obtained from KSPCB before commissioning of the project and copy of the CTO will be sent to Ministry on receipt. |
| (viii) | Adequate precautions shall be taken during transportation of the construction material so that it does not affect the environment adversely. | **Complied**<br>Following precautionary measures are undertaken during transportation of the construction material as environment safeguard:<br>• Tarpaulin cover is being used during transportation of construction material<br>• All vehicles coming into the site are under a speed restriction of 20 km/hr<br>• Regular Water Sprinkling is done on the approach road by water tankers.<br>• It is ensured that all vehicles entering the Port have a valid PUC certification |

| 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 October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | | • The dumpers have speed governors ensuring adherence to speed limit<br>  <br>**Water Sprinkling in Progress**<br>  <br>**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 October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | |  <br>**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**<br>There was no visit by officers of Ministry/Regional Office at Bangalore during the compliance period.<br><br>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 | **Noted** |

| 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 October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | the satisfaction of the Ministry. | |
| (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**<br>AVPPL is the concessionaire for implementing the project and operating it for the next 40 years, based on concession agreement signed between the GoK &, AVPPL on 17.08.2015. Vizhinjam International Seaport Limited (VISL) is the nodal agency for development of the port on behalf of GoK. As on date, there is no change in the project profile. |
| (xiii) | The project proponent shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work. | **Complied**<br>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**<br>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 | **Noted for Compliance**<br>EC has been obtained from MoEF vide letter dated 03.01.2014 (F.No.11-122/2011-IA.III). As per EIA Notification 2006 and Office Memorandum (O.M.) dated 12.04.2016, the validity of the EC is for seven years up to 03.01.2021. As per the provisions of MoEF&CC, the validity of the EC may be further extended for a maximum period of three years. |

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|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | the amendments and rules made thereafter. | VISL had submitted online application and required relevant documents on PARIVESH for extension of EC on 08.10.2020, 03.11.2020 and 19.11.2020. The Proposal (IA/KL/MIS/178082/2020) was considered in the 246th and 247th EAC meeting of Infra-1 committee of MoEF&CC held on 20.10.2020 and 23.11.2020; wherein VISL and NABET accredited consultant-L&T-IEL had made a presentation to the committee members.<br><br>Thereafter, MoEF&CC vide letter No. IA/KL/MIS/178082/2020 dated 29.12.2020 (Enclosed as **Annexure XI**) have extended the validity of EC of Vizhinjam port by 3 years till 02.01.2024. |
| 14. | All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities. | **Complied**<br>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.<br><br>Further, necessary approvals from concerned Statutory Departments / Agencies have been obtained for the construction designs/drawings relating to the proposed construction as mentioned hereunder:<br>• 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.<br>• 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).<br>• CTE for consumer pump inside the Vizhinjam port premises was obtained on 07.03.2021 (Consent No.: PCB/TVM- |

| 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 October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | | DO/NTA/PTP/15/2021) for the period of 5 years valid up to 28.02.2026 (enclosed as **Annexure X**).<br>• 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 and a copy of the same should be forwarded to the Regional office of this Ministry at Bangalore. | **Complied**<br>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).<br><br>Copy of the EC is available on VISL website at http://www. vizhinjamport.in/eia-30-5-13.php. The same is also uploaded on Adani Ports and Special Economic Zone (APSEZ) website at https://www.adaniports.com/Downloads |
| 16. | This Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project. | **Noted** |
| 17. | Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under | **Noted**<br>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 |

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|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | Section 16 of the National Green Tribunal Act, 2010. | 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**<br>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.<br><br>Copy of the EC is available on VISL website at http://www. vizhinjamport.in/eia-30-5-13.php. The same is also uploaded on APSEZ website at https://www.adaniports.com/Downloads |
| 19. | The proponent shall upload the status of compliance of the stipulated Clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; SPM, RSPM, $SO_2$, NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain. | **Complied**<br>The copy of the latest HYCR for the period April 2020 to September 2020 including the results of six monthly monitoring data for the same period has been uploaded on VISL website http://www.vizhinjamport.in and also on APSEZ website https://www.adaniports.com/Downloads.<br><br>The HYCR for the period April 2020 to September 2020 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA vide email dated 01.12.2020 (a copy of the email is enclosed as **Annexure XII**).<br><br>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 |

| 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 October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | | Sediment) are enclosed as **Annexure II**. 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**<br>HYCRs on the status of compliance of the stipulated clearance conditions including results of monitored data are regularly submitted to all the concerned agencies.<br><br>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 April 2020 to September 2020 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA vide email dated 01.12.2020 (a copy of the email is enclosed as **Annexure XII**). |
| 21. | The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned Kerala State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986 as amended subsequently, shall also be put on the website of the company along with the status of compliance of Clearance conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail. | **Will be Complied**<br>The project is in construction phase. The same shall be complied post commissioning during operational phase. |

**Enclosures:**

| Annexure Number | Details of Annexure |
|---|---|
| Annexure I: | Shoreline Monitoring Report (October 2020 to March 2021) |
| Annexure II: | Environment Monitoring Report (October 2020 to March 2021) |
| Annexure III: | CSR Activities by AVPPL (October 2020 to March 2021) |
| Annexure IV: | Compliance of Conditions of KCZMA Recommendation for EC/CRZ Clearance |
| Annexure V: | Compliance of the Response/Commitments made during Public Hearing |
| Annexure VI: | Status of Environment Management Plan |
| Annexure VII: | G.O(Rt)No.183/2018/F&WLD – Approved Scheme for Phase-2 Afforestation |
| Annexure VIII: | EMP Expenditure (October 2020 to March 2021) |
| Annexure IX: | Environment Health, Safety & CSR Organizational Structure |
| Annexure X: | CTE for Consumer Pump inside the Vizhinjam Port |
| Annexure XI: | Extension of EC Validity Letter from MoEF&CC |
| Annexure XII: | Submission Email of HYCR for the Period April 2020 to September 2020 |

# Annexure I

# Shoreline Monitoring Report

# (October 2020 to March 2021)

SHANKAR SURVEYS

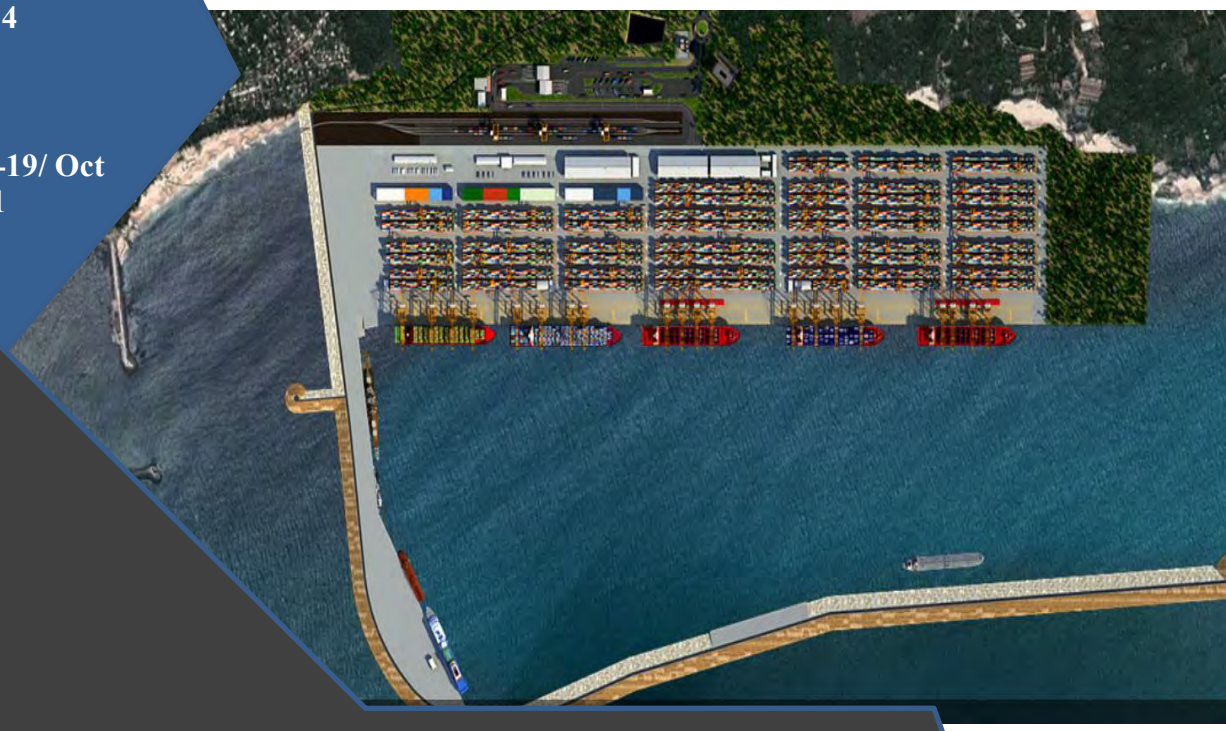
# Adani Vizhinjam Port Pvt. Ltd

## OCEANOGRAPHIC AND BATHYMETRIC DATA COLLECTION FOR ASSESSMENT OF SHORELINE CHANGES

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

Date: 29th May 2021

SAC Ref #: SAC/P167-19/ Oct 2020 – Mar 2021 Rev 1



# HALF YEARLY REPORT
# (OCTOBER 2020 TO MARCH 2021)

# "APPROVAL SHEET"

| *Prepared by:* | *Signed* | *Date* |
|---|---|---|
| *V Mehta* |  | *29/05/2021* |

| *Checked and Approved by:* | *Signed* | *Date* |
|---|---|---|
| *S Philip* |  | *29/05/2021* |

## REVISION CONTROL

| Date | Rev | Section / Page No. | Remarks | Comment by |
|---|---|---|---|---|
| 18/05/2021 | 0 | | Submitted for approval | |
| 29/05/2021 | 1 | Sec 2, Pg 11 | Additional bigger figure provided for metocean locations | NIOT |
| | | Sec 2, Pg 12 | Port limit shown in Figure 2-2 | NIOT |
| | | Sec 3.1, Pg 16 | Photographs showing relocation of AWS | NIOT |
| | | Sec 3.3, Pg 17 | Beach sample collection dates added | NIOT |
| | | Sec 3.3, Pg 20 | Water sample collection dates added | NIOT |
| | | Sec 3.4, Pg 21 | Figure showing grab sampling locations modified to show all locations as suggested | NIOT |
| | | Sec 4.2, Pg 23 | Figure 4-2 changed for better clarity | NIOT |
| | | Sec 5.2, Pg 29 | Better picture added showing ADCP | NIOT |
| | | Sec 5.3, Pg 31 | Replaced 'local' with 'temporary' in first paragraph | AVPPL |
| | | Sec 5.3, Pg 32 | Added specifications of Valeport ATG | NIOT |
| | | Sec 5.4, Pg 33 & 34 | Additional figures showing plan view and schematic of AWS provided | NIOT |
| | | Sec 5.8, Pg 40 | Turbidity sensor details with brief specification provided | NIOT |

| | | | | |
|---|---|---|---|---|
| | | Sec 6.1, Pg 44 | Random manual tide check table added | NIOT |
| | | Sec 6.1, Pg 47 & 48 | Removed zero data in December 2020 tide graph, reasons for data gaps provided | NIOT |
| | | Sec 6.2, Pg 50 | Added column of Hmax in Table 6-1, sentence deleted as suggested | AVPPL & NIOT |
| | | Sec 6.2, Pg 51 & 52 | Time series of wave data graphs amended as suggested | NIOT |
| | | Sec 6.3, Pg 53 | Changed 'January-February' to 'January 2021 – February 2021', added start and end time in Table 6-2. Surface current speed at all locations checked and found to be correct | NIOT |
| | | Sec 6.7, Pg 66 | Modified the nearest depth which could be attained in cross shore profiles. Added reasons wherever onshore profiling could not be carried out | NIOT |
| | | Sec 6.9, Pg 77 | Changed 'For post-monsoon' to 'In the month of December 2020'. Also elaborated the reason for beach sample not being collected in some places | NIOT |
| | | Sec 6.9, Pg 80 | Changed 'monsoon' to 'post-monsoon' in Table 6-14 | NIOT |
| | | Sec 6.9, Pg 83 to | Added grain size distribution curves for 4 beach samples as suggested | NIOT |
| | | Sec 6.10, Pg 92 | Added grain size distribution curves for 4 grab samples as suggested | NIOT |
| | | Sec 6.11, Pg 103 | Amended Figure 6-23 Turbidity Buoy 3 time series as suggested | NIOT |
| | | Sec 6.11, Pg 106 | Validation of turbidity sensor data provided for monsoon period | NIOT |
| | | Sec 6.12, Pg 107 & 108 | Brief write-up of equipment used and methodology included | NIOT |

# Table of Contents

## List of Tables



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## ABBREVIATIONS

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

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

# DEFINITIONS

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

# 1 EXECUTIVE SUMMARY

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

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

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

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

Shankar 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 October 2020 to March 2021.

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 (Mar-May), monsoon (Jun-Oct), and Post-monsoon period (Nov-Feb), to measure in real-time turbidity from three levels and three locations, bathymetric survey of up to 20m contour in two seasons, cross-shore profiling (CSP) from 10m CD (4 CSP lines carried out up to a depth of 20m during the months of January, May, August and October) to 100m inland from the high water line along a stretch of 40 km, water & grab sampling, littoral environmental observation and river crossing survey. All these are to be carried out for a period of 3 years commencing June 2019.

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

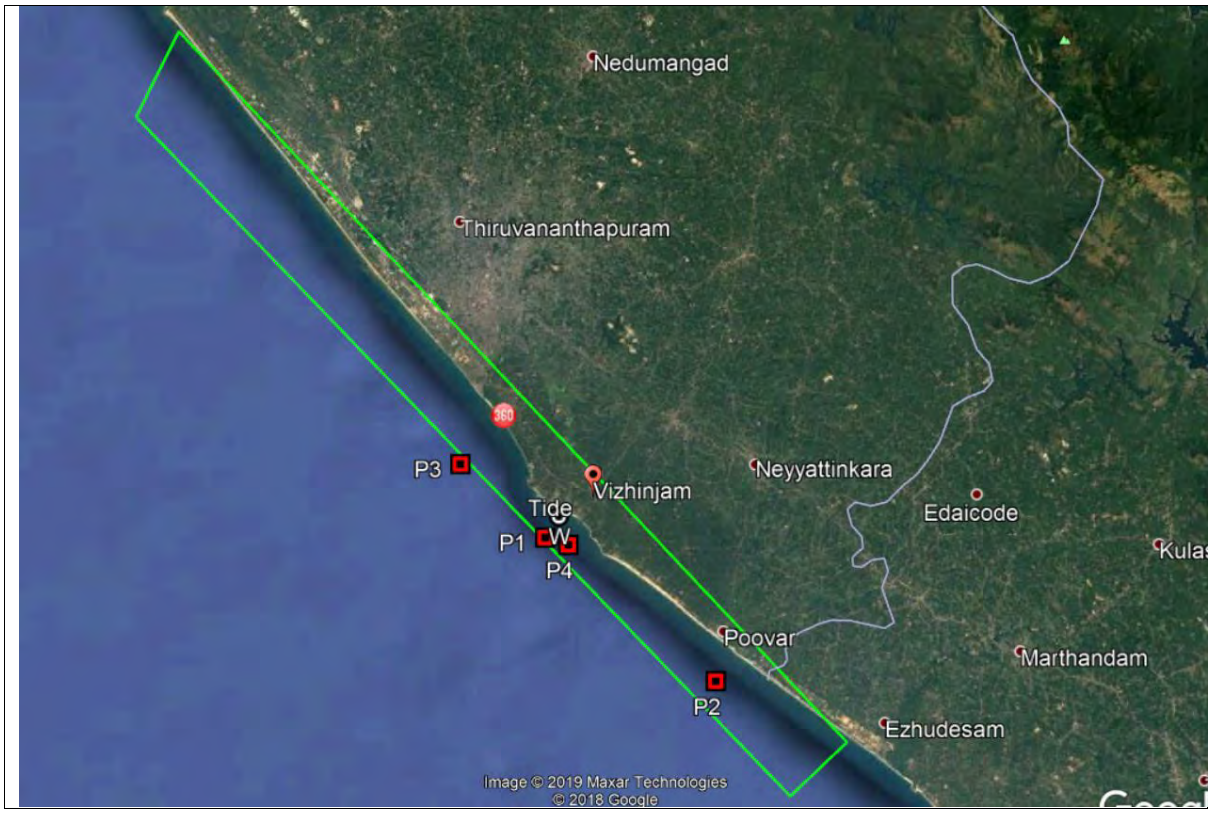



Figure 2-1: General Survey Location

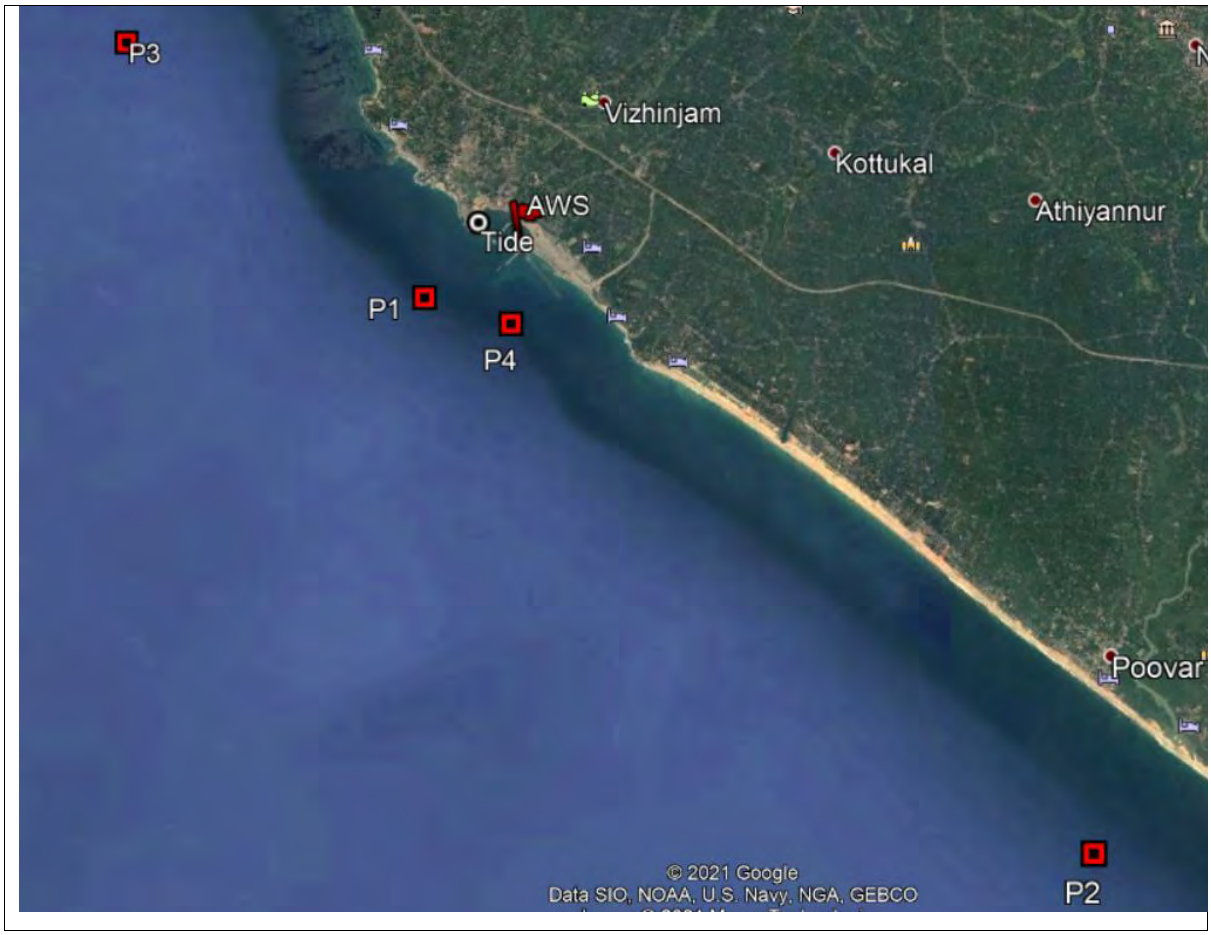



Figure 2-2: MetOcean Locations

①

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 2-3. The cross-shore profiles are named as CSP-01 to CSP-81. CSP-01 corresponds to the southernmost profile which lies to the south of the existing Vizhinjam Harbour and gradually increases progressing towards north for the entire 40 km stretch (20 km on either side of the port) with a 500 m interval between each CSP line, CSP-81 being the northernmost profile.


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

# 3 SCOPE OF WORK

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

- To mobilise a suitable marine spread and a survey boat at site for carrying out the operations.
- To provide requisite personnel and equipment for undertaking of oceanographic measurements and study of shoreline.
- Monthly cross-shore beach profiling perpendicular to the shoreline for a 40 km stretch at intervals of 500m, using RTK or total station landward up to 100m from HTL or +2m of HTL and using shallow draft boats, sled or any other suitable techniques seaward down to 10m CD (4 CSP Lines carried out up to a depth of 20 m in the months of January, May, August and October).
- Monthly monitoring of littoral zone (at the CSP locations) to observe the littoral transport direction and alongshore current speed by means of appropriate drogue observations and visual observations.
- Monthly photographic documentation of geomorphological changes (at the CSP locations).
- Seasonal beach sediment sampling and analysis (at the CSP locations).
- Bathymetric survey twice in a year, i.e. just after the monsoon season and just prior to the commencement of the next monsoon to generate 0.5m contours (with bathymetric survey lines spaced at 25 m interval) in areas with depths to 20m CD using multi beam echo sounder.
- Bathymetry/cross section survey for 500m length of rivers debouching in a 40 km stretch of the coast.
- Seabed sediment sampling and analysis in 80 sq. km with one sample per sq km.
- Collection and analysis of water samples at specified periods (seasonal) for total suspended solids (TSS) and turbidity from four specified locations.
- Current measurements (both magnitude and direction) using Acoustic Doppler Current Profiler (ADCP) at four locations, as marked in Figure 2-1, for the duration of full tidal cycle/30 days each during Pre-monsoon (Mar-May), Monsoon (Jun-Oct) and Post-monsoon period (Nov-Feb).
- Wave observations using WRB Datawell DWG-G shall be carried out at one location as marked on the location map.
- Tide measurements using an automatic tide gauge close to the survey area to observe the tidal variations around the clock at 6-minute intervals or as specified to cover one full year. The tide gauge shall be connected to the nearest Survey of India Benchmark.

- Collection of wind speed & direction, atmospheric pressure, humidity, temperature at 1 location specified by the client/EIC (Engineer In Charge) by establishing an automatic weather station.
- 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<br>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 EMCON Automatic Tide Gauge (ATG) was replaced by the Valeport Tidemaster ATG on 13th March 2021. The location co-ordinates of the tide station are provided below:

Table 3-2: Tide station location coordinates

| Tide Station Co-ordinates<br>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 |

The Gill Metpack Automatic Weather Station with rain gauge was shifted from the Ayur Bay Resort to the terrace of the Port Control Office building on 26th March 2021 as instructed by AVPPL. The following table shows the coordinates of the AWS installation:

Table 3-3: Weather station location coordinates

| **Weather Station Co-ordinates** | | | |
|---|---|---|---|
| **WGS-84 Spheroid, UTM Projection, CM 75 East, Zone 43, North** | | | |
| **Name** | **Latitude** | **Longitude** | **Height above CD (m)** |
| Weather station (on top of Ayur Bay Resort) | 08° 22' 13.53" N | 77° 00' 08.78" E | 28.456 |
| Weather station (on top of Port Control Office building) | 08° 22’ 22.75” N | 76° 59' 39.62" E | 13.335 |

*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.*

*The system was shifted from the Ayur Bay Resort to the terrace of the Port Control Office on 26th March 2021 as per the instructions from AVPPL. The wind sensor was installed at a height of 14.785m above MSL (15.335m above CD). As suggested by NIOT, 7% of the speed was reduced to derive the wind speeds at 10m above MSL.*

① The photograph of relocation is provided below:

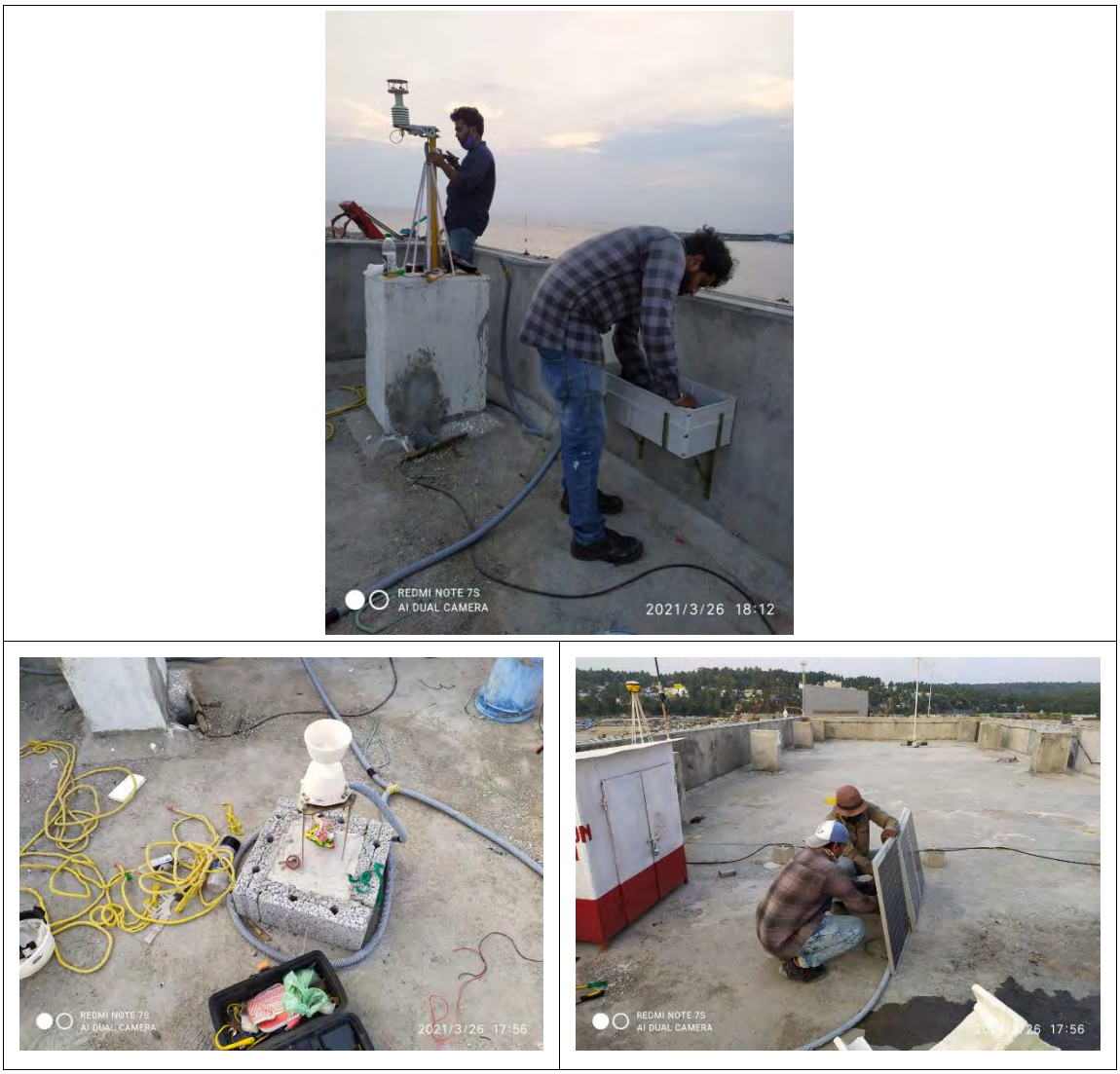



Figure 3-1: Relocation of AWS to Port Control Office building

## 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<br>WGS-84, UTM Projection, CM 75° East, Zone 43, North | | | | | | |
|---|---|---|---|---|---|---|
| Buoy No. | Easting | Northing | Water Depth (m) | Depth of sensor placement (m) | | |
| | | | | Surface | Mid-depth | Bottom |
| Turbidity Buoy-1 | 720497.55 | 923507.87 | 22.3 | 5.0 | 10.0 | 15.0 |
| Turbidity Buoy-2 | 718843.20 | 925075.84 | 22.0 | 5.0 | 10.0 | 15.0 |
| Turbidity Buoy-3 | 718784.75 | 926000.91 | 14.4 | 4.0 | 8.0 | 12.0 |

## 3.3 Beach and Water Sampling

A total of 81 beach samples were to be collected in two seasons, as part of the contract. The samples were to be analyzed for grain size distribution as per IS 1498. The samples were collected from 19th to 28th December 2020. The coordinates of the beach sampling locations are provided in the table below.

Table 3-5: Beach Sampling Locations

| BEACH SAMPLING LOCATIONS<br>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 |

| BEACH SAMPLING LOCATIONS<br>WGS-84, UTM Projection, CM 75° East, Zone 43, North | | |
|---|---|---|
| BS-11 | 8° 17.6207' N | 77° 5.7379' E |
| BS-12 | 8° 17.7276' N | 77° 5.5946' E |
| BS-13 | 8° 17.8899' N | 77° 5.3756' E |
| BS-14 | 8° 18.0524' N | 77° 5.1568' E |
| BS-15 | 8° 18.2151' N | 77° 4.9388' E |
| BS-16 | 8° 18.3603' N | 77° 4.7165' E |
| BS-17 | 8° 18.5517' N | 77° 4.5120' E |
| BS-18 | 8° 18.7213' N | 77° 4.3003' E |
| BS-19 | 8° 18.8852' N | 77° 4.0829' E |
| BS-20 | 8° 19.0488' N | 77° 3.8659' E |
| BS-21 | 8° 19.2152' N | 77° 3.6499' E |
| BS-22 | 8° 19.3848' N | 77° 3.4369' E |
| BS-23 | 8° 19.5582' N | 77° 3.2282' E |
| BS-24 | 8° 19.7318' N | 77° 3.0196' E |
| BS-25 | 8° 19.9075' N | 77° 2.8098' E |
| BS-26 | 8° 20.0796' N | 77° 2.5989' E |
| BS-27 | 8° 20.2492' N | 77° 2.3841' E |
| BS-28 | 8° 20.4130' N | 77° 2.1703' E |
| BS-29 | 8° 20.5731' N | 77° 1.9581' E |
| BS-30 | 8° 20.7305' N | 77° 1.7499' E |
| BS-31 | 8° 20.8951' N | 77° 1.5274' E |
| BS-32 | 8° 21.0493' N | 77° 1.2973' E |
| BS-33 | 8° 21.1815' N | 77° 1.0911' E |
| BS-34 | 8° 21.3210' N | 77° 0.8491' E |
| BS-35 | 8° 21.3974' N | 77° 0.6359' E |
| BS-36 | 8° 21.6830' N | 77° 0.4829' E |
| BS-37 | 8° 21.8799' N | 77° 0.2980' E |
| BS-38 | 8° 22.1369' N | 77° 0.1947' E |
| BS-39 | 8° 22.3420' N | 76° 59.9895' E |
| BS-40 | 8° 22.5417' N | 76° 59.7689' E |
| BS-41 | 8° 22.8201' N | 76° 59.0753' E |
| BS-42 | 8° 23.0287' N | 76° 58.7934' E |
| BS-43 | 8° 23.1727' N | 76° 58.6741' E |
| BS-44 | 8° 23.3709' N | 76° 58.5145' E |

| BEACH SAMPLING LOCATIONS<br>WGS-84, UTM Projection, CM 75° East, Zone 43, North | | |
|---|---|---|
| BS-45 | 8° 23.7061' N | 76° 58.3743' E |
| BS-46 | 8° 23.8974' N | 76° 58.3798' E |
| BS-47 | 8° 24.1304' N | 76° 58.2814' E |
| BS-48 | 8° 24.4789' N | 76° 58.1346' E |
| BS-49 | 8° 24.6320' N | 76° 58.0289' E |
| BS-50 | 8° 24.8665' N | 76° 57.8917' E |
| BS-51 | 8° 25.0976' N | 76° 57.7474' E |
| BS-52 | 8° 25.3176' N | 76° 57.5868' E |
| BS-53 | 8° 25.5653' N | 76° 57.4562' E |
| BS-54 | 8° 25.7602' N | 76° 57.2767' E |
| BS-55 | 8° 25.9643' N | 76° 57.0963' E |
| BS-56 | 8° 26.1500' N | 76° 56.9073' E |
| BS-57 | 8° 26.3461' N | 76° 56.7308' E |
| BS-58 | 8° 26.5741' N | 76° 56.5678' E |
| BS-59 | 8° 26.7782' N | 76° 56.4051' E |
| BS-60 | 8° 26.9997' N | 76° 56.2272' E |
| BS-61 | 8° 27.2030' N | 76° 56.0492' E |
| BS-62 | 8° 27.4175' N | 76° 55.8762' E |
| BS-63 | 8° 27.6142' N | 76° 55.6937' E |
| BS-64 | 8° 27.8102' N | 76° 55.5014' E |
| BS-65 | 8° 28.0132' N | 76° 55.3255' E |
| BS-66 | 8° 28.2159' N | 76° 55.1437' E |
| BS-67 | 8° 28.4224' N | 76° 54.9642' E |
| BS-68 | 8° 28.6228' N | 76° 54.7840' E |
| BS-69 | 8° 28.8276' N | 76° 54.6048' E |
| BS-70 | 8° 29.0316' N | 76° 54.4243' E |
| BS-71 | 8° 29.1104' N | 76° 54.3586' E |
| BS-72 | 8° 29.3118' N | 76° 54.1755' E |
| BS-73 | 8° 29.5150' N | 76° 53.9964' E |
| BS-74 | 8° 29.7202' N | 76° 53.8181' E |
| BS-75 | 8° 29.9258' N | 76° 53.6393' E |
| BS-76 | 8° 30.1345' N | 76° 53.4652' E |
| BS-77 | 8° 30.3450' N | 76° 53.2940' E |
| BS-78 | 8° 30.5558' N | 76° 53.1226' E |

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

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

The water samples were collected from 10th to 13th February 2021.

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 |

## 3.4 Grab Sampling

A total of 80 grab samples were collected from the offshore area in one season (March 2021) 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. An image of all the locations is provided in the figure below:

①

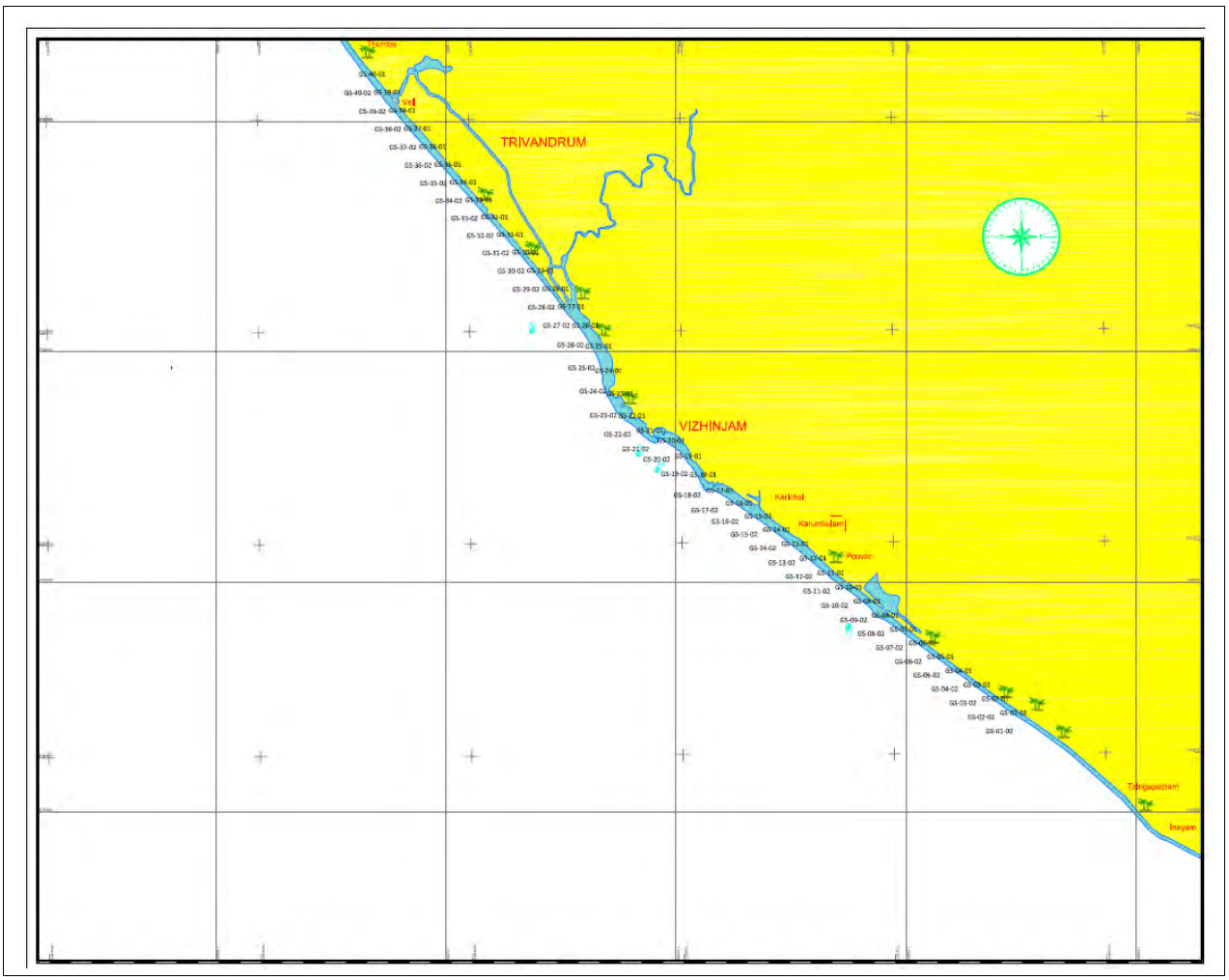



Figure 3-2: Grab Sampling Locations

# 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. | Land Surveyor |
| Adarsh Jayashankar | Oceanographer |
| 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:

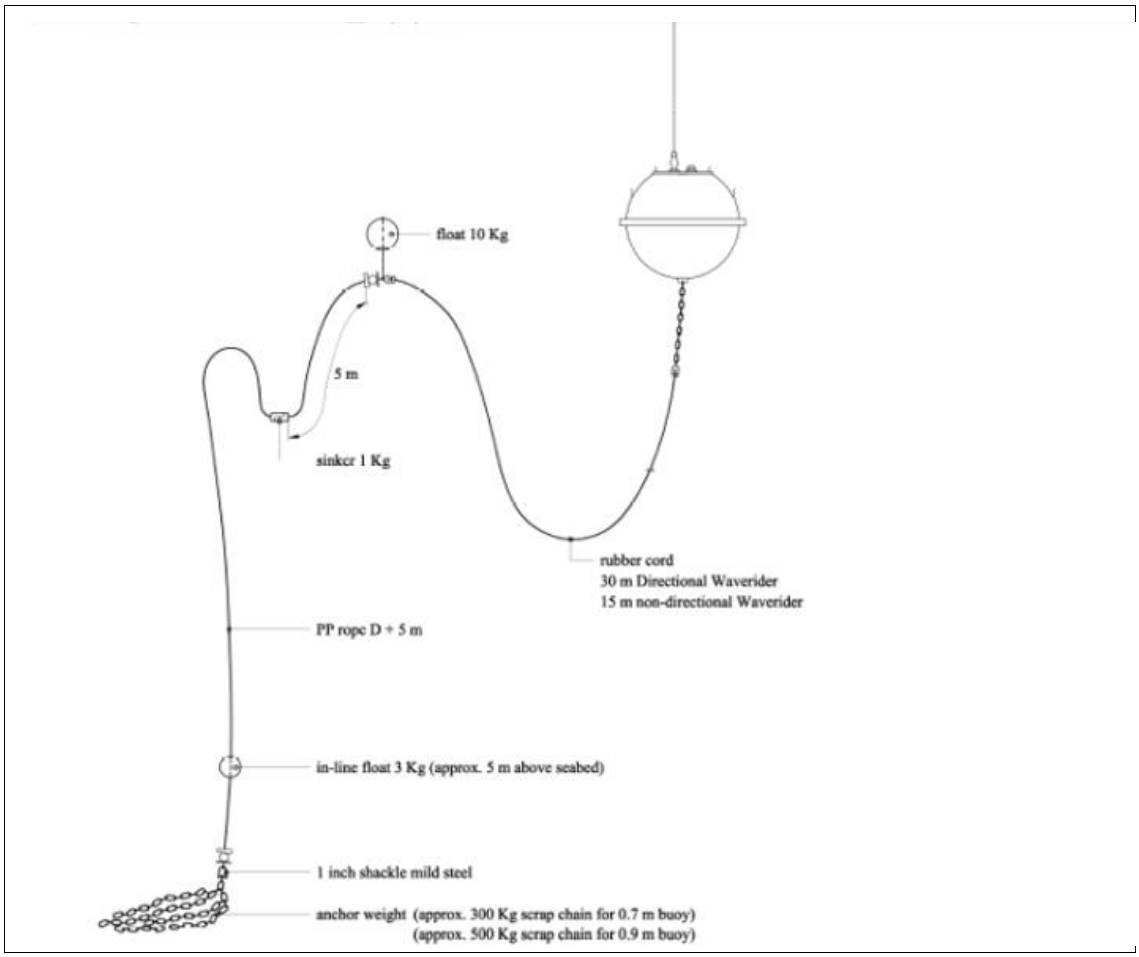



Figure 5-1: WRB Mooring Diagram

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


Figure 5-4: ADCP deployed at Pachalloor


Figure 5-5: ADCP deployed at Mulloor

.

## 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 temporary benchmark, situated on top of the jetty. The tide station was programmed to measure the tide at 5-minute intervals throughout the duration of the project.

The EMCON ATG was replaced by a Valeport Tidemaster ATG on 13th March 2021.

A photograph of the tide gauge location is shown below:


Figure 5-6: Tide Gauge

The specifications of Valeport Tidemaster ATG is provided below:

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

## 5.4 Automatic Weather Station (AWS)

A Gill Metpack Automatic Weather Station (AWS) was installed atop Ayur Bay Resort at Nellikunnu. This was shifted on 26th March 2021 to the terrace of the Port Control Office building. The system measures wind speed/direction, atmospheric pressure, temperature, relative humidity and rainfall.

The system consists of the following:

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

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

Some images of the automatic weather station are provided below:

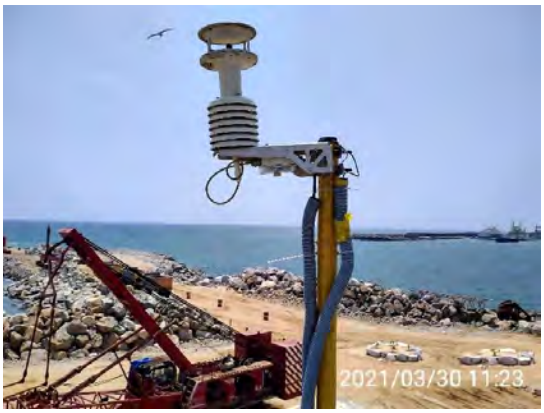




Figure 5-7: AWS on top of Port Control Office building

Plan and Schematic view of the AWS installation is provided in the figures below:

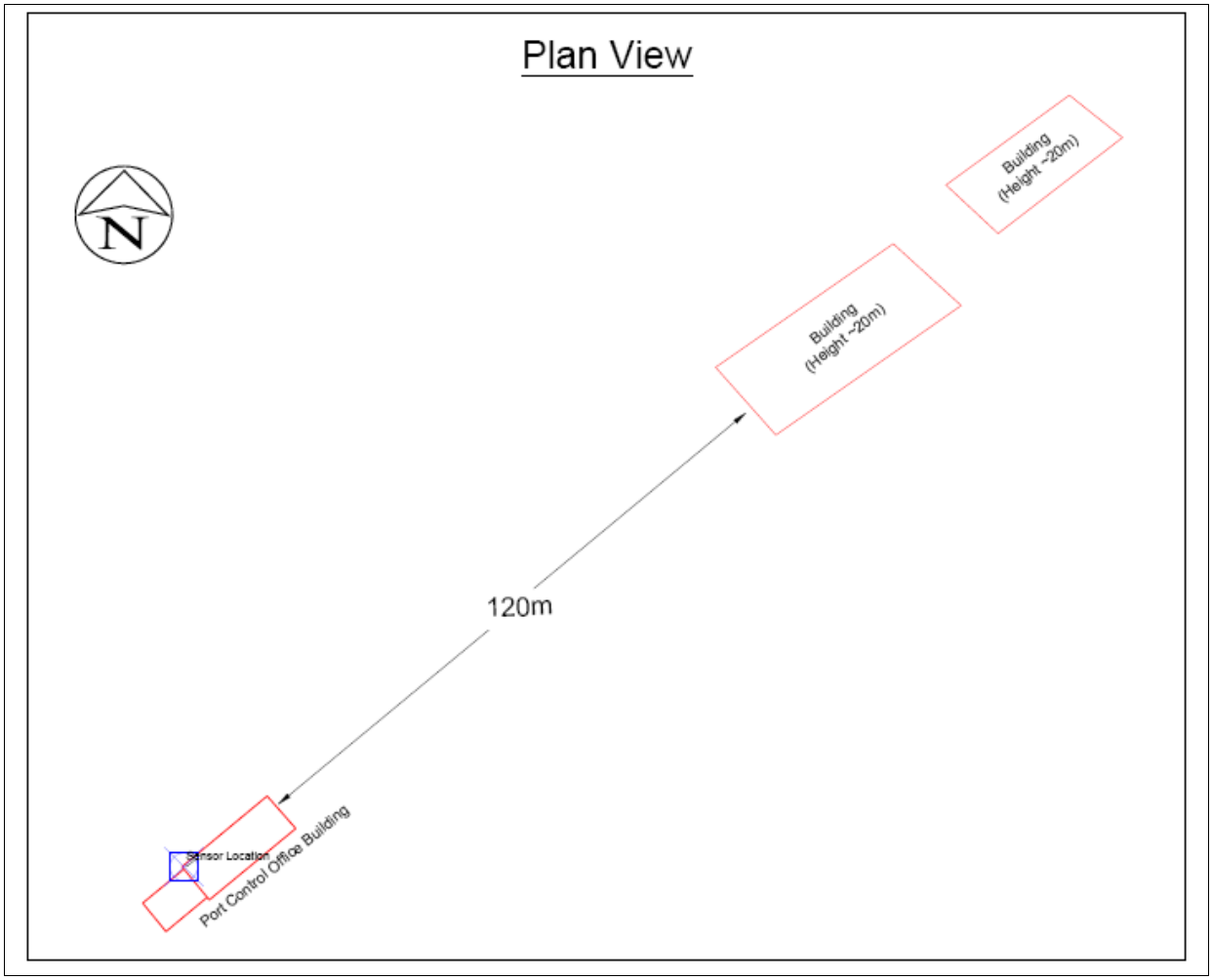



Figure 5-8: Plan View of AWS Installation

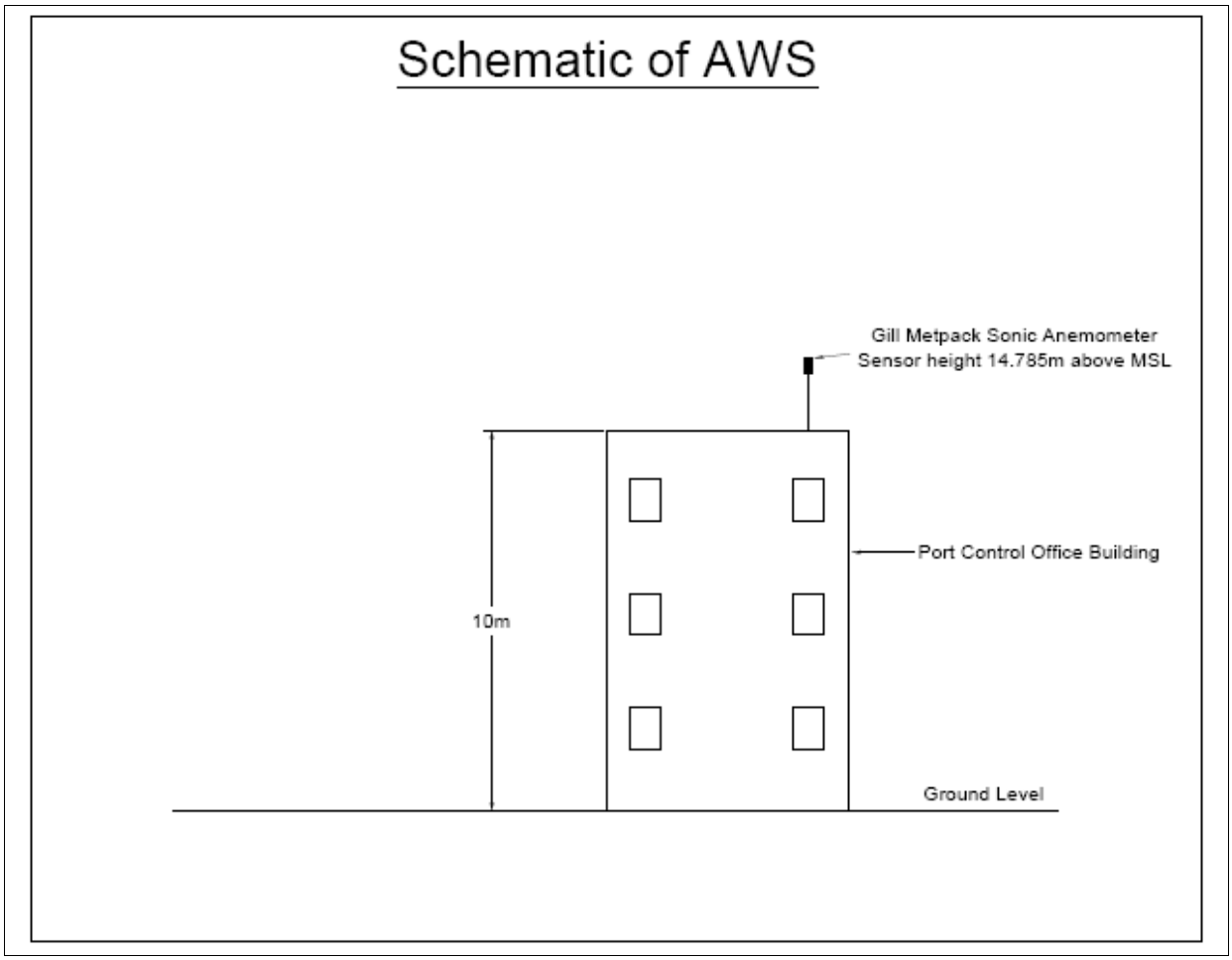



Figure 5-9: Schematic Plan of AWS Installation

## 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 5-10: RTK System with base station and rover

## 5.6 Multibeam Echo Sounder System

An R2Sonic 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 March 2021 are given below.

Table 5-1: MBES Calibration results

| Parameter | Value | Comments |
|---|---|---|
| Latency | 0.00s | Trimble SPS 855 positioning system |
| Roll | -0.45° | DMS accuracy 0.05° in roll |
| Pitch | 6.00º | DMS accuracy 0.05° in pitch |
| Yaw | 8.00º | Accuracy better than 0.2° |

## 5.7 DGPS Positioning System

Vessel positioning was carried out by the Trimble SPS 855 dual antenna DGPS system which also provides the heading. Vessel track and offset positions were recorded digitally in the navigation software. The positioning system was interfaced to the navigation software as well as the digital data acquisition system. DGPS positioning accuracy of the moving vessel was better than ±1m.

The computed position of the vessel from the DGPS receiver was interfaced to the navigation computer system. Hypack 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.

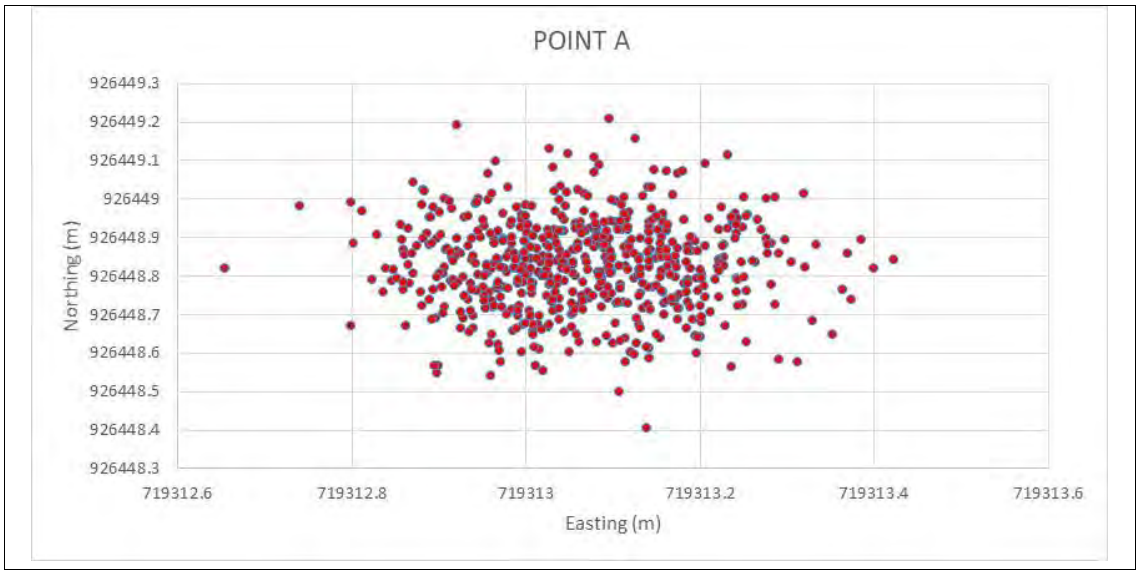
### 5.7.1 DGPS Consistency Check

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

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

Time was synchronized between Trimble/Hypack and the observer's watch, for which local time (GMT+5.30) was used. The Trimble SPS 855 DGPS antenna positions were logged in the Hypack navigation software. The logged data was processed to derive the final positions of both the points.

The difference between the calculated distance and measured distance was found to be within the permissible accuracy limit. The scatter plot of the DGPS calibration is shown in the figure below.



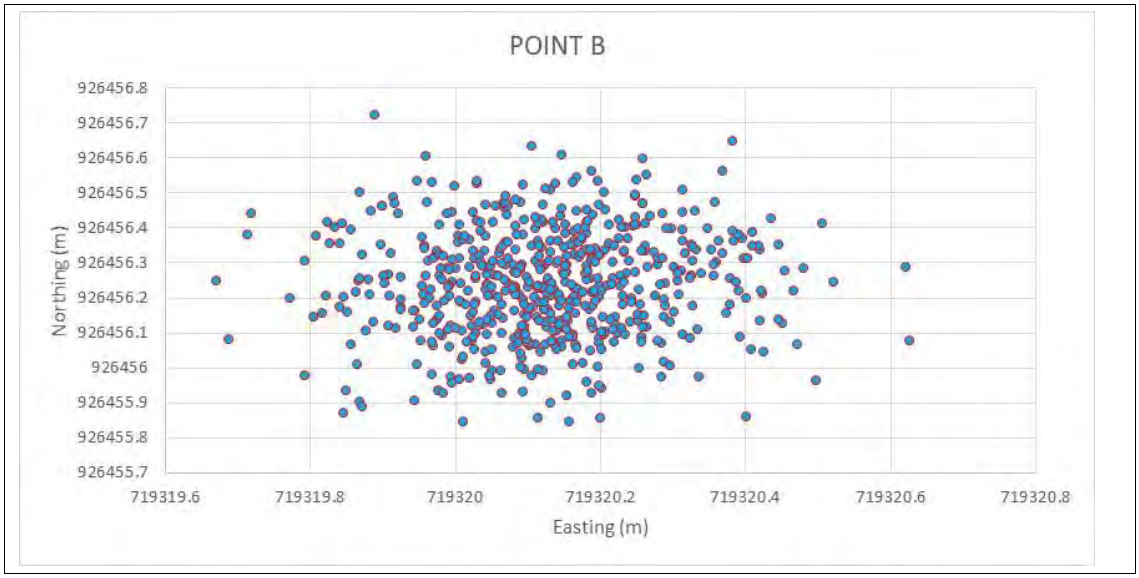




Figure 5-11: Scatter Plot of DGPS calibration on board M.F.B. Bethel

Table 5-2: DGPS Calibration results

| AVERAGE POSITIONS | | |
|---|---|---|
| **POINT** | **EASTING** | **NORTHING** |
| **A** | 719313.07 | 926448.83 |
| **B** | 719320.13 | 926456.24 |
| **Distance between points** | | **10.24 m** |
| **Measured Distance** | | **10.00 m** |
| **Difference** | | **0.24 m** |

### 5.7.2 Gyrocompass Calibration

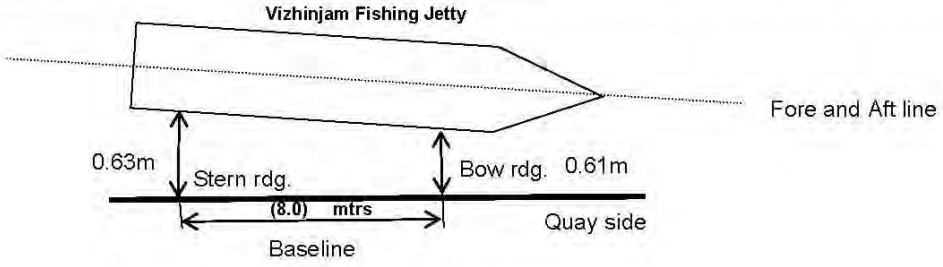
The calculated heading of the vessel was compared with the recorded gyrocompass heading to derive a calculated-observed (C-O) value, which was entered into the navigation software before commencing the survey. The gyro calibration for the month of March 2021 is provided in the figure below.

**GYRO CALIBRATION**
(Quay/Tape off set Method)

| | | | |
|---|---|---|---|
| **Job** | **AVPPL Shoreline Monitoring** | **Job No** | **P167-19** |
| **Client** | **AVPPL** | **Vessel** | **MFB Bathel** |
| **Location** | **Vizhinjam Fishing Jetty** | **Date** | **21-Mar-21** |
| **Gyro S/N** | **855** | | |

| **Quay heading(T)** | **Baseline length(m)** | **Gyro Name : TRIMBLE** | **Quayside on:** |
|---|---|---|---|
| **43.61** | **8.00** | **S/No. 855** | **Starboard** |

| Observations | | | | Calculations | | | |
|---|---|---|---|---|---|---|---|
| Time | Gyro (true) | Bow | Stern | Calc. angle | Calculated Heading | True Quay Hdg | C-O |
| 15:45:00 | 43.6 | 0.5 | 0.5 | 0.00 | 43.60 | 43.61 | 0.01 |
| 15:45:10 | 43.6 | 0.6 | 0.5 | -0.72 | 44.32 | 43.61 | -0.71 |
| 15:45:20 | 44.0 | 0.6 | 0.8 | 1.43 | 42.57 | 43.61 | 1.04 |
| 15:45:30 | 44.2 | 0.4 | 0.6 | 1.43 | 42.77 | 43.61 | 0.84 |
| 15:45:40 | 43.6 | 0.9 | 0.7 | -1.43 | 45.03 | 43.61 | -1.42 |
| 15:45:50 | 44.3 | 0.5 | 0.8 | 2.15 | 42.15 | 43.61 | 1.46 |
| 15:46:00 | 43.5 | 0.8 | 0.5 | -2.15 | 45.65 | 43.61 | -2.04 |
| **Average** | **43.83** | **0.61** | **0.63** | **0.10** | **43.73** | **43.61** | **-0.12** |




Note: Drawing not on scale only for representaion purpose

| Signed | | | |
|---|---|---|---|
| **Designation** | **Name** | **Signature** | **Date** |
| **Surveyor** | **Arun P K** | | **21-Mar-21** |
| **Party Chief** | **Unnikrishnan K U** | | **21-Mar-21** |

Figure 5-12: Gyrocompass Calibration 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.

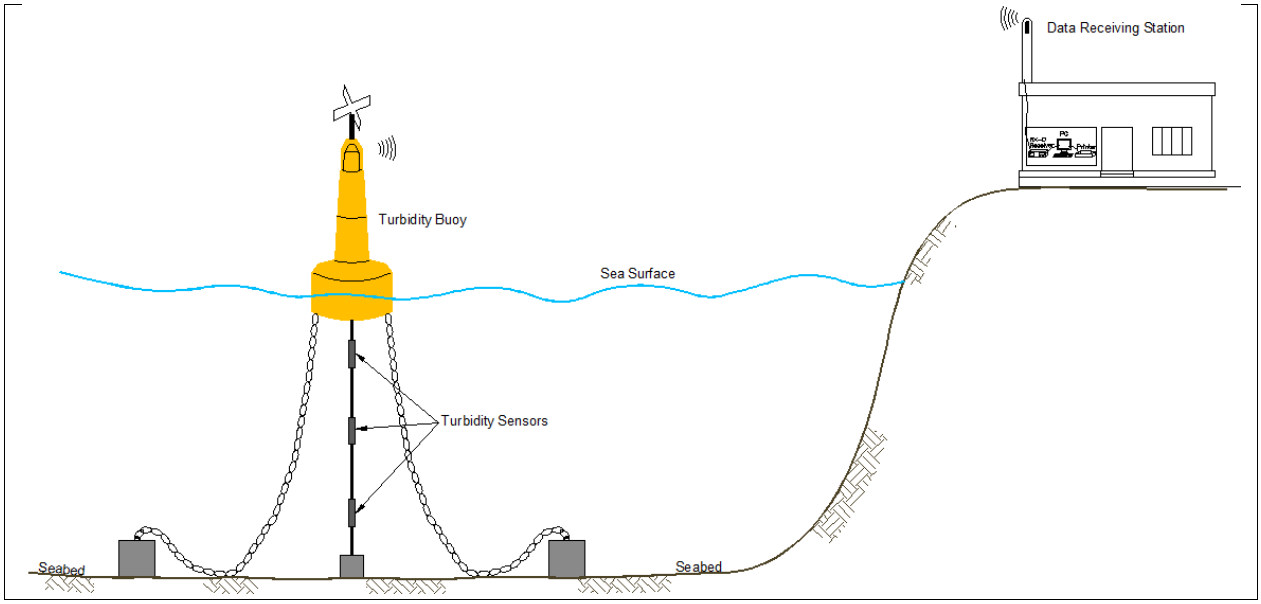



Figure 5-13: Turbidity buoy Mooring Diagram

The sensor details are provided below:

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

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


Figure 5-14: Turbidity Buoy-3

# 6 SURVEY RESULTS

## 6.1 Tidal Measurements

The tides were observed near the Coast Guard jetty. The tide is referenced to the chart datum, the 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:

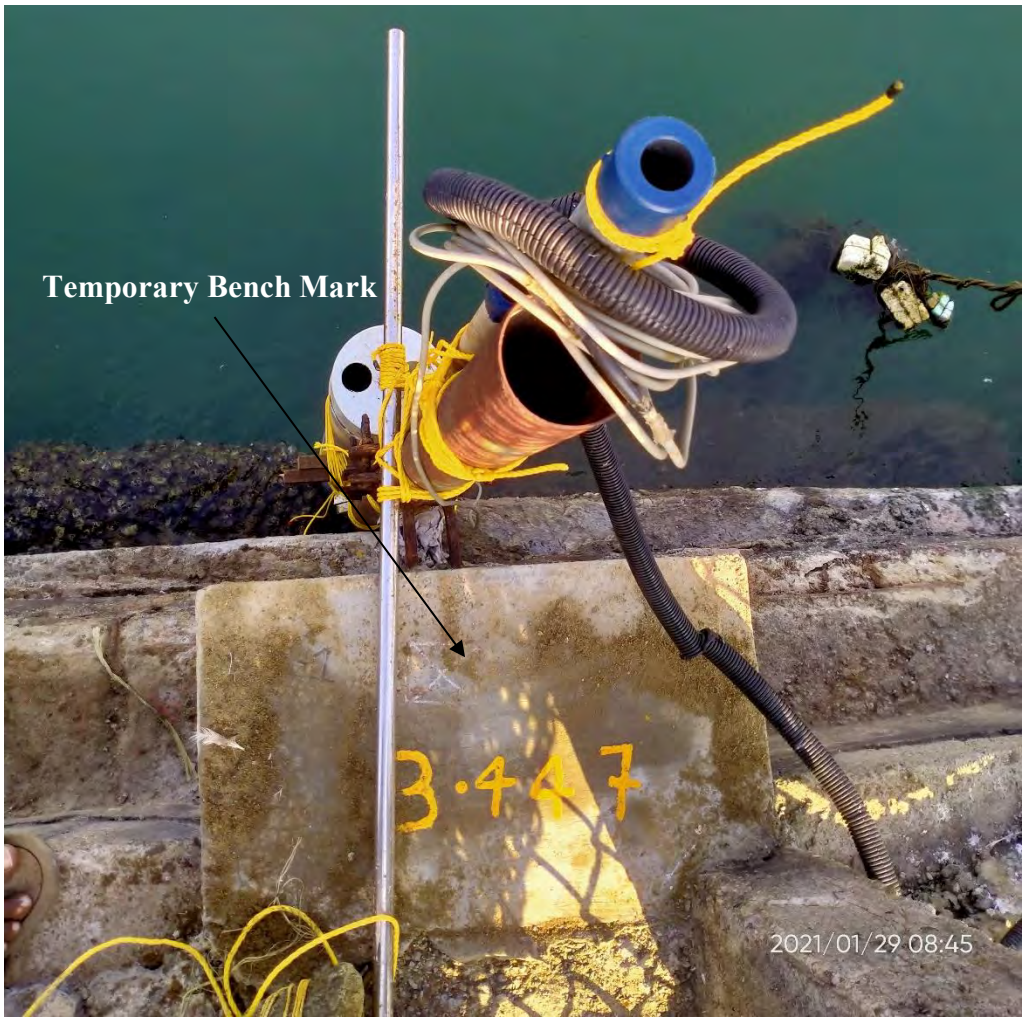



Figure 6-1: Location of TBM

① The data obtained from the ATG was validated by carrying out random manual tide checks using measuring tape. Some of the random manual tide checks for the month of March are given in the table below:

Table 6-1: Manual vs ATG tide reading comparison

| Date & Time | Manual Reading (m) | ATG Reading (m) | Difference (m) |
|---|---|---|---|
| 11/03/2021 12:30 | 1.39 | 1.40 | 0.01 |
| 11/03/2021 12:35 | 1.40 | 1.40 | 0.00 |
| 11/03/2021 12:40 | 1.39 | 1.37 | 0.02 |
| 11/03/2021 12:45 | 1.40 | 1.39 | 0.01 |
| 13/03/2021 16:00 | 1.30 | 1.28 | 0.02 |
| 13/03/2021 16:06 | 1.26 | 1.25 | 0.02 |
| 13/03/2021 16:12 | 1.28 | 1.25 | 0.03 |
| 13/03/2021 16:18 | 1.25 | 1.22 | 0.03 |
| 13/03/2021 16:24 | 1.27 | 1.25 | 0.02 |
| 13/03/2021 16:30 | 1.21 | 1.23 | 0.02 |
| 16/03/2021 11:30 | 1.21 | 1.18 | 0.03 |
| 16/03/2021 11:36 | 1.24 | 1.23 | 0.01 |
| 16/03/2021 11:42 | 1.27 | 1.27 | 0.00 |
| 16/03/2021 11:48 | 1.29 | 1.27 | 0.02 |
| 16/03/2021 11:54 | 1.32 | 1.29 | 0.03 |
| 16/03/2021 12:00 | 1.32 | 1.31 | 0.01 |
| 20/03/2021 10:00 | 0.98 | 0.95 | 0.03 |
| 20/03/2021 10:06 | 0.96 | 0.95 | 0.01 |
| 20/03/2021 10:12 | 0.97 | 0.96 | 0.01 |
| 20/03/2021 10:18 | 0.96 | 0.96 | 0.00 |
| 20/03/2021 10:24 | 0.97 | 0.93 | 0.04 |
| 20/03/2021 10:30 | 0.94 | 0.93 | 0.01 |

From the above table it can be inferred that the data obtained from the ATG is meeting the required accuracy.

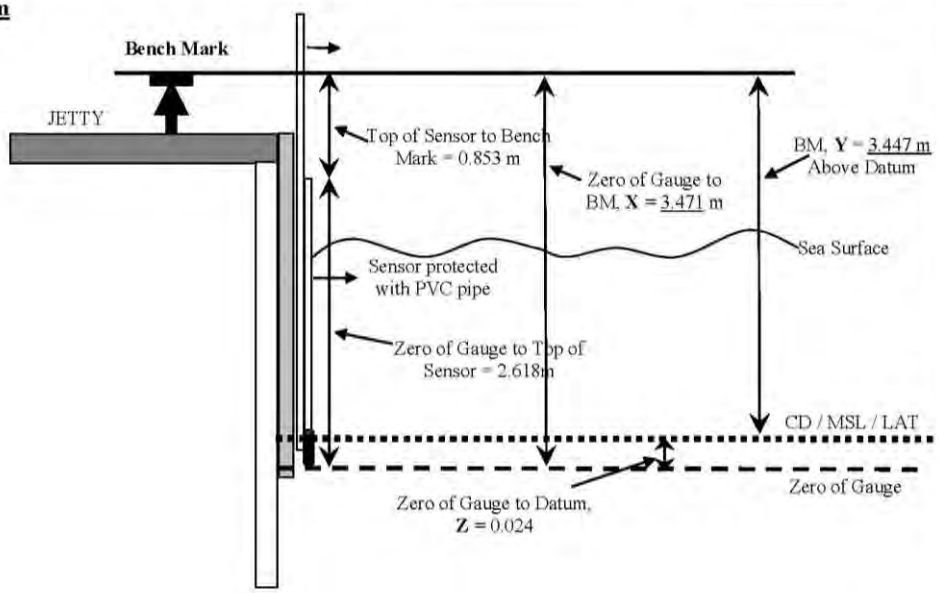
The offset calculation of the EMCON tide gauge based on the ‘jetty top’ value is given in the figure below:

**TIDE GAUGE INSTALLATION**

| | | | |
|---|---|---|---|
| **Job Number** | P167-19 | **Project** | Shoreline Monitoring at Vizhinjam |
| **Client** | AdaniVizhinjam Port Pvt. Ltd. | | |
| **Location** | Vizhinjam | **Installation Date** | 25/01/2021 |
| **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 Chart Datum** |
| **Levelled By** | **Unnikrishnan K U** | |

**Calculations:**

| | |
|---|---|
| **X, Length from Bench Mark to Zero of Tide Gauge** | **3.471 m** |
| **Y, Level of Bench Mark above Datum** | **3.447m** |
| **Z, Tide Correction factor, Z=X - Y** | **0.024** |
| **Corrected Reading = Tide Reading - Z** | |

Figure 6-2: Schematic Diagram of EMCON Tide Gauge

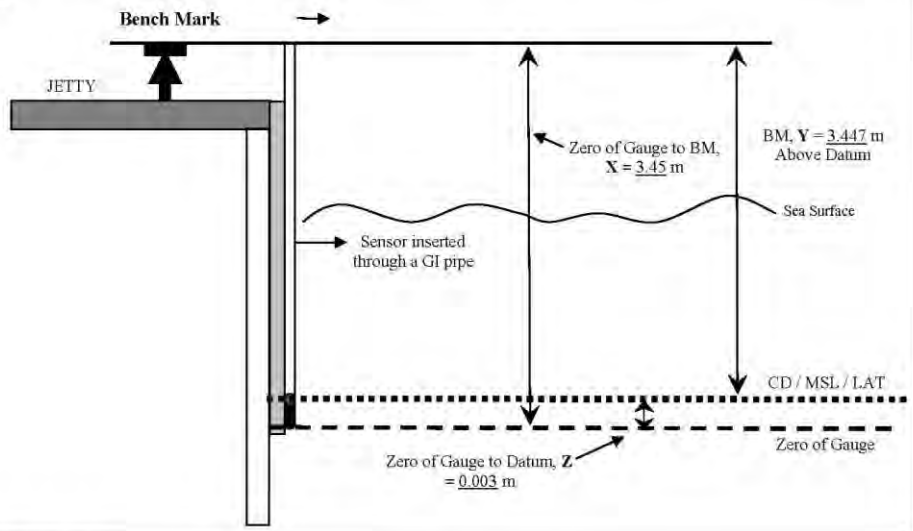
The EMCON ATG was replaced by the Valeport Tidemaster ATG on 13th March 2021. The schematic diagram for this is provided in the figure below.

**TIDE GAUGE INSTALLATION**

| | | | |
|---|---|---|---|
| **Job Number** | P167-19 | **Project** | Shoreline Monitoring at Vizhinjam |
| **Client** | Adani Vizhinjam Port Pvt. Ltd. | | |
| **Location** | Vizhinjam | **Installation Date** | 13/03/2021 |
| **Tide Gauge Sr. No.** | **33468** | **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** | |

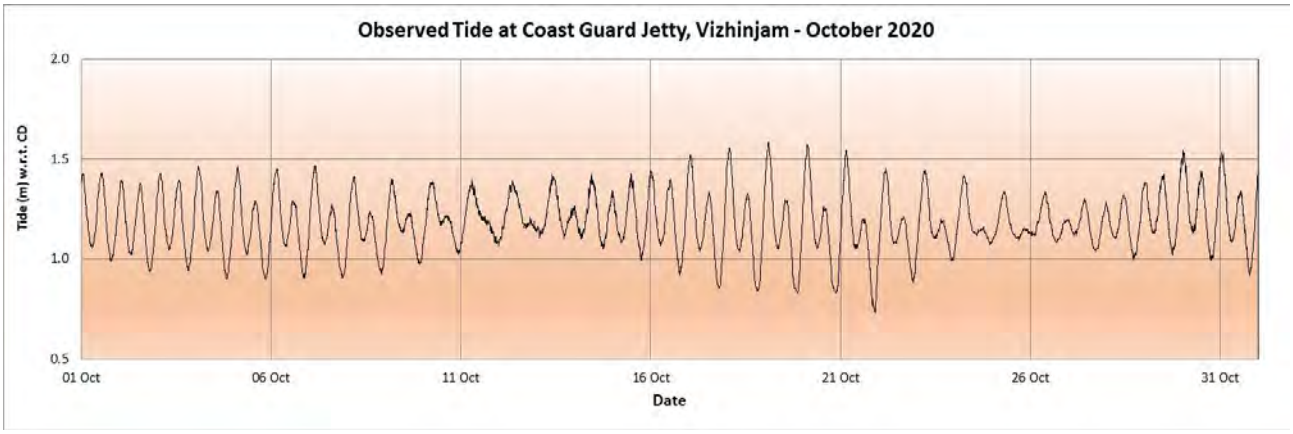
**Checked the level from zero of the gauge to BM on: 13/03/2021**

**Calculations:**

| | |
|---|---|
| **X, Length from Bench Mark to Zero of Tide Gauge** | **3.45m** |
| **Y, Level of Bench Mark above Datum** | **3.447 m** |
| **Z, Tide Correction factor, Z=X - Y** | **0.003 m** |
| **Tide height in m above Datum = Raw Tide reading - Z** | |

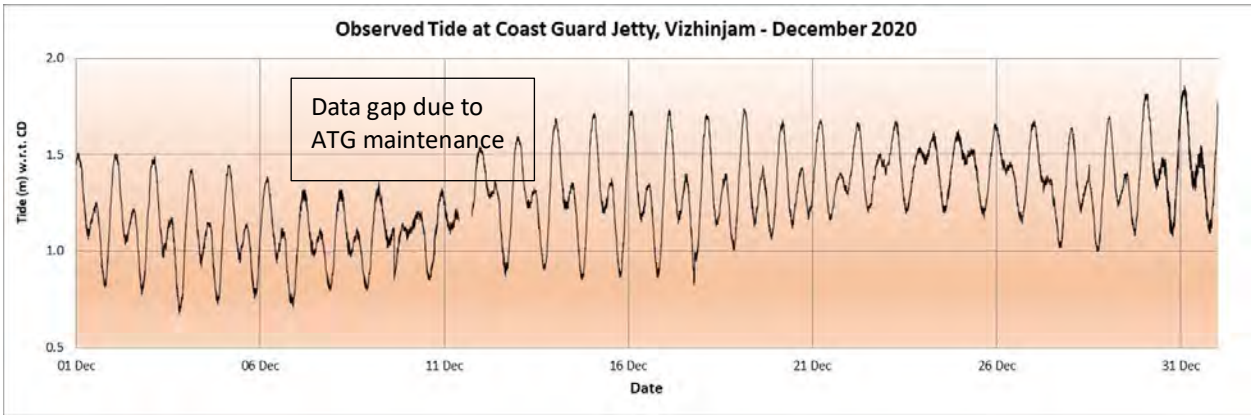
Figure 6-3: Schematic Diagram of Valeport Tide Gauge

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 - October 2020
Tide (m) w.r.t. CD
2.0
1.5
1.0
0.5
01 Oct
06 Oct
11 Oct
16 Oct
21 Oct
26 Oct
31 Oct
Date


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

①


Observed Tide at Coast Guard Jetty, Vizhinjam - December 2020
Data gap due to
ATG maintenance
Tide (m) w.r.t. CD
2.0
1.5
1.0
0.5
01 Dec
06 Dec
11 Dec
16 Dec
21 Dec
26 Dec
31 Dec
Date

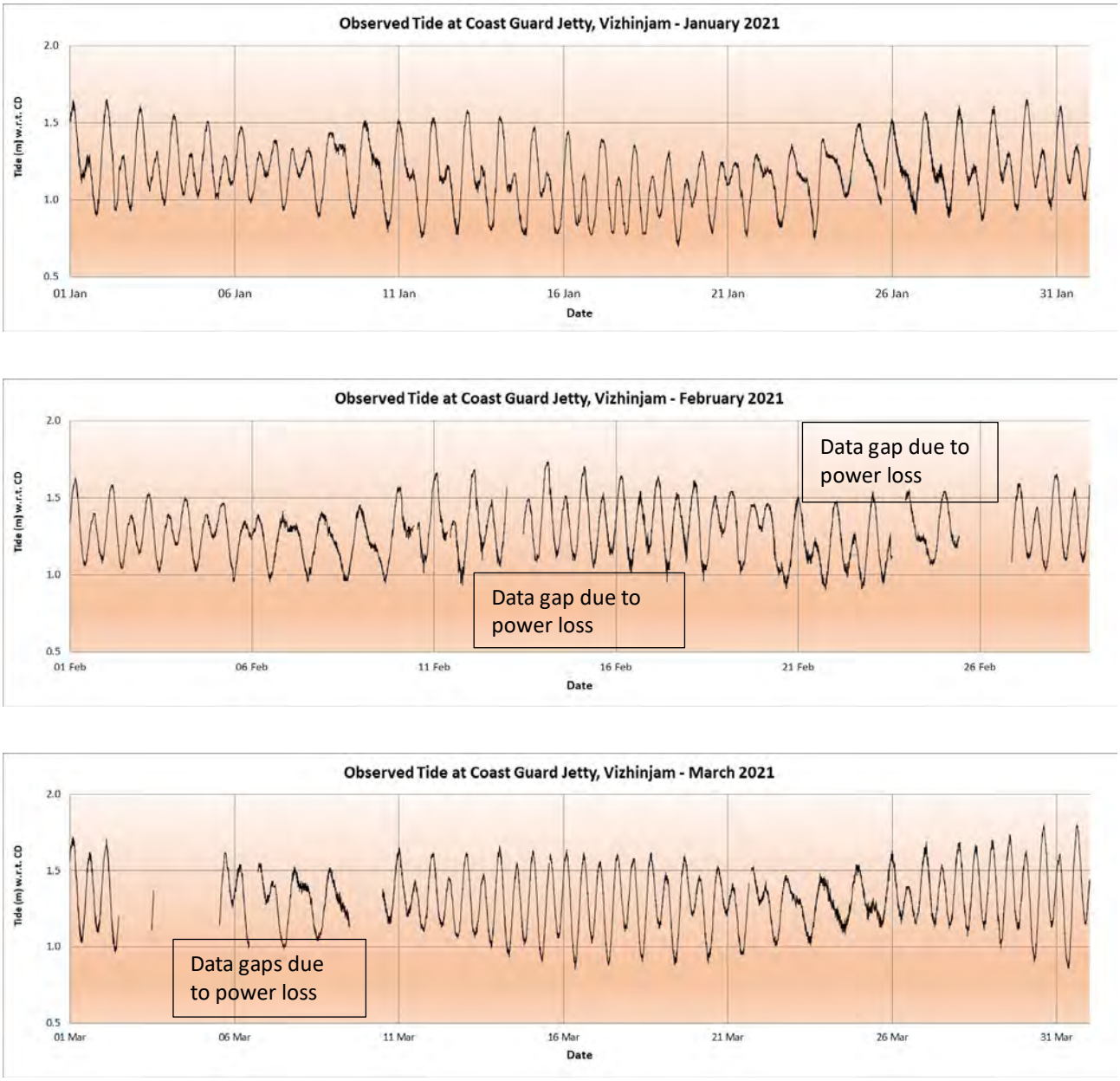



Figure 6-4: Time series of tide

## 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 October 2020 to March 2021:

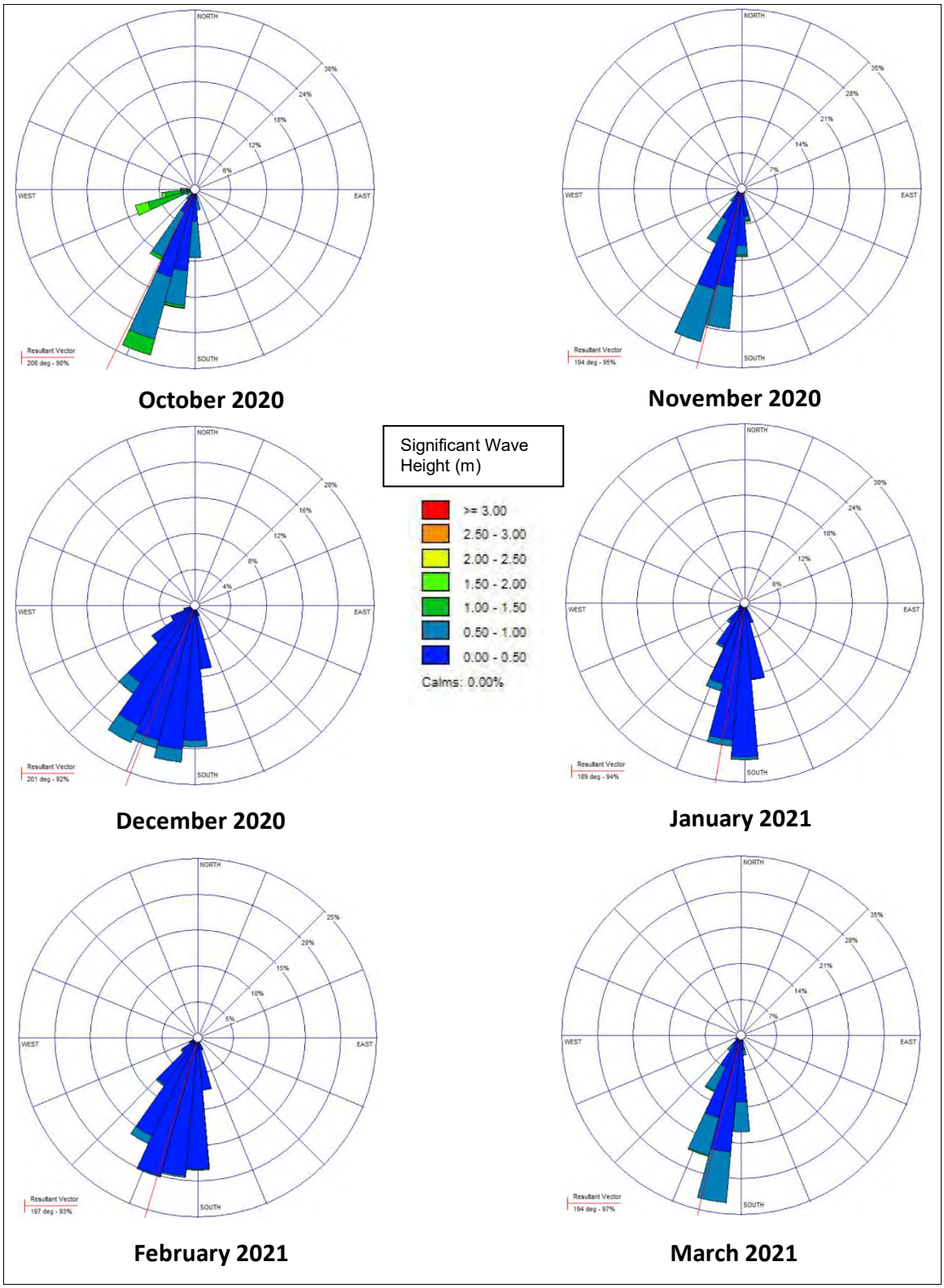



Figure 6-5: Wave Rose (Hs in metre v/s Direction)

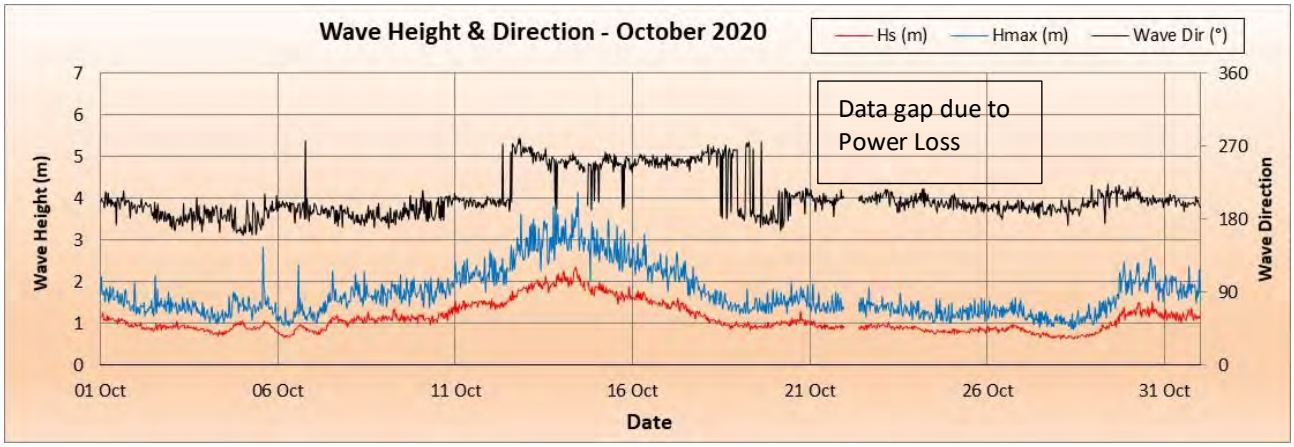
The following table provides the monthly maximum significant wave height (Hs) and wave period (Tp) observed during the seasons.

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

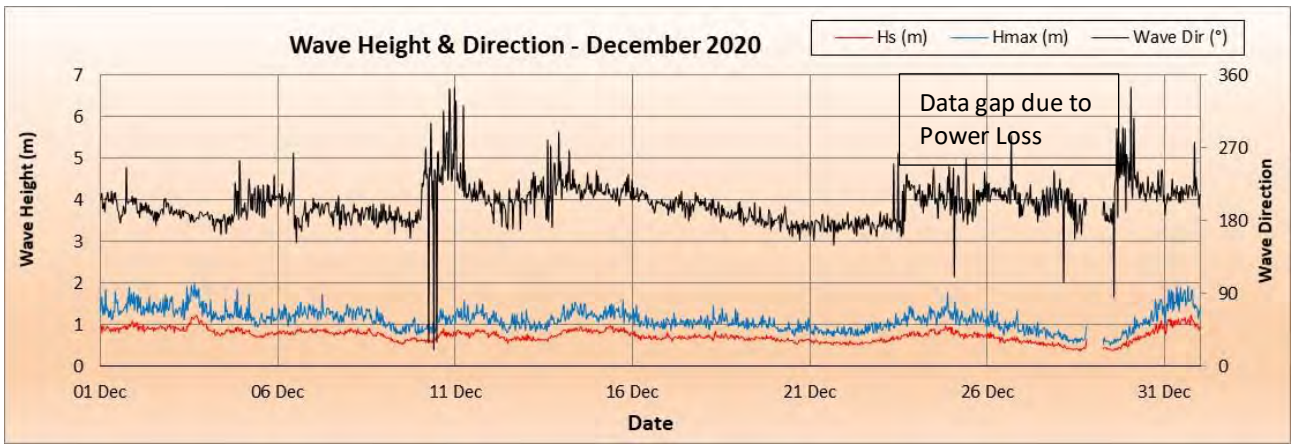
| Maximum significant wave height (Hs), Hmax and Maximum wave period (Tp) | | | | |
|---|---|---|---|---|
| **Month** | **Hs (m)** | **Predominant Direction (°)** | **Hmax (m)** | **Tp (sec)** |
| October 2020 | 2.36 | 206 | 4.15 | 20.00 |
| November 2020 | 1.68 | 194 | 2.92 | 22.22 |
| December 2020 | 1.23 | 201 | 1.99 | 22.22 |
| January 2021 | 1.17 | 189 | 2.04 | 20.00 |
| February 2021 | 1.07 | 197 | 2.13 | 22.22 |
| March 2021 | 1.56 | 194 | 2.70 | 18.18 |

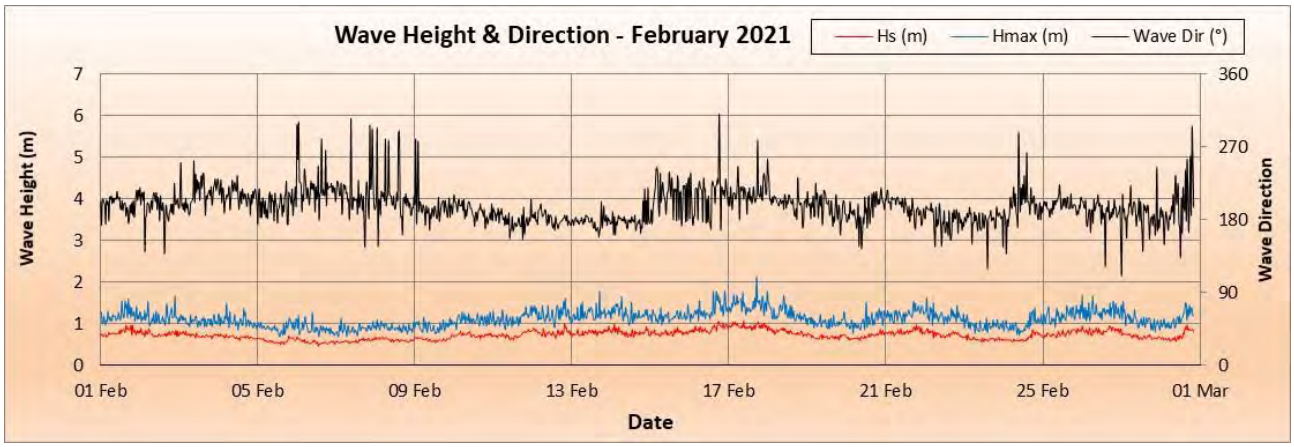
① The above table indicates that after the withdrawal of the monsoon, the wave heights decreased.

The time series of wave data from October 2020 to March 2021 is shown below.


Wave Height & Direction - October 2020
Hs (m)
Hmax (m)
Wave Dir (°)
Data gap due to Power Loss
Wave Height (m)
Wave Direction
0
1
2
3
4
5
6
7
0
90
180
270
360
01 Oct
06 Oct
11 Oct
16 Oct
21 Oct
26 Oct
31 Oct
Date


Wave Height & Direction - November 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 Nov
06 Nov
11 Nov
16 Nov
21 Nov
26 Nov
01 Dec
Date


Wave Height & Direction - December 2020
Hs (m)
Hmax (m)
Wave Dir (°)
Data gap due to Power Loss
Wave Height (m)
Wave Direction
0
1
2
3
4
5
6
7
0
90
180
270
360
01 Dec
06 Dec
11 Dec
16 Dec
21 Dec
26 Dec
31 Dec
Date



①

Figure 6-6: Time series of wave parameters

## 6.3 Current Measurements

Current meters were deployed at four locations during January to February 2021 to measure the speed and direction of the current at three different levels, i.e., surface, mid-depth and near bottom.

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

Table 6-3: ADCP Mooring Locations

| Location | Water Depth (m) | Period of Observation | Latitude | Longitude | Frequency |
|---|---|---|---|---|---|
| P1 (Vizhinjam) | 22.1 | 12th Jan 2021 12:30 hrs to 12th Feb 2021 10:00 hrs | 08° 21' 55.4"N | 76° 58' 51.6"E | 600 kHz |
| P2 (Poovar) | 23.1 | 12th Jan 2021 12:00 hrs to 12th Feb 2021 08:50 hrs | 08° 17' 35.8"N | 77° 04' 03.5"E | 600 kHz |
| P3 (Pachalloor) | 21.9 | 13th Jan 2021 03:40 hrs to 12th Feb 2021 04:40 hrs | 08° 24' 08.6"N | 76° 56' 16.1"E | 600 kHz |
| P4 (Mulloor) | 22.9 | 12th Jan 2021 10:00 hrs to 13th Feb 2021 09:00 hrs | 08° 21' 42.3"N | 76° 59' 33.9"E | 600 kHz |

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

Table 6-4: 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) |
| Jan – Feb 2021 | 68.6 | 73.1 | 61.7 | 86.2 |

The current rose plot of surface current speed at Location 1 (Vizhinjam) is shown below.

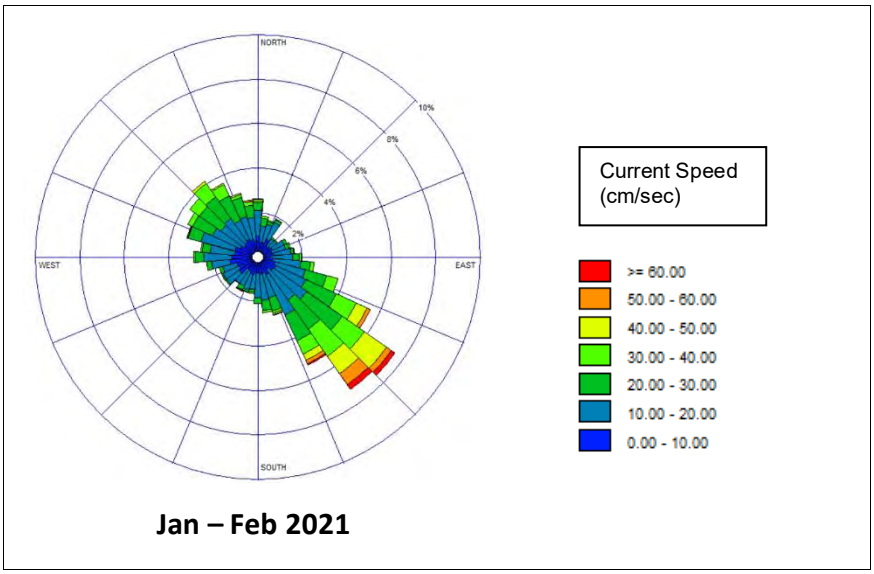



Figure 6-7: Rose Plot (surface speed in cm/sec) – P1 (Vizhinjam)

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

The current rose plot of surface current speed at Location 2 (Poovar) is shown below.

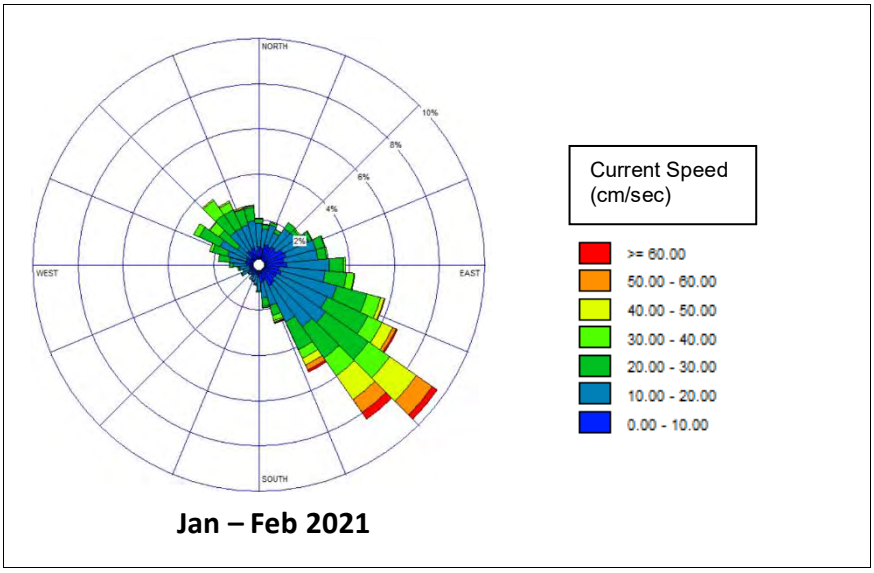



Figure 6-8: Rose Plot (surface speed in cm/sec) – P2 (Poovar)

The rose plot reveals a flow parallel to the shore. During the observation period, the flow was predominantly towards the southeast.

The current rose plot of surface current speed at Location 3 (Pachalloor) is shown below.

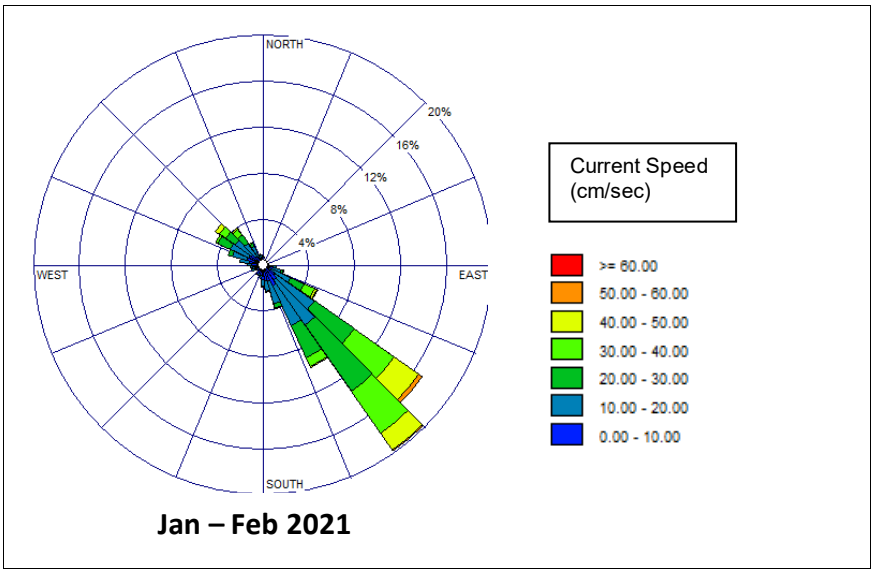



Figure 6-9: Rose Plot (surface speed in cm/sec) – P3 (Pachalloor)

The rose plot reveals a flow parallel to the shore and was predominantly towards the southeast.

The current rose plot of surface current speed at Location 4 (Mulloor) is shown below.

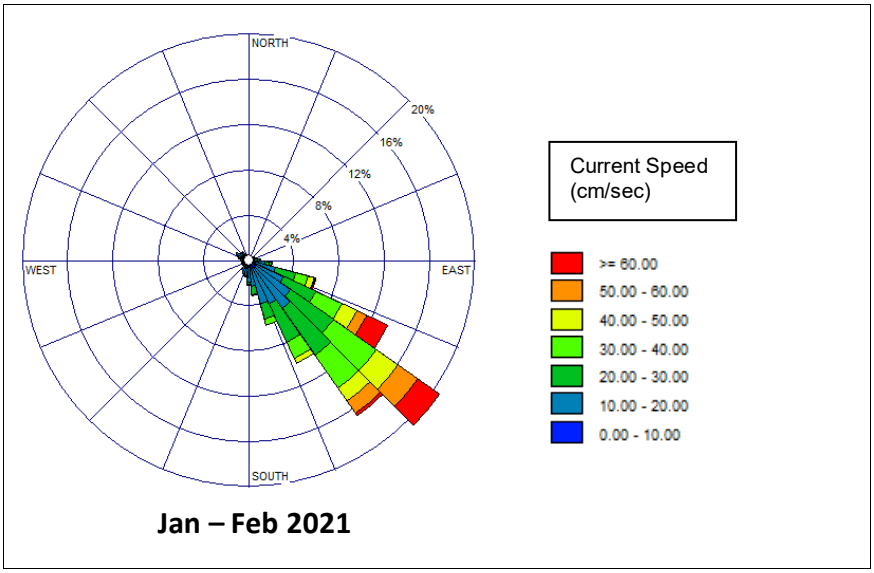



Figure 6-10: Rose Plot (surface speed in cm/sec) – P4 (Mulloor)

The rose plot reveals 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 system was shifted to the terrace of the Port Control Office building on 26th March 2021 as per instructions from AVPPL. The wind data for all the months is compiled and presented in the form of rose plots below.

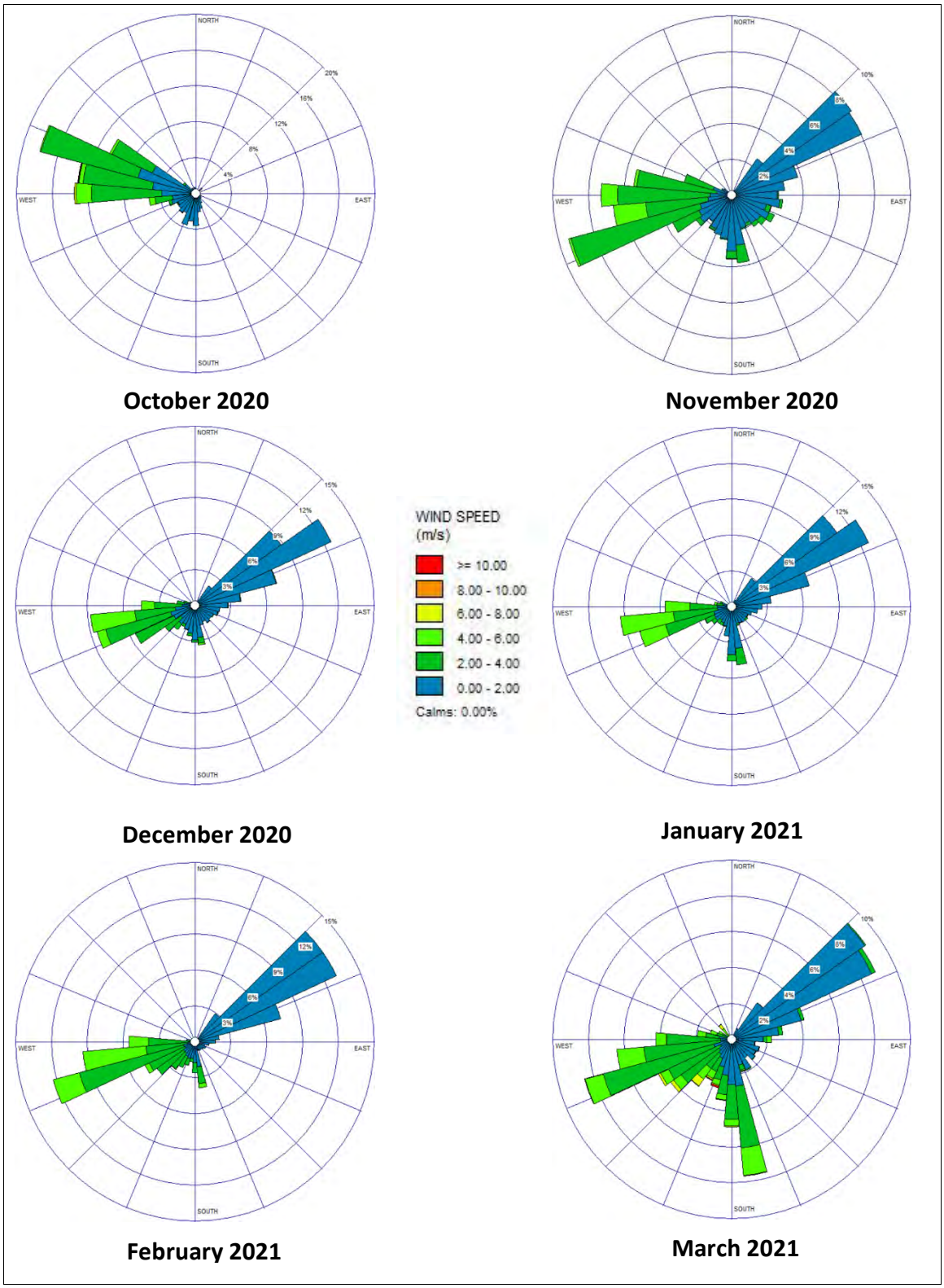



Figure 6-11: Wind rose (Speed in m/s vs direction)

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

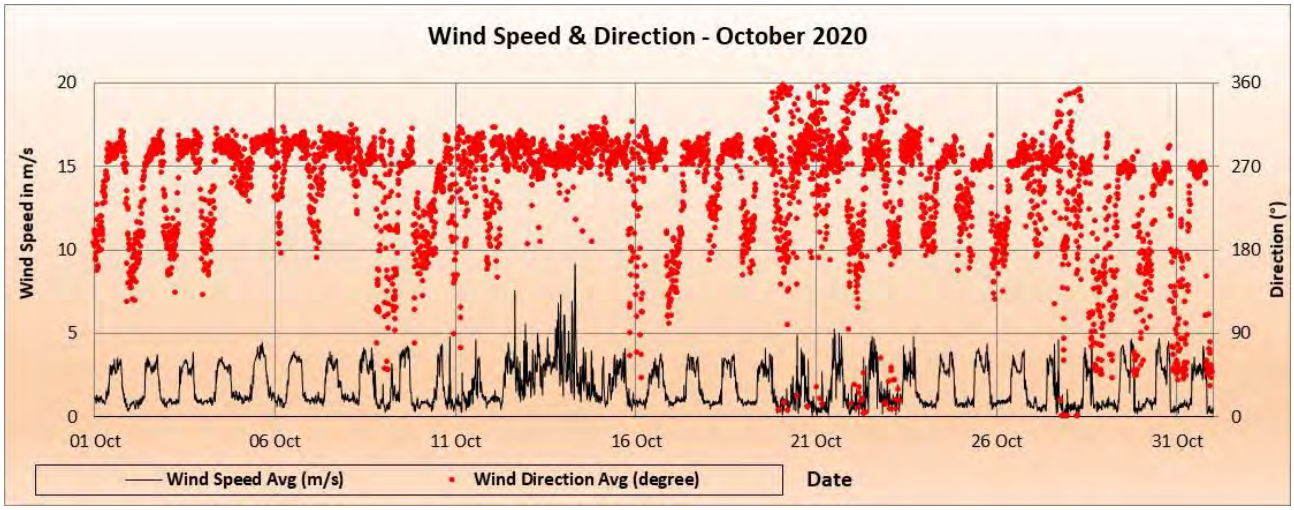
Table 6-5: Monthly maximum wind speed from seaside

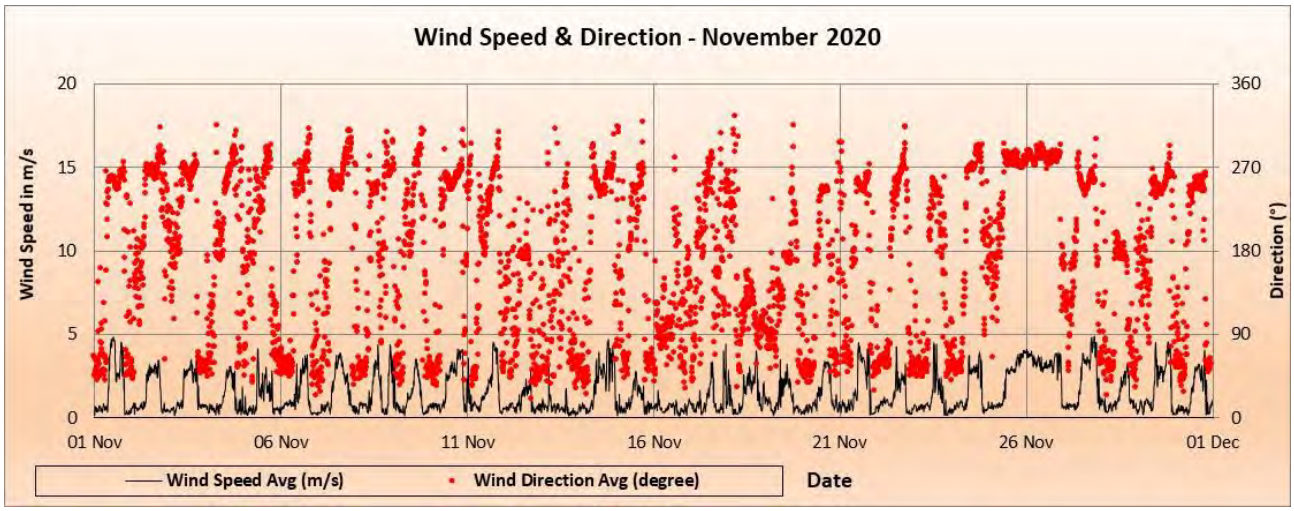
| Month | Wind Speed (m/s) | Predominant Direction (°) |
|---|---|---|
| October 2020 | 9.21 | 348.0 |
| November 2020 | 4.90 | 253.2 |
| December 2020 | 5.19 | 248.0 |
| January 2021 | 4.90 | 252.5 |
| February 2021 | 4.87 | 249.2 |
| March 2021 | 13.62 | 246.1 |

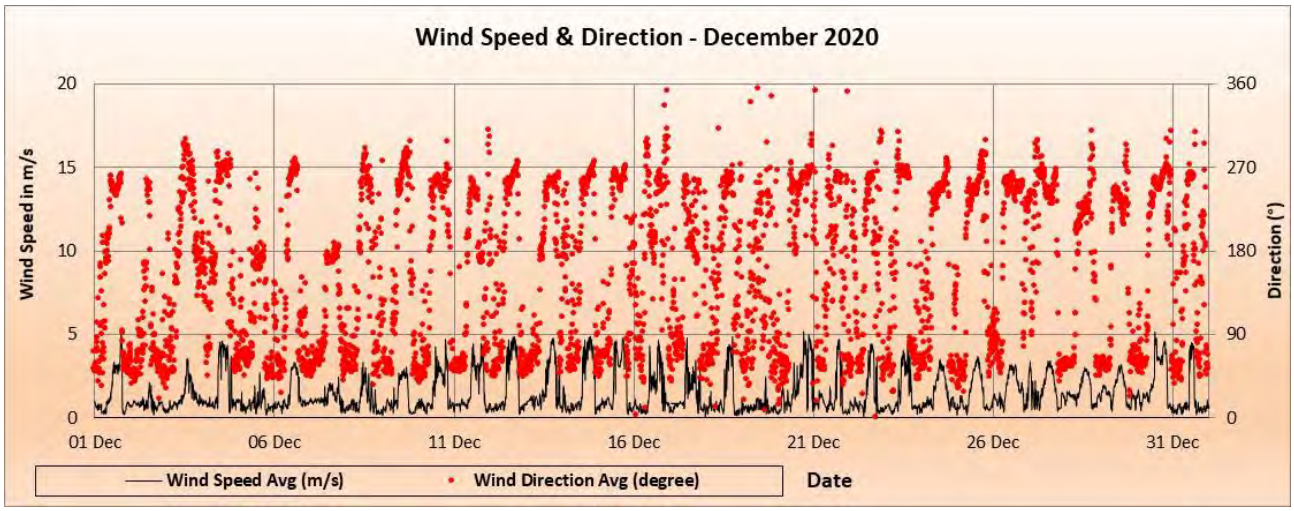
Table 6-6: Monthly maximum wind speed from landside

| Month | Wind Speed (m/s) | Predominant Direction (°) |
|---|---|---|
| October 2020 | 3.57 | 149.3 |
| November 2020 | 4.03 | 83.1 |
| December 2020 | 4.48 | 69.3 |
| January 2021 | 4.35 | 67.5 |
| February 2021 | 5.00 | 61.6 |
| March 2021 | 7.07 | 77.1 |

The time series of wind data from October 2020 to March 2021 is shown below.


Wind Speed & Direction - October 2020
Wind Speed in m/s
Direction (°)
20
15
10
5
0
360
270
180
90
0
01 Oct
06 Oct
11 Oct
16 Oct
21 Oct
26 Oct
31 Oct
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Date


Wind Speed & Direction - November 2020
Wind Speed in m/s
Direction (°)
20
15
10
5
0
360
270
180
90
0
01 Nov
06 Nov
11 Nov
16 Nov
21 Nov
26 Nov
01 Dec
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Date


Wind Speed & Direction - December 2020
Wind Speed in m/s
Direction (°)
20
15
10
5
0
360
270
180
90
0
01 Dec
06 Dec
11 Dec
16 Dec
21 Dec
26 Dec
31 Dec
Wind Speed Avg (m/s)
Wind Direction Avg (degree)
Date

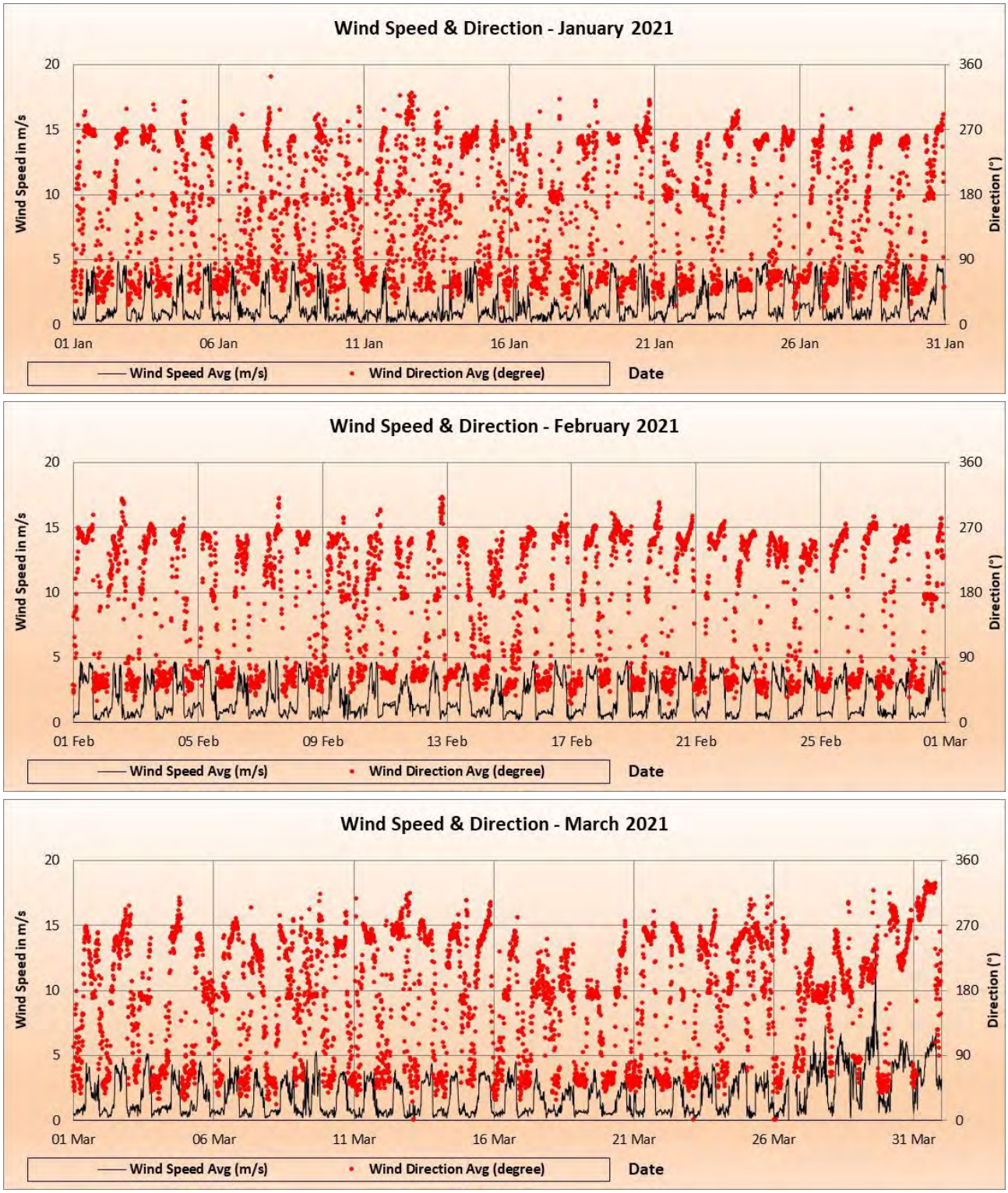



Figure 6-12: Time series of wind data

The percentage occurrence tables for atmospheric pressure, temperature and relative humidity for the period of October 2020 to March 2021 are shown below.

Table 6-7: Frequency distribution of atmospheric pressure

| Frequency Distribution | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|
| **Atm. Pressure (mb)** | **Percentage Occurrence** | | | | | |
| <1000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1000-1004 | 16.04 | 6.80 | 2.40 | 9.28 | 1.24 | 2.03 |
| 1004-1008 | 74.19 | 63.48 | 60.92 | 66.78 | 46.52 | 59.19 |
| >1008 | 9.77 | 29.72 | 36.69 | 23.94 | 52.24 | 38.78 |
| **Total** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** |

Table 6-8: Frequency distribution of temperature

| Frequency Distribution | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|
| **Temperature (°)** | **Percentage Occurrence** | | | | | |
| 20-24 | 0.67 | 2.04 | 6.29 | 14.30 | 9.89 | 2.58 |
| 24-28 | 78.12 | 53.97 | 57.00 | 54.36 | 43.57 | 42.98 |
| 28-32 | 21.21 | 43.99 | 36.69 | 31.34 | 46.54 | 54.31 |
| >32 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.14 |
| **Total** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** |

Table 6-9: Frequency distribution of relative humidity

| Frequency Distribution | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|
| **Rel. Humidity (%)** | **Percentage Occurrence** | | | | | |
| 50-60 | 0.00 | 0.09 | 2.87 | 5.51 | 9.27 | 3.73 |
| 60-70 | 1.44 | 8.47 | 18.66 | 13.00 | 21.84 | 18.28 |
| 70-80 | 23.70 | 33.37 | 33.62 | 27.89 | 38.28 | 39.95 |
| >80 | 74.86 | 58.07 | 44.85 | 53.60 | 30.60 | 38.03 |
| **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 October 2020 to March 2021 are shown below.


Figure 6-13: Histogram of atmospheric pressure


Figure 6-14: Histogram of temperature

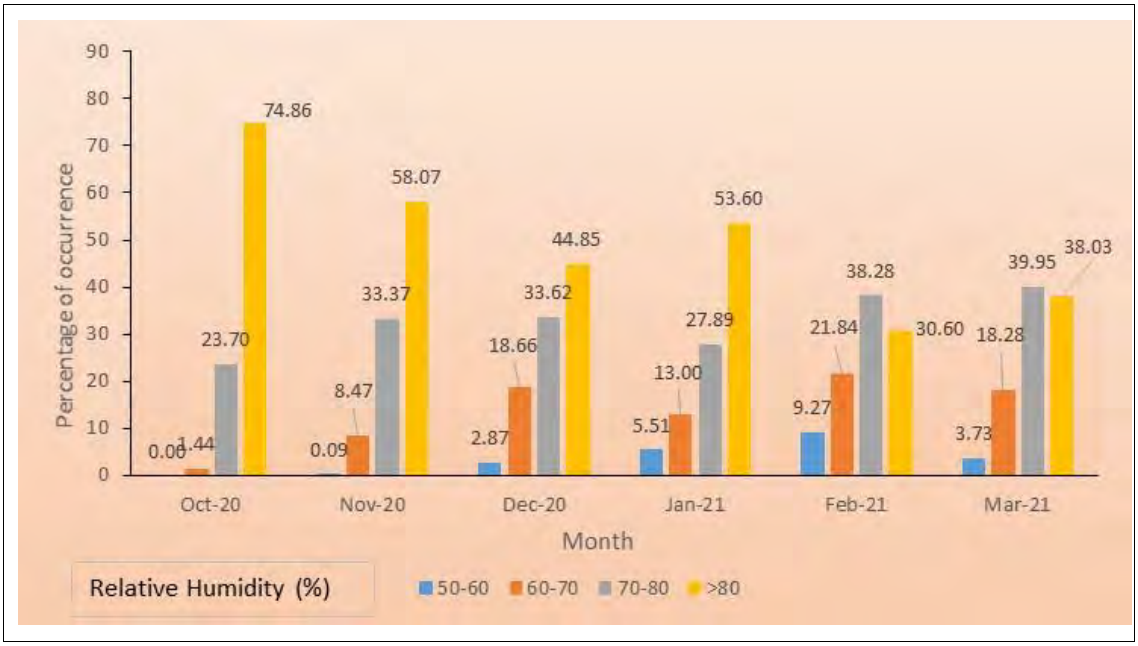



Figure 6-15: Histogram of relative humidity

The following table shows the amount of rainfall received during the entire period from October 2020 to March 2021.

Table 6-10: Cumulative rainfall

| Month | Cumulative Rainfall (mm) |
|---|---|
| October 2020 | 138.4 |
| November 2020 | 54.4 |
| December 2020 | 72.4 |
| January 2021 | 40.0 |
| February 2021 | 13.0 |
| March 2021 | 12.8 |

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

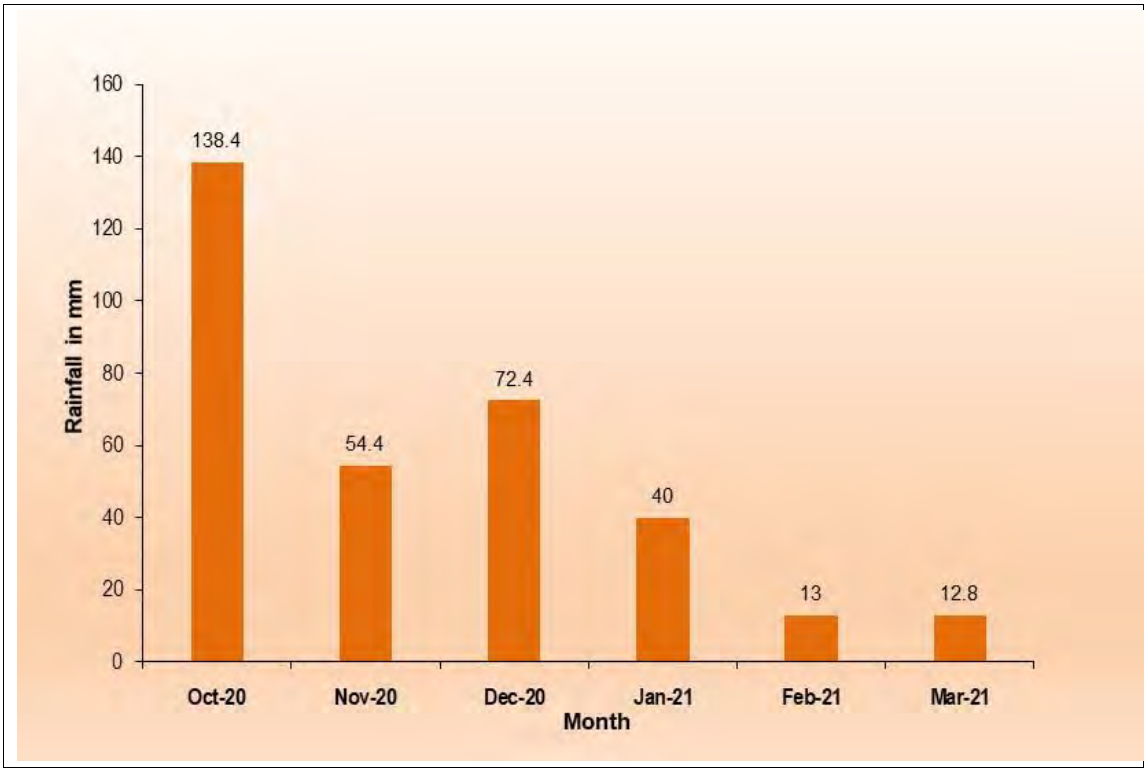



Figure 6-16: Histogram of cumulative rainfall

## 6.5 Littoral Environment Observations

The LEO was carried out at all 80 locations in all the months. At CSP-32, the observations could not be carried out due to strong objection faced from the locals in the area. 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 northerly trend in the post-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 6-11: Monthly maximum along shore current

| Month | Max Speed (cm/s) / Direction | Line No. | Location |
|---|---|---|---|
| October 2020 | 29.40 / North | CSP-24 | Karumkulam |
| November 2020 | 18.05 / North | CSP-21 | Poovar Beach North |
| December 2020 | 15.23 / North | CSP-15 | Poovar Beach South |
| January 2021 | 29.78 / North | CSP-18 | Poovar |
| February 2021 | 15.23 / North | CSP-15 | Poovar Beach South |
| March 2021 | 13.30 / Bi-directional | CSP-26 | Pulluvila |

## 6.6 Photographic Documentation

Photographic documentation was carried out for all the 81 locations, coinciding with the cross-shore profiling.

The latest photographs for the month of March 2021 are provided in **Annexure I**. As a common reference point, a flag was fixed at each of the cross-shore profiling alignments while taking the photograph. Using the RTK system, this point was staked during the photography.

## 6.7 Cross Shore Profiles

The cross-shore profiling for the period was carried out using RTK in the onshore region and a wide swath bathymetric system in the offshore region. The nearest depth which could be attained was about 2 to 3m due to the presence of waves breaking in the zone. The boat is not able to approach this zone, due to breakers nearshore considering the safety of personnel onboard.

At CSP 32 in the onshore region, the cross shore profiling could not be carried out due to opposition from the local people. There is a steep hill which lies on the CSP 35 line, due to which cross-shore profiling is not possible in the onshore area.

For the month of October 2020, the offshore CSP data did not pass the quality control check as a result of latency bias in the multibeam echo sounder and is therefore not provided.

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

Table 6-12: 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 | | |

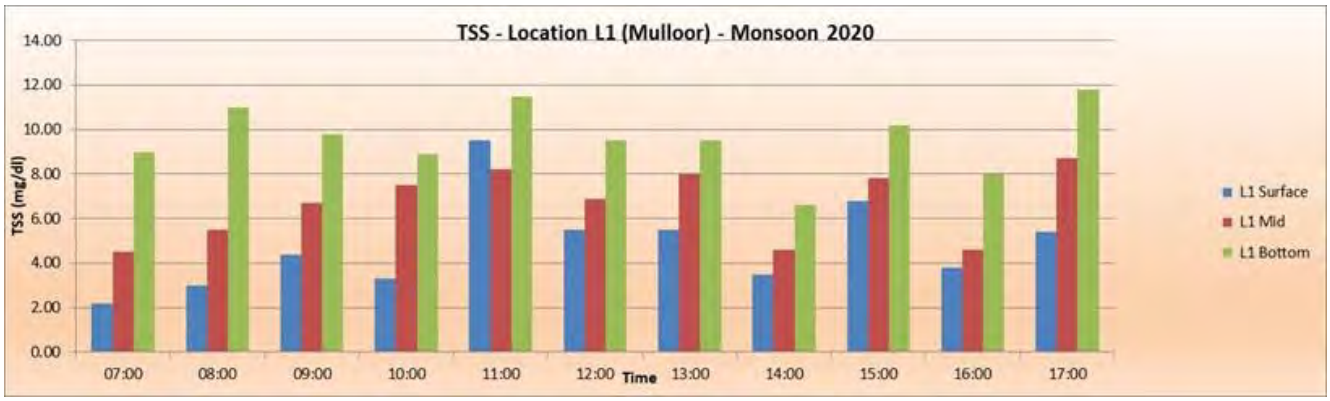
| CSP NO. | LANDMARK | LOCATION |
|---|---|---|
| CSP-38 | ADANI PORT RECLAMATION AREA | ADANI PORT OFFICE VIZHINJAM |
| CSP-39 | | |
| CSP-40 | | |
| CSP-41 | VIZHINJAM LIGHT HOUSE | KOVALAM |
| CSP-42 | | |
| CSP-43 | | |
| CSP-44 | | |
| CSP-45 | | |
| CSP-46 | | |
| CSP-47 | SAMUDRA BEACH PARK | 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 | | |

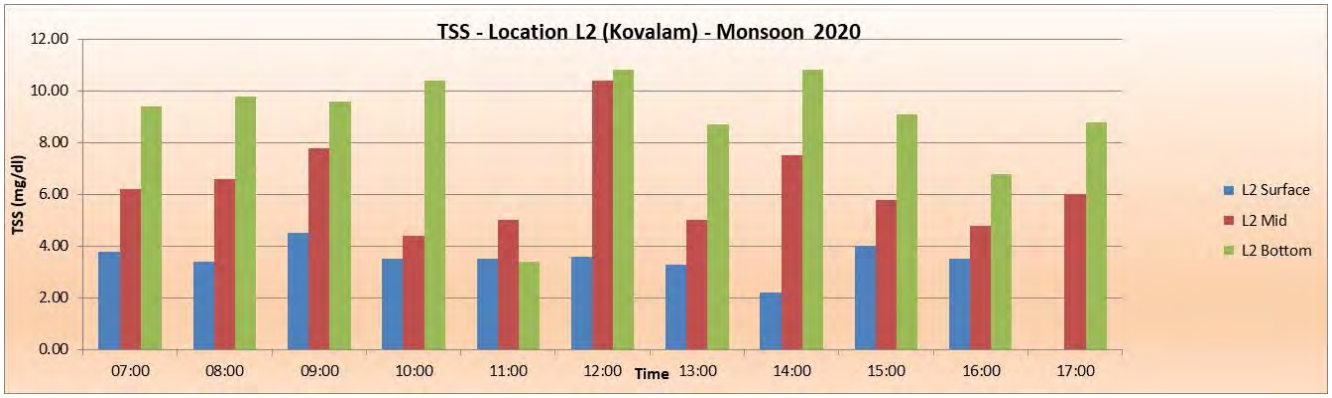
| CSP NO. | LANDMARK | LOCATION |
|---|---|---|
| CSP-78 | ST. THOMAS' CHURCH | VALIYA VELI |
| CSP-79 | | |
| CSP-80 | CHRISTIAN BROTHEREN CHURCH | THUMBA |
| CSP-81 | | |

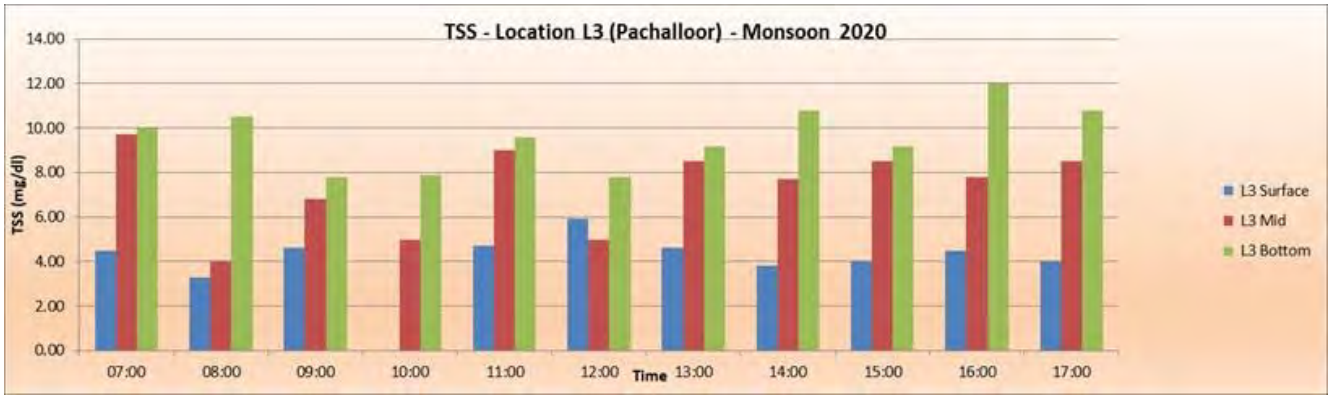
## 6.8 Water Sampling

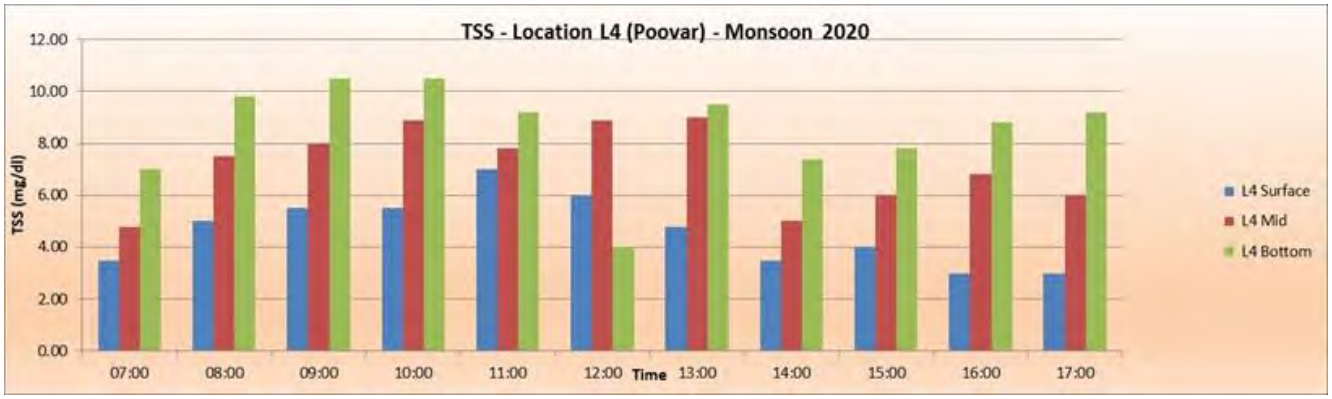
Water samples were collected from 4 locations, namely, L1 (Mulloor), L2 (Kovalam), L3 (Pachalloor) and L4 (Poovar) from three levels: surface, mid-depth and near bottom during the monsoon and post-monsoon season. The parameters measured were Total Suspended Solids, Turbidity and Salinity at NABL accredited laboratory in Kochi (Standard[s] Environmental & Analytical Laboratories, Accreditation and Approval: NABL as per ISO 17025:2005).

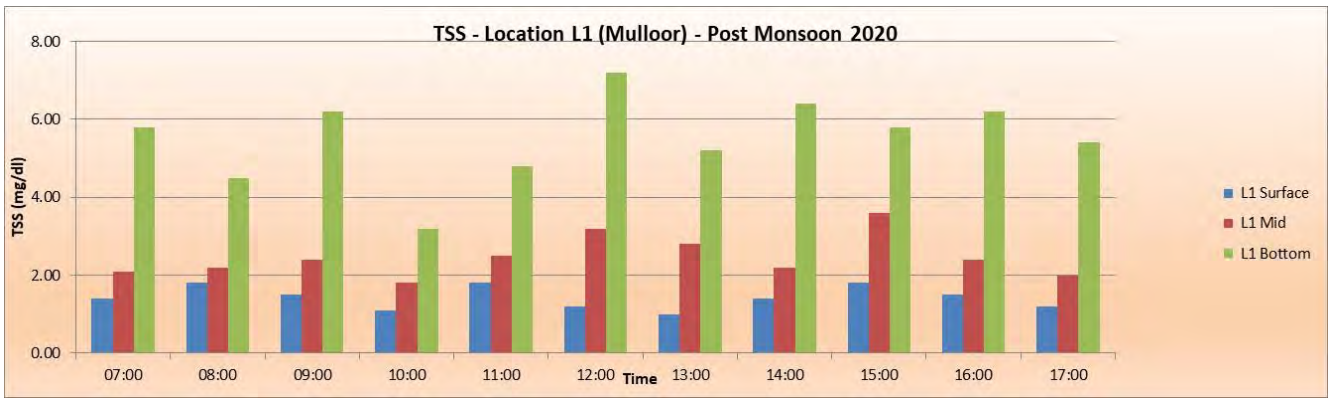
The time series for Total Suspended Solids (in mg/l) for the above locations are provided below.

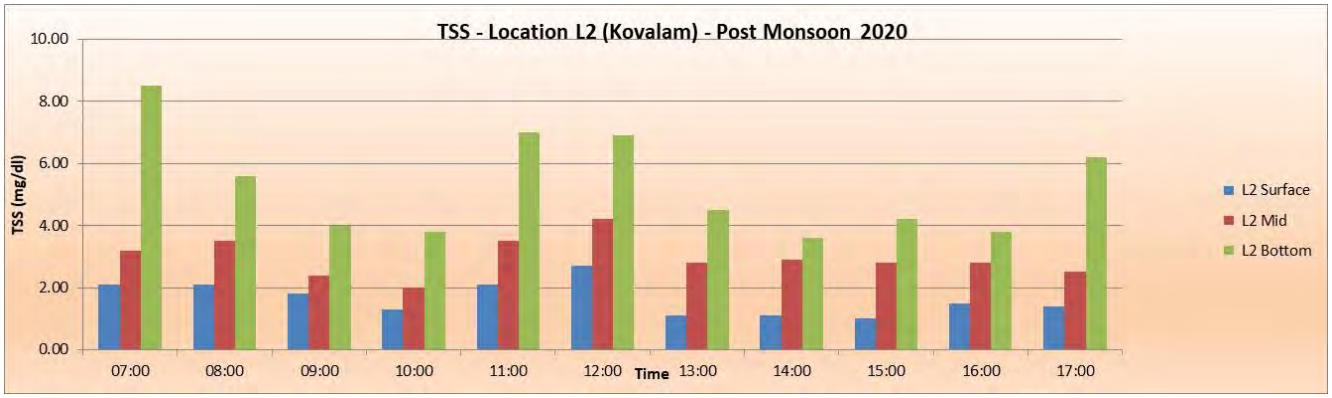


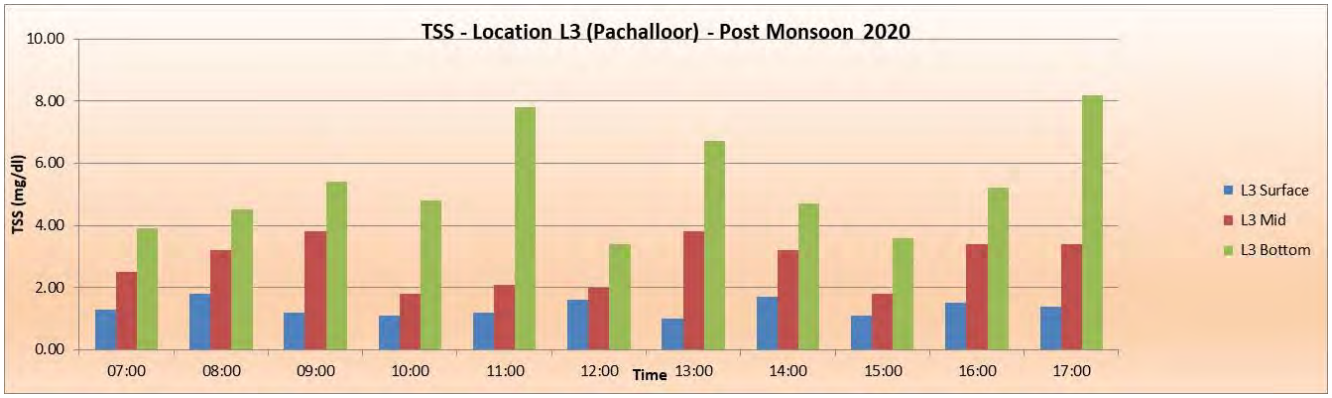




TSS - Location L3 (Pachalloor) - Monsoon 2020
TSS (mg/dl)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
07:00
08:00
09:00
10:00
11:00
12:00
Time
13:00
14:00
15:00
16:00
17:00
L3 Surface
L3 Mid
L3 Bottom


TSS - Location L4 (Poovar) - Monsoon 2020
TSS (mg/dl)
12.00
10.00
8.00
6.00
4.00
2.00
0.00
07:00
08:00
09:00
10:00
11:00
12:00
Time
13:00
14:00
15:00
16:00
17:00
L4 Surface
L4 Mid
L4 Bottom


TSS - Location L1 (Mulloor) - Post Monsoon 2020
TSS (mg/dl)
8.00
6.00
4.00
2.00
0.00
07:00
08:00
09:00
10:00
11:00
12:00
Time
13:00
14:00
15:00
16:00
17:00
L1 Surface
L1 Mid
L1 Bottom



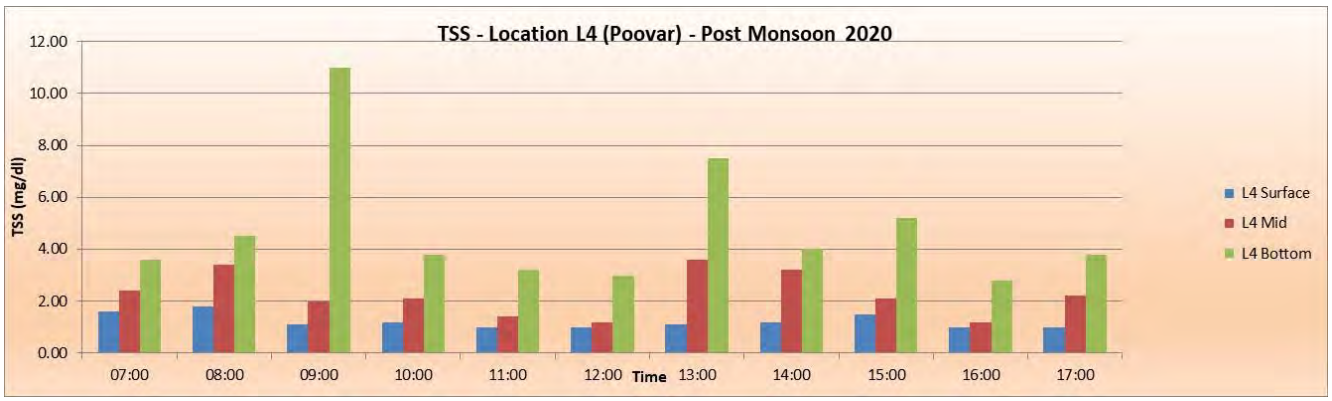
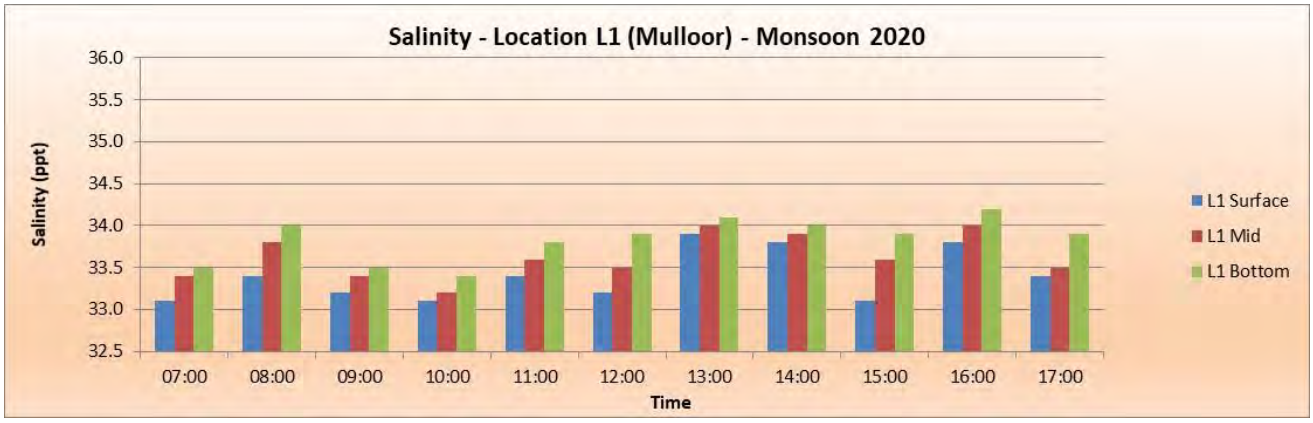
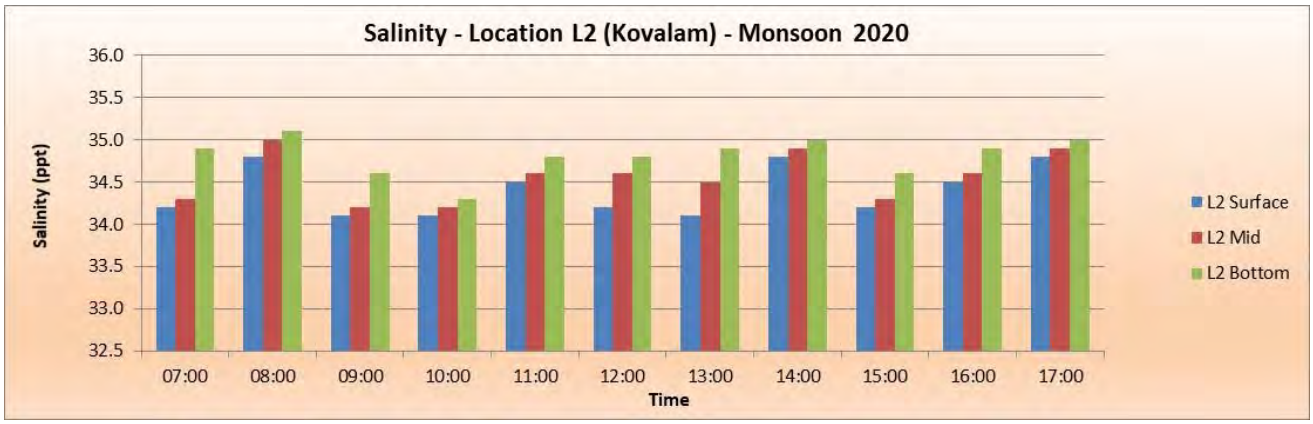



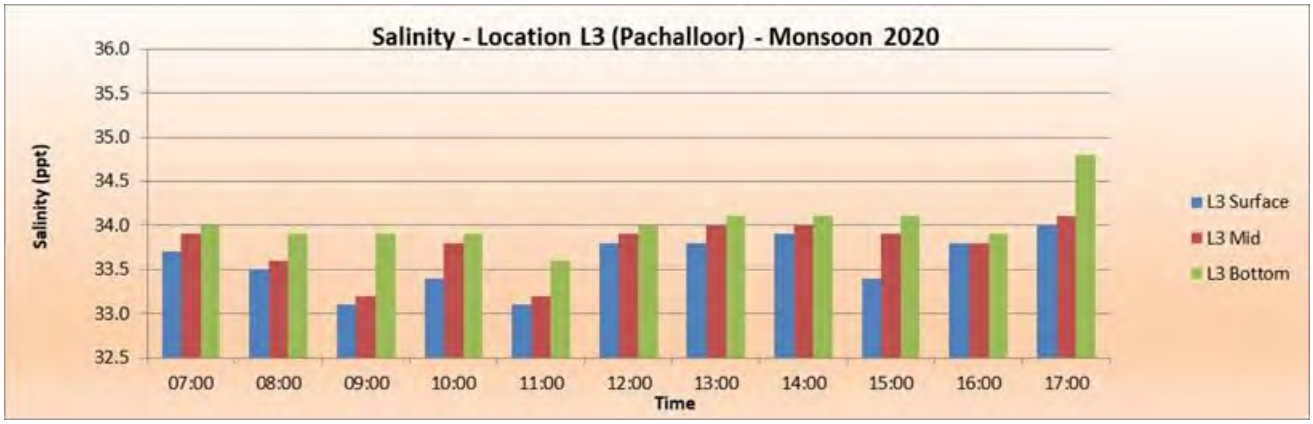

Figure 6-17: Time Series of TSS

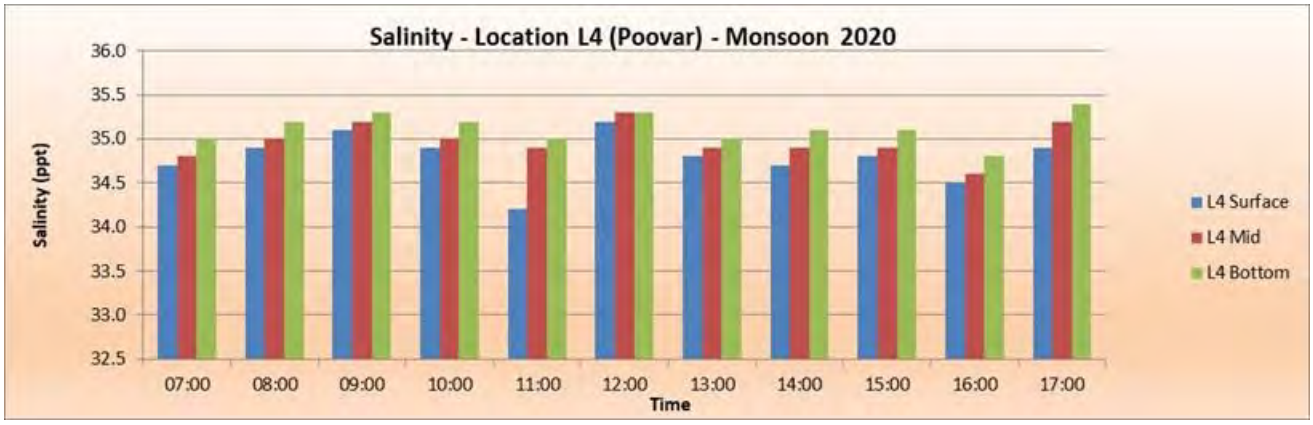
The maximum Total Suspended Solids recorded was 12 mg/dl near the bottom at Location 3 (Pachalloor) in the monsoon and 11 mg/dl near the bottom at Location 4 (Poovar) during the post-monsoon period.

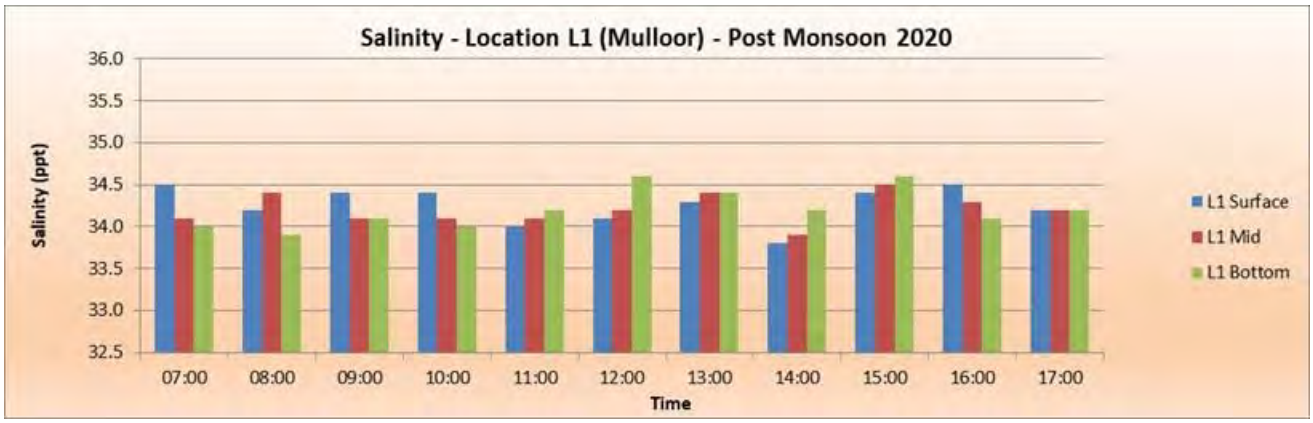
The time series for salinity at all three levels for all the locations is given as follows.

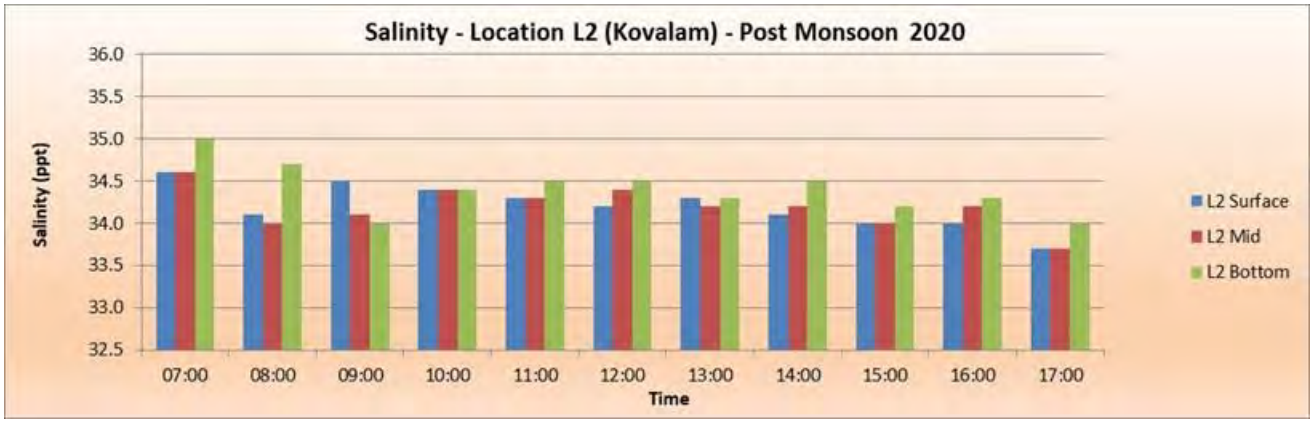

Salinity - Location L1 (Mulloor) - Monsoon 2020
Salinity (ppt)
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
Time
L1 Surface
L1 Mid
L1 Bottom


Salinity - Location L2 (Kovalam) - Monsoon 2020
Salinity (ppt)
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
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) - Monsoon 2020
Salinity (ppt)
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
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


Salinity - Location L4 (Poovar) - Monsoon 2020
Salinity (ppt)
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
Time
L4 Surface
L4 Mid
L4 Bottom


Salinity - Location L1 (Mulloor) - Post Monsoon 2020
Salinity (ppt)
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
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) - Post Monsoon 2020
Salinity (ppt)
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
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

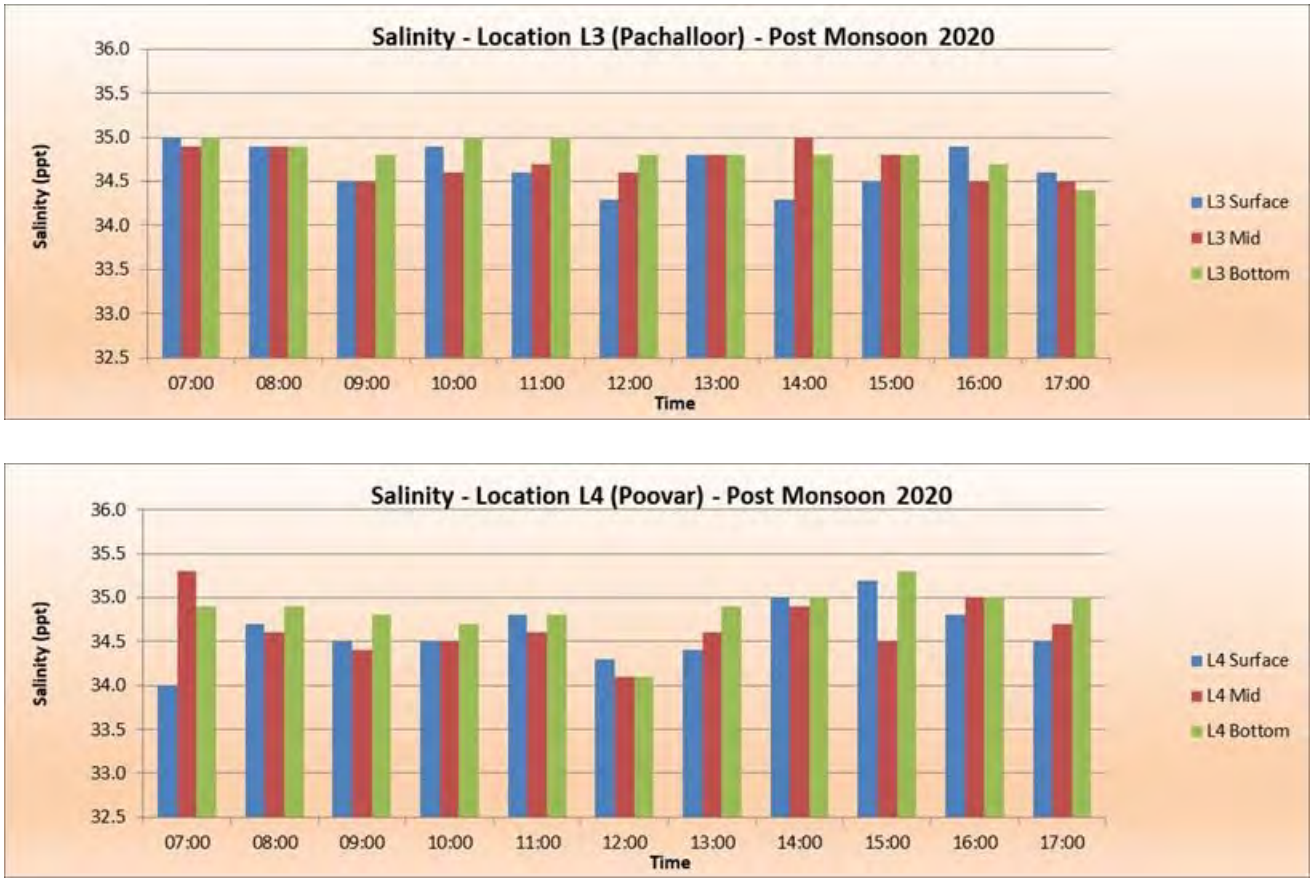
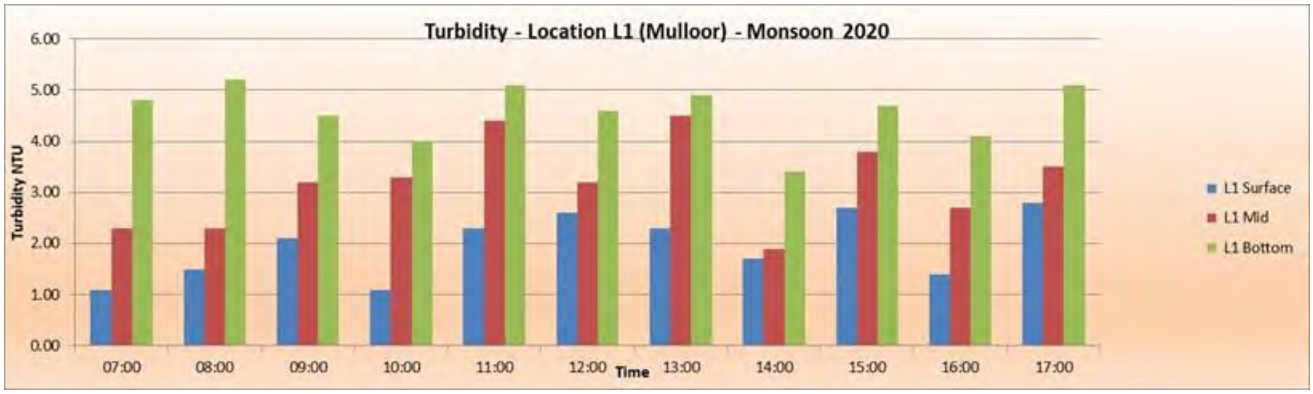
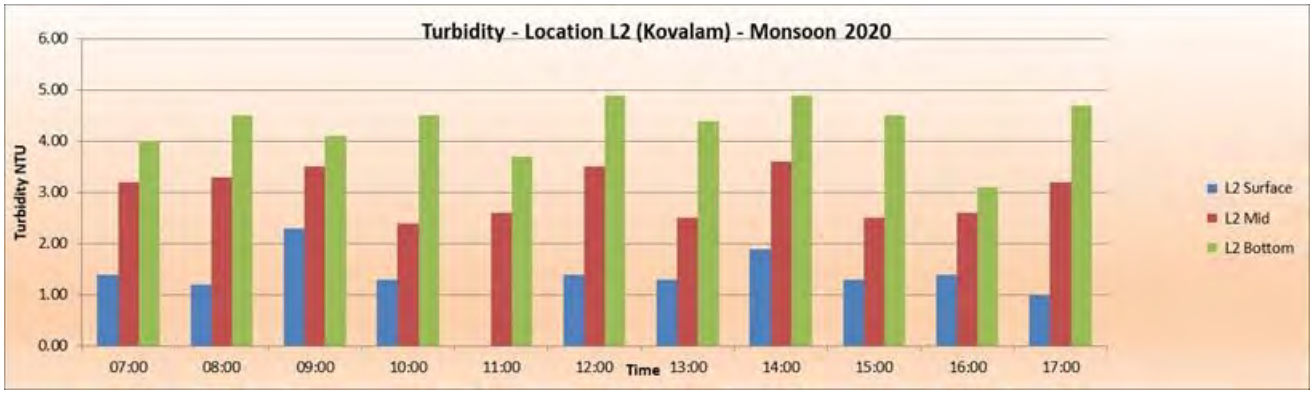


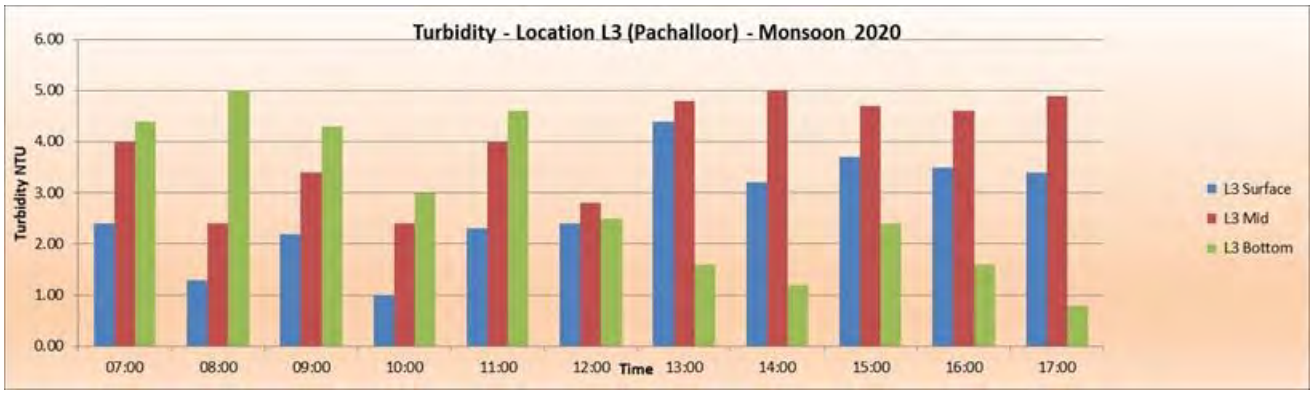

Figure 6-18: Time Series of salinity

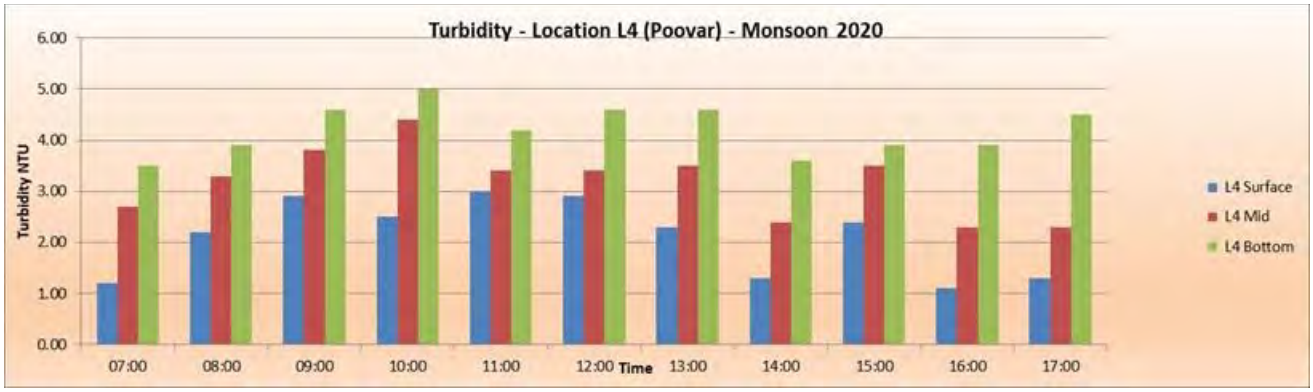
For the monsoon period, the salinity values are seen to be in the range of 33.1 and 35.4 ppt, whereas for the post-monsoon period, the salinity at all locations is seen to be between 33.7 and 35.3 parts per thousand (ppt).

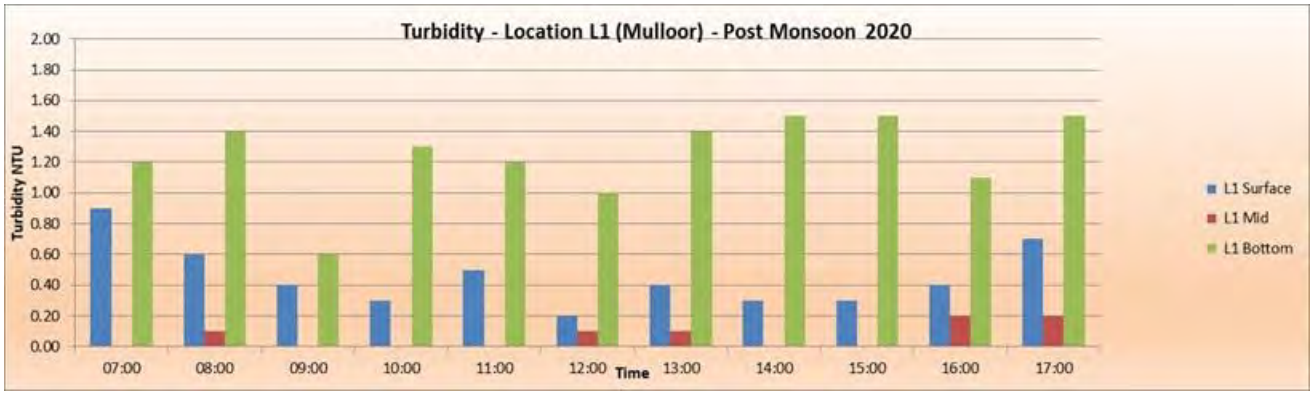
The time series for turbidity at all levels for the locations is shown below.

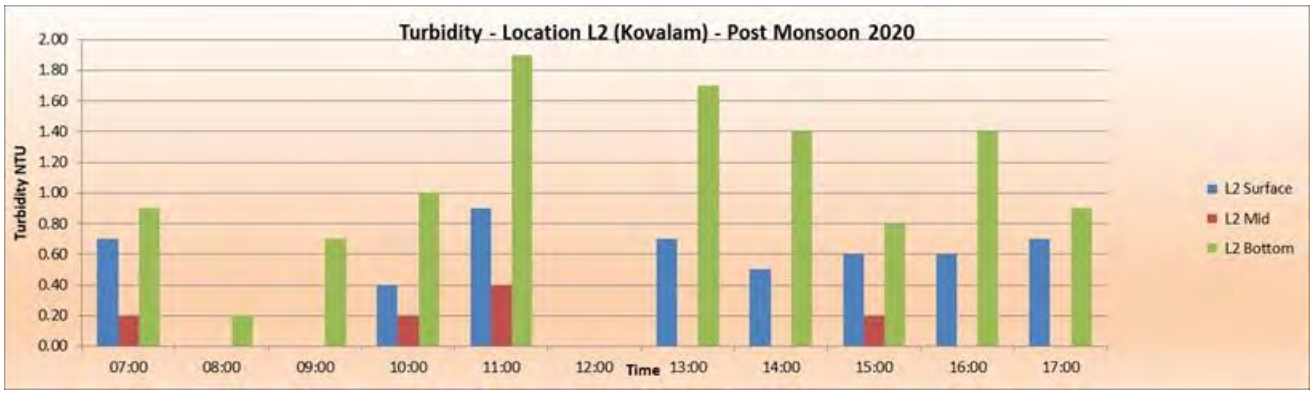


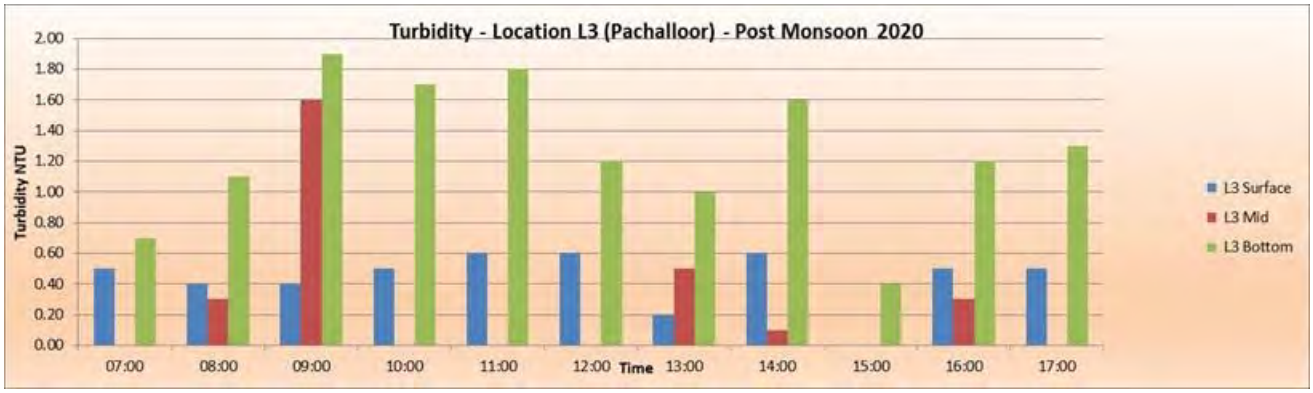

Turbidity - Location L2 (Kovalam) - Monsoon 2020
Turbidity NTU
6.00
5.00
4.00
3.00
2.00
1.00
0.00
07:00
08:00
09:00
10:00
11:00
12:00
Time
13:00
14:00
15:00
16:00
17:00
L2 Surface
L2 Mid
L2 Bottom


Turbidity - Location L3 (Pachalloor) - Monsoon 2020
Turbidity NTU
6.00
5.00
4.00
3.00
2.00
1.00
0.00
07:00
08:00
09:00
10:00
11:00
12:00
Time
13:00
14:00
15:00
16:00
17:00
L3 Surface
L3 Mid
L3 Bottom


Turbidity - Location L4 (Poovar) - Monsoon 2020
Turbidity NTU
6.00
5.00
4.00
3.00
2.00
1.00
0.00
07:00
08:00
09:00
10:00
11:00
12:00
Time
13:00
14:00
15:00
16:00
17:00
L4 Surface
L4 Mid
L4 Bottom


Turbidity - Location L1 (Mulloor) - Post Monsoon 2020
Turbidity NTU
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
07:00
08:00
09:00
10:00
11:00
12:00
Time
13:00
14:00
15:00
16:00
17:00
L1 Surface
L1 Mid
L1 Bottom


Turbidity - Location L2 (Kovalam) - Post Monsoon 2020
Turbidity NTU
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
07:00
08:00
09:00
10:00
11:00
12:00
Time
13:00
14:00
15:00
16:00
17:00
L2 Surface
L2 Mid
L2 Bottom


Turbidity - Location L3 (Pachalloor) - Post Monsoon 2020
Turbidity NTU
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
07:00
08:00
09:00
10:00
11:00
12:00
Time
13:00
14:00
15:00
16:00
17:00
L3 Surface
L3 Mid
L3 Bottom

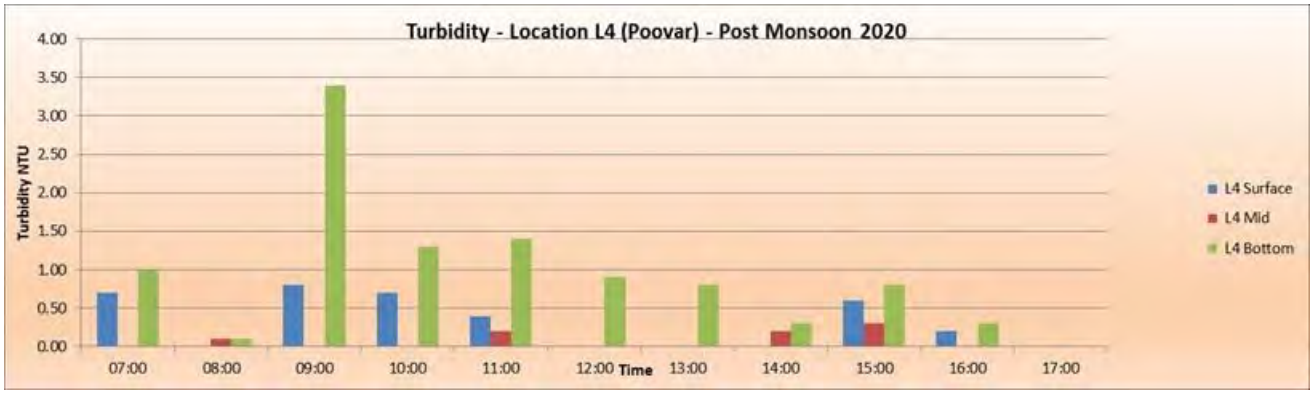



Figure 6-19: Time Series of Turbidity at water sampling locations

For the monsoon period the maximum turbidity recorded was 5.2 NTU near the bottom at Location L1 (Mulloor) and maximum turbidity recorded during post-monsoon period was 3.4 NTU near the bottom at Location L4 (Poovar).

***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 at 61 out of the 81 locations in the month of September 2020 (monsoon). 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. At other locations the samples could not be collected due to non-availability of beach in those locations. In the month of December 2020, 75 out of 81 beach samples were collected. At the remaining locations, due to erosion of the beaches as a result of wave breaking, these areas could not be accessed. The waves were directly incident on the seawall.

The following table shows the D50 value (in mm) of the sediments collected along with the soil classification for the monsoon period.

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

| 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 | | | | | |

| Sample Name | Gravel % | Sand % | Mud% | Total | D50 (mm) | Classification |
|---|---|---|---|---|---|---|
| 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 Applicable | | | | | |
| BS-12 | Not Applicable | | | | | |
| BS-13 | 0 | 100 | 0 | 100 | 0.5070 | Medium Sand |
| BS-14 | 0 | 100 | 0 | 100 | 0.5063 | Medium Sand |
| BS-15 | 0 | 100 | 0 | 100 | 0.3208 | Fine Sand |
| BS-16 | 0 | 100 | 0 | 100 | 0.4787 | Medium Sand |
| BS-17 | 0 | 100 | 0 | 100 | 0.4629 | Medium Sand |
| BS-18 | 0 | 100 | 0 | 100 | 0.4235 | Fine Sand |
| BS-19 | 0 | 100 | 0 | 100 | 0.4542 | Medium Sand |
| BS-20 | 0 | 100 | 0 | 100 | 0.4511 | Medium Sand |
| BS-21 | 0 | 100 | 0 | 100 | 0.4429 | Medium Sand |
| BS-22 | 0 | 100 | 0 | 100 | 0.3483 | Fine Sand |
| BS-23 | 0 | 100 | 0 | 100 | 0.4528 | Medium Sand |
| BS-24 | 0 | 100 | 0 | 100 | 0.4920 | Medium Sand |
| BS-25 | 0 | 100 | 0 | 100 | 0.5347 | Medium Sand |
| BS-26 | 0 | 100 | 0 | 100 | 0.4408 | Medium Sand |
| BS-27 | 0 | 100 | 0 | 100 | 0.4850 | Medium Sand |
| BS-28 | 0 | 100 | 0 | 100 | 0.6174 | Medium Sand |
| BS-29 | 0 | 100 | 0 | 100 | 0.5639 | Medium Sand |
| BS-30 | 0 | 100 | 0 | 100 | 0.5362 | Medium Sand |
| BS-31 | 0 | 100 | 0 | 100 | 0.5460 | Medium Sand |
| BS-32 | 0 | 100 | 0 | 100 | 0.7454 | Medium Sand |
| BS-33 | 0 | 100 | 0 | 100 | 0.4309 | Medium Sand |
| BS-34 | 0 | 100 | 0 | 100 | 0.5686 | Medium Sand |
| BS-35 | 0 | 100 | 0 | 100 | 0.5945 | Medium Sand |
| BS-36 | 0 | 100 | 0 | 100 | 0.6209 | Medium Sand |
| BS-37 | 0 | 100 | 0 | 100 | 0.7077 | Medium Sand |
| BS-38 | 0 | 100 | 0 | 100 | 0.6733 | Medium Sand |
| BS-39 | 0 | 100 | 0 | 100 | 0.7194 | Medium Sand |
| BS-40 | 0 | 100 | 0 | 100 | 0.7342 | Medium Sand |
| BS-41 | 0 | 100 | 0 | 100 | 0.2495 | Fine Sand |
| BS-42 | 0 | 100 | 0 | 100 | 0.7333 | Medium Sand |
| BS-43 | 0 | 100 | 0 | 100 | 0.7199 | Medium Sand |
| BS-44 | 0 | 100 | 0 | 100 | 0.2233 | Fine Sand |
| BS-45 | 0 | 100 | 0 | 100 | 0.1979 | Fine Sand |
| BS-46 | 0 | 100 | 0 | 100 | 0.4012 | Fine Sand |
| BS-47 | Not Applicable | | | | | |
| BS-48 | Not Applicable | | | | | |

| Sample Name | Gravel % | Sand % | Mud% | Total | D50 (mm) | Classification |
|---|---|---|---|---|---|---|
| BS-49 | Not Applicable | | | | | |
| BS-50 | Not Applicable | | | | | |
| BS-51 | Not Applicable | | | | | |
| BS-52 | Not Applicable | | | | | |
| BS-53 | 0 | 100 | 0 | 100 | 0.2073 | Fine Sand |
| BS-54 | 0 | 100 | 0 | 100 | 0.1650 | Fine Sand |
| BS-55 | 0 | 100 | 0 | 100 | 0.3410 | Fine Sand |
| BS-56 | 0 | 100 | 0 | 100 | 0.2638 | Fine Sand |
| BS-57 | 0 | 100 | 0 | 100 | 0.4751 | Medium Sand |
| BS-58 | 0 | 100 | 0 | 100 | 0.4383 | Medium Sand |
| BS-59 | Not Applicable | | | | | |
| BS-60 | 0 | 100 | 0 | 100 | 0.5177 | Medium Sand |
| BS-61 | 0 | 100 | 0 | 100 | 0.5523 | Medium Sand |
| BS-62 | 0 | 100 | 0 | 100 | 0.5506 | Medium Sand |
| BS-63 | 0 | 100 | 0 | 100 | 0.3746 | Fine Sand |
| BS-64 | 0 | 100 | 0 | 100 | 0.3148 | Fine Sand |
| BS-65 | Not Applicable | | | | | |
| BS-66 | 0 | 100 | 0 | 100 | 0.3529 | Fine Sand |
| BS-67 | 0 | 100 | 0 | 100 | 0.3193 | Fine Sand |
| BS-68 | 0 | 100 | 0 | 100 | 0.3162 | Fine Sand |
| BS-69 | 0 | 100 | 0 | 100 | 0.4155 | Fine Sand |
| BS-70 | 0 | 100 | 0 | 100 | 0.4134 | Fine Sand |
| BS-71 | 0 | 100 | 0 | 100 | 0.3796 | Fine Sand |
| BS-72 | 0 | 100 | 0 | 100 | 0.4008 | Fine Sand |
| BS-73 | 0 | 100 | 0 | 100 | 0.3531 | Fine Sand |
| BS-74 | 0 | 100 | 0 | 100 | 0.3810 | Fine Sand |
| BS-75 | 0 | 100 | 0 | 100 | 0.3965 | Fine Sand |
| BS-76 | 0 | 100 | 0 | 100 | 0.3363 | Fine Sand |
| BS-77 | 0 | 100 | 0 | 100 | 0.3215 | Fine Sand |
| BS-78 | 0 | 100 | 0 | 100 | 0.3252 | Fine Sand |
| BS-79 | 0 | 100 | 0 | 100 | 0.3582 | Fine Sand |
| BS-80 | 0 | 100 | 0 | 100 | 0.5145 | Medium Sand |
| BS-81 | 0 | 100 | 0 | 100 | 0.3617 | Fine Sand |

The following table shows the D50 value (in mm) of the sediments collected along with the soil classification for the post-monsoon period.

① Table 6-14: Beach sample soil classification (Post-monsoon period)

| Sample Name | Gravel % | Sand % | Mud% | Total | D50 (mm) | Classification |
|---|---|---|---|---|---|---|
| BS-1 | 0 | 100 | 0 | 100 | 0.4005 | Fine Sand |
| BS-2 | 0 | 100 | 0 | 100 | 0.3360 | Fine Sand |
| BS-3 | 0 | 100 | 0 | 100 | 0.3758 | Fine Sand |
| BS-4 | 0 | 100 | 0 | 100 | 0.4980 | Medium Sand |
| BS-5 | 0 | 100 | 0 | 100 | 0.4361 | Medium Sand |
| BS-6 | 0 | 100 | 0 | 100 | 0.3416 | Fine Sand |
| BS-7 | 0 | 100 | 0 | 100 | 0.5163 | Medium Sand |
| BS-8 | 0 | 100 | 0 | 100 | 0.4657 | Medium Sand |
| BS-9 | 0 | 100 | 0 | 100 | 0.4326 | Medium Sand |
| BS-10 | 0 | 100 | 0 | 100 | 0.4307 | Medium Sand |
| BS-11 | Not Applicable | | | | | |
| BS-12 | Not Applicable | | | | | |
| BS-13 | 0 | 100 | 0 | 100 | 0.3618 | Fine Sand |
| BS-14 | 0 | 100 | 0 | 100 | 0.3503 | Fine Sand |
| BS-15 | 0 | 100 | 0 | 100 | 0.3236 | Fine Sand |
| BS-16 | 0 | 100 | 0 | 100 | 0.3237 | Fine Sand |
| BS-17 | 0 | 100 | 0 | 100 | 0.3539 | Fine Sand |
| BS-18 | 0 | 100 | 0 | 100 | 0.3503 | Fine Sand |
| BS-19 | 0 | 100 | 0 | 100 | 0.3368 | Fine Sand |
| BS-20 | 0 | 100 | 0 | 100 | 0.4351 | Medium Sand |
| BS-21 | 0 | 100 | 0 | 100 | 0.3307 | Fine Sand |
| BS-22 | 0 | 100 | 0 | 100 | 0.4500 | Medium Sand |
| BS-23 | 0 | 100 | 0 | 100 | 0.4778 | Medium Sand |
| BS-24 | 0 | 100 | 0 | 100 | 0.4845 | Medium Sand |
| BS-25 | 0 | 100 | 0 | 100 | 0.4988 | Medium Sand |
| BS-26 | 0 | 100 | 0 | 100 | 0.4410 | Medium Sand |
| BS-27 | 0 | 100 | 0 | 100 | 0.4146 | Medium Sand |
| BS-28 | 0 | 100 | 0 | 100 | 0.7270 | Medium Sand |
| BS-29 | 0 | 100 | 0 | 100 | 0.6105 | Medium Sand |
| BS-30 | 0 | 100 | 0 | 100 | 0.7059 | Medium Sand |
| BS-31 | 0 | 100 | 0 | 100 | 0.3514 | Fine Sand |
| BS-32 | Not Applicable | | | | | |
| BS-33 | 0 | 100 | 0 | 100 | 0.2357 | Fine Sand |
| BS-34 | 0 | 100 | 0 | 100 | 0.2718 | Fine Sand |
| BS-35 | Not Applicable | | | | | |
| BS-35A | 0 | 100 | 0 | 100 | 0.2282 | Fine Sand |
| BS-36 | 0 | 100 | 0 | 100 | 0.4642 | Medium Sand |
| BS-37 | 0 | 100 | 0 | 100 | 0.4596 | Medium Sand |
| BS-38 | 0 | 100 | 0 | 100 | 0.4749 | Medium Sand |
| BS-39 | 0 | 100 | 0 | 100 | 0.5272 | Medium Sand |
| BS-40 | 0 | 100 | 0 | 100 | 0.5256 | Medium Sand |
| BS-40A | 0 | 100 | 0 | 100 | 0.2702 | Fine Sand |
| BS-41 | 0 | 100 | 0 | 100 | 0.3061 | Fine Sand |

| Sample Name | Gravel % | Sand % | Mud% | Total | D50 (mm) | Classification |
|---|---|---|---|---|---|---|
| BS-42 | 0 | 100 | 0 | 100 | 0.2719 | Fine Sand |
| BS-43 | 0 | 100 | 0 | 100 | 0.2066 | Fine Sand |
| BS-44 | 0 | 100 | 0 | 100 | 0.2673 | Fine Sand |
| BS-45 | 0 | 100 | 0 | 100 | 0.3492 | Fine Sand |
| BS-46 | 0 | 100 | 0 | 100 | 0.3389 | Fine Sand |
| BS-47 | 0 | 100 | 0 | 100 | 0.3458 | Fine Sand |
| BS-48 | 0 | 100 | 0 | 100 | 0.3274 | Fine Sand |
| BS-49 | Not Applicable | | | | | |
| BS-50 | Not Applicable | | | | | |
| BS-51 | Not Applicable | | | | | |
| BS-52 | Not Applicable | | | | | |
| BS-53 | 0 | 100 | 0 | 100 | 0.3670 | Fine Sand |
| BS-54 | 0 | 100 | 0 | 100 | 0.3600 | Fine Sand |
| BS-55 | 0 | 100 | 0 | 100 | 0.3614 | Fine Sand |
| BS-56 | 0 | 100 | 0 | 100 | 0.4239 | Medium Sand |
| BS-57 | 0 | 100 | 0 | 100 | 0.3419 | Fine Sand |
| BS-58 | 0 | 100 | 0 | 100 | 0.3454 | Fine Sand |
| BS-59 | 0 | 100 | 0 | 100 | 0.3477 | Fine Sand |
| BS-60 | 0 | 100 | 0 | 100 | 0.3325 | Fine Sand |
| BS-61 | 0 | 100 | 0 | 100 | 0.3422 | Fine Sand |
| BS-62 | 0 | 100 | 0 | 100 | 0.3371 | Fine Sand |
| BS-63 | 0 | 100 | 0 | 100 | 0.3640 | Fine Sand |
| BS-64 | 0 | 100 | 0 | 100 | 0.3852 | Fine Sand |
| BS-65 | 0 | 100 | 0 | 100 | 0.3218 | Fine Sand |
| BS-66 | 0 | 100 | 0 | 100 | 0.3316 | Fine Sand |
| BS-67 | 0 | 100 | 0 | 100 | 0.3796 | Fine Sand |
| BS-68 | 0 | 100 | 0 | 100 | 0.3637 | Fine Sand |
| BS-69 | 0 | 100 | 0 | 100 | 0.3700 | Fine Sand |
| BS-70 | 0 | 100 | 0 | 100 | 0.3639 | Fine Sand |
| BS-71 | 0 | 100 | 0 | 100 | 0.3662 | Fine Sand |
| BS-72 | 0 | 100 | 0 | 100 | 0.3292 | Fine Sand |
| BS-73 | 0 | 100 | 0 | 100 | 0.3365 | Fine Sand |
| BS-74 | 0 | 100 | 0 | 100 | 0.3318 | Fine Sand |
| BS-75 | 0 | 100 | 0 | 100 | 0.3245 | Fine Sand |
| BS-76 | 0 | 100 | 0 | 100 | 0.3335 | Fine Sand |
| BS-77 | 0 | 100 | 0 | 100 | 0.3427 | Fine Sand |
| BS-78 | 0 | 100 | 0 | 100 | 0.3487 | Fine Sand |
| BS-79 | 0 | 100 | 0 | 100 | 0.3382 | Fine Sand |
| BS-80 | 0 | 100 | 0 | 100 | 0.3392 | Fine Sand |
| BS-81 | 0 | 100 | 0 | 100 | 0.3293 | Fine Sand |

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 during the monsoon and post-monsoon periods.

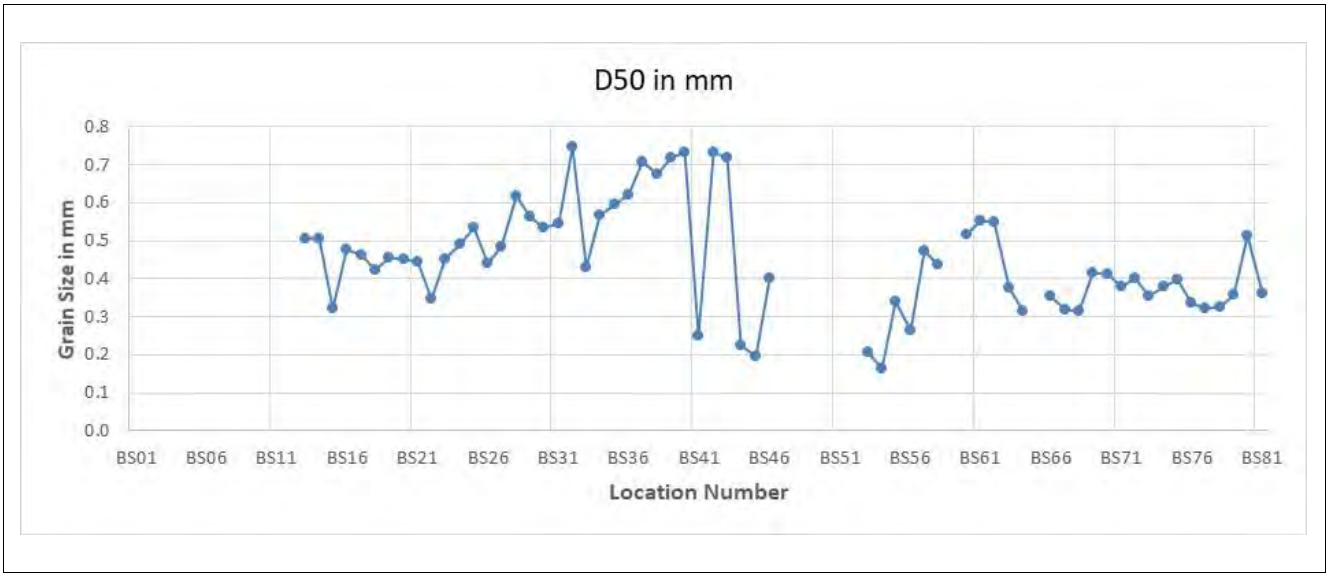



Figure 6-20: Distribution of D50 value of beach samples (monsoon period)

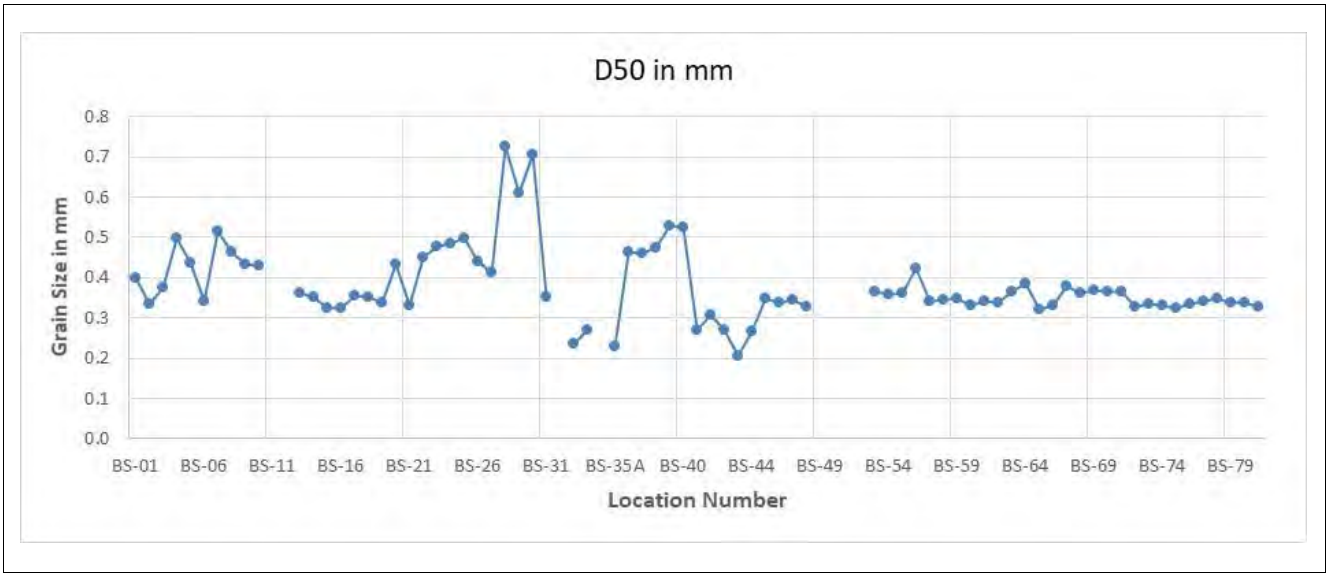



Figure 6-21: Distribution of D50 value of beach samples (post-monsoon period)

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

① The following are some of the graphs of grain size distribution curves drawn for few beach samples (BS-15, BS-20, BS-25 and BS-30) for two seasons.

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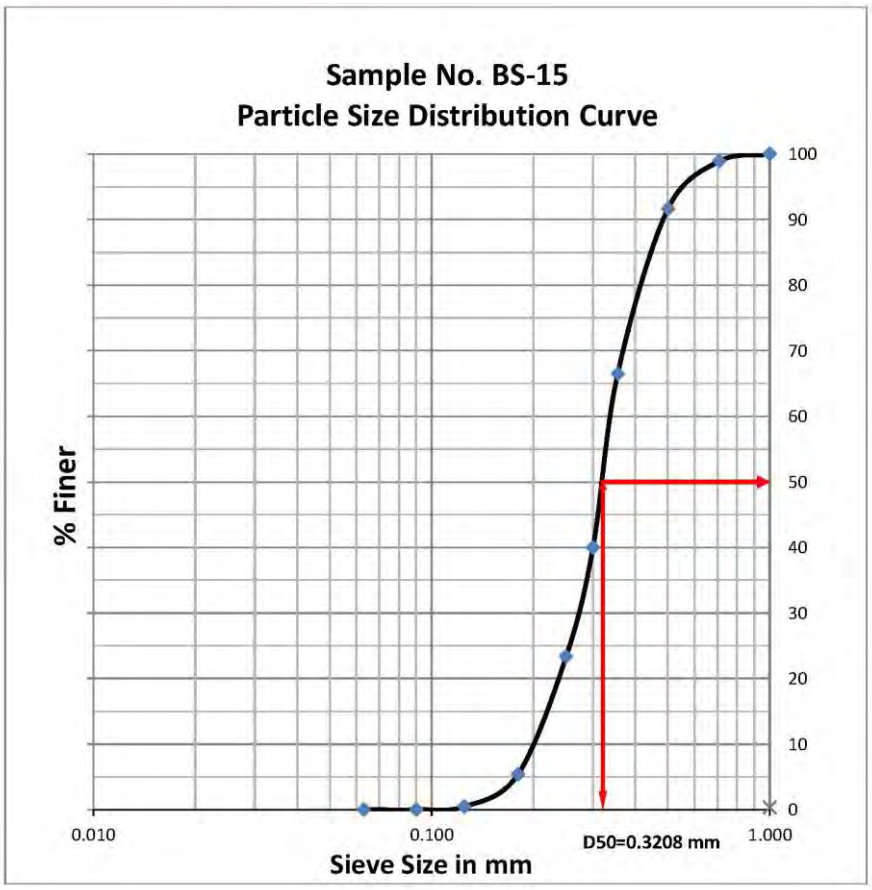


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Figure 6-22: Grain size distribution curve for BS-15 (Monsoon)

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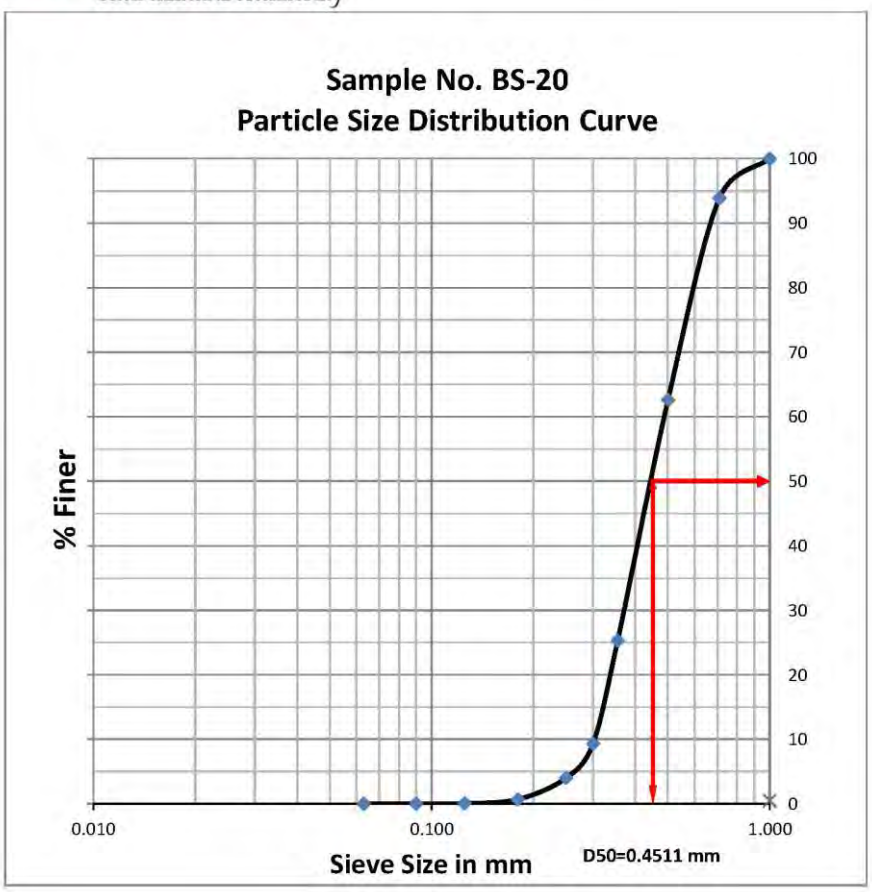


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Figure 6-23: Grain size distribution curve for BS-20 (Monsoon)

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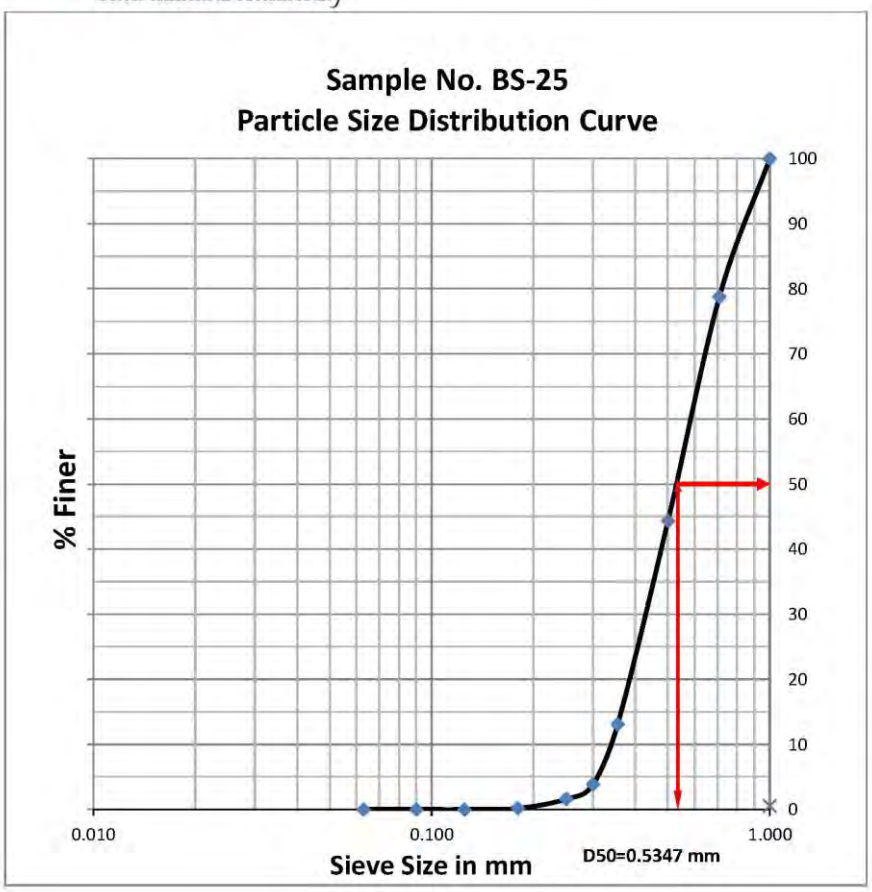


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Figure 6-24: Grain size distribution curve for BS-25 (Monsoon)

Standard[S]
Environmental Monitoring

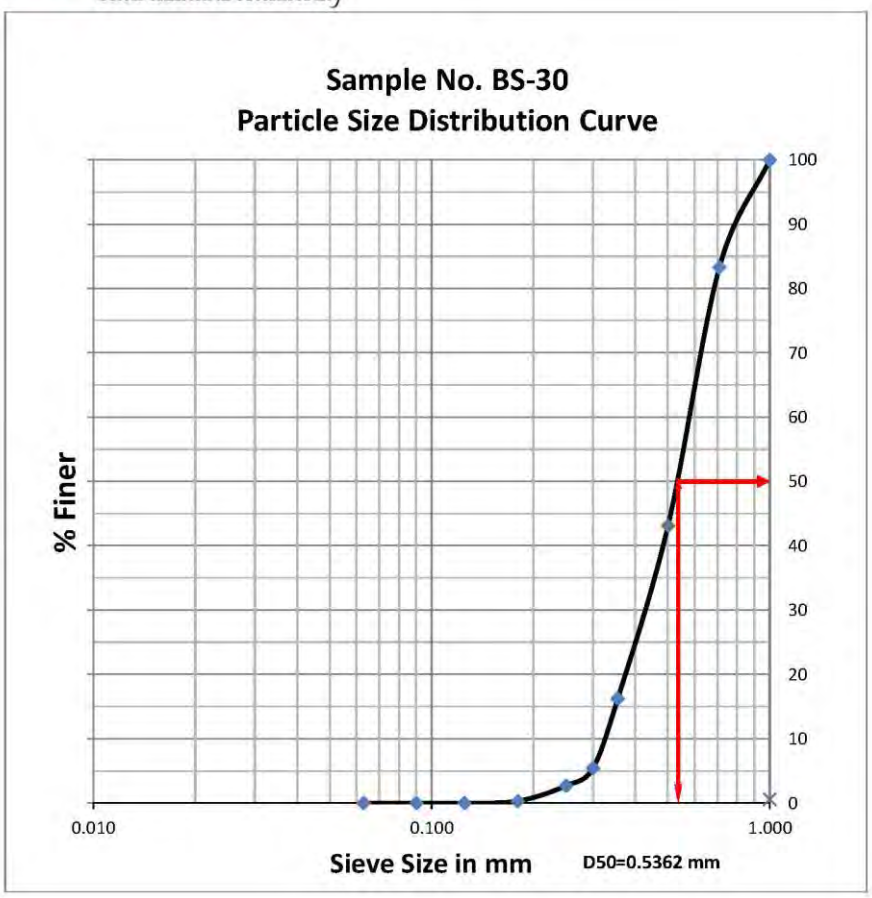


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Figure 6-25: Grain size distribution curve for BS-30 (Monsoon)

Standard[S] Environmental Monitoring

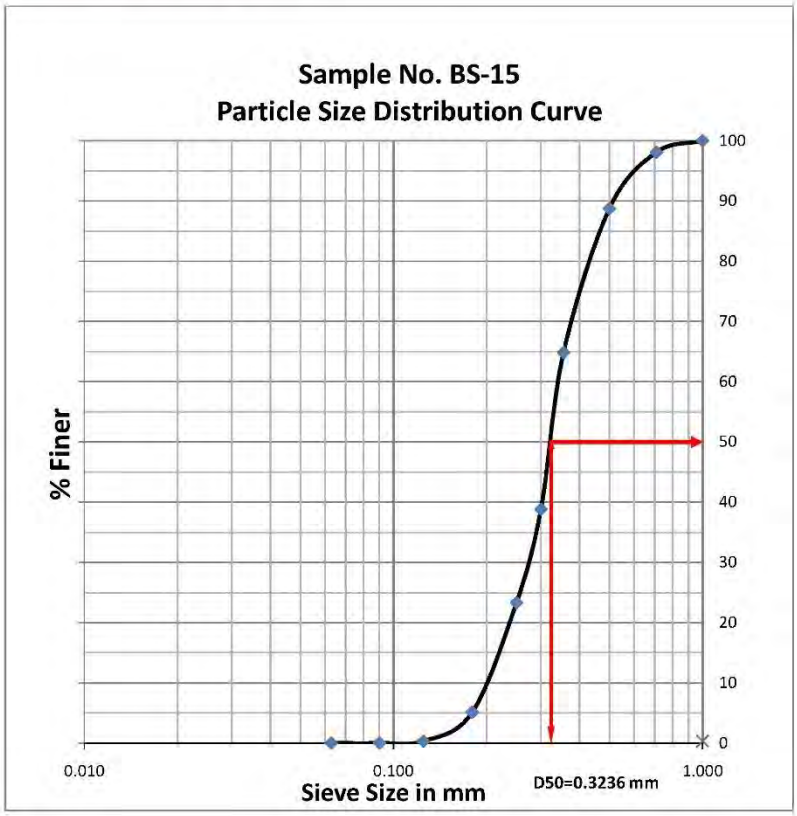


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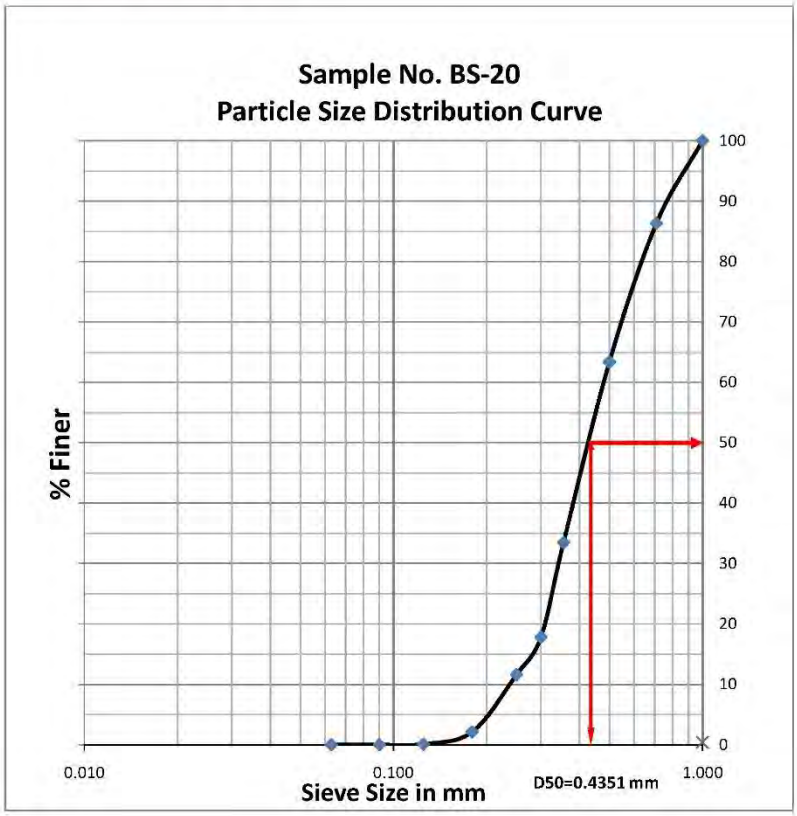
Figure 6-26: Grain size distribution curve for BS-15 (Post-monsoon)

Standard[S] Environmental Monitoring

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

Figure 6-27: Grain size distribution curve for BS-20 (Post-monsoon)

Standard[S]
Environmental Monitoring

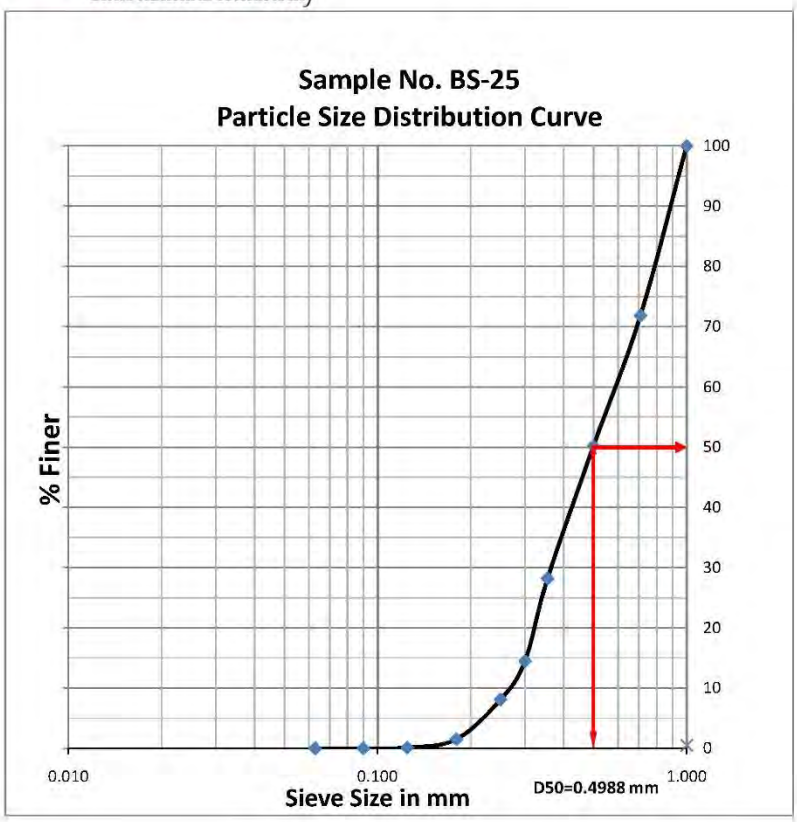


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Figure 6-28: Grain size distribution curve for BS-25 (Post-monsoon)

Standard[S] Environmental Monitoring

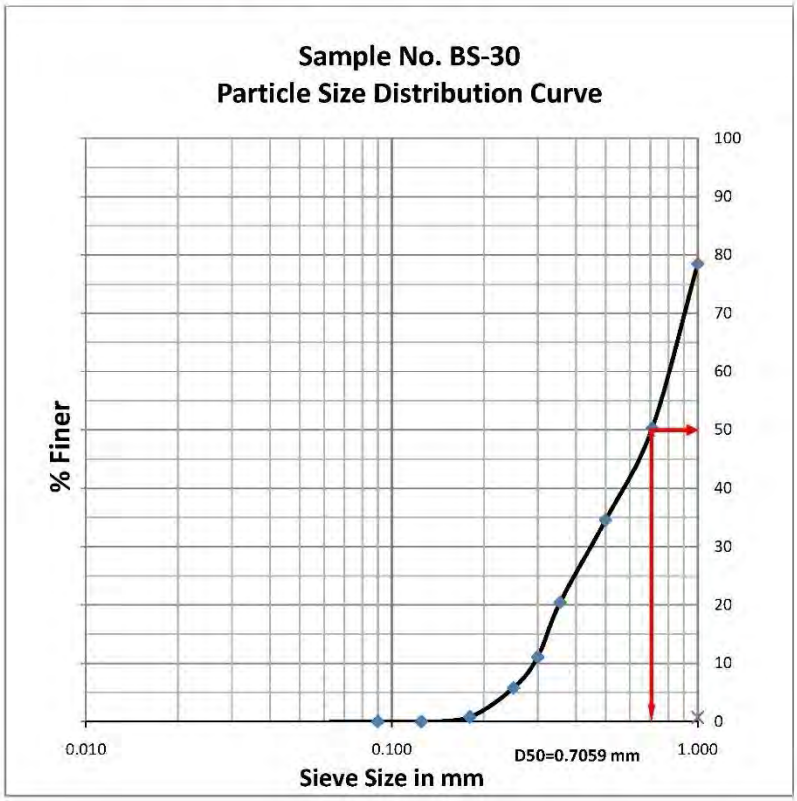


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Figure 6-29: Grain size distribution curve for BS-30 (Post-monsoon)

## 6.10 Grab Sampling

Marine grab samples were collected from all 80 locations in the month of March 2021. The following table shows the D50 value (in mm) of the sediments collected along with the soil classification.

Table 6-15: Grab sample soil classification

| Sample Name | Gravel % | Sand % | Mud% | Total | D50 (mm) | Classification |
|---|---|---|---|---|---|---|
| GS-01-01 | 0 | 100 | 0 | 100 | 0.4546 | Medium Sand |
| GS-01-02 | 0 | 100 | 0 | 100 | 0.4558 | Medium Sand |
| GS-02-01 | 0 | 100 | 0 | 100 | 0.4455 | Medium Sand |
| GS-02-02 | 0 | 100 | 0 | 100 | 0.4416 | Medium Sand |
| GS-03-01 | 0 | 100 | 0 | 100 | 0.4658 | Medium Sand |
| GS-03-02 | 0 | 100 | 0 | 100 | 0.4648 | Medium Sand |
| GS-04-01 | 0 | 100 | 0 | 100 | 0.4545 | Medium Sand |
| GS-04-02 | 0 | 100 | 0 | 100 | 0.4580 | Medium Sand |
| GS-05-01 | 0 | 100 | 0 | 100 | 0.4591 | Medium Sand |
| GS-05-02 | 0 | 100 | 0 | 100 | 0.4585 | Medium Sand |
| GS-06-01 | 0 | 100 | 0 | 100 | 0.4509 | Medium Sand |
| GS-06-02 | 0 | 100 | 0 | 100 | 0.4447 | Medium Sand |
| GS-07-01 | 0 | 100 | 0 | 100 | 0.4548 | Medium Sand |
| GS-07-02 | 0 | 100 | 0 | 100 | 0.4417 | Medium Sand |
| GS-08-01 | 0 | 100 | 0 | 100 | 0.4571 | Medium Sand |
| GS-08-02 | 0 | 100 | 0 | 100 | 0.4609 | Medium Sand |
| GS-09-01 | 0 | 100 | 0 | 100 | 0.4673 | Medium Sand |
| GS-09-02 | 0 | 100 | 0 | 100 | 0.4719 | Medium Sand |
| GS-10-01 | 0 | 100 | 0 | 100 | 0.4660 | Medium Sand |
| GS-10-02 | 0 | 100 | 0 | 100 | 0.4730 | Medium Sand |
| GS-11-01 | 0 | 100 | 0 | 100 | 0.4593 | Medium Sand |
| GS-11-02 | 0 | 100 | 0 | 100 | 0.4700 | Medium Sand |
| GS-12-01 | 0 | 100 | 0 | 100 | 0.4656 | Medium Sand |
| GS-12-02 | 0 | 100 | 0 | 100 | 0.4597 | Medium Sand |
| GS-13-01 | 0 | 100 | 0 | 100 | 0.4708 | Medium Sand |
| GS-13-02 | 0 | 100 | 0 | 100 | 0.4672 | Medium Sand |
| GS-14-01 | 0 | 100 | 0 | 100 | 0.4592 | Medium Sand |
| GS-14-02 | 0 | 100 | 0 | 100 | 0.4635 | Medium Sand |
| GS-15-01 | 0 | 100 | 0 | 100 | 0.4718 | Medium Sand |
| GS-15-02 | 0 | 100 | 0 | 100 | 0.4607 | Medium Sand |
| GS-16-01 | 0 | 100 | 0 | 100 | 0.4692 | Medium Sand |
| GS-16-02 | 0 | 100 | 0 | 100 | 0.4570 | Medium Sand |
| GS-17-01 | 0 | 100 | 0 | 100 | 0.4613 | Medium Sand |
| GS-17-02 | 0 | 100 | 0 | 100 | 0.4580 | Medium Sand |
| GS-18-01 | 0 | 100 | 0 | 100 | 0.4611 | Medium Sand |
| GS-18-02 | 0 | 100 | 0 | 100 | 0.4575 | Medium Sand |

| Sample Name | Gravel % | Sand % | Mud% | Total | D50 (mm) | Classification |
|---|---|---|---|---|---|---|
| GS-19-01 | 0 | 100 | 0 | 100 | 0.4597 | Medium Sand |
| GS-19-02 | 0 | 100 | 0 | 100 | 0.4564 | Medium Sand |
| GS-20-01 | 0 | 100 | 0 | 100 | 0.4468 | Medium Sand |
| GS-20-02 | 0 | 100 | 0 | 100 | 0.4614 | Medium Sand |
| GS-21-01 | 0 | 100 | 0 | 100 | 0.4658 | Medium Sand |
| GS-21-02 | 0 | 100 | 0 | 100 | 0.4606 | Medium Sand |
| GS-22-01 | 0 | 100 | 0 | 100 | 0.4705 | Medium Sand |
| GS-22-02 | 0 | 100 | 0 | 100 | 0.4747 | Medium Sand |
| GS-23-01 | 0 | 100 | 0 | 100 | 0.4671 | Medium Sand |
| GS-23-02 | 0 | 100 | 0 | 100 | 0.4686 | Medium Sand |
| GS-24-01 | 0 | 100 | 0 | 100 | 0.4719 | Medium Sand |
| GS-24-02 | 0 | 100 | 0 | 100 | 0.4669 | Medium Sand |
| GS-25-01 | 0 | 100 | 0 | 100 | 0.4591 | Medium Sand |
| GS-25-02 | 0 | 100 | 0 | 100 | 0.4644 | Medium Sand |
| GS-26-01 | 0 | 100 | 0 | 100 | 0.4418 | Medium Sand |
| GS-26-02 | 0 | 100 | 0 | 100 | 0.4591 | Medium Sand |
| GS-27-01 | 0 | 100 | 0 | 100 | 0.4580 | Medium Sand |
| GS-27-02 | 0 | 100 | 0 | 100 | 0.4651 | Medium Sand |
| GS-28-01 | 0 | 100 | 0 | 100 | 0.4633 | Medium Sand |
| GS-28-02 | 0 | 100 | 0 | 100 | 0.4586 | Medium Sand |
| GS-29-01 | 0 | 100 | 0 | 100 | 0.4597 | Medium Sand |
| GS-29-02 | 0 | 100 | 0 | 100 | 0.4599 | Medium Sand |
| GS-30-01 | 0 | 100 | 0 | 100 | 0.4574 | Medium Sand |
| GS-30-02 | 0 | 100 | 0 | 100 | 0.4612 | Medium Sand |
| GS-31-01 | 0 | 100 | 0 | 100 | 0.4583 | Medium Sand |
| GS-31-02 | 0 | 100 | 0 | 100 | 0.4566 | Medium Sand |
| GS-32-01 | 0 | 100 | 0 | 100 | 0.4667 | Medium Sand |
| GS-32-02 | 0 | 100 | 0 | 100 | 0.4706 | Medium Sand |
| GS-33-01 | 0 | 100 | 0 | 100 | 0.4490 | Medium Sand |
| GS-33-02 | 0 | 100 | 0 | 100 | 0.4647 | Medium Sand |
| GS-34-01 | 0 | 100 | 0 | 100 | 0.4650 | Medium Sand |
| GS-34-02 | 0 | 100 | 0 | 100 | 0.4704 | Medium Sand |
| GS-35-01 | 0 | 100 | 0 | 100 | 0.4586 | Medium Sand |
| GS-35-02 | 0 | 100 | 0 | 100 | 0.4509 | Medium Sand |
| GS-36-01 | 0 | 100 | 0 | 100 | 0.4747 | Medium Sand |
| GS-36-02 | 0 | 100 | 0 | 100 | 0.4573 | Medium Sand |
| GS-37-01 | 0 | 100 | 0 | 100 | 0.4696 | Medium Sand |
| GS-37-02 | 0 | 100 | 0 | 100 | 0.4467 | Medium Sand |
| GS-38-01 | 0 | 100 | 0 | 100 | 0.4611 | Medium Sand |
| GS-38-02 | 0 | 100 | 0 | 100 | 0.4650 | Medium Sand |
| GS-39-01 | 0 | 100 | 0 | 100 | 0.4677 | Medium Sand |
| GS-39-02 | 0 | 100 | 0 | 100 | 0.4656 | Medium Sand |
| GS-40-01 | 0 | 100 | 0 | 100 | 0.4518 | Medium Sand |
| GS-40-02 | 0 | 100 | 0 | 100 | 0.4625 | Medium Sand |

The classification is based on Wentworth scale as provided below:

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

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

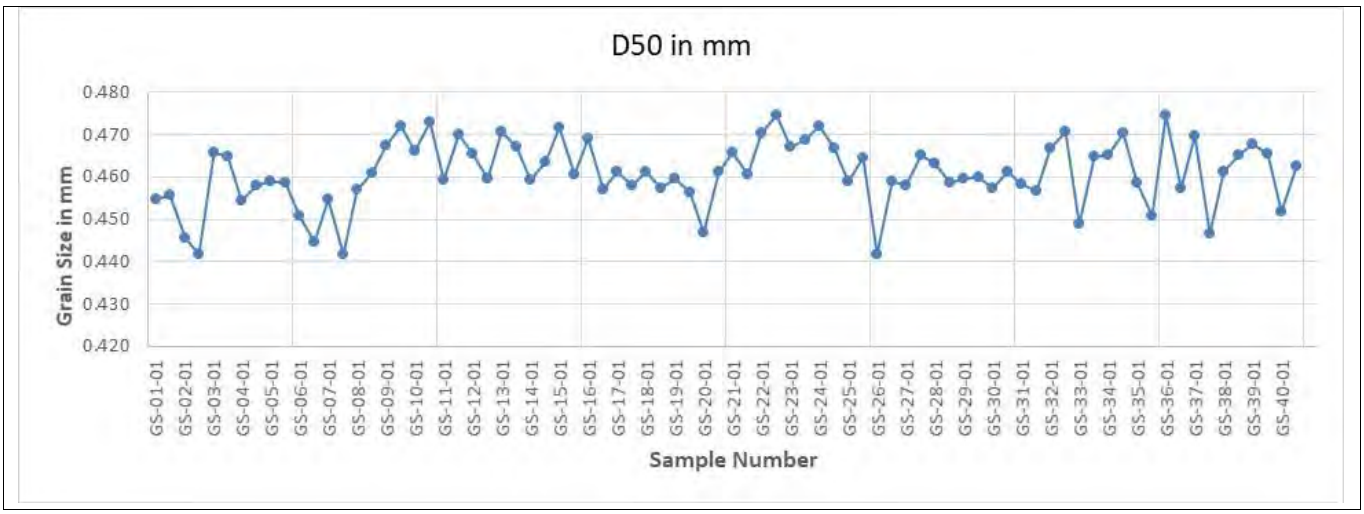



Figure 6-30: Distribution of D50 value of grab samples

Based on the above, it is inferred that the grab samples were mostly medium sand.

① A few graphs of grain size distribution curves are shown in the figures below.

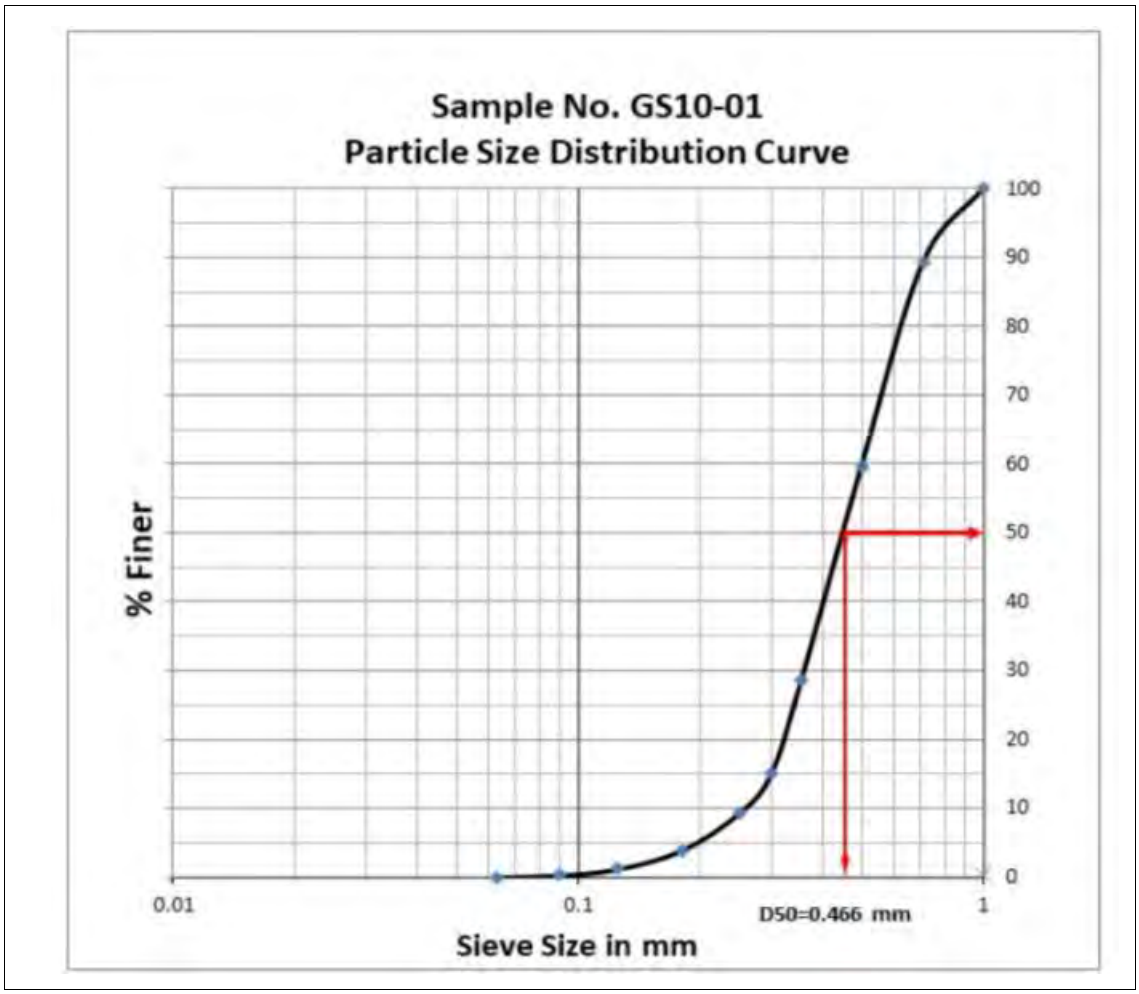



Figure 6-31: Grain size distribution curve for GS-10-01

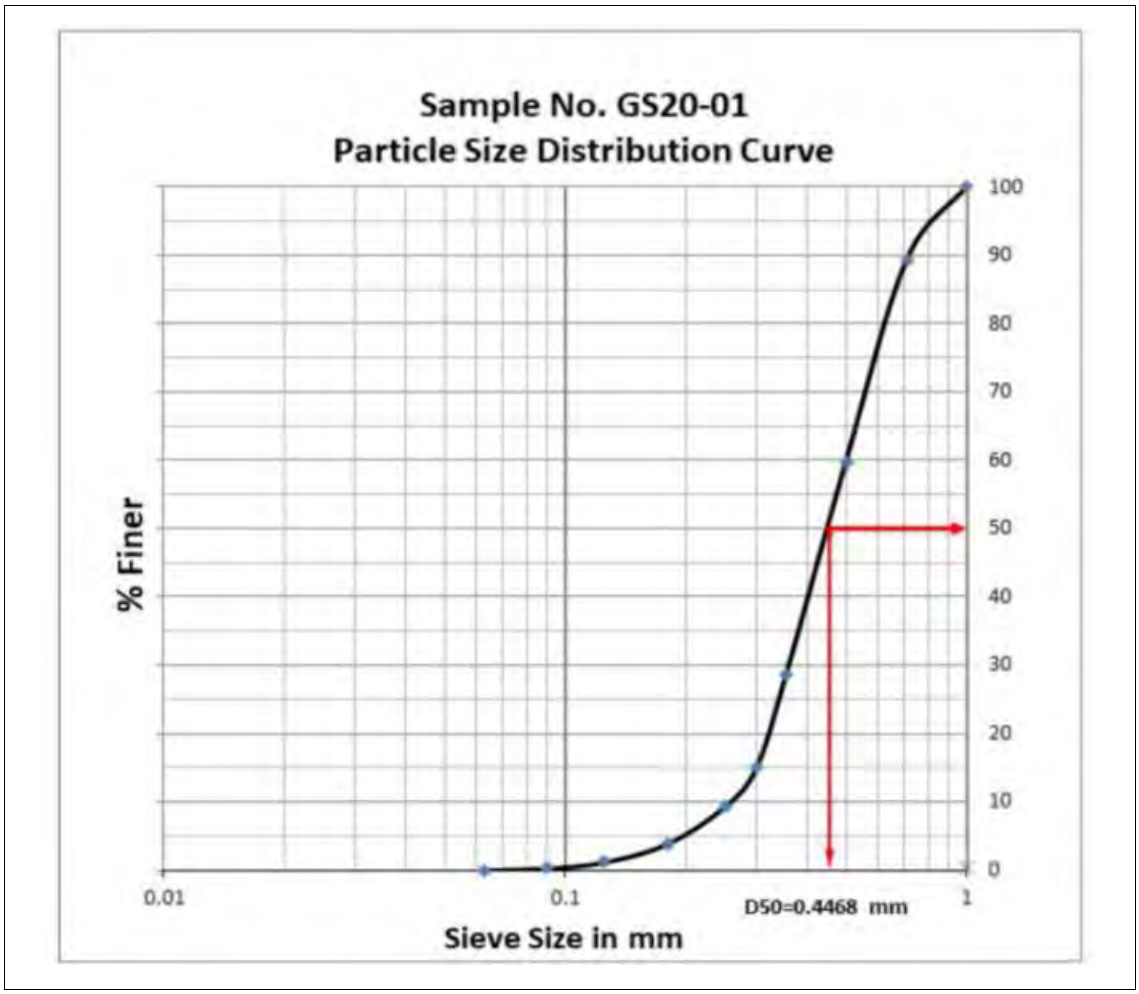



Figure 6-32: Grain size distribution curve for GS-20-01

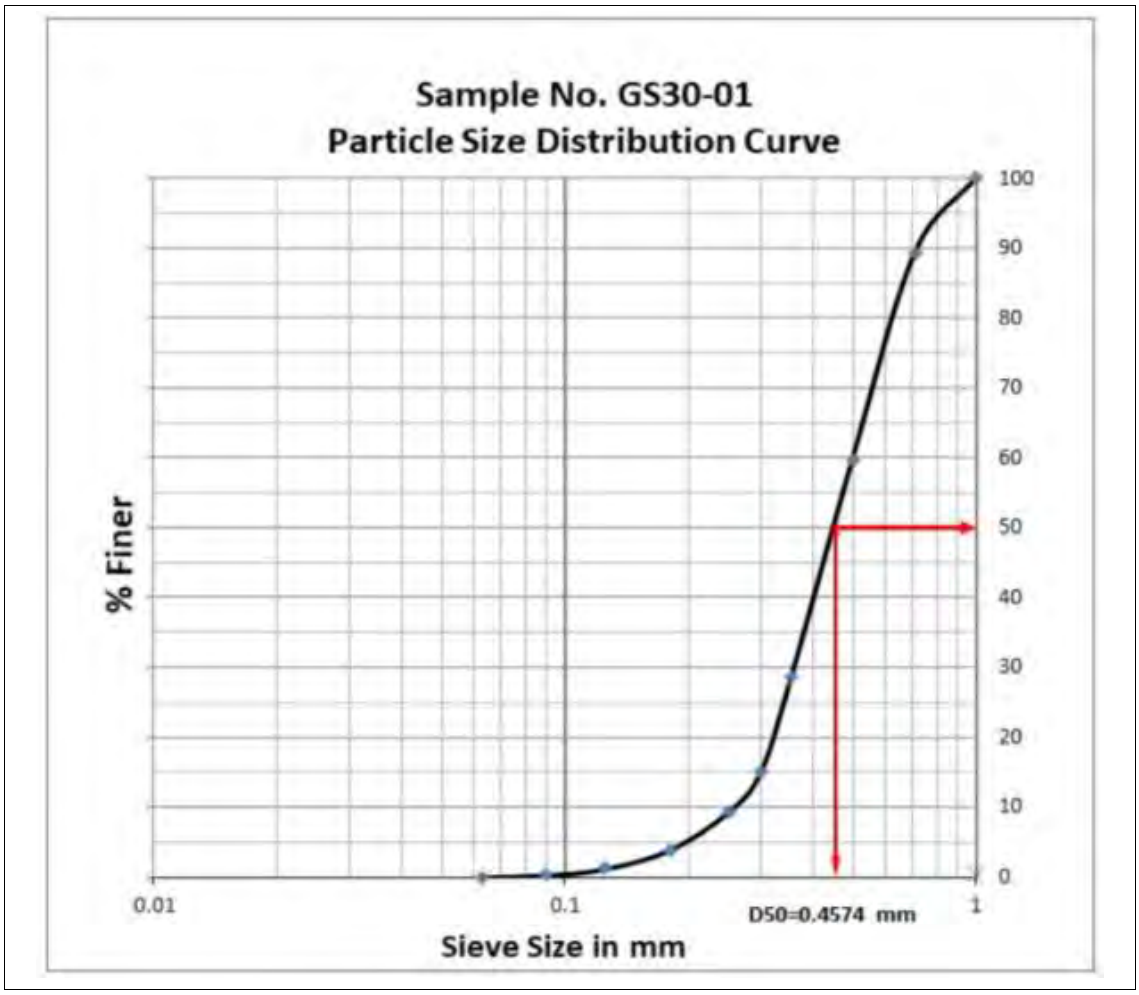



Figure 6-33: Grain size distribution curve for GS-30-01

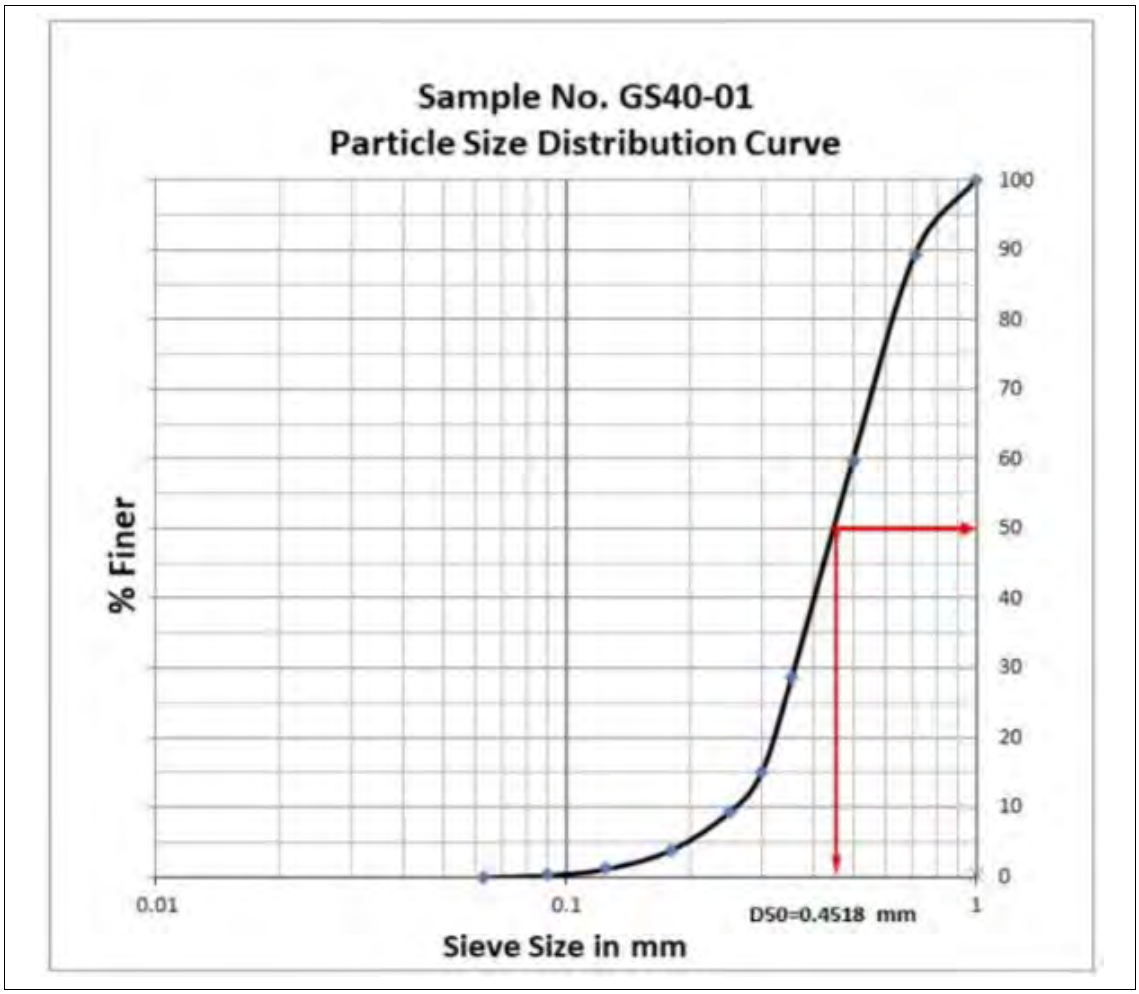



Figure 6-34: Grain size distribution curve for GS-40-01

## 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.

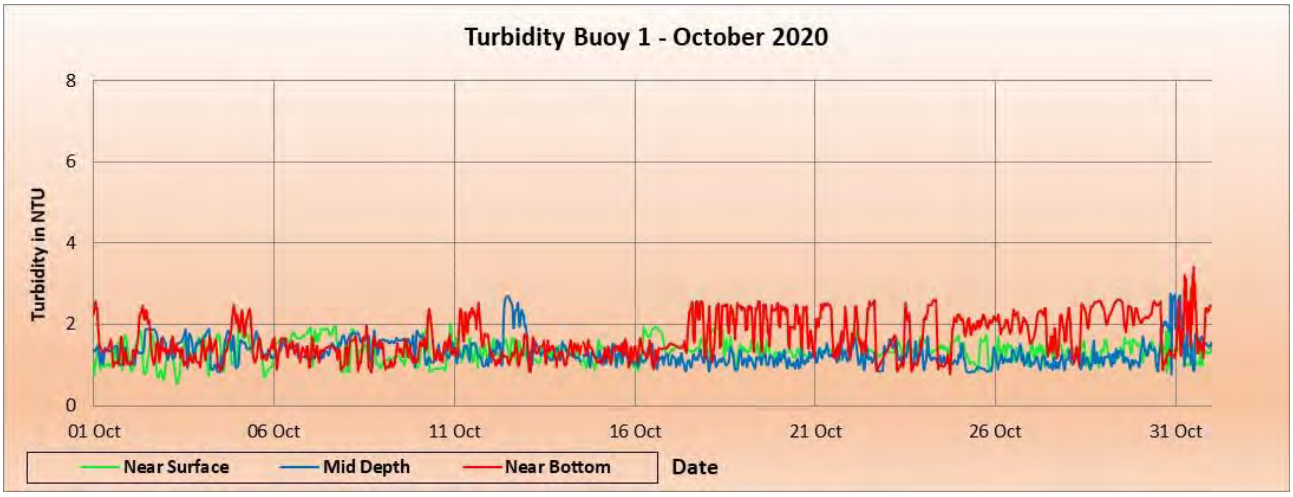
Turbidity monitoring buoys were deployed at three locations and the turbidity was measured at three different depths i.e. surface, mid-depth and bottom.

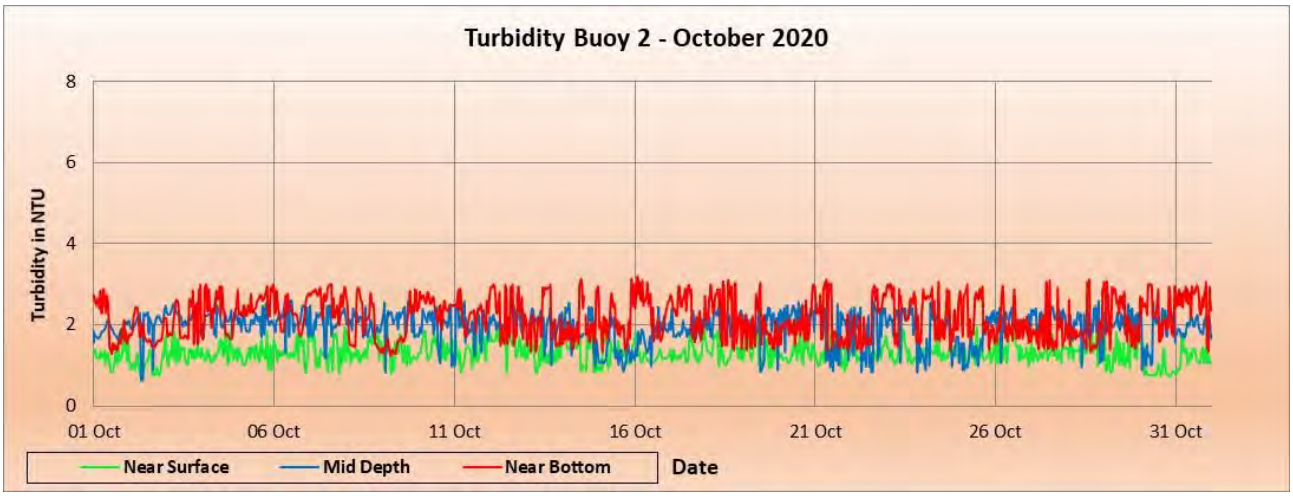
A summary of the maximum turbidity data (measured in NTU) recorded for the period of October 2020 to March 2021 at each turbidity buoy location is placed in the table below.

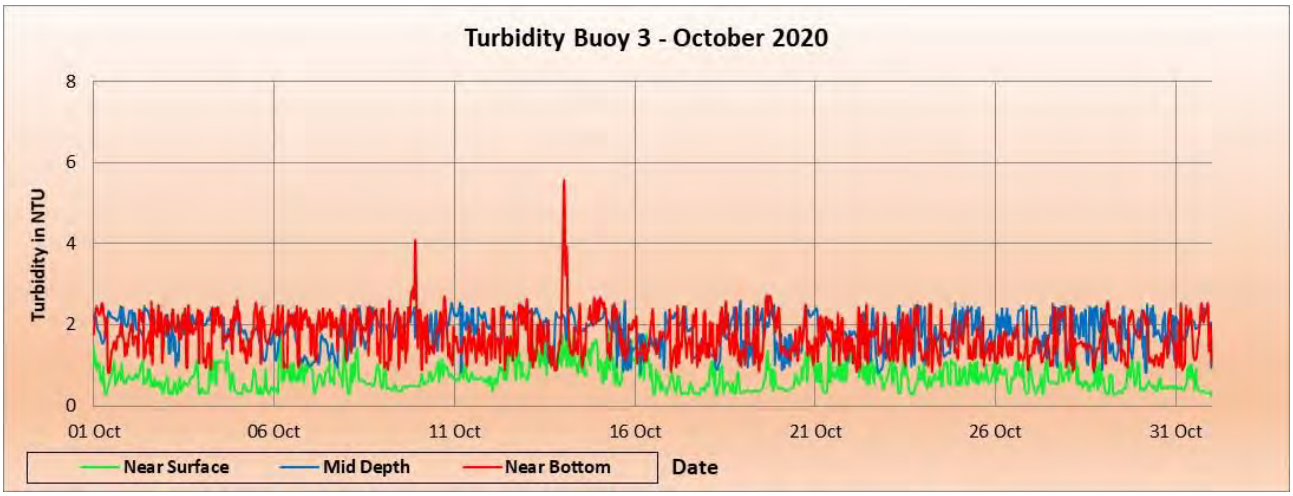
Table 6-16: Summary of maximum turbidity values in NTU

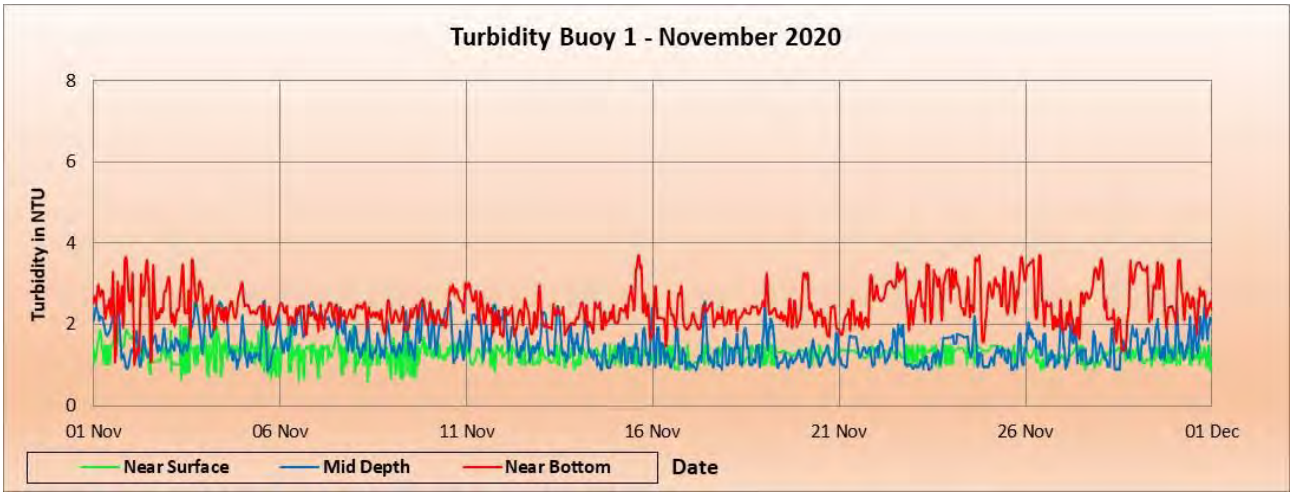
| Location | Maximum Turbidity (NTU) | Depth | Month and Year |
|---|---|---|---|
| Turbidity Buoy-1 | 5.14 | Near Bottom | January 2021 |
| Turbidity Buoy-2 | 3.20 | Near Bottom | October 2020 |
| Turbidity Buoy-3 | 6.32 | Near Bottom | March 2021 |

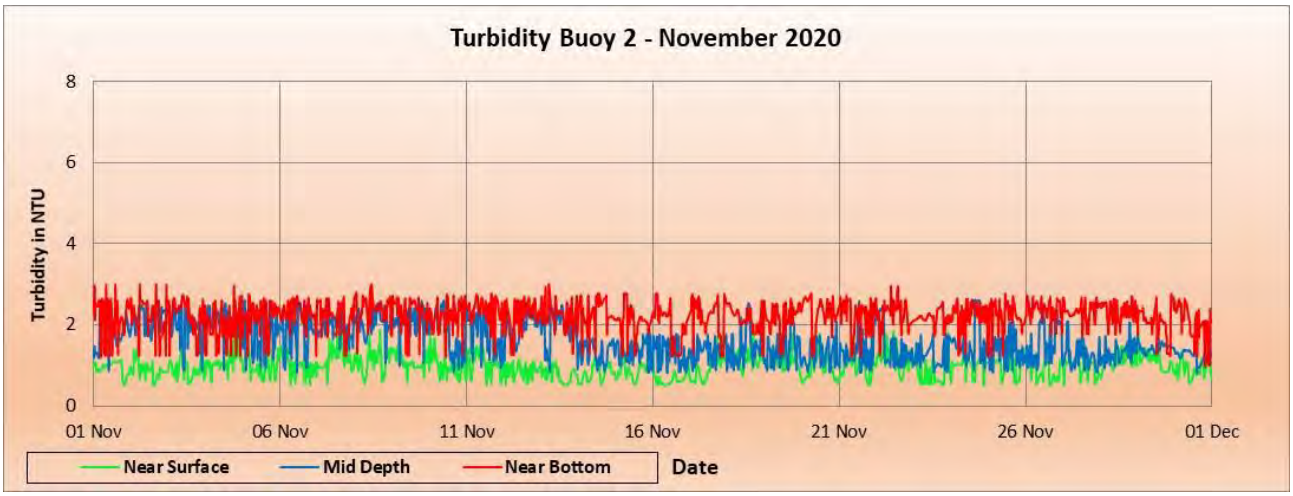
The time series curves of turbidity measurements from October 2020 to March 2021 are shown below.

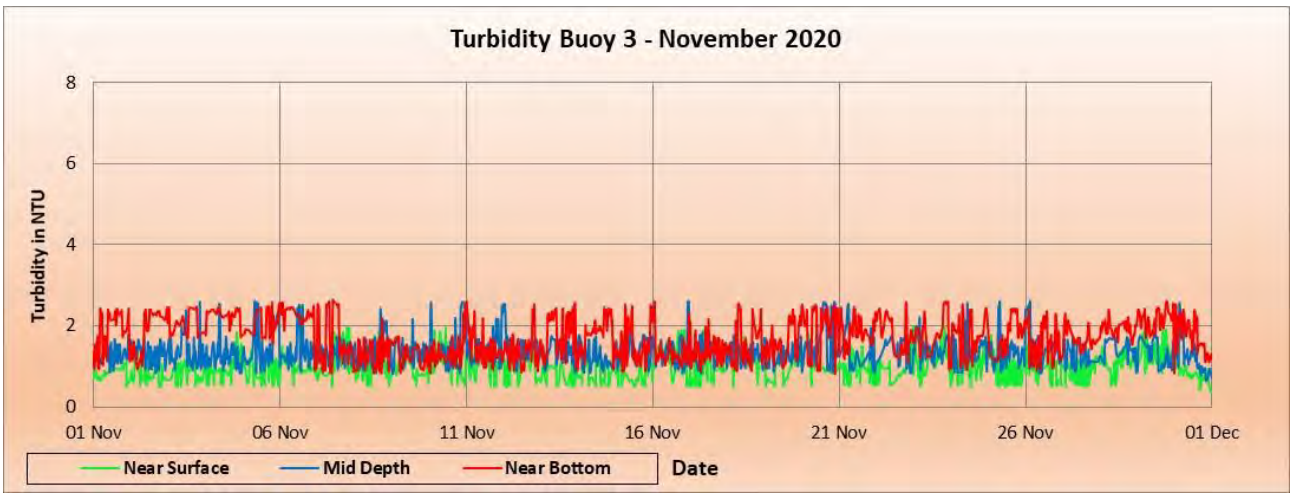

Turbidity Buoy 1 - October 2020
Turbidity in NTU
8
6
4
2
0
01 Oct
06 Oct
11 Oct
16 Oct
21 Oct
26 Oct
31 Oct
Near Surface
Mid Depth
Near Bottom
Date

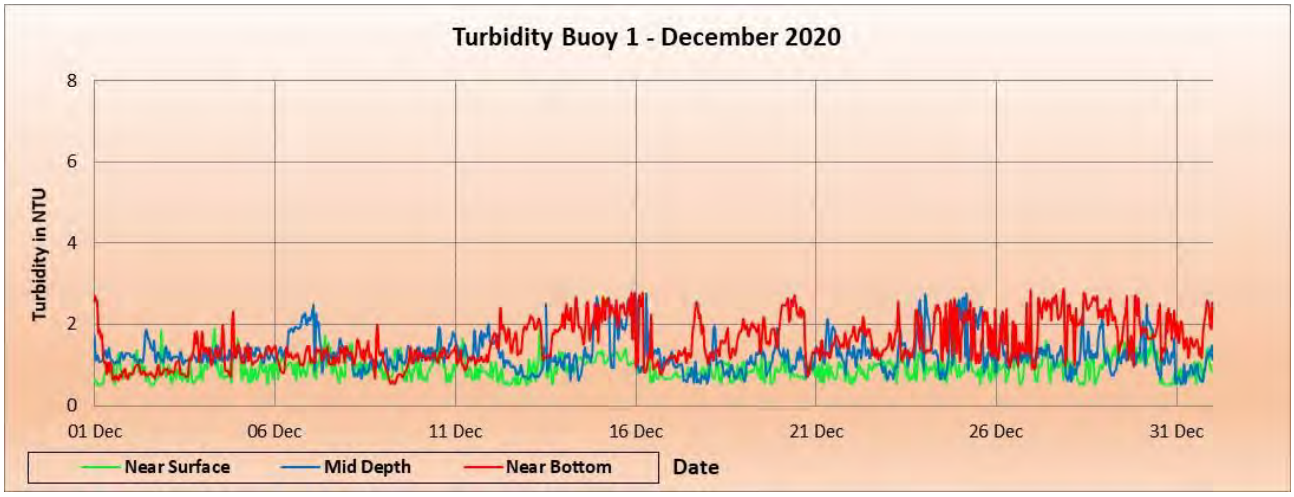

Turbidity Buoy 2 - October 2020
Turbidity in NTU
8
6
4
2
0
01 Oct
06 Oct
11 Oct
16 Oct
21 Oct
26 Oct
31 Oct
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 3 - October 2020
Turbidity in NTU
8
6
4
2
0
01 Oct
06 Oct
11 Oct
16 Oct
21 Oct
26 Oct
31 Oct
Near Surface
Mid Depth
Near Bottom
Date


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


Turbidity Buoy 2 - November 2020
Turbidity in NTU
8
6
4
2
0
01 Nov
06 Nov
11 Nov
16 Nov
21 Nov
26 Nov
01 Dec
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 3 - November 2020
Turbidity in NTU
8
6
4
2
0
01 Nov
06 Nov
11 Nov
16 Nov
21 Nov
26 Nov
01 Dec
Near Surface
Mid Depth
Near Bottom
Date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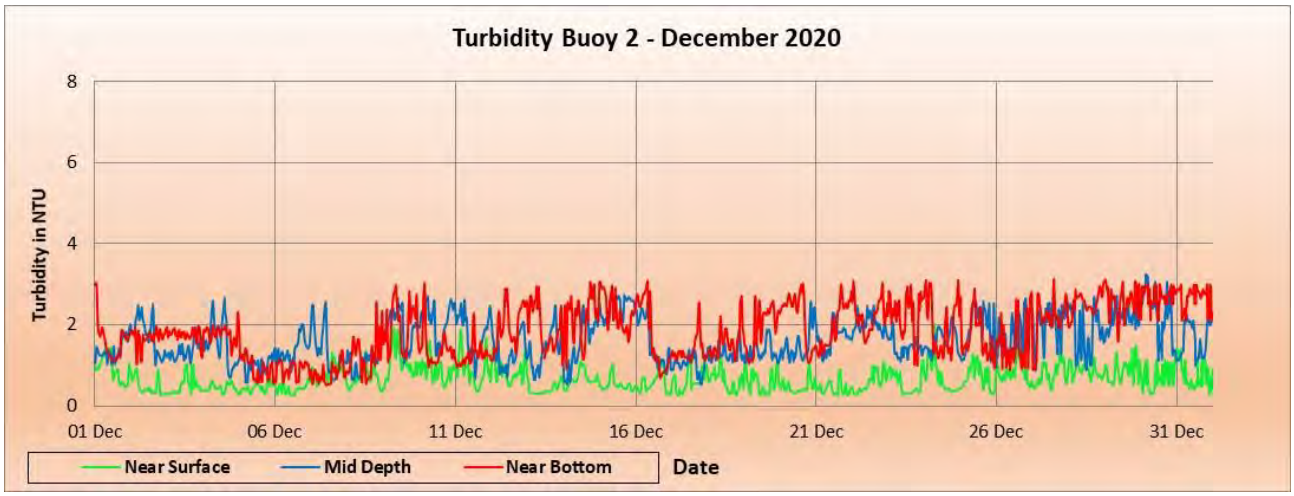
Turbidity in NTU
0
2
4
6
8
01 Dec
06 Dec
11 Dec
16 Dec
21 Dec
26 Dec
31 Dec
Near Surface
Mid Depth
Near Bottom
Date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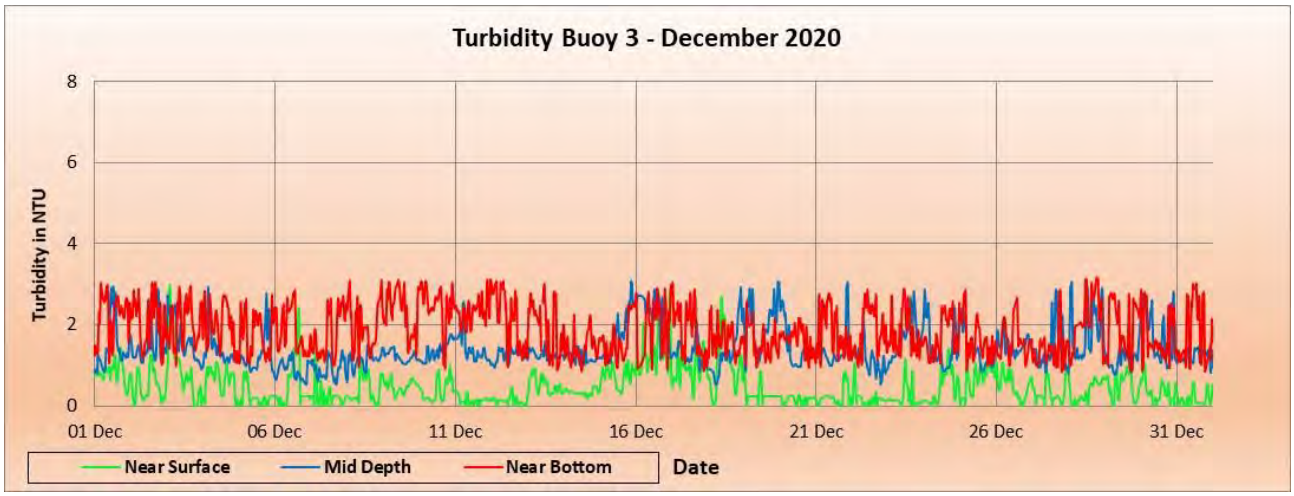
Turbidity in NTU
0
2
4
6
8
01 Dec
06 Dec
11 Dec
16 Dec
21 Dec
26 Dec
31 Dec
Near Surface
Mid Depth
Near Bottom
Date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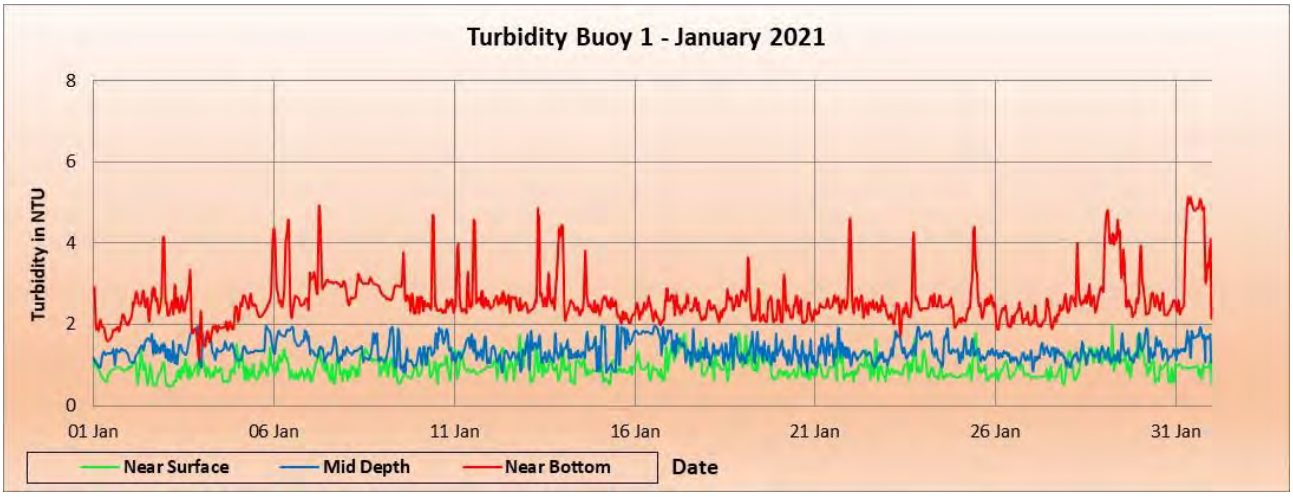
Turbidity in NTU
0
2
4
6
8
01 Dec
06 Dec
11 Dec
16 Dec
21 Dec
26 Dec
31 Dec
Near Surface
Mid Depth
Near Bottom
Date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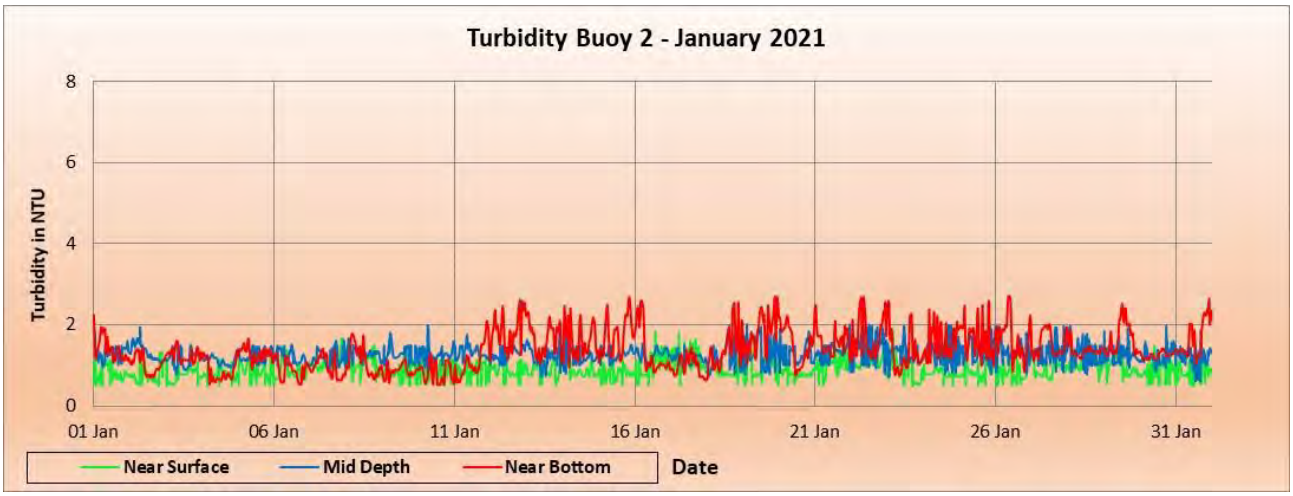
Turbidity in NTU
0
2
4
6
8
01 Jan
06 Jan
11 Jan
16 Jan
21 Jan
26 Jan
31 Jan
Near Surface
Mid Depth
Near Bottom
Date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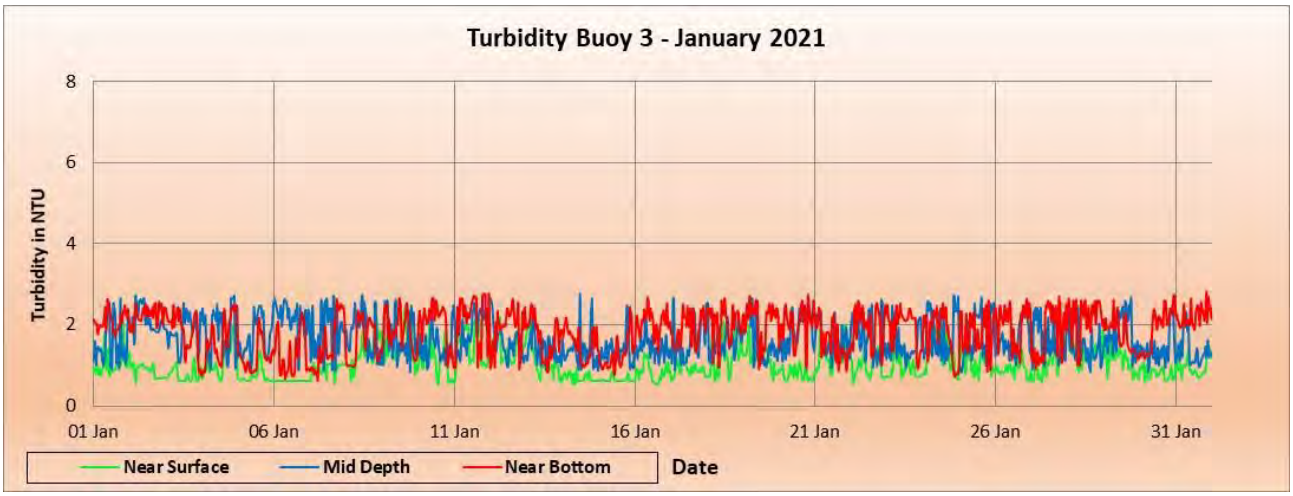
Turbidity in NTU
0
2
4
6
8
01 Jan
06 Jan
11 Jan
16 Jan
21 Jan
26 Jan
31 Jan
Near Surface
Mid Depth
Near Bottom
Date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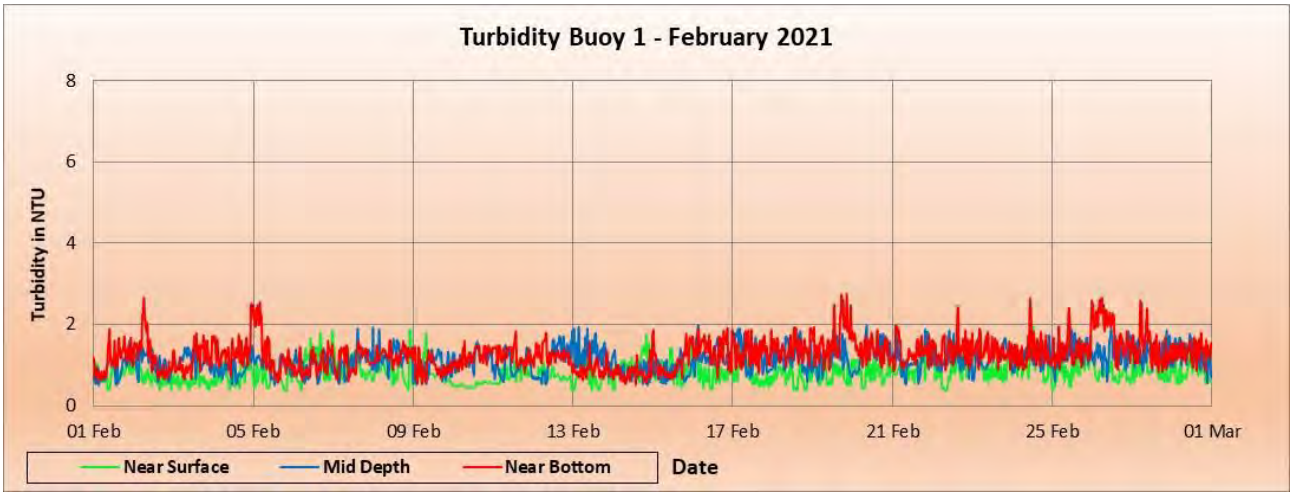
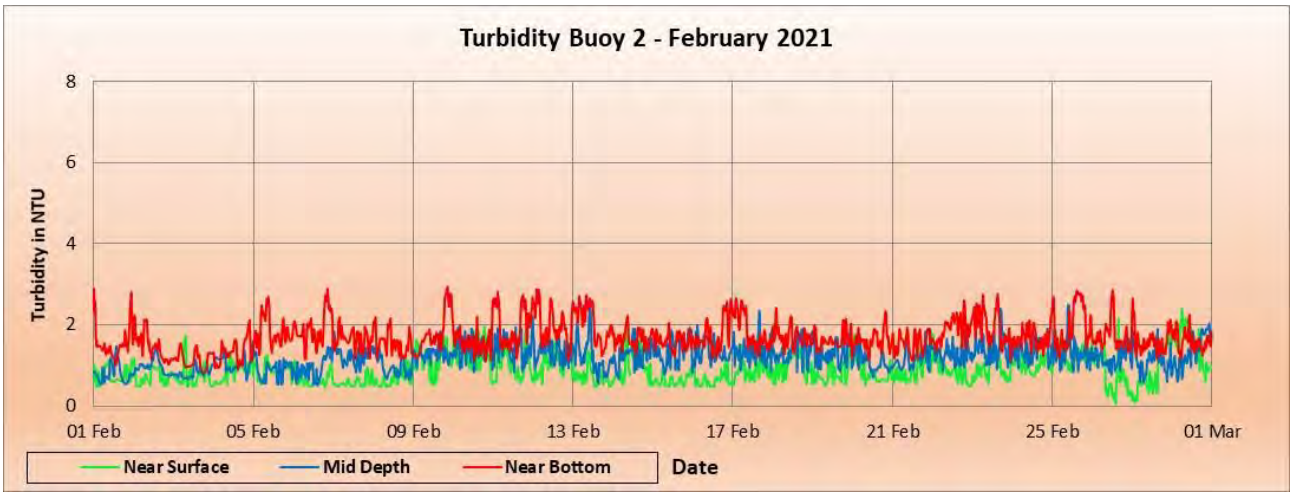
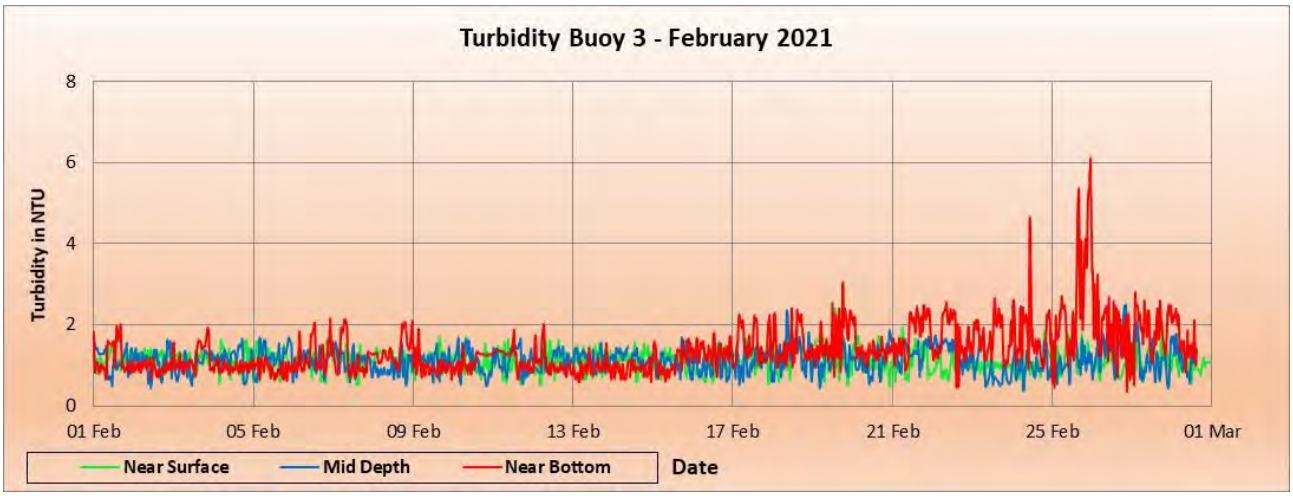
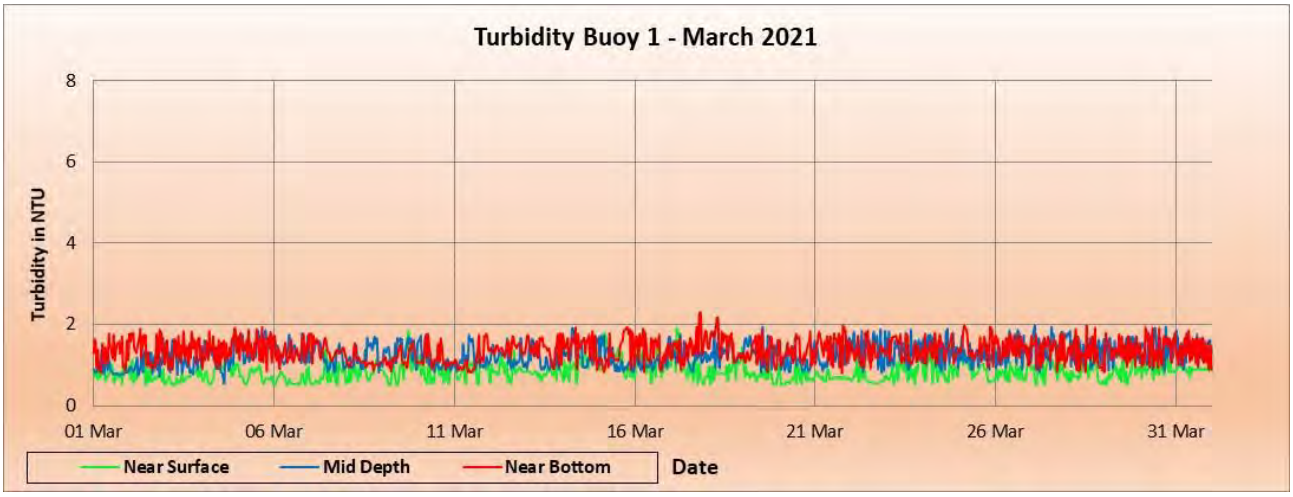
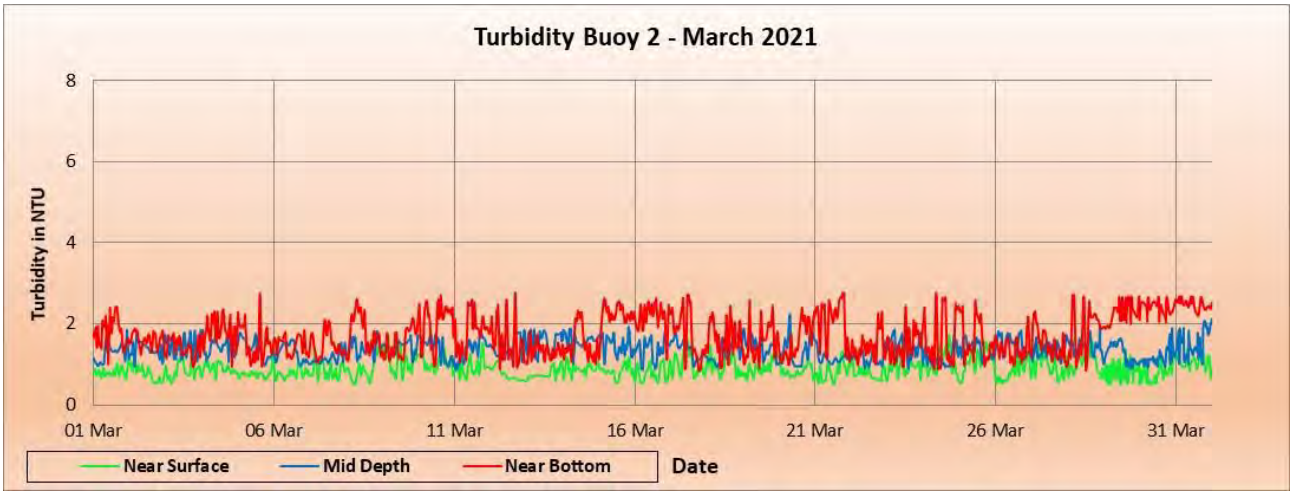
Turbidity in NTU
0
2
4
6
8
01 Jan
06 Jan
11 Jan
16 Jan
21 Jan
26 Jan
31 Jan
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 1 - February 2021
Turbidity in NTU
0
2
4
6
8
01 Feb
05 Feb
09 Feb
13 Feb
17 Feb
21 Feb
25 Feb
01 Mar
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 2 - February 2021
Turbidity in NTU
0
2
4
6
8
01 Feb
05 Feb
09 Feb
13 Feb
17 Feb
21 Feb
25 Feb
01 Mar
Near Surface
Mid Depth
Near Bottom
Date


Turbidity Buoy 3 - February 2021
Turbidity in NTU
0
2
4
6
8
01 Feb
05 Feb
09 Feb
13 Feb
17 Feb
21 Feb
25 Feb
01 Mar
Near Surface
Mid Depth
Near Bottom
Date



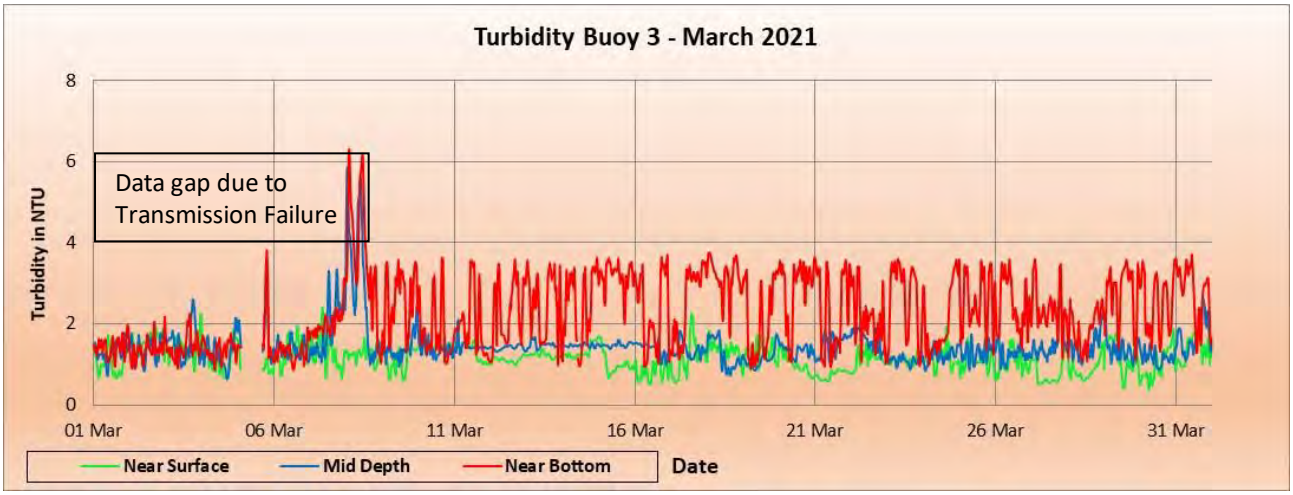




Figure 6-35: Time Series of Turbidity measurements

① The validation of turbidity sensor data was carried out for the monsoon period (September 2020). The samples were collected on 18th September 2020. The following table provides the turbidity values measured from the buoys and from that of the collected samples, which were analysed for turbidity as per IS 3025, Part 10:1984 (reaffirmed 2017) in a NABL approved laboratory.

Table 6-17: Turbidity Values

| **Turbidity Values in NTU** | | | | | | |
|---|---|---|---|---|---|---|
| **Buoy No.** | **Observed from Buoy** | | | **Values from Collected Water Samples** | | |
| | Sur | Mid | Bot | Sur | Mid | Bot |
| Turbidity Buoy-1 | 1.50 | 2.62 | 1.45 | 1.30 | 2.10 | 1.60 |
| Turbidity Buoy-2 | 1.11 | 1.20 | 0.84 | 0.90 | 1.40 | 0.60 |
| Turbidity Buoy-3 | 0.59 | 1.74 | 1.81 | 0.70 | 1.50 | 2.00 |

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

## 6.12 Bathymetry

Survey Location

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

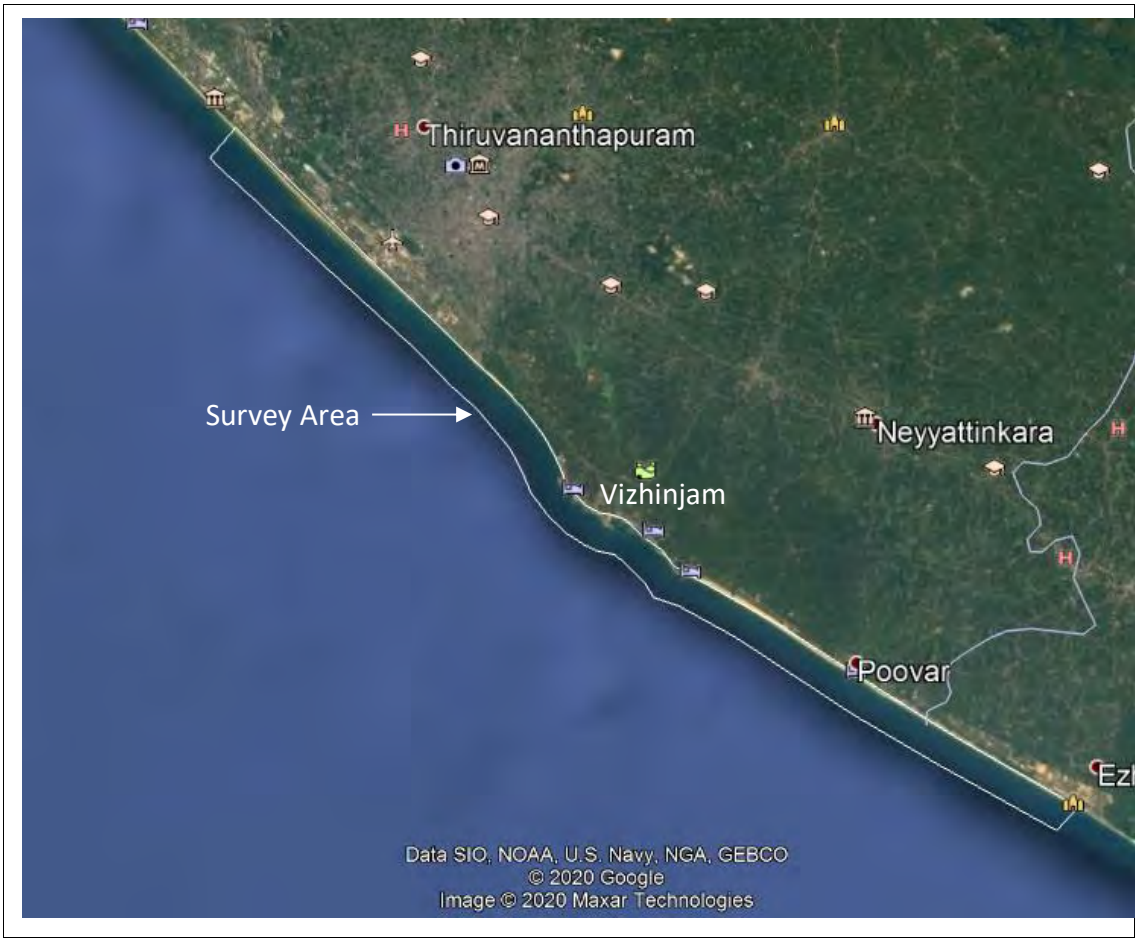



Figure 6-36: Bathymetry area coverage

① Line Plan and Survey Methodology

The survey lines were planned at intervals of 25m parallel to the coast up to the depth of 20m. The vessel was positioned using a Trimble DGPS system which also provided the heading. The vessel 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. An AML MINOS Sound Velocity Probe (SVP) was used to measure the speed of sound of in the water column. Motion compensation was achieved by using a DMS-05 Motion Reference Unit (MRU). Quality checks were constantly performed at every step of the data processing. Data was processed using Hypack software. Calibration values obtained from the patch test were applied to the acquired data along with the required sound velocity profile and tide data for creation of final xyz file.

Results

The bathymetric survey of the area about 40 km in length was carried out up to the 20m contour using a multibeam echo sounder.

The maximum depth recorded by multibeam echo sounder is 24.9m below CD in the northwestern part at location 713500.5 mE, 932400.5 mN. The seabed is seen to slope gently towards the southwest.

A0 size charts with xyz data has been provided to AVPPL in the month of January 2021 for further vetting by NIOT.

An image of colour coded bathymetry of the area is provided below:

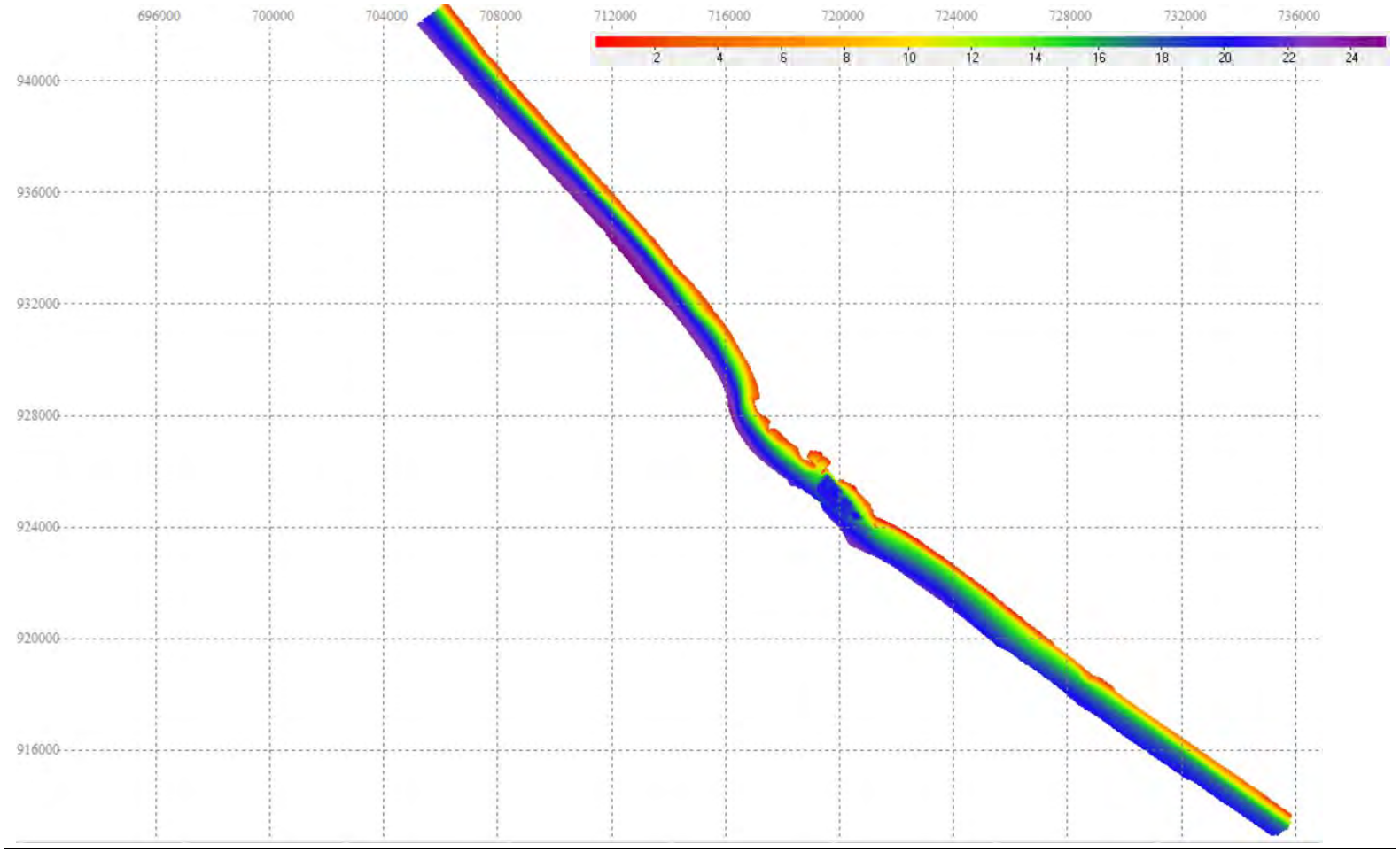



Figure 6-37: Colour coded Bathymetry

# 7 WEATHER

During the period from October 2020 to March 2021, the weather was generally conducive to the survey operations with few exceptions of bad weather. While carrying out the cross-shore profiles, due to the breakers near shore the data collection was severely hampered. At times, the boat has to take a turn between 2 to 3m water depth, due to heavy breakers in the nearshore section, considering the safety of personnel and the multibeam system.

# 8 REFERENCES

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

- AVPPL Service order 5700267194 dated 3rd May 2019
- Web site https://www.vizhinjamport.in/home.html, and https://www.vizhinjamport.in/download/Feasibility-Report.pdf
- WMO manual, section 5.2.2
- SAC Project Execution Plan SAC/P167-19/PEP AVPPL
- Monthly survey reports from October 2020 to March 2021

# 9 CONCLUSIONS

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

1. Tide was mixed semi diurnal with a maximum range being observed during spring tide.
2. The significant wave heights were more than 2m for the month of October 2020, after which the wave heights reduced. The maximum wind speeds were blowing from the westerly direction.
3. The current direction was predominantly towards 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 northerly direction in the post-monsoon months and in the month of March 2021, the same was bi-directional.
5. The salinity was in the range of 33.1 and 35.4 ppt for the samples collected in the monsoon period and between 33.7 to 35.8 ppt for samples collected in post-monsoon period.

6. The Total Suspended Solids were less than 12 mg/l during monsoon and less than 11 mg/dl during post-monsoon period in all the locations.
7. The maximum turbidity recorded at the water sampling locations was 5.2 NTU near the bottom of Location L1 (Mulloor) during the monsoon period and 3.4 NTU near the bottom at Location L4 (Poovar) during the post-monsoon period.
8. At the location of the turbidity buoys, the maximum turbidity recorded at Location 1 was 5.14 NTU near the bottom in the month of January 2021, maximum turbidity measured at Location 2 was 3.20 NTU near the bottom in the month of October 2020 and that recorded at Location 3 was 6.32 NTU near the bottom in the month of March 2021.
9. The beach samples consisted of medium to fine sand.
10. The grab samples consisted of medium sands.
11. The seabed is seen to slope gently towards the southwest. The maximum depth recorded by multibeam echo sounder is 24.9m below CD in the northwestern part of the survey area at location 713500.5 mE, 932400.5 mN.

# 10 ACKNOWLEDGEMENTS

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

# Annexure I

# Photo Documentation at CSP Locations - March 2021

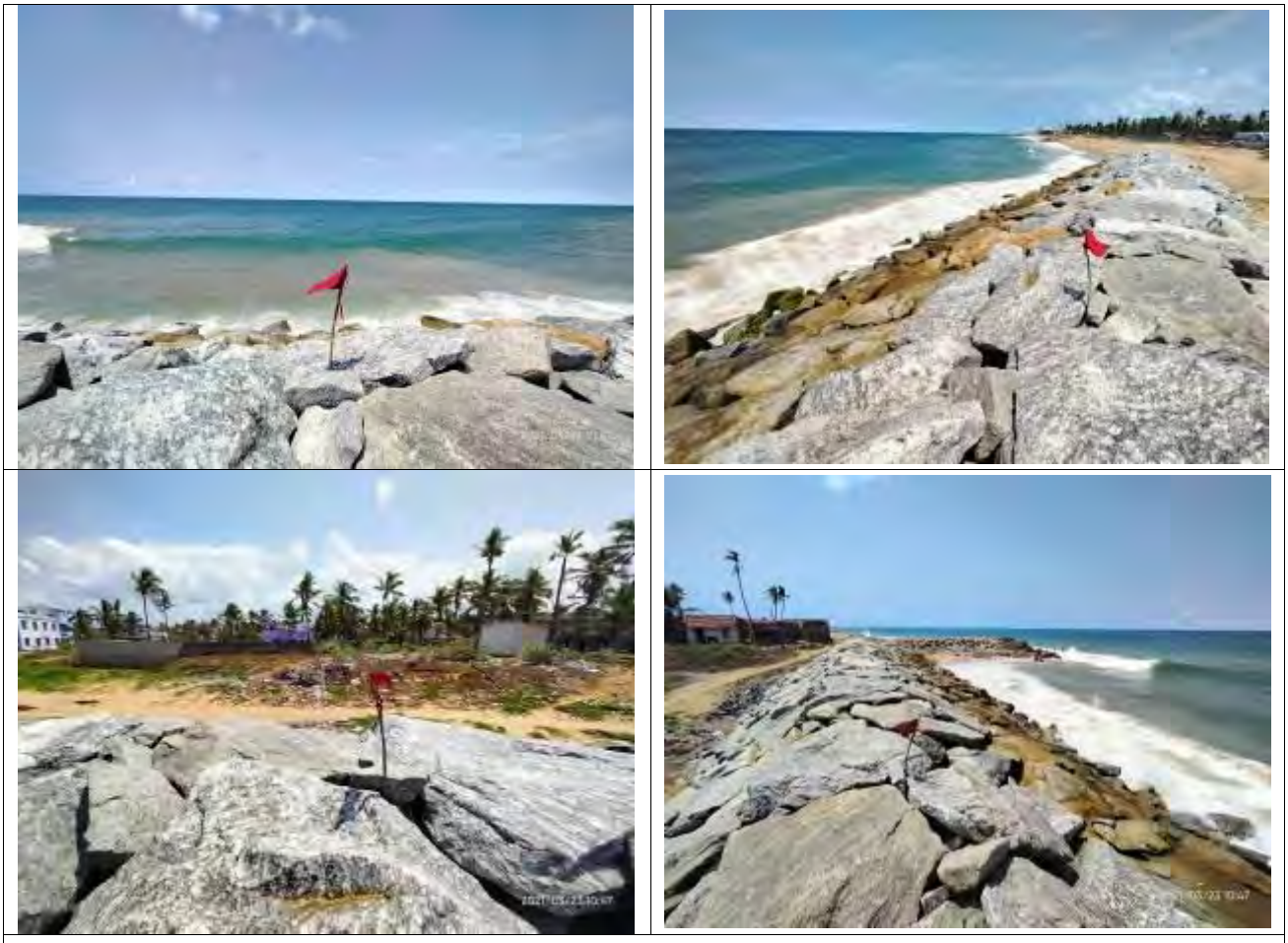


**Figure 1- March CSP 01**

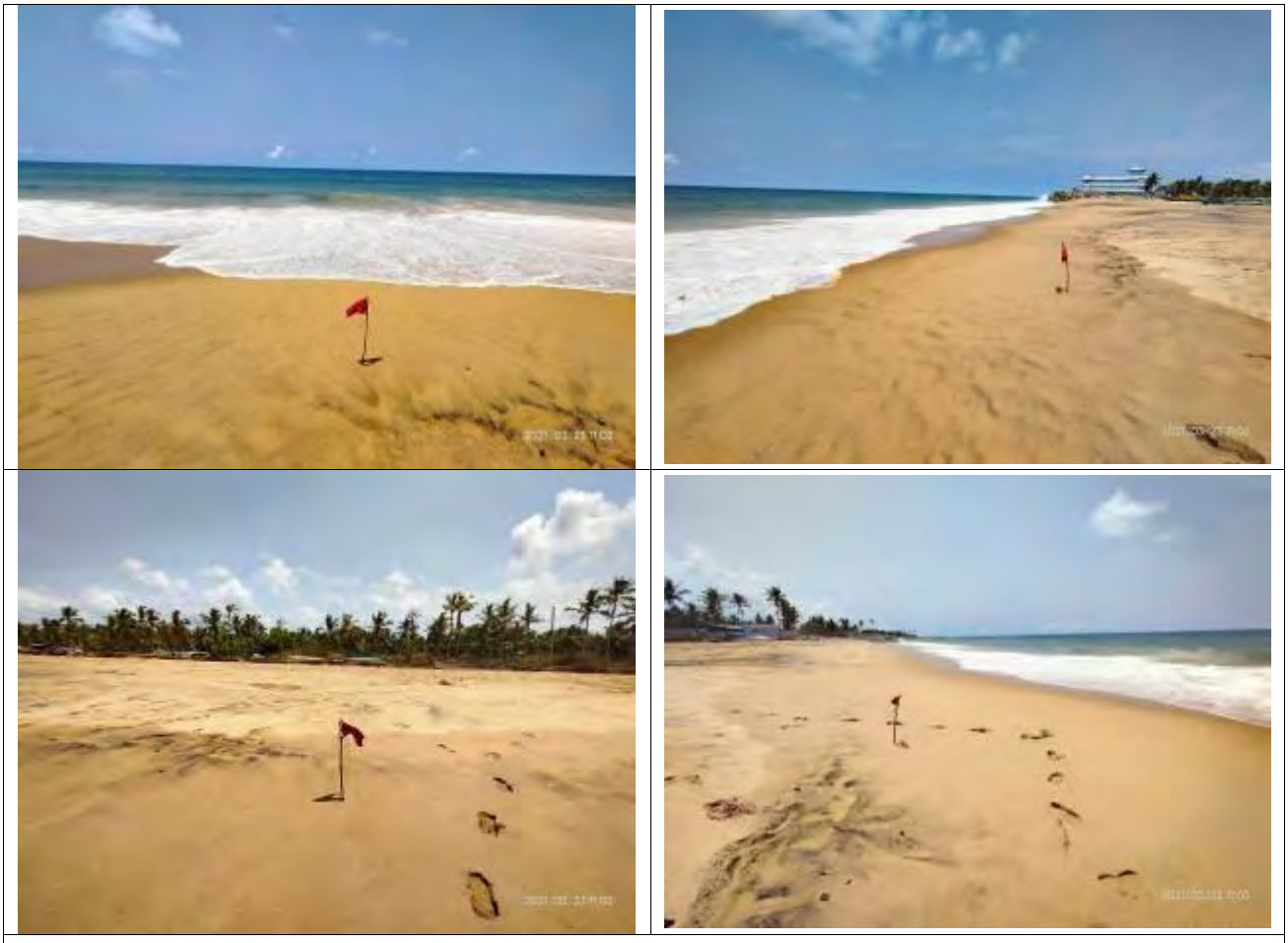
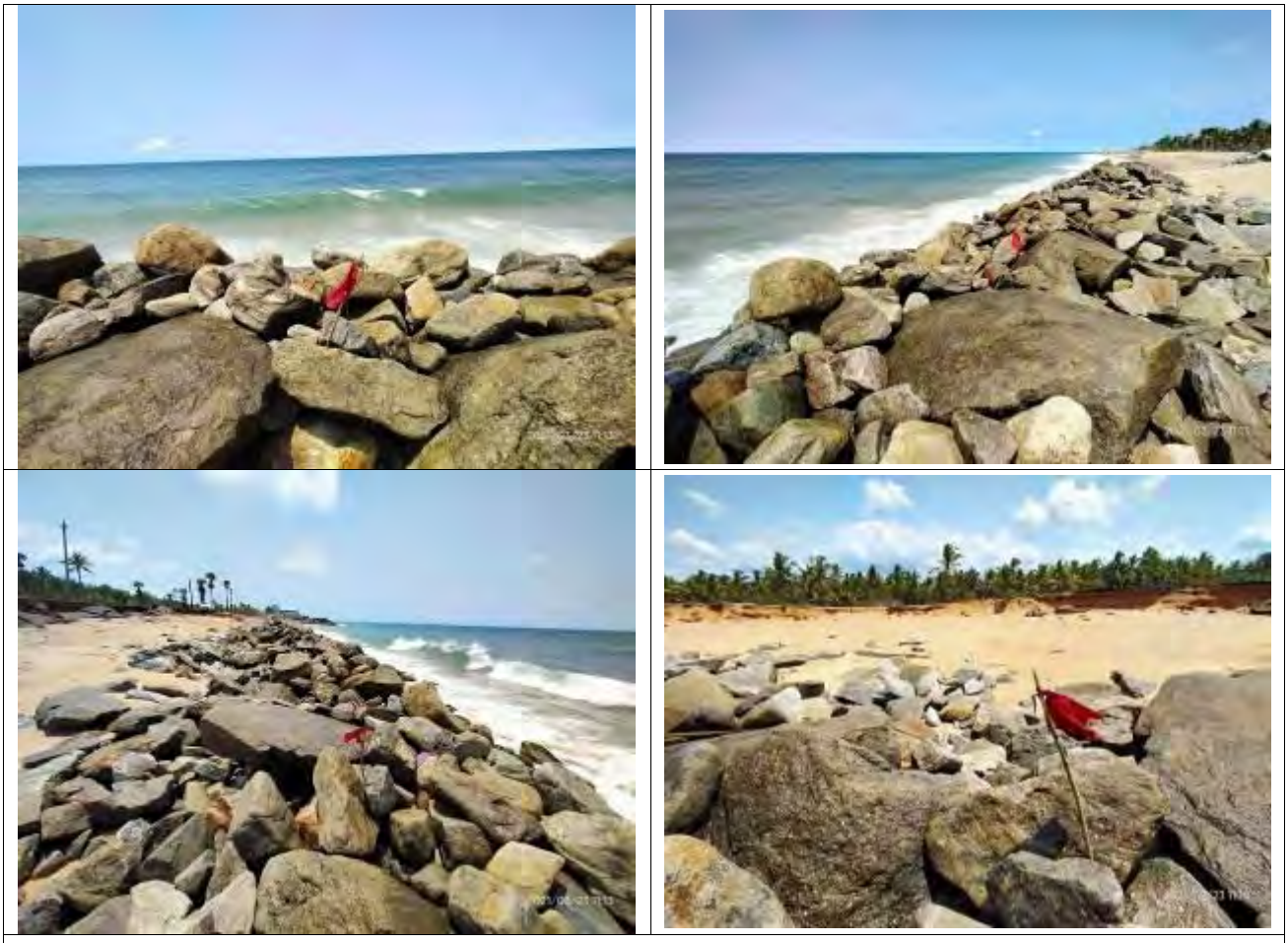


**Figure 2- March CSP 02**



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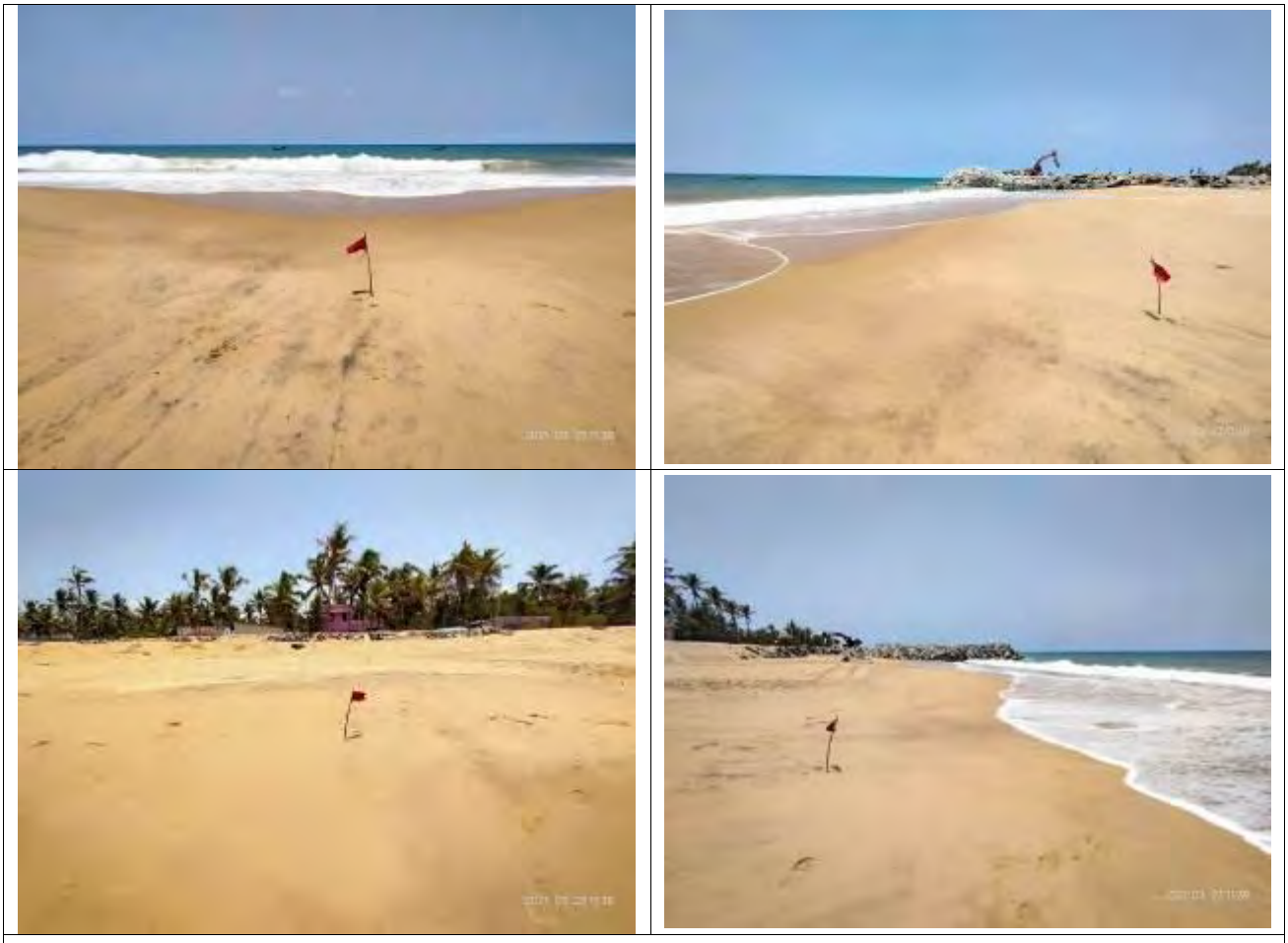

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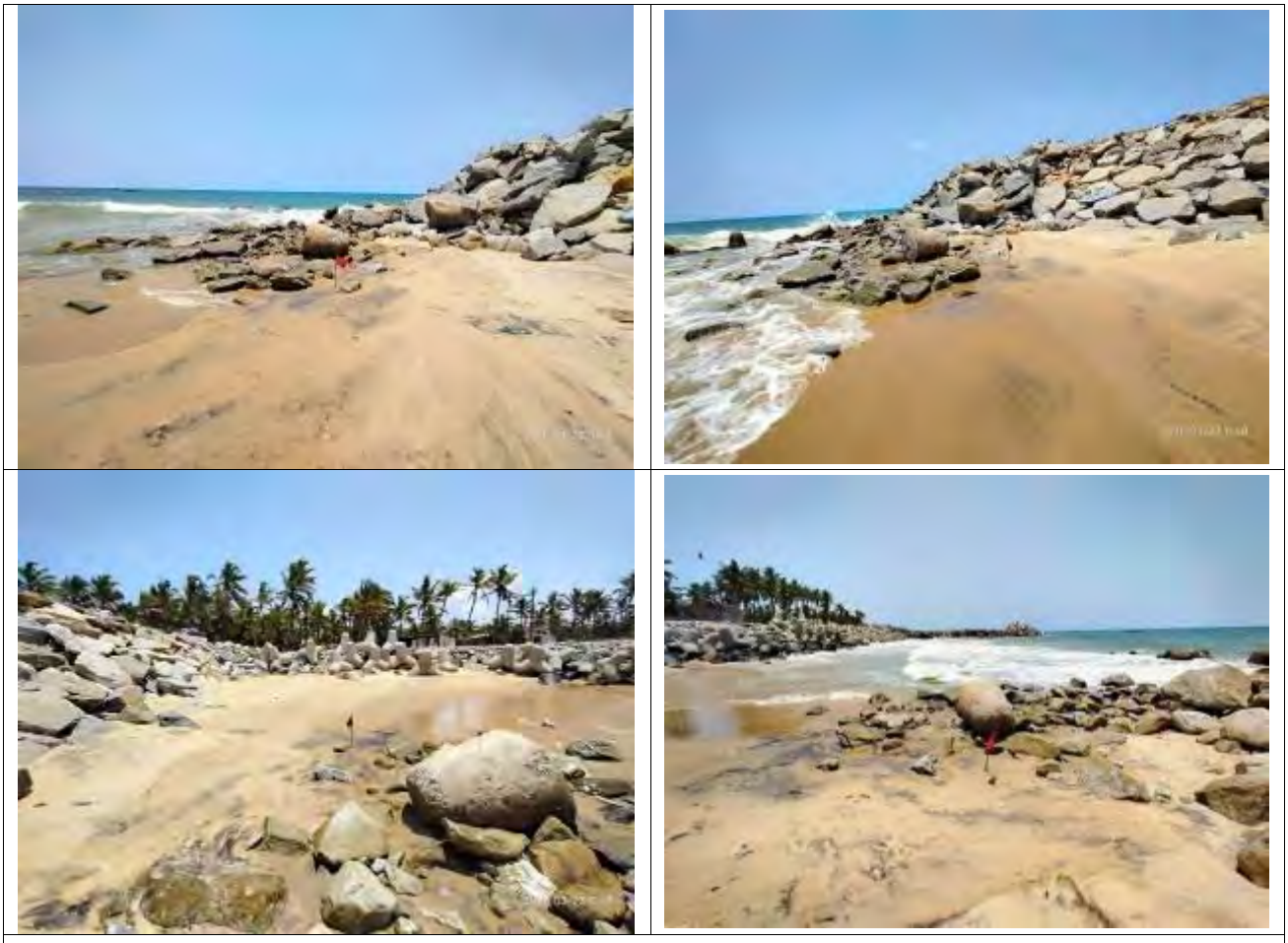
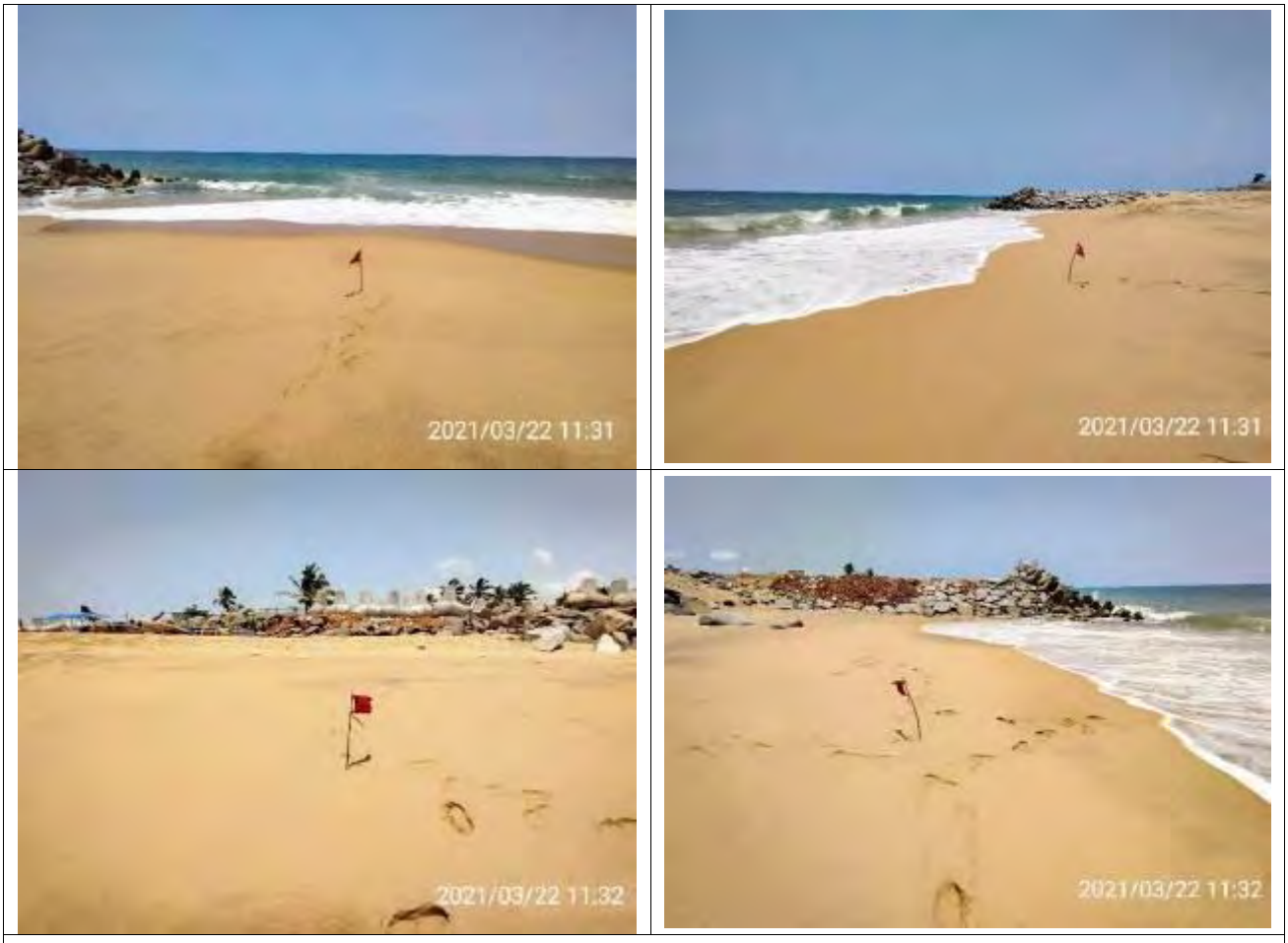


**Figure 5- March CSP 05**

**Figure 6- March CSP 06**

**Figure 7- March CSP 07**

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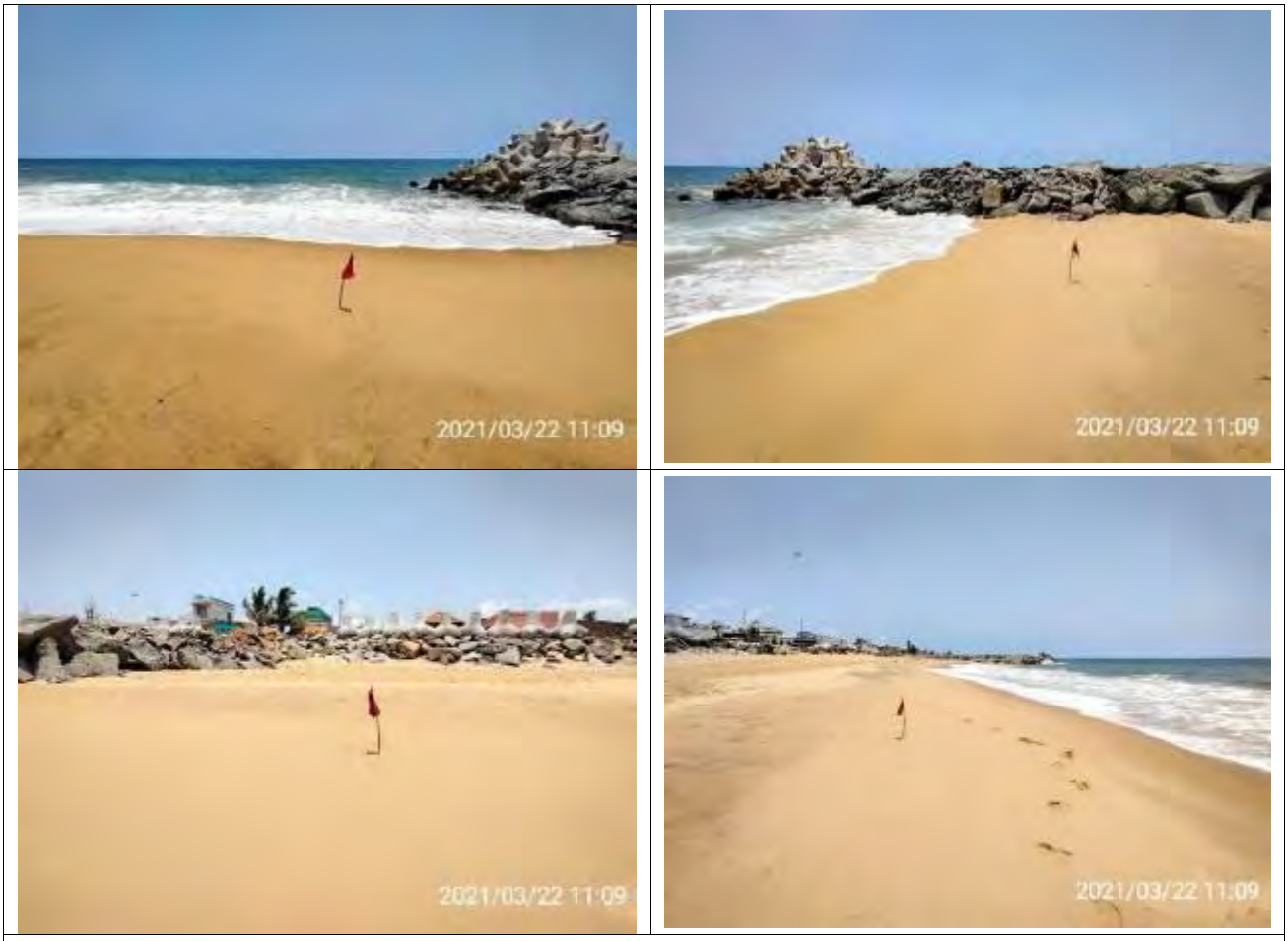



**Figure 9- March CSP 09**


**Figure 10- March CSP 10**

**Figure 11- March CSP 11**

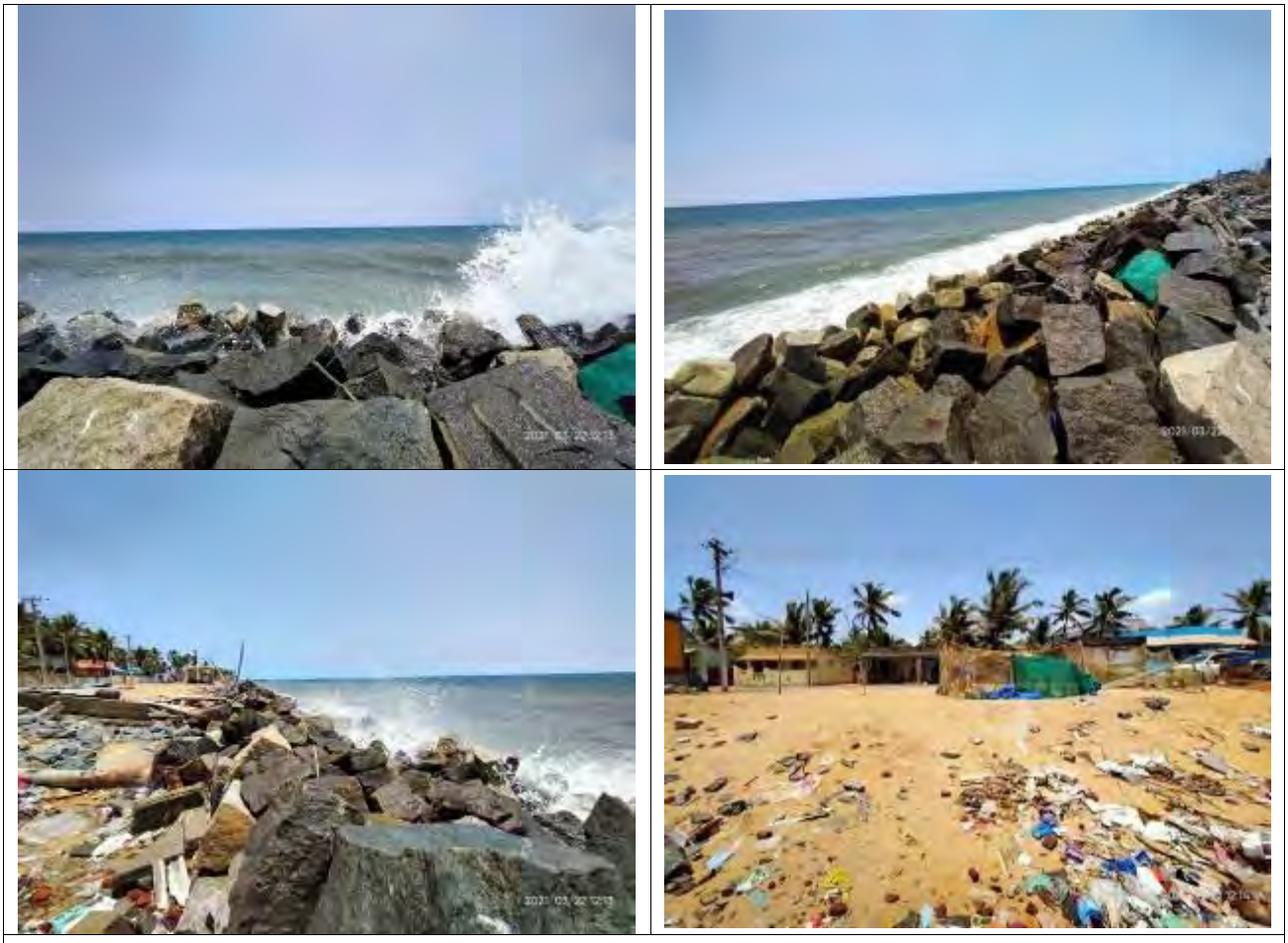
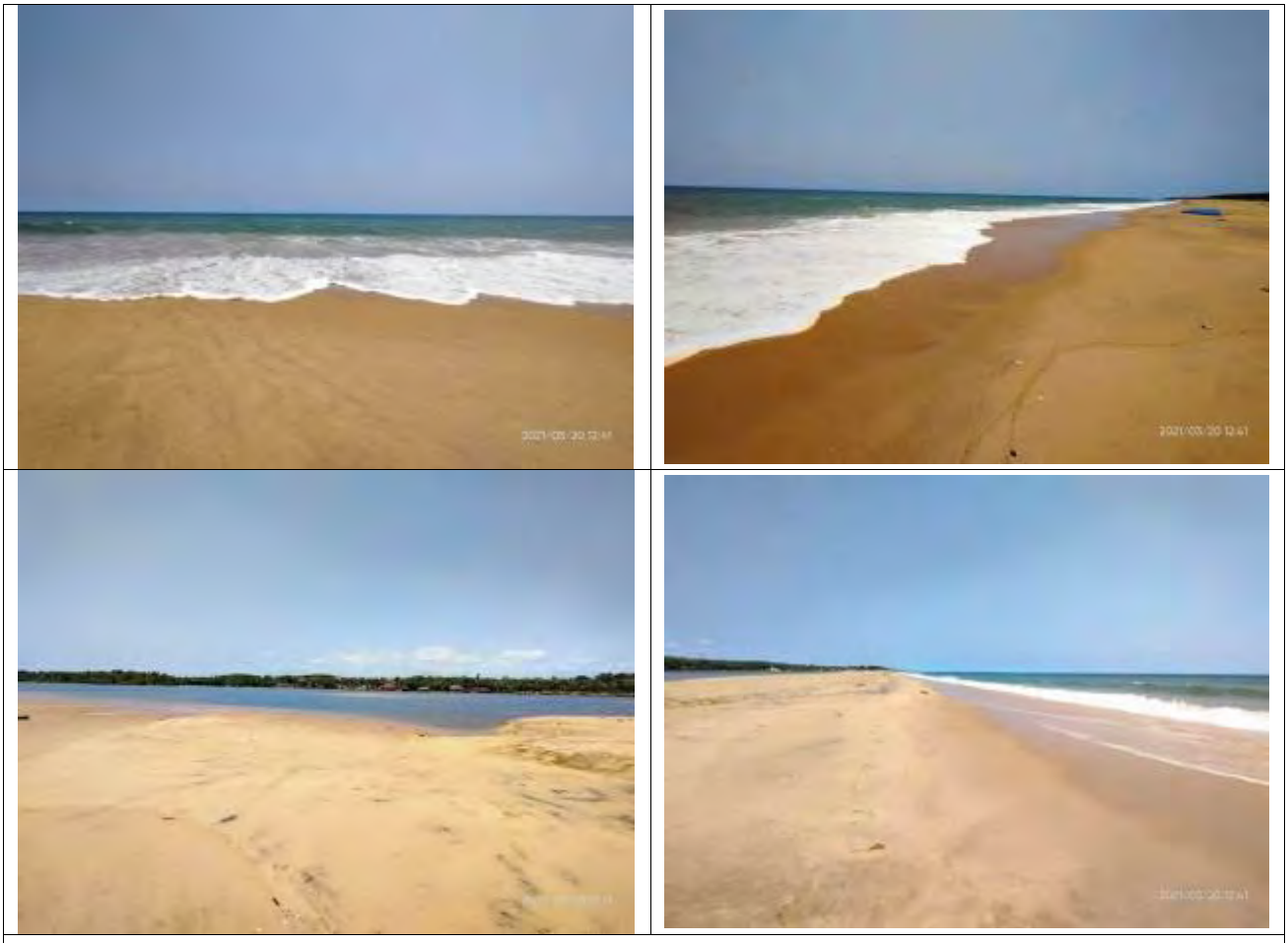


**Figure 12- March CSP 12**

**Figure 13- March CSP 13**

**Figure 14- March CSP 14**

**Figure 15- March CSP 15**



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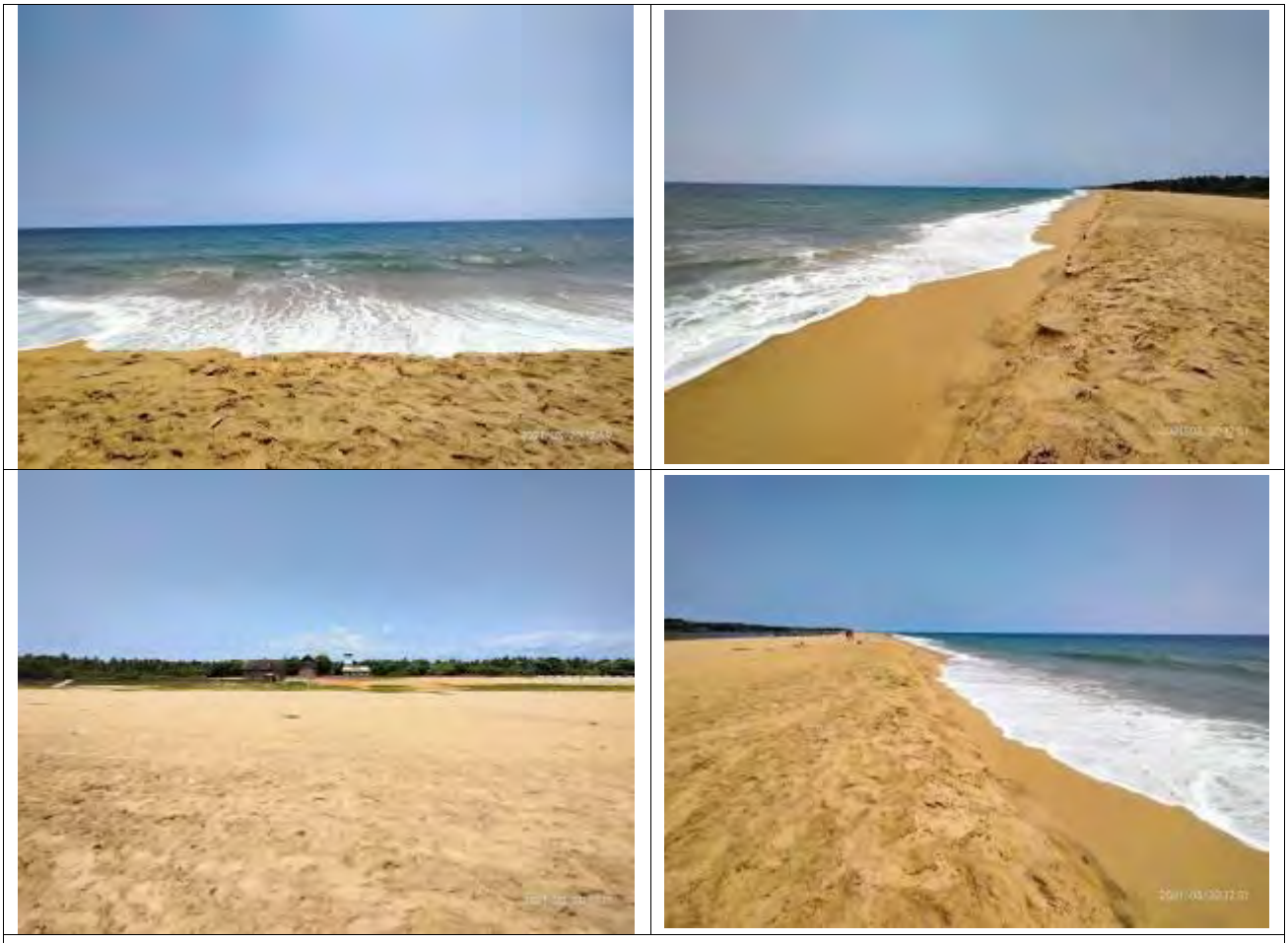

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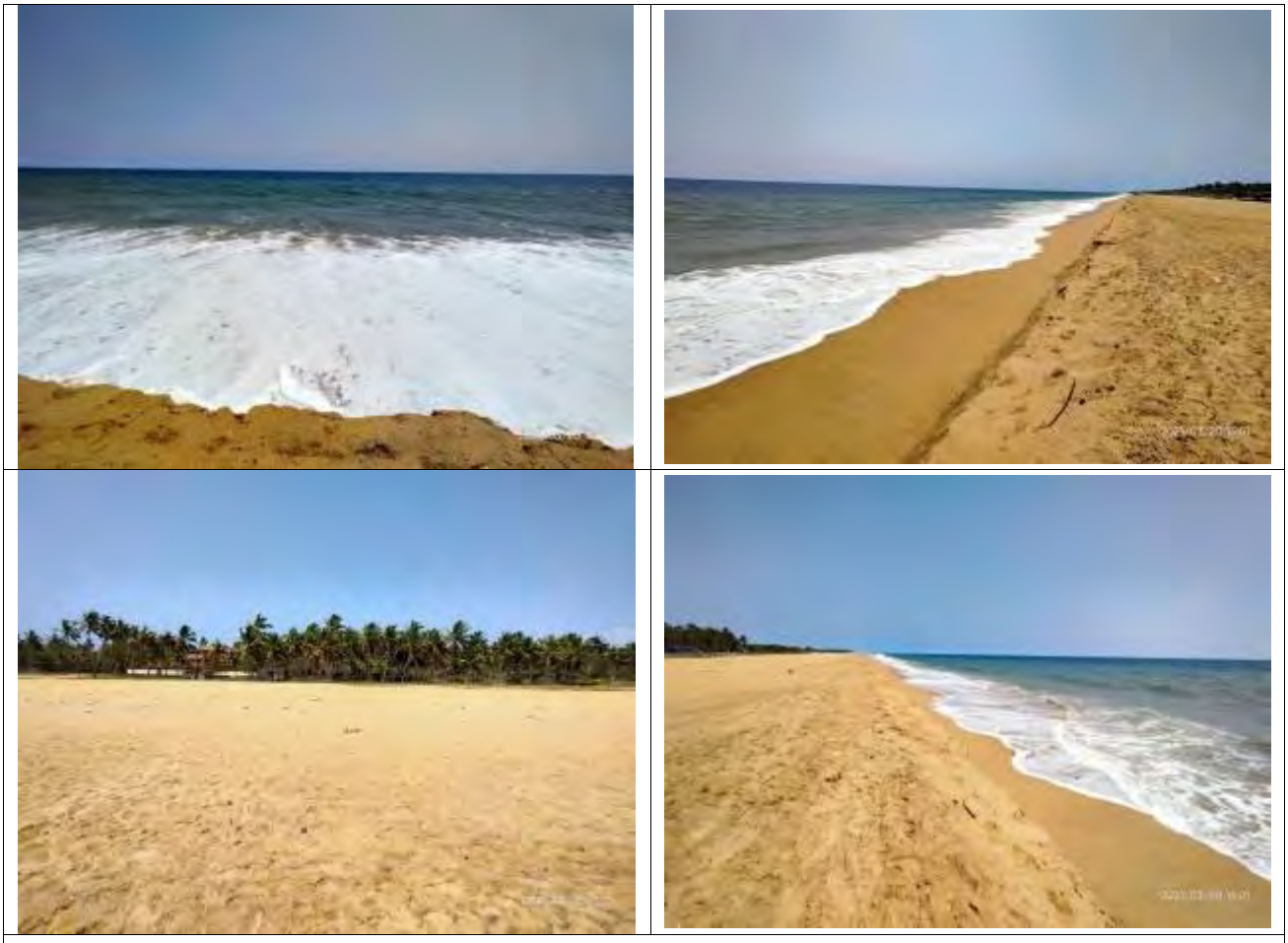

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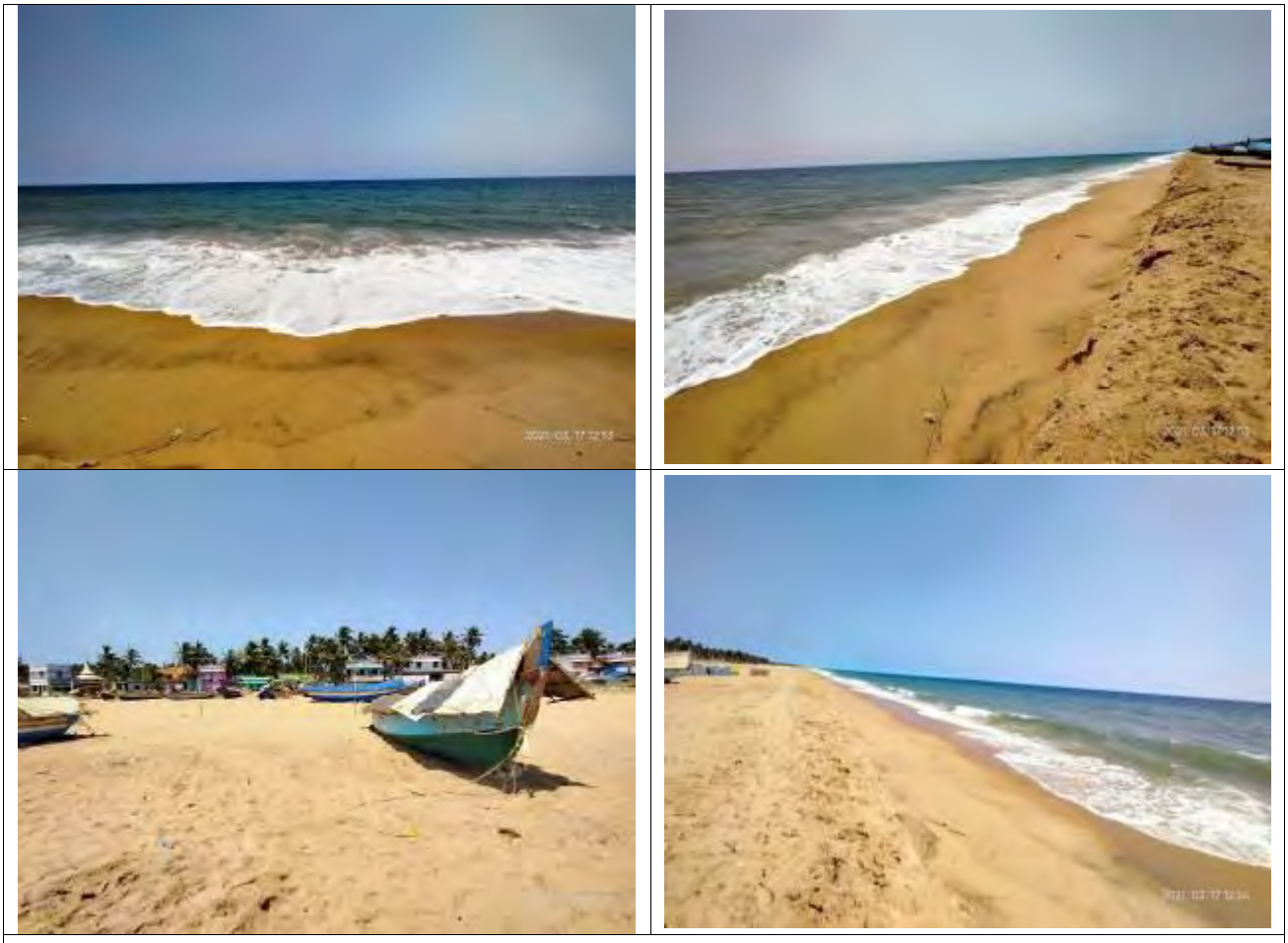

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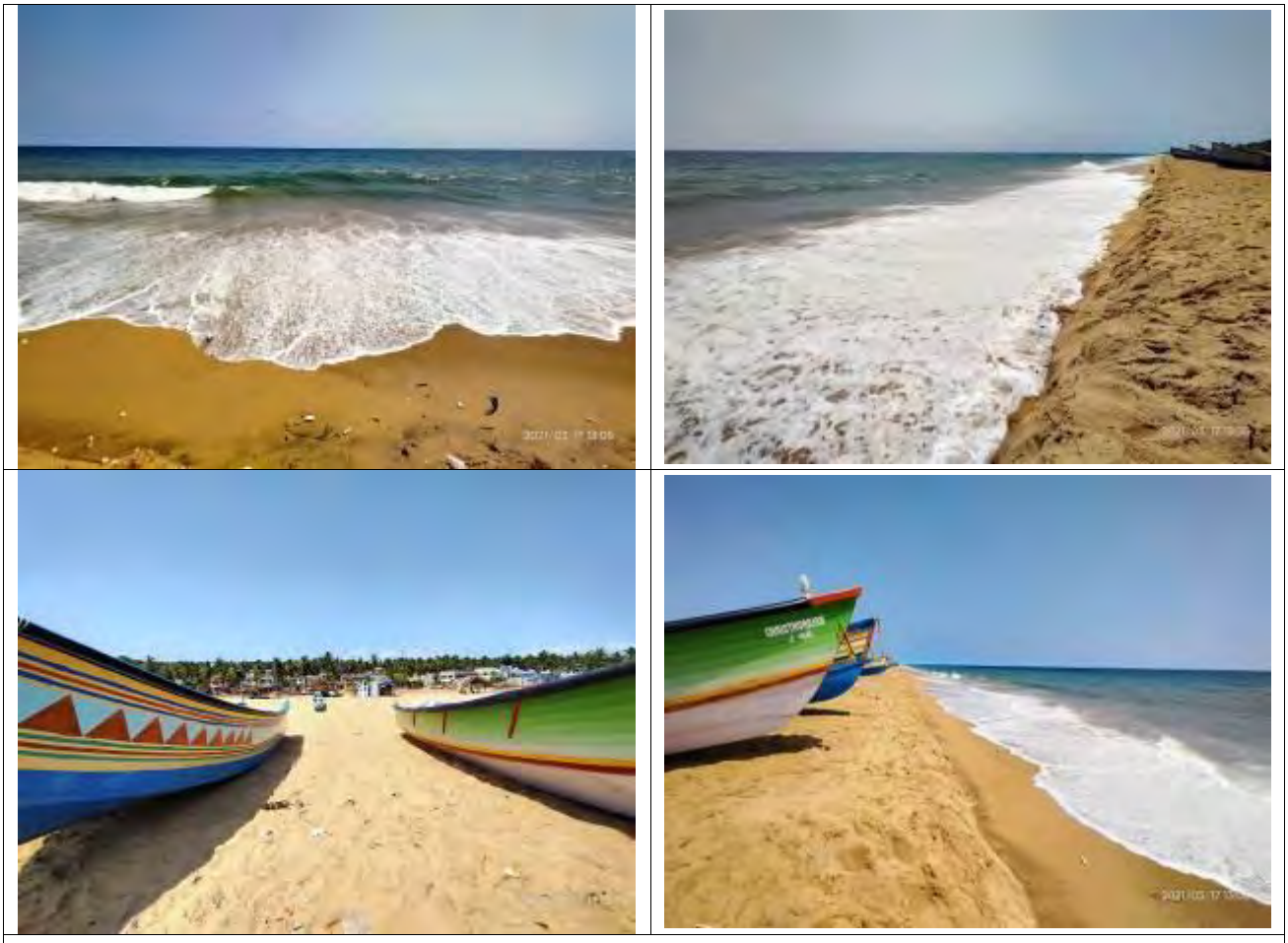

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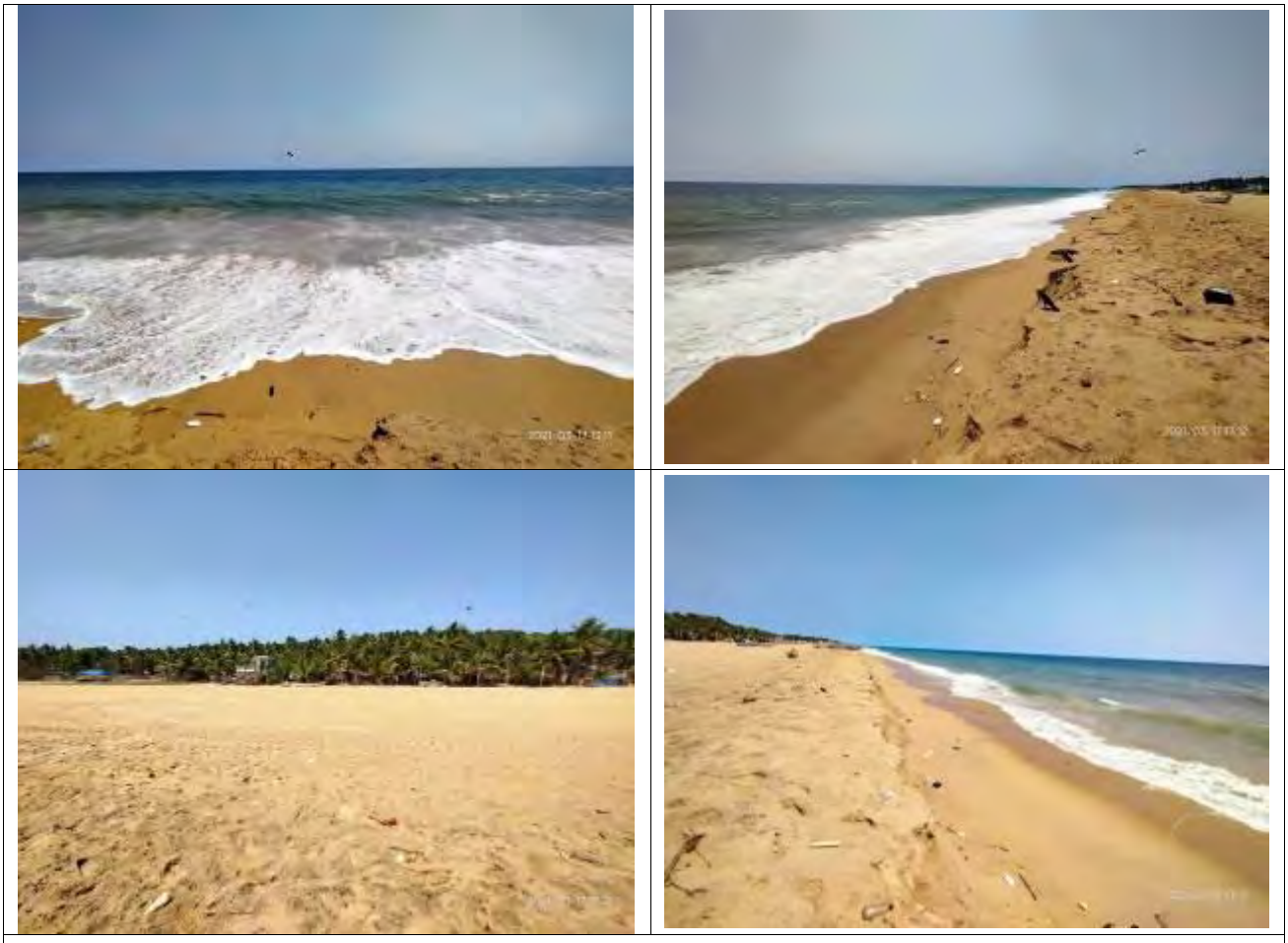

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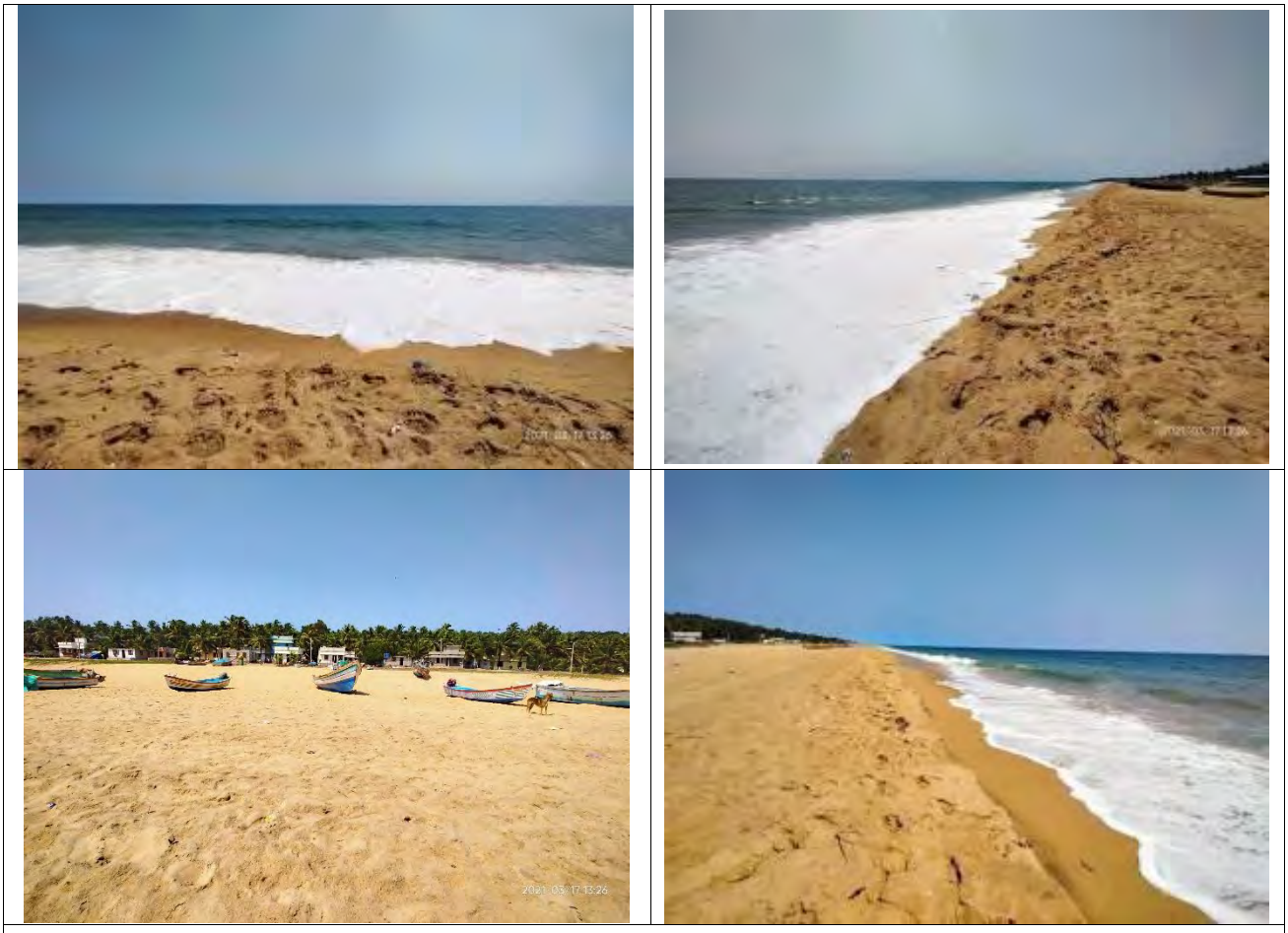

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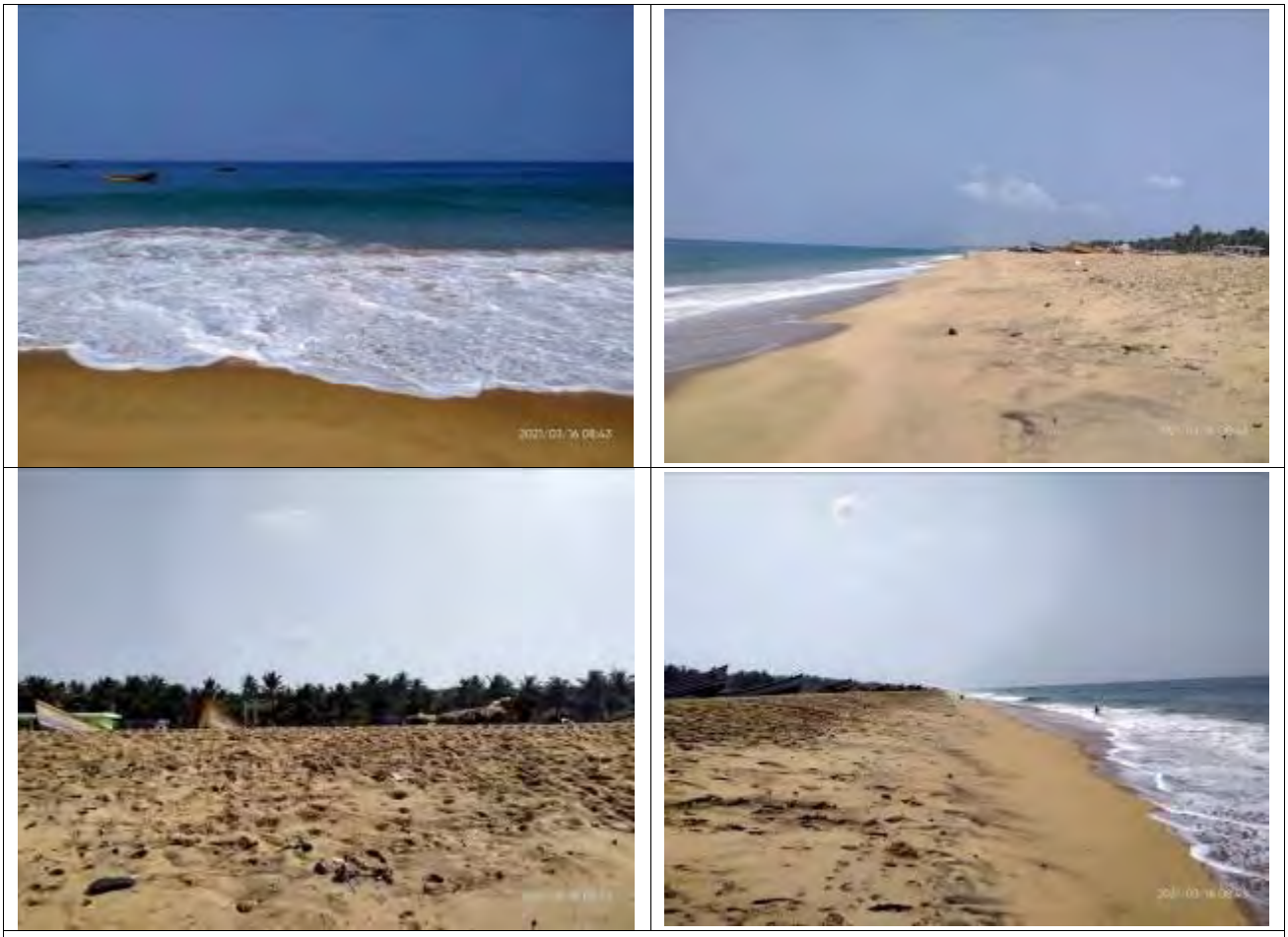

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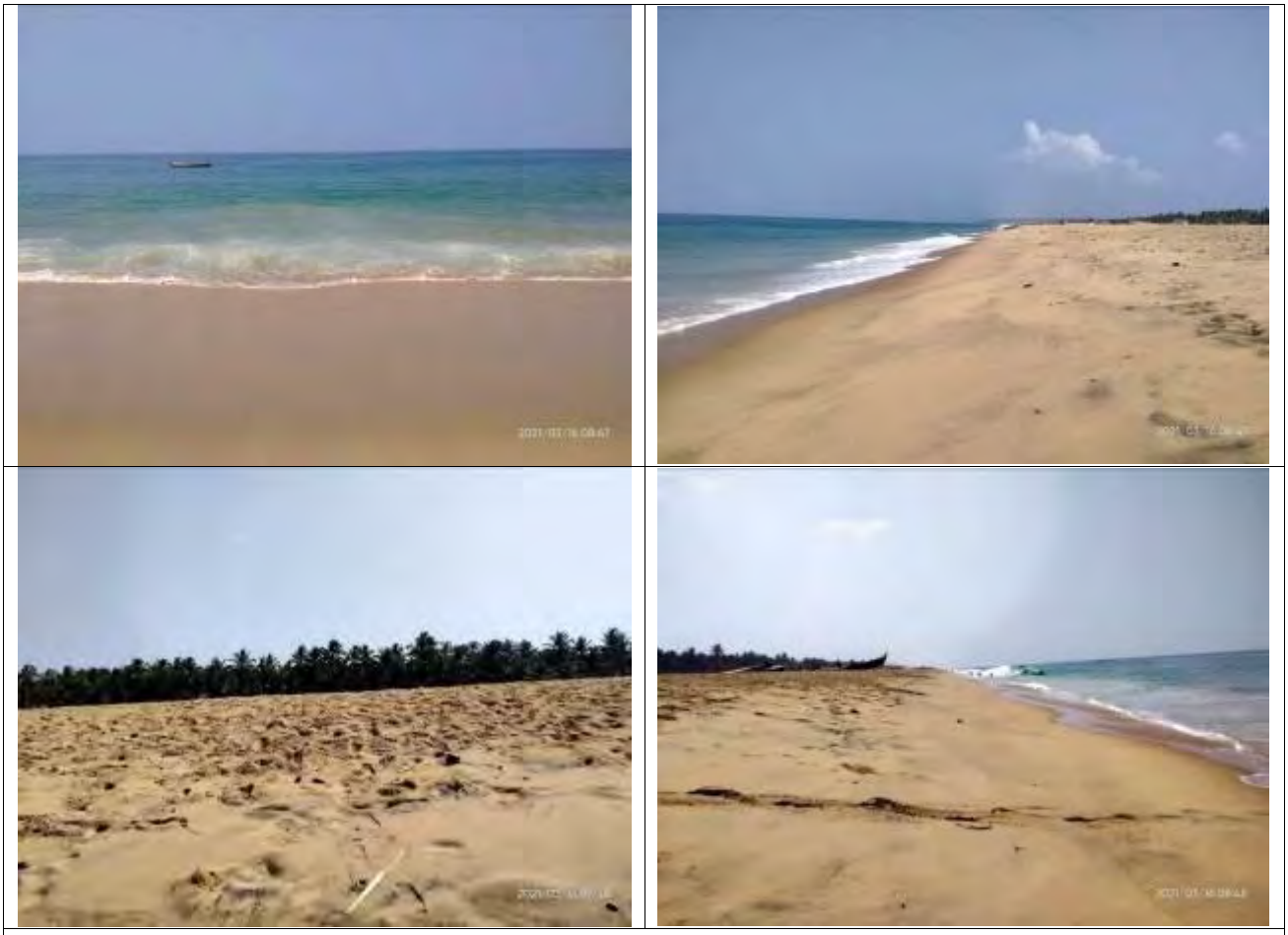

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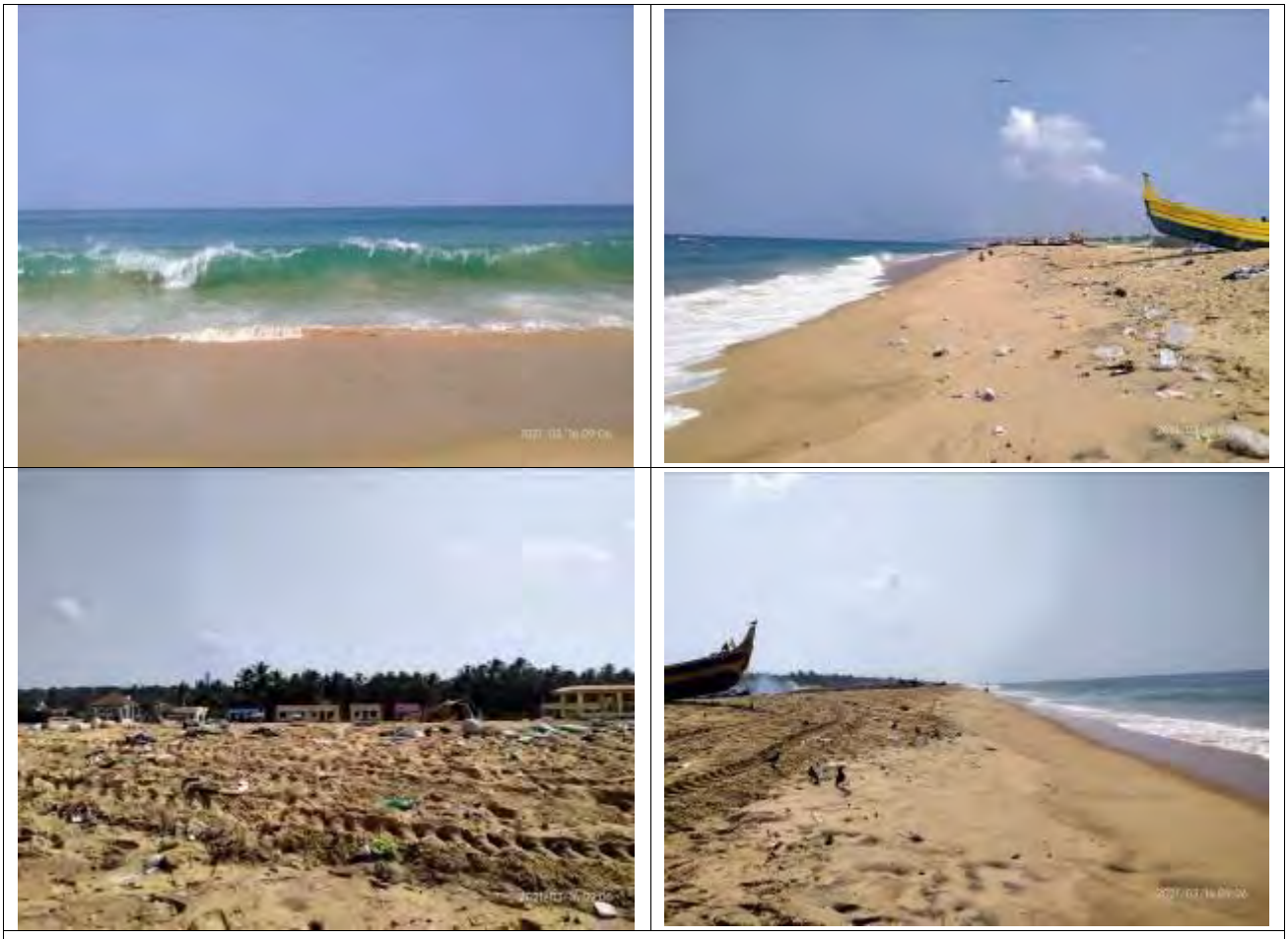

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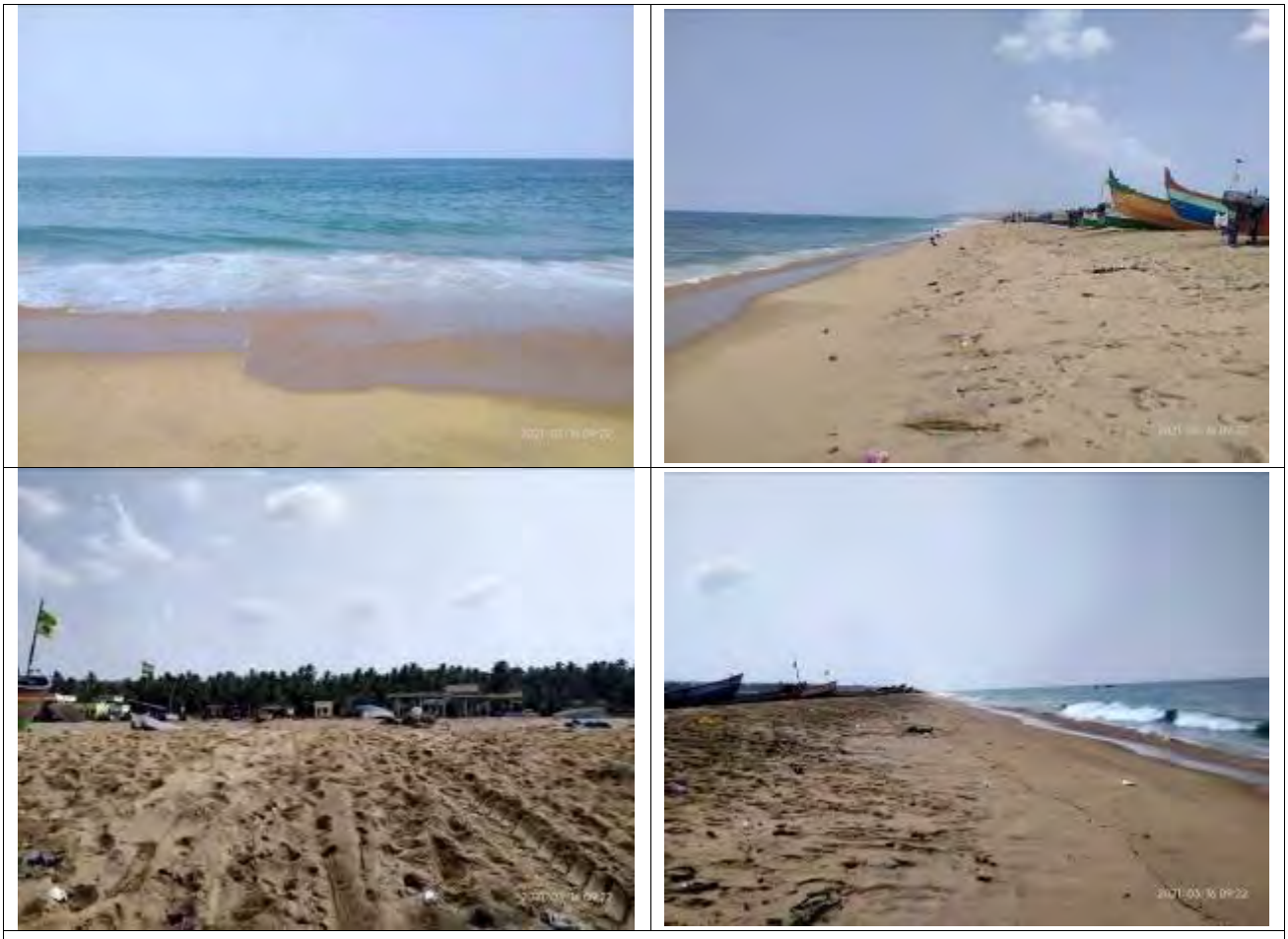

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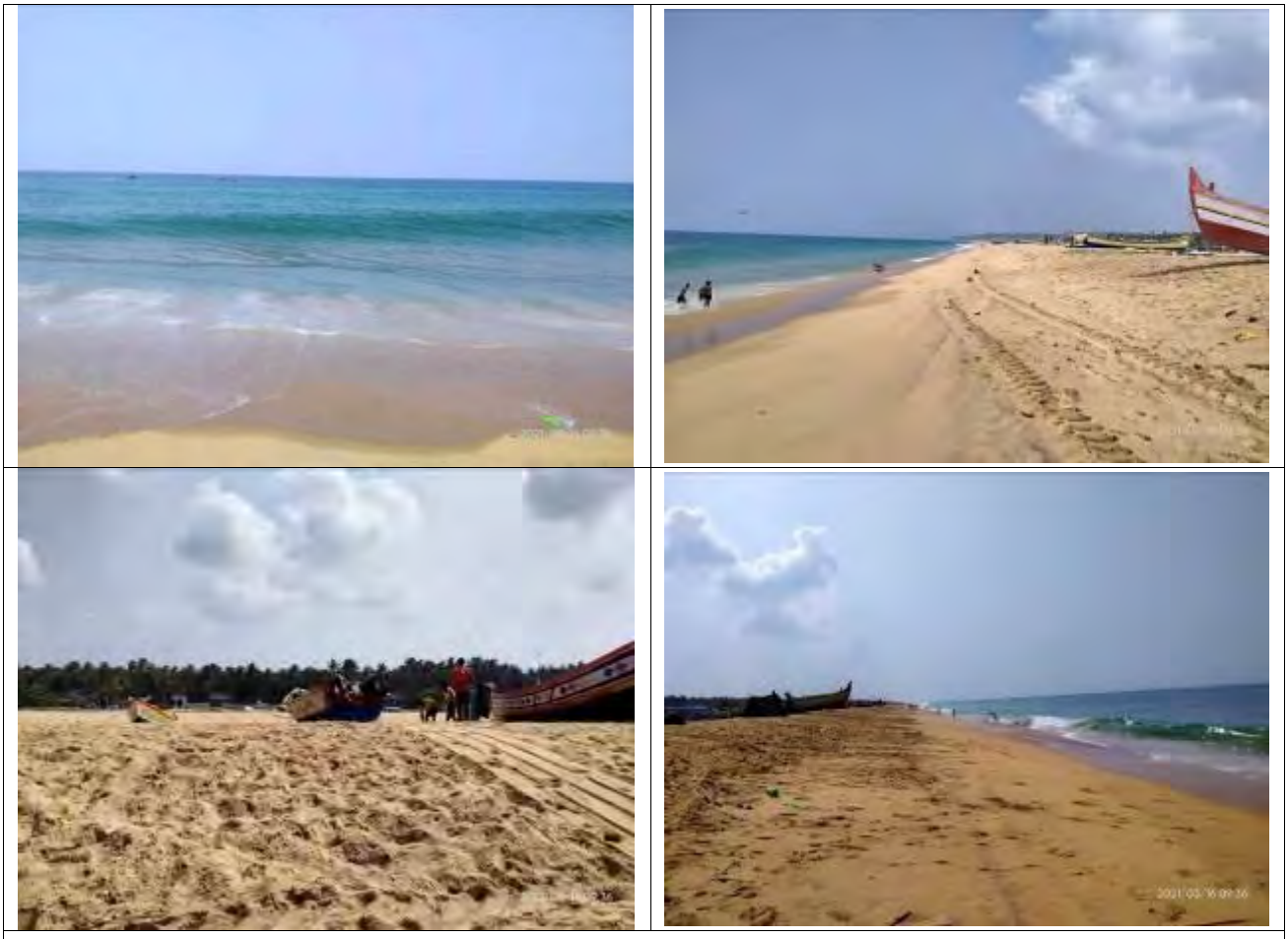

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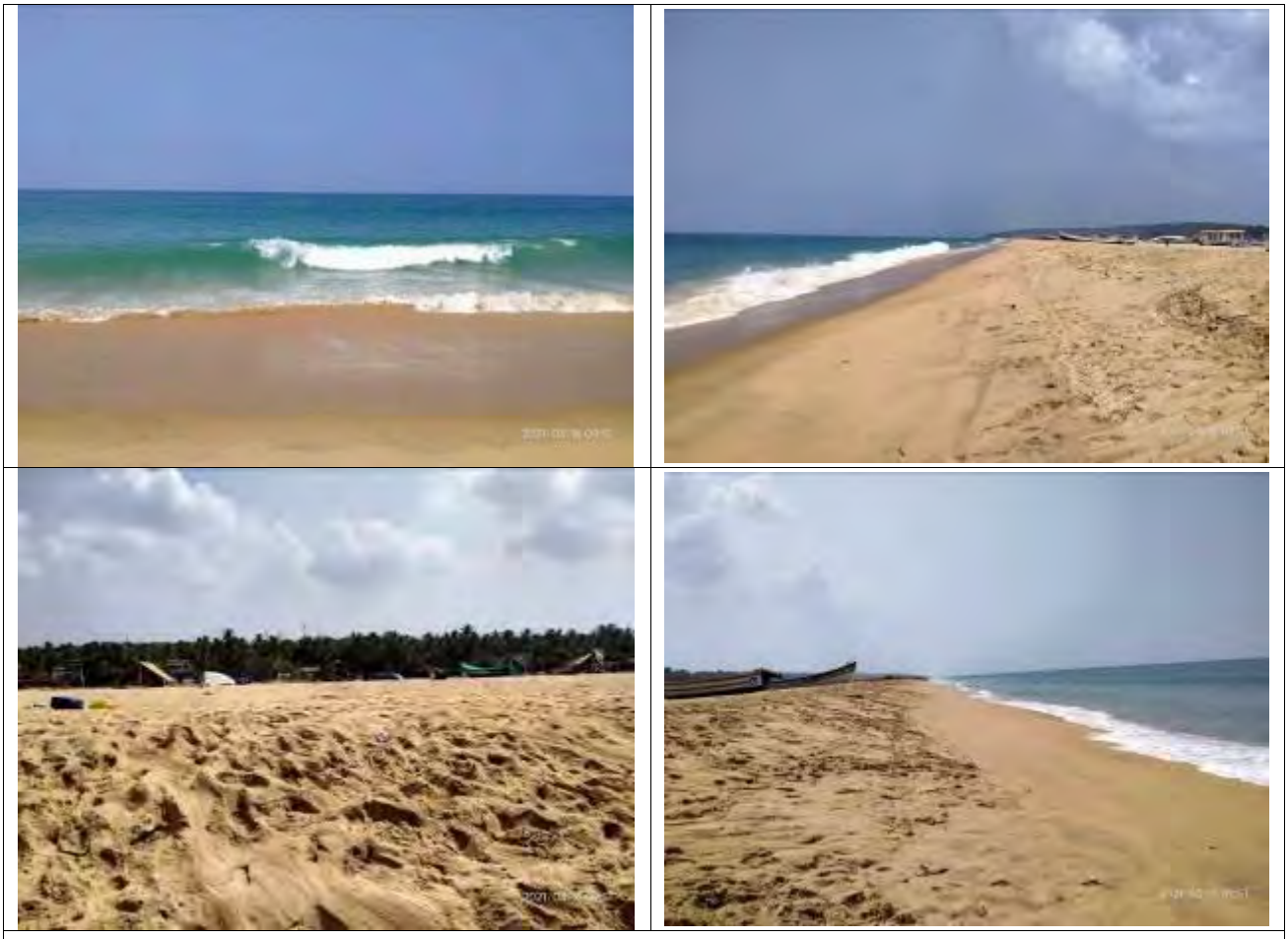

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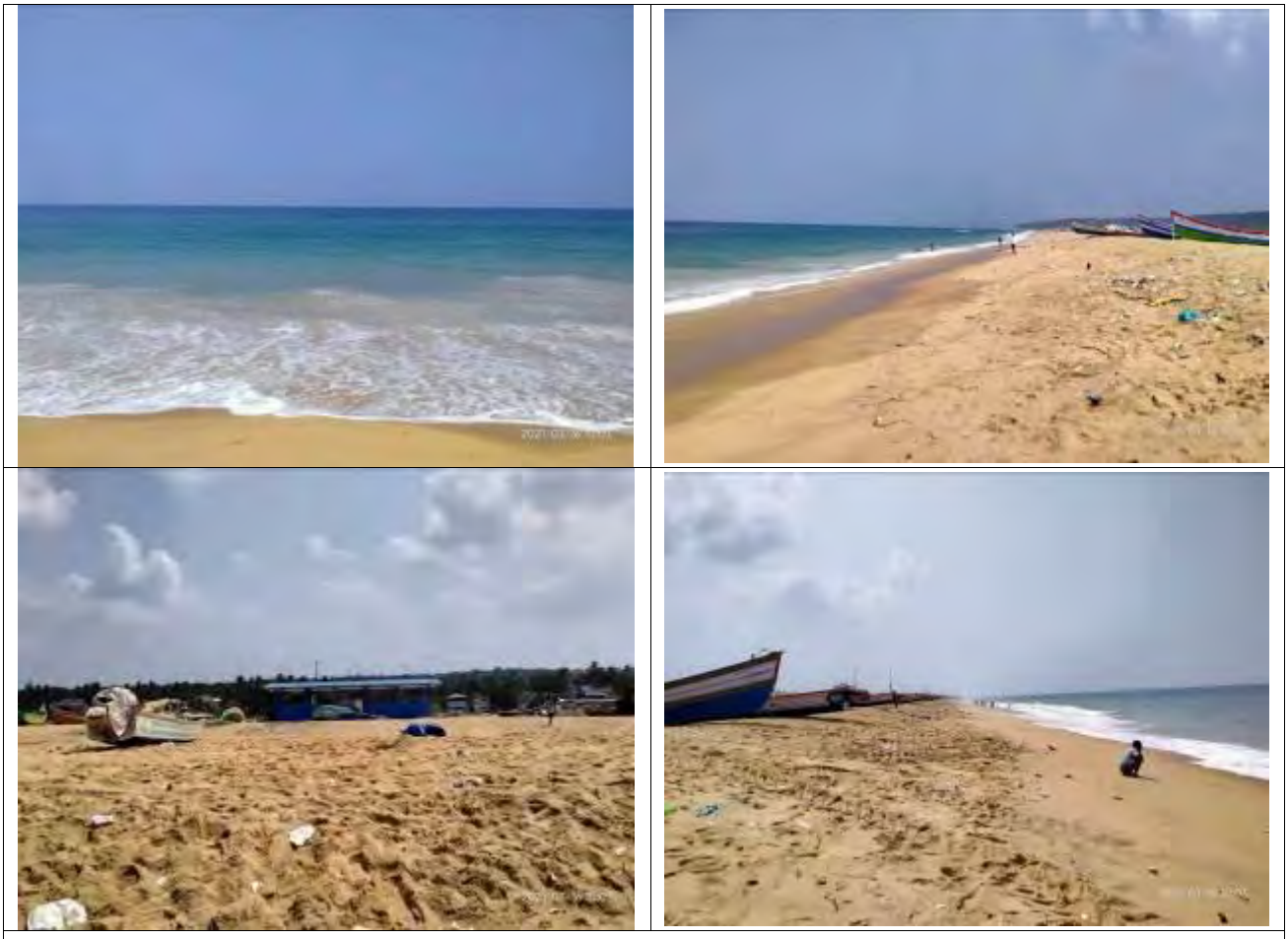

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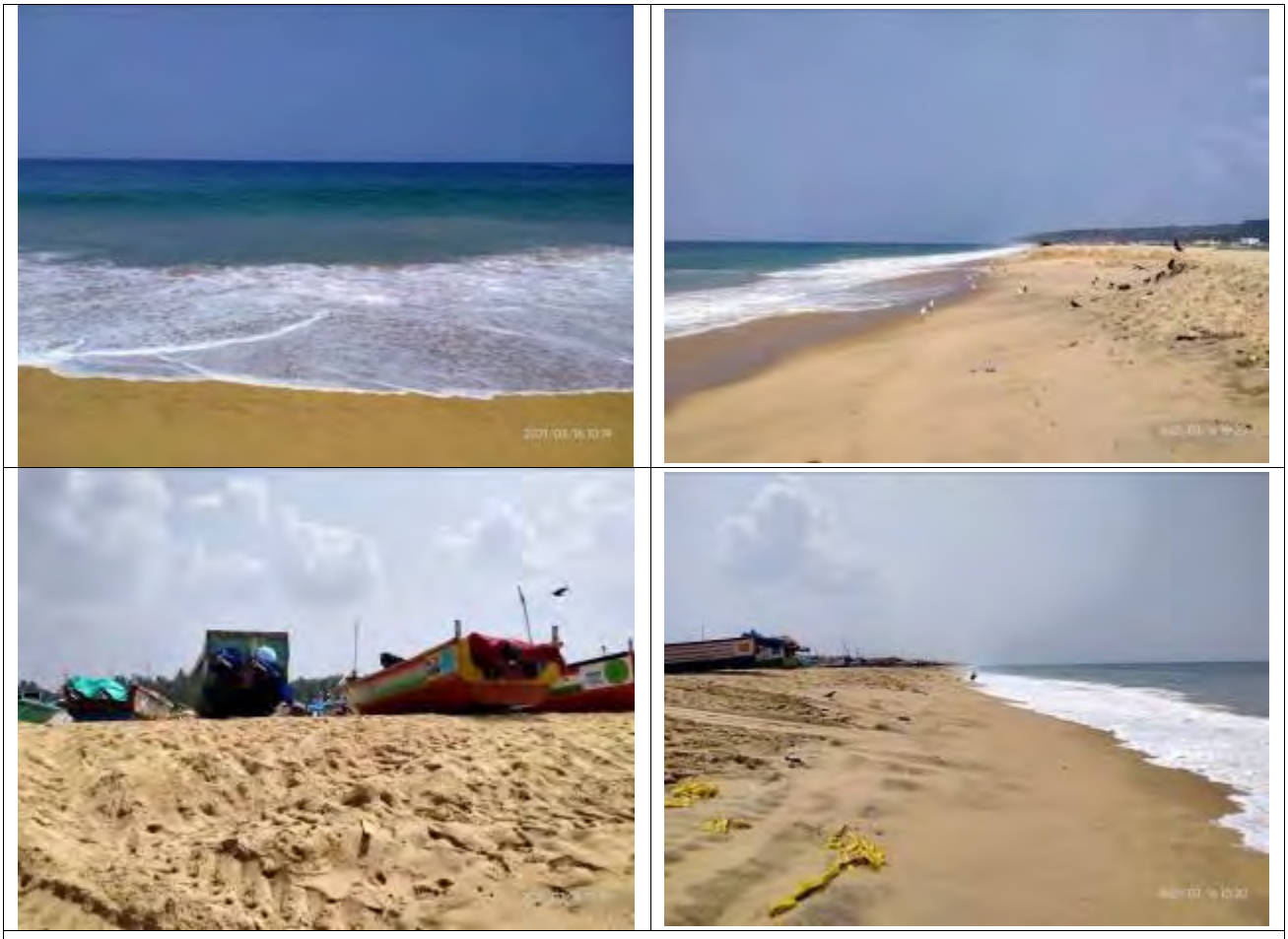

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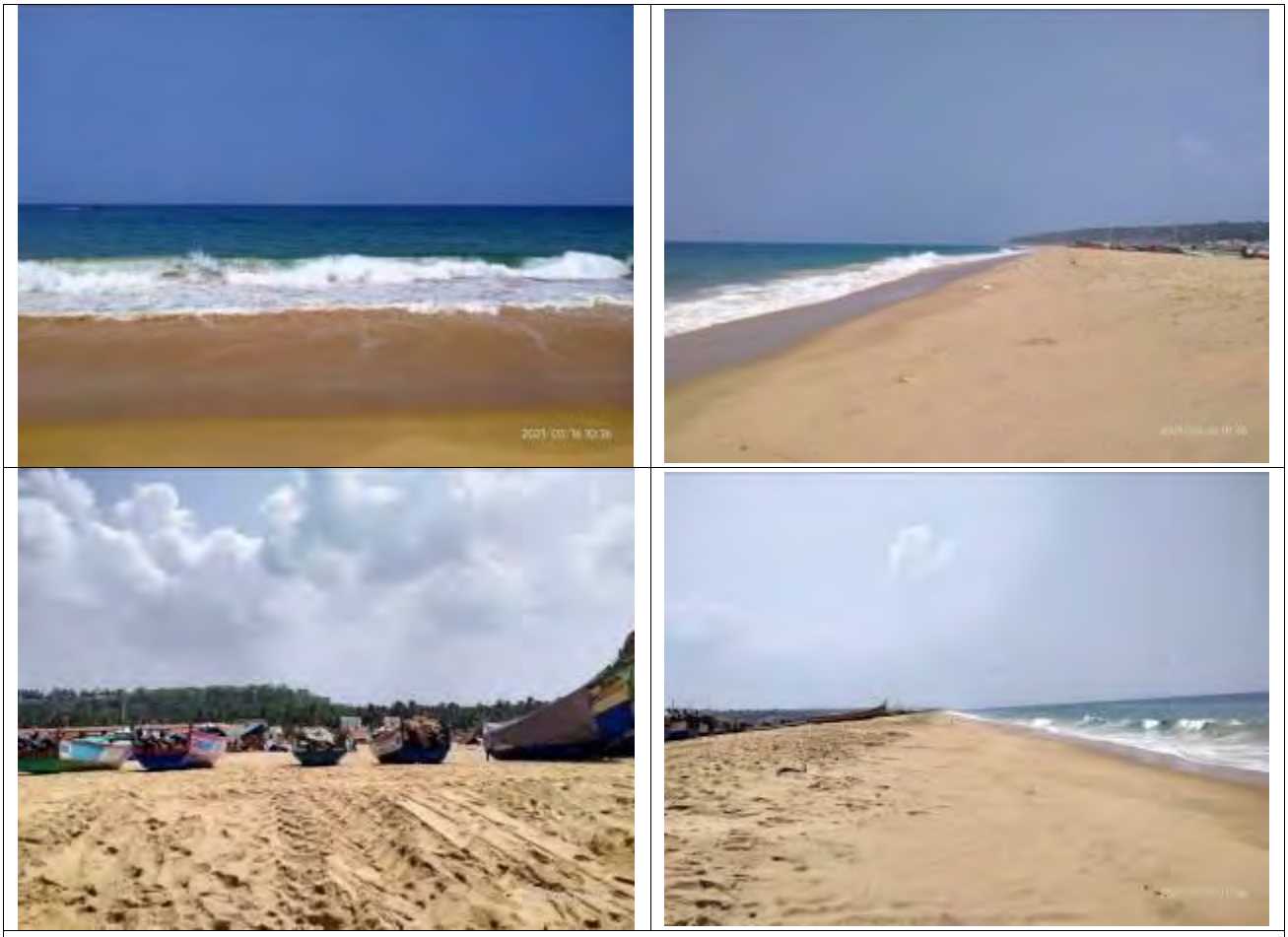

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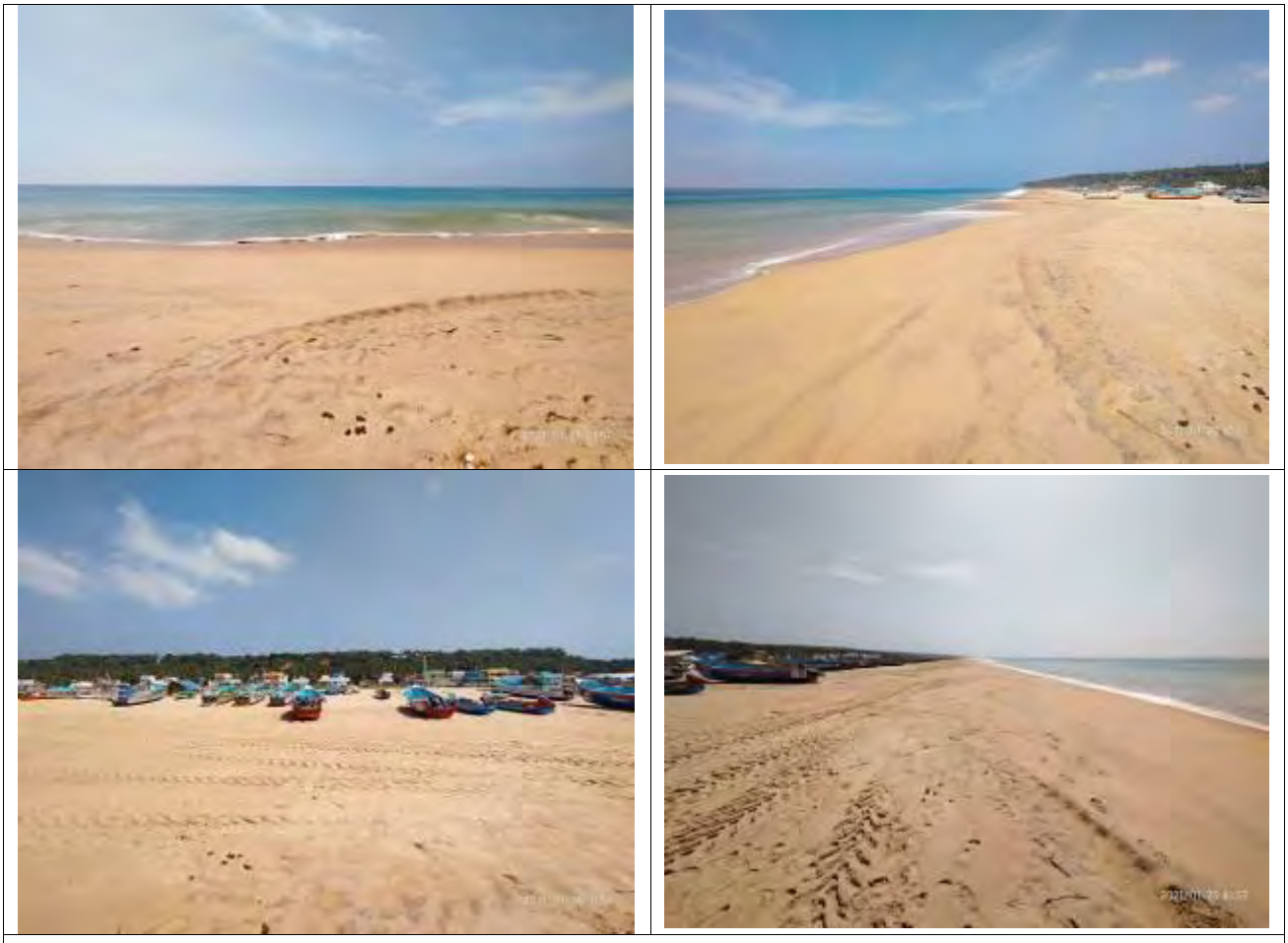


**Figure 32- March CSP 32**

**Figure 33- March CSP 33**

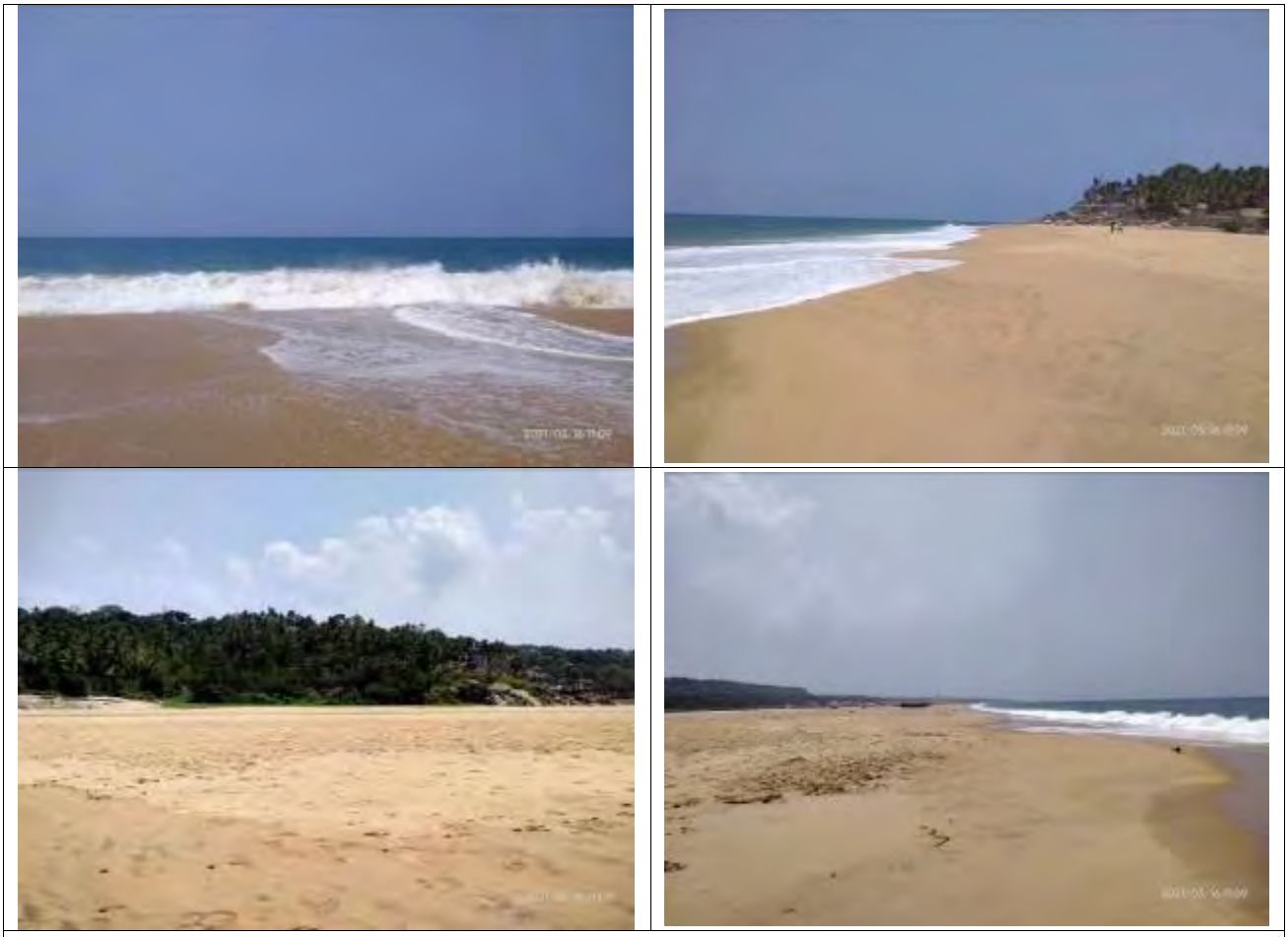


**Figure 34- March CSP 34**

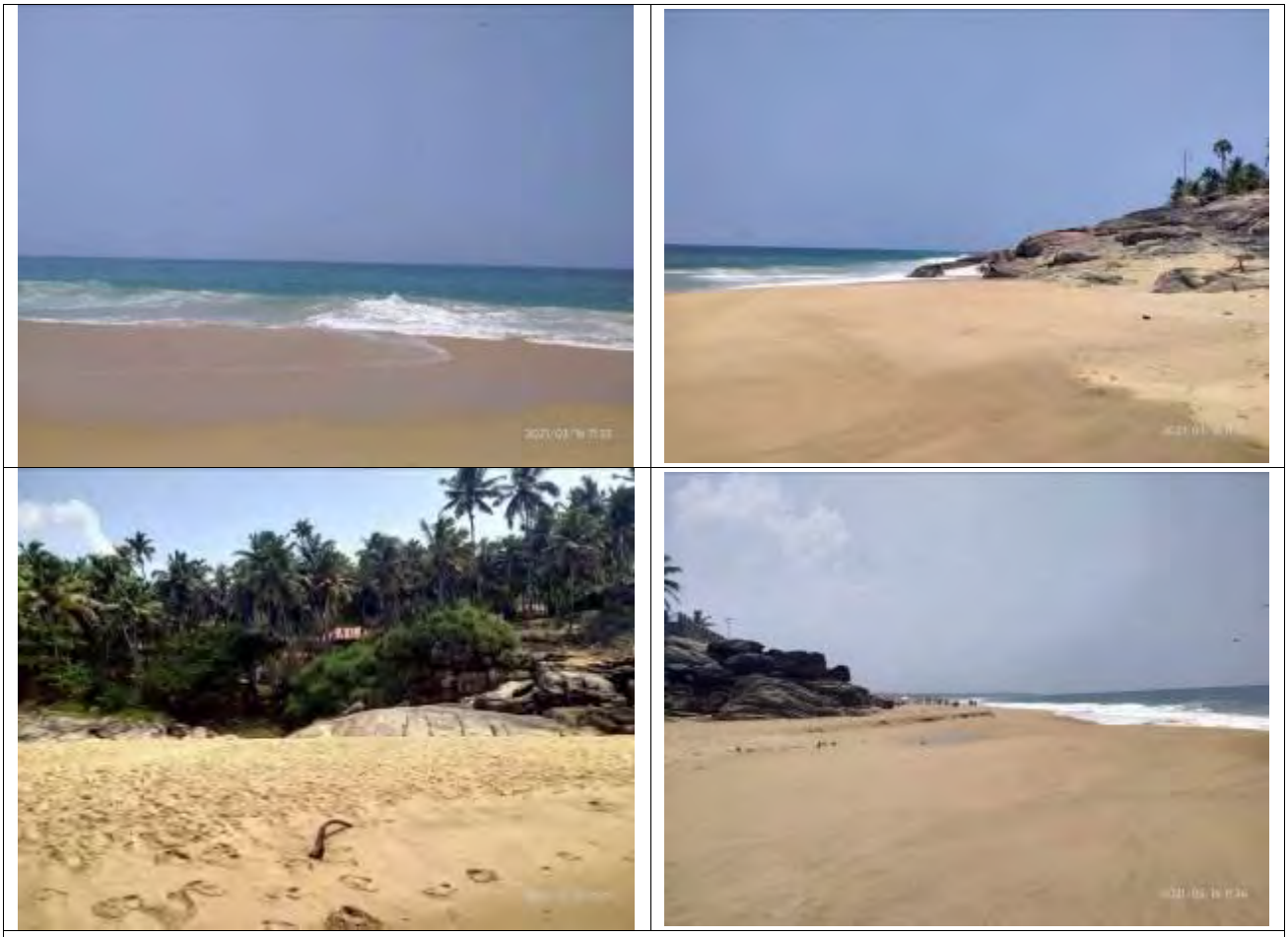
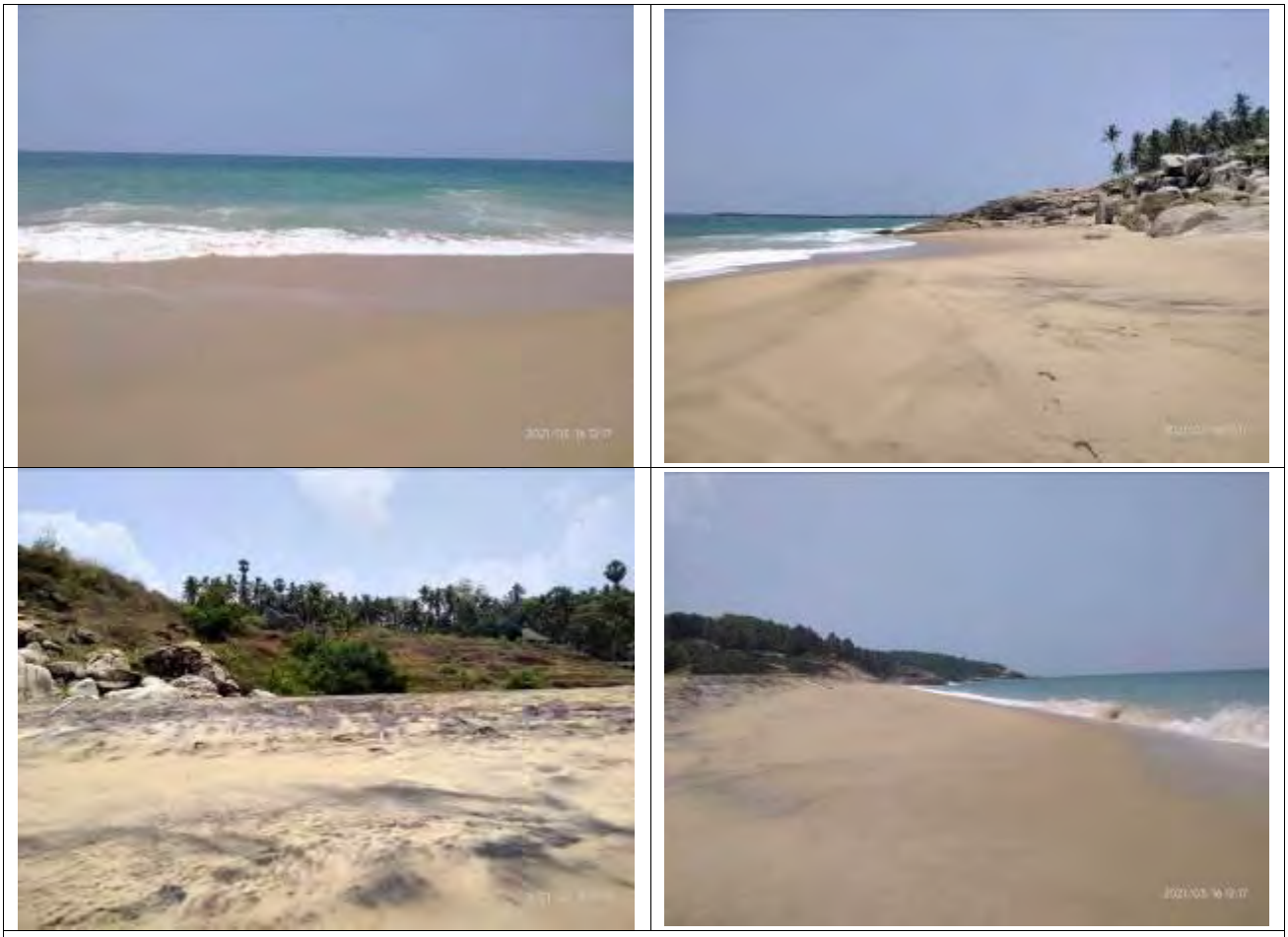


**Figure 35- March CSP 35**




**Figure 36- March CSP 35-A**

**Figure 37- March CSP 36**



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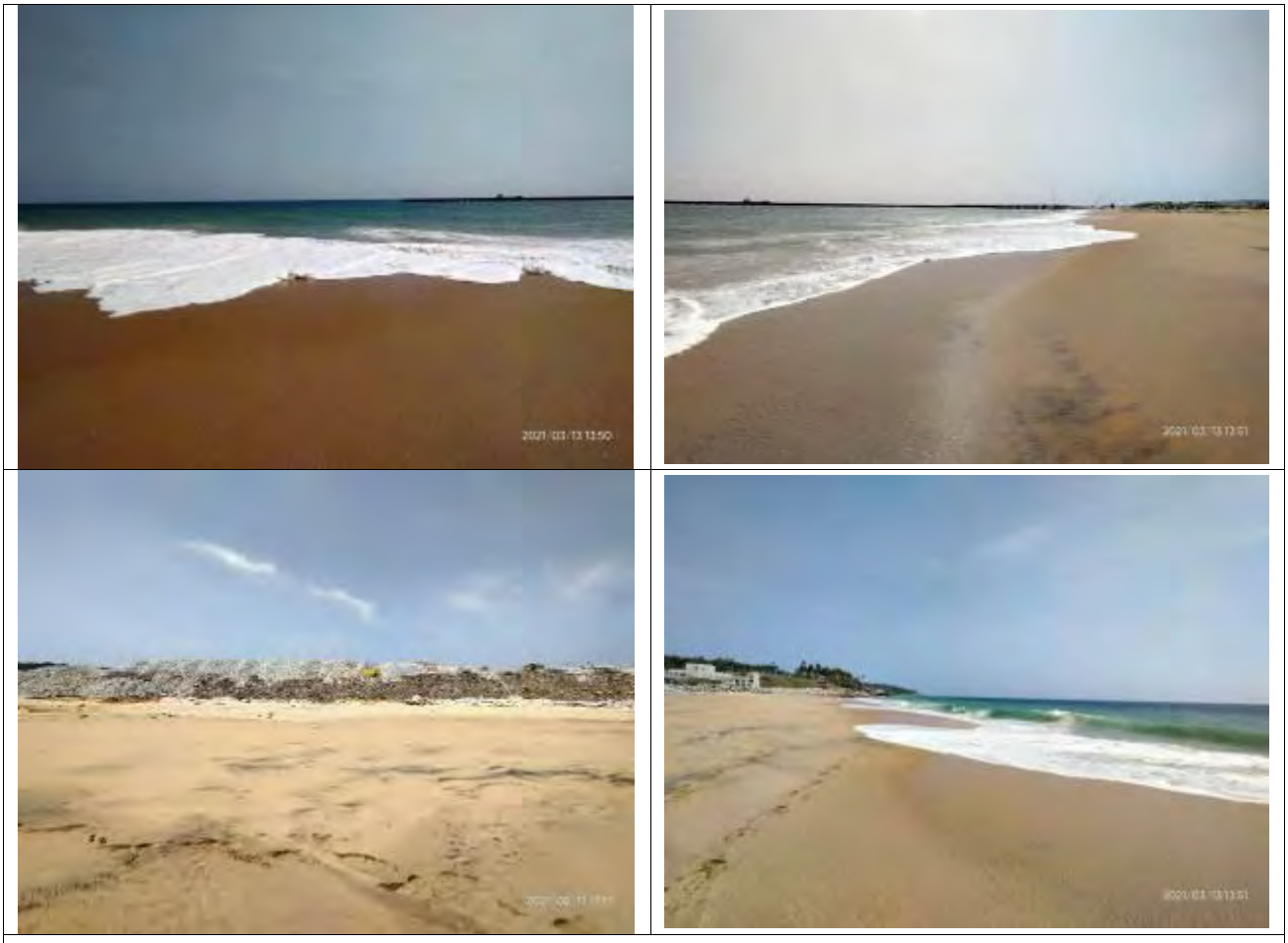

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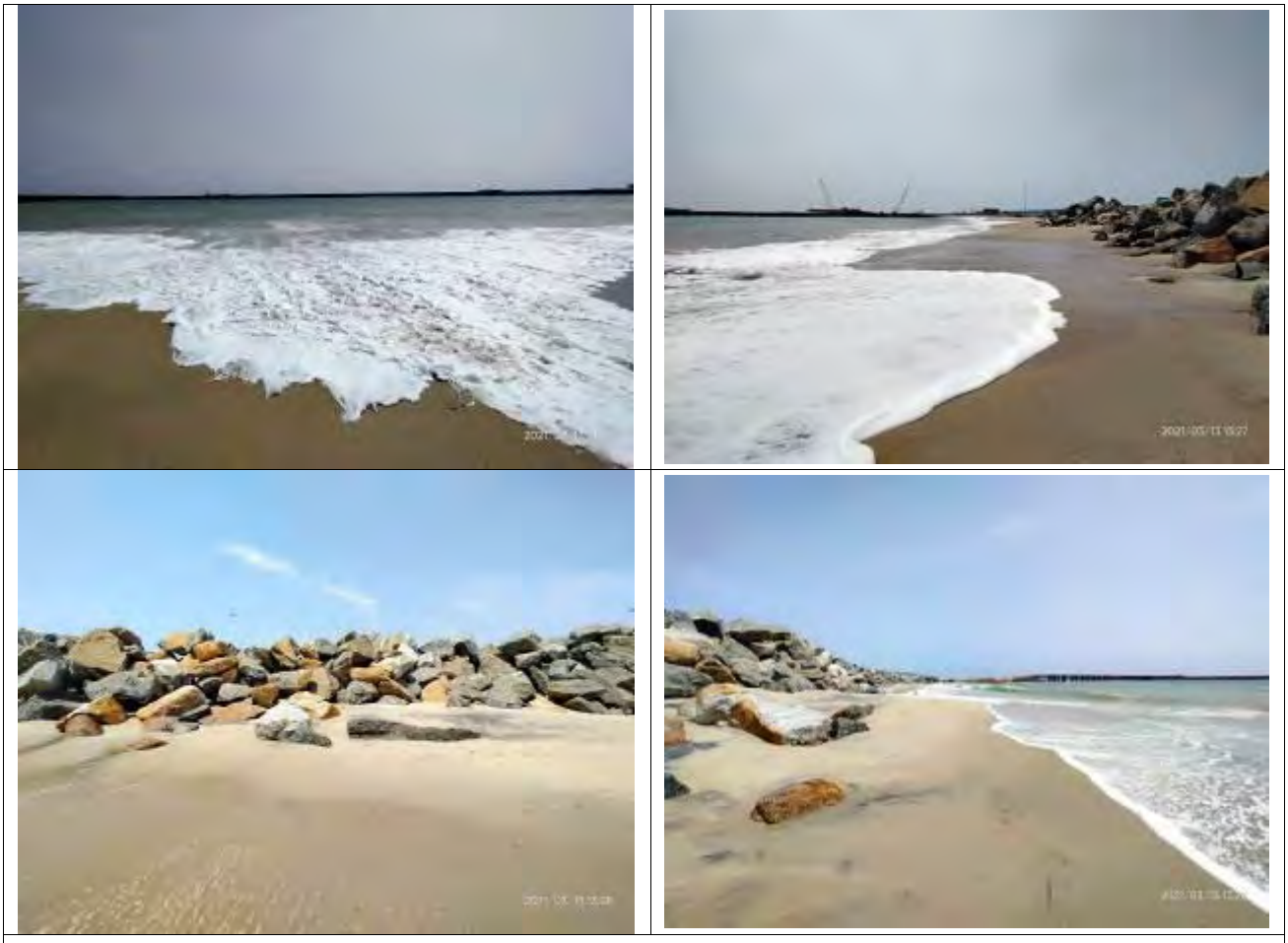

**Figure 40- March CSP 39**

**Figure 41- March CSP 40**

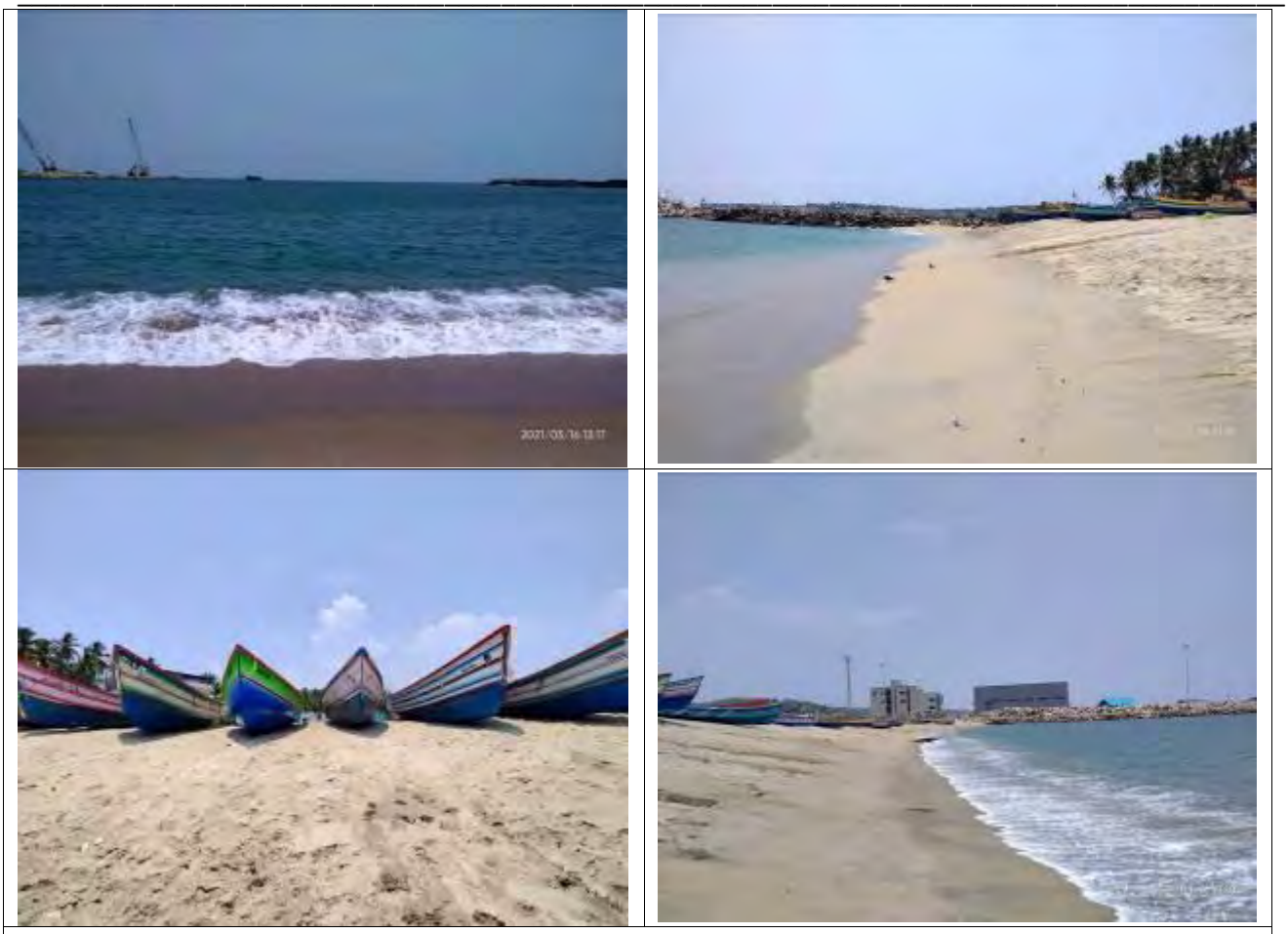

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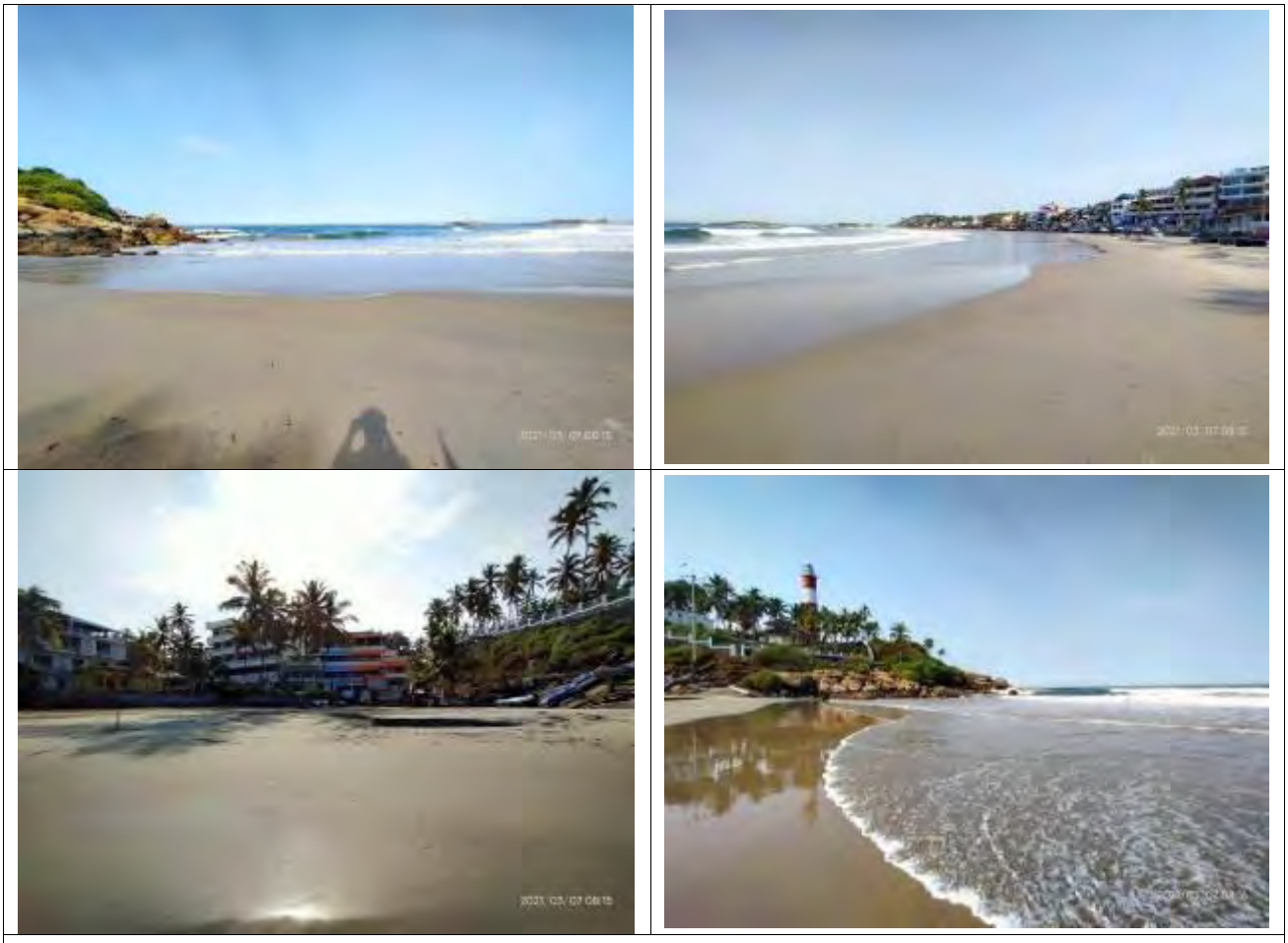
**Figure 43- March CSP 41**



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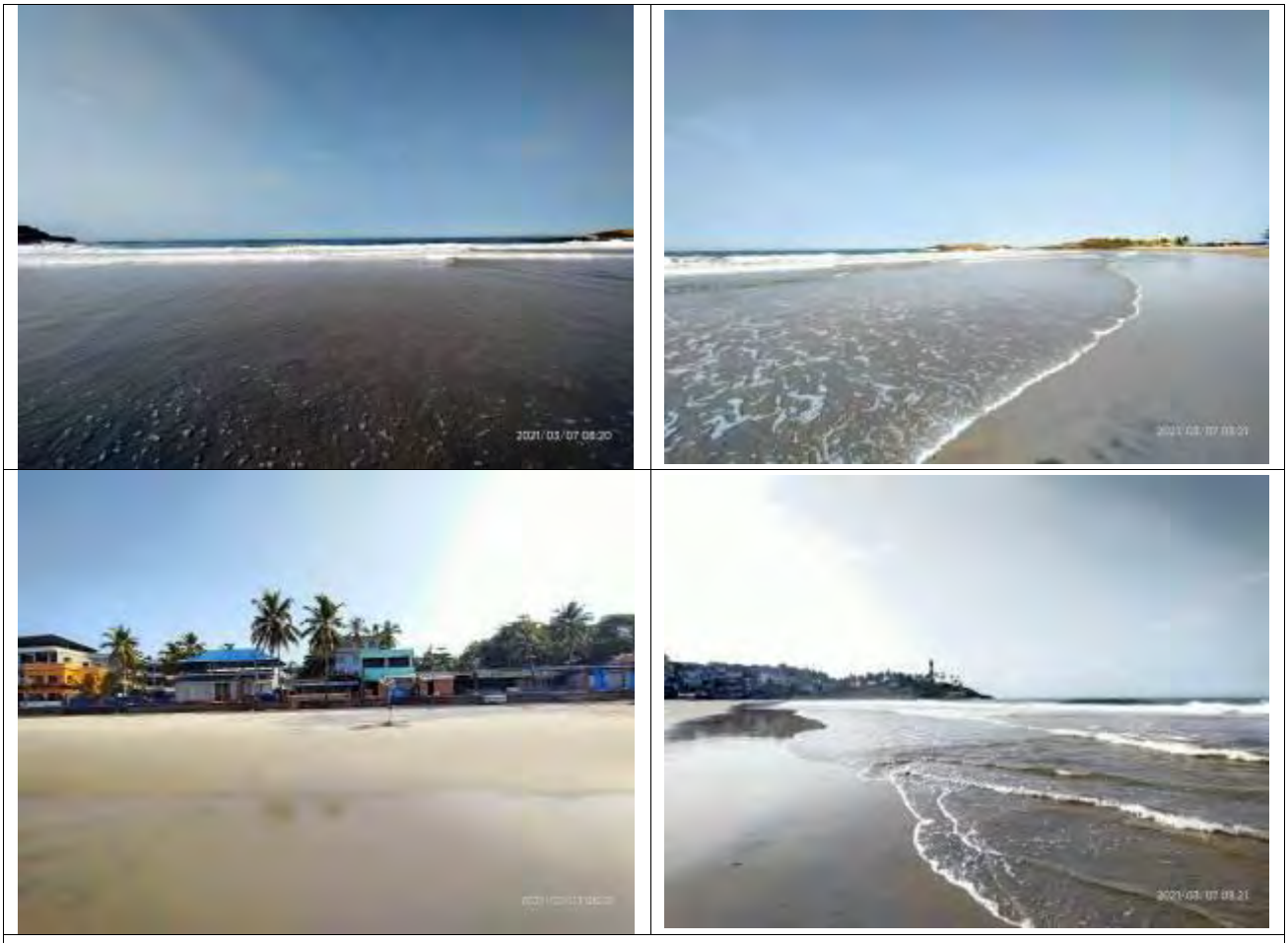

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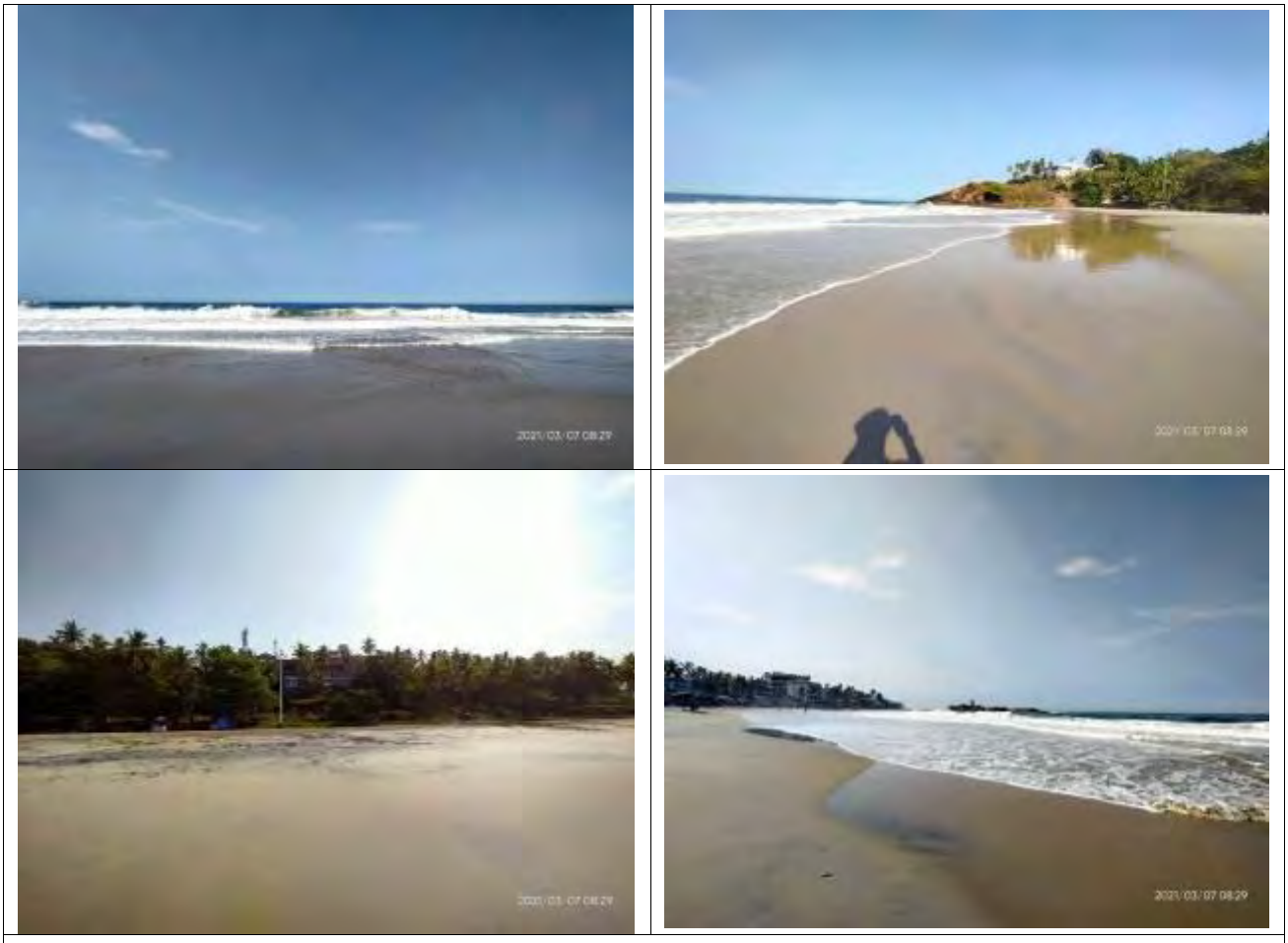

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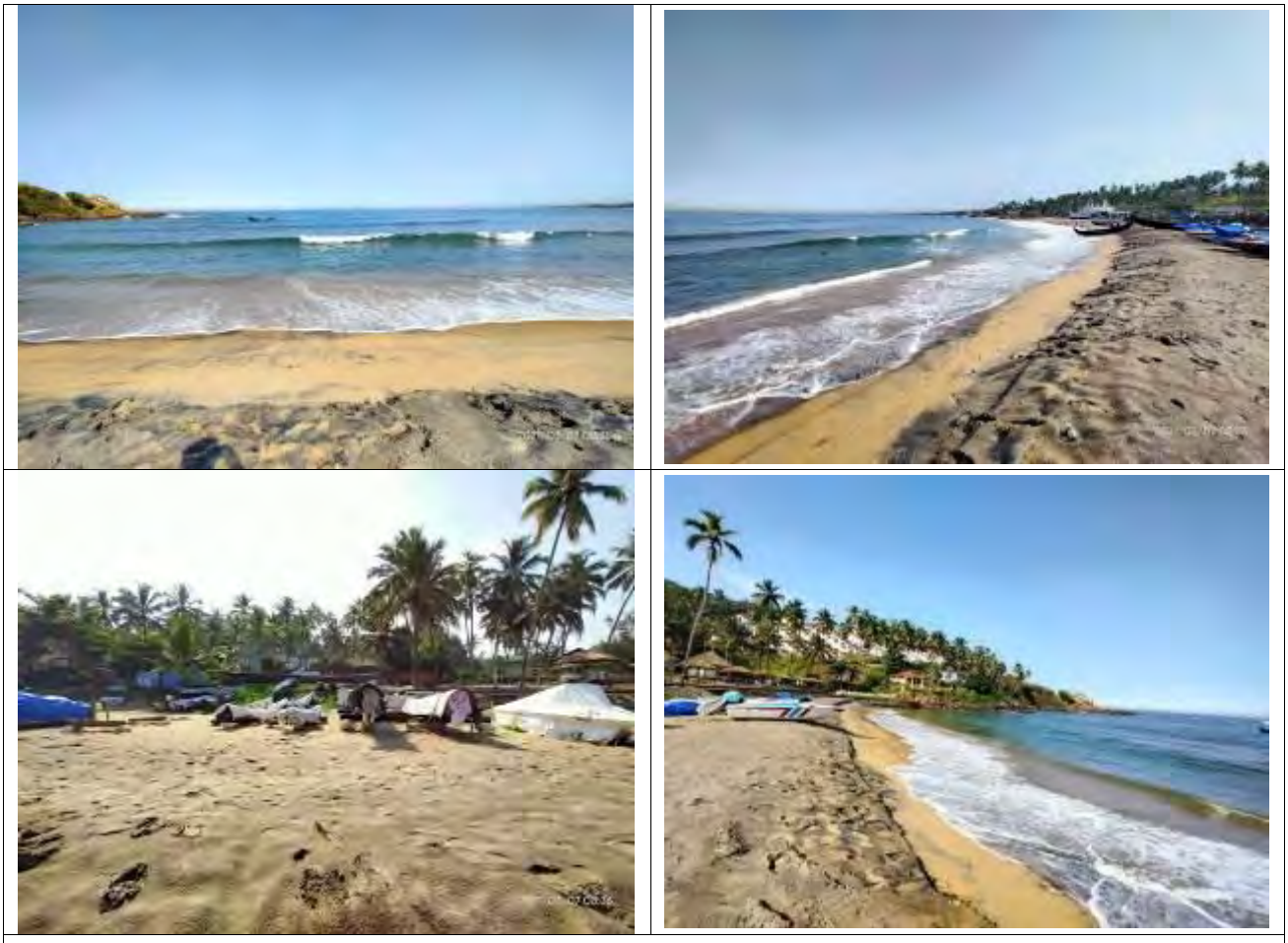

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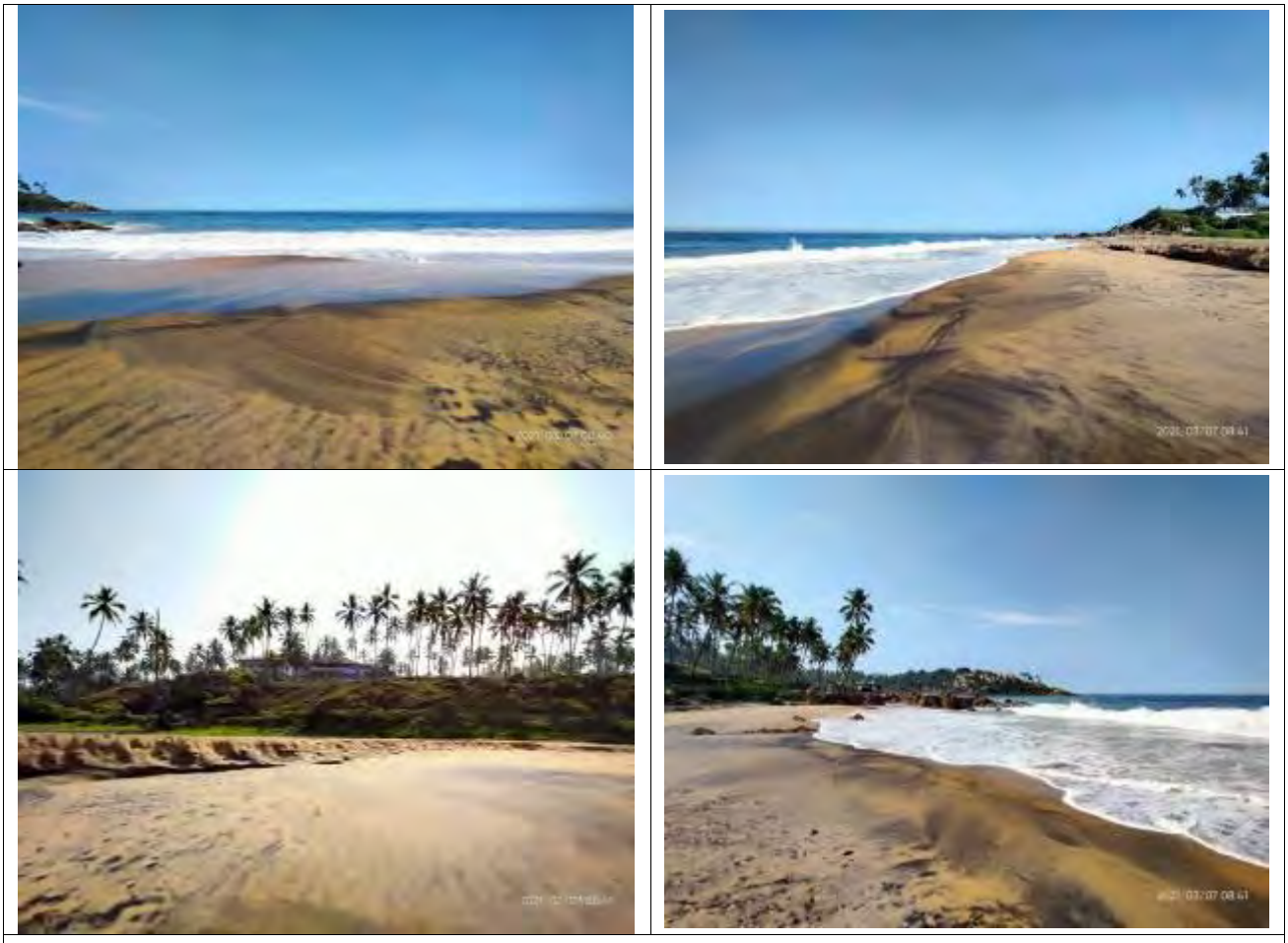

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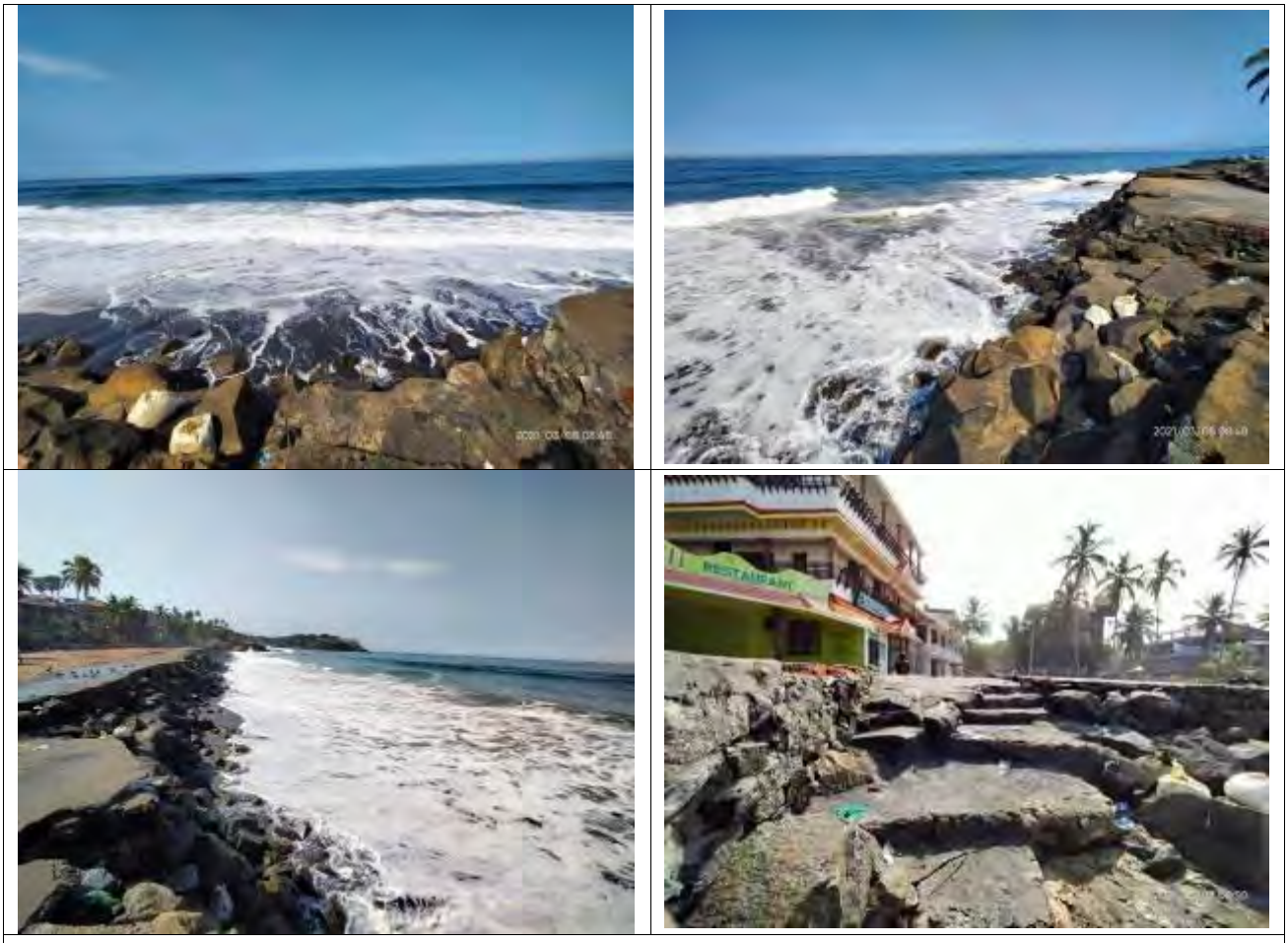

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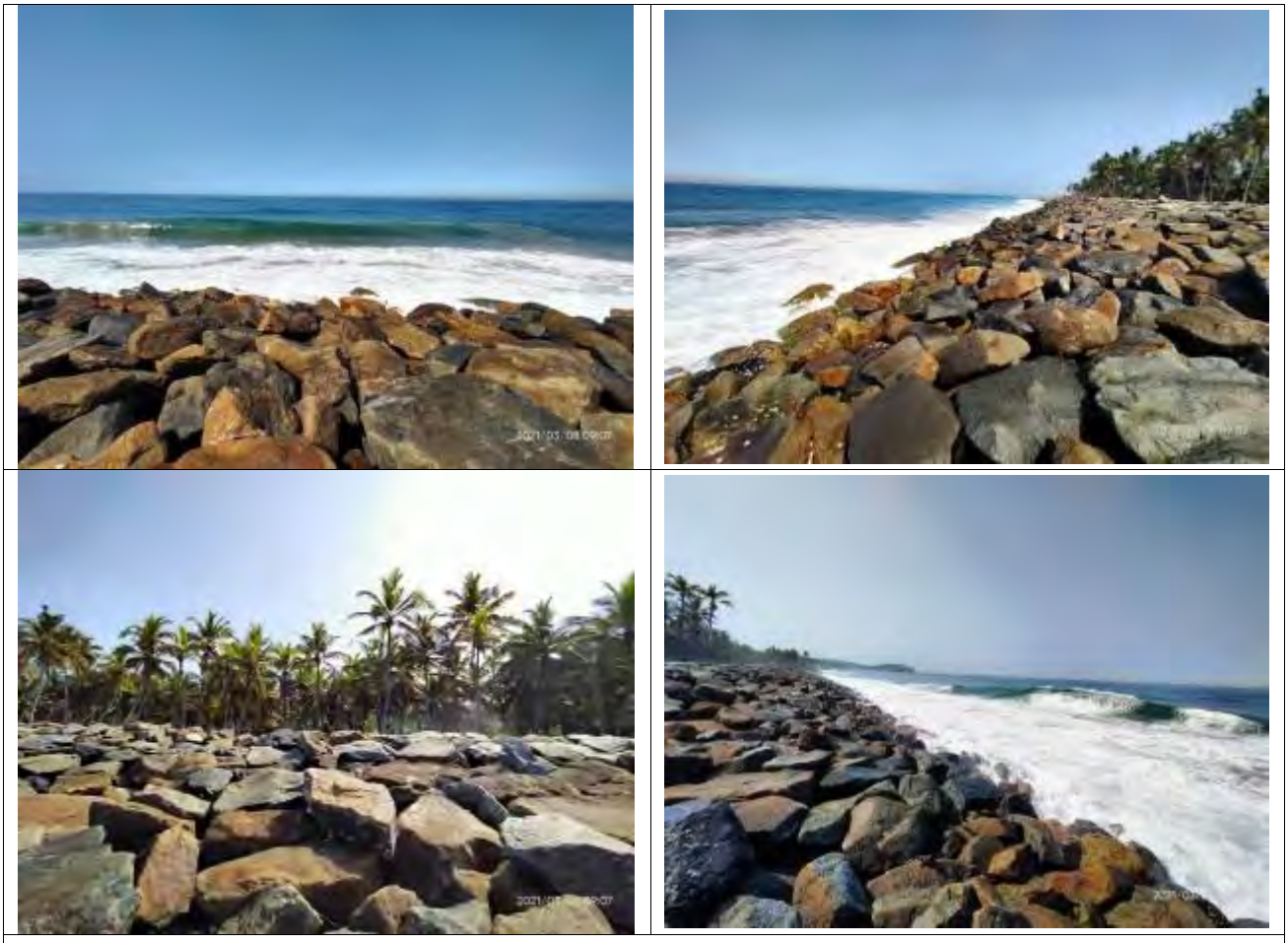
**Figure 50- March CSP 48**



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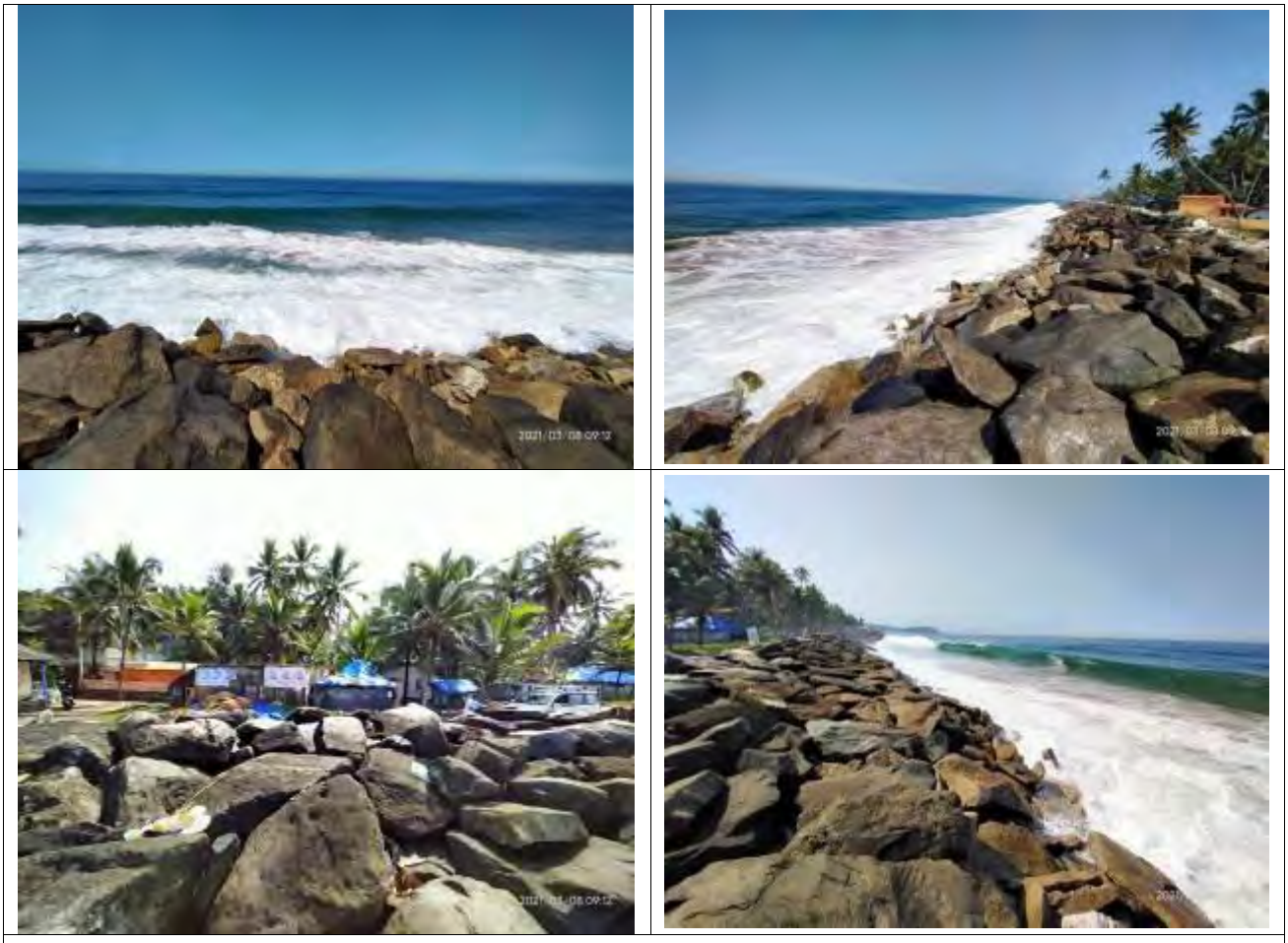

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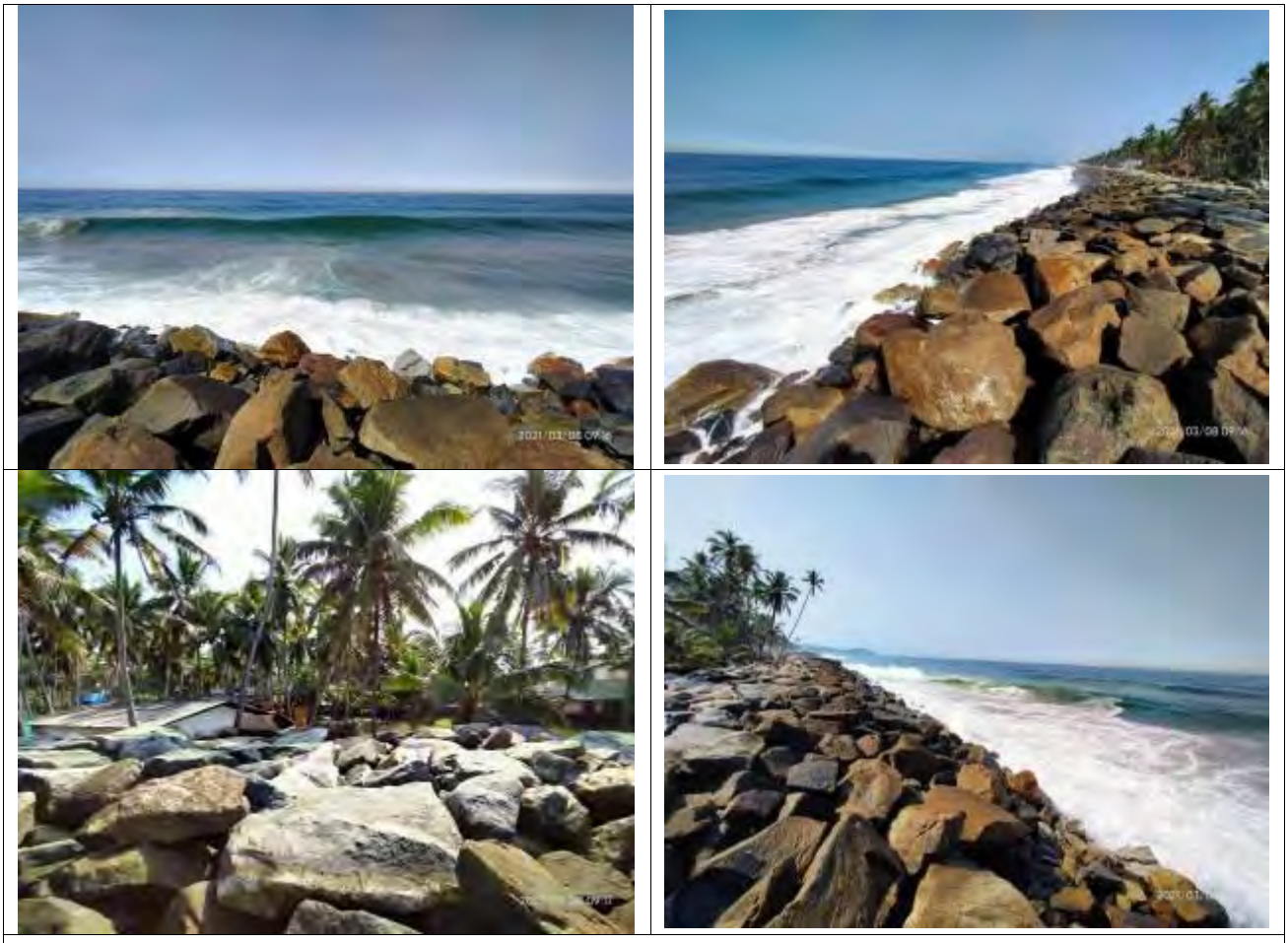

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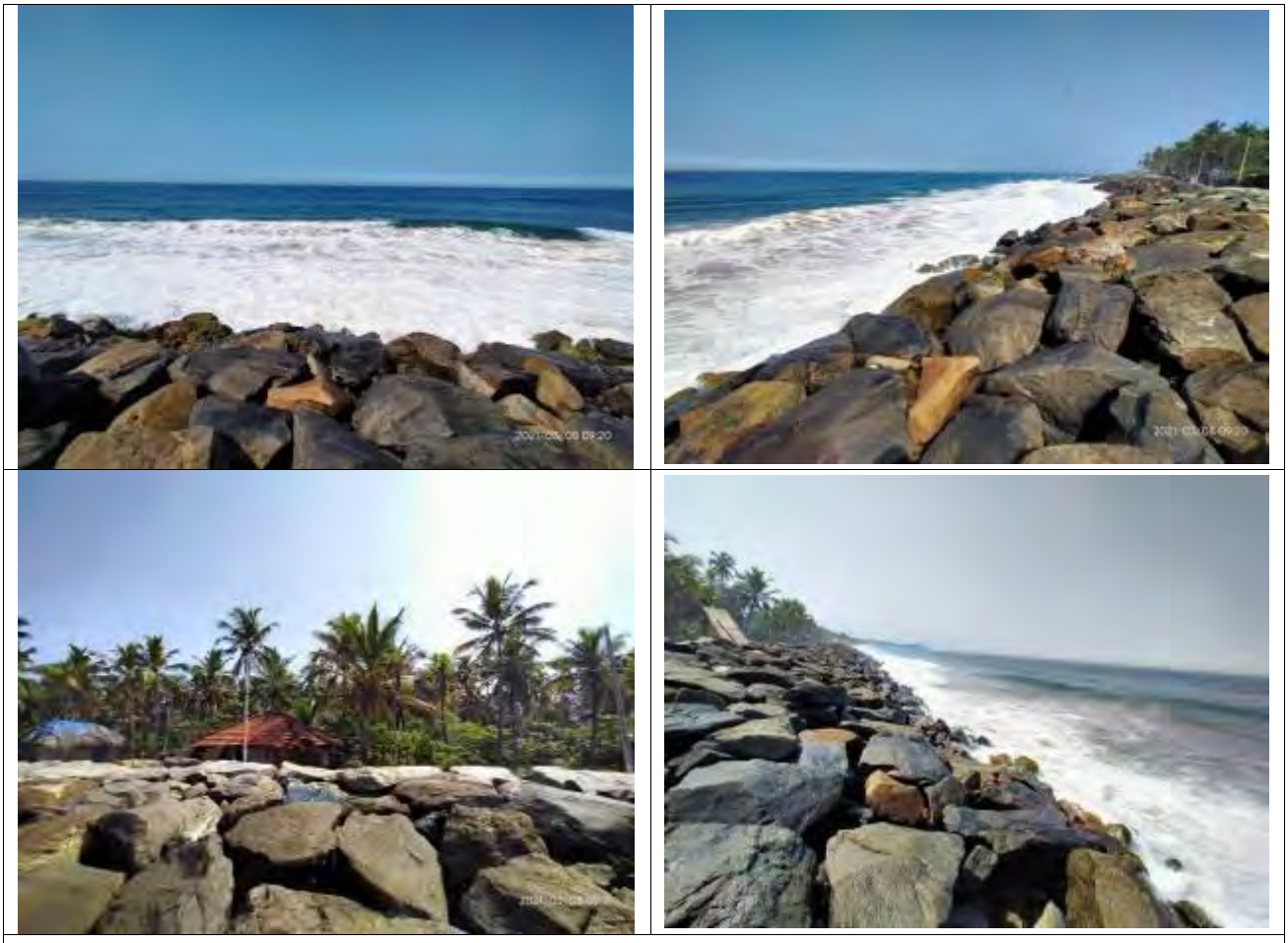

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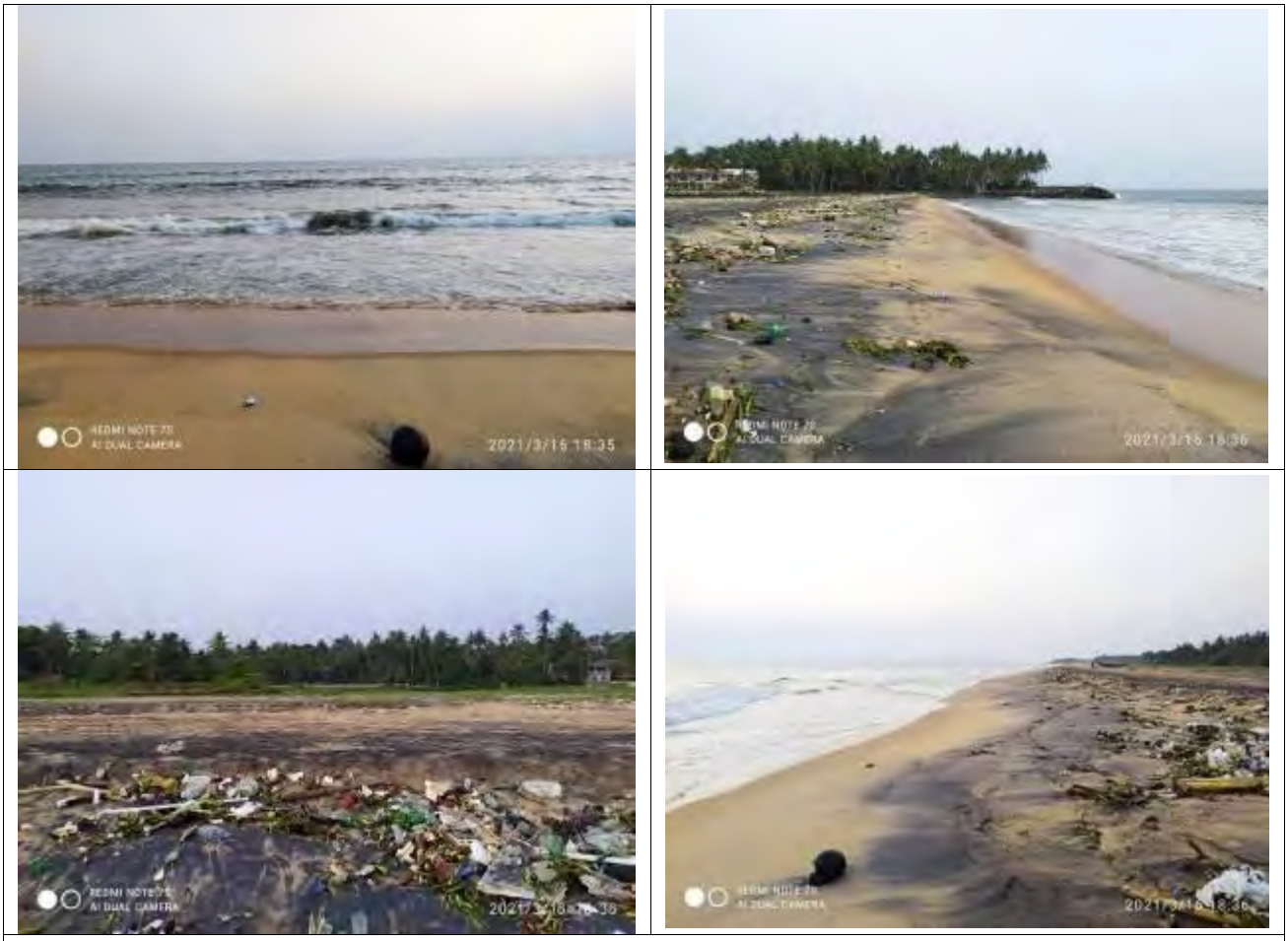
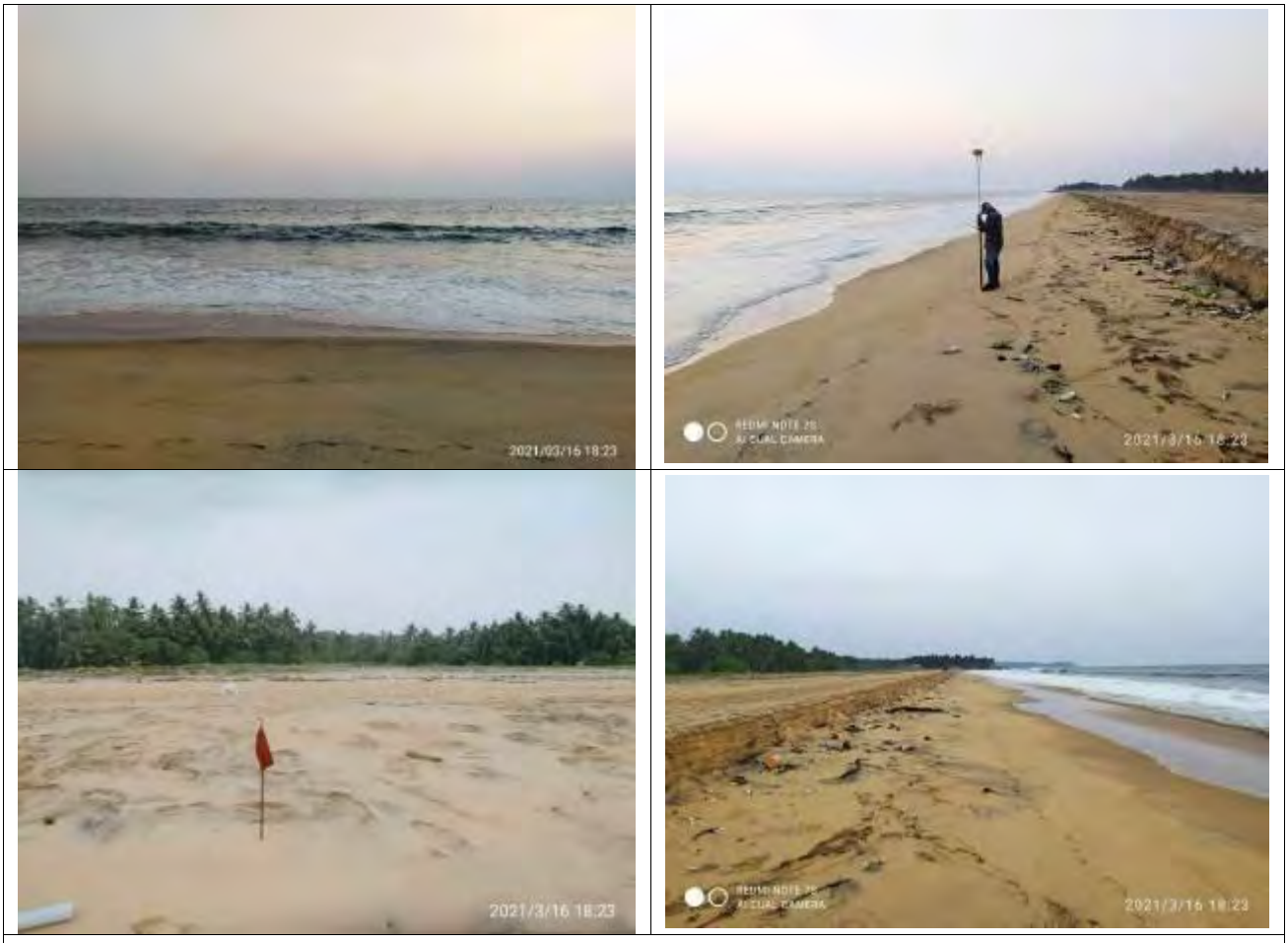


**Figure 55- March CSP 53**



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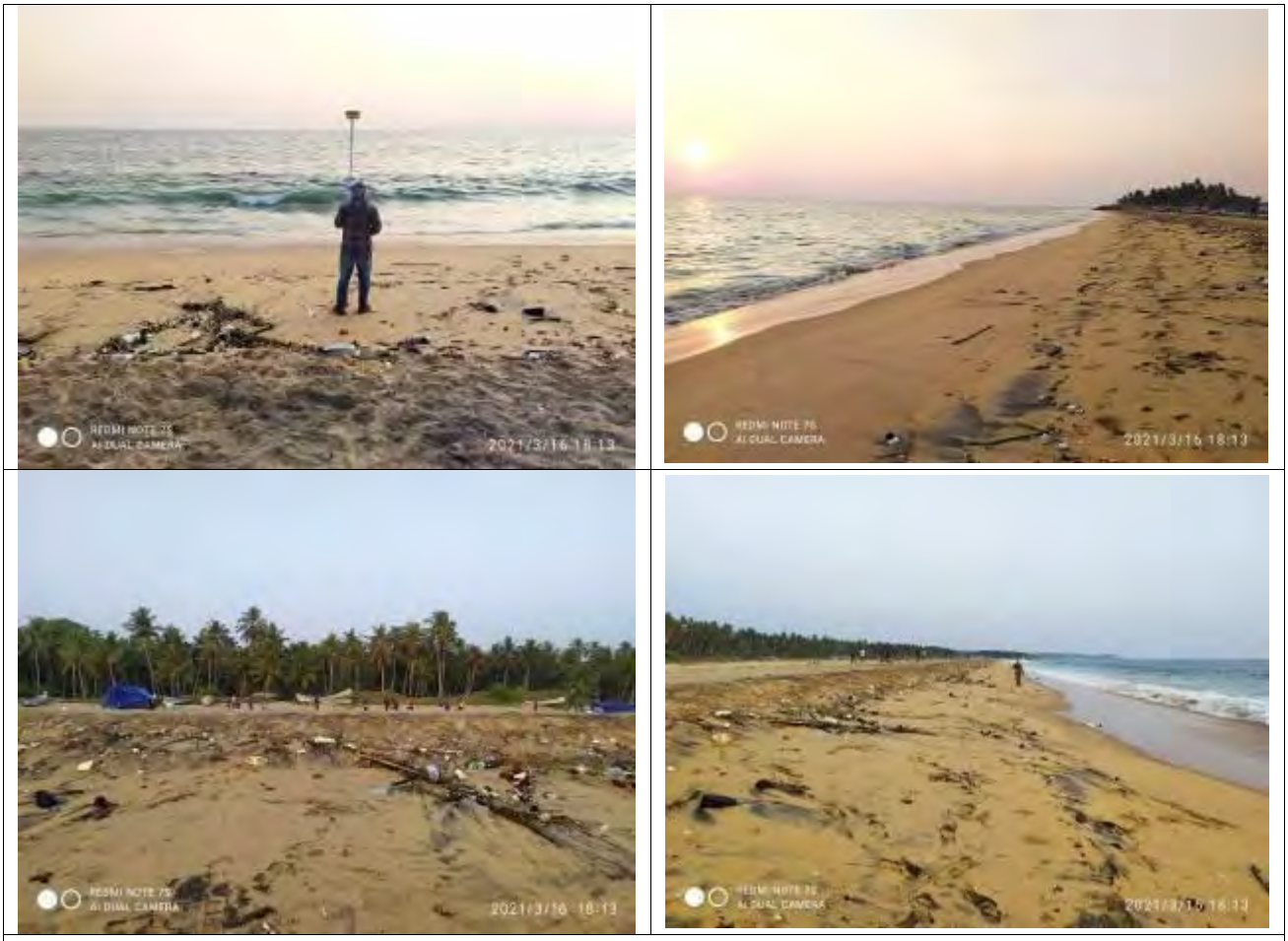
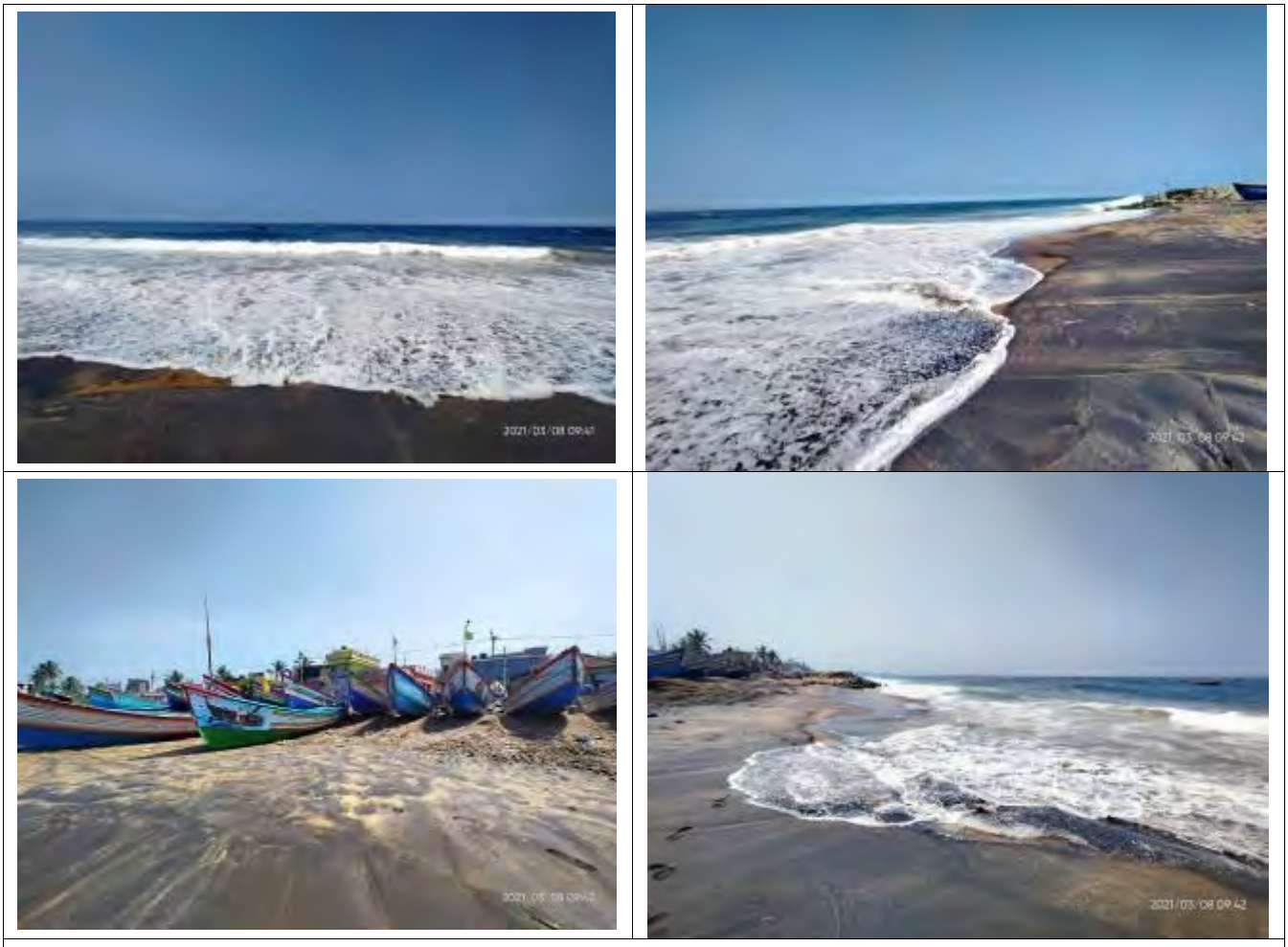


**Figure 57- March CSP 55**


**Figure 58- March CSP 56**



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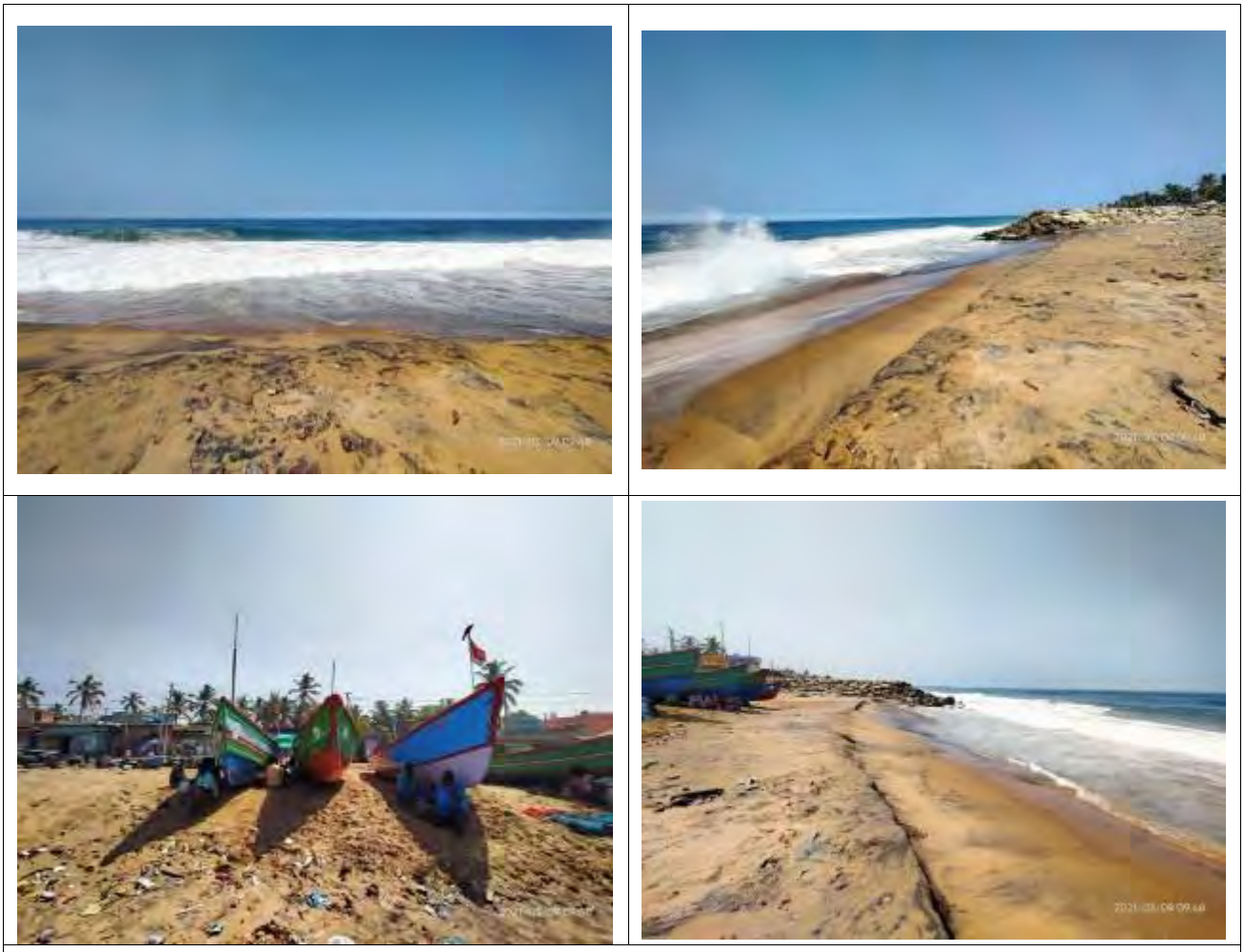


**Figure 60- March CSP 58**

**Figure 61- March CSP 59**

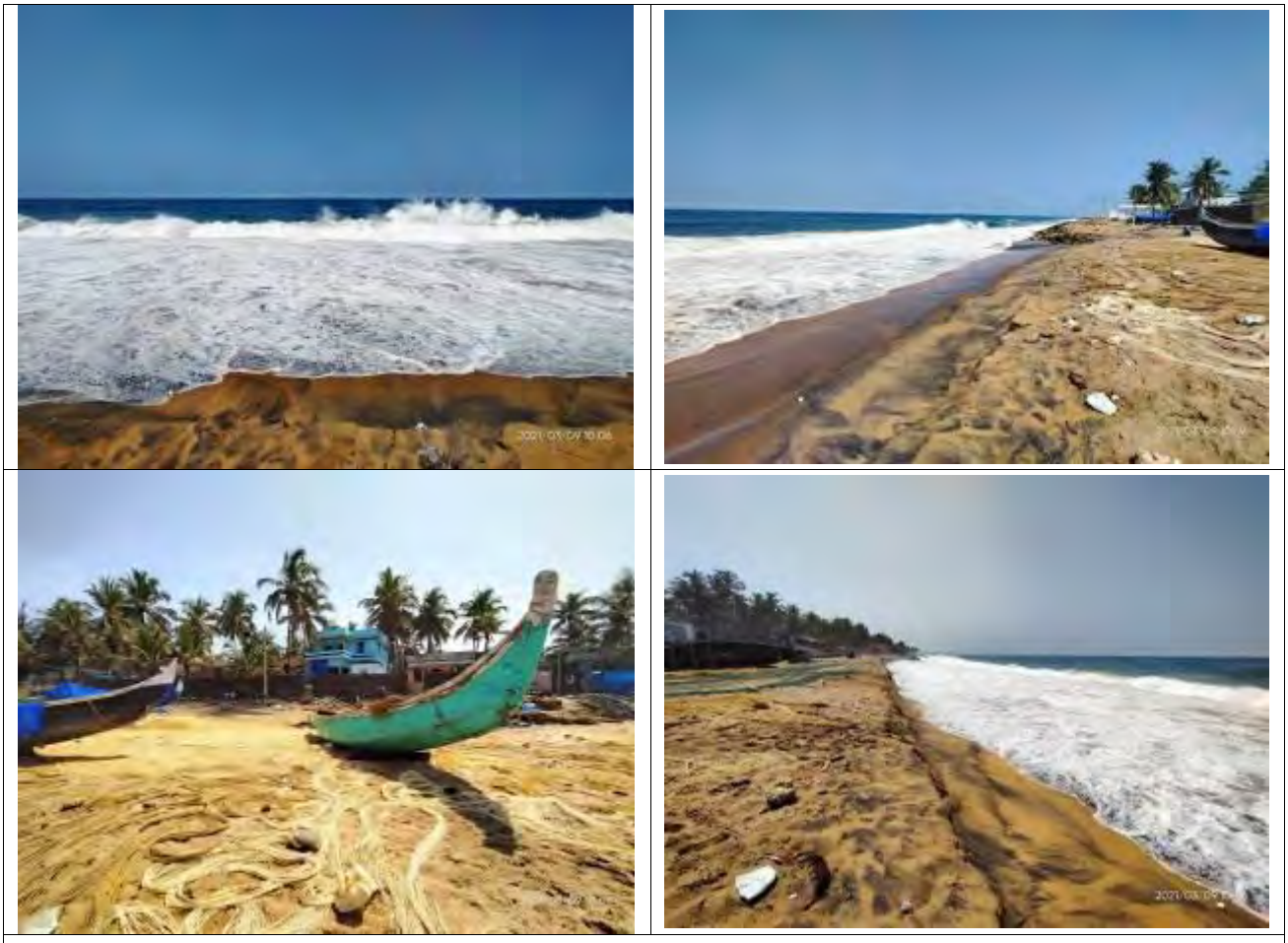


**Figure 62- March CSP 60**

**Figure 63- March CSP 61**

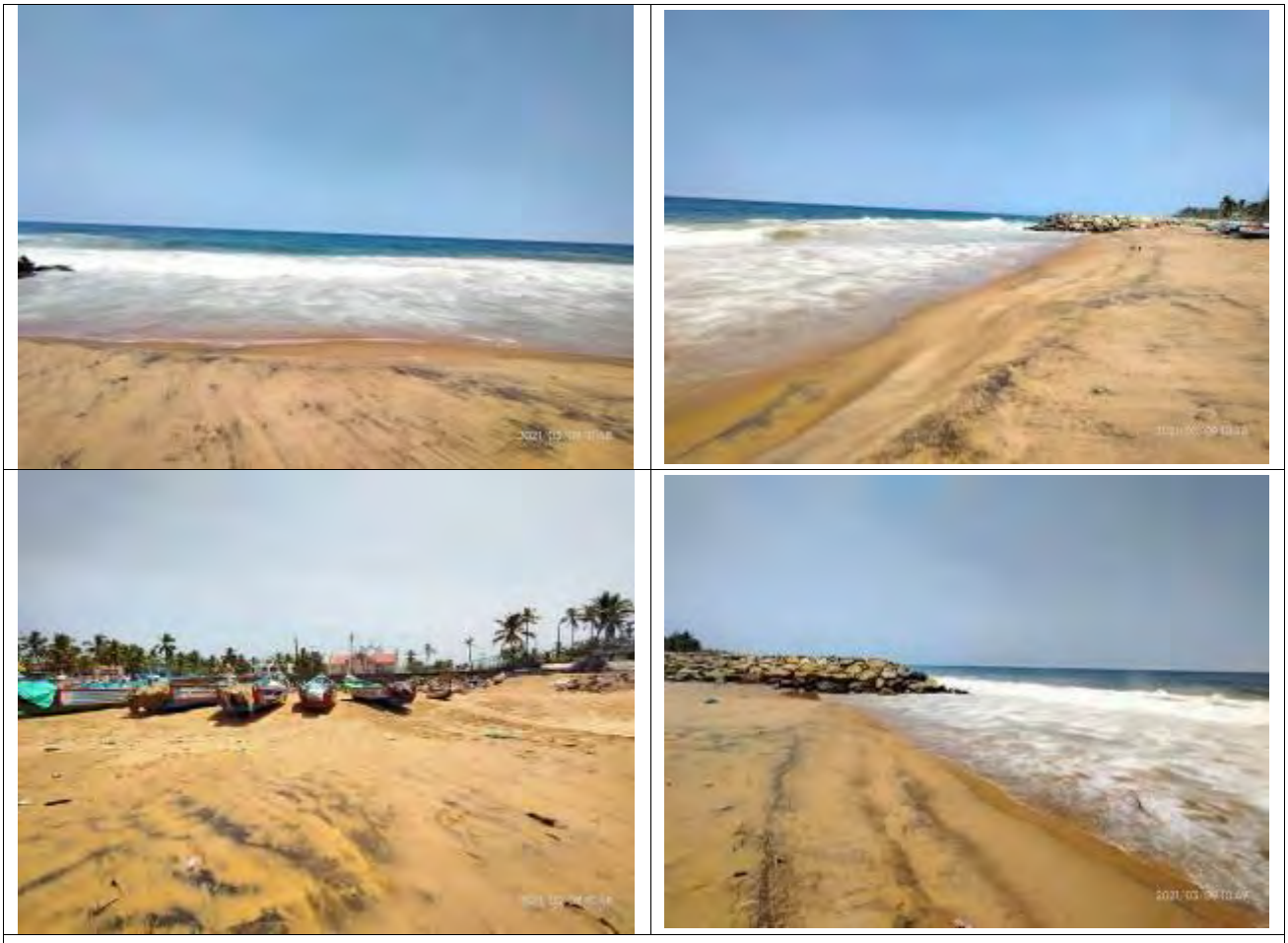
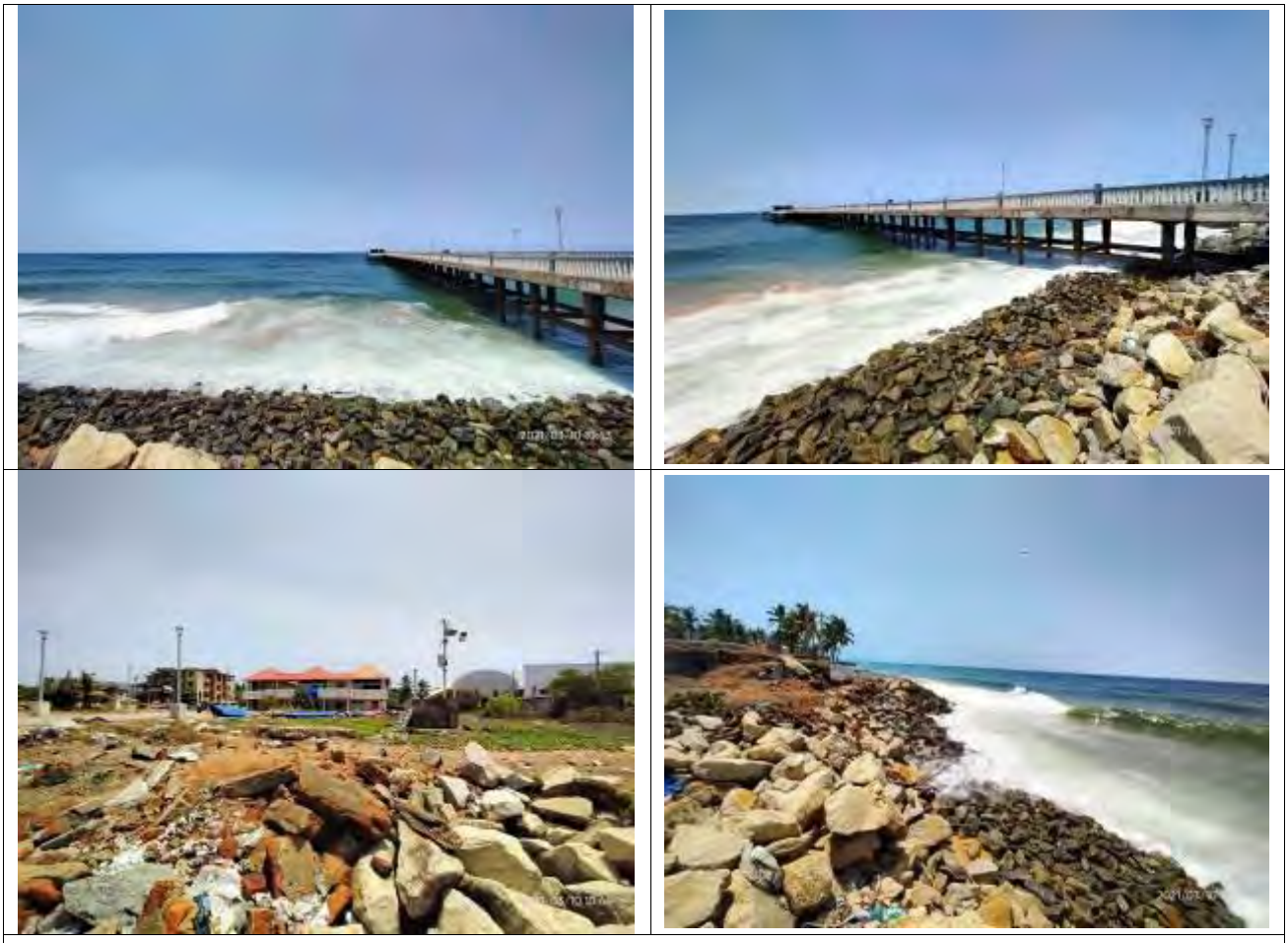


**Figure 64- March CSP 62**

**Figure 65- March CSP 63**



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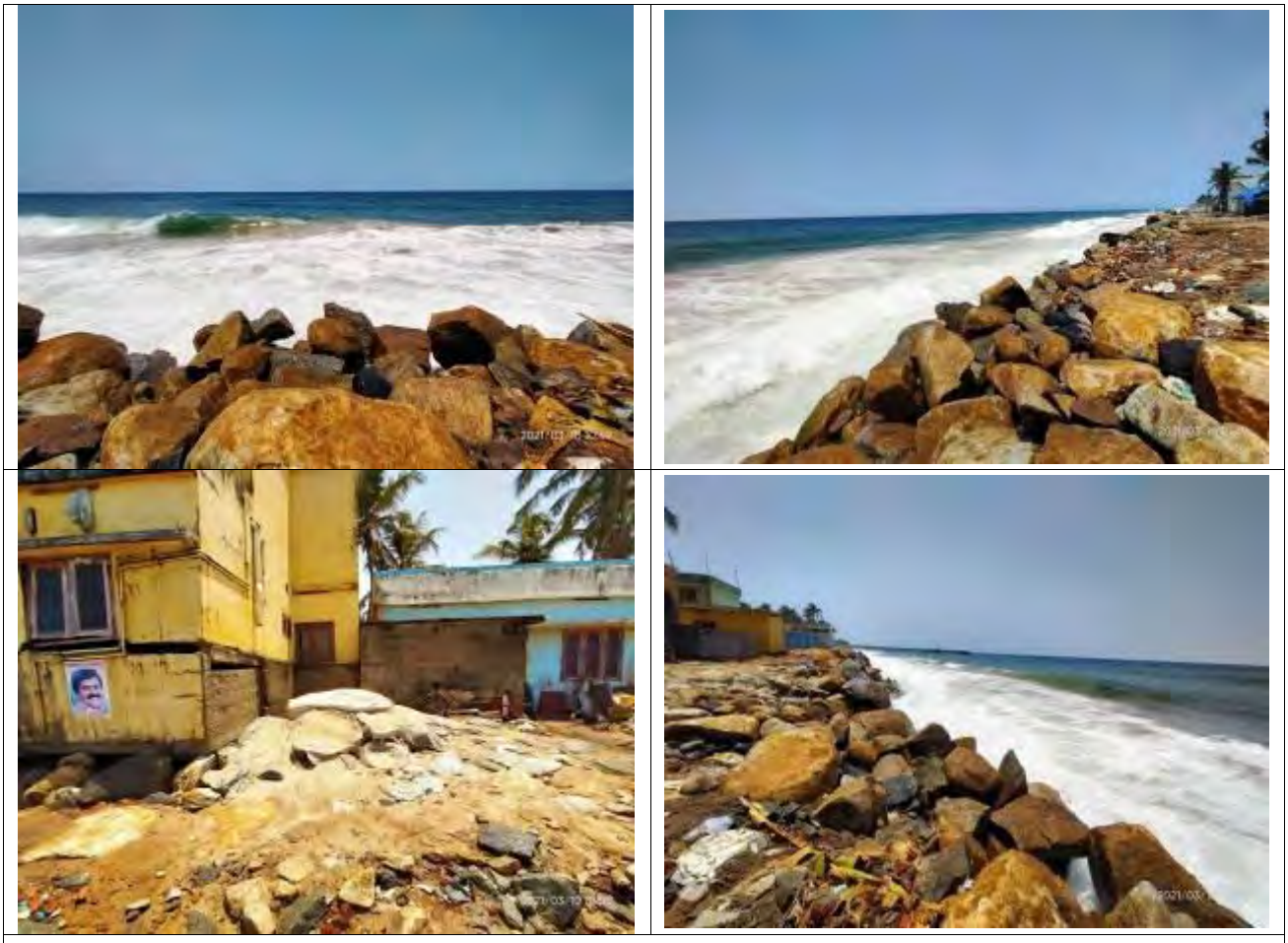


**Figure 67- March CSP 65**

**Figure 68- March CSP 66**

**Figure 69- March CSP 67**

**Figure 70- March CSP 68**

**Figure 71- March CSP 69**

**Figure 72- March CSP 70**

**Figure 73- March CSP 71**

**Figure 74- March CSP 72**

**Figure 75- March CSP 73**

**Figure 76- March CSP 74**

**Figure 77- March CSP 75**

**Figure 78- March CSP 76**

**Figure 79- March CSP 77**

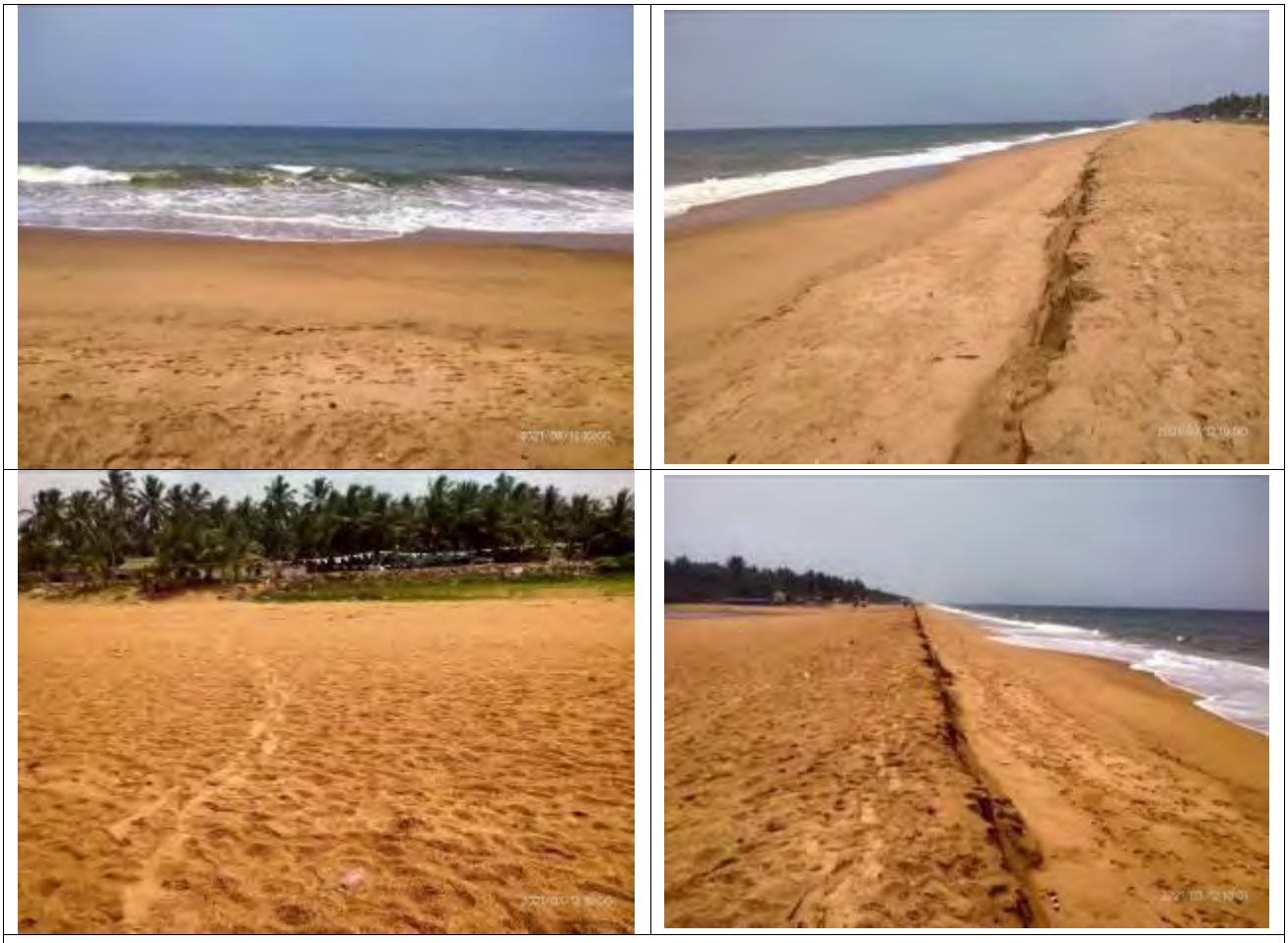


**Figure 80- March CSP 78**

**Figure 81- March CSP 79**

**Figure 82- March CSP 80**

**Figure 83- March CSP 81**

# Annexure II

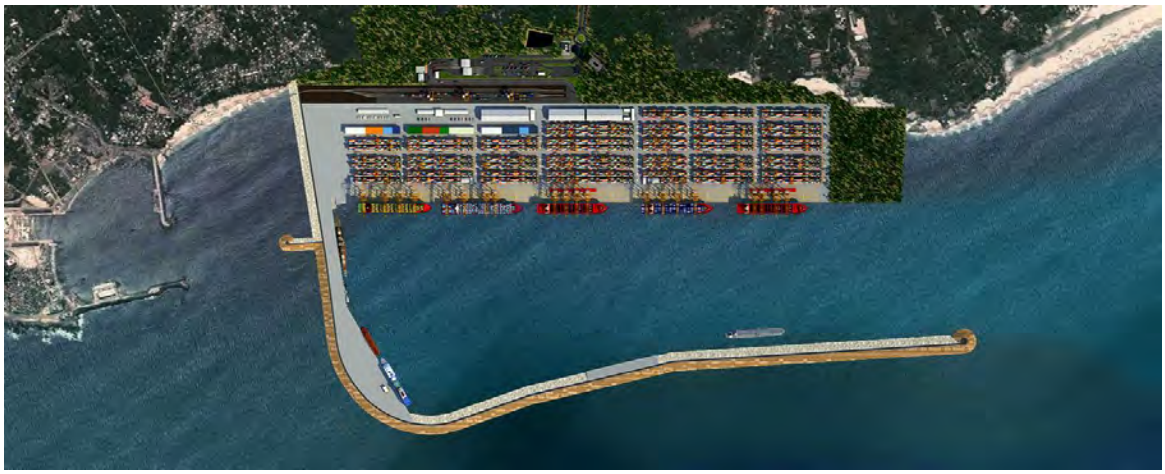
# Environment Monitoring Report

# (October 2020 to March 2021)

# HALF YEARLY ENVIRONMENT MONITORING REPORT

**For the period**

## October 2020 to March 2021



# Adani Vizhinjam Port Pvt. Ltd.

**Vizhinjam, Kerala**

## CONTENTS

# 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 with affiliates established all over India and overseas. AEC 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 is at Nashik, Maharashtra. The strength of the organization is the years of hard work, dedication and contribution made by the staff who are experts in their respective fields and they produce innovative ideas for the growth of the organization.

AEC has made itself capable of testing of water, waste water, air, noise monitoring, hazardous and non-hazardous waste testing, fuel, food and agriculture testing. The state-of-art Laboratory set-up of AEC for Chemical, Biological and Mechanical Testing is at Nashik. The Laboratory is accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) in accordance with ISO/IEC 17025:2017 in the Chemical, Biological and Mechanical Testing disciplines (Certificate number: TC-5509). The Laboratory is recognized by the Ministry of Environment, Forests & Climate Change (MoEF&CC), Govt. of India (GoI), New Delhi under Environment (Protection) Act, 1986. AEC is also ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 certified organization.

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

AEC has been 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 mentioned service order, viz. Ambient Air Monitoring (twice in a week), Ambient Noise Monitoring (fortnightly), Marine Ecological Survey including

marine water, sediment, phytoplankton and zooplankton analysis (monthly), Ground Water and Surface Water Analysis (monthly), Soil Analysis (yearly).

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 conditions mentioned in service order.

This present report is the consolidated half yearly report over the six month period of October 2020 to March 2021.

# 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 as 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 and 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 samples, appropriate preservation techniques with respect to parameters analysed are followed and samples are transported with due care to the laboratory.

## 2. Chain of Custody:

First, after receiving the samples at the laboratory, assigning Sample ID is a very systematic and methodical way of representing sample identification. 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 on which the analysis was started and date on 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. 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 the 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 $\leq 2$.
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: Incharge Sampling | Yes | |

**Note:** It is not necessary that this form be filled for 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: Executive-Customer Support | | |

**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: Technical Manager | | |

**Note:** It is not necessary that this form be filled for 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 | |
| Has the preservative has been added after sampling or preserved as per sampling/ Test method? | Yes | |
| Are proper storage conditions maintained? | Yes | |
| Is the sample quantity is adequate? | Yes | |
| Is sample properly identified? | Yes | |
| Is proper type of container used? | Yes | |
| Checked By: Incharge Sampling | | |

**Note:** It is not necessary that this form be filled for 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 |
|---|---|---|
| Are 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 for 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 samples. 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 October 2020 to March 2021.

**Table 3.1: Ambient Air Quality Monitoring Locations**

| Sr. No. | Location | Latitude | Longitude |
|---|---|---|---|
| 1. | Venganoor | 80,23',55.10"N | 770,00',11.30"E |
| 2. | Proposed Port Estate Area | 80,22',13.46"N | 770,00',08.25"E |
| 3. | Port Site | 80,22',41.47"N | 770,01',02.94"E |
| 4. | Chani | 80,20',56.86"N | 770,03',16.19"E |
| 5. | Balaramapuram | 80,25',37.60"N | 770,02',43.80"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/$m^3$ | 1.0 | By portable CO meter |
| 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), mg/$m^3$ | 8 h | 02 | 02 |
| | | 1 h | 04 | 04 |
| 6. | Hydrocarbon (HC), ppm | - | - | - |

## 4. Ambient Air Quality Monitoring Results for the period October 2020 to March 2021:

**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 |
| 01.10.2020 | 36 | 10 | <4.0 | <6.5 | <1 | <1 |
| 05.10.2020 | 35 | 14 | <4.0 | <6.5 | <1 | <1 |
| 08.10.2020 | 40 | 10 | <4.0 | <6.5 | <1 | <1 |
| 12.10.2020 | 52 | 12 | <4.0 | 6.60 | <1 | <1 |
| 15.10.2020 | 46 | 20 | <4.0 | <6.5 | <1 | <1 |
| 19.10.2020 | 58 | 18 | 4.40 | 7.10 | <1 | <1 |
| 22.10.2020 | 56 | 13 | 4.20 | 6.60 | <1 | <1 |
| 26.10.2020 | 60 | 16 | <4.0 | <6.5 | <1 | <1 |
| 29.10.2020 | 60 | 16 | <4.0 | <6.5 | <1 | <1 |
| 02.11.2020 | 65 | 16 | <4.0 | <6.5 | <1 | <1 |
| 05.11.2020 | 62 | 18 | <4.0 | <6.5 | <1 | <1 |
| 09.11.2020 | 38 | 10 | <4.0 | <6.5 | <1 | <1 |
| 12.11.2020 | 58 | 41 | 4.50 | 7.10 | <1 | <1 |
| 16.11.2020 | 44 | 16 | <4.0 | <6.5 | <1 | <1 |
| 19.11.2020 | 56 | 14 | <4.0 | <6.5 | <1 | <1 |
| 23.11.2020 | 62 | 16 | 4.20 | 8.00 | <1 | <1 |
| 26.11.2020 | 60 | 20 | 5.10 | 6.60 | <1 | <1 |
| 30.11.2020 | 65 | 22 | <4.0 | <6.5 | <1 | <1 |
| 03.12.2020 | 48 | 20 | <4.0 | <6.5 | <1 | <1 |
| 07.12.2020 | 30 | 12 | <4.0 | <6.5 | <1 | <1 |
| 10.12.2020 | 48 | 20 | <4.0 | 7.10 | <1 | <1 |
| 14.12.2020 | 50 | 22 | 4.20 | <6.5 | <1 | <1 |
| 17.12.2020 | 47 | 26 | 5.10 | <6.5 | <1 | <1 |
| 21.12.2020 | 51 | 28 | <4.0 | 6.60 | <1 | <1 |

| Date | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_2$ | CO | HC |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 24.12.2020 | 46 | 21 | 4.80 | 6.60 | <1 | <1 |
| 28.12.2020 | 51 | 18 | <4.0 | <6.5 | <1 | <1 |
| 31.12.2020 | 40 | 12 | <4.0 | <6.5 | <1 | <1 |
| 04.01.2021 | 47 | 18 | <4.0 | <6.5 | <1 | <1 |
| 07.01.2021 | 45 | 14 | <4.0 | <6.5 | <1 | <1 |
| 11.01.2021 | 40 | 10 | <4.0 | <6.5 | <1 | <1 |
| 14.01.2021 | 42 | 12 | 4.50 | 8.50 | <1 | <1 |
| 18.01.2021 | 51 | 25 | <4.0 | <6.5 | <1 | <1 |
| 21.01.2021 | 55 | 28 | <4.0 | 7.10 | <1 | <1 |
| 25.01.2021 | 50 | 20 | <4.0 | 7.50 | <1 | <1 |
| 28.01.2021 | 52 | 26 | <4.0 | 8.00 | <1 | <1 |
| 01.02.2021 | 58 | 24 | <4.0 | <6.5 | <1 | <1 |
| 04.02.2021 | 46 | 12 | <4.0 | <6.5 | <1 | <1 |
| 08.02.2021 | 55 | 22 | <4.0 | <6.5 | <1 | <1 |
| 11.02.2021 | 43 | 14 | <4.0 | <6.5 | <1 | <1 |
| 15.02.2021 | 49 | 20 | <4.0 | <6.5 | <1 | <1 |
| 18.02.2021 | 52 | 24 | 4.20 | 7.20 | <1 | <1 |
| 22.02.2021 | 46 | 16 | 4.70 | 7.70 | <1 | <1 |
| 25.02.2021 | 48 | 19 | 4.70 | 8.10 | <1 | <1 |
| 01.03.2021 | 56 | 20 | <4.0 | <6.5 | <1 | <1 |
| 04.03.2021 | 48 | 16 | <4.0 | <6.5 | <1 | <1 |
| 08.03.2021 | 53 | 22 | <4.0 | 6.80 | <1 | <1 |
| 11.03.2021 | 50 | 20 | 5.60 | 8.10 | <1 | <1 |
| 15.03.2021 | 46 | 18 | <4.0 | 6.80 | <1 | <1 |
| 18.03.2021 | 58 | 24 | 4.20 | 7.20 | <1 | <1 |
| 22.03.2021 | 60 | 26 | 5.00 | 8.10 | <1 | <1 |
| 25.03.2021 | 54 | 20 | 4.40 | 7.20 | <1 | <1 |

| Date | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_2$ | CO | HC |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 29.03.2021 | 56 | 24 | 4.20 | 7.80 | <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 |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 01.10.2020 | 42 | 12 | <4.0 | <6.5 | <1 | <1 |
| 05.10.2020 | 34 | 18 | <4.0 | <6.5 | <1 | <1 |
| 08.10.2020 | 42 | 16 | <4.0 | <6.5 | <1 | <1 |
| 12.10.2020 | 46 | 16 | 4.20 | 7.10 | <1 | <1 |
| 15.10.2020 | 54 | 18 | <4.0 | <6.5 | <1 | <1 |
| 19.10.2020 | 62 | 24 | 4.50 | 7.10 | <1 | <1 |
| 22.10.2020 | 54 | 18 | 4.80 | 6.60 | <1 | <1 |
| 26.10.2020 | 66 | 16 | <4.0 | <6.5 | <1 | <1 |
| 29.10.2020 | 64 | 16 | <4.0 | <6.5 | <1 | <1 |
| 02.11.2020 | 80 | 24 | 4.20 | 7.10 | <1 | <1 |
| 05.11.2020 | 78 | 22 | 4.50 | 8.00 | <1 | <1 |
| 09.11.2020 | 40 | 12 | <4.0 | <6.5 | <1 | <1 |
| 12.11.2020 | 44 | 16 | 4.80 | 8.50 | <1 | <1 |
| 16.11.2020 | 48 | 22 | <4.0 | <6.5 | <1 | <1 |
| 19.11.2020 | 54 | 14 | <4.0 | <6.5 | <1 | <1 |
| 23.11.2020 | 80 | 20 | 5.10 | 8.50 | <1 | <1 |
| 26.11.2020 | 75 | 18 | 4.20 | 7.50 | <1 | <1 |
| 30.11.2020 | 81 | 51 | 5.10 | 7.50 | <1 | <1 |
| 03.12.2020 | 46 | 22 | <4.0 | <6.5 | <1 | <1 |

| Date | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_2$ | CO | HC |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 07.12.2020 | 32 | 14 | <4.0 | <6.5 | <1 | <1 |
| 10.12.2020 | 46 | 23 | <4.0 | 6.60 | <1 | <1 |
| 14.12.2020 | 52 | 18 | 4.50 | <6.5 | <1 | <1 |
| 17.12.2020 | 40 | 20 | 5.10 | <6.5 | <1 | <1 |
| 21.12.2020 | 60 | 24 | <4.0 | <6.5 | <1 | <1 |
| 24.12.2020 | 42 | 18 | <4.0 | <6.5 | <1 | <1 |
| 28.12.2020 | 46 | 14 | <4.0 | <6.5 | <1 | <1 |
| 31.12.2020 | 38 | 12 | 4.20 | 6.60 | <1 | <1 |
| 04.01.2021 | 48 | 22 | <4.0 | <6.5 | <1 | <1 |
| 07.01.2021 | 44 | 12 | <4.0 | <6.5 | <1 | <1 |
| 11.01.2021 | 42 | 8 | <4.0 | <6.5 | <1 | <1 |
| 14.01.2021 | 40 | 11 | 5.10 | 8.00 | <1 | <1 |
| 18.01.2021 | 54 | 22 | <4.0 | <6.5 | <1 | <1 |
| 21.01.2021 | 52 | 26 | 4.50 | 6.60 | <1 | <1 |
| 25.01.2021 | 55 | 28 | 5.10 | 7.10 | <1 | <1 |
| 28.01.2021 | 56 | 30 | 5.40 | 7.50 | <1 | <1 |
| 01.02.2021 | 62 | 24 | <4.0 | <6.5 | <1 | <1 |
| 04.02.2021 | 52 | 22 | <4.0 | <6.5 | <1 | <1 |
| 08.02.2021 | 48 | 16 | <4.0 | <6.5 | <1 | <1 |
| 11.02.2021 | 50 | 18 | <4.0 | <6.5 | <1 | <1 |
| 15.02.2021 | 52 | 20 | <4.0 | <6.5 | <1 | <1 |
| 18.02.2021 | 60 | 22 | 4.20 | 6.80 | <1 | <1 |
| 22.02.2021 | 56 | 20 | <4.0 | <6.5 | <1 | <1 |
| 25.02.2021 | 58 | 24 | 4.20 | 7.20 | <1 | <1 |
| 01.03.2021 | 58 | 24 | <4.0 | <6.5 | <1 | <1 |
| 04.03.2021 | 54 | 20 | <4.0 | <6.5 | <1 | <1 |
| 08.03.2021 | 50 | 18 | <4.0 | <6.5 | <1 | <1 |

| Date | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_2$ | CO | HC |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 11.03.2021 | 52 | 22 | <4.0 | 6.8 | <1 | <1 |
| 15.03.2021 | 50 | 18 | <4.0 | 6.8 | <1 | <1 |
| 18.03.2021 | 62 | 26 | 4.2 | 7 | <1 | <1 |
| 22.03.2021 | 68 | 28 | 4.5 | 7.2 | <1 | <1 |
| 25.03.2021 | 60 | 20 | 4.2 | 7 | <1 | <1 |
| 29.03.2021 | 58 | 16 | 4.2 | 6.8 | <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 |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 01.10.2020 | 37 | 10 | <4.0 | <6.5 | <1 | <1 |
| 05.10.2020 | 36 | 16 | <4.0 | <6.5 | <1 | <1 |
| 08.10.2020 | 38 | 10 | <4.0 | <6.5 | <1 | <1 |
| 12.10.2020 | 42 | 16 | <4.0 | 7.10 | <1 | <1 |
| 15.10.2020 | 47 | 17 | <4.0 | <6.5 | <1 | <1 |
| 19.10.2020 | 59 | 24 | 4.40 | 7.10 | <1 | <1 |
| 22.10.2020 | 53 | 17 | 4.20 | 6.60 | <1 | <1 |
| 26.10.2020 | 60 | 16 | <4.0 | <6.5 | <1 | <1 |
| 29.10.2020 | 62 | 18 | <4.0 | <6.5 | <1 | <1 |
| 02.11.2020 | 82 | 23 | <4.0 | <6.5 | <1 | <1 |
| 05.11.2020 | 85 | 20 | 4.50 | 6.60 | <1 | <1 |
| 09.11.2020 | 32 | 10 | <4.0 | <6.5 | <1 | <1 |
| 12.11.2020 | 84 | 24 | 4.80 | 7.50 | <1 | <1 |
| 16.11.2020 | 40 | 12 | <4.0 | <6.5 | <1 | <1 |
| 19.11.2020 | 44 | 18 | 4.20 | 6.60 | <1 | <1 |
| 23.11.2020 | 80 | 25 | 5.10 | 7.80 | <1 | <1 |
| 26.11.2020 | 83 | 20 | <4.0 | <6.5 | <1 | <1 |

| Date | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_2$ | CO | HC |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 30.11.2020 | 78 | 24 | 4.50 | 8.00 | <1 | <1 |
| 03.12.2020 | 80 | 30 | 7.9 | 12.7 | 1.1 | <1 |
| 07.12.2020 | 72 | 24 | 8.2 | 13.2 | 1.2 | <1 |
| 10.12.2020 | 68 | 22 | 9 | 14.1 | 1.14 | <1 |
| 14.12.2020 | 91 | 41 | 8.2 | 13.7 | 1.16 | <1 |
| 17.12.2020 | 78 | 32 | 7.1 | 13.7 | <1 | <1 |
| 21.12.2020 | 84 | 40 | 8.2 | 14.1 | 1.04 | <1 |
| 24.12.2020 | 76 | 38 | 10.2 | 14.6 | <1 | <1 |
| 28.12.2020 | 89 | 52 | 7.3 | 14.6 | 1.03 | <1 |
| 31.12.2020 | 82 | 34 | 4.5 | 8 | <1 | <1 |
| 04.01.2021 | 78 | 30 | 7.60 | 10.40 | <1 | <1 |
| 07.01.2021 | 69 | 20 | 7.90 | 11.30 | <1 | <1 |
| 11.01.2021 | 65 | 26 | 8.70 | 12.30 | <1 | <1 |
| 14.01.2021 | 85 | 38 | 8.20 | 11.80 | <1 | <1 |
| 18.01.2021 | 74 | 32 | 7.90 | 11.80 | <1 | <1 |
| 21.01.2021 | 82 | 36 | 7.60 | 12.70 | <1 | <1 |
| 25.01.2021 | 74 | 34 | 8.20 | 13.20 | <1 | <1 |
| 28.01.2021 | 84 | 49 | 7.10 | 13.20 | <1 | <1 |
| 01.02.2021 | 74 | 24 | 5.10 | 6.60 | <1 | <1 |
| 04.02.2021 | 80 | 28 | 5.90 | 7.60 | <1 | <1 |
| 08.02.2021 | 79 | 26 | 5.90 | 8.00 | <1 | <1 |
| 11.02.2021 | 91 | 32 | 6.10 | 6.80 | <1 | <1 |
| 15.02.2021 | 88 | 28 | 7.20 | 8.10 | <1 | <1 |
| 18.02.2021 | 90 | 34 | 7.50 | 8.10 | <1 | <1 |
| 22.02.2021 | 89 | 26 | 6.40 | 7.70 | <1 | <1 |
| 25.02.2021 | 92 | 30 | 6.70 | 8.10 | <1 | <1 |
| 01.03.2021 | 80 | 26 | 5.30 | 6.80 | <1 | <1 |
| 04.03.2021 | 92 | 34 | 5.60 | 7.20 | <1 | <1 |
| 08.03.2021 | 90 | 32 | 5.30 | 7.70 | <1 | <1 |
| 11.03.2021 | 89 | 30 | 7.20 | 8.90 | <1 | <1 |
| 15.03.2021 | 84 | 28 | 7.00 | 8.50 | <1 | <1 |

| Date | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_2$ | CO | HC |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 18.03.2021 | 80 | 25 | 7.20 | 8.10 | <1 | <1 |
| 22.03.2021 | 78 | 22 | 7.00 | 9.40 | <1 | <1 |
| 25.03.2021 | 85 | 30 | 6.40 | 8.00 | <1 | <1 |
| 29.03.2021 | 82 | 29 | 7.00 | 8.90 | <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 |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 01.10.2020 | 38 | 11 | <4.0 | <6.5 | <1 | <1 |
| 05.10.2020 | 50 | 12 | <4.0 | <6.5 | <1 | <1 |
| 08.10.2020 | 45 | 10 | <4.0 | <6.5 | <1 | <1 |
| 12.10.2020 | 58 | 16 | 4.20 | 7.10 | <1 | <1 |
| 15.10.2020 | 39 | 18 | <4.0 | <6.5 | <1 | <1 |
| 19.10.2020 | 68 | 19 | 5.10 | 7.10 | <1 | <1 |
| 22.10.2020 | 56 | 12 | 4.80 | 7.10 | <1 | <1 |
| 26.10.2020 | 68 | 16 | <4.0 | <6.5 | <1 | <1 |
| 29.10.2020 | 65 | 16 | <4.0 | <6.5 | <1 | <1 |
| 02.11.2020 | 83 | 20 | <4.0 | <6.5 | <1 | <1 |
| 05.11.2020 | 65 | 22 | 4.20 | 6.60 | <1 | <1 |
| 09.11.2020 | 78 | 24 | 4.50 | 7.10 | <1 | <1 |
| 12.11.2020 | 70 | 16 | <4.0 | <6.5 | <1 | <1 |
| 16.11.2020 | 34 | 14 | <4.0 | <6.5 | <1 | <1 |
| 19.11.2020 | 60 | 12 | <4.0 | <6.5 | <1 | <1 |
| 23.11.2020 | 81 | 24 | 4.50 | 8.00 | <1 | <1 |
| 26.11.2020 | 83 | 24 | 4.80 | 8.50 | <1 | <1 |
| 30.11.2020 | 80 | 20 | <4.0 | <6.5 | <1 | <1 |
| 03.12.2020 | 46 | 18 | <4.0 | <6.5 | <1 | <1 |
| 07.12.2020 | 32 | 10 | <4.0 | <6.5 | <1 | <1 |

| Date | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_2$ | CO | HC |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 10.12.2020 | 44 | 16 | <4.0 | 7.10 | <1 | <1 |
| 14.12.2020 | 52 | 20 | 4.50 | <6.5 | <1 | <1 |
| 17.12.2020 | 38 | 14 | <4.0 | <6.5 | <1 | <1 |
| 21.12.2020 | 68 | 24 | <4.0 | 6.60 | <1 | <1 |
| 24.12.2020 | 56 | 22 | 4.50 | 6.60 | <1 | <1 |
| 28.12.2020 | 52 | 20 | 4.60 | 7.20 | <1 | <1 |
| 31.12.2020 | 36 | 10 | <4.0 | <6.5 | <1 | <1 |
| 04.01.2021 | 42 | 10 | <4.0 | <6.5 | <1 | <1 |
| 07.01.2021 | 34 | 14 | <4.0 | <6.5 | <1 | <1 |
| 11.01.2021 | 42 | 14 | <4.0 | <6.5 | <1 | <1 |
| 14.01.2021 | 48 | 20 | 4.50 | <6.5 | <1 | <1 |
| 18.01.2021 | 36 | 14 | <4.0 | <6.5 | <1 | <1 |
| 21.01.2021 | 64 | 20 | <4.0 | <6.5 | <1 | <1 |
| 25.01.2021 | 52 | 18 | <4.0 | <6.5 | <1 | <1 |
| 28.01.2021 | 50 | 16 | <4.0 | <6.5 | <1 | <1 |
| 01.02.2021 | 42 | 14 | <4.0 | <6.5 | <1 | <1 |
| 04.02.2021 | 50 | 16 | <4.0 | <6.5 | <1 | <1 |
| 08.02.2021 | 55 | 18 | <4.0 | <6.5 | <1 | <1 |
| 11.02.2021 | 46 | 15 | 4.70 | <6.5 | <1 | <1 |
| 15.02.2021 | 58 | 20 | <4.0 | <6.5 | <1 | <1 |
| 18.02.2021 | 60 | 21 | <4.0 | <6.5 | <1 | <1 |
| 22.02.2021 | 48 | 10 | <4.0 | <6.5 | <1 | <1 |
| 25.02.2021 | 50 | 14 | <4.0 | <6.5 | <1 | <1 |
| 01.03.2021 | 40 | 12 | <4.0 | <6.5 | <1 | <1 |
| 04.03.2021 | 48 | 14 | <4.0 | <6.5 | <1 | <1 |
| 08.03.2021 | 52 | 18 | 4.20 | 6.80 | <1 | <1 |
| 11.03.2021 | 66 | 24 | 4.40 | 7.20 | <1 | <1 |
| 15.03.2021 | 56 | 20 | <4.0 | <6.5 | <1 | <1 |
| 18.03.2021 | 62 | 22 | 4.20 | 6.80 | <1 | <1 |
| 22.03.2021 | 50 | 16 | 4.50 | 7.70 | <1 | <1 |
| 25.03.2021 | 53 | 18 | 4.20 | 8.00 | <1 | <1 |

| Date | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_2$ | CO | HC |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 29.03.2021 | 50 | 14 | <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 |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 01.10.2020 | 38 | 10 | <4.0 | <6.5 | <1 | <1 |
| 05.10.2020 | 39 | 16 | <4.0 | <6.5 | <1 | <1 |
| 08.10.2020 | 48 | 12 | <4.0 | <6.5 | <1 | <1 |
| 12.10.2020 | 50 | 19 | <4.0 | <6.5 | <1 | <1 |
| 15.10.2020 | 64 | 12 | <4.0 | <6.5 | <1 | <1 |
| 19.10.2020 | 66 | 16 | 5.10 | 6.60 | <1 | <1 |
| 22.10.2020 | 54 | 10 | 4.20 | <6.5 | <1 | <1 |
| 26.10.2020 | 52 | 21 | <4.0 | <6.5 | <1 | <1 |
| 29.10.2020 | 50 | 20 | <4.0 | <6.5 | <1 | <1 |
| 02.11.2020 | 80 | 20 | 4.50 | 7.50 | <1 | <1 |
| 05.11.2020 | 82 | 22 | 4.20 | 7.10 | <1 | <1 |
| 09.11.2020 | 42 | 10 | <4.0 | <6.5 | <1 | <1 |
| 12.11.2020 | 85 | 25 | 5.10 | 7.50 | <1 | <1 |
| 16.11.2020 | 55 | 12 | <4.0 | <6.5 | <1 | <1 |
| 19.11.2020 | 58 | 14 | <4.0 | <6.5 | <1 | <1 |
| 23.11.2020 | 82 | 24 | 4.80 | 7.10 | <1 | <1 |
| 26.11.2020 | 78 | 20 | 4.80 | 7.50 | <1 | <1 |
| 30.11.2020 | 80 | 22 | 4.20 | 8.00 | <1 | <1 |
| 03.12.2020 | 56 | 28 | 7.60 | 13.20 | 1.2 | <1 |
| 07.12.2020 | 32 | 16 | 7.90 | 12.70 | 1.3 | <1 |
| 10.12.2020 | 50 | 25 | 9.60 | 14.60 | 1.12 | <1 |
| 14.12.2020 | 66 | 31 | 8.20 | 14.10 | 1.18 | <1 |
| 17.12.2020 | 47 | 23 | 7.10 | 14.10 | <1 | <1 |

| Date | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_2$ | CO | HC |
| | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $mg/m^3$ | ppm |
| 21.12.2020 | 87 | 36 | 9.00 | 14.60 | 1.01 | <1 |
| 24.12.2020 | 60 | 30 | 9.00 | 14.60 | <1 | <1 |
| 28.12.2020 | 85 | 34 | 7.90 | 15.10 | 1.03 | <1 |
| 31.12.2020 | 38 | 11 | <4.0 | <6.5 | <1 | <1 |
| 04.01.2021 | 50 | 28 | 4.50 | 8.00 | <1 | <1 |
| 07.01.2021 | 52 | 30 | 5.10 | 6.60 | <1 | <1 |
| 11.01.2021 | 49 | 27 | 4.50 | 7.10 | <1 | <1 |
| 14.01.2021 | 48 | 24 | 4.80 | 7.10 | <1 | <1 |
| 18.01.2021 | 55 | 32 | 5.10 | 8.50 | <1 | <1 |
| 21.01.2021 | 56 | 34 | 5.10 | 7.50 | <1 | <1 |
| 25.01.2021 | 54 | 32 | 5.40 | 7.10 | <1 | <1 |
| 28.01.2021 | 60 | 36 | 5.60 | 8.50 | <1 | <1 |
| 01.02.2021 | 62 | 26 | 4.50 | 8.00 | <1 | <1 |
| 04.02.2021 | 50 | 20 | 5.10 | 6.60 | <1 | <1 |
| 08.02.2021 | 70 | 30 | 4.80 | 7.10 | <1 | <1 |
| 11.02.2021 | 46 | 18 | 4.70 | 7.20 | <1 | <1 |
| 15.02.2021 | 68 | 28 | 5.30 | 8.10 | <1 | <1 |
| 18.02.2021 | 54 | 24 | 5.00 | 7.20 | <1 | <1 |
| 22.02.2021 | 56 | 25 | 4.70 | 7.20 | <1 | <1 |
| 25.02.2021 | 58 | 26 | 5.30 | 6.80 | <1 | <1 |
| 01.03.2021 | 60 | 24 | 5.00 | 6.80 | <1 | <1 |
| 04.03.2021 | 52 | 22 | 5.30 | 8.50 | <1 | <1 |
| 08.03.2021 | 72 | 32 | 5.30 | 7.20 | <1 | <1 |
| 11.03.2021 | 51 | 20 | 4.40 | 7.70 | <1 | <1 |
| 15.03.2021 | 66 | 26 | 5.00 | 9.40 | <1 | <1 |
| 18.03.2021 | 72 | 30 | 5.00 | 7.70 | <1 | <1 |
| 22.03.2021 | 65 | 28 | 4.70 | 8.10 | <1 | <1 |
| 25.03.2021 | 74 | 34 | 5.00 | 8.10 | <1 | <1 |
| 29.03.2021 | 70 | 30 | 4.20 | 7.70 | <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 $PM_{10}$, µg/ $m^3$ | 100 | Oct-2020 | 49 | 52 | 48 | 54 | 51 |
| | | Nov-2020 | 57 | 64 | 68 | 70 | 71 |
| | | Dec-2020 | 46 | 45 | 80 | 47 | 58 |
| | | Jan-2021 | 48 | 49 | 76 | 46 | 53 |
| | | Feb-2021 | 50 | 55 | 85 | 51 | 58 |
| | | Mar-2021 | 53 | 57 | 84 | 53 | 65 |
| Particulate matter (size less than 2.5µm) or $PM_{2.5}$, µg/ $m^3$ | 60 | Oct-2020 | 14 | 17 | 16 | 14 | 15 |
| | | Nov-2020 | 19 | 22 | 20 | 20 | 19 |
| | | Dec-2020 | 20 | 18 | 35 | 17 | 26 |
| | | Jan-2021 | 19 | 20 | 33 | 16 | 30 |
| | | Feb-2021 | 19 | 21 | 29 | 16 | 25 |
| | | Mar-2021 | 21 | 21 | 28 | 18 | 27 |
| Sulphur dioxide ($SO_2$), µg/$m^3$ | 80 | Oct-2020 | 4.30 | 4.50 | 4.30 | 4.70 | 4.65 |
| | | Nov-2020 | 4.60 | 4.65 | 4.62 | 4.50 | 4.60 |
| | | Dec-2020 | 4.70 | 4.60 | 7.84 | 4.53 | 8.29 |
| | | Jan-2021 | 4.50 | 5.03 | 7.90 | 4.50 | 5.01 |
| | | Feb-2021 | 4.53 | 4.20 | 6.35 | 4.70 | 4.93 |
| | | Mar-2021 | 4.68 | 4.28 | 6.44 | 4.30 | 4.88 |
| Nitrogen Dioxide ($NO_2$), µg/ $m^3$ | 80 | Oct-2020 | 6.77 | 6.93 | 6.93 | 7.10 | 6.60 |
| | | Nov-2020 | 7.23 | 7.85 | 7.30 | 7.55 | 7.45 |
| | | Dec-2020 | 6.77 | 6.60 | 13.19 | 6.88 | 14.13 |
| | | Jan-2021 | 7.78 | 7.30 | 12.09 | <6.5 | 7.55 |
| | | Feb-2021 | 7.67 | 7.00 | 7.63 | <6.5 | 7.28 |
| | | Mar-2021 | 7.43 | 6.93 | 8.17 | 7.30 | 7.91 |
| Carbon Monoxide (CO), µg/$m^3$ | 4 | Oct-2020 | <1 | <1 | <1 | <1 | <1 |
| | | Nov-2020 | <1 | <1 | <1 | <1 | <1 |
| | | Dec-2020 | <1 | <1 | <1 | <1 | <1 |
| | | Jan-2021 | <1 | <1 | <1 | <1 | <1 |
| | | Feb-2021 | <1 | <1 | <1 | <1 | <1 |
| | | Mar-2021 | <1 | <1 | <1 | <1 | <1 |

| Parameter | NAAQS 2009 | Month | Venganoor | Proposed Port Estate Area | Port Site | Chani | Balaramapuram |
|---|---|---|---|---|---|---|---|
| Hydrocarbon (HC), ppm | - | Oct-2020 | <1 | <1 | <1 | <1 | <1 |
| | | Nov-2020 | <1 | <1 | <1 | <1 | <1 |
| | | Dec-2020 | <1 | <1 | <1 | <1 | <1 |
| | | Jan-2021 | <1 | <1 | <1 | <1 | <1 |
| | | Feb-2021 | <1 | <1 | <1 | <1 | <1 |
| | | Mar-2021 | <1 | <1 | <1 | <1 | <1 |

## 6. Graphical representation of Results

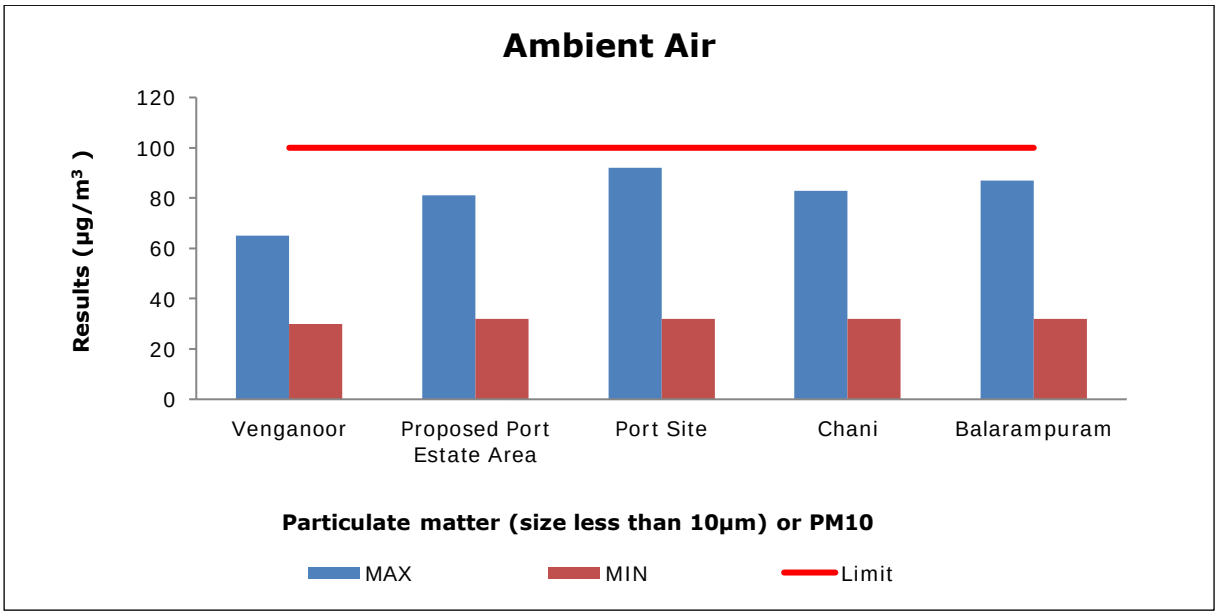



**Figure 3.2: Particulate matter (size less than 10µm) ($PM_{10}$)**

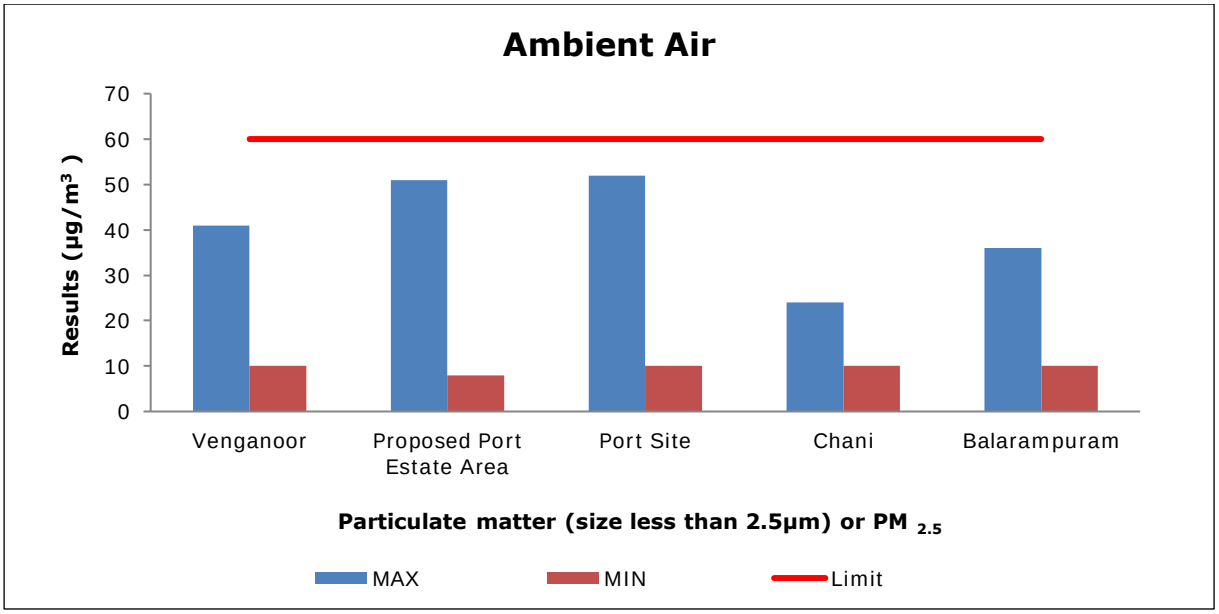



**Figure 3.3: Particulate matter (size less than 2.5µm) ($PM_{2.5}$)**

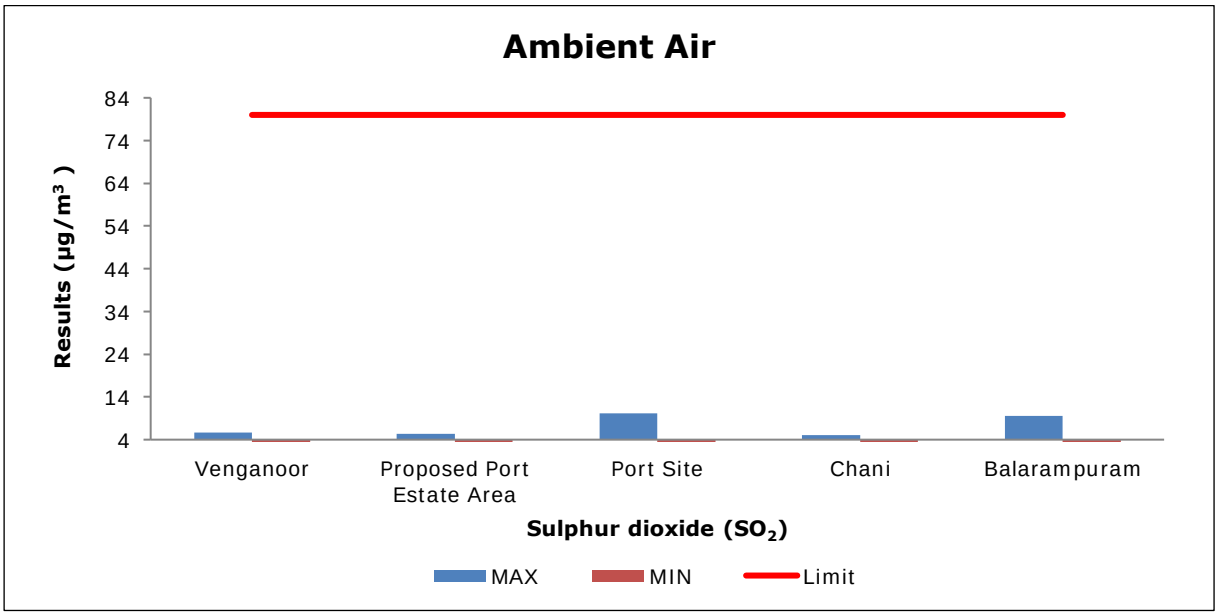



**Figure 3.4: Sulphur dioxide ($SO_2$)**

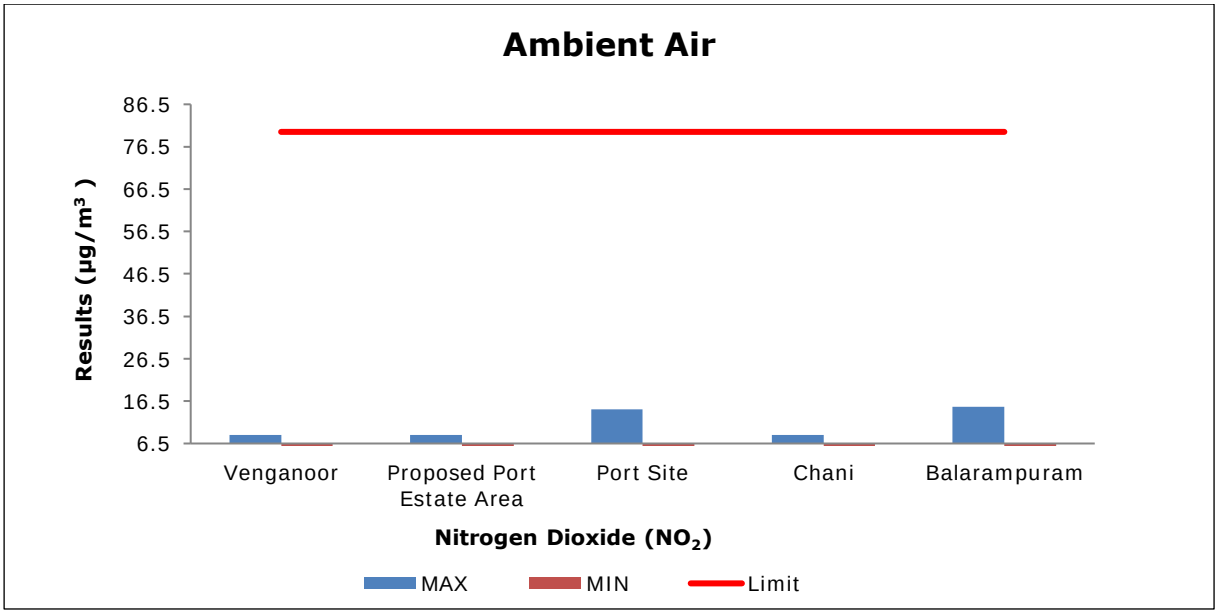



**Figure 3.5: Nitrogen Dioxide ($NO_2$)**

## 7. Summary - Ambient Air Quality

During the period of October 2020 to March 2021, at the location **Venganoor**, the concentration of $PM_{10}$ was observed in the range between 30-65 µg/m$^3$ with an average of 50 µg/m$^3$, $PM_{2.5}$ was observed in the range between 10-41 µg/m$^3$ with an average of 19 µg/m$^3$, $SO_2$ was observed in the range between <4.0-5.60 µg/m$^3$ with an average of 4.59 µg/m$^3$, $NO_2$ was observed in the range between <6.5-8.50 µg/m$^3$ with an average of 7.32 µg/m$^3$, CO was observed <1 mg/m$^3$ and HC was observed <1 ppm for all Six months.

At the location **Proposed Port Colony**, concentration of $PM_{10}$ was observed in the range between 32-81 µg/m$^3$ with an average of 54 µg/m$^3$, $PM_{2.5}$ was observed in the range between 8-51 µg/m$^3$ with an average of 20 µg/m$^3$, $SO_2$ was observed in the range between <4.0-5.40 µg/m$^3$ with an average of 4.58 µg/m$^3$, $NO_2$ was observed in the range between <6.5-8.50 µg/m$^3$ with an average of 7.21 µg/m$^3$, CO was observed <1 mg/m$^3$ and HC was observed <1 ppm for all six months.

At the location **Port site**, concentration of $PM_{10}$ was observed in the range between 32-92 µg/m$^3$ with an average of 73 µg/m$^3$, $PM_{2.5}$ was observed in the range between 10-52 µg/m$^3$ with an average of 27 µg/m$^3$, $SO_2$ was observed in the range between <4.0–10.20 µg/m$^3$ with an average of 6.69 µg/m$^3$, $NO_2$ was observed in the range between <6.5-14.60 µg/m$^3$ with an average of 9.70 µg/m$^3$, CO was observed in the range between <1-1.2 mg/m$^3$ with an average of <1 mg/m$^3$ and HC was observed <1 ppm for all six months.

At the location **Chani**, concentration of $PM_{10}$ was observed in the range between 32-83 µg/$m^3$ with an average of 54 µg/$m^3$, $PM_{2.5}$ was observed in the range between 10-24 µg/$m^3$ with an average of 17 µg/$m^3$, $SO_2$ was observed in the range between <4.0 −5.10 µg/$m^3$ with an average of 4.49 µg/$m^3$, $NO_2$ was observed in the range between <6.5-8.50 µg/$m^3$ with an average of 7.22 µg/$m^3$, CO was observed <1 mg/$m^3$ and HC was observed <1 ppm for all six months.

At the location **Balaramapuram**, concentration of $PM_{10}$ was observed in the range between 32-87 µg/$m^3$ with an average of 60 µg/$m^3$, $PM_{2.5}$ was observed in the range between 10-36 µg/$m^3$ with an average of 24 µg/$m^3$, $SO_2$ was observed in the range between <4.0-9.60 µg/$m^3$ with an average of 5.53 µg/$m^3$, $NO_2$ was observed in the range between <6.5−15.10 µg/$m^3$ with an average of 8.85 µg/$m^3$, CO was observed in the range between <1-1.3 mg/$m^3$ with an average of <1 mg/$m^3$ and HC was observed <1 ppm for all six 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 (October 2020 to March 2021).

# 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 October 2020 to March 2021 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.

**Table 4.1: Ambient Noise Monitoring Stations details**

| Sr. No. | Location | Area Type | Latitude | Longitude |
|---|---|---|---|---|
| 1. | Port Site | Industrial | 80,23',55.10"N | 770,00',11.30"E |
| 2. | Balaramapuram | Commercial | 80,22',13.46"N | 770,00',08.25"E |
| 3. | Proposed Port Estate Area | Residential | 80,22',41.47"N | 770,01',02.94"E |
| 4. | Chani | Residential | 80,20',56.86"N | 770,03',16.19"E |
| 5. | Venganoor | Residential | 80,25',37.60"N | 770,02',43.80"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 October 2020 to March 2021.

**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) | | | | | |
| Oct-20 | 08.10.2020 | 91.5 | 78.4 | 55.9 | 50.2 | 69.8 | 65.3 |
| | 22.10.2020 | 84.8 | 81.5 | 42.1 | 42.6 | 62.1 | 54.0 |
| Nov-20 | 05.11.2020 | 74.6 | 60.6 | 54.1 | 52.1 | 69.0 | 56.0 |
| | 19.11.2020 | 76.7 | 64.2 | 50.0 | 49.3 | 70.3 | 59.6 |
| Dec-20 | 10.12.2020 | 69.6 | 62.7 | 59.4 | 64.8 | 64.8 | 61.2 |
| | 24.12.2020 | 71.5 | 62.0 | 53.0 | 54.7 | 65.1 | 59.3 |
| Jan-21 | 07.01.2021 | 71.2 | 66.8 | 48.0 | 47.6 | 64.7 | 59.4 |
| | 21.01.2021 | 71.5 | 62.0 | 53.2 | 54.7 | 65.1 | 59.2 |
| Feb-21 | 04.02.2021 | 67.2 | 58.1 | 61.6 | 52.0 | 65.1 | 55.0 |
| | 18.02.2021 | 78.7 | 68.7 | 61.2 | 61.5 | 68.9 | 64.4 |
| Mar-21 | 04.03.2021 | 77.5 | 61.2 | 64.1 | 60.2 | 71.5 | 60.6 |
| | 18.03.2021 | 72.8 | 64.4 | 64.0 | 57.4 | 68.0 | 60.8 |
| **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) | | | | | |
| Oct-20 | 12.10.2020 | 81.2 | 76.2 | 34.7 | 34.6 | 57.1 | 47.3 |
| | 26.10.2020 | 83.4 | 73.7 | 38.8 | 39.4 | 58.5 | 50.6 |
| Nov-20 | 09.11.2020 | 66.5 | 57.0 | 46.9 | 47.3 | 59.2 | 51.9 |
| | 23.11.2020 | 71.3 | 50.7 | 48.2 | 47.8 | 63.4 | 48.8 |
| Dec-20 | 14.12.2020 | 66.7 | 53.9 | 46.2 | 40.5 | 59.8 | 46.4 |
| | 28.12.2020 | 64.1 | 53.8 | 55.6 | 45.0 | 59.0 | 49.7 |
| Jan-21 | 11.01.2021 | 71.4 | 53.1 | 45.3 | 45.2 | 62.4 | 48.3 |
| | 25.01.2021 | 65.8 | 53.5 | 48.6 | 40.8 | 59.1 | 47.2 |
| Feb-21 | 08.02.2021 | 61.9 | 47.9 | 46.6 | 44.1 | 58.4 | 45.4 |
| | 22.02.2021 | 65.9 | 59.8 | 46.4 | 42.4 | 59.9 | 53.4 |
| Mar-21 | 08.03.2021 | 61.3 | 52.5 | 52.9 | 51.2 | 59.1 | 51.8 |
| | 22.03.2021 | 61.2 | 53 | 58.9 | 51.4 | 60.7 | 52.2 |
| **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 | Lmax Day time | Lmax Night time | Lmin Day time | Lmin Night time | Leq Day time | Leq Night time |
|---|---|---|---|---|---|---|---|
| | | dB (A) | | | | | |
| Oct-20 | 09.10.2020 | 84.2 | 66.1 | 34.7 | 34.7 | 53.1 | 43.5 |
| | 23.10.2020 | 86.0 | 70.6 | 40.2 | 37.9 | 52.8 | 44.3 |
| Nov-20 | 06.11.2020 | 62.8 | 52.3 | 54.1 | 38.1 | 54.2 | 44.1 |
| | 20.11.2020 | 65.0 | 48.2 | 50.0 | 45.0 | 54.4 | 43.8 |
| Dec-20 | 11.12.2020 | 64.7 | 48.5 | 40.3 | 38.2 | 54.6 | 44.2 |
| | 25.12.2020 | 62.2 | 48.8 | 48.6 | 41.7 | 54.2 | 44.5 |
| Jan-21 | 08.01.2021 | 61.3 | 47.3 | 43.1 | 43.5 | 54.8 | 44.3 |
| | 22.01.2021 | 60.0 | 46.2 | 44.4 | 39.1 | 53.0 | 42.9 |
| Feb-21 | 05.02.2021 | 63.3 | 46.8 | 46.0 | 42.2 | 54.8 | 44.3 |
| | 19.02.2021 | 61.8 | 49.6 | 43.4 | 40.2 | 53.4 | 44.6 |
| Mar-21 | 05.03.2021 | 68.0 | 49.2 | 47.2 | 45.1 | 54.6 | 44.4 |

| Month | Date | Lmax Day time | Lmax Night time | Lmin Day time | Lmin Night time | Leq Day time | Leq Night time |
|---|---|---|---|---|---|---|---|
| | | dB (A) | | | | | |
| | 19.03.2021 | 63.1 | 53.3 | 40.1 | 39.8 | 54.2 | 44.6 |
| 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) | | | | | |
| Oct-20 | 10.10.2020 | 77.6 | 63.3 | 34.5 | 35.4 | 52.8 | 42.1 |
| | 24.10.2020 | 78.4 | 63.4 | 33.3 | 34.5 | 53.5 | 42.2 |
| Nov-20 | 07.11.2020 | 65.8 | 48.5 | 41.3 | 37.1 | 54.3 | 44.3 |
| | 21.11.2020 | 56.7 | 46.2 | 40.5 | 41.4 | 49.3 | 43.6 |
| Dec-20 | 12.12.2020 | 59.6 | 46.9 | 44.7 | 38.4 | 51.7 | 43.8 |
| | 26.12.2020 | 59.4 | 46.4 | 44.2 | 40.2 | 52.3 | 43.0 |
| Jan-21 | 09.01.2021 | 52.3 | 49.9 | 40.8 | 38.1 | 49.5 | 44.0 |
| | 23.01.2021 | 57.6 | 46.9 | 41.9 | 39.1 | 51.7 | 42.2 |
| Feb-21 | 06.02.2021 | 58.8 | 44.4 | 44.3 | 38.1 | 53.8 | 42.3 |
| | 20.02.2021 | 61.4 | 45.2 | 40.5 | 41.9 | 52.0 | 43.8 |
| Mar-21 | 06.03.2021 | 62.8 | 43.9 | 39 | 35.5 | 54.8 | 40.3 |
| | 20.03.2021 | 60 | 46.2 | 44.4 | 39.1 | 52.9 | 42.9 |
| 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) | | | | | |
| Oct-20 | 11.10.2020 | 75.5 | 64.4 | 34.6 | 34.5 | 49.0 | 40.4 |
| | 25.10.2020 | 77.5 | 68.2 | 34.4 | 34.5 | 47.3 | 41.6 |
| Nov-20 | 08.11.2020 | 49.3 | 46.2 | 39.5 | 37.0 | 45.2 | 41.2 |
| | 22.11.2020 | 51.8 | 46.0 | 38.4 | 37.1 | 46.2 | 41.8 |
| Dec-20 | 13.12.2020 | 52.8 | 43.2 | 37.9 | 38.3 | 47.0 | 39.8 |
| | 27.12.2020 | 55.2 | 44.7 | 43.5 | 38.6 | 49.6 | 42.1 |

| 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) | | | | | |
| Jan-21 | 10.01.2021 | 56.5 | 38.5 | 37.4 | 36.7 | 48.8 | 37.6 |
| | 24.01.2021 | 48.2 | 42.9 | 38.6 | 37.8 | 44.3 | 40.4 |
| Feb-21 | 07.02.2021 | 56.0 | 43.6 | 43.5 | 36.9 | 51.0 | 40.6 |
| | 21.02.2021 | 55.8 | 44.6 | 39.0 | 36.4 | 48.2 | 40.6 |
| Mar-21 | 07.03.2021 | 52.8 | 43.2 | 38.8 | 36.2 | 45.6 | 39.9 |
| | 21.03.2021 | 43.6 | 40.8 | 38.0 | 35.8 | 41.4 | 39.1 |
| **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 (75) Night Time(70) | Day Time (65) Night Time (55) |
| $L_{max}$ Day time dB (A) | Max | 86.0 | 78.4 | 77.5 | 91.5 | 83.4 |
| | Min | 60.0 | 52.3 | 43.6 | 67.2 | 61.2 |
| | Avg. | 66.9 | 62.5 | 56.3 | 75.6 | 68.4 |
| $L_{max}$ Night time dB (A) | Max | 70.6 | 63.4 | 68.2 | 81.5 | 76.2 |
| | Min | 46.2 | 43.9 | 38.5 | 58.1 | 47.9 |
| | Avg. | 52.2 | 49.3 | 47.2 | 65.9 | 57.1 |
| $L_{min}$ Day time dB (A) | Max | 54.1 | 44.7 | 43.5 | 64.1 | 58.9 |
| | Min | 34.7 | 33.3 | 34.4 | 42.1 | 34.7 |
| | Avg. | 44.3 | 40.8 | 38.6 | 55.6 | 47.4 |
| $L_{min}$ Night time dB (A) | Max | 45.1 | 41.9 | 38.6 | 64.8 | 51.4 |
| | Min | 34.7 | 34.5 | 34.50 | 42.6 | 34.6 |
| | Avg. | 40.5 | 38.2 | 36.7 | 53.9 | 44.1 |
| Leq Day time dB (A) | Max | 54.8 | 54.8 | 51.0 | 71.5 | 63.4 |
| | Min | 52.8 | 49.3 | 41.4 | 62.1 | 57.1 |

| Parameter | | Proposed Port Estate Area | Chani | Venganoor | Port Site | Balaramapuram |
|---|---|---|---|---|---|---|
| | | Residential | Residential | Residential | Industrial | Commercial |
| | | Day Time (55) Night Time (45) | | | Day Time (75) Night Time(70) | Day Time (65) Night Time (55) |
| | Avg. | 54.0 | 52.4 | 47.0 | 67.0 | 59.7 |
| Leq Night time dB (A) | Max | 44.6 | 44.3 | 42.1 | 65.3 | 53.4 |
| | Min | 42.9 | 40.3 | 37.6 | 54.0 | 45.4 |
| | Avg. | 44.1 | 42.9 | 40.4 | 59.6 | 49.4 |

## 6. Graphical representation of Results

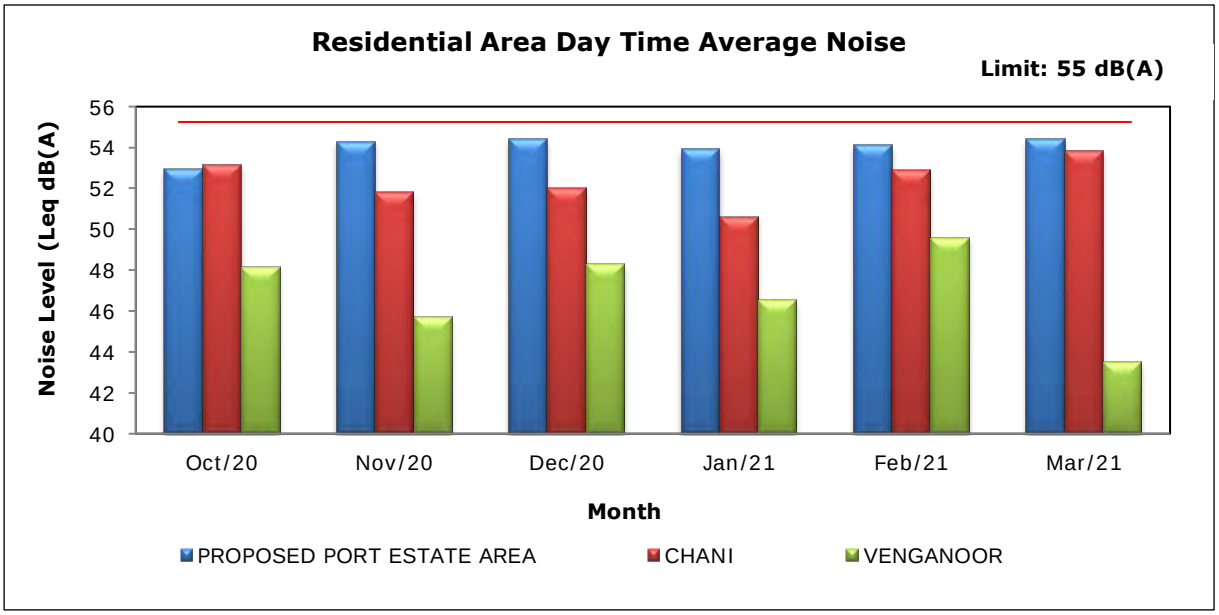



**Figure 4.2: Residential Area Noise Level at day time**

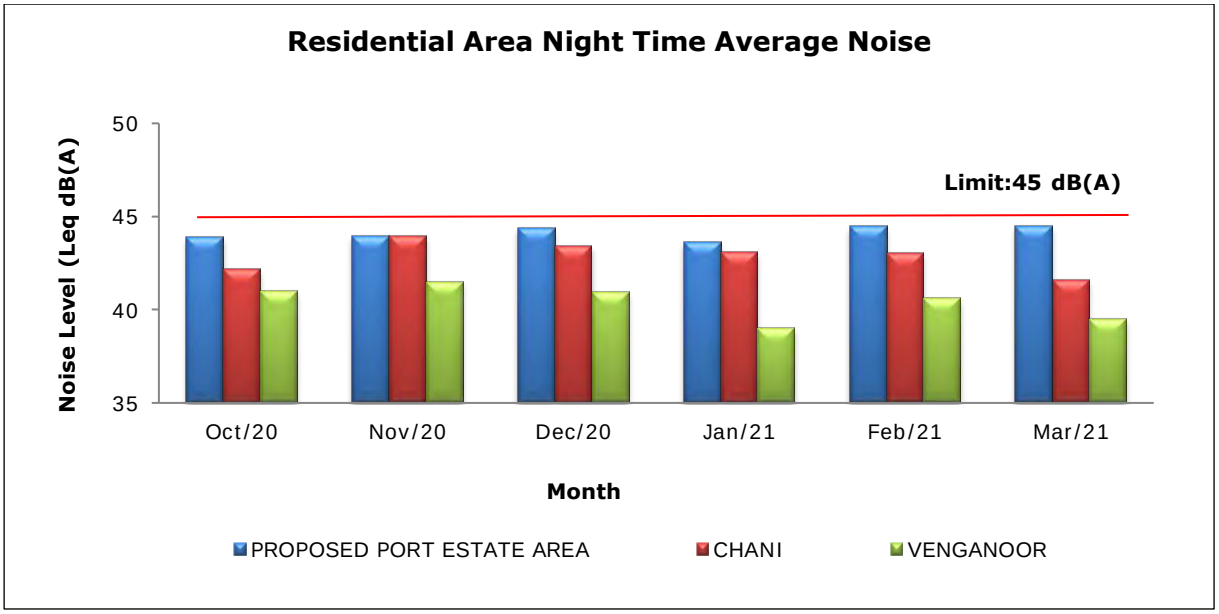



**Figure 4.3: Residential Area Noise Level at Night time**

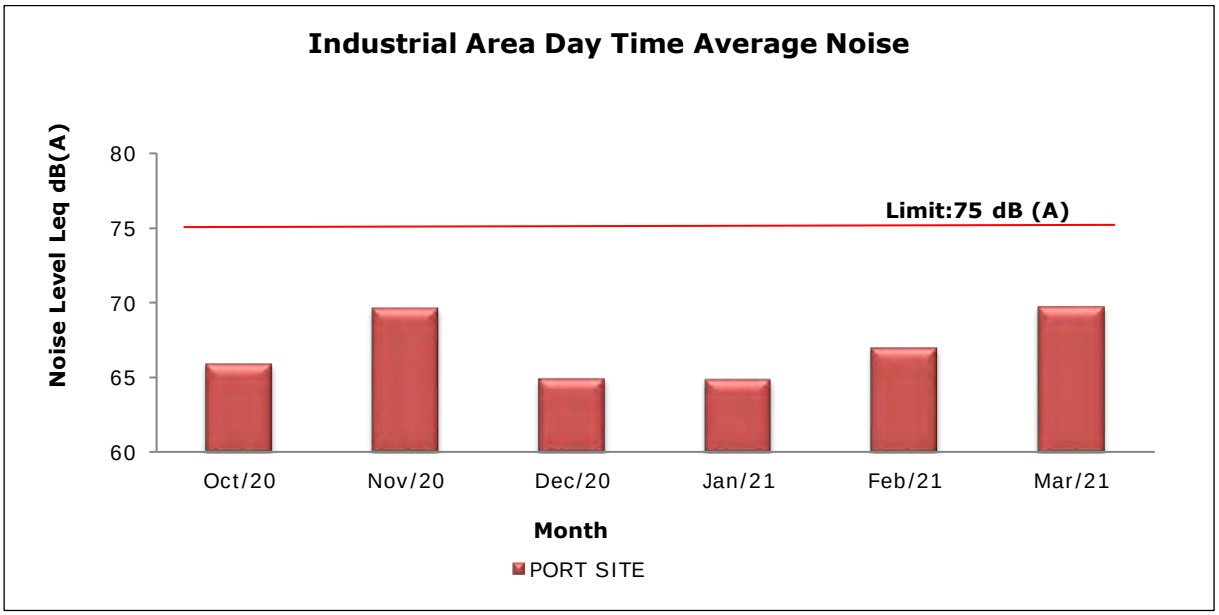



**Figure 4.4: Industrial Area Noise Level at day time**

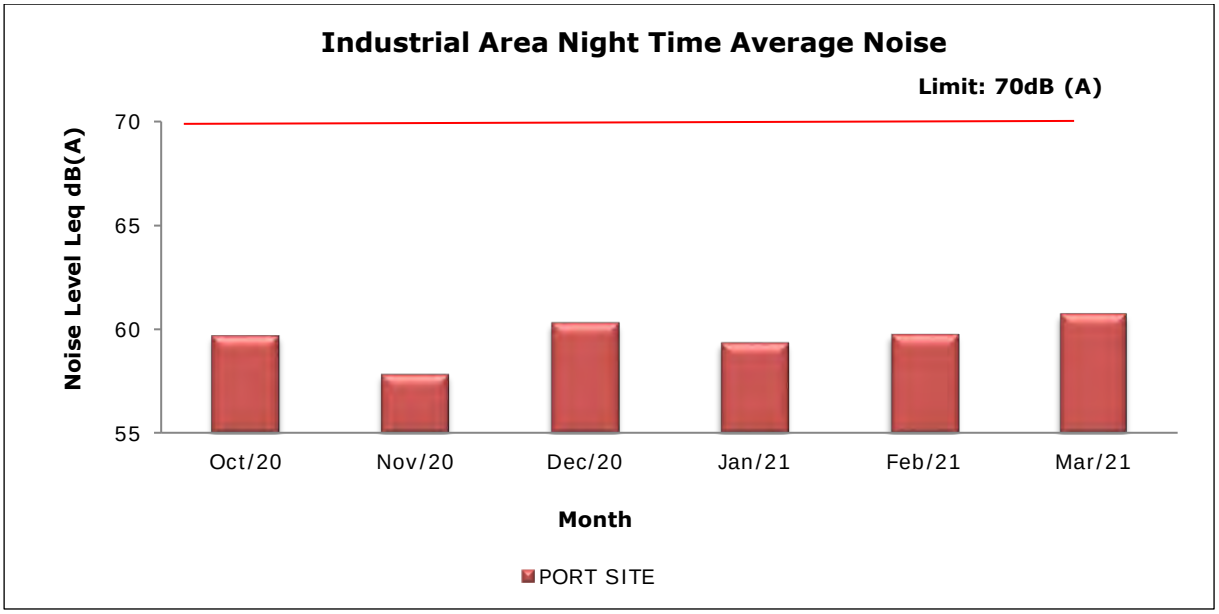



**Figure 4.5: Industrial Area Noise Level at night time**

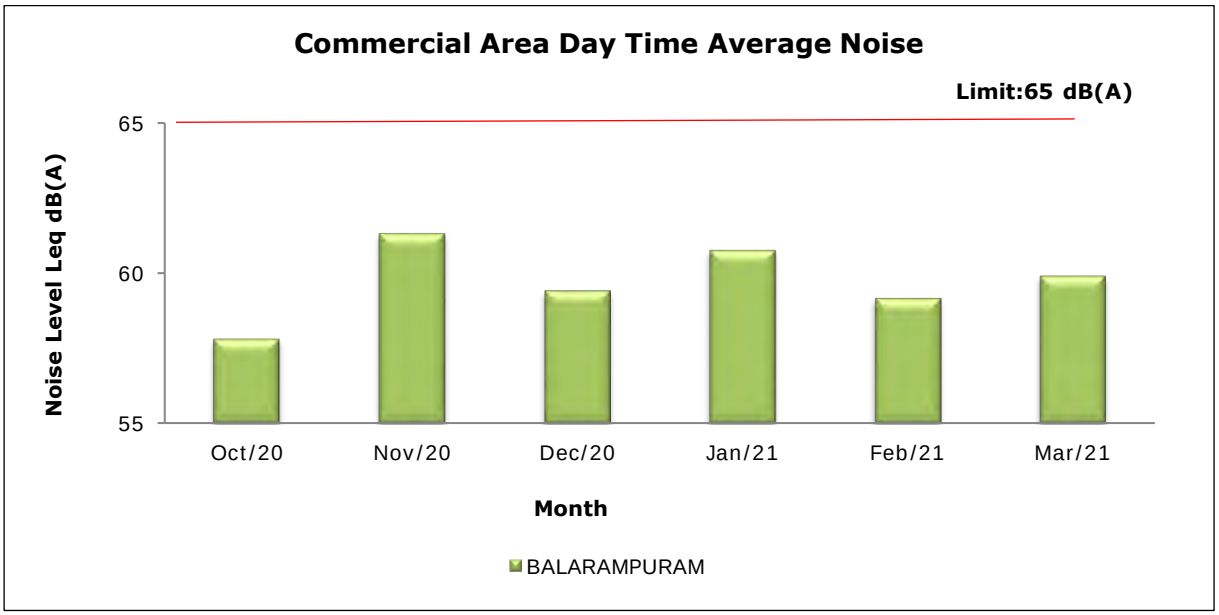



**Figure 4.6: Commercial Area Noise Level at day time**

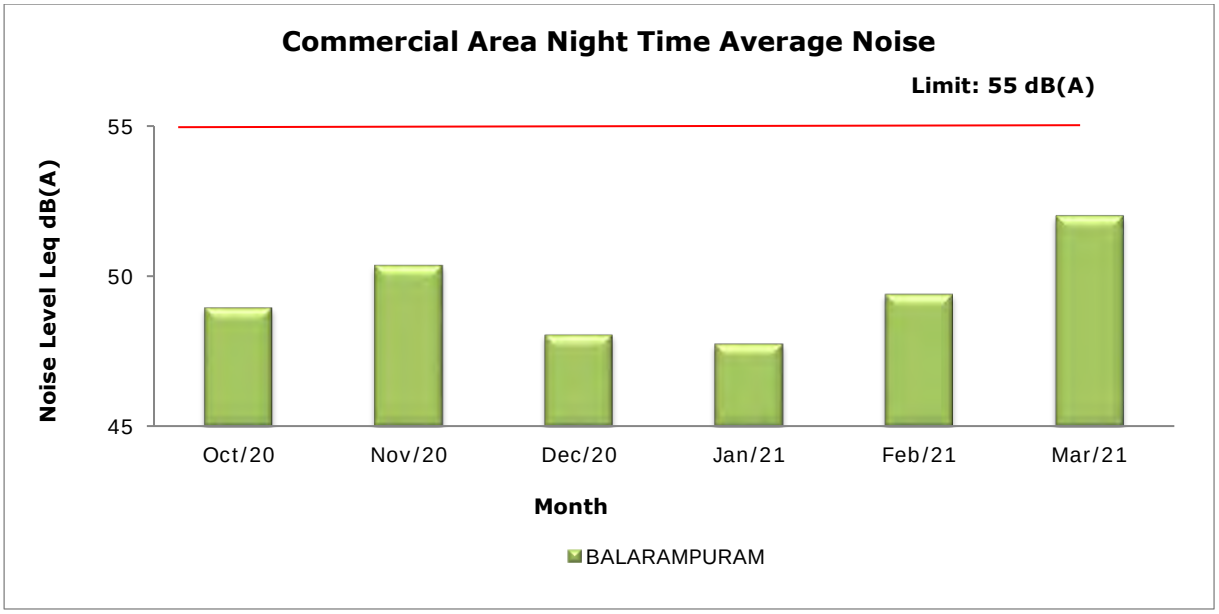



**Figure 4.7: Commercial Area Noise Level at night time**

## 7. Summary - Ambient Noise Monitoring

During the period October 2020 to March 2021 average noise level observed at residential areas i.e. at Proposed Port Estate Area, Chani and Venganoor during day time were 54 dB(A), 52.4 dB(A) and 47 dB(A) respectively and during night time 44.1 dB(A), 42.9 dB(A) and 40.4 dB(A) respectively.

At industrial area i.e. at Port Site area average noise level observed at day time 67 dB (A) and at night time 59.6 dB (A).

At commercial area i.e. Balaramapuram area average noise level observed at day time 59.7 dB (A) and at night time 49.4 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 (October 2020 to March 2021).

# 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. Sampling and analysis of marine water at high tide and low tide during October 2020 and March 2021 carried out at different locations such as; Near Kovalam Beach, Proposed Dredging site, South of Break Water, Port Basin, Inner Approach Channel and Kovalam Beach. 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 | 80,22',22.542"N | 760,58',50.421"E |
| 2. | Proposed Dredging Site | 80,21',48.789"N | 760,59',14.919"E |
| 3. | South of Break Water | 80,22',1.438"N | 760,59',44.487"E |
| 4. | Port Basin | 80,21',37.680"N | 770,00',44.861"E |
| 5. | Inner Approach Channel | 80,21',00.195"N | 770,00',27.918"E |
| 6. | Kovalam Beach | 80,23',2.358"N | 760,58',22.560"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, RA 2009 |
| 2. | pH Value | - | 1 | IS 3025 (Part 11):1983, RA 2017 |
| 3. | Turbidity | N.T.U. | 0.1 | IS 3025 (Part 10):1984, RA 2017 |
| 4. | Electrical Conductivity (at 25$^o$C) | µmho/cm | 0.1 | IS 3025( Part 14): 1984, RA 2006 |
| 5. | Total Suspended Solids | mg/L | 5 | IS 3025 (Part 17): 1984, RA 2017 |
| 6. | Total Dissolved Solids | mg/L | 5 | IS 3025 (Part 16):1984, RA 2006,E.d2.1(1999-1) |
| 7. | Dissolved Oxygen | mg/L | 0.05 | IS 3025 (Part 38): 1989, RA 2014 |
| 8. | Biochemical Oxygen Demand (3 days, 27$^o$C) | mg/L | 1 | IS 3025 (Part 44): 1993, RA 2014 |
| 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, 5-50 |
| 13. | Ammonical Nitrogen (as $NH_3$-N) | mg/L | 5 | APHA, 23rd Ed., 2017, 4500 $NH_3$, B & C, 4 -114, 4-119 |
| 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, 4-164 |
| 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 |
| 22. | Phytoplankton | No./100ml | ND | APHA, 23rd Ed., 2017 |

| Sr. No. | Parameter | Unit | Detection Limit | Method Reference |
|---|---|---|---|---|
| 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:**<br>**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 |
| Faecal Coliforms | /100ml | *Max.* 500 |
| Biochemical Oxygen Demand | mg/L | *Max.* 5 |

| Parameter | Unit | # E(P)A Rules, 1986 |
|---|---|---|
| (3 days, 27$^{o}$C) | | |
| **#:** Environment (Protection) Rules, 1986, Schedule I, Table 1.4, Primary Water Quality Criteria for Class – IV Water (For Harbour Waters). | | |

## 4. Marine Water Analysis Results for the period October 2020 to March 2021

**Table 5.4: Marine Water Analysis Results**

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Temperature (°C) | Oct-20 | High tide | 28.2 | 27.5 | 28.4 | 27.2 | 27.3 | 27.4 |
| | | | Low tide | 27.3 | 27.2 | 28.1 | 27.3 | 27.5 | 27.6 |
| | | Nov-20 | High tide | 27.2 | 27.4 | 27.8 | 27.4 | 27.2 | 27.4 |
| | | | Low tide | 27.6 | 27.2 | 27.6 | 27.6 | 27.4 | 27.6 |
| | | Dec-20 | High tide | 28.1 | 27.8 | 28.4 | 29.3 | 28.1 | 28.6 |
| | | | Low tide | 28.1 | 27.9 | 28.4 | 29.3 | 28.1 | 28.6 |
| | | Jan-21 | High tide | 27.9 | 27.7 | 27.8 | 27.9 | 27.8 | 28.1 |
| | | | Low tide | 27.6 | 27.4 | 27.6 | 27.6 | 27.5 | 27.6 |
| | | Feb-21 | High tide | 27.8 | 27.7 | 27.6 | 27.8 | 27.9 | 27.7 |
| | | | Low tide | 27.6 | 27.5 | 27.4 | 27.7 | 27.8 | 27.5 |
| | | Mar-21 | High tide | 28 | 27.9 | 27.6 | 27.9 | 27.9 | 28 |
| | | | Low tide | 27.9 | 27.7 | 27.6 | 27.8 | 27.7 | 27.9 |
| 2 | Colour and Odour | Oct-20 | High tide & Low tide | No visible colour or offensive odour | | | | | |
| | | Nov-20 | High tide & Low tide | No visible colour or offensive odour | | | | | |
| | | Dec-20 | High tide & Low tide | No visible colour or offensive odour | | | | | |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Jan-21 | High tide & Low tide | No visible colour or offensive odour | | | | | |
| | | Feb-21 | High tide & Low tide | No visible colour or offensive odour | | | | | |
| | | Mar-21 | High tide & Low tide | No visible colour or offensive odour | | | | | |
| 3 | pH Value | Oct-20 | High tide | 7.78 | 8.12 | 7.88 | 8.18 | 7.91 | 8.03 |
| | | | Low tide | 8.15 | 8.08 | 8.13 | 8.11 | 8.19 | 7.67 |
| | | Nov-20 | High tide | 7.97 | 7.68 | 8.03 | 8.05 | 8.15 | 8.12 |
| | | | Low tide | 7.94 | 7.68 | 8.14 | 7.78 | 8.16 | 8.18 |
| | | Dec-20 | High tide | 7.97 | 7.91 | 7.93 | 8.1 | 7.99 | 8.1 |
| | | | Low tide | 8.09 | 8.11 | 8.12 | 7.91 | 8.07 | 8.08 |
| | | Jan-21 | High tide | 7.36 | 7.57 | 7.62 | 7.69 | 7.68 | 7.72 |
| | | | Low tide | 7.72 | 7.64 | 7.76 | 7.61 | 7.77 | 7.79 |
| | | Feb-21 | High tide | 8.1 | 8.4 | 8.44 | 8.5 | 7.92 | 8.28 |
| | | | Low tide | 8.4 | 8.2 | 8.46 | 8.46 | 8.5 | 8.5 |
| | | Mar-21 | High tide | 7.88 | 7.56 | 8.1 | 8.09 | 7.85 | 7.56 |
| | | | Low tide | 8.17 | 8.18 | 8.07 | 7.65 | 7.82 | 7.86 |
| 4 | Turbidity (N.T.U.) | Oct-20 | High tide | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| | | | Low tide | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Nov-20 | High tide | <0.2 | <0.2 | <0.2 | <0.2 | <.0.2 | <0.2 |
| | | | Low tide | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| | | Dec-20 | High tide | 0.31 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| | | | Low tide | 1.2 | <0.2 | <0.2 | 0.5 | 0.24 | 2 |
| | | Jan-21 | High tide | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| | | | Low tide | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| | | Feb-21 | High tide | 1.82 | 0.62 | 0.48 | 0.62 | 2.24 | 0.68 |
| | | | Low tide | 1.24 | 0.98 | 1.36 | 2.48 | 0.51 | 0.42 |
| | | Mar-21 | High tide | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| | | | Low tide | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| 5 | Electrical Conductivity (at 25°C) (µmho/cm) | Oct-20 | High tide | 43741 | 44838 | 42306 | 47258 | 46612 | 46838 |
| | | | Low tide | 45322 | 45516 | 43225 | 48870 | 47580 | 48709 |
| | | Nov-20 | High tide | 47100 | 46700 | 47600 | 46700 | 47400 | 47300 |
| | | | Low tide | 47500 | 47100 | 47100 | 46800 | 47400 | 47300 |
| | | Dec-20 | High tide | 48600 | 48500 | 49600 | 49200 | 48600 | 49100 |
| | | | Low tide | 49000 | 48900 | 49600 | 49000 | 49500 | 48900 |
| | | Jan-21 | High tide | 56300 | 55900 | 55100 | 55800 | 55500 | 55400 |
| | | | Low tide | 55500 | 55600 | 55000 | 55700 | 55400 | 55100 |
| | | | High tide | 63200 | 66700 | 64800 | 66000 | 65100 | 64200 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Feb-21 | Low tide | 64100 | 66600 | 64800 | 68200 | 64800 | 65500 |
| | | Mar-21 | High tide | 44800 | 44500 | 44700 | 44600 | 44700 | 44800 |
| | | | Low tide | 45100 | 45000 | 44700 | 44600 | 47600 | 44500 |
| 6 | Total Suspended Solids (mg/L) | Oct-20 | High tide | <5 | <5 | <5 | <5 | <5 | <5 |
| | | | Low tide | <5 | <5 | <5 | <5 | <5 | <5 |
| | | Nov-20 | High tide | 16 | 16 | 20 | 14 | 20 | 19 |
| | | | Low tide | 19 | 27 | 16 | 23 | 7 | 10 |
| | | Dec-20 | High tide | 6 | 7 | <5 | <5 | 6 | 6 |
| | | | Low tide | <5 | 7 | 6 | 8 | <5 | 6 |
| | | Jan-21 | High tide | <5 | <5 | <5 | <5 | <5 | <5 |
| | | | Low tide | <5 | <5 | <5 | <5 | <5 | <5 |
| | | Feb-21 | High tide | 8 | 12 | 18 | 12 | 10 | 9 |
| | | | Low tide | 11 | 10 | 12 | 10 | 12 | 18 |
| | | Mar-21 | High tide | 7 | 5 | 8 | 7 | 7 | 6 |
| | | | Low tide | <5 | 6 | 6 | <5 | 7 | <5 |
| 7 | Total Dissolved Solids (mg/L) | Oct-20 | High tide | 27120 | 27800 | 26230 | 29300 | 28900 | 29040 |
| | | | Low tide | 28100 | 28220 | 26800 | 30300 | 29500 | 30200 |
| | | Nov-20 | High tide | 27310 | 27080 | 27600 | 27080 | 27490 | 27430 |
| | | | Low tide | 27550 | 27310 | 27310 | 27140 | 27490 | 27430 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Dec-20 | High tide | 28240 | 29510 | 28830 | 28720 | 29420 | 28480 |
| | | | Low tide | 28600 | 28530 | 28730 | 28610 | 28850 | 29410 |
| | | Jan-2021 | High tide | 33780 | 33540 | 33070 | 33480 | 33320 | 33230 |
| | | | Low tide | 33300 | 33360 | 33010 | 33420 | 33240 | 33060 |
| | | Feb-21 | High tide | 40450 | 42690 | 41470 | 42240 | 41660 | 41090 |
| | | | Low tide | 41020 | 42620 | 41470 | 43650 | 41470 | 41920 |
| | | Mar-21 | High tide | 25970 | 25900 | 25930 | 25920 | 25920 | 25980 |
| | | | Low tide | 26160 | 26100 | 25930 | 25870 | 27650 | 25860 |
| 8 | Dissolved Oxygen (mg/L) | Oct-20 | High tide | 6.1 | 6.1 | 5.8 | 6.8 | 6.3 | 6.1 |
| | | | Low tide | 5.7 | 6.8 | 5.9 | 5.9 | 6.2 | 6.7 |
| | | Nov-20 | High tide | 5.6 | 5.5 | 6.0 | 6.1 | 5.4 | 5.5 |
| | | | Low tide | 5.6 | 5.9 | 5.8 | 5.6 | 5.7 | 5.8 |
| | | Dec-20 | High tide | 5.8 | 5.0 | 6.1 | 6.2 | 5.0 | 5.0 |
| | | | Low tide | 5.2 | 5.2 | 5.7 | 6.0 | 6.0 | 5.8 |
| | | Jan-21 | High tide | 5.2 | 5.0 | 5.2 | 5.1 | 5.0 | 5.0 |
| | | | Low tide | 4.9 | 5.2 | 5.0 | 4.7 | 4.9 | 5.0 |
| | | Feb-21 | High tide | 4.8 | 5.2 | 5.1 | 5.3 | 5.2 | 5.0 |
| | | | Low tide | 4.6 | 4.8 | 5.1 | 5.2 | 4.9 | 4.8 |
| | | | High tide | 5.2 | 5.2 | 5.3 | 5.5 | 5.1 | 5.1 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Mar-21 | Low tide | 4.8 | 5.1 | 5.2 | 5.1 | 5.1 | 5 |
| 9 | Biochemical Oxygen Demand (3 days, 27°C) (mg/L) | Oct-20 | High tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | | Low tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | Nov-20 | High tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | | Low tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | Dec-20 | High tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | | Low tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | Jan-21 | High tide | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | Low tide | 1 | 1 | 1 | 2 | 1 | 1 |
| | | Feb-21 | High tide | 2 | <1 | 1 | 1 | 1 | 1 |
| | | | Low tide | 2 | 1 | 1 | 1 | 1 | 1 |
| | | Mar-21 | High tide | 1.1 | <1 | <1 | 1 | 1.1 | <1 |
| | | | Low tide | 1.2 | 1.1 | <1 | 1.1 | 1 | 1.1 |
| 10 | Floating Materials (Oil, Grease and Scum) (Including Petroleum Products) (mg/L) | Oct-20 | High tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | | Low tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | Nov-20 | High tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | | Low tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | Dec-20 | High tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | | Low tide | <1 | <1 | <1 | <1 | <1 | <1 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Jan-21 | High tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | | Low tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | Feb-21 | High tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | | Low tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | Mar-21 | High tide | <1 | <1 | <1 | <1 | <1 | <1 |
| | | | Low tide | <1 | <1 | <1 | <1 | <1 | <1 |
| 11 | Nitrite (as $NO_2$) (mg/L) | Oct-20 | High tide | 0.05 | 0.05 | 0.07 | 0.17 | 0.04 | 0.05 |
| | | | Low tide | 0.04 | 0.05 | 0.05 | 0.07 | 0.03 | 0.04 |
| | | Nov-20 | High tide | <0.01 | <0.01 | <0.01 | 0.02 | <0.01 | <0.01 |
| | | | Low tide | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | Dec-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 |
| | | Jan-21 | 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 |
| | | Feb-21 | 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 |
| | | Mar-21 | 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 |
| 12 | | | High tide | 2.31 | 2.24 | 2.83 | 2.45 | 1.85 | 2.33 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | Nitrate (as $NO_3$) (mg/L) | Oct-20 | Low tide | 2.22 | 2.67 | 2.21 | 2.33 | 1.87 | 1.86 |
| | | Nov-20 | High tide | 1.40 | 1.19 | 1.31 | 1.69 | 1.52 | 1.44 |
| | | | Low tide | 1.64 | 1.21 | 1.42 | 1.67 | 1.19 | 1.07 |
| | | Dec-20 | High tide | 1.75 | 1.73 | 1.9 | 1.53 | 2.02 | 1.58 |
| | | | Low tide | 1.77 | 1.70 | 1.77 | 2.21 | 1.90 | 2.32 |
| | | Jan-21 | High tide | 1.61 | 1.56 | 1.46 | 1.54 | 1.57 | 1.69 |
| | | | Low tide | 1.66 | 1.53 | 1.61 | 1.51 | 1.47 | 1.59 |
| | | Feb-21 | High tide | 1.40 | 1.41 | 1.30 | 1.50 | 1.50 | 1.20 |
| | | | Low tide | 1.40 | 1.32 | 1.51 | 1.36 | 1.60 | 1.70 |
| | | Mar-21 | High tide | 1.69 | 0.81 | 0.74 | 0.63 | 0.67 | 0.52 |
| | | | Low tide | 0.57 | 0.60 | 0.70 | 0.76 | 0.56 | 0.61 |
| 13 | Phenolic Compounds (as $C_6H_5OH$) (mg/L) | Oct-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 |
| | | Nov-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 |
| | | Dec-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 |
| | | Jan-21 | 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 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Feb-21 | 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 |
| | | Mar-21 | 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) | Oct-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 |
| | | Nov-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 |
| | | Dec-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 |
| | | Jan-21 | 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 |
| | | Feb-21 | 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 |
| | | Mar-21 | 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) | Oct-20 | High tide | 1.08 | 0.83 | 1.31 | 1.03 | 0.98 | 0.96 |
| | | | Low tide | 0.83 | 1.15 | 1.06 | 0.87 | 0.86 | 0.98 |
| | | | High tide | 0.87 | 0.93 | 0.85 | 1.16 | 0.67 | 1.22 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Nov-20 | Low tide | 0.92 | 1.05 | 0.87 | 1.03 | 1.16 | 0.9 |
| | | Dec-20 | High tide | 1.06 | 1.16 | 1.32 | 0.9 | 1 | 1.02 |
| | | | Low tide | 1.17 | 1.04 | 1.28 | 1.39 | 0.98 | 1.07 |
| | | Jan-21 | High tide | 1.13 | 1.01 | 1.1 | 1.11 | 1.01 | 1.26 |
| | | | Low tide | 1.03 | 1.38 | 1.13 | 0.89 | 0.99 | 1.01 |
| | | Feb-21 | High tide | 1.1 | 1.09 | 1.4 | 0.89 | 1.22 | 1.16 |
| | | | Low tide | 1.08 | 1.74 | 0.89 | 1.31 | 0.91 | 0.93 |
| | | Mar-21 | High tide | 0.93 | 0.74 | 0.72 | 0.81 | 0.82 | 0.56 |
| | | | Low tide | 0.68 | 0.69 | 0.82 | 0.71 | 0.68 | 0.8 |
| 16 | Total Phosphorous (as P) (mg/L) | Oct-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 |
| | | Nov-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 |
| | | Dec-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 |
| | | Jan-21 | 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 |
| | | Feb-21 | 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 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Mar-21 | 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) | Oct-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 |
| | | Nov-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 |
| | | Dec-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 |
| | | Jan-21 | 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 |
| | | Feb-21 | 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 |
| | | Mar-21 | 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) | Oct-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 |
| | | Nov-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 |
| | | | High tide | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Dec-20 | Low tide | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 |
| | | Jan-21 | 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 |
| | | Feb-21 | 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 |
| | | Mar-21 | 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) | Oct-20 | High tide | 35 | 35 | 34.9 | 34.9 | 34.8 | 34.9 |
| | | | Low tide | 34.8 | 34.8 | 34.8 | 34.8 | 34.9 | 35.1 |
| | | Nov-20 | High tide | 34.6 | 34.2 | 34.9 | 34.4 | 34.8 | 34.6 |
| | | | Low tide | 34.2 | 34.6 | 34.6 | 34.4 | 34.6 | 34.8 |
| | | Dec-20 | High tide | 33 | 34 | 34 | 34 | 33 | 34 |
| | | | Low tide | 34 | 34 | 34 | 34 | 34 | 34 |
| | | Jan-21 | High tide | 32 | 31 | 31 | 32 | 31 | 31 |
| | | | Low tide | 31 | 32 | 31 | 31 | 31 | 31 |
| | | Feb-21 | High tide | 32 | 34 | 33 | 33 | 32 | 32 |
| | | | Low tide | 32 | 34 | 33 | 34 | 33 | 32 |
| | | Mar-21 | High tide | 34 | 33 | 34 | 34 | 34 | 33 |
| | | | Low tide | 34 | 34 | 33 | 34 | 34 | 33 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| 20 | Total Chlorophyll ($mg/m^3$) | Oct-20 | High tide | 0.3 | 0.8 | 0.3 | 0.6 | 0.4 | 0.6 |
| | | | Low tide | 0.4 | 0.6 | 0.6 | 0.9 | 1.1 | 0.9 |
| | | Nov-20 | High tide | 0.8 | 1.1 | 1.2 | 0.9 | 1.0 | 1.1 |
| | | | Low tide | 0.9 | 0.9 | 0.8 | 1.1 | 1.0 | 0.9 |
| | | Dec-20 | High tide | 0.6 | 0.9 | 0.9 | 0.8 | 0.9 | 0.8 |
| | | | Low tide | 0.8 | 1.1 | 1.1 | 1.1 | 1.2 | 0.9 |
| | | Jan-21 | High tide | 0.8 | 0.6 | 0.9 | 0.9 | 0.8 | 0.9 |
| | | | Low tide | 1.1 | 0.8 | 1.1 | 1.2 | 1.1 | 1.1 |
| | | Feb-21 | High tide | 0.9 | 1.2 | 1.0 | 0.8 | 1.0 | 1.1 |
| | | | Low tide | 0.8 | 1.1 | 0.9 | 0.7 | 0.9 | 1.0 |
| | | Mar-21 | High tide | 0.9 | 1.1 | 1.1 | 1.0 | 1.0 | 0.9 |
| | | | Low tide | 1 | 1.2 | 1 | 0.9 | 1.1 | 1.1 |
| 21 | Total Coliforms (MPN Index/100 mL) | Oct-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 |
| | | Nov-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 |
| | | Dec-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 |
| | | | High tide | 2 | <1.8 | 6.8 | 2 | 170 | <1.8 |

| Sr. No. | Parameter | Month | | Near Kovalam Beach | Proposed Dredging Site | South of Break Water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|---|---|
| | | Jan-21 | Low tide | 6.8 | 2 | 11 | <1.8 | 13 | <1.8 |
| | | Feb-21 | High tide | <1.8 | <1.8 | <1.8 | <1.8 | 7.8 | <1.8 |
| | | | Low tide | <1.8 | <1.8 | <1.8 | <1.8 | <1.8 | <1.8 |
| | | Mar-21 | 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) | Oct-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 |
| | | Nov-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 |
| | | Dec-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 |
| | | Jan-21 | High tide | 2 | <1.8 | 4 | <1.8 | 31 | <1.8 |
| | | | Low tide | 6.8 | 2 | 7.8 | <1.8 | 2 | <1.8 |
| | | Feb-21 | High tide | <1.8 | <1.8 | <1.8 | <1.8 | 4.5 | <1.8 |
| | | | Low tide | <1.8 | <1.8 | <1.8 | <1.8 | <1.8 | <1.8 |
| | | Mar-21 | 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**

**6.**

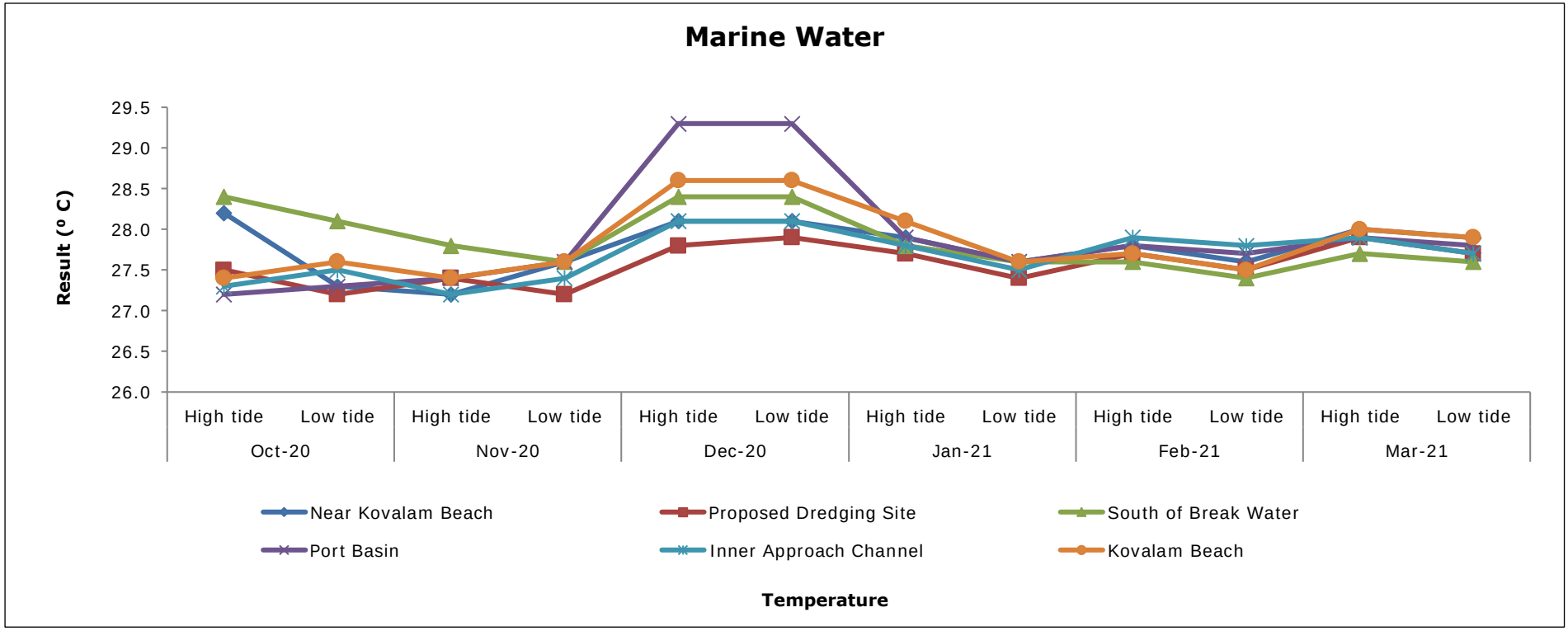



**Figure 5.2: Marine Water Analysis for Temperature**

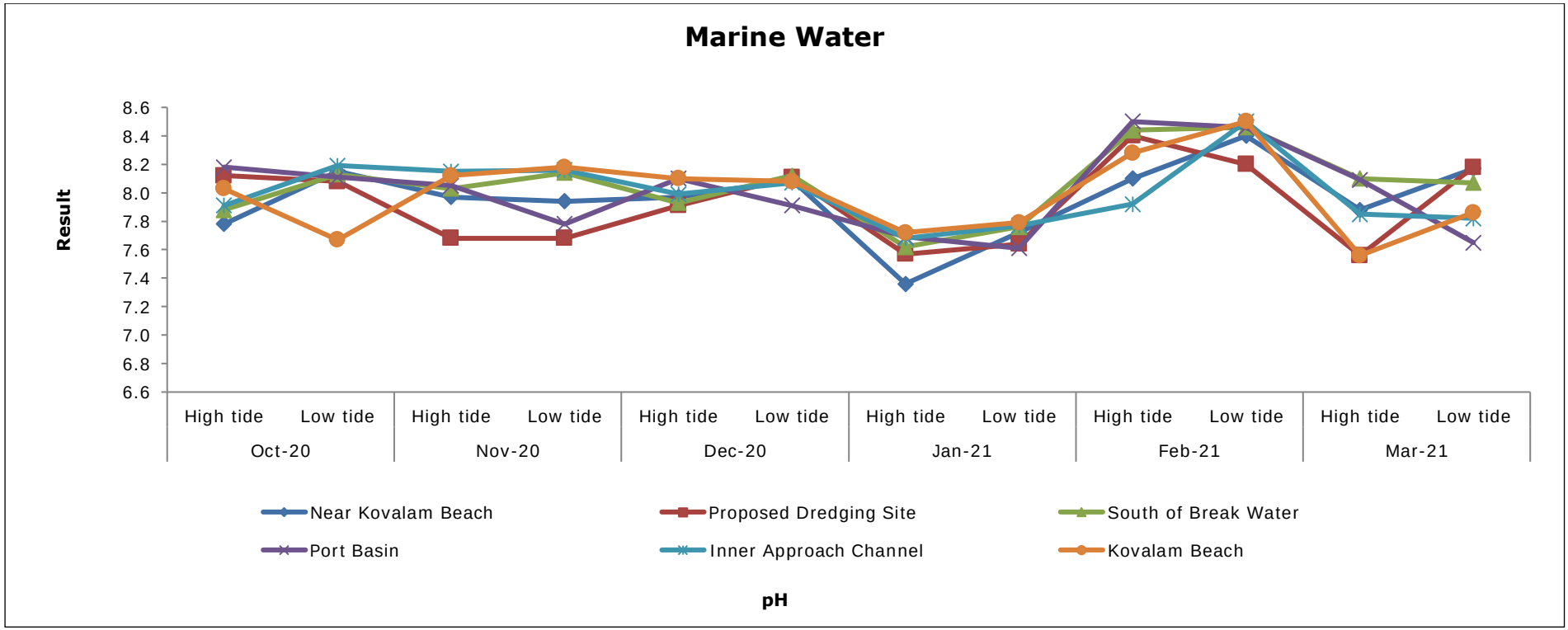



**Figure 5.3: Marine Water Analysis for pH**

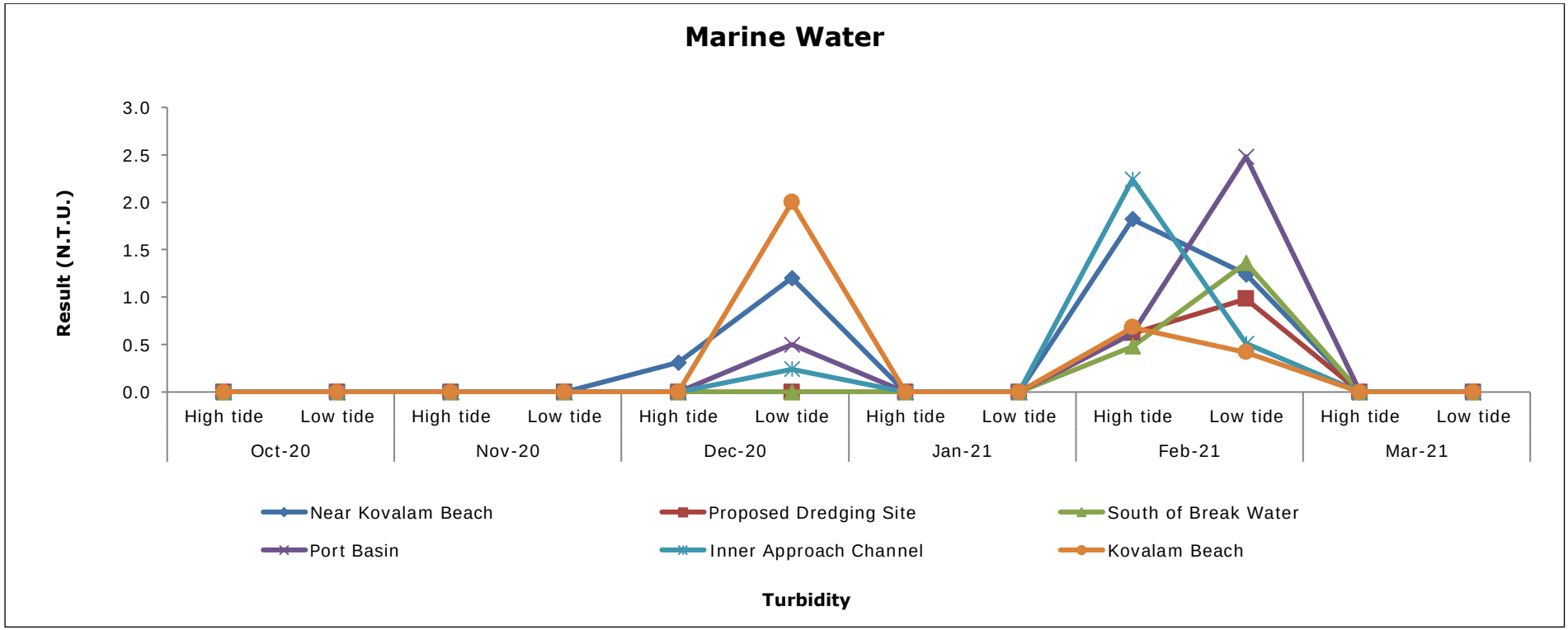



**Figure 5.4: Marine Water Analysis for Turbidity**

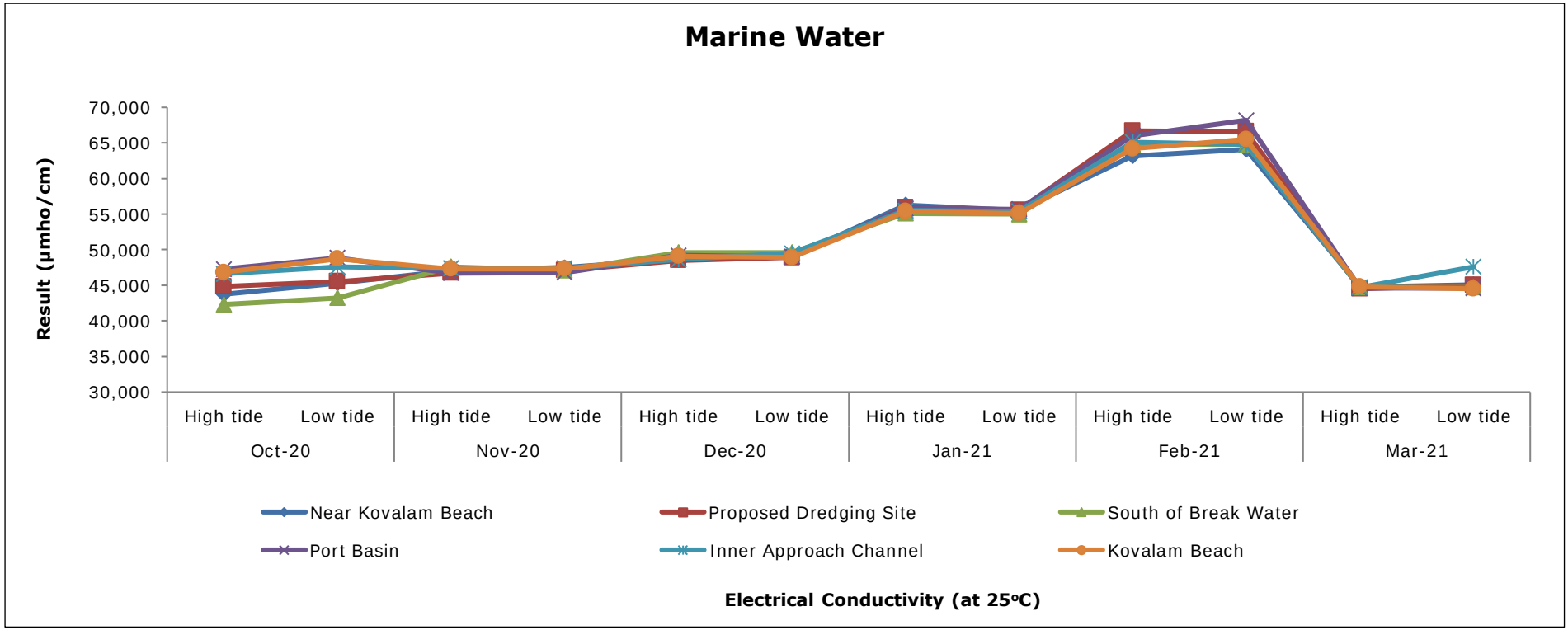



**Figure 5.5: Marine Water Analysis for Electrical Conductivity**

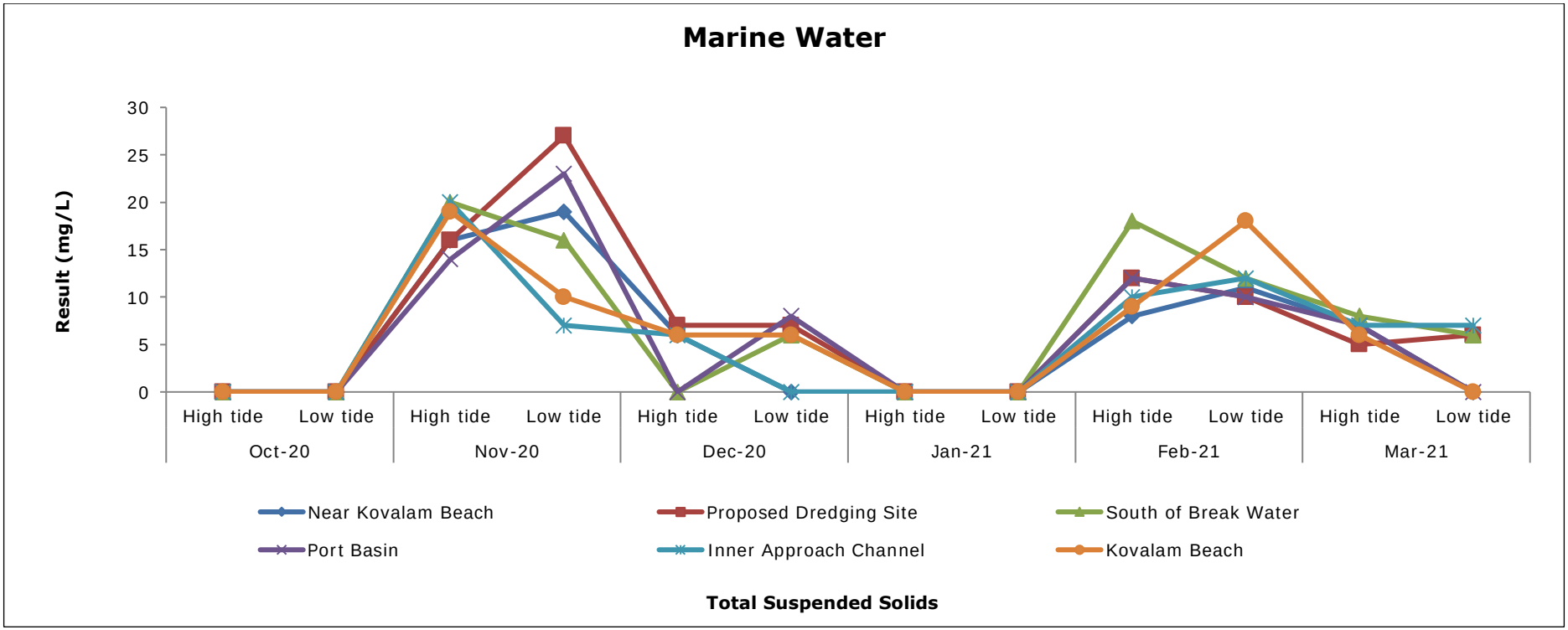



**Figure 5.6: Marine Water Analysis for Total Suspended Solids**

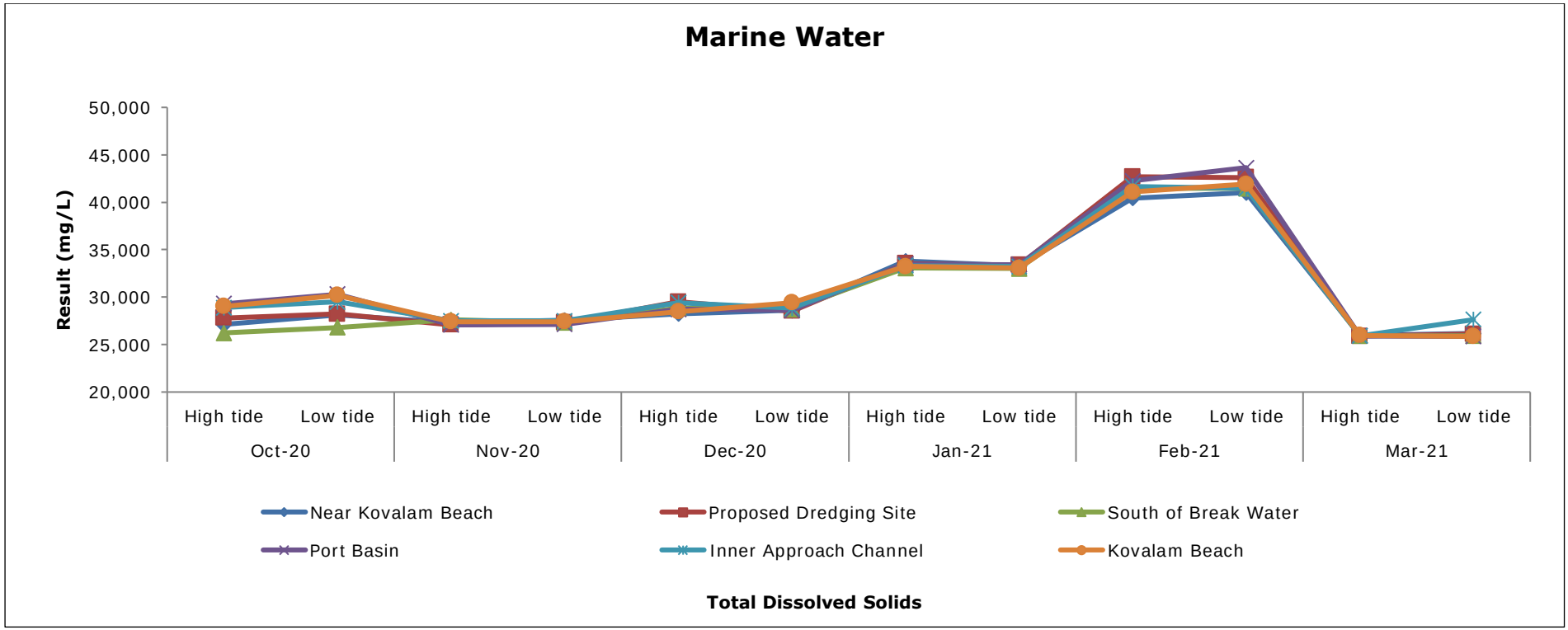



**Figure 5.7: Marine Water Analysis for Total Dissolved Solids**

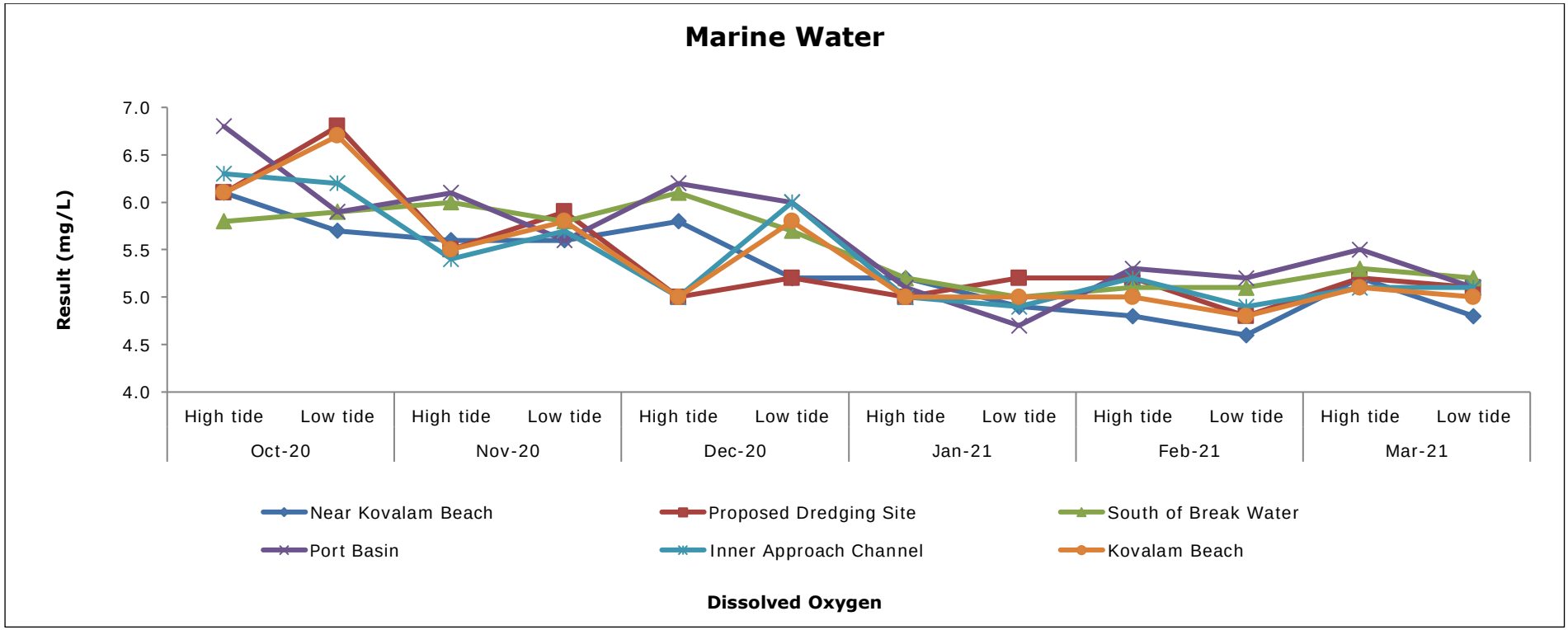



**Figure 5.8: Marine Water Analysis for Dissolved Oxygen**

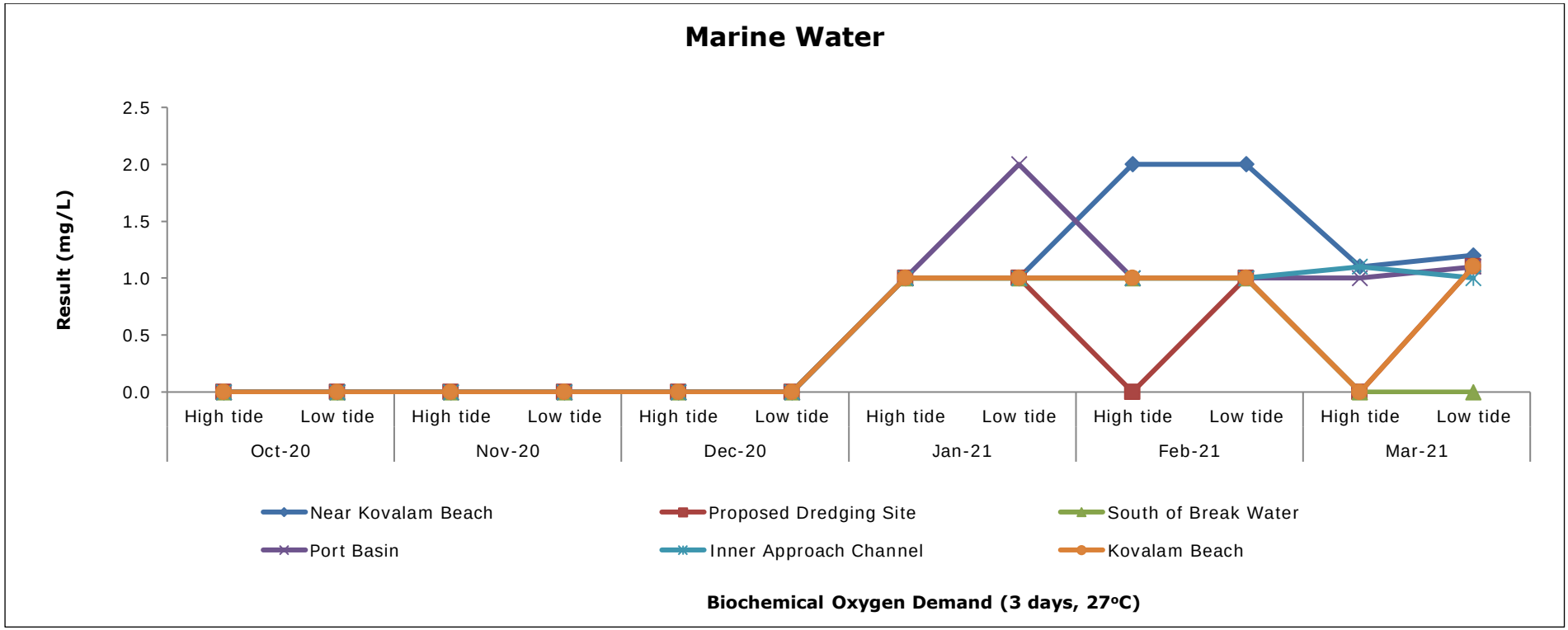



**Figure 5.9: Marine Water Analysis for Biochemical Oxygen Demand**

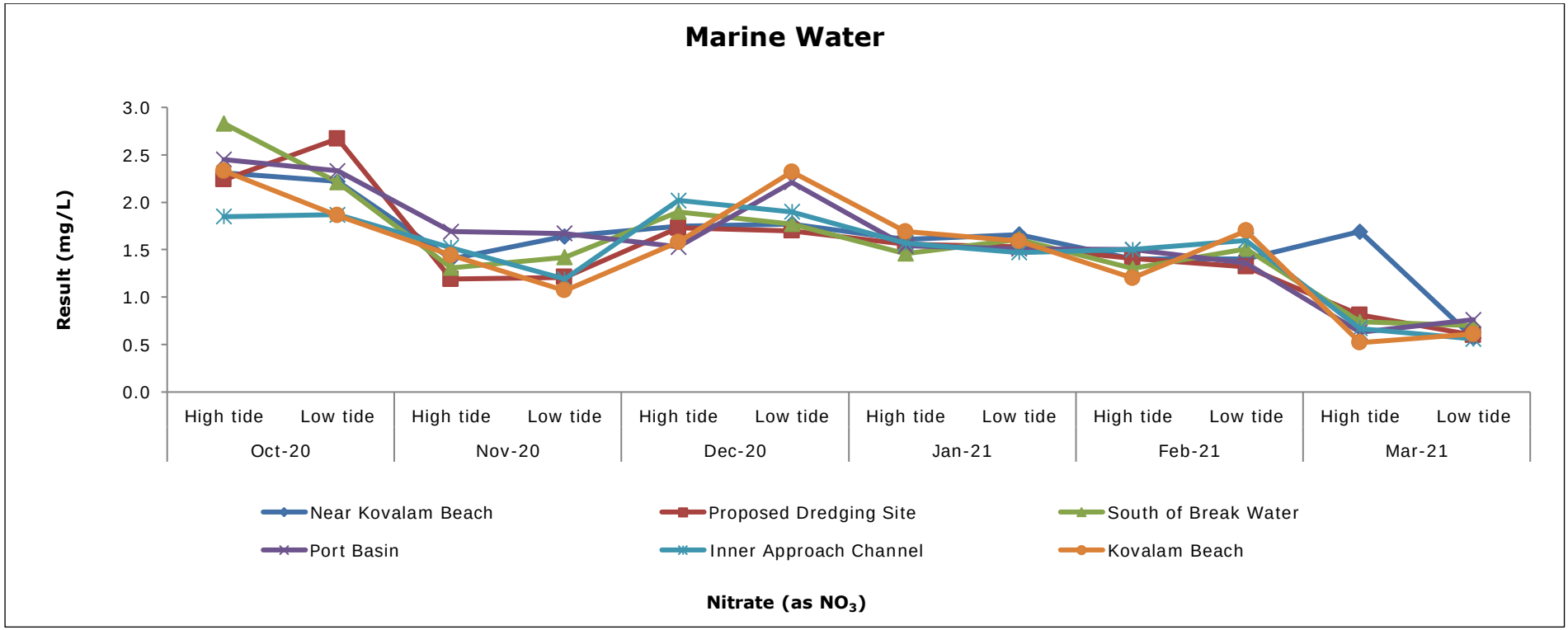



**Figure 5.10: Marine Water Analysis for Nitrate as $NO_3$**

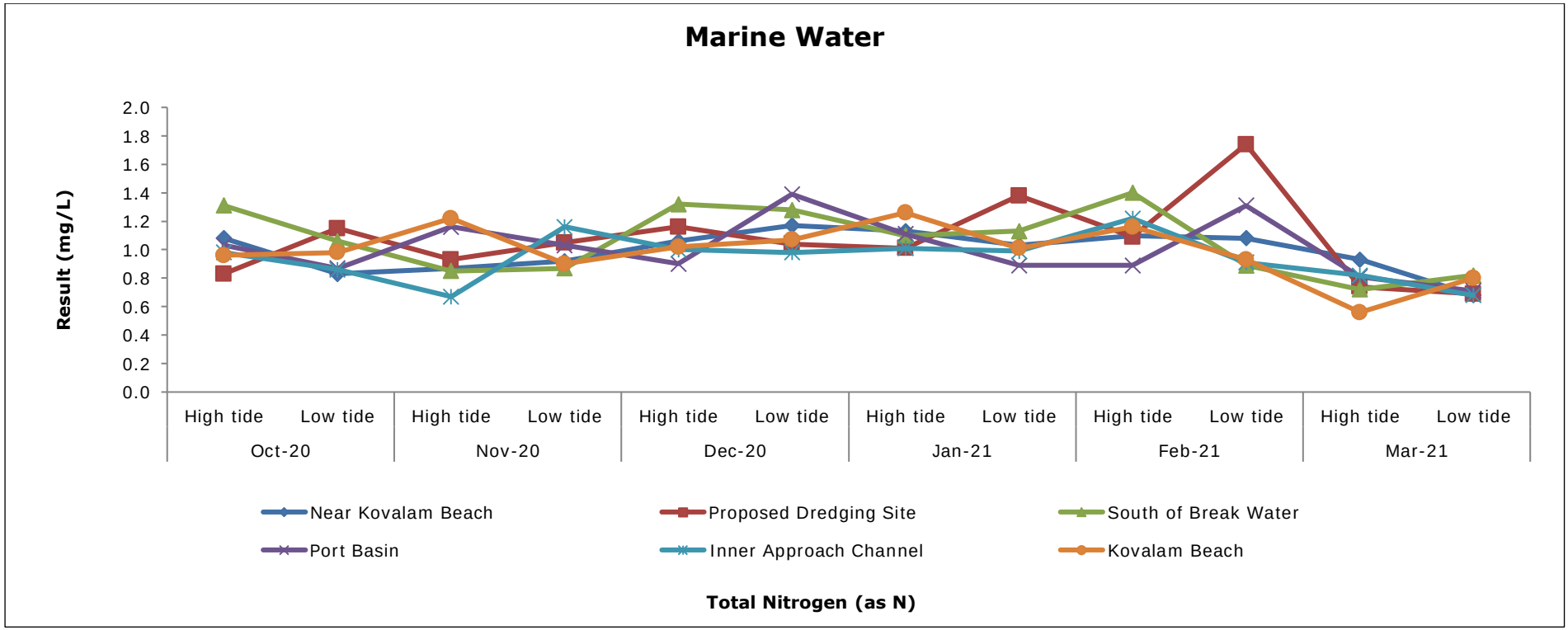



**Figure 5.11: Marine Water Analysis for Total Nitrogen as N**

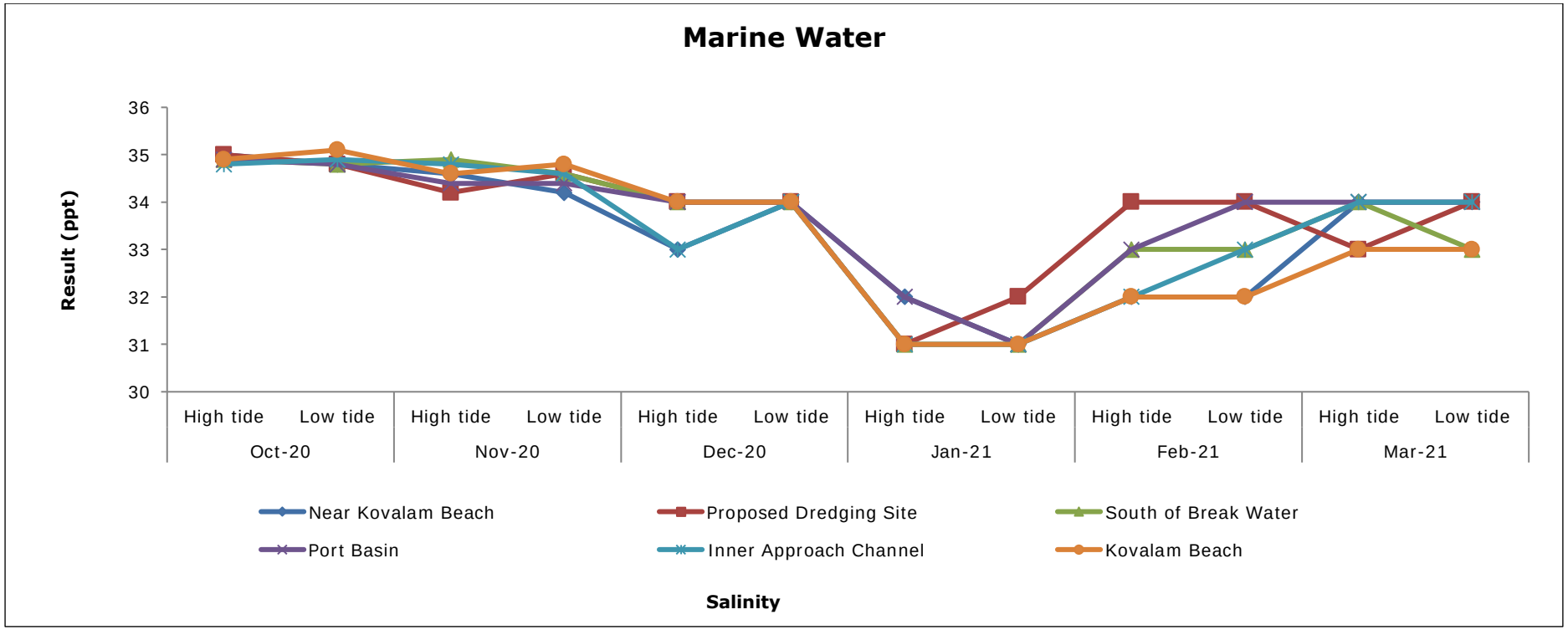



**Figure 5.12: Marine Water Analysis for Salinity**

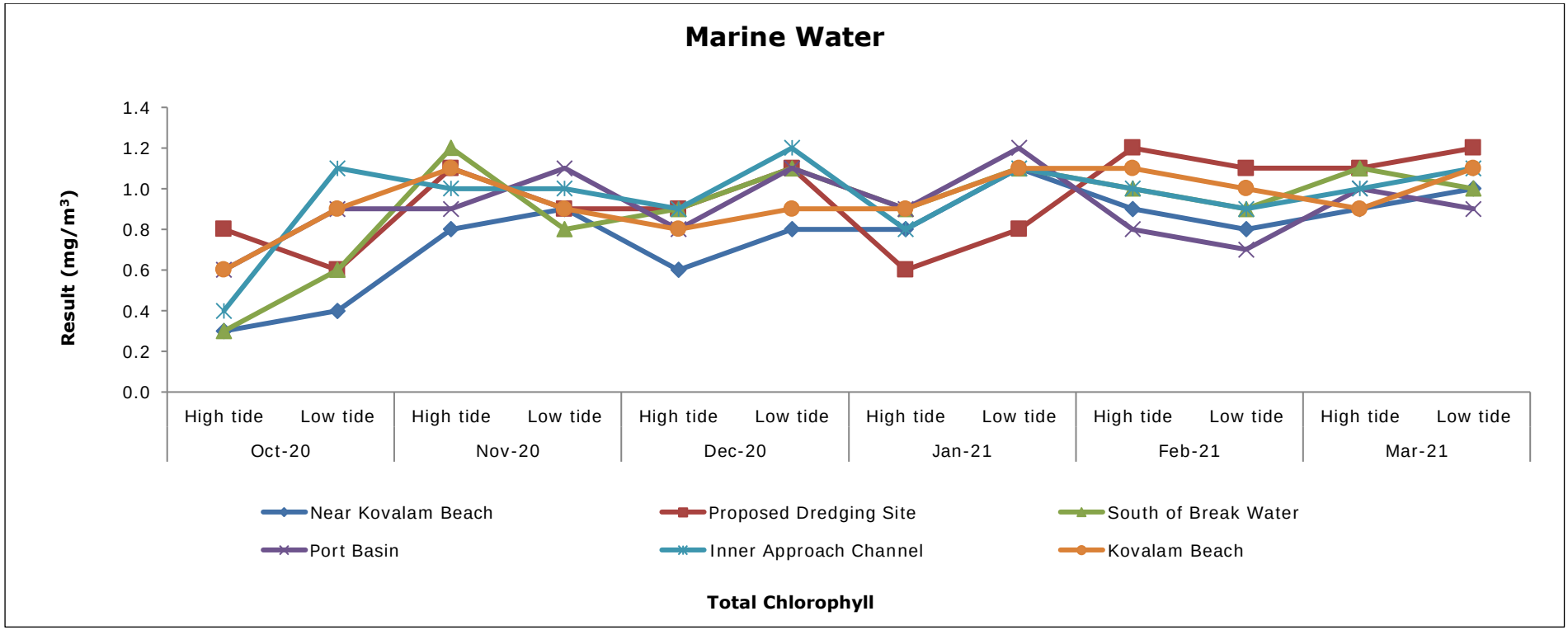



**Figure 5.13: Marine Water Analysis for Total Chlorophyll**

## 7. Summary - Marine water analysis:

During the months of October 2020 to March 2021, 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 27.2-28.2$^0$C, no visible colour or offensive odour was observed, concentration of pH were observed in the range between 7.36-8.40, Turbidity was observed in the range between <0.2-1.82 N.T.U, Electrical Conductivity (at 25$^o$C) was observed in the range between 43741-64100 µmho/cm, Total Suspended Solids were observed in the range between <5-19 mg/L, Total Dissolved Solids were observed in the range between 25970-41020 mg/L, Dissolved Oxygen was observed in the range between 4.6-6.1 mg/L, Biochemical Oxygen Demand (3 days, 27$^o$C) was observed in the range <1-2 mg/L, Nitrite (as $NO_2$) was observed in the range between <0.01-0.05 mg/L, Nitrate (as $NO_3$) was observed in the range between 0.57-2.31 mg/L, Total Nitrogen (as N) was observed in the range between 0.68-1.17 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 31-35 ppt, Total Chlorophyll was observed in the range between 0.3-1.1 mg/m$^3$, Total Coliforms was observed in the range between <1.8-6.8 MPN Index/100 mL and Faecal Coliforms was observed in the range between <1.8-6.8 MPN Index/100 mL.

At the location **Proposed Dredging Site**, the low tide and high tide Temperature was observed in the range between 27.2-27.9$^0$C, no visible colour or offensive odour was observed, concentration of pH were observed in the range between 7.56-8.40, Turbidity was observed in the range between <0.2-0.98 N.T.U, Electrical Conductivity (at 25$^o$C) was observed in the range between 44500-66700 µmho/cm, Total Suspended Solids were observed in the range between <5-27 mg/L, Total Dissolved Solids were observed in the range between 25900-42690 mg/L, Dissolved Oxygen was observed in the range between 4.8-6.8 mg/L, Biochemical Oxygen Demand (3 days, 27$^o$C) was observed in the range between <1-1.1 mg/L, Nitrite (as $NO_2$) was observed in the range between <0.01-0.05 mg/L, Nitrate (as $NO_3$) was observed in the range between 0.6-2.67 mg/L, Total Nitrogen (as N) was observed in the range between 0.69-1.74 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 31-35 ppt, Total Chlorophyll was observed in the range between 0.6-1.2 mg/$m^3$, Total Coliforms was observed in the range between <1.8-2 MPN Index/100 mL and Faecal Coliforms was observed in the range between <1.8-2 MPN Index/100 mL.

At the location **South of Break Water**, the low tide and high tide Temperature was observed in the range between 27.4-28.4 $^0$C, no visible colour or offensive odour was observed, concentration of pH were observed in the range between 7.62-8.46, Turbidity was observed in the range between <0.2-1.36 N.T.U, Electrical Conductivity (at 25$^o$C) was observed in the range between 42306-64800 µmho/cm, Total Suspended Solids were observed in the range between <5-20 mg/L, Total Dissolved Solids were observed in the range between 25930- 41470 mg/L, Dissolved Oxygen was observed in the range between 5-6.1 mg/L, Biochemical Oxygen Demand (3 days, 27$^o$C) was observed in the range between <1-1 mg/L, Nitrite (as $NO_2$) was observed in the range between <0.01-0.07 mg/L, Nitrate (as $NO_3$) was observed in the range between 0.7-2.83 mg/L, Total Nitrogen (as N) was observed in the range between 0.72-1.40 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 31-34.9 ppt, Total Chlorophyll was observed in the range between 0.3-1.2 mg/$m^3$, Total Coliforms was observed in the range between <1.8-11 MPN Index/100 mL and Faecal Coliforms was observed in the range between <1.8-7.8 MPN Index/100 mL

At the location **Port Basin**, the low tide and high tide Temperature was observed in the range between 27.2-29.3$^o$C, no visible colour or offensive odour were observed, concentration of pH were observed in the range between 7.61-8.50, Turbidity was observed in the range between <0.2-2.48 N.T.U, Electrical Conductivity (at 25$^o$C) was observed in the range between 44600-68200 µmho/cm, Total Suspended Solids were observed in the range between <5-23 mg/L, Total Dissolved Solids were observed in the range between 25870- 43650 mg/L, Dissolved Oxygen was observed in the range between 4.7-6.8 mg/L, Biochemical Oxygen Demand (3 days, 27$^o$C) was observed in the range between <1-2 mg/L, Nitrite (as $NO_2$) was observed in the range between <0.01-0.17 mg/L, Nitrate (as $NO_3$) was observed in the range between 0.63-2.45 mg/L, Total Nitrogen (as N) was observed in the range between 0.71-1.39 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

31-34.9 ppt, Total Chlorophyll was observed in the range between 0.6-1.2 mg/$m^3$, Total Coliforms was observed in the range between <1.8 -2 MPN Index/100 mL and Faecal Coliforms was observed <1.8 MPN Index/100 mL.

At the location **Inner Approach Channel**, the low tide and high tide Temperature was observed in the range between 27.2-28.1$^0$C, no visible colour or offensive odour was observed, concentration of pH were observed in the range between 7.68-8.5, Turbidity was observed in the range between <0.2-2.24 N.T.U, Electrical Conductivity (at 25$^o$C) was observed in the range between 44700- 65100 µmho/cm, Total Suspended Solids were observed in the range between <5-20 mg/L, Total Dissolved Solids were observed in the range between 25920- 41660 mg/L, Dissolved Oxygen was observed in the range between 4.9-6.3 mg/L, Biochemical Oxygen Demand (3 days, 27$^o$C) was observed in the range between <1-1.1 mg/L, Nitrite (as $NO_2$) was observed in the range between <0.01-0.04 mg/L, Nitrate (as $NO_3$) was observed in the range between 0.56-2.02 mg/L, Total Nitrogen (as N) was observed in the range between 0.67-1.22 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 31-34.9 ppt, Total Chlorophyll was observed in the range between 0.4-1.2 mg/$m^3$, Total Coliforms were observed in the range between <1.8−170 MPN Index/100 mL and Faecal Coliforms were observed in the range between <1.8−31 MPN Index/100 mL.

At the location **Kovalam Beach**, the low tide and high tide Temperature was observed in the range between 27.4-28.6 $^0$C, no visible colour or offensive odour was observed, concentration of pH were observed in the range between 7.56-8.5, Turbidity was observed in the range between <0.2-2 N.T.U, Electrical Conductivity (at 25$^o$C) was observed in the range between 44500-65500 µmho/cm, Total Suspended Solids were observed in the range between <5-19 mg/L, Total Dissolved Solids were observed in the range between 25860- 41920 mg/L, Dissolved Oxygen was observed in the range between 4.8-6.7 mg/L, Biochemical Oxygen Demand (3 days, 27$^o$C) was observed in the range between <1-1.1 mg/L, Nitrite (as $NO_2$) was observed in the range between <0.01-0.05 mg/L, Nitrate (as $NO_3$)was observed in the range between 0.52-2.33 mg/L, Total Nitrogen (as N) was observed in the range between 0.56-1.26 mg/L, Floating materials, Phenolic Compounds (as $C_6H_5OH$), Ammonical Nitrogen (as $NH_3$-N), Total Phosphorous (as P), Reactive Phosphorous, Polycyclic Aromatic Hydrocarbon were observed below the detection limits. Salinity was observed in the range between 31-35.1 ppt, Total Chlorophyll was observed in the range between 0.6-1.1 mg/$m^3$, Total Coliforms and Faecal Coliforms were observed <1.8 MPN Index/100 mL.

## 8. Sediment Analysis Results

**Table 5.5: Near Kovalam Beach**

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Texture | - | Sandy | Sandy | Sandy | Sandy | Sandy | Sandy |
| Organic Matter | % | 1.81 | 0.233 | 1.69 | 1.62 | 0.324 | 0.276 |
| Total Phosphorus (as P) | mg/kg | 15.5 | 15.2 | 30.2 | 25.2 | 37.6 | 36.0 |
| Aluminium (as Al) | mg/kg | 1091 | 1080 | 702 | 741 | 793 | 604 |
| Chromium (as Cr) | mg/kg | 8.91 | 18.3 | 12.2 | 12.2 | 13.2 | <5 |
| Copper (as Cu) | mg/kg | 1.74 | 1.65 | <1 | <1 | <1 | <1 |
| Iron (as Fe) | mg/kg | 5294 | 3050 | 3425 | 3364 | 3110 | 3472 |
| Lead (as Pb) | mg/kg | 5.97 | 5.82 | 9.6 | 8.7 | 7.0 | 12.0 |
| Manganese (as Mn) | mg/kg | 14.6 | 14.2 | 12.3 | 12.3 | 12.9 | 3.02 |
| Mercury (as Hg) | mg/kg | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 |
| Zinc (as Zn) | mg/kg | 8.18 | 5.21 | 5.31 | 4.9 | 4.15 | <2.5 |
| Nickel (as Ni) | mg/kg | 3.63 | 4.22 | <3 | <3 | <3 | 5.45 |
| **Benthic Organism** | | | | | | | |
| Micro Benthic Organism | /$m^2$ | 90420 | 90400 | 93200 | 93000 | 91000 | 90000 |
| Macro Benthic Organism | /$m^2$ | 81600 | 81500 | 82800 | 79000 | 80000 | 78000 |
| **Total** | **/$m^2$** | **172020** | **171900** | **176000** | **172000** | **171000** | **168000** |

**Table 5.6: Proposed Dredging Site**

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Texture | - | Sandy | Sandy | Sandy | Sandy | Sandy | Sandy |
| Organic Matter | % | 1.68 | 1.59 | 2.36 | 0.55 | 0.393 | 0.526 |
| Total Phosphorus (as P) | mg/kg | 13.6 | 12.8 | 20.2 | 35.1 | 15.9 | 29.4 |
| Aluminium (as Al) | mg/kg | 1092 | 725 | 527 | 765 | 751 | 469 |
| Chromium (as Cr) | mg/kg | 7.82 | 7.91 | <5 | <5 | <5 | <5 |
| Copper (as Cu) | mg/kg | 2.2 | 2.21 | <1 | <1 | <1 | <1 |
| Iron (as Fe) | mg/kg | 5358 | 2652 | 2412 | 2171 | 1673 | 1455 |
| Lead (as Pb) | mg/kg | 3.44 | 3.51 | 2.00 | 1.99 | 4.18 | 6.58 |
| Manganese (as Mn) | mg/kg | 17.3 | 13.8 | 10.2 | 9.04 | 9.16 | 4.52 |
| Mercury (as Hg) | mg/kg | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 |
| Zinc (as Zn) | mg/kg | 8.62 | 4.22 | 5.3 | 6.02 | 5.44 | <2.5 |
| Nickel (as Ni) | mg/kg | 3.69 | 4.11 | 3.21 | 3.74 | 3.81 | 3.44 |
| **Benthic Organism** | | | | | | | |
| Micro Benthic Organism | /$m^2$ | 14600 | 14300 | 14500 | 14500 | 14100 | 14100 |
| Macro Benthic Organism | /$m^2$ | 95400 | 95300 | 95500 | 94600 | 95200 | 95100 |
| **Total** | **/$m^2$** | **110000** | **109600** | **110000** | **109100** | **109300** | **109200** |

**Table 5.7: South of Breakwater**

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Texture | - | Sandy | Sandy | Sandy | Sandy | Sandy | Sandy |
| Organic Matter | % | 1.32 | 3.19 | 1.24 | 5.34 | 0.857 | 0.896 |
| Total Phosphorus (as P) | mg/kg | 22.4 | 16.8 | 20.9 | 23.4 | 14.9 | 49.3 |
| Aluminium (as Al) | mg/kg | 468 | 421 | 472 | 751 | 712 | 559 |
| Chromium (as Cr) | mg/kg | 12.7 | 14.1 | 7.83 | 7.02 | 7.04 | 9.33 |
| Copper (as Cu) | mg/kg | 1.35 | 1.36 | 1.20 | 1.19 | 1.39 | <1 |
| Iron (as Fe) | mg/kg | 3925 | 2248 | 2645 | 2488 | 2699 | 1480 |
| Lead (as Pb) | mg/kg | 8.8 | 8.62 | 4.8 | 3.22 | 3.03 | 14.2 |
| Manganese (as Mn) | mg/kg | 8.8 | 9.92 | 5.1 | 5.19 | 5.22 | 8.26 |
| Mercury (as Hg) | mg/kg | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 |
| Zinc (as Zn) | mg/kg | <2.5 | 3.91 | 3.1 | 3.47 | 3.42 | <2.5 |
| Nickel (as Ni) | mg/kg | <3 | <3 | <3 | <3 | <3 | 3.96 |
| **Benthic Organism** | | | | | | | |
| Micro Benthic Organism | /$m^2$ | 34200 | 34100 | 34200 | 34500 | 34400 | 34300 |
| Macro Benthic Organism | /$m^2$ | 25500 | 25300 | 25400 | 25500 | 26400 | 26300 |
| **Total** | **/$m^2$** | **59700** | **59400** | **59600** | **60000** | **60800** | **60600** |

**Table 5.8: Port Basin**

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Texture | - | Sandy | Sandy | Sandy | Sandy | Sandy | Sandy |
| Organic Matter | % | 0.38 | 6.79 | 1.15 | 9.65 | 0.928 | 0.899 |
| Total Phosphorus (as P) | mg/kg | 15.9 | 12.6 | 36.3 | 32.8 | 50.1 | 13.7 |
| Aluminium (as Al) | mg/kg | 448 | 730 | 950 | 750 | 713 | 6328 |
| Chromium (as Cr) | mg/kg | 11.0 | 13.6 | 9.62 | 7.2 | 7.85 | 10.1 |
| Copper (as Cu) | mg/kg | 1.44 | 1.42 | 1.35 | 1.29 | 1.54 | 3.77 |
| Iron (as Fe) | mg/kg | 3269 | 2620 | 3108 | 2802 | 2837 | 9358 |
| Lead (as Pb) | mg/kg | 7.48 | 6.12 | 5.08 | 5.8 | 7.06 | 20.9 |
| Manganese (as Mn) | mg/kg | 7.57 | 12.4 | 22.2 | 19.1 | 19.1 | 38.9 |
| Mercury (as Hg) | mg/kg | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 |
| Zinc (as Zn) | mg/kg | <2.5 | 3.95 | 6.92 | 6.86 | 5.59 | 11.4 |
| Nickel (as Ni) | mg/kg | <3 | 3.01 | 3.24 | <3 | <3 | 11.5 |
| **Benthic Organism** | | | | | | | |
| Micro Benthic Organism | /$m^2$ | 73400 | 73300 | 74800 | 75000 | 74000 | 73000 |
| Macro Benthic Organism | /$m^2$ | 67600 | 67400 | 68400 | 68600 | 69000 | 68000 |
| **Total** | **/$m^2$** | **141000** | **140700** | **143200** | **143600** | **143000** | **141000** |

**Table 5.9: Inner Approach Channel**

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Texture | - | Sandy | Sandy | Sandy | Sandy | Sandy | Sandy |
| Organic Matter | % | 1.39 | 0.153 | 1.78 | 0.4 | 0.56 | 0.31 |
| Total Phosphorus (as P) | mg/kg | 14.3 | 21.4 | 20.5 | 30.2 | 31.7 | 14.2 |
| Aluminium (as Al) | mg/kg | 1189 | 630 | 600 | 762 | 699 | 697 |
| Chromium (as Cr) | mg/kg | <5 | 11.2 | <5 | <5 | <5 | <5 |
| Copper (as Cu) | mg/kg | 2.24 | 1.67 | <1 | <1 | <1 | <1 |
| Iron (as Fe) | mg/kg | 2509 | 2771 | 2980 | 3142 | 2939 | 3686 |
| Lead (as Pb) | mg/kg | 4.08 | 6.68 | 3.72 | 2.59 | 4.53 | 13.4 |
| Manganese (as Mn) | mg/kg | 12.3 | 7.11 | 9.25 | 10.2 | 10.8 | 11.4 |
| Mercury (as Hg) | mg/kg | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 |
| Zinc (as Zn) | mg/kg | 3.2 | <2.5 | <2.5 | <2.5 | <2.5 | 3.38 |
| Nickel (as Ni) | mg/kg | <3 | <3 | <3 | <3 | <3 | 6.84 |
| **Benthic Organism** | | | | | | | |
| Micro Benthic Organism | /$m^2$ | 33700 | 33600 | 33700 | 33800 | 33700 | 33500 |
| Macro Benthic Organism | /$m^2$ | 8500 | 8600 | 8700 | 8800 | 8900 | 8700 |
| **Total** | **/$m^2$** | **42200** | **42200** | **42400** | **42600** | **42600** | **42200** |

**Table 5.10: Kovalam Beach**

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Texture | - | Sandy | Sandy | Sandy | Sandy | Sandy | Sandy |
| Organic Matter | % | 0.88 | 0.081 | 1.62 | 0.33 | 0.24 | 0.299 |
| Total Phosphorus (as P) | mg/kg | 14.1 | 13.6 | 25.2 | 38.5 | 34 | 36.3 |
| Aluminium (as Al) | mg/kg | 1013 | 923 | 741 | 730 | 791 | 707 |
| Chromium (as Cr) | mg/kg | 3.06 | 14.6 | 12.2 | 16.9 | 16.9 | 6.69 |
| Copper (as Cu) | mg/kg | 1.95 | 1.42 | <1 | <1 | <1 | <1 |
| Iron (as Fe) | mg/kg | 4522 | 2950 | 3364 | 3235 | 2587 | 3947 |
| Lead (as Pb) | mg/kg | 4.25 | 9.45 | 8.7 | 9.52 | 8.59 | 14.8 |
| Manganese (as Mn) | mg/kg | 13 | 11.9 | 12.3 | 11.7 | 11.1 | 12.4 |
| Mercury (as Hg) | mg/kg | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 |
| Zinc (as Zn) | mg/kg | 6.87 | 3.86 | 4.9 | 6.91 | 5.51 | 4.81 |
| Nickel (as Ni) | mg/kg | 3.75 | <3 | <3 | <3 | <3 | 5.81 |
| **Benthic Organism** | | | | | | | |
| Micro Benthic Organism | /$m^2$ | 92500 | 92400 | 93000 | 93700 | 93500 | 93400 |
| Macro Benthic Organism | /$m^2$ | 86300 | 86200 | 79000 | 82700 | 83000 | 82000 |
| **Total** | **/$m^2$** | **178800** | **178600** | **172000** | **176400** | **176500** | **175400** |

## 9. Graphical representation of Results for sediment analysis

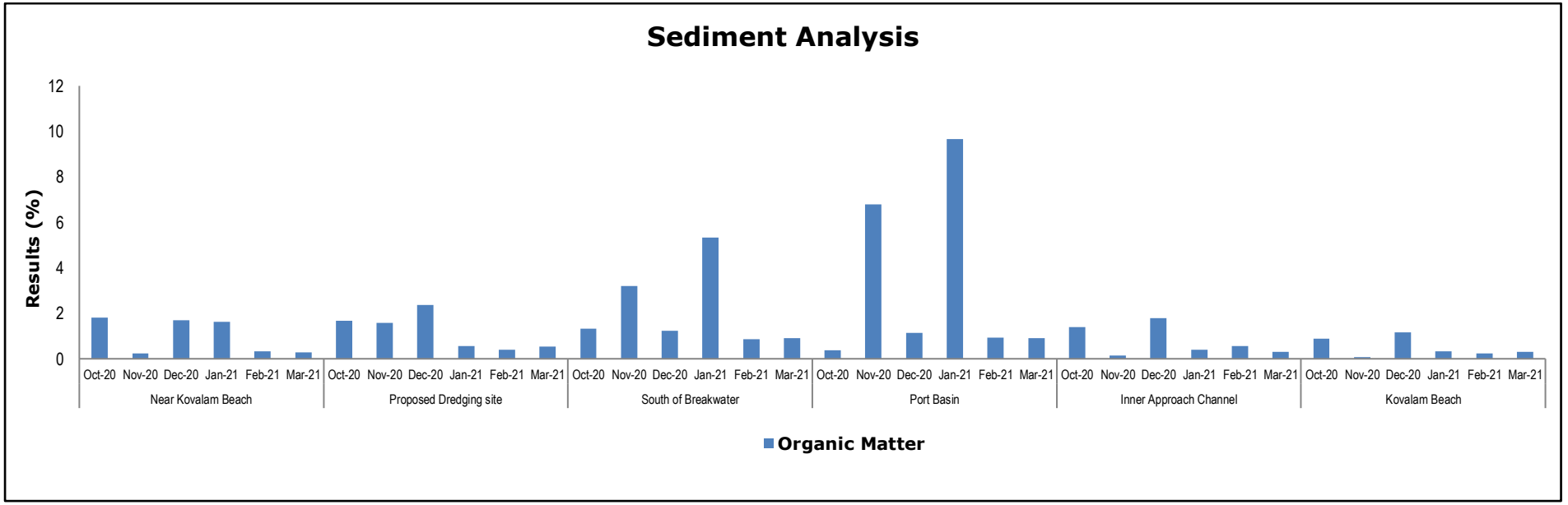



**Figure 5.14: Sediment analysis for Organic Matter**

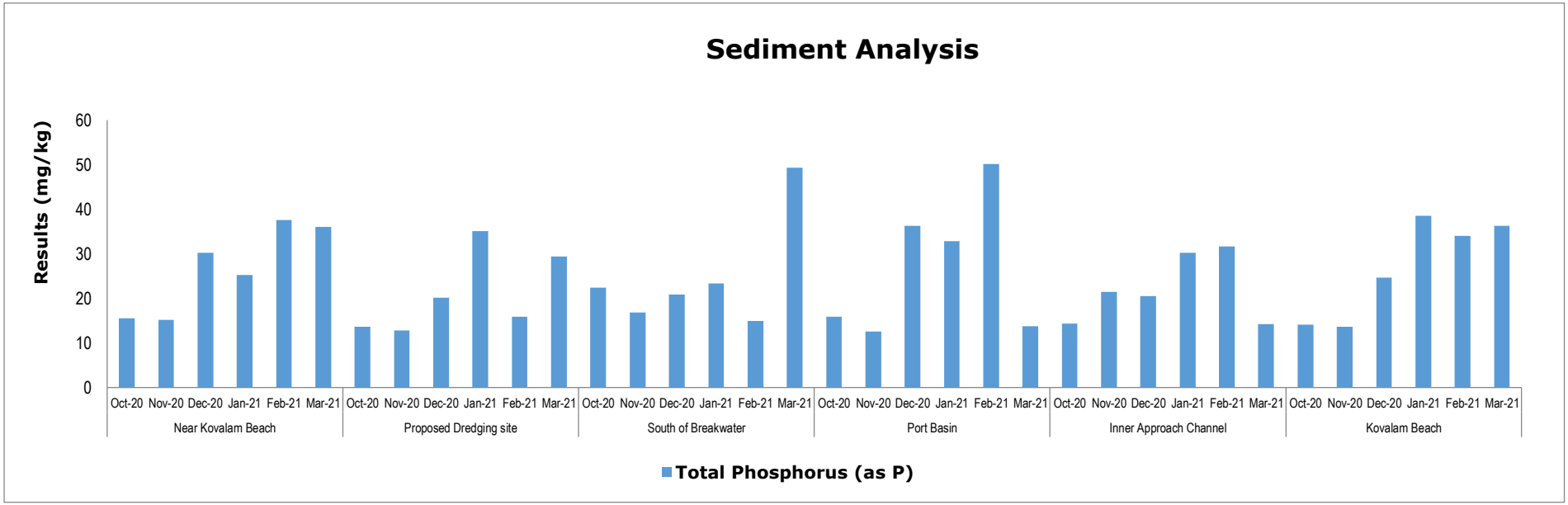



**Figure 5.15: Sediment analysis for Total Phosphorus**

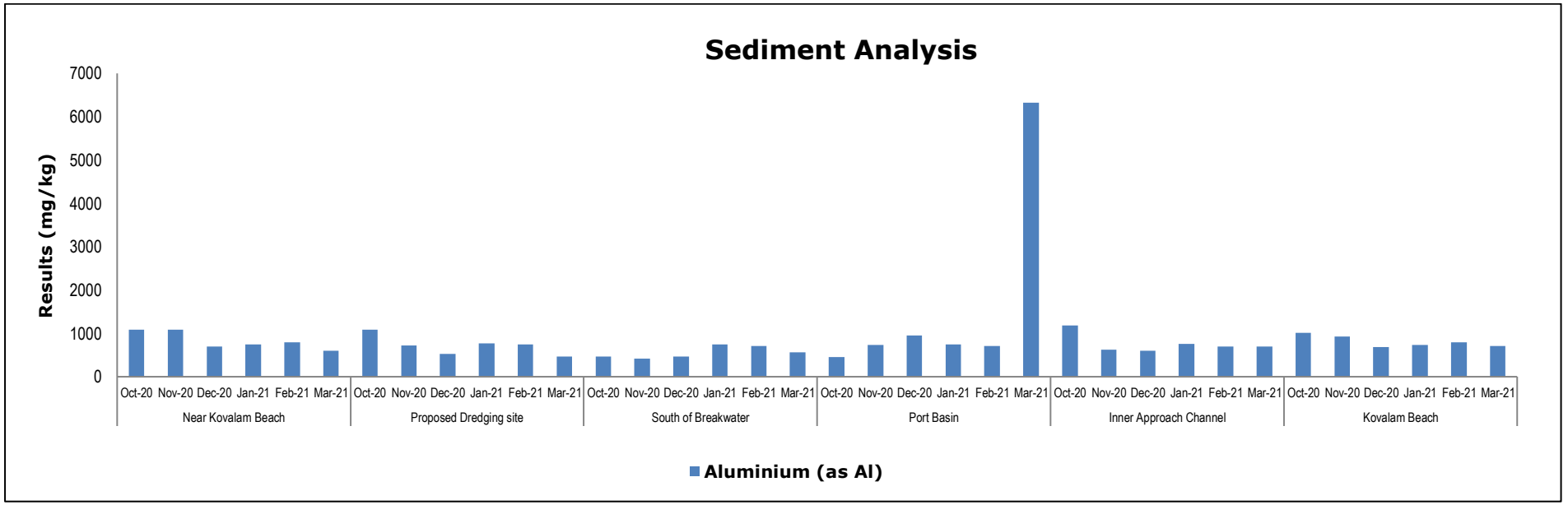



**Figure 5.16: Sediment analysis for Aluminium**

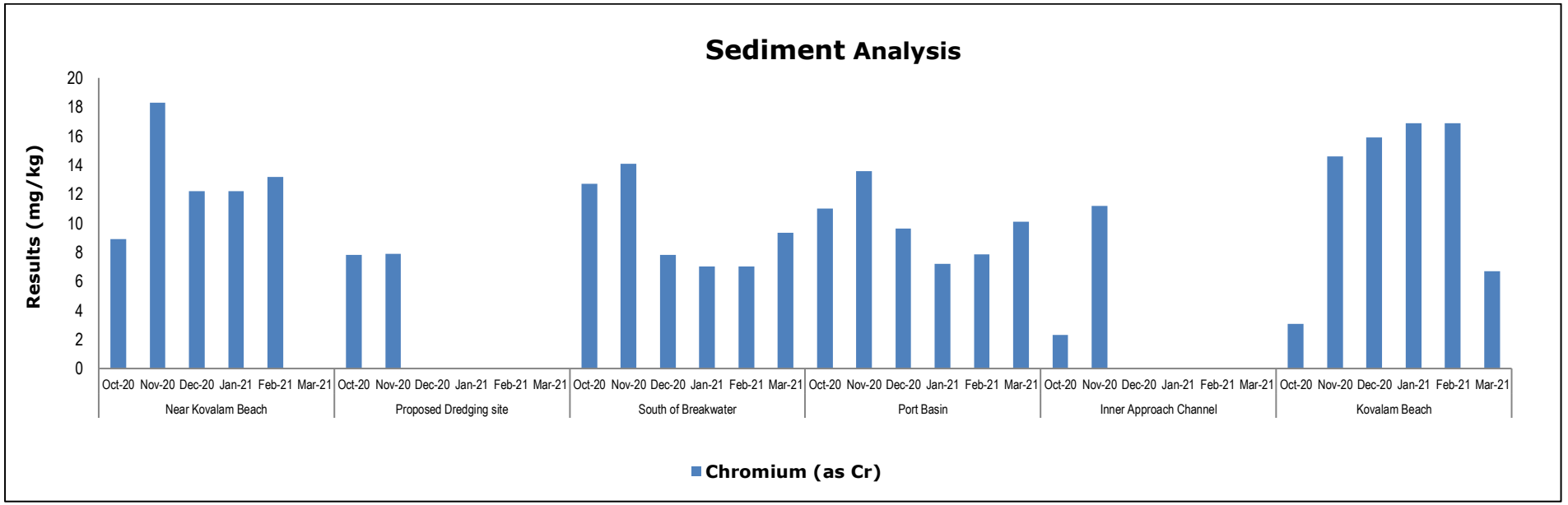



**Figure 5.17: Sediment analysis for Chromium**

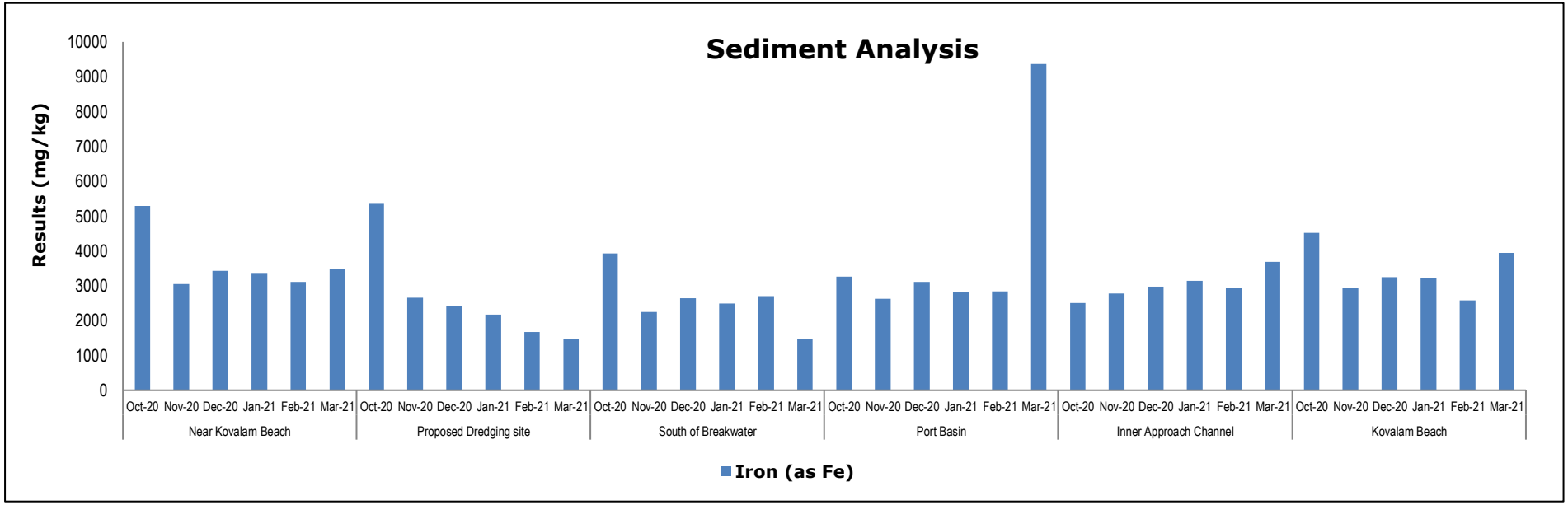



**Figure 5.18: Sediment analysis for Iron**

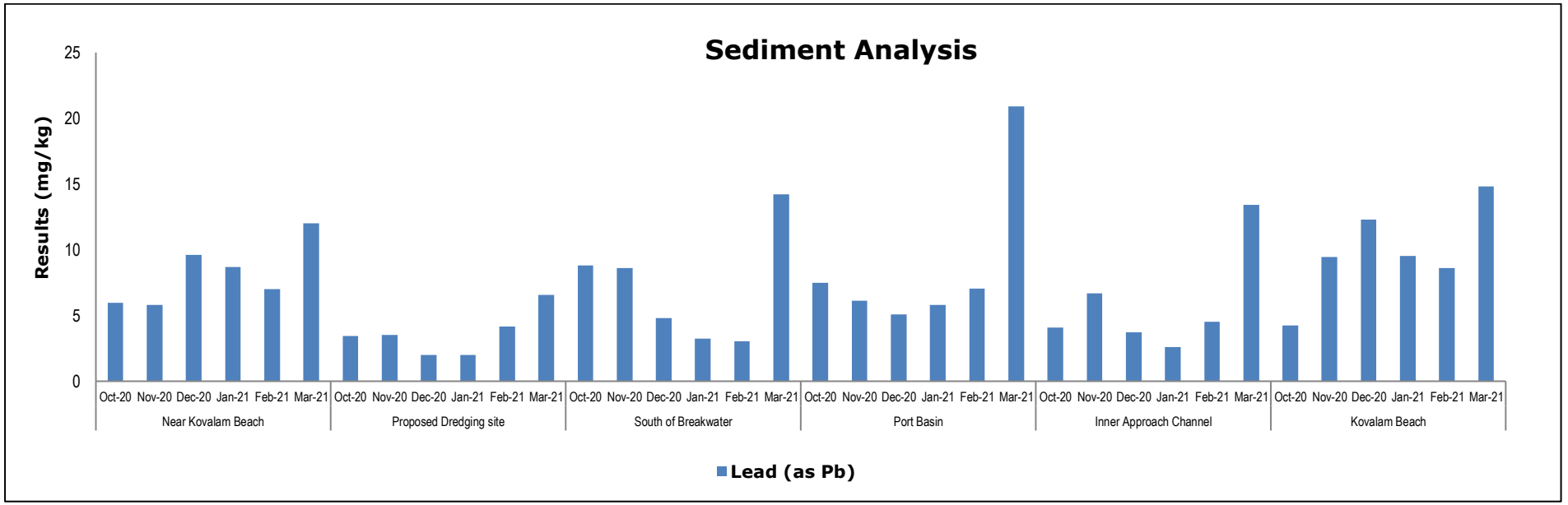



**Figure 5.19: Sediment analysis for Lead**

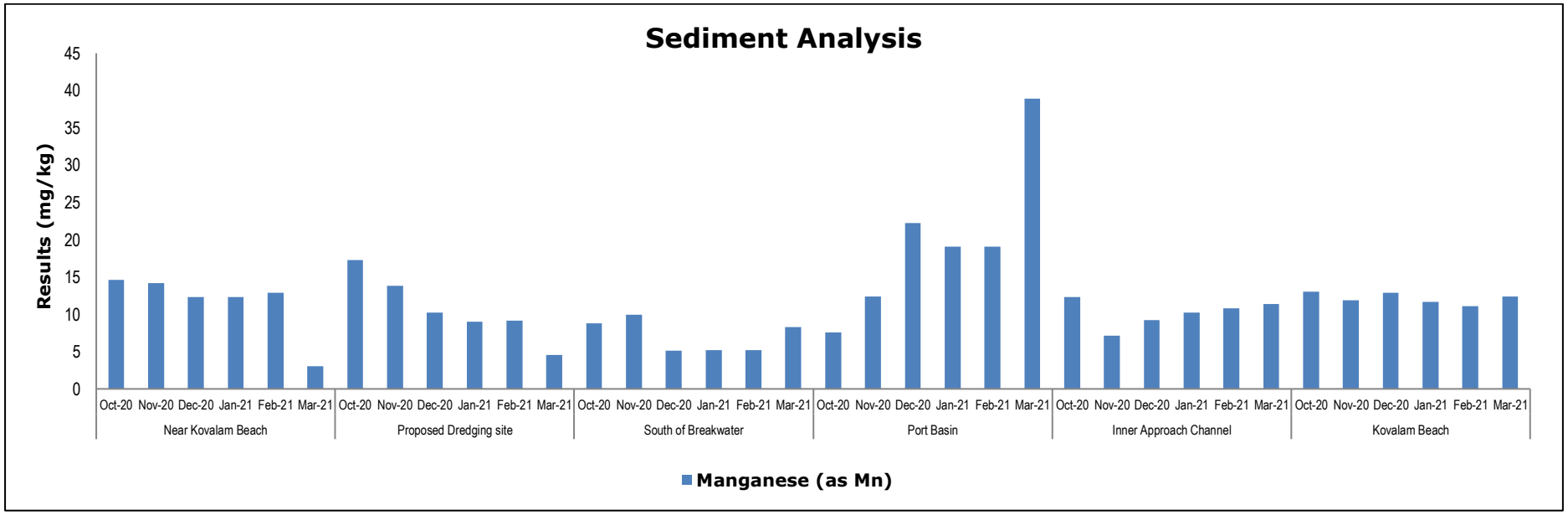



**Figure 5.20: Sediment analysis for Manganese**

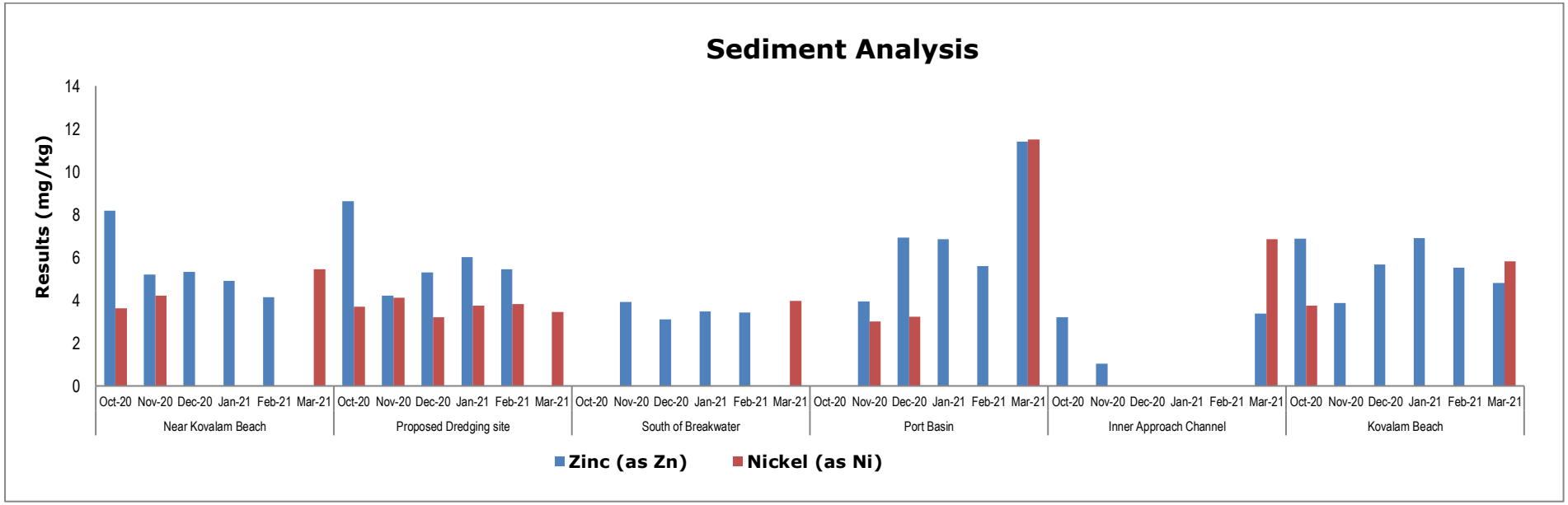



**Figure 5.21: Sediment analysis for Zinc and Nickel**

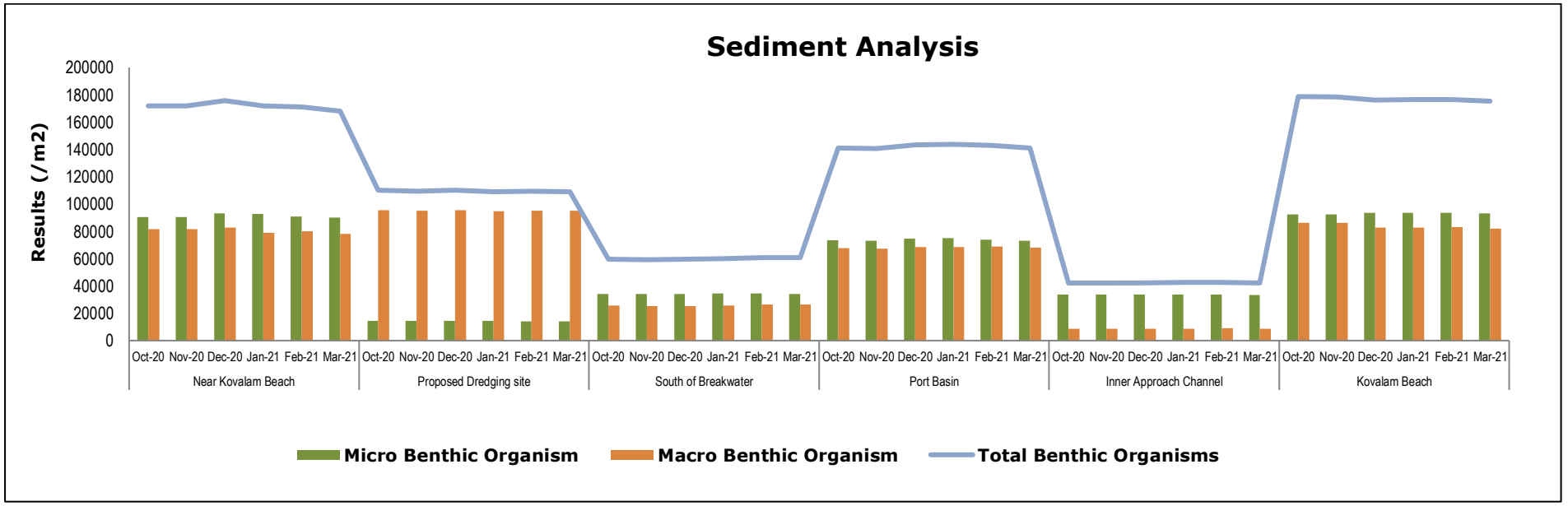



**Figure 5.22: Sediment analysis for Benthic Organism**

## 10.Summary- Sediment Analysis:

During the months of October 2020 to March 2021, 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 0.23-1.81%, Total Phosphorus (as P) was observed in the range between 15.2-37.6 mg/kg. Aluminium (as Al) was observed in the range between 604-1091 mg/kg. Chromium (as Cr) was observed in the range between <5-18.3 mg/kg. Copper (as Cu) was observed in the range between <1-1.74 mg/kg. Iron (as Fe) was observed in the range between 3050-5294 mg/kg. Lead (as Pb) was observed in the range between 5.82-12 mg/kg. Manganese (as Mn) was observed in the range between 3.02-14.6 mg/kg. Mercury (as Hg) was observed <0.04 mg/kg. Zinc (as Zn) was observed in the range between <2.5-8.18 mg/kg. Nickel (as Ni) was observed in the range between <3-5.45 mg/kg. Micro benthic organisms were observed in the range between 90000-93200 /$m^2$ and macro benthic organisms were observed in the range between 78000-82800 /$m^2$.

At the location **Proposed Dredging site**, the observed texture was sandy, Organic matter was observed in the range between 0.39-2.36 %, Total Phosphorus (as P) was observed in the range between 12.8-35.1 mg/kg. Aluminium (as Al) was observed in the range between 469-1092 mg/kg. Chromium (as Cr) was observed in the range between <5-7.91 mg/kg. Copper (as Cu) was observed in the range between <1-2.21 mg/kg. Iron (as Fe) was observed in the range between 1455-5358 mg/kg. Lead (as Pb) was observed in the range between 1.99-6.58 mg/kg. Manganese (as Mn) was observed in the range between 4.52-17.3 mg/kg. Mercury (as Hg) was observed <0.04 mg/kg. Zinc (as Zn) was observed in the range between <2.5-8.62 mg/kg. Nickel (as Ni) was observed in the range between 3.21-4.11 mg/kg. Micro benthic organisms were observed in the range between 14100-14600 /$m^2$ and macro benthic organisms were observed in the range between 94600-95500 /$m^2$.

At the location **South of break water**, the observed texture was sandy, Organic matter was observed in the range between 0.857-5.34 %, Total Phosphorus (as P) was observed in the range between 14.9-49.3 mg/kg. Aluminium (as Al) was observed in the range between 421-751 mg/kg. Chromium (as Cr) was observed in the range between 7.02-14.1 mg/kg. Copper (as Cu) was observed in the range between <1-1.39 mg/kg. Iron (as Fe) was observed in the range between 1480-3925 mg/kg. Lead (as Pb) was observed in the range between 3.03-14.2 mg/kg. Manganese (as Mn) was

observed in the range between 5.1-9.92 mg/kg. Mercury (as Hg) was observed <0.04 mg/kg. Zinc (as Zn) was observed in the range between <2.5 – 3.91 mg/kg. Nickel (as Ni) was observed in the range between below <3–3.96 mg/kg. Micro benthic organisms were observed in the range between 34100-34500/$m^2$ and macro benthic organisms were observed in the range 25300-26400/$m^2$.

At the location **Port Basin**, the observed texture was sandy, Organic matter was observed in the range between 0.38-9.65 %, Total Phosphorus (as P) was observed in the range between 12.6-50.1 mg/kg. Aluminium (as Al) was observed in the range between 448-6328 mg/kg. Chromium (as Cr) was observed in the range between 7.2-13.6 mg/kg. Copper (as Cu) was observed in the range between 1.29-3.77 mg/kg. Iron (as Fe) was observed in the range between 2620-9358 mg/kg. Lead (as Pb) was observed in the range between 5.08-20.9 mg/kg. Manganese (as Mn) was observed in the range between 7.57-38.9 mg/kg. Mercury (as Hg) was observed <0.04 mg/kg. Zinc (as Zn) was observed in the range between <2.5-11.4 mg/kg. Nickel (as Ni) was observed in the range between <3-11.5 mg/kg. Micro benthic organisms were observed in the range between 73000-75000/$m^2$ and macro benthic organisms were observed in the range between 67400-69000/$m^2$.

At the location **Inner Approach Channel**, the observed texture was sandy, Organic matter was observed in the range between 0.15-1.78 %, Total Phosphorus (as P) was observed in the range between 14.2-31.7 mg/kg. Aluminium (as Al) was observed in the range between 600-1189 mg/kg. Chromium (as Cr) was observed in the range between <5-11.2 mg/kg. Copper (as Cu) was observed in the range between <1-2.24 mg/kg. Iron (as Fe) was observed in the range between 2509-3686 mg/kg. Lead (as Pb) was observed in the range between 2.59-13.4 mg/kg. Manganese (as Mn) was observed in the range between 7.11-12.3 mg/kg. Mercury (as Hg) was observed <0.04 mg/kg. Zinc (as Zn) was observed in the range between <2.5-3.38 mg/kg. Nickel (as Ni) was observed in the range between <3 -6.84 mg/kg. Micro benthic organisms were observed in the range between 33500-33800/$m^2$ and macro benthic organisms were observed in the range between 8500-8900/$m^2$.

At the location **Kovalam Beach**, the observed texture was sandy, Organic matter was observed in the range between 0.08-1.16 %, Total Phosphorus (as P) was observed in the range between 13.6-38.5 mg/kg. Aluminium (as Al) was observed in the range between 680-1013 mg/kg. Chromium (as Cr) was observed in the range between 3.06-16.9 mg/kg. Copper (as Cu) was observed in the range between <1-1.95 mg/kg. Iron (as Fe) was observed in the range between 2587-4522 mg/kg. Lead (as Pb) was

observed in the range between 4.25-14.8 mg/kg. Manganese (as Mn) was observed in the range between 11.1-13 mg/kg. Mercury (as Hg) was observed <0.04 mg/kg. Zinc (as Zn) was observed in the range between 3.86-6.91 mg/kg. Nickel (as Ni) was observed in the range between <3-5.81 mg/kg. Micro benthic organisms were observed in the range between 92400-93700 /$m^2$ and macro benthic organisms were observed in the range between 82000-86300 /$m^2$.

### 11.Marine Water Analysis for Phytoplankton and Zooplankton

**Table 5.11: Total Phytoplankton and Zooplankton Results**

| Parameter | Month | Near Kovalam Beach | Proposed Dredging Site | South of Break water | Port Basin | Inner Approach Channel | Kovalam Beach |
|---|---|---|---|---|---|---|---|
| Total Phytoplankton No/100 mL | Oct-20 | 4230900 | 398900 | 1437100 | 128600 | 1362000 | 4418600 |
| | Nov-20 | 4248300 | 401700 | 1446100 | 132800 | 1378400 | 4438800 |
| | Dec-20 | 4235700 | 391000 | 1416600 | 129500 | 1339200 | 4310400 |
| | Jan-21 | 4219800 | 377900 | 1383800 | 125400 | 1281400 | 4203100 |
| | Feb-21 | 4222600 | 381200 | 1373300 | 128500 | 1310900 | 4240500 |
| | Mar-21 | 4229000 | 393300 | 1380400 | 132000 | 1337200 | 4349600 |
| Total Zooplankton No/100 mL | Oct-20 | 8898 | 9164 | 10478 | 5942 | 11155 | 9584 |
| | Nov-20 | 8407 | 8830 | 9288 | 5595 | 10899 | 9341 |
| | Dec-20 | 8560 | 9122 | 9688 | 5986 | 11242 | 9492 |
| | Jan-21 | 9108 | 9387 | 9983 | 6195 | 11495 | 9836 |
| | Feb-21 | 8638 | 9034 | 9638 | 5949 | 11153 | 9312 |
| | Mar-21 | 8191 | 8769 | 9193 | 5320 | 10859 | 8886 |

## 12. Graphical representation of Results for Marine Phytoplankton and Zooplankton

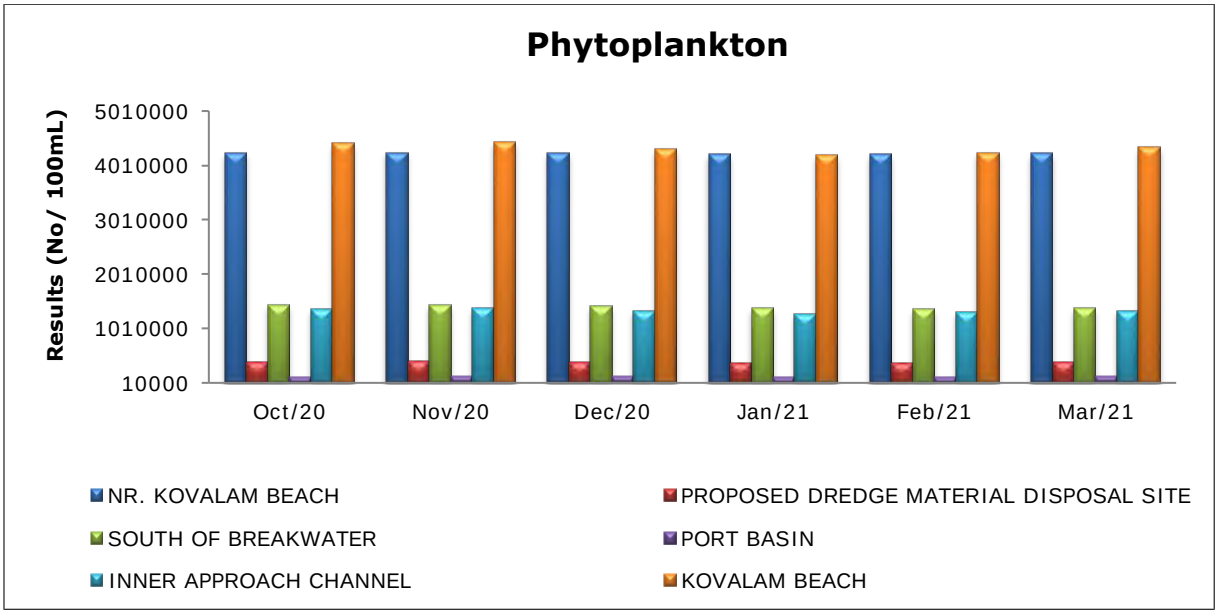



**Figure 5.23: Marine Water Analysis for Total Phytoplankton**

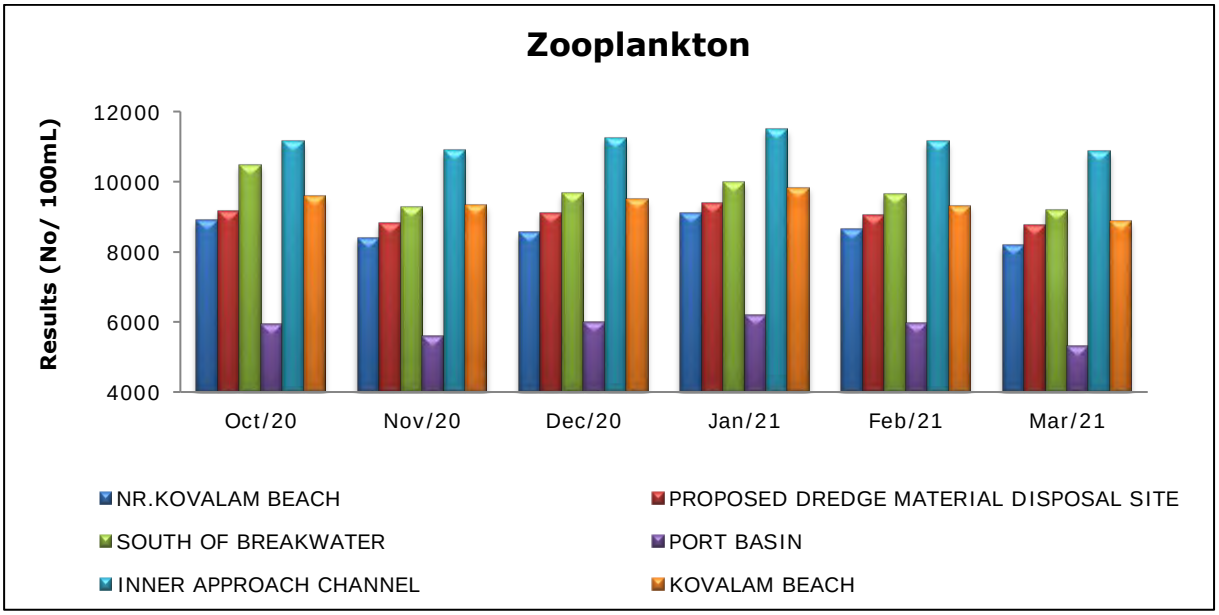



**Figure 5.24: Marine Water Analysis for Total Zooplankton**

## 13.Summary-Marine Water Analysis for Phytoplankton and Zooplankton

During the months October 2020 to March 2021, 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 4219800-4248300 No/100 mL and Zooplanktons were observed in the range between 8191-9108 No/100 mL.

At the location **Proposed Dredging site**, Phytoplankton were observed in the range between 377900-401700 No/100 mL and Zooplanktons were observed in the range between 8769-9387 No/100 mL.

At the location **South of Breakwater**, Phytoplankton were observed in the range between 1373300-1446100 No/100 mL and Zooplanktons were observed in the range between 9193-10478 No/100 mL.

At the location **Port Basin**, Phytoplankton were observed in the range between 125400-132800 No/100 mL and Zooplanktons were observed in the range between 5320-6195 No/100 mL.

At the location **Inner Approach Channel**, Phytoplankton were observed in the range between 1281400-1378400 No/100 mL and Zooplanktons was observed in the range between 10859-11495 No/100 mL.

At the location **Kovalam Beach**, Phytoplankton were observed in the range between 4203100-4438800 No/100 mL and Zooplanktons was observed in the range between 8886-9836 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 October 2020 to March 2021. 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 |

| Sr. No. | Parameter | Unit | Detection Limit | Method Reference |
|---|---|---|---|---|
| 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 |
| 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 |

| Sr. No. | Parameter | Unit | Detection Limit | Method Reference |
|---|---|---|---|---|
| xi. | Endosulfan (☐,☐& 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 | USEPA 551.1.REV 1.1995,1 AEC/C/SAP/INS/5-16 |
| b) | Dibromochloromethane | mg/L | 0.01 | USEPA 551.1.REV 1.1995,1 AEC/C/SAP/INS/5-16 |
| c) | Bromodichloroethane | mg/L | 0.01 | USEPA 551.1.REV 1.1995,1 AEC/C/SAP/INS/5-16 |
| d) | Chloroform | mg/L | 0.01 | USEPA 551.1.REV 1.1995,1 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 October 2020 to March 2021:

**Table 6.3: Location - Port Site**

| Parameter | Unit | Acceptable Limit as per IS 10500: 2012 | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|---|
| **Organoleptic & Physical Parameters** | | | | | | | | |
| Colour | Hazen Units | *Max.* 5 | 1 | 1 | 1 | 1 | 1 | 1 |
| Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| pH Value | - | 6.5 to 8.5 | 6.6 | 7.15 | 7.2 | 6.77 | 7.5 | 7.27 |
| Turbidity | N.T.U. | *Max.* 1 | <0.2 | <0.2 | <0.2 | 0.43 | 2.6 | <0.2 |
| Total Dissolved Solids | mg/L | *Max.* 500 | 442 | 400 | 424 | 448 | 450 | 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 | <0.025 | <0.025 |
| Ammonia (as $NH_3$- N) | mg/L | *Max.*0.5 | <0.1 | <0.1 | <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 | <0.1 | <0.1 |
| Barium (as Ba) | mg/L | *Max.* 0.7 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Boron (as B) | mg/L | *Max.* 0.5 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Calcium (as Ca) | mg/L | *Max.* 75 | 35.3 | 40.0 | 38.5 | 39.3 | 44.0 | 36.8 |
| Chloramines (as $Cl_2$) | mg/L | *Max.* 4.0 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Chloride (as Cl) | mg/L | *Max.*250 | 135 | 122 | 146 | 145 | 134 | 145 |
| Copper (as Cu) | mg/L | *Max.*0.05 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluoride (as F) | mg/L | *Max.* 1 | 0.4 | 0.5 | 0.2 | 0.8 | 0.3 | 0.6 |
| Iron (as Fe) | mg/L | *Max.*0.3 | 0.217 | <0.06 | <0.06 | 0.191 | <0.06 | <0.06 |
| Magnesium (as Mg) | mg/L | *Max.* 30 | 19.0 | 19.4 | 22.8 | 23.3 | 24.0 | 21.3 |
| Manganese (as Mn) | mg/L | *Max.*0.1 | 0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Mineral Oil | mg/L | *Max.*0.5 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Nitrate (as $NO_3$) | mg/L | *Max.*45 | 13.9 | 12.3 | 3.29 | 17.6 | 29.3 | 27.8 |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | *Max.* 0.001 | <0.001 | <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 | <0.005 | <0.005 |
| Silver (as Ag) | mg/L | *Max.* 0.1 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Sulphate (as $SO_4$) | mg/L | *Max.* 200 | 25.2 | 53.4 | 40.0 | 56.4 | 43.3 | 42.6 |
| Sulphide (as $H_2S$) | mg/L | *Max.* 0.05 | <0.025 | <0.025 | <0.025 | <0.025 | <0.025 | <0.025 |

| Parameter | Unit | Acceptable Limit as per IS 10500: 2012 | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|---|
| Total Alkalinity (as $CaCO_3$) | mg/L | *Max.*200 | 140 | 142 | 180 | 150 | 150 | 140 |
| Total Hardness (as $CaCO_3$) | mg/L | *Max.* 200 | 168 | 180 | 190 | 194 | 190 | 180 |
| Zinc (as Zn) | mg/L | *Max*. 5 | 0.154 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Cadmium (as Cd) | mg/L | *Max.* 0.003 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Cyanide (as CN) | mg/L | *Max.*0.05 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Lead (as Pb) | mg/L | *Max.* 0.01 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 |
| Mercury (as Hg) | mg/L | *Max.* 0.001 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 |
| Molybdenum (as Mo) | mg/L | *Max.* 0.07 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Nickel (as Ni) | mg/L | *Max.*0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Alachlor | µg/L | 20 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Atrazine | µg/L | 2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Aldrin/Dieldrin | µg/L | 0.03 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Alpha HCH | µg/L | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Beta HCH | µg/L | 0.04 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Butachlor | µg/L | 125 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlorpyrifos | µg/L | 30 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Delta HCH | µg/L | 0.04 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2,4D chlorophenoxyacetic acid | µg/L | 30 | <0.07 | <0.07 | <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 | <0.01 | <0.01 |
| Endosulfan (a, b & Sulphate) | µg/L | 0.4 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Ethion | µg/L | 3 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| γ HCH (Lindane) | µg/L | 2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Isoproturon | µg/L | 9 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Malathion | µg/L | 190 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Methyl Parathion | µg/L | 0.3 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Monocrotophos | µg/L | 1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Phorate | µg/L | 2 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Polychlorinated Biphenyls (PCB) | mg/L | *Max.*0.0005 | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 |

| Parameter | Unit | Acceptable Limit as per IS 10500: 2012 | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|---|
| Polynuclear Aromatic Hydrocarbons (PAH) | mg/L | *Max.*0.0001 | <0.00007 | <0.00007 | <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 | <0.005 | <0.005 |
| Total Chromium (as Cr) | mg/L | *Max.* 0.05 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| **Trihalomethanes** | | | | | | | | |
| Bromoform | mg/L | *Max*. 0.1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibromochloro Methane | mg/L | *Max*. 0.1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Bromodichloroethane | mg/L | *Max*. 0.06 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chloroform | mg/L | *Max*. 0.2 | <0.01 | <0.01 | <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 | 4.5 | <1.8 |
| Total Coliforms | MPN Index /100 mL | - | 140 | 920 | 350 | 350 | 240 | 23 |

**Table 6.4: Location - Proposed Port Estate Area**

| Parameter | Unit | Acceptable Limit as per IS 10500: 2012 | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|---|
| **Organoleptic & Physical Parameters** | | | | | | | | |
| Colour | Hazen Units | *Max.* 5 | 1 | 1 | 1 | 1 | 1 | 1 |
| Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| pH Value | - | 6.5 to 8.5 | 6.7 | 6.68 | 6.7 | 6.55 | 6.66 | 6.83 |
| Turbidity | N.T.U. | *Max.* 1 | <0.2 | <0.2 | 0.54 | 0.48 | 0.9 | <0.2 |
| Total Dissolved Solids | mg/L | *Max.* 500 | 160 | 98 | 74 | 86 | 54 | 44 |
| **General Parameters concerning substances undesirable in excessive amounts** | | | | | | | | |
| Aluminum (as Al) | mg/L | *Max.* 0.03 | <0.025 | <0.025 | <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 | <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 | <0.1 | <0.1 |

| Parameter | Unit | Acceptable Limit as per IS 10500: 2012 | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|---|
| Barium (as Ba) | mg/L | *Max.* 0.7 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Boron (as B) | mg/L | *Max.* 0.5 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Calcium (as Ca) | mg/L | *Max.* 75 | 9.6 | 10.4 | 5.61 | 16.8 | 3.2 | 3.2 |
| Chloramines (as $Cl_2$) | mg/L | *Max.* 4.0 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Chloride (as Cl) | mg/L | *Max.*250 | 47.5 | 30.5 | 34.5 | 17.0 | 16.5 | 15 |
| Copper (as Cu) | mg/L | *Max.*0.05 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluoride (as F) | mg/L | *Max.* 1 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 |
| Iron (as Fe) | mg/L | *Max.*0.3 | <0.06 | <0.06 | <0.06 | 0.193 | <0.06 | 0.08 |
| Magnesium (as Mg) | mg/L | *Max.* 30 | 5.3 | 4.37 | 2.91 | 9.72 | 2.9 | 2.92 |
| Manganese (as Mn) | mg/L | *Max.*0.1 | 0.02 | 0.052 | <0.02 | <0.02 | <0.02 | <0.02 |
| Mineral Oil | mg/L | *Max.*0.5 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Nitrate (as $NO_3$) | mg/L | *Max.*45 | 7 | 4.87 | 3.37 | 1.32 | 3.26 | 2.8 |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | *Max.* 0.001 | <0.001 | <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 | <0.005 | <0.005 |
| Silver (as Ag) | mg/L | *Max.* 0.1 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Sulphate (as $SO_4$) | mg/L | *Max.* 200 | 30.1 | 18.7 | 15.3 | 9.0 | 9.36 | 5.97 |
| Sulphide (as $H_2S$) | mg/L | *Max.* 0.05 | <0.025 | <0.025 | <0.025 | <0.025 | <0.025 | <0.025 |
| Total Alkalinity (as $CaCO_3$) | mg/L | *Max.*200 | 32 | 17.5 | 12.5 | 30 | 13 | 7.5 |
| Total Hardness (as $CaCO_3$) | mg/L | *Max.* 200 | 46 | 44 | 26 | 82 | 20 | 20 |
| Zinc (as Zn) | mg/L | *Max.* 5 | <0.05 | 0.104 | <0.05 | <0.05 | <0.05 | <0.05 |
| Cadmium (as Cd) | mg/L | *Max.* 0.003 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Cyanide (as CN) | mg/L | *Max.*0.05 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Lead (as Pb) | mg/L | *Max.* 0.01 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 |
| Mercury (as Hg) | mg/L | *Max.* 0.001 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 |
| Molybdenum (as Mo) | mg/L | *Max.* 0.07 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Nickel (as Ni) | mg/L | *Max.*0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Alachlor | µg/L | 20 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Atrazine | µg/L | 2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Aldrin/Dieldrin | µg/L | 0.03 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Alpha HCH | µg/L | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

| Parameter | Unit | Acceptable Limit as per IS 10500: 2012 | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|---|
| Beta HCH | µg/L | 0.04 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Butachlor | µg/L | 125 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlorpyrifos | µg/L | 30 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Delta HCH | µg/L | 0.04 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2,4D chlorophenoxyacetic acid | µg/L | 30 | <0.07 | <0.07 | <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 | <0.01 | <0.01 |
| Endosulfan (a, b & Sulphate) | µg/L | 0.4 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Ethion | µg/L | 3 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| γ HCH (Lindane) | µg/L | 2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Isoproturon | µg/L | 9 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Malathion | µg/L | 190 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Methyl Parathion | µg/L | 0.3 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Monocrotophos | µg/L | 1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Phorate | µg/L | 2 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Polychlorinated Biphenyls (PCB) | mg/L | *Max.*0.0005 | <0.00007 | <0.00007 | <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 | <0.00007 | <0.00007 |
| Total Arsenic (as As) | mg/L | *Max*. 0.01 | <0.005 | <0.005 | <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 | <0.02 | <0.02 |
| **Trihalomethanes** | | | | | | | | |
| Bromoform | mg/L | *Max*. 0.1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibromochloro Methane | mg/L | *Max*. 0.1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Bromodichloroethane | mg/L | *Max*. 0.06 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chloroform | mg/L | *Max*. 0.2 | <0.01 | <0.01 | <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 | <1.8 | 130 |
| Total Coliforms | MPN Index /100 mL | - | 350 | 350 | <1.8 | 350 | <1.8 | 430 |

**Table 6.5: Location - PAF Area**

| Parameter | Unit | Acceptable Limit as per IS 10500: 2012 | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|---|
| **Organoleptic & Physical Parameters** | | | | | | | | |
| Colour | Hazen Units | *Max.* 5 | 1 | 1 | 1 | 1 | 1 | 1 |
| Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| $p^H$ Value | - | 6.5 to 8.5 | 7.42 | 6.72 | 6.75 | 6.52 | 6.94 | 6.83 |
| Turbidity | N.T.U. | *Max.* 1 | <0.2 | <0.2 | <0.2 | 0.2 | 0.8 | <0.2 |
| Total Dissolved Solids | mg/L | *Max.* 500 | 470 | 476 | 442 | 480 | 460 | 464 |
| **General Parameters concerning substances undesirable in excessive amounts** | | | | | | | | |
| Aluminum (as Al) | mg/L | *Max.* 0.03 | <0.025 | <0.025 | <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 | <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 | <0.1 | <0.1 |
| Barium (as Ba) | mg/L | *Max.* 0.7 | 0.234 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Boron (as B) | mg/L | *Max.* 0.5 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Calcium (as Ca) | mg/L | *Max.* 75 | 26 | 33.7 | 28 | 31.3 | 34 | 32.1 |
| Chloramines (as $Cl_2$) | mg/L | *Max.* 4.0 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Chloride (as Cl) | mg/L | *Max.*250 | 224 | 115 | 234 | 244 | 234 | 244 |
| Copper (as Cu) | mg/L | *Max.*0.05 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluoride (as F) | mg/L | *Max.* 1 | 0.4 | 0.8 | 0.4 | 0.5 | 0.3 | 0.8 |
| Iron (as Fe) | mg/L | *Max.*0.3 | <0.06 | <0.06 | <0.06 | 0.195 | <0.06 | <0.06 |
| Magnesium (as Mg) | mg/L | *Max.* 30 | 14.6 | 17.5 | 17 | 18.5 | 19.4 | 17.5 |
| Manganese (as Mn) | mg/L | *Max.*0.1 | 0.052 | <0.02 | <0.02 | <0.02 | <0.02 | 0.041 |
| Mineral Oil | mg/L | *Max.*0.5 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Nitrate (as $NO_3$) | mg/L | *Max.*45 | 26.3 | 24.8 | 29.5 | 34.5 | 36.9 | 34.4 |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | *Max.* 0.001 | <0.001 | <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 | <0.005 | <0.005 |
| Silver (as Ag) | mg/L | *Max.* 0.1 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Sulphate (as $SO_4$) | mg/L | *Max.* 200 | 55.9 | 44 | 45 | 42.3 | 32.1 | 24.6 |
| Sulphide (as $H_2S$) | mg/L | *Max.* 0.05 | <0.025 | <0.025 | <0.025 | <0.025 | <0.025 | <0.025 |
| Total Alkalinity (as $CaCO_3$) | mg/L | *Max.*200 | 12.5 | 5.0 | 12.5 | 42.5 | 13.0 | 17.5 |

| Parameter | Unit | Acceptable Limit as per IS 10500: 2012 | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|---|
| Total Hardness (as $CaCO_3$) | mg/L | *Max.* 200 | 126 | 156 | 140 | 154 | 165 | 152 |
| Zinc (as Zn) | mg/L | *Max*. 5 | <0.05 | 0.105 | <0.05 | <0.05 | <0.05 | <0.05 |
| Cadmium (as Cd) | mg/L | *Max.* 0.003 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Cyanide (as CN) | mg/L | *Max.*0.05 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Lead (as Pb) | mg/L | *Max.* 0.01 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 |
| Mercury (as Hg) | mg/L | *Max.* 0.001 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 |
| Molybdenum (as Mo) | mg/L | *Max.* 0.07 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Nickel (as Ni) | mg/L | *Max.*0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Alachlor | µg/L | 20 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Atrazine | µg/L | 2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Aldrin/Dieldrin | µg/L | 0.03 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Alpha HCH | µg/L | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Beta HCH | µg/L | 0.04 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Butachlor | µg/L | 125 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlorpyrifos | µg/L | 30 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Delta HCH | µg/L | 0.04 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2,4D chlorophenoxyacetic acid | µg/L | 30 | <0.07 | <0.07 | <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 | <0.01 | <0.01 |
| Endosulfan (a, b & Sulphate) | µg/L | 0.4 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Ethion | µg/L | 3 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| γ HCH (Lindane) | µg/L | 2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Isoproturon | µg/L | 9 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Malathion | µg/L | 190 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Methyl Parathion | µg/L | 0.3 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Monocrotophos | µg/L | 1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Phorate | µg/L | 2 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Polychlorinated Biphenyls (PCB) | mg/L | *Max.*0.0005 | <0.00007 | <0.00007 | <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 | <0.00007 | <0.00007 |
| Total Arsenic (as As) | mg/L | *Max*. 0.01 | <0.005 | <0.005 | <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 | <0.02 | <0.02 |

| Parameter | Unit | Acceptable Limit as per IS 10500: 2012 | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|---|
| **Trihalomethanes** | | | | | | | | |
| Bromoform | mg/L | *Max*. 0.1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibromochloro Methane | mg/L | *Max*. 0.1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Bromodichloroethane | mg/L | *Max*. 0.06 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chloroform | mg/L | *Max*. 0.2 | <0.01 | <0.01 | <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 | <1.8 | <1.8 |
| Total Coliforms | MPN Index /100 mL | - | 150 | 70 | <1.8 | 280 | 150 | <1.8 |

## 4. Graphical representation of Results for the period October 2020 to March 2021.

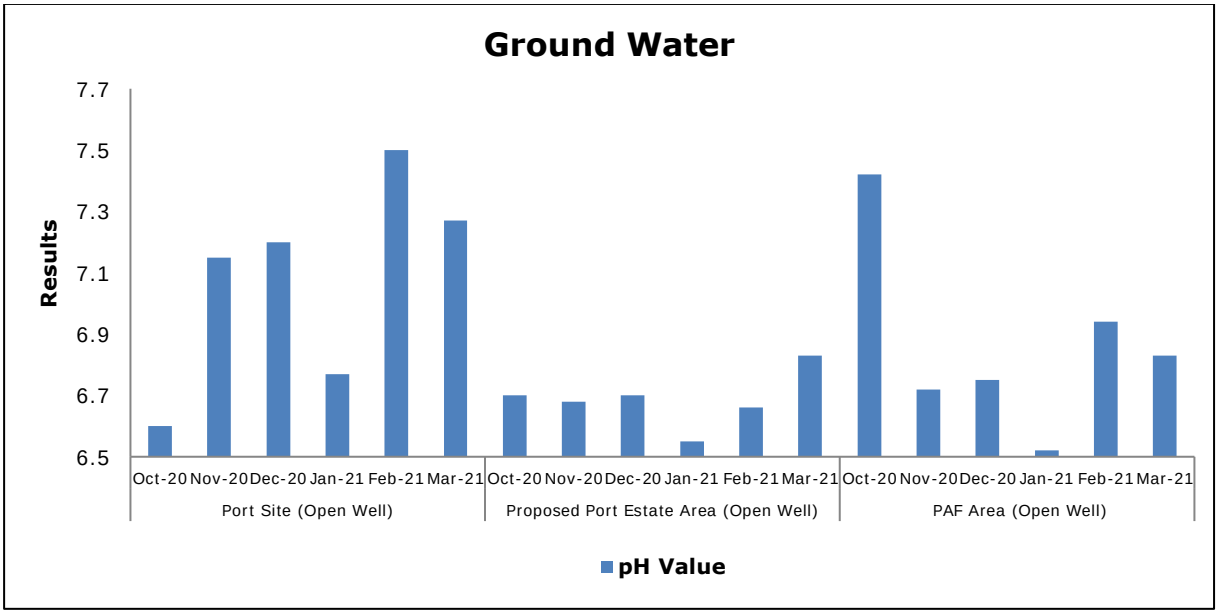



**Figure 6.2: Ground Water Analysis for pH**

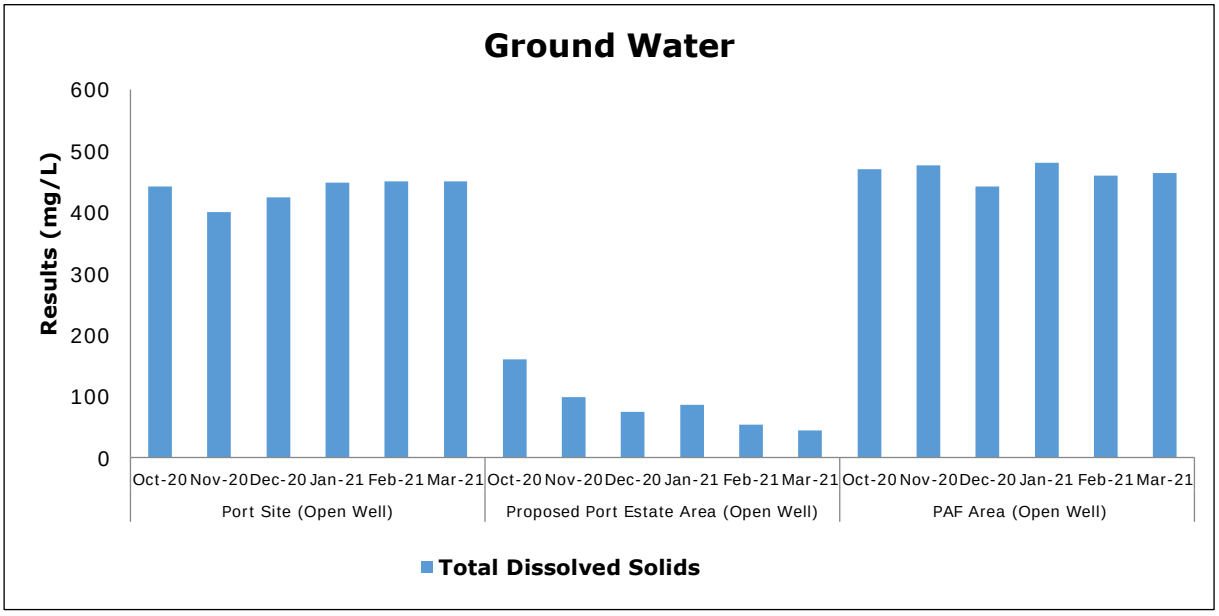



**Figure 6.3: Ground Water Analysis for Total Dissolved Solids**

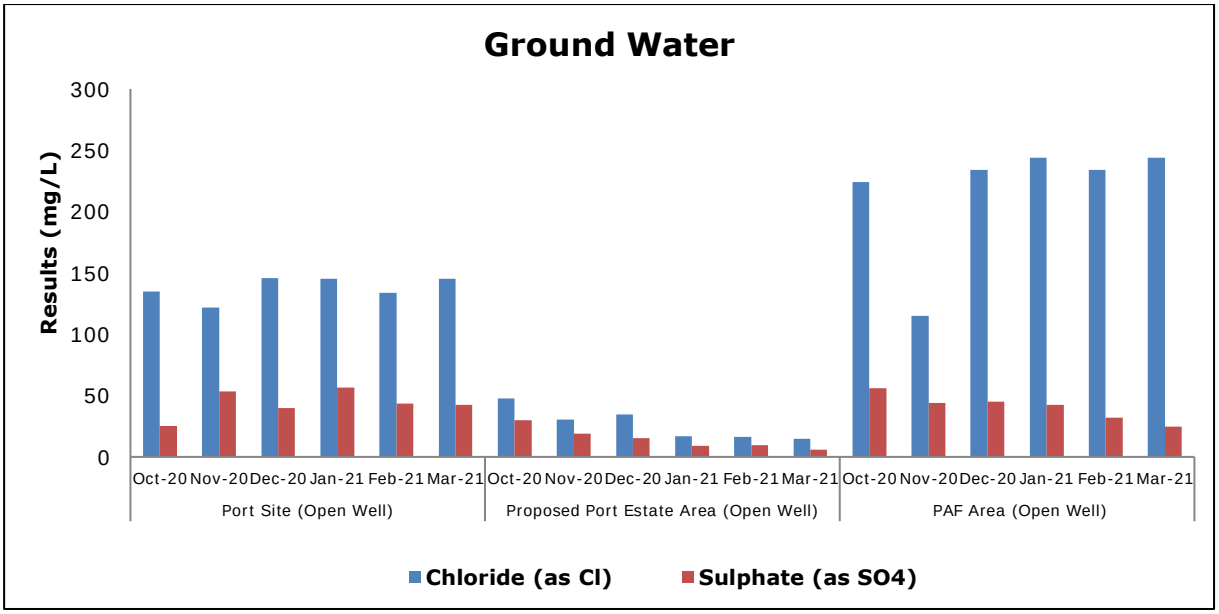



**Figure 6.4: Ground Water Analysis for Chloride and Sulphate**

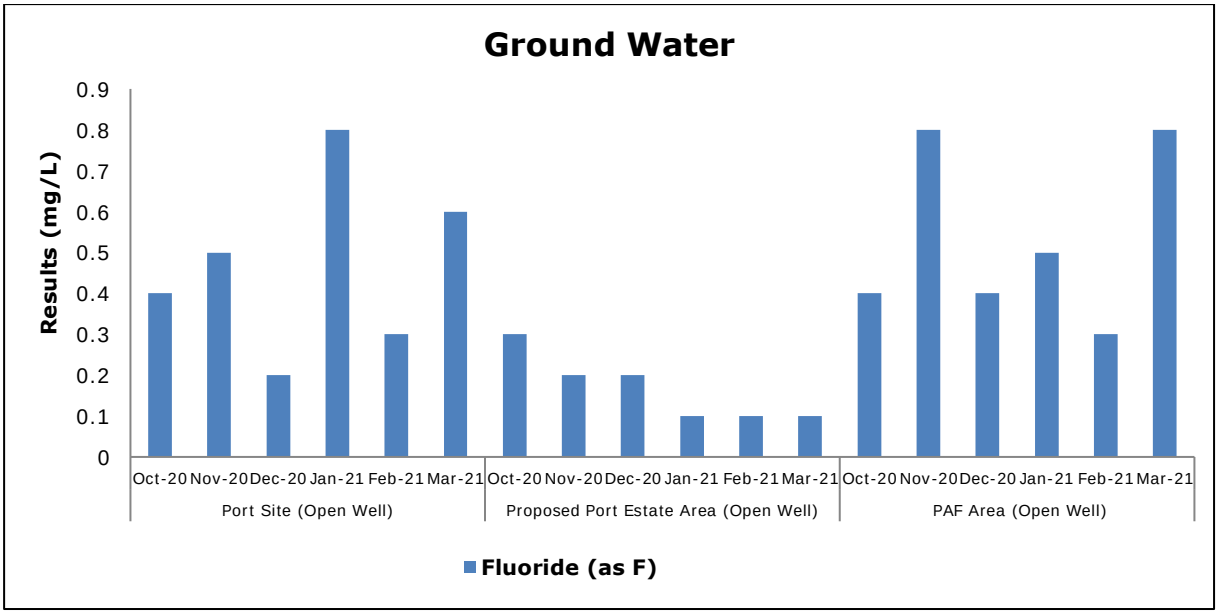



**Figure 6.5: Ground Water Analysis for Fluoride**

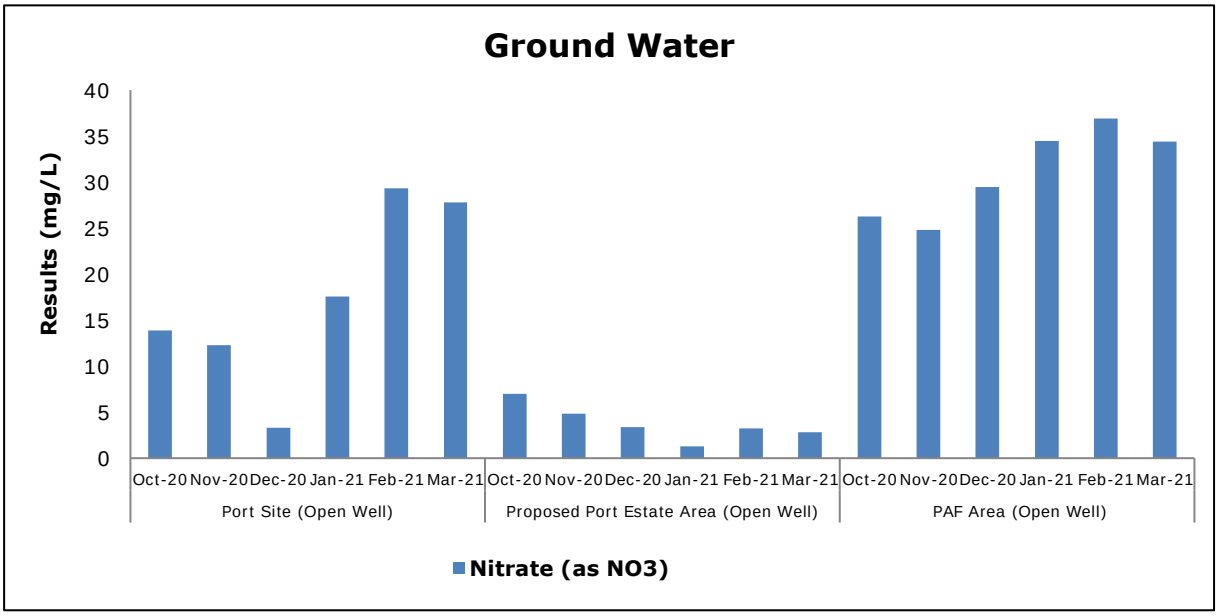



**Figure 6.6: Ground Water Analysis for Nitrate**

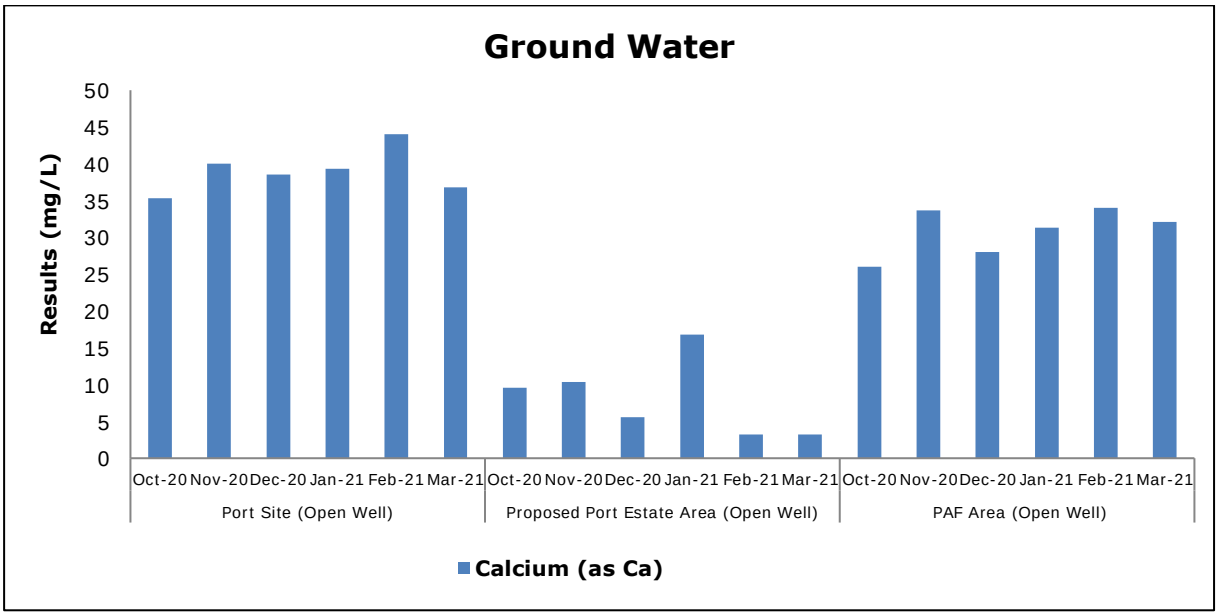



**Figure 6.7: Ground Water Analysis for Calcium**

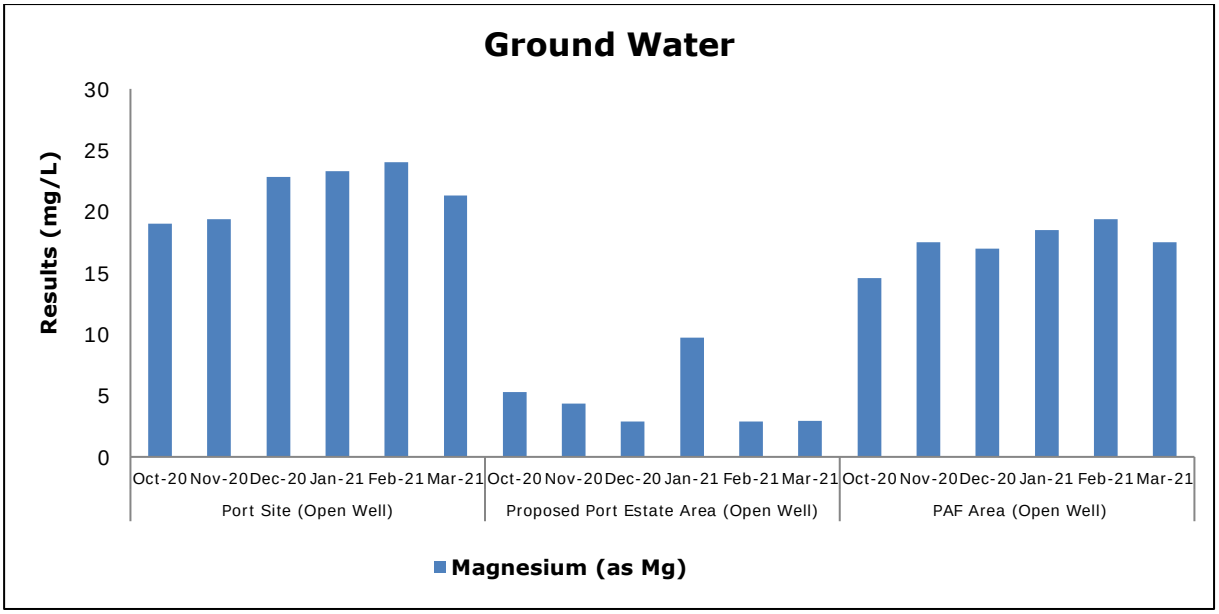



**Figure 6.8: Ground Water Analysis for Magnesium**

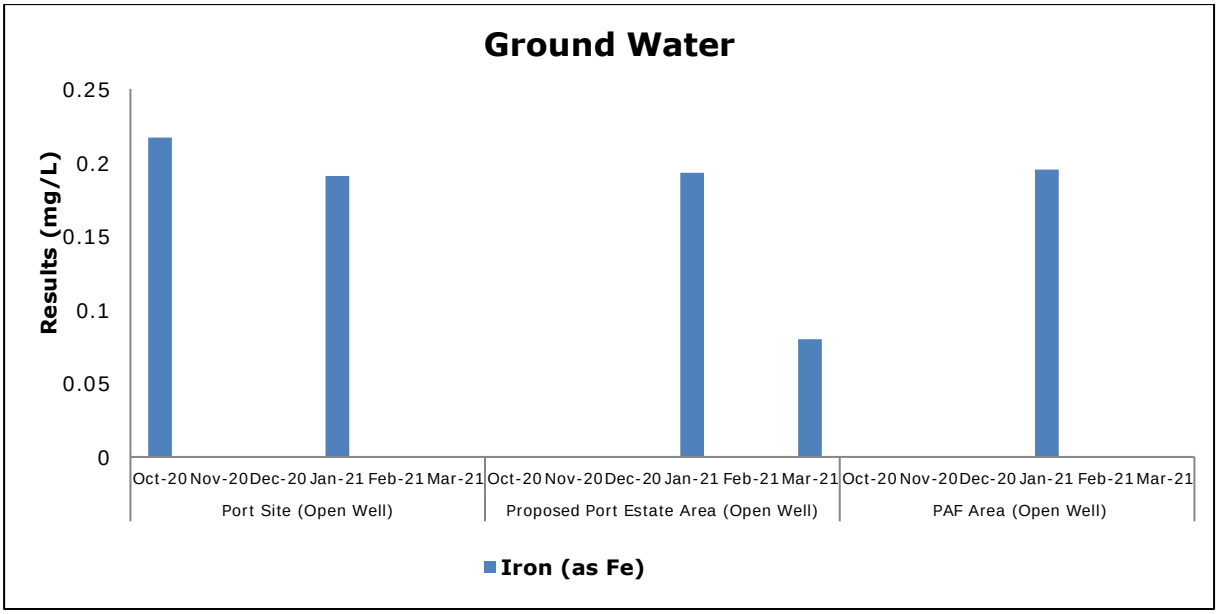



**Figure 6.9: Ground Water Analysis for Iron**

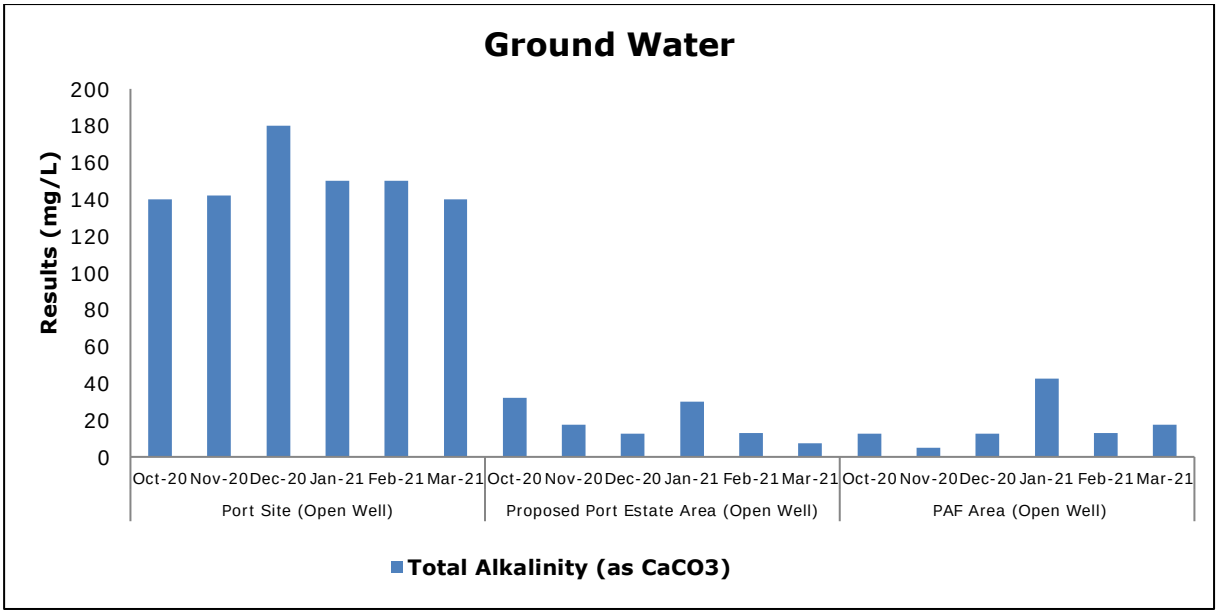



**Figure 6.10: Ground Water Analysis for Total Alkalinity**

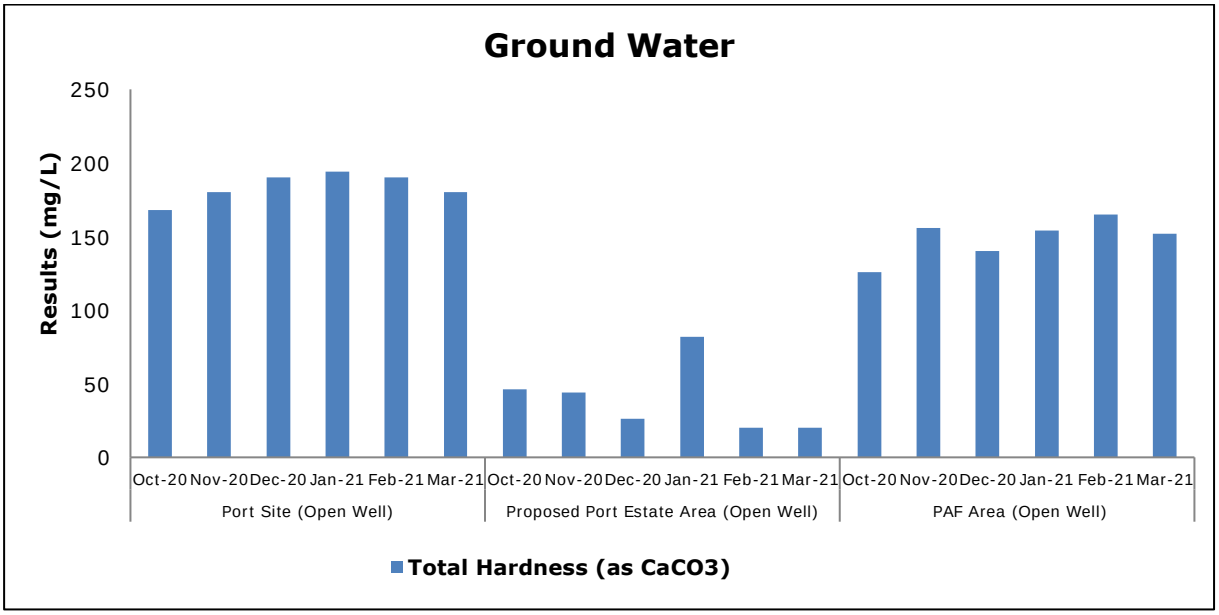



**Figure 6.11: Ground Water Analysis for Total Hardness**

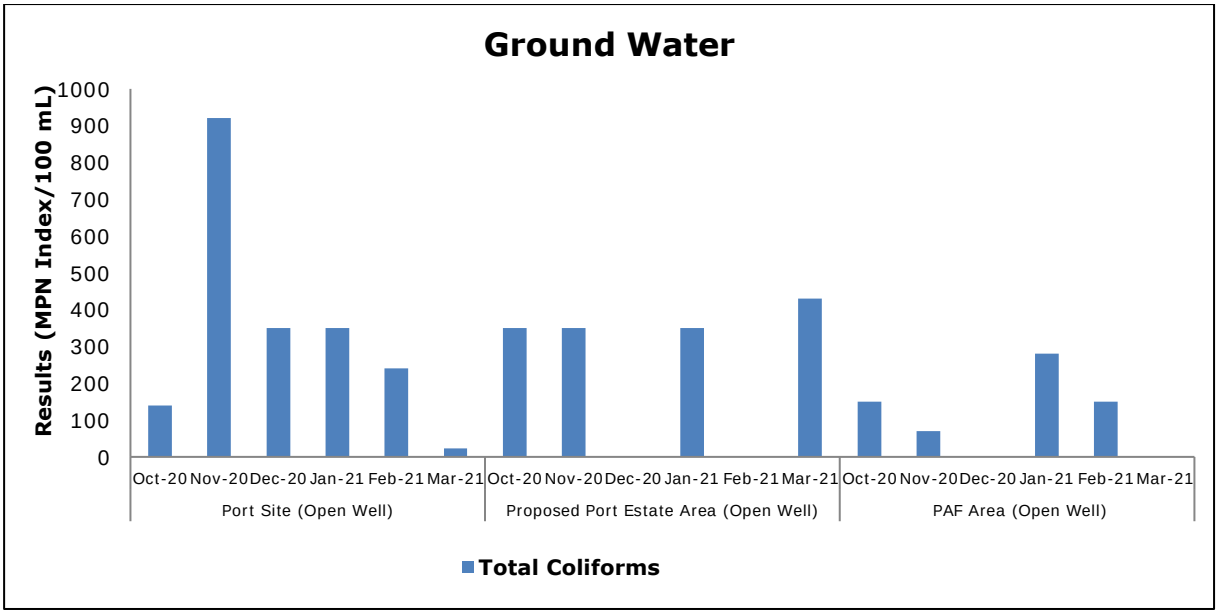



**Figure 6.12: Ground Water Analysis for Total Coliforms**

## 5. Summary- Ground Water Analysis

During the period October 2020 to March 2021, following is the summary of ground water 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 6.6-7.5. Turbidity was observed <0.2-2.6 N.T.U., Total Dissolved Solids were observed in the range between 400-450 mg/L. Calcium (as Ca) was observed in the range between 35.3-44 mg/L. Chloride (as Cl) was observed in the range between 122-146 mg/L. Fluoride (as F) was observed in the range between 0.2-0.8 mg/L. Iron (as Fe) was observed in the range between <0.06-0.217 mg/L. Magnesium (as Mg) was observed in the range between 19-24 mg/L. Manganese (as Mn) was observed in the range between <0.02-0.02 mg/L. Nitrate (as $NO_3$) was observed in the range between 3.29-29.3 mg/L. Sulphate (as $SO_4$) was observed in the range between 25.2-56.4 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 140-180 mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 168-194 mg/L. Manganese (as Mn) was observed in the range between <0.02-0.02 mg/L, Zinc (as Zn) was observed in the range between <0.05-0.154 mg/L, Sulphate (as $SO_4$) was observed in the range between 25.2-56.4 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 140-180 mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 168-194 mg/L. Aluminium(as Al), Ammonia (as $NH_3$-N), Anionic Detergents, Barium (as Ba), Boron (as B), Chloramines (as $Cl_2$), Copper (as Cu), Mineral Oil, Phenolic Compounds(as

$C_6H_5OH$), Selenium (as Se), Silver (as Ag), Sulphide (as $H_2S$), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Molybdenum (as Mo), Nickel (as Ni), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues, Trihalomethanes, Polychlorinated Biphenyls (PCB) and Polynuclear Aromatic Hydrocarbons (PAH) were observed Below Detection Limit. Bacteriological parameters such as *E.coli* was observed in the range between <1.8-4.5 MPN Index/100 mL and Total Coliforms were observed in the range between 23-920 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 6.55-6.83. Turbidity was observed in the range between <0.2-0.9 N.T.U., Total Dissolved Solids were observed in the range between 44-160 mg/L. Calcium (as Ca) was observed in the range between 3.2-16.8 mg/L. Chloride (as Cl)was observed in the range between 15-47.5 mg/L. Fluoride (as F) was observed in the range between 0.1-0.3 mg/L. Iron (as Fe) was observed in the range between <0.06-0.193 mg/L. Magnesium (as Mg) was observed in the range between 2.9-9.72 mg/L. Manganese (as Mn) was observed in the range between <0.02-0.052 mg/L. Nitrate (as $NO_3$) was observed in the range between 1.32-7 mg/L. Sulphate (as $SO_4$)was observed in the range between 5.97-30.1 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 7.5-32 mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 20-82 mg/L. Zinc (as Zn) was observed in the range between <0.05-0.104 mg/L. Aluminium (as Al), Ammonia (as $NH_3$- N), Anionic Detergents, Barium (as Ba), Boron (as B), Chloramines (as $Cl_2$), Copper (as Cu), Mineral Oil, Phenolic Compounds (as $C_6H_5OH$), Selenium (as Se), Silver (as Ag), Sulphide (as $H_2S$), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Molybdenum (as Mo), Nickel (as Ni), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues, Trihalomethanes, Polychlorinated Biphenyls (PCB) and Polynuclear Aromatic Hydrocarbons (PAH) were observed Below Detection Limit. Bacteriological parameters such as *E.coli* was observed <1.8-130 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 6.52-7.42. Turbidity was observed in the range between <0.2-0.8 N.T.U., Total Dissolved Solids were observed in the range between 442-480 mg/L. Calcium (as Ca) was observed in the range between 26-34 mg/L. Chloride (as Cl) was observed in the range between 115-244 mg/L. Fluoride (as F) was observed in the range between 0.3-0.8 mg/L. Iron (as Fe) was observed <0.06-0.195 mg/L. Magnesium (as Mg) was observed in the

range between 14.6-19.4 mg/L. Manganese (as Mn) was observed <0.02-0.052 mg/L. Nitrate (as $NO_3$) was observed in the range between 24.8-36.9 mg/L. Sulphate (as $SO_4$) was observed in the range between 24.6-55.9 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 5-42.5 mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 126-165 mg/L and Zinc (as Zn) was observed in the range between <0.05-0.105 mg/L, Barium (as Ba) was observed in the range between <0.1-0.234 mg/L. Aluminium, Ammonia (as $NH_3$-N), Anionic Detergents, Boron (as B), Chloramines (as $Cl_2$), Copper (as Cu), Mineral Oil, Phenolic Compounds (as $C_6H_5OH$), Selenium (as Se), Silver (as Ag), Sulphide (as $H_2S$), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Molybdenum (as Mo), Nickel (as Ni),Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues, Trihalomethanes, Polychlorinated Biphenyls (PCB) and Polynuclear Aromatic Hydrocarbons (PAH) were observed Below Detection Limit. Bacteriological parameters such as *E.coli* was observed <1.8 MPN Index/100 mL and Total Coliforms were observed in the range <1.8-280 MPN Index/100 mL.

## 6. Surface Water Analysis Results for the period October 2020 to March 2021:

**Table 6.6: Location - Poovar West Canal**

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| **Physical Parameters** | | | | | | | |
| Colour | Hazen Units | 1 | 1 | 1 | 1 | 1 | 1 |
| Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| pH Value | - | 6.82 | 6.65 | 6.6 | 6.54 | 6.7 | 6.8 |
| Turbidity | N.T.U. | 0.44 | 0.93 | 3.98 | 1.8 | 1.2 | <0.2 |
| Electrical Conductivity (at 25°C) | µmho/cm | 156 | 828 | 184 | 1160 | 2678 | 700 |
| Total Dissolved Solids | mg/L | 92 | 482 | 104 | 650 | 1500 | 392 |
| **Chemical Parameters** | | | | | | | |
| Dissolved Oxygen | mg/L | 6.2 | 6.1 | 7.6 | 6.3 | 6.8 | 6.4 |
| Biochemical Oxygen Demand (3 days, 27°C) | mg/L | <1 | <1 | <1 | <1 | <1 | <1 |
| Oil & Grease | mg/L | <1 | <1 | <1 | <1 | <1 | <1 |
| Free Ammonia | mg/L | <0.1 | <0.1 | <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 | <0.1 | <0.1 |
| Barium (as Ba) | mg/L | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Boron (as B) | mg/L | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Calcium (as Ca) | mg/L | 10.4 | 44.9 | 5.61 | 46.0 | 66.1 | 15.2 |
| Chloride (as Cl) | mg/L | 30 | 310 | 36.5 | 310 | 770 | 154 |
| Copper (as Cu) | mg/L | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluoride (as F) | mg/L | 0.3 | 0.2 | 0.2 | 1.1 | 0.5 | 0.2 |
| Iron (as Fe) | mg/L | 0.144 | 0.383 | <0.06 | 0.996 | 0.398 | 0.204 |
| Magnesium (as Mg) | mg/L | 5.83 | 26.2 | 3.4 | 25.7 | 35.2 | 8.26 |
| Manganese (as Mn) | mg/L | <0.02 | 0.063 | <0.02 | 0.07 | 0.083 | <0.02 |
| Mineral Oil | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Nitrate (as $NO_3$) | mg/L | 2.38 | 3.22 | 3.46 | 3.47 | 2.42 | 2.32 |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Selenium (as Se) | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Silver (as Ag) | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Sulphate (as $SO_4$) | mg/L | 27 | 30 | 31.2 | 17.3 | 65.2 | 21 |
| Total Phosphate (as $PO_4$) | mg/L | <0.1 | <0.1 | 0.23 | <0.1 | <0.1 | <0.1 |

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Total Alkalinity (as $CaCO_3$) | mg/L | 12.5 | 20 | 17.5 | 38.7 | 220 | 17.5 |
| Total Hardness (as $CaCO_3$) | mg/L | 50 | 220 | 28 | 61 | 310 | 72 |
| Calcium Hardness (as $CaCO_3$) | mg/L | 26 | 220 | 14 | 40 | 165 | 34 |
| Zinc (as Zn) | mg/L | <0.05 | <0.05 | <0.05 | 0.061 | <0.05 | <0.05 |
| Sodium (as Na) | mg/L | 7 | 52.2 | 19.8 | 44.1 | 103 | 150 |
| Potassium (as K) | mg/L | 0.7 | 2.2 | 2.9 | 5.0 | 2.0 | 0.03 |
| Sodium Absorption Ratio | - | 6.53 | 1.53 | 1.62 | 2.38 | 2.55 | 7.76 |
| Cadmium (as Cd) | mg/L | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Cyanide (as CN) | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Lead (as Pb) | mg/L | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 |
| Mercury (as Hg) | mg/L | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 |
| **Pesticide Residues** | | | | | | | |
| Alachlor | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Atrazine | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Aldrin/Dieldrin | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Alpha HCH | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Beta HCH | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Butachlor | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlorpyrifos | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Delta HCH | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2,4D chlorophenoxyacetic acid | µg/L | <0.07 | <0.07 | <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 | <0.01 | <0.01 |
| Endosulfan (a, b & Sulphate) | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Ethion | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| γ HCH (Lindane) | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Isoproturon | µg/L | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Malathion | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Methyl Parathion | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Monocrotophos | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Phorate | µg/L | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Polynuclear Aromatic Hydrocarbons (PAH) | mg/L | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 |

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Total Arsenic (as As) | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total Chromium (as Cr) | mg/L | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| **Biological Analysis** | | | | | | | |
| Total Coliforms | MPN Index/ 100 mL | 31 | 34 | 150 | 540 | 220 | 7.8 |
| Faecal Coliforms | MPN Index/ 100 mL | <1.8 | 22 | 49 | 130 | 130 | <1.8 |

**Table 6.7: Location - Vizhinjam Branch Canal**

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| **Physical Parameters** | | | | | | | |
| Colour | Hazen Units | 1 | 1 | 1 | 1 | 1 | 1 |
| Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| pH Value | - | 7.12 | 7.07 | 7 | 6.59 | 7 | 6.73 |
| Turbidity | N.T.U. | 0.29 | 1.2 | 1.97 | 1.92 | 0.3 | <0.2 |
| Electrical Conductivity (at 25°C) | µmho/cm | 208 | 246 | 255 | 502 | 252 | 264 |
| Total Dissolved Solids | mg/L | 126 | 138 | 142 | 280 | 142 | 156 |
| **Chemical Parameters** | | | | | | | |
| Dissolved Oxygen | mg/L | 6.2 | 6.7 | 6.7 | 6.7 | 5 | 6 |
| Biochemical Oxygen Demand (3 days, 27°C) | mg/L | <1 | <1 | <1 | <1 | <1 | <1 |
| Oil & Grease | mg/L | <1 | <1 | <1 | <1 | <1 | <1 |
| Free Ammonia | mg/L | <0.1 | <0.1 | <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 | <0.1 | <0.1 |
| Barium (as Ba) | mg/L | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Boron (as B) | mg/L | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Calcium (as Ca) | mg/L | 11 | 11.2 | 10.4 | 17.6 | 12 | 11.2 |
| Chloride (as Cl) | mg/L | 51 | 38.5 | 38 | 97 | 38.5 | 48.9 |
| Copper (as Cu) | mg/L | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluoride (as F) | mg/L | 0.2 | 0.2 | 0.2 | 0.3 | 0.4 | 0.3 |
| Iron (as Fe) | mg/L | 0.227 | <0.06 | <0.06 | 0.19 | 0.68 | 1.71 |
| Magnesium (as Mg) | mg/L | 4.7 | 4.86 | 6.31 | 8.75 | 6.32 | 5.83 |
| Manganese (as Mn) | mg/L | <0.02 | <0.02 | <0.02 | <0.02 | 0.039 | 0.307 |
| Mineral Oil | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Nitrate (as $NO_3$) | mg/L | 6.05 | 4.78 | 5.41 | 5.94 | 3.09 | 2.94 |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Selenium (as Se) | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Silver (as Ag) | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Sulphate (as $SO_4$) | mg/L | 4.88 | 6.33 | 11.2 | 19.4 | 7.67 | 2.82 |
| Total Phosphate (as $PO_4$) | mg/L | <0.1 | <0.1 | 0.18 | <0.1 | <0.1 | <0.1 |
| Total Alkalinity (as $CaCO_3$) | mg/L | 30 | 35 | 52.5 | 40 | 55 | 65 |

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Total Hardness (as $CaCO_3$) | mg/L | 48 | 48 | 52 | 80 | 56 | 52 |
| Calcium Hardness (as $CaCO_3$) | mg/L | 28 | 28 | 26 | 44 | 30 | 28 |
| Zinc (as Zn) | mg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Sodium (as Na) | mg/L | 25.1 | 22.5 | 22.5 | 50.8 | 19.3 | 41.2 |
| Potassium (as K) | mg/L | 3.6 | 1.3 | 4.1 | 0.77 | 0.33 | 0.42 |
| Sodium Absorption Ratio | - | 1.6 | 1.4 | 1.36 | 2.47 | 1.12 | 2.48 |
| Cadmium (as Cd) | mg/L | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Cyanide (as CN) | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Lead (as Pb) | mg/L | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 |
| Mercury (as Hg) | mg/L | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 |
| **Pesticide Residues** | | | | | | | |
| Alachlor | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Atrazine | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Aldrin/Dieldrin | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Alpha HCH | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Beta HCH | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Butachlor | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlorpyrifos | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Delta HCH | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2,4D chlorophenoxyacetic acid | µg/L | <0.07 | <0.07 | <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 | <0.01 | <0.01 |
| Endosulfan (a, b & Sulphate) | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Ethion | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| γ HCH (Lindane) | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Isoproturon | µg/L | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Malathion | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Methyl Parathion | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Monocrotophos | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Phorate | µg/L | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Polynuclear Aromatic Hydrocarbons (PAH) | mg/L | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 | <0.00007 |
| Total Arsenic (as As) | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Total Chromium (as Cr) | mg/L | <0.02 | <0.02 | <0.02 | <0.02 | 0.042 | 0.025 |
| **Biological Analysis** | | | | | | | |
| Total Coliforms | MPN Index/ 100 mL | 240 | 240 | 1600 | 350 | 540 | 7.8 |
| Faecal Coliforms | MPN Index/ 100 mL | <1.8 | <1.8 | 170 | 110 | 240 | <1.8 |

**Table 6.8: Location - Vellayani Lake**

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| **Physical Parameters** | | | | | | | |
| Colour | Hazen Units | 1 | 1 | 1 | 1 | 2 | 1 |
| Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| pH Value | - | 6.68 | 6.56 | 6.68 | 6.54 | 6.66 | 6.78 |
| Turbidity | N.T.U. | <0.2 | 0.44 | <0.2 | <0.2 | 0.2 | <0.2 |
| Electrical Conductivity (at 25°C) | µmho/ cm | 161 | 169 | 182 | 375 | 186 | 176 |
| Total Dissolved Solids | mg/L | 94 | 96 | 102 | 210 | 104 | 104 |
| **Chemical Parameters** | | | | | | | |
| Dissolved Oxygen | mg/L | 5.9 | 4.2 | 6.9 | 6.8 | 6.1 | 5.8 |
| Biochemical Oxygen Demand (3 days, 27°C) | mg/L | 2 | 5 | <1 | <1 | <1 | 2 |
| Oil & Grease | mg/L | <1 | <1 | <1 | <1 | <1 | <1 |
| Free Ammonia | mg/L | <0.1 | <0.1 | <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 | <0.1 | <0.1 |
| Barium (as Ba) | mg/L | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Boron (as B) | mg/L | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Calcium (as Ca) | mg/L | 7.2 | 11.2 | 7.21 | 12.8 | 8 | 9.61 |
| Chloride (as Cl) | mg/L | 29 | 29 | 30 | 37.5 | 33.5 | 36 |
| Copper (as Cu) | mg/L | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluoride (as F) | mg/L | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 |
| Iron (as Fe) | mg/L | 0.292 | <0.06 | <0.06 | 0.2 | <0.06 | 0.654 |
| Magnesium (as Mg) | mg/L | 3.89 | 5.35 | 4.37 | 5.83 | 5.8 | 3.89 |
| Manganese (as Mn) | mg/L | <0.02 | 0.055 | <0.02 | <0.02 | <0.02 | 0.073 |

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| Mineral Oil | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Nitrate (as $NO_3$) | mg/L | 2.22 | 2.01 | 2 | 2.02 | 2.34 | 1.94 |
| Phenolic Compounds (as $C_6H_5OH$) | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Selenium (as Se) | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Silver (as Ag) | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Sulphate (as $SO_4$) | mg/L | 2.28 | 4.67 | 9 | 13.1 | 4.39 | 4.17 |
| Total Phosphate (as $PO_4$) | mg/L | <0.1 | 1.53 | 0.66 | <0.1 | <0.1 | <0.1 |
| Total Alkalinity (as $CaCO_3$) | mg/L | 45 | 32.5 | 35 | 32.5 | 33 | 27.5 |
| Total Hardness (as $CaCO_3$) | mg/L | 34 | 50 | 36 | 56 | 44 | 40 |
| Calcium Hardness (as $CaCO_3$) | mg/L | 18 | 28 | 18 | 32 | 20 | 24 |
| Zinc (as Zn) | mg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Sodium (as Na) | mg/L | 17.5 | 16.1 | 17.5 | 14.9 | 15.4 | 28.7 |
| Potassium (as K) | mg/L | 3.7 | 2.1 | 3.5 | 0.5 | 0.33 | 0.39 |
| Sodium Absorption Ratio | - | 1.31 | 1.4 | 1.26 | 0.86 | 1.01 | 1.97 |
| Cadmium (as Cd) | mg/L | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Cyanide (as CN) | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Lead (as Pb) | mg/L | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 |
| Mercury (as Hg) | mg/L | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 |
| **Pesticide Residues** | | | | | | | |
| Alachlor | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Atrazine | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Aldrin/Dieldrin | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Alpha HCH | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Beta HCH | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Butachlor | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlorpyrifos | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Delta HCH | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2,4D chlorophenoxyacetic acid | µg/L | <0.07 | <0.07 | <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 | <0.01 | <0.01 |
| Endosulfan (a, b & Sulphate) | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Ethion | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |

| Parameter | Unit | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 |
|---|---|---|---|---|---|---|---|
| γ HCH (Lindane) | µg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Isoproturon | µg/L | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Malathion | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Methyl Parathion | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Monocrotophos | µg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Phorate | µg/L | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 |
| Polynuclear Aromatic Hydrocarbons (PAH) | mg/L | <0.000 07 | <0.000 07 | <0.000 07 | <0.000 07 | <0.000 07 | <0.000 07 |
| Total Arsenic (as As) | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total Chromium (as Cr) | mg/L | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| **Biological Analysis** | | | | | | | |
| Total Coliforms | MPN Index/ 100 mL | 350 | 110 | 210 | 350 | 23 | 110 |
| Faecal Coliforms | MPN Index/ 100 mL | <1.8 | <1.8 | 79 | 94 | 4.5 | 79 |

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

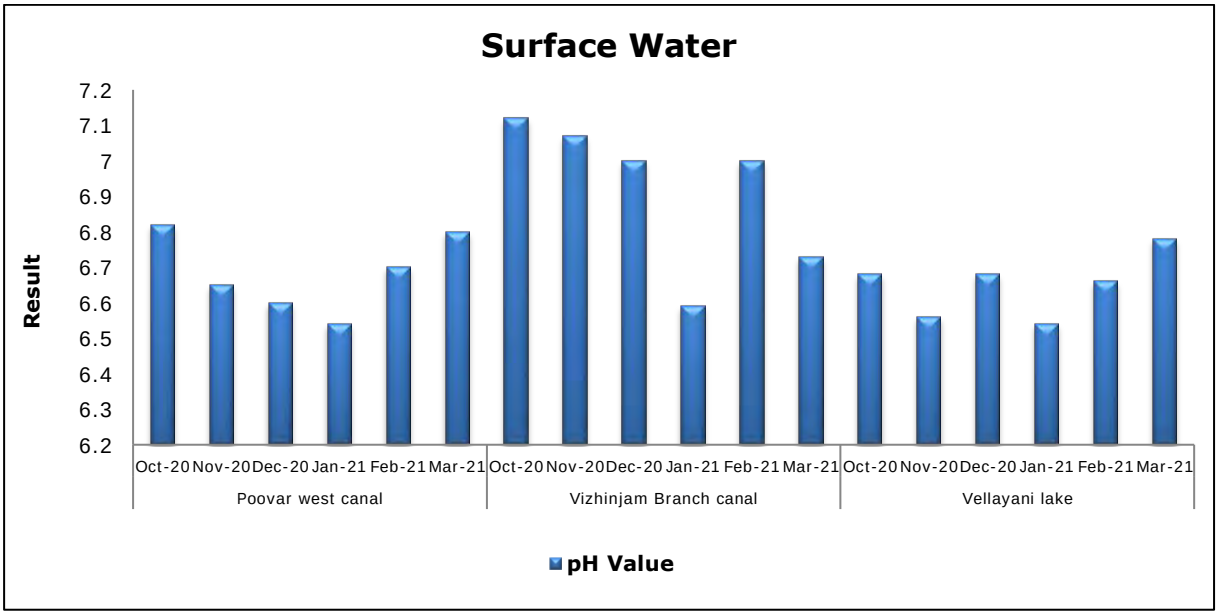



**Figure 6.13: Surface Water Analysis for pH value**

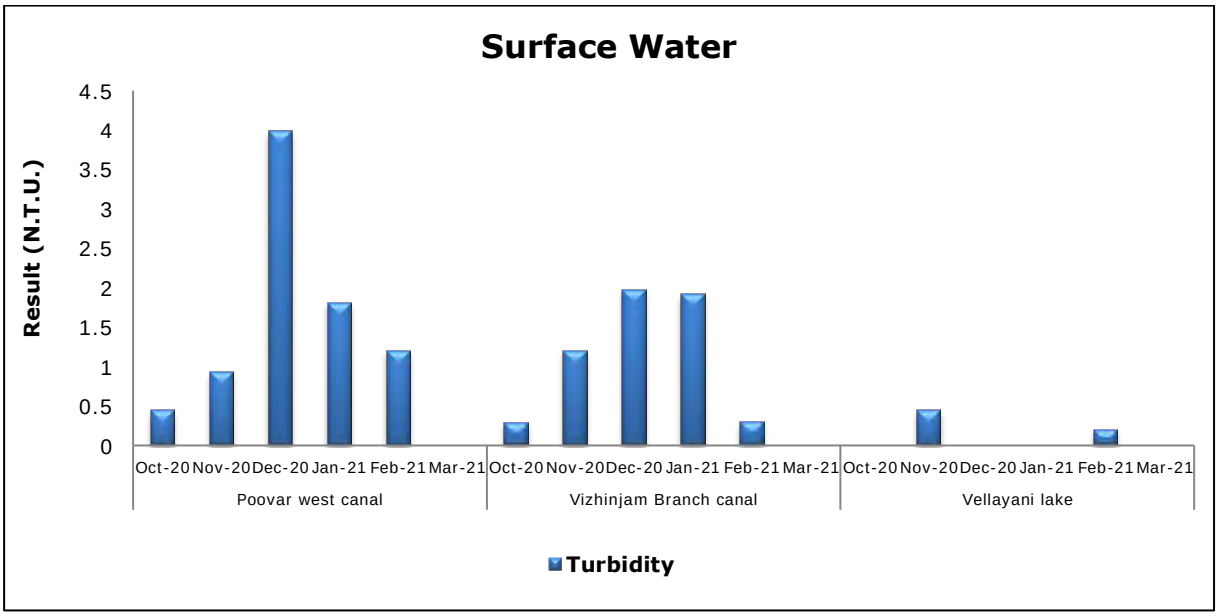



**Figure 6.14: Surface Water Analysis for Turbidity**

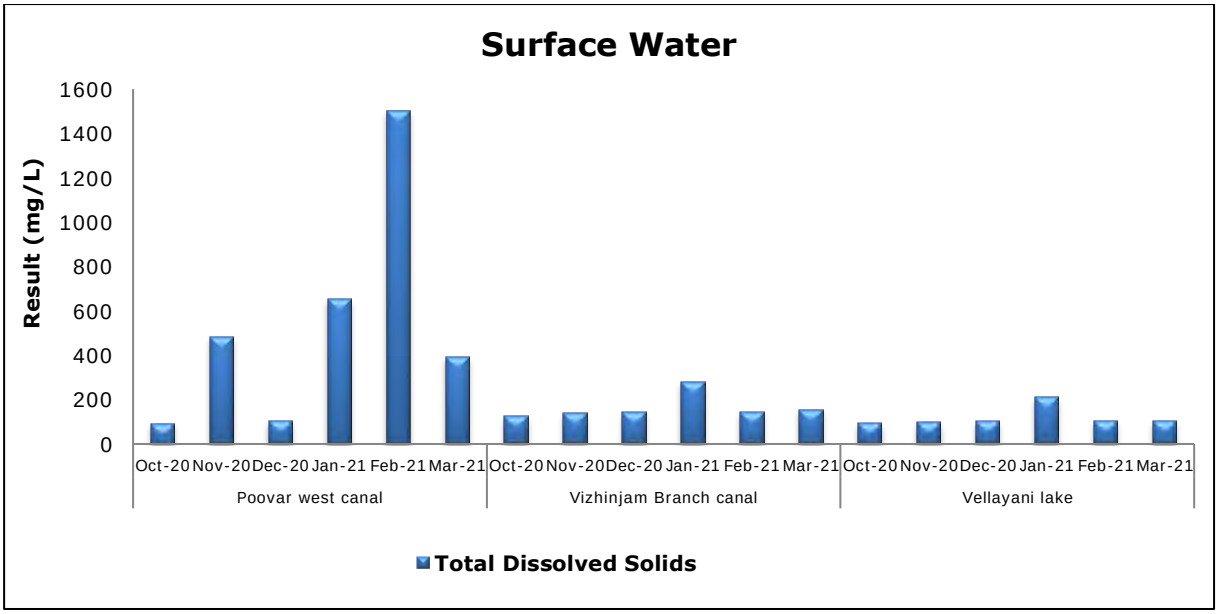



**Figure 6.15: Surface Water Analysis for Total Dissolved Solids**

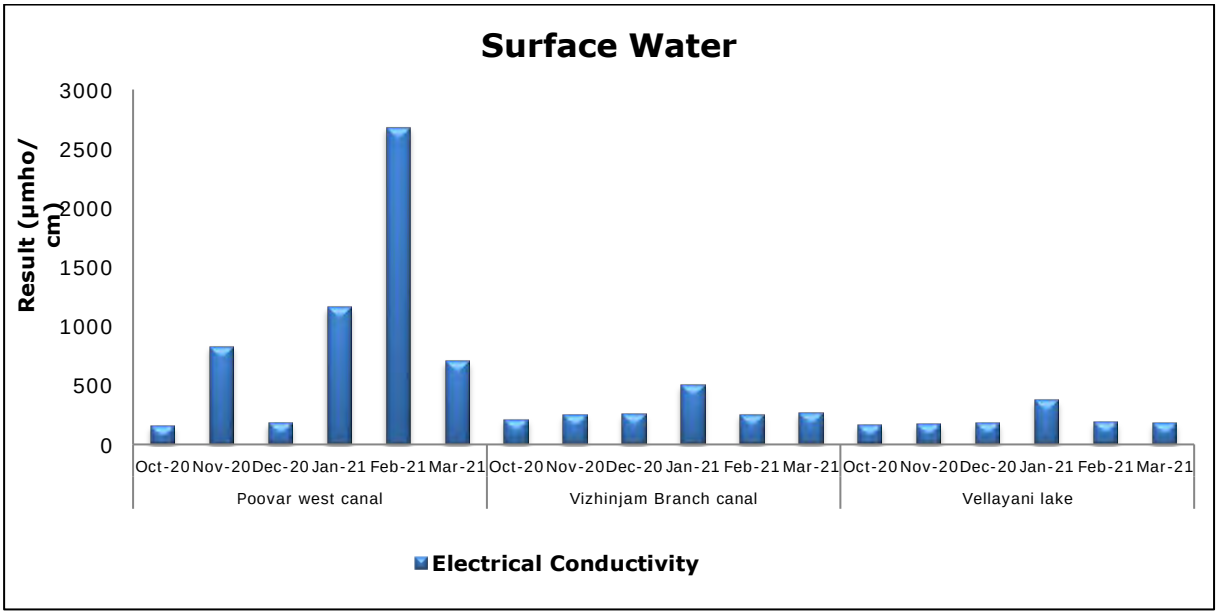



**Figure 6.16: Surface Water Analysis for Electrical Conductivity**

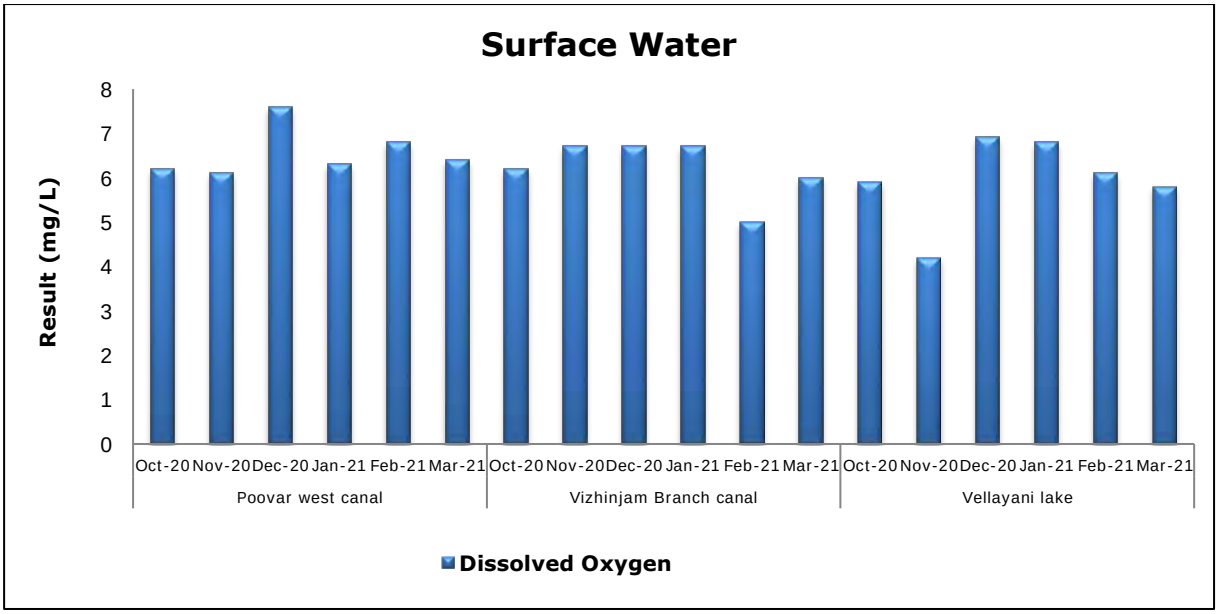



**Figure 6.17: Surface Water Analysis for Dissolved oxygen**

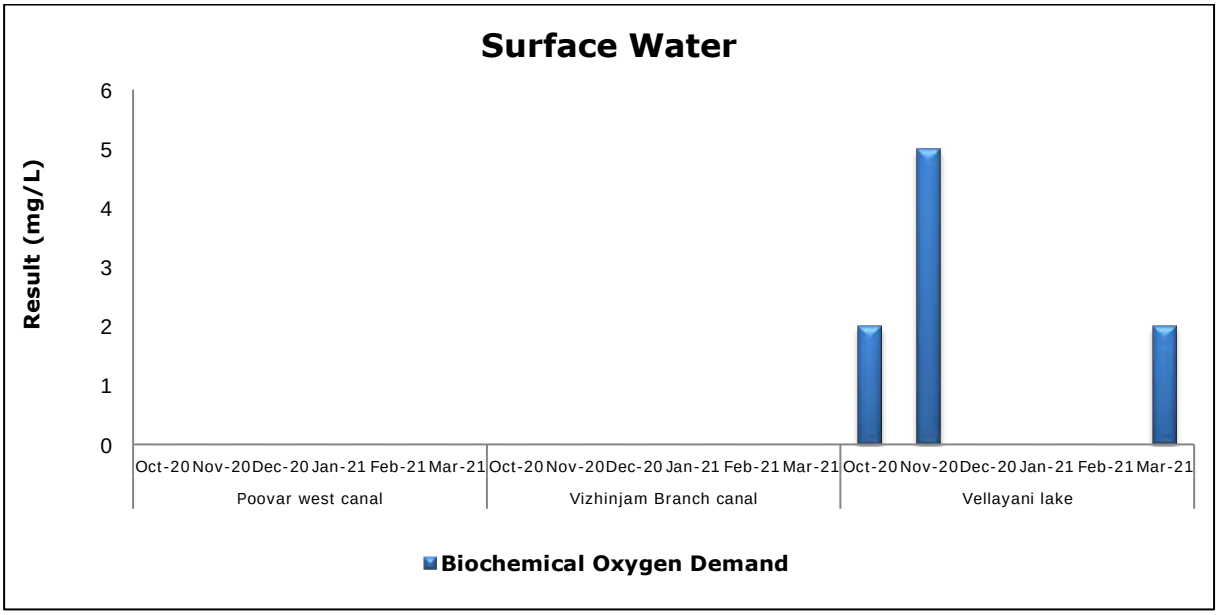



**Figure 6.18: Surface Water Analysis for Biochemical Oxygen Demand**

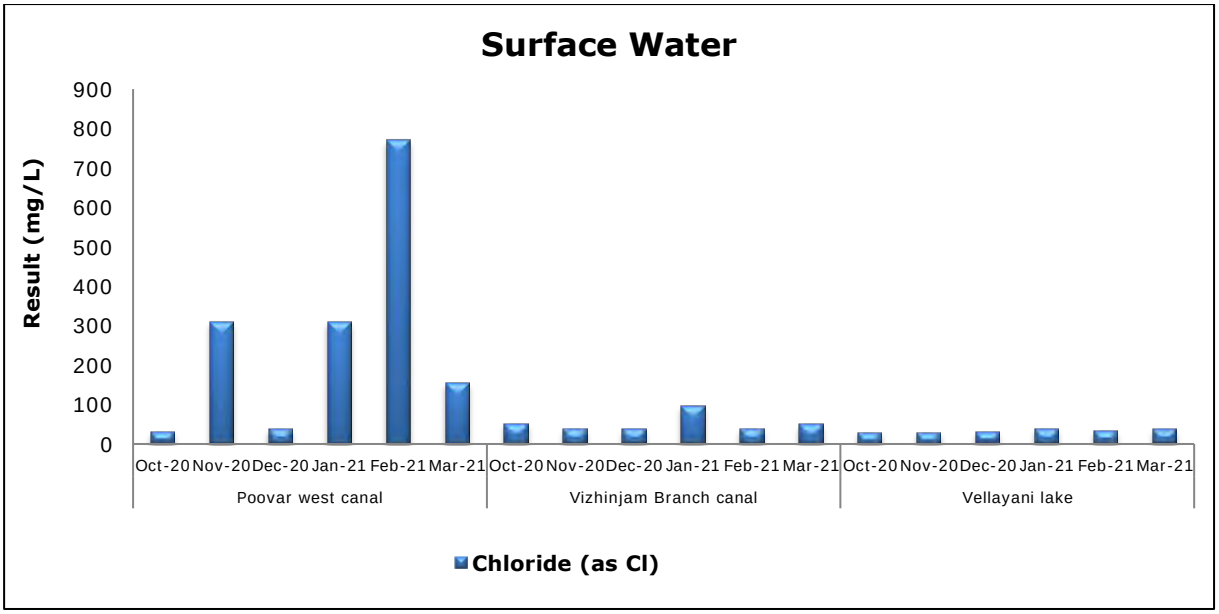



**Figure 6.19: Surface Water Analysis for Chloride**

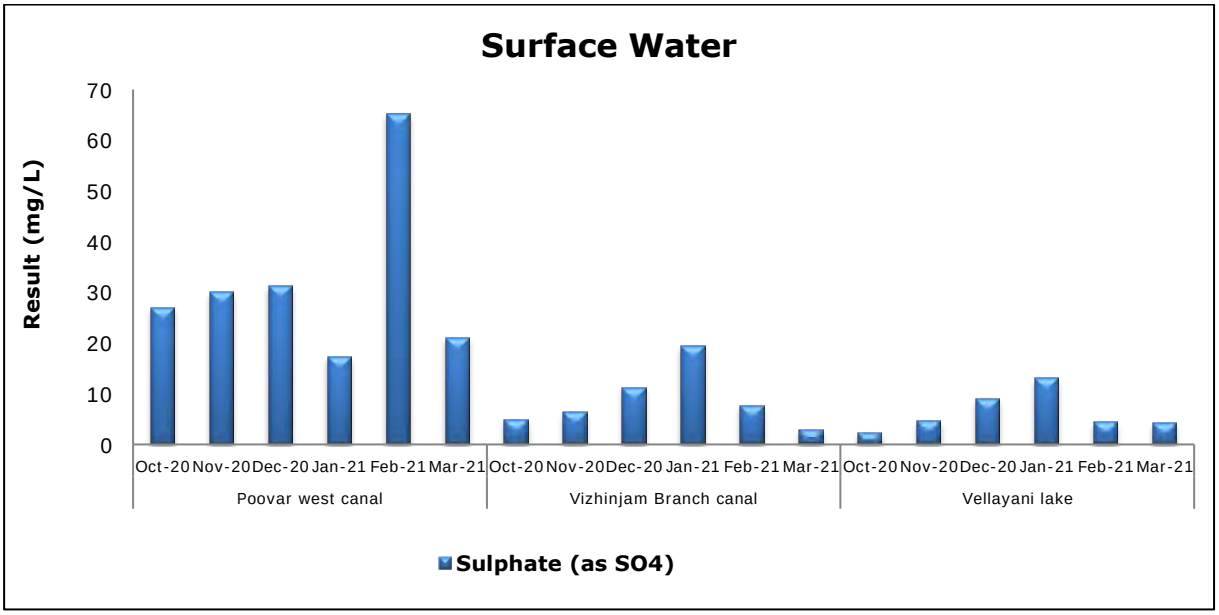



**Figure 6.20: Surface Water Analysis for Sulphate**

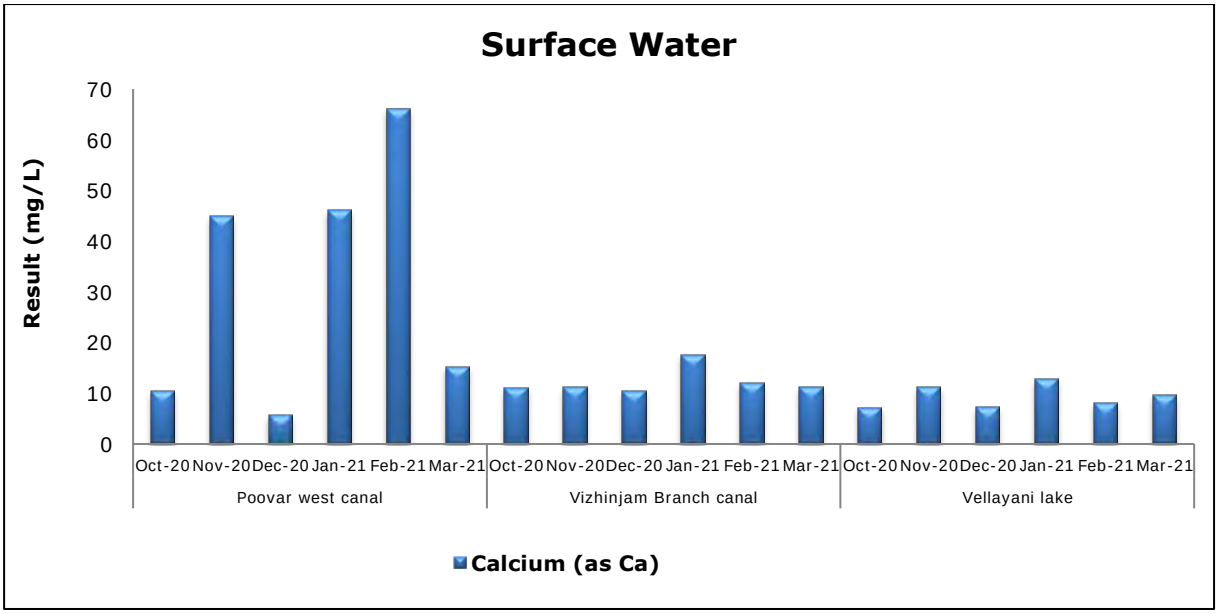



**Figure 6.21: Surface Water Analysis for Calcium**

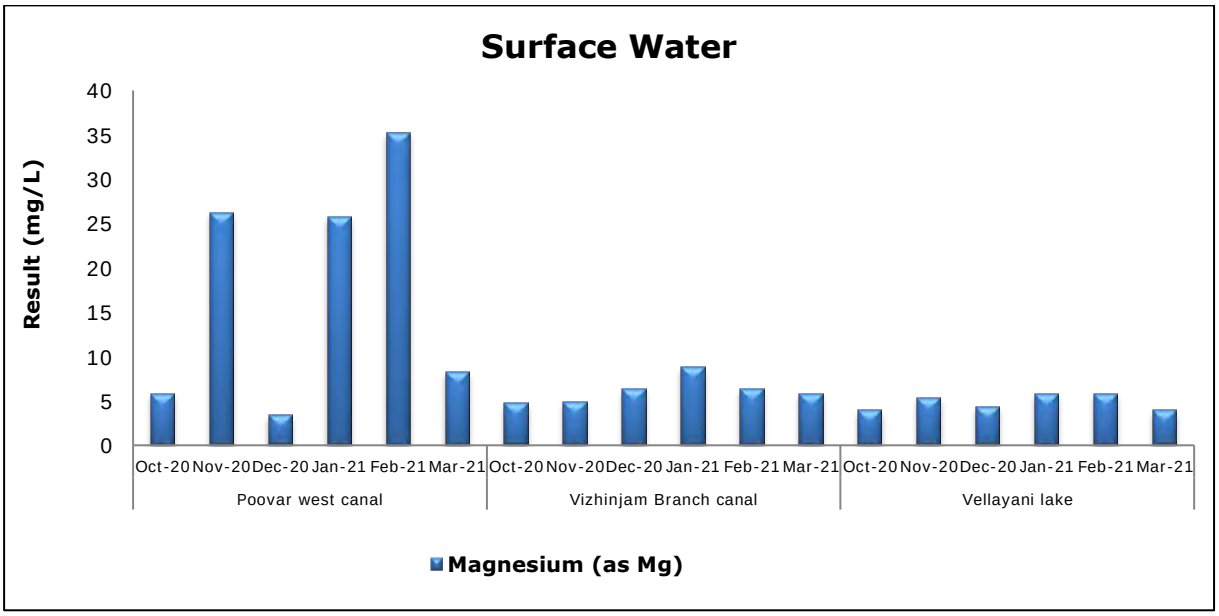



**Figure 6.22: Surface Water Analysis for Magnesium**

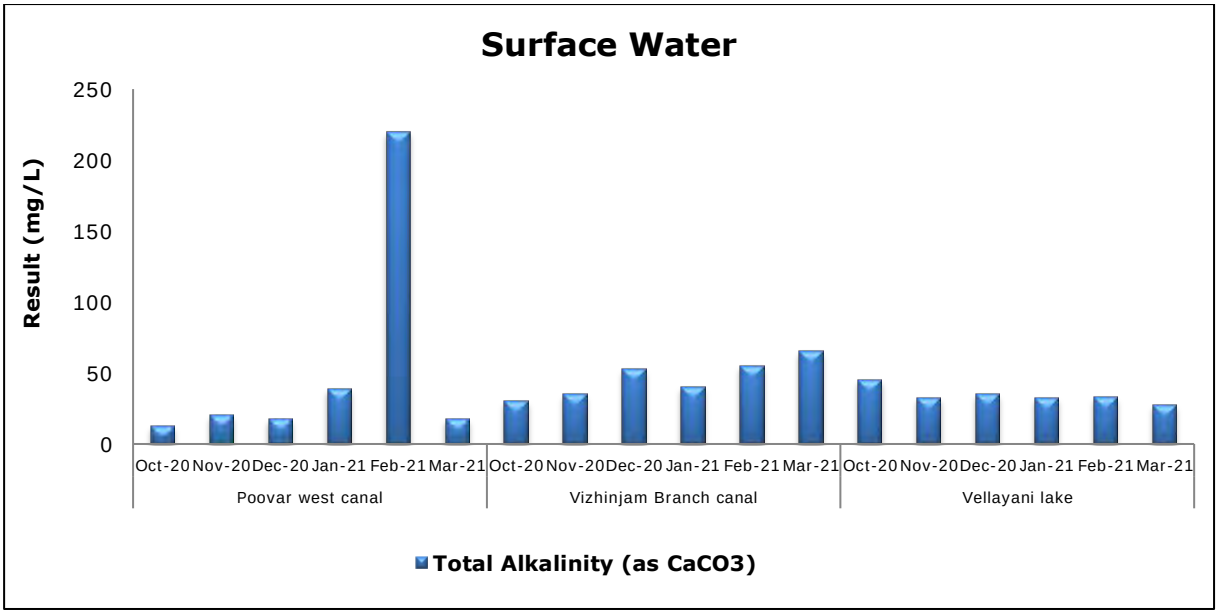



**Figure 6.23: Surface Water Analysis for Total Alkalinity**

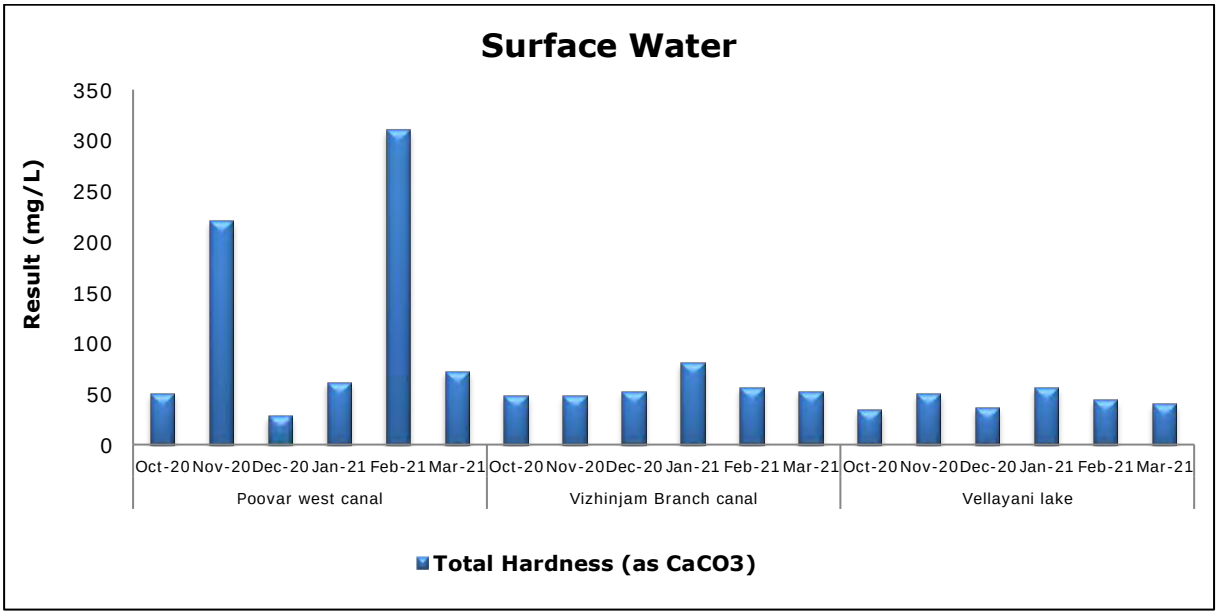



**Figure 6.24: Surface Water Analysis for Total Hardness**

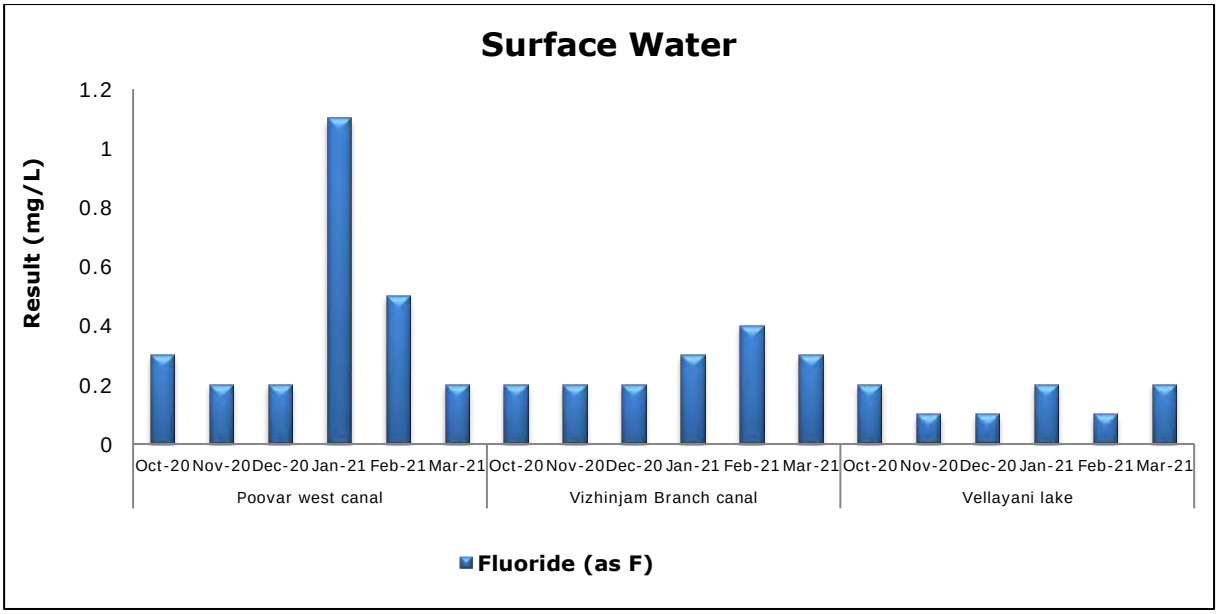



**Figure 6.25: Surface Water Analysis for Fluoride**

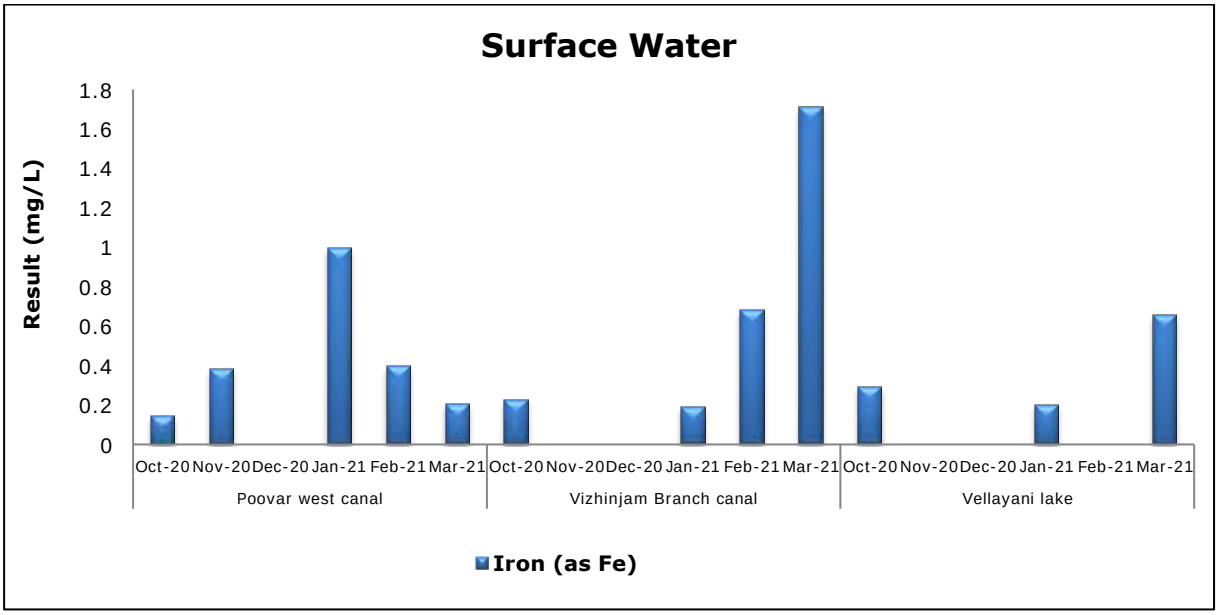



**Figure 6.26: Surface Water Analysis for Iron**

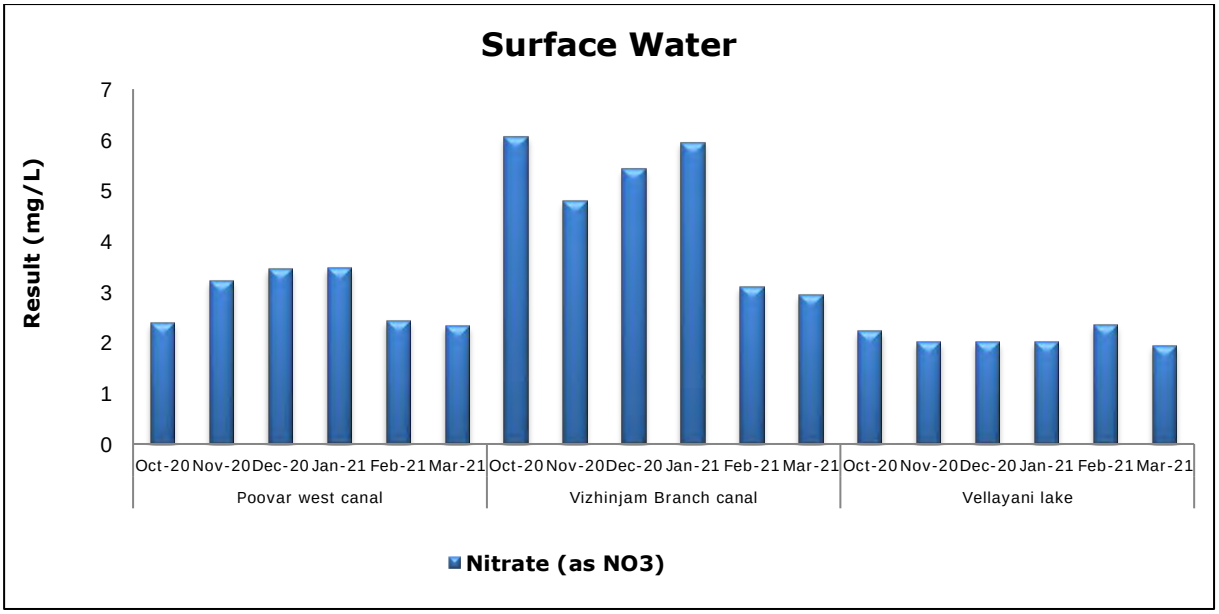



**Figure 6.27: Surface Water Analysis for Nitrate**

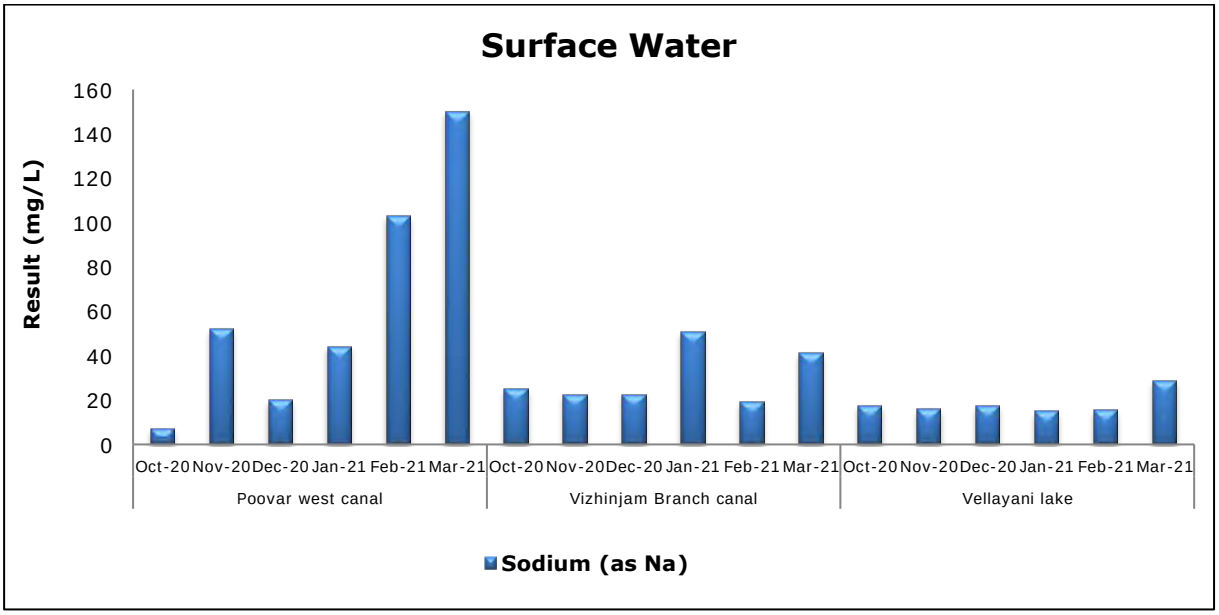



**Figure 6.28: Surface Water Analysis for Sodium**

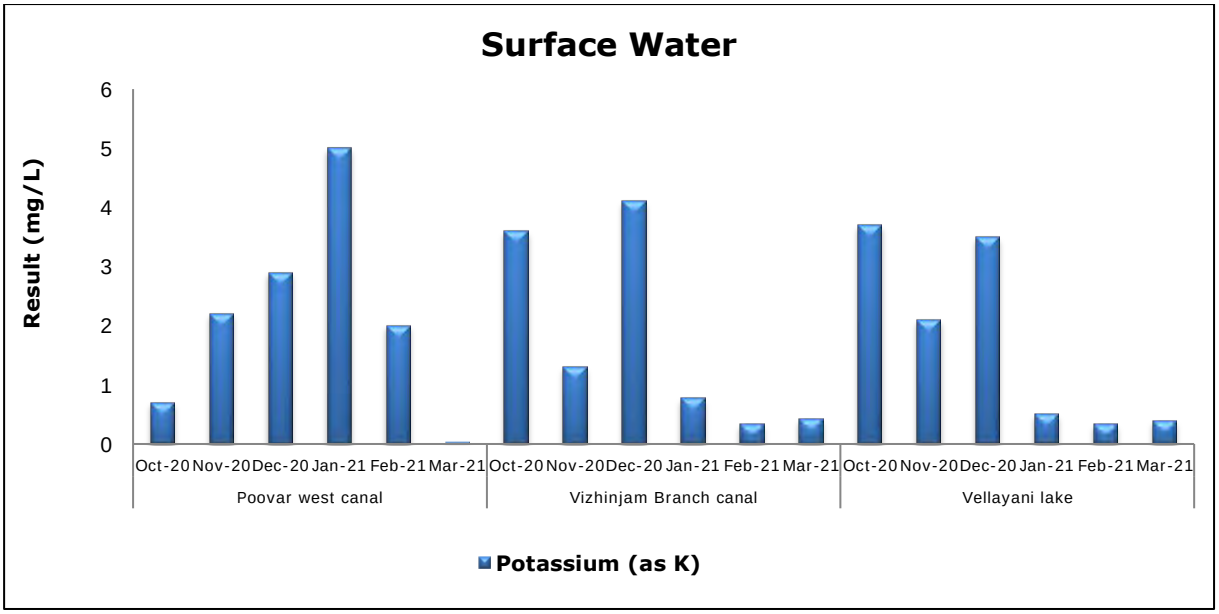



**Figure 6.29: Surface Water Analysis for Potassium**

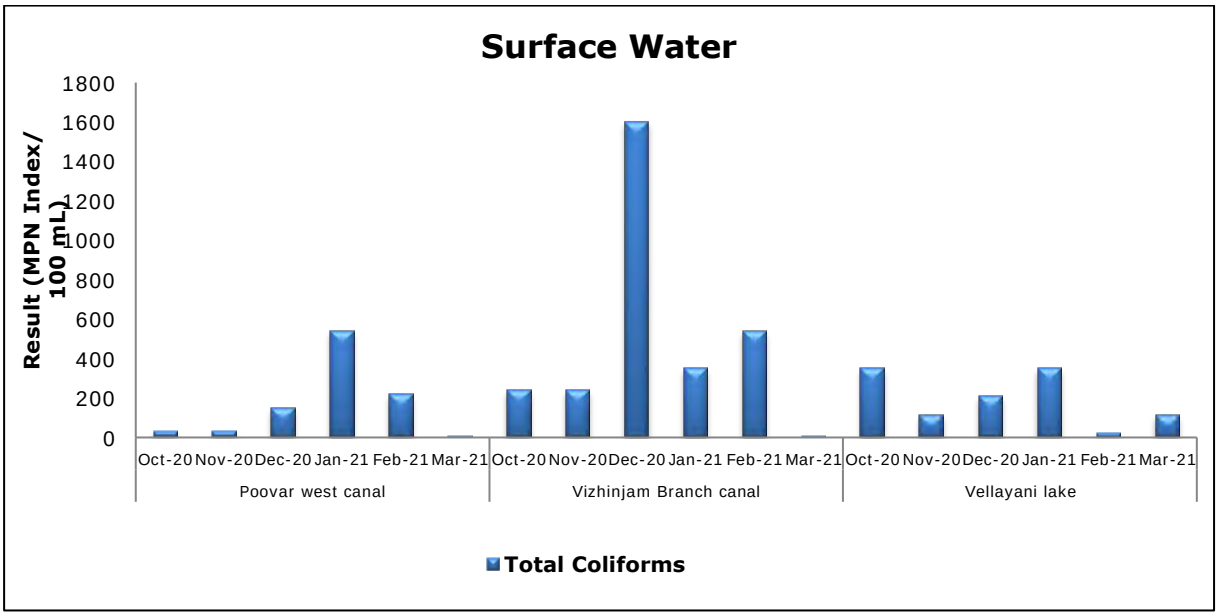



**Figure 6.30: Surface Water Analysis for Total Coliforms**

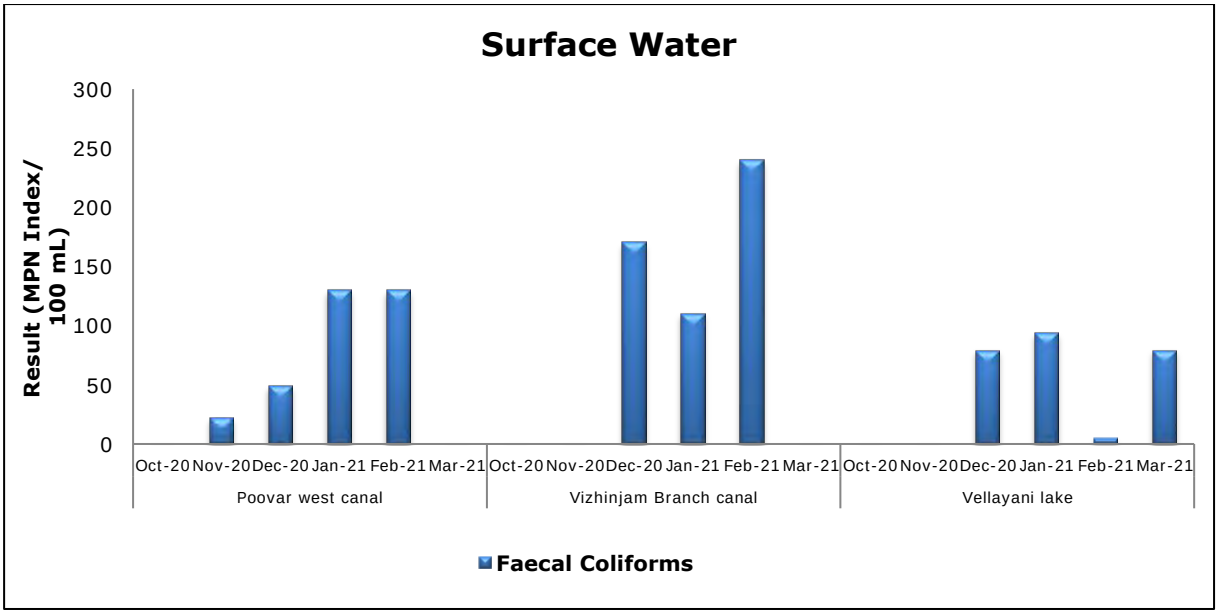



**Figure 6.31: Surface Water Analysis for Faecal Coliforms**

## 8. Summary of Surface water

During the period October 2020 to March 2021, 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 6.54-6.82. Turbidity was observed in the range between <0.2-3.98 N.T.U., Total Dissolved Solids were observed in the range between 92-1500 mg/L. Electrical Conductivity was observed in the range between 156-2678 µmho/cm. Dissolved Oxygen was observed in the range between 6.1-7.6 mg/L. Biochemical Oxygen Demand (3 days, 27$^{o}$C) was observed <1 mg/L. Calcium (as Ca) was observed in the range between 5.6-66.1 mg/L. Chloride (as Cl) was observed in the range between 30-770 mg/L. Fluoride (as F) was observed in the range 0.2-1.1 mg/L. Iron (as Fe) was observed in the range between <0.06 – 0.996 mg/L. Magnesium (as Mg) was observed in the range between 3.4-35.2 mg/L. Manganese (as Mn) was observed in the range between <0.02-0.083 mg/L. Nitrate (as $NO_3$) was observed in the range between 2.3-3.47 mg/L. Sulphate (as $SO_4$) was observed in the range between 17.3-65.2 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 12.5-220 mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 28-310 mg/L. Calcium Hardness (as $CaCO_3$) was observed in the range between 14-220 mg/L. Sodium (as Na) was observed in the range between 7-150 mg/L. Potassium (as K) was observed in the range between 0.03-5 mg/L. Sodium Absorption Ratio was observed in the range between 1.5-7.76, Total Phosphate (as $PO_4$) was observed in the range between <0.1-0.23 mg/L, Zinc (as Zn) was observed in the range between <0.05-0.061 mg/L, Oil & Grease, Free Ammonia, Anionic Detergents, Barium (as Ba), Boron (as B), Copper (as Cu), Mineral Oil, Phenolic Compounds (as $C_6H_5OH$), Selenium (as Se), Silver (as Ag), Cadmium (as Cd), Cyanide (as CN), Lead (as Pb), Mercury (as Hg), Total Arsenic (as As), Total Chromium (as Cr), Pesticide Residues and Polynuclear Aromatic Hydrocarbons (PAH) were observed below detection limit. Bacteriological parameters such as Total Coliforms were observed in the range between 7.8-540 MPN Index/100 mL and Faecal Coliforms were observed in the range between <1.8-130 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 6.59-7.12. Turbidity was observed in the range between <0.2– 1.97 N.T.U., Total Dissolved Solids were observed in the range between 126-280 mg/L. Electrical Conductivity was observed in the range between 208-502 µmho/cm. Dissolved Oxygen was observed in the range

between 5-6.7 mg/L. Biochemical Oxygen Demand (3 days, 27°C) was observed <1 mg/L. Calcium (as Ca) was observed in the range between 10.4-17.6 mg/L. Chloride (as Cl) was observed in the range between 38-97 mg/L. Fluoride (as F) was observed in the range between 0.2-0.4 mg/L. Iron (as Fe) was observed in the range between <0.06 – 1.71 mg/L. Magnesium (as Mg) was observed in the range between 4.7-8.75 mg/L. Nitrate (as $NO_3$) was observed in the range between 2.94-6.05 mg/L. Sulphate (as $SO_4$) was observed in the range between 2.82-19.4 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 30-65 mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 48-80 mg/L. Calcium Hardness (as $CaCO_3$) was observed in the range between 26-44 mg/L. Sodium (as Na) was observed in the range between 19.3-50.8 mg/L. Potassium (as K) was observed in the range between 0.33-4.1 mg/L. Sodium Absorption Ratio was observed in the range between 1.12-2.48. Manganese (as Mn) was observed in the range between <0.02-0.307 mg/L, Total Phosphate (as $PO_4$) was observed in the range between <0.1-0.18 mg/L, Total Chromium (as Cr) was observed in the range between <0.02-0.042 mg/L, Oil & Grease, Free Ammonia, 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 Limits. Bacteriological parameters such as Total Coliforms were observed in the range between 7.8-1600 MPN Index/100 mL and Faecal Coliforms were observed in the range between <1.8-240 MPN Index/100 mL.

At the location **Vellayani Lake**, Colour was observed in the range between 1-2 Hazen unit and odour was agreeable. pH was observed in the range between 6.54-6.78. Turbidity was observed in the range between <0.2 to 0.44 N.T.U., Total Dissolved Solids were observed in the range between 94-210 mg/L. Electrical Conductivity was observed in the range between 161-375 µmho/cm. Dissolved Oxygen was observed in the range between 4.2-6.9 mg/L. Biochemical Oxygen Demand (3 days, 27°C) was observed in the range between <1-5 mg/L. Calcium (as Ca) was observed in the range between 7.2-12.8 mg/L. Chloride (as Cl) was observed in the range between 29-37.5 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 <0.06–0.654 mg/L. Magnesium (as Mg) was observed in the range between 3.89-5.83 mg/L. Manganese (as Mn) was observed in the range between <0.02-0.073 mg/L. Nitrate (as $NO_3$) was observed in the range between 1.94-2.34 mg/L. Sulphate (as $SO_4$) was observed in the range between 2.28-13.1 mg/L. Total Alkalinity (as $CaCO_3$) was observed in the range between 27.5-45

mg/L. Total Hardness (as $CaCO_3$) was observed in the range between 34-56 mg/L. Calcium Hardness (as $CaCO_3$) was observed in the range between 18-32 mg/L. Sodium (as Na) was observed in the range between 14.9-28.7 mg/L. Potassium (as K) was observed in the range between 0.33-3.7 mg/L. Sodium Absorption Ratio was observed in the range between 0.86-1.97, Total Phosphate (as $PO_4$) was observed in the range between <0.1-1.53 mg/L, Oil & Grease, Free Ammonia, 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 23-350 MPN Index/100 mL and Faecal Coliforms were observed in the range between <1.8-94 MPN Index/100 mL.

# CHAPTER 7

# Soil Analysis

## 1. Soil sampling location details:

This chapter describes the sampling location, methodology adopted for analysis and analysis results of soil during the period October 2020 to March 2021. Soil sampling was carried out at four locations including Port Site, Proposed Port Estate Area, along with road Network (Mulloor) and along with Rail Network (Balarampuram).

**Table 7.1: Soil Sampling Location details**

| Sr. No. | Location | Latitude | Longitude |
|---|---|---|---|
| 1. | Port Site | $8^0$,22′,20.43″N | 770,00′,04.06″E |
| 2. | Proposed Port Estate Area | $77^0$,01′,44.11″E | $77^0$,01′,44.11″E |
| 3. | Along with road Network (Mulloor) | 80,22′,41.01″N | 770,00′,45.71″E |
| 4. | Along with Rail Network (Balarampuram) | 80,25′,48.80″N | 770,02′,22.00″E |

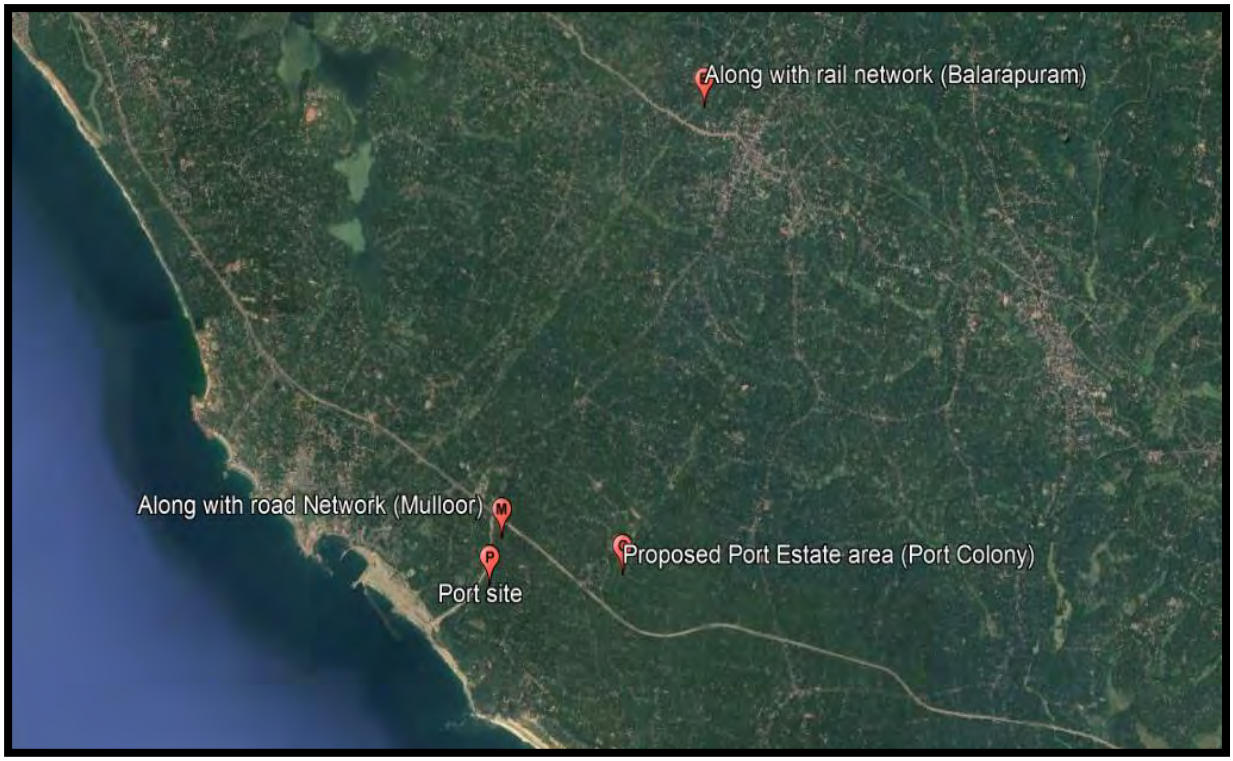



**Figure 7.1: Google earth views of sampling locations of Soil**

## 2. Methodology of Sampling and Analysis:

**Table 7.2: Soil Analysis methodology**

| Sr. No. | Parameter | Unit | Detection Limit | Method Reference |
|---|---|---|---|---|
| 1. | Texture | - | 1 | AEC/C/SAP/S-3 |
| 2. | Particle Size Distribution | % | 1 | AEC/C/SAP/S-3 |
| 3. | pH (1:5 Suspension) | - | 1 | FAO 1976,Sec. III, 1, Page no.65 |
| 4. | Electrical Conductivity (1:5 Suspension at $25^0$C) | µS/cm | 5 | FAO 1976,Sec. III, 5, Page no.85 |
| 5. | Porosity | % | - | WI/SAP-Soil/5/19 |
| 6. | Total Kjeldhal Nitrogen (as TKN) | mg/kg | 20 | FAO 1976,Sec. III, 4, Page no.78 |
| 7. | Available Phosphorus (as P) | mg/kg | 5 | FAO 1976,Sec.III, 12-1,Page no.157 |
| 8. | Available Potassium (as K) | mg/kg | 1 | FAO 1976,Sec.III, 8-1,Page no. 115 |
| 9. | Total Organic Carbon | g/100g (%) | 0.025 | FAO 1976,Sec.III, 3,Page no.73 |
| 10. | Organic Matter | g/100g (%) | 0.025 | FAO 1976,Sec. III, 3,Page no.73 |
| 11. | Available Sodium | mg/kg | 1 | FAO 1976, Sec. III, 8-1,Page no.115 |
| 12. | Lead (as Pb) | mg/kg | 0.5 | USEPA/SW 846/7000B |

**Note:**
**FAO:** Food & Agriculture Organization, United Nations

### 3. Soil Analysis Results for the period October 2020 to March 2021:

**Table 7.3: Soil Analysis Result**

| Sr. No. | Parameters | | Units | Results | | | |
|---|---|---|---|---|---|---|---|
| | | | | Port Site | Port Colony | Along Road Network (Mullor) | Along Rail Network (Balarampuram) |
| 1. | Texture | | - | Sandy | Sandy | Sandy | Sandy |
| 2. | Particle Size Distribution | Gravel | % | 3.22 | 0.86 | 2.6 | 3.29 |
| | | Sand | | 66.58 | 66.50 | 71.22 | 52.47 |
| | | Silt | | 22.13 | 24.11 | 20.54 | 32.11 |
| | | Clay | | 8.07 | 8.53 | 5.64 | 12.13 |
| 3. | pH (1:5 Suspension) | | - | 6.59 | 6.65 | 7 | 6.73 |
| 4. | Electrical Conductivity (1:5 Suspension at $25^0$C) | | µS/cm | 161 | 27.9 | 52.5 | 15.2 |
| 5. | Porosity | | % | 22.41 | 44.69 | 42.69 | 42.13 |
| 6. | Infiltration (Void Ratio) | | - | 1.95 | 1.57 | 1.71 | 2.11 |
| 7. | Total Kjeldhal Nitrogen (as TKN) | | mg/kg | 35.8 | 49.7 | 111 | 30.4 |
| 8. | Available Phosphorus (as P) | | mg/kg | 56.7 | 59.1 | 76.6 | 55.3 |
| 9. | Available Potassium (as K) | | mg/kg | 30.7 | 46.1 | 20.6 | 28.4 |
| 10. | Total Organic Carbon | | g/100g (%) | 0.688 | 0.736 | 0.24 | 0.398 |
| 11. | Organic Matter | | g/100g (%) | 1.19 | 1.26 | 0.41 | 0.686 |
| 12. | Available Sodium | | mg/kg | 2.60 | 8.90 | 7.98 | 7.50 |
| 13. | Lead (as Pb) | | mg/kg | 3.80 | 8.12 | 11.3 | 3.08 |
| **Note:** All results are on air dry basis. | | | | | | | |

## 4. Graphical representation of Results for the period October 2020 to March 2021:

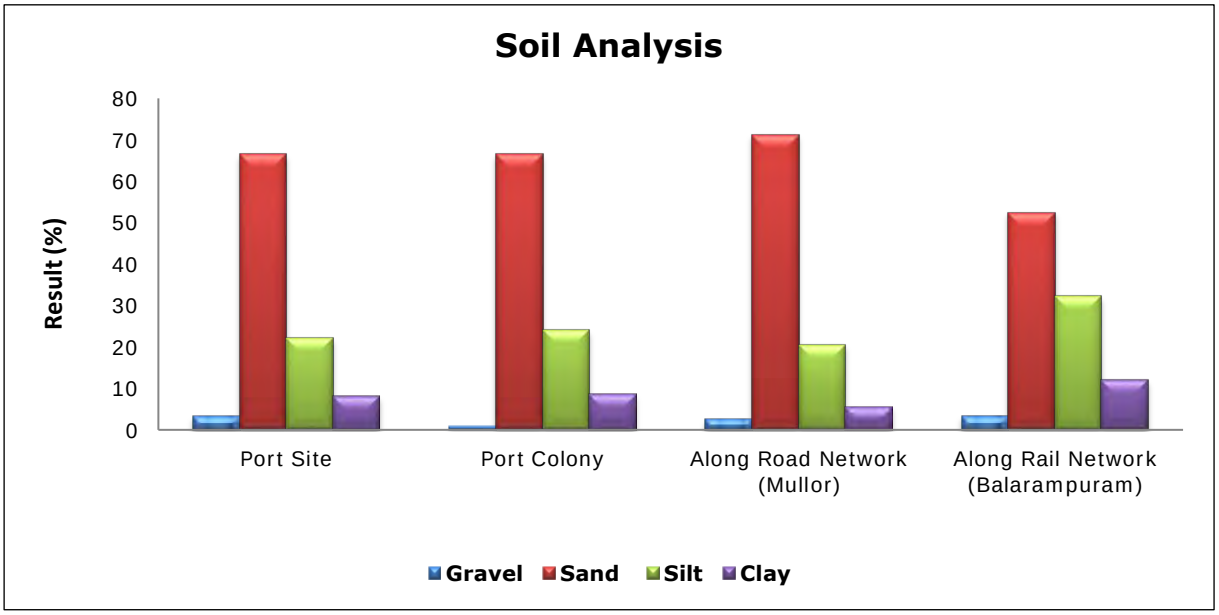



**Figure 7.2: Soil Analysis for Particle Size Distribution**

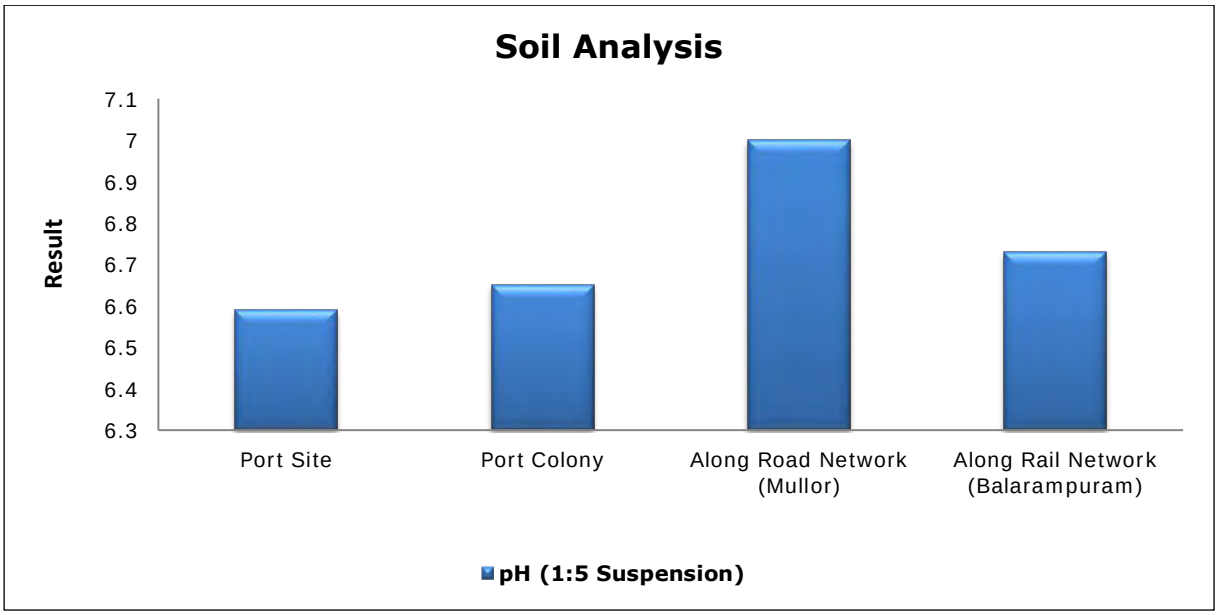



**Figure 7.3: Soil Analysis for pH**

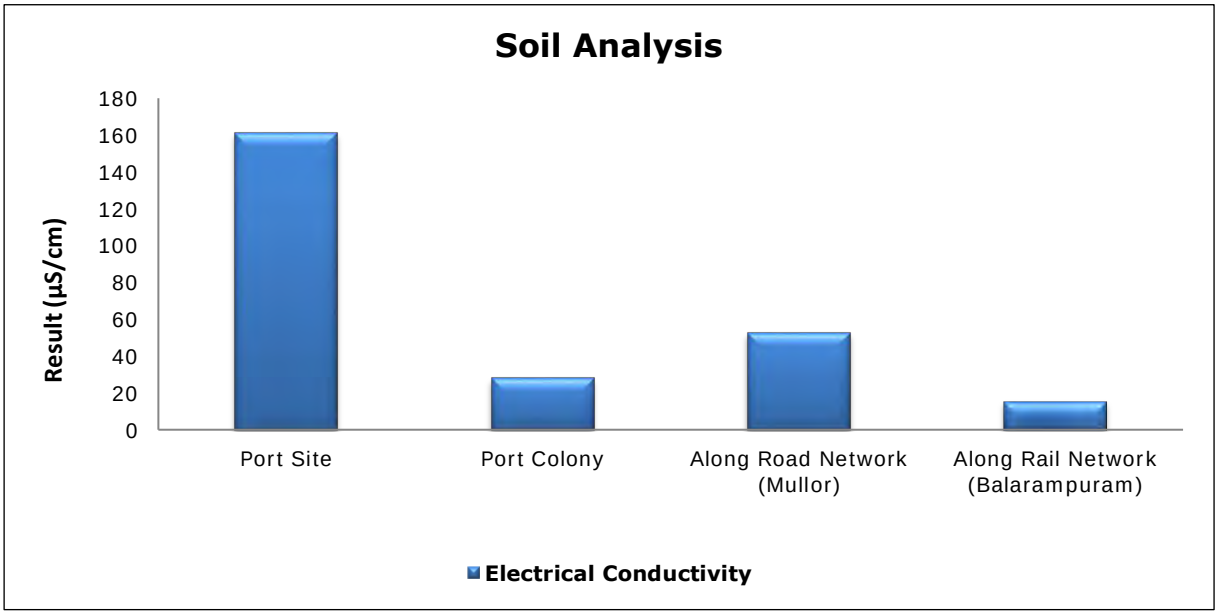



**Figure 7.4: Soil Analysis for Electrical Conductivity (1:5 Suspension at 25$^0$C)**

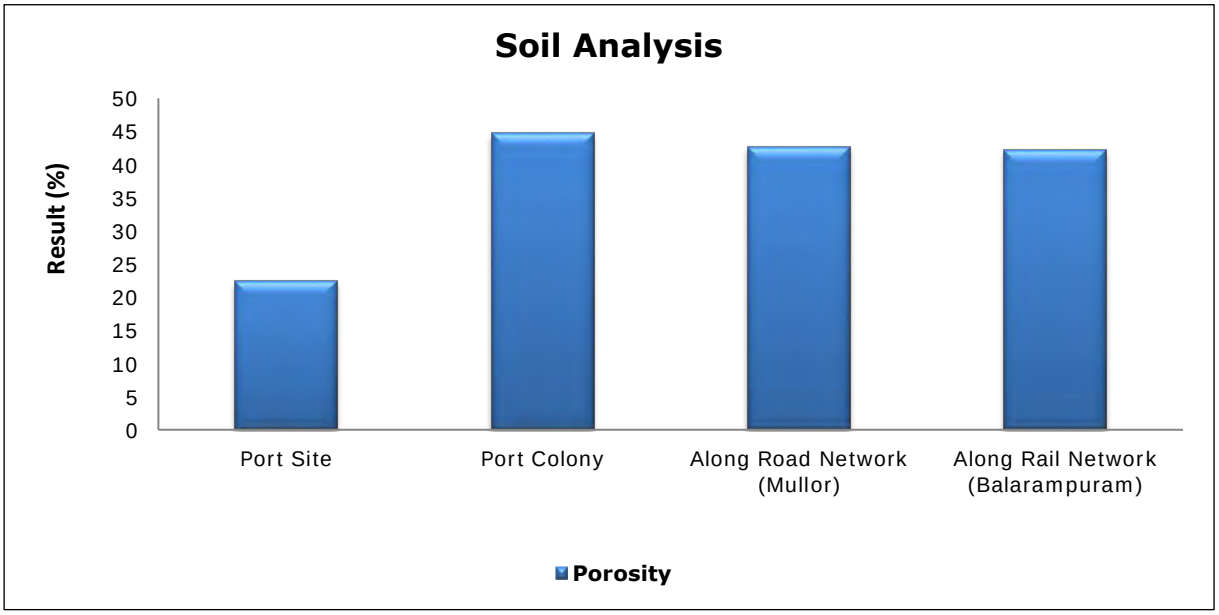



**Figure 7.5: Soil Analysis for Porosity**

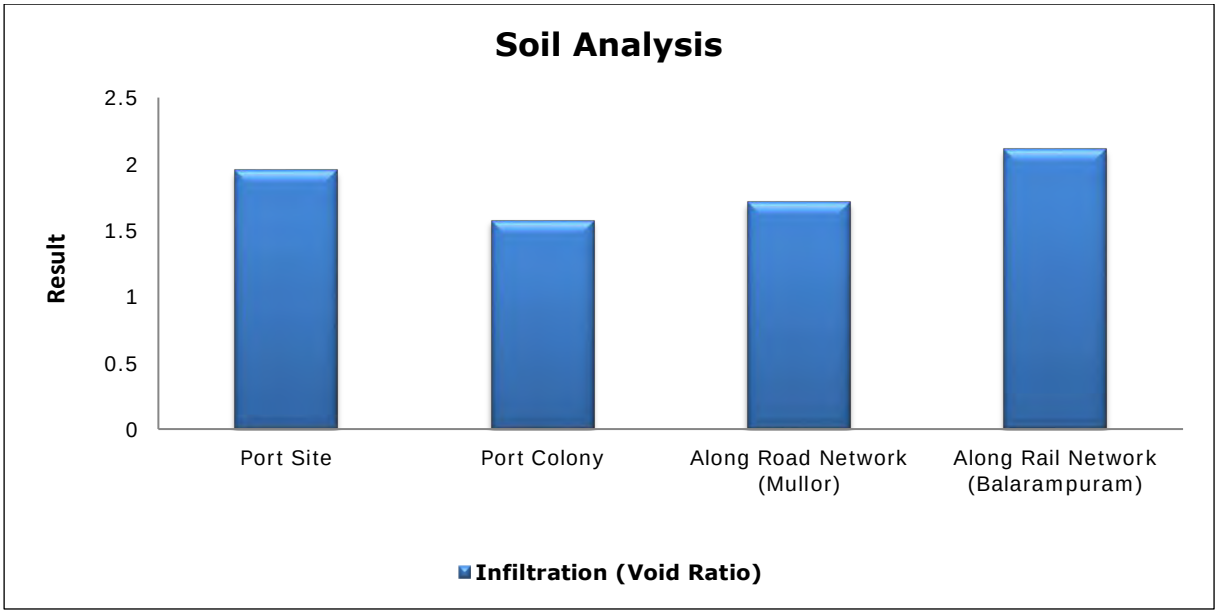



**Figure 7.6: Soil Analysis for Infiltration (Void Ratio)**

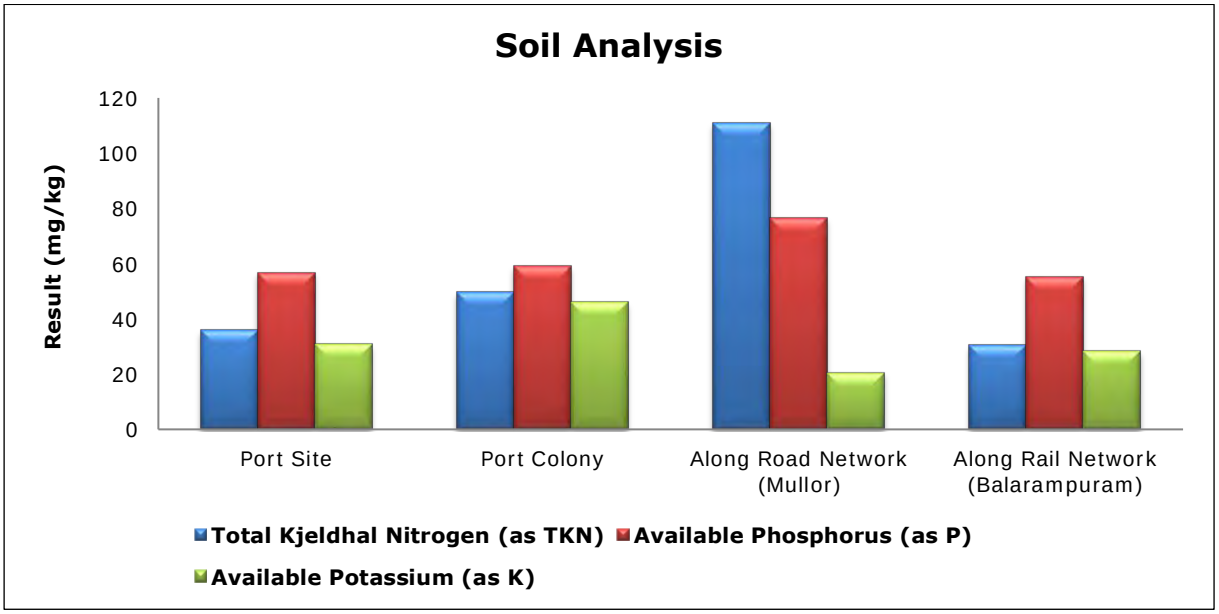



**Figure 7.7: Soil Analysis for Total Kjeldhal Nitrogen, Available Phosphorus and Available Potassium**

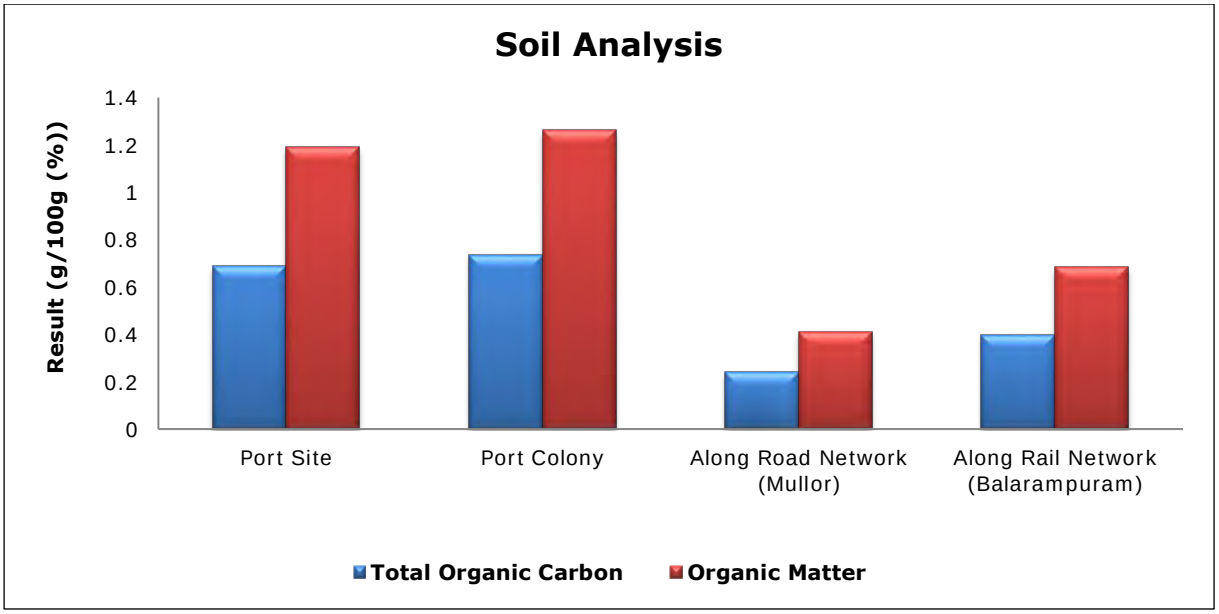



**Figure 7.8: Soil Analysis for Total Organic Carbon and Organic Matter**

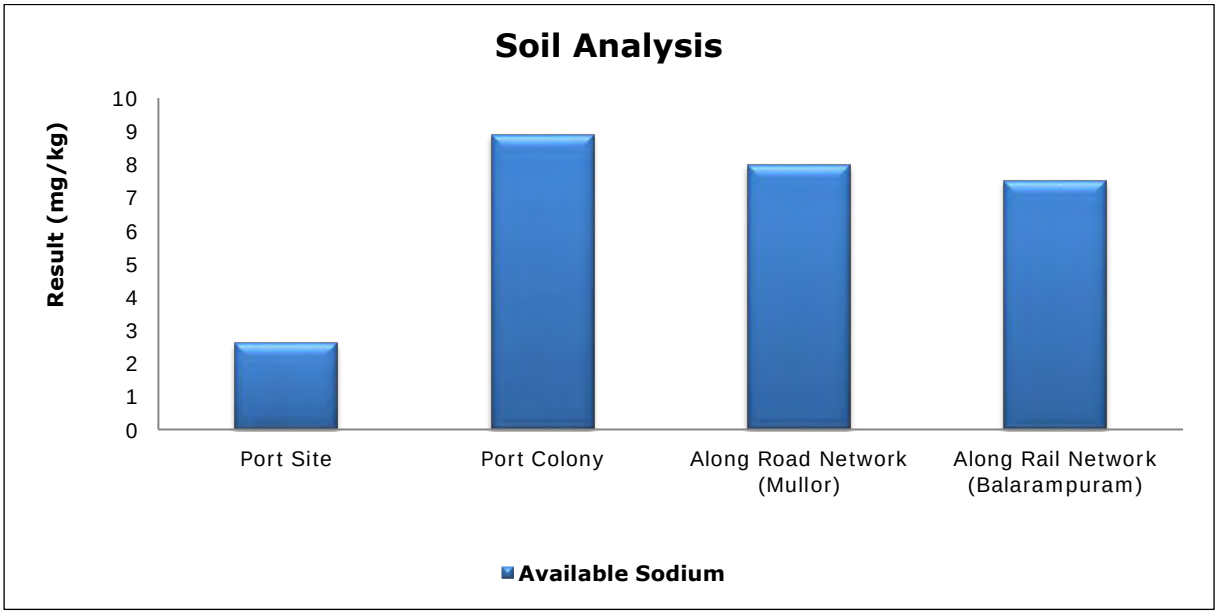



**Figure 7.9: Soil Analysis for Available Sodium**

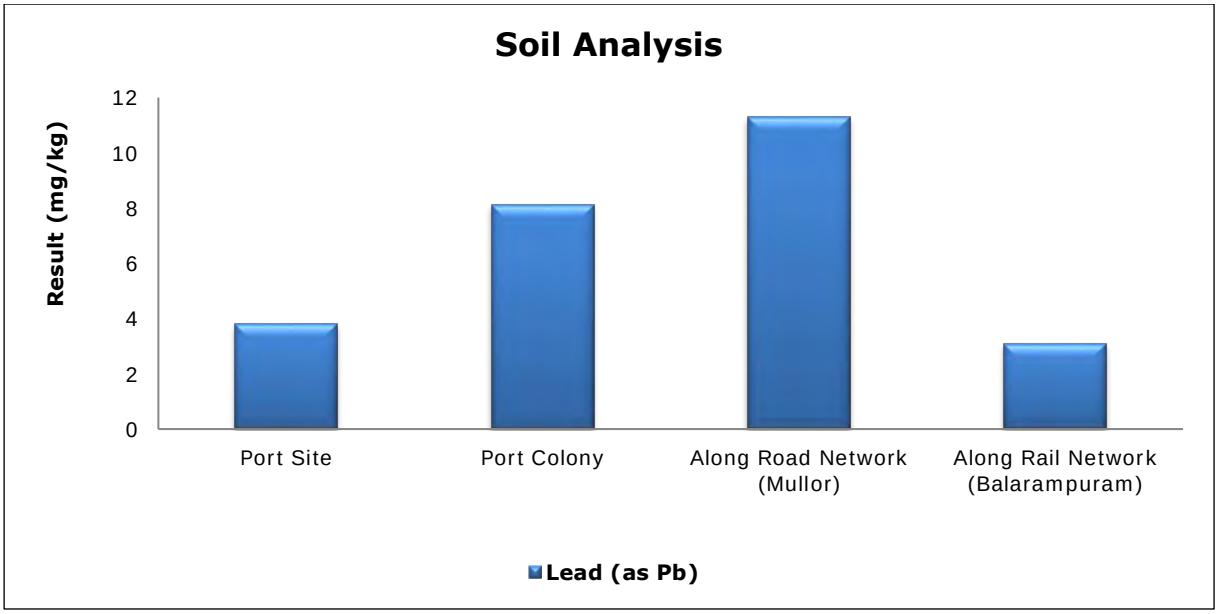



**Figure 7.10: Soil Analysis for Lead**

## 5. Summary- Soil Analysis:

During the months of October 2020 to March 2021, following is the summary of sediment analysis:

At the location **Port Site**, the observed texture was sandy, Gravel was observed 3.22%, Sand was observed 66.58%, Silt was observed 22.13% and Clay was observed 8.07%, pH (1:5 suspension) was observed 6.59. Electrical Conductivity (1:5 Suspension at $25^0$C) was observed 161 µS/cm. Porosity was observed 22.41%. Infiltration (Void Ratio) was observed 1.95. Total Kjeldhal Nitrogen (as TKN) was observed 35.8 mg/kg. Available Phosphorus (as P) was observed 56.7 mg/kg. Available Potassium (as K) was observed 30.7 mg/kg. Total Organic Carbon was observed 0.688 g/100g (%). Organic matter was observed 1.19 g/100g (%). Available Sodium was observed 2.60 mg/kg and Lead (as Pb) was observed 3.80 mg/kg.

At the location **Port Colony**, the observed texture was sandy, Gravel was observed 0.86%, Sand was observed 66.50%, Silt was observed 24.11% and Clay was observed 8.53%, pH (1:5 suspension) was observed 6.65. Electrical Conductivity (1:5 Suspension at $25^0$C) was observed 27.9 µS/cm. Porosity was observed 44.69%. Infiltration (Void Ratio) was observed 1.57. Total Kjeldhal Nitrogen (as TKN) was observed 49.7 mg/kg. Available Phosphorus (as P) was observed 59.1 mg/kg. Available Potassium (as K) was observed 46.1 mg/kg. Total Organic Carbon was observed 0.736 g/100g (%). Organic matter was observed 1.26 g/100g (%). Available Sodium was observed 8.90 mg/kg and Lead (as Pb) was observed 8.12 mg/kg.

At the location **Along Road Network (Mullor),** the observed texture was sandy, Gravel was observed 2.6%, Sand was observed 71.22%, Silt was observed 20.54% and Clay was observed 5.64%, pH (1:5 suspension) was observed 7.00. Electrical Conductivity (1:5 Suspension at $25^0$C) was observed 52.5 µS/cm. Porosity was observed 42.69%. Infiltration (Void Ratio) was observed 1.71. Total Kjeldhal Nitrogen (as TKN) was observed 111 mg/kg. Available Phosphorus (as P) was observed 76.6 mg/kg. Available Potassium (as K) was observed 20.6 mg/kg. Total Organic Carbon was observed 0.24 g/100g (%). Organic matter was observed 0.41 g/100g (%). Available Sodium was observed 7.98 mg/kg and Lead (as Pb) was observed 11.3 mg/kg.

At the location **Along Rail Network (Balarampuram),** the observed texture was sandy, Gravel was observed 3.29%, Sand was observed 52.47%, Silt was observed

32.11% and Clay was observed 12.13%, pH (1:5 suspension) was observed 6.73. Electrical Conductivity (1:5 Suspension at $25^0$C) was observed 15.2 µS/cm. Porosity was observed 42.13%. Infiltration (Void Ratio) was observed 2.11. Total Kjeldhal Nitrogen (as TKN) was observed 30.4 mg/kg. Available Phosphorus (as P) was observed 55.3 mg/kg. Available Potassium (as K) was observed 28.4 mg/kg. Total Organic Carbon was observed 0.398 g/100g (%). Organic matter was observed 0.686 g/100g (%). Available Sodium was observed 7.50 mg/kg and Lead (as Pb) was observed 3.08 mg/kg.

# Annexure III

# CSR Activities by AVPPL

# (October 2020 to March 2021)

**Annexure III**

# Half Yearly Report

## (Oct 2020 – March 2021)

# CSR-VIZHINJAM

**Adani Foundation**
**Adani Vizhinjam Port Pvt. Ltd.**
**Vizhinjam, Thiruvananthapuram**
**Kerala - 695525**

## INTRODUCTION

Developing a port based eco-system in harmony with the needs of the local people and connecting them to the benefits of local development are the fundamental principles employed in the CSR intervention at Vizhinjam during the year. This half yearly report (October 2020 – March 2021) has been prepared in line with the activities carried out in the nearby five wards of Adani Vizhinjam Port viz Mulloor, Kottappuram, Venganoor, Vizhinjam and Harbour. These five wards are selected for intensive intervention as it comes within 2 kilometre from the port construction site. This is also envisaged in the Environmental Impact Assessment (EIA) study report.

The CSR intervention during the reporting period generally followed the CSR intervention strategy of Adani Foundation. Hence the report is prepared based on the consolidation of activities in four major heads.

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

The initiatives during the period has created a platform in building the skill set of the local youth, enhance employability, equipping them to initiate entrepreneurial activities, keeping healthy practices of sanitation and solid waste management and to reach out to the unreachable in the neighbourhoods of Vizhinjam project location. There will also be initiatives to help locals to establish their own small businesses to build a flourishing ecosystem around Vizhinjam. The immense goodwill of the people and willingness of Government to go to extra mile is among the many positive signs towards extending the CSR activities to these communities.

## I. EDUCATION (SDG-4 - Quality Education)

The focus of intervention during the period was to improve 'quality of education' and to provide better facilities for children in the intervention areas especially those from fishing communities. Following are the major activities activities carried out under Education during the period

i. **Monthly Open House & Poets and men of Literature meet (SDG-10 - Reduced Inequalities & SDG-4 - Quality Education)**
   - Gandhi Jayanti Celebrations – Oct 2nd
   - Green Campaign
   - International Girl Child Day, World food day and Hand wash day
   - Children's Day Celebrations – 14th Nov
   - Christmas Celebrations
   - Session on Literature and Cartoon
   - National Youth Day 2021

ii. **Distribution of bicycle (SDG-10 - Reduced Inequalities)**

iii. **Benevolent Support (SDG-10 - Reduced Inequalities)**

### 1.1 Monthly Open House & Poets and men of Literature Meet (SDG-10 - Reduced Inequalities)

- **Gandhi Jayanti Celebrations - 2nd Oct 2020**

The 151st birth anniversary of Mahatma Gandhi was celebrated on 2nd October 2020 with a floral tribute to the father of nation with the prayer-*Raghupati Ragava Raja Ram*. The programme was attended by 23 students of literature group and adolescent clubs etc. A book on Gandhijis life – (*Gandhijiaariyanto know Gandhi*) in Malayalam was presented to all Children. Children sang songs and Keerthanas about Gandhi. A Gandhiyan club has been formed at end of the programme to promote Gandhian thoughts among like-minded people and communities.

- **Green Campaign– Cleaning and manuring**

As part of Green Campaign, CSR team along with students' groups cleaned the area and applied manure for 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

- **Children's Day Celebrations – 14th Nov 2020**

Children's day was celebrated at Vizhinjam on November 14th by conducting programs under the theme "togetherness", for children. The day made memorable by engaging programmes of Vanchi Pattu (Folk songs), planting of saplings, craft making, speeches, drawing & Poster making on themes. The programs were conducted through virtual platforms.



- **Christmas Celebration**

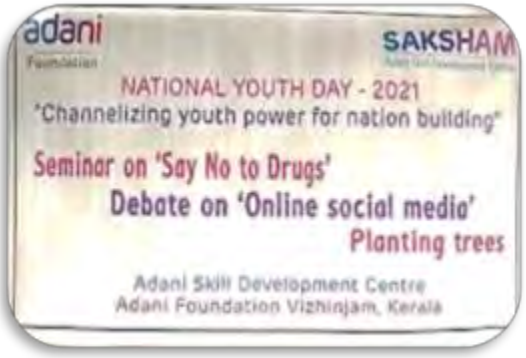
The literature student's club and merit scholarship students have jointly organized Christmas celebrations at CV smaraka memorial Library at Thennoorkonam on 21st of December 2020. The programme was attended by 27 students, 8 teachers, CSR staff and few parents, by cutting cakes and performing cultural programmes.

- **Session on Literature and Cartoon**

Literature students meet was conducted on 16.01.2021 after a long gap of one year covid restrictions. The chief guest of the meet was **Mr. Hari Charutha** – Cartoonist and poet. He spoke about literature and cartoons on the basis of his life and experience. The guest was surprised to see the student's caliber in expressing through cartoons. The programme was attended by 50 students of vizhinjam.

- **National Youth Day 2021**

As part of National Youth Day, AVPPL/AF arranged a seminar on "**Say No to Drugs**", planting trees by the youth and conducted a debate on "Online Social Media".




The seminar session was handled by Mr. Shibu Circle Inspector, Kerala Excise Department, Neyyattinkara, Trivandrum. The programme was participated by 60 youth from the intervening communities

As part of celebrations, the youth group planted trees in the land close to the community resource center. The programmes concluded with a debate on "Online Social Media" moderated by CSR team.


## 1.2 Bicycle distribution (SDG-10 - Reduced Inequalities)

Adani foundation distributed 100 Bicycles to the girl children of widows belonging to Below Poverty Line in which 40 bicycles were distributed during the reporting period. The distribution of bicycle was done by keeping all the COVID-19 protocols. The list of students who received bicycles is as follows

| Sl No | Name | Ward | Phone No |
|---|---|---|---|
| 1 | Badriya | Harbour | 9847451847 |
| 2 | Hafsa Hassan | Harbour | 8111987804 |
| 3 | Noufiya. S | Harbour | 8606637302 |
| 4 | Shahana. M | Harbour | 9567852467 |
| 5 | Nadhiya D | Harbour | 7560889277 |
| 6 | Angel Paradise. N. P | Mulloor | 9497271397 |
| 7 | Vaishnavi | Venganoor | 8129389524 |
| 8 | Jaseenth Raj | Venganoor | 8129057244 |
| 9 | Soufia. N S | Vizhinjam | 8301817568 |
| 10 | Shanibha. B | Vizhinjam | 9061213394 |
| 11 | Abhi Benz | Vizhinjam | 7994879084 |
| 12 | Anushka | Kottapuram | 9895890744 |
| 13 | Shanumol | Kottapuram | 9061205789 |
| 14 | Sunitha | Kottapuram | 7994327237 |
| 15 | Kejina Kennady | Kottapuram | 7510269569 |

| | | | |
|---|---|---|---|
| 16 | Maghana | Kottapuram | 7025331361 |
| 17 | Sajitha | Kottapuram | 8593865987 |
| 18 | Suchithra | Kottapuram | 7034161934 |
| 19 | Vineesha | Kottapuram | 8848866801 |
| 20 | Stephana | Kottapuram | 7356694406 |
| 21 | Jincy | Kottapuram | 9895023368 |
| 22 | Jisha | Kottapuram | 9142086667 |
| 23 | Anumol | Kottapuram | 7994237134 |
| 24 | Ashvini Antony | Kottapuram | 6235221619 |
| 25 | Asha | Kottapuram | 7034161934 |
| 26 | Rani Mariya | Kottapuram | 7994796614 |
| 27 | Rithi R P | Kottapuram | 9048042202 |
| 28 | Jijeesha | Kottapuram | 9567879134 |
| 29 | Nidthiya | Kottapuram | 9995958216 |
| 30 | Raji M | Kottapuram | 9074490901 |
| 31 | Eby A M | Kottapuram | 7356047261 |
| 32 | Nafila Mol | Vizhinjam | 9526566332 |
| 33 | Rajeena | Harbour | 9526566392 |
| 34 | Aishath Shani | Venganoor | 9645918200 |
| 35 | Avani b rajesh | Mulloor | 9633504810 |
| 36 | Avanhthika | Mulloor | 9745899298 |
| 37 | Fathima Farhana | Vizhinjam | 9995278255 |
| 38 | Lekshmi SS | Mulloor | 8129508784 |
| 39 | Geethu | kottappuram | 8590414940 |
| 40 | Aliya | vizhinjam | 9995196660 |






### 1.3. Benevolent Support (SDG-10 - Reduced Inequalities)

A computer is provided to Kumari. Jayalekshmi, a 17 year is old plus 2 student, who is suffering from cerebral palsy. She is the daughter of Anitha S, one of the Sanginies. , Getting a computer was one of her dreams shared during the

interaction with CSR team. Hence, it is provided a new computer for her to make her education meaningful and enjoyable as equivalent to other students on 29.10.2020.

## II. COMMUNITY HEALTH (SDG-3 - Good Health and Well Being)

The major activities carried out under Community Health included Mobile Health Unit, Cancer Care support, Clean Campaigns, Community Awareness Programmes, Solid Waste Management, Kitchen Garden, Farm School, other Health initiatives and SuPoshan intervention. Following are the details

### 2.1 MOBILE HEALTH CARE UNIT ( SDG-3-Good Health and Well Being)

Mobile Health Care Unit (MHCU) started functioning in the neighboring communities of Vizhinjam since June 2017. Helpage India is the partnering agency for executing the project. The unit consists of an allopathic doctor, pharmacist and a social worker along with a mobile van and medicines operating 6 days a week. The service of MHU has reached to 55377 over the last four year. The updates of MHCU for the period is as follows

- During the period from October 2020- March 2021 Vizhinjam MHCU has provided checkups to 7209.
- The MHCU Team visited 2 houses of bedridden patients and provided necessary medicines.

- Awareness conducted on Seasonal Diseases, Elder Abuse, Cancer, Corona, Hypertension, Diabetes, Skin disease and sanitation in each site.
- 367 Glucose check-ups were done for the patients.
- Arranged awareness on Corona virus at all the sites.

**Monthly break-up of patients supported during Oct 2020 - March 2021**

| | 2020 | | | 2021 | | | Total |
|---|---|---|---|---|---|---|---|
| **MHU Sites** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | |
| New Church | 112 | 243 | 199 | 315 | 156 | 189 | 1214 |
| Kadakkulam | 94 | 176 | 132 | 91 | 134 | 140 | 767 |
| Karayadivila | 122 | 129 | 186 | 45 | 131 | 176 | 789 |
| Thulavila/Kanjiramvila | 37 | 54 | 88 | 13 | 24 | 59 | 275 |
| Theruvu | 177 | 178 | 182 | 120 | 162 | 251 | 1070 |
| SNDP | 97 | 103 | 113 | 155 | 106 | 132 | 706 |
| Gateway | 116 | 93 | 122 | 69 | 101 | 94 | 595 |
| Township | 184 | 145 | 164 | 70 | 113 | 118 | 794 |
| Marian Nagar | 110 | 114 | 108 | 63 | 121 | 119 | 635 |
| Near Aquarium | 89 | 85 | 42 | 32 | 53 | 63 | 364 |
| **Total** | **1138** | **1320** | **1336** | **973** | **1101** | **1341** | **7209** |

**Blood glucose test done by Vizhinjam MHU during the period October 2020 – March 2021**

| Total Tests | | | Total Positive Blood Sugar | | |
|---|---|---|---|---|---|
| **Male** | **Female** | **Total** | **Male** | **Female** | **Total** |
| **187** | **180** | **367** | **56** | **83** | **139** |

**Medical Camps conducted under MHCU during the year**

During the period 3, medical camps were conducted and 106 treatments were provided at Harbour, Kottappuram, Mullor, Venganoor and Vizhinjam and patients attended the camp.


## 2.2. Cancer Care Support (SDG-3 - Good Health and Well Being)

The project area of vizhinjam has a high incidence of cancer. More than 152 cases were reported during the year 2020 by Abhayam Charitable Society, one of the leading NGO working in this region. Among that 54 Cancer patients are in the critical stage of terminal illness.

Adani foundation has handed over 14 wheel chairs, 15 water bed, 15 walker, 15 bundle urine bag, and 15 packets of diapers to Abhayam Charitable Society for their cancer care activities, especially palliative care support. Abhayam Charitable Trust will be managing these materials among the needy on a rotation basis. The CSR team will also join with the members of Abhayam charitable society in the entire process.

The materials were handed over to Sr.Lucy of Abhayam Charitable Society on 29.12.2020 in a function presided over by Father Rev. Dr. Michle Thomas, Vicar, Vizhinjam Parish and officials of Abhayam Charitable Society.

Further to that nutritious food supplements include 1. Ensure 500 gm, 2.Every day 1 kg and 3.Oats 1 Kg has been providing to meet their immediate nutrient requirement. This will further support these patients to meet their daily food requirement without spending much owns it. The patient's age group ranges from one year to 55 years of age, coming from various strata of society in different economic backgrounds

**List of Patients**

| Sl No | Patient Name | Age | Ward | Disease |
|---|---|---|---|---|
| 1 | Abhijith | 10 | Mullor | Bone Cancer, Kidney Failure |
| 2 | Fegy | 18 | Mulloor | Thyroid Cancer |
| 3 | Helen | 42 | Venganoor | Breast Cancer |
| 4 | Easter Paul | 45 | Venganoor | Throat Cancer |
| 5 | Titus | 55 | Kottappuram | Throat Cancer |

| | | | | |
|---|---|---|---|---|
| 6 | Selvi | 55 | Kottappuram | Bone Cancer |
| 7 | Sreejith | 22 | Kottukal | Neyosifrance |
| 8 | Rani Francis | 42 | Kottappuram | Lymphoma |
| 9 | Paniyamma | 40 | Kottappuram | Breast Cancer |
| 10 | Adhilian Antony | 3 | Kottappuram | Eye- Cancer |
| 11 | Silvayyan | 50 | Venganoor | Mouth Cancer |
| 12 | Aron | 13 | Kottappuram | Heart Problem |
| 13 | Alima | 9 | Kottappuram | Heart Problem |
| 14 | Feno | 4 | Kottappuram | Blood Cancer |
| 15 | Rusy | 40 | Kottappuram | Bone Cancer |

### 2.3. Clean Campaign (SDG-11 - Sustainable Cities & Communities &SDG-3 - Good Health and Well Being)

AF has started the clean campaign programme in the community with strict COVID protocol. One of the livelihood groups, promoted under the CSR of AVPPL/AF- Karsheeka Karma Sena is coordinating the campaign. Most of the members who are actively participating in the cleaning campaign are from widow's category as part of our Widow's engagement programme. The following areas were cleaned during the reporting period.

| Sl.No | Date | Venue with ward and Landmark | No. of Manpower engaged |
|---|---|---|---|
| 1 | 10.10.2020 | Kanjiravila Laksham Veedu-Kottappuram | 6 |
| 2 | 12.10.2020 | Thannininnavila-Kottappuram | 6 |
| 3 | 15.10.2020 | Thannininnavila-Kottappuram | 6 |
| 4 | 16.10.2020 | Thannininnavila-Kottappuram | 6 |
| 5 | 17.10.2020 | CSR Office -Mukkola | 2 |
| 6 | 21.10.2020 | Vizmart-Vizhinjam | 6 |
| 7 | 22.10.2020 | Police Station-Vizhinjam | 4 |
| 8 | 23.10.2020 | Police Station-Vizhinjam | 4 |
| 9 | 31.10.2020 | Police Station-Vizhinjam | 5 |
| 10 | 02.11.2020 | Police Station-Vizhinjam | 10 |
| 11 | 03.11.2020 | Police Station-Vizhinjam | 10 |
| 12 | 04.11.2020 | Police Station-Vizhinjam | 10 |
| 13 | 05.11.2020 | Police Station-Vizhinjam | 10 |
| 14 | 06.11.2020 | Karimpallikara Near Port - Kottappuram | 10 |
| 15 | 07.11.2020 | Karimpallikara Near Port - Kottappuram | 10 |
| 16 | 09.11.2020 | Karimpallikara Near Port - Kottappuram | 15 |
| 17 | 10.11.2020 | Karimpallikara Near Port - Kottappuram | 15 |

| | | | |
|---|---|---|---|
| 18 | 12.11.2020 | Karimpallikara Near Port - Kottappuram | 15 |
| 19 | 13.11.2020 | Karimpallikara Near Port - Kottappuram | 10 |
| 20 | 14.11.2020 | Karimpallikara Near Port - Kottappuram | 13 |
| 21 | 17.11.2020 | Karimpallikara Near Port - Kottappuram | 12 |
| 22 | 19.11.2020 | Karimpallikara Near Port - Kottappuram | 12 |
| 23 | 21.11.2020 | Karimpallikara Near Port - Kottappuram | 7 |
| 24 | 24.11.2020 | Karimpallikara Near Port - Kottappuram | 10 |
| 25 | 25.11.2020 | CSR office -Mukkola | 10 |
| 26 | 25.11.2020 | CSR office -Mukkola | 10 |
| 27 | 03.12.2020 | Vayalinkara Near Port-Kottappuram | 9 |
| 28 | 05.12.2020 | Vayalinkara Near Port-Kottappuram | 5 |
| 29 | 07.12.2020 | Vayalinkara Near Port-Kottappuram | 11 |
| 30 | 08.12.2020 | Vayalinkara Near Port-Kottappuram | 3 |
| 31 | 09.12.2020 | Vayalinkara Near Port-Kottappuram | 5 |
| 32 | 10.12.2020 | Vayalinkara Near Port-Kottappuram | 5 |
| 33 | 11.12.2020 | Vizhinjam Theruv-Vizhinjam | 14 |
| 34 | 12.12.2020 | Vizhinjam Theruv-Vizhinjam | 4 |
| 35 | 15.12.2020 | Vizhinjam Theruv-Vizhinjam | 7 |
| 36 | 16.12.2020 | Panavilacode-Mulloor | 6 |
| 37 | 17.12.2020 | Panavilacode-Mulloor | 6 |
| 38 | 19.12.2020 | Panavilacode-Mulloor | 4 |
| 39 | 21.12.2020 | Panavilacode-Mulloor | 3 |
| 40 | 22.12.2020 | Panavilacode-Mulloor | 3 |
| 41 | 23.12.2020 | Panavilacode-Mulloor | 7 |
| 42 | 24.12.2020 | Panavilacode-Mulloor | 8 |

| | | | |
|---|---|---|---|
| 43 | 28.12.2020 | Panavilacode-Mulloor | 7 |
| 44 | 29.12.2020 | Panavilacode-Mulloor | 7 |
| 45 | 30.12.2020 | Panavilacode-Mulloor | 7 |
| 46 | 04.01.2021 | Panavilacode Near Mulloor | 6 |
| 47 | 05.01.2021 | Panavilacode Near Mulloor | 9 |
| 48 | 06.01.2021 | Panavilacode Near Mulloor | 11 |
| 49 | 07.01.2021 | Thottam Near Mulloor | 16 |
| 50 | 08.01.2021 | Thottam Near Mulloor | 16 |
| 51 | 09.01.2021 | Thottam Near Mulloor | 12 |
| 52 | 11.01.2021 | Thottam Near Mulloor | 6 |
| 53 | 12.01.2021 | Thottam Near Mulloor | 10 |
| 54 | 13.01.2021 | KanjiravilaLakshamVeedu Near CSR Office | 10 |
| 55 | 14.01.2021 | KanjiravilaLakshamVeedu Near CSR Office | 15 |
| 56 | 15.01.2021 | KanjiravilaLakshamVeedu Near CSR Office | 15 |
| 57 | 16.01.2021 | KanjiravilaLakshamVeedu Near CSR Office | 10 |
| 58 | 18.01.2021 | KanjiravilaLakshamVeedu Near CSR Office | 12 |
| 59 | 21.01.2021 | Labour Camp Mukkola | 10 |
| 60 | 22.01.2021 | Labour Camp Mukkola | 11 |
| 61 | 23.01.2021 | Labour Camp Mukkola | 11 |
| 62 | 25.01.2021 | Labour Camp Mukkola | 8 |
| 63 | 26.01.2021 | Labour Camp Mukkola | 11 |
| 64 | 27.01.2021 | Labour Camp Mukkola | 10 |
| 65 | 28.01.2021 | Labour Camp Mukkola | 9 |
| 66 | 29.01.2021 | Labour Camp Mukkola | 11 |
| 67 | 30.01.2021 | Labour Camp Mukkola | 11 |
| 68 | 01.02.2021 | Panavilacode Near St.Antony'sKurishadi | 15 |

| | | | |
|---|---|---|---|
| 69 | 02.02.2021 | Panavilacode Near St.Antony'sKurishadi | 10 |
| 70 | 03.02.2021 | Panavilacode Near St.Antony'sKurishadi | 10 |
| 71 | 04.02.2021 | Panavilacode Near St.Antony'sKurishadi | 8 |
| 72 | 12.02.2021 | KarimpallikaraNear Port Area | 10 |
| 73 | 13.02.2021 | KarimpallikaraNear Port Area | 14 |
| 74 | 15.02.2021 | KarimpallikaraNear Port Area | 14 |
| 75 | 16.02.2021 | KarimpallikaraNear Port Area | 14 |
| 76 | 24.02.2021 | Harbour | 10 |
| 77 | 25.02.2021 | Harbour | 10 |
| **Total Man days engaged** | | | **710** |

**2.4. Community Awareness Programme (SDG-11 - Sustainable Cities & Communities &SDG-3 - Good Health and Well Being)**

As we are living with Covid19, it is important for all members of community to have awareness on personal cleanliness, cleanliness of the Surroundings and ensure proper community monitoring for its effectiveness. AF has started the community awareness programme in the Vizhinjam with strict COVID protocol. One of the volunteer's groups, promoted under the CSR of AVPPL/AF- Karsheeka Karma Sena is

coordinating the programme. Most of the members who are actively participating in the community awareness are from widow's category as part of our Widow's engagement programme. The following community awareness programmes were conducted during the period.

| Sl NO | Date | Venue with Ward | No of Participants |
|---|---|---|---|
| 1 | 16.01.2021 | Vellamkolly | 15 |
| 2 | 20.01.2021 | Manali | 15 |
| 3 | 27.01.2021 | Manali | 20 |
| 4 | 27.01.2021 | Kurishadinada | 20 |
| 5 | 28.01.2021 | Santhipuram | 20 |
| 6 | 01.02.2021 | Aluninnavila | 17 |
| 7 | 03.02.2021 | Pazhayavila | 15 |
| 8 | 06.02.2021 | Vilayil Vila Aiswara | 16 |
| 9 | 06.02.2021 | Thalakodu Near Mulloor | 17 |
| 10 | 07.02.2021 | Kidarakuzhi Near Mulloor | 17 |
| 11 | 09.02.2021 | MeleAmbalam Near Harbour | 15 |
| 12 | 10.02.2021 | Vattavila | 16 |
| 13 | 12.02.2021 | Aluninnavila –Nelekanda Colony | 16 |
| 14 | 13.02.2021 | SNDP -Kovalam | 14 |
| 15 | 13.02.2021 | Mullor | 16 |
| 16 | 13.02.2021 | Manali | 14 |
| 17 | 14.02.2021 | Kanjiram Vila -Mukkola | 17 |
| 18 | 15.02.2021 | Muslim Palli | 15 |
| 19 | 17.02.2021 | Kurishadi Near Mulloor | 15 |
| 20 | 18.02.2021 | Venganoor | 16 |
| 21 | 1 9.02.2020 | Ediviyunnavila | 17 |
| 22 | 20.02.2021 | Thalacodu | 14 |
| 23 | 20.02.2021 | Vilayilvila | 11 |
| 24 | 21.02.2021 | Kidarkuzhi Society | 12 |
| 25 | 22.02.2021 | Velikkamvila | 14 |
| 26 | 23.02.2021 | Pallithura -167 Anganwadi | 11 |
| 27 | 23.02.2021 | Pallithura -168 Anganwadi | 14 |
| 28 | 24.02.2021 | Vattavila | 19 |
| 29 | 01.03.2021 | Kovalam | 15 |
| 30 | | Manali | 13 |
| 31 | 02.03.2021 | Harbour | 14 |
| 32 | 06.03.2021 | Kappalchal | 16 |
| 33 | 07.03.2021 | Habour | 14 |
| 34 | 09.03.2021 | Kapinattavila | 15 |

| | | | |
|---|---|---|---|
| 35 | 10.03.2021 | Shihana | 20 |
| 36 | 11.03.2021 | Pattani Colony | 17 |
| 37 | | Soorya 2 -Vizhinjam | 19 |
| 38 | | Harbour | 15 |
| 39 | 12.03.2021 | Rahmaniya NHG | 21 |
| 40 | | Rubiya NHG | 16 |
| 41 | 13.03.2021 | Township | 19 |
| 42 | | Harbour | 11 |
| 43 | | Mavila | 17 |
| 44 | | Karikkathi | 17 |
| 45 | | Panavila | 15 |
| 46 | 14.03.2021 | Aluninnavila | 14 |
| 47 | | Kurshadinada | 15 |
| 48 | | Valanvila Santhipuram | 15 |
| 49 | | Valannvila -Mulloor | 15 |
| 50 | | Harbour | 13 |
| 51 | | Harbour | 17 |
| 52 | | Aluninnavila | 15 |
| 53 | | Valayam Ninnavila | 13 |
| 54 | | Pulinkudi | 14 |
| 55 | | Pottavila | 15 |
| 56 | 15.03.2021 | Mahar | 17 |
| 57 | | Thazyottuvilakam | 15 |
| 58 | | Alameen Kudumbasree | 13 |
| 59 | | Mehubin Kudumbasree-Harbour | 17 |
| 60 | | Kottappuram | 15 |
| 61 | 16.03.2021 | Siraj NHG -Harbour | 14 |
| 62 | | Al-Hand - Harbour | 15 |
| 63 | | Sulthana NHG-Harbour | 15 |
| 64 | | Neelakanda Colony | 15 |
| 65 | 17.03.2021 | Kanjiravila | 15 |
| 66 | | Mele Ambalam | 16 |
| 67 | | Thazyottuvilakam | 17 |
| 68 | 18.03.2021 | Al-Ameen | 20 |
| 69 | | Abdhu NHG | 15 |
| 70 | | Harbour | 13 |
| 71 | | Karikkathi | 15 |
| 72 | | Kaverikasu | 15 |
| 73 | 20.03.2021 | Harbour | 19 |
| 74 | | Harbour NHG | 20 |
| 75 | | Kidarakuzhi | 15 |
| 76 | | Varutattu | 17 |
| 77 | | Mannakallu | 15 |
| 78 | | Panavila | 15 |

| | | | |
|---|---|---|---|
| 79 | 21.03.2021 | Varuthattu | 17 |
| 80 | | Kalluvila | 21 |
| 81 | 22.03.2021 | Kovalam | 15 |
| 82 | | Pallithura | 17 |
| 83 | 23.03.2021 | Harbour | 16 |
| 84 | 24.03.2021 | Pazyavila Daya Kudumbasree | 15 |
| 85 | | Venganoor | 18 |
| 86 | 25.03.2021 | Manali Road | 12 |
| **Total Number of Participants** | | | **1360** |




**TOT to Community Resource Persons for community Engagement**

As part of the community cleaning and awareness programme a ToT was conducted to equip and refresh the Community Resource Persons to lead

the citizen led campaign under CSR. The training was conducted on the 9th and 10th of December 2020 with the support of Suchitwa Mission, Departments of Women and Child Development, Fisheries and Agricultural and Insurance Company Govt. of India. The programme was conducted with the objective to disseminate awareness on cleanliness, the value of kitchen garden, Swachh agrahi – Kutumb, Govt. Schemes and need based interventions.

The programme was attended by 32 prospective volunteers belonging to 5 wards. Following are the details of the sessions and respective departments.

| Sl.No | Session -Topic | Official - department |
|---|---|---|
| 1 | Meaning of solid waste | Suchitwa mission |
| 2 | Home centric solid waste management – methods | Suchitwa mission |
| 3 | Kitchen Bin –demonstration | Suchitwa mission |
| 4 | Institutional waste management Mechanisms | Suchitwa mission |
| 5 | Green – protocol norms | Suchitwa Missions |
| 6 | 3 tier waste management by HKS,MCF and RRF in LSGDs | Suchitwa Missions |
| 7 | MHU -schemes | Dr Vishnu, MHCU |
| 8 | Govt. Schemes related to Children | ICDS- supervisor |
| 9 | Schemes on Department of fisheries | Department of fisheries |
| 10 | Agricultural Insurance Schemes | Agriculture Insurance Company, Govt of India. |
| 11 | Progress of Port Project | Adani Foundation |

## 2.5. SOLID WASTE MANAGEMENT (SDG-11 - Sustainable Cities & Communities &SDG-3 - Good Health and Well Being)

Adani Foundation, in association with Trivandrum Municipal Corporation, has installed 26 "**Thumboormozhi Aero Bins**" in the communities of Kottappuram, Vizhinjam and Harbour divisions as a one-stop solution for the alarming issue of Solid Waste Management. Municipal Corporation employed 9 sanitation workers for the day to day management of bins. The following table depict the location of bins and quantum of waste handled through this bins.

| Sl.No | Location of Bins | No.of Bins | No of families Served | Quantum of Waste /day |
|---|---|---|---|---|
| 1 | Vizhinjam Market | 8 | 850 | 220 Kg |
| 2 | Harbour Mathippuram | 10 | 1000 | 300 Kg |
| 3 | Kottappuram – Charuvila | 3 | 250 | 100 kg |
| 4 | Puloorkonam, Vizhinjam | 5 | 500 | 150 Kg |
| Total | | 26 | 2600 | 770 kg |

## 2.6. SEVAH - Kitchen Garden - Subsistence to Sustainability (SDG-3 - Good Health and Well Being)

kitchen garden our new normal initiative in COVID setting, positioned as "safe to eat vegetables for all homes "(SEVAH) is organized with input support from (VFPCK) vegetable and fruit promotion council of Kerala, by supplying vegetable seedlings and kits. Though it is intended for 1000 families, the first phase it is targeted for 260 families. The individual training was given for each and every beneficiary by segregating them into small batches. The distribution of inputs was planned into 2 Phases and the first one was Input Kit distribution and the second phase was Seedling distribution.260 benificiaries were made into 20 member 13 no's groups in SHG format

**Input Kit and planting material distribution.**

Ten item input kits comprising of 25 grow bags, seeds, organic manure, and bio plant protection items was distributed on 18th Nov. the distribution was supplemented with a method demonstration on items included in kits. A total of 260 kits distributed. The requisite scientific training has been provided to all 260 targeted beneficiaries.

Seven items of three replication, thus twenty one plants were distributed to each of 260 beneficiaries. A total of 5980 no's vegetable seedlings, cuttings and seedlings of passion fruits were supplied.

**Details of input distribution**

| Sl No | Name of the Group | Place | No of benificiaries |
|---|---|---|---|
| 1 | Varnam & Haritham | Kovalam School | 40 |
| 2 | Padam | Mariyan Nagar | 20 |
| 3 | Krishideepam | Venganoor | 20 |
| 4 | Gramam & EnteThottam | Venganoor | 40 |
| 5 | Kedharam & Vayaloram | Venganoor | 40 |
| 6 | Kissan | Mulloor | 30 |
| 7 | Green House | Muloor | 21 |
| 8 | Healthy Garden | Harbour | 29 |
| 9 | Karshaka Sangam | Mulloor | 20 |
| Total Members | | | 260 |

**Mechanism of monitoring and management**

In the case of the observed and reported incidence of pest and disease attack, remedies are mentioned directly, through phone or through WhatsApp seva group. In majority of cases PP operation was done using the Bio control agents provided through kits. The reported attacks were for leaf eating mealy bugs, miners, and caterpillars. The disease incidence was fewer or nil. There is one incidence of seed born leaf spots, but it is not that dangerous.

**SEVAH- WhatsApp group and SEVAH- post office account.**

A Whats App group for kitchen garden in the name SEVAH is initiated to rectify the plant protection doubts, display the beneficiaries efforts in the form of photo, meetings etc. The group is linked to KVK –Mitranikethan experts, to have an expert opinion in case of any requirement. An account in the name of SEVAH is initiated at post office –vizhinjam to deposit the savings of the kitchen garden group and to withdraw the savings in case of any Agri-related purchases.

**SEVA- Monthly group meetings- to follow up**

Regular Monthly meetings for SEVAH were ensured by coordinators to access the plant growth through a colour gradient sheet ,and to collect monthly savings for depositing, to ensure continuity. The group meeting reports were presented at mothly review meetings of coordinators and remedial measures will be communicated.

**Harvest and Family budget saved – from Kitchen garden**

| Sl No | Name of the Group | Monthly average yield /family | Average Rate /kg (₹) | Amount saved for vegetable purchase/ month (₹) |
|---|---|---|---|---|
| 1 | Varnam&Haritham | 20kg | 40 | 800.00 |
| 2 | Padam | 25kg | 40 | 1000.00 |
| 3 | Krishideepam | 19.2 kg | 40 | 768.00 |

| | | | | |
|---|---|---|---|---|
| 4 | Gramam&EnteThottam | 17.8 kg | 40 | 712.00 |
| 5 | Kedharam&Vayaloram | 18.3kg | 40 | 732.00 |
| 6 | Kissan | 25kg | 40 | 1000.00 |
| 7 | Green House | 20kg | 40 | 800.00 |
| 8 | Healthy Garden | 18kg | 40 | 720.00 |
| 9 | KarshakaSangam | 22kg | 40 | 880.00 |
| **Average** | | **20.57** | **₹ 40** | **₹ 823.00** |

Average – amount saved/family/month is ₹ 823.

Average monthly earnings 4500-25,000Rs/month

**Sustainability model**

Kitchen garden project for 260 homes initiated during November 23rd with the distribution of input kit and planting stock progressing well during the period. The 13 selected groups had followed the technical advice of this office, right from the preparation of potting mixture –planting, plant protection and the final harvest. Being hybrid varieties, the per plant average yield resulted in significant monthly savings for the purchase of vegetables.

Monthly accumulated savings of groups has been increased to 25,000 in the SEVA Account at Post office. This becomes the seed money for further expenditure on input purchase and subsequent plant maintenance. The model of group members as stake holders, savings and subsequent expenditure from beneficiary savings as seed money is the primitive model towards a producer company. Hence SEVAH group on scaling up will become a producer institution supporting the cultivation of vegetables @ Homes.

**Input -Back ward linkages – through satellite nursery**

Karma sena the women enterprise group were trained for making planting materials. A mini nursery for vegetable seedlings was established adjoining to CSR office for the supply of seedlings for replacement and gap filling.

Besides they are taking care of the input requirements and need of organic manures.

**Start of – season 2 –From subsistence to business model**

As the first season of plant output is likely to end by 20th April 2021. Technical training on schedule of activities for the season 2 was initiated .The groups were trained to undertake new business model.

**Business Model Format**

The 20 member group is divided into 5 member 4 groups

(A,B,C,D,E,F,G & H are different vegetable in the combination)

| **combination** | **Combo-1** | **Combo 2** | **Combo-3** | **Combo-4** |
|---|---|---|---|---|
| Vegetable MIX items | A and B | C and D | E and F | G and H |
| Grow bag nos | 20 | 20 | 20 | 20 |
| No of grow bag for own kitchen garden | 5 | 5 | 5 | 5 |
| Total Grow bags | 25 | 25 | 25 | 25 |

| **Combo-1(A & B)** | **Combo-2(C & D)** | **Combo-3(E& F)** | **Combo-4(G & H)** |
|---|---|---|---|
| **Group-1** | **Group-2** | **Group-3** | **Group-4** |
| Home 1 | Home - 6 | Home 11 | Home-16 |
| Home-2 | Home-7 | Home-12 | Home-17 |
| Home-3 | Home-8 | Home-13 | Home-18 |
| Home-4 | Home-9 | Home-14 | Home-19 |
| Home-5 | Home-10 | Home-15 | Home-20 |

**Graduating to Producer Company**

The proposed business model once got established in proposed 1000 homes, it is proposed to formulate all homes as a unit to produce organic vegetables for the community. The SEVAH management committee will become the organizing body for all forward and backward linkages for this sustainable Kitchen garden producer company. The graduation period to full-fledged producer company will be in a 2years from now as proposed.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Foundation

**2.7. FARM school - Community Schooling on Agriculture technology and crop management (SDG-3 - Good Health and Well Being)**

The farm school uses a learning-by- doing approach which provides the farmers with a structured experience in which prospective students can learn the theory and practice of farming as a business, implement that learning and then evaluate the progress of their farms and of their own farm The iterative process is intended to reinforce learning so that by the end of one session the FS, the prospective Agripreuners are on a clear pathway to commanding the progress of their own farm activities.

Farm School (FS) is designed for aspiring farmers to learn and practice Agricultural skills need to run a small-scale organic farm. The intention is to decentralize agricultural knowledge to community so that they can

attain knowledge on various components of the farm, thus can initiate their own Agri- initiative or as a group venture.

**The proposed learning Units**

1. Vegetable nursery -and vegetable cultivation

2. Irrigation –technology –and fertigation method's

3. Bio composting Models.

4. Nutrition Garden

5. Crop museum

6. Honey production –system.

7. Land scaping and ornamental gardening.

8. Nursery - Plant propagation technology

**Proposed Training**

The training on various short term programmes will be on approved modules. Training will be conducted as round the year programme for prospective Agripreuners in small batches.

**Setting of farm school**

The setting of farm school in 1 acre at mukkola, vizhinjam along vizhinjam Balaramapuram highway, is happening at a fast pace. The land preparation is completed; a bamboo shed for training is completed constructed by tribes of kottur forest, required irrigation base works completed. The remaining work on Layout on drip irrigation, green house, and rain shelter is being done. It is expected to commission this unit in 1 month time.

**2.8. Other health initiatives - (SDG-11 - Sustainable Cities & Communities &SDG-3 - Good Health and Well Being)**

- **World disability day-December 3rd**

In connection with world disability day on 3rd December 2020, following programmes were organized.

**Wheel Chair Support**: Ms. Remya, 34 years a physically challenged female was provided with a wheel chair. She hails from a family where her mother, uncle and brother all are physically handicapped.

**Help Desk**: Adani Foundation started a help desk for the disabled people to get access for many of their services and schemes for government and other allied agencies. The programme was launched by handing over the request for support to Master.Vijil, a 9 year's old physically challenged boy from **Kottappuram.**

**Further,** Adani foundation facilitated Mr.Sudhir, Govt staff of zonal office, Trivandrum Municipal Corporation, Vizhinjam who himself is physically challenged but came forward to extend all support with regard to many of the government schemes and other services for the physically challenged.

- **World Cancer care day- 4th February 2021**

Adani Foundation commemorated world cancer Day on 04.02.2021. While there is no magical solution to preventing any type of cancer, research shows that adopting a healthy diet and good lifestyle habits can contribute to lowering the risk of cancer. Unfortunately, most people today work round the clock with very little time to exercise and unhealthy foods are a major feature of such fast-paced lifestyles. This World Cancer Day, it is important to highlight the fact that taking out a little time to change dietary habits along with a healthy amount of exercise can go a long way, especially in cases where there is a history of cancer in the family. While risk factors like genetics and environment may be beyond one's control, incorporating the following habits in one's lifestyle do help to reduce the risk of cancer, if not prevent it altogether:

To commemorate the occasion, Adani Foundation has supported a few cancer patients from very difficult backgrounds with necessary packed foods like 1. Ensure 500 gm, 2.Every day 1 kg and 3.Oats 1 Kg to meet their immediate nutrient requirement.


- **International Women's Day 2020-2021**

Adani foundation CSR of AVPPL commemorated the international women's day in a highly professional manner. It is based on the campaign theme **Choose to challenge** .The theme has wide implication in terms of the women centered CSR activities Adani foundation is undertaking. Though our experience of working through CSR initiatives, it is our understanding that we can all choose to challenge and call out gender bias and inequality and could seek out and celebrate women's achievements. This can help to create an inclusive world in our working arena of CSR. It is a felt case for our women Stakeholders in various women enterprises. It is implicit knowledge that all changes happens out of challenges.

The programmes on women's day are marked by its variety. The dusk of the day was spent exclusively for acknowledging best and upcoming women enterprises supported by CSR. The CEO of AVPPL Mr. Rajesh Jha, Presiding a simple function organized at City office, Trivandrum, congratulated the women enterprise groups on their successful endeavors on various arenas. The Clean 4U group was adjudged as the best women's group with maximum success. Karshika Karma sena was adjudged as the group with steady development and the one group with emerging status. The CEO had given away the mementos of achievement to both groups.

The meeting was coordinated by Dr. Anil Balakrishnan, Southern CSR Head, and was attended by other top level executives of AVPPL and Staff of Adani foundation.

An awareness programme on Cervical Cancer was handled by Dr. Chandini, Rtd Supernatant, women and child hospital Thycaud Trivandrum. It was an all-women programme organized in association with IMA women wing Trivandrum. She spoke at length regarding the cause and preventive care for cervical cancer, a common cancer among women. The programme was attended by women stake holders/beneficiaries attached with CSR activities.

Cancer being a common mortality cause in Vizhinjam has its roots in reasons like consuming Tobacco, heredity pesticides in vegetables, and other genetic parameters. The kitchen garden programme initiated among women family members of 260 families in 4 wards of vizhinjam is a success. Vegetables of organic origin were obtained from kitchen garden in surplus and distributed to needy cancer patients.

A cancer patient Mr. Varghese (75) suffering from mouth cancer, from Kottapuram area of Vizhinjam, and two children Aaron 10yrs (male), Alma 8yrs (female) who, underwent open heart surgery, all from same family were supplied with Organic vegetables produced from CSRs kitchen garden project .( among 260 families)This has served as a means of good food. The encouragement from successful kitchen garden is a form promotion to practice the same at home in whatever space they have.

A women gathering was organized at CSR office, Mukkola vizhinjam by afternoon of March 8$^{th}$. This has the participation of women stake holders of CSR, women enterprise groups, Community volunteers, ASDC skill students, Digital Literacy Resource persons, Suposhan Sanginis, and CSR staff members. A total of 65 women participated.

A joyful sports event on various local games for women was organized in the courtyard space of CSR office. It was an occasion for realizing the strength of women and sharing happiness and joy among women.

It is to be noted one year since we have been affected with COVID 19, the world had taken it as a challenge to surmount the crisis of covid 19. All over the world it is the women in majority, who as health workers, mothers, and home makers, and other professionals who stood in defense to tame the disease. The same is the case with the small town of vizhinjam, that our women members' attitude in difficult conditions for choosing to take challenge made everybody proud in CSR to salute their achievements.

- **National Girl Child Day 24th January 2021**

AVPPL/AF celebrated National Girl Child Day- 2021 as part of its Corporate Social Responsibility on 24th January 2021 at Aswathy auditoriyam, Vizhinjam. The beauty of the programme was that it was totally organized by the girl children of Vizhinjam.

- The programme was inaugurated by Kumari. Arya Rajendran, Mayor of Thiruvananthapuram Municipal Corporation who is the youngest mayor in India. Vizhinjam Ward Councilor Smt. Sameera presided over the function.
- As the representatives of girl children Kumari. Abhirami delivered 'Girl Child Day message' and Kumari. Devika delivered felicitation address, Kumari. Shreya welcomed the audience and Kumari. Sania expressed vote of thanks. Kumari. Jeeva Kennedy was the master of ceremony.The main theme of the programme was to "grow into strong women".
- A session on the Rights of the Child was also organized in the morning and the session was handled by Mrs. Navya Tennyson, Coordinator CHILDLINE, Trivandrum followed by a discussion and a video show on children's rights – 'Komal'.

Adani Foundation awarded following girls who have proved their ability in various fields at state and national levels.

- Kumari. Abhina Jawahar won the first prize in the senior girl's category in the school archery competition at the national and state level.,
- Kumari Sameera, a member of the team that won second prize in the girl's category in the state level school kabaddi competition.
- Kumari. Anjana a short story writer from vizhinjam and a participant of monthly literature meet.
- Kumari Alfia, who got 'A' grade in the girl's category in recitation competition at district level school Arabic poetry, and
- Kumari Vineesha, Kumari. Jennifer, who are represented the school in the rugby competition and reached the national level.

In addition, the Adani Foundation awarded scholarship certificates to Kumaries Sheriff Muhammad, Anu Bala, Rizwana, Abhirami, Kirtana and Geoffrey John as representatives of the Scholarship Scheme for 50 gifted students every year. This was followed by various cultural programme of girl children.

## 2.9 SUPOSHAN (SDG No.2 and SDG No4)

SuPoshan is a special project of Adani Foundation to alleviate malnutrition among children in 0-5 years of age and anaemia in adolescent girls, pregnant women, lactating mothers and women in the reproductive age. The activities under SuPoshan includes:-

- Identifying malnourished and anaemic and facilitating them to become healthy. sensitizing communities to maintain cleanliness and good health habits
- Frequent Village Level Meetings, Home visits and Counselling sessions to understand the needs and priorities of the communities and facilitate to overcome it.
- Promotion of coming up voluntarily in communities to serve themselves and to act as a quick response team in any emergencies arising from the communities from time to time.

### Outcome

- 54 children of severe, moderate Acute Malnourished (SAM/MAM) and underweight (UW) status have been changed to healthy by periodic testing and regular supply of RUTF.
- 304 Anemic women were converted into healthy.
- Kitchen Garden has been promoted in 260 families with special focus on the houses having malnourished and anemic children. Also conducted several classes, food exhibition and recipe competitions on preparing nutritious food items using the locally available nutrient rich vegetables and other resources.
- More than 12 health camps were organized by the Sanginis in association with MHCU, where the malnourished children and anemic girls were referred to the doctor and provided proper medication.
- Important days such as Nutrition Month, Breast Feeding Week, International Women's Day, ORS Week, Poshan Pakwada, are

celebrated with increased participation and ownership from the community.

- Awareness programmes on health and nutrition has a good reach of up to 4928 Households

| Sl.No | Programme | Reach (2020 – 21) |
|---|---|---|
| 1 | Household visits | 4928 |
| 2 | Family based counseling | 830 |
| 3 | Anganwadi visits | 222 |
| 4 | Focus Group Discussions | 160 |
| 5 | Village Level Events | 26 |
| 6 | Anthropometric Measurements | 1959 |
| **Total** | | **8125** |

**Breakup of awareness through FGDs and Village Level Meetings**

| Month | FGD Adolescent girl | | FGD Mothers | | Village Meeting | | Total | |
|---|---|---|---|---|---|---|---|---|
| | No of Prog. | No of Parti. | No of Prog. | No of Parti. | No of Prog. | No of Parti. | **No of Prog.** | **No of Part.** |
| **Total** | **51** | **419** | **109** | **873** | **26** | **368** | **186** | **1660** |

## Calendar of events, celebrations and important days (SuPoshan & CSR)

| SL NO | DATE | PARTICULARS OF PROGRAMME | PARTICIPANTS | VENUE | THEME |
|---|---|---|---|---|---|
| 5 | 11/11/2020 | International Day of the Girl Child | 42 | Kovalam, Venganoor | "My voice, our equal future" |
| 6 | 15/11/2020 | Global Hand Washing Day | 52 | Karayadivila, Panavila | "Save lives, Clean your hands" |
| 7 | 16/11/2020 | World Food Day | 75 | Neelakanda Colony, Harbour | "Nourish, Sustain Together with Right food" |
| 8 | 15/11/2020 to 21/11/2020 | Newborn Care Week | 38 | Pattani Colony, Kottapuram, Mukkola | " Quality, Equity, Dignity for every newbor n at every health f |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | acility and everywhere " |
| 9 | 16/03/2021 to 31/03/2021 | Poshan Pakhwada | 28 | Pallithura | - |
| 10 | 08/03/2021 | International Women's Day | 43 | CSR Office | " Choose To Challenge " |
| **Total** | | | **278** | | |

## III. SUSTAINABLE LIVELIHOOD DEVELOPMENT (SLD) (SDG-8 Decent Work and Economic Growth & SDG-1 No Poverty)

### 3.1 Skill Development (SDG-8 Decent Work and Economic Growth)

The skill development activities include Domain training, Non Domain Training, Digital Literacy programme, Competitive Exam Coaching programme,and English Language skill training. Following are the details of skill development activities during the period

- **Skill Training**

| Domain Batches | | | |
|---|---|---|---|
| Sl No | Name of Course | No of Students | Placement |
| 1 | General Duty Assistant | 20 | 12 students were placed in different health care institutions like Anathapuri Hospital, Asha Homecare |
| 2 | Retail Sales Associate | 21 | Ongoing |
| 3 | Beauty Therapist | 26 | 5 placed, 8 Self-Employed and 12 upskilling |
| 4 | Data Entry Operator | 25 | 13 students were placed in different companies like |

| | | | |
|---|---|---|---|
| | | | Airtel, Sivaji Motors and 5 Upskilling |
| **Total** | | **92** | |
| **Non-Domain Batches** | | | |
| 1 | Basic Home Health Care (Patient Care) | 7 | 4 placed and 3 Self Employed |
| 2 | Data Entry Operator (E-Seva) | 8 | 6 Self Employed and 2 upskilling |
| 3 | Beautician | 8 | 4 placed and 3 self-employed and 1 upskilling |
| **Total** | | **23** | |

**Placement Details – Domain & Non-Domain Batches**

Placements of the completed domain batch trainees are still progressing. We had approached different hospitals and Patient Care centre related to the placements of GDA trainees. Good responses are getting from the sectors regarding the placements after the pandemic Covid 19 issues. Shopping Malls, Two/Three-Wheeler Showrooms are getting started after the Covid 19 situations and placement openings for the Retail Sales trainees are finding out by our Placement Officer.

The details of the placed non-domain trainees under ASDC Vizhinjam Centre is as follows,

| Sl. No. | Name of the Trainees | Trade | Company Name | Offered Salary |
|---|---|---|---|---|
| 1 | Leela | Basic Home Health Care | Home Care | 12,000 |
| 2 | Beena | Basic Home Health Care | Home Care | 10,000 |
| 3 | Lissy A M | Basic Home Health Care | Home Care | 10,000 |
| 4 | Bindu V | Basic Home Health Care | Home Care | 9,000 |
| 5 | Clincy | Assistant Beauty Therapist | Fairglow Beauty Parlor, Trivandrum | 8,000 |
| 6 | Greeshma Prabhath | Assistant Beauty Therapist | Soniya Beauty Parlor, Balaramapuram | 8,000 |

In total 23 trainees were trained by ASDC Vizhinjam centre in non-domain batches like Basic Home Health Care, Assistant Beauty Therapist and Data Entry Operator. From this, 6 were placed and the remaining 16 were self-employed. They were started their own enterprises and started earning.

Below are the placement details of our domain batch trainees placed in different sectors,

| Sl. No. | Name of the Trainees | Trade | Company Name | Job Role | Offered Salary |
|---|---|---|---|---|---|
| 1 | Greeshma M P | General Duty Assistant | Reliance | Customer Relationship Executive | 18,000 |
| 2 | Vineeth | Data Entry Operator | Santhwanam, Mulloor | Cashier | 14,000 |
| 3 | Santhosh Kumar | General Duty Assistant | SAP Police Training Camp, Trivandrum | Gardener | 18,000 |
| 4 | Aravind | General Duty Assistant | ESAF, Trivandrum | Customer Relationship Executive | 14,000 |
| 5 | Athira Anilkumar | Data Entry Operator | Popular Vehicles, Trivandrum | Receptionist | 12,500 |
| 6 | Sajitha Justin | Beauty Therapist | Phoenix Beauty Parlor | Beauty Therapist | 4,000 |
| 7 | Mable. J | Beauty Therapist | Fairness Beauty Parlor | Beauty Therapist | 6,000 |
| 8 | Sabari S S | Retail Sales Associate | Travancore Titanium Products LTD | Executive | 15,000 |
| 9 | Akhila CB | Retail Sales Associate | Punalur Govt. Thaluk Hospital | ECG technician | 12,000 |
| 10 | Veena ks | Retail Sales Associate | Punalur Govt. Thaluk Hospital | ECG Technician | 12,000 |
| 11 | Ancysharu | Data Entry Operator | Popular Hyundai | Customer Relationship Executive | 12,787 |
| 12 | SARATH KUMAR S P | Data Entry Operator | Ideal Solution | Customer Relationship Executive | 8,000 |

| | | | | | |
|---|---|---|---|---|---|
| 13 | Akhila B P | Beauty Therapist | Fairness Beauty Parlor | Beauty Therapist | 6,000 |
| 14 | Shiny Ancy. A | Beauty Therapist | Phoenix Beauty Parlor | Beauty Therapist | 4,000 |
| 15 | BINU.J | Data Entry Operator | Ideal Solution | Customer Relationship Executive | 8,000 |
| 16 | Anju. K. N | Data Entry Operator | Ideal Solution | Customer Relationship Executive | 8,000 |
| 17 | Nivya s prem | Data Entry Operator | Ideal Solution | Customer Relationship Executive | 8,000 |
| 18 | Primy. M | Data Entry Operator | Ideal Solution | Customer Relationship Executive | 8,000 |
| 19 | Salini MS | Data Entry Operator | Ideal Solution | Customer Relationship Executive | 8,000 |
| 20 | Baby | Data Entry Operator | Ideal Solution | Customer Relationship Executive | 8,000 |
| 21 | Asseba | Data Entry Operator | Ideal Solution | Customer Relationship Executive | 8,000 |
| 22 | Ajitha | Beauty Therapist | Deyyana beauty parlor | Beauty Therapist | 6,000 |
| 23 | Suchithra | Beauty Therapist | Queen Beauty Parlor | Beauty Therapist | 6,000 |
| 24 | Josmi | Beauty Therapist | Style Ladies Beauty Parlor | Beauty Therapist | 6,000 |
| 25 | Arathy Anilkumar | Data Entry Operator | Popular Hyundai | Customer Relationship Executive | 10,000 |
| 26 | Abdul | Data Entry Operator | ICICI | Sales Executive | 10,000 |

**SPANDHANAM – Patient Care Unit**

The beneficiaries of Patient Care training programme formed a group with name “SPANDANAM Patient Care Unit” with 7 members.

**SWAP Data Services**

The beneficiaries of Data training programme formed a group with name "SWAP Data Service" with 2 members and started their unit at VIZ Mart, Vizhinjam.

**Other Events**

**On the Job Training support**

Patient Care group - Jubilee Hospital, Trivandrum

RSA Trainees - Big Bazar, Trivandrum

GDA trainees - Jubilee Hospital, Trivandrum

**Guest Sessions for RSA trainees –**

- Adv. Sundareshan, Former Managing Director in Travancore Cements, Palakkad cooperative Sugar mill, Special Economic Zone (Adani Mundra Port).
- Mr. Prasanth, M.Com, M.Ed., NET, Research Scholar, Alagappa University, Tamil Nadu..

**Guest Lecture & Mock test for GDA**

Ms. Sreelekshmi, trainer in HLFPPT and Resource Person for Kudumbhashree HARSHAM project in Kerala.

Mrs. SathiKumari, Asst. General Manager (Operations), ASHA Home Care Assistance, Trivandrum and Mr. Sreedath, Senior Coordinator, ASHA Home Care Assistance

Mr. Satheesh, Supervisor Aster Medcity, Ernakulam.

**Guest session on the eve of World AIDS day –**

Mr. Kaveesher Krishnan, Former Project Director, Global LINKAGE Project, Family Health International

**Guest session on General Safety Rules –**

Mr. Shaji Joseph, Executive- Health Safety Environment, HOWE Engineering Projects (India) Pvt. Ltd., Adani Vizhinjam Port

**Guest Session on Beauty Therapist –**

Mrs. Viji & Mrs. Sajini experienced BT trainers with 20 years of training experience.

**Achievement**

1st Rank - Ms. Archana Satheesh from ongoing Data Entry Operator batch for achieving 1st rank in MSc. Demography and Biostatics from University of Kerala

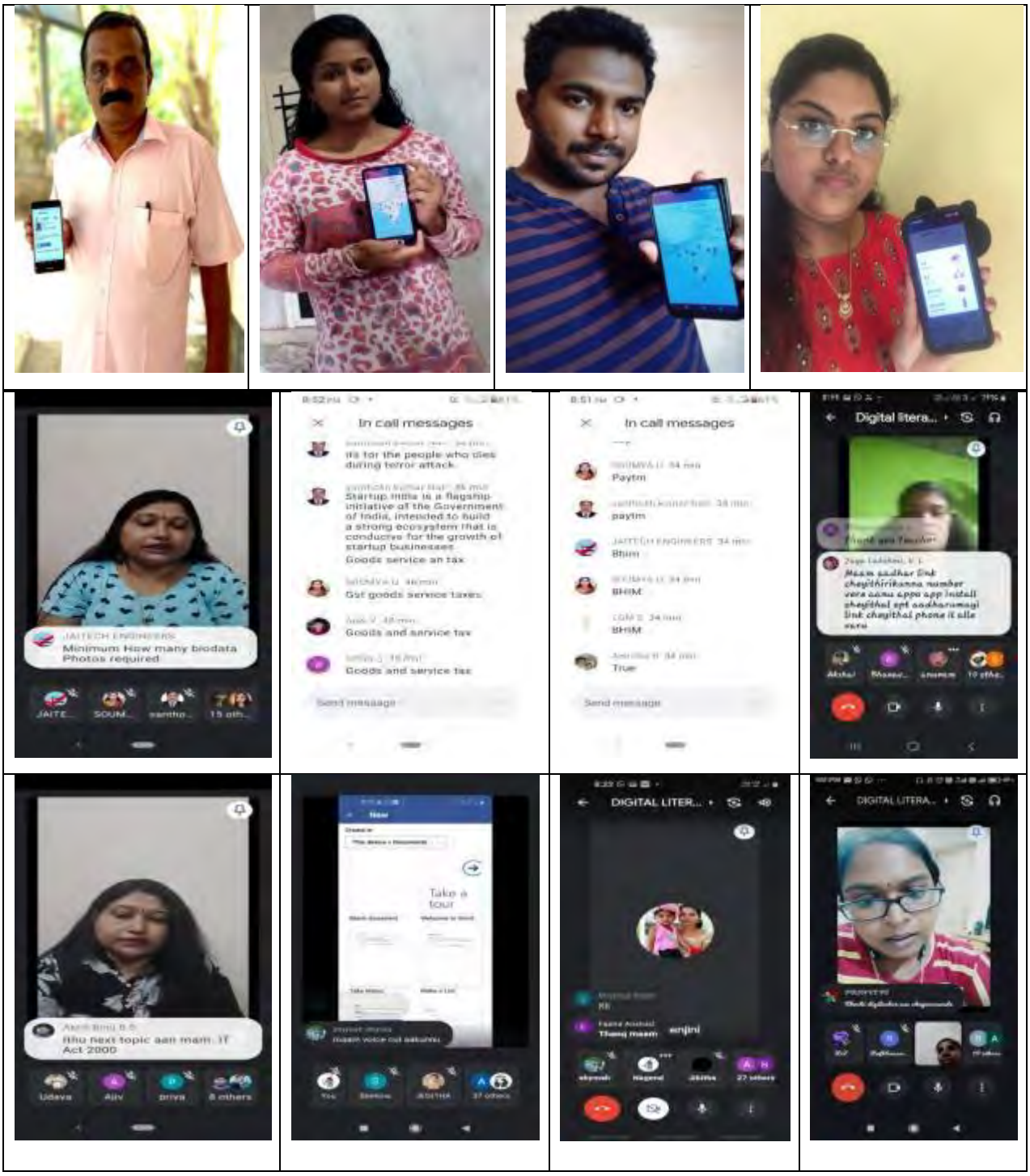






- **DIGITAL LITERACY PROGRAMME ((SDG-8 Decent Work and Economic Growth)**

This year the digital literacy has reached to 2047 out of the proposed target of 2000. The program covers internet banking, social media, mobile banking, Digi locker, MS office, cyber security, barcode etc.... The program helped in making the people to equip on online transactions, bill payments like KSEB, water bills, school fee payments and e-commerce activities during this pandemic restriction. The Digital Literacy batches beneficiaries installing many meaningful Apps as a result of the training such as BHIM App, Saksham App and Digi-Locker.




**"Coaching for success" – Competitive Exam Coaching Programme (SDG-8 - Good jobs & Economic growth)**

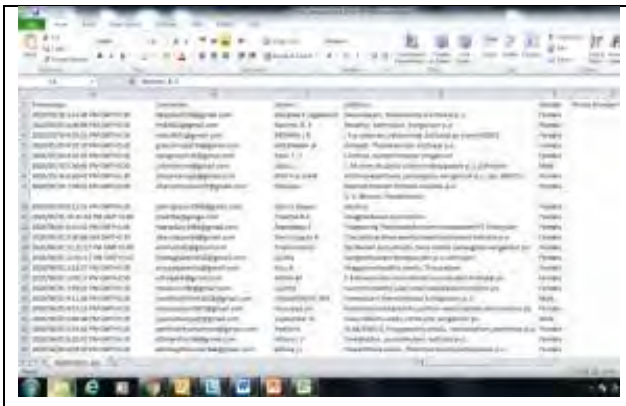
**Virtual Training Classes**

Training sessions along with daily mock test is going on with an average of 100 students' participation. Weekly mock test, timetable and study materials are shared through google drive link. A total of 630 students are accessing the E-learning platform developed for Competitive Exam Preparation.

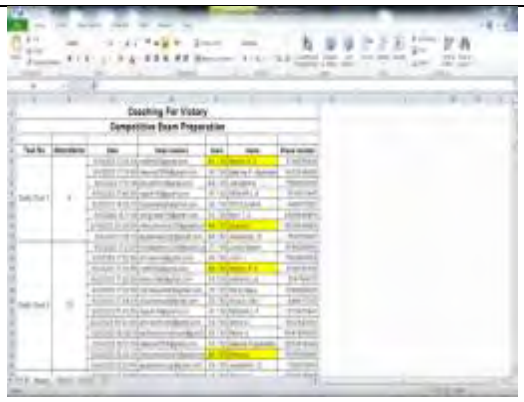
**E-Learning Activities**

In addition to the virtual classes, other e-learning activities have been progressing simultaneously as follows.

- Study materials like Rank file pages, easy study methods from You Tube and voice clips related to the daily test topics links has been shared on a regular basis.
- Daily online test for a score of 50 has been conducting on a regular basis.
- 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.
- 630 students have been registered for the programme until 30/19/2020 through "Google form" and it was decided to stop the registration for this year.
- Adani Foundation is providing G -SUITE ID for the registered students for online classes as well as for utilizing the resources in a more advanced method.
- After the successful completion of every day test the top scorers will be announced by the coordinator in the group



| NAME OF THE CANDIDATE | Total score |
|---|---|
| SHANIMOL B | 15.00 / 40 |
| Archana vl | 15.00 / 40 |
| Sibina.I.S | 14.00 / 40 |
| CHINCHU. J | 13.00 / 40 |
| Sabarinath | 13.00 / 40 |
| PRINCY V | 12.00 / 40 |
| Sukanya | 12.00 / 40 |
| Rakhi Raj | 10.00 / 40 |

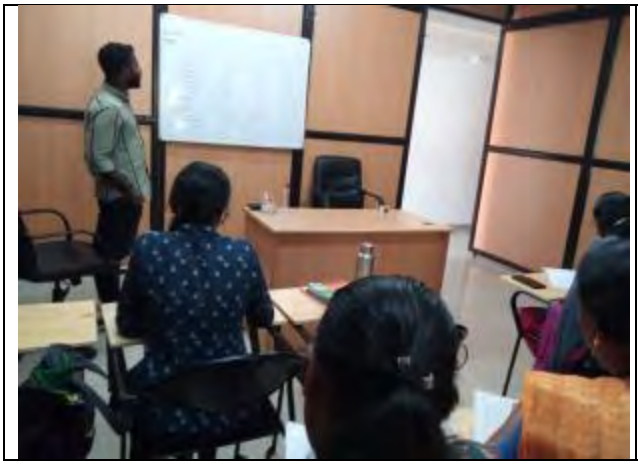


| NAME OF THE CANDIDATE | Total score |
|---|---|
| Susmi.S | 29.00 / 40 |
| Sukanya | 22.00 / 40 |
| Resmi. R. S | 23.00 / 40 |
| Reshma | 30.00 / 40 |
| Prijila.S.S | 33.00 / 40 |
| Miniajikumar | 22.00 / 40 |
| Karthika. K. P | 36.00 / 40 |
| Jayasree. | 30.00 / 40 |
| CHINCHU. J | 23.00 / 40 |
| Chinchu | 26.00 / 40 |
| Total Responses : 23 | |

- Virtual sessions have been conducting 5 days in a week.
- Considering the suggestions of tutors', daily mock test pattern has changed and brought into action from 15th October 2020 onwards.
- In the new method, questions have been provided without options and students are required to type the answers in local language Malayalam. It has been brought to make the learning process more effective.
- A placement grooming programme has been introduced during the reporting period for those candidates who are interested in Private Jobs. Candidate registration in Timesjob, Naukri and indeed are monitoring by the team.

After the declaration of Covid 19 relaxations, we started coaching for competitive exam preparation on offline mode. Kerala Public Service Commission declared 10th level preliminary test for the Office Assistant, Office staff and Lower Division Clerk posts. It will start from 20th February onwards on district

wise. We started providing intensive coaching methods to candidates for achieving the preliminary test with good score. We scheduled the classes as, 10am to 11am combine study session, 11am to 1pm topic wise classes by the tutor and from 1pm to 2 pm daily mock test and revision. Many students are very effectively participating the sessions regularly. We are providing up-to-date study material available in the market for the combine study purpose.




**10th Level Preliminary Test**

Kerala Public Service Commission has been started conducting 10th Level Preliminary test for the Last Grade, Office Assistant, Lower Division Clerk and many other vacancies on 20th February, 25th February and 6th March 2021. All our candidates attending the Competitive Exam Preparation training had applied and give confirmation for attending the test. Almost 90% of our candidates were attended the test on these days at different exam Centers across Kerala. We are expecting a good result in the preliminary test and hope all the candidates will be selected for the main level.

**12th Level Preliminary Test**

For the first time in Kerala the Public Service Commission are going to conduct Preliminary test for the candidates based on the 12th Level for various Government related jobs in different departments. Lower Division Clerk, Lower

Division Clerk Typist, Assistant etc... are some of the position where candidates can apply for. Public Service Commission had declared the test date on 10th and 18th April 2021. By 5th April, we are going to conducting daily mock test on the 12th Level Preliminary test syllabus.

From the month of April 2021, we are providing the Competitive Exam Preparation classes as offline so that the candidates can effectively use the interactive sessions and also they can spend more time at Centre for reference and combine study purposes.

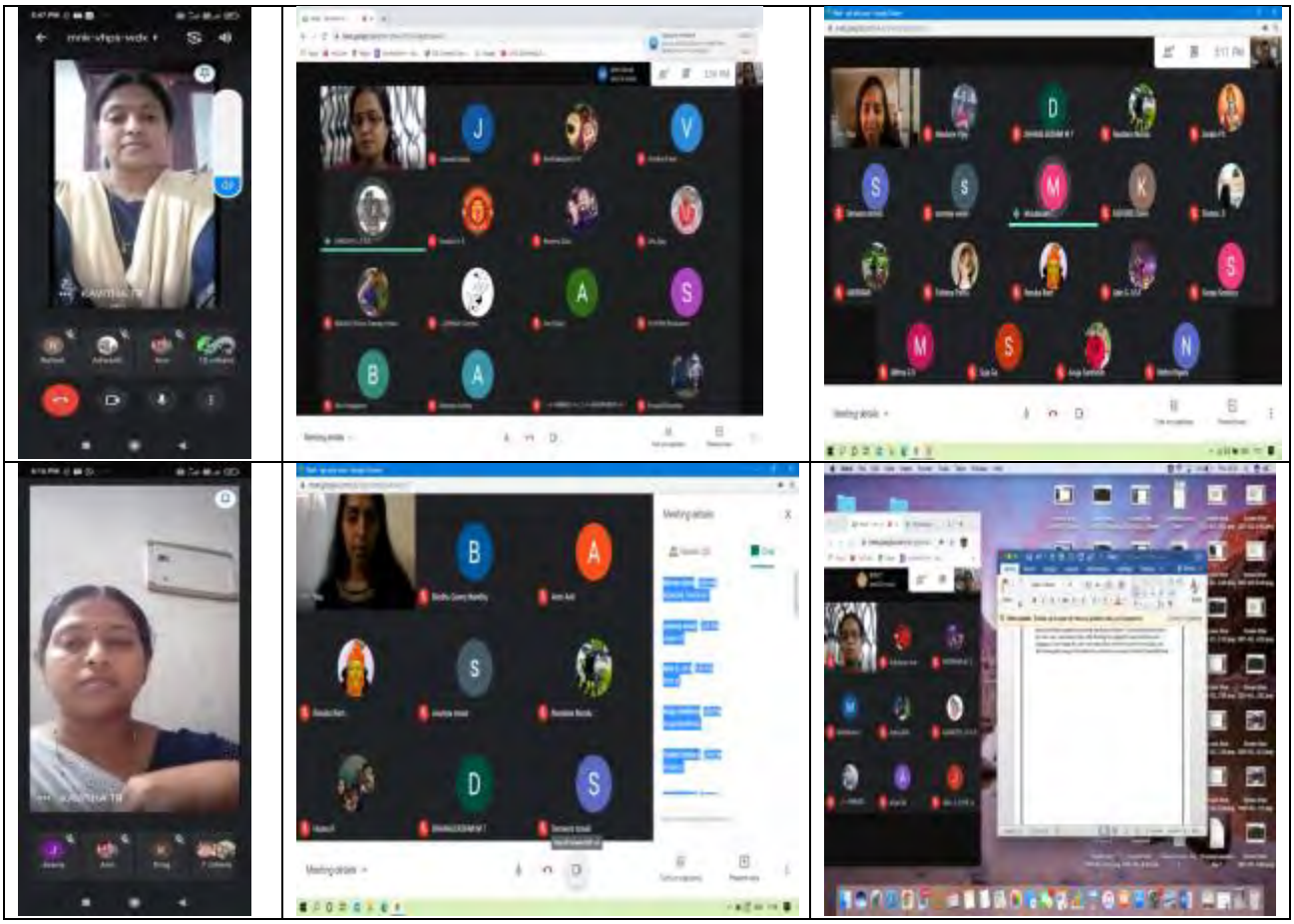
- **ENGLISH LANGUAGE SKILLS TRAINING (SDG-4 - Quality Education)**

ASDC Vizhinjam started Basic Functional English classes for the community students through virtual platform. As of now, 3 batches with 113 students in each batch are under ongoing status. As part of the programme, we have received a student list from the following educational institutions.

1) St Mary's H S S, Vizhinjam
2) VPS Boys, Venganoor
3) HSS For Girls, Venganoor

An entry level exam has been conducted to evaluate capability of the students through Google form. Ms. Reena R Pillai, Ms. Reshma Latheef and Mrs. Kavitha are coordinating the batches respectively. Both have worked as Communication/IT trainers in ASAP, Kerala.

Based on the developed modules, all the three batches were successfully completed by the tutors and all the assignment works submitted by the students were collected successfully. Feedback from all the students were collected and verified. Students participated very effectively in this training programme and did their activities very neatly and clearly. Assignment works like News Making, Letter writing, discussions, debate etc.... were conducted by the tutors and captured digitally.



### 3.2. LIVELIHOOD UPDATES (SDG-1 No Poverty)

Sustainable Livelihood Development is one of the core activities focused during the year as a tool for economic empowerment of poor community people, especially women. 1328 women from the communities of Vizhinjam are trained on five basic entrepreneurial modules of business management covering Self-Management, Cash Management, Debt Management ideas to business and Leadership. From that 22 livelihood units are conceptualized, wherein 17 are streamlined as indicated in the table. The efforts paved the way for making the poor community people self-reliant. The funding pattern for all the units followed as 10% beneficiary contribution, 40% bank loan, 25% subsidy from Vizhinjam

International Sea Port Ltd (VISL) and 25% subsidy from Adani Vizhinjam Port Private Ltd (AVPPL).

**VizMart,** a new market outlet has been opened with 14 shops of community women on 29.08.2019 at Vizhinjam under CSR. Adv. Rakhi Ravikumar, Deputy Mayor of Trivandrum Corporation inaugurated the Onam sales fest on 05.09.2019. The mart has been developed under the CSR of Adani Foundation and handed over to women groups on 29.08.2019 to source the products and arrange counters. This is one step ahead of handholding with better market connectivity for the livelihood groups and their products.

The units functioning in this mart are (1) You, Me & Tea café shop, (2) Turn to Fresh - Organic Shop, (3) Agro clinic, (4) Vegetable Shop, (5) Textile shop, (6) SRM-stitching unit, (7) Laundry & ironing unit, (8) Elite Fancy shop, (9) Kitchen utensils unit, (10) Prime Hi-tech laundry unit (11) Data-plus unit, (12) Clean Four You (13) S.R.M Stitching (14) Tender Coconut unit (15). Lottery unit (16) SWAP Data Services

**VIZMART**, resumed its service after lockdown. The team members were trained on taking Covid-19 precautions and how to promote door to door delivery than sales through shops. 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 of Adani Foundation. Presently, started product promotion through what's app and social Medias.

The market for livelihood products has been running adhering to all the COVID protocols. A register has been kept for the registration of customers visiting in the shopping centre. A mobile application has been initiated during the reporting period. 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

**Following table gives the status of existing livelihood units**

| Sl No | Group | Type of Business | Business Status during the financial year |
|---|---|---|---|
| 1 | Clean 4 U(A five member women group) | Hi Tech Cleaning for Flats, Hospitals, Offices, water tank, Vehicle and Public Institutions | • Hosted a web site www.clean4u.info for the customer registration.<br>• The clients included offices, hospitals, flats, houses etc.<br>• The turnover during the year was Rs. 1056000 /-<br>• Purchased an own four wheeler<br>• Initial loan closed and avail another loan for expansion<br>• Average monthly turnover was close to Rs.85,000/-<br>• Supplied contract cleaning cum housekeeping staff to CSR, ASDC, HOWE Guest House and ITD Company.<br>• Started the service of disinfection |
| 2 | Anaswara Poultry Unit | Hitech poultry with 14 cages of 630 chicken for 7 member | • The total revenue for the group for the financial year is Rs. 3,00,000 /-<br>• The unit is progressing with second cycle<br>• Initial Loan closed |
| 3 | Thripti Poultry Unit | 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. 3,00,000/-<br>• The unit is progressing with second cycle<br>• Initial Loan closed |
| 4 | Harbour Canteen Unit | Canteen unit specially for traditional seafood's | • Daily turnover of Rs.8,000 to Rs.10,000 and gets an average profit of Rs.750 per day<br>• The turnover during the year was Rs.15,84,000/- |

| | | | |
|---|---|---|---|
| | | | • Canteen runs in the building of Harbour Engineering Department at Mathippuram |
| 5 | Sreebhadra Big Shopper Unit | Big shopper/Cloth Bag /Nonwoven Bag Unit | • The group has made a turnover of Rs.1,49,000/-for the current financial year<br>• Supplying cloth bags, face mask etc. |
| 6 | Eco Shop unit | Selling of fresh vegetables at VizMart | • An organic vegetable selling unit started at Vizmart on 05.09.2019<br>• The turnover of the group for the financial year was Rs. 11,88,000/-<br>• Procuring vegetables from the local farmers and selling at VizMart |
| 7 | Vizhinjam Karshika Karmasena | Clearing of vegetation and other agri works | • Turn over for the financial year was 13,61,000/-<br>• The clean Campaign including community cleaning and the cleaning of public places are coordinating by the Group.<br>• Registered partner for clearing the vegetation in acquired land of Vizhinjam port.<br>• Started selling fertilizer, growbags, etc.<br>• Partner for preparation of seedlings for kitchen garden group<br>• |
| 7 | Prime Events | Power Laundry Unit and Steam Pressing Team | • Consultancy partner for Viz Mart – Livelihood market<br>• Steam pressing and hi-tech power laundry units are started on 05.09.2019<br>• The group has made a turnover of Rs.8,41.600 for the financial year |

| | | | |
|---|---|---|---|
| 9 | Data Plus | Data entry Photostat, projects, designing and online jobs | • Shop commenced on 17.10.2018<br>• The group has made a turnover of Rs.9,77.900 for the financial year<br>• Digital Literacy programme has been successfully supported by the group since 2018 |
| 10 | Thattukkada Unit (3 members) | Shop for preparation & Selling of steam based snacks | • The unit provide only the breakfast<br>• The shop has made a turnover of 10,56,000/- for the financial year |
| 11 | You Me & Tea Café (3 members) | Canteen unit, traditional Kerala Foods | • Started the unit at VizMart from 05.09.2019.<br>• Made a turnover of Rs. 12,57,000/-<br>• Started selling Milk and Milk products as an outlet. |
| 12 | SRM Stitching & Garments unit (3 Members) | Spot stitching and garments | • Started a unit at VizMart from 05-09-2019.<br>• The group has made a turnover of Rs. 2, 16, 800 /-<br>• Stitched more than 10000 cloth facemasks for AVPPL/AF<br>• Started selling ladies garments |
| 14 | Turn to fresh - organic shop (3 members) | Virgin coconut oil, natural pickles and other provisional items | • Started a unit at VizMart on 18-11-2019<br>• The group has made a turnover of Rs. 9,02,000/- for the financial year.<br>• Whole sale dealer for provisions.<br>• Started sales counter for Nestle Products and mineral water |
| 15 | SWAP Data Services (3 Members) | Data Services, E-seva, Photostat, Mementos & Gift items | • Started a new unit at VizMart on 1st December 2020.<br>• Trained group of ASDC Vizhinjam<br>• The group has made a turnover of Rs. 62, 000/- in 3 months |
| 16 | Elite Gift and Fancy shop (3 | Gift items, fancy items, handicrafts, | • The group has made a monthly turnover of Rs. 88,000/-. in last 5 months<br>• This group has been closed |

| | | | |
|---|---|---|---|
| | Members) | etc. | |
| 17 | SPANDHANAM Patient Care Unit (5 Members) | Providing patient care services for bedridden patients in houses as well as in nearby hospitals. | • Started new unit at VizMart in the month of January 2021.<br>• The group has made an annual turnover of Rs.1,44,000/- in three months |
| 18 | Tender Coconut Unit | Selling of Tender Coconut | • Started |
| 19 | Lottery Unit | Selling of Kerala Govt. Lotteries | • Started |
| 20 | Kitchen Garden | Production of Homestead pesticide free Vegetables 260 members (Not for Sale) | Annual turnover is Rs. 16,64000/- for the financial year |

**Livelihood training programme –for Expatriates**

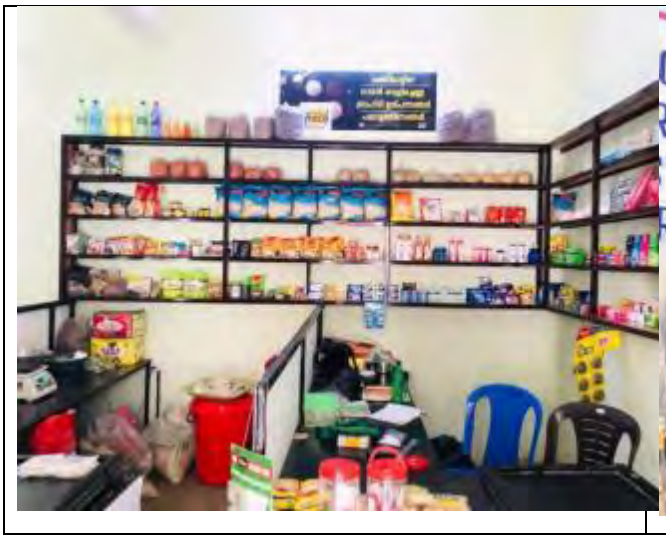
One-week training programme for Expatriates were conducted from 12th to 21st January 2021. This programme is initiated as part of the expatriates' welfare programme of Vizhinjam Parish, Trivandrum Social Service Society. The programme was intended for the prospective expatriates who intend to formulate their own business. The programme was attended by 13.

The scheduled were as follows

| Sl no | Day | Training topics covered. |
|---|---|---|
| 1 | 12.1.2021 | Orientation to the programme |
| 2 | 14.1.2021 | Self-management |
| 3 | 18.1.2021 | Cash management |
| 4 | 19.1.2021 | Debt Management |
| 5 | 20.1.2021 | Leadership management |
| 6 | 21.1.2021 | Project preparation. |

The follow up of the programme such as project preparation, bank linkage and setting up of units will be initiated next financial year.






### 3.4 COMMUNITY SPORTS (SDG-16 Peace, Justice and strong Institutions)

As part of the community sports supported Kovalam FC a professional football club from vizhinjam by providing nutritious food supplements and motivational sessions during the period

## IV. COMMUNITY INFRASTRUCTURE DEVELOPMENT

### 4.1. Community Health Centre, Vizhinjam (SDG-3Good Health and Well Being)

The construction work of Community Health Center at Vizhinjam has been resumed after the COVID restrictions. The project cost is Rs. 7.79 cr where the Government component of Rs.482 lakhs and CSR component of 297 lakhs from Adani Foundation. Adani Foundation handed over the first installment of Rs.1.18 crores to the Harbour Engineering Department on 03.10.2018.


### 4.2. HALP School, Harbour Road, Vizhinjam (SDG-4 Quality Education)

The works of rain roof and sanitation facilities in HALP School are completed during the period. An inauguration cum handing over ceremony will be organised in the first week of April 2021. The work included side roofing; toilet blocks for boys, washing facility for staff and installation of water pump.


### 4.3. LPS School, Kidarakkuzhy ( SDG-4 Quality Education)

In Kidarakkuzhy LP School, the following works are completed

- Toilet block for boys & staff, Urinals for boys, Soak pit & septic tank

### 4.4. Oldage Home (Ambranchi villa, Andoorkonam, Vizhinjam) (SDG-3-Good Health and Wellbeing)

The works of Oldage home "Snehasanthram" at Ambranchivila has been completed and handed over to the old age home management. The facilities provided included Kitchen platforms, Toilet /wash rooms, washing facility & bathrooms separately, beautification works of existing well (Plaster, cleaning color etc.), Outside area with IPS or paver, Light weight shed b/w two existing building and Racks for storage. This was inaugurated by Honorable MLA Mr. Vincent and blessings were offered by Rev Father of Kottappuram Church Dr Michael Thomas on 12.2.2021.

### 4.5. Mudippura Nada LP School, Venganoor (SDG-4Quality Education)

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 covid lockdown issues are over.


### 4.6. Gangayar Canal (SDG-6Clean Water and Sanitation)

The proposed maintenance to ensure proper water flow and desilting of Gangayar initiated during the month of December 2020. The work has been entrusted to Minor Irrigation Department under the supervision of Harbour Engineering Department. The project cost of Rs.89 lakhs for the same has been shared equally by AVPPL and VISL. But as the tenders for the work shown an additional expense of Rs. 30 lakhs Minor

Irrigation Department official request VISL/AVPPL to allot the same in the Monitoring committee meeting held on 19th February 2021. Additional fund may be transferred in the month of March.

The proposal included the following

- 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

### 4.7. Other major projects proposed for 2021-22 (SDG-11 Sustainable Cities and community)

| Project | |
|---|---|
| Community Sitting Space with solar lights & small parks 5 Nos | |
| Model Anaganwadi, Vizhinjam (Nr. Police Station) | 1500 Sqft Montessori model Anganwadi at Govt. Vizhinjam LP School compound. |
| Costal Police station and Police station at Vizhinjam | Completed the work of Compound wall – High masonry 1.8 mts and top barbed wired 1, Mild Steel Main Gate and a Wicket gate |
| MRF | As per the request received from Trivandrum Municipal Corporation it is decided to construct an MRF at harbor ward. Land for the same will be allotted by Harbour Engineering Department. The operation of the unit will be done by Trivandrum Municipal Corporation under the technical support of Suchithwa Mission and Clean Kerala Company. A Haritha Karma Sena will be formed for the daily collection of waste after the commissioning of the proposed unit. The MRF will include<br>• 3500 sqft building<br>• Shredding Machine<br>• Baling Machine<br>• Dust remover and<br>• Conveyor belt |

| | |
|---|---|
| Kottukal School | A roof top class rooms in the existing building<br>As per the structural certificate a block estimate for the same was prepared during the period. |

### 4.8. Vayalinkara – Model Village Plan SDG-11 Sustainable Cities and community)

A model village development work progressing at Vayalinkara area and is in final stage of completion. The work of drainage plan, concrete pavements, drinking water pipe line extension and street light plan are progressing with HOWE. The work resumed after COVID restrictions. A village level committee constituted to support AF is monitoring the day to day progress. The villagers, especially housewives are also joined with the contractors in the construction activities. This has increased the ownership of community in the development of their areas.

**OTHERS ((SDG-16 Peace, Justice and strong Institutions)**

**Community Grievances**

**Ensuring proper water flow - "Gangayar Canal"**

As the community people reported the sand accumulation at Gangayar causing flooding and which is directly affected more than 100 houses during rainy season, AVPPL- AF has been regularly removing sand from

the mouth of Ganagayar to ensure proper water flow to sea. The dredging department of HOWE is doing the work at the mouth of Gangayar River joining sea at Valiyakadappuram every day. A proposal for permanent solution by developing a culvert and distillation are drafted by Minor irrigation department accepted and will do the work and AVPPL & VISL will share the cost equally in the next financial year. The work was awarded to a contractor and postponed due to the state assembly election model code of conduct came in to existence.

The proposal included the following

- 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
- Fencing

**Strike by Vizhinjam parish**

A 32 days long strike was started on 30.09.2020 by the fishermen mainly against the government. A monitoring committee constituted by Govt. under the chairmanship of Special Project Director Smt. Sreevidhya IAS to review the issues raised the church people. The committee met 5 times during the reporting period and reviewed all the follow up actions. One of

the CSR team representing AVPPL in the monitoring committee and related field visits for the issues like shifting of cross and shrine from port site, solid waste management, ten bedded hospital at Thulavila, Kottappuram and cracks of houses due to piling at port site.

**Reporting the progress of Vizhinjam Port to community stakeholder**

As per the environmental audit compliance, the progress of Port activities has been circulated to the community groups with following progress through virtual platforms from July 2020 onwards

| **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) | 850 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. Inauguration done on 30-09-2020 by Hon'ble Minister for Ports, GoK.<br>• All other buildings are at advanced stage of completion.<br>• Yard development works are in progress |
| Port Access Road (2 Km) | In progress. 2 nos bridge construction are in progress. Piling of bridge is completed. |
| Main Electrical Substation and Port Electrical System | Construction completed. Commissioning will be done soon. |

Table depicting the details of members informed

| **Sl.No** | **Month** | **People Informed** |
|---|---|---|
| 1 | October | 694 |
| 2 | November | 565 |
| 3 | December | 624 |
| 4 | January | 787 |
| 5 | February | 1046 |

| | | |
|---|---|---|
| 6 | March | 1739 |
| **Total** | | **5455** |

Press Coverage

ചന്ദ്രിക

**അജ്ഞാത ജീവിയുടെ ആക്രമണം: കാട് വെട്ടിത്തെളിച്ചു**

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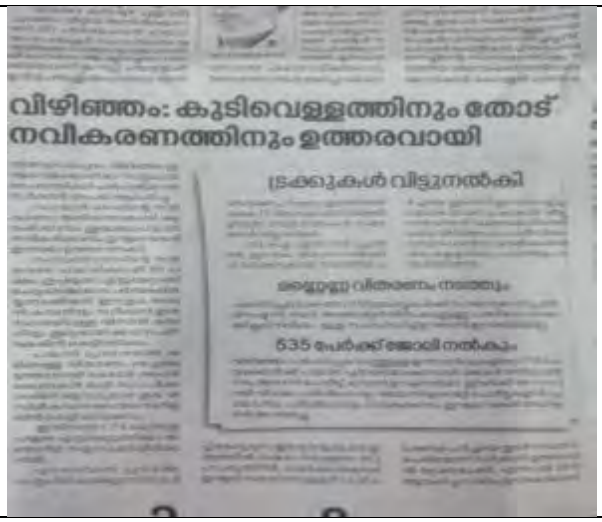

വിഴിഞ്ഞം: കുടിവെള്ളത്തിനും തോട് നവീകരണത്തിനും ഉത്തരവായി

ട്രക്കുകൾ വിട്ടുനൽകി

635 പേർക്ക് ജോലി നൽകും

THE TIMES OF INDIA, THIRUVANANTHAPURAM
THURSDAY, OCTOBER 29, 2020

# Vizhinjam port: Talks productive, agitation may end



GETTING TOGETHER: Ministers Kadannappally Ramachandran and Kadakampally Surendran at a meeting with representatives of Vizhinjam fishermen

TIMES NEWS NETWORK

**Thiruvananthapuram:** With ministers Kadannappally Ramachandran and Kadakampally Surendran meeting the representatives of local fishermen of Vizhinjam who have been agitating at the port construction site, stage is set for the continuation of the construction of the port.

Speaking to TOI, Father Michael Thomas, the vicar of Our Lady of Good Voyage Church, Kottapuram, under whose leadership the agitation is going on, said the outcome of the meeting was positive. The two ministers listened to all the demands and even agreed to address them in a time-bound manner.

"However, we will not call off the agitation immediately because promises were made in the past too, which were never kept. We have asked for a detailed minutes of meeting (MOM) with a deadline before which each work would be completed. After receiving a copy of MOM in our hands, we will call off the agitation," Fr Thomas said, adding that the ministers have also agreed to issuing such an MOM at the earliest.

Government sources said works to prepare a detailed MOM with timelines of implementation of each demand commenced soon after the meeting. It is expected to be completed in a day or two. "We have addressed three of their demands. Government orders were issued for three projects already," a government official said. These include orders on repair and renovation of Gangayar drain, replacement of old and damaged drinking water pipelines with new ones and distribution of extra kerosene.

The orders on Gangayar drain and KWA pipelines were issued last week. The copy of order on distribution of kerosene was handed over to the agitators on Wednesday during the meeting. The government had promised the fishermen to provide extra kerosene to cover additional distance owing to the works of port for a period of 24 months. This was based on a report submitted by in livelihood impact assessment committee in 2015. But the distribution stopped after 14 months. The latest order is to resume the distribution at the earliest.

# ലോക ദിന്നശേഷി ദിനത്തോടനുബന്ധിച്ച് വീൽചെയറുകൾ വിതരണം ചെയ്തു

# ക്യാൻസർ രോഗികൾക്ക് സഹായഹസ്തവുമായി അദാനി സി.എസ്.ആർ

# ദേശീയ ബാലികാ ദിനാഘോഷം

വിഴിഞ്ഞം• അദാനി തുറമുഖ കമ്പനിയുടെ സാമൂഹിക പ്രതിബദ്ധതാ പദ്ധതി ഭാഗമായി സംഘടിപ്പിച്ച ദേശീയ ബാലികാ ദിനാഘോഷം മേയർ ആര്യാ രാജേന്ദ്രൻ ഉദ്ഘാടനം ചെയ്തു. കൗൺസിലർ സമീറ അധ്യക്ഷയായി. ചൈൽഡ് ലൈൻ കൗൺസിലർ നവ്യാ ടെന്നിസൺ ചർച്ചാ ക്ലാസ് നയിച്ചു. വിവിധ മേഖലകളിൽ കഴിവു തെളിയിച്ച പെൺകുട്ടികളെ അനുമോദിച്ചു.

# ദേശീയ ബാലികാ ദിനം ആഘോഷിച്ചു


# അഗതി മന്ദിരത്തിന്റെ നവീകരിച്ച ബ്ലോക്ക് ഉദ്ഘാടനം ചെയ്തു

വിഴിഞ്ഞം: വിഴിഞ്ഞം തുറമുഖത്തിന്റെ സാമൂഹ്യപ്രതിബദ്ധതാ പദ്ധതിയിലുൾപ്പെടുത്തി നവീകരിച്ച സ്നേഹസാന്ദ്രം അഗതിമന്ദിരത്തിന്റെ പുതിയ ബ്ലോക്കിന്റെ ഉദ്ഘാടനം അഡ്വ. എം. വിൻസെന്റ് എം. എൽ.എ നിർവഹിച്ചു.വിഴിഞ്ഞം സിന്ധു യാത്രാ മാതാ ചർച്ച് ഇടവക വികാരി റവ.ഡോ. മൈക്കിൾ തോമസ് ആശിർവാദ കർമ്മം നടത്തി .നിരാലംബരും വാർദ്ധക്യം ബാധിച്ചവരുമായ 7 വനിതകൾക്ക് മാത്രംസൌകര്യം ഉണ്ടായിരുന്ന മന്ദിരം നവീകരിച്ചതോടെ 20 പേർക്ക് കിടക്കാനുള്ള ഇടമായി മാറി. പ്രത്യേകം ടോയ് ലറ്റ് ബ്ലോക്ക് , വാഷിംഗ് ഏര്യാ ,മീറ്റിംഗ് ഏര്യ എന്നിവയും ഇവിടെ സജ്ജമാക്കിയിട്ടുണ്ട്. സ്ഥാപനമേധാവി റവ.ഡോ. മൈക്കിൾ തോമസിന്റെ അദ്ധ്യക്ഷതയിൽ നടന്ന ഉദ്ഘാടന ചടങ്ങിൽ അദാനി ഫൗണ്ടേഷൻ റീജനൽ മേധാവി ഡോ. അനിൽ ബാലകൃഷ്ണൻ മുഖ്യ പ്രഭാഷണം നടത്തി.

NAUTICAL TIMES
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# സ്നേഹസാന്ദ്രം അഗതി മന്ദിരത്തിന്റെ നവീകരിച്ച ബ്ലോക്ക് ഉദ്ഘാടനം ചെയ്തു

വിഴിഞ്ഞം: വിഴിഞ്ഞം തുറമുഖത്തിന്റെ സാമൂഹ്യ പ്രതിബദ്ധതാ പദ്ധതിയി ലുൾപ്പെടുത്തി നവീകരിച്ച 'സ്നേഹസാന്ദ്രം' അഗതി മന്ദിരത്തിന്റെ പുതിയ ബ്ലോക്ക് ബഹു. കോവളം എം.എൽ.എ അഡ്വ. എം. വിൻസെന്റ് അവർകൾ ഉദ്ഘാടനം ചെയ്തു. വിഴിഞ്ഞം സിഗ്നൽ യാത്രാ മാതാ ചർച്ച് ഇവക വികാരി റവ.ഡോ. മൈക്കിൾ തോമസ് പുതിയ ബ്ലോക്കിന്റെ ആശിർവാദ കർമ്മം നിർവ്വഹിച്ചു.

7 കിടക്കകൾ മാത്രം ഉണ്ടായിരുന്ന സ്ഥാപനം നവീകരണത്തിന് ശേഷം 30 പേർക്ക് വാസയോഗ്യമായി ഉയർന്നു. പ്രത്യേകം തയ്യാറ്റ് ബ്ലോക്ക് , വാഷിംഗ് ഏരിയ ,മീറ്റിംഗ് സ്പേസ് എന്നിവയും ഇതോടൊപ്പം സജ്ജമാക്കിയിട്ടുണ്ട്.

സ്ഥാപന മേധാവി റവ.ഡോ. മൈക്കിൾ തോമസിന്റെ അദ്ധ്യക്ഷതയിൽ തുടർന്ന് നടന്ന പൊതുസമ്മേളനത്തിൽ അതാനി ഫൗണ്ടേഷൻ റീജണൽ മേധാവി റവ.ഡോ. അനിൽ ബാലകൃഷ്ണൻ ആമുഖപ്രഭാഷണം നടത്തി. സമൂഹത്തിൽ നിരാലംബരായവർക്ക് പ്രത്യേകിച്ച് വാർദ്ധക്യം ബാധിച്ച വരിലേക്ക് ആശ്രയം ആയിട്ടാണ് ഈ സ്ഥാപനം സജ്ജമാക്കിയിട്ടുള്ളതെന്നും ഇതിനായി കാരുണ്യത്തോടെ സഹായിക്കുന്ന സുമനസ്സുകൾ ദൈവീക പ്രവർത്തനങ്ങൾ തന്നെയാണ് നടത്തുന്നതെന്നും അദ്ദേഹം തന്റെ പ്രഭാഷണത്തിൽ അഭിപ്രായപ്പെട്ടു.

അതാനി ഫൗണ്ടേഷൻ പോലെ നിരവധിപേരുടെ സഹായത്തോടുകൂടിയാണ് ആണ് ഈ സ്ഥാപനം ഇത്രമാത്രം പ്രവർത്തന ക്ഷമമായി വിഴിഞ്ഞം ഇടവകയുടെ നേതൃത്വത്തിൽ കൂടുതൽ പേർക്ക് സഹായം ലഭ്യമാകുന്ന രീതിയിൽ ഈ സ്ഥാപനം മുന്നോട്ടു കൊണ്ടുപോകാനുള്ള ശ്രമങ്ങൾ ആരംഭിച്ചതായും റവ.ഡോ. മൈക്കിൾ തോമസ് അധ്യക്ഷപ്രസംഗത്തിൽ പറഞ്ഞു.

കോവിഡ് മാനദണ്ഡങ്ങൾ പാലിച്ചു കൊണ്ട് നടന്ന ചടങ്ങിൽ സ്നേഹസാന്ദ്രം അഗതിമന്ദിരത്തിന്റെ കമ്മിറ്റി അംഗങ്ങൾ, വിഴിഞ്ഞം ഇടവക കൗൺസിൽ പ്രതിനിധികൾ, അതാനി ഫൗണ്ടേഷൻ പ്രതിനിധികൾ, മറ്റ് അഭ്യുദയകാംക്ഷികൾ എന്നിവർ പങ്കെടുത്തു. അന്തേവാസികൾക്കായി വസ്ത്രങ്ങളും സ്നേഹവിരുന്നും ചടങ്ങിന്റെ ഭാഗമായി ഒരുക്കിയിരുന്നു.

# അന്താരാഷ്ട്ര വനിതാ ദിനത്തിൽ വനിതാ സംരംഭക ഗ്രൂപ്പുകൾക്ക് അവാർഡുകൾ നൽകി

വിഴിഞ്ഞം: തിരുവനന്തപുരം - അതാനി വിഴിഞ്ഞം തുറമുഖ കമ്പനിയുടെ സാമൂഹ്യ പ്രതിബദ്ധതാ പദ്ധതിയുടെ ഭാഗമായി പ്രവർത്തിക്കുന്ന വനിതാ സംരംഭക ഗ്രൂപ്പുകളിൽ മികച്ച ഗ്രൂപ്പുകൾക്ക് വനിതാ ദിനത്തിൽ അവാർഡുകൾ നൽകി.

സാമൂഹ്യ പ്രതിബദ്ധതാ പദ്ധതിയുടെ ഭാഗമായി രൂപീകരിച്ചിട്ടുള്ള 17 വനിതാ സംരംഭങ്ങളിൽ ഏറ്റവും വിജയകരമായി പ്രവർത്തിച്ചു വരുന്ന കാറ്റഗറിയിൽ ക്ലീനിങ് മേഖലയിൽ പ്രവർത്തിക്കുന്ന ക്ലീൻ ഹോർ യുവി തെയാണ് തിരഞ്ഞെടുത്തത്.

മുൻനിരയിലുള്ള വനിതാ സംരംഭങ്ങളുടെ കാറ്റഗറിയിൽ വനിതാ കർഷിക കർമ്മസേനയും തിരഞ്ഞെടുക്കപ്പെട്ടു.

വനിതാ ദിനത്തിൽ അതാനി വിഴിഞ്ഞം തുറമുഖ കമ്പനി സിഇഒ ശ്രീ മാരേഷ് നായർ വിജയികളായ വനിതാ സംരംഭകർക്ക് അവാർഡുകൾ വിതരണം ചെയ്തു.

ഇത വിഭാഗം നഷ്ടപ്പെടുത്തുമെന്ന് മേധാവി ഓപ്പറേഷൻ അനിൽ ബാലകൃഷ്ണൻ എന്നിവരുടെ സാന്നിധ്യം ചടങ്ങിൽ ശ്രദ്ധേയമായി.

വരുന്ന ഒരു വർഷത്തിനകം നിലവിലുള്ള തീരദേശങ്ങൾ ഉൾപ്പെടെയുള്ള ഗ്രാമങ്ങൾ വിപുലീകരണത്തിനും സാധ്യതയുള്ളതായ വീട്ടമ്മമാർക്ക് അതി ലഘു ജീവിത മാർഗമായി തിരഞ്ഞെടുത്ത അതിനാവശ്യമായ എല്ലാ പിന്തുണയും അതാനി ഗ്രൂപ്പ് നൽകുമെന്നും ശ്രീ. മാരേഷ് തന്റെ പ്രസംഗത്തിൽ പറഞ്ഞു.

സാമൂഹ്യപ്രതിബദ്ധതാ പ്രവർത്തനങ്ങളുടെ ഭാഗമായി പ്രവർത്തിച്ചു വരുന്ന വനിതാ സംരംഭങ്ങളിൽ ആയി നൂറോളം വനിതകൾ തൊഴിൽ എടുത്തുവരുന്നുണ്ട്.

വനിതാ ദിനത്തിൽ ഇവരുടെ കുടുംബവും വിവിധ കലാ പരിപാടികളും സംഘടിപ്പിച്ചിരുന്നു.

# Annexure IV

# Compliance of Conditions of KCZMA Recommendation for EC/CRZ Clearance

**Annexure IV**

| Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| (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**<br>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:<br>• 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.<br>• 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).<br>• CTE for consumer pump inside the Vizhinjam port premises was obtained on 07.03.2021 (Consent No.: PCB/TVM-DO/NTA/PTP/15/2021) for the period of 5 years valid up to 28.02.2026 (enclosed as **Annexure X**).<br>• 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**<br>All safety measures are being adopted. Full time Environment & Safety professionals are employed by AVPPL, contractors & subcontractors to oversee the implementation of environmental safety measures. Organizational Structure for Environment, Health, and Safety (EHS) & CSR for construction phase is enclosed as **Annexure IX**. All |

| Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | | work plans are executed after assessing the defined EHS plans.<br><br>It is also submitted that dredging of lakes or kayals are not envisaged as part of this project. |
| (iii) | The project proponent must obtain necessary clearance separately from the Kerala State Pollution Control Board, Health Department and other appropriate Authorities when such implementation programmes are undertaken. | **Complied**<br>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**<br>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**<br>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.<br>• No solid waste is being disposed of in the CRZ area.<br>• 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 | **Being Complied**<br>There was no visit by officials of KCZMA during the compliance period. All necessary support will be extended to officials of KCZMA during |

| Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | (KCZMA) for inspection of the project site and its premises at any time. | inspection of the project/site visit; at any time. |
| (vii) | The KCZMA may be duly informed of any construction/developmental works/major activities undertaken in the CRZ area of the project | **Complied**<br>• 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.<br>• Regular meetings are held with officials of KCZMA to appraise them on various project related activities.<br>• HYCRs are being furnished to KCZMA including the details of the development works.<br><br>Following construction activities have taken place till March 2021:<br>• No dredging was carried out during the compliance period from October 2020 to March 2021. The dredged material till 31.03.2021 amounting to 2.90 $Mm^3$ has been utilized for reclamation of 36 Ha area. The dredged material has been used for reclamation.<br>• Berth Construction: Piling (617 nos.) and casting of pile muffs (617 nos.) have been completed.<br>• Breakwater construction is in progress<br>• Boundary wall work along available front has been completed at various locations - Truck terminal 1, 2, & 3, and pocket 4; remaining construction work is in progress, on hold due to local issues or not handed over to AVPPL due to disputes.<br>• Following buildings construction work are completed:<br>o Gas Insulated Substation (GIS) substation<br>o Substation building (Inside port)<br>o Port Operations Building<br>o Port Canteen |

| Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | | • Following construction work is in progress:<br>o RMU buildings-yard<br>o RMU buildings-berth<br>o Workshop Building<br>o Gate Complex<br>o Driver Rest Room<br>o DG Shed Building<br>o Water Tank & Pump House<br>o Security Building<br>o Port User Building (PUB) Building<br>o Storm Water Drain<br>o Yard Development<br>o Approach Road<br>o Paver Blocks<br>o Electrical Works |
| (viii) | Environmental clearance must be obtained from the Ministry of Environment & Forests. | **Complied**<br>Environment & CRZ Clearance (EC) has been obtained from Ministry of Environment & Forest vide MoEF letter dated 03.01.2014 (F.No.11-122/2011-IA.III).<br><br>As per EIA Notification 2006 and Office Memorandum (O.M.) dated 12.04.2016, the validity of the EC is for seven years up to 03.01.2021. As per the provisions of MoEF&CC, the validity of the EC may be further extended for a maximum period of three years.<br><br>VISL had submitted online application and required relevant documents on parivesh for extension of EC on 08.10.2020, 03.11.2020 and 19.11.2020. The Proposal (IA/KL/MIS/178082/2020) was considered in the 246$^{th}$ and 247$^{th}$ EAC meeting of Infra-1 committee of MoEF&CC held on 20.10.2020 and 23.11.2020; wherein VISL and NABET accredited consultant-L&T-IEL had made a presentation to the committee members.<br><br>Thereafter, MoEF&CC vide letter No. |

| Half Yearly Compliance of Conditions Stipulated in KCZMA Recommendation for Environment and CRZ Clearance (EC) for the Period October 2020 to March 2021 | | |
|---|---|---|
| **S. No.** | **Conditions** | **Compliance Status as on 31.03.2021** |
| | | IA/KL/MIS/178082/2020 dated 29.12.2020 (Enclosed as **Annexure XI**) have increased the validity of EC of Vizhinjam port by 3 years till 02.01.2024. |
| (ix) | An adequate financial provision has to be made for environmental protection measures. | **Complied**<br>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. 17.47 Crores has been spent on environmental protection measures. The activity wise fund break up and expenditure during the compliance period October 2020 to March 2021 is enclosed as **Annexure VIII**. |
| (x) | Scrutiny fee of Rs. 10,00,000/- (Rupees Ten lakh only) to be remitted under the head account 1425-800-97 applications for scrutiny fee etc. for CRZ clearance, in the district/Sub Treasury concerned, if private parties are involved in the project and the challan receipt in original be forwarded to the Science & Technology Department quoting this letter. | **Not Applicable**<br>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 V

# Compliance of the Response/Commitments made during Public Hearing

**Annexure V**

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| 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**<br>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. 94.15 crores have been disbursed till 31.03.2021 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 few balance LAPs is in progress. *(Source: VISL)*<br><br>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 VI**. |
| 2 | Land under the Jamaath which includes Karimppaly, Magham, Varuthari Pally, etc. need to be protected and should not be acquired. | **Complied**<br>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**<br>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**<br>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. The EPC Contractor is finalising the design for |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | 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. Government of Kerala (GoK) has initiated discussions with fishermen representatives for removal of the boats to facilitate construction work and these discussions are ongoing. *(Source: VISL)* |
| 5 | Existing harbour will be improved under the CSR provisions of the project | **Being Complied**<br>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**<br>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**<br>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 October 2020 to March 2021 is enclosed as **Annexure I**.<br><br>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).<br><br>Four mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC; as detailed below: |

| Data Period | Submitted With HYCR for the Period |
|---|---|
| Feb 2015 to Feb 2017 | Apr 2017 to Sep 2017 |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | <table><tr><td>Mar 2017 to Feb 2018</td><td>Apr 2018 to Sep 2018</td></tr><tr><td>Mar 2018 to Feb 2019</td><td>Apr 2019 to Sep 2019</td></tr><tr><td>Mar 2019 to Feb 2020</td><td>Apr 2020 to Sep 2020</td></tr></table><br>These mathematical modelling reports have affirmed that the shoreline change is in line with prediction in the EIA study. As per the latest mathematical modelling report, from all the data analyses and model studies carried out by L&T IEL, it can be concluded that there was minimal variation on shoreline, beach morphology and water quality compared to the previous years and that the port construction has not caused any unnatural changes to these parameters in the vicinity of the port.<br><br>In continuation with the same practise Adani Vizhinjam Port Pvt. Ltd. (AVPPL) have submitted the shoreline data from March 2020 to February 2021 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. |
| 8 | Water supply provision to the Vizhinjam fishing village | **Complied**<br>Water Supply Scheme for provision to the local people has been commissioned in April 2013 by VISL by expending an amount of Rs. 8.10 crores. For Operation & Maintenance (O&M) of the same an amount of Rs. 5.38 crores has been spent till date. From 04.04.2019 onwards, O&M of the scheme is being done by Kerala Water Authority (KWA). *(Source: VISL)* |
| 10 | Railway work will be initiated after Environment Clearance (EC) | **Will be Complied**<br>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 submitted to Southern |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | Railway for its approval. All the required clarifications have been provided to Southern Railways and the approval expected shortly. *(Source: VISL)* |
| 11 | Job Opportunity - Preference will be given to local people during construction stage | **Being Complied**<br>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, 178 people are from Kerala and out of them 83 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**<br>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**<br>Adequate budgetary provision has been kept for waste management as part of EMP as well as CSR.<br><br>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 which will be constructed along with project.<br><br>Additionally, as a part of CSR activities, AVPPL are taking up activities with respect to solid waste management (Refer **Annexure III**). |
| 17 | Upgradation of PHC at Vizhinjam will be carried out | **Being Complied**<br>The construction work of Community Health Center at Vizhinjam has been resumed after the COVID restrictions. The project cost is Rs. 7.79 Crores where the Government component |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | 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.<br><br>  <br>  |
| 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**<br>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 31.03.2021 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**<br>This is one of the objectives of the project and this will be fully materialised once all phases of the project are implemented. |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | Presently, development of dedicated road connectivity approach road (2.0 km) from the port to the NH-47 Bypass is in progress and 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**<br>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; which will be part of the operational EMP. |
| 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**<br>No dredging was carried out during the compliance period from October 2020 to March 2021. The dredged material till 31.03.2021 amounting to 2.90 $Mm^3$ has been utilized for reclamation of 36 Ha area. The dredged material has been used for reclamation.<br><br>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**<br>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 |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | consultants have been appointed as required in the concession agreement signed with AVPPL. Organizational Structure for Environment, Health, and Safety (EHS) & CSR for construction phase is enclosed as **Annexure IX**.<br><br>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. |
| 25 | VISL will ensure that livelihood issues of Mussel collectors are addressed as per the EIA report | **Being Complied**<br>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**<br>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 submitted to Southern Railway for its approval. All the required clarifications have been provided to Southern Railways and the approval expected shortly. *(Source: VISL)*<br><br>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 |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | process of constructing the approach road to port taking into account the recommendation given by the report.<br><br>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 EMP/RAP/CSR will be ensured through the institutional and regulatory mechanism with regular monitoring and periodic compliance reports to the MoEF | **Being Complied**<br>Refer point 24 above.<br><br>Regular monitoring of Environment Parameters are being carried out. Detailed Monitoring Reports for the period April 2020 to September 2020 is enclosed as **Annexure II**. 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.<br><br>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 April 2020 to September 2020 has been submitted to the MoEF&CC, Regional Office (Bangalore), Zonal office of the CPCB (Bangalore), KSPCB & KCZMA vide email dated 01.12.2020 (a copy of the email is enclosed as **Annexure XII**). |
| 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**<br>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. |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | Additionally, as during the course of development of port more trees are being cut, AVPPL had applied for necessary permissions from Forest Dept. for cutting of trees. Thereafter, GoK and Forest Dept. have further identified land of area 35 Ha for Phase-2 of compensatory afforestation in lieu of trees felled for development of Vizhinjam port project. Phase-2 of the scheme has been approved by GoK vide Government Order No. G.O(Rt)No.183/2018/F&WLD dated 26.06.2020 (**Annexure VII**). Govt. has accorded Administrative sanction of Rs. 2.61 Crores for the scheme for Phase-2.<br><br>AVPPL, in collaboration with Forest department, nursery works have been completed and planting operations have begun in 11 Ha of area at Kerala University Campus, Karyavattom (at an aerial distance of 23 km from the Vizhinjam Port project site). |
| 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**<br>Earlier it was proposed that the fishermen at Adimalathura will be compensated for the construction period of three years, treating them as temporarily affected. However, based on the request of the fishermen (stating that demarcation of the shipping channel and movement of ships would affect them permanently) their compensation has been enhanced considering seven years of livelihood loss. The GoK order to this effect has been issued on 31.05.2018 and compensation has been disbursed to 600 eligible fishermen amounting to a total of Rs. 35.13 Crore. 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**<br>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 |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | committee constituted by GoK. The Master Plan will be 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**<br>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**<br>Details of CSR activities carried out during the compliance period are given in **Annexure III**.<br><br>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**<br>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 31.03.2021 to the disbursal agency identified for the work. *(Source: VISL)* |
| 38 | As per the Entitlement Framework, Hardship Allowance is suggested in the EIA/EMP for resort workers who lost their job due to acquisition of the resort | **Complied**<br>Compensation for livelihood loss; Rs 6.08 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**<br>As the project is in construction stage, construction stage EMP is being implemented. Operation stage EMP will be implemented during operation stage. Refer **Annexure VI** for status of Construction stage EMP. |
| 41 | A dedicated port road directly connecting to NH-47 bypass is envisaged. | **Being Complied**<br>This is part of the concession agreement signed with AVPPL and is in the process of being developed. Refer point 26 above. |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| 43 | The port project will not affect the inflow of Neyyar river and AVM canal | **Noted for Compliance**<br>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**<br>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**<br>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**<br>This is part of the proposed port estate development. |
| 49 | CSR activity suggested a skill development centre to equip the local people to adapt to the industrial needs of port/tourism and fisheries so that they can be appropriately employed based on their merit. However during construction period the EIA study has suggested to adequately employ local population to the maximum extent possible | **Being Complied**<br>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, 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. Tender for fixing transaction advisor has been invited. *(Source: VISL)*<br><br>Preference is being given to local people based on Skill & competency during the |

| Compliance of the Response/Commitments made during Public Hearing | | |
|---|---|---|
| **S. No.** | **Responses/Commitments** | **Status as on 31.03.2021** |
| | | construction stage. Out of the total persons employed at site for different construction activities, an average of 178 people are from Kerala and out of them 83 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**<br>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**<br>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.<br><br>Restrictions on fishing will be as per the applicable laws. |
| 53 | There will only be a movement of 8 barges per day during the construction period of 3 years and the same will not be a hindrance for the fisherman to cross since this is far less than the number of ships being crossed by them daily in the international ship channel. | **Noted** |
| 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**<br>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 VI

# Status of Environment Management Plan

**Annexure VI**

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| 1 | Capital dredging | Marine water quality<br>Marine ecology | o Check turbidity levels with baseline levels as reference during entire monitoring programme<br>o Preparation of Dredge/reclamation Management plan<br>o Discharge of waste into sea will be prohibited<br>o Oil Spill control measures will be adopted<br>o Ensure that slop tanks will be provided to barges/ workboats for collection of liquid/ solid waste<br>o Marine environmental monitoring as per environmental monitoring programme | **Being Compiled**<br>o No dredging was carried out during the compliance period from October 2020 to March 2021. The dredged material till 31.03.2021 amounting to 2.90 $Mm^3$ has been utilized for reclamation of 36 Ha area. The dredged material has been used for reclamation.<br>o Turbidity buoys at 3 locations identified by NIOT are carrying out real time turbidity measurement.<br>o Dredging Management plan has been prepared<br>o Discharge of waste into sea is prohibited<br>o After duly incorporating the comments of Indian Coast Guard (ICG), the final facility Level Oil Spill Disaster Contingency Plan (OSDCP) in line with the National Oil Spill-Disaster Contingency Plan (NOS-DCP) has been submitted to ICG for approval vide letter No. AVPPL/ICG/2020-21/1134 dated 22.05.2020. After final review by PRT (West), ICG has made specific remarks on the compliance of OSDCP prepared in line with NOS-DCP guidelines; directing AVPPL to submit the OSDCP for approval only after pollution response equipment are in place. Considering that the procurement of pollution response equipment will be in line with the |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | | | development of the port, the final OSDCP will be submitted to ICG for approval prior to commissioning of the port; when the pollution response equipment are in place..<br>o Marine Environmental Monitoring at 5 locations as per the Environment Monitoring Plan prescribed in EIA has commenced since August 2016, one additional marine water monitoring location has been added from October 2017 after suggestion from NGT committee and the parameters are within permissible limits.<br>o 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 | o 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.<br>o To reduce impacts from exhausts, | **Being Complied**<br>o Rock placing for breakwater construction was initiated using the stones brought through barges from nearby harbours.<br>o It is ensured that all vehicles entering the Port have a valid PUC certification<br>o Adequate sized construction yard has been provided for storage of construction materials, equipment tools, earthmoving equipment, etc.<br>o The dumpers have speed governors ensuring adherence to speed limit |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | | emission control norms will be enforced / adhered.<br>o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards<br>o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt<br>o Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment etc.<br>o Provide enclosures on all sides of construction site<br>o Movement of material will be mostly during non-peak hours.<br>o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic<br>o Water sprinkling will be carried out to suppress fugitive dust | o Signage for speed control are displayed inside port area<br>o Water sprinkling is carried out for supressing dust<br>o It is ensured that all trucks transporting material are covered by tarpaulin.<br>o Regular awareness programme on various Environment aspects is being imparted to workers and employees. |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | | o Environmental awareness program will be provided to the personnel involved in developmental works<br>o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation | |
| | | Noise | o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB<br>o Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A)<br>o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used<br>o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors<br>o Noise attenuation will be practiced | **Being Complied**<br>o Noise levels are being monitored every fortnight and are found to be well within the permissible limits within the project area.<br>o Contractors are also monitoring the Noise level in their work area and results are within the stipulated limits.<br>o 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<br>Potential Impacts and Mitigation Measures of Various Project Activities | | | | |
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| **S. No.** | **Activity** | **Relevant Environmental Components likely to be impacted** | **Proposed Mitigation Measures** | **Status as on 31.03.2021** |
| | | | for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers<br>o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10pm) to minimise noise impacts<br>o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc.<br>o Ambient noise levels will be monitored at regular intervals | |
| | | Disturbance to Natural Drainage pattern | o Port development is mostly on reclaimed land<br>o Rainwater/surface water harvesting pond included in design<br>o Existing drainage near port boundary (backup area) will be integrated with port storm water drainage & management plan<br>o Existing drains / Streams that are passing in ware house area will not be closed/ diverted. And these | **Being Complied**<br>o Measures have been taken for maintaining the natural flow of the streams debouching in the construction site, by laying drain pipes beneath the temporary road.<br>o A study has been conducted to access the rainwater harvesting potential and recommend for planning accurate, successful and implementable rainwater harvesting management system within the proposed sites for the sustainable development of existing groundwater resources and thereby suitable |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | | streams will be de-silted and enhanced to improve their carrying capacities | 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.<br>o 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.<br>o No work has started in warehouse area and drains/streams passing through the area are not closed/ diverted. |
| | | Vegetation and Strain on existing | o Port development is planned mostly on reclaimed land; | **Being Complied**<br>o Care is taken to limit the felling of trees to the bare |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | infrastructure | o Land use at backup area, PAF Zone and warehouse area will be mostly coconut plantation and low mixed plantation<br>o Adequate green belt will be developed in port and its associated (backup area, PAF, warehouse and road & rail connectivity).<br>o Temporary workers camp with self-sufficient infrastructure facilities. | minimum. Plantation of saplings along the road margins, road medians and port boundary are planned as part of the master plan development.<br>o Temporary Worker camp has been provided with all necessary infrastructure facilities (Water, Electricity, Sanitation, Fuel, etc.) |
| | | Existing Traffic | o NH-47 bypass under construction around 2.0 km from the proposed Port site and the Transportation of construction materials will be carried out during non- peak hours. Hence a dedicated road of 45 M RoW is proposed to connect site with NH Bypass<br>o Regularization of truck movement<br>o Majority of rock for breakwater construction will be transported through sea route via barges from nearby quarry sites<br>o A dedicated rail network of approximately 15 km is proposed | **Being Complied**<br>o Traffic monitoring & regularization is being carried out for maximum efficiency.<br>o Trial run of rock placing for breakwater construction was initiated using the stones brought through barges from nearby harbours.<br>o 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 submitted to Southern Railway for its approval. All the required clarifications have been provided to Southern Railways and the |

| Status of Environment Management Plan-Port Site-Construction Stage<br>Potential Impacts and Mitigation Measures of Various Project Activities | | | | |
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| **S. No.** | **Activity** | **Relevant Environmental Components likely to be impacted** | **Proposed Mitigation Measures** | **Status as on 31.03.2021** |
| | | | from port to Nemom railway station | approval expected shortly. *(Source: VISL)* |
| 3. | Land Reclamation | Existing Water Resources like Groundwater and surface water | o Land to be reclaimed will be separated from adjoining land by creating containment bund.<br>o Return sea water will be sent back to sea through appropriate channels. | **Being Complied**<br>o No dredging was carried out during the compliance period from October 2020 to March 2021. The dredged material till 31.03.2021 amounting to 2.90 $Mm^3$ has been utilized for reclamation of 36 Ha area. The dredged material has been used for reclamation.<br>o During dredging return sea water is sent back to sea through appropriate channels.<br>o The existing drains are maintained for unhindered disposal of surface drainage water. |
| 4. | Solid Waste Management | Soil quality | o Construction waste will be used within port site for filling of low lying areas.<br>o Composted bio-degradable waste will be used as manure in greenbelt.<br>o Other recyclable wastes will be sold.<br>o Excavated soil at backup, PAF Zone and ware house area will be stockpiled in a corner of the site in bunded area to avoid run off with storm water.<br>o General refuse generated on-site will be collected in waste skips and separated from construction waste. | **Being Complied**<br>o Construction waste is used within port site for filling of low lying areas in line to C&D Waste Management Rules 2016, as amended.<br>o No burning of refuse at construction sites is being done.<br>o Contractors working at the site have been made responsible for management of Solid Waste during construction stage. They are complying with the provisions pertaining to management of Solid Waste in line to Solid Waste Management Rules 2016, as amended.<br>o There is no disposal of waste in the project area which may lead to groundwater contamination. |

| Status of Environment Management Plan-Port Site-Construction Stage<br>Potential Impacts and Mitigation Measures of Various Project Activities | | | | |
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| **S. No.** | **Activity** | **Relevant Environmental Components likely to be impacted** | **Proposed Mitigation Measures** | **Status as on 31.03.2021** |
| | | | o Burning of refuse at construction sites will be prohibited.<br>o All control measure will be taken to avoid the contamination of groundwater during construction phase | |
| 5. | Handling of hazardous wastes | Human safety and property loss | o Adequate safety measures as per OSHA standards will be adopted<br>o Construction site will be secured by fencing with controlled/limited entry points.<br>o Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms.<br>o Construction site will be secured by fencing with controlled/ limited entry points<br>o Medical facilities including first aid will be available for attending to injured workers.<br>o Handling and storage as per statutory guidelines. | **Being Complied**<br>o Adequate safety measures as per OSHA standards are adopted as and when necessary as per the HSE Plan.<br>o Construction site is being secured by fencing wherever possible with controlled/limited entry points.<br>o 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.<br>o Handling and storage is as per statutory guidelines.<br>o Hazardous waste is disposed through approved KSPCB/CPCB vendors. |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | | o Positive isolation procedures will be adhered<br>o Hazardous wastes will be disposed through approved KSPCB/CPCB vendors. | |
| 6. | Water Resources | Water scarcity / Pollution | o Water requirement during the construction is expected to be around 0.10 MLD<br>o Water will be sourced from Vellayani lake<br>o Avoid/minimise the loss during conveyance<br>o Optimized utilization of the water<br>o Care will be taken to prevent the runoff from the construction site to the nearby natural streams, if any | **Being Complied**<br>o 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.<br>o On an average about 100 KLD of water is being consumed for construction related activities. |
| 7. | Fishing | Fishermen and fishing villages | o Signboards will be placed at the construction activities in order to make fishermen aware of the | **Being Complied**<br>o Signboards have been placed for demarcation of construction area. |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | | ongoing construction activities<br>o Necessary marker buoys will be installed<br>o Interactions will be initiated with the fishing community before commencement of construction works | o Using the technological advancement the dedicated CSR team of AVPPL are in constant touch with the fishermen/fishing community members to facilitate the flow of various project related information/updates.<br>o AVPPL CSR team also provides regular updates to the committee which has been formed by the local church representatives adjoining to the port area, who in turn pass on port project execution information to the fishermen. |
| 8. | Tourism | Effect on tourism | o Tourism activity is observed at Kovalam located about 2.0 km 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.<br>o A cruise terminal and related facilities is part and parcel of the project. This is to largely compensate the losses made | **Being Complied**<br>o The tourism activity in the nearby Kovalam area is not impacted by the construction of the port.<br>o Shoreline monitoring for a stretch of 40 km (20 Km on both sides of the project site) is being done and reports are regularly submitted to regulatory authorities.<br>o Once the first phase of port becomes operational, it would naturally attract cruise tourism. Based on the development of cruise business, dedicated cruise berths will be planned in a phased manner. Action is also being taken in consultation with the State tourism department, to design port linked tourism packages covering the Kovalam-Vizhinjam-Poovar tourism corridor |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | | o For all acquired properties and land adequate compensation will be provided based on legally valid documents | o 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 31.03.2021 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. |
| 9 | Breakwater | Change in shoreline | o Shoreline monitoring shall be carried out<br>o Suitable Shoreline protection measures will be implemented based on the observations | **Being Complied**<br>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:<br>o 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 |

| Status of Environment Management Plan-Port Site-Construction Stage<br>Potential Impacts and Mitigation Measures of Various Project Activities | | | | |
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| **S. No.** | **Activity** | **Relevant Environmental Components likely to be impacted** | **Proposed Mitigation Measures** | **Status as on 31.03.2021** |
| | | | | 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.<br>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).<br>o Four mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC. These mathematical modelling reports have affirmed that the shoreline change is in line with prediction in the EIA study. As per the latest mathematical modelling report, from all the data analyses and model studies carried out by L&T IEL, it can be concluded that there was minimal variation on shoreline, beach morphology and water quality compared to the previous years and that the port construction has not caused any unnatural changes to these parameters in the vicinity of the port.<br>o In continuation with the same practice AVPPL have |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | | | submitted the shoreline data from March 2020 to February 2021 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. |
| 10 | Effect on existing fishing harbour | Movement of fishing boats | o Detailed modelling studies have been carried out on tranquillity conditions in the fishing harbour with port development. The studies reveal that the tranquillity conditions will be improved in fishing harbour with construction of the port. Further minor accretion happening within the fishing harbour will be arrested<br>o Traffic of Marine vessel/ fishing boats will be planned without affecting each other<br>o Adoption of fishing harbour to manage it to perform as per International standard<br>o A new fishing harbour provided under CSR initiatives because of additional tranquillity creator. | **Being Complied**<br>o Wave, current and tide data are being monitored along with the shoreline monitoring of 40 km stretch. Based on the above, the modelling studies done at the EIA stage has been further evaluated.<br>o During operation phase traffic of Marine vessel/fishing boats will be planned without affecting each other as per the applicable laws.<br>o 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. The EPC Contractor 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. Government of Kerala (GoK) has initiated discussions with fishermen representatives for |

| Status of Environment Management Plan-Port Site-Construction Stage<br>Potential Impacts and Mitigation Measures of Various Project Activities | | | | |
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| **S. No.** | **Activity** | **Relevant Environmental Components likely to be impacted** | **Proposed Mitigation Measures** | **Status as on 31.03.2021** |
| | | | o Loss of livelihood will be either taken care of in the new port premises or adequately compensated mostly in the form of employment | removal of the boats to facilitate construction work and these discussions are ongoing. *(Source: VISL)*<br>o 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. 94.15 crores have been disbursed till 31.03.2021 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 few balance LAPs is in progress. *(Source: VISL)* |
| 11 | Shoreline changes | Erosion/accretion | Final shoreline Impact management plan will be prepared in consultation with agencies like CESS/INCOIS, NGO and local bodies and will implemented. | **Being Complied**<br>o NIOT has been engaged to give technical advice on aspects related to shoreline monitoring & shoreline evolution.<br>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.<br>o Wave, current and tide data are being monitored a 40 km stretch. |

| Status of Environment Management Plan-Port Site-Construction Stage<br>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 31.03.2021** |
| | | | | o L&T IEL had prepared Mathematical Modelling Reports based on Shoreline Monitoring data; which were vetted by NIOT.<br>o Four mathematical modelling reports have been prepared by L&T IEL so far and submitted to MoEF&CC. These mathematical modelling reports have affirmed that the shoreline change is in line with prediction in the EIA study. As per the latest mathematical modelling report, from all the data analyses and model studies carried out by L&T IEL, it can be concluded that there was minimal variation on shoreline, beach morphology and water quality compared to the previous years and that the port construction has not caused any unnatural changes to these parameters in the vicinity of the port.<br>o In continuation with the same practice AVPPL have submitted the shoreline data from March 2020 to February 2021 to L&T IEL for mathematical modelling to assess the impact on shoreline under the guidance of NIOT. |

| Environmental Management Plan – Rail*/Road Corridors<br>*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 31.03.2021** |
| 1 | Environmental Management and Monitoring Facility Equipment for EMP (Meters, Vehicles and Buildings) | o This will include institutional requirements, training, environmental management and monitoring. Provision for purchasing required equipment. | **Noted for Compliance**<br>o An Environment Management Cell has been established to look after day to day affairs like Monitoring, Training<br>o Appropriate institutional mechanism for maintenance of health, hygiene, safety, security has been put in place. An officer of VISL has been designated as Head (EHS & CSR) for effective implementation of the stipulated EHS safeguards & CSR activities. AVPPL, the concessionaire executing the project has also appointed officers for EHS & CSR, Horticulture. In addition to the above, independent environment, health and safety consultants have been appointed as required in the concession agreement signed with AVPPL. Organizational Structure for Environment, Health, and Safety (EHS) & CSR for construction phase is enclosed as **Annexure IX**.<br>o It is also ensured that contractors working at site also deploy EHS professional to implement suggested EMP measures. Proper provisions for maintenance of health, hygiene, safety, security for workforce in labour colony has also been provided/ ensured.<br>o Necessary equipment will be purchased; adequate provisions have been made in the |

| Environmental Management Plan – Rail*/Road Corridors<br>*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 31.03.2021** |
| | | | budget for the same.<br>o Third party environmental monitoring has commenced since August 2016 and the monitoring results are satisfactory. |
| 2 | Altered Road embankment | o Retaining walls and gabions should be provided | **Noted for Compliance**<br>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.<br>o KSREC have studied the impact due to construction of port approach road.<br>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.<br>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.<br>o Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. | **Being Compiled**<br>o Regular Water Sprinkling is done on the approach road by water tankers.<br>o Water spraying is carried out at regular intervals after compaction<br>o Tarpaulin cover is used in vehicles delivering materials. |
| 4 | Air Pollution | o Vehicles and machinery are to be maintained so that emissions conform to National and State standards. | **Being Complied**<br>o Ambient air quality monitoring is carried out at 5 locations as per the Environment Monitoring Plan |

| Environmental Management Plan – Rail*/Road Corridors<br>*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 31.03.2021** |
| | | o All vehicles and machineries should obtain Pollution Under Control Certificates (PUC). | prescribed in EIA and has commenced since August 2016, the results obtained are within the limits prescribed by National Ambient Air Quality Standards (NAAQS)<br>o It is ensured that all vehicles entering port have Pollution Under Control (PUC) Certificate. |
| 5 | Noise | o Machinery and vehicles will be maintained to keep their noise to a minimum.<br>o Construction of noise barriers of an average length of 100m and eight feet height wherever necessary.<br>o Proper maintenance of the rail track and rail wagon, by frequent lubrication to avoid frictional noise.<br>o Regular monitoring shall be carried out as per the Environmental Monitoring Plan. | **Being Compiled**<br>o All the machinery and vehicles are maintained to keep the noise at minimum<br>o Noise monitoring is being done since August 2016, and the readings are within the limits at port site<br>o Regular monitoring of ambient Noise is carried out since August 2016 as per the Environmental Monitoring Plan prescribed in EIA and results are within the prescribed limit at port site. |
| 6 | Loss of low lying land and ponds | o Impacted ponds can be enhanced by constructing bridged structures like Gabions to avoid plugging of springs.<br>o Mitigation/Compensation shall be affected for the completely impacted ponds.<br>o At Chainage km 6.500 the Railway alignment goes below the Existing NH and then at km 6.600 it will hit pond. The pond will be excavated partially and the soil material shall be used to fill in the | **Will be complied**<br>o AVPPL had awarded the work to KSREC to undertake study on Groundwater impact due to construction of port approach road and also suggest mitigation measures.<br>o For impacted ponds in road alignment an elevated road is planned as suggested by KSREC. Other suitable mitigation measures as suggested in the KSREC report will be adopted during construction. |

| Environmental Management Plan – Rail*/Road Corridors<br>*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 31.03.2021** |
| | | western part and an equivalent area lost may be excavated to compensate the loss of effective pond area. | o 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 submitted to Southern Railway for its approval. All the required clarifications have been provided to Southern Railways and the approval expected shortly. *(Source: VISL)* |
| 7 | Flood Impacts and Cross Drainage Structures | o Formation level should be raised according to the design and the cross drainage structures suitably planned for the flood events. | **Being Complied** |
| 8 | Alteration of drainage | o In sections along watercourses, earth and stone will be properly disposed of so as not to block rivers and streams, thereby preventing any adverse impact on water quality.<br>o All necessary measures shall be taken to prevent earthworks and stone works from impeding cross drainage at streams and canals or existing irrigation and drainage systems in conformity to the Contractors visual integration and management plan and EMP. | **Will be Complied**<br>o AVPPL had awarded the work to KSREC to undertake study on Groundwater impact due to construction of port approach road and also suggest mitigation measures.<br>o For impacted on water quality, suitable mitigation measure as suggested in the KSREC report will be adopted. |
| 9 | Contamination from Wastes | o All justifiable measures will be taken to prevent | **Being Complied**<br>Measures are being taken up to prevent the |

| Environmental Management Plan – Rail*/Road Corridors<br>*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 31.03.2021** |
| | | the wastewater produced during construction from entering directly into rivers and irrigation systems. | 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 | o Borrow pits are to be identified, opened and closed after consultations and proper documentation. | **Will be Complied as and when required** |
| 11 | Quarrying and Material sources | o Quarrying will be carried out at approved and licensed quarries only. | **Will be Complied**<br>The road constructed so far has been made with material available on site. |
| 12 | Soil Erosion and Soil Conservation | o On slopes and other suitable places along the two proposed corridors, trees and grass should be planted.<br>o On sections with filling and deep cutting their slopes should be covered by sod, or planted with grass, etc.<br>o If existing irrigation and drainage system, ponds are damaged, they will be suitably repaired.<br>o Retaining walls and gabions shall be suitably provided. | **Will be Complied**<br>o AVPPL had awarded the work to KSREC to undertake study on Groundwater impact due to construction of port approach road. KSREC has submitted the final report with recommendations and AVPPL is in the process of constructing the approach road to port.<br>o Suitable mitigation measures as suggested in the KSREC report will be adopted during construction. |
| 13 | Loss of agricultural topsoil | o Arable land should not be used for topsoil borrowing.<br>o Topsoil will be kept and reused after excavation is | **Being Complied**<br>o Arable land is not being used for topsoil borrowing<br>o The topsoil excavated is being stored and will be |

| Environmental Management Plan – Rail*/Road Corridors<br>*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 31.03.2021** |
| | | over.<br>o Any surplus to be used on productive agricultural land. | reused during development of greenbelt. |
| 14 | Compaction of Soil and Damage to Vegetation | o Construction vehicles should operate within the Corridor of Impact avoiding damage to soil and vegetation. | **Will be Complied** |
| 15 | Loss of trees and Avenue Planting | o Areas of trees cleared will be replaced according to Compensatory Afforestation Policy under the Forest Conservation Act - 1980.<br>o Landscaping shall be done at major junctions. | **Being Compiled**<br>o 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.<br>o Additionally, as during the course of development of port more trees are being cut, AVPPL had applied for necessary permissions from Forest Dept. for cutting of trees. Thereafter, GoK and Forest Dept. have further identified land of area 35 Ha for Phase-2 of compensatory afforestation in lieu of trees felled for development of Vizhinjam port project. Phase-2 of the scheme has been approved by GoK. AVPPL, in collaboration with Forest department, nursery works have been completed and planting operations have begun in 11 Ha of area at Kerala University Campus, Karyavattom (at an aerial distance of 23 km from |

| Environmental Management Plan – Rail*/Road Corridors<br>*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 31.03.2021** |
| | | | the Vizhinjam Port project site). |
| 16 | Vegetation clearance | o Tree clearing within the ROW should be avoided beyond that which is directly required for construction activities and/ or to reduce accidents.<br>o Especially in plantation and house garden areas both along road and rail alignment. | **Will be complied**<br>o 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 | o Construction workers should protect natural resources and animals. Hunting of birds and other local animals is prohibited. | **Being Complied**<br>o Regular awareness sessions are conducted for the construction workers regarding importance of natural resources and animals.<br>o Hunting of birds & other local animals is strictly prohibited |
| 18 | Traffic Jams and congestion | o If there is traffic congestion during construction, measures should be taken to relieve it as far as possible with the co-operation of the traffic police. | **Being Complied**<br>In order to avoid traffic congestion, if any, during the construction of the road, measures will be taken to relieve it as far as possible with the co-operation of the traffic police. |
| 19 | Health and Safety | o All contractors' staff and workers must wear high visibility purpose made overalls or trousers/waist coat at all times. All operators working with any materials above head height (even in trenches) must wear hard hats all at times on the worksite. | **Being Compiled**<br>o All the workers are provided with Personal Protective Equipment's (PPE) and it is ensured that they wear it all the time<br>o Also all the contractors working at site have a dedicated health and safety person to oversee the work carried out. |

| Environmental Management Plan – Rail*/Road Corridors<br>*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 31.03.2021** |
| 20 | Pollution of Streams parallel or along the alignments | o Construction material/waste should be disposed of properly so as not to block or pollute streams or ponds with special attention to confining concrete work. | **Being Complied**<br>Construction materials/waste are being disposed properly; so as not to block or pollute streams or ponds. |
| 21 | Cultural Remains | o Construction should be stopped until authorised department assess the remains to preserve Archaeological relics and cultural structures like Temples, mosques and churches.<br>o Archaeologists will supervise the excavation to avoid any damage in the relics. | **Will be Complied**<br>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)<br>*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 31.03.2021** |
| 1 | Material transport and construction activities | Air Quality/Dust | o To reduce impacts from exhausts, emission control norms will be enforced / adhered.<br>o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards.<br>o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt.<br>o Providing adequately sized construction yard for storage of construction materials, equipment, tools, earthmoving equipment, etc.<br>o Provide enclosures on all sides of construction site<br>o Movement of material will be mostly during non-peak hours.<br>o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic<br>o Water should be sprayed during the construction phase, at mixing sites, and temporary roads.<br>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.<br>o Vehicles delivering materials should be covered to | **Complied**<br>o Monthly Environment Monitoring is being carried out and all the parameters are within the stipulated limit<br>o It is ensured that all vehicles entering the area have a valid PUC certification<br>o It is ensured that all the vehicles entering the site are following speed limit<br>o Tarpaulin cover is used in vehicles<br>o Water sprinkling is carried out to arrest dust generation.<br>o Environment awareness programs are being carried out for staff/contractors on a regular basis. |

| Environment Management Plan – Warehouse Area* (Construction Phase)<br>*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 31.03.2021** |
| | | | reduce spills and dust blowing off the load.<br>o Environmental awareness program will be provided to the personnel involved in developmental works.<br>o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation. | |
| | | Noise | o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB.<br>o Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A).<br>o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used<br>o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors.<br>o Noise attenuation will be practiced for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers.<br>o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimize noise impacts. | **Complied**<br>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)<br>*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 31.03.2021** |
| | | | o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc.<br>o Ambient noise levels will be monitored at regular intervals | |
| 2 | Construction of Buildings, Roads, Sheds, etc. | Vegetation and Strain on existing infrastructure | o Most of the land is covered with coconut trees and few other trees. Trees that are cut down will be accounted for and the same no. of trees of the same or some other species will be replanted at another location to compensate for the loss of greenery. | **Being Complied**<br>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.<br><br>Additionally, as during the course of development of port more trees are being cut, AVPPL had applied for necessary permissions from Forest Dept. for cutting of trees. Thereafter, GoK and Forest Dept. have further identified land of area 35 Ha for Phase-2 of compensatory afforestation in lieu of trees felled for development of |

| Environment Management Plan – Warehouse Area* (Construction Phase)<br>*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 31.03.2021** |
| | | | | Vizhinjam port project. Phase-2 of the scheme has been approved by GoK. AVPPL, in collaboration with Forest department, nursery works have been completed and planting operations have begun in 11 Ha of area at Kerala University Campus, Karyavattom (at an aerial distance of 23 km from the Vizhinjam Port project site). |
| | | Water Environment | o The streams 1 and 2 will be made to avoid entering the warehouse area by diverging them into the Karichal River.<br>o A tunnel like arrangement with RCC structures will be used so as to not affect the streams (3 and 4) that will go through the warehouse area. The streams will be made to go under the warehouse areas through the tunnel.<br>o Another option is to divert the stream through the boundary<br>o An application has been filed with the irrigation department for permission. | **Will be Complied**<br>No work is carried out in the area. Will be appropriately planned in consultation with the concerned departments |
| | | | o The low lying area in the region is already made use by the local people, and has been degraded. There are no active ecological systems in the area. As far | **Will be Complied**<br>Will be appropriately planned in consultation with the concerned |

| Environment Management Plan – Warehouse Area* (Construction Phase)<br>*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 31.03.2021** |
| | | | 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.<br>o Filling of low lying areas (if required) shall be done | departments |
| | | | o 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 | o As mentioned above, formidable measures will be taken to avoid the disturbance to the natural flow of water. If some structure or building comes in the way of the existing flow of water, the flow will be redirected to the closest stream in the drainage pattern.<br>o In sections along watercourses, earth and stone will be properly disposed of so as not to block rivers and streams, thereby preventing any adverse impact on water quality.<br>o All necessary measures shall be taken to prevent earthworks and stone works from impeding | **Will be Complied** |

| Environment Management Plan – Warehouse Area* (Construction Phase)<br>*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 31.03.2021** |
| | | | cross drainage at streams and canals or existing irrigation and drainage systems in conformity EMP. | |
| | | Existing Traffic | o Transportation of construction materials will be carried out during non- peak hours.<br>o Regularization of truck movement.<br>o Existing roads shall be strengthened and shall be used for the construction material transportation. | **Will be Complied** |
| 3 | Solid Waste Management | Soil quality | o Construction waste will be used within warehouse site for filling of low lying areas.<br>o Composted bio-degradable waste will be used as manure in greenbelt. Other recyclable wastes will be sold.<br>o Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water.<br>o General refuse generated on-site will be collected in waste skips and separated from construction waste.<br>o Burning of refuse at construction sites will be prohibited. | **Will be Complied** |

| Project Annex Facility (PAF) Zone - Construction Phase<br>*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 31.03.2021** |
| 1 | Material transport and construction activities | Air Quality/Dust | o To reduce impacts from exhausts, emission control norms will be enforced / adhered.<br>o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards.<br>o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt.<br>o Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc.<br>o Provide enclosures on all sides of construction site<br>o Movement of material will be mostly during non-peak hours.<br>o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic<br>o Water should be sprayed during the construction phase, at mixing sites, and temporary roads<br>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.<br>o Vehicles delivering materials should be covered to | **Complied**<br>o Monthly Environment Monitoring is being carried out and all the parameters are within the stipulated limit<br>o It is ensured that all vehicles entering the area have a valid PUC certification<br>o Vehicles entering the site have are following speed limit<br>o Tarpaulin cover is used for vehicles transporting the construction material<br>o Water sprinkling is carried out on the temporary roads by contractors<br>o Environment awareness program is provided to the personnel engaged in development work |

| Project Annex Facility (PAF) Zone - Construction Phase<br>*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 31.03.2021** |
| | | | reduce spills and dust blowing off the load.<br>o Environmental awareness program will be provided to the personnel involved in developmental works.<br>o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation. | |
| | | Noise | o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB.<br>o Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A).<br>o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used<br>o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors.<br>o Noise attenuation will be practiced for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers.<br>o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am | **Complied**<br>o 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<br>*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 31.03.2021** |
| | | | to 10 pm) to minimise noise impacts.<br>o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs,<br>etc.<br>o Ambient noise levels will be monitored at regular intervals | |
| 2 | Construction of Buildings, Roads, Parking features, etc. | Vegetation and Strain on existing infrastructure | o Most of the land is covered with coconut trees and few other trees. Trees that are cut down will be accounted for and the same no. of trees of the same or some other species will be replanted at another location to compensate for the loss of greenery.<br>o There are very few existing buildings and infrastructure on the PAF zone area land which will be acquired and people in that area will be rehabilitated. | **Will be Complied**<br>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. Additionally, as during the course of development of port more trees are being cut, AVPPL had applied for necessary permissions from Forest Dept. for cutting of trees. Thereafter, GoK and Forest Dept. have further identified land of area 35 Ha for Phase-2 of compensatory afforestation in lieu of trees felled for development of Vizhinjam port project. Phase-2 of the scheme has been approved by GoK. AVPPL, |

| Project Annex Facility (PAF) Zone - Construction Phase<br>*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 31.03.2021** |
| | | | | in collaboration with Forest department, nursery works have been completed and planting operations have begun in 11 Ha of area at Kerala University Campus, Karyavattom (at an aerial distance of 23 km from the Vizhinjam Port project site). |
| | | Existing Traffic | o Transportation of construction materials will be carried out during non-peak hours.<br>o Regularization of truck movement.<br>o The existing roads shall be strengthened and shall be used for the construction material transportation. | **Will be Complied** |
| | | Solid Waste | o Construction waste will be used within port site for filling of low lying areas.<br>o Composted bio-degradable waste will be used as manure in greenbelt. Other recyclable wastes will be sold.<br>o Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water.<br>o General refuse generated on-site will be collected in waste skips and separated from construction waste.<br>o Burning of refuse at construction sites will be prohibited. | **Will be Complied** |

| BACK UP AREA – Construction Phase<br>*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 31.03.2021** |
| 1 | Material transport and construction activities | Air Quality | o To reduce impacts from exhausts, emission control norms will be enforced / adhered.<br>o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards<br>o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt<br>o Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc.<br>o Provide enclosures on all sides of construction site<br>o Movement of material will be mostly during non-peak hours.<br>o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic<br>o Water sprinkling will be carried out to suppress fugitive dust<br>o Environmental awareness program will be provided to the personnel involved in developmental works<br>o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation | **Being Complied**<br>o Ambient air quality monitoring is carried out at 5 locations as per the Environment Monitoring Plan prescribed in EIA and has commenced since August 2016, the results obtained are within the limits prescribed by NAAQS<br>o It is ensured that all vehicles entering the port have PUCs<br>o Water sprinkling was carried out at regular interval over the temporary road during transportation of cut material.<br>o All the trucks transporting material are covered by tarpaulin cover.<br>o Signage's for speed control are placed within the port area<br>o Adequate storage for construction material is provided within the port area on reclaimed land<br>o Environmental awareness program was carried out for contractors working at site. |

| BACK UP AREA – Construction Phase<br>*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 31.03.2021** |
| | | Noise | o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB<br>o Procurement of machinery/construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A)<br>o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used<br>o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors<br>o Noise attenuation will be practiced for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers<br>o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimise noise impacts<br>o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc.<br>o Ambient noise levels will be monitored at regular intervals | **Being Compiled**<br>o All the machinery and vehicles are maintained to keep the noise at minimum<br>o Regular Noise monitoring is being carried since August 2016, and the readings are within the limits at port site<br>o At present only building work has commenced in limited way and barriers will be installed where ever necessary in future<br>o 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<br>*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 31.03.2021** |
| 2 | Construction Activities | Water Environment | o Formation level should be raised according to the design and the cross drainage structures suitably planned for the flood events.<br>o All justifiable measures will be taken to prevent the wastewater produced during construction from entering directly into the water bodies. | **Being Compiled**<br>o 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.<br>o No wash water is disposed into the water bodies.<br>o 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 | o On slopes and other suitable places along the two proposed corridors, trees and grass should be planted.<br>o On sections with filling and deep cutting their slopes should be covered by sod, or planted with grass, etc.<br>o If existing irrigation and drainage system, ponds are damaged, they will be suitably repaired.<br>o Retaining walls and gabions shall be suitably provided. | **Will be Complied** |
| | | | o Arable land should not be used for topsoil | **Will be Complied** |

| BACK UP AREA – Construction Phase<br>*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 31.03.2021** |
| | | | borrowing.<br>o Topsoil will be kept and reused after excavation is over.<br>o Any surplus to be used on productive agricultural land. | |
| | | | o Construction vehicles should operate within the Backup Areas avoiding damage to soil and vegetation. | **Being Complied**<br>Construction vehicles are being operated only alongside the road and port boundaries; thereby avoiding damage to soil and vegetation. |
| | | | o Areas of trees cleared will be replaced according to Compensatory Afforestation Policy under the Forest Conservation Act - 1980.<br>o Landscaping shall be done at major junctions. | Refer point No.15 of Environment Management Plan – Road/Rail Corridors |
| | | | o Tree clearing within the backup areas should be avoided beyond that which is directly required for construction activities and/or to reduce accidents. | Will be complied to the extent possible considering the technical requirements |

# Annexure VII

# G.O(Rt)No.183/2018/F&WLD – Approved Scheme for Phase-2 Afforestation

**GOVERNMENT OF KERALA**

**Abstract**

Forest & Wildlife Department- Implementation of the scheme for compensatory afforestation in lieu of tree felling for development of Vizhinjam International seaport project by M/S Adani Vizhinjam port private Limited- Phase II- Administrative Sanction accorded- Orders issued.

**FOREST & WILDLIFE (E) DEPARTMENT**

**G.O.(Rt)No.144/2020/F&WLD** Dated,Thiruvananthapuram, 26/06/2020

Read: 1 G.O(Rt.)No.183/2018/F&WLD dated 21/04/2018

2 Letter No.SW3-18396/17; dated 15/05/2020 from the Additional Principal Chief conservator of Forests(Social Forestry), Thiruvananthapuram.

**ORDER**

As per G.O read as 1st paper above, administrative sanction was accorded for the implementation of the scheme of compensatory afforestation in lieu of tree felling for Vizhinjam International seaport project by M/s Adani Vizhinjam Port Private Limited- Phase I with the financial outlay of ₹80,50,000/- (Rupees Eighty Lakhs Fifty Thousand only). Now, the Additional Principal Chief conservator of Forests (Social Forestry), Thiruvanathapuram as per his letter read 2nd paper above, submitted a scheme for compensatory afforestation in 35 Ha.of land identified at Kerala University Campus, Kariyavattom, Sewage treatment plant, Valiyathura, Vikram Sarabhai Space Centre, Thumba, Travancore Titanium Products Lmt, Veli respectively for compensatory afforestation during 2020-21 with a budget estimate for Rs. 261 lakh.

Government have examined the matter in detail are pleased to aacord administrative sanction for the implementation of the scheme for compensatory afforestation Phase II in lieu of tree felling for Vizhinjam International Seaport Project for an amount of ₹261 lakh (Rupees Two crores Sixtyone lakhs) at the expenditure of M/s Adani Vizhinjam Port Pvt Limited. The scheme appended is also approved.

(By order of the Governor)
**JAYASREE M**
**DEPUTY SECRETARY**

To:

The Principal Chief Conservator of Forests & Head of Forest Force, Thiruvananthapuram

The Additional Principal Chief Conservator of Forests, (Social Forestry),

Thiruvananthapuram

The Principal Accountant General (Audit) Kerala, Thiruvananthapuram

The Accountant General (A&E/Audit), Kerala, Thiruvananthapuram

The Fisheries and Ports Department

The I & P R (Web & New Media) department.
Stock file/Office copy

Forwarded /By order

Section Officer

# Annexure VIII

# EMP Expenditure (October 2020 to March 2021)

| adani | Adani Vizhinjam Port Private Ltd | From : October 2020<br>To : March 2021 |
|---|---|---|

**Vizhinjam International Deepwater Multipurpose Seaport**
**EMP Expenditure**

**EMP Expenditure:** **Annexure VIII**

| S. No. | Environmental Management Plan | Commitment in EIA | Oct 2016 to Mar 2017 | Apr 2017 to Sep 2017 | Oct 2017 to Mar 2018 | Apr 2018 to Sep 2018 | Oct 2018 to Mar 2019 | Apr 2019 to Sep 2019 | Oct 2019 to Mar 2020 | Apr 2020 to Sep 2020 | Oct 2020 to Mar 2021 | 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 | 0.30 | 0.29 | 0.152 | 0.298 | 2.79 |
| 5 | Water quality monitoring at major water bodies | 0.054 | | | | | | | | | | |
| 6 | Noise monitoring at sensitive locations | 0.009 | | | | | | | | | | |
| 7 | Soil quality monitoring at sensitive locations | 0.002 | | | | | | | | | | |
| 8 | Marine water quality and sediment and marine biology | 1.08 | | | | | | | | | | |
| 9 | Shoreline changes | 0.3 | 1.059 | 1.08 | 1.36 | 1.68 | 1.65 | 1.02 | 1.52 | 1.295 | 1.363 | 12.027 |
| 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 : October 2020<br>To : March 2021 |
|---|---|---|

**Vizhinjam International Deepwater Multipurpose Seaport**
**EMP Expenditure**

| S. No. | Environmental Management Plan | Commitment in EIA | Oct 2016 to Mar 2017 | Apr 2017 to Sep 2017 | Oct 2017 to Mar 2018 | Apr 2018 to Sep 2018 | Oct 2018 to Mar 2019 | Apr 2019 to Sep 2019 | Oct 2019 to Mar 2020 | Apr 2020 to Sep 2020 | Oct 2020 to Mar 2021 | 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 | 0.135 | 0.685 |
| 17 | Water and waste water treatment plants | 4 | - | - | - | - | - | - | - | - | - | 0 |
| 18 | Battery of toilets with bimonthly maintenance provision | 1 | - | - | - | - | - | - | - | - | - | 0 |
| 19 | Desilting and strengthen of Streams | 0.5 | - | - | - | - | - | - | - | - | - | 0 |
| 20 | Enhancement of water bodies (ponds along road & rail) | 0.1 | - | - | - | - | - | - | - | - | - | 0 |
| 21 | Enhancement of religious structures (Temple) | 0.05 | - | - | - | - | - | - | - | - | - | 0 |
| 22 | Cultural property rehabilitation cost for sacred grove | 0.01 | - | - | - | - | - | - | - | - | - | 0 |
| | **TOTAL** | **39.937** | **1.409** | **1.44** | **2.46** | **3.193** | **2.27** | **1.37** | **1.96** | **1.572** | **1.796** | **17.47** |

# Annexure IX

# Environment Health, Safety & CSR Organizational Structure

**Annexure IX**

**Environment Health, Safety & CSR Organizational Structure:**

| S. No. | Name | Designation | Experience | Qualification | Organization |
|---|---|---|---|---|---|
| 1. | Prasad Kurien | GM-Environment | 30 years | B-Tech Civil Engg., M-Tech Env Engg., PMP | VISL |
| 2. | Y D Manmohan | Environment Specialist | 30 Years | BE – Civil Engg ME Env. Engg. | STUP |
| 3. | Anil Balakrishnan | Head – CSR | 23 Years | MSW, Phd. | AVPPL |
| 4. | Hebin C | Head – Environment | 14 Years | MS, Oceanography & Coastal Area Studies | AVPPL |
| 5. | Jesse Benjamin Fullonton | Assistant Manager - Environment | 10 Years | BSc. Chemical Tech; Msc. Env. Tech | AVPPL |
| 6. | Kanwar P Malik | Head - Horticulture | 16 Years | BSc - Agriculture | AVPPL |
| 7. | Arumugam S | Assistant Manager - Safety, Environment and Health | 2 Years | M.Tech – Industrial Safety Engineering | AVPPL |
| 8. | Sebastian Britto. A.G | Sr. Project Officer | 24 Years | MA, Economics | AVPPL |
| 9. | Rakesh R.S | Sr. Project Officer | 23 Years | MBA, Bsc Agriculture | AVPPL |
| 10. | Stephen Vinod | Project Officer | 20 Years | BA, Economics | AVPPL |
| 11. | George Zen | Consultant – Livelihood | 35 Years | BA, Sociology | AVPPL |
| 12. | Maya G | Project Officer Community Health | 11 Years | BA, IT-TTC | AVPPL |
| 13. | Meera Mariyam Skariah | Community Mobilizer | 3 Years | MSW | AVPPL |
| 14. | Shaji Joseph | Safety Executive | 13 Years | Diploma in mechanical & Diploma in fire and safety | HOWE |

# Annexure X

# CTE for Consumer Pump inside the Vizhinjam Port

**FILE NO. :PCB/TVM-DO/ICE/NTA/PTP/01/2021**
**Date of issue :05/03/2021**

# KERALA STATE POLLUTION CONTROL BOARD

## CONSENT TO ESTABLISH

ISSUED UNDER

**Section 25 of Water (Prevention & Control of Pollution) Act, 1974**
**Section 21 of the Air (Prevention & Control of Pollution) Act, 1981**

and

**Environment (Protection) Act, 1986**

**As per Application No. :15226590**
**Dated:02-03-2021**

**TO**

**M/s AVPPL- CONSUMER FUEL STATION**
**Adani Vizhinjam Port Pvt Limited**
**Second Floor,**
**Vipanchika Tower,**
**Thycaud,**
**Trivandrum,**
**Kerala-695014**

**Consent No. :PCB/TVM-DO/NTA/PTP/15/2021**

**Valid Upto :28/02/2026**

## 1. GENERAL

1.1. This integrated consent is granted subject to the power of the Board to withdraw consent, review and make variation in or revoke all or any of the conditions as the Board deems fit.

| | | |
|---|---|---|
| 1 | **VALIDITY** | 28/02/2026 |
| 2 | Name and Address of the establishment | AVPPL- CONSUMER FUEL STATION ADANI VIZHINJAM PORT PVT LTD<br>MULLOR POST<br>VIZHINJAM TRIVANDAM 695521 |
| 3 | Communication | Telephone :91-9099056757<br>Fax :0471-2325600<br>E-mail:hebin.c@adani.com |
| 4 | Occupier Details | Adani Vizhinjam Port Pvt Limited<br>Second Floor, Vipanchika Tower,<br>Thycaud, Trivandrum, Kerala-695 014. |
| 5 | Local Body | Vizinjam |
| 6 | Survey Number | At Vizhinjam Port Area |
| 7 | Village | Vizhinjam |
| 8 | Taluk | NEYYATTINKARA |
| 9 | District | Thiruvananthapuram |
| 10 | Capital Investment(Rs in Lakhs) | 150 LAKHS |
| 11 | Scale | Small |
| 12 | Category | GREEN |
| 13 | Annual fee(Rs)<br><br>Total Fee remitted(Rs) | 18250/-<br><br>91250/- |
| 14 | RAW MATERIAL | PRODUCTS |
| | | High speed Diesel @400 Kilo Liters |
| 15 | Total Power Required (HP) | Specified later |

## 2. CONDITIONS AS PER
## The Water(Prevention and Control of Pollution)Act, 1974

2.1 In case of generation of trade effluent from the industry, effluent treatment system consisting of treatment units having adequate capacity established as per the proposal submitted along with the application shall be made functional before commissioning. Additional facilities required, if any, to achieve the standards laid down by the Board u/s 17(1) (g) of the Water Act shall also be made along with.

2.2 Water Consumption : 2000 L/DAY

2.3 Effluent Generation : 1600L/day

2.4 The characteristics of effluent after treatment shall confirm to the following tolerance limits:

| **SI.NO.** | **Characteristics** | **Unit** | **Tolerance Limit** | |
|---|---|---|---|---|
| | | | **Sewage** | **Trade Effluent** |

2.5 Mode of disposal of treated effluent : Treated water will be used for greenbelt

## 3. CONDITIONS AS PER
## The Air(Prevention and Control of Pollution)Act, 1981

3.1 Adequate air pollution control measures shall be provided before commissioning of the industry. Additional facilities required, if any, to achieve the standards laid down by the Board shall also be made along with.

| Stack No. | Sources of Emission | Emission Rate(Nm3/Hr) | Stack Height above | | Control Equipment |
|---|---|---|---|---|---|
| | | | Ground Level | Roof Level | |
| 1 | D G SET OF CAPACITY 50 kvA | | 2.5 m | | ACOUSTIC ENCLOSURE |

3.2 Emission characteristics shall not exceed the following:

| SI.No. | Parameter | Limiting Standards (mg/Nm3) |
|---|---|---|

## 4. CONDITIONS AS PER
## The Environment (Protection) Act, 1986.

4.1 The construction activities shall be carried out strictly in compliance with the provisions of the Noise Pollution (Regulation and Control)Rules 2000.

4.2 Used lead acid batteries shall be disposed of as per the Batteries (Management and Handling) Rules, 2001

4.3 Hazardous waste generated, if any, shall be handled as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

4.4 e-waste shall be disposed off safely as per the E-Waste (Management) Rules, 2016.

## 5. SPECIFIC CONDITIONS

5.1 This consent is granted subject to the power of the Board to review/revoke the consent as the Board deems fit and make variations in all or any of the conditions as per section 21 of the Air (Prevention and Control of Pollution) Act 1981 and section 25 of the Water (Prevention and Control of pollution) Act 1974.
5.2 No change or alteration of the unit shall be made without the prior permission of the Board. Any change in the particulars furnished in the references and/or in the identity of the occupier/authorized agent shall be intimated to the Board forthwith.
5.3 This consent unless withdrawn earlier and subject to condition no. 5.1 shall be valid for five years from the date of issue. At the end of validity period if the construction is in progress the same shall be renewed through online. If the construction is yet to be started, the applicant shall apply afresh for consent to establish.
5.4 The date of commissioning of the unit shall be intimated to the Board in advance.

5.5 The applicant shall obtain Integrated Consent to Operate from the Board before commissioning of the

unit.

5.6 The applicant shall comply with the instructions that the Board may issue from time to time regarding prevention and control of air, water, and land pollution.

5.7 Sufficient number of oil traps shall be provided in the premises of the unit so that spillages and wastewater do not mix with storm water and the natural drains of the surrounding area are protected.

5.8 Waste oil generated during evacuation of storage tanks shall be disposed as per provisions of the Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008.

5.9 Additional safety measures as prescribed by Petroleum & Explosives Safety Organisation (PESO) shall be implemented.

5.10 Subject to condition 5.9, fill point, dispensing unit, vent pipes etc. shall be established keeping a minimum distance of 50 m from schools, residences, hospitals etc.

5.11 The storage tanks shall be placed in cement concreted enclosure to prevent any leakage.

5.12 The DG set, if proposed, installed keeping a minimum distance of square root of (KVA/2) meter from other residences and shall be provided with acoustic enclosure.

5.13 The concentration of Particulate Matter in ambient air measured at 1 m from the boundary of the unit shall not exceed 100 microgram/m3.

5.14 There shall not be any fugitive emission or effluent discharge from the premises of the unit.

5.15 Safety measures including provision for detecting any fuel leak from the storage tanks and preventive measures for any ground water contamination shall be provided as per the advice from the concerned oil company. There shall not be any leakage of storage tanks into the ground water.

5.16 Necessary clearness from Fire & Rescue Departments and other Government Institutions shall be obtained prior to starting of construction of the retail outlet.

5.17 Necessary clearances shall be obtained from KCZMA prior to starting of construction of the retail outlet.

5.18 This consent is granted on the basis of the inspection, affidavit and other documents furnished by the applicant. If the statement furnished in the affidavit /document is found false, the consent issued will be withdrawn/cancelled.

5.19 Rent agreement /consent of land owner shall be renewed periodically, failing which the consent will become invalid automatically.

5.20 The location of the industry/out let shall be as per the approved drawing attached. No change or

alteration to it shall be made without prior permission of the Board.

DATE :07/03/2021

SIGNATURE & SEAL OF ISSUING AUTHORITY

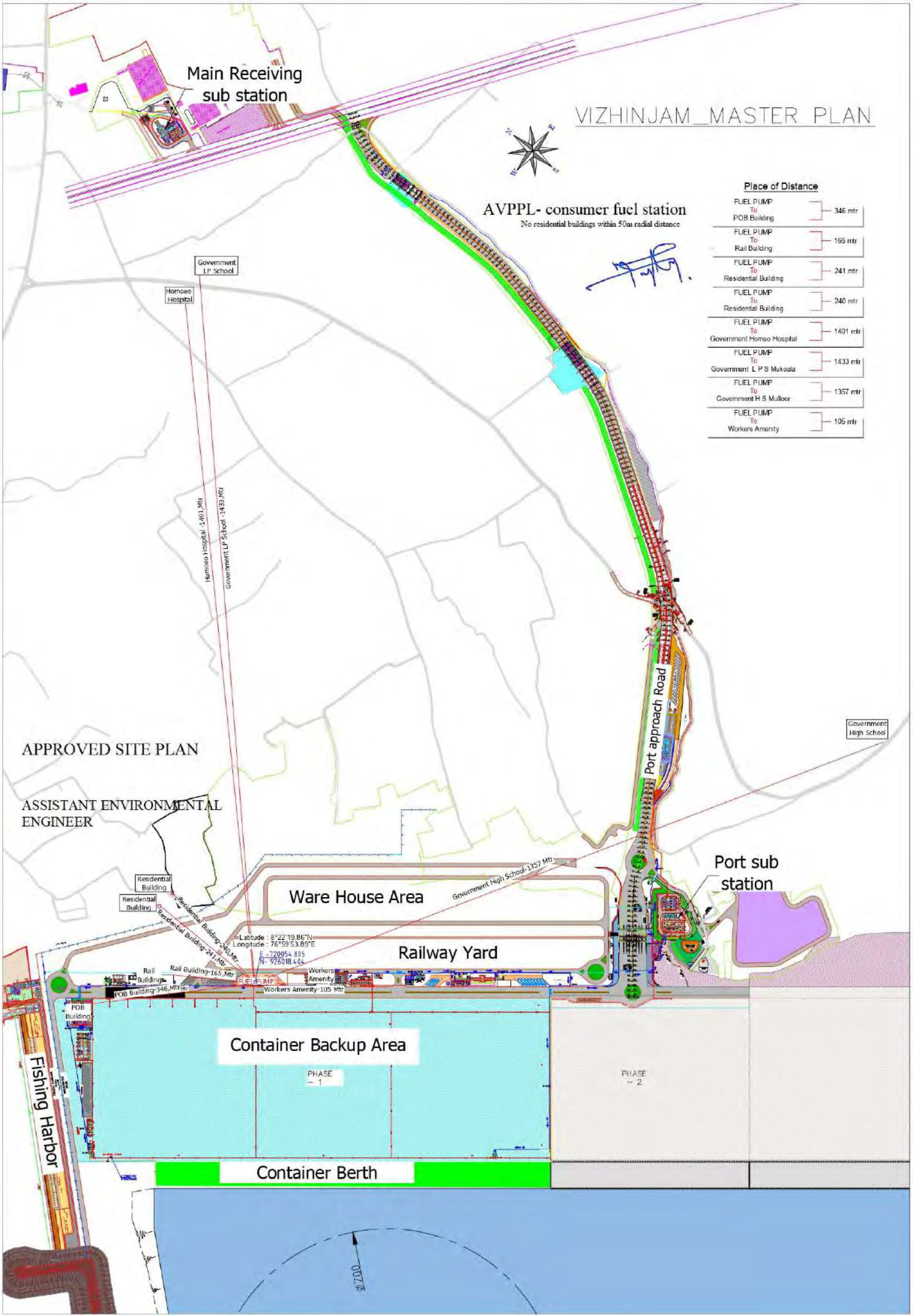
ASSISTANT ENVIRONMENTAL ASSISTANT
ENVIRONMENTAL ENGINEER ,
DISTRICT OFFICE THIRUVANANTHAPURAM

To

Adani Vizhinjam Port Pvt Limited  Second Floor,
Vipanchika Tower,
Thycaud,
Trivandrum,
Kerala-695014

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

2. For verifying this document please go to krocmms.nic.in and search using date of issue/name of the unit/Application Number in “Consent Granted Applications” link in the home page of the Board’s Online Consent Management and Monitoring System.


VIZHINJAM_MASTER PLAN
Main Receiving sub station
AVPPL- consumer fuel station
No residential buildings within 50m radial distance
Place of Distance
FUEL PUMP To POB Building 346 mtr
FUEL PUMP To Rail Building 165 mtr
FUEL PUMP To Residential Building 241 mtr
FUEL PUMP To Residential Building 240 mtr
FUEL PUMP To Government Homeo Hospital 1401 mtr
FUEL PUMP To Government L P S Mukoala 1433 mtr
FUEL PUMP To Government H S Mulloor 1357 mtr
FUEL PUMP To Workers Amenity 105 mtr
Government LP School
Homoeo Hospital
Homoeo Hospital -1401 Mtr
Government LP School -1433 Mtr
Port approach Road
Government High School
APPROVED SITE PLAN
ASSISTANT ENVIRONMENTAL ENGINEER
Residential Building
Residential Building
Residential Building-240 Mtr
Residential Building-241 Mtr
Government High School-1357 Mtr
Ware House Area
Port sub station
Latitude : 8°22'19.86"N
Longitude : 76°59'53.89"E
E -720054.805
N- 926018.404
Railway Yard
Rail Building
Rail Building-165 Mtr
FUEL PUMP
Workers Amenity
Workers Amenity-105 Mtr
POB Building-346 Mtr
POB Building
Container Backup Area
PHASE -- 1
PHASE -- 2
Fishing Harbor
Container Berth

# Annexure XI

# Extension of EC Validity Letter from MoEF&CC

**F. No. 11-122/2011-IA.III**
**Proposal No. : IA/KL/MIS/178082/2020**
Government of India
Ministry of Environment, Forests and Climate Change
(I.A. Division)

**Indira Paryavaran Bhawan**
**Jor Bagh Road, Ali Ganj,**
**New Delhi - 110003**
**E-mail: ad.raju@nic.in**
**Tele fax: 011: 24695296**

Dated: 29th December, 2020

**To**

**The GM Environment**
M/s Vizhinjam International Seaport Ltd.
1st floor, Vipanchika Towers, Thycaud,
Thiruvanathapuram – 695 001, Kerala

**Subject: Development of Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam in Thiruvananthapuram district, Kerala by M/s Vizhinjam International Seaport Ltd. - Extension of validity of Environmental and CRZ Clearance**

**Ref.: (i) MoEF EC letter No. 11-122/2011-IA.III, dated 03rd January 2014**
**(ii) Your letter No. VISL/2014-15/EE&EI-9/368, dated 06th October 2020**

Sir,

This is in continuation of this Ministry's letter of even number as referred above and your letter under reference, wherein you have requested the Ministry for Extension of Validity of the aforesaid proposal.

2. Your application was considered and placed before the EAC for extension of validity of Environmental Clearance for the period of three years as per MoEF&CC Notification dated 14th September, 2016. Environmental and CRZ Clearance for the aforementioned project was granted *vide* letter no. 11-122/2011-IA.III, dated 03rd January 2014, which is valid up to 02nd January, 2021.

3. Following reasons were given for extension of the validity period of EC/CRZ clearance-

i. Initial time consumed (about two years) for the global bid process in selecting a concessionaire for this government project under PPP model after the issuance of EC.
ii. Delay in construction of breakwater due to difficulties reported by the concessionaire in sourcing rock
iii. Work of dredging and reclamation, berth, container yard can only be completed with the advancement of breakwater.
iv. Outbreak of COVID 19 pandemic and its impacts.

4. The EAC, taking into account the submission made by the project proponent for the current proposal "Development of Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam in Thiruvananthapuram district, Kerala by M/s Vizhinjam International Seaport Ltd" had a detailed deliberation during its 247th meeting held on 23rd - 24th November, 2020 and recommended the proposal for extension of the validity of Environmental and CRZ Clearance granted by the Ministry *vide* letter No. 11-122/2011-IA.III, dated 03rd January 2014 for further period of three years i.e., up to 02nd January, 2024 with all conditions as specified in the same Environmental Clearance letter.

5. The Ministry of Environment, Forest and Climate Change has considered the proposal based on the recommendations of the Expert Appraisal Committee (Infrastructure, CRZ and other Miscellaneous projects) and hereby decided to accord extension of validity of EC of aforementioned project issued by the Ministry *vide* letter No. 11-122/2011-IA.III, dated 03rd January 2014 for further period of three years i.e., up to 02nd January, 2024 under the EIA Notification, 2006 as amended, subject to strict compliance of all conditions specified in the EC letter of even no. dated 03rd January 2014.

This issue with the approval of the competent Authority

**(Amardeep Raju)**
Scientist-E

Copy to:

1. The additional chief Secretary, Department of Environment, Govt. of Kerala, Thiruvanathapuram – 695 001, Kerala.
2. Member Secretary, Kerala Coastal Zone Management Authority and Member Secretary, Kerala State Counsel for Science Technology and Environment, Sasthra Bhavan, Pattom, Thiruvananthapuram 695004, Kerala.
3. The Member Secretary, Kerala Pollution Control Board, Plamoodu Jn., Pattom Palace PO, Thiruvananthapuram 695004, Kerala.
4. Addl. Principal Chief Conservator of Forest (C) Ministry of Env., Forest and Climate Change, Regional Office (SZ), Kendriya Sadan, 4th Floor, E&F Wings, 17th Main Road, Koramangala II Block, Bangalore – 560034.
5. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi – 32.
6. Monitoring Cell, MoEF&CC, Indira Paryavaran Bhavan, New Delhi.
7. Guard File/Record File
8. Notice Board.

**(Amardeep Raju)**
Scientist-E

# Annexure XII

# Submission Email of HYCR for the Period April 2020 to September 2020

## Jesse Benjamin Fullonton

**From:** PRASAD KURIEN <prasad.kurien@vizhinjamport.in>
**Sent:** Tuesday, 1 December, 2020 01:58 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; MD & CEO
**Subject:** EP12.1/7/2013-14/Ker - Apr 2020 - Sep 2020-
**Attachments:** EC_F. No. 11-1222011-IA.III dated 03.01.2014-HYCR-Apr2020-Sep2020_ 27.11.2020_cd.pdf



Subject: EP12.1/7/2013-14/Ker - Apr 2020 - Sep 2020

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 Apr 2020 to Sep 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 (HYCR) of Conditions of Environmental and CRZ Clearance for the Period October 2020 to March 2021**

**May 2021**