Vizhinjam International Seaport Limited

(A Government of Kerala Undertaking)

VISL/2014-15/EE&EI-9/229

27-05-2016

Additional Director (S)
Ministry of Environment, Forests & Climate Change, Regional Office (Southern Zone)
Kendriya Sadan, IV Floor, E & F Wings 17th Main Road, IInd Block, Koramangala,
BANGALORE-560 034,
PH :080-25532577. Fax: 080-25537184,

Dear Sir,

Sub: Vizhinjam International Deepwater Multipurpose Seaport - Environmental Clearance – Half yearly Compliance report

Ref: 1) F.No. 11-122/2011-IA.III dated 3rd Jan 2014 of MoEF issuing Environmental Clearance
2) No.1285/A3/13/KCZMA/S&TD dated 24-08-2013

This has reference to the Environmental & CRZ Clearance (EC) issued on 3rd Jan 2014 (ref 1) by the Ministry of Environment, Forests & Climate Change (MoEF&CC) to the proposed Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam in Thiruvananthapuram District in Kerala State based on the recommendation of the KCZMA vide the reference cited (2).

The compliance report of conditions stipulated in the cited references for the half yearly period from October 2015 to March 2016 is enclosed herewith, in both hard and soft copy for records and reference.

Yours faithfully
For Vizhinjam International Seaport Ltd.

Managing Director & CEO

Encl: Compliance report (hard & soft copy)

Copy to:

(1) The Director (Monitoring-IA III Division), Ministry of Environment, Forests & Climate Change, Indira Paryavaran Bhavan, Jor Bagh, New Delhi

(2) The Scientist D & in charge, Central Pollution Control Board (CPCB), Zonal Office, 1st & 2nd Floors, Nisarga Bhavan, A Block, Thimmaiah Main Road, 7th D Cross, Shivanagar, Opp.Pushpanjalai Theatre, Bengluru-560010

(3) Chief Environmental Engineer, Kerala State Pollution Control Board, Thiruvanathapuram Regional Office, Plamoodu. Pattom P.O., Thiruvananthapuram- 695 004

(4) Member Secretary, KCZMA, Shatra Bhavan, Pattom.P.O, Thiruvananthapuram-4

(5) Shri. Santoshkumar Mohapatra, Director & CEO, Adani Vizhinjam Port Private Ltd (AVPPL), 2nd Floor, Vipanchika Tower, Near Govt. Guest House, Thycaud. P.O., Thiruvananthapuram-14

Vizhinjam International Seaport Limited
(A Government of Kerala Undertaking)

Vizhinjam International Deepwater Multipurpose Seaport

Half yearly Compliance report of conditions of

Environmental and CRZ Clearance

Period: Oct 2015 to March 2016

May 2016

Vizhinjam International Deepwater Multipurpose Seaport

Half yearly Compliance report of conditions of

Environmental and CRZ Clearance

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Vizhinjam International Deepwater Multipurpose Seaport

Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance

Preface

The Vizhinjam International Deepwater Mutipurpose Seaport project is a flagship project of the Government of Kerala (GoK) . The project site is located at Vizhinjam, 16km south of the capital city of Thiruvananthapuram. A fully owned company of the GoK named Vizhinjam International Seaport Ltd.(VISL), was formed to oversee the activities related to the development of the project.

The Ministry of Environment, Forests & Climate Change (MoEF), Government of India issued Environmental & CRZ clearance to the project vides its letter F.No.11-122/2011-IA.IIIdated 3rd Jan 2014. This was based on the recommendations of the Expert Appraisal Committee (EAC) of the MoEF which considered (i) the Comprehensive Environmental Impact Assessment (EIA) study report, (ii) Environmental Public hearing report, (iii) other related reports and (iv) recommendations of the Kerala Coastal Zone Management Authority.

Pursuant to the Environmental Clearance, the Government of Kerala has entered into a concession agreement with M/s Adani Vizhinjam Port Private Ltd. (AVPPL), on 17th Aug 2015 for development and operation of the project for a concession period of 40 years. The preliminary works for the development of the project were initiated at the site on 16th November 2015, followed by official inauguration on 5th Dec 2015. As required under the Environmental & CRZ clearance, this document containing the half yearly compliance report for the period from October 2015 to March 2016 is submitted.

Since the Environmental Clearance was issued to Vizhinjam International Seaport Ltd. (VISL), by the MoEF, this compliance report is being submitted by VISL. Considering that the concessionaire, M/s Adani Vizhinjam Port Private Ltd. (AVPPL) is developing the port for operation with a concession period of 40 years, VISL intends to transfer the EC to M/s AVPPL, for which application is being submitted to the MoEF simultaneously.

Managing Director & CEO

Vizhinjam International Seaport Ltd.

Thiruvananthapuram

27th May 2016

Section 1

Half yearly Compliance report on conditions stipulated in

Environmental & CRZ Clearance

(Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Section 1 Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi) (Compliance Period: Oct 2015 to March 2016)		
Sr. No.	**Conditions**	**Compliance Status as on 31-03-2016**
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.	"Consent for Establishment" has been obtained from Kerala State Pollution Control Board (KSPCB) vide Consent No. PCB/HO/TVM/ICE/ 08/2015 dated 15.09.2015. Copy attached as **Annexure 1**. Compliance of this will be separately submitted to KSPCB as required.
(ii)	Project Proponent shall carry out intensive monitoring with regulatory reporting six monthly on shore line changes to the Regional Office, MoEF.	Shoreline monitoring of 40 Km stretch (20km on either side of port site) is being done. Report for the period from Feb 2015 to May 2015 was submitted to MoEF vide letter No. VISL/2014-15/EE&EI-9/1047 dated 27-11-2015. Report for the period from June 2015 to October 2015 enclosed as **Annexure 2** in CD. Report for the period from November 2015 to Feb 2016 will be forwarded to MoEF after review by National Institute of Ocean Technology (NIOT), Chennai, the technical advisors to the shoreline monitoring programme.
(iii)	The capital dredged material (7.6 Mm^3) shall be utilized for reclamation of berths.	Dredged material is being used for reclamation purposes only.
(iv)	Additional fish landing centre shall be developed as part of the proposed Vizhinjam port for upliftment of fisheries sector.	The work for construction of the fish landing centre (Rs.16 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
(v)	The project shall be executed in such a manner that there is minimum disturbance to fishing activity.	Construction of the project is confined to the project area only. Regular interaction taking place between project personnel and fishermen for dissemination of information on the progress of the works..

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Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)
(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
(vi)	Steps would be taken to safeguard the interests of the fisheries sector as detailed in the Resettlement Action Plan (RAP), Corporate Social Responsibility (CSR) and in the Integrated Fishing Community Management (IFCMP), namely a component of Rs.7.1 crores as part of the compensation package for the fisheries sector, as livelihood restoration measures for mussel collectors, shore seine fishermen and others. Rs.41.30 crores as part of CSR activities in the fisheries sector under (i) water supply scheme (7.3crores) (ii) new fishing landing centre (16crores) (iii) adoption of existing fishing harbor (5crores) (iv) sea food park (4crores) (iii) skill development centre (4crores) (iv) environmental sanitation (3crores) and (v) solid waste management (2crores).	In consultation with the fishermen, an enhanced livelihood compensation package amounting to Rs. 23.80 crores was sanctioned by GoK, instead of Rs.7.1 crores suggested earlier in the EIA stage. Out of this amount, Rs.11.70 crores have been disbursed till 21st May 2016 for a total number of 183 livelihood affected PAP's whose verification were complete in all respects. Verification of the documents of balance PAP's are in progress. The status of the CSR activities envisaged in the fisheries sector is as follows. **Water supply** : Scheme has been commissioned in April, 2013 by VISL by expending an amount of Rs. 7.33 crores. For O&M of the same an amount of Rs.2.94 crores has been spent till date. **Fish Landing centre**: The work for construction of the fish landing centre (Rs.16 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. **Existing fishing harbour**: Action for modernization of the existing fishing harbour is being initiated through the harbour engineering department. **Seafood park**: Action for procurement of land for seafood park (Rs.26 crores) has been initiated by VISL **Skill development centre**: Action being initiated through Adani Foundation, the CSR wing of AVPPL **Environmental sanitation & Solid Waste Management:** Action initiated through Adani Foundation, the CSR wing of AVPPL in the wards in the neighbourhood of the project, viz.Vizhinjam, Kottappuram & Harbour

Section 1

Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
(vii)	Rail connectivity shall be parallel to the harbour road on elevated structures at +4/5.00 m level without affecting the entry to the existing harbor.	The same will be taken into consideration while designing the railway line.
(viii)	Compensation packages in accordance with the Central/State Government norms shall be given to all the authorized-cum-affected (having valid clearances as applicable) resort owners.	Discussion for fixing of compensation packages for the affected resort owners have been initiated by the District level Planning Committee (DLPC) headed by the District Collector and is in progress
(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.	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.	Refer to item (vi) above. In addition to the above, AVPPL as part of its CSR activities have initiated the following in the region through Adani Foundation. (i) Sanitation & Solid Waste Management (ii) Skill development (iii) Employability centre (iv) Rural infrastructure upgradation & (v) Drinking water supply. AVPPL have installed 16 water tanks in the water scarce areas in the project neighbourhood and water is being supplied on a daily basis on mobile water tankers.
(xi)	Oil Contingency Management Plan shall be put in place.	Oil Contingency Management Plan will be prepared and implemented during operation phase.
(xii)	All the recommendations/conditions stipulated by Kerala Coastal Zone Management Authority (KCZMA) shall be complied with.	Compliance report of KCZMA is enclosed in **Section 2**

Section 1

Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
(xiii)	The responses/commitments made during public hearing shall be complied with in letter and spirit.	The status of the commitments made during Public Hearing & actions on the same is enclosed as **Annexure 3**
(xiv)	All the recommendation of the EMP shall be complied with in letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF along with half yearly compliance report to MoEF-RO.	Status of EMP is enclosed as **Annexure 4**
(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.	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
(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.	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.	There will not be any withdrawal of groundwater in CRZ Area.
(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.	The project is in construction phase. The same shall be complied during operational phase.

Section 1

Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
(xix)	No hazardous chemicals shall be stored in the Coastal Regulation Zone area.	No hazardous chemical is being stored in the Coastal Regulation Zone area.
(xx)	The waste water generated from the activity shall be collected, treated and reused properly.	The project is in construction phase. The same shall be complied during operational phase
(xxi)	Sewage Treatment facility should be provided in accordance with the CRZ Notification.	The detailed port facility layout planning is under progress. Provision for installing sewage treatment facility will be kept and implemented.
(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.	No solid waste is being disposed of in the Coastal Regulation Zone area.
(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.	Will be complied
(xxiv)	No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.	Construction of the project is as per the approvals obtained.
(xxv)	The approach channel shall be properly demarcated with lighted buoys for safe navigation and adequate traffic control guidelines shall be framed.	The project is in construction phase. The same will be complied during operational phase
(xxvi)	The project proponent shall take up development of green belt in the project area, wherever possible. Adequate budget shall be provided in the Environment Management Plan for such development.	Will be complied

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Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
(xxvii)	The fund earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes.	Willl be complied
(xxviii)	The project proponent shall set up an organisational 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.	An officer of VISL has been designated as Head (EHS & CSR) for effective implementation of the stipulated EHS safeguards & CSR activities. AVPPL, the concessionaire executing the project has also appointed officers for EHS & CSR. In addition to the above, independent environment, health and safety consultants are being appointed as required in the concession agreement signed with AVPPL.
(xxix)	Staff Colony should be located beyond CRZ area.	Port facility planning will be 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.	All the construction activities are being carried out as per existing Central/local rules. Necessary permissions under CRZ Notification 2011 & its amendments have been obtained. Further, necessary approvals from concerned Statutory Departments / Agencies have been obtained for the construction designs/drawings relating to the proposed construction as mentioned hereunder. ❖ Consent to Establish from State Pollution Control Board vide Consent No. PCB/HO/TVM/ICE/08/2015, dated 15.09.2015. ❖ All permits required for construction of buildings as per building by laws will be obtained. ❖ Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 7.12.2015 **(Annexure-5)**

Section 1

Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
(ii)	Adequate provision for infrastructure facilities including water supply, fuel and sanitation must be ensured for construction workers during the construction phase of the project to avoid any damage to the environment.	Necessary infrastructure facilities viz, water supply, fuel & sanitation are being provided to the construction workers.
(iii)	Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.	At present no land side digging activity is being carried out.
(iv)	Borrow sites for each quarry sites for road construction material and dump sites must be identified keeping in view the following: (a) No excavation or dumping on private property is carried out without written consent of the owner. (b) No excavation or dumping shall be allowed on wetlands, forest areas or other ecologically valuable or sensitive locations. (c) Excavation work shall be done in close consultation with the Soil Conservation and Watershed Development Agencies working in the area, and (d) Construction spoils including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump sites for such materials must be secured so that they shall not leach into the ground water.	Quarry material shall be obtained from approved quarry sites only. The road so far constructed (a temporary road for construction purposes) has been made with material available on site and a) No excavation has been carried out in private property b) No excavation or dumping has been carried out in wetlands, forest area etc. c) No major excavation has been undertaken d) 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.	Quarry material shall be obtained from approved quarry sites only.

Section 1

Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
(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.	• No solid waste is being disposed of in the Coastal Regulation Zone area. • Solid waste will be handled as per the Solid Waste (Management and Handling) Rules, 2000. • Sewage Treatment Plant (STP) of 50 KLD will be installed in phased manner • Regular Air, water & noise monitoring will be carried out and reports will be submitted to the Kerala State Pollution Control Board
(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.	Consent for Operate (CFO) under the Water (Prevention and control of Pollution) Act, 1974 and the Air (Prevention and control of Pollution) Act, 1981 shall be obtained from Kerala State Pollution Control Board before commissioning of the project. Copy of the CFO 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.	Necessary measures are being taken
(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.

Section 1 Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi) (Compliance Period: Oct 2015 to March 2016)		
Sr. No.	**Conditions**	**Compliance Status as on 31-03-2016**
(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.
(xi)	The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied to the satisfaction of the Ministry.	Noted.
(xii)	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment & Forests.	Adani Vizhinjam Port Private Ltd (AVPLL) is the concessionaire for implementing the project and operating it for the next 40 years, based on concession agreement signed between the Government of Kerala &, AVPPL on 17th Aug 2015. Action being taken to transfer of EC to AVPPL under reference to the MoEF.
(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.	Concession agreement with M/s AVPPL was signed on 17th Aug 2014. The layout of the port has been approved by Govt. of Kerala by letter No.308799/E1/15/F&PD dated 30-10-15 **(Annexure 6)**. The preliminary construction activities commenced at site on 16th November 2015 followed by official inauguration on 5th Dec 2015. Financing agreement forming part of financial closure was submitted by the concessionaire on 13th May 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.	This condition does not pertain to project proponent. However it is learnt that KSPCB has complied with the same.

Section 1 Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi) (Compliance Period: Oct 2015 to March 2016)		
Sr. No.	**Conditions**	**Compliance Status as on 31-03-2016**
13.	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 2006, including the amendments and rules made thereafter.	Noted
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.	All required clearances shall be obtained before start of operation. However necessary approvals from concerned Statutory Departments / Agencies have been obtained to the proposed construction as mentioned below. ❖ Consent to Establish from State Pollution Control Board vide Consent No. PCB/HO/TVM/ICE/08/2015, dated 15.09.2015. ❖ All permits required for construction of buildings as per building by laws will be obtained. ❖ Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 7.12.2015

Section 1

Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
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 and intimated (with copy of advertisement) to the regional office of MoEF, vide letter No.VISL/EC/MoEF/2013 dated 20-01-2014. **(Annexure 7)**. Copy of the environment clearance is available on VISL website at http://www.vizhinjamport.in/eia-30-5-13.php
16.	This Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.	Noted
17.	Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	Three appeals challenging the EC granted to the project (two appeals filed at NGT, Southern Regional Bench, Chennai and one at NGT, Principal Bench, Delhi) and one original application (OA-filed at NGT, Principal Bench Delhi) indirectly challenging the CRZ Notification,2011 were filed as per the NGT Act,2010. The appeals filed at Chennai bench were later transferred to the Delhi bench. The hearing in the appeals and OA are in the final stages.

Section 1

Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
18.	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zila Parishad/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
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, SO2, 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.	The copy of this compliance report will be uploaded in company's web site http://www.vizhinjamport.in and will be submitted to the Zonal office of CPCB and the SPCB. The ambient air quality level will be displayed as required

Section 1

Half yearly Compliance report on conditions stipulated in Environmental & CRZ Clearance (Letter. F.No.11-122/2011-IA.III dated 03-01-2014 of the Director-IA-III, MoEF, New Delhi)

(Compliance Period: Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
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.	Although the EC was granted on 3rd January 2014, the concession agreement was signed only on 17th Aug 2015. The preliminary construction activities commenced at site on 16th November 2015 followed by official inauguration on 5th Dec 2015. This is the compliance report for the period from October 2015 to March 2016, ie, after the commencement of construction. For intimation regarding compliance during the pre-construction period, please refer to letters (i) No.VISL/2014-15/EE&EI-9 dated 19th Nov 2014 (ii) No.VISL/2014-15/EE&EI-9/526 dated 30th May 2015 & (iii) No.VISL/2014-15/EE&EI-9/1047 dated 27th Nov 2015 addressed to Additional Director (S) MoEF, Regional office (SZ), Bangalore-34 **(Annexure 8)**.
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.	The project is in construction phase. The same shall be complied post commissioning during operational phase.

Enclosures

Section 2. Half yearly compliance report of conditions stipulated in KCZMA recommendation for Environment & CRZ Clearance

Annexures:

1. Consent for Establishment issued by KSPCB (No. PCB/HO/TVM/ICE/ 08/2015 dated 15.09.2015)

2. Report on Shoreline monitoring June to Oct 2015 (in CD)

3. Status of the commitments made during Public Hearing

4. Status of compliance of Environmental Management Plan

5. NOC from Airport Authority of India (No. AAI/SR/NOC/RHQ dated 7.12.2015)

6. Approval of port layout issued by Government of Kerala (No.308799/E1/15/F&PD dated 30-10-2015)

7. Copy of advertisement relating to grant of EC in newspaper(s) and intimation to MoEF, RO(SZ), Bangalore

8. Intimation of compliance to MoEF, RO(SZ), Bangalore during the pre-construction period

9. Copy of EC issued by MoEF (F.No.11-122/2011-IA.III dated 3rd Jan 2014)

10. Copy of recommendation by KCZMA (No.1285/A3/13/KCZMA/S&TD dated 24-08-2013)

Section 2

Half yearly compliance report of conditions stipulated in

KCZMA recommendation for Environment and CRZ Clearance

(Letter.1285/A3/13/KCZMA/S&TD dated 24-08-2013 of the Member Secretary, KCZMA)

(Compliance Period: Oct 2015 to March 2016)

Section 2
Half yearly compliance report of conditions stipulated in KCZMA recommendation for Environment and CRZ Clearance
(Letter.1285/A3/13/KCZMA/S&TD dated 24-08-2013 of the Member Secretary, KCZMA)
(Compliance Period:Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
(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.	Necessary approvals from concerned Statutory Departments / Agencies have been obtained ❖ Consent to Establish from State Pollution Control Board vide Consent No. PCB/HO/TVM/ICE/08/2015, dated 15.09.2015. ❖ All permits required for construction of buildings as per building by laws will be obtained as and when required. ❖ Airport Authority of India NOC vide NOC no AAI/SR/NOC/RHQ dated 7.12.2015
(ii)	Since the project envisages development of roads, infrastructural facilities, dredging of the lake and kayals proper environmental safety measures must be ensured.	All safety measures are being adopted. It is also brought to notice 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.	Consent for Establishment" has been obtained from Kerala State Pollution Control Board vide Consent No. PCB/HO/TVM/ICE/08/2015, dated 15.09.2015.
(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.	There is no mangrove 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.	• No solid waste is being disposed of in the Coastal Regulation Zone area. • Currently no effluent is generated
(vi)	The project proponent should provide necessary facilities for official of the Kerala Coastal Zone Management Authority (KCZMA) for inspection of the project site and its premises at any time.	Noted

Section 2
Half yearly compliance report of conditions stipulated in KCZMA recommendation for Environment and CRZ Clearance
(Letter.1285/A3/13/KCZMA/S&TD dated 24-08-2013 of the Member Secretary, KCZMA)
(Compliance Period:Oct 2015 to March 2016)

Sr. No.	Conditions	Compliance Status as on 31-03-2016
(vii)	The KCZMA may be duly informed of any construction/developmental works/major activities undertaken in the CRZ area of the project	Vide letter No.VISL/2014-15/EE&EI-9/1047 dated 27-11-2015, KCZMA was informed of the commencement of the construction activities at site. Presently the following construction activities are in progress: • Temporary approach road of 1.2 KM • Dredging and reclamation
(viii)	Environmental clearance must be obtained from the Ministry of Environment & Forests.	Environment & CRZ Clearance has been obtained from Ministry of Environment & Forest vide MoEF letter dated 03rd January, 2014 (F.No.11-122/2011-IA.III)
(ix)	Adequate financial provisions has to be made for environmental protection measures.	A total of Rs 40 Crore has been set aside for environmental protection measures as per the EIA report
(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 chalan receipt in original be forwarded to the Science & Technology Department quoting this letter.	Not applicable since the application for CRZ/Environmental clearance was submitted by Vizhinjam International Seaport Ltd.(VISL), a Government of Kerala undertaking

Annexure 1

Consent for Establishment issued by KSPCB

(No. PCB/HO/TVM/ICE/ 08/2015 dated 15.09.2015)

FILE NO. PCB/HO/TVM/IC/06/2015

KERALA STATE POLLUTION CONTROL BOARD

INTEGRATED CONSENT TO ESTABLISH

ISSUED UNDER

The Water (Prevention & Control of Pollution) Act, 1974
The Air (Prevention & Control of Pollution) Act, 1981 &
The Environment (Protection) Act, 1986

As per application no:1680500 dated 24.08.2015

TO

Consent No. PCB/HO/TVM/ICE/08/2015

M/s ADANI VIZHINJAM PORT PRIVATE LIMITED VIZHINJAM

Date: 15/09/2015 **Valid upto: 31/07/2018**

KERALA STATE POLLUTION CONTROL BOARD

Copy to:

1. The Senior Environmental Engineer, Regional Office, Thiruvananthapuram
2. The Environmental Engineer, District Office, Thiruvananthapuram
3. Stock File

1. GENERAL

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

1	**Validity**	**31/07/2018**
2	Name and Address of the establishment	Adani Vizhinjam Port Private Limited at Vizhinjam – 695 521
3	Communication	Telephone : 0-9099938893 Fax: 079-25555602 Email: shalinm.shah@adani.com
4	Occupier details	Santosh K. Mohapatra Director Adani Vizhinjam Port Private Limited Adani House, Near Mithakhali Six Roads, Navrangpura, Ahmedabad-380009
5	Local Body	Thiruvananthapuram Corporation, Kottukal Grama Panchayath
6	Survey Number	753 Part and others
7	Village	Vizhinjam , Kottukal
8	Taluk	Thiruvananthapuram
9	District	Thiruvananthapuram
10	Capital Investment (Rs in Lakhs)	555200
11	Scale	Large
12	Category	Orange
13	Annual fee(Rs) Total Fee remitted(Rs)	44,41,600 13324800
14	Activity	Establishment of Deep water multi purpose seaport and connected activities within the premises of the project

KERALA STATE POLLUTION CONTROL BOARD

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

2.1 In case of generation of waste water including sewage from the port, effluent treatment system consisting of treatment units having adequate capacity shall be established and shall be made functional before commissioning. The proposal for the same shall be got approved by the Board before establishing the unit.

2.2 Water Consumption : 498000 l/day

2.3 Effluent Generation : 498000 l/day

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

Sl. No.	Characteristics	Unit	Tolerance limit
1.	Oil & Grease	mg/l, max	10
2.	BOD, (3 day at 27°C)	mg/l, max	30
3.	pH		6.5-8.5
4.	Suspended solids	mg/l, max	100

2.5 Continuous monitoring system shall be provided in the effluent treatment plant and the result shall be displayed in the public domain

2.6 Delay pond shall be provided to the storm water drains before discharging into back water, sea to contain oil pollution.

3 CONDITIONS AS PER Air (Prevention & Control of Pollution) Act, 1981

3.1 The DG set shall be established and operated confirming to the Environmental Protection Rules applicable for DG sets.

3.2 Clean diesel fuel such as low sulphur fuel shall be used for cargo handling equipments & truckers in the harbour.

3.3 Continuous ambient air quality monitoring system shall be provided at suitable locations and the results shall be displayed in the public domain.

KERALA STATE POLLUTION CONTROL BOARD

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 Waste (Management, Handling and Transboundary Movement) Rules, 2008.

4.4 e-waste shall be disposed off safely as per the e-waste (Management and Handling) Rules, 2011.

5. SPECIFIC CONDITIONS

5.1 The location of the port shall be as per the approved drawing attached.

5.2 At the end of the validity period if the construction is in progress, the same shall be got renewed. If the construction is not started in the consent period, the applicant shall apply afresh for consent to establish.

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

5.4 The date of commissioning of the project shall be intimated, at least one month in advance, to the District Office and Head Office of the Board at Thiruvananthapuram.

5.5 Consent to Operate under the Water (Prevention and Control of Pollution) Act 1974; the Air (Prevention and Control of Pollution) Act 1981 and under relevant rules of Environmental Protection Act, 1986 shall be obtained before commissioning the Harbour.

5.6 Adequate facilities including sanitation and safe management of sewage complying with IS 2470(part 1) 1985 shall be provided for the construction workers during the construction phase of the project.

5.7 Adequate measures for control of dust and noise should be taken during transportation of the construction materials in the construction site. The ambient air quality at the boundary of the premises shall not exceed the stipulated limits.

5.8 Approval of the Board should be obtained for establishing /operation of Concrete Mix Plant /Hot Mix plant at the time of construction.

KERALA STATE POLLUTION CONTROL BOARD

5.9. Proposal for treatment and disposal facilities for bio degradable waste shall be provided before commissioning and non-biodegradable waste shall be disposed through genuine recyclers or common TSDF.

5.10 Co - treatment Facility along with sewage is to be provided for managing septage from nearby Grama Panchayats as part of CSR activity.

5.11 Treated water should be reused to the maximum extent for Irrigation and balance shall be disposed through soak pit for ground water recharging.

5.12 Hazardous wastes including waste oil, cargo residue containing oil, chemical, wash water, ballast water, sludge & filter from ships shall be properly collected, segregated, stored and disposed as per the provisions of the Hazardous waste (Management Handling and Transboundary) movement Rules.

5.13 Aforestation with suitable species of trees shall be provided for 10% to 20 % of total land area in consultation with social forestry under Forest Department.

5.14 Dredged materials shall be properly collected and utilized without causing any environmental degradation.

5.15 All the conditions stipulated in the Environmental Clearance and CRZ clearance dated 03.01.2014 issued by competent Authorities should be complied with.

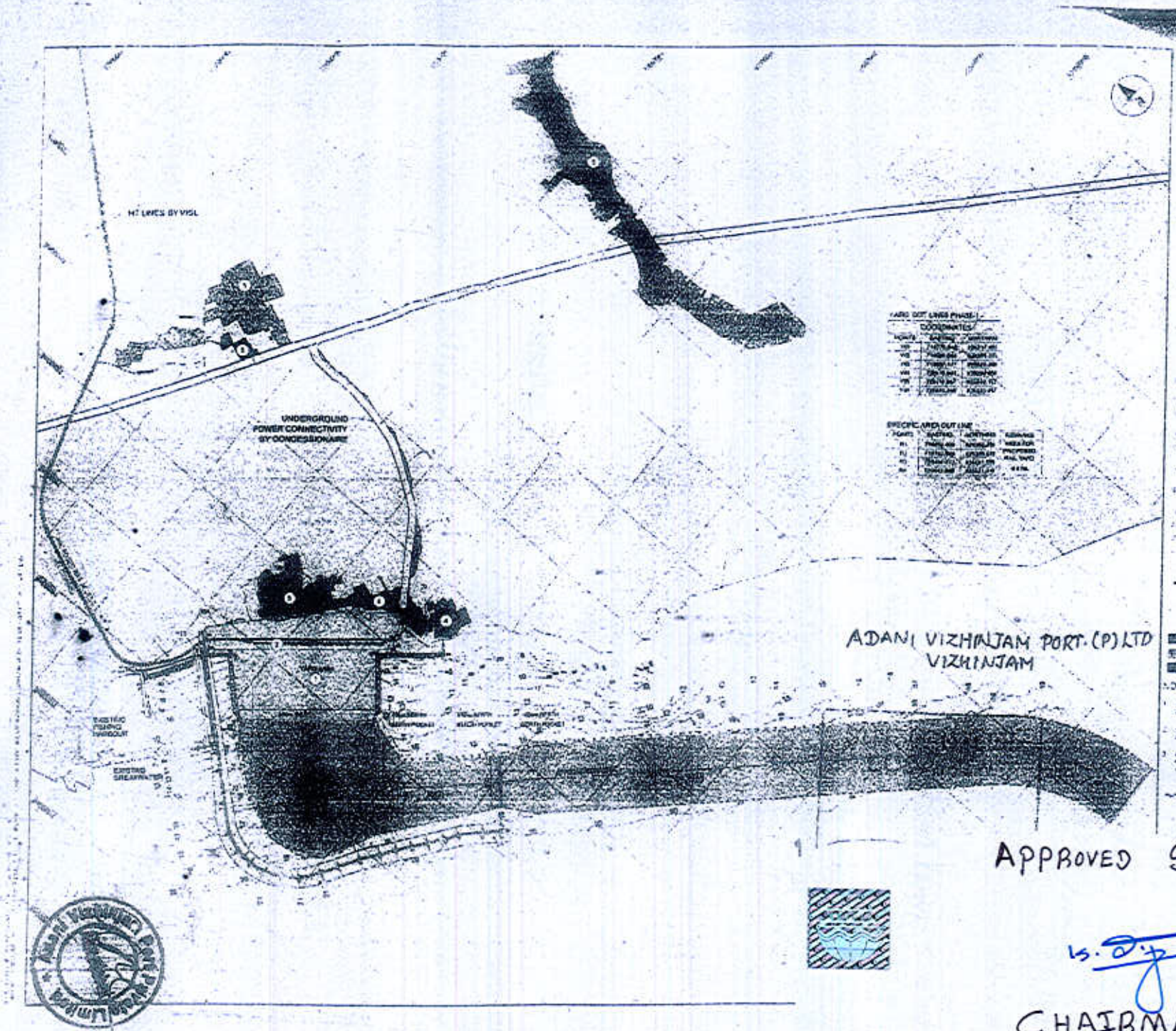
DATE: 15/09/2015

SIGNATURE & SEAL OF ISSUING AUTHORITY

CHAIRMAN

KERALA STATE POLLUTION CONTROL BOARD

OFFICE SEAL


KEYNOTE
HT LINES BY VISL
UNDERGROUND POWER CONNECTIVITY BY CONCESSIONAIRE
LEGEND
ADANI VIZHINJAM PORT (P) LTD
VIZHINJAM
APPROVED SITE PLAN
CHAIRMAN
KERALA STATE POLLUTION CONTROL BOARD

Annexure 2

Report on Shoreline monitoring (in CD)

Period: June to Oct 2015

Report on

Oceanographic & Bathymetric Data Collection for

Assessment of Shoreline Changes

Monsoon Period (June – October 2015)

For Vizhinjam International Seaport Ltd.

Client

Vizhinjam International Seaport Ltd

First Floor, Vipanchika Towers, Near Govt. Guest House
Thycaud, Thiruvananthapuram 695014
Kerala, India
Tel : +91 471 2328614 Tel/Fax: +91 471 2328616
E-mail: **mail@vizhinjamport.in**

Advisor to VISL

National Institute Of Ocean Technology

(Ministry Of Earth Sciences, Govt. of India)
NIOT Campus, Velachery- Tambaram Main Road,
Pallikaranai, Chennai-600 100, INDIA
Phone: 6678 3325 / 3322 ; Fax: 91-44-22460645

Survey Contractor

Ocean Science & Surveying Pvt. Ltd.

C-005-006, Platform Floor, Tower # 8,
Railway Station Complex
Sector 11, CBD, Belapur,
Navi Mumbai 400 614
Maharashtra, India
Tel. +91 22 27595100
Fax No. +91 22 27595110
E-mail: mail@oceanscience.in
Web: http://www.oceanscience.in

Report no.

OSaS/P18115/VISL/Monsoon/104 Rev 1
22nd February 2016

DOCUMENT ISSUE FORM

Document Type	Periodic Survey Report (Monsoon)
Prelim/Draft/Final/Other	Final
Document Title	Report on Oceanographic & Bathymetric Data Collection for Assessment of Shoreline Changes Monsoon Period (June – October 2015) For Vizhinjam International Seaport Ltd. OSaS Doc no. OSaS/P18115/VISL/Monsoon/104 Rev 0
Prepared by	S Philip
Prepared at	Ocean Science & Surveying Pvt. Ltd. Data Processing Centre, Navi Mumbai.
Submitted to	Vizhinjam International seaport Ltd (VISL)
No. of Copies	5 Hard Copies
Project No.	P18115

Revisions

Rev	Date	Description	Prepared by		Checked by	
			Name	Signature	Name	Signature
0	08.01.2016	Draft	S Philip		F Patel	
1	22.02.2016	Final	S Philip		F Patel	

Revision Details

Section	Page	Amendments
6.4	76,80,84	Unit changed from ‘m’ to ‘s’
6.5	87,91,95,99,103	Pressure scale revised
6.5	88,92,96,100,104	Units added in atmospheric parameters
9	111	Wikipedia removed from the references

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DEFINITIONS

Project Owner	Vizhinjam International Seaport Ltd.
Advisor to VISL	National Institute of Ocean Technology, Chennai
Survey Contractor	Ocean Science & Surveying Pvt. Ltd., Navi Mumbai, India (Ocean Science)
Survey Requirement	Oceanographic & Bathymetric Survey for Shoreline Monitoring
Chart Datum	Chart datum is the level to which soundings on a 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 the water body moves in the ocean. The speed is denoted in cm/s
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 m/s
Wind Direction	Wind direction is an indicator of the direction that the wind is coming 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

ABBREVIATIONS

CES	Coastal Erosion Stone
C.M.	Central Meridian
CD	Chart Datum
cm	Centimetre
dd mm.mmm	Degrees minutes. decimal minutes
DGPS	Differential Global Positioning System
DTM	Digital Terrain Model
EC	Environmental & CRZ Clearance
EEZ	Exclusive Economic Zone
GcGPS	Globally Corrected Global Positioning System
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
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
MoEF	Ministry of Environment & Forests
MU	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
PEP	Project Execution Plan
PVD	Progressive vector diagram
RTK	Real Time Kinematics
SBES	Single Beam Echo Sounder

SoI	Survey of India
SOW	Scope of Work
TEU	Twenty Foot Equivalent Unit
UNCLOS	United Nations Convention of 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

1. EXECUTIVE SUMMARY

Vizhinjam International Seaport Limited (VISL) is a special purpose government company (fully owned by Government of Kerala) that would act as an implementing agency for the development of a green field port - Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam, a district of Thiruvananthapuram, the capital city of Kerala.

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, Government of India for a long term shoreline monitoring programme including the seasonal bathymetry mapping.

To that end, Ocean Science & Surveying Pvt. Ltd, (**www.oceanscience.in**), hereinafter referred to as Ocean Science, 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 letter of award; VISL/2014-15/EE&EI-1/96 dated 28th January 2015.

As part of the study, NIOT provided a wave rider buoy to be deployed off Mulloor and the data was to be monitored by Ocean Science. Accordingly, a resort (Sea Park) at Mulloor was hired where the receiver of the wave rider buoy was set up to monitor the waves. Later the Ocean Science team had to shift from the resort to another building at Mukkola junction, and in the month of July 2015, the receiver was shifted to the new premises.

This report provides the results of the data collected during the second season, i.e. monsoon period from June to October 2015. All the sensors went operational towards mid of February 2015. The second set of current observations were held from 5th July to 4th August 2015.

Due to unseasonal rains experienced after the monsoon months, the bathymetric survey of the 15 x 40 km area could not be covered as expected. The survey could be completed only by 4th January 2016. Hence the report is submitted in January 2016.

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

Vizhinjam, (Malayalam: വിഴിഞ്ഞം) is a district of the capital city Thiruvananthapuram (Trivandrum) of the state of Kerala, India. It is located at approximately 08°22′45″N, 76°59′29″E, and 14 km south of the capital city. The city is historically known for being an important port, dating back to the 8th Century AD.

The port is proposed to be developed in a landlord model having a PPP development component. 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 & equipments) will be shared on Public Private Partnership (PPP) basis availing Viability Gap Funding (VGF) from Government of India. The PPP concessionaire so selected will be given the right to operate the Phase I development of the port (800 m berth length) 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 located at the southern tip of India with hardly 10 nautical miles from the international sea route (Suez – Far East route & Far East – Middle East route), the port has the potential to become the future transhipment hub of the country.

The present study is to document the existing shoreline change pattern in different seasons of the year, with the aim of understanding future changes in pattern, if any, during or after the implementation of the port project.

The study comprises carrying out wave, wind and tide observations at one location for one year, as well as current for 30 days each, at four locations, during 3 different seasons; summer (Jan-May), monsoon (June-Sept), and post monsoon (Oct-Dec), bathymetric survey of about 600 sq km, cross shore profiling from 10m CD to 100m inland from the high water line, water & grab sampling, littoral environmental observation, river crossing survey etc.

A Google Earth image showing the locations of the observations, including the wave/current measurement location is given in **Figure 1**. The location showing cross shore profile lines which also indicates the LEO, photographic documentation points and beach sampling locations are shown in **Figure 2**.

The first phase of report (pre-monsoon) was submitted on 20th June 2015.

Figure 1 – General survey location

P1, P2 and P3 corresponds to ADCP locations which are denoted as C and P4 corresponds to both ADCP and wave location which is denoted as W. The tide gauge location is denoted as T.

The cross shore profiling lines, LEO, photographic documentation points and beach sampling locations are indicated in the image below: The cross shore profiles are named as CSP-01 to CSP-81. CSP-01 corresponds to the southernmost profile which lies south of the existing Vizhinjam Harbour.

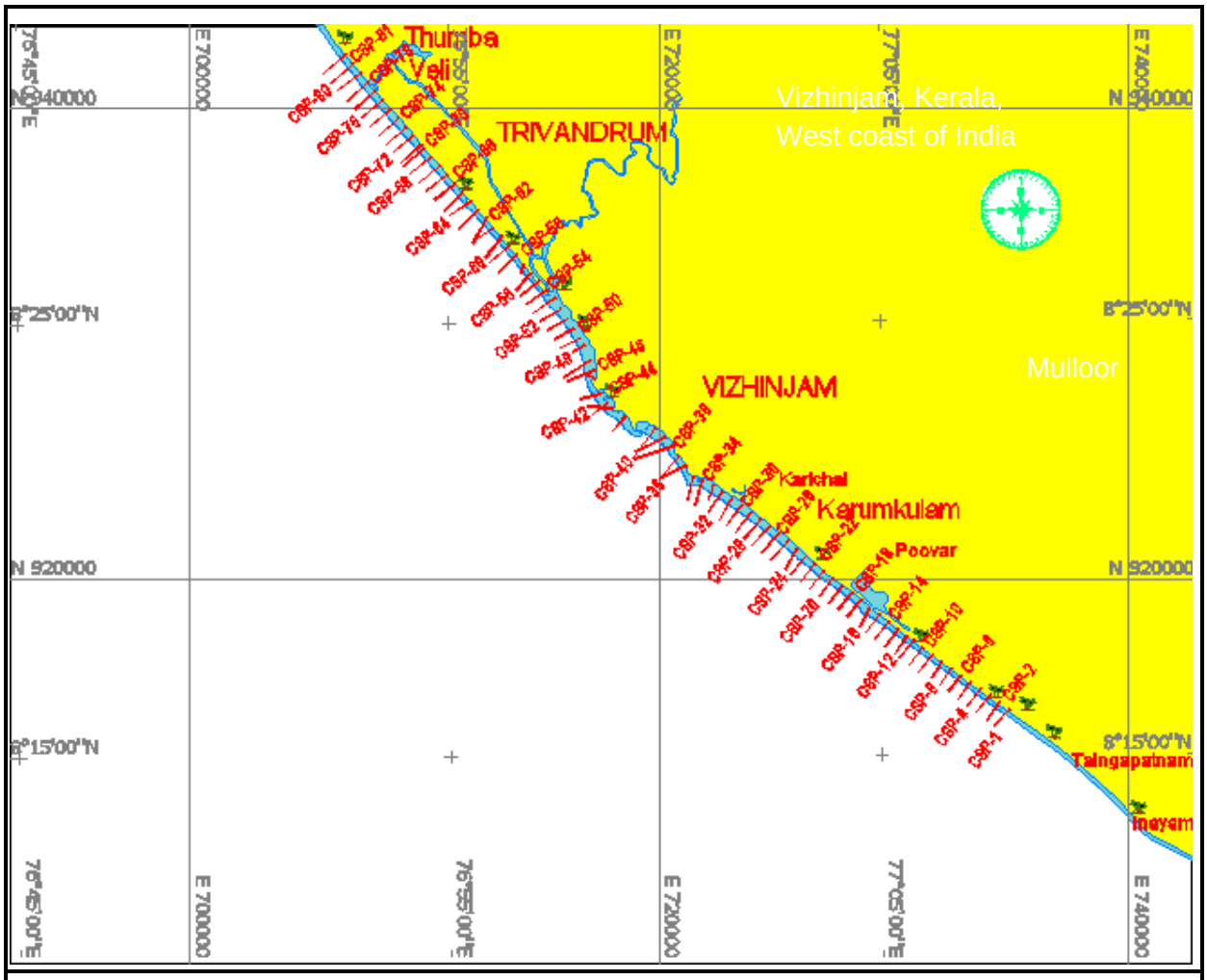


Figure 2 – Cross Shore Profile/LEO/Beach Sampling Locations

3. SCOPE OF WORK

The survey scope of work as provided in the RFQ and as per the contract included 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.
- Study of shore line.
- Monthly cross shore beach profiling perpendicular to the shoreline for 30 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.
- Monthly monitoring of littoral zone (at the cross shore beach profiling locations) to observe the littoral transport direction and alongshore current speed by means of appropriate drogue observations and visual observations.
- Monthly photographic documentation of geomorphological changes (at the cross shore beach profiling locations).
- Seasonal beach sediment sampling and analysis (at the cross shore beach profiling locations).
- Bathymetric survey in an area of 600 sq km (40 x 15 km) 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 and 1m contour (with bathymetric survey lines spaced at 300m intervals) in areas with depth greater than 20m CD at a spacing of 300m using single beam.

- Bathymetry/cross section survey for 500m length of rivers debouching in a 40 km stretch of the coast.
- Seabed sediment sampling and analysis in 600 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 three locations, as marked in Figure 1, for the duration of full tidal cycle/30 days each during monsoon (June-Oct), post-monsoon (Nov-Feb) and summer months (Mar-May).
- Wave observations using WRB Datawell DWG-G shall be carried out at one location as marked in 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. The data shall be used to derive the harmonic constituents.
- Collection of wind speed & direction, atmospheric pressure, humidity, temperature at 1 location specified by the client/EIC by establishing an automatic weather station to cover a full year.
- Analysis and processing of the data and submission of periodic reports in soft & hard copies.

3.1 Additional Scope of Work

In addition to the above scope, VISL extended the shoreline monitoring to 40 km from 30 km via the work order VISL/2014-15/EE&EI-1/381 dated 21st April 2014. Accordingly additional activities were carried out as per the list below:

1. Fixing of ten more reference stations
2. Beach sampling of additional 10 samples
3. Cross shore profiling, LEO and photographic documentation of another 10 km

3.2 Location Co-ordinates

The location co-ordinates of current and wave observations are provided below:

Location Co-ordinates			
WGS-84 Spheroid, UTM Projection, CM 75 East, Zone 43, North			
Name	**Latitude**	**Longitude**	**Depth w.r.t CD (m)**
ADCP - P1 (Vizhinjam)	08° 22' 06.38"N	76° 58' 58.62"E	21.2
ADCP- P2 (Poovar)	08° 18' 00.25"N	77° 03' 55.24"E	22.5
ADCP- P3 (Pachalloor)	08° 25' 01.15"N	76° 56' 28.60"E	21.6
ADCP/Wave - P4 (Mulloor)	08° 21' 43.15"N	76° 59' 25.86"E	27.3

Table 1: Current/Wave Locations

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

Tide Station Co-ordinates			
WGS-84 Spheroid, UTM Projection, CM 75 East, Zone 43, North			
Name	**Latitude**	**Longitude**	**Height above CD (m)**
Tide station	08° 22' 33.68"N	76° 59' 16.65"E	3.251

Table 2: Tide Station Location Co-ordinates

The location co-ordinates of weather station are provided below:

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
On top of Bank of India building, Mukkola	08° 22' 56.33"N	77° 00' 25.02"E	72.6

Table 3: Weather Station Location Co-ordinates

Since the system was installed at heights, above CD, of 28.456m till 30th July 2015 and 72.6m from 31st July onwards, 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 both the levels.

The weather station was relocated to a building in Mukkola, since the survey team had to relocate from the resort.

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.

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

Table 4: Geodetic Parameters

4.2 Vessels

The following vessels were utilised for the survey operations.

Figure 3 – Survey Vessel MFB Samuel

Figure 4 – Survey Vessel MFB Bethel

Figure 5 – Survey/Transit Vessel MFB Sindhu Yatra Matha

Figure 6 – Survey boat used for River Crossing Survey

4.3 Personnel

The following survey personnel from Ocean Science/VISL were assigned to the project in the capacities listed in the table below.

Ocean Science & Surveying		
Name	**Designation**	**Period**
S PHILIP	Project Manager / Oceanographer	Duration of Project
HEBIN C	Party Chief / Oceanographer	Duration of Project
Jai Prakash PANDEY	Hydrographic Surveyor	03rd to 31st Oct 2015
ABHILASH L	Hydrographic Surveyor	04th to 18th Aug 2015
UNNIKRISHNAN KU	Hydrographic Surveyor	01st Jun to 06th Aug; 16th Aug to 10th Oct; 29th to 31st Oct 2015
Sangramjeet BEHERA	Electronics Engineer	01st Jun to 25th July; 15th to 19th Aug; 06th to 31st Oct 2015
Prasant PANDA	Electronics Engineer	04th Aug to 24th Sept; 26th Sept to 06th Oct 15
Vikram Singh CHOUHAN	Electronics Engineer	17th to 31st Oct 2015
Vishtasp MEHTA	Geophysicist	02nd to 09th Sept 2015
Vizhinjam International Seaport Ltd.		
Name	**Designation**	**Period**
Ajit SURENDRAN	Chief Project Co-ordinator & Head (EHS & CSR)	Duration of Project
PRADEEP A.S	Engineer (EI)	Duration of Project
Siril DAS	Technical Assistant	Duration of Project

Table 5: Survey Personnel

5. SURVEY EQUIPMENT DETAILS

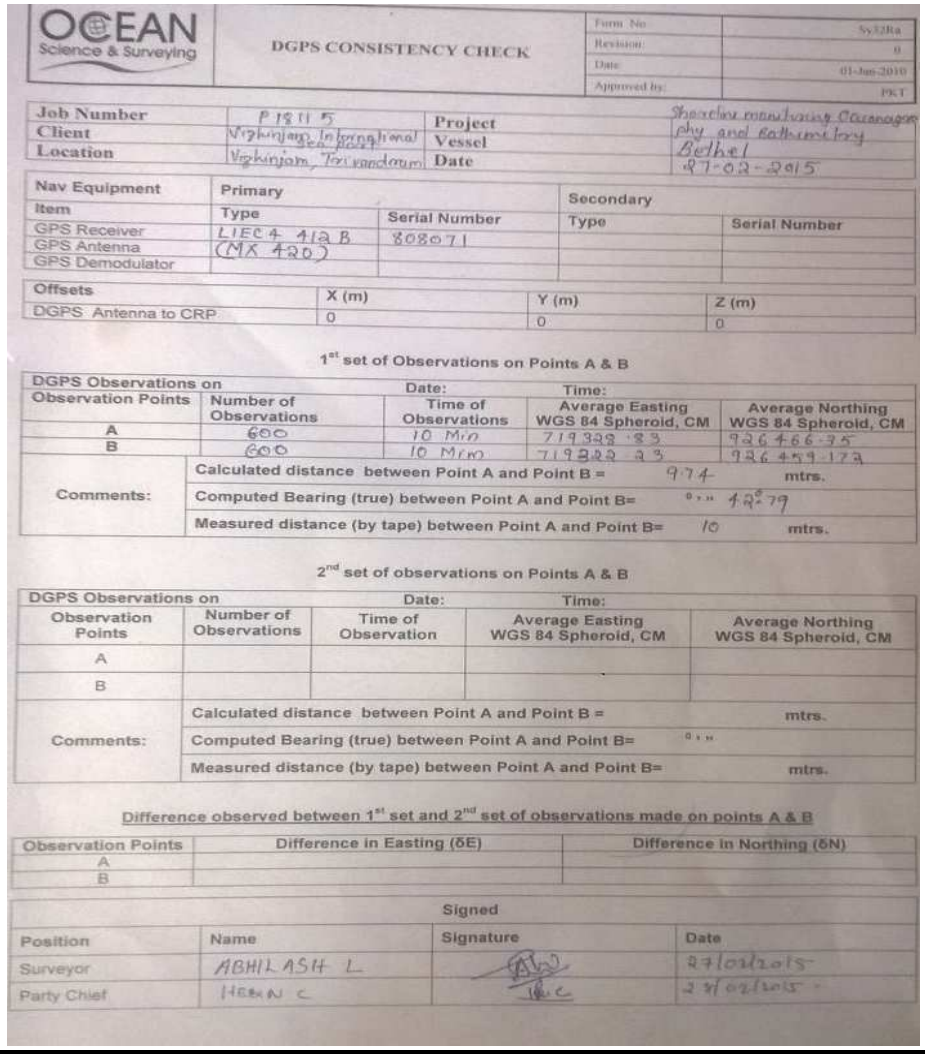
5.1 General

The Wave Rider Buoy was deployed from the vessel MFB Samuel. ADCP's were deployed in a downward looking mode from four different boats for the 30 day period. The multibeam survey up to the 20m contour was carried out from the boat MFB Bethel. The single beam survey for the larger area was carried out using the boat Samuel.

The equipment used for the project is described below:

5.2 DGPS Positioning System

Vessel positioning was carried out by the Metric Accuracy MX 420 DGPS system using MF based correction signals. Vessel track and offset positions were recorded digitally using QINSy survey data acquisition software. The system is installed permanently on board the survey vessel. The DGPS consistency checks carried out during the course of survey is provided below:



OCEAN Science & Surveying

DGPS CONSISTENCY CHECK

Form No	Sv32Ra
Revision	0
Date	01-Jan-2010
Approved by	PKT

Job Number	P1811 5	Project	Shoreline monitoring Cacanagore
Client	Vizhinjam International Seaport	Vessel	phy and Bathymetry
Location	Vizhinjam, Trivandrum	Date	Bethel 27-02-2015

Nav Equipment	Primary		Secondary	
Item	Type	Serial Number	Type	Serial Number
GPS Receiver	LIEC 4 412 B (MX 420)	808071		
GPS Antenna				
GPS Demodulator				

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

1st set of Observations on Points A & B

DGPS Observations on Date: Time:

Observation Points	Number of Observations	Time of Observations	Average Easting WGS 84 Spheroid, CM	Average Northing WGS 84 Spheroid, CM
A	600	10 Min	719328.83	926466.35
B	600	10 Min	719322.23	926459.179

Comments:	Calculated distance between Point A and Point B = 9.74 mtrs.
	Computed Bearing (true) between Point A and Point B= 42°79
	Measured distance (by tape) between Point A and Point B= 10 mtrs.

2nd set of observations on Points A & B

DGPS Observations on Date: Time:

Observation Points	Number of Observations	Time of Observation	Average Easting WGS 84 Spheroid, CM	Average Northing WGS 84 Spheroid, CM
A				
B				

Comments:	Calculated distance between Point A and Point B = mtrs.
	Computed Bearing (true) between Point A and Point B= ° ' "
	Measured distance (by tape) between Point A and Point B= mtrs.

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

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

Signed

Position	Name	Signature	Date
Surveyor	ABHILASH L		27/02/2015
Party Chief	HEBIN C		27/02/2015

Figure 7 – DGPS Consistency Check

5.3 Navigation & Heading System

The navigation computer running QINSy (Quality Integrated Navigation System) navigation software received the corrected GPS latitude and longitude from the DGPS system for the Multibeam survey. EIVA navigation software was used to navigate the boat and to acquire the single beam data. The antenna position was converted into local UTM co-ordinates by the navigation software.

The vessel's centre of gravity (COG) was defined as the central reference point (CRP) for the entire survey and deployment operations. Positioning data was logged at 1-second updates in the software.

A Standard Meridian Gyro was used to obtain the accurate heading of the survey boat. The calibration detail of the Gyro is given below:

OCEAN Science & Surveying

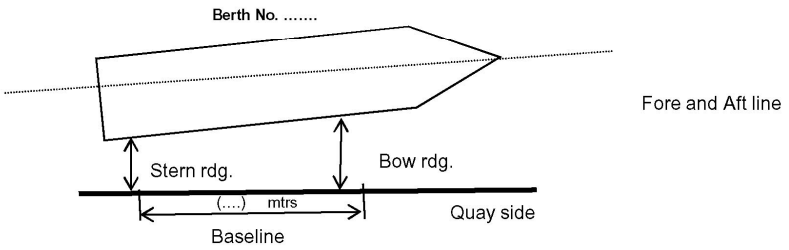
GYRO CALIBRATION
(Quay/Tape off set Method)

Form No.:	Sy37R
Revision:	0
Date:	1-Jan-2010
Approved By:	PKT

Job No	P18115	**Project**	
Client	VISL	**Vessel**	**Bethel**
Location	Vizhinjam	**Date**	**27/02/2015**
Gyro S/N	Meridian Surveyor - 5265		

Quay heading (true)	Baseline length(m)		Quayside on:
42.79	**5.3**		**Starboard**

Observations				Calculations			
Time	Gyro (true)	Bow	Stern	Calc. angle	Calculated Heading	True Quay Hdg	C-O
08:11:56	39.3	0.66	0.6	0.65	39.95	42.79	2.84
08:12:04	38.7	0.68	0.62	0.65	39.35	42.79	3.44
08:12:14	39.5	0.6	0.58	0.22	39.72	42.79	3.07
08:12:22	38.9	0.6	0.57	0.32	39.22	42.79	3.57
08:12:33	39	0.67	0.64	0.32	39.32	42.79	3.47
08:12:43	38.8	0.72	0.67	0.54	39.34	42.79	3.45
08:12:52	39	0.65	0.63	0.22	39.22	42.79	3.57
08:13:02	39	0.72	0.69	0.32	39.32	42.79	3.47
08:13:13	39.1	0.67	0.61	0.65	39.75	42.79	3.04
08:13:22	38.4	0.7	0.62	0.86	39.26	42.79	3.53
08:13:29	39.1	0.64	0.59	0.54	39.64	42.79	3.15
Average	39.03	0.66	0.62	0.48	39.46	**C-O**	**3.33**



Note: Drawing not on scale only procedure adopted showing

Gyro SN:

Signed			
Designation	**Name**	**Signature**	**Date**
Surveyor	ABHILASH L		27/02/2015
Party Chief	HEBIN C		27/02/2015

Figure 8 – Gyro Calibration Details

5.4 Currentmeter

Teledyne RDI Workhorse Sentinel 600 KHz ADCP currentmeter were deployed at the 4 locations. The ADCPs were programmed to record the currents at intervals of 10 minutes. A typical ADCP deployment setup is given below:

Figure 9 – ADCP installed in a downward looking mode

A schematic representation of ADCP deployed to measure the current profile is given below:

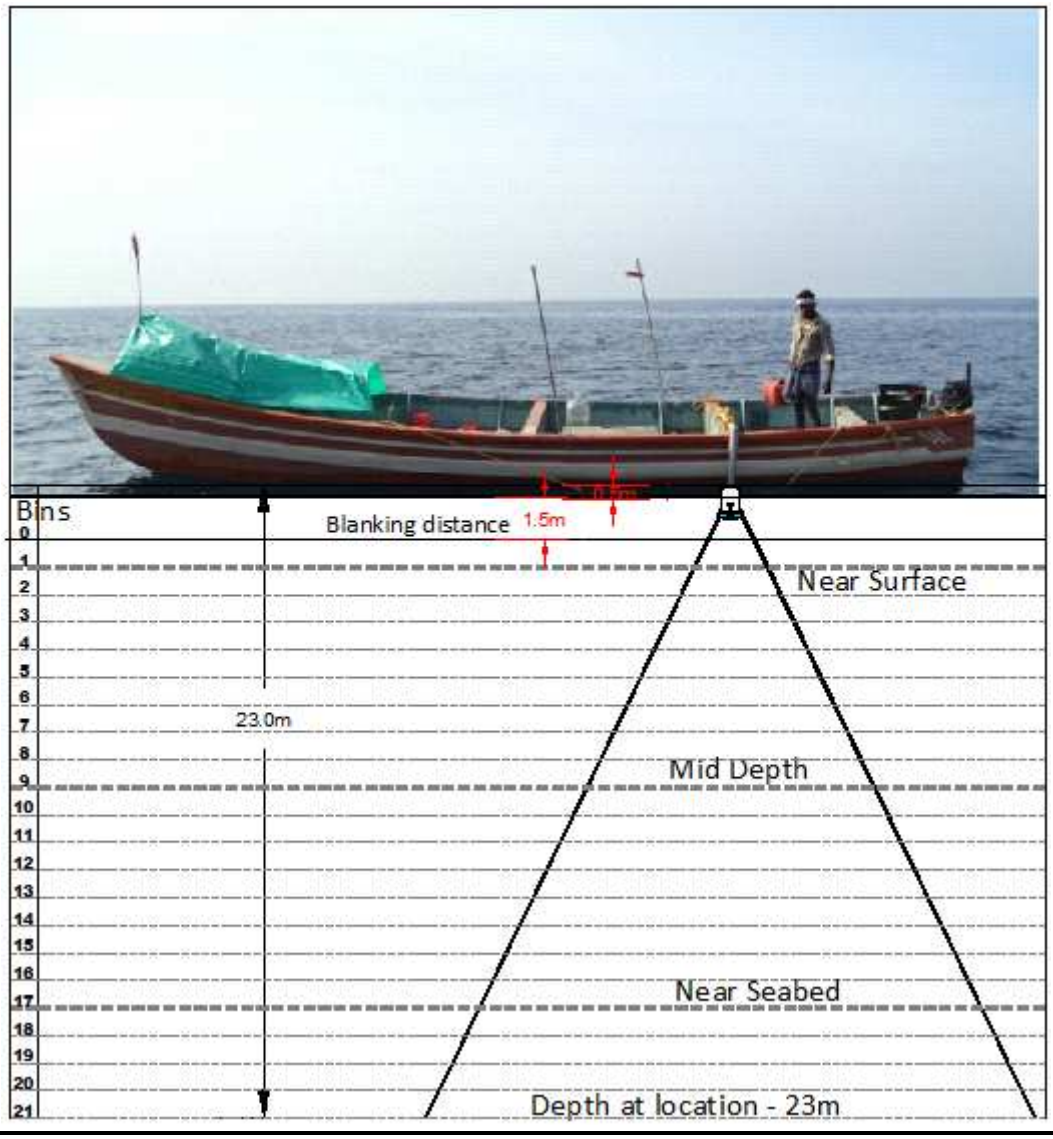


Figure 10 – Schematic diagram of Surface, Mid depth and Near bottom measurement of ADCP

5.5 Wave Rider Buoy

NIOT deployed the wave rider buoy in collaboration with VISL and is monitored by Ocean Science. 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 the Seapark Beach Resort, where the Ocean Science personnel stayed till July 2015. Since the survey personnel had to shift from the resort on 31st July, the receiver was shifted to a house in Mukkola junction.

The system consists of wave rider buoy (DWR G make) with HF whip/LED flasher, GPS antennae, 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 is 1.5° within the range of 0° to 360°.

5.5.1 Calibration of the equipment

The wave rider buoy is factory-calibrated and Datawell does not recommend recalibration of the buoy.

5.5.2 Principles of Wave measurement

The GPS wave buoy measurement principle bears a strong analogy with the Doppler-shift phenomenon of a nearby passing car 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.

5.5.3 Mooring of the instrument

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:

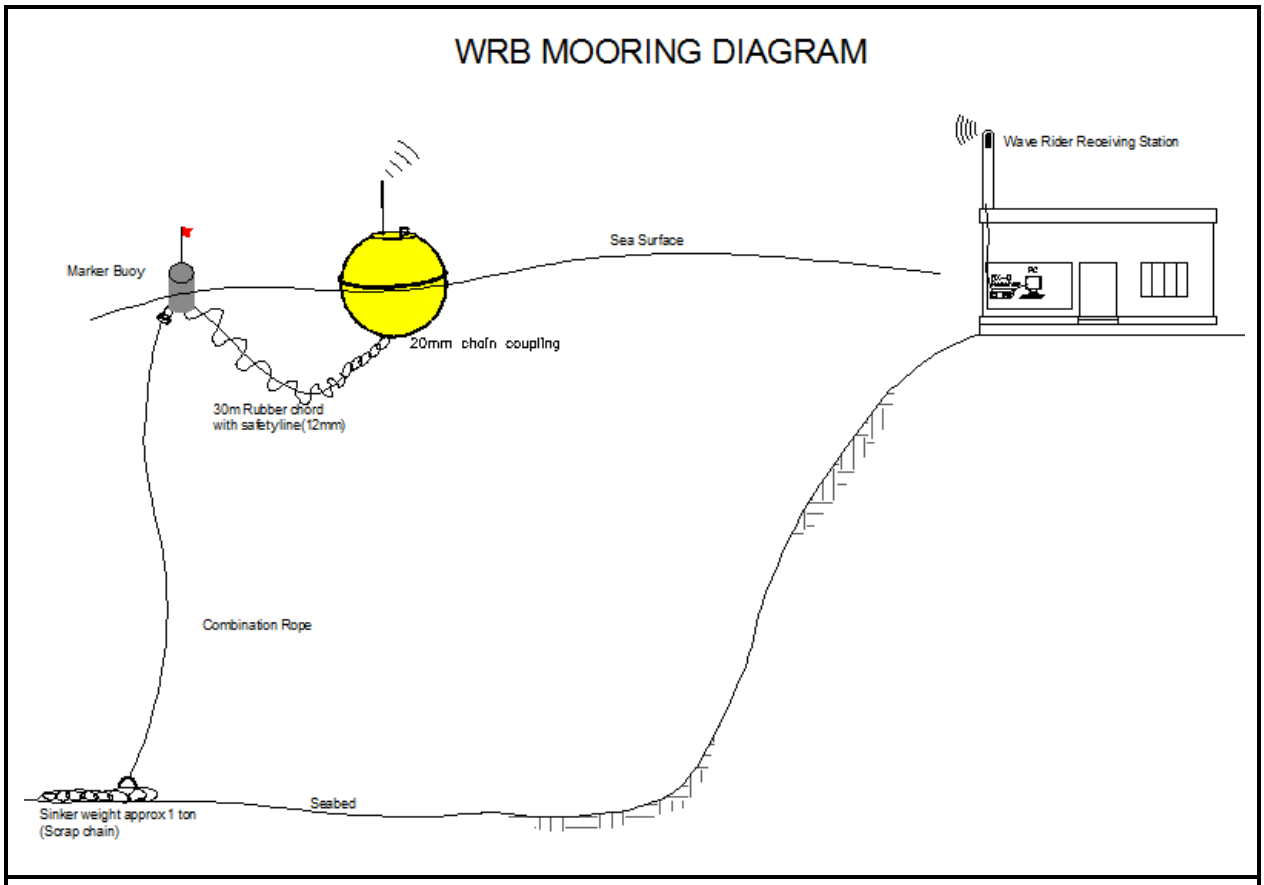


Figure 11 – WRB Mooring Diagram

A photograph of WRB deployed at the site is provided below:

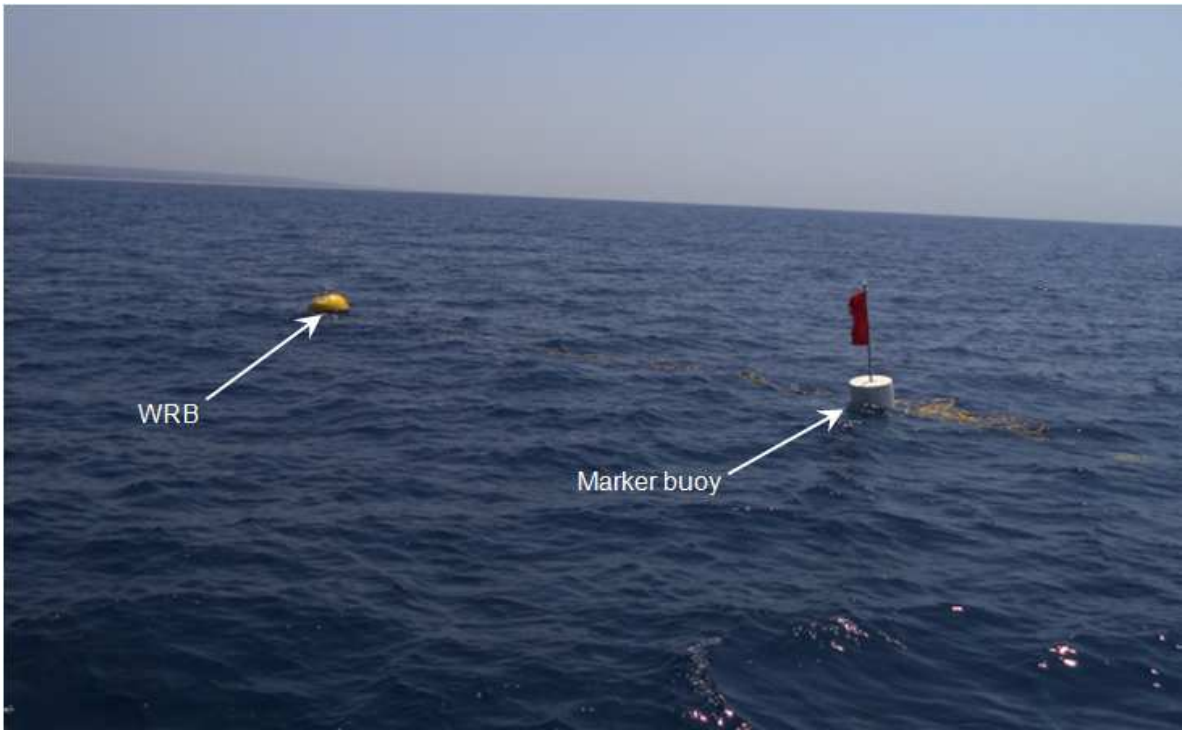


Figure 12 – WRB deployed at location P4 (Mulloor)

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 wave rider buoy without hindering the wave data measurements along with sufficient crew on board for around the clock watch-keeping. Another fibre boat was kept for movement of the watch-keepers to remove the fishing nets whenever required.

5.6 Automatic Tide Gauge

A Valeport 740 Tidemaster automatic tide gauge was installed near the Coast Guard jetty, inside the fishing harbour for measuring the tides. The location is close to the existing tide gauges installed by NIOT. The sensor was installed on a 5m long pipe to ensure that the sensor is always in water, irrespective of the phases of tide. This was levelled to the local bench mark, situated on top of the jetty. The tide station was programmed to measure the tide at 6-minute intervals throughout the duration of the project.

A photograph of the tide gauge location is provided below:

Figure 13 – Location of Tide Gauge

5.7 Automatic Weather Station

An automatic weather station was installed atop Ayur Bay resort at Nellikunnu. Since the personnel had to shift from the resort, the AWS was shifted on top of Bank of India building at Mukkola on 31st July 2015. The system measures wind speed/direction, atmospheric pressure, temperature, relative humidity and rainfall.

The system consists of the following:

- Gill sonic anemometer
- Microstep pressure sensor
- Microstep relative humidity & temperature sensor
- Meteoservis Rain gauge
- Microstep datalogger

The data is logged on a PC installed at the receiving station at intervals of 10 minutes. The data is transmitted through a UHF link.

An image of automatic weather station is provided below:

Figure 14 – Automatic Weather Station on top of Ayur Bay Resort, Nellikunnu (Mulloor)

5.8 Real Time Kinematic (RTK) Survey

RTK system was mobilised at site to carry out cross shore profiling on the landward side. The system comprises the following:

- Hemisphere GPS R320 GNSS base station
- Hemisphere GPS R 320 rover

A photograph of the system is provided below:

Figure 15 – RTK System fixed at BM-1

5.9 Bathymetric Survey

The bathymetric survey was carried out using the following systems:

- Odom Echotrac Mk III for the singlebeam survey area
- Geoswath GS+ 250 kHz wide swath bathymetric system for the Multibeam survey area

The calibration details of the bathymetric system are given below:

5.9.1 Single Beam Echo Sounder

The single beam echo sounder was calibrated on a daily basis using the 'bar check' method. Actual sound velocity measured using the SVP probe was used in the system. An image of the bar check carried out during the survey is appended below:

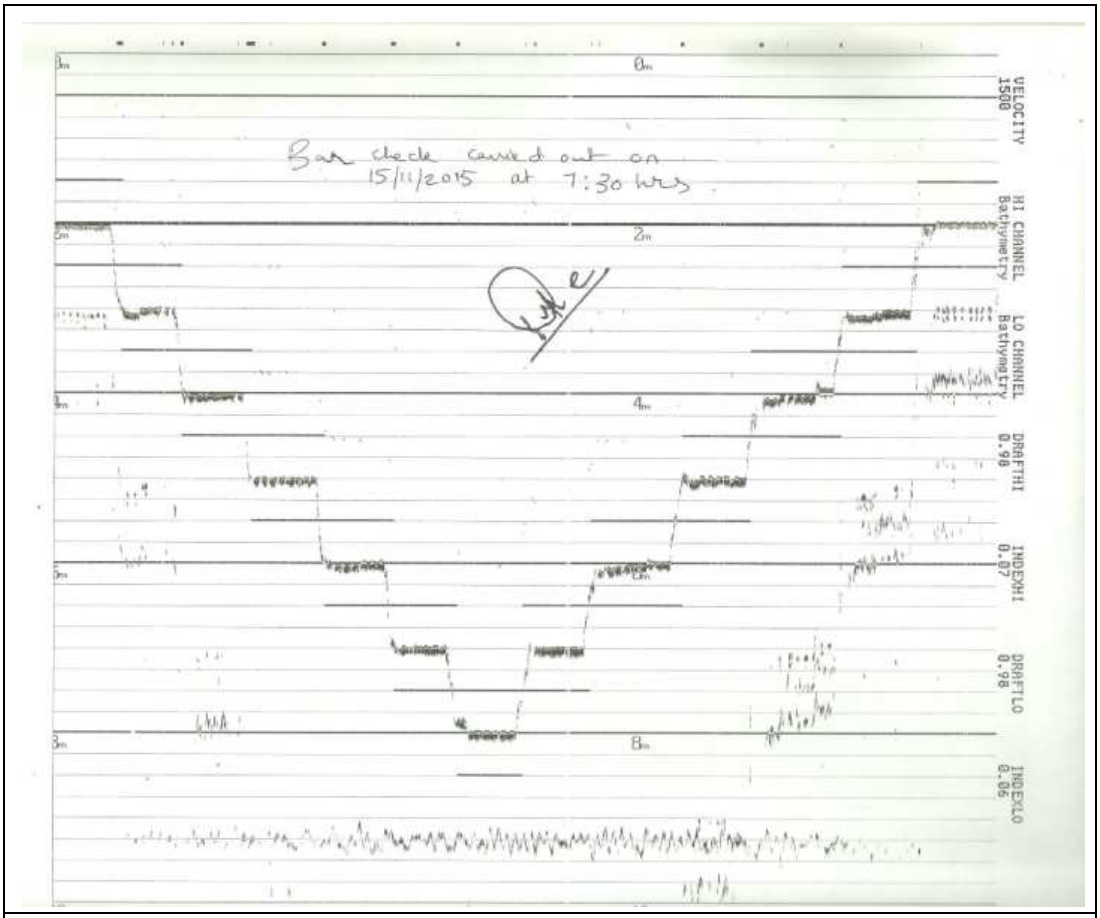


Figure 16 – Bar Check Record

5.9.2 Multi Beam Echo Sounder

The calibration (or patch test) of the Geoswath Plus (GS+) MBES was used to fix the time and angle offsets between the positioning system and the transducer head.

The system offsets were entered in the acquisition software prior to surveying and raw data acquisition. Some of these were easily measured and entered and others were corrected through the calibration procedure. Standard 'patch test' techniques were used for calibrating the system, with the aim of quantifying and compensating for inherent roll, pitch, heading and latency errors. The succeeding paragraphs describe the results of the multibeam calibration carried out on 13th October 2015.

5.9.2.1 Antenna and Sensor Offsets

The antenna and the sensor offsets were measured with the aid of a measuring tape and entered in the Geoswath+ Data Acquisition Module along with the vessel dimensions. The image below denotes the window in the GS+ software to enter different offset values:

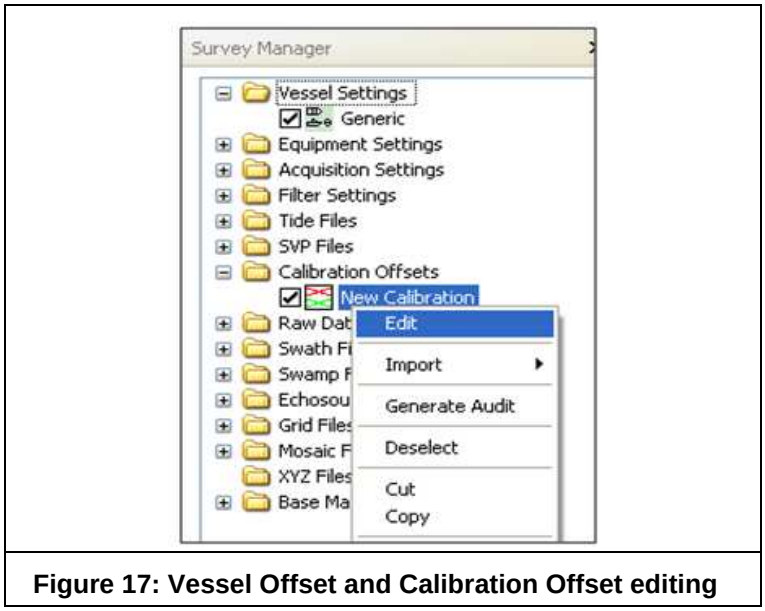


Figure 17: Vessel Offset and Calibration Offset editing

The different offsets used are given below:

- Transducer Sensor offsets measured as the distance from the COG to the transducer point (X= 0.3 m, Y= 11.5m for MFB Bethel).
- Antenna offsets measured as the distance from the COG to the Antenna (X= 3.3m , Y= 0 m and Z= 4m from water line).
- The Time offset (Latency) introduced by DGPS computer/ navigation computers or during the serial data transfers.

An image of the equipment offset is given below:

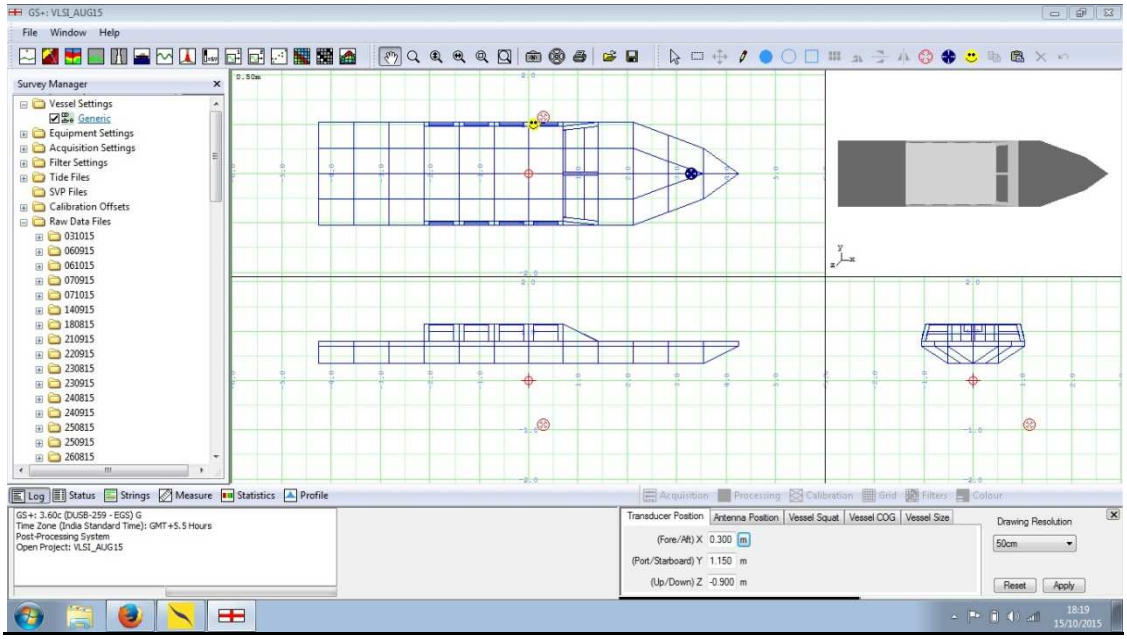


Figure 18: MBES Sensor Offsets of MFB Bethel

5.9.2.2 Roll Calibration

- Three survey lines, approx 800 - 1000m's long, are run acquiring GS+ data in opposite directions at 4 knots over flat topography, with 100% overlap.
- Sound velocity from the miniSVS was used in the system.
- Observed tide at Coast Guard jetty, Vizhinjam was applied to the calibration files.

The roll calibration values for port roll is calculated by selecting two lines run in opposite direction and using the calibration control in the software, running through coarse, medium and fine iteration. The same is repeated for starboard roll, by selecting other two lines.

An image of port roll calibration is provided below:

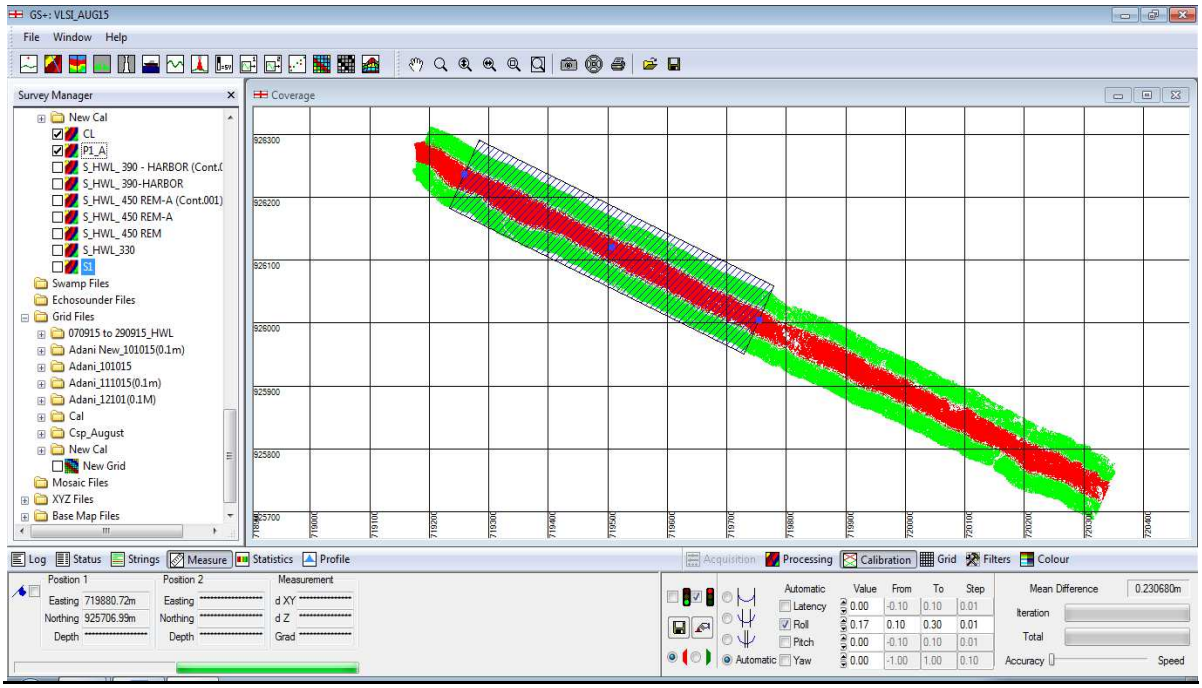


Figure 19: Calibration Results of Port Roll

An image of starboard roll calibration is provided below:

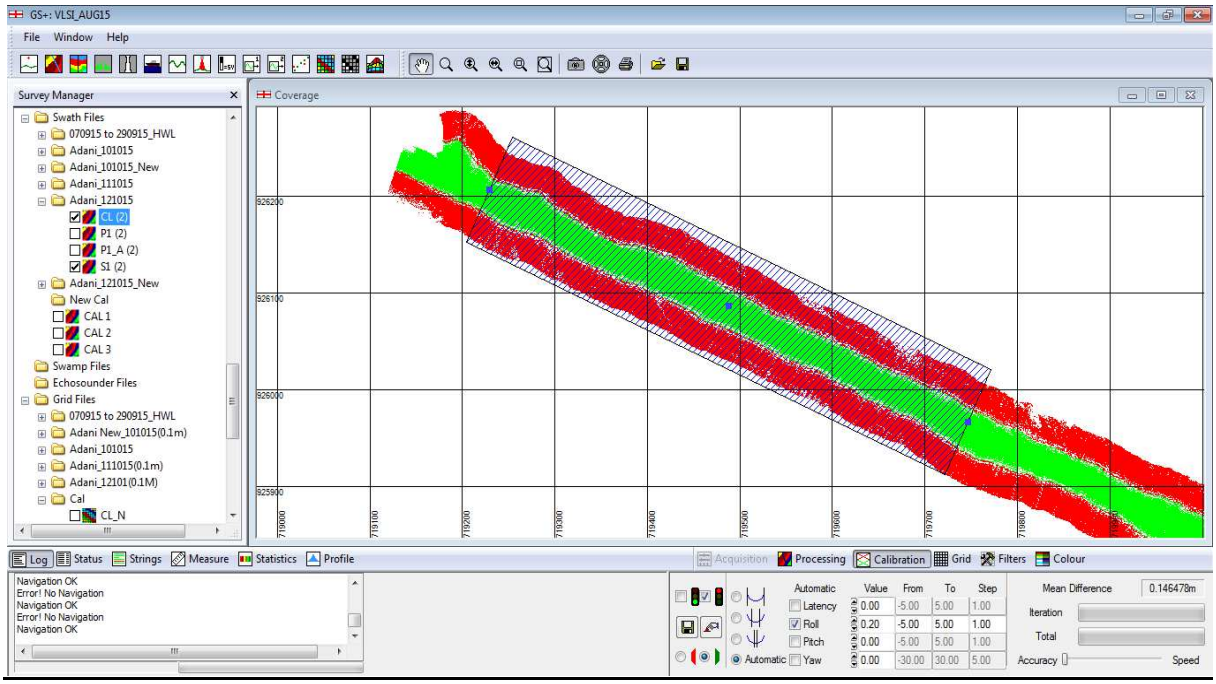


Figure 20: Calibration Results of Starboard Roll

5.9.2.3 Pitch Calibration

The pitch is the (fore/aft) angular difference between the attitude sensor axis and the transducers. On the standard 'V' plate of GS+ head, the attitude sensor and transducers are mechanically aligned, so pitch is near 0. In shallow waters, pitch can be left at 0 as the errors will be small.

5.9.2.4 Yaw & Latency Calibration

A latency offset will have the same effect on the position of a seafloor feature for both port and starboard. Yaw will have the opposite effect on port to that on starboard. This difference can be used to improve the latency and yaw calibrations. By comparing the port and starboard yaw calibrations for different latencies, the correct latency can be found – this will be where the yaw values given by the automated calibration are the same for the port and starboard transducers. This only applies when using the V – plate transducer, as they are in alignment on the plate.

To carry out this calibration, first complete the roll calibration on a flat area, then:

- Collect a set of yaw calibration lines (at least 3 lines with 100% overlap over a slope or any feature)
- Obtain a value for the latency from either port or starboard data
- Run through the coarse, medium and fine calibrations for port yaw, using this latency
- Run through the coarse, medium and fine calibrations for starboard yaw, using this latency
- Check if the yaw values are the same; if not, change the latency and repeat.

Try reducing the latency value by 0.5 second each time. Once the yaw values start to converge then start reducing the latency in 0.01s steps.

The calculation for the present job is given below:

Yaw Port (°)	Latency (s)	Yaw Starboard (°)
5.70	0.90	4.80
5.60	0.95	5.40
5.10	1.00	5.70
4.80	1.05	6.20
5.50	0.96	5.50

Table 6: Yaw & Latency Calculation

From the above methods, the yaw is 5.5° and latency is 0.96 seconds.

5.9.2.5 MBES Calibration Results

The calibration results are provided below:

Parameter	Value	Comments
Latency	0.96s	MX 420 DGPS system
Port Roll	0.17º	DMS accuracy 0.05º in roll (~3.5cm at 40m)
Starboard Roll	0.20º	DMS accuracy 0.05º in roll (~3.5cm at 40m)
Pitch	0	
Yaw	5.5°	Accuracy better than 0.2°

Table 7: Calibration Results

The image from GS+ software depicting the calibration values are given below:

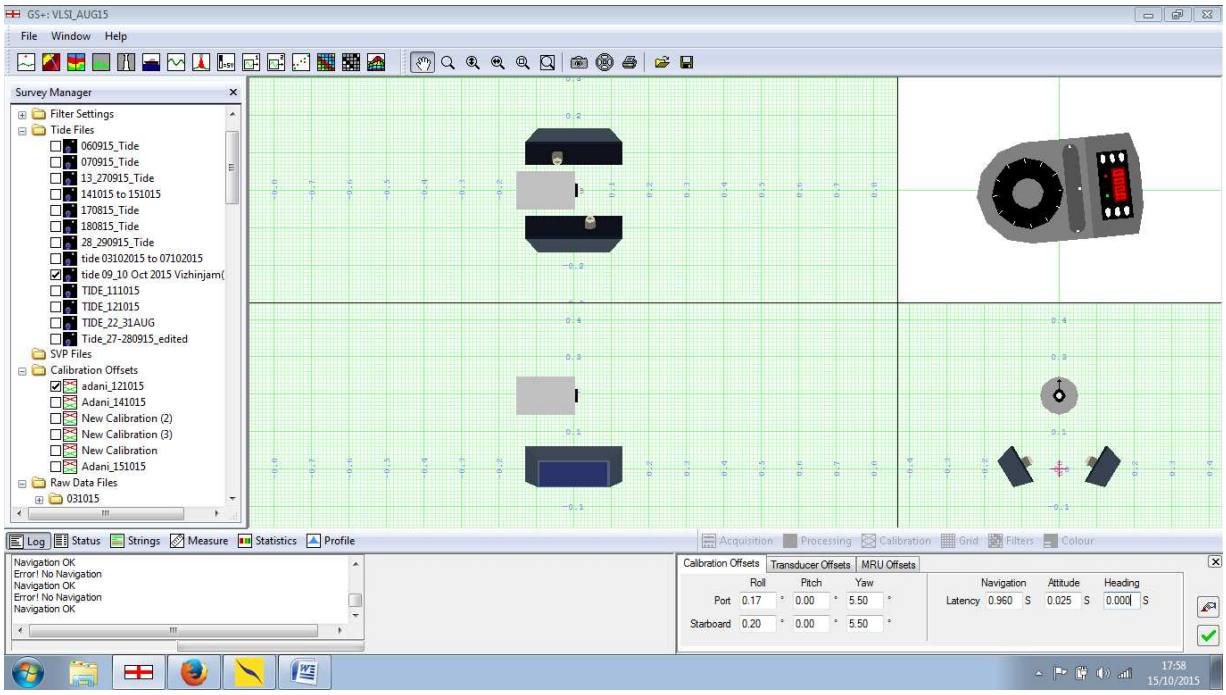


Figure 21: Calibration results shown in Editor.

As per the calibration values obtained, the three survey lines were re-processed. The processed lines were then compared with that of previous lines processed without calibrated values. The results are given below:

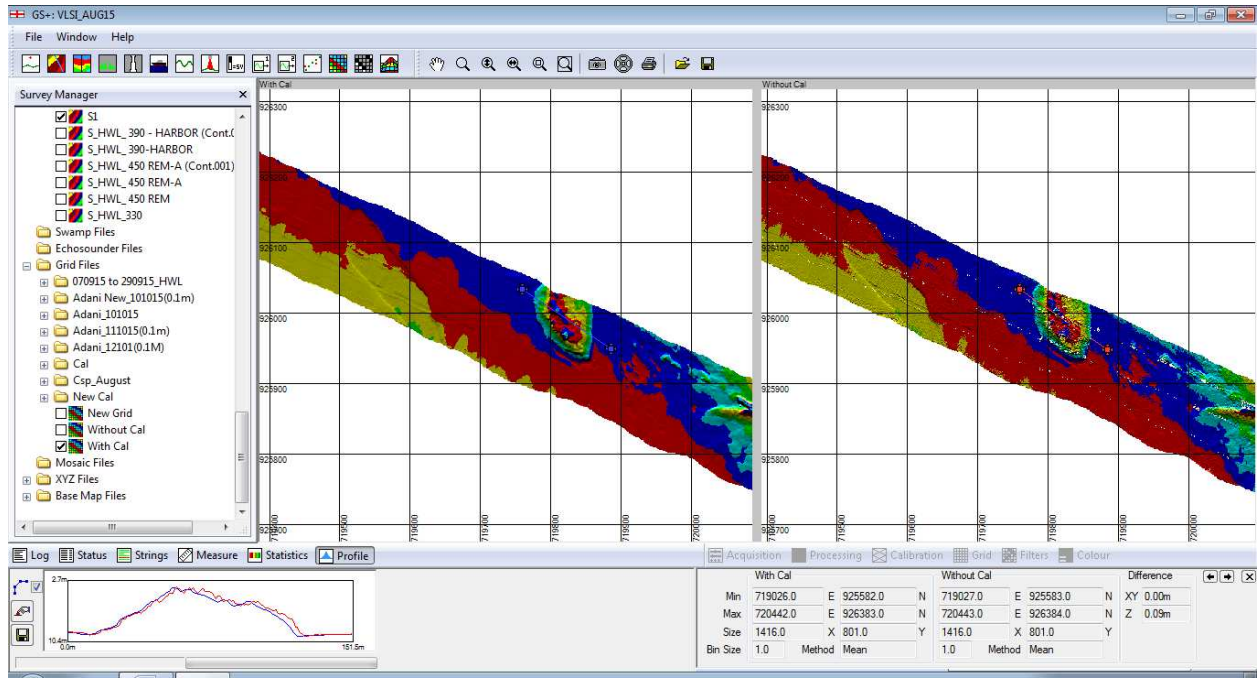


Figure 22: Comparison of 'without' calibration (L) and 'with' calibration (R) grids

The profile shown in red line is for un-calibrated and blue line is for calibrated, indicating a good calibration.

5.10 Grab and Water Sampling

A Van Veen grab was used for collecting the grab samples and a Niskin 5 litre bottle was used to collect the water samples.

The grab samples were analysed as per IS 1498.

The water samples were 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.

5.11 Data Processing and Interpretation

Navigation data was processed using EIVA software. The single beam data was logged in EIVA Navipack and after applying tide; the data was processed and plotted using AutoCAD.

The Multibeam data was processed in the GS+ software. After applying the calibration values, sound velocity and the tide, the processed data was QC-ed in the in-house software 'C-View'.

ADCP data was processed using WinADCP® / WinSC® and the data was plotted in MS Excel®. The processed wave data from the buoy was plotted in MS Excel.

Grab samples were analysed at Geo Foundations & Structures Pvt. Ltd., Kochi and the water samples were analysed at Standard^{S} Environmental & Analytical Laboratories, Kochi, both of which are NABL approved laboratory.

6. SURVEY RESULTS

The results obtained for the monsoon season are presented in this section.

6.1 Control Points

As per the contract, 41 reference stations were fixed along the 40 km survey boundary using RTK DGPS system. This was apart from the three reference stations; BM-1, BM-2 and BM-3 which were fixed for all future references.

The co-ordinates of BM-1 and BM-2 were provided by VISL (Detailed Project Report on Rail Connectivity to Vizhinjam International Seaport: Kerala, 2011) prior to start of survey. BM-1 lies next to the Sri Nagar Bhagavathy Temple, Mulloor. BM-2 consists of a chiselled square on the rock adjacent to the compound wall of the Kollamkodu Sahib Dargah at Vizhinjam. BM-3 was set up on the roof of the VISL Project Office. The Survey of India Benchmark (SOI BM) which lies on a rock adjoining the basement on the western side of Vizhinjam mosque was also provided. This point is 6.945m above chart datum.

The image below depicts all the locations:

Figure 23 – Benchmark locations

The details of BM-1, BM -2 and BM-3 are given below:

Station Description	Co-ordinates in WGS 84		Height above Chart Datum (metre)
	Geographical	UTM	
BM-1 (Near Mulloor temple)	08° 21’ 55”.7808 N 77° 00’ 13”.6084 E	720657.1797 mE 925265.7437 mN	11.5576
BM-2 (Kollamkodu Sahib Dargah)	08° 22’ 33”.5100 N 76° 59’ 12”.1368 E	718770.2408 mE 926415.5205 mN	11.209 m
BM-3 (On the roof of VISL Project office)	8° 22’ 21”.7313 N 77° 00’ 03”.3253 E	720338.4535 mE 926061.5341 mE	44.0577

Table 8: Details of stations BM-1, BM-2 & BM-3

Photographs of the three stations are provided below:

Figure 24 – BM-2 adjacent to Dargah, Vizhinjam

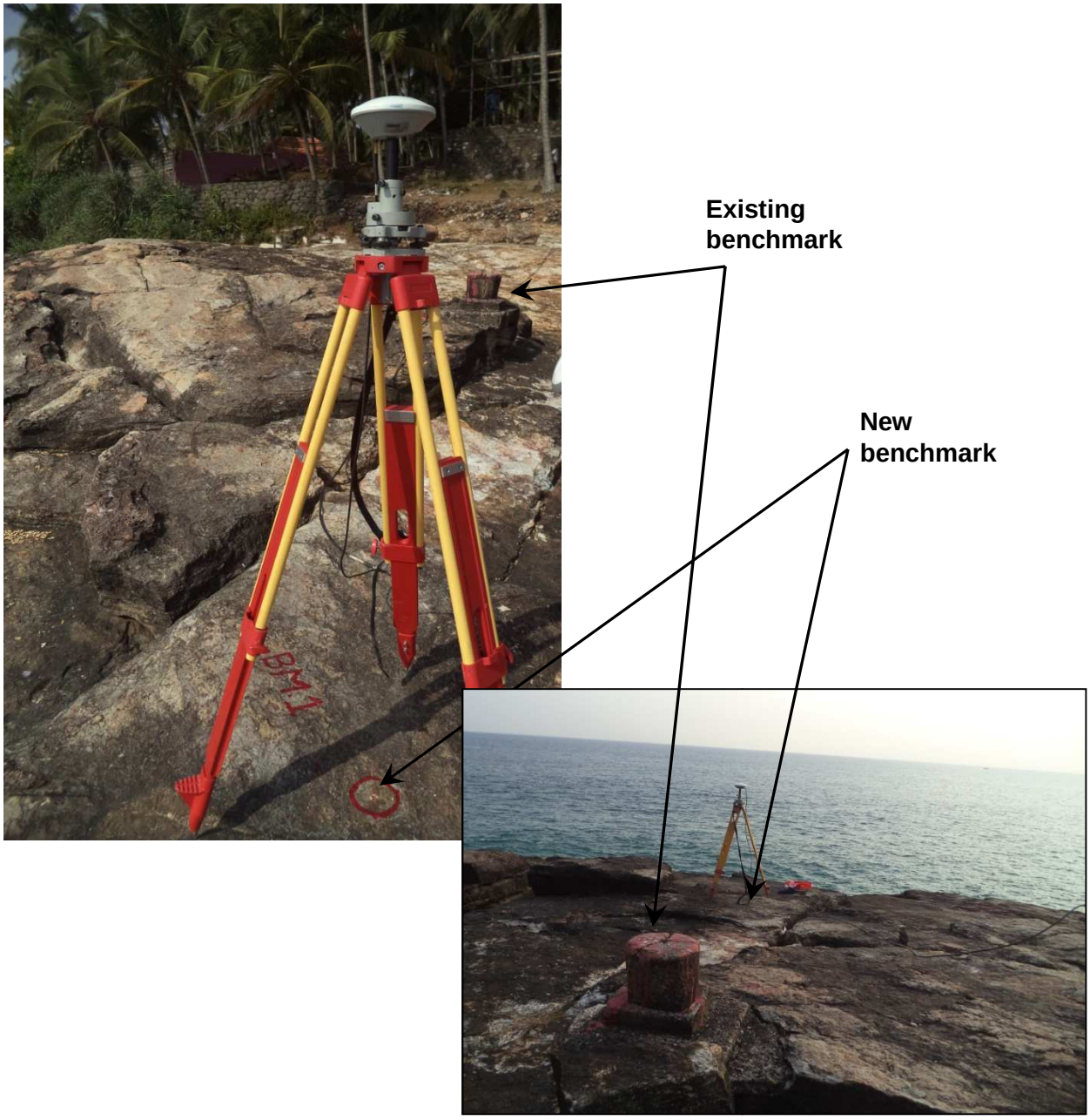


Figure 25 – BM-1 near to Sri Nagar Bhagavathy temple, Mulloor

Figure 26 – BM-3 roof top of VISL Project Office

The image below shows the SoI benchmark which is behind the Dargah at Vizhinjam.

Figure 27 – SoI Benchmark

Based on the above benchmark co-ordinates, 41 reference points were fixed along the shore during the first phase of the survey. Most of the points were fixed on existing rocks, concrete structures and few of them were also fixed on the existing CES markers. Considering BM-1 as centre, the points were named NIOT-CP-1 to NIOT-CP-19 to the south (Poovar) and NIOT-CP-A to NIOT-CP-V to the north (Shankumugham). During the course of the project, a few points had to be relocated due to damage/non-access to site.

The following table provides the updated details of the existing reference stations:

Sl No.	Reference Points	Easting	Northing	Latitude	Longitude	Height above CD (m)
1	NIOT_CP-19	734945.865	914388.234	8° 15'59".37475 N	77° 7'58".59693 E	5.052
2	NIOT_CP-18	734116.42	915024.1573	8° 16'20".21262 N	77° 7'31".61235 E	5.86
3	NIOT_CP-17	733111.267	915744.911	8° 16'43.84109 N	77° 6'58".90161 E	11.668
4	NIOT_CP-16	732485.4329	916183.7851	8° 16'58".23085 N	77° 6'38".53276 E	5.0749
5	NIOT_CP-15	731570.272	916840.7065	8° 17'19".76585 N	77° 6'8".74908 E	5.658
6	NIOT_CP-14	730843.3861	917407.4855	8° 17'38".33474 N	77° 5'45".09983 E	7.7322
7	NIOT_CP-13	730390.4197	917721.6701	8° 17'48".63657 N	77° 5'30".35551 E	7.7694
8	NIOT_CP-12	729654.9678	918329.1176	8° 18'8".52996 N	77° 5'6".43234 E	4.4221
9	NIOT_CP-11	728738.3202	919038.8737	8° 18'31".78333 N	77° 4'36".60606 E	3.9544
10	NIOT_CP-10	727993.7027	919569.1662	8° 18'49".16695 N	77° 4'12".36870 E	3.7986
11	NIOT_CP-9	729397.4389	920046.5818	8° 19'4".46345 N	77° 4'58".31359 E	4.3316
12	NIOT_CP-8	726454.8538	920766.0091	8° 19'28".37591 N	77° 3'22".29415 E	3.9366
13	NIOT_CP-7	725656.2954	921415.6312	8° 19'49".65109 N	77° 2'56".31253 E	4.2844
14	NIOT_CP-6	724768.7938	922157.4539	8° 20'13".94139 N	77° 2'27".43947 E	4.2148
15	NIOT_CP-5	724159.7014	922134.6909	8° 20'13".30291 N	77° 2'7".53371 E	3.8251
16	NIOT_CP-4	723270.1977	923410.6967	8° 20'54".97675 N	77° 1'38".68346 E	3.0972
17	NIOT_CP-3	722465.6274	923988.1456	8° 21'13".90304 N	77° 1'12".49001 E	3.1602
18	NIOT_CP-2	721481.8683	924273.9063	8° 21'23".36632 N	77° 0'40".39178 E	11.4171
19	NIOT_CP-1	721226.3295	924486.3499	8° 21'30".32234 N	77° 0'32".07696 E	14.6213
20	NIOT_CP-A	720194.5904	926065.8282	8° 22'21".89482 N	76° 59'58".62481 E	11.6288
21	NIOT_CP-B	717970.883	927172.091	8° 22'58".26291 N	76° 58'46".13906 E	22.9947
22	NIOT_CP-C	717565.394	927637.0357	8° 23'13".46045 N	76° 58'32".96422 E	4.4694
23	NIOT_CP-D	717237.5958	928806.139	8° 23'51".56131 N	76° 58'22".44381 E	3.3282
24	NIOT_CP-E	716979.2207	929552.944	8° 24'15".90758 N	76° 58'14".12252 E	4.7432
25	NIOT_CP-F	716489.6905	930413.2052	8° 24'43".98399 N	76° 57'58".26496 E	5.5908
26	NIOT_CP-G	715943.5657	931284.6071	8° 25'12".43215 N	76° 57'40".55899 E	5.2857
27	NIOT_CP-H	715577.856	931801.862	8° 25'29".32541 N	76° 57'28".9107 E	4.371
28	NIOT_CP-I	714782.774	932862.004	8° 26'03".95636 N	76° 57'2".87784 E	4.619
29	NIOT_CP-J	714171.7189	933470.9072	8° 26'23".87197 N	76° 56'43".00490 E	7.8878
30	NIOT_CP-K	713749.7645	933992.4272	8° 26'40".91294 N	76° 56'29".29807 E	7.6638
31	NIOT_CP-L	713118.6205	934741.1346	8° 27'5".38141 N	76° 56'8".79020 E	4.2566
32	NIOT_CP-M	712542.8348	935407.128	8° 27'27".14889 N	76° 55'50".07774 E	4.0076
33	NIOT_CP-N	711773.0753	935995.2397	8° 27'46".41283 N	76° 55'25".01160 E	6.3616

Sl No.	Reference Points	Easting	Northing	Latitude	Longitude	Height above CD (m)
34	NIOT_CP-O	711328.4672	936796.413	8° 28'12".55834 N	76° 55'10".60768 E	7.6976
35	NIOT_CP-P	710540.4298	937692.2264	8° 28'41".83894 N	76° 54'44".99218 E	5.7295
36	NIOT_CP-Q	709869.231	938480.1943	8° 29'7".59078 N	76° 54'23".17776 E	5.4124
37	NIOT_CP-R	709080.5573	939351.7461	8° 29'36".08144 N	76° 53'57".53564 E	4.3292
38	NIOT_CP-S	708512.7295	940019.1963	8° 29'57".89418 N	76° 53'39".07962 E	5.08
39	NIOT_CP-T	707885.2999	940760.5905	8° 30'22".12280 N	76° 53'18".68634 E	6.2363
40	NIOT_CP-U	707297.3093	941476.2951	8° 30'45".50894 N	76° 52'59".57765 E	4.7072
41	NIOT_CP-V	706563.5161	942438.4132	8° 31'16".93766 N	76° 52'35".74070 E	4.814
42	NIOT_CP_ LEELA	717068.81	928439.539	8° 23'39".65832 N	76° 58'16".86749 E	20.082
43	NIOT_BM-1	720657.1797	925265.7437	8° 21'55".78077 N	77° 0'13".60836 E	11.5576
44	NIOT_BM-3 (VISL Office)	720338.4535	926061.5341	8° 22'21".73127 N	77° 0'3".32532 E	44.0577
45	NIOT_BM-2	718770.2408	926415.5205	8° 22'33".51000 N	76° 59'12".13680 E	11.209

Table 9: Control Point Co-ordinates

All the points were engraved as per their respective names. The points NIOT_CP_19, NIOT_CP_17, NIOT_CP_H and NIOT_CP_I were relocated with respect to the earlier points. An additional point inside the Leela hotel was also fixed, which is shown in point 42 above.

6.2 Tidal Measurements

The tides were observed near the Coast Guard jetty for the first season. The tide is referenced to the chart datum, the value of which was provided by VISL. The temporary benchmark is marked on the wharf and is 3.261 above chart datum. An image of the TBM is provided below:

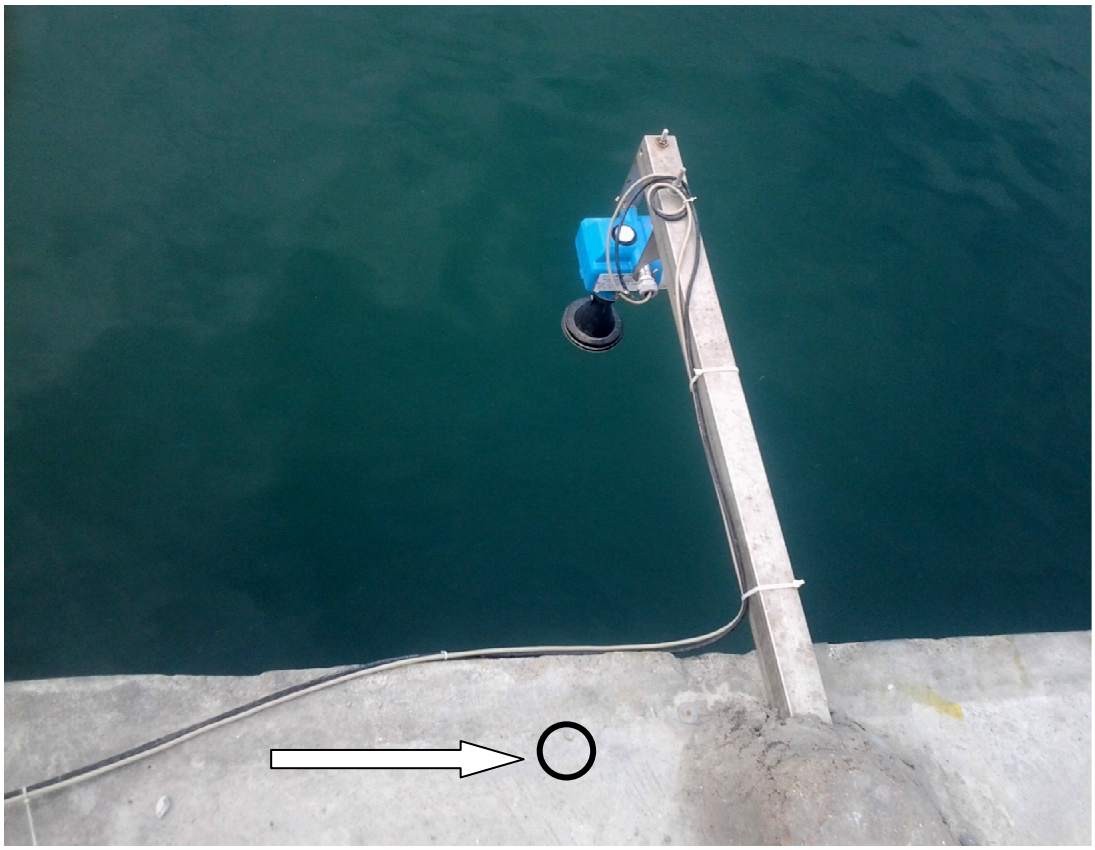


Figure 28 – Location of TBM

The observed tides are mixed semi diurnal in nature. The maximum range was observed during the springs.

The tidal data collected for the period is placed at Annexure I. From the second week of July to the second week of August, the tidal values obtained had spurious data. For that period, predicted tide using the harmonic constituents derived from February to June 2015 was used, which is also presented in the Annexure.

6.3 Current Measurements

Acoustic Doppler Current Profilers (ADCP) were mobilised for mapping the current in the survey area. One 600 kHz Rio Grande and three 600 kHz Sentinel ADCPs were deployed at the locations for measuring currents.

The following table gives the deployment details of the ADCPs in the survey area:

ADCP MOORING LOCATIONS WGS-84, UTM Projection, CM 75° East, Zone 43, North					
Location	**Water Depth (m)**	**Period of Observation**	**Easting**	**Northing**	**Frequency**
P1 (Vizhinjam)	21.2	5th July to 4th Aug 2015	08° 22' 06.38"N	76° 58' 58.62"E	600 kHz
P2 (Poovar)	22.5	5th July to 4th Aug 2015	08° 18' 00.25"N	77° 03' 55.24"E	600 kHz
P3 (Pachalloor)	21.6	5th July to 4th Aug 2015	08° 25' 01.15"N	76° 56' 28.60"E	600 kHz
P4 (Mulloor)	27.3	5th July to 4th Aug 2015	08° 21' 43.15"N	76° 59' 25.86"E	600 kHz

Table 10: ADCP Mooring Locations

The results of the data obtained by the ADCPs at the four locations are documented below, location-wise.

6.3.1 Location P1 (Vizhinjam)

The ADCP was deployed for a period of 30 days to cover one lunar cycle. It was deployed on an 'L' frame installed on a boat, in a downward looking mode and was used to measure the speed and direction of the current.

The data was recovered after 30 days of observation and after quality checks, spurious data were filtered out.

A maximum current of 83.2 cm/s was measured at the water surface on 1st August 2015.

Refer to the following compass plots for speed and direction of the currents, where the speed data is plotted in cm/s:

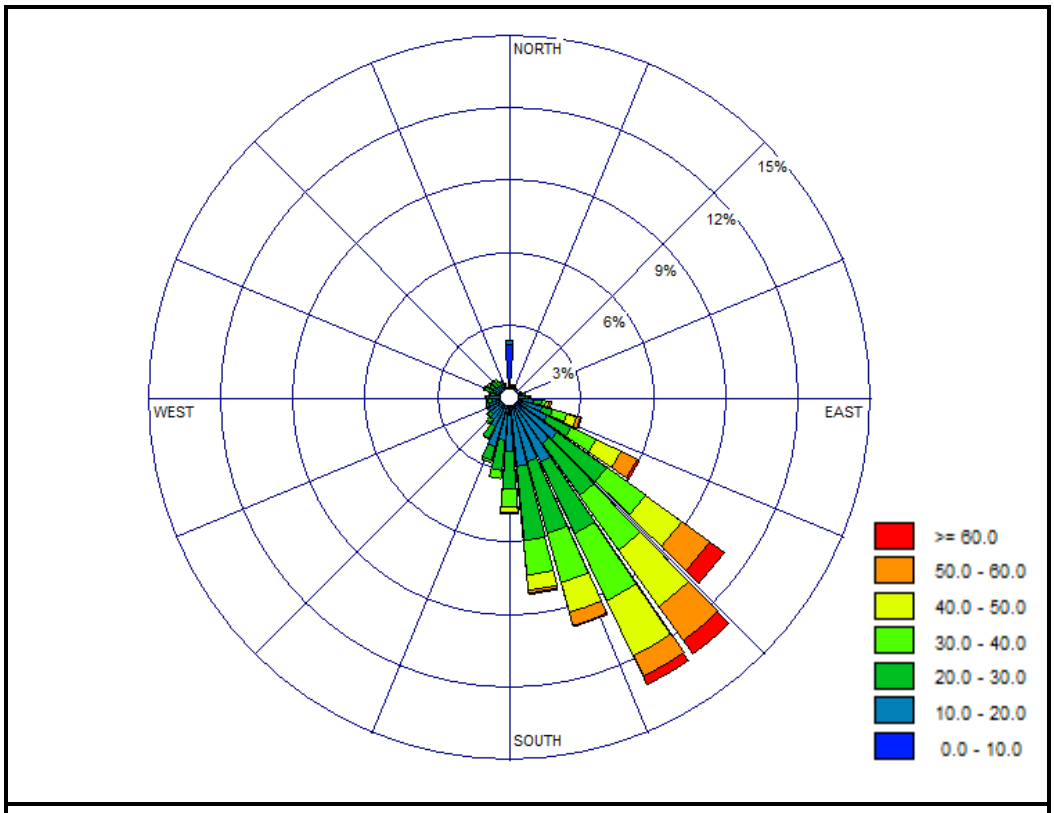


Figure 29 – Compass plot (Surface speed in cm/s) – P1

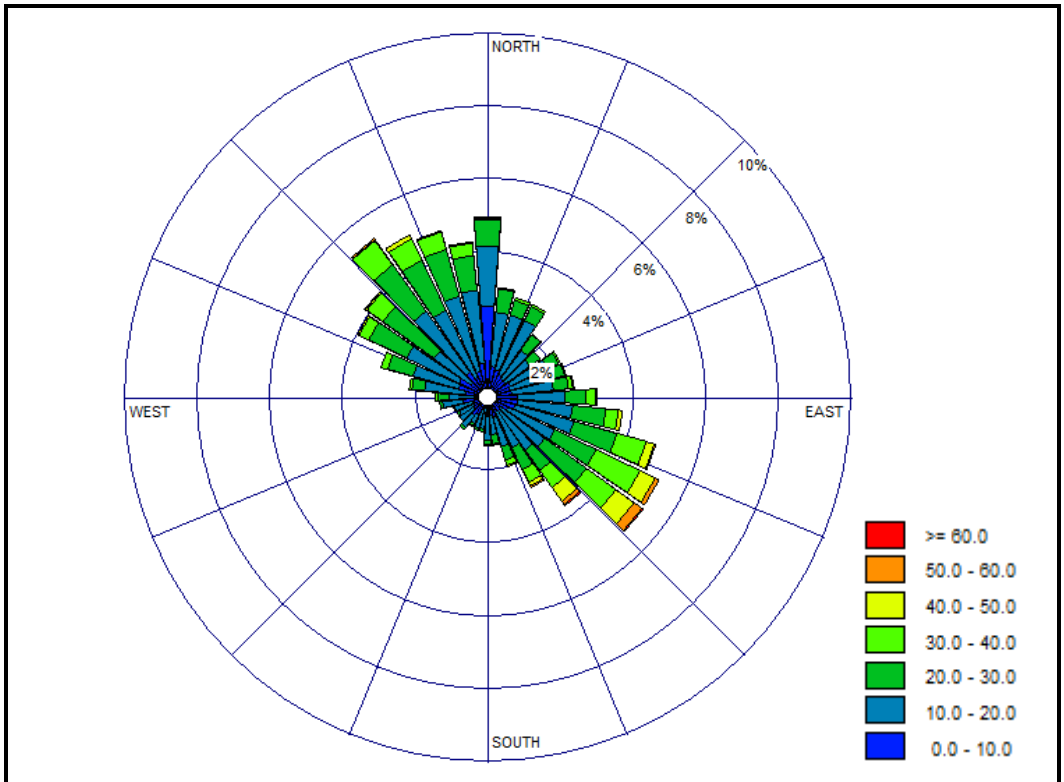


Figure 30 – Compass plot (Mid Depth speed in cm/s) – P1

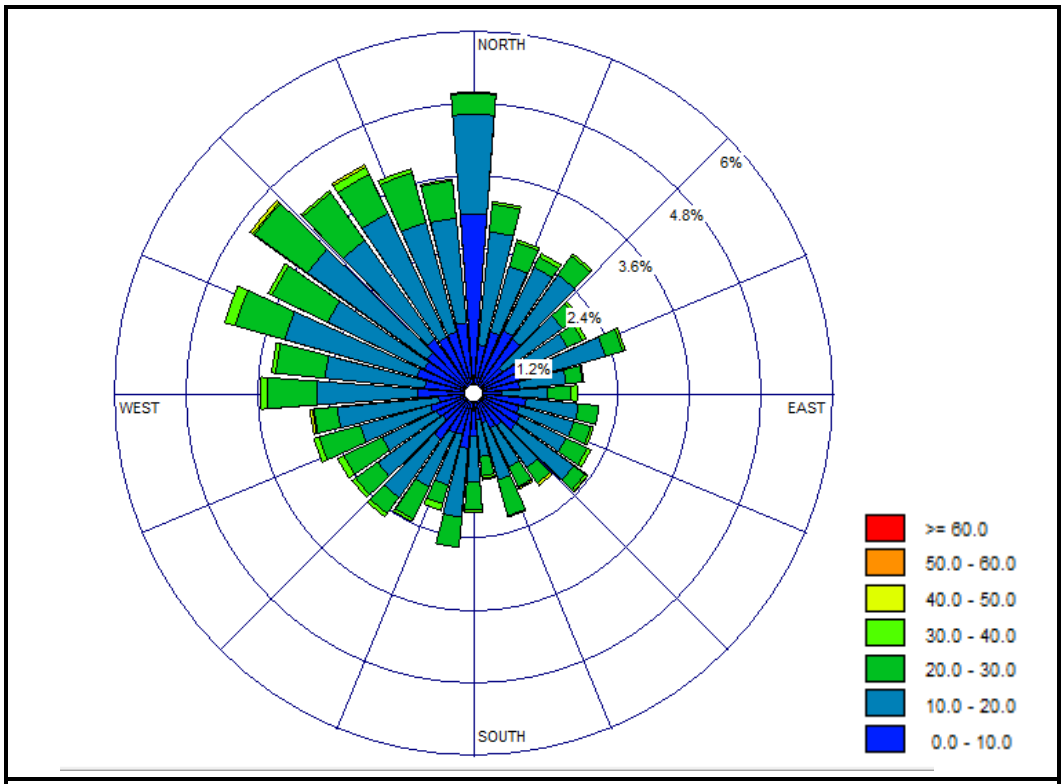


Figure 31 – Compass plot (Near Bottom speed in cm/s) – P1

The data reveals that the surface current flow was south-easterly.

The following table and figures give the histogram of frequency distribution & percentage exceedance curve of current speed:

Frequency Distribution			
Speed (Cm/s)	**Surface**	**Mid**	**Bottom**
0 – 10	639	1108	1447
10 – 20	1247	1830	2093
20 – 30	1056	985	820
30 – 40	668	396	93
40 – 50	502	111	11
50 – 60	259	31	0
60 – 70	72	3	0
>70	21	0	0
Total	**4464**	**4464**	**4464**

Table 11: Frequency Distribution of current speed - P1

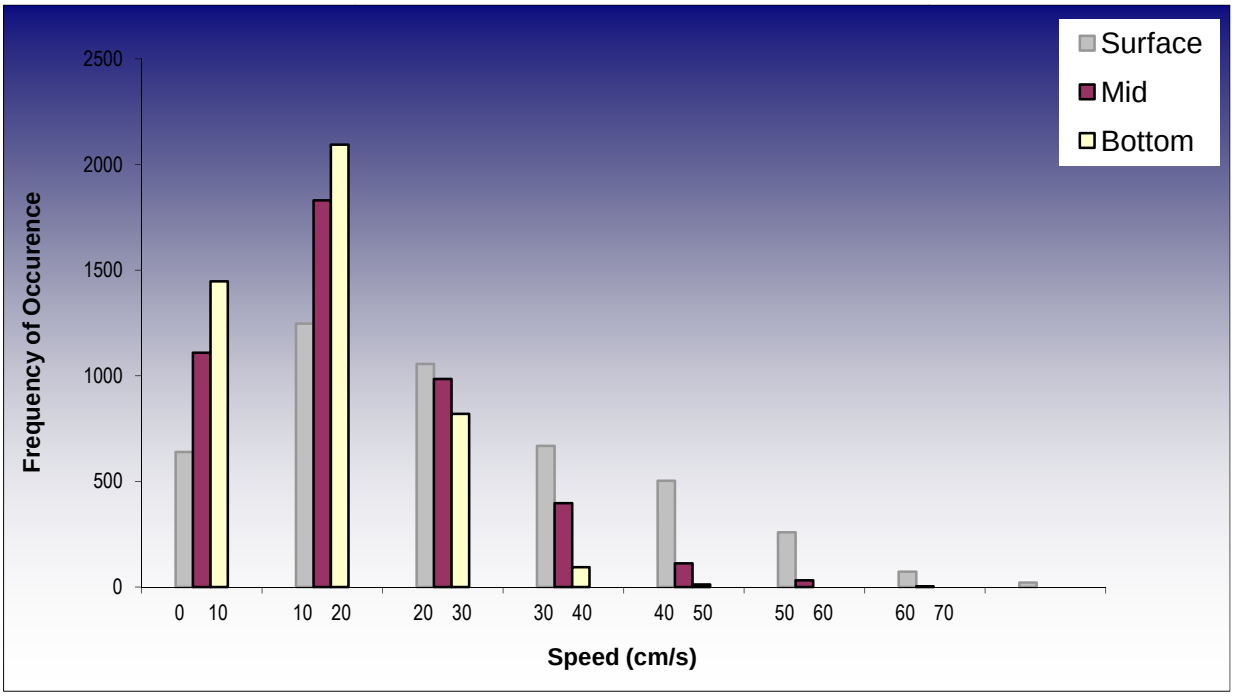


Figure 32 – Frequency Distribution of current speed – P1

Frequency Distribution			
Speed (cm/s)	**% of Surface**	**% of Mid**	**% of Bottom**
0	100	100	100
10	85.68	75.17	67.59
20	57.72	34.17	20.7
30	34.05	12.1	2.33
40	19.08	3.23	0.25
50	7.82	0.74	0
60	2.02	0.04	0
70	0.47	0	0

Table 12: Percentage of Exceedance of current speed – P1

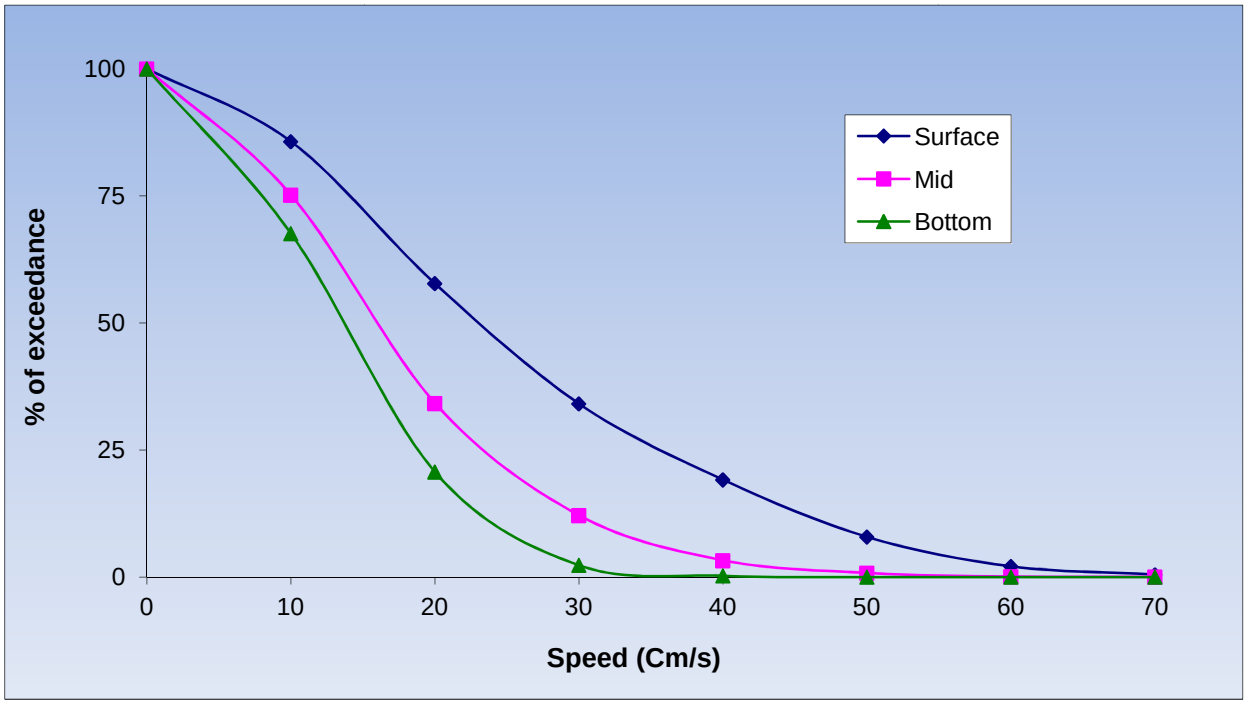


Figure 33 – Frequency Distribution of current speed – P1

The exceedance curve reveals that the current speed was mainly in the range of 0 to 40 cm/s during the period of observation.

The exceedance curves are given only for 3 levels (near surface, mid depth and near bottom obtained from the bin numbers 1, 13 and 26 respectively).

Progressive vector diagram for the full observation period is given below:

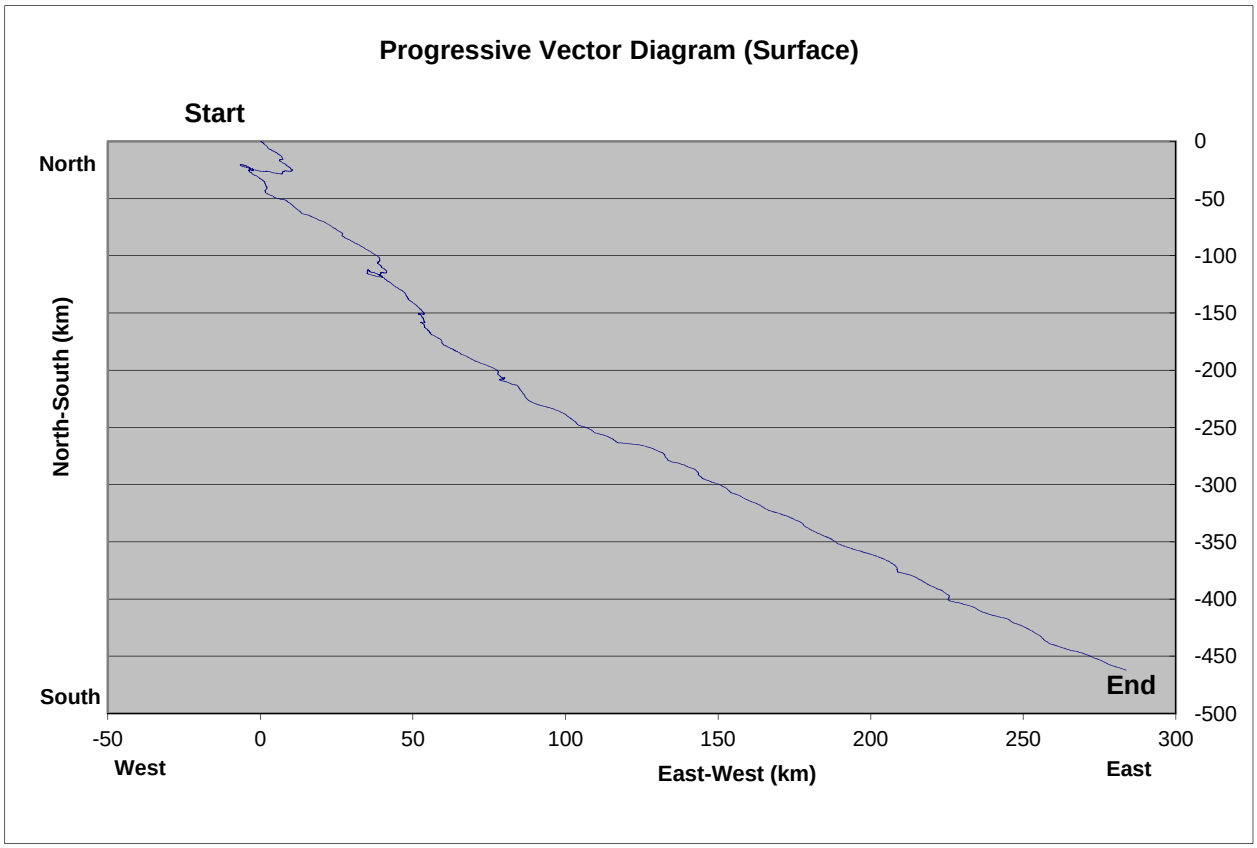


Figure 34 – Progressive Vector Diagram – P1

The progressive vector diagram is used to simulate a Lagrangian display from Eulerian measurements (a moored currentmeter). The progressive vector diagram is constructed by drawing the first current vector in a Cartesian co-ordinate grid. The second vector is then added to the first vector, its tail sitting on the head of the first vector, and so on, as shown in the above figure. The x- and y-axis, which are in velocity units (cm/s), are converted to space units (km) by noting that a water parcel travelling at 1 cm/s for 1 hour will have covered a distance of 1 cm/s times 3600 seconds, or 0.36 km. The above figure reveals that a parcel of water would have travelled about 540 km southeastwards during one lunar cycle.

6.3.2 Location P2 (Poovar)

The ADCP was deployed for a period of 30 days to cover one lunar cycle. It was deployed on an 'L' frame installed on a boat, in a downward looking mode and was used to measure the speed and direction of the current.

The data was recovered after 30 days of observation and after quality checks, spurious data were filtered out.

A maximum current of 85.7 cm/s was measured at the water surface on 31st July 2015.

Refer to the following compass plots for speed and direction of the currents, where the speed data is plotted in cm/s:

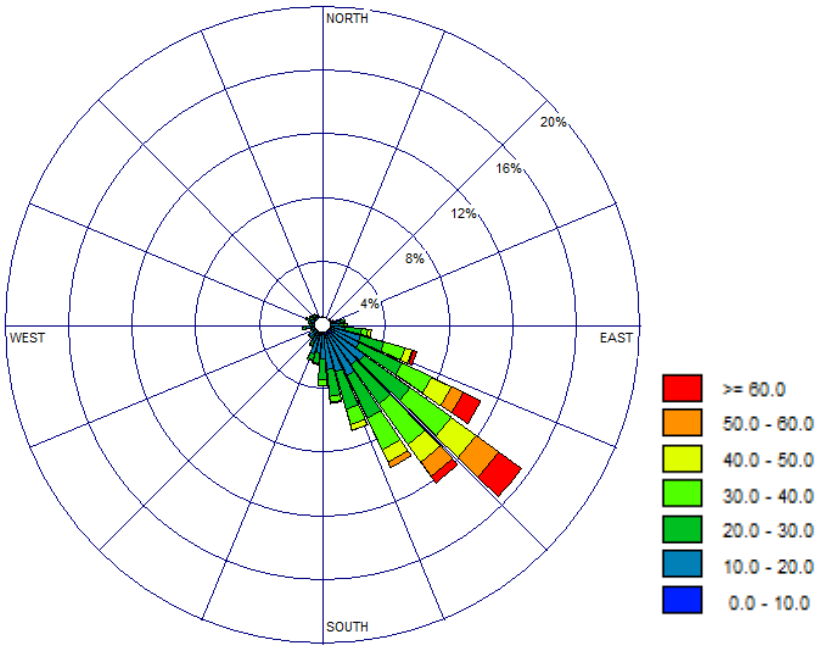


Figure 35 – Compass plot (Surface speed in cm/s) – P2

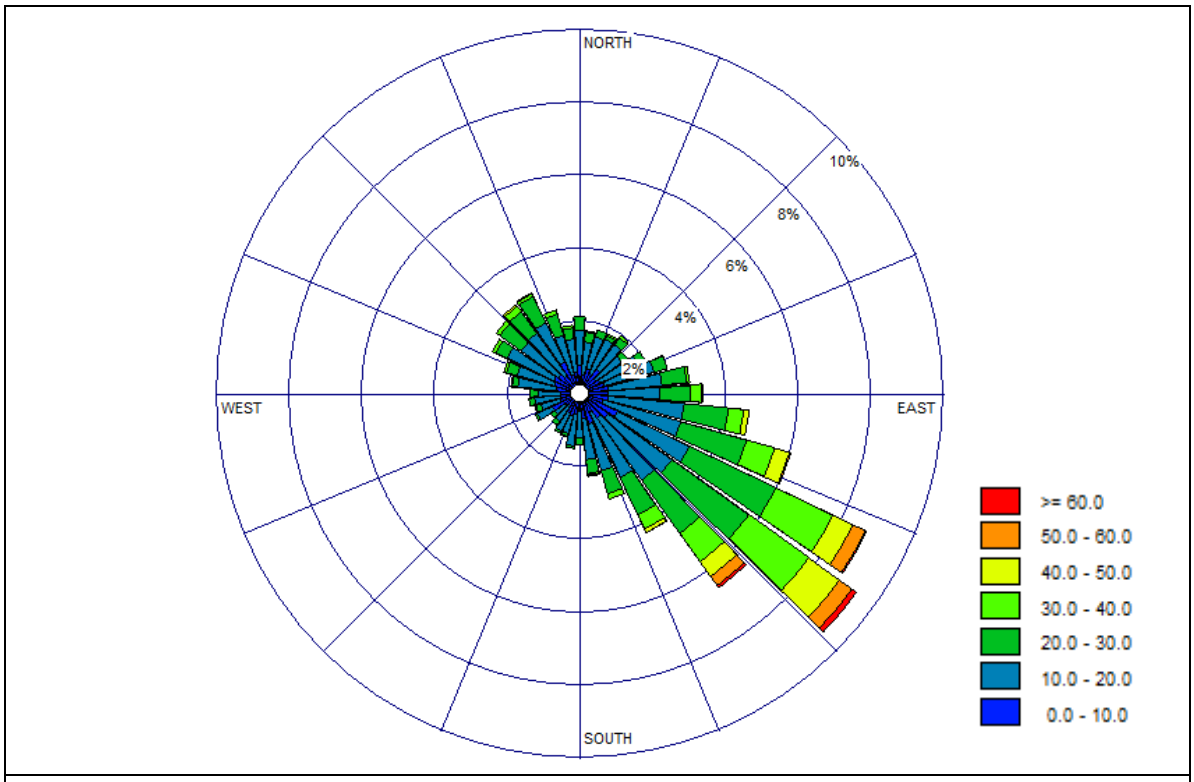


Figure 36 – Compass plot (Mid Depth speed in cm/s) – P2

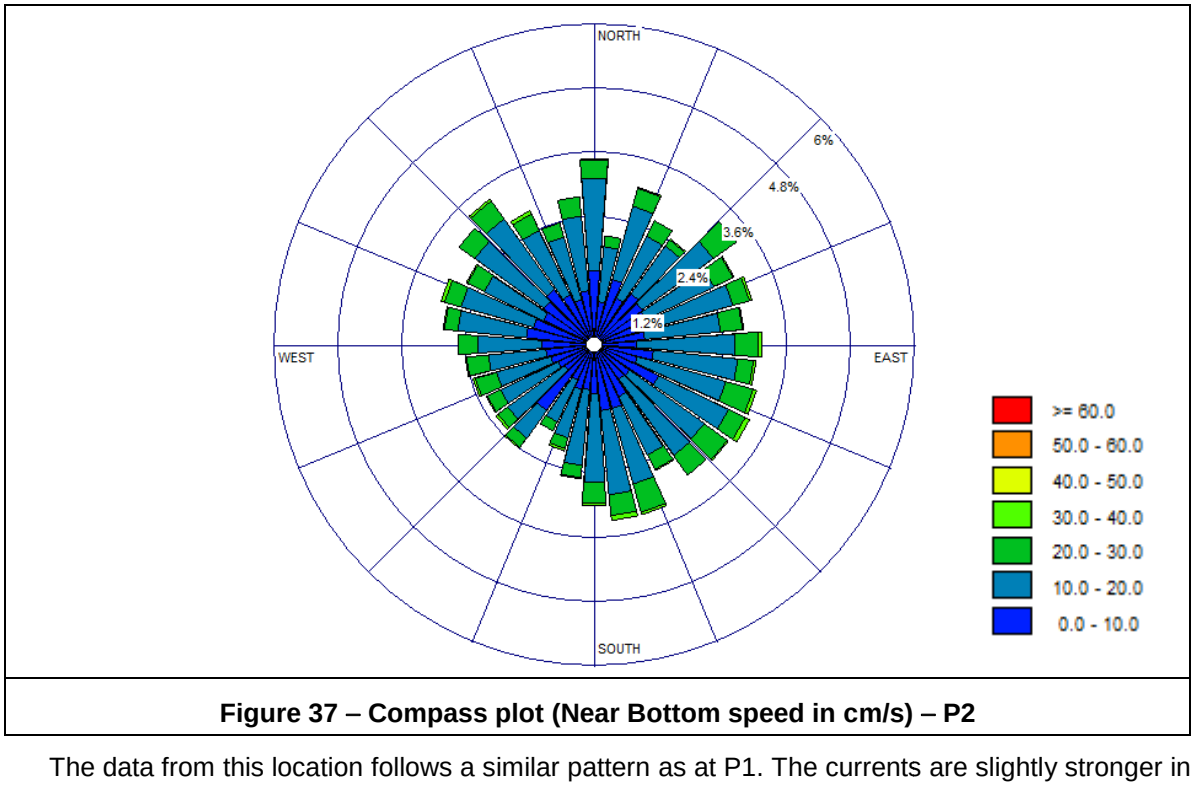


Figure 37 – Compass plot (Near Bottom speed in cm/s) – P2

The data from this location follows a similar pattern as at P1. The currents are slightly stronger in this location.

The following table and figures give the histogram of frequency distribution & percentage exceedance curve:

Frequency Distribution			
Speed (Cm/s)	**Surface**	**Mid**	**Bottom**
0 – 10	626	1119	1656
10 – 20	1420	1853	2205
20 – 30	1109	941	554
30 – 40	650	356	49
40 – 50	304	132	0
50 – 60	188	52	0
60 – 70	104	11	0
>70	63	0	0
Total	**4464**	**4464**	**4464**

Table 13: Frequency Distribution of current speed – P2

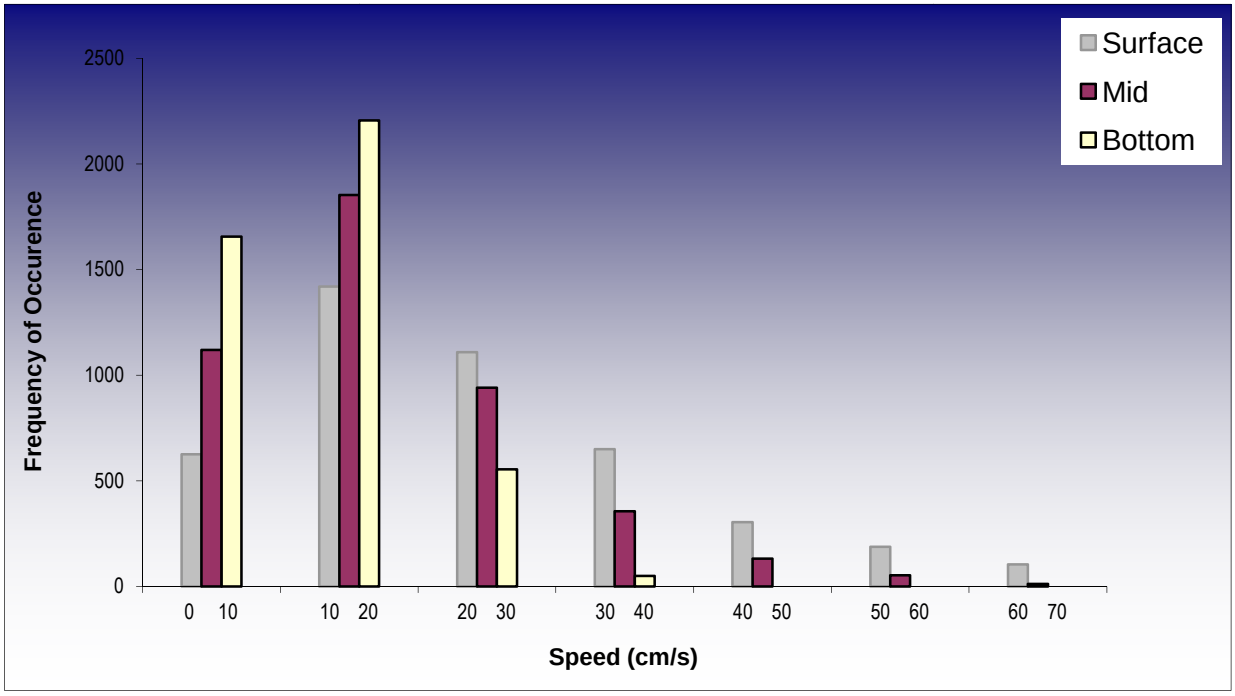


Figure 38 – Frequency Distribution of current speed – P2

Frequency Distribution			
Speed (cm/s)	**% of Surface**	**% of Mid**	**% of Bottom**
0	100	100	100
10	85.98	74.93	62.9
20	54.17	33.42	13.51
30	29.32	12.34	1.1
40	14.76	4.37	0
50	7.95	1.41	0
60	3.74	0.25	0
70	1.41	0	0

Table 14: Percentage of Exceedance of current speed – P2

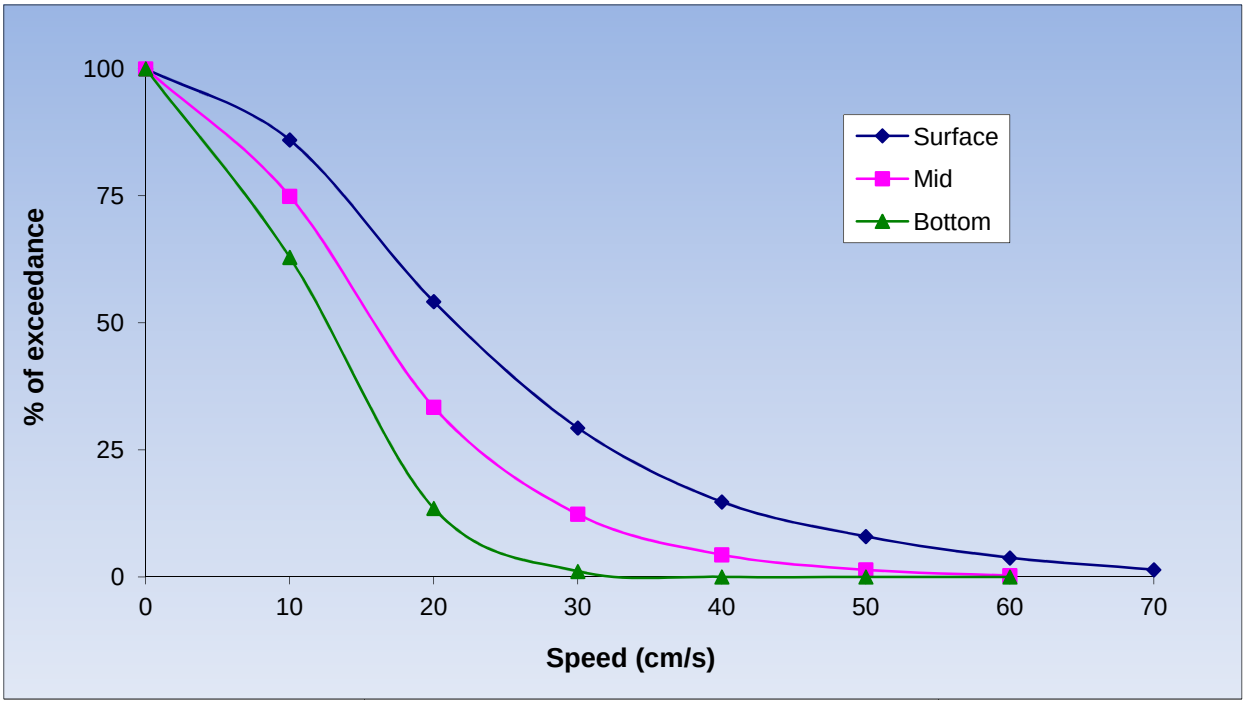


Figure 39 – Exceedance Curve of current speed – P2

The exceedance curve reveals that the speed exceeded 40 cm/s about 4.34% of the observation period (at mid-depth).

The progressive vector diagram for the complete lunar cycle is provided below:

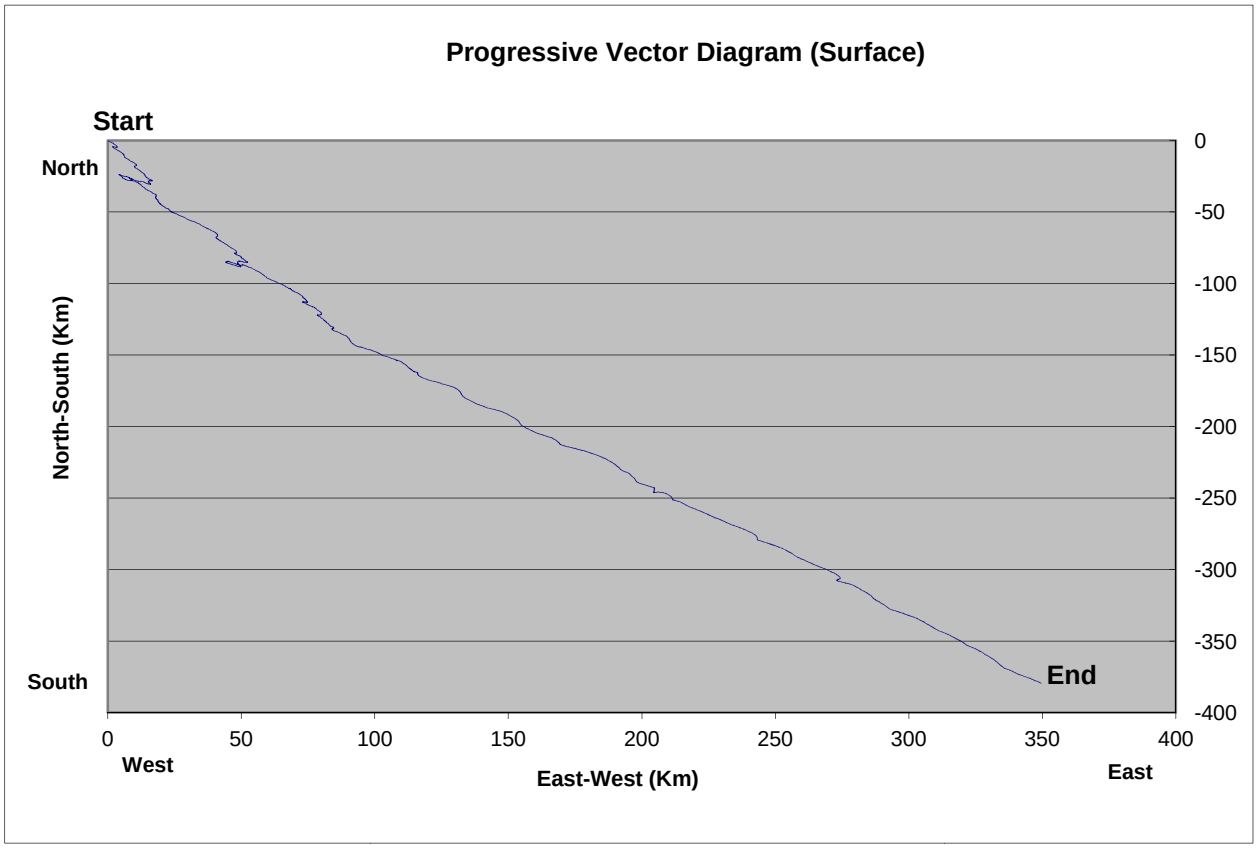


Figure 40 – Progressive Vector Diagram – P2

The above figure reveals that a parcel of water would have travelled about 515 km towards southeast.

6.3.3 Location P3 (Pachalloor)

The ADCP was deployed for a period of 30 days to cover one lunar cycle. It was deployed on an 'L' frame on a downward looking mode to measure the speed and direction.

After recovery, the data was properly QC-ed for removing spurious data.

A maximum speed of 67.9 Cm/s was observed on 31st July 2015 at 22:40 hours.

Refer to the following compass plots for speed and direction of the currents:

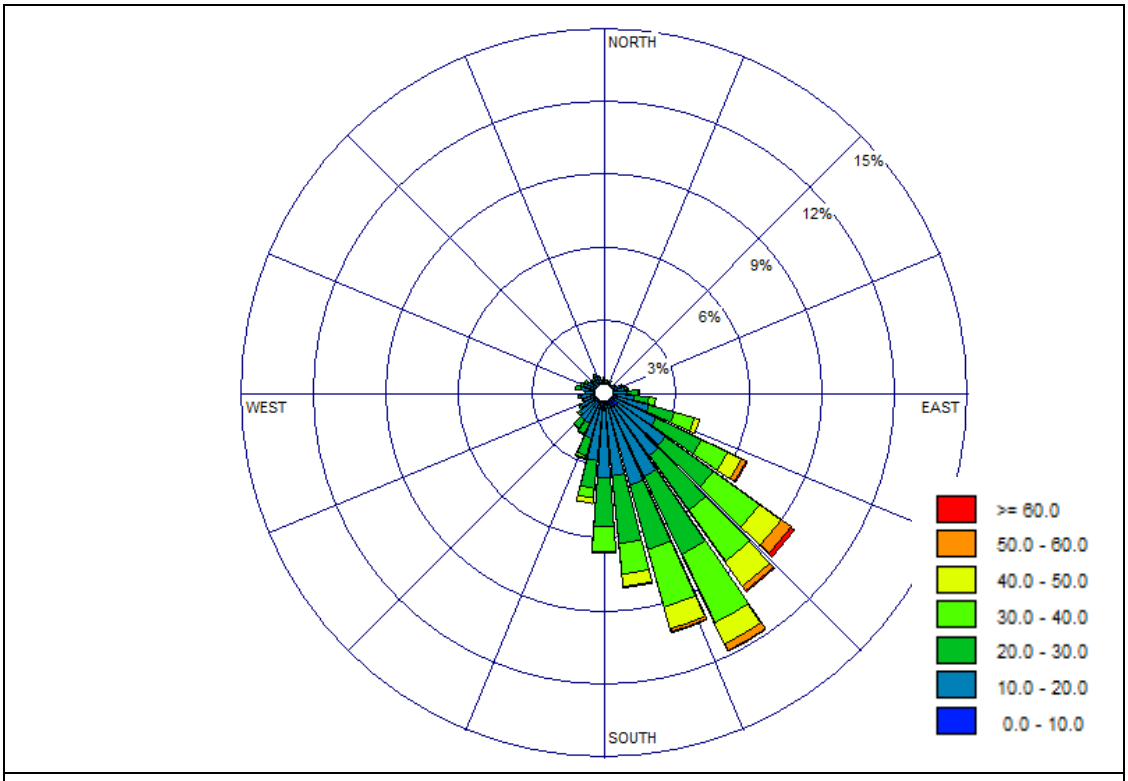


Figure 41 – Compass plot (Surface speed in cm/s) – P3

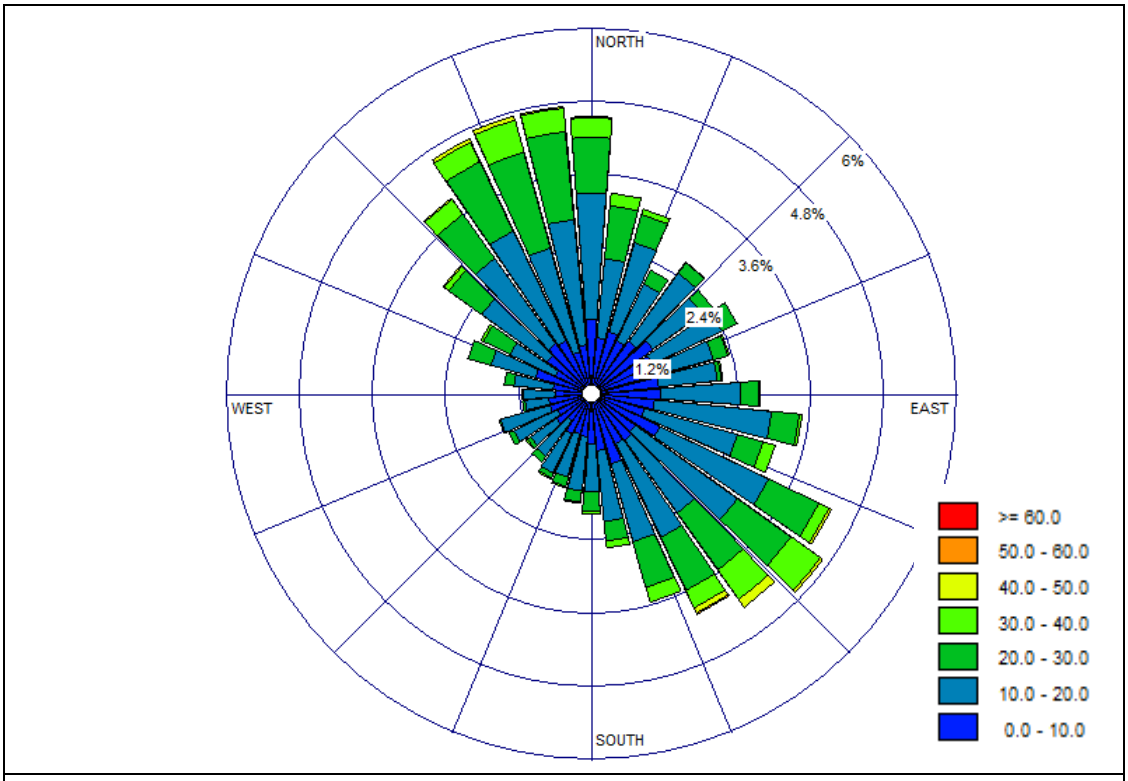


Figure 42 – Compass plot (Mid Depth speed in cm/s) – P3

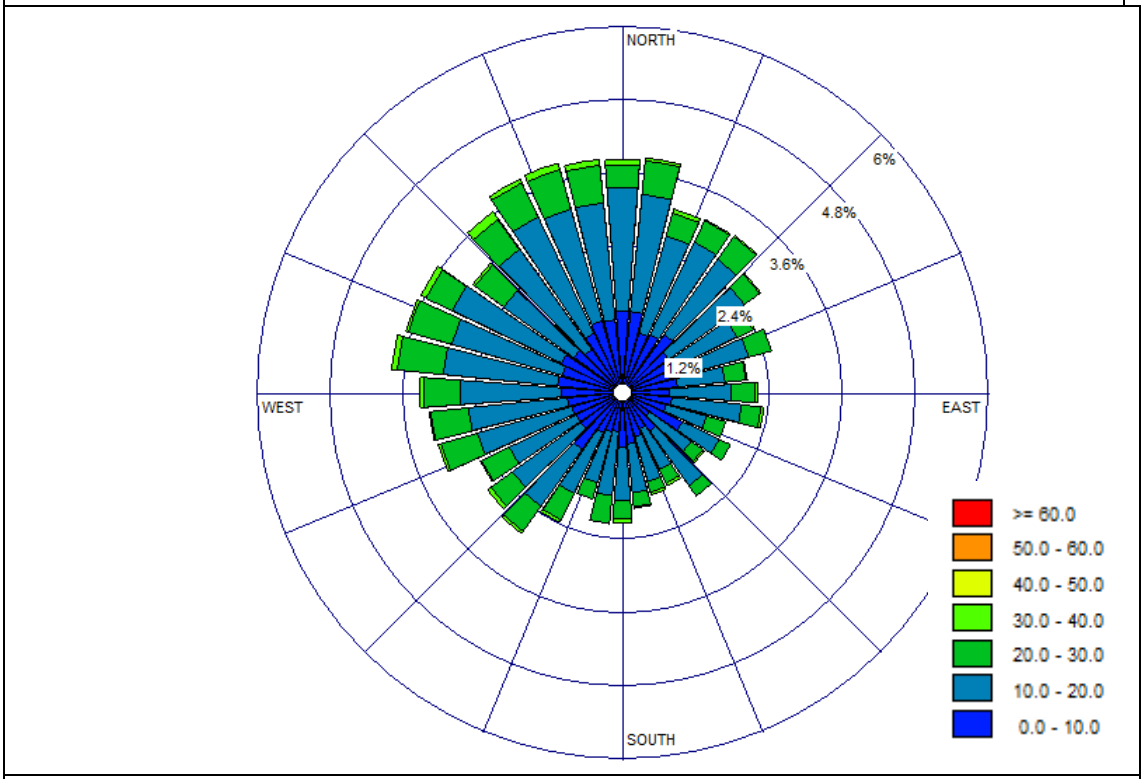


Figure 43 – Compass plot (Near Bottom speed in cm/s) – P3

The data reveals a south-easterly flow with maximum readings in the range up to 50 cm/s.

The following table and figures give the histogram of frequency distribution & percentage exceedance curve:

Frequency Distribution			
Speed (cm/s)	**Surface**	**Mid**	**Bottom**
0 – 10	681	1459	1513
10 – 20	1609	1962	2177
20 – 30	1122	799	699
30 – 40	709	218	75
40 – 50	259	25	0
50 – 60	66	1	0
60 – 70	18	0	0
>70	0	0	0
Total	**4464**	**4464**	**4464**

Table 15: Frequency Distribution of current speed - P3

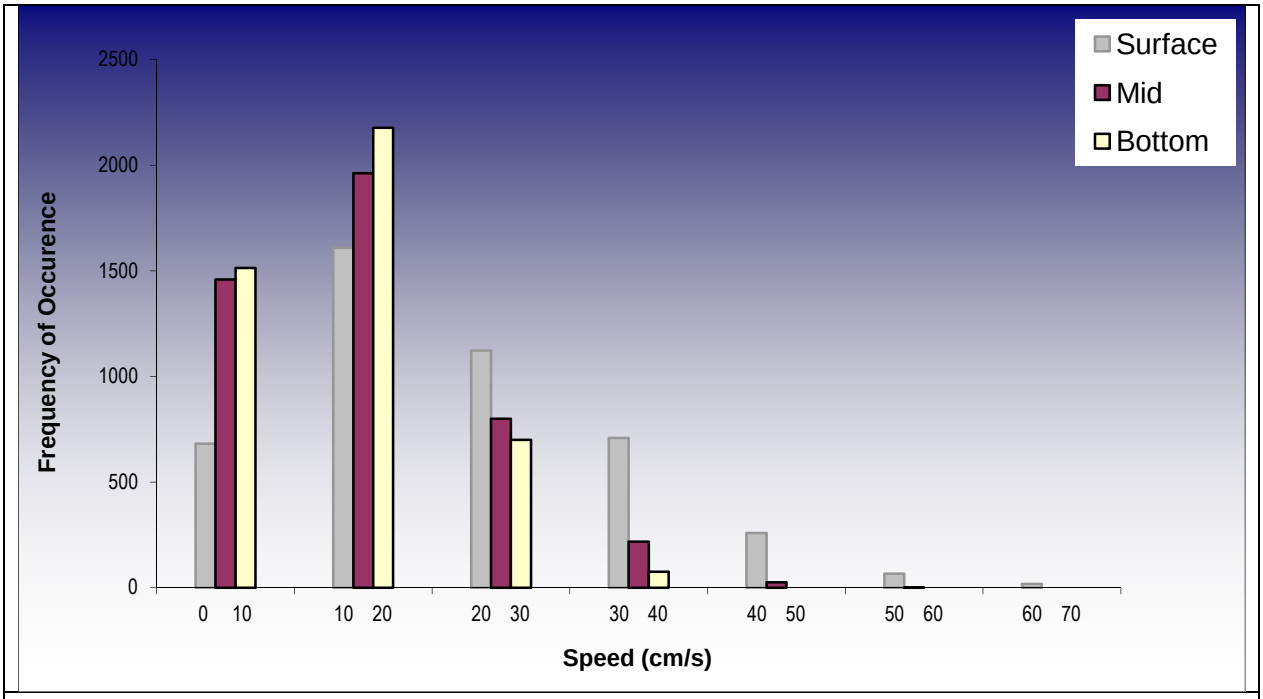


Figure 44 – Histogram of current speed – P3

Frequency Distribution			
Speed (cm/s)	**% of Surface**	**% of Mid**	**% of Bottom**
0	100	100	100
10	84.74	67.32	66.11
20	48.7	23.36	17.34
30	23.57	5.47	1.68
40	7.68	0.58	0
50	1.88	0.02	0
60	0.4	0	0
70	0	0	0

Table 16: Percentage of Exceedance – P3

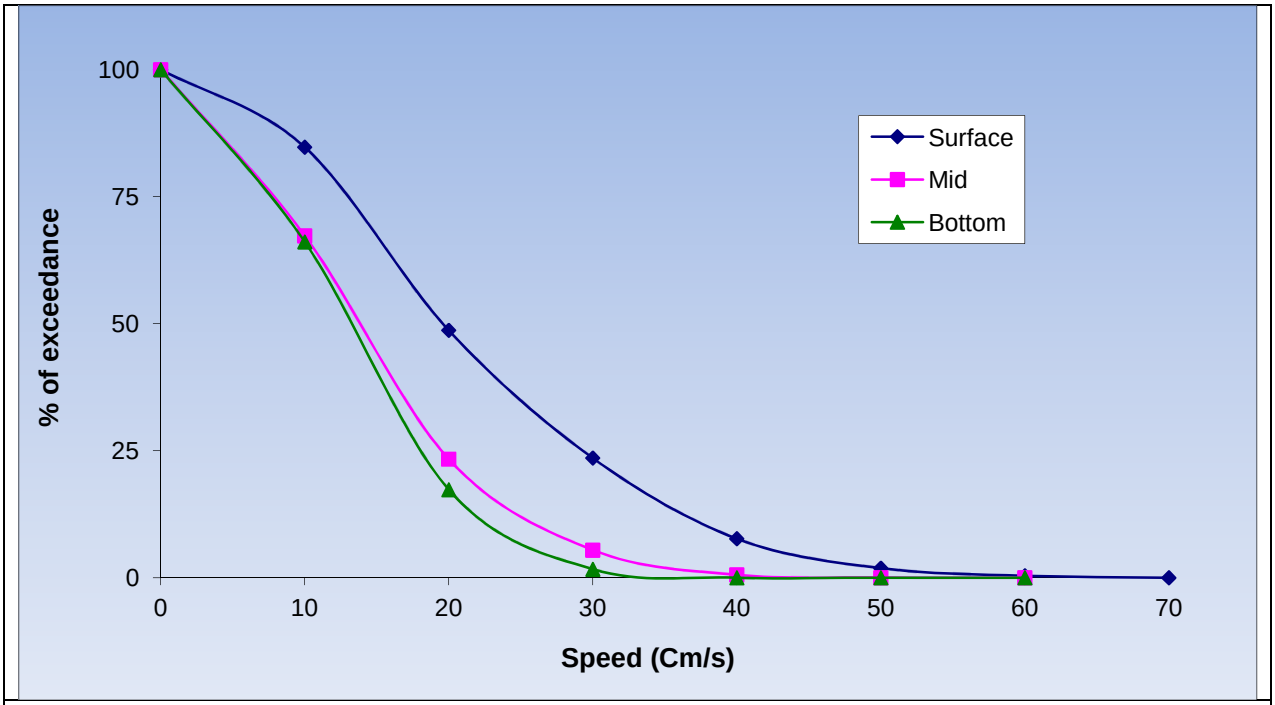


Figure 45 – Exceedance Curve – P3

The data reveals bulk of the observations were less than 50 cm/s.

The progressive vector diagram for the lunar cycle is given in the following figure:

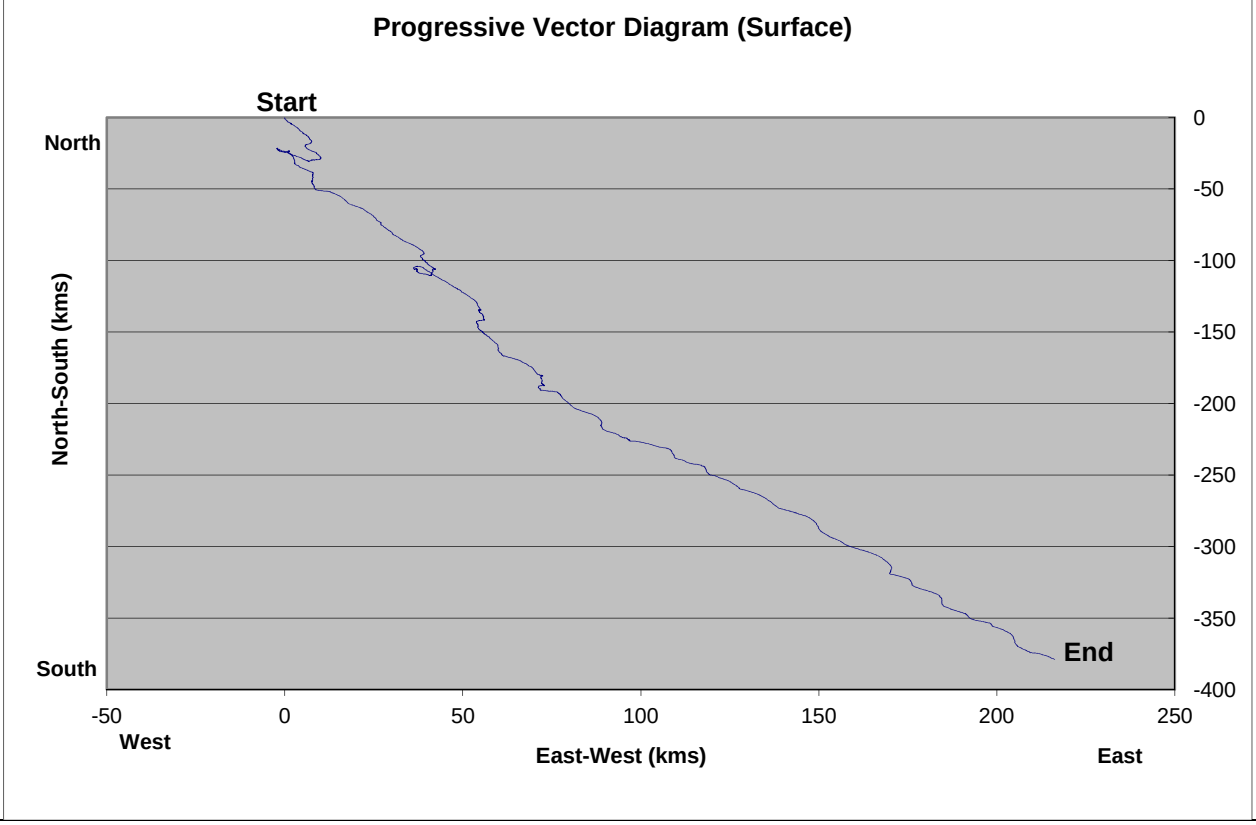


Figure 46 – Progressive Vector Diagram – P3

The above PVD shows the parcel moving about 435 km towards southeast during the one lunar cycle.

6.3.4 Location P4 (Mulloor)

The ADCP was deployed for a period of 30 days to cover one lunar cycle. It was deployed on an 'L' frame on a downward looking mode to measure the speed and direction.

After recovery, the data was properly QC-ed for removing spurious data.

A maximum speed of 81.8 cm/s was observed on 31st July 2015 at 23:30 hours.

Refer to the following compass plots for speed and direction of the currents:

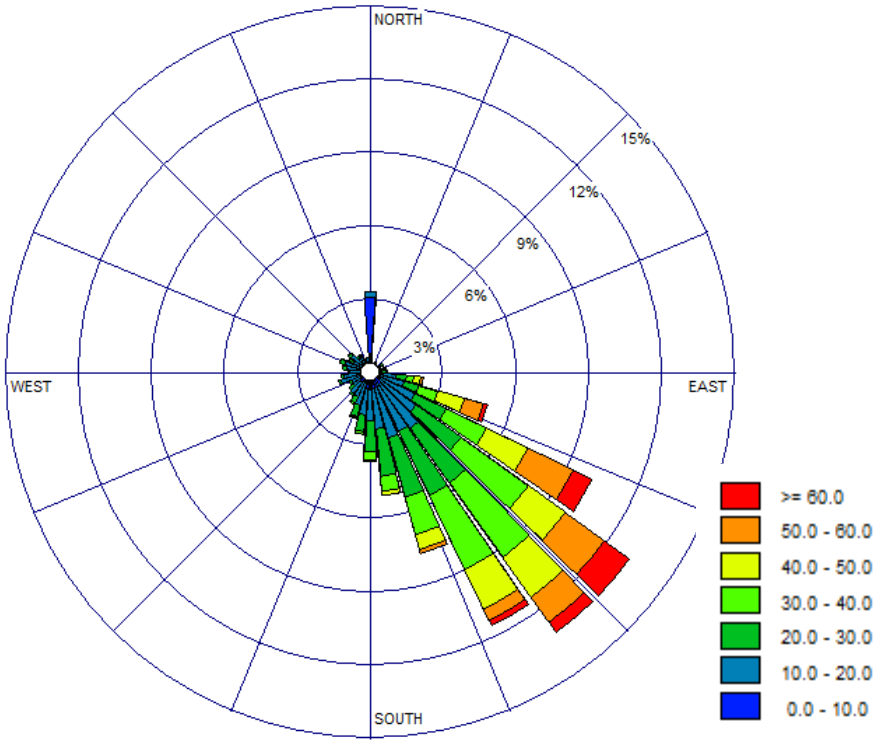


Figure 47 – Compass plot (Surface speed in cm/s) – P4

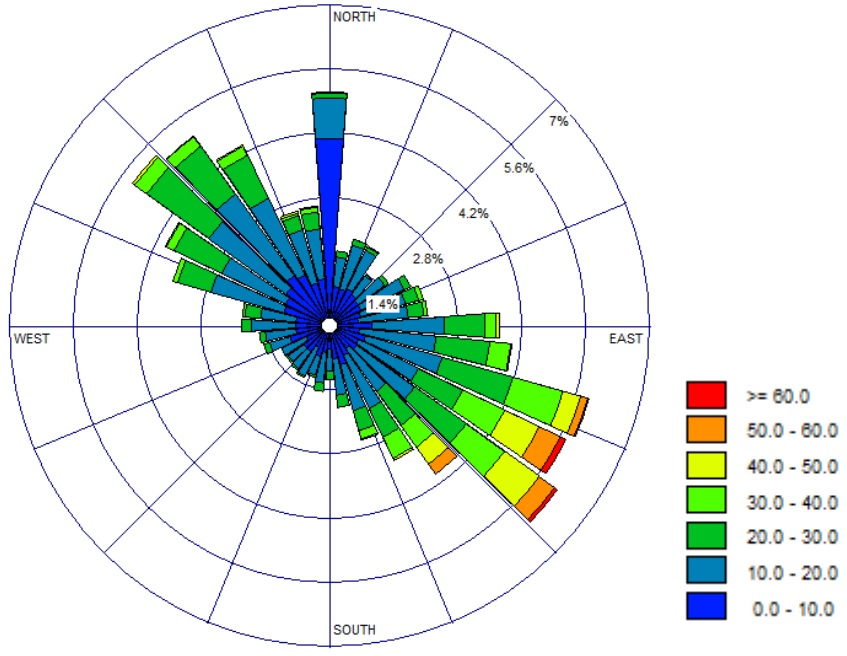


Figure 48 – Compass plot (Mid Depth speed in cm/s) – P4

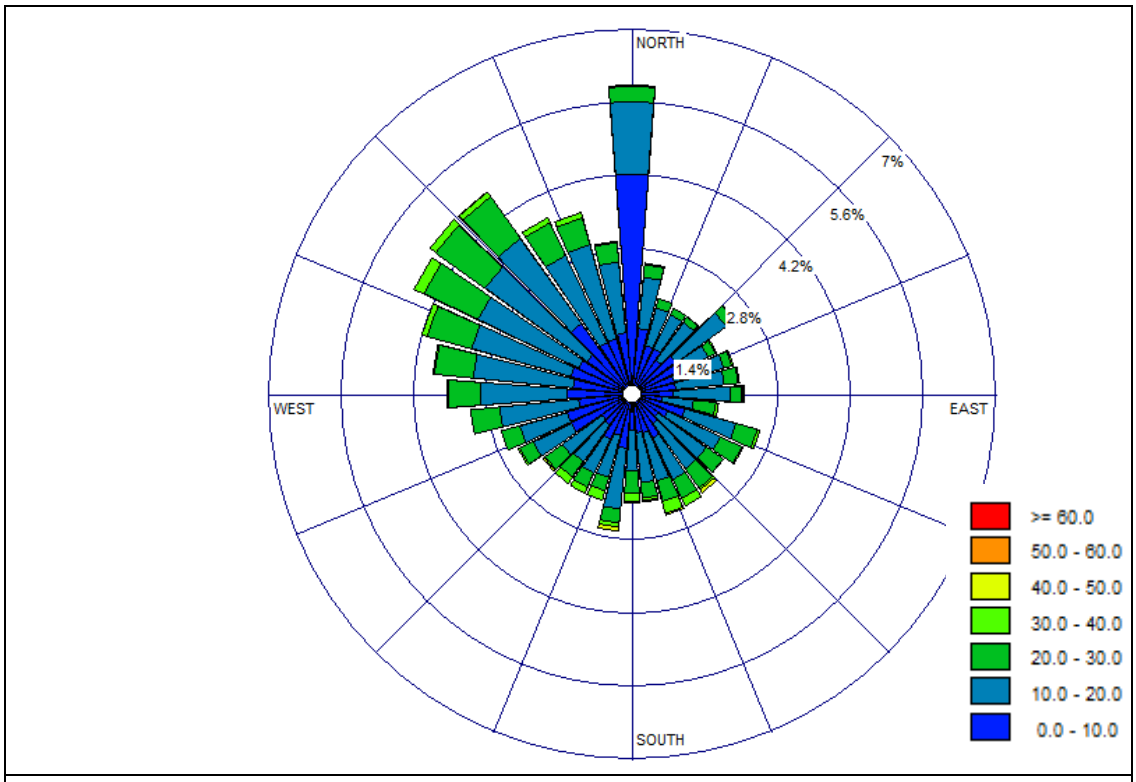


Figure 49 – Compass plot (Near Bottom speed in cm/s) – P4

The currents observed at Mulloor also show the same trend as all the previous locations, with speeds up to 20 cm/s observed 82% of the observation period.

The following table and figures give the histogram of frequency distribution & percentage exceedance curve:

Frequency Distribution			
Speed (cm/s)	**Surface**	**Mid**	**Bottom**
0 – 10	773	1461	1725
10 – 20	1174	1706	1923
20 – 30	898	795	694
30 – 40	734	300	107
40 – 50	439	133	15
50 – 60	312	58	0
60 – 70	90	11	0
>70	42	0	0
Total	**4462**	**4462**	**4462**

Table 17: Frequency Distribution of current speed – P4

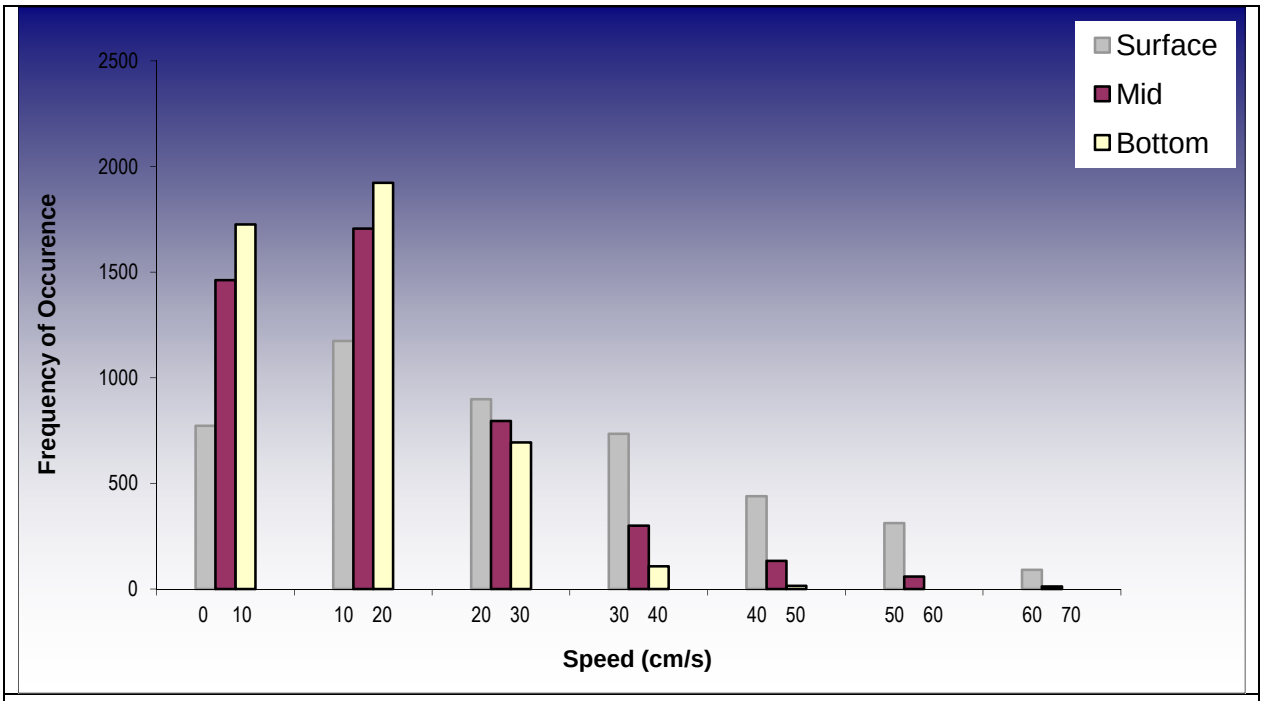


Figure 50 – Histogram of current speed – P4

Frequency Distribution			
Speed (cm/s)	**% of Surface**	**% of Mid**	**% of Bottom**
0	100	100	100
10	82.68	67.27	61.36
20	56.36	29.05	18.28
30	36.24	11.25	2.73
40	19.79	4.53	0.34
50	9.95	1.55	0
60	2.96	0.25	0
70	0.94	0	0

Table 18: Percentage of Exceedance – P4

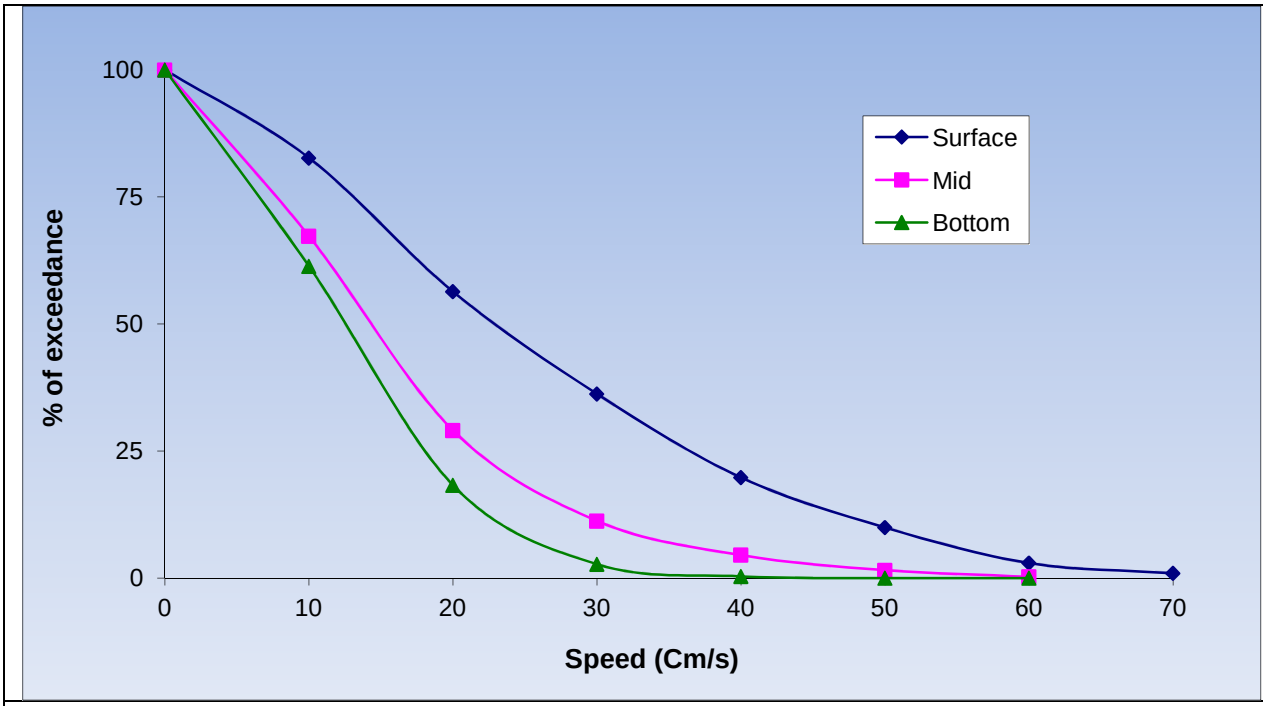


Figure 51 – Exceedance Curve – P4

The progressive vector diagram for the lunar cycle is given in the following figure:

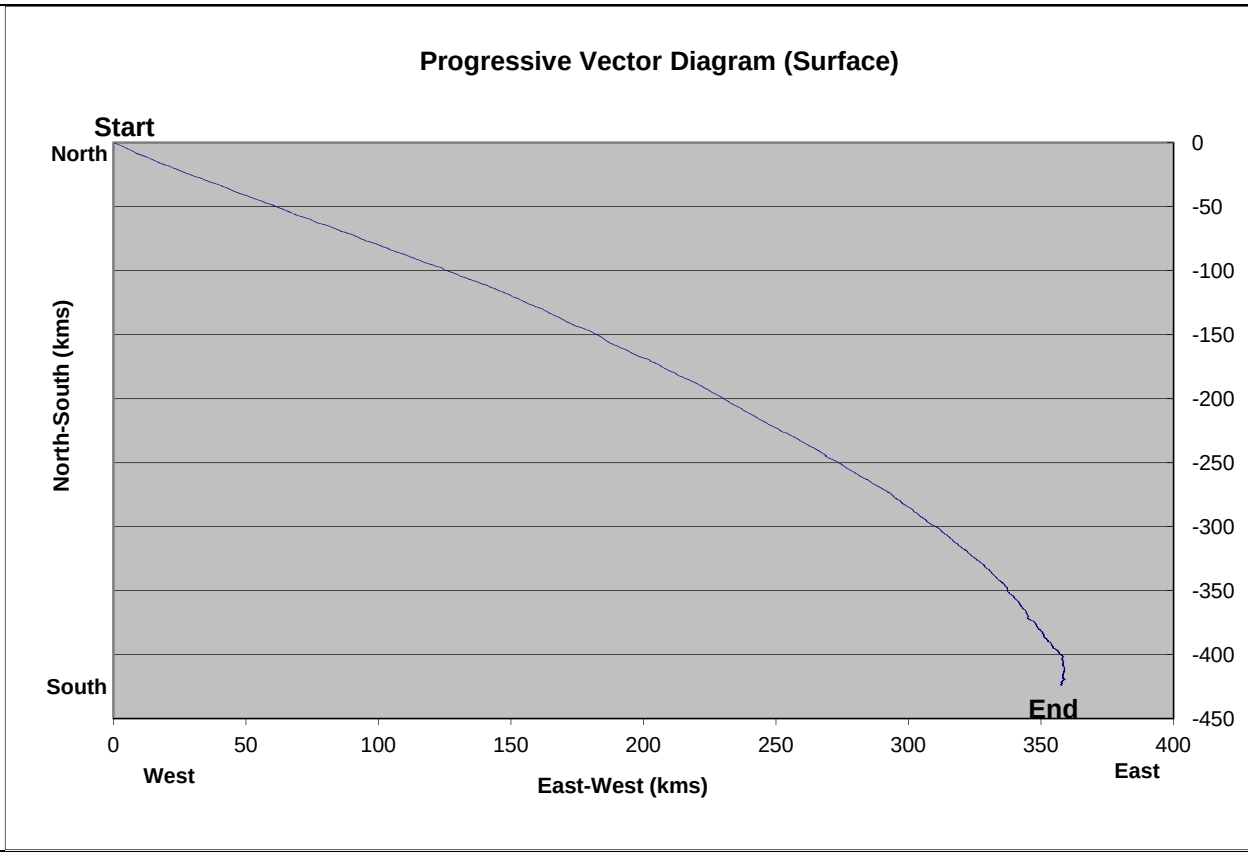


Figure 52 – Progressive Vector Diagram – P4

The above PVD shows the parcel moving about 540 km towards southeast during the one lunar cycle.

The time series curves for all the locations are placed at Annexure II.

6.4 Wave Measurements

The WRB supplied by NIOT was deployed at the required location on 10th February 2015. The receiver was set up at the resort where Ocean Science personnel are staying. Later the receiver was shifted to a different location as described elsewhere in this report. The processed data received, was then plotted for time series and rose diagram, which are provided below:

Refer to the following rose plot of Hs v/s direction for the month of June 2015:

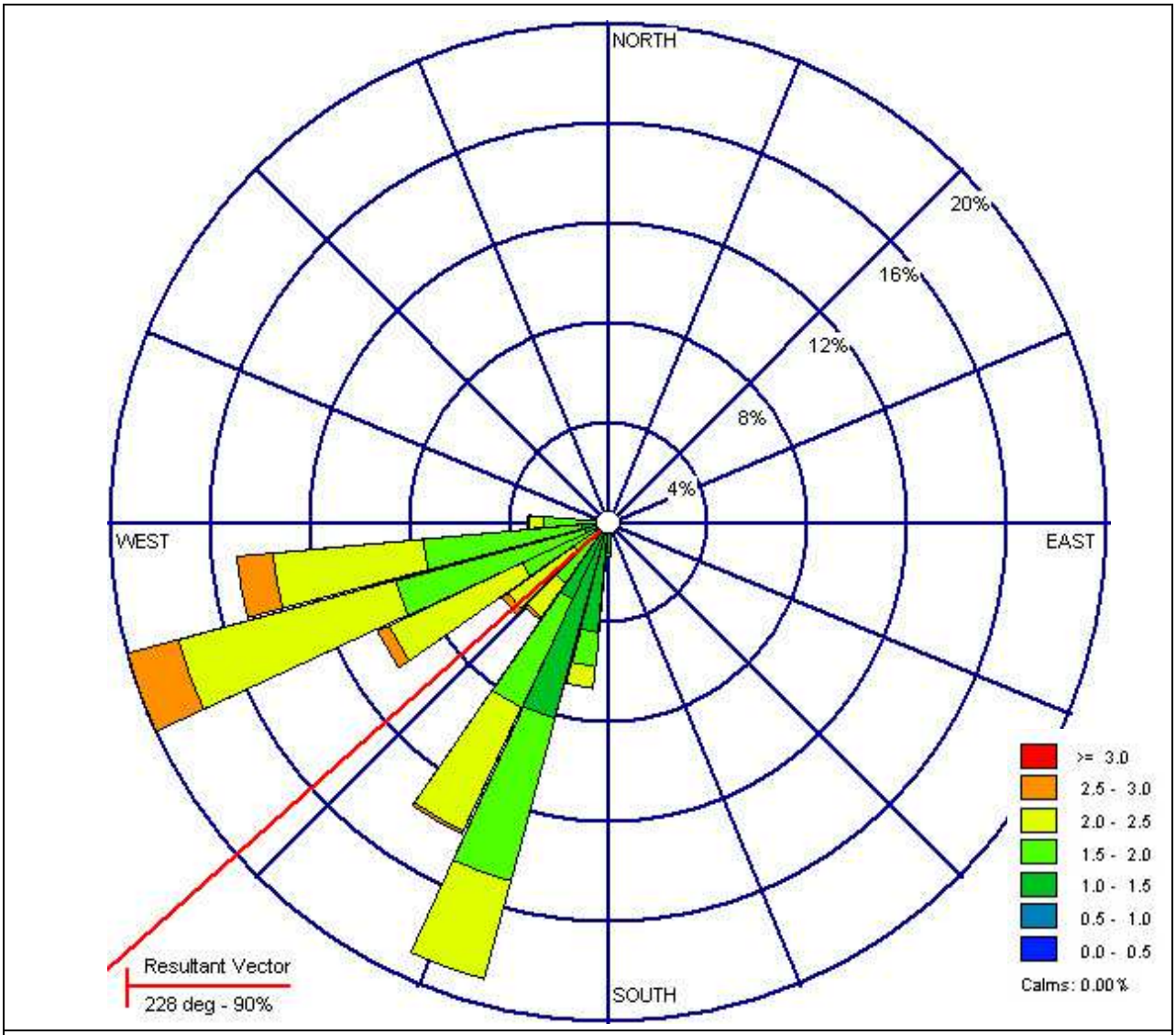


Figure 53 – Wave Rose (Hs in metre v/s Direction) during June 2015

The wave direction was south of south-westerly during the first part and as monsoon progressed, the direction changed to west of south-westerly with height increasing to more than 2m.

The frequency distribution table and histogram for the month is provided below:

FREQUENCY DISTRIBUTION				
Significant Wave Height (m)	H_s		H_{max}	
	No. of Observations	Percentage of Occurrence	No. of Observations	Percentage of Occurrence
0.0 - 0.5	0	0.0	0	0.0
0.5 – 1.0	3	0.20	0	0.0
1.0 – 1.5	336	25.11	21	1.52
1.5 – 2.0	492	36.77	199	14.37
2.0 – 2.5	459	34.30	297	21.44
2.5 – 3.0	48	3.59	377	27.22
3.0 – 3.5	0	0	328	23.68
3.5 – 4.0	0	0	121	8.74
4.0 – 4.5	0	0	36	2.60
>4.5	0	0	6	0.43
Total	**1338**	**100**	**1385**	**100**

Table 19: Frequency Distribution of wave heights (June 2015)

The histogram of significant wave height during observation period of June 2015 is given below:

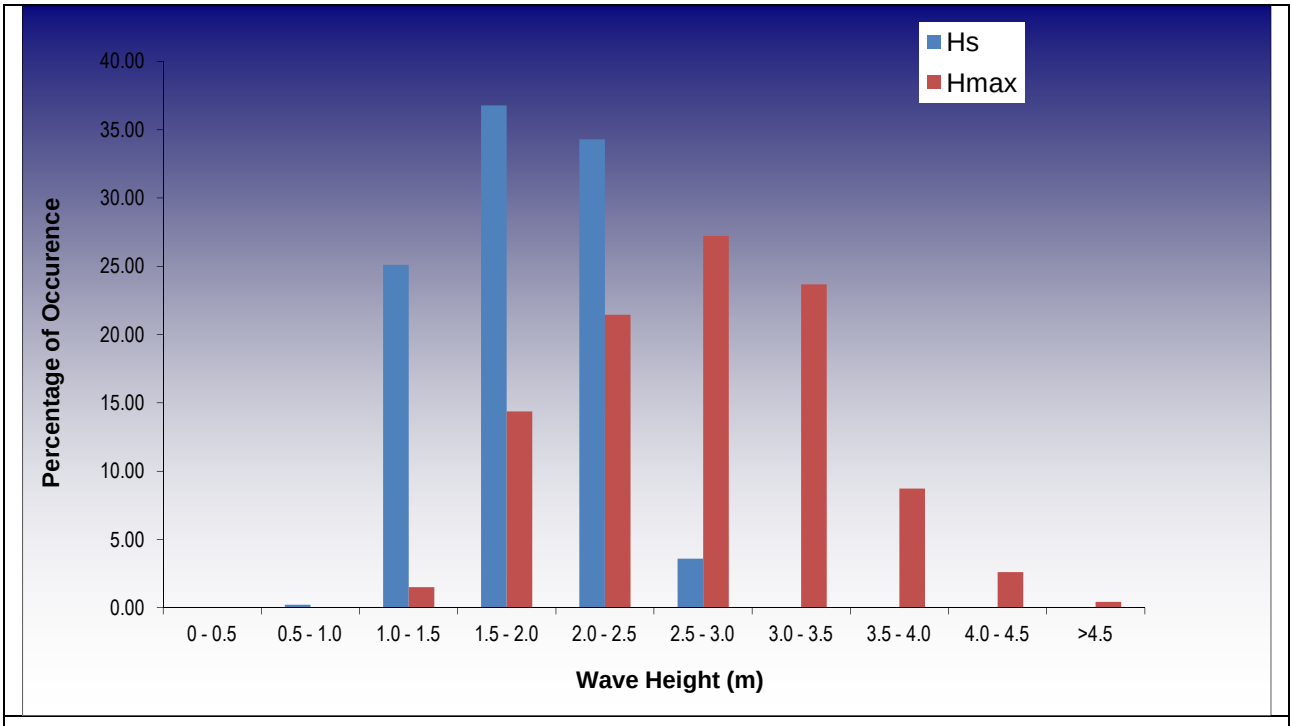


Figure 54 – Histogram of wave heights (June 2015)

As can be observed above, for about 80% of the observations the maximum wave height was above 2m.

The following image shows the wave rose drawn with respect to wave period V/s direction:

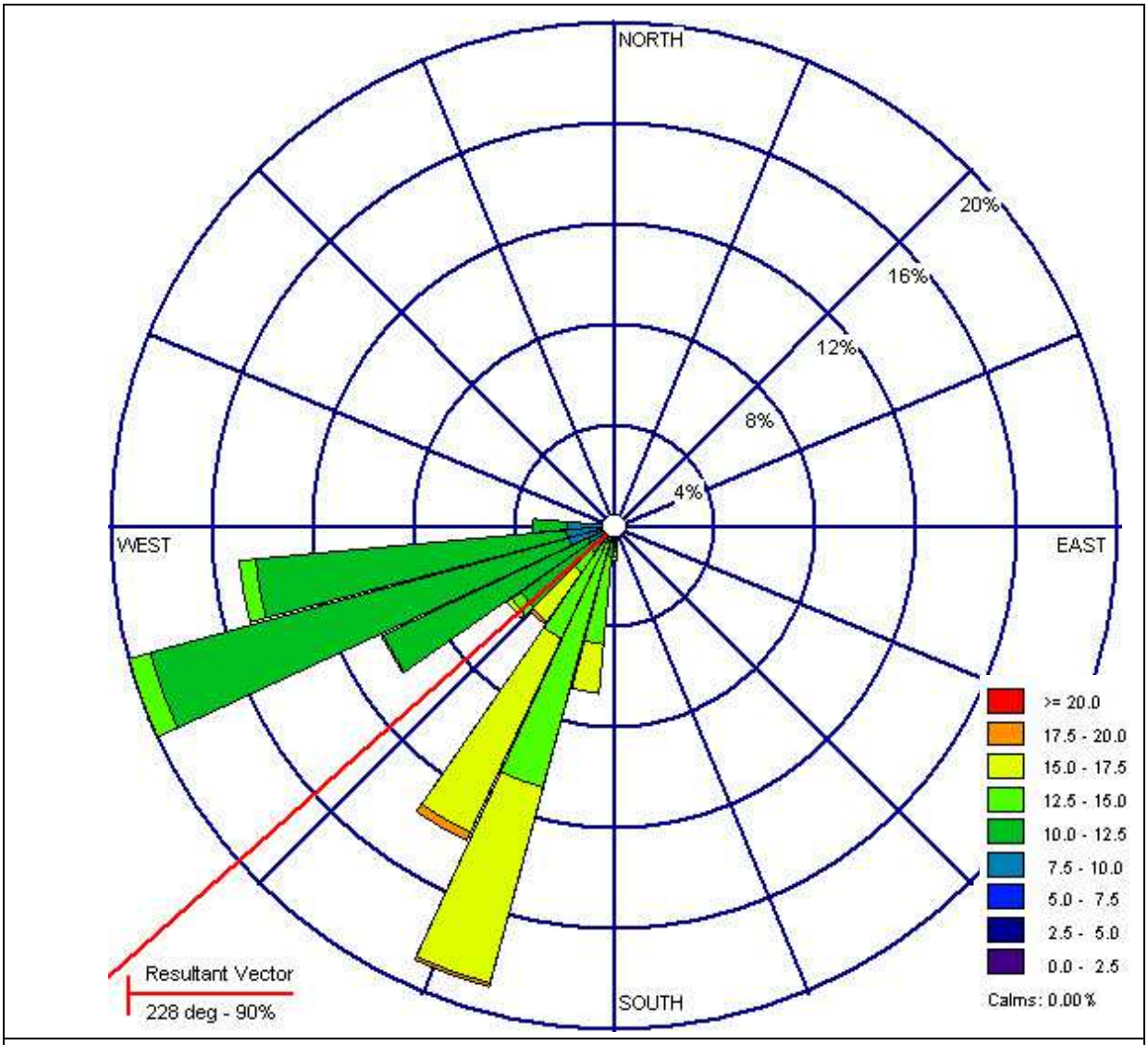


Figure 55 – Wave Rose (Tp in seconds v/s Direction) during June 2015

The histogram drawn for Wave period for June 2015 is given below:

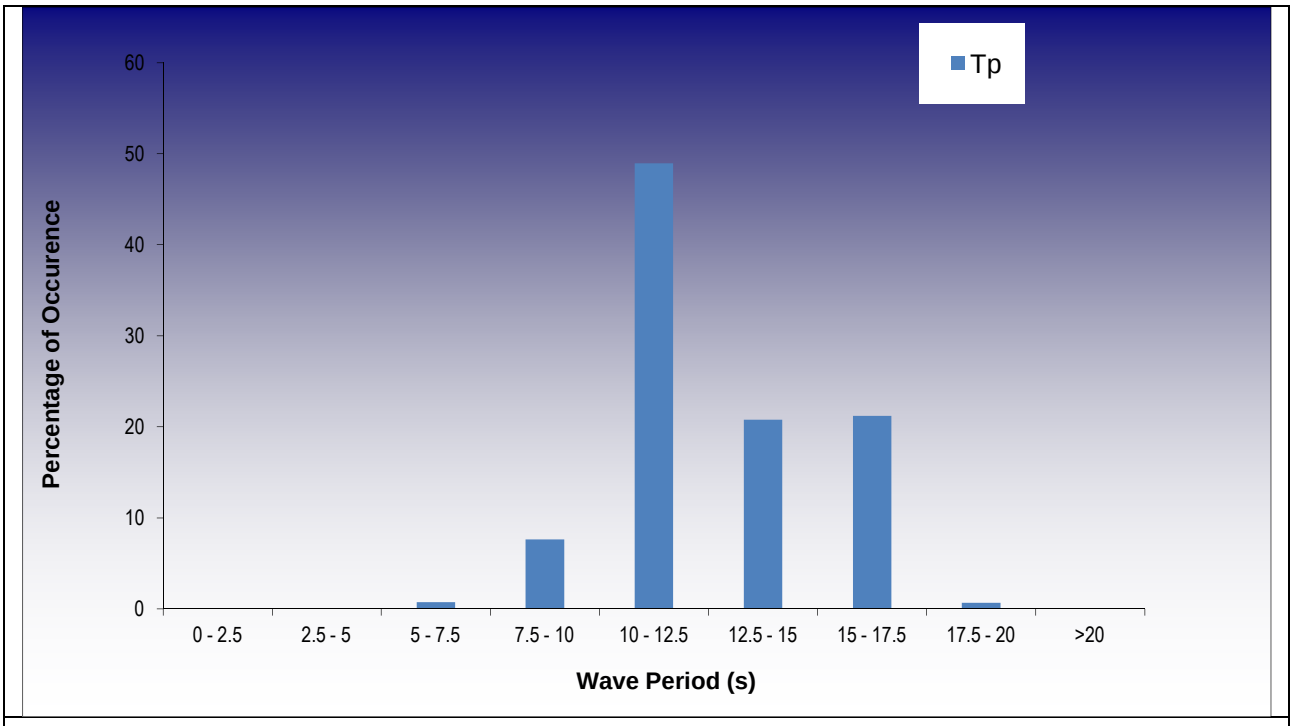


Figure 56 – Histogram of wave period (June 2015)

The above image indicates that during the month of June 2015, the wave period was in the range of 10 to 17 seconds, with bulk of wave period in the range of 12 to 16 seconds.

The wave rose plot for the month of July 2015 is given below:

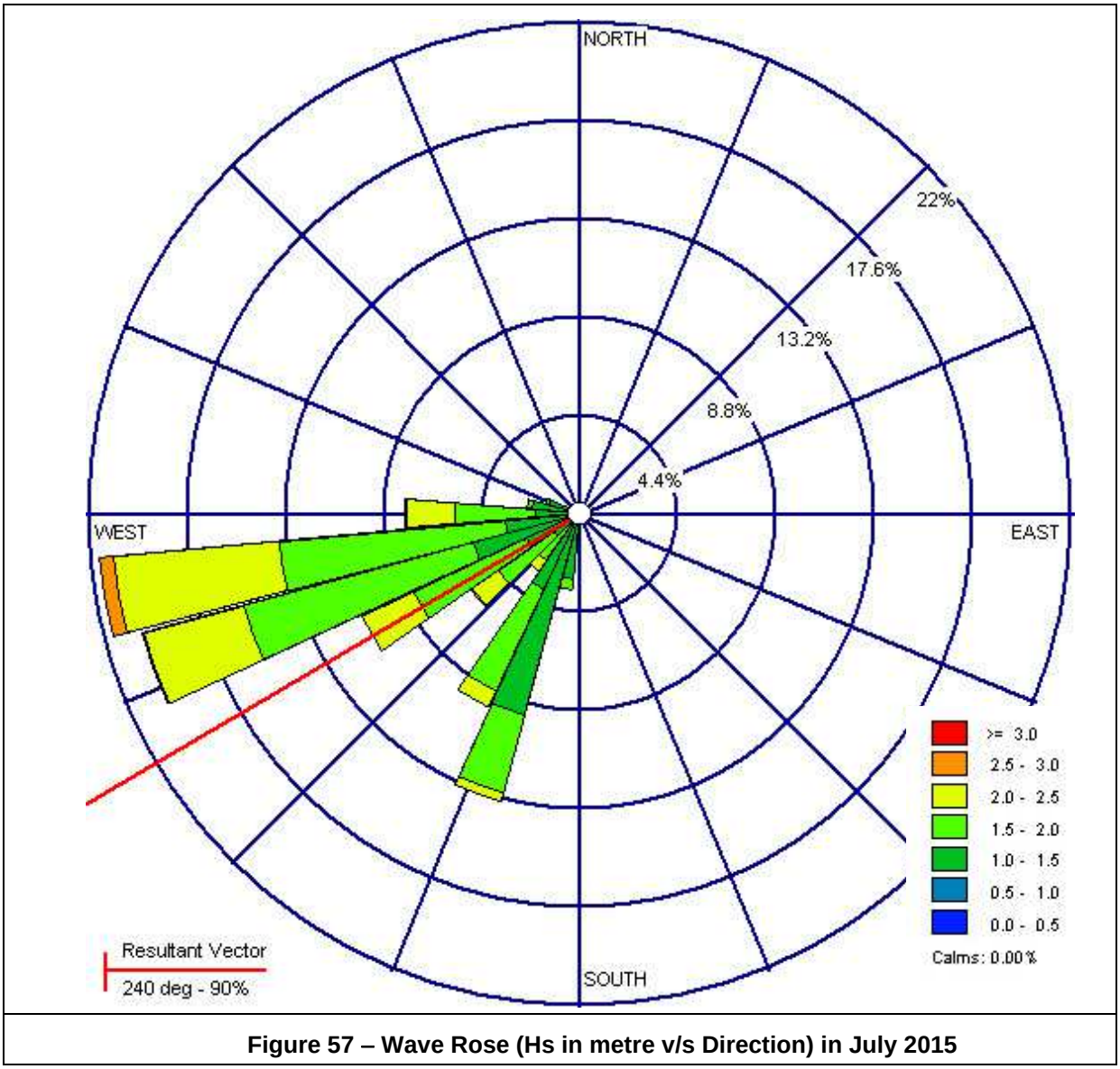


Figure 57 – Wave Rose (Hs in metre v/s Direction) in July 2015

The above rose plot indicates the monsoonal waves, with majority of waves from the westerly to west of south-westerly.

The frequency distribution table and histogram for the month is provided below:

FREQUENCY DISTRIBUTION				
Significant Wave Height (m)	H_s		H_{max}	
	No. of Observations	Percentage of Occurrence	No. of Observations	Percentage of Occurrence
0.0 - 0.5	0	0.0	0	0.0
0.5 – 1.0	1	0.07	0	0.0
1.0 – 1.5	514	37.33	9	0.64
1.5 – 2.0	622	45.17	253	17.93
2.0 – 2.5	231	16.78	411	29.13
2.5 – 3.0	9	0.65	446	31.61
3.0 – 3.5	0	0	226	16.02
3.5 – 4.0	0	0	53	3.76
4.0 – 4.5	0	0	11	0.78
>4.5	0	0	2	0.14
Total	**1377**	**100**	**1411**	**100**

Table 20: Frequency Distribution of wave heights (July 2015)

The histogram of significant wave height during observation period of July 2015 is given below:

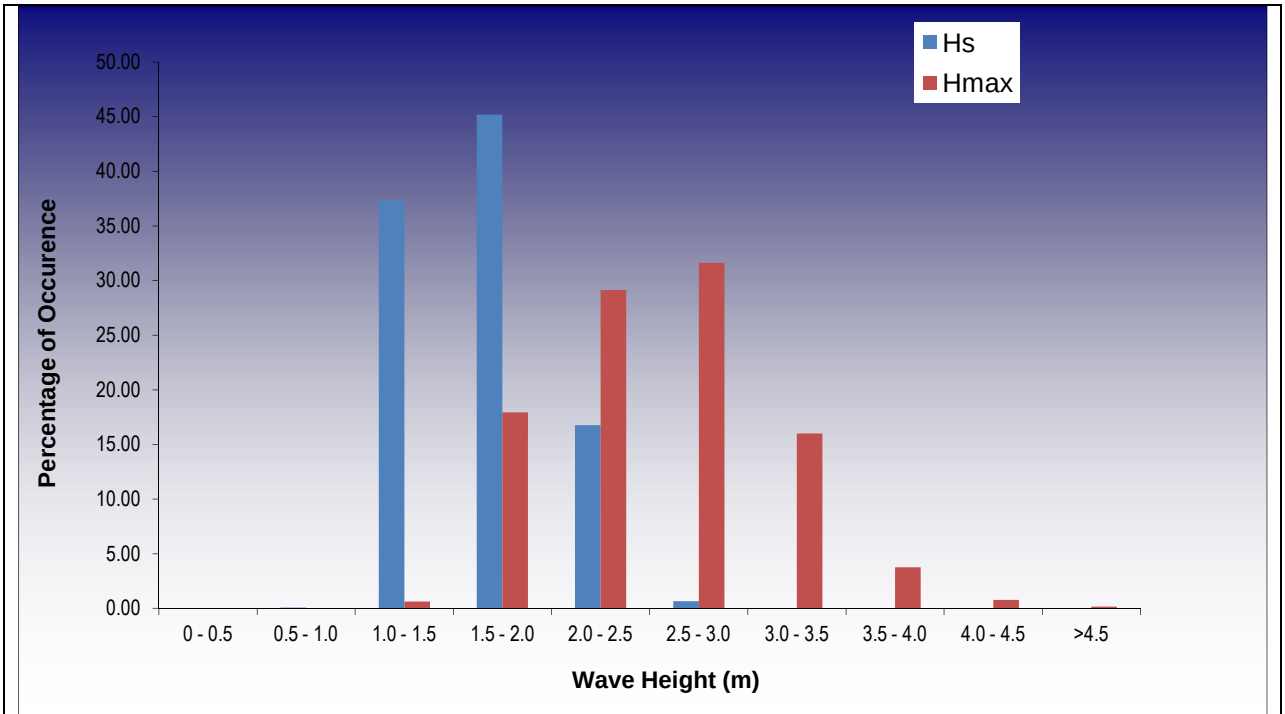


Figure 58 – Histogram of wave heights (July 2015)

As can be observed above, the maximum occurrence of significant wave height was in the range of 1 to 2.5m. The recorded maximum wave height shows 45% occurrence in the 1.5 to 2m region.

The following image shows the wave rose drawn with respect to wave period V/s direction:

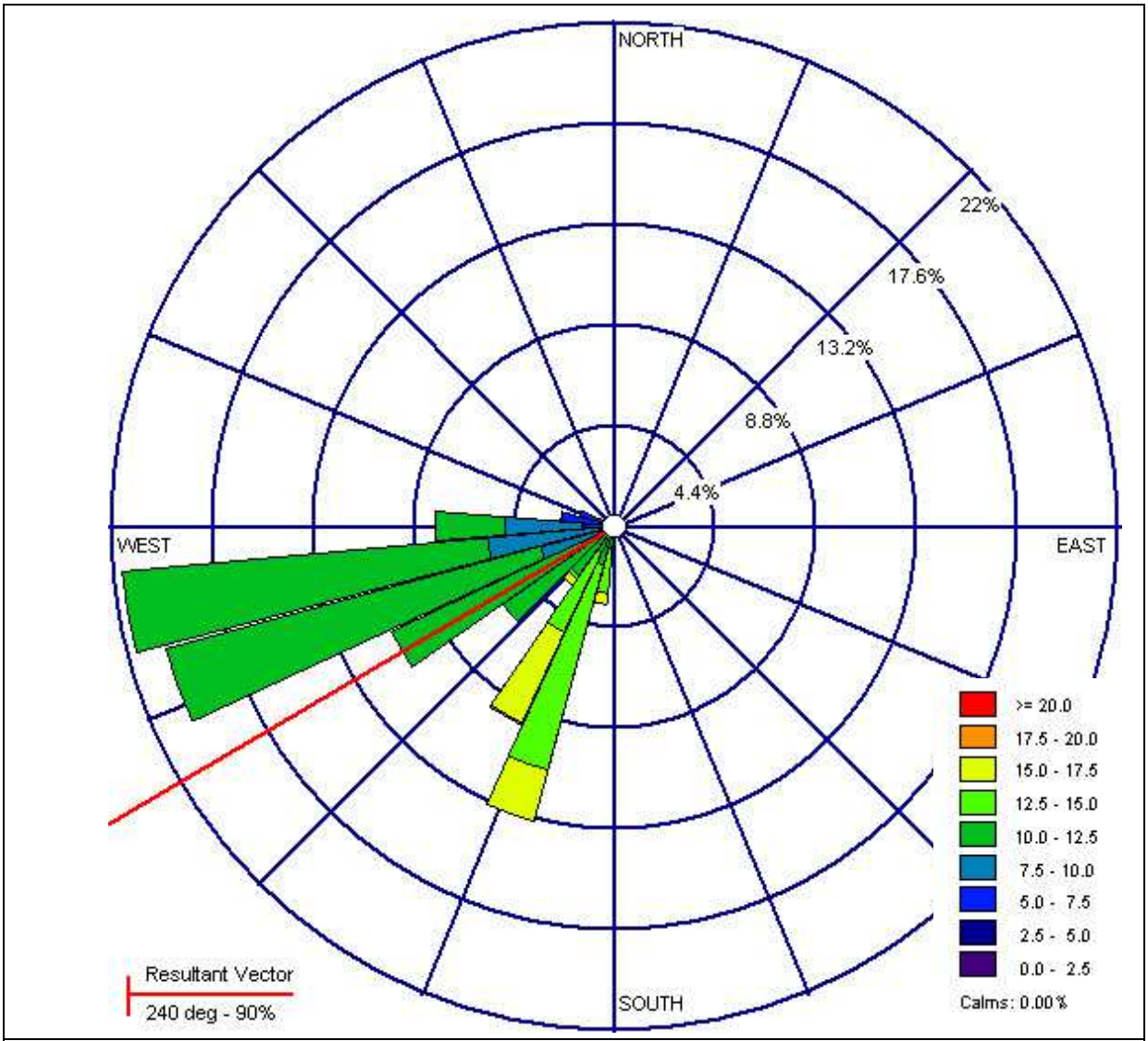


Figure 59 – Wave Rose (Tp in seconds v/s Direction) during July 2015

The histogram drawn for Wave period for July 2015 is given below:

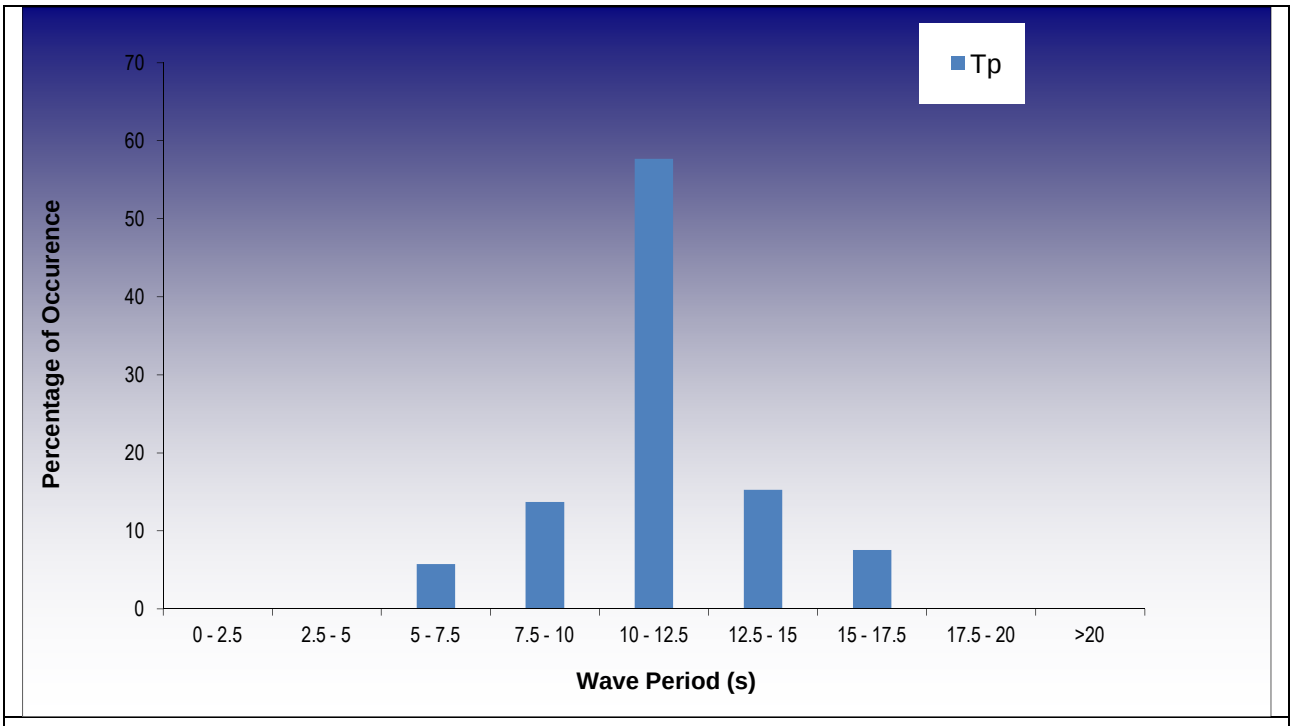


Figure 60 – Histogram of wave period (July 2015)

The above image indicates that during the month of July 2015, the wave period was in the range of 5 to 18 seconds, with bulk of wave period in the range of 10 to 15 seconds.

The wave rose plot for the month of August 2015 is given below:

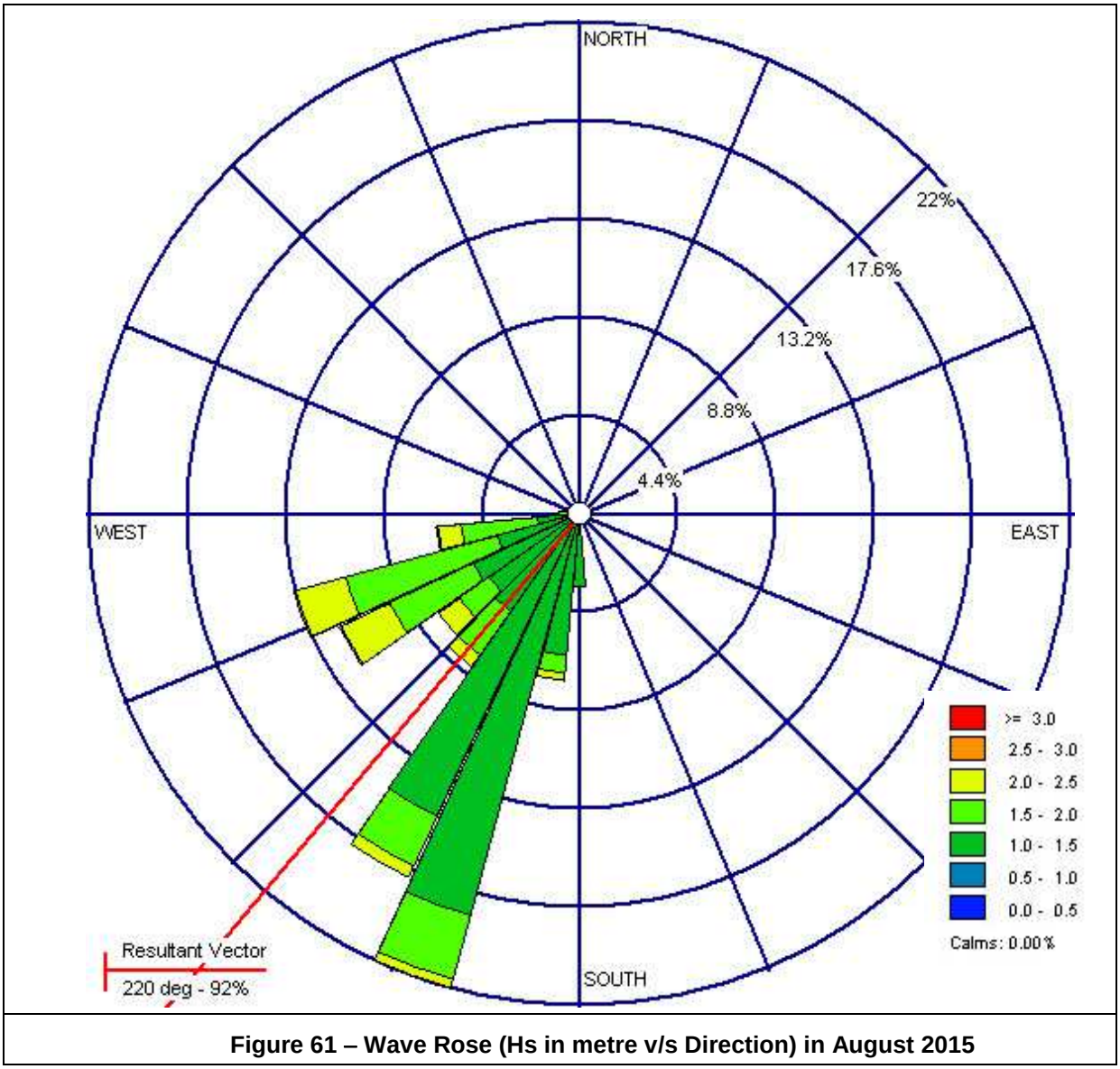


Figure 61 – Wave Rose (Hs in metre v/s Direction) in August 2015

In the month of August, the waves were back to south of south-westerly with less intensity.

The frequency distribution table and histogram for the month is provided below:

FREQUENCY DISTRIBUTION				
Significant Wave Height (m)	H_s		H_{max}	
	No. of Observations	Percentage of Occurrence	No. of Observations	Percentage of Occurrence
0.0 - 0.5	0	0.0	0	0.0
0.5 – 1.0	1	0.07	0	0.0
1.0 – 1.5	514	37.33	9	0.64
1.5 – 2.0	622	45.17	253	17.93
2.0 – 2.5	231	16.78	411	29.13
2.5 – 3.0	9	0.65	446	31.61
3.0 – 3.5	0	0	226	16.02
3.5 – 4.0	0	0	53	3.76
4.0 – 4.5	0	0	11	0.78
>4.5	0	0	2	0.14
Total	**1377**	**100**	**1411**	**100**

Table 21: Frequency Distribution of wave heights (August 2015)

The histogram of significant wave height during observation period of August 2015 is given below:

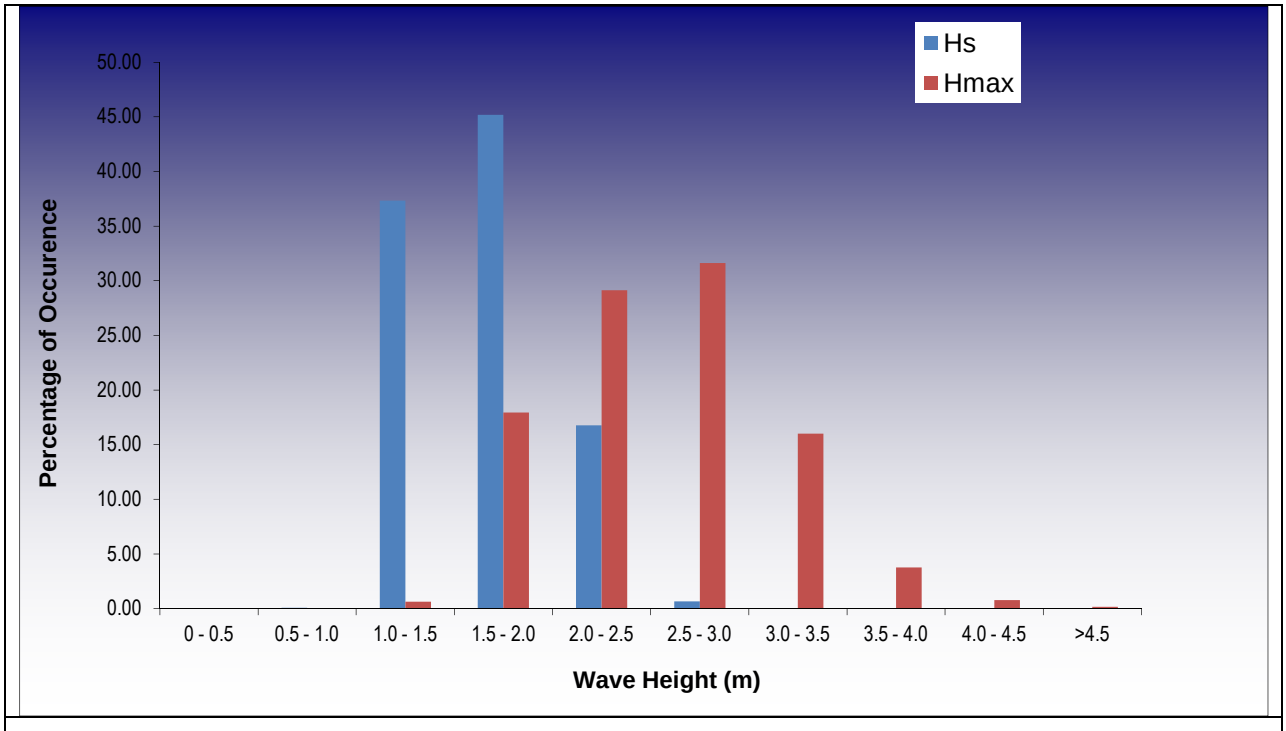


Figure 62 – Histogram of wave heights (August 2015)

As can be observed above, the maximum occurrence of significant wave height was in the range of 1 to 2.5m. The maximum wave height of 2m and more occurred for more than 90% of the observations.

The following image shows the wave rose drawn with respect to wave period V/s direction:

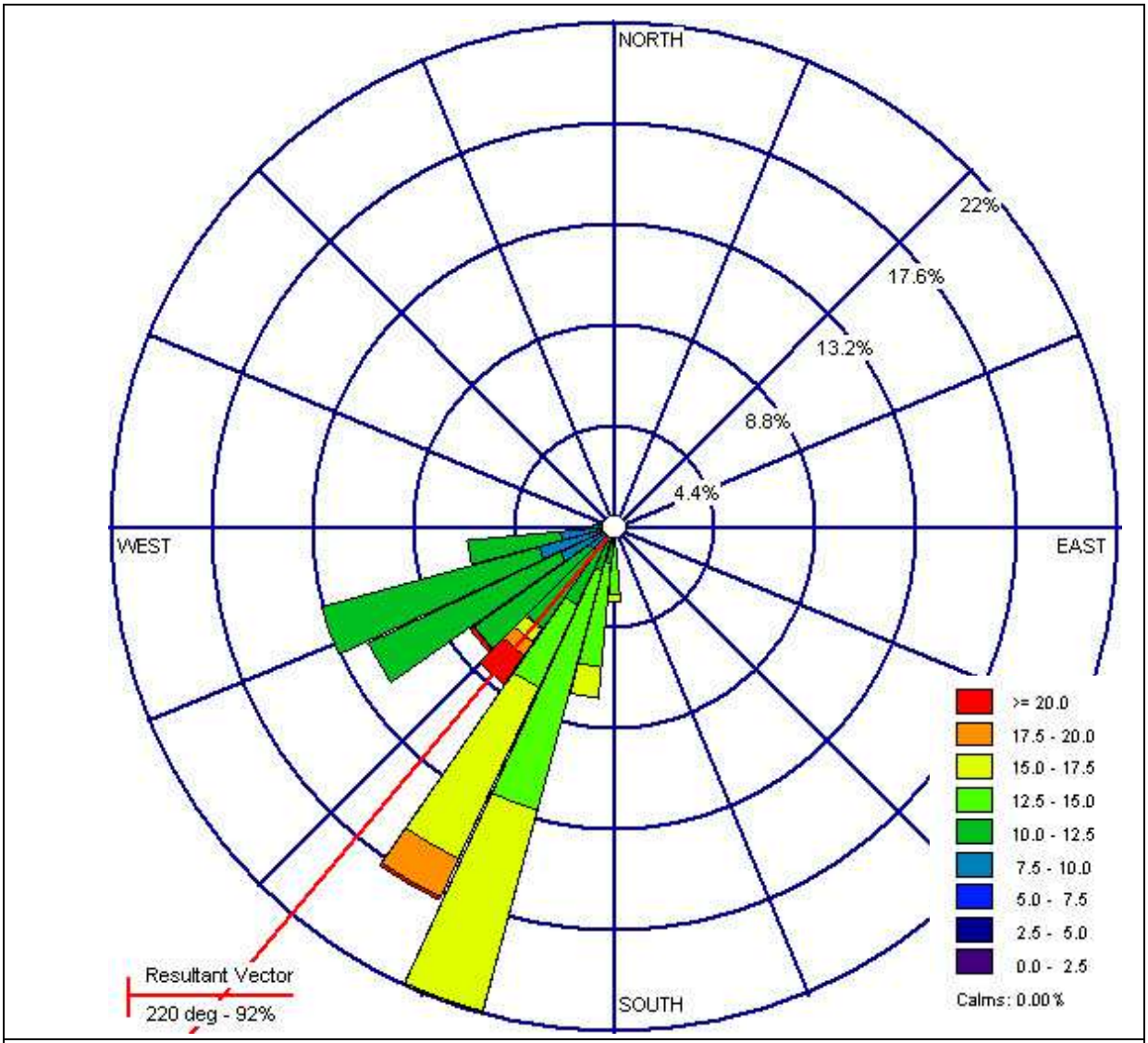


Figure 63 – Wave Rose (Tp in seconds v/s Direction) during August 2015

The histogram drawn for Wave period for August 2015 is given below:

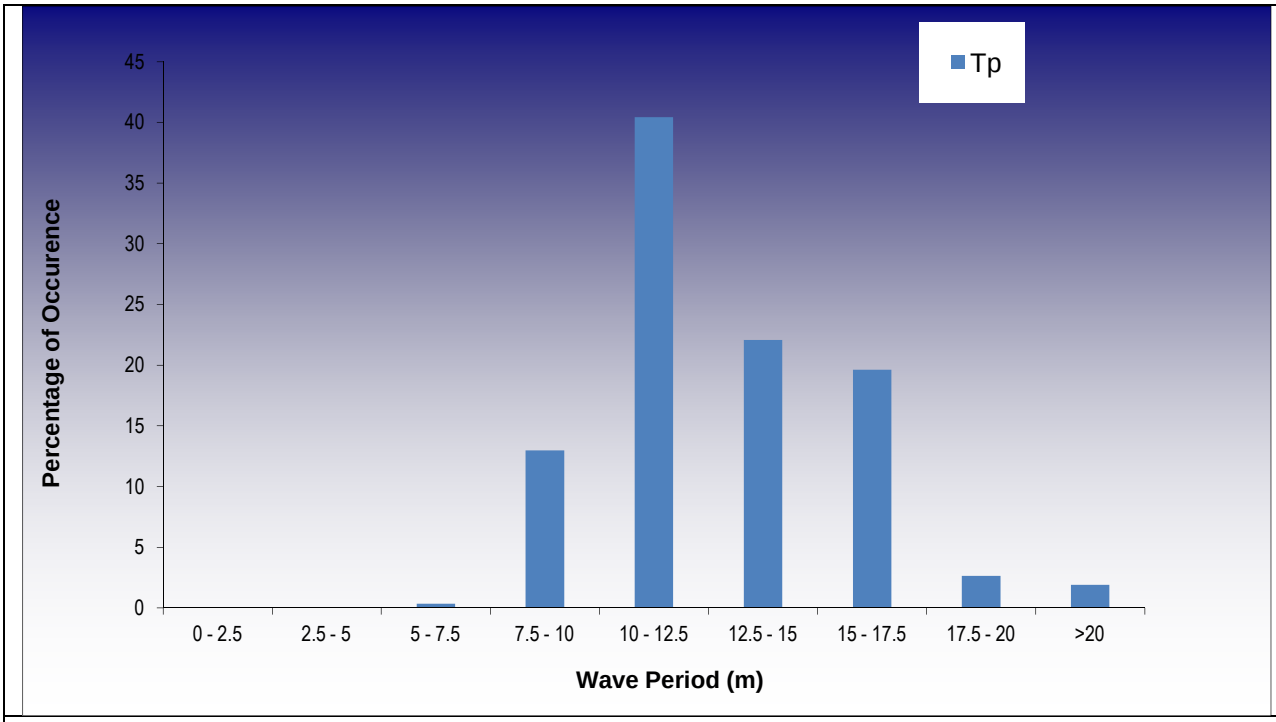


Figure 64 – Histogram of wave period (August 2015)

The above image indicates that during the month of August 2015, the wave period was in the range of 5 to 20 seconds. About 2% of the observation, the wave period was 20 seconds and more indicating long period waves.

The wave rose plot for the month of September 2015 is given below:

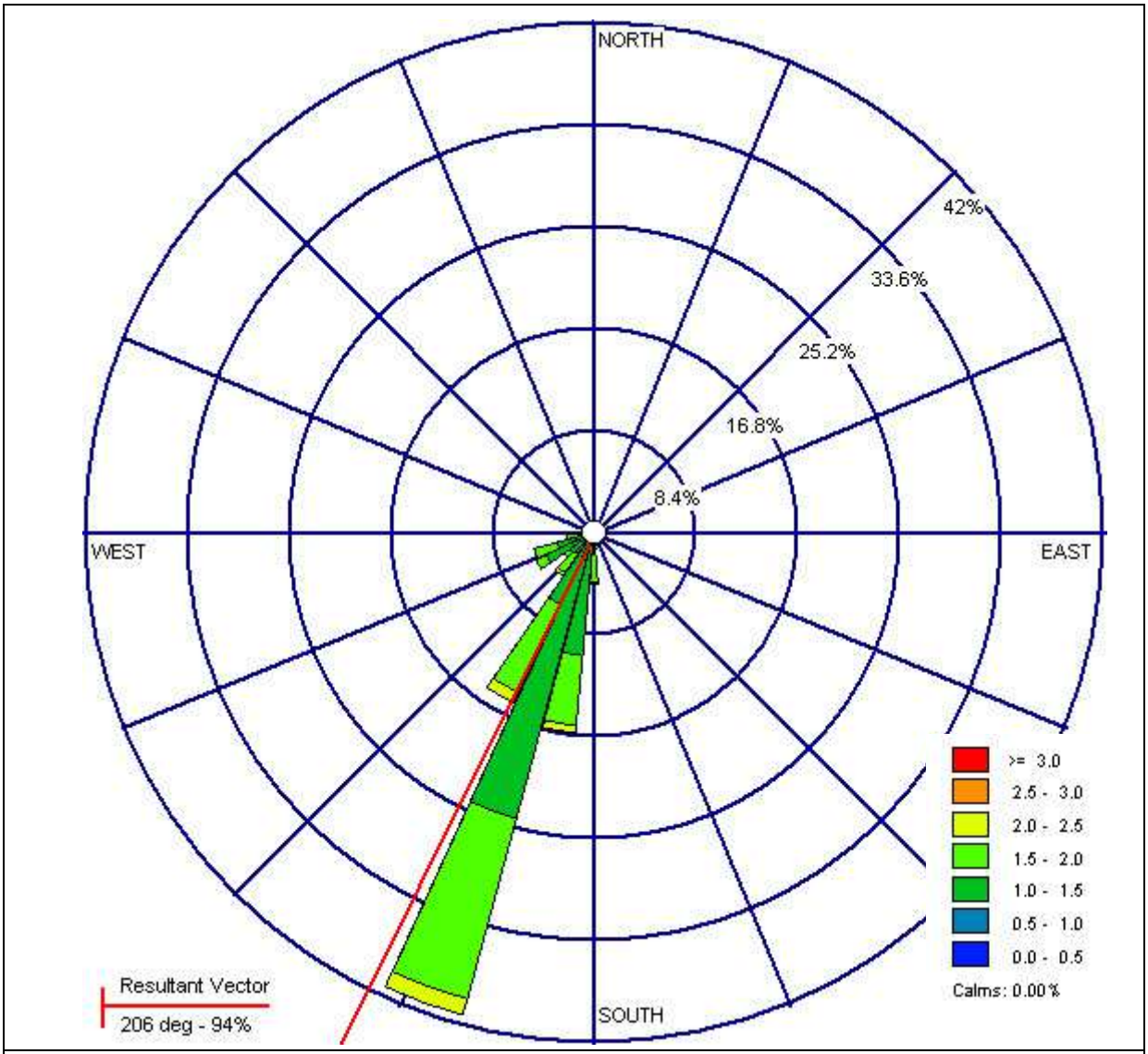


Figure 65 – Wave Rose (Hs in metre v/s Direction) in September 2015

The rose plot indicates south southwesterly waves up to 2m height.

The frequency distribution table and histogram for the month is provided below:

FREQUENCY DISTRIBUTION				
Significant Wave Height (m)	H_s		H_{max}	
	No. of Observations	Percentage of Occurrence	No. of Observations	Percentage of Occurrence
0.0 - 0.5	0	0.0	0	0.0
0.5 – 1.0	1	0.07	0	0.0
1.0 – 1.5	514	37.33	9	0.64
1.5 – 2.0	622	45.17	253	17.93
2.0 – 2.5	231	16.78	411	29.13
2.5 – 3.0	9	0.65	446	31.61
3.0 – 3.5	0	0	226	16.02
3.5 – 4.0	0	0	53	3.76
4.0 – 4.5	0	0	11	0.78
>4.5	0	0	2	0.14
Total	**1377**	**100**	**1411**	**100**

Table 22: Frequency Distribution of wave heights (September 2015)

The histogram of significant wave height during observation period of September 2015 is given below:

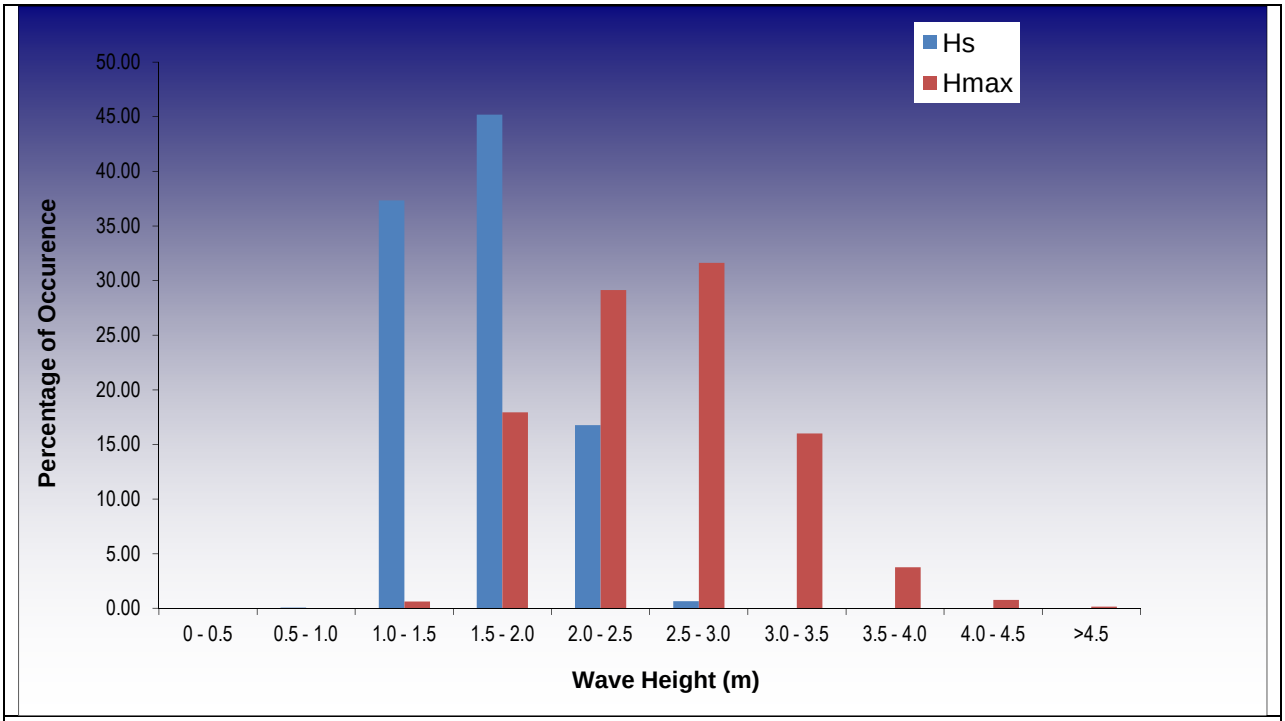


Figure 66 – Histogram of wave heights (September 2015)

As can be observed above, the maximum occurrence of significant wave height was in the range of 0.5 to 2.5m. The recorded maximum wave height shows 90% occurrence in 2m to 4.5m range.

The following image shows the wave rose drawn with respect to wave period V/s direction:

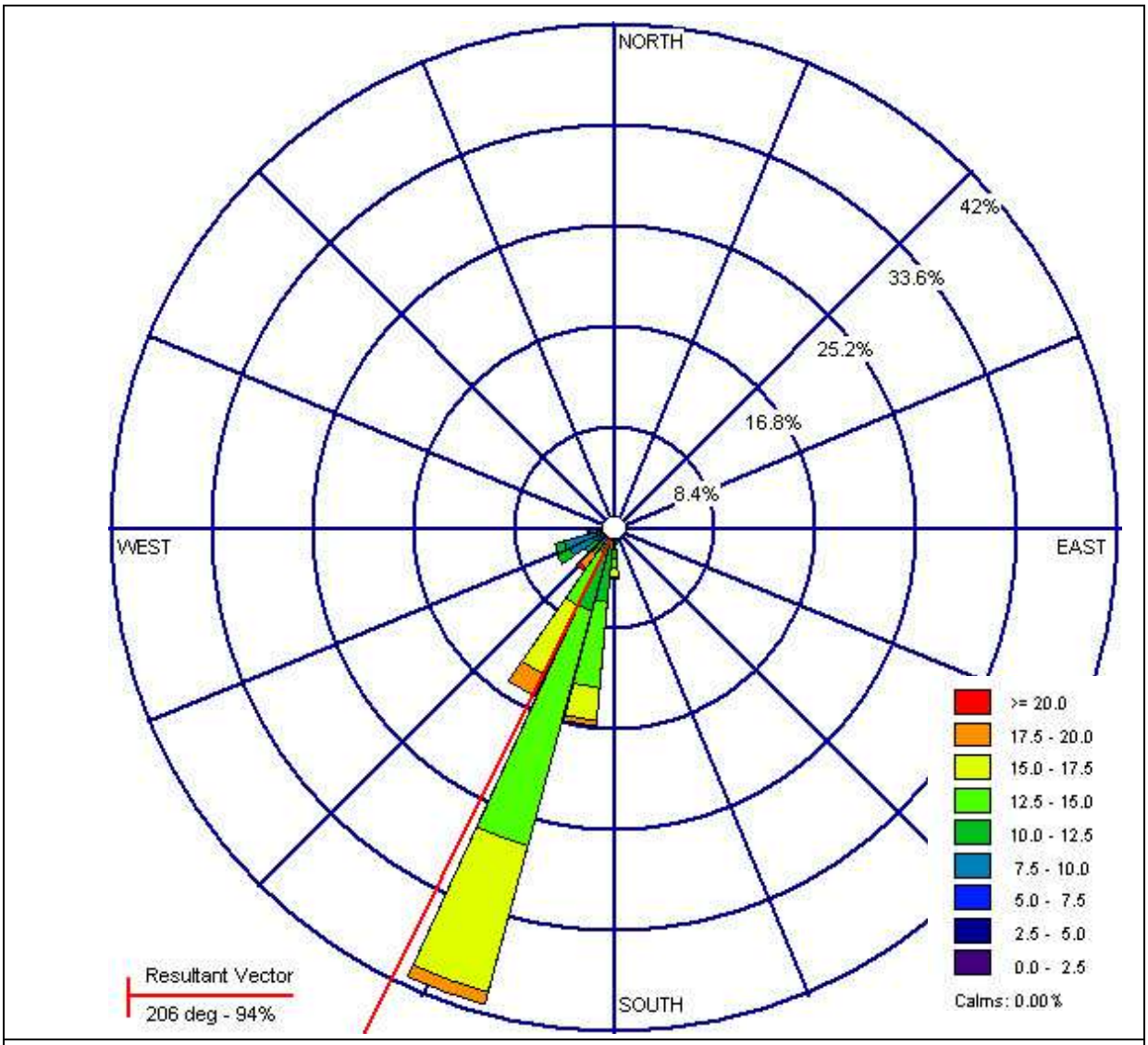


Figure 67 – Wave Rose (Tp in seconds v/s Direction) during September 2015

The histogram drawn for Wave period for September 2015 is given below:

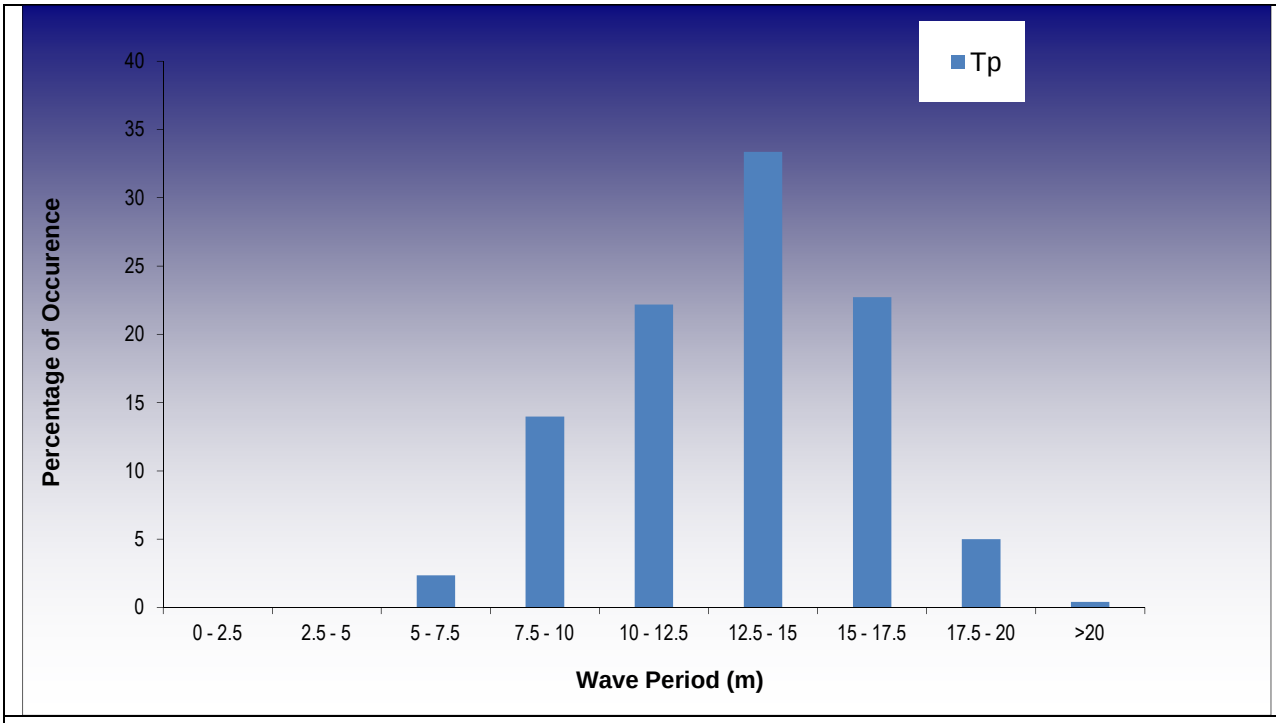


Figure 68 – Histogram of wave period (September 2015)

The above image indicates that during the month of September 2015, the wave period was in the range of 5 to 20 seconds. For about 78% of the observation, the wave period was in the range of 5 to 18 seconds.

The wave rose plot for the month of October 2015 is given below:

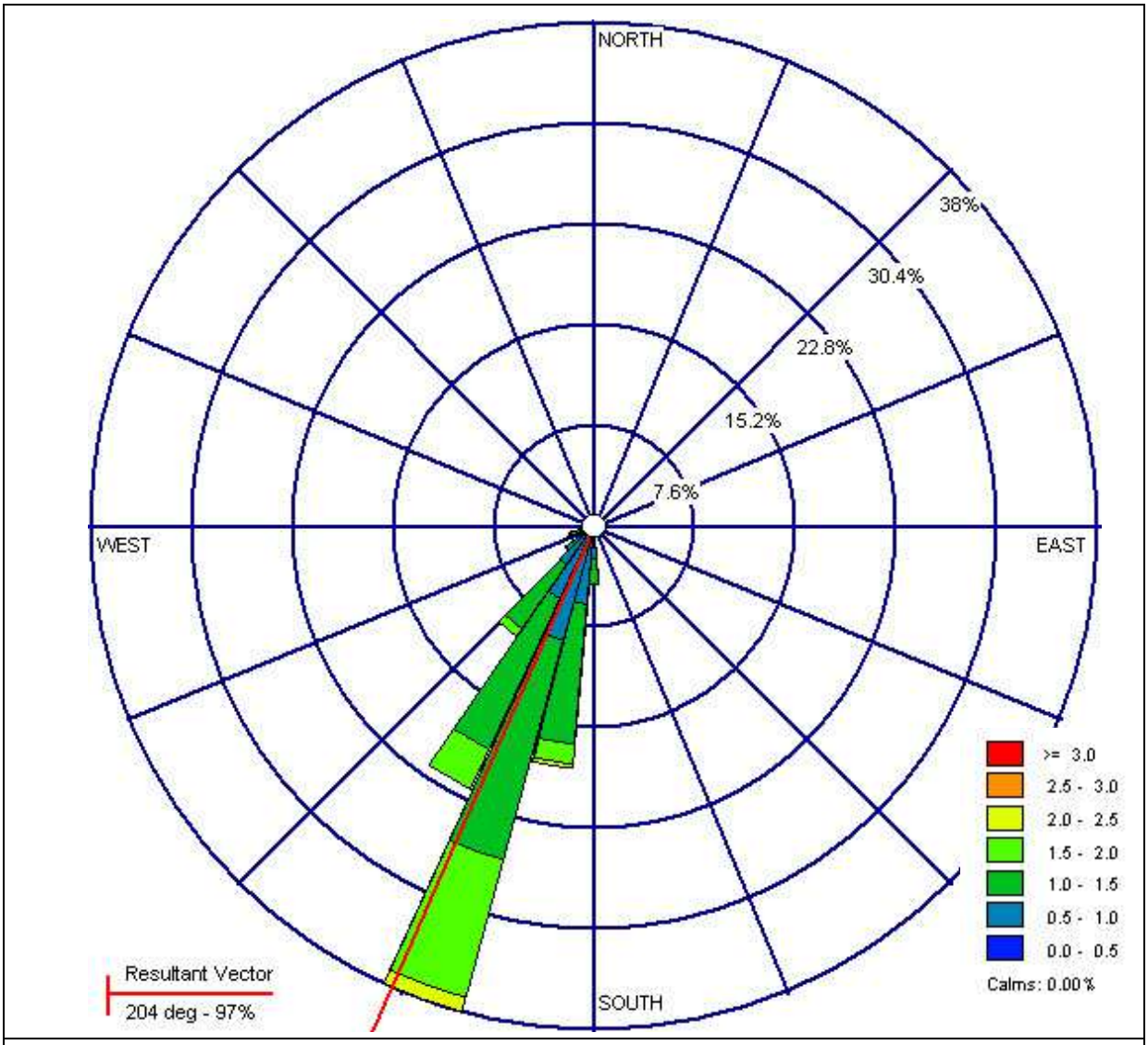


Figure 69 – Wave Rose (Hs in metre v/s Direction) in October 2015

The wave data for the month of October shows a similar trend as that in September, wave height less than 2.5m.

The frequency distribution table and histogram for the month is provided below:

FREQUENCY DISTRIBUTION				
Significant Wave Height (m)	H_s		H_{max}	
	No. of Observations	Percentage of Occurrence	No. of Observations	Percentage of Occurrence
0.0 - 0.5	0	0.0	0	0.0
0.5 – 1.0	1	0.07	0	0.0
1.0 – 1.5	514	37.33	9	0.64
1.5 – 2.0	622	45.17	253	17.93
2.0 – 2.5	231	16.78	411	29.13
2.5 – 3.0	9	0.65	446	31.61
3.0 – 3.5	0	0	226	16.02
3.5 – 4.0	0	0	53	3.76
4.0 – 4.5	0	0	11	0.78
>4.5	0	0	2	0.14
Total	**1377**	**100**	**1411**	**100**

Table 23: Frequency Distribution of wave heights (October 2015)

The histogram of significant wave height during observation period of October 2015 is given below:

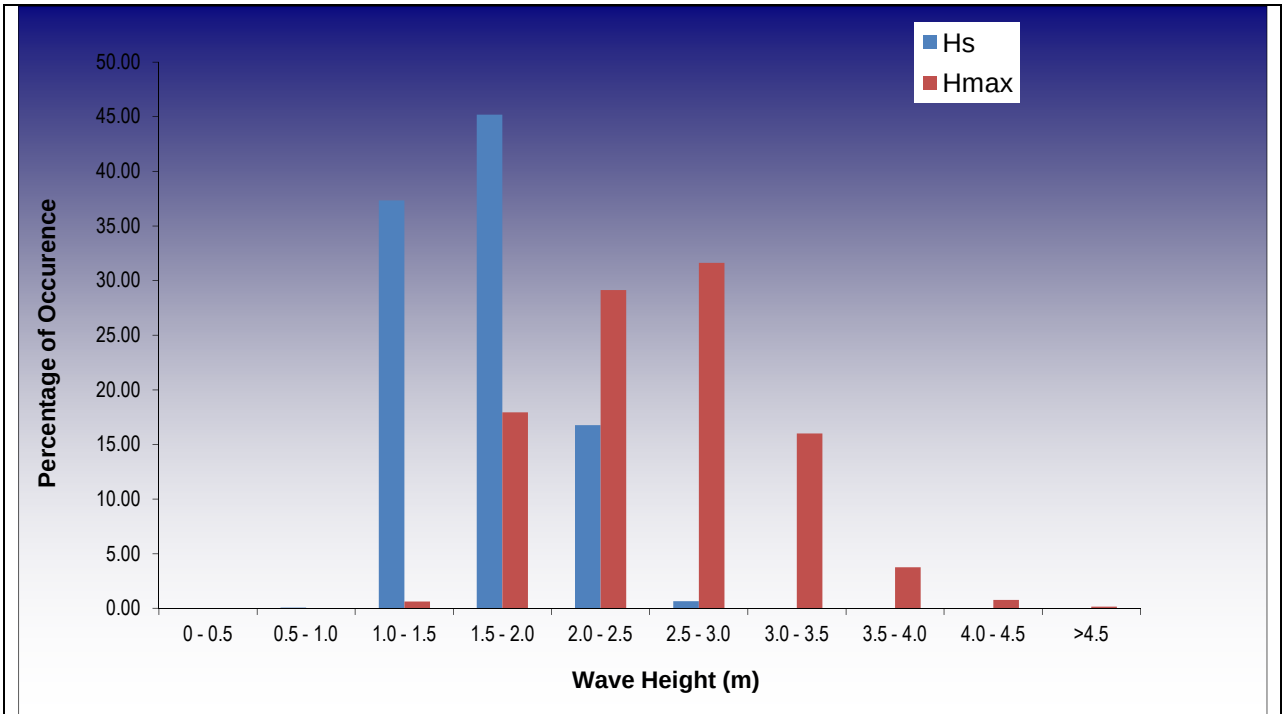


Figure 70 – Histogram of wave heights (October 2015)

As can be observed above, the maximum occurrence of significant wave height was in the range of 0.5 to 2.5m.

The following image shows the wave rose drawn with respect to wave period V/s direction:

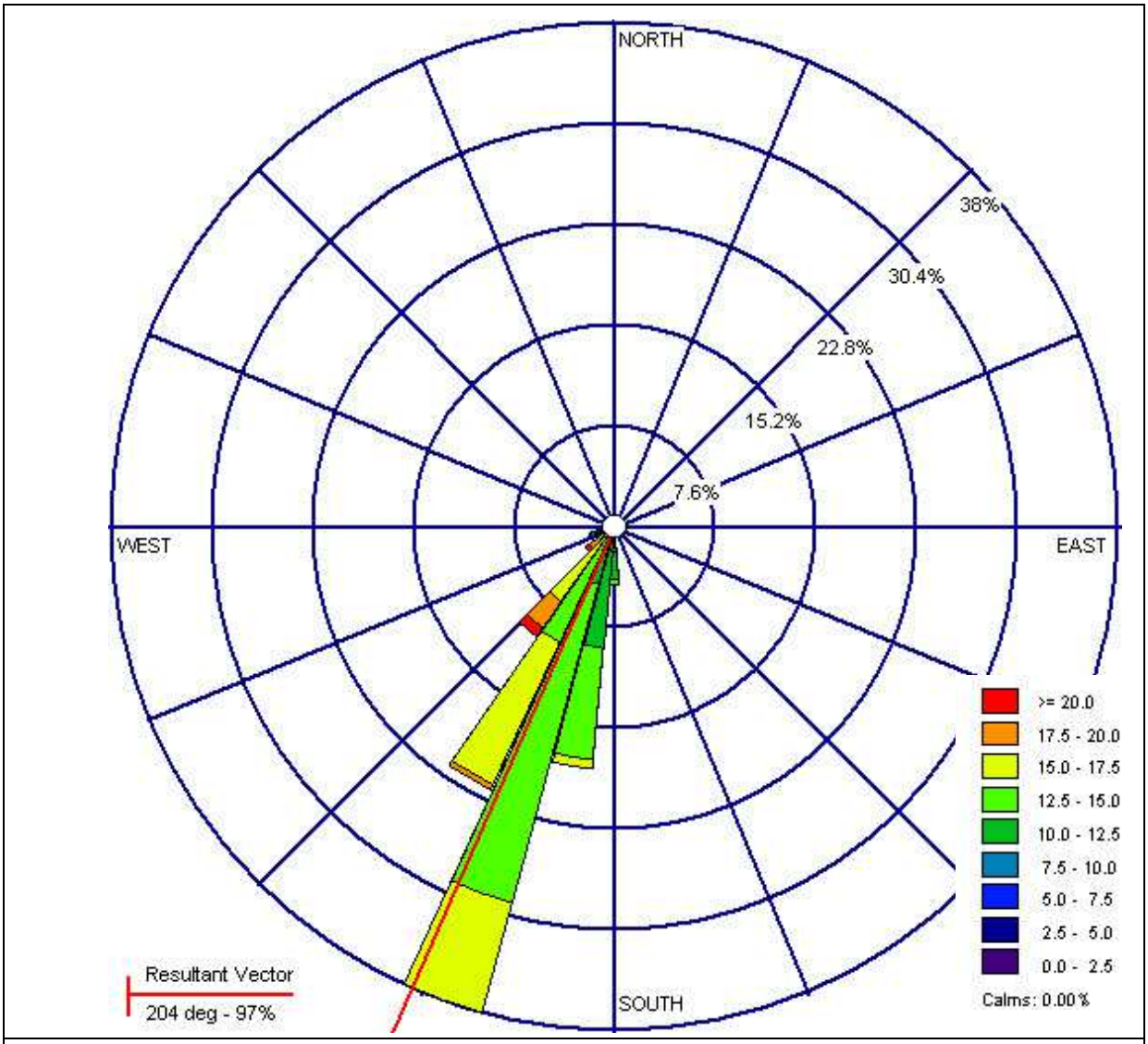


Figure 71 – Wave Rose (Tp in seconds v/s Direction) during October 2015

The histogram drawn for Wave period for September 2015 is given below:

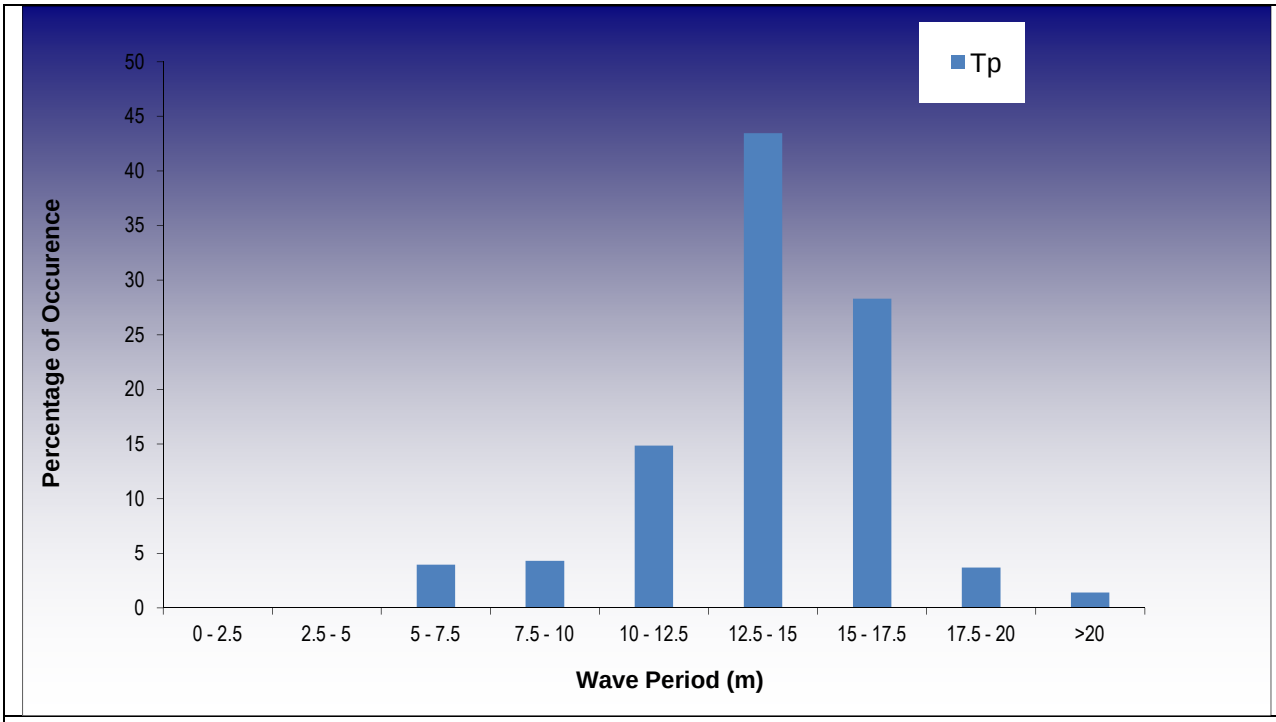


Figure 72 – Histogram of wave period (October 2015)

The above image indicates that during the month of September 2015, the wave period was in the range of 5 to 20 seconds. For about 90% of the observation, the wave period was in the range of 8 to 18 seconds.

The time series graph for the monsoon months are provided in Annexure III.

6.5 Measurement of Meteorological Parameters

The data for the months of observation are compiled in the successive paragraphs:

The wind rose for the month of June 2015 is provided below:

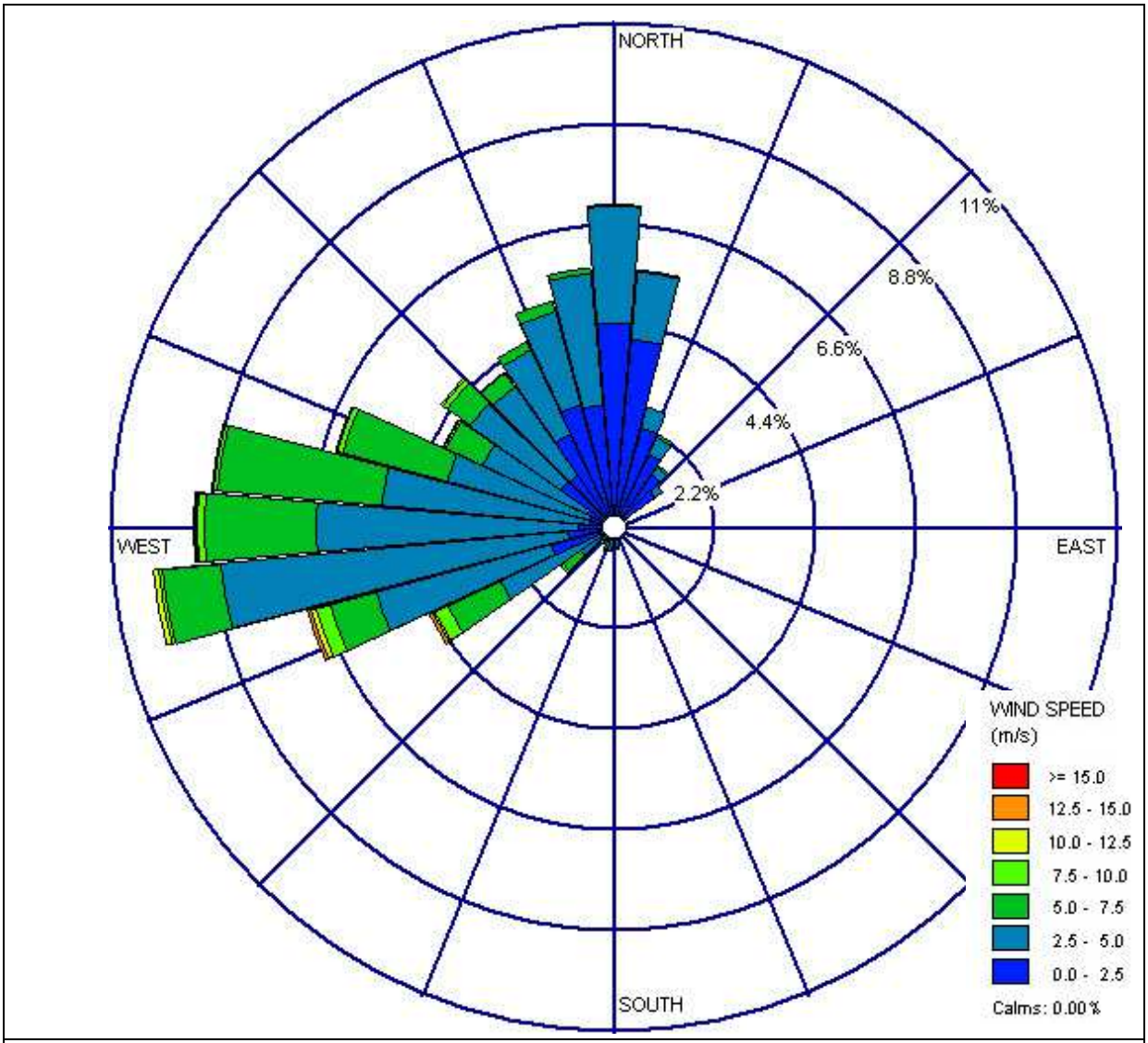


Figure 73 – Wind Rose (Speed in m/s v/s Direction) during June 2015

The rose plot reveals the monsoon westerly winds along with few northerly winds as well.

The frequency distribution table for wind speed for the month of June 2015 drawn for the reduced level (10m above MSL) is given below:

Frequency Distribution		
Wind Speed (m/s)	**No. of observations**	**Percentage of Occurrence**
0 – 2.5	1312	35.9
2.5 – 5	1754	48.0
5 – 7.5	513	14.0
7.5 – 10	49	1.3
10 – 12.5	16	0.4
12.5 - 15	9	0.2
>15	0	0.0
Total	**3653**	**100**

Table 24: Frequency Distribution of wind speed (June 2015)

The histogram of wind speed for the month of June 2015 is given below:

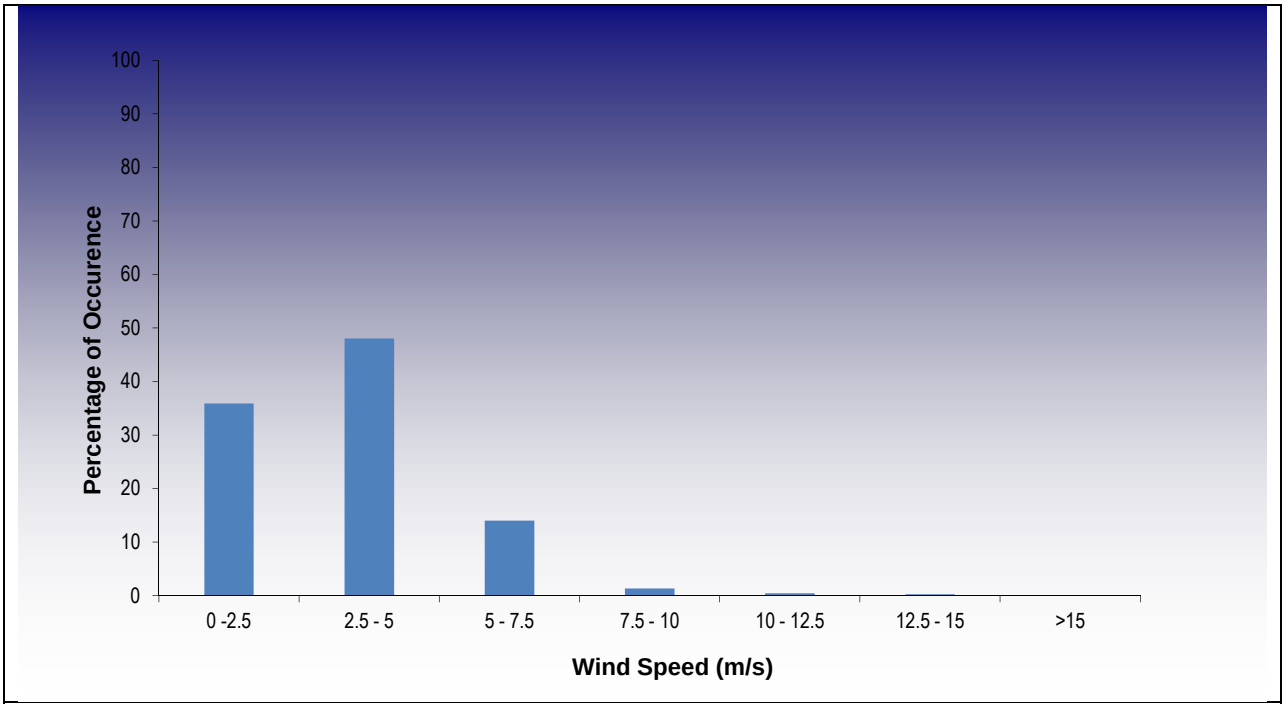


Figure 74 – Histogram of wind speed (June 2015)

As can be seen from the above images, for about 90% of the observation period the wind speed was from 0 to 8 m/s. The winds blowing from the sea has shown a greater magnitude than that blowing from land. The maximum wind speed attained during June 2015 period (estimated speed at 10m above ground) was 13.9 m/s on 27th June 2015.

The percentage occurrence table drawn for atmospheric pressure, temperature and relative humidity is presented below:

①

Frequency Distribution		
Atm Pressure (mb)	**No. of observations**	**Percentage of Occurrence**
<1000	0	0.0
1000-1004	570	15.6
1004-1008	2673	73.2
> 1008	409	11.2
Total	**3652**	**100**
Temperature (°C)	**No. of observations**	**Percentage of Occurrence**
20-24	94	2.6
24-28	2157	59.1
28-32	1401	38.4
>32	0	0.0
Total	**3652**	**100**
RH (%)	**No. of observations**	**Percentage of Occurrence**
50-60	0	0
60-70	0	0
70-80	405	11.1
>80	3247	88.9
Total	**3652**	**100**

Table 25: Frequency Distribution of met parameters (June 2015)

The histogram drawn for the parameters above for the month of June 2015 is shown below:

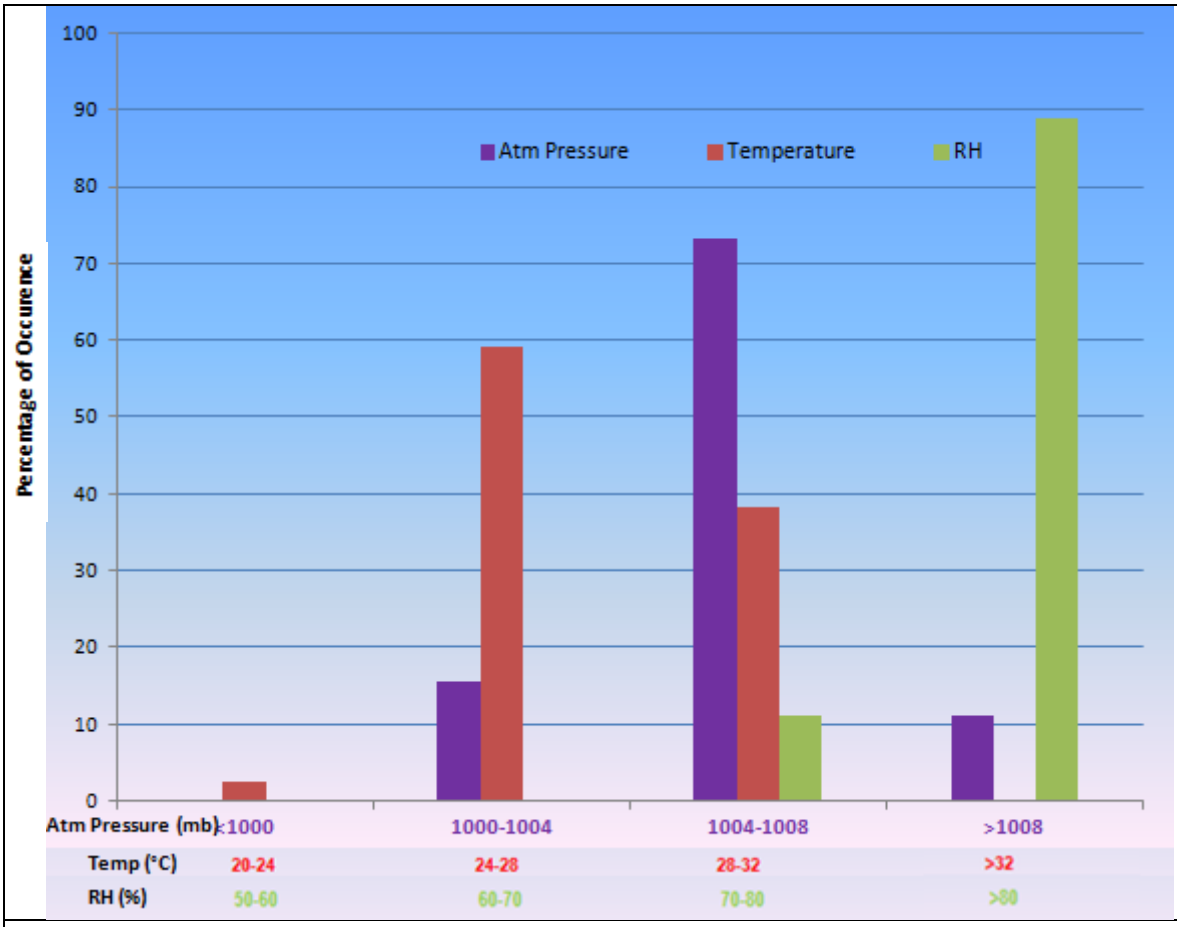


Figure 75 – Histogram of met parameters (June 2015)

The data represented above reveals that about 90% of the observations, the atmospheric pressure was below 1010mb. The temperature hovered around 20 to 32°C and the relative humidity was more than 80% during the bulk of the observations.

The wind rose for the month of July 2015 is provided below:

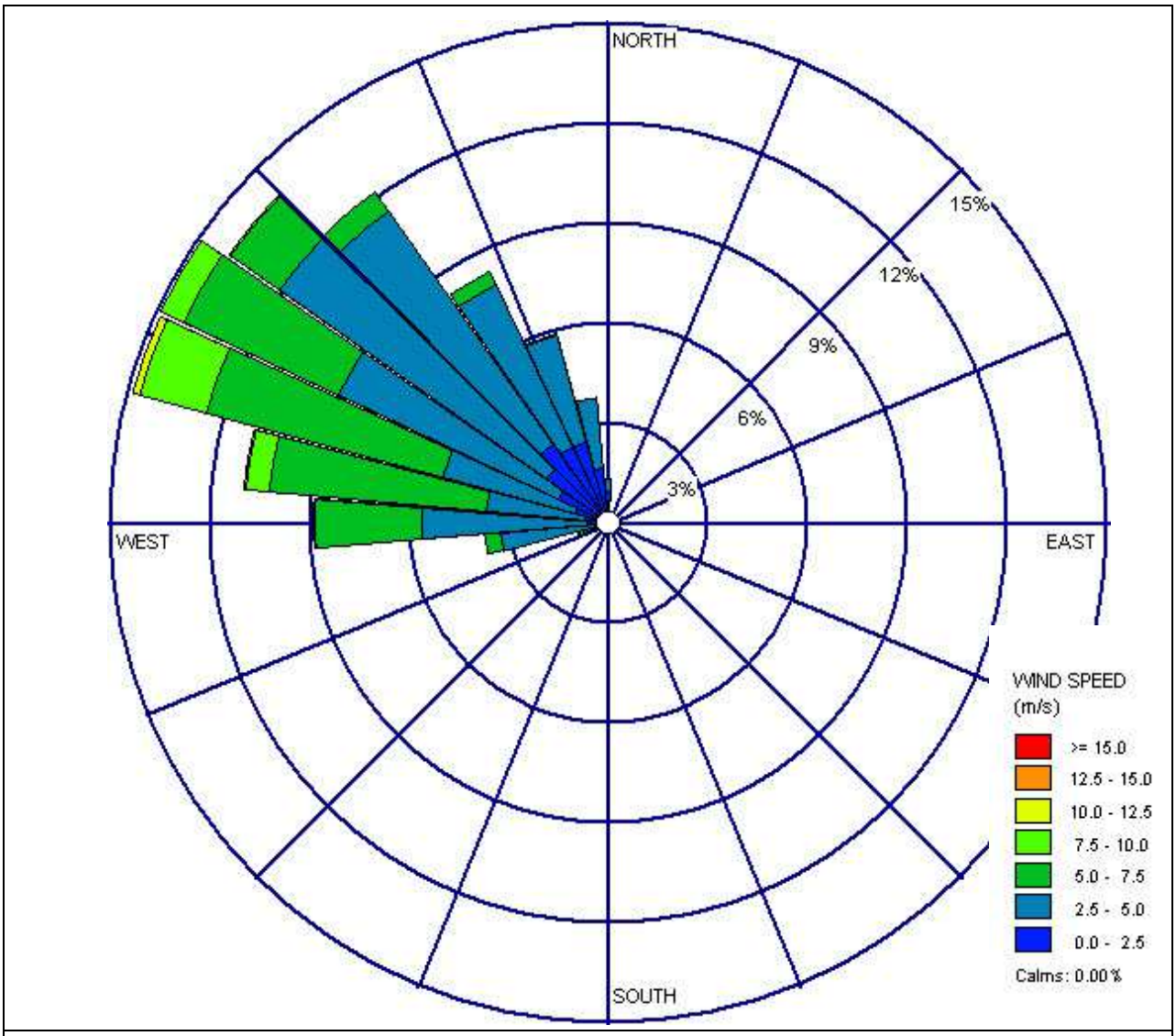


Figure 76 – Wind Rose (Speed in m/s v/s Direction) during July 2015

The rose plot indicates westerly to north-westerly winds.

The frequency distribution table for the month of July 2015 is given below:

Frequency Distribution		
Wind Speed (m/s)	**No. of observations**	**Percentage of Occurrence**
0 – 2.5	716	18.9
2.5 – 5	1985	52.5
5 – 7.5	927	24.5
7.5 – 10	141	3.7
10 – 12.5	10	0.3
12.5 - 15	1	0.03
>15	0	0.0
Total	**3780**	**100**

Table 26: Frequency Distribution of wind speed (July 2015)

The histogram of wind speed for the month of July 2015 is given below:

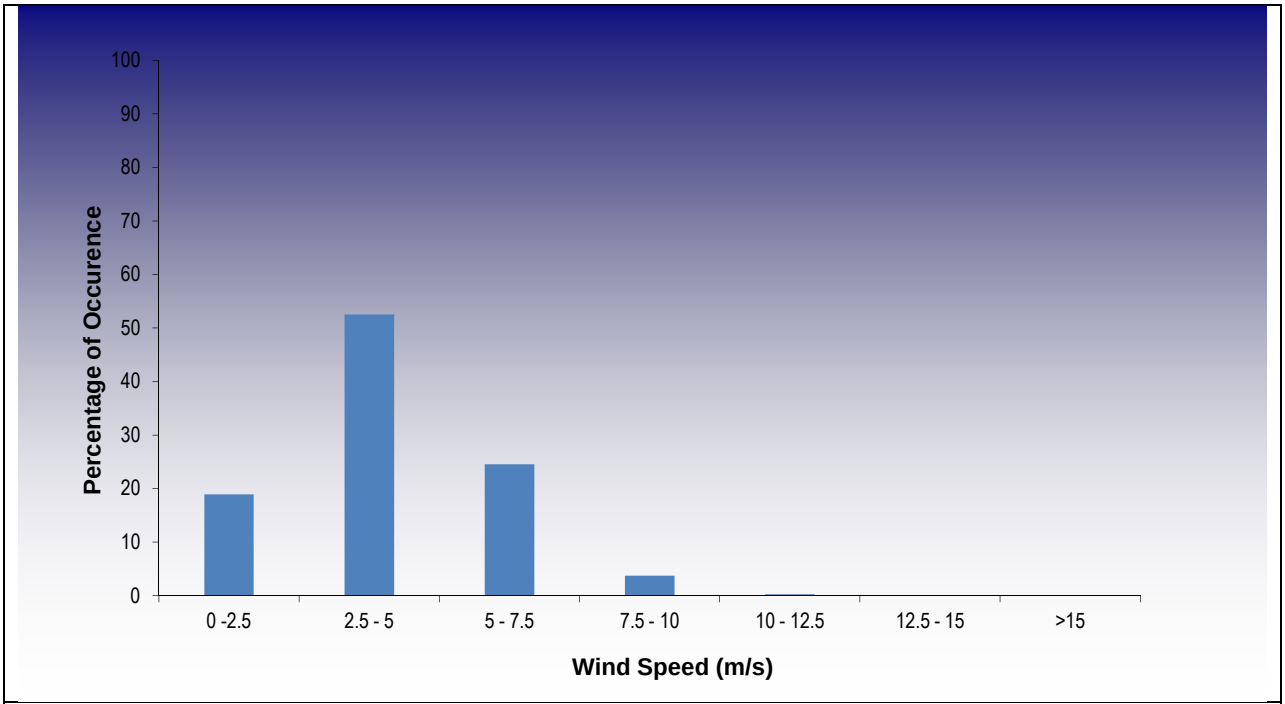


Figure 77 – Histogram of wind speed (July 2015)

As can be seen from the above images, for about 96% of the observation period the wind speed was less than 8 m/s. The maximum wind speed attained during July 2015 period was 13.4 m/s on 19th July 2015.

The percentage occurrence table drawn for atmospheric pressure, temperature, relative humidity and rainfall is presented below:

①

Frequency Distribution		
Atm Pressure	**No. of observations**	**Percentage of Occurrence**
<1000	0	0.0
1000-1004	311	8.2
1004-1008	2474	65.5
> 1008	994	26.3
Total	**3779**	**100**
Temperature	**No. of observations**	**Percentage of Occurrence**
20-24	71	1.9
24-28	3055	80.8
28-32	653	17.3
>32	0	0.0
Total	**3779**	**100**
RH	**No. of observations**	**Percentage of Occurrence**
50-60	0	0
60-70	6	0.2
70-80	593	15.7
>80	3178	84.1
Total	**3777**	**100**

Table 27: Frequency Distribution of met parameters (July 2015)

The histogram drawn for the above parameters for the month of July 2015 is shown below:

①

Figure 78 – Histogram of met parameters (July 2015)

The data represented above reveals that for about 90% of the observations, the atmospheric pressure was below 1010mb. The temperature hovered around 20 to 32°C and the relative humidity was more than 80% during the bulk of the observations.

The wind rose for the month of August 2015 is provided below:

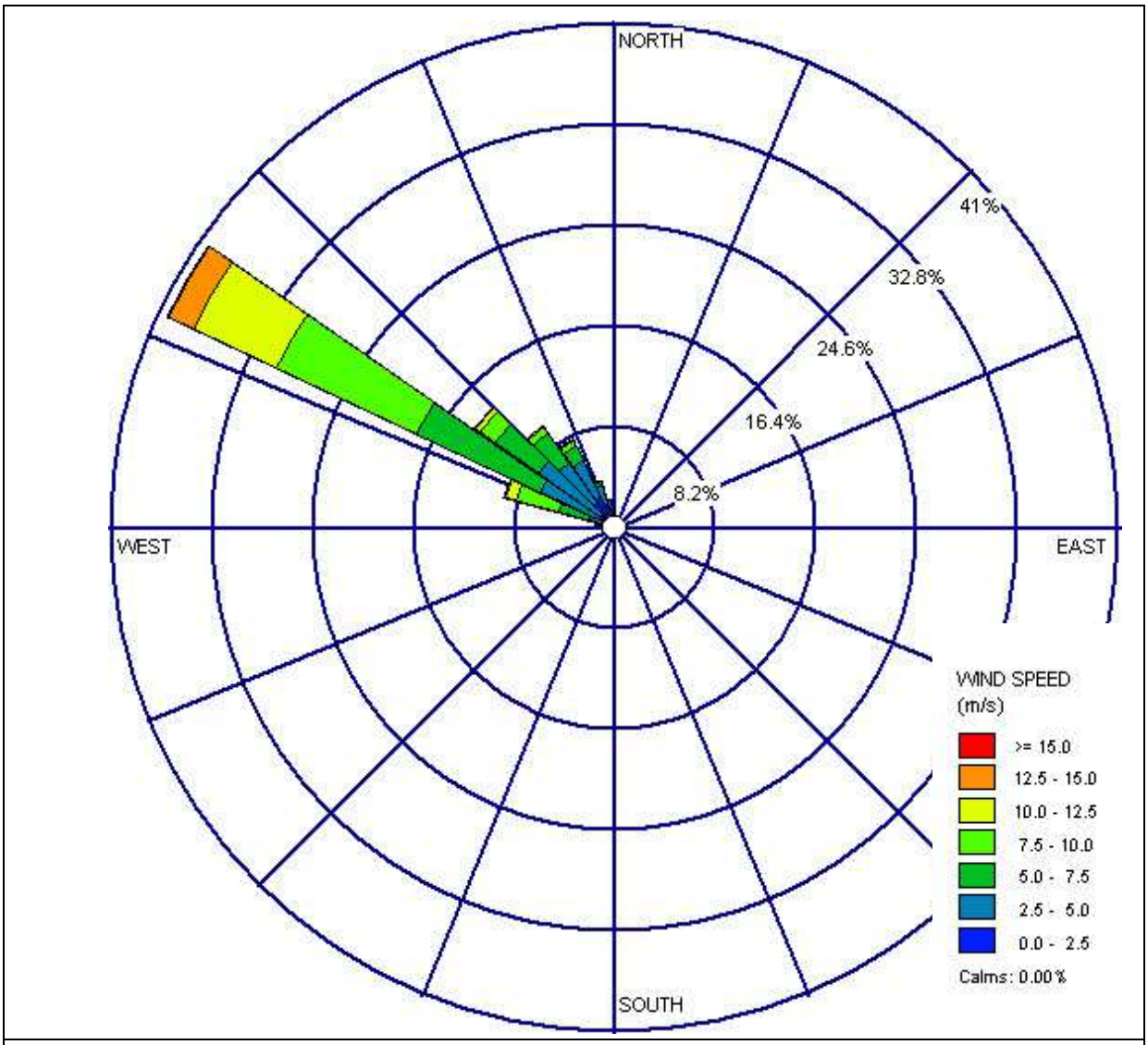


Figure 79 – Wind Rose (Speed in m/s v/s Direction) during August 2015

The rose plot indicates the wind blowing from north-westerly with speeds of less than 15m/s.

The frequency distribution table for the month of August 2015 is given below:

Frequency Distribution		
Wind Speed (m/s)	**No. of observations**	**Percentage of Occurrence**
0 – 2.5	951	22.5
2.5 – 5	1361	32.2
5 – 7.5	1114	26.4
7.5 – 10	639	15.1
10 – 12.5	151	3.6
12.5 - 15	9	0.2
>15	0	0.0
Total	**4225**	**100**

Table 28: Frequency Distribution of wind speed (August 2015)

The histogram of wind speed for the month of August 2015 is given below:

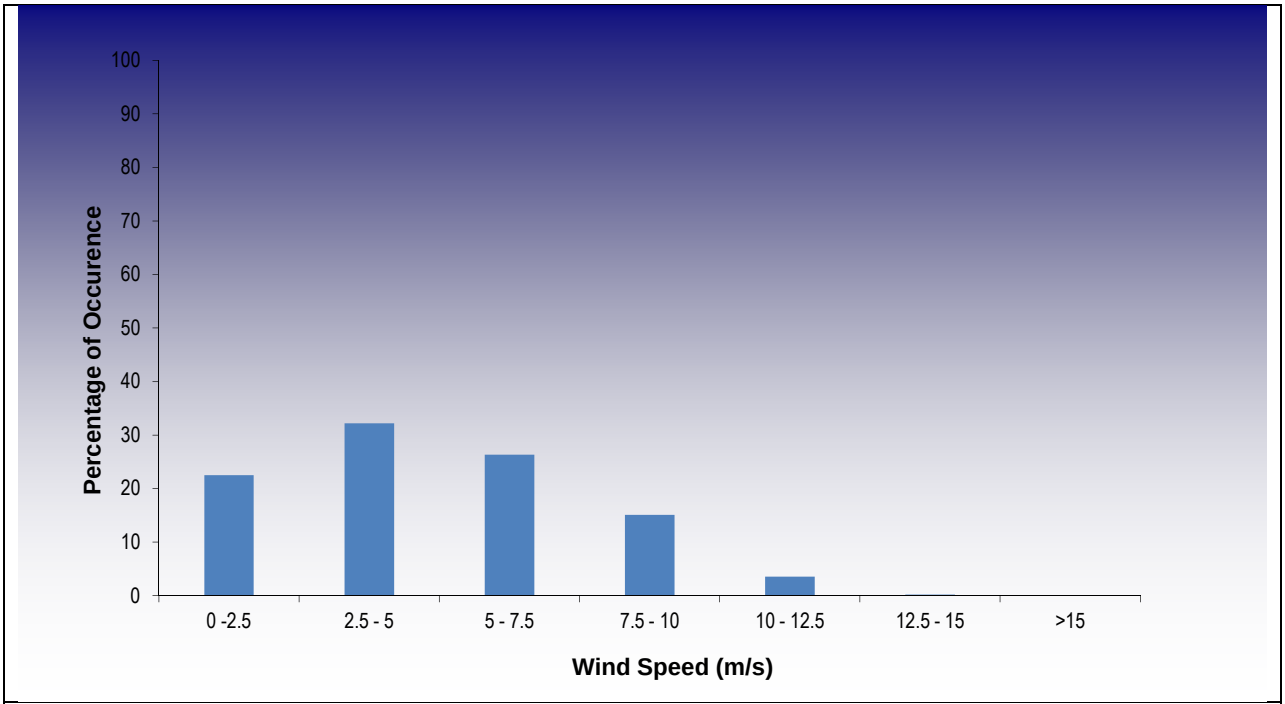


Figure 80 – Histogram of wind speed (August 2015)

As can be seen from the above images the wind speed was from 1 to 8 m/s. The maximum wind speed attained during the period was 13.5 m/s on 13th August 2015.

The percentage occurrence table drawn for atmospheric pressure, temperature and relative humidity is presented below:

①

Frequency Distribution		
Atm Pressure	**No. of observations**	**Percentage of Occurrence**
<1000	516	12.2
1000-1004	3391	80.3
1004-1008	317	7.5
>1008	0	0.0
Total	**4224**	**100**
Temperature	**No. of observations**	**Percentage of Occurrence**
20-24	34	0.8
24-28	2913	69
28-32	1275	30.2
>32	2	0.05
Total	**4224**	**100**
RH	**No. of observations**	**Percentage of Occurrence**
50-60	0	0
60-70	63	1.5
70-80	804	19
>80	3357	79.5
Total	**4224**	**100**

Table 29: Frequency Distribution of met parameters (August 2015)

The histogram drawn for the above parameters for the month of August 2015 is shown below:

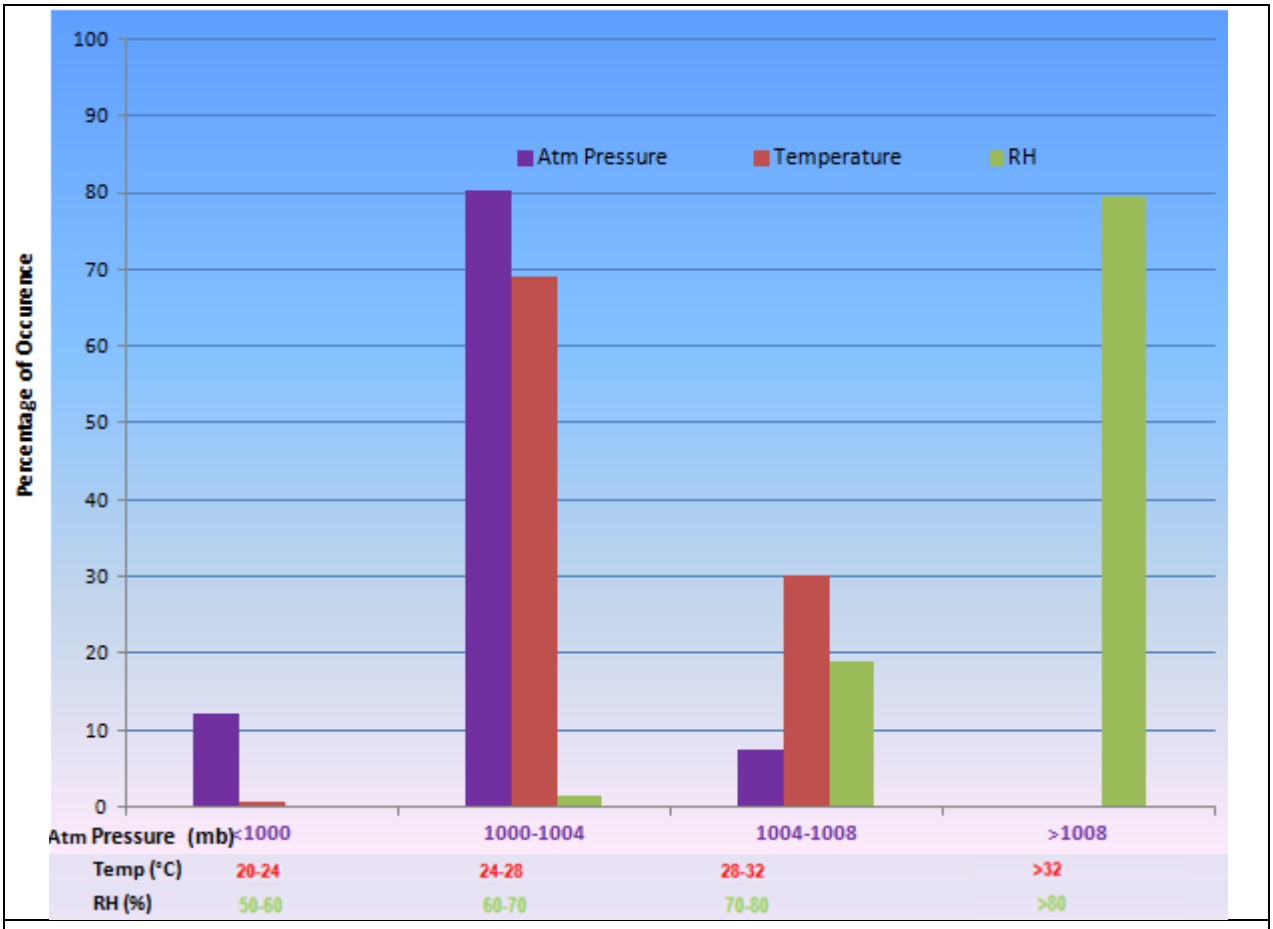


Figure 81 – Histogram of met parameters (August 2015)

The data represented above reveals that the atmospheric pressure was below 1008mb throughout the observation period. The temperature hovered around 20 to 32°C and the relative humidity was more than 80% during the bulk of the observations.

The wind rose for the month of September 2015 is provided below:

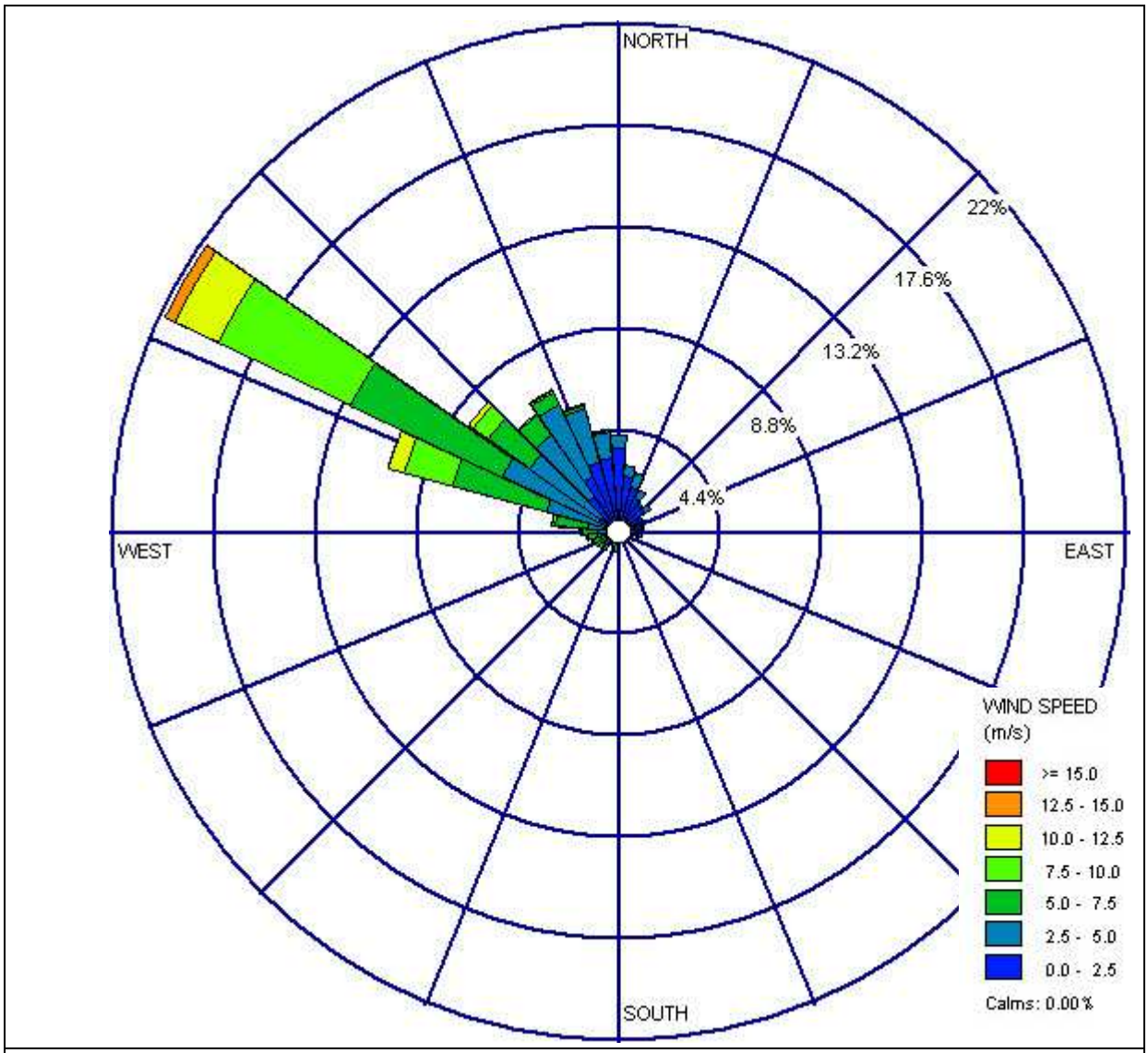


Figure 82 – Wind Rose (Speed in m/s v/s Direction) during September 2015

The rose plot indicates a northwesterly flow with speeds less than 15m/s.

The frequency distribution table for the month of September 2015 is given below:

Frequency Distribution		
Wind Speed (m/s)	**No. of observations**	**Percentage of Occurrence**
0 – 2.5	1813	42.0
2.5 – 5	1450	33.6
5 – 7.5	778	18.0
7.5 – 10	246	5.7
10 – 12.5	28	0.6
12.5 - 15	3	0.1
>15	0	0.0
Total	**4318**	**100**

Table 30: Frequency Distribution of wind speed (September 2015)

The histogram of wind speed for the month of September 2015 is given below:

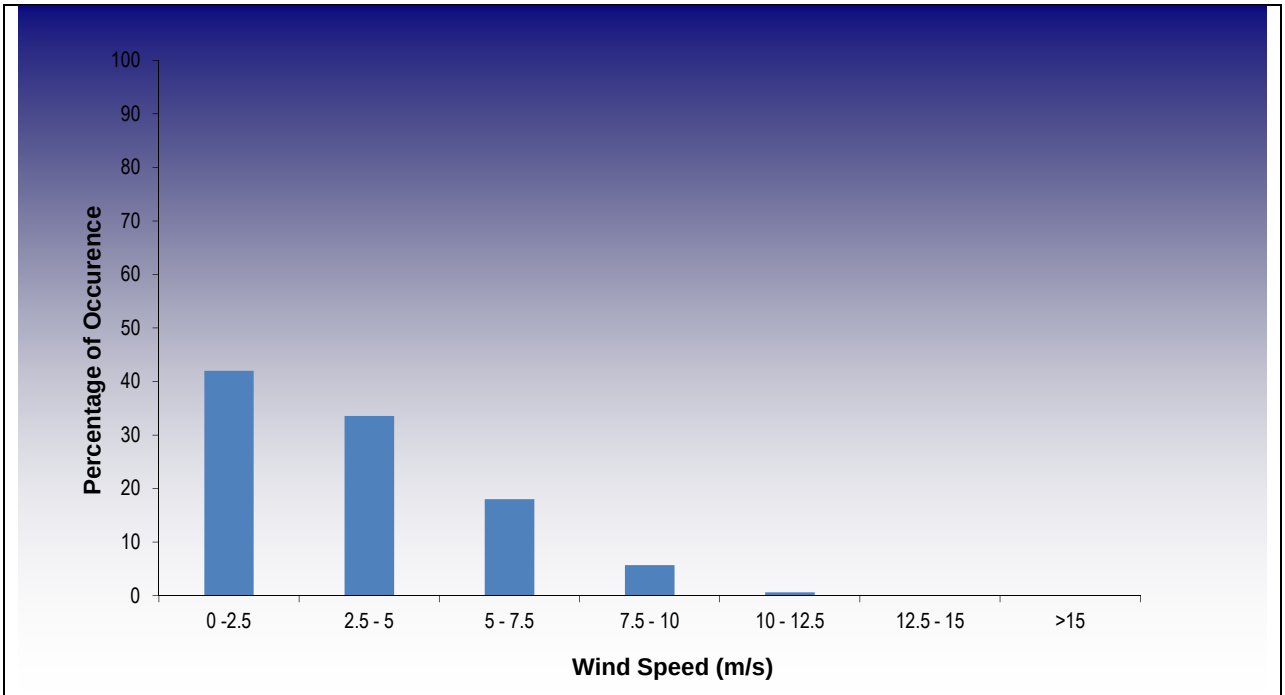


Figure 83 – Histogram of wind speed (September 2015)

As can be seen from the above images the wind speed was less than 14m/s. The maximum wind speed attained during the period was 13.7m/s on 15th September 2015.

The percentage occurrence table drawn for atmospheric pressure, temperature and relative humidity is presented below:

①

Frequency Distribution		
Atm Pressure	**No. of observations**	**Percentage of Occurrence**
<1000	847	19.6
1000-1004	2770	64.2
1004-1008	701	16.2
>1008	0	0.0
Total	**4318**	**100**
Temperature	**No. of observations**	**Percentage of Occurrence**
20-24	158	3.7
24-28	2893	67.0
28-32	1267	29.3
>32	0	0
Total	**4318**	**100**
RH	**No. of observations**	**Percentage of Occurrence**
50-60	0	0
60-70	11	0.3
70-80	154	3.6
>80	4153	96.2
Total	**4224**	**100**

Table 31: Frequency Distribution of met parameters (September 2015)

The histogram drawn for the above parameters for the month of September 2015 is shown below:

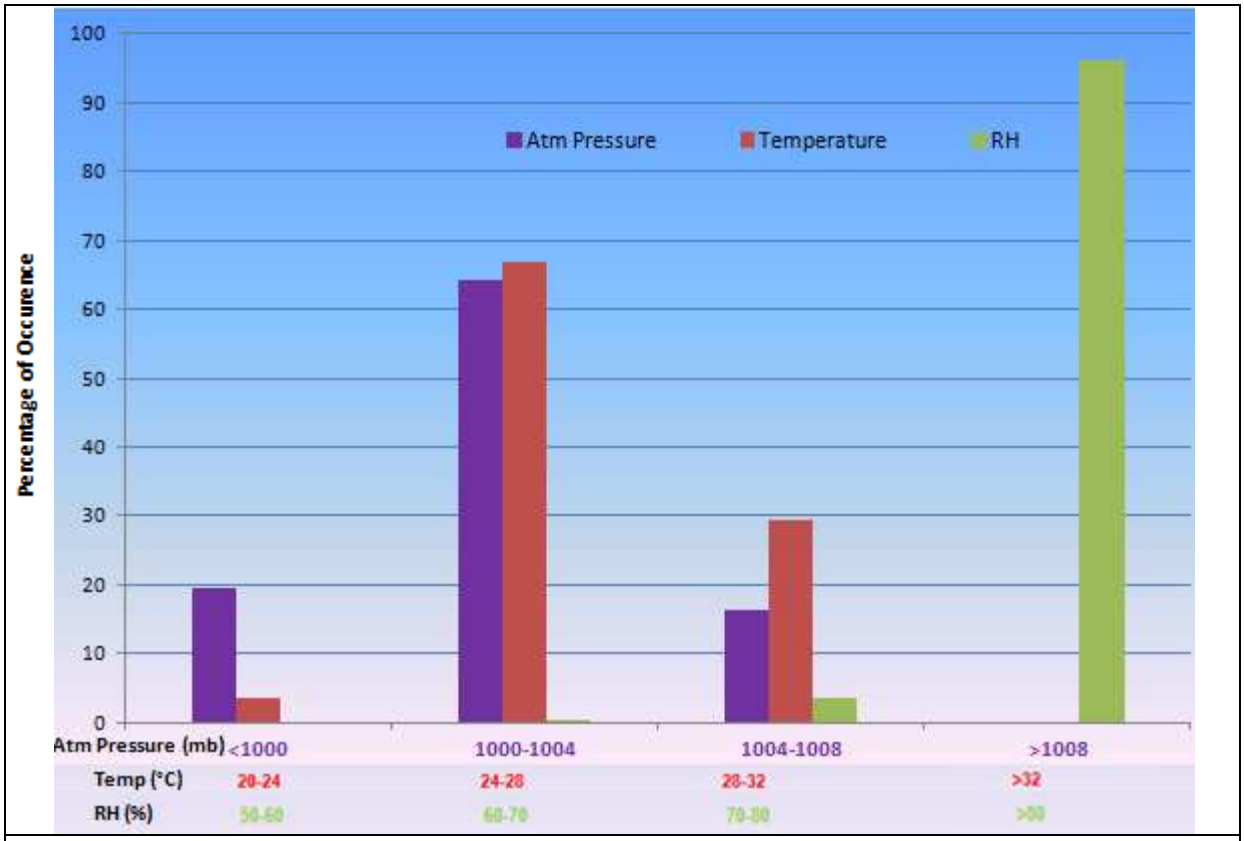


Figure 84 – Histogram of met parameters (September 2015)

The data represented above reveals that the atmospheric pressure was below 1008mb throughout the observation period. The temperature hovered around 20 to 32°C and the relative humidity was more than 80% during the bulk of the observations.

The wind rose for the month of October 2015 is provided below:

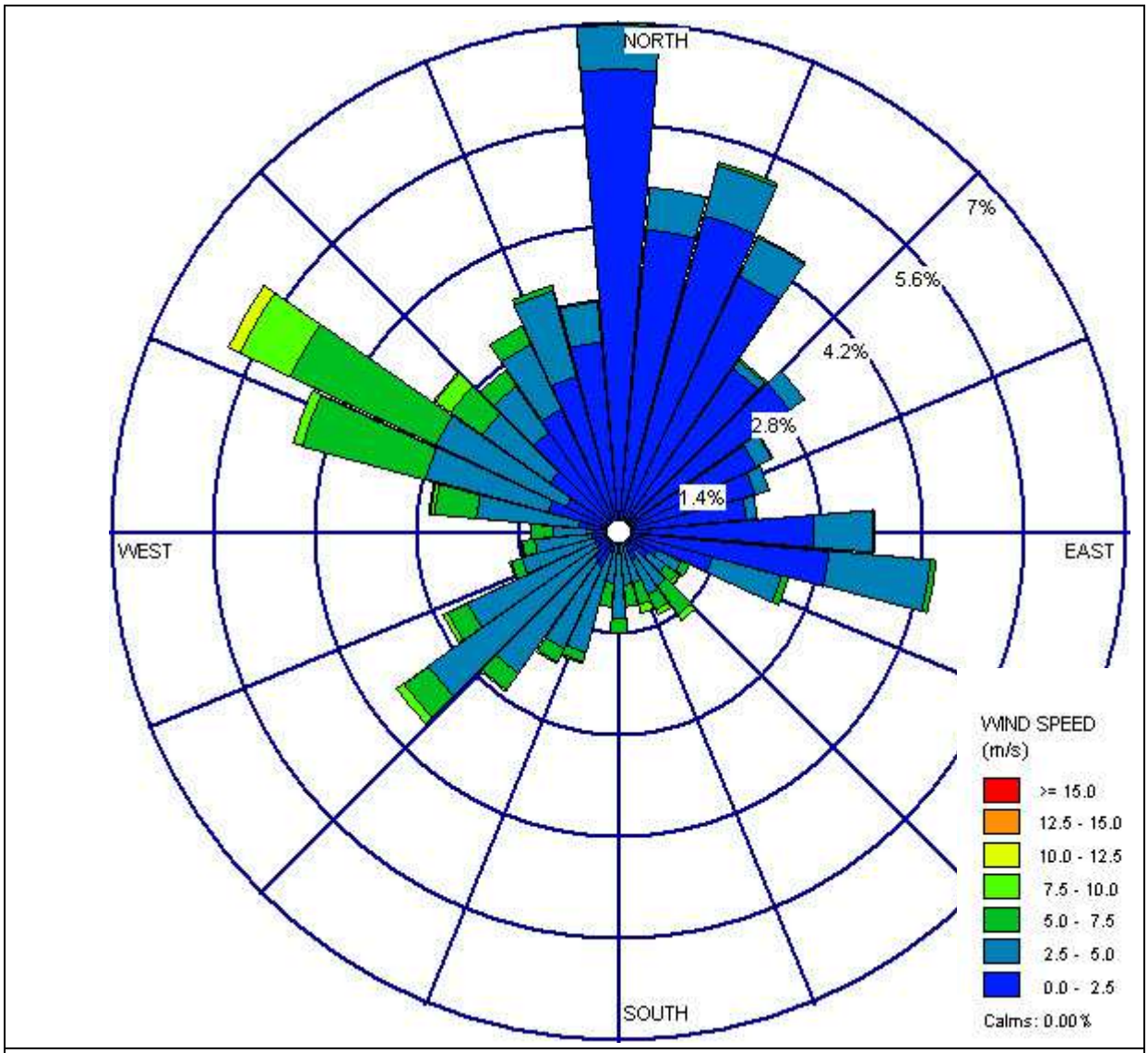


Figure 85 – Wind Rose (Speed in m/s v/s Direction) during October 2015

The rose plot indicates a north-westerly to south-westerly wind with speeds more than 5m/s and winds with less than 5m/s from other directions.

The frequency distribution table for the month of October 2015 is given below:

Frequency Distribution		
Wind Speed (m/s)	**No. of observations**	**Percentage of Occurrence**
0 – 2.5	2743	63.35
2.5 – 5	1308	30.21
5 – 7.5	238	5.50
7.5 – 10	39	0.90
10 – 12.5	2	0.05
12.5 - 15	0	0.0
>15	0	0.0
Total	**4330**	**100**

Table 32: Frequency Distribution of wind speed (October 15)

The histogram of wind speed for the month of October 2015 is given below:

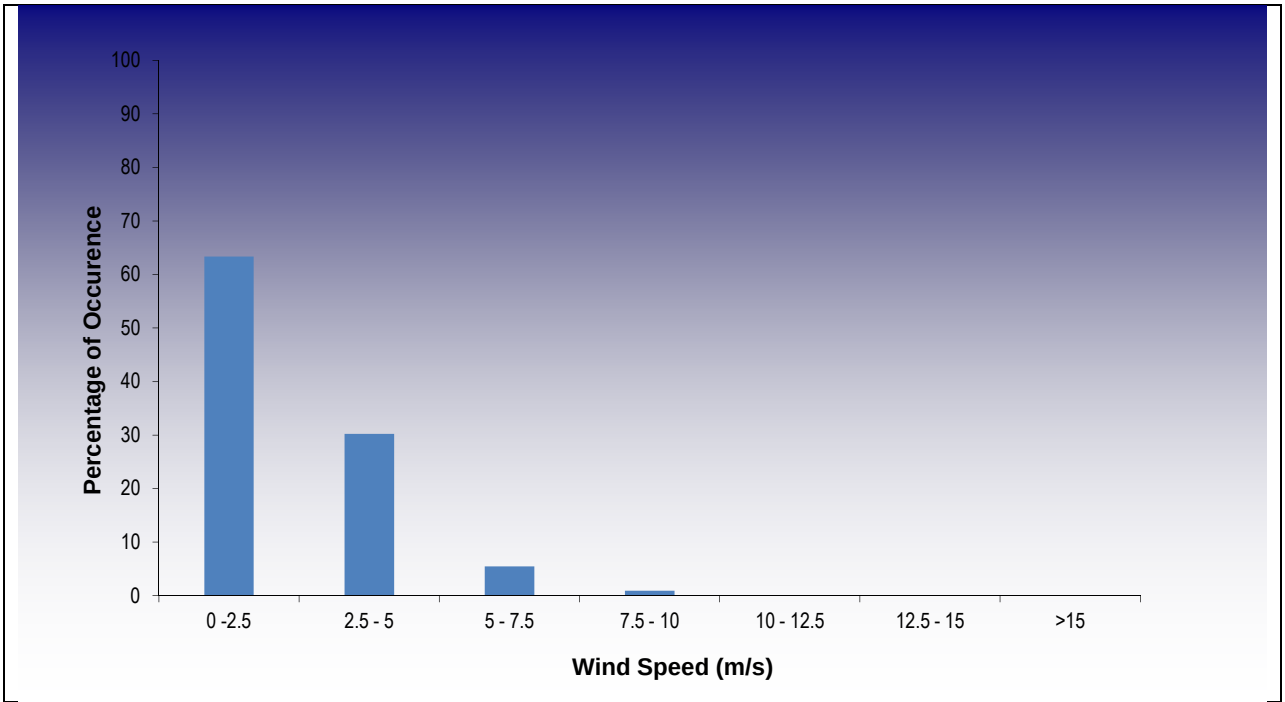


Figure 86 – Histogram of wind speed (October 15)

As can be seen from the above data the wind speed varied from 1 to 11 m/s. The maximum wind speed attained during the period was 11 m/s on 10th October 2015.

The percentage occurrence table drawn for atmospheric pressure, temperature and relative humidity is presented below:

Frequency Distribution		
Atm Pressure	**No. of observations**	**Percentage of Occurrence**
<1000	75	1.7
1000-1004	2821	65.2
1004-1008	1432	33.1
>1008	0	0.0
Total	**4328**	**100**
Temperature	**No. of observations**	**Percentage of Occurrence**
20-24	314	7.3
24-28	2775	64.1
28-32	1235	28.5
>32	3	0.07
Total	**4327**	**100**
RH	**No. of observations**	**Percentage of Occurrence**
50-60	0	0
60-70	4	0.1
70-80	61	1.4
>80	4263	98.5
Total	**4224**	**100**

Table 33: Frequency Distribution of met parameters (October 15)

The histogram drawn for the above parameters for the month of October 2015 is shown below:

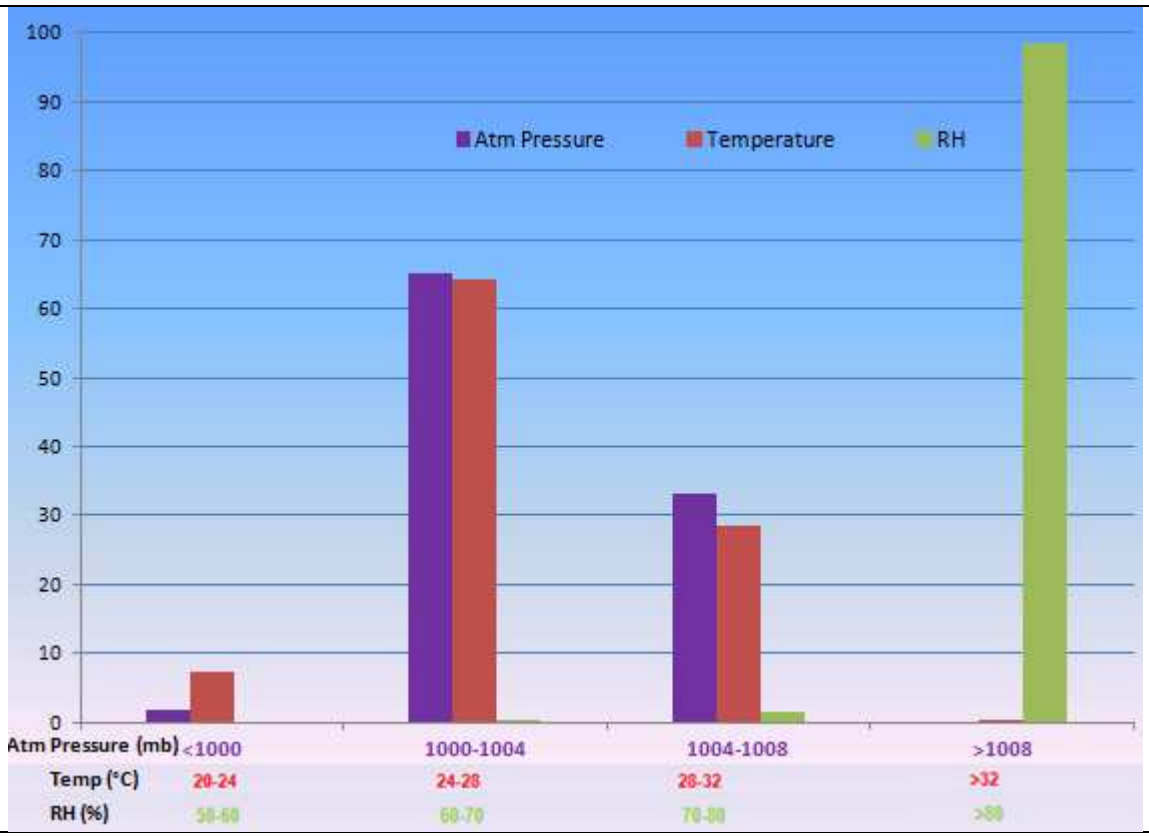


Figure 87 – Histogram of met parameters (October 2015)

The data represented above reveals that the atmospheric pressure was below 1008mb throughout the observation period. The temperature hovered around 20 to 32°C and the relative humidity was more than 80% during the bulk of the observations.

The rainfall recorded for the monsoon months are provided below:

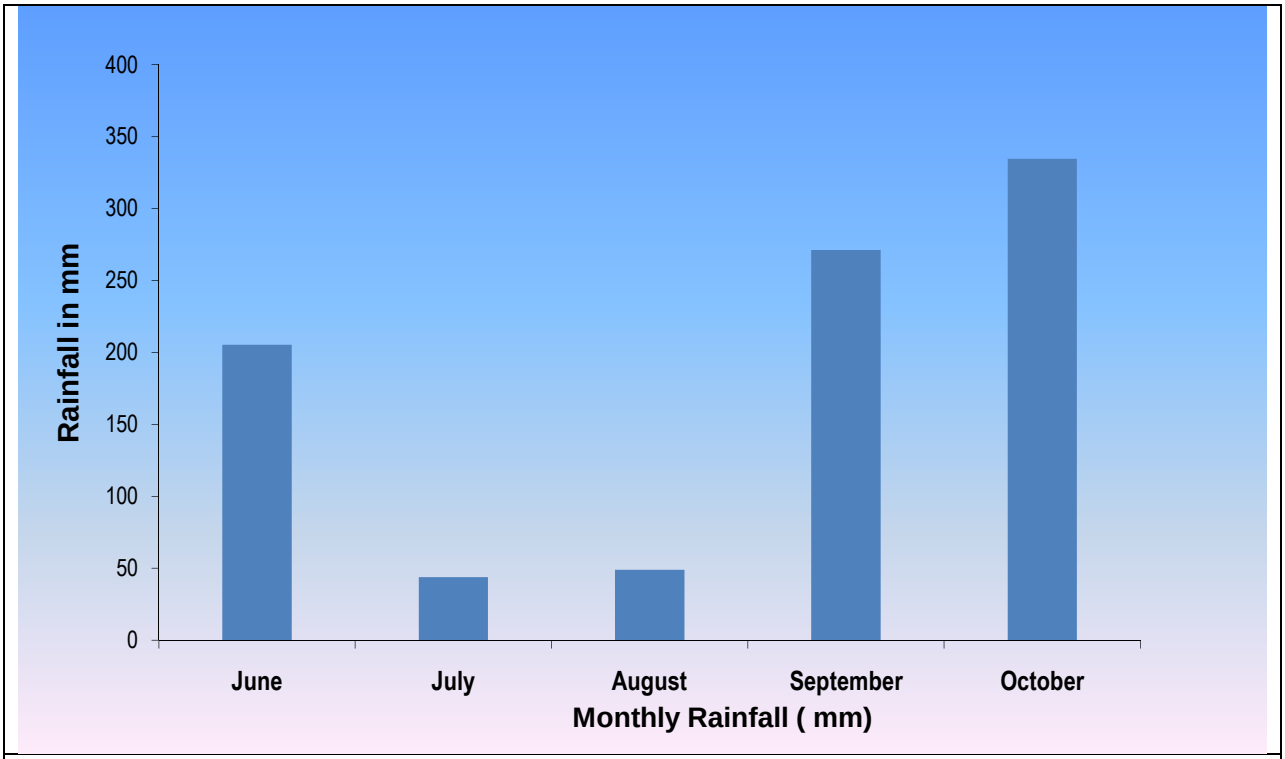


Figure 88 – Rainfall recoded for monsoon months

As can be seen in the above histogram, rains were less in the months of July and August. In September and October, the rains were heavier compared to the other months.

The time series graphs for the monsoon period are placed at Annexure IV.

6.6 Littoral Environmental Observations

The LEO was carried out for all the months. The LEO plate was deployed at the desired locations and the same was tracked for about ten minutes. 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 data sheets for all the months are placed at Annexure V. Many LEO plates were lost during the monsoon months, due to the heavy breakers.

The along shore current always followed a southerly trend, with a speed of up to 50cm/s during the monsoon months.

6.7 Photographic Documentation

The photographic documentation coinciding with the LEO was also carried out for all the months. The photographs for the period are placed at Annexure VI. As a common reference point, a red flag was fixed at each of the cross shore profiling area while taking the photograph. Using the RTK system, this point was staked during the photography.

During the active monsoonal months the beach was not visible in a majority of the locations north of Vizhinjam Harbour. This is clearly photographed and shown in the Annexure.

The beach has shown changes in the gradient due to wave action during the monsoon months.

6.8 Cross Shore Profiling

The cross shore profiling for the period was carried out using a combination of wide swath bathymetric system offshore and RTK onshore. In the breaker area, no data could be acquired and hence that area is shown in 'dashed line', in the enclosed AutoCAD charts.

It can be seen that the data in the monsoon has shown changes in the depth pattern. Due to high waves, no beach was visible during June to August, north of Vizhinjam Harbour. Accordingly, no beach profile could be carried out at the sites – CSP 49 to CSP 63 as can also be seen in the photographic documentation.

The charts for the full period are placed in Annexure VII.

6.9 Bathymetric Survey

The bathymetric survey was carried out as per the specifications; using a multibeam echo sounder up to the 20m contour and a single beam echo sounder for the remainder of the area, along lines spaced 300m apart. An area of 40 x 15 km was covered during the monsoon campaign.

The charts are drawn on a scale of 1:10,000 and one chart comprising all the bathy is drawn on a scale of 1:50,000.

The water depths within the survey area vary between the 0m contour in many places along the shoreline to the 57m contour along the western boundary towards the open sea. The seabed slopes gently to very gently towards the southwest from the northeast throughout the area with a variable gradient ranging from 1 in 24 in the nearshore area as revealed by the closely spaced contours to more than 1 in 500 towards the open sea. The minimum depth of 0.1m is obtained by multibeam echo sounder along the shoreline near Vizhinjam port. Near the port premises, the seabed is irregular with changes in water depth from 0m to 9m. Off the harbour area, the water depth increases from the 5m contour to the 20m contour with an average gradient of 1 in 48.

From 20m depth to 50m, the slope is very gentle. The maximum depth in the area recorded was 57.6m which is about 14.8 km @ 228° from the existing harbour mouth.

The single and multibeam survey area is given below:

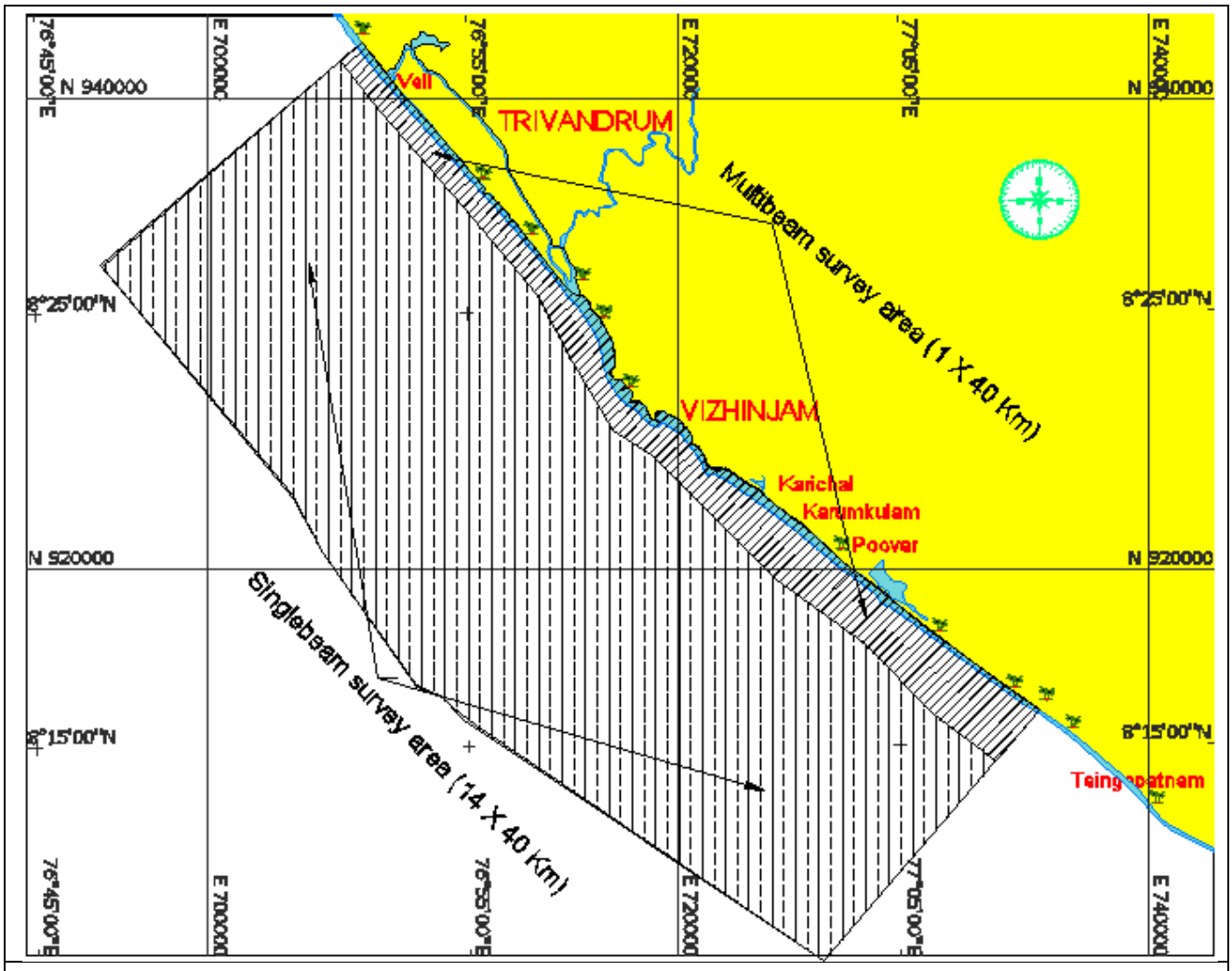


Figure 89 – Bathymetric Survey Area

The bathymetric charts are placed at Annexure VIII.

6.10 River Crossing Survey

The river crossing survey was carried out at 7 river crossings. The survey was carried out for 500m length of rivers debouching in the 40 km stretch of the sea. In the major rivers (Poovar, Chovara, Thiruvallam and Veli) survey was carried out using a singlebeam echo sounder. The other three streams were surveyed using the RTK system. The water depths shown in the chart for the major rivers are the actual water levels recorded using the echo sounder. The boundary of the rivers was fixed using RTK and those (dry) heights are denoted with respect to CD. The river/stream wise survey findings are given below:

6.10.1 Poovar River

Poovar River lies south of Vizhinjam which is locked during a major part of the year. During the monsoon, the wave action breaks the partition, and the river joins with the sea. The survey was carried out in the month of July 2015. The river is a tourist spot with numerous resorts situated along the banks, with tourist boats plying in the area.

As can be seen in the chart, a maximum water level of 6.2m was recorded toward the northern portion. Towards south of the river, the depths vary from less than 1 to 2.5m.

6.10.2 Chovara River

Chovara River lies between Vizhinjam and Poovar river. This river is also is locked during a major part of the year. During monsoon, the wave action breaks the partition, and the river joins with the sea. The survey was carried out in the month of July 2015.

The depth was uniform along the centre of the river with a depth of 2 to 2.5m. The depth provided is the raw depth and no tide is applied to the recorded depth. The drying heights shown in the chart are fixed using RTK which is referenced to CD.

6.10.3 Mulloor Stream

The stream lies next to the new harbour road. The survey was carried out using RTK system. There were a few inches of water in the stream during the period and accordingly, the spot value is provided which is with respect to CD.

6.10.4 Karimpallickara Stream

This narrow stream lies between Mulloor and Vizhinjam. The spot values obtained using the RTK system is provided in this section. The heights are with respect to CD.

6.10.5 Gangayattumkara Stream

The stream lies next to the fishing harbour. A considerable amount of rain water is discharged through this stream during the rainy season. The spot values obtained from the RTK system are shown in the chart referenced to the chart datum.

6.10.6 Thiruvallam River

Thiruvallam River lies north of Vizhinjam. This is a confluence of two rivers. The survey was carried out using a shallow draft boat and the depth as recorded is provided without applying any tide. About 7m of water was observed in the mouth of the river. Towards north of the river, the depth decreases to 4m. The spot values fixed using RTK is also shown which is referenced to CD.

6.10.7 Veli River

Veli River lies north of the airport. It is a tourist spot with many tourist boats plying. The raw depths recorded are shown in the chart along with the spot values fixed using RTK, with respect to CD.

The charts of all the river/stream sections are placed at Annexure IX.

6.11 Water & Soil Sampling

The collected water and soil samples were tested at approved laboratory in Kochi. The water results are placed at Annexure X. The soil sampling report shall be submitted once the results obtained from the lab are compared with those of the results from NIOT.

6.12 Progress Report till October 31, 2015

The following image shows the progress report of the project carried out till the month of Oct 31 2015.

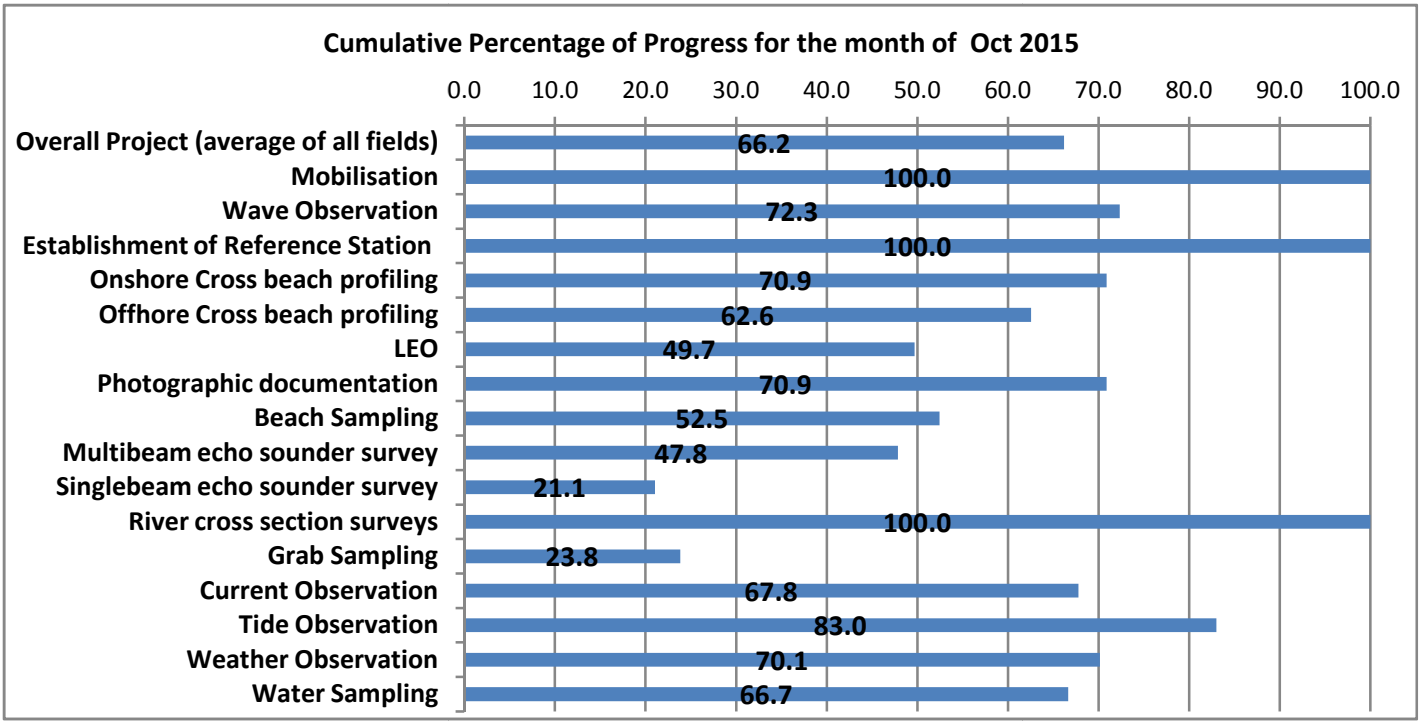


Table 34: Progress Chart till October 31, 2015

7. WEATHER

During the monsoon months, the waves were of the order of more than 2m. Due to the wave force, the beach profiling could not be carried out due to lack of beach. Even though the rains were less in the months of July and August, September and October months experienced above normal rains.

A satellite image obtained from IMD for the month of October 2015 is provided below, which shows a local disturbance experienced on 18th October 2015.

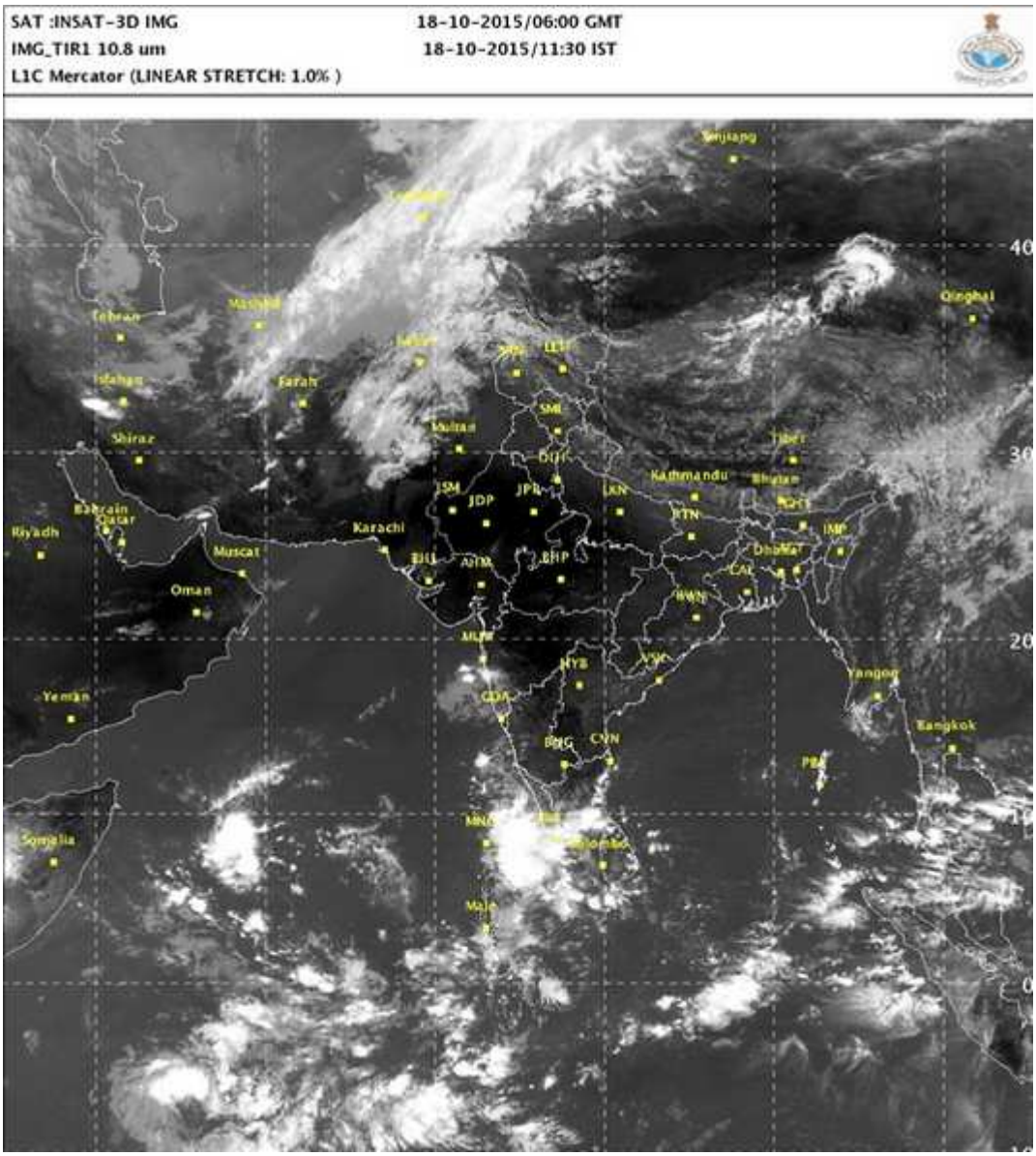


Figure 90 – Local Disturbance experienced at Vizhinjam on 18th October 2015

8. CONCLUSIONS

The following observations were identified during the first phase of the project.

1. The observed currents were of the order of 50 cm/s in the deeper area and were seen to generally follow the local topography, except during high winds.
2. Tide was mixed semi diurnal with a maximum range of 0.7m during spring tide.
3. The wave heights were greater during the monsoon months.
4. The wind speed decreased towards September 2015 once the monsoon receded.
5. The maximum water depth observed was 58m, which is 14.8km from the mouth of harbour.
6. The analysis of water samples reveals a constant salinity of about 35‰. The total suspended solids were comparatively more at the bottom than at the surface.

9. REFERENCES

Reference was made to the following in the preparation of this report.

1. Ocean Science Inception Report, OSaS/P18115/VISL/Mob Rev 0 dated 26th February 2015
2. www.vizhinjamport.in
3. Images of the survey area from Google Earth®
4. India Meteorological Department
5. WMO manual, Chapter 5 for reducing wind speed to 10m above ground (provided by NIOT)
6. IS 3025; Part 10 & 17
7. APHA Standard Methods for the Examination of Water and Wastewater, 20th Edition. (Method 2540 C and 2540 D)

10. ACKNOWLEDGEMENTS

Ocean Science gratefully acknowledges the support and co-operation received from the personnel of VISL, throughout the course of the survey.

The scientists/technicians from NIOT are also acknowledged for their support and guidance during the course of the project.

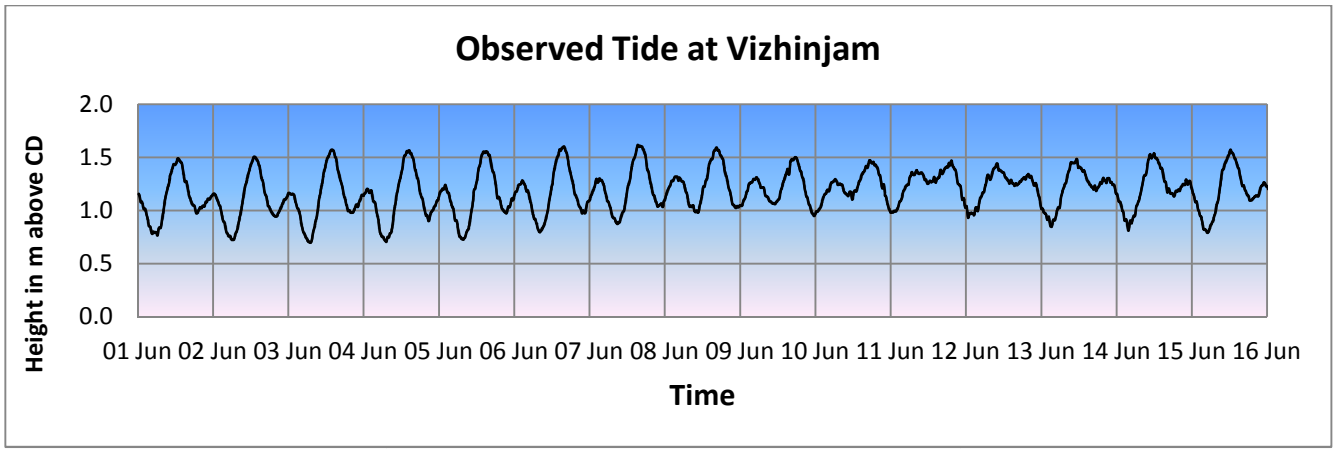
The crew of the boat and all local support obtained during the observation are also acknowledged.

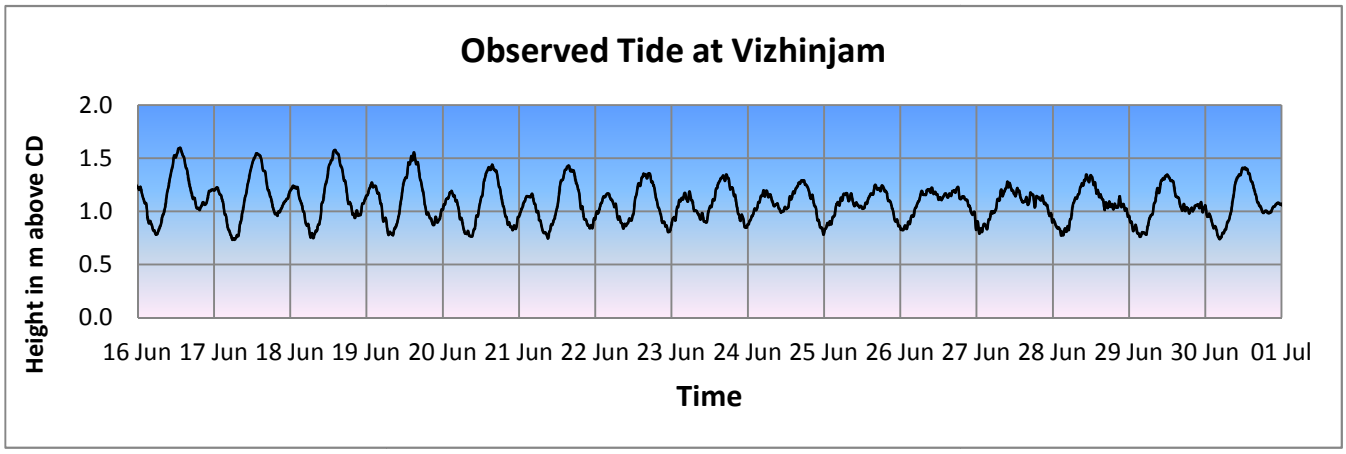
Weather forecast during the period was regularly observed at INCOIS and India Meteorological Department's web site.

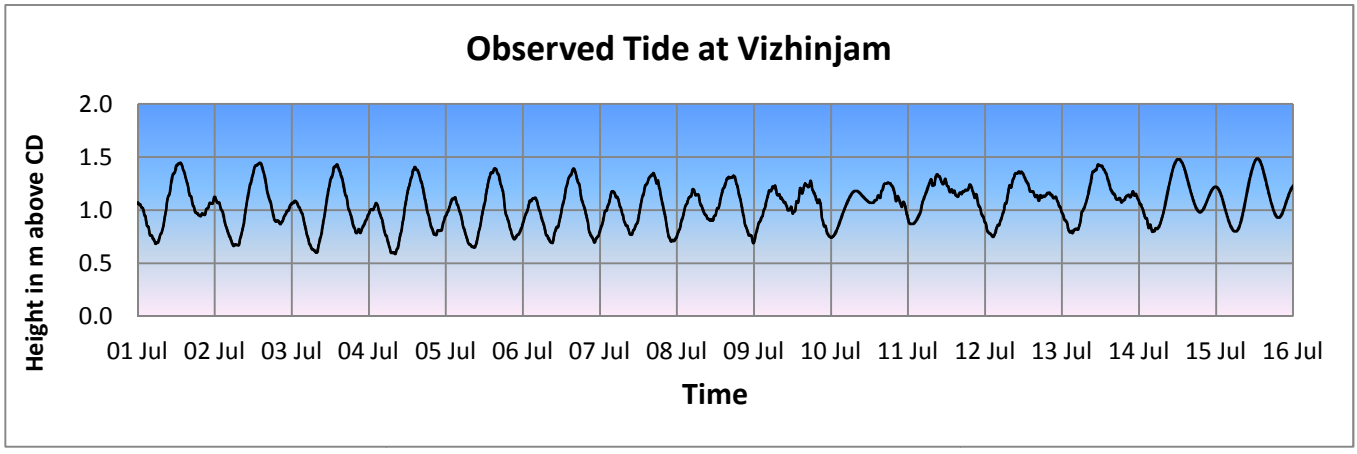
Annexure I

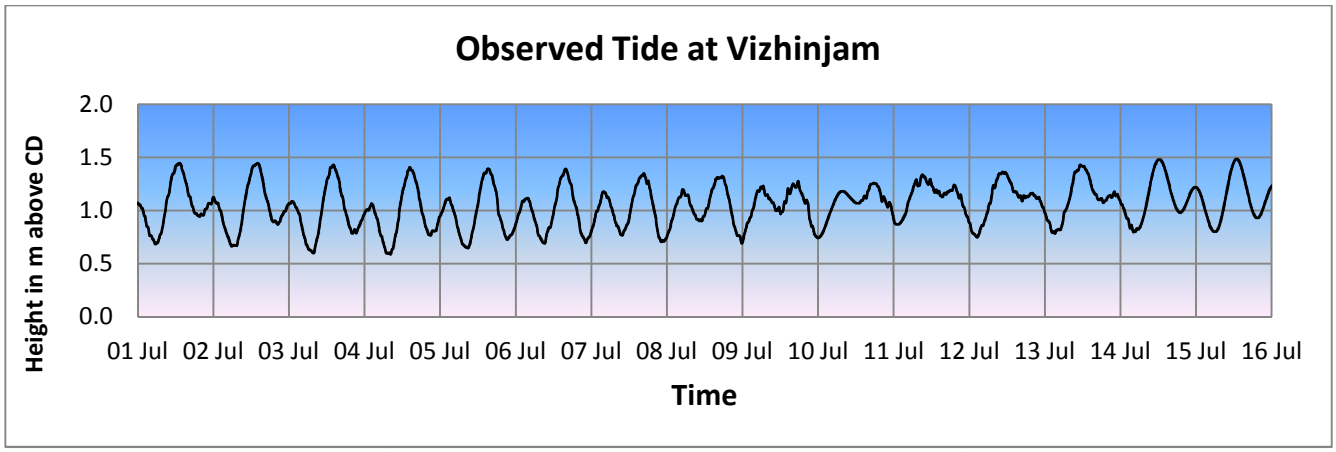
Tide Data

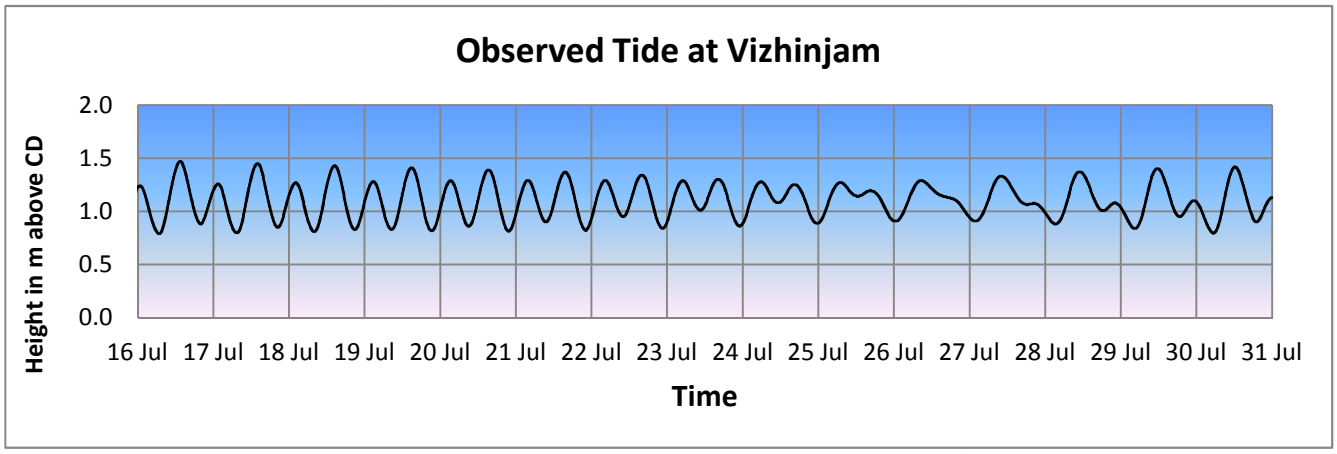
June – Oct 2015

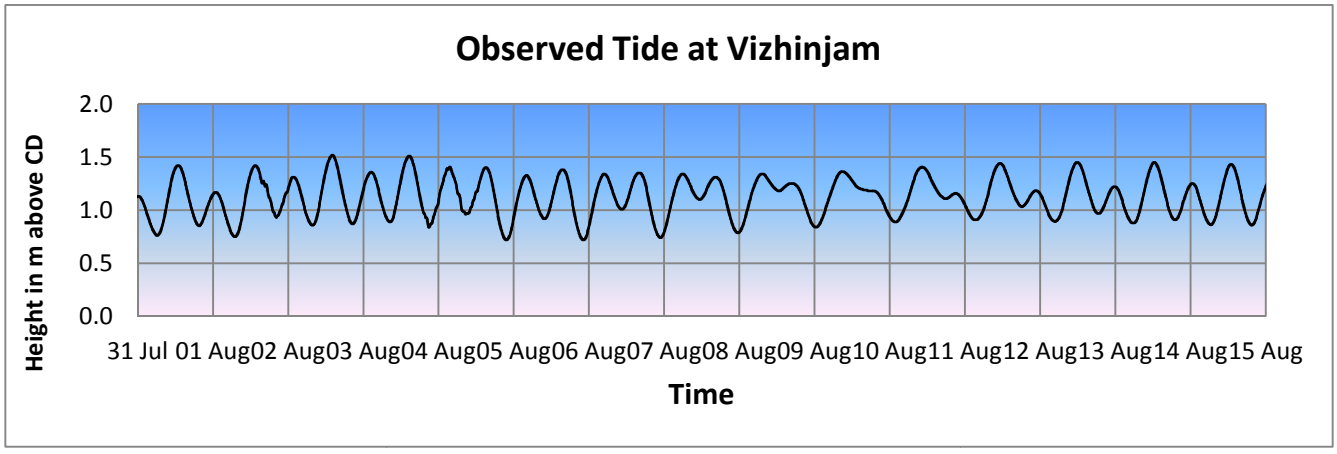

Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
01 Jun 02 Jun 03 Jun 04 Jun 05 Jun 06 Jun 07 Jun 08 Jun 09 Jun 10 Jun 11 Jun 12 Jun 13 Jun 14 Jun 15 Jun 16 Jun
Time

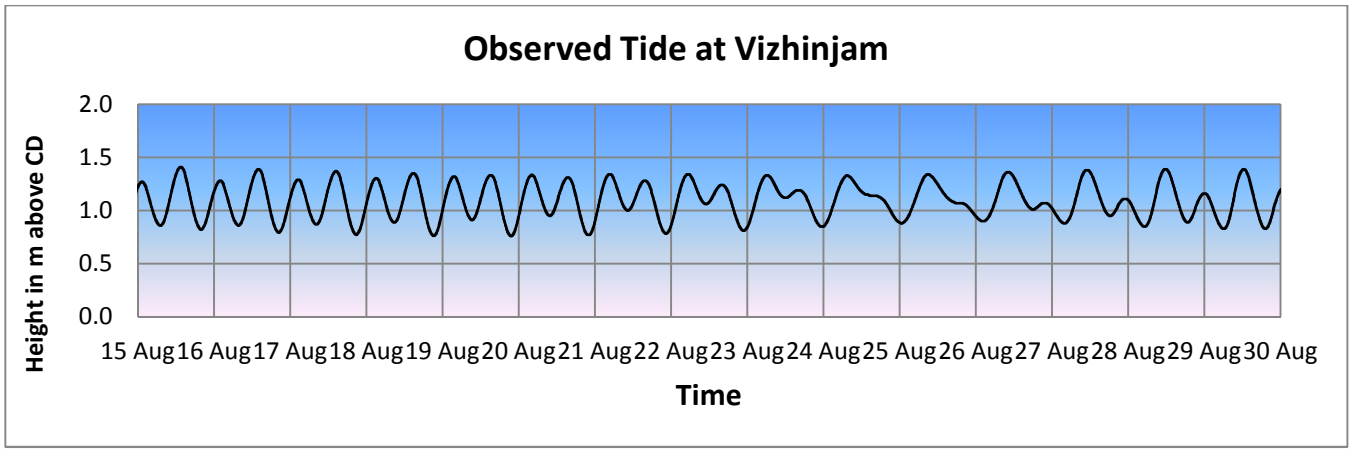

Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
16 Jun 17 Jun 18 Jun 19 Jun 20 Jun 21 Jun 22 Jun 23 Jun 24 Jun 25 Jun 26 Jun 27 Jun 28 Jun 29 Jun 30 Jun 01 Jul
Time

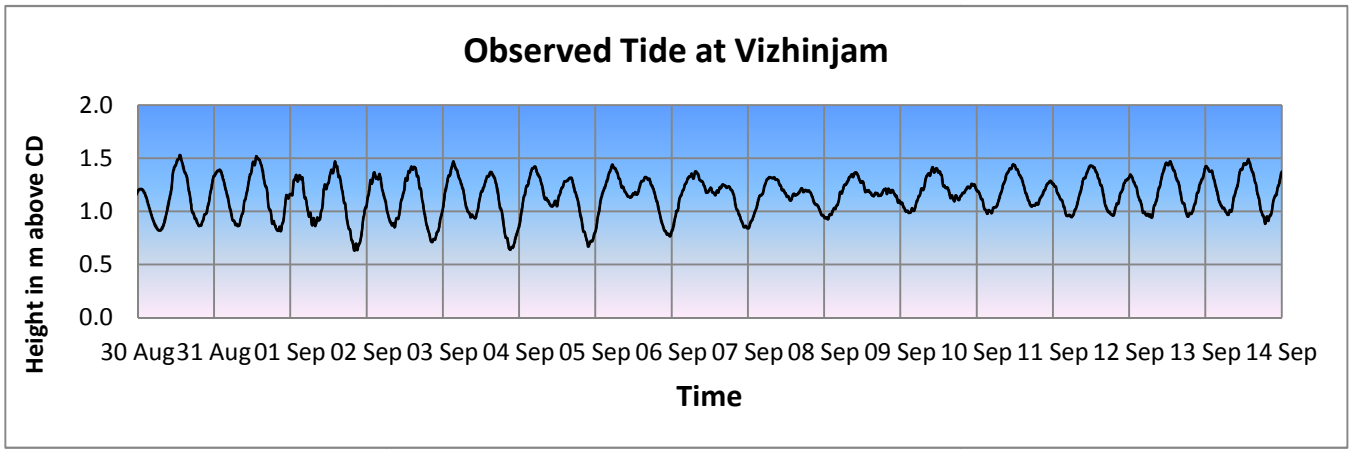

Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
01 Jul 02 Jul 03 Jul 04 Jul 05 Jul 06 Jul 07 Jul 08 Jul 09 Jul 10 Jul 11 Jul 12 Jul 13 Jul 14 Jul 15 Jul 16 Jul
Time

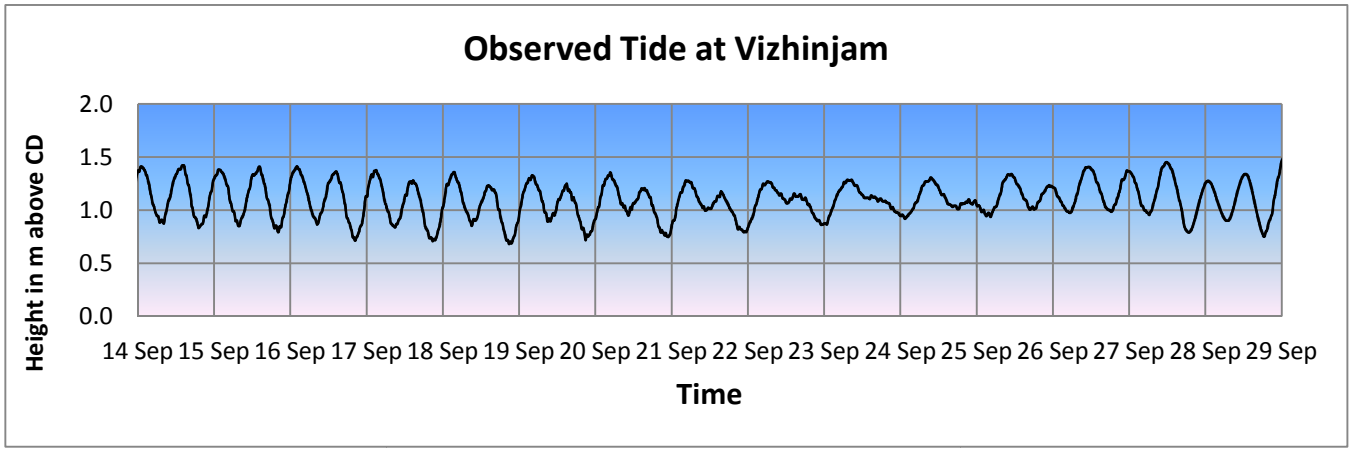

Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
01 Jul 02 Jul 03 Jul 04 Jul 05 Jul 06 Jul 07 Jul 08 Jul 09 Jul 10 Jul 11 Jul 12 Jul 13 Jul 14 Jul 15 Jul 16 Jul
Time

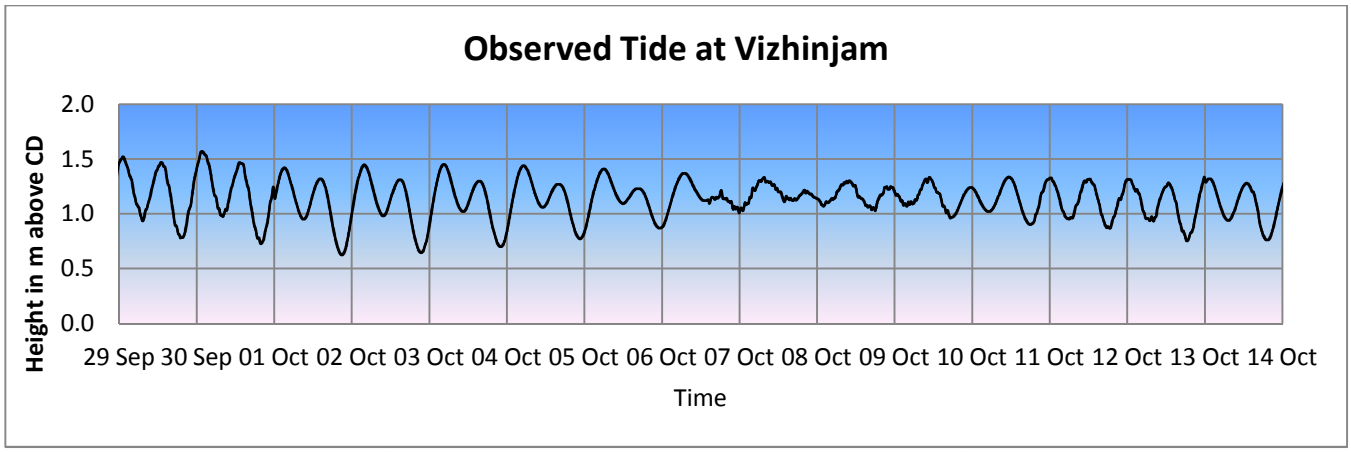

Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
16 Jul 17 Jul 18 Jul 19 Jul 20 Jul 21 Jul 22 Jul 23 Jul 24 Jul 25 Jul 26 Jul 27 Jul 28 Jul 29 Jul 30 Jul 31 Jul
Time

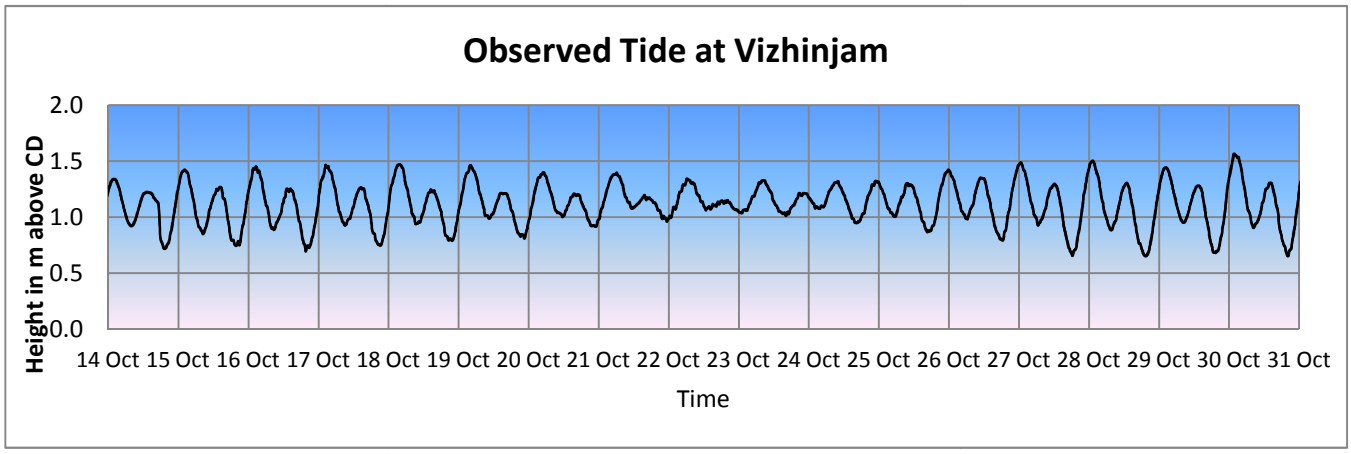

Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
31 Jul 01 Aug 02 Aug 03 Aug 04 Aug 05 Aug 06 Aug 07 Aug 08 Aug 09 Aug 10 Aug 11 Aug 12 Aug 13 Aug 14 Aug 15 Aug
Time


Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
15 Aug 16 Aug 17 Aug 18 Aug 19 Aug 20 Aug 21 Aug 22 Aug 23 Aug 24 Aug 25 Aug 26 Aug 27 Aug 28 Aug 29 Aug 30 Aug
Time


Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
30 Aug 31 Aug 01 Sep 02 Sep 03 Sep 04 Sep 05 Sep 06 Sep 07 Sep 08 Sep 09 Sep 10 Sep 11 Sep 12 Sep 13 Sep 14 Sep
Time


Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
14 Sep 15 Sep 16 Sep 17 Sep 18 Sep 19 Sep 20 Sep 21 Sep 22 Sep 23 Sep 24 Sep 25 Sep 26 Sep 27 Sep 28 Sep 29 Sep
Time

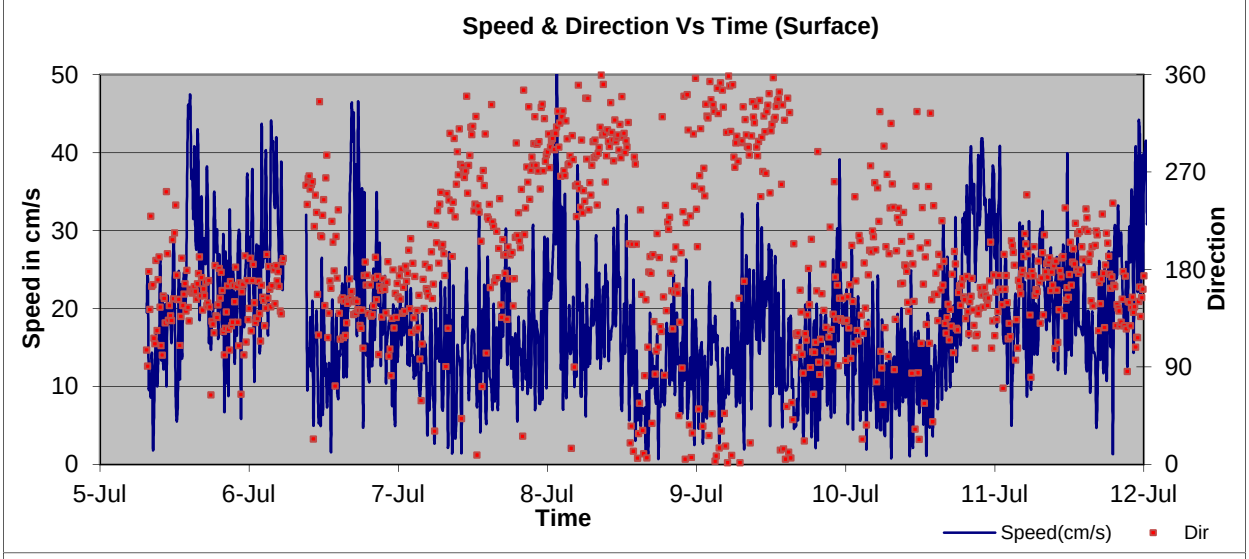

Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
29 Sep 30 Sep 01 Oct 02 Oct 03 Oct 04 Oct 05 Oct 06 Oct 07 Oct 08 Oct 09 Oct 10 Oct 11 Oct 12 Oct 13 Oct 14 Oct
Time

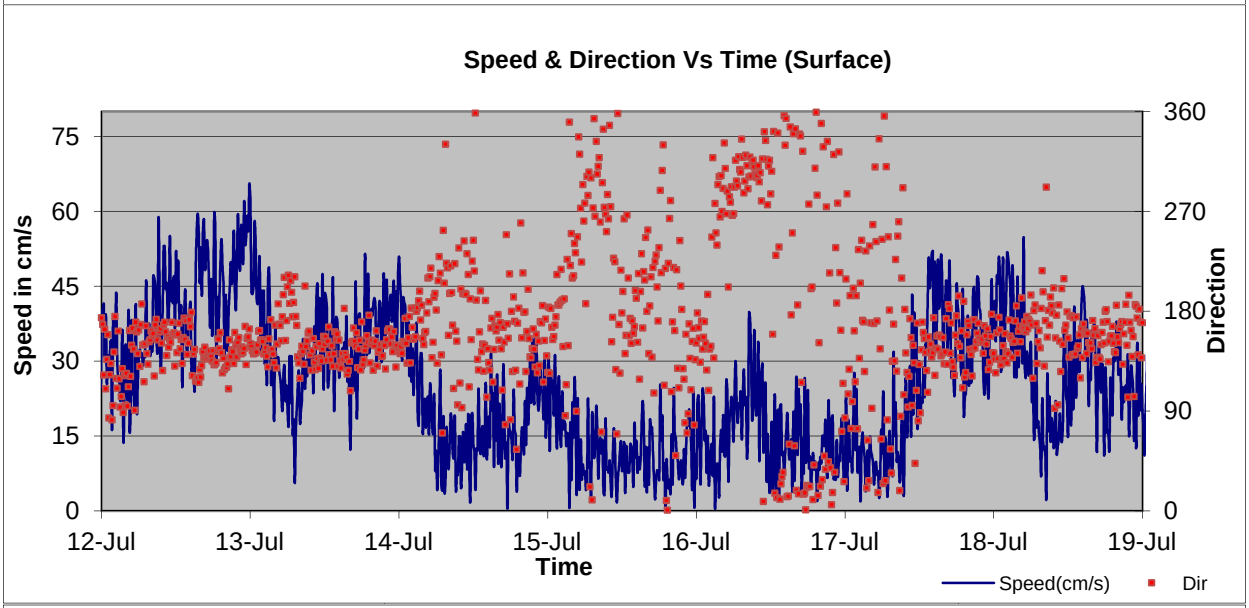

Observed Tide at Vizhinjam
Height in m above CD
2.0
1.5
1.0
0.5
0.0
14 Oct 15 Oct 16 Oct 17 Oct 18 Oct 19 Oct 20 Oct 21 Oct 22 Oct 23 Oct 24 Oct 25 Oct 26 Oct 27 Oct 28 Oct 29 Oct 30 Oct 31 Oct
Time

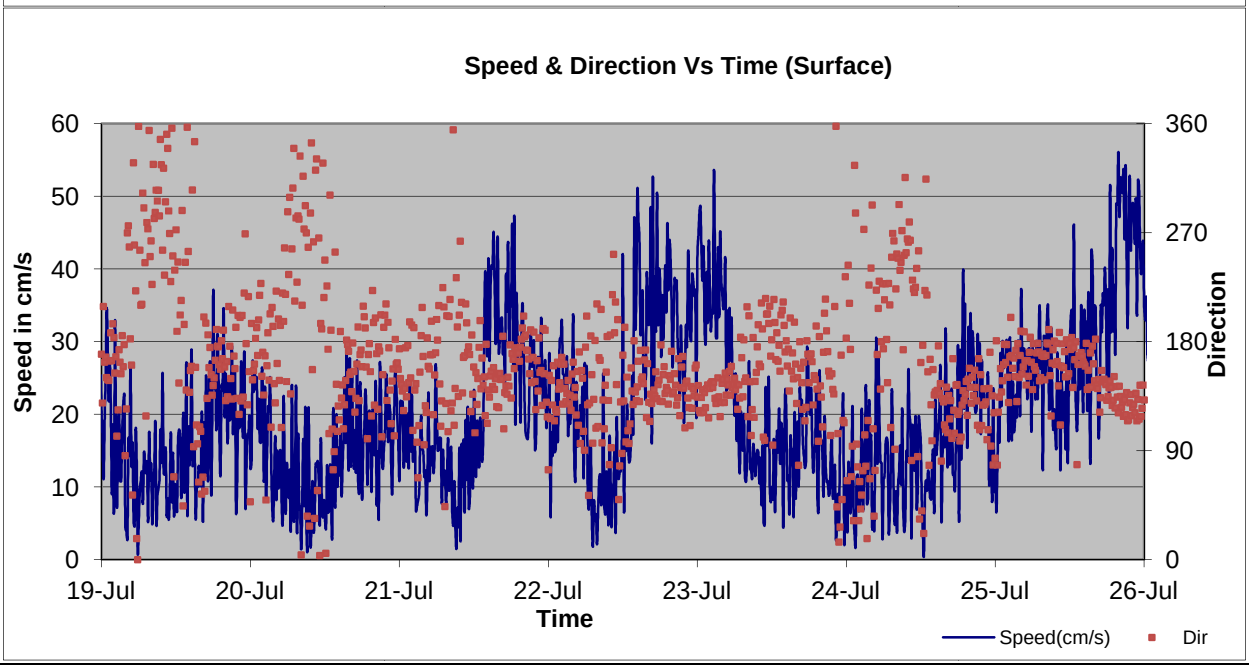
Annexure II

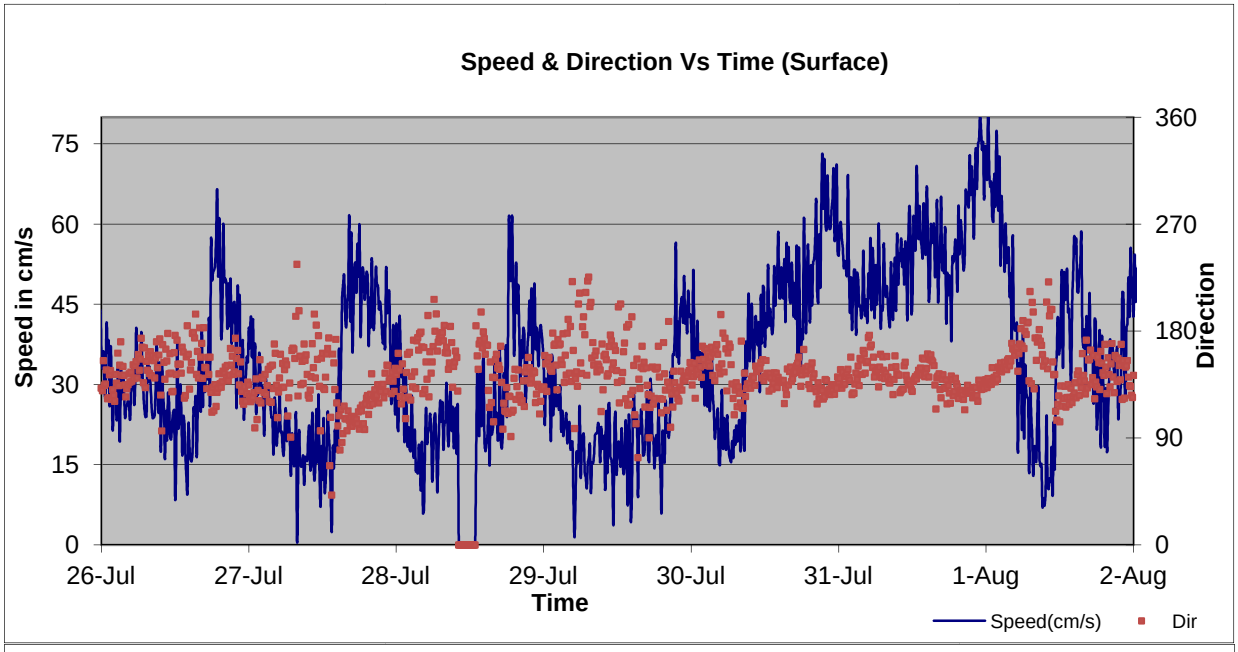
Current Data

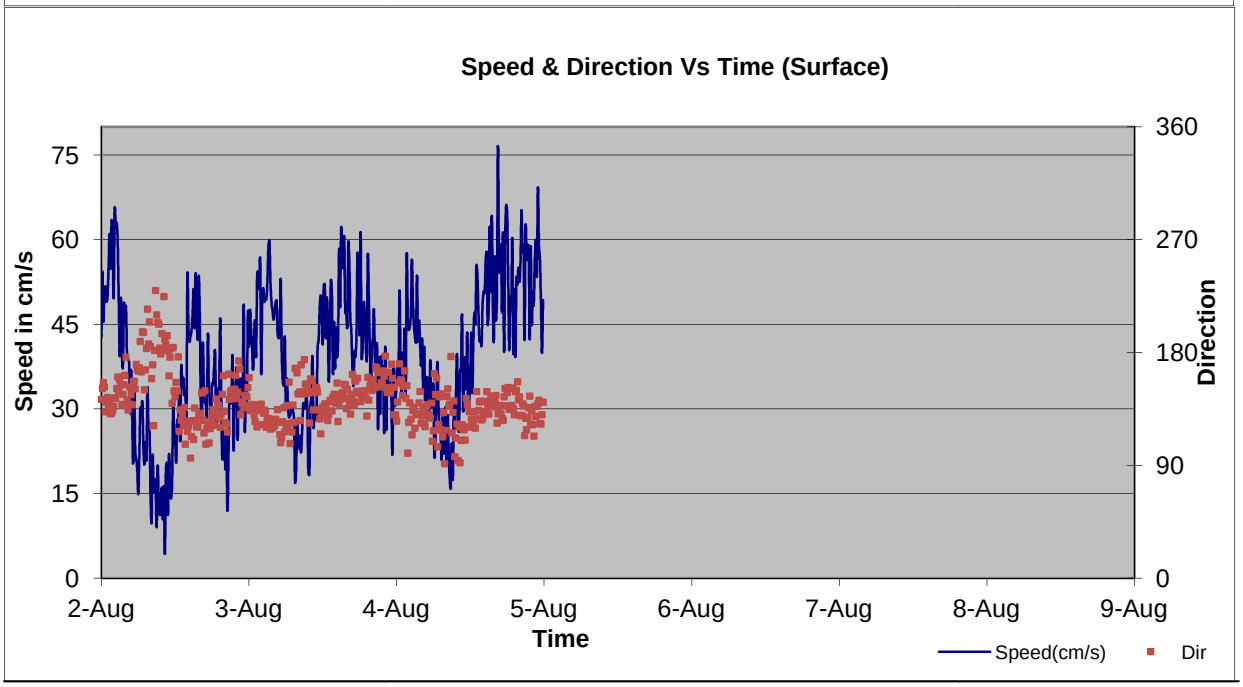
Location P1

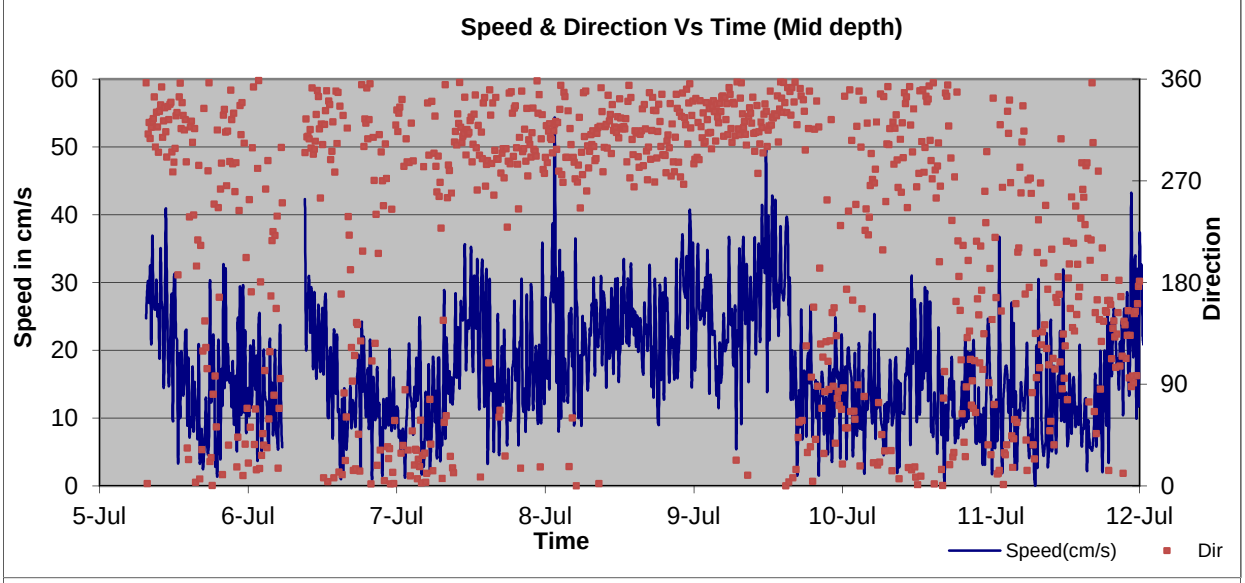

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir

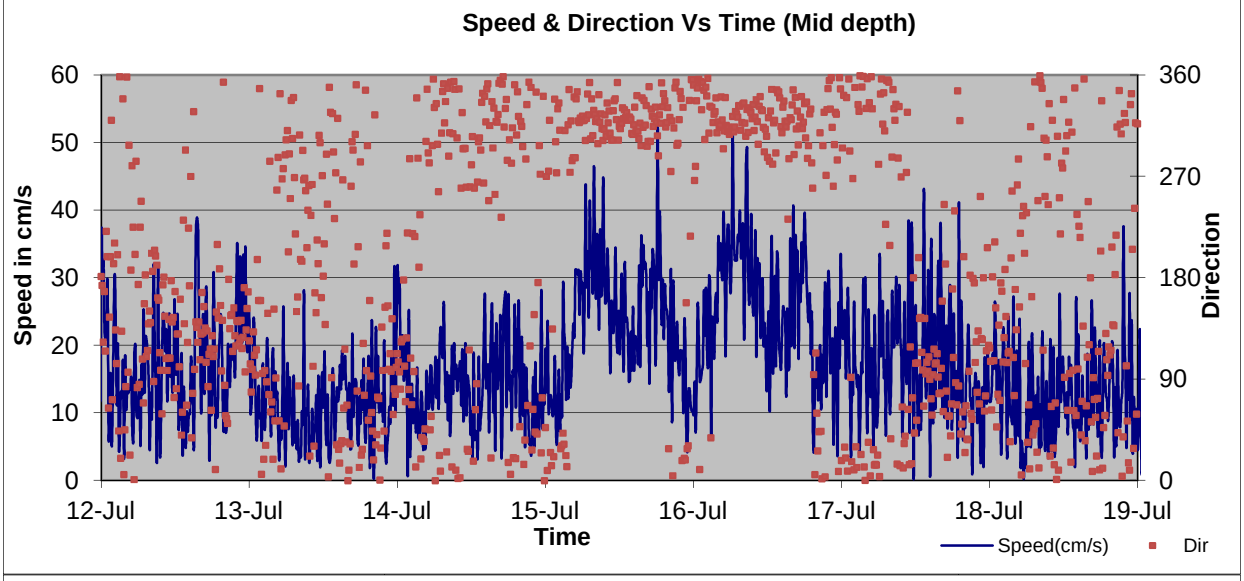

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir

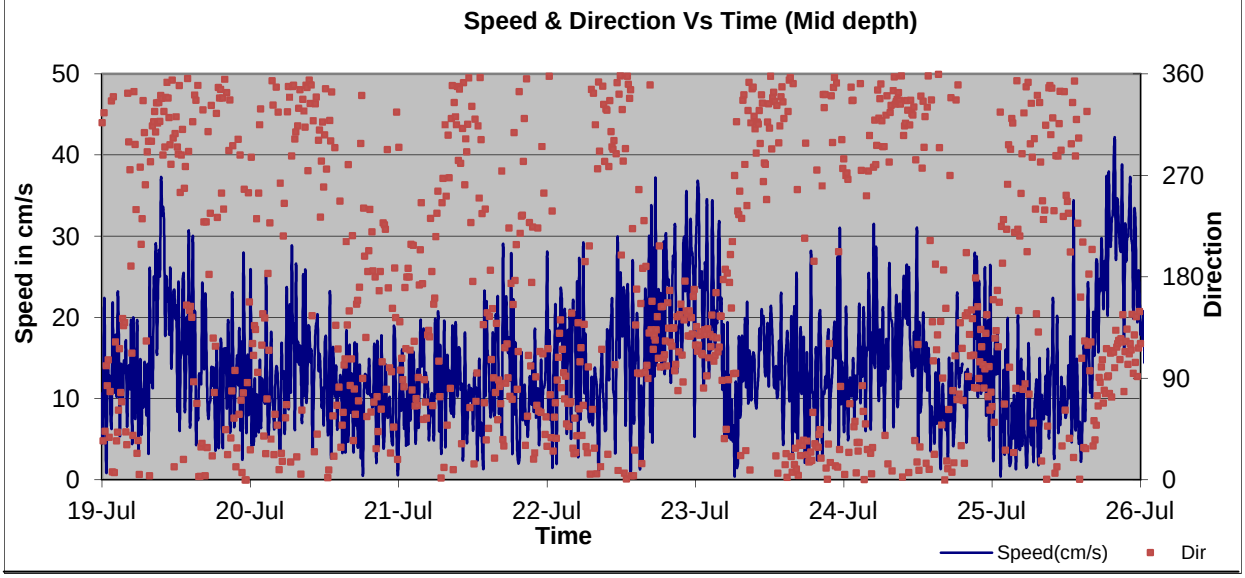

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

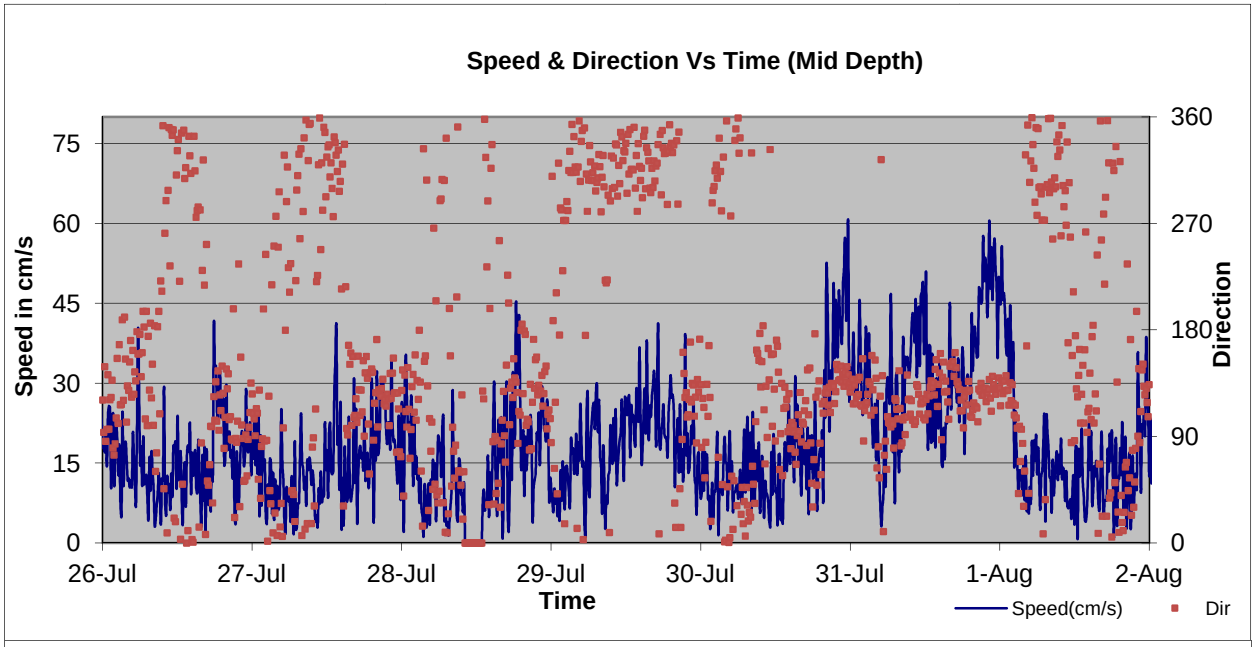

Speed & Direction Vs Time (Surface)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Time
Speed(cm/s)
Dir

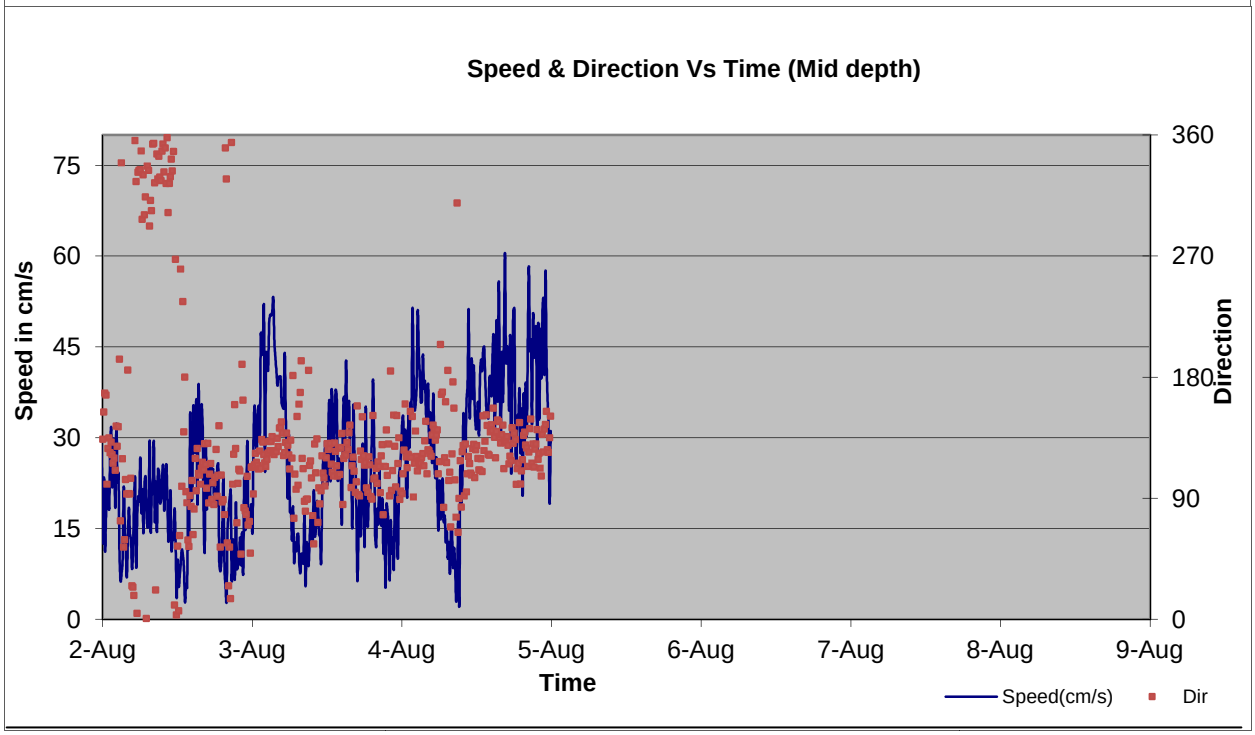

Speed & Direction Vs Time (Surface)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Time
Speed(cm/s)
Dir

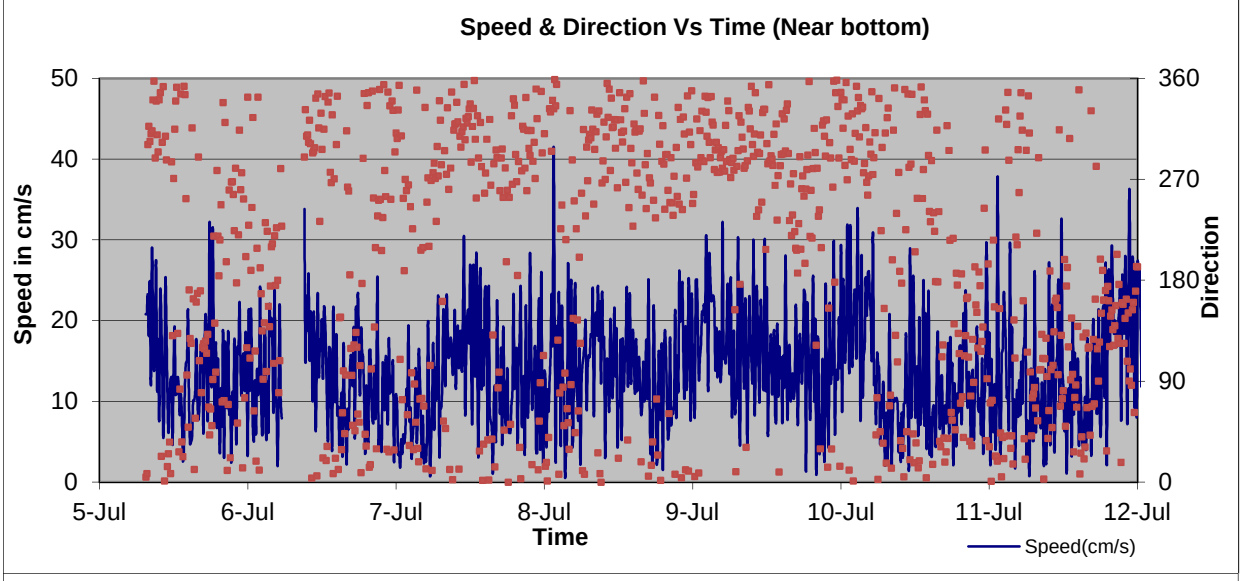

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir

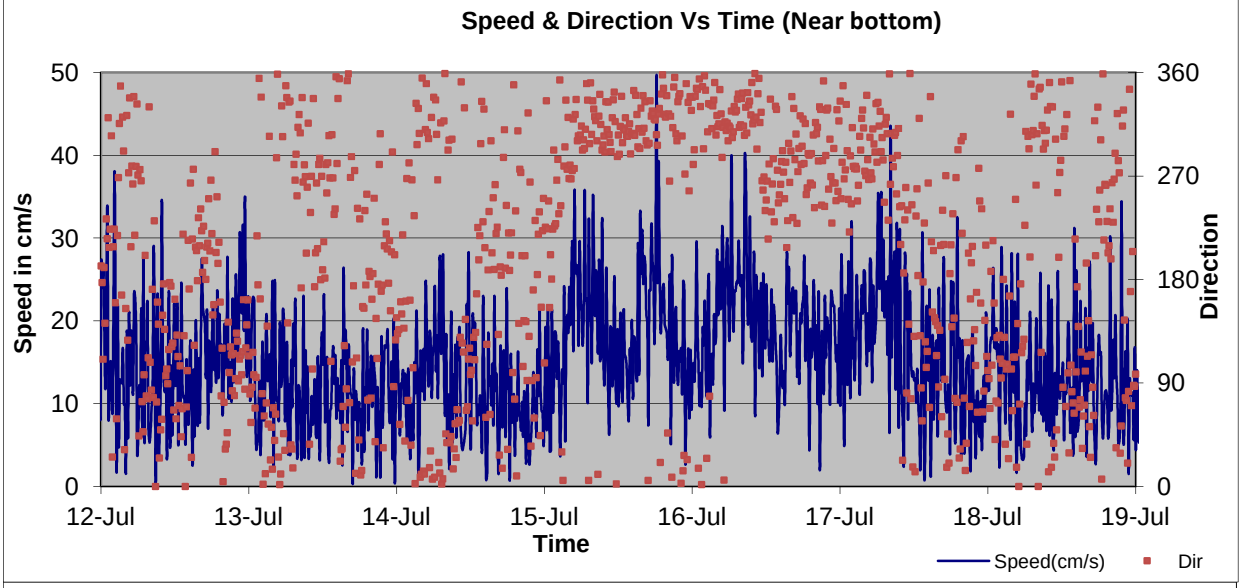

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir

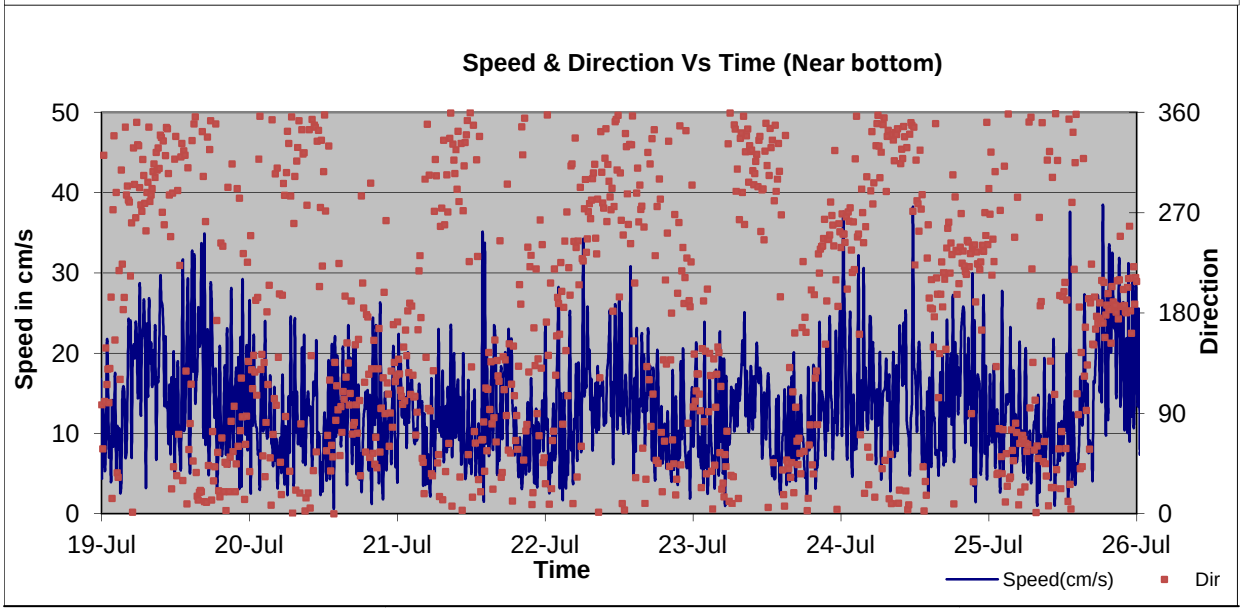

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

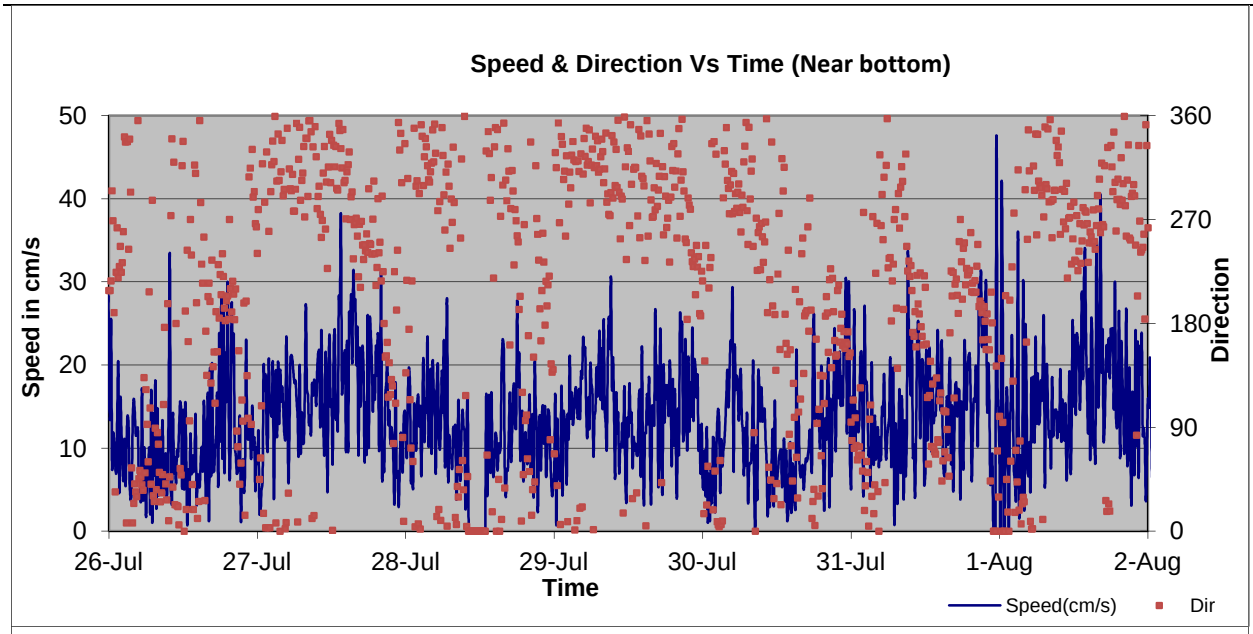

Speed & Direction Vs Time (Mid Depth)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Time
Speed(cm/s)
Dir

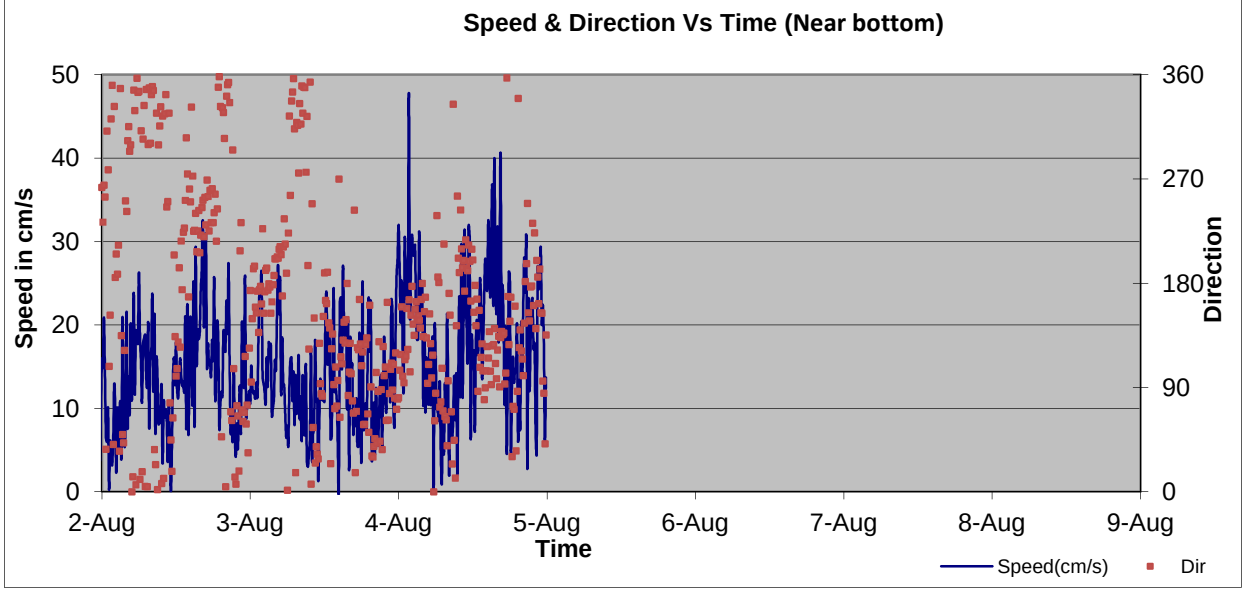

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Time
Speed(cm/s)
Dir


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

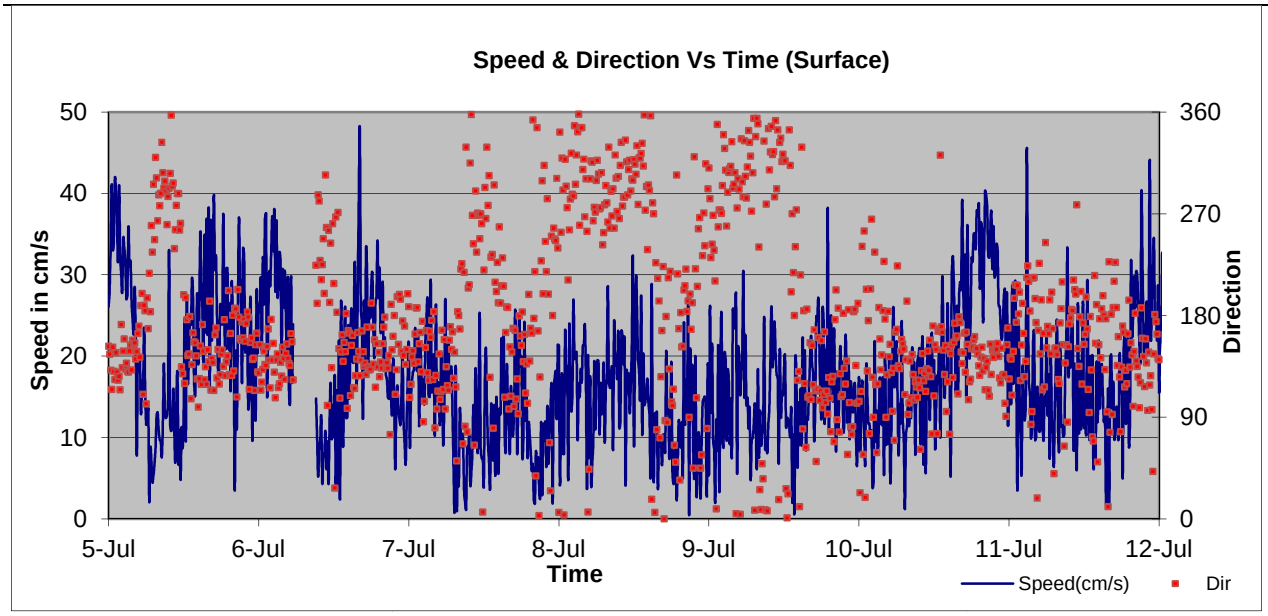

Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Speed(cm/s)
Dir

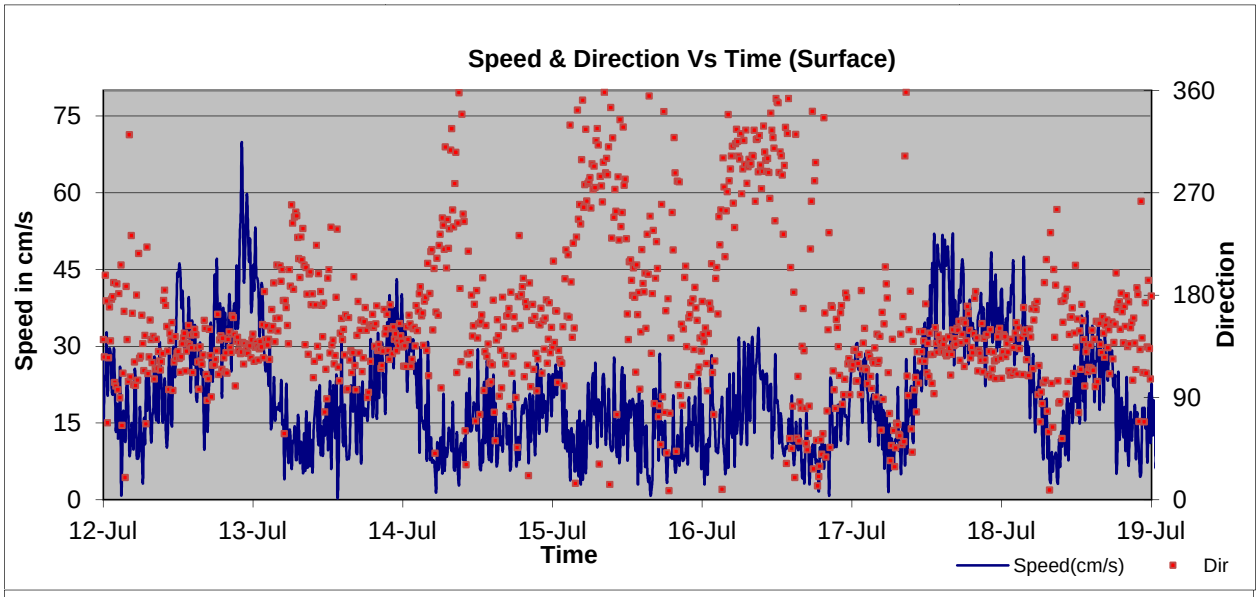

Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Speed(cm/s)
Dir

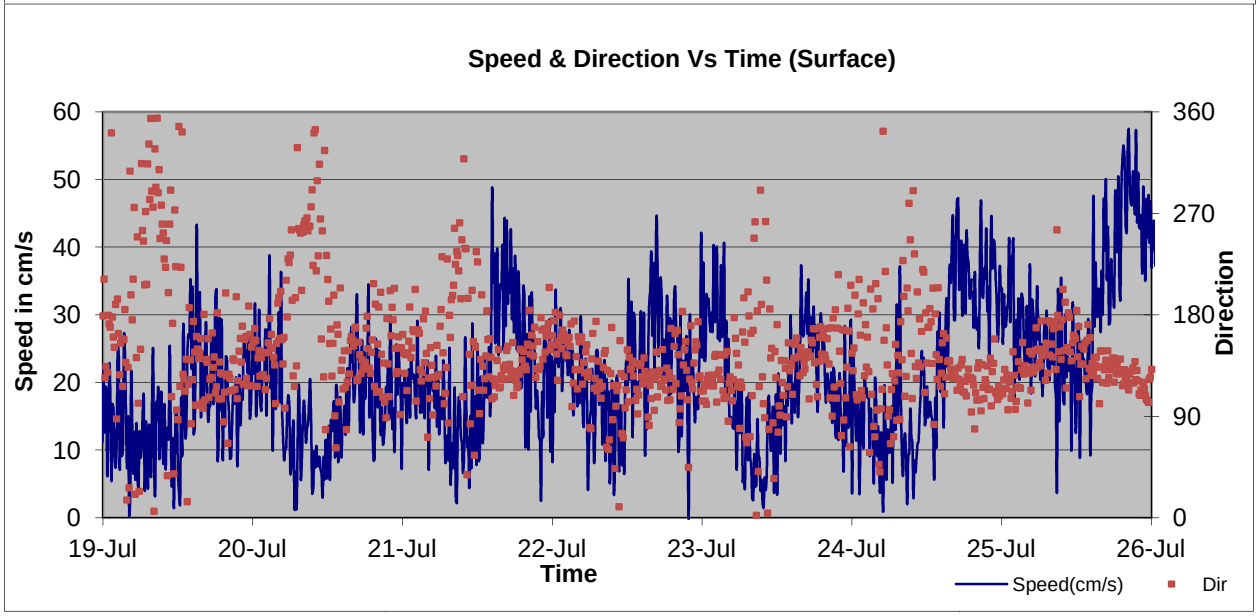
Annexure II

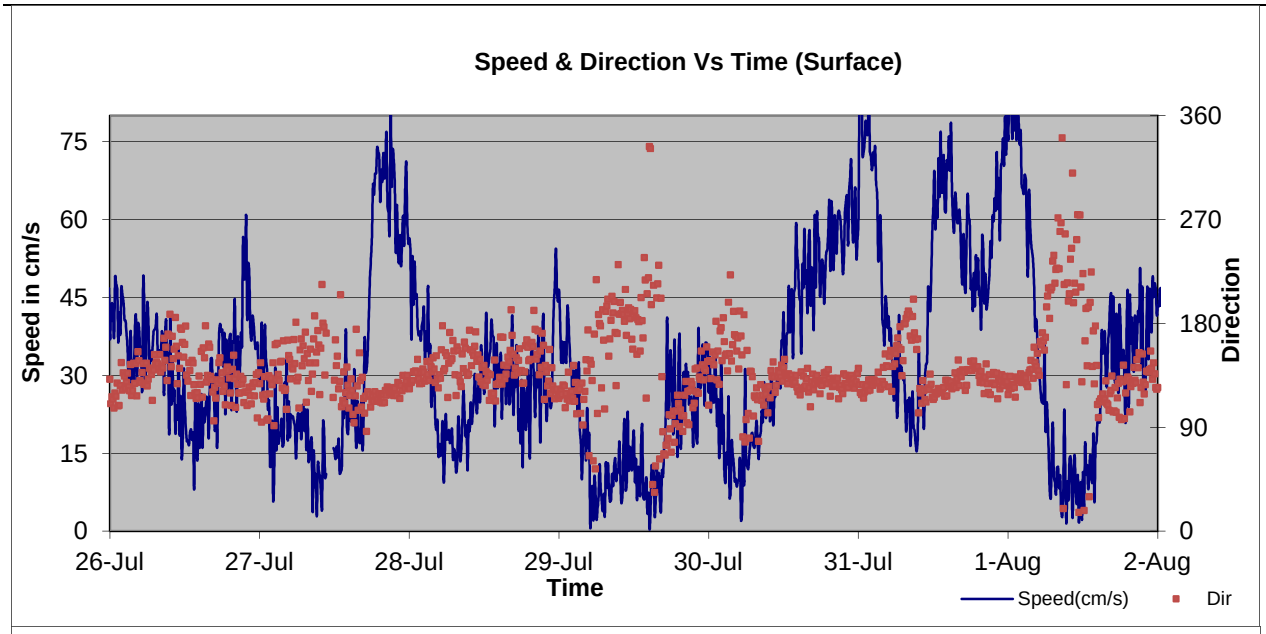
Current Data

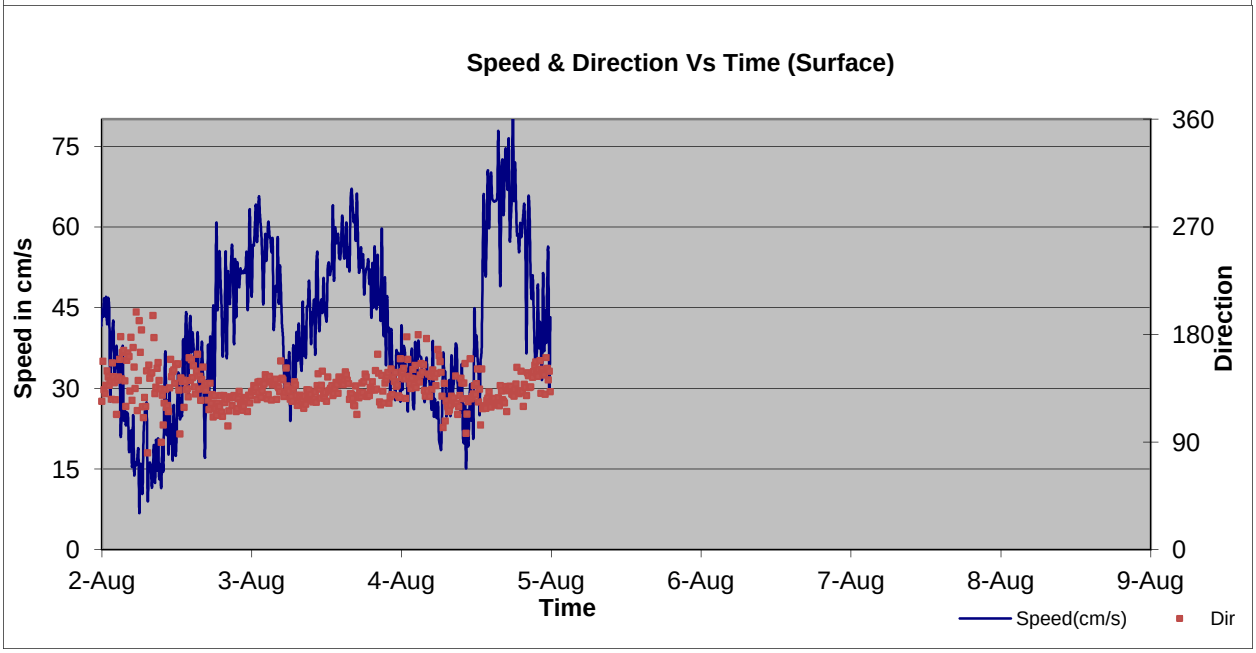
Location P2

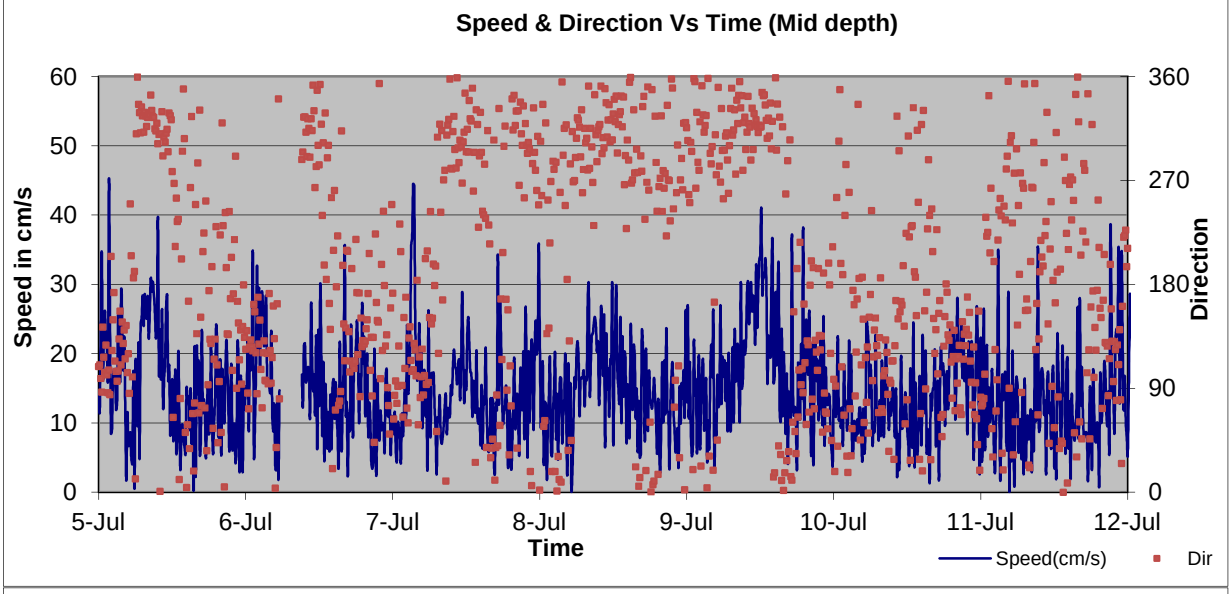

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir

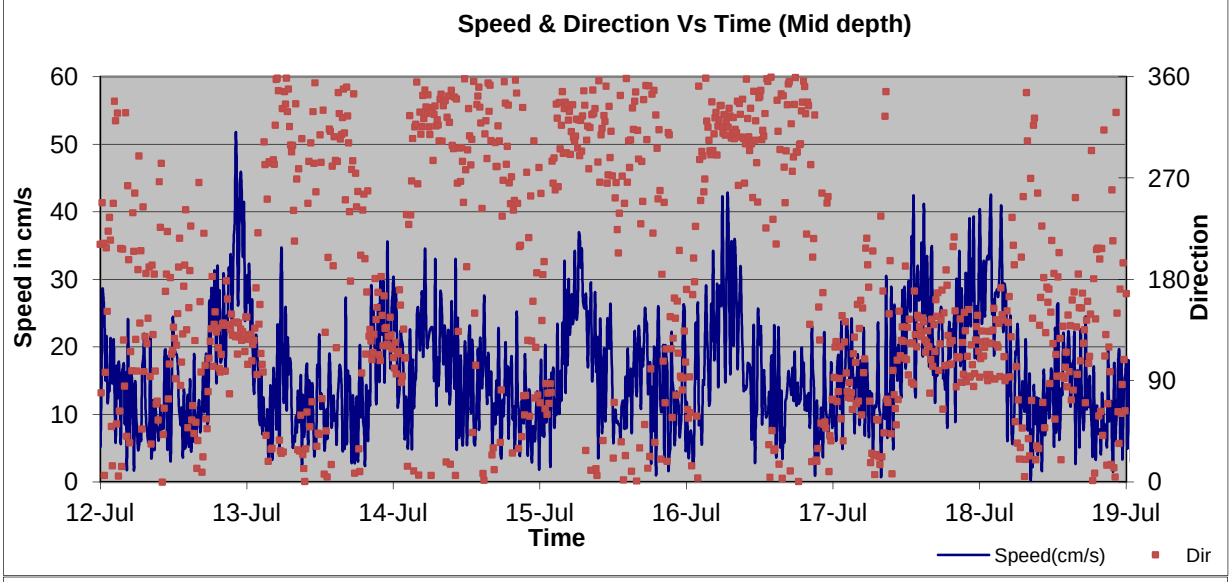

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir

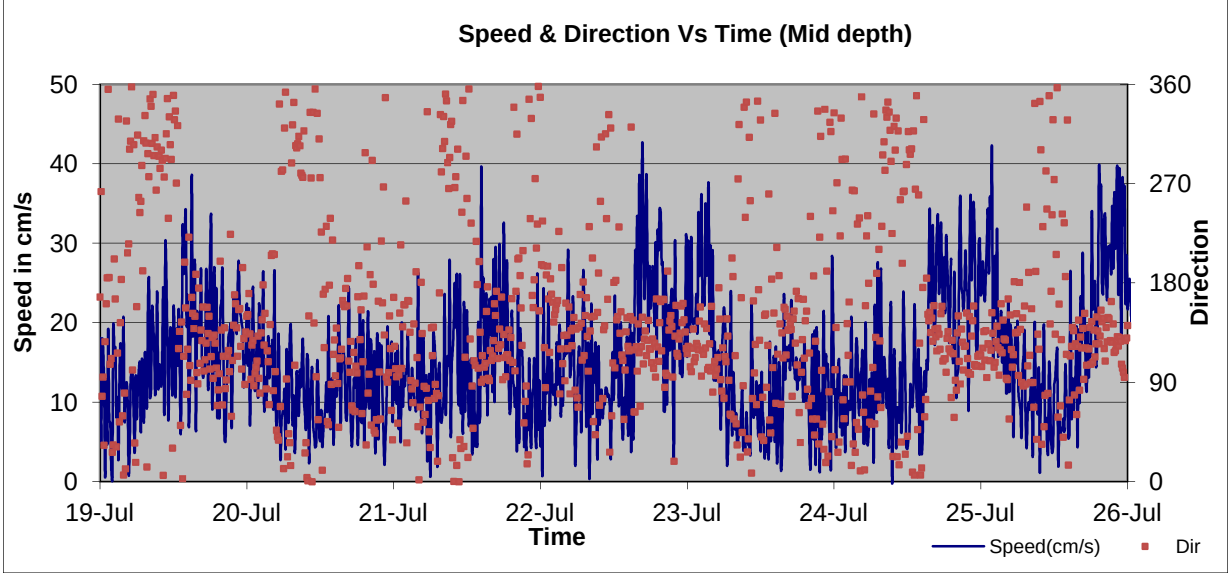

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

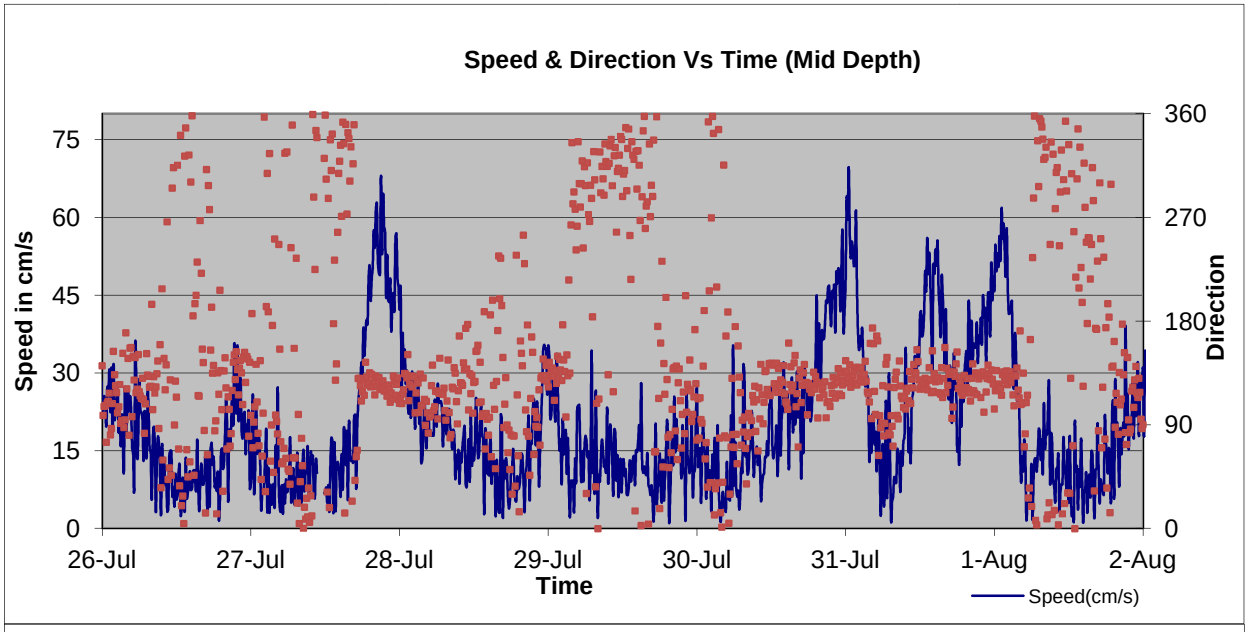

Speed & Direction Vs Time (Surface)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Time
Speed(cm/s)
Dir

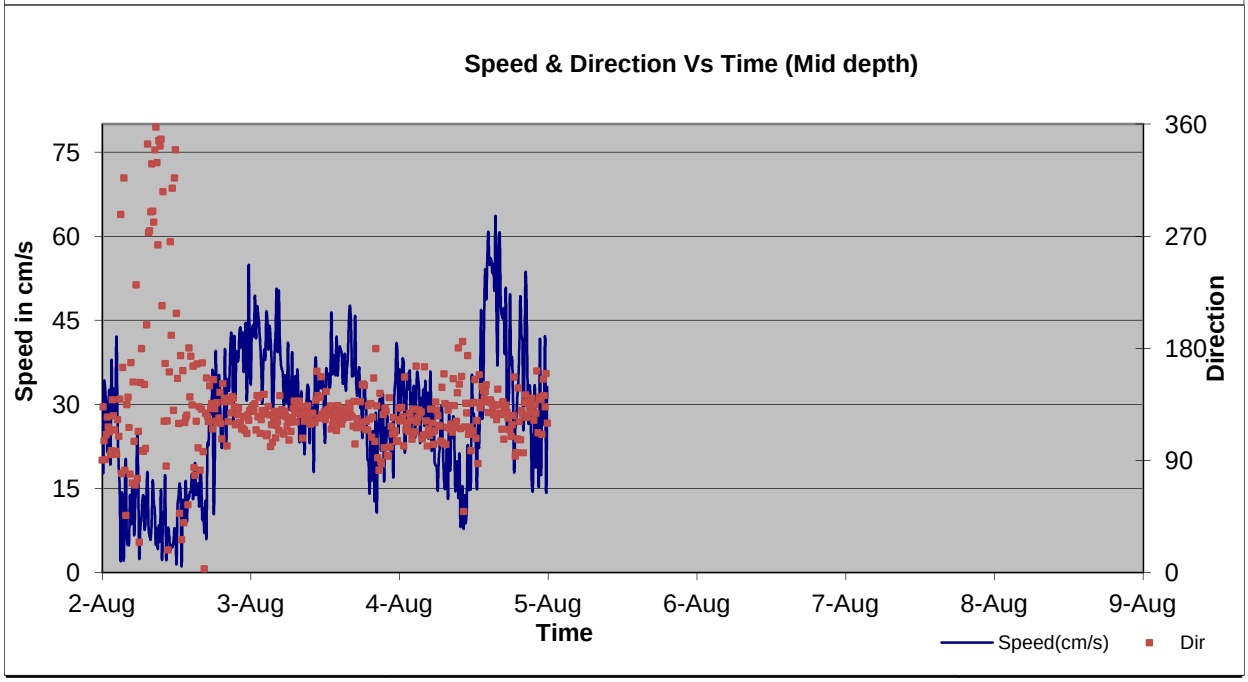

Speed & Direction Vs Time (Surface)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Time
Speed(cm/s)
Dir

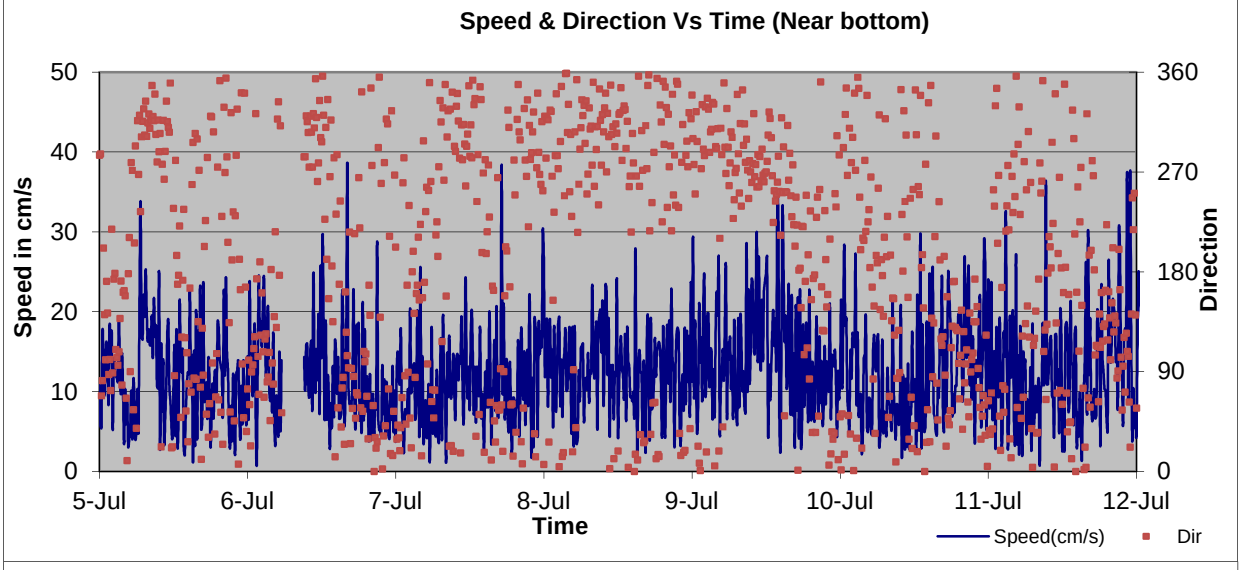

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir

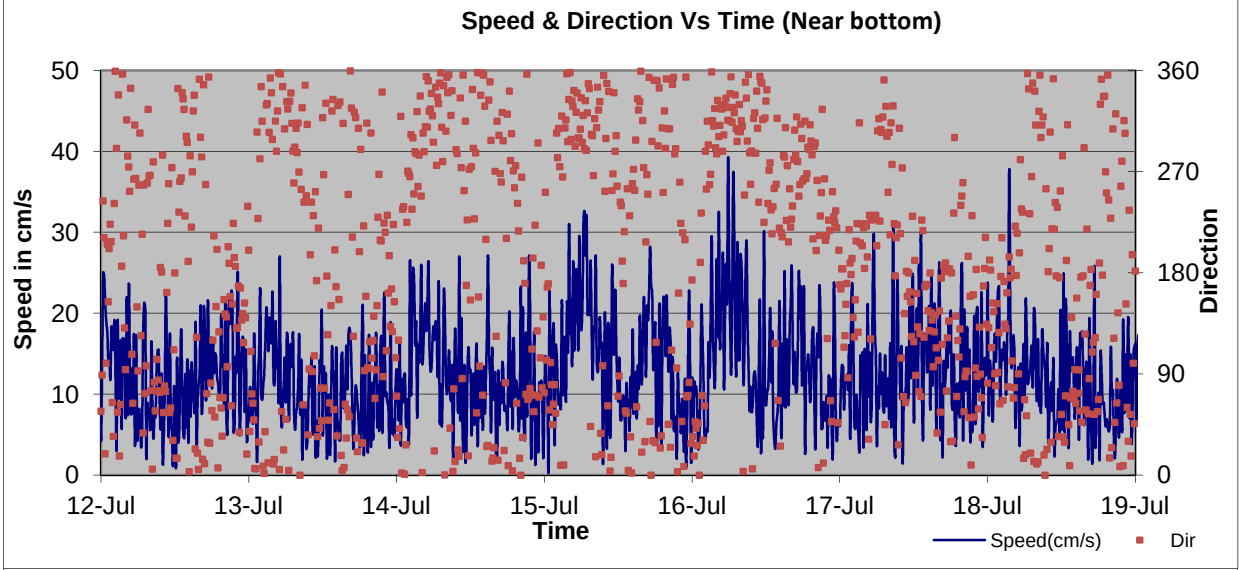

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir

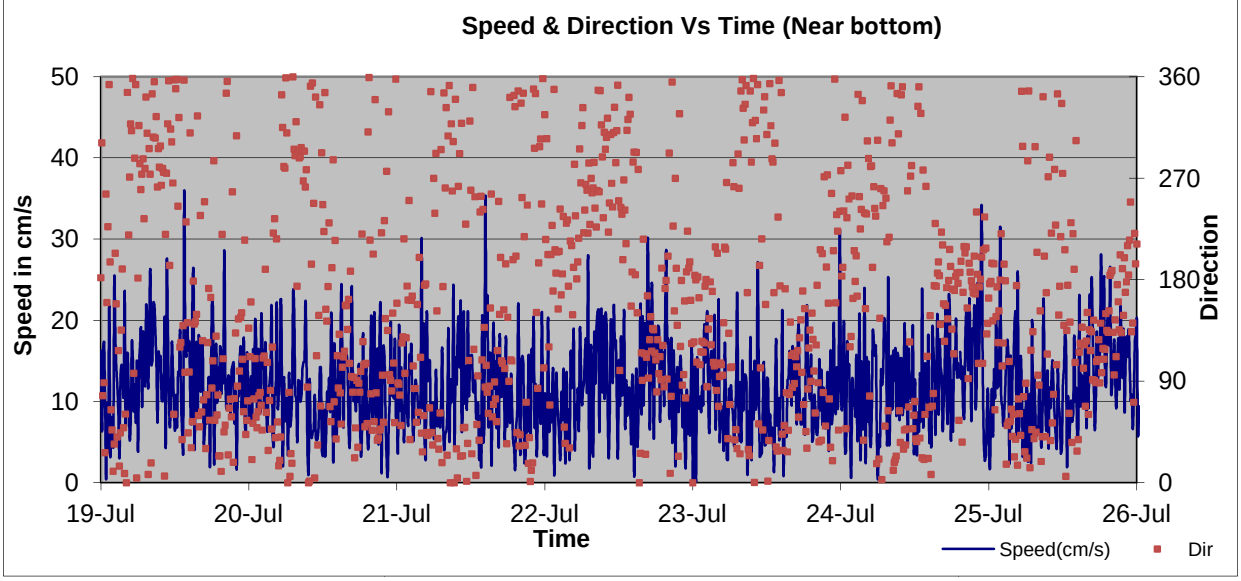

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

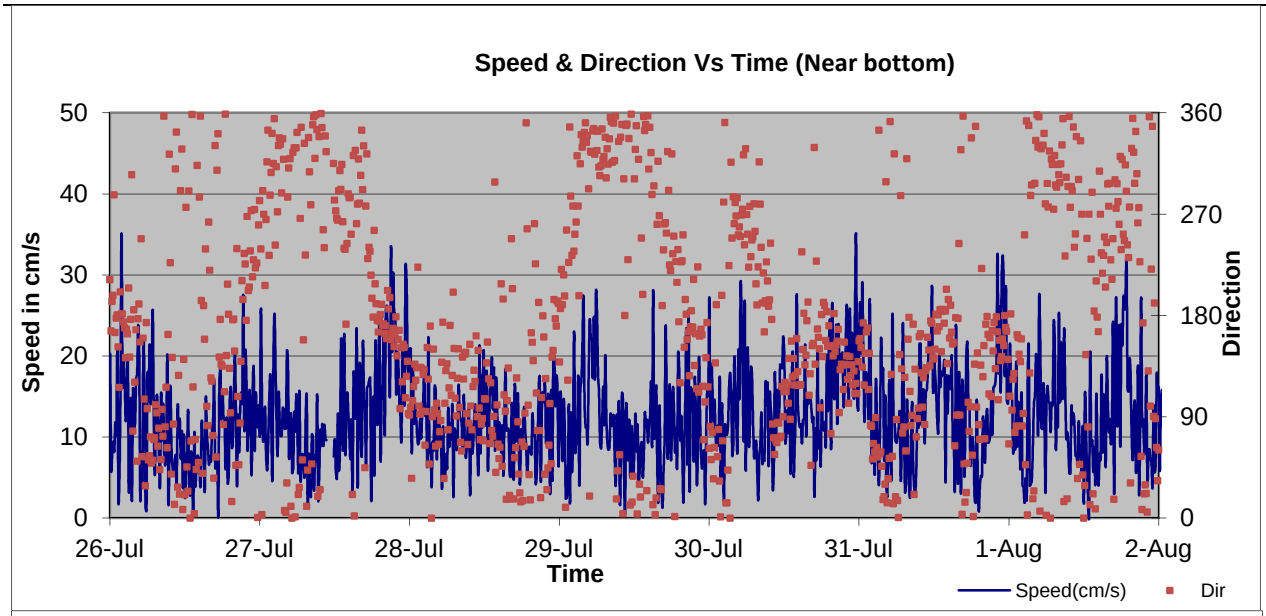

Speed & Direction Vs Time (Mid Depth)
Speed in cm/s
Direction
Time
0
15
30
45
60
75
0
90
180
270
360
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Speed(cm/s)

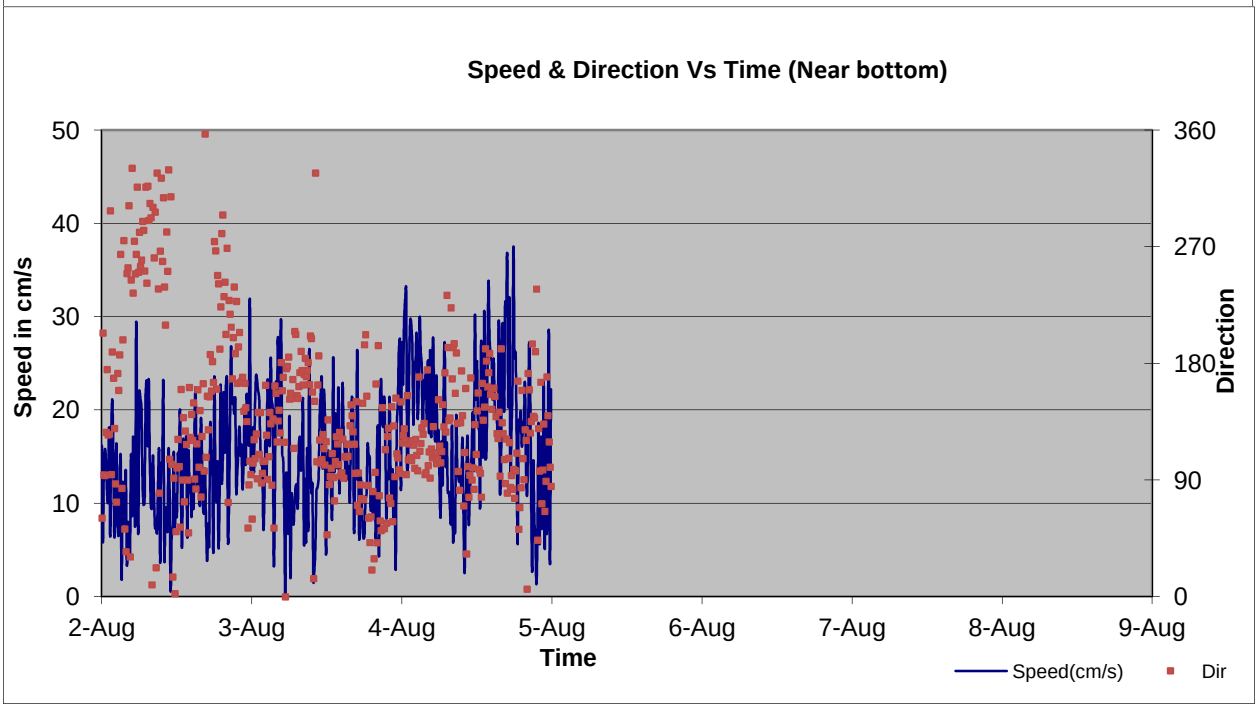

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
0
15
30
45
60
75
0
90
180
270
360
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Speed(cm/s)
Dir


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

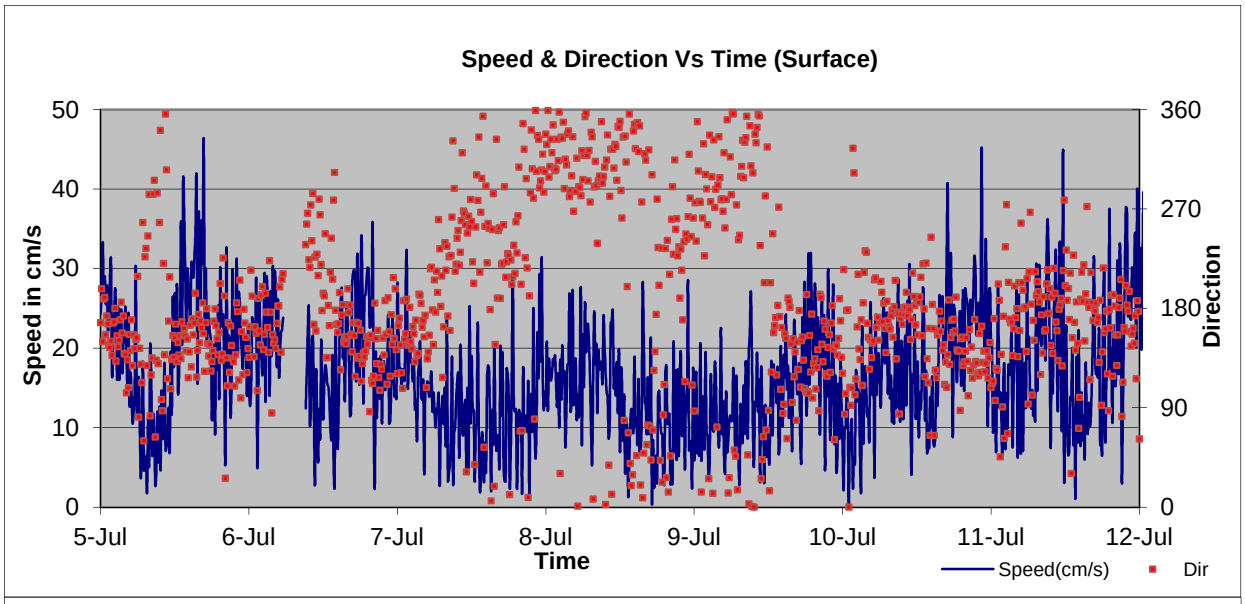

Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Speed(cm/s)
Dir

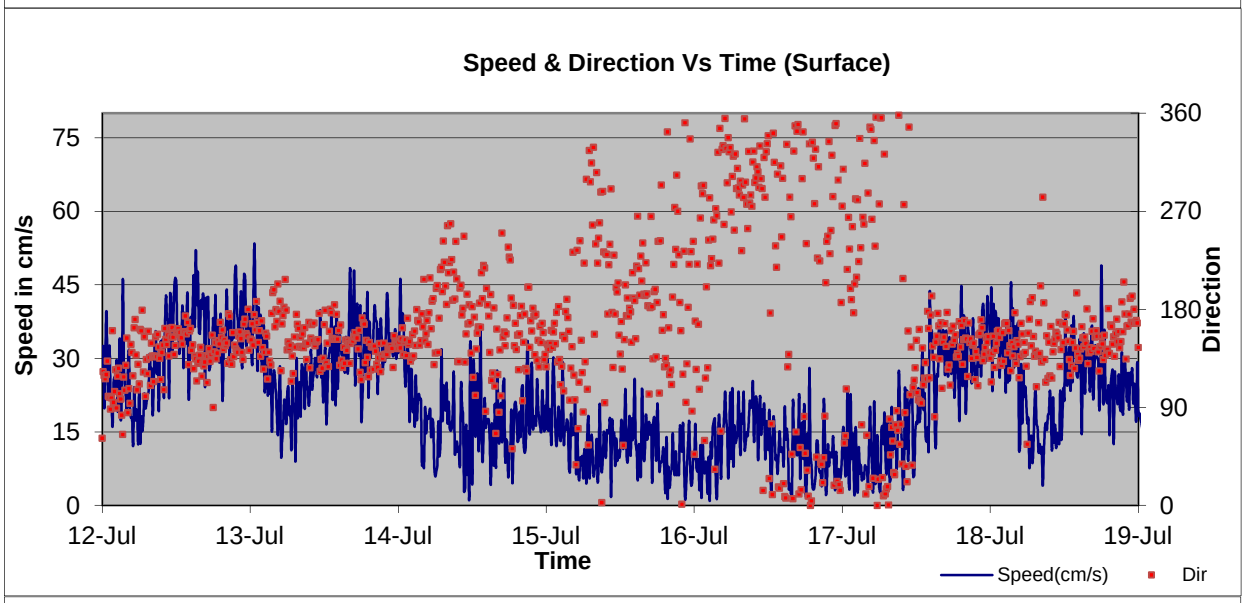

Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Speed(cm/s)
Dir

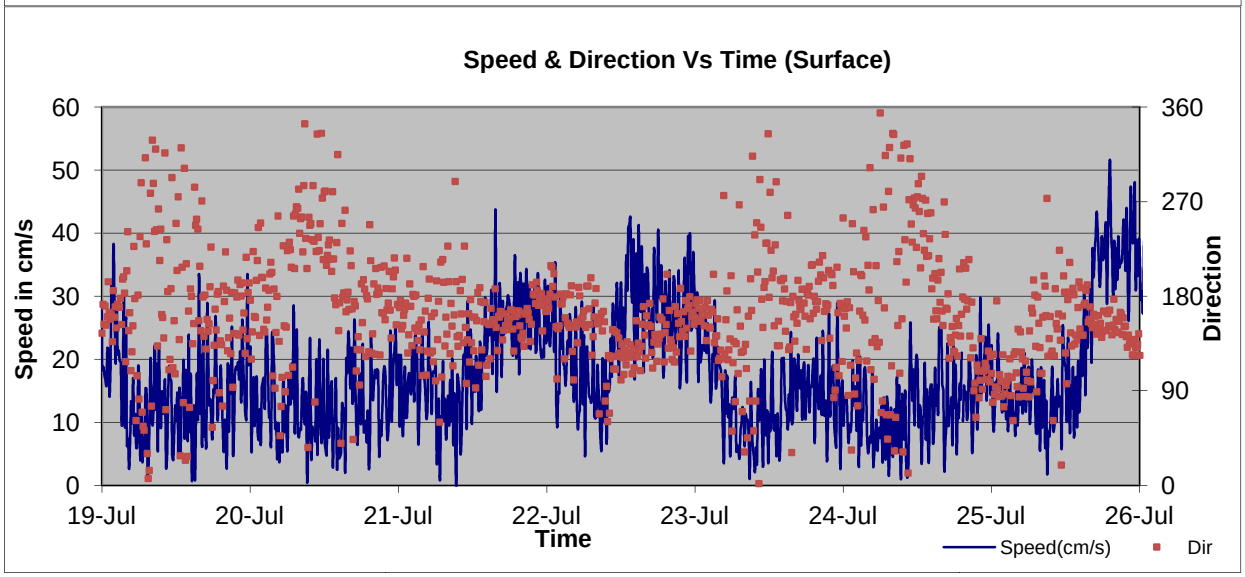
Annexure II

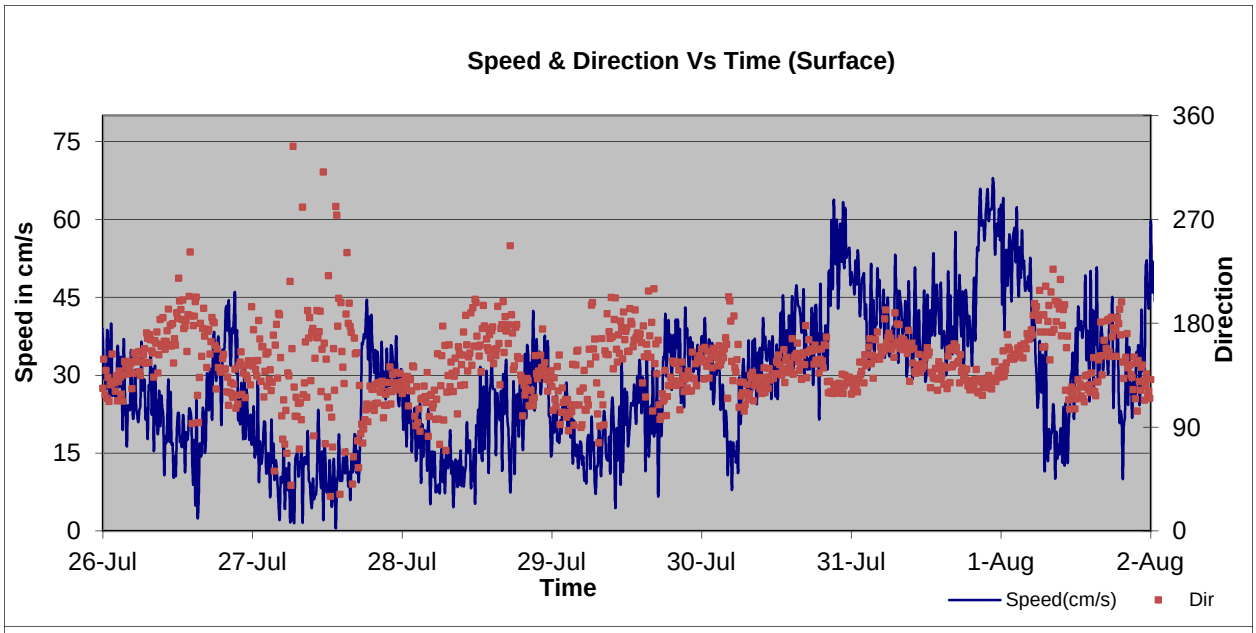
Current Data

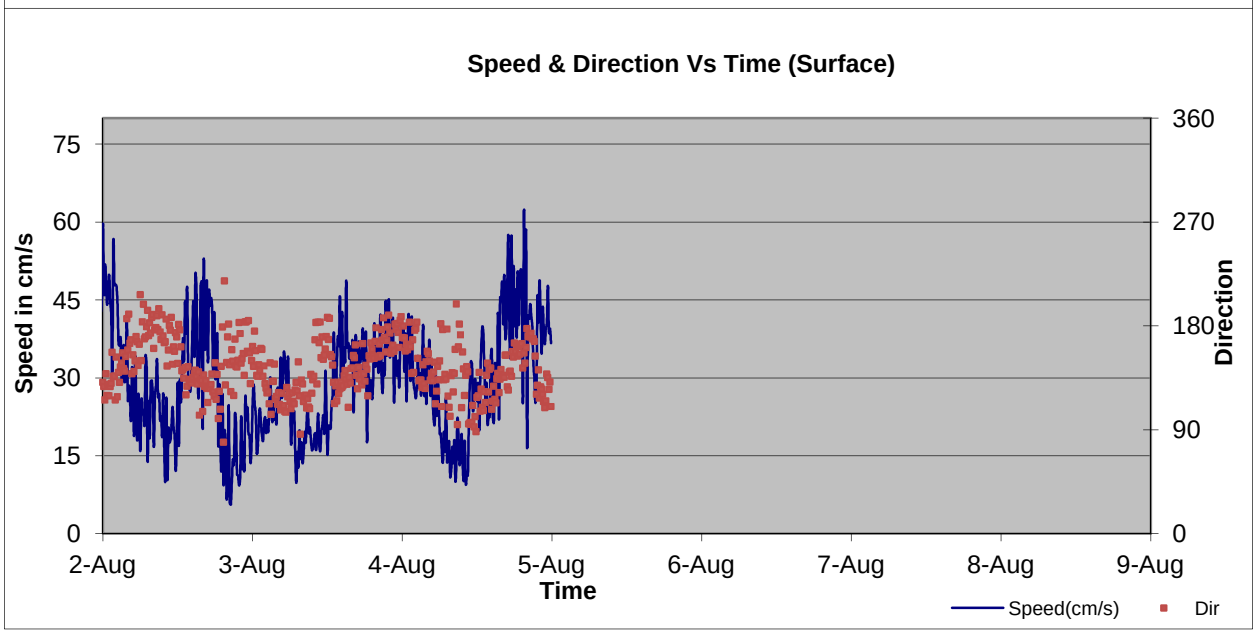
Location P3

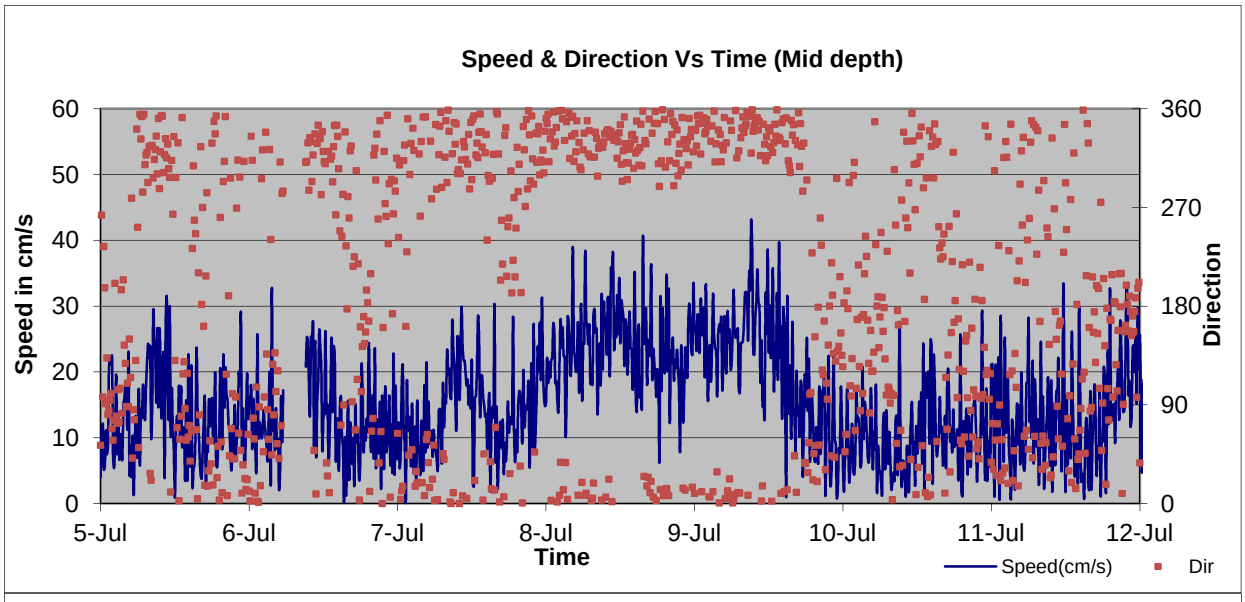

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir

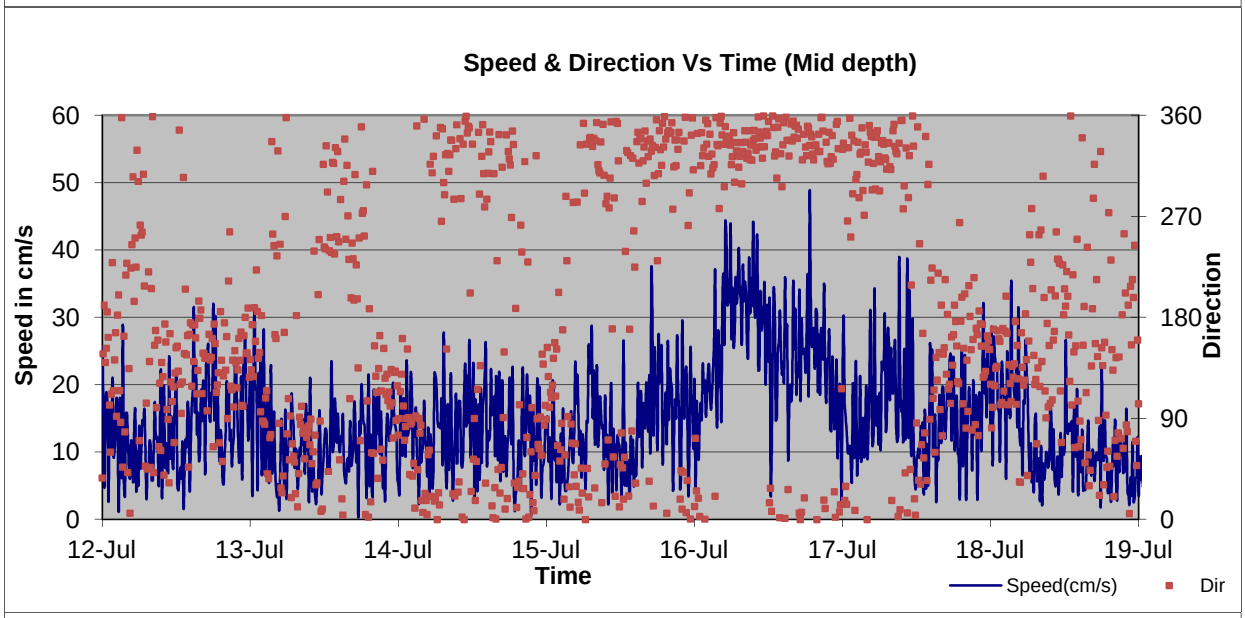

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir

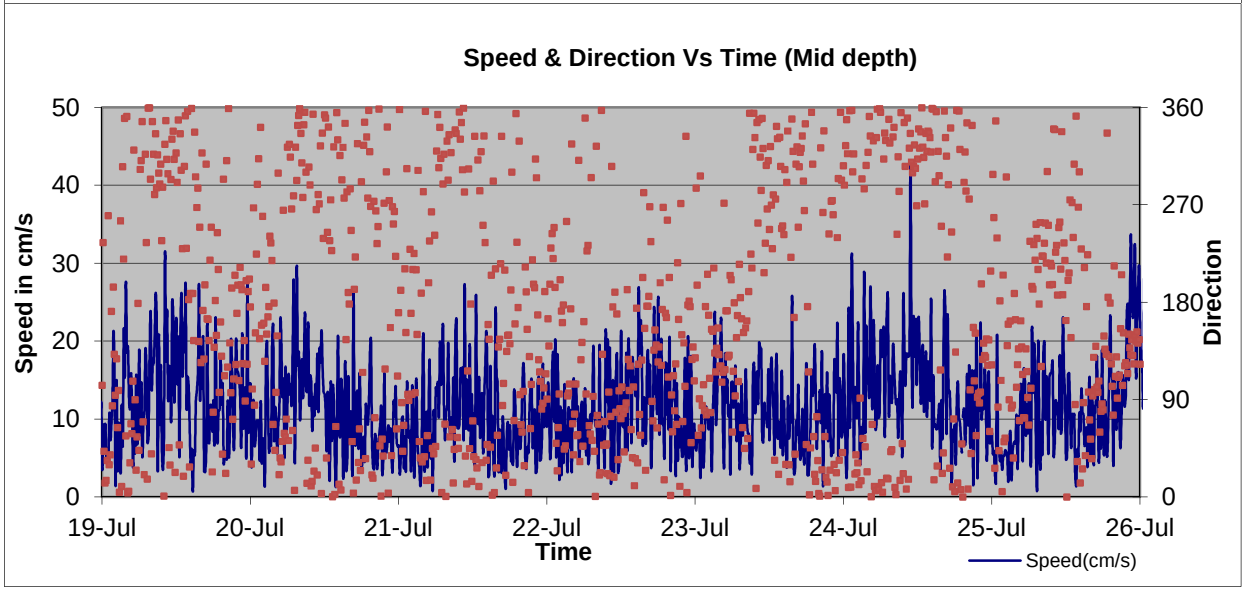

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

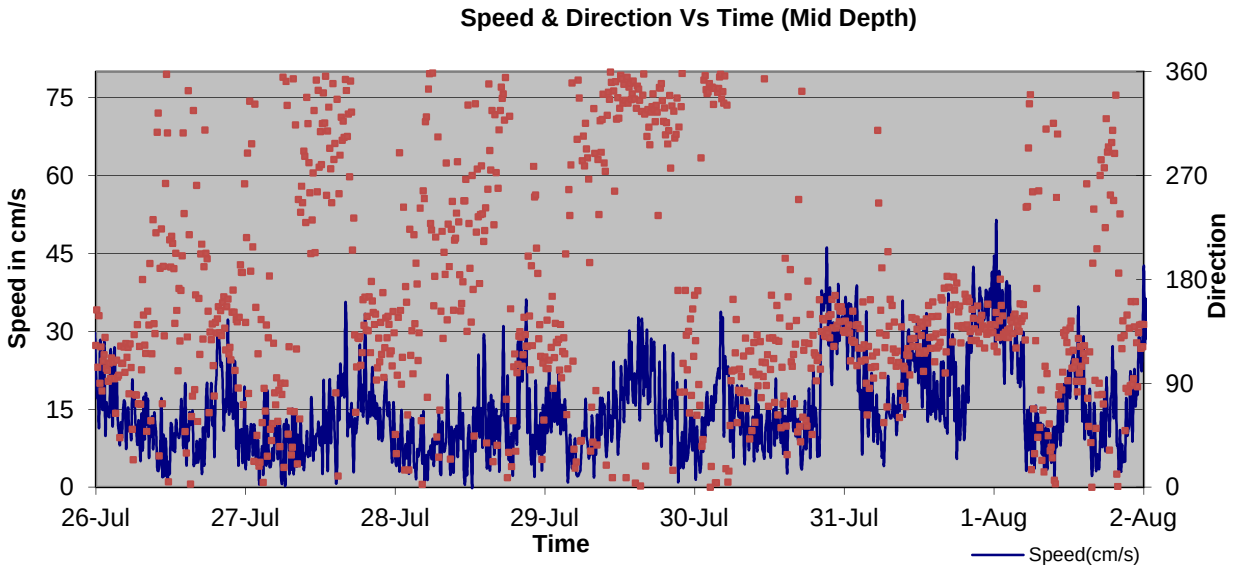

Speed & Direction Vs Time (Surface)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Time
Speed(cm/s)
Dir

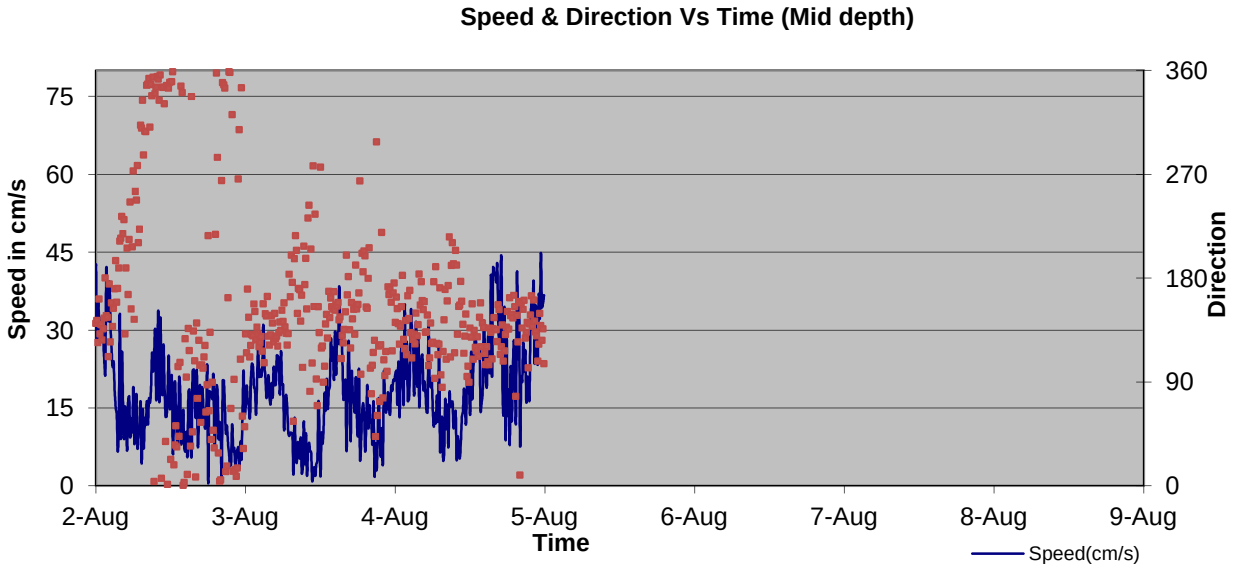

Speed & Direction Vs Time (Surface)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Time
Speed(cm/s)
Dir

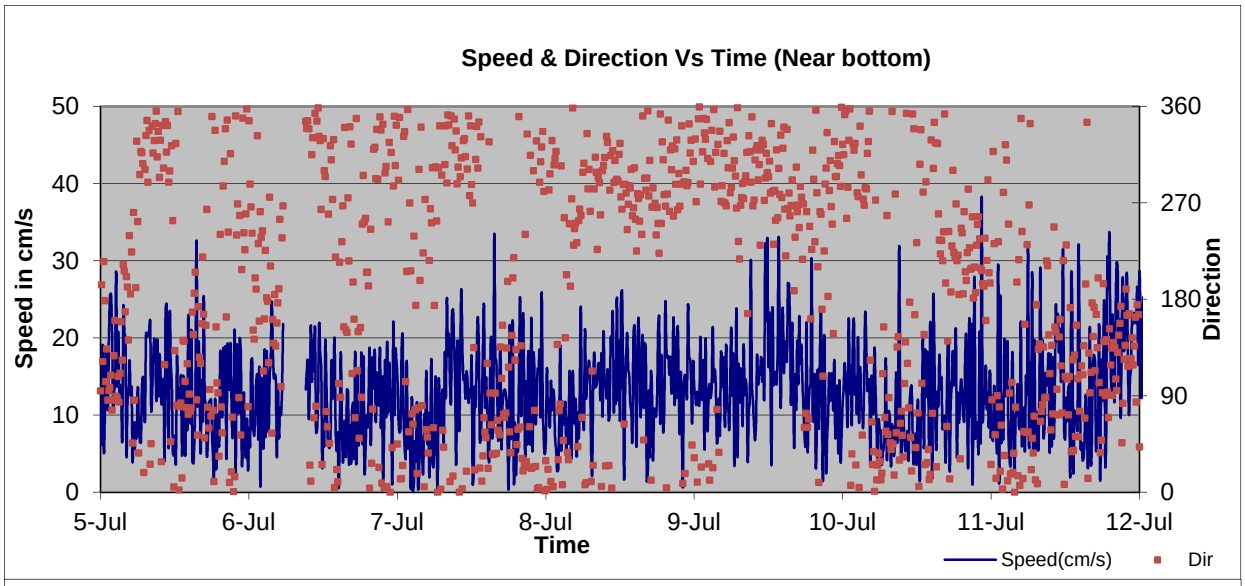

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir

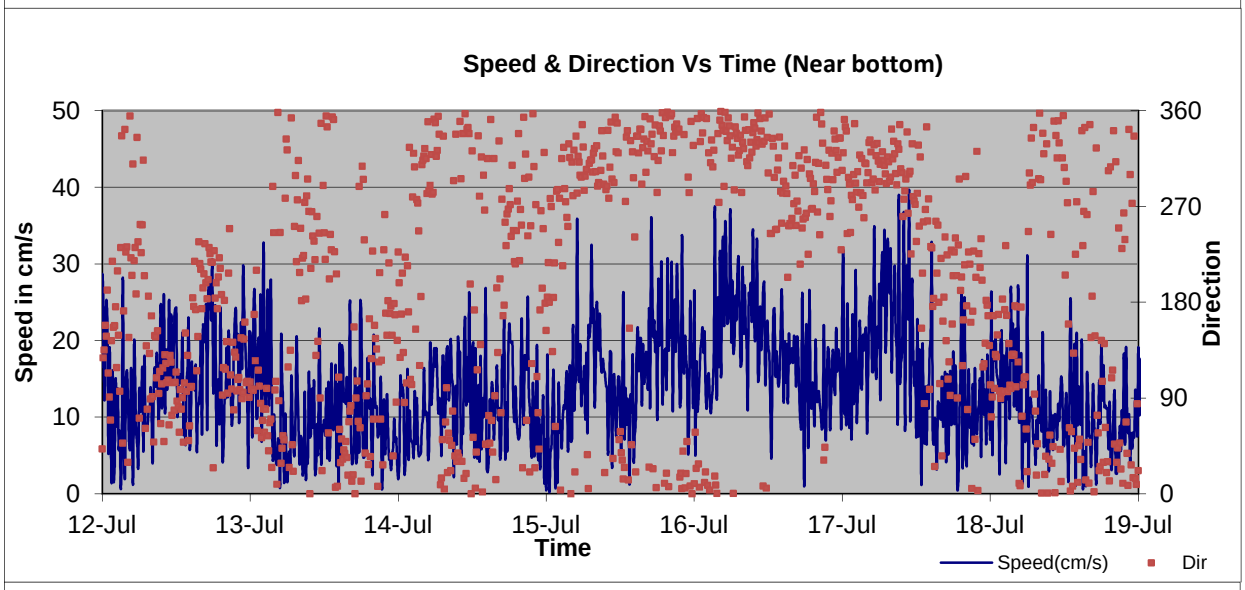

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir

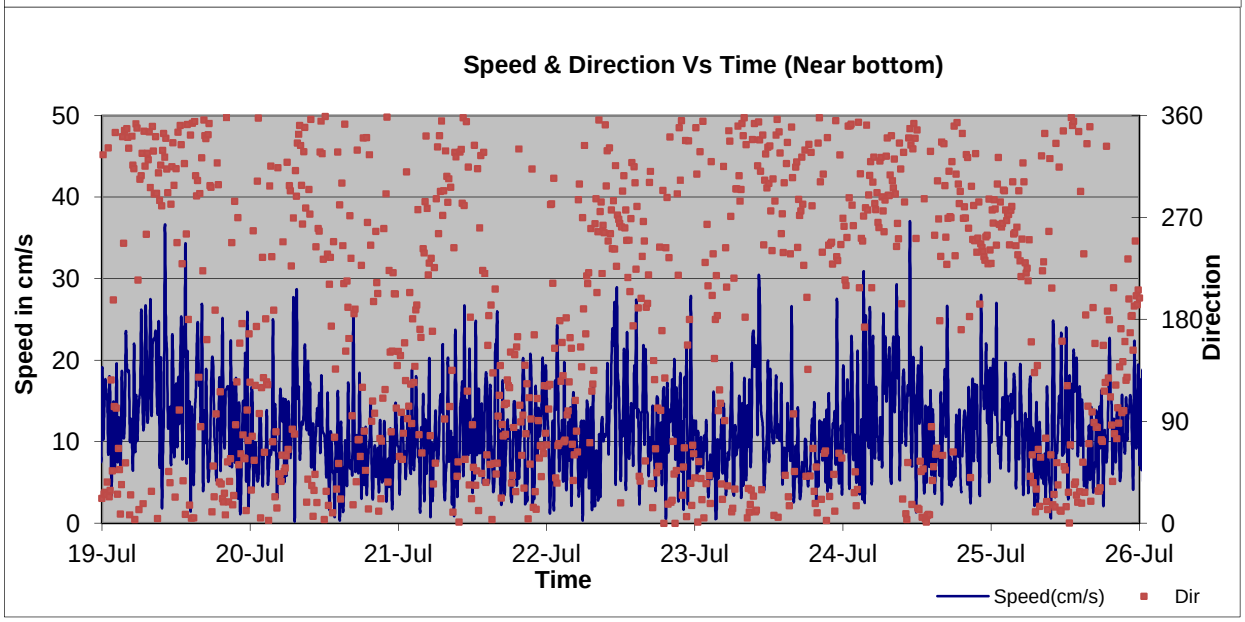

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)

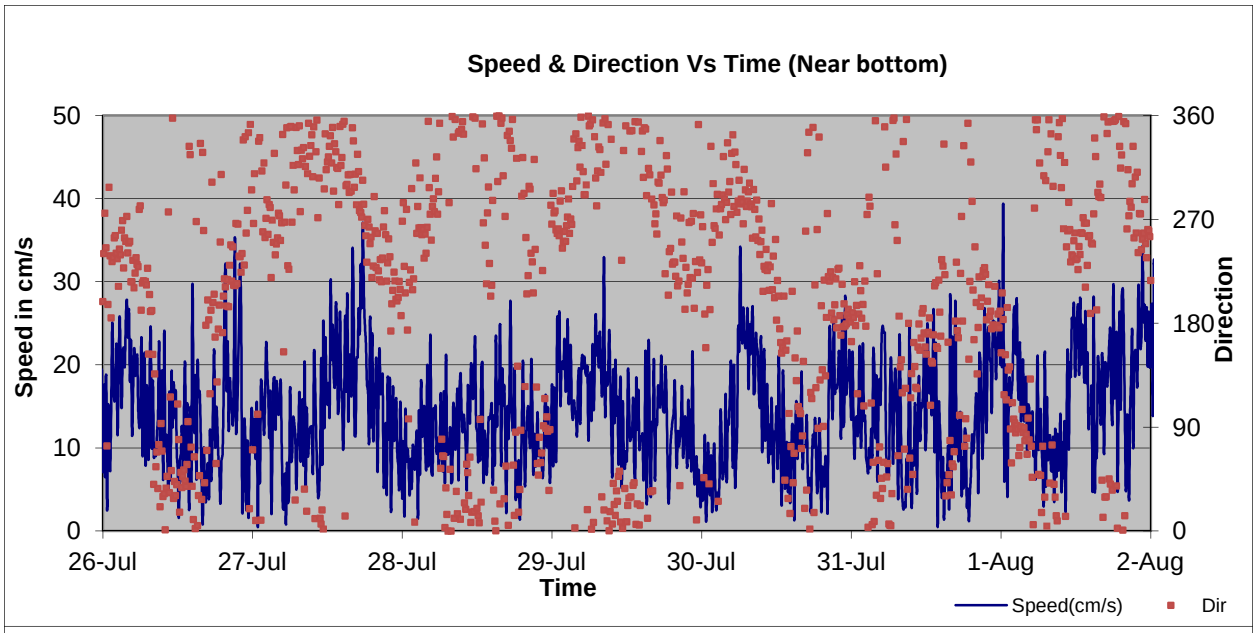

Speed & Direction Vs Time (Mid Depth)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Time
Speed(cm/s)

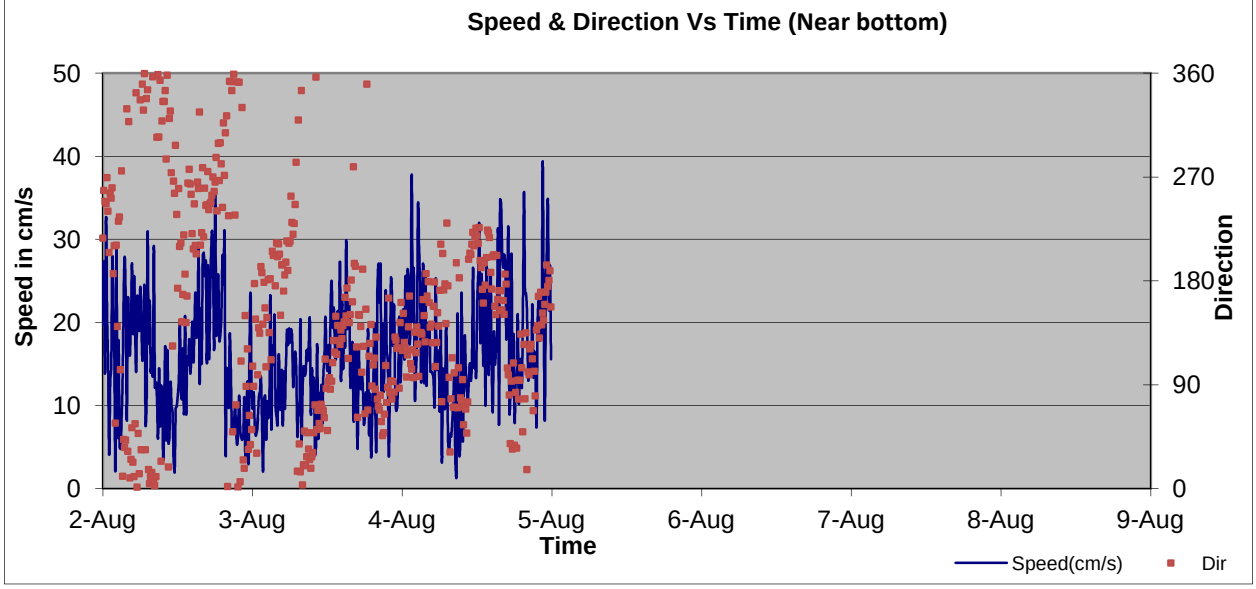

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Time
Speed(cm/s)


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

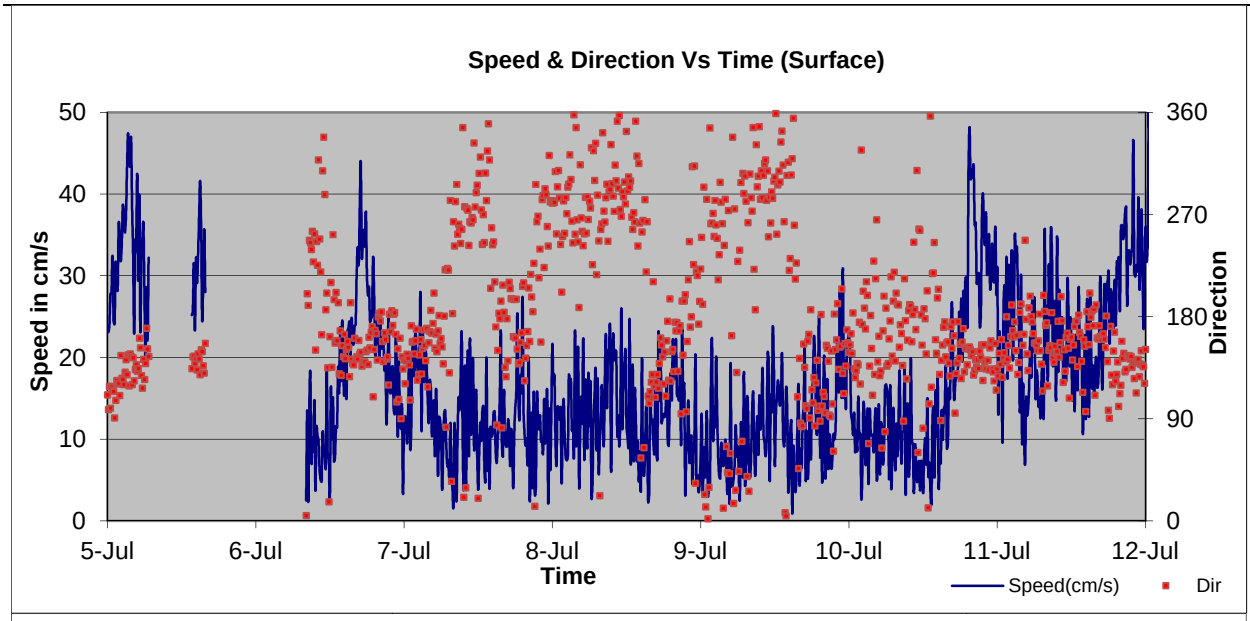

Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Speed(cm/s)
Dir

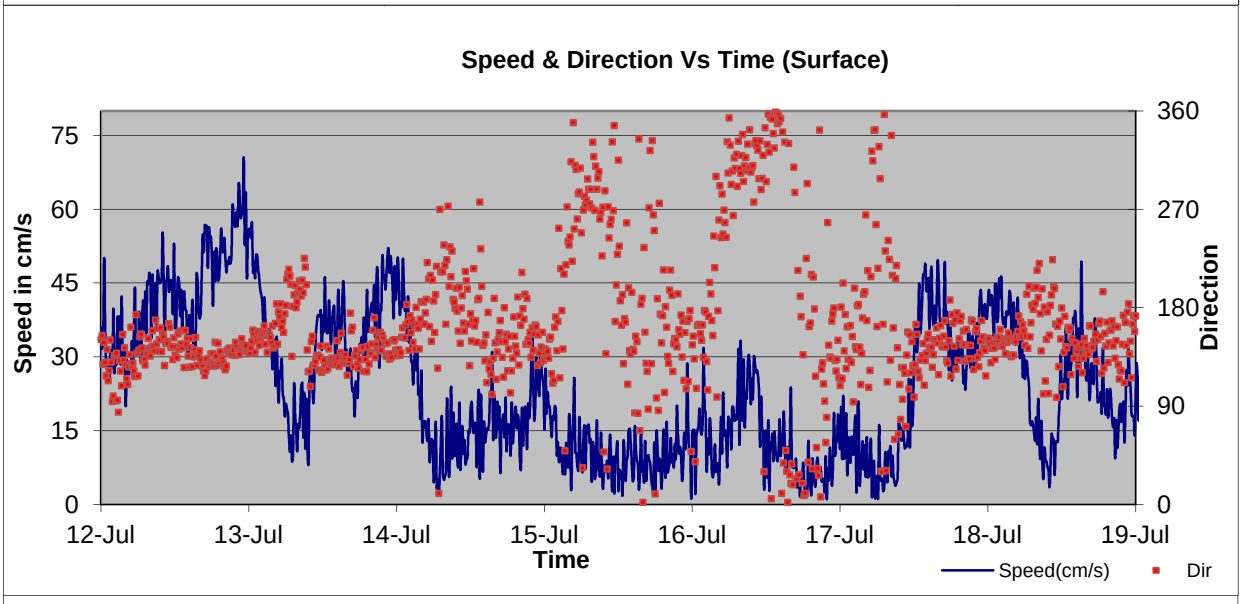

Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Speed(cm/s)
Dir

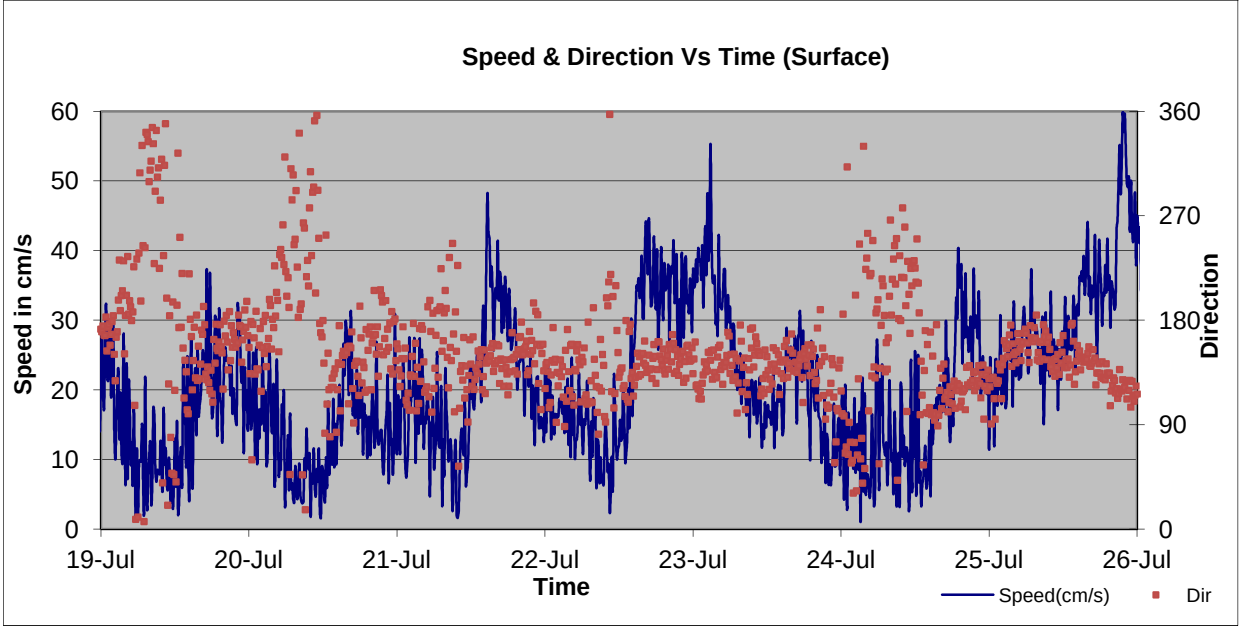
Annexure II

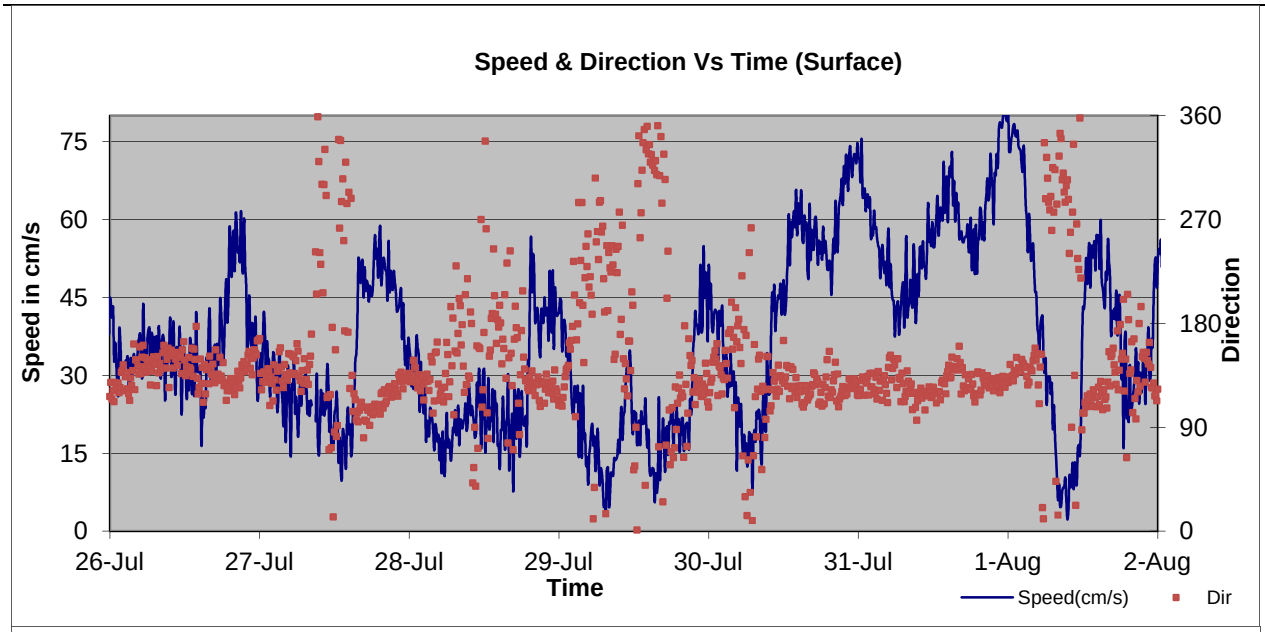
Current Data

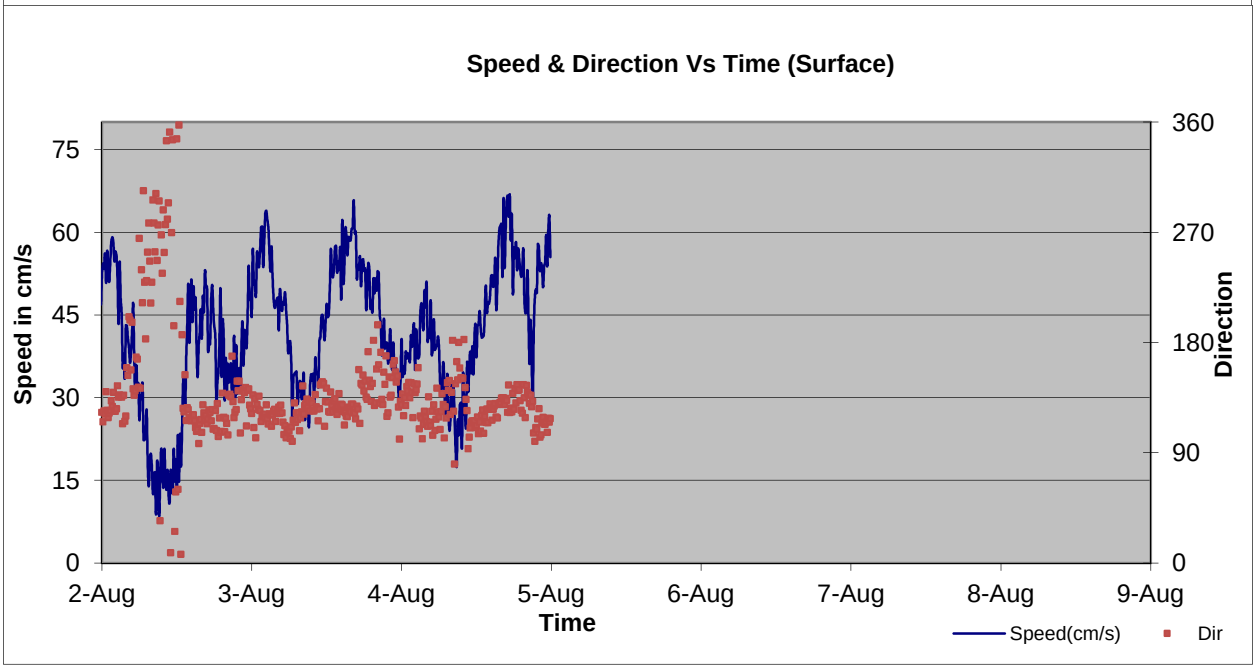
Location P4

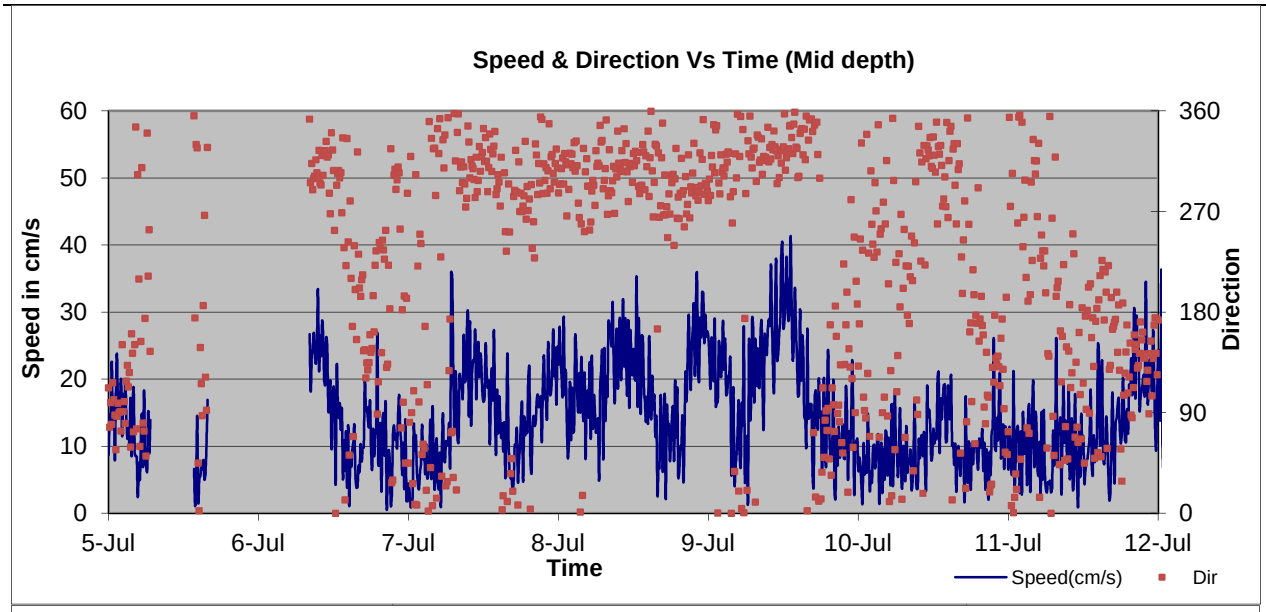

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir

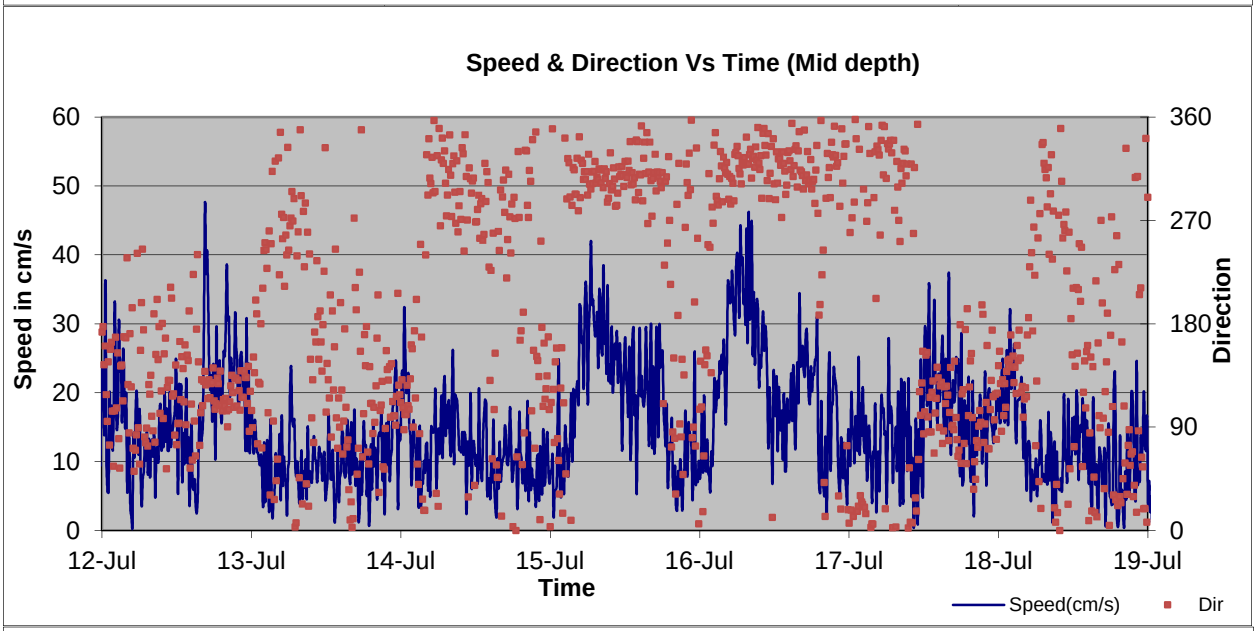

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir

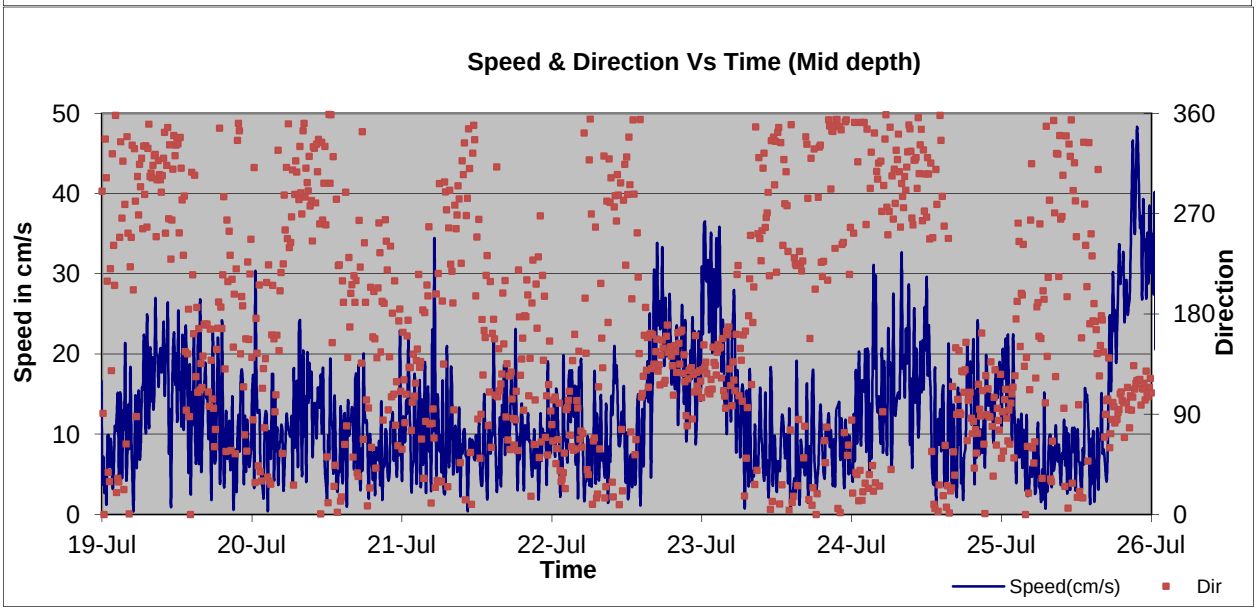

Speed & Direction Vs Time (Surface)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

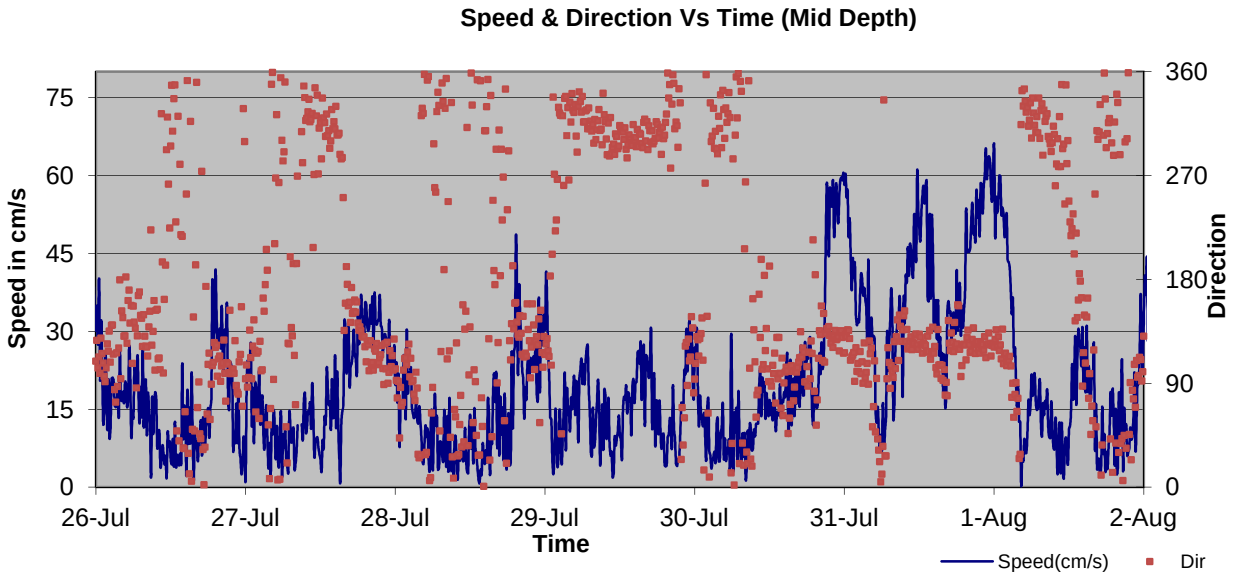

Speed & Direction Vs Time (Surface)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Time
Speed(cm/s)
Dir

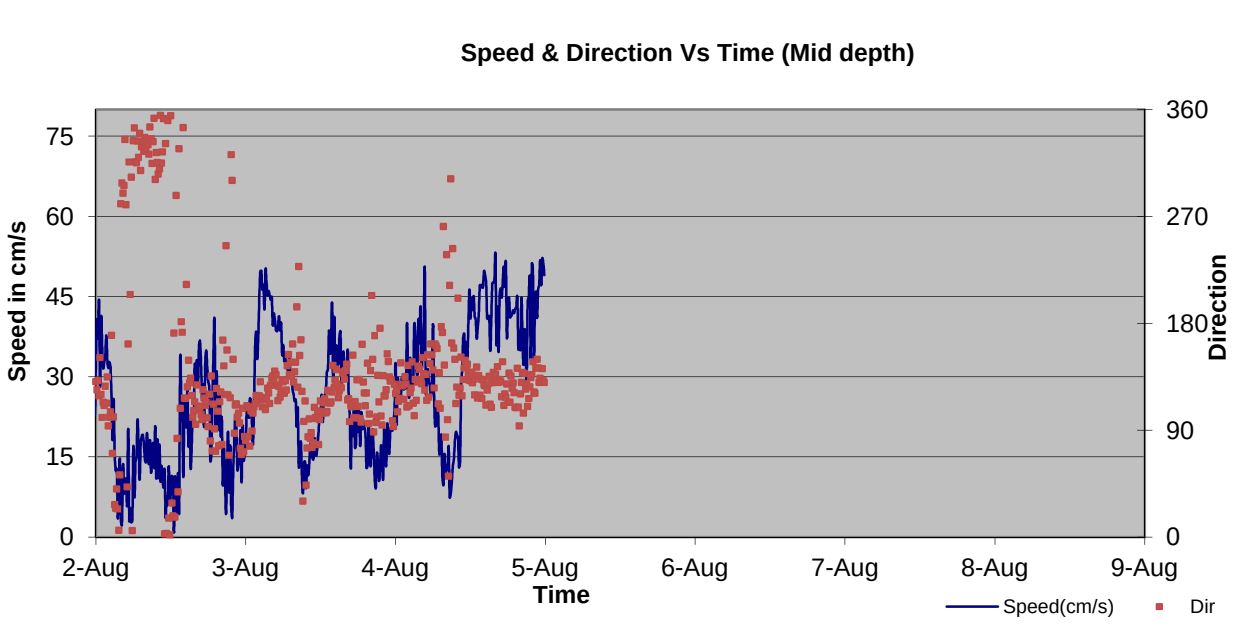

Speed & Direction Vs Time (Surface)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Time
Speed(cm/s)
Dir

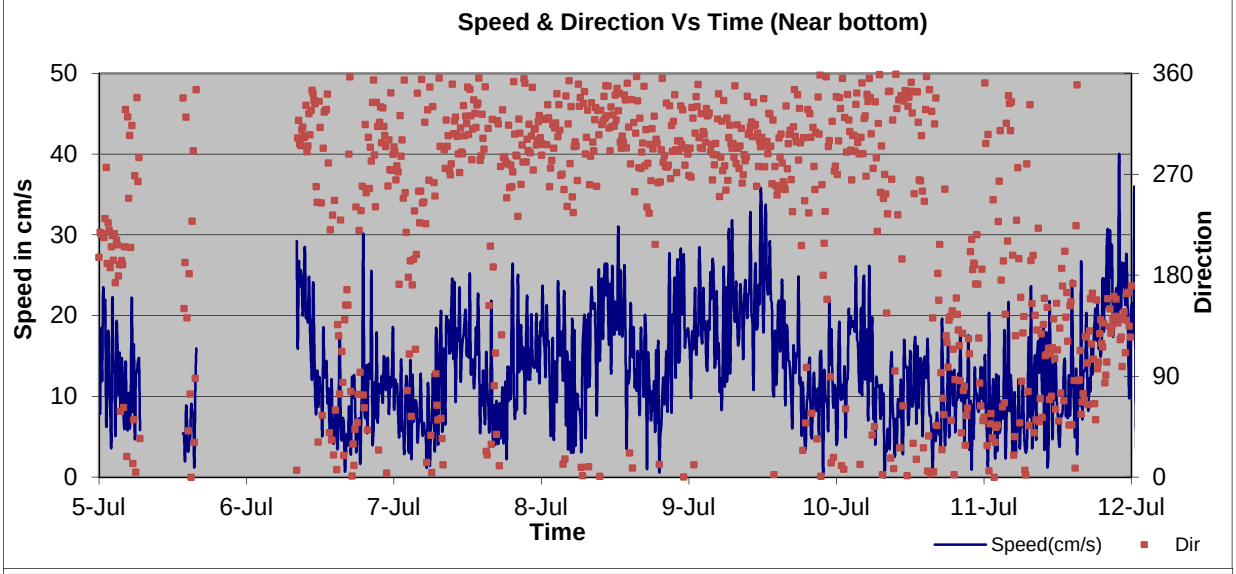

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir

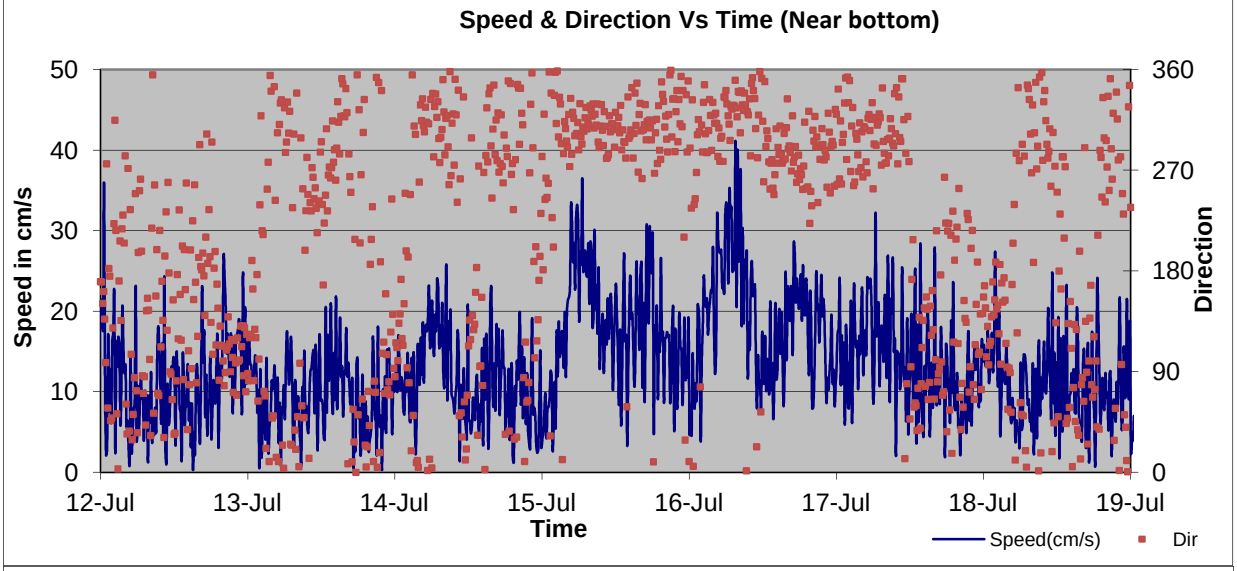

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir

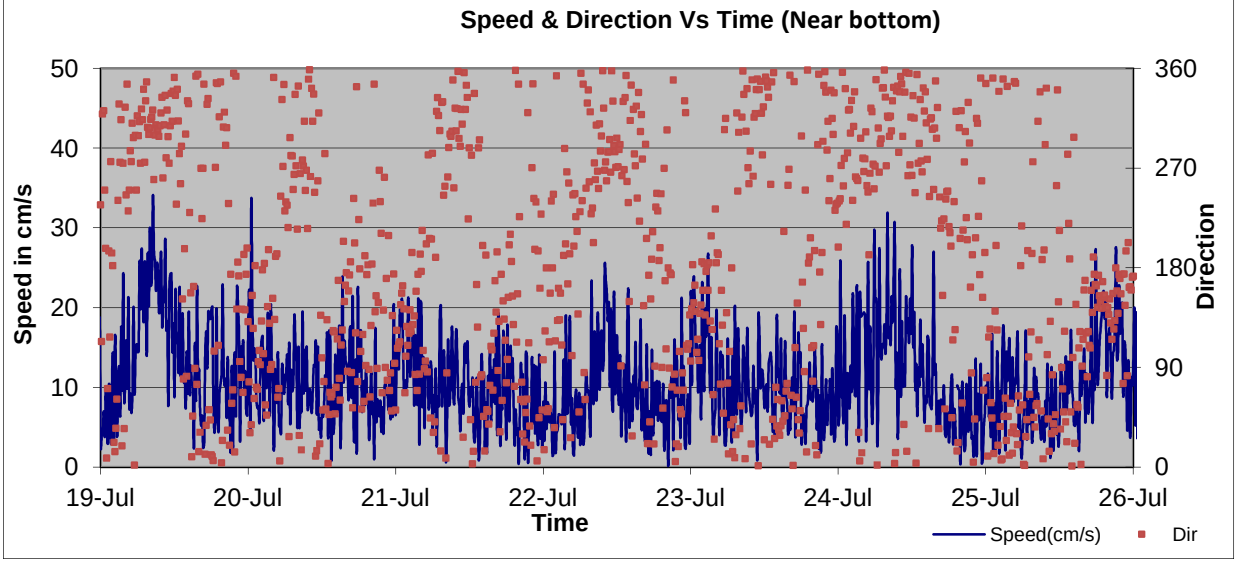

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

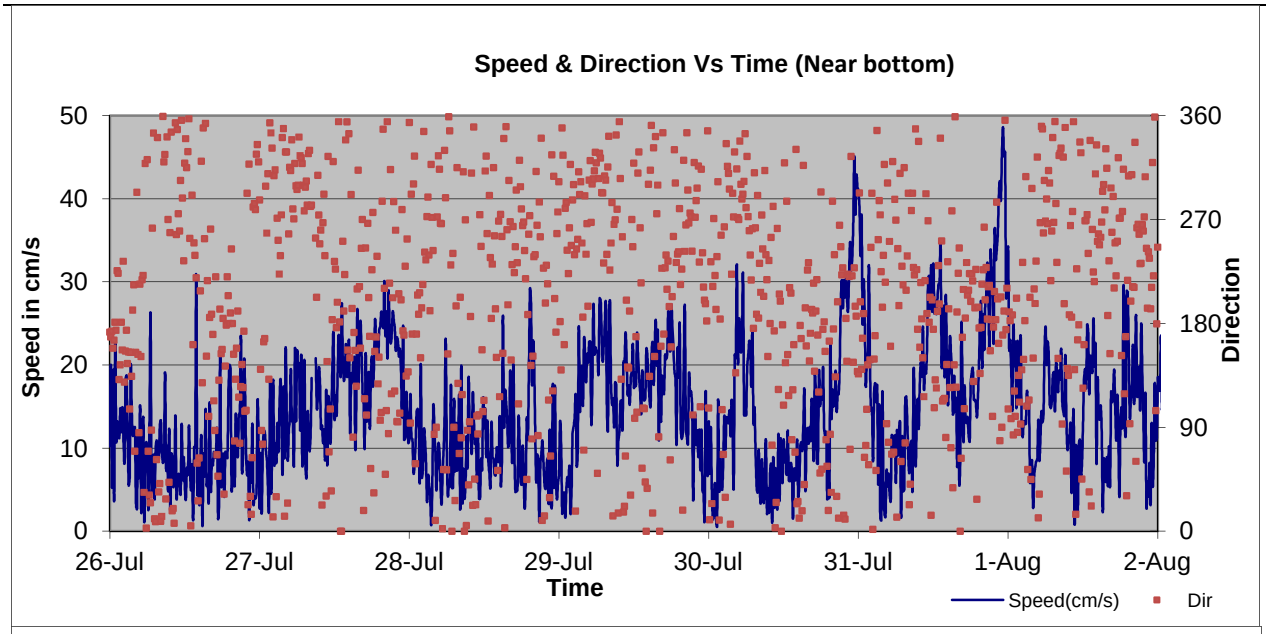

Speed & Direction Vs Time (Mid Depth)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Time
Speed(cm/s)
Dir

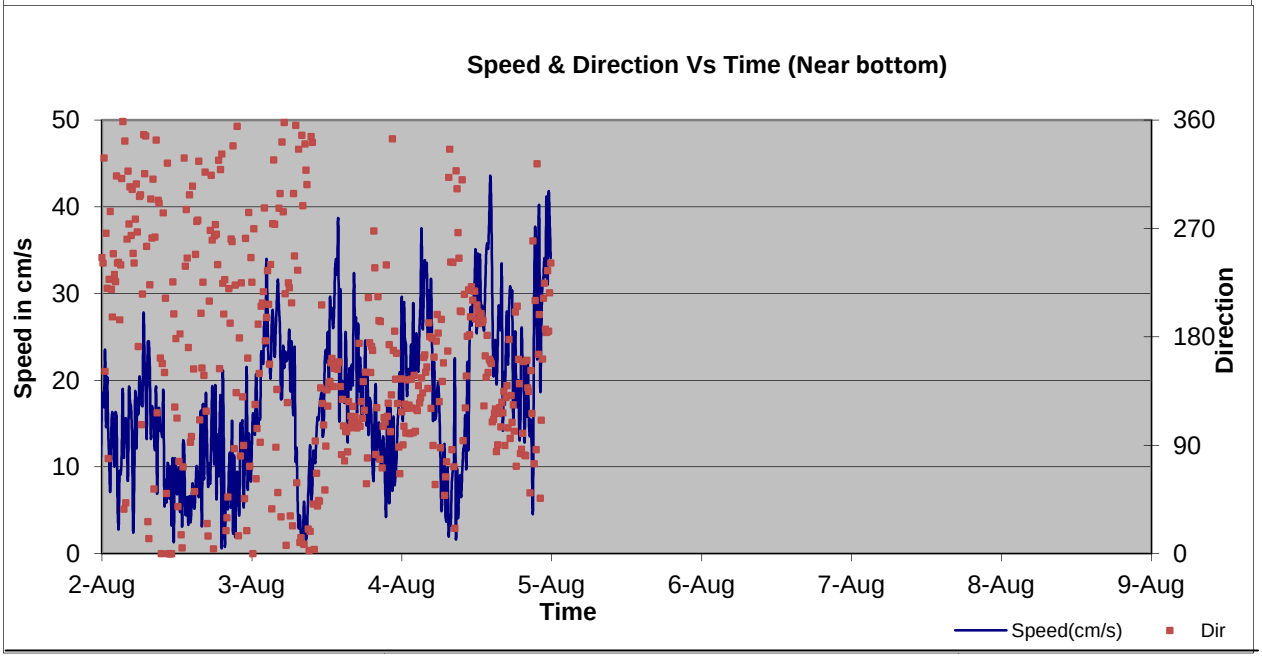

Speed & Direction Vs Time (Mid depth)
Speed in cm/s
75
60
45
30
15
0
360
270
180
90
0
Direction
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Time
Speed(cm/s)
Dir


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
5-Jul
6-Jul
7-Jul
8-Jul
9-Jul
10-Jul
11-Jul
12-Jul
Speed(cm/s)
Dir


Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
12-Jul
13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
Speed(cm/s)
Dir

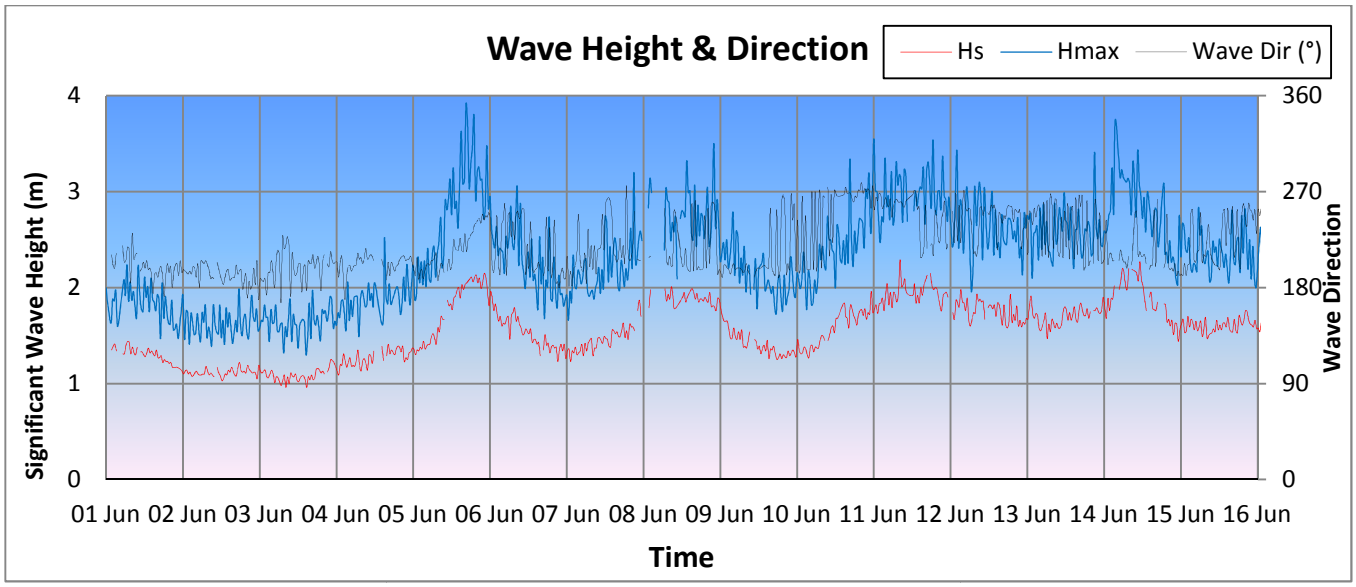

Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
Speed(cm/s)
Dir

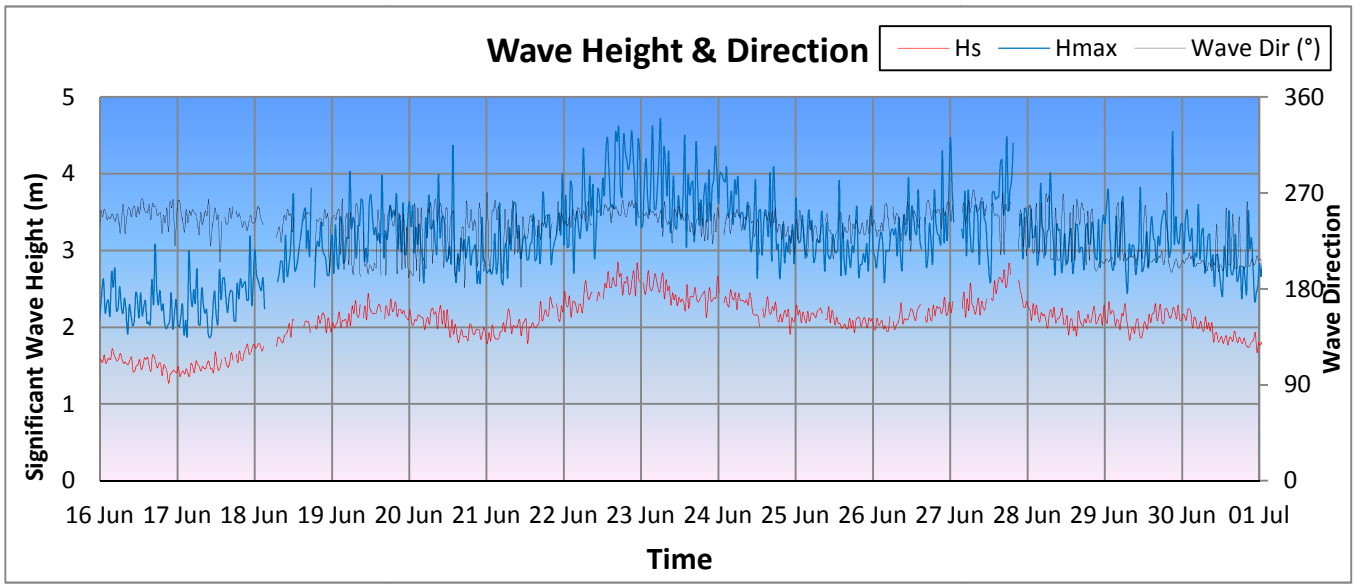

Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
50
40
30
20
10
0
360
270
180
90
0
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
Speed(cm/s)
Dir

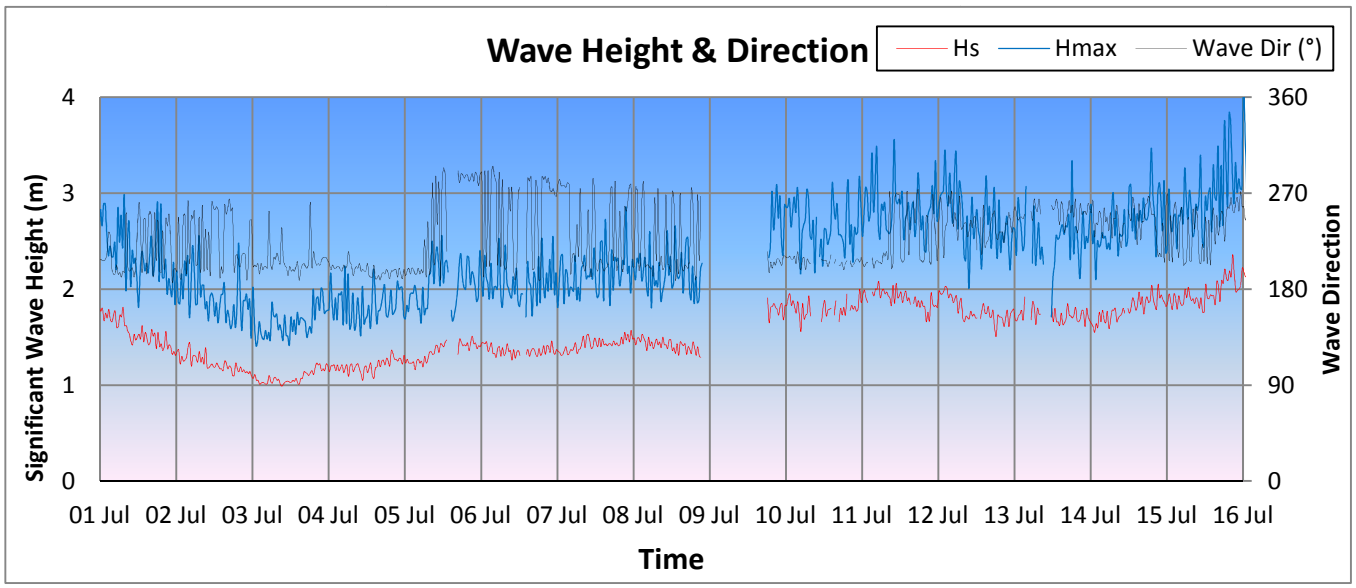

Speed & Direction Vs Time (Near bottom)
Speed in cm/s
Direction
Time
50
40
30
20
10
0
360
270
180
90
0
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
Speed(cm/s)
Dir

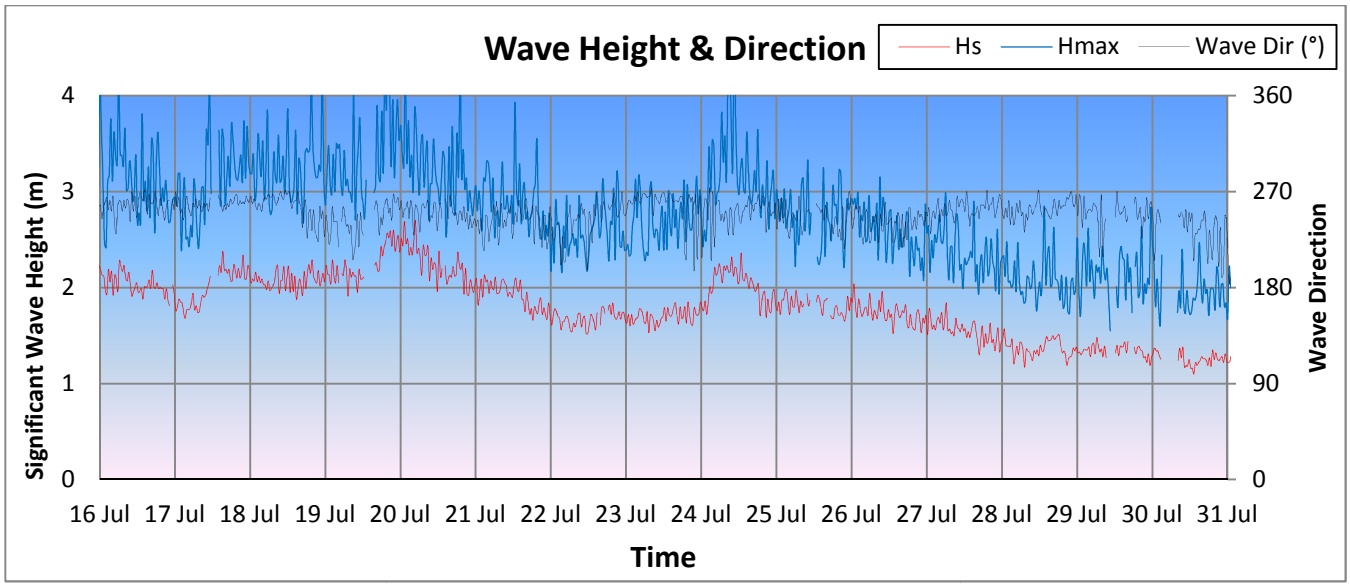
Annexure III

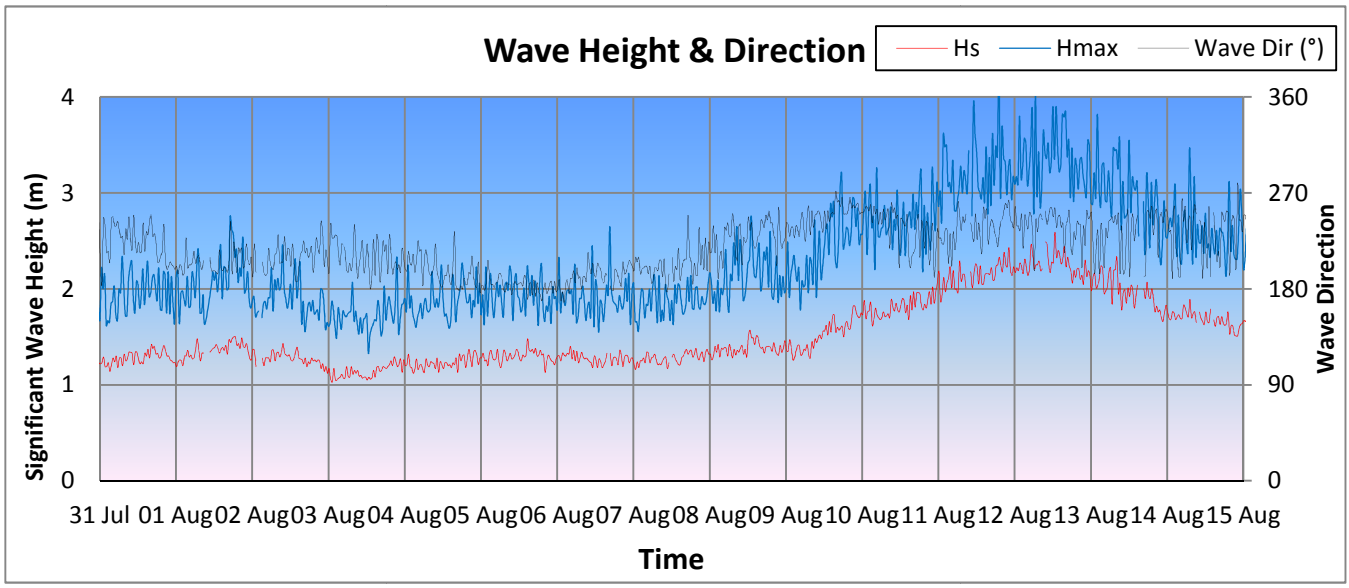
Wave Data

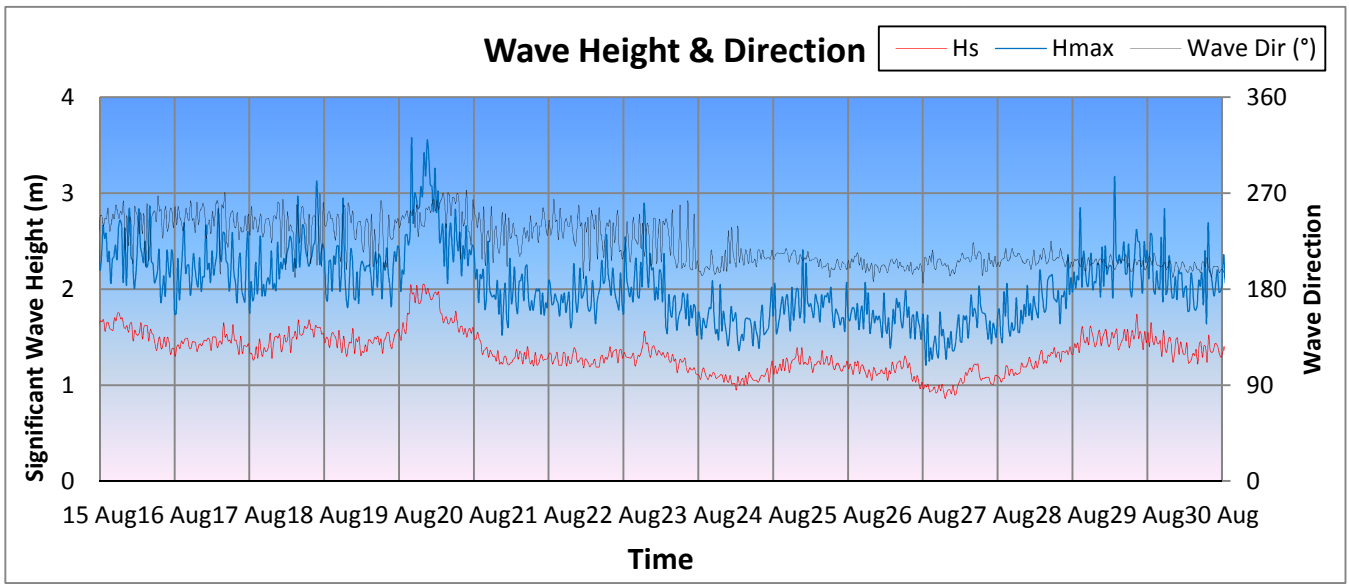

Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
0
90
180
270
360
01 Jun 02 Jun 03 Jun 04 Jun 05 Jun 06 Jun 07 Jun 08 Jun 09 Jun 10 Jun 11 Jun 12 Jun 13 Jun 14 Jun 15 Jun 16 Jun
Time

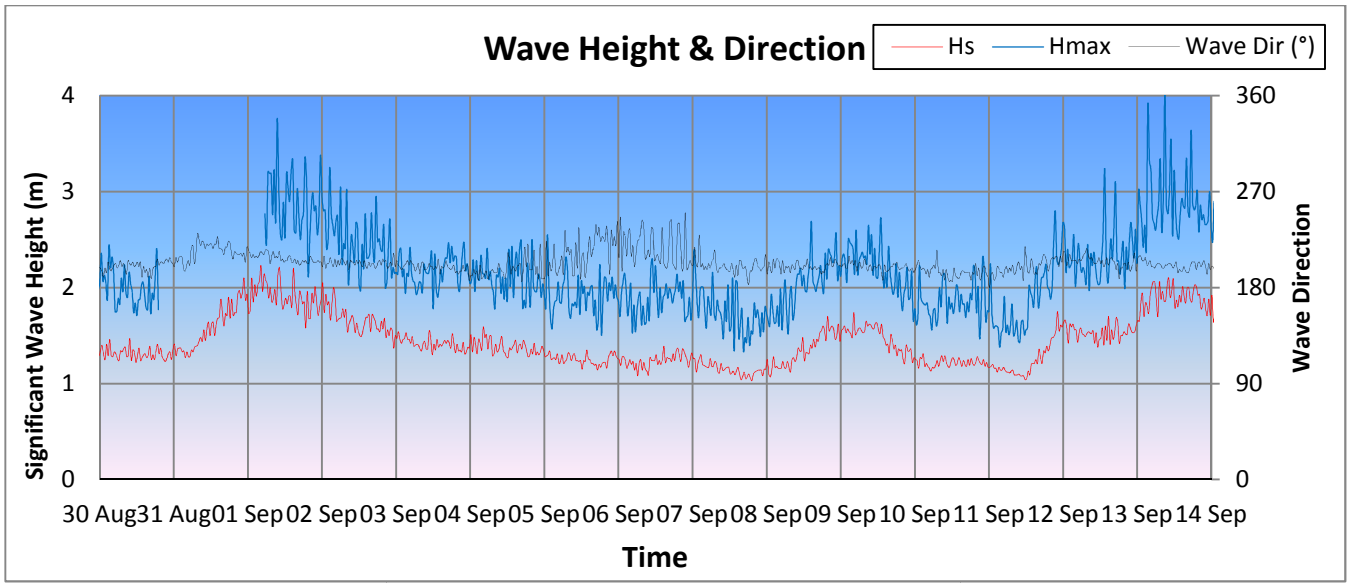

Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
5
0
90
180
270
360
16 Jun 17 Jun 18 Jun 19 Jun 20 Jun 21 Jun 22 Jun 23 Jun 24 Jun 25 Jun 26 Jun 27 Jun 28 Jun 29 Jun 30 Jun 01 Jul
Time

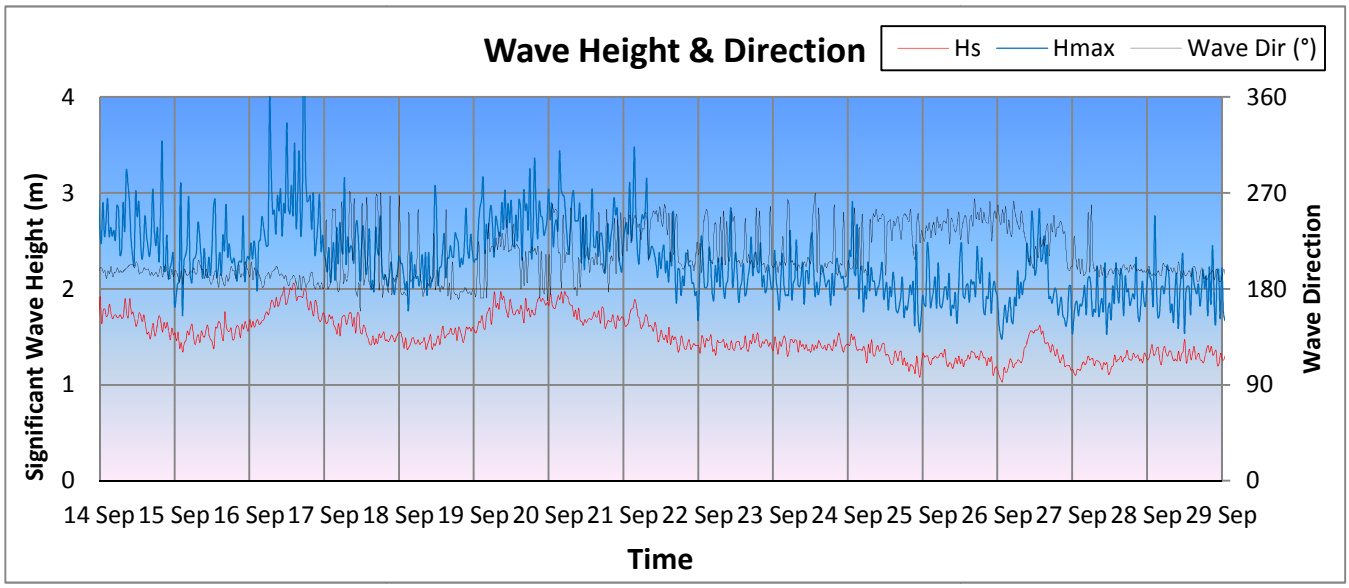

Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
0
90
180
270
360
01 Jul 02 Jul 03 Jul 04 Jul 05 Jul 06 Jul 07 Jul 08 Jul 09 Jul 10 Jul 11 Jul 12 Jul 13 Jul 14 Jul 15 Jul 16 Jul
Time

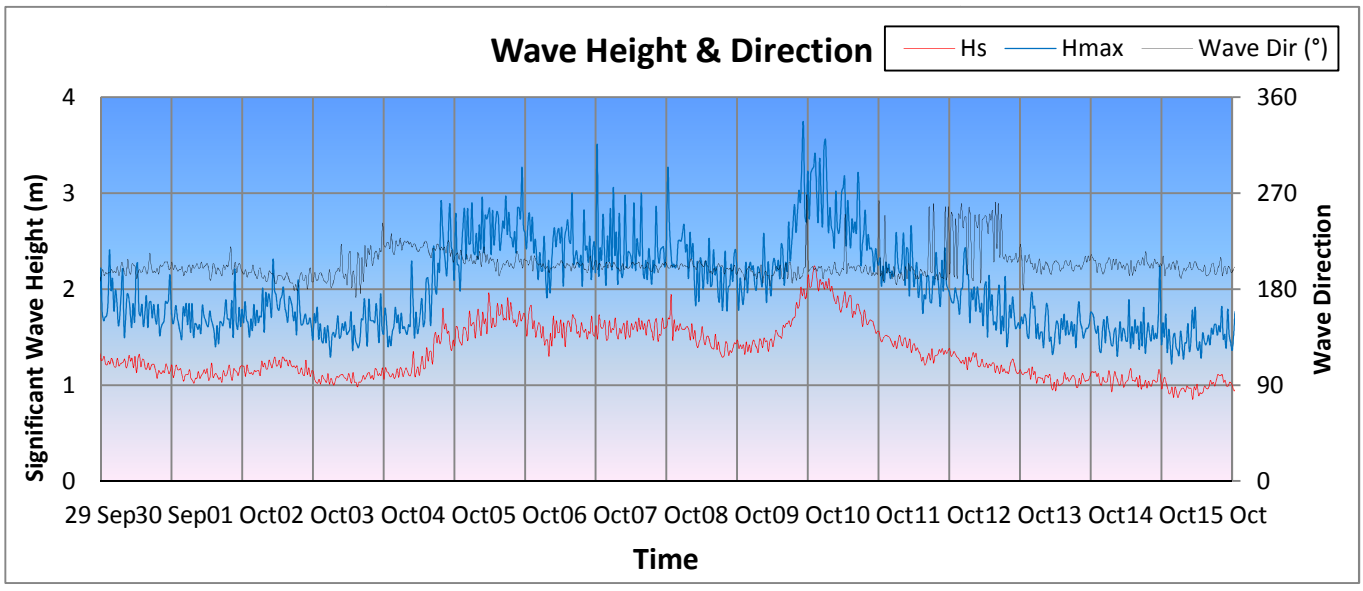

Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
0
90
180
270
360
16 Jul 17 Jul 18 Jul 19 Jul 20 Jul 21 Jul 22 Jul 23 Jul 24 Jul 25 Jul 26 Jul 27 Jul 28 Jul 29 Jul 30 Jul 31 Jul
Time

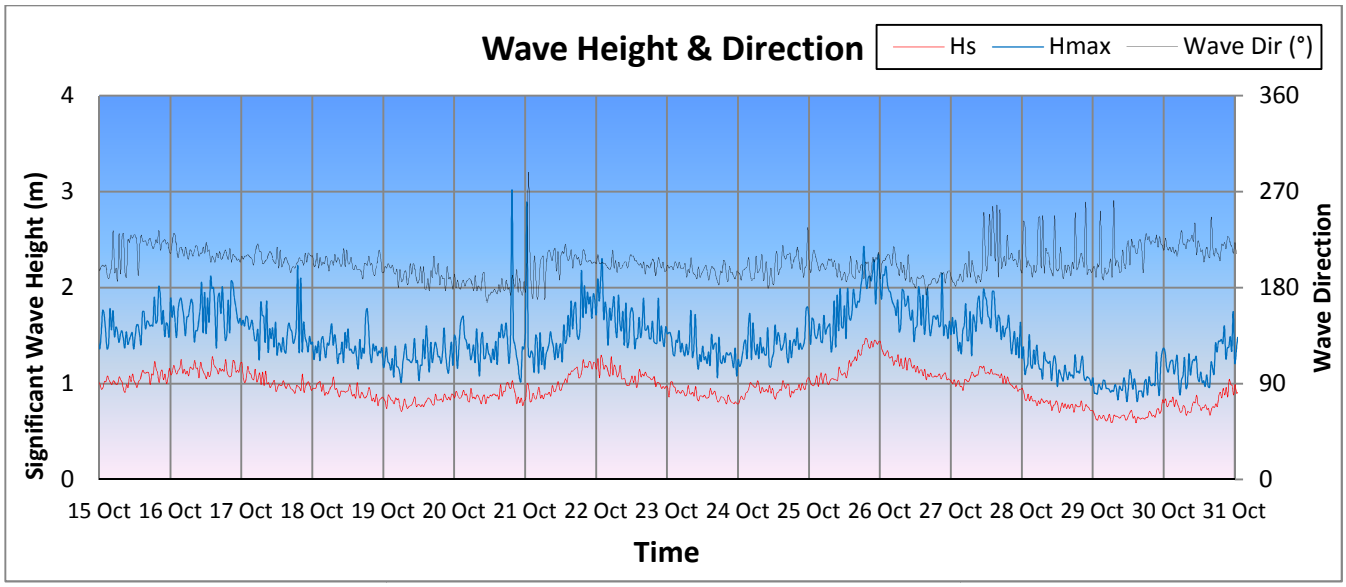

Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
0
90
180
270
360
31 Jul 01 Aug 02 Aug 03 Aug 04 Aug 05 Aug 06 Aug 07 Aug 08 Aug 09 Aug 10 Aug 11 Aug 12 Aug 13 Aug 14 Aug 15 Aug
Time


Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
0
90
180
270
360
15 Aug 16 Aug 17 Aug 18 Aug 19 Aug 20 Aug 21 Aug 22 Aug 23 Aug 24 Aug 25 Aug 26 Aug 27 Aug 28 Aug 29 Aug 30 Aug
Time


Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
0
90
180
270
360
30 Aug 31 Aug 01 Sep 02 Sep 03 Sep 04 Sep 05 Sep 06 Sep 07 Sep 08 Sep 09 Sep 10 Sep 11 Sep 12 Sep 13 Sep 14 Sep
Time

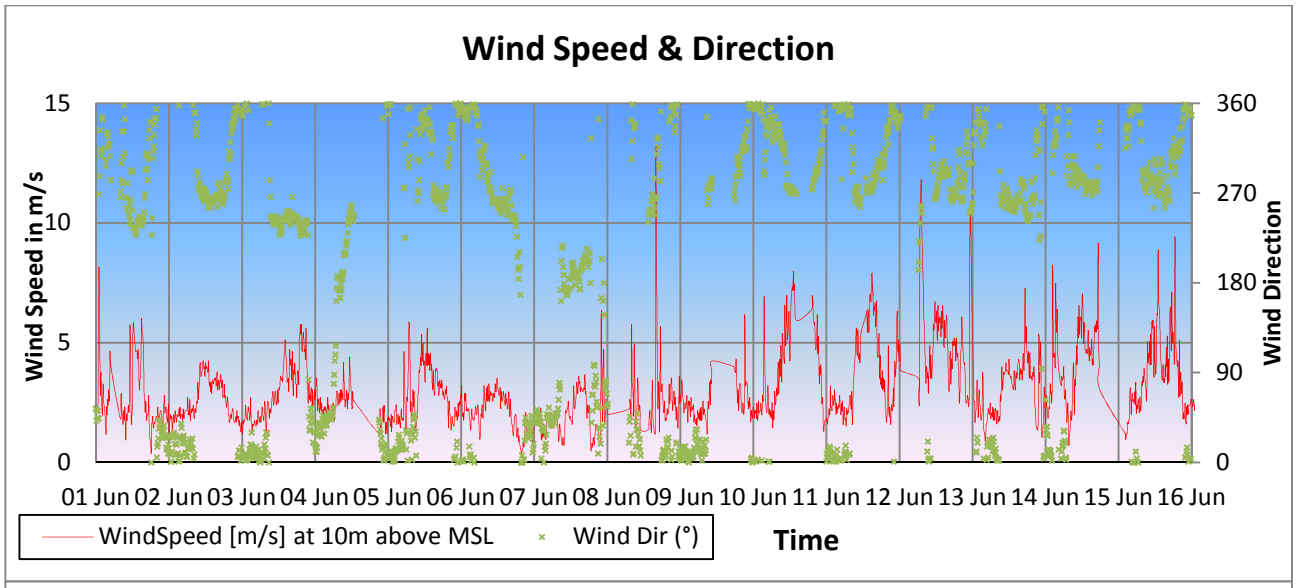

Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
0
90
180
270
360
14 Sep 15 Sep 16 Sep 17 Sep 18 Sep 19 Sep 20 Sep 21 Sep 22 Sep 23 Sep 24 Sep 25 Sep 26 Sep 27 Sep 28 Sep 29 Sep
Time

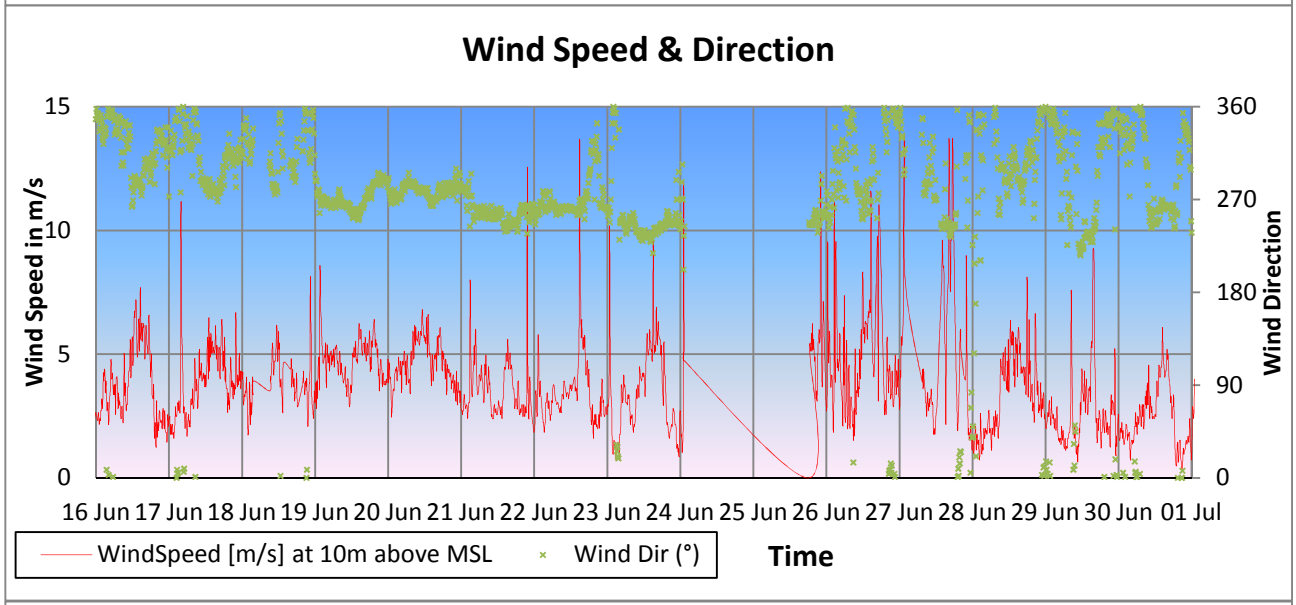

Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
0
90
180
270
360
29 Sep 30 Sep 01 Oct 02 Oct 03 Oct 04 Oct 05 Oct 06 Oct 07 Oct 08 Oct 09 Oct 10 Oct 11 Oct 12 Oct 13 Oct 14 Oct 15 Oct
Time

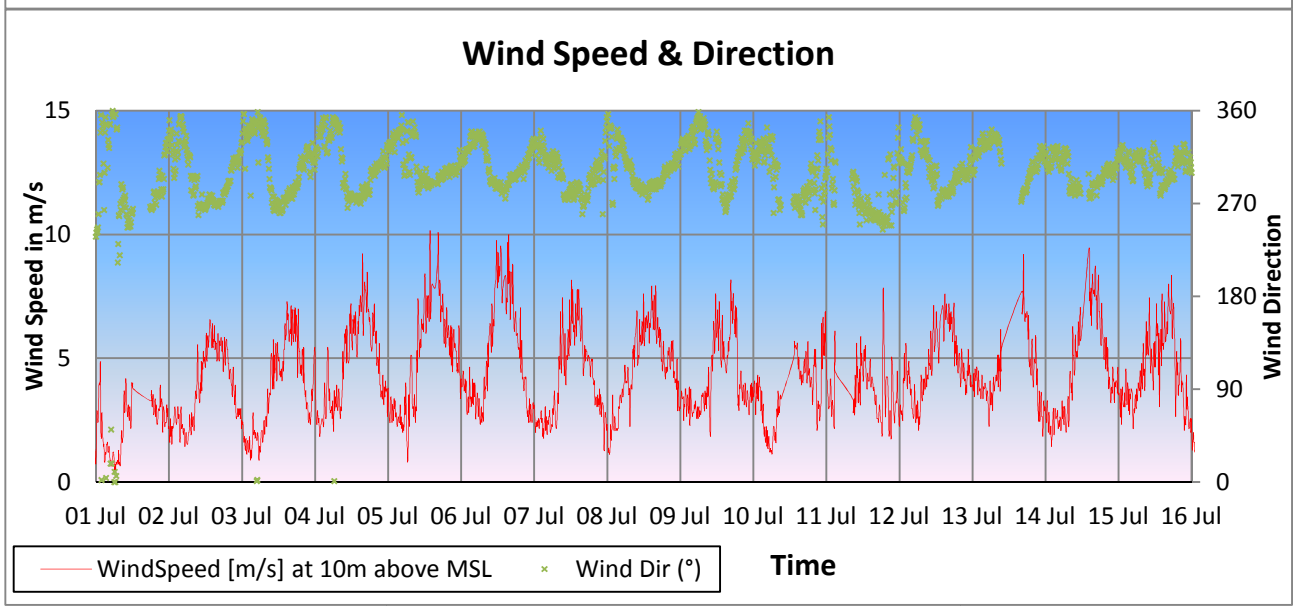

Wave Height & Direction
Hs
Hmax
Wave Dir (°)
Significant Wave Height (m)
Wave Direction
0
1
2
3
4
0
90
180
270
360
15 Oct 16 Oct 17 Oct 18 Oct 19 Oct 20 Oct 21 Oct 22 Oct 23 Oct 24 Oct 25 Oct 26 Oct 27 Oct 28 Oct 29 Oct 30 Oct 31 Oct
Time

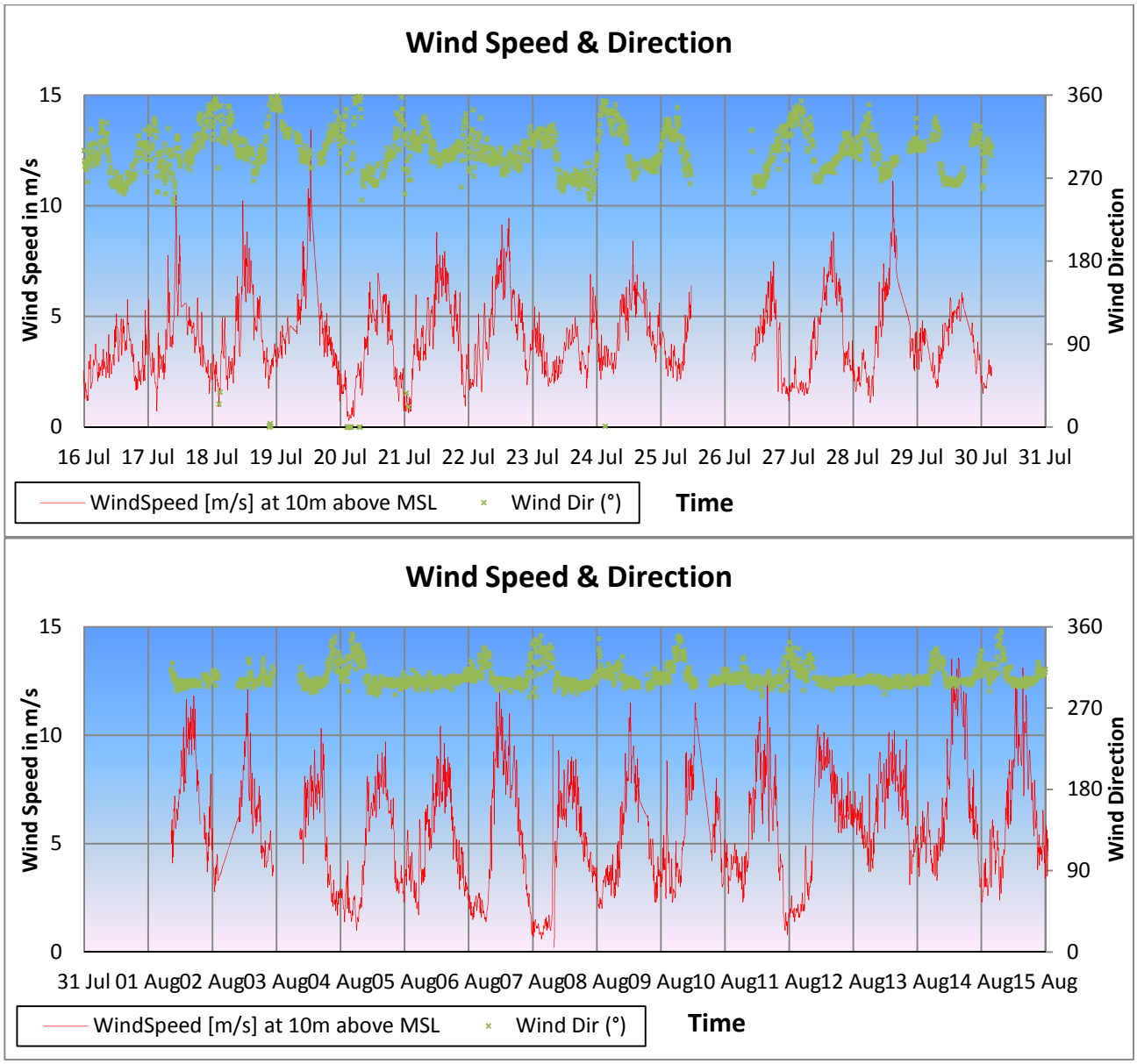
Annexure IV

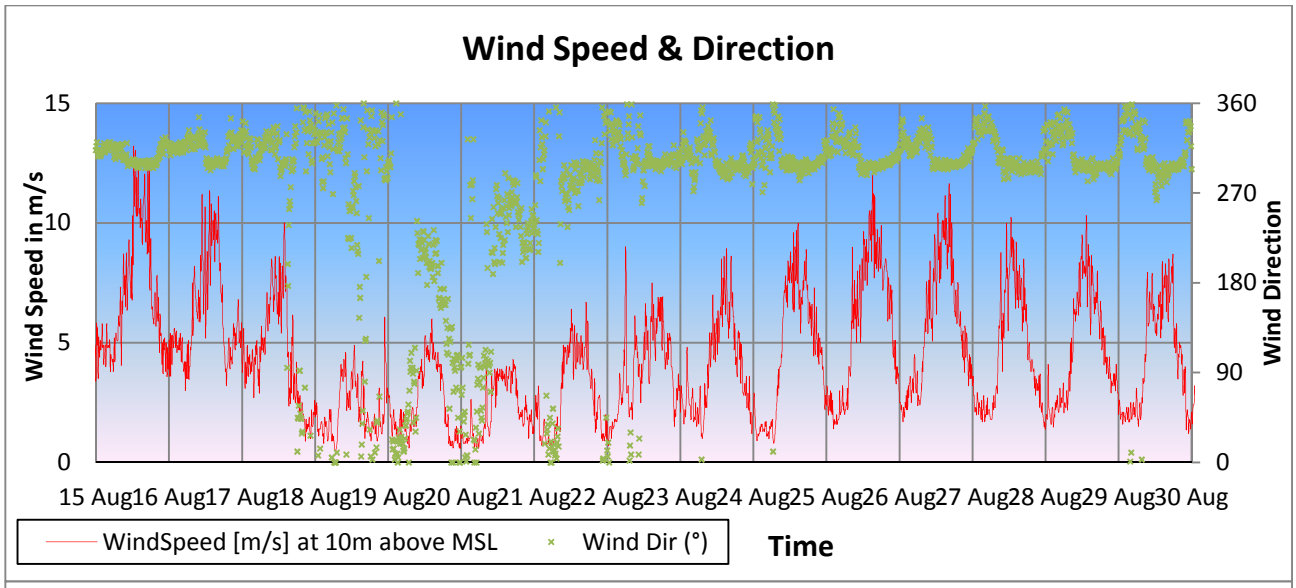
Met Data

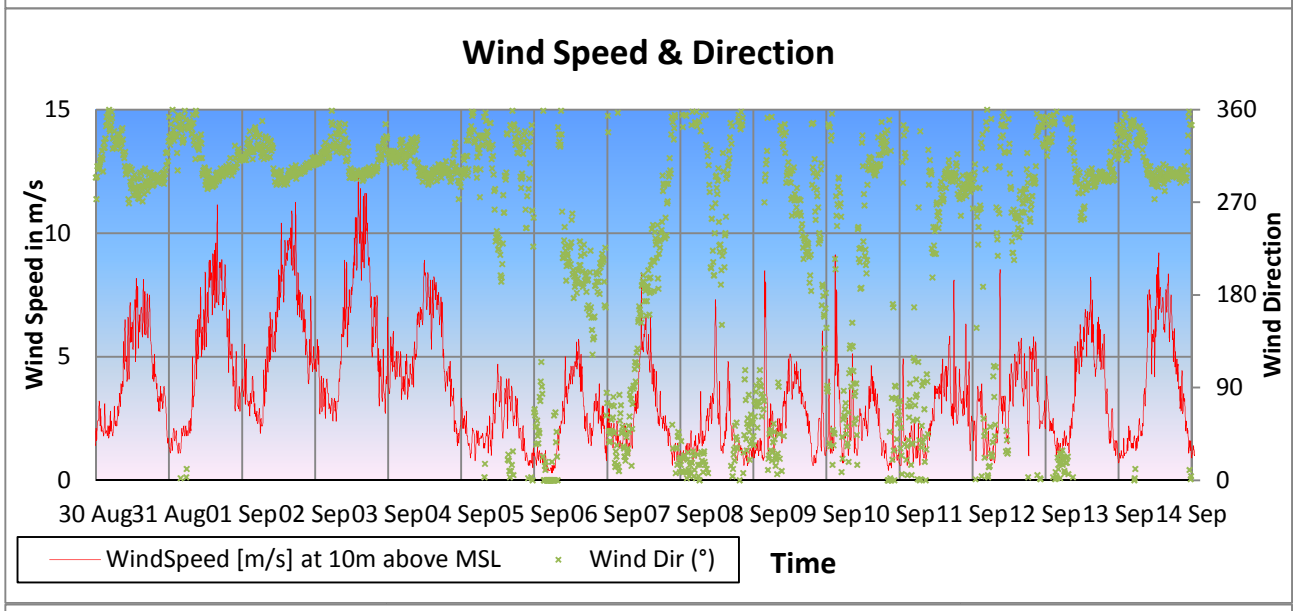

Wind Speed & Direction
Wind Speed in m/s
Wind Direction
15
10
5
0
360
270
180
90
0
01 Jun 02 Jun 03 Jun 04 Jun 05 Jun 06 Jun 07 Jun 08 Jun 09 Jun 10 Jun 11 Jun 12 Jun 13 Jun 14 Jun 15 Jun 16 Jun
WindSpeed [m/s] at 10m above MSL
Wind Dir (°)
Time

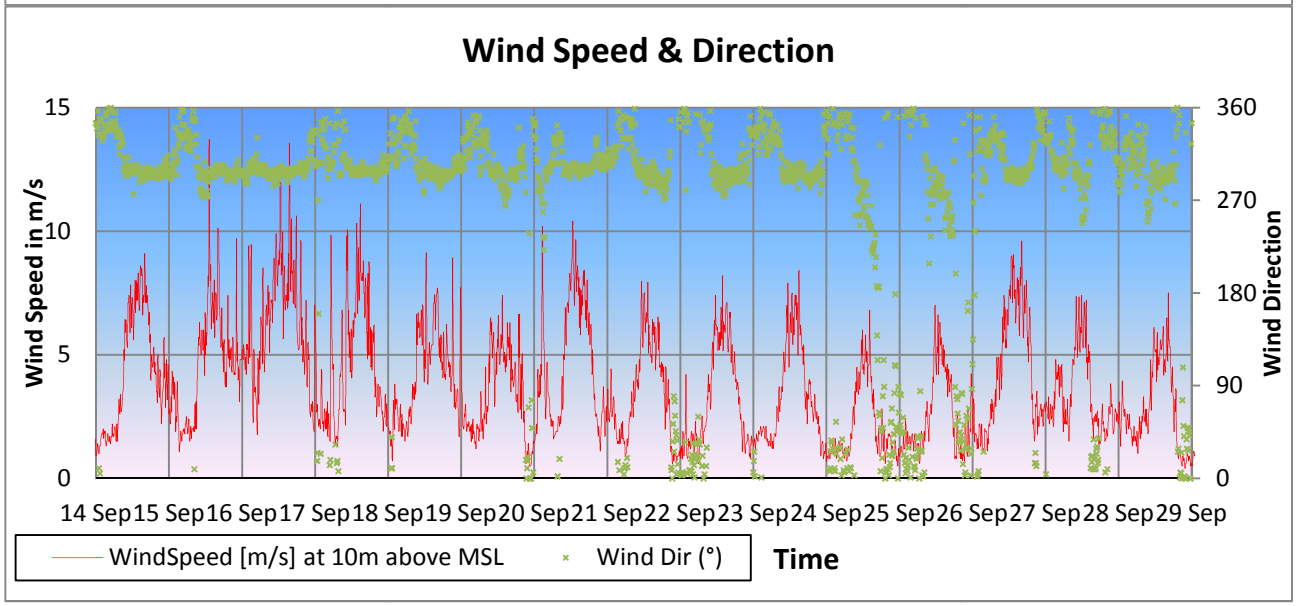

Wind Speed & Direction
Wind Speed in m/s
Wind Direction
15
10
5
0
360
270
180
90
0
16 Jun 17 Jun 18 Jun 19 Jun 20 Jun 21 Jun 22 Jun 23 Jun 24 Jun 25 Jun 26 Jun 27 Jun 28 Jun 29 Jun 30 Jun 01 Jul
WindSpeed [m/s] at 10m above MSL
Wind Dir (°)
Time

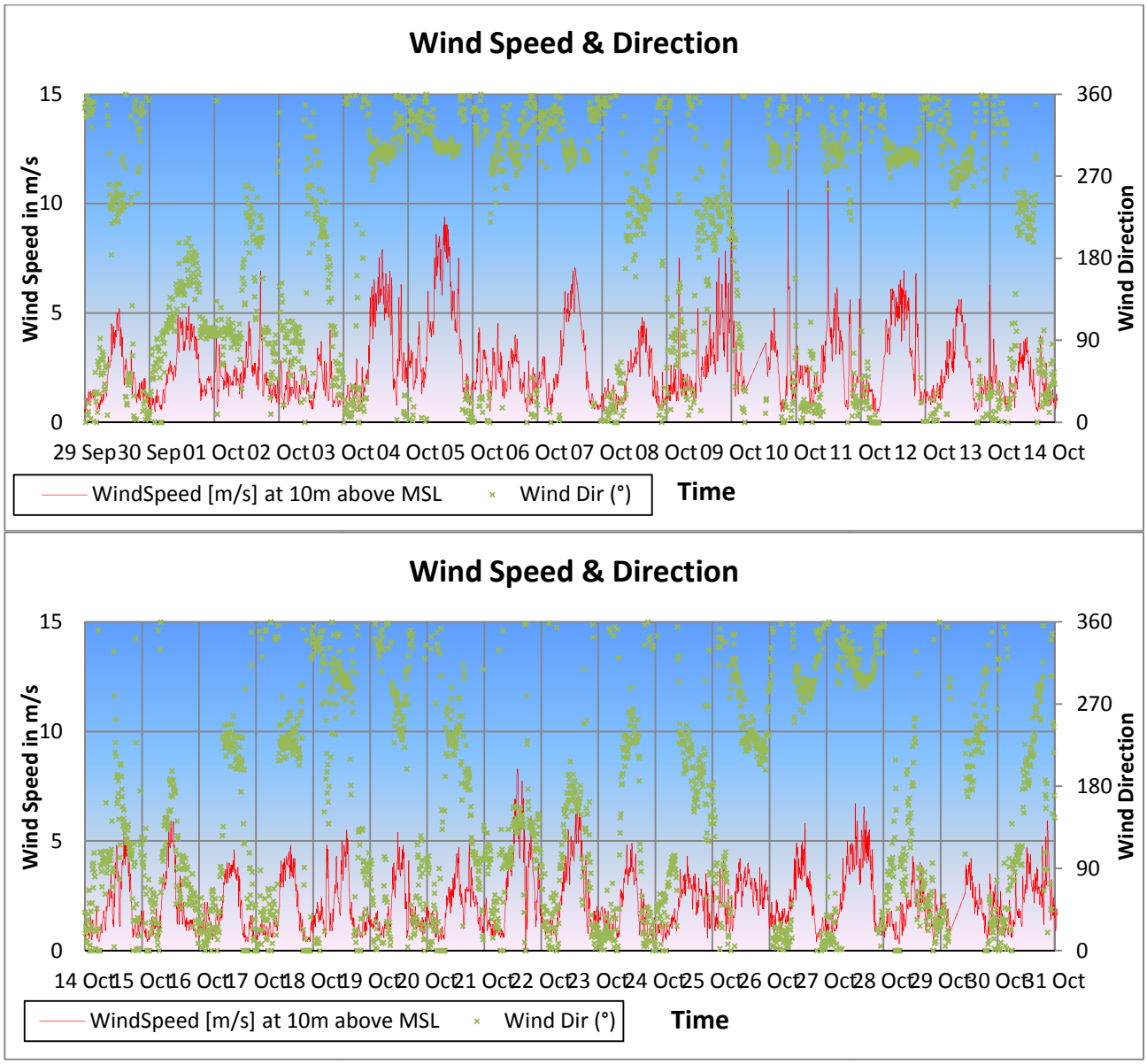

Wind Speed & Direction
Wind Speed in m/s
Wind Direction
15
10
5
0
360
270
180
90
0
01 Jul 02 Jul 03 Jul 04 Jul 05 Jul 06 Jul 07 Jul 08 Jul 09 Jul 10 Jul 11 Jul 12 Jul 13 Jul 14 Jul 15 Jul 16 Jul
WindSpeed [m/s] at 10m above MSL
Wind Dir (°)
Time


Wind Speed & Direction
Wind Speed in m/s
Wind Direction
15
10
5
0
360
270
180
90
0
16 Jul 17 Jul 18 Jul 19 Jul 20 Jul 21 Jul 22 Jul 23 Jul 24 Jul 25 Jul 26 Jul 27 Jul 28 Jul 29 Jul 30 Jul 31 Jul
WindSpeed [m/s] at 10m above MSL
Wind Dir (°)
Time
Wind Speed & Direction
Wind Speed in m/s
Wind Direction
15
10
5
0
360
270
180
90
0
31 Jul 01 Aug 02 Aug 03 Aug 04 Aug 05 Aug 06 Aug 07 Aug 08 Aug 09 Aug 10 Aug 11 Aug 12 Aug 13 Aug 14 Aug 15 Aug
WindSpeed [m/s] at 10m above MSL
Wind Dir (°)
Time


Wind Speed & Direction
Wind Speed in m/s
Wind Direction
15
10
5
0
360
270
180
90
0
15 Aug16 Aug17 Aug18 Aug19 Aug20 Aug21 Aug22 Aug23 Aug24 Aug25 Aug26 Aug27 Aug28 Aug29 Aug30 Aug
WindSpeed [m/s] at 10m above MSL
Wind Dir (°)
Time


Wind Speed & Direction
Wind Speed in m/s
Wind Direction
15
10
5
0
360
270
180
90
0
30 Aug31 Aug01 Sep02 Sep03 Sep04 Sep05 Sep06 Sep07 Sep08 Sep09 Sep10 Sep11 Sep12 Sep13 Sep14 Sep
WindSpeed [m/s] at 10m above MSL
Wind Dir (°)
Time


Wind Speed & Direction
Wind Speed in m/s
Wind Direction
15
10
5
0
360
270
180
90
0
14 Sep15 Sep16 Sep17 Sep18 Sep19 Sep20 Sep21 Sep22 Sep23 Sep24 Sep25 Sep26 Sep27 Sep28 Sep29 Sep
WindSpeed [m/s] at 10m above MSL
Wind Dir (°)
Time



Few data gaps in the data occurred when there was power failure for more than 5 hours, and the receiving computer system shut down.

Annexure V

LEO (June 2015)

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
23/06/2015	CSP 01	11:11	11:15	734877	914455	734895	914435	11.21	138	L	96	1.75	6	20	LEO plate moving towards south
23/06/2015	CSP 02	11:25	11:28	734481	914756	734553	914698	51.36	129	L	110	1.75	6	20	LEO plate moving towards south
23/06/2015	CSP 03	11:36	11:42	734139	914983	734221	914922	28.39	127	L	112	1.75	7.5	10	LEO plate moving towards south
23/06/2015	CSP 04	12:01	12:05	733659	915326	733723	915278	33.33	127	L	114	1.75	6	15	LEO plate moving towards south
23/06/2015	CSP 05	12:15									115	1.75	6	10	New sea wall laid
23/06/2015	CSP 06	12:30									110	1.75	6	10	New sea wall laid
23/06/2015	CSP 07	12:55									112	1.75	5	10	New sea wall laid
23/06/2015	CSP 08	13:00									116	1.75	5	10	New sea wall laid
23/06/2015	CSP 09	13:19									115	1.75	5	10	New sea wall laid
23/06/2015	CSP 10	13:32	13:42	731221	917091	731289	917040	14.17	127	L	118	1.75	5	10	LEO plate moving towards south, Speed in LEO plate is noticed
23/06/2015	CSP 11	14:00	14:10	730822	917380	731171	917125	72.04	126	L	119	1.75	5	10	LEO plate moving towards south, Speed in LEO plate is noticed
23/06/2015	CSP 12	14:25	14:34	730563	917571	730726	917450	37.59	127	L	117	1.75	5	10	LEO plate moving towards south, Speed in LEO plate is noticed
23/06/2015	CSP 13	14:44	14:51	730154	917874	730270	917788	34.38	127	L	120	1.75	5	10	LEO plate moving towards south, Speed in LEO plate is noticed
23/06/2015	CSP 14	15:01	15:06	729755	918174	729818	918123	27.02	129	L	121	1.75	5	10	LEO plate moving towards south, Speed in LEO plate is noticed

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
23/06/2015	CSP 15	15:15	15:21	729352	918470	729423	918423	23.65	124	L	118	1.75	5	10	LEO plate moving towards south, Speed in LEO plate is noticed
23/06/2015	CSP 16	15:30	15:33	728954	918746	729039	918690	56.55	123	L	117	1.75	5	10	LEO plate moving towards south, Speed in LEO plate is noticed
24/06/2015	CSP 17	09:57	10:08	728530	919089	728616	919001	18.64	136	L	98	2	7.5	20	
24/06/2015	CSP 18	10:11	10:19	728163	919405	728233	919351	18.42	128	L	93	2	7.5	20	Rip current noticed
24/06/2015	CSP 19	10:28	10:32	727761	919708	727829	919659	34.92	126	L	96	2	7.5	20	
24/06/2015	CSP 20	10:49	10:57	727370	919995	727444	919941	19.09	126	L	110	2	8.5	20	
24/06/2015	CSP 21	11:11	11:16	726963	920305	727052	920237	37.33	127	L	110	2	10	20	Rip current noticed
24/06/2015	CSP 22	11:40	11:43	726579	920611	726600	920595	14.67	127	L	106	2	8.5	20	
24/06/2015	CSP 23	11:56	12:02	726187	920932	726237	920890	18.14	130	L	110	2	10	20	
24/06/2015	CSP 24	12:24	12:33	725796	921259	725810	921248	3.30	128	L	106	2	10	20	Rip current noticed
24/06/2015	CSP 25	12:47	12:53	725433	921561	725518	921489	30.94	130	L	115	2	8.5	15	
24/06/2015	CSP 26	13:17	13:26	725028	921891	725078	921849	12.09	130	L	120	2	8.5	20	
24/06/2015	CSP 27	13:49	13:55	724633	922204	724717	922138	29.67	128	L	115	2	8.5	20	
24/06/2015	CSP 28	14:20	14:25	724254	922492	724354	922416	41.87	127	L	115	2	8.5	20	
24/06/2015	CSP 29	14:46	14:51	723856	922786	723947	922722	37.08	125	L	115	2	10	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
24/06/2015	CSP 30	15:10	15:15	723457	923067	723502	923037	18.03	124	L	106	2	10	20	
25/06/2015	CSP 31	08:36	08:40	723031	923372	723080	923335	25.58	127	L	112	1	7.5	20	
25/06/2015	CSP 32	08:55	09:01	722628	923652	722649	923638	7.01	124	L	113	1	7.5	20	
25/06/2015	CSP 33	09:37	09:42	722256	923899	722329	923852	28.94	123	L	112	1	7.5	20	
25/06/2015	CSP 34	09:54	09:59	721804	924159	721832	924143	10.75	120	L	111	1	8.5	20	
25/06/2015	CSP 35	10:20	10:25							L	113	1	8.5	10	Bay beach and high wave action. Turbulent wave noticed between the bay
25/06/2015	CSP 36	11:06	11:11	721058	924859	721106	924765	35.18	153	L	110	1	8.5	20	
25/06/2015	CSP 37	11:48	11:54	720863	925130	720895	925081	16.26	147	L	110	1	7	15	
25/06/2015	CSP 38	12:14	12:19	720594	925623	720603	925572	17.26	170	L	108	1	7	15	
25/06/2015	CSP 39	12:40									102	1	7	10	LEO not taken, due to rocks and high wave action
25/06/2015	CSP 40	13:04	13:09	719774	926407	719800	926383	11.79	133	L	96	1	10	10	
25/06/2015	CSP 41	14:03									98	1.5	7	10	Bay beach and high wave action. Turbulent wave noticed between the bay
25/06/2015	CSP 42	14:21	14:25	718011	927333	717991	927357	13.02	320	R	97	1.5	7	20	
25/06/2015	CSP 43	14:35	14:40	717801	927545	717758	927563	15.54	293	R	94	1.5	7	20	
25/06/2015	CSP 44	14:49	14:54	717537	927896	717491	927954	24.68	322	R	96	1.5	7	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
25/06/2015	CSP 45	15:05	15:10	717248	928537	717218	928488	19.15	211	L	93	1.5	7	20	
25/06/2015	CSP 46	15:17									94	1.5	7	10	LEO not taken due to Seawall
25/06/2015	CSP 47	15:30									110	1.5	7	10	LEO not taken due to Seawall
25/06/2015	CSP 48	15:53									109	2	7	10	LEO not taken due to Seawall
25/06/2015	CSP 49	16:01									112	2	7	10	LEO not taken due to Seawall
25/06/2015	CSP 50	16:11									112	2	7	10	LEO not taken due to Seawall
25/06/2015	CSP 51	16:20									113	2	7	10	LEO not taken due to Seawall
25/06/2015	CSP 52	16:24									112	2	7	10	LEO not taken due to Seawall
26/06/2015	CSP 53	09:40	09:49	715481	931964	715528	931915	12.54	136	L	112	1.5	8	20	
26/06/2015	CSP 54	10:07	10:18	715207	932290	715246	932234	10.29	146	L	113	1.5	8	15	
26/06/2015	CSP 55	10:30	10:35	714889	932684	714930	932630	22.42	142	L	110	1.5	8	15	
26/06/2015	CSP 56	10:49									112	1.5	8	10	LEO not taken due to Seawall
26/06/2015	CSP 57	11:03									108	1.5	8	10	LEO not taken due to Seawall
26/06/2015	CSP 58	11:24									111	1.5	8	10	LEO not taken due to Seawall
26/06/2015	CSP 59	11:41									114	1.5	8	10	LEO not taken due to Seawall
26/06/2015	CSP 60	11:57									116	2	7	10	LEO not taken due to Seawall

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
26/06/2015	CSP 61	12:08									115	2	7	10	LEO not taken due to Seawall
26/06/2015	CSP 62	12:25									108	2	7	10	LEO not taken due to Seawall
26/06/2015	CSP 63	12:31									110	2	7	15	LEO not taken due to Seawall
26/06/2015	CSP 64	13:12	13:14	711931	936083	711949	936049	32.35	151	L	111	2	6	15	
26/06/2015	CSP 65	13:26									113	2	6	10	LEO not taken due to Seawall
26/06/2015	CSP 66	13:50									112	2	6	10	LEO not taken due to Seawall
26/06/2015	CSP 67	14:02									113	2	6	15	LEO not taken due to Seawall
26/06/2015	CSP 68	14:12	14:16	710617	937562	710673	937492	37.51	141	L	114	2	6	15	Veli estuary influenced leo speed
26/06/2015	CSP 69	14:31	14:34	710273	937947	710323	937884	44.65	141	L	115	2	6	15	Veli estuary influenced leo speed
26/06/2015	CSP 70	14:45	14:49	709952	938306	710011	938234	38.85	140	L	114	2	6	15	Veli estuary influenced leo speed
26/06/2015	CSP 71	15:06	15:10	709823	938465	709885	938393	39.82	139	L	113	2	6	15	Veli estuary influenced leo speed
27/06/2015	CSP 72	08:43	08:47	709499	938842	709539	938800	24.17	136	L	99	1.5	8	20	Veli estuary influenced leo speed
27/06/2015	CSP 73	09:01	09:04	709174	939206	709237	939132	53.99	140	L	101	1.5	8	20	Veli estuary influenced leo speed
27/06/2015	CSP 74	09:34	09:46	708847	939585	708925	939490	17.07	141	L	108	1.5	8	20	Veli estuary influenced leo speed
27/06/2015	CSP 75	09:57	10:03	708514	939972	708618	939849	44.74	140	L	112	1.5	8	20	Veli estuary influenced leo speed
27/06/2015	CSP 76	10:19	10:22	708189	940357	708258	940268	62.56	142	L	113	1.5	7	20	Veli estuary influenced leo speed

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
27/06/2015	CSP 77	10:38	10:43	707876	940736	707961	940629	45.55	142	L	114	2	6	20	
27/06/2015	CSP 78	10:56	11:01	707501	941178	707570	941111	32.06	134	L	115	2	6	20	
27/06/2015	CSP 79	11:05	11:10	707248	941507	707343	941387	51.02	142	L	113	2	6	20	
27/06/2015	CSP 80	11:18	11:22	706937	941911	707008	941819	48.42	142	L	112	2	6	20	
27/06/2015	CSP 81	11:35	11:40	706628	942307	706700	942210	40.27	143	L	114	2	6	20	

LEO (July 2015)

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
18/07/2015	CSP 01	13:13	13:20	734811	914501	734854	914463	13.66	131	L	102	2	8	20	LEO plate moving towards south
18/07/2015	CSP 02	13:31	13:35	734436	914783	734582	914675	75.67	126	L	103	2	8	20	LEO plate moving towards south
18/07/2015	CSP 03	14:00									107	2	8	15	New sea wall laid
18/07/2015	CSP 04	14:17	14:20	733622	915362	733704	915296	58.48	129	L	108	2	8	20	New sea wall laid
18/07/2015	CSP 05	14:32									106	2	7	15	New sea wall laid
18/07/2015	CSP 06	15:39									108	2	7	15	New sea wall laid
18/07/2015	CSP 07	15:48									106	2	7	15	New sea wall laid
18/07/2015	CSP 08	16:11									107	2	7	15	New sea wall laid
18/07/2015	CSP 09	16:29	16:34	731544	916830	731584	916797	17.29	130	L	105	2	7	15	New sea wall laid
18/07/2015	CSP 10	16:42	16:47	731195	917102	731347	916992	62.54	126	L	107	2	7	15	LEO plate moving towards south, Speed in LEO plate is noticed
19/07/2015	CSP 11	08:49	08:53	730811	917371	730848	917349	17.94	121	L	97	1	7.5	20	
19/07/2015	CSP 12	09:04	09:09	730538	917574	730746	917411	88.09	128	L	99	1	7.5	20	heavy wind speed from northwest to north
19/07/2015	CSP 13	09:25	09:30	730128	917879	730258	917784	53.67	126	L	100	1	7.5	20	heavy wind speed from northwest to north

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
19/07/2015	CSP 14	09:45	09:50	729742	918179	729754	918159	7.77	149	L	106	1	7.5	20	heavy wind speed from northwest to north
19/07/2015	CSP 15	10:05	10:09	729347	918470	729445	918397	50.92	127	L	108	1	7	20	heavy wind speed from northwest to north
19/07/2015	CSP 16	10:35	10:40	729071	918655	729116	918619	19.21	129	L	109	1	7	20	heavy wind speed from northwest to north
19/07/2015	CSP 17	12:19	12:23	728528	919080	728580	919031	29.77	133	L	112	1.5	6	20	heavy wind speed from northwest to north
19/07/2015	CSP 18	12:40	12:44	728160	919386	728291	919284	69.18	128	L	114	1.5	6	20	heavy wind speed from northwest to north
20/07/2015	CSP 19	08:23	08:28	727763	919685	727805	919646	19.11	133	L	105	1.5	7.5	20	
20/07/2015	CSP 20	08:52	08:57	727359	919986	727412	919947	21.93	126	L	107	1.5	7.5	20	
20/07/2015	CSP 21	09:15	09:20	726962	920292	727033	920235	30.35	129	L	108	1.5	7.5	20	
20/07/2015	CSP 22	09:33	09:38	726567	920613	726629	920555	28.30	133	L	108	1.5	7.5	20	
20/07/2015	CSP 23	09:49	09:54	726186	920926	726229	920878	21.48	138	L	110	1.5	7.5	20	
20/07/2015	CSP 24	10:05	10:10	725792	921250	725915	921140	55.00	132	L	113	1.5	7.5	20	
20/07/2015	CSP 25	10:51	10:55	725410	921569	725482	921506	39.86	131	L	112	1.5	7.5	20	
20/07/2015	CSP 26	11:09	11:14	725029	921877	725180	921751	65.56	130	L	115	1.5	7.5	20	
20/07/2015	CSP 27	11:30	11:35	724627	922196	724718	922123	38.89	129	L	117	1.5	7.5	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
20/07/2015	CSP 28	11:49	11:54	724230	922497	724349	922413	48.55	125	L	113	1.5	7.5	20	
20/07/2015	CSP 29	12:07	12:12	723836	922788	723878	922759	17.01	125	L	110	1.5	7.5	20	
20/07/2015	CSP 30	12:28	12:33	723451	923062	723542	923001	36.52	124	L	115	1.5	7.5	20	
20/07/2015	CSP 31	12:49	12:54	723039	923354	723119	923296	32.94	126	L	113	1.5	7.5	20	
20/07/2015	CSP 32	13:08	13:13	722618	923651	722724	923585	41.62	122	L	117	1.5	7.5	20	
20/07/2015	CSP 33	13:35	13:40	722246	923926	722323	923863	33.16	129	L	115	1.5	7.5	20	
20/07/2015	CSP 34	13:52	13:58	721821	924218	721854	924180	13.98	139	L	114	1.5	7.5	20	
21/07/2015	CSP 35	10:40									106	1.5	8	20	
21/07/2015	CSP 36	11:11	11:17	721065	924820	721100	924767	17.64	147	L	102	1.5	7	20	
21/07/2015	CSP 37	11:54	11:59	720862	925125	720882	925097	11.47	144	L	104	1.5	7	20	
21/07/2015	CSP 38	12:31	12:33	720582	925638	720602	925594	40.28	156	L	104	1.5	7	20	
21/07/2015	CSP 39	13:01									106	1.5	8	20	
21/07/2015	CSP 40	13:20	13:27	719719	926452	719789	926408	19.69	122	L	104	1.5	7	20	
22/07/2015	CSP 41	08:27	08:32	718468	926932	718484	926903	11.04	151	L	106	0.75	10	15	
22/07/2015	CSP 42	08:41	846	718001	927340	717983	927364	2.63	323	L	86	0.75	10	20	
22/07/2015	CSP 43	08:52	08:55	717801	927547	717757	927562	25.83	289	L	88	0.75	10	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
22/07/2015	CSP 44	09:01	09:04	717562	927845	717531	927906	38.01	333	L	96	0.75	10	20	
22/07/2015	CSP 45	09:17	09:21	717242	928553	717264	928588	17.23	32	L	87	0.75	10	20	
22/07/2015	CSP 46	09:29	09:33	717244	928897	717244	928902	2.08	0	L	94	0.75	10	15	LEO not taken due to Seawall
22/07/2015	CSP 47	09:45									106	0.75	10	15	LEO not taken due to Seawall
22/07/2015	CSP 48	10:05									104	0.75	10	15	LEO not taken due to Seawall
22/07/2015	CSP 49	10:13									107	0.75	10	15	LEO not taken due to Seawall
22/07/2015	CSP 50	10:23									112	0.75	10	15	LEO not taken due to Seawall
22/07/2015	CSP 51	10:36									119	0.75	10	15	LEO not taken due to Seawall
22/07/2015	CSP 52	10:45									106	0.75	10	15	LEO not taken due to Seawall
22/07/2015	CSP 53	11:30	11:35	715336	932121	715447	931991	56.98	140	L	98	0.75	10	20	
22/07/2015	CSP 54	11:44	11:48	715205	932304	715256	932234	36.09	144	L	111	0.75	10	20	
22/07/2015	CSP 55	11:53	11:58	714900	932707	714977	932589	46.97	147	L	109	0.75	10	20	
22/07/2015	CSP 56	12:00	12:05								114	0.75	10	10	
22/07/2015	CSP 57	12:23									110	0.75	10	10	
22/07/2015	CSP 58	13:06									108	1	10	10	
22/07/2015	CSP 59	13:10									106	1	8	10	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
22/07/2015	CSP 60	13:20									112	1	8	10	
22/07/2015	CSP 61	13:43									109	1	7.5	10	
22/07/2015	CSP 62	13:57									106	1	7.5	10	
22/07/2015	CSP 63	14:06									108	1	7.5	10	
22/07/2015	CSP 64	14:25	14:28	711946	936075	711960	936065	9.56	126	L	112	1	7.5	10	
22/07/2015	CSP 65	14:35									110	1	7.5	15	
22/07/2015	CSP 66	14:58	15:01	711284	936833	711328	936773	41.34	144	L	112	1	7.5	15	
22/07/2015	CSP 67	15:15	15:20	710940	937215	711034	937113	46.24	137	L	114	1	7.5	15	
22/07/2015	CSP 68	15:30	15:35	710601	937595	710645	937550	20.98	136	L	109	1	7.5	20	
22/07/2015	CSP 69	15:40	15:43	710283	937951	710314	937916	25.97	138	L	110	1	7.5	20	
22/07/2015	CSP 70	15:50	15:55	709952	938331	710019	938246	36.08	142	L	112	1	7.5	20	
22/07/2015	CSP 71	16:13	16:18	709816	938482	709901	938372	46.34	142	L	109	1	7.5	20	
22/07/2015	CSP 72	16:19	16:23	709490	938842	709559	938768	42.16	137	L	106	1	7.5	20	
22/07/2015	CSP 73	16:33	16:36	709136	939245	709180	939190	39.13	141	L	112	1	7.5	20	
22/07/2015	CSP 74	16:56	16:59	708813	939611	708866	939548	45.74	140	L	109	1.5	7.5	20	
22/07/2015	CSP 75	17:08	17:12	708481	940000	708547	939916	44.51	142	L	110	1.5	7.5	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
22/07/2015	CSP 76	17:16	17:20	708159	940381	708243	940293	50.69	136	L	112	1.5	7.5	20	
22/07/2015	CSP 77	17:24	17:29	707870	940741	707932	940660	34.00	143	L	108	1.5	7.5	20	
22/07/2015	CSP 78	17:33	17:39	707550	941127	707606	941047	27.13	145	L	106	1.5	7.5	20	
22/07/2015	CSP 79	17:41	17:45	707233	941523	707295	941431	46.23	146	L	104	1.5	7.5	20	
22/07/2015	CSP 80	17:49	17:53	706915	941933	706992	941828	54.25	144	L	103	1.5	7.5	20	

LEO (August 2015)

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
31/08/2015	CSP 01	14:24	14:27	734806	914509	734902	914434	67.68	128	L	104	1.75	12	15	
31/08/2015	CSP 02	15:04	15:08	734468	914748	734501	914709	21.29	140	L	102	2	12	15	
31/08/2015	CSP 03	15:55	15:59	734066	915019	734119	914933	42.09	148	L	104	1.75	10	15	
31/08/2015	CSP 04	16:38	16:42	733604	915319	733707	915243	53.34	126	L	100	1.75	10	15	
31/08/2015	CSP 05	16:52	16:57	733250	915612	733297	915580	18.95	124	L	106	1.75	10	15	
31/08/2015	CSP 06	17:06	17:10	732847	915904	732899	915862	27.85	129	L	107	1.75	10	15	
31/08/2015	CSP 07	17:18	17:22	732443	916204	732514	916149	37.42	128	L	109	1.75	10	15	
31/08/2015	CSP 08	17:40	17:45	732044	916495	732119	916433	32.44	130	L	111	1.75	10	15	
01/09/2015	CSP 09	10:32	10:37	731625	916778	731536	916865	41.49	314	R	87	1.75	8	15	
01/09/2015	CSP 10	10:46	10:51	731228	917086	731125	917158	41.89	305	R	86	1.75	8	15	
01/09/2015	CSP 11	11:00	11:05	730822	917386	730659	917501	66.49	305	R	83	1.75	8	15	
01/09/2015	CSP 12	11:13	11:19	730461	917574	730242	917813	90.05	318	R	85	1.75	8	15	
01/09/2015	CSP 13	11:35	11:40	730159	917883	730001	918005	66.54	308	R	87	1.75	8	15	
01/09/2015	CSP 15	12:02	12:07	729333	918484	729207	918568	50.48	304	R	82	1.75	8	15	
01/09/2015	CSP 16	12:22	12:27	728920	918760	728788	918864	56.02	308	R	85	1.75	8	15	
01/09/2015	CSP 17	12:47	12:53	728553	919072	728430	919180	45.47	311	R	86	1.75	8	15	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
01/09/2015	CSP 18	13:09	13:14	728175	919392	728068	919480	46.18	309	R	84	1.75	8	15	
01/09/2015	CSP 19	13:21	13:25	727772	919692	727664	919763	53.85	303	R	87	1.75	8	15	
01/09/2015	CSP 20	13:41	13:47	727373	919986	727230	920106	51.86	310	R	83	1.75	8	15	
01/09/2015	CSP 21	16:29	16:34	726979	920297	726855	920400	53.73	310	R	92	1.75	8	20	
01/09/2015	CSP 22	16:45	16:50	726592	920620	726476	920696	46.23	303	R	94	1.75	8	20	
01/09/2015	CSP 23	16:55	17:00	726197	920929	726053	921048	62.27	310	R	93	2.25	8	20	
01/09/2015	CSP 24	17:10	17:15	725798	921269	725702	921345	40.81	308	R	92	1.75	8	20	
01/09/2015	CSP 25	17:28	17:33	725377	921611	725251	921725	56.64	312	R	94	1.75	8	20	
01/09/2015	CSP 26	17:44	17:49	725046	921880	724892	922004	65.91	309	R	93	1.75	8	20	
01/09/2015	CSP 27	18:08	18:13	724632	922200	724511	922303	52.97	310	R	95	2.25	8	20	
01/09/2015	CSP 28	18:26	18:32	724249	922496	724158	922570	32.58	309	R	95	2.25	8	20	
02/09/2015	CSP 29	11:14	11:19	723852	922788	723987	922690	55.61	126	R	95	1.75	10	20	
02/09/2015	CSP 30	11:34	11:40	723463	923069	723462	923069	0.28	270	R	98	1.75	10	20	
02/09/2015	CSP 31	11:53	11:59	723046	923364	722988	923400	18.96	302	R	96	1.75	10	20	
02/09/2015	CSP 32	12:14	12:20	722634	923660	722678	923627	15.28	127	L	100	1.75	8	20	
02/09/2015	CSP 33	13:07	13:13	722257	923941	722219	923968	12.95	305	R	88	1.75	8	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
02/09/2015	CSP 34	13:24	13:29	721821	924221	721774	924252	18.77	303	R	97	1.75	8	20	
02/09/2015	CSP 35										102	1.75	8	15	
02/09/2015	CSP 36	15:59	16:03	721100	924818	721142	924770	26.58	139	L	102	1.75	8	20	
02/09/2015	CSP 37	16:22	16:27	720791	925164	720835	925120	20.74	135	L	102	1.75	8	20	
02/09/2015	CSP 38	16:54	16:57	720591	925641	720614	925578	37.26	160	L	102	1.75	8	20	
02/09/2015	CSP 39									L	102	1.75	8	20	
02/09/2015	CSP 40	17:45	17:50	719812	926381	719767	926402	16.55	295	L	100	1.75	8	20	
03/09/2015	CSP 41	10:00	10:05	718473	926914	718473	926914	0.00	180	L	98	1.75	8	20	
03/09/2015	CSP 42	10:25	10:27	718033	927283	718016	927298	18.89	311	L	89	1.25	7	20	
03/09/2015	CSP 43	10:40	10:47	717795	927540	717730	927570	17.05	295	L	88	1.25	7	20	
03/09/2015	CSP 44	11:13	11:17	717511	927903	717514	927898	2.43	149	L	98	1.25	7	20	
03/09/2015	CSP 45	11:40	11:46	717235	928532	717238	928535	1.18	45	L	98	1.25	6	20	
03/09/2015	CSP 46	12:40	12:43	717231	928888	717234	928876	6.87	166	L	98	1.25	6	20	
03/09/2015	CSP 47									L	102	1.75	8	15	Seawall
03/09/2015	CSP 48									L	100	1.75	8	15	Seawall
03/09/2015	CSP 49									L	102	1.75	7	15	Seawall

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
03/09/2015	CSP 50									L	100	1.75	7	15	Seawall
03/09/2015	CSP 51									L	100	1.75	7	15	Seawall
03/09/2015	CSP 52									L	100	1.75	7	15	Seawall
04/09/2015	CSP 53	10:24	10:35	715487	931911	715470	931934	4.33	324	R	89	1.75	8	20	
04/09/2015	CSP 54	10:58	11:05	715198	932296	715186	932313	4.95	325	R	88	1.75	8	20	
04/09/2015	CSP 55	11:27	11:34	714888	932688	714871	932706	5.89	317	R	88	1.75	8	20	
04/09/2015	CSP 56									R	87	1.75	8	15	Seawall
04/09/2015	CSP 57	12:18	12:20	714198	933404	714203	933399	5.89	135	R	88	1.75	7	15	
04/09/2015	CSP 58										89	1.75	8	15	Seawall
04/09/2015	CSP 59										100	1.75	7	15	Seawall
04/09/2015	CSP 60	15:44	15:50	713273	934586	713268	934590	1.78	309	R	89	1.75	7	15	
04/09/2015	CSP 61									R	89	1.75	7	15	Seawall
04/09/2015	CSP 62	17:36	17:40	712609	935337	712598	935345	5.67	306	R	88	1.75	7	15	
04/09/2015	CSP 63									R	89	1.75	7	15	Seawall
04/09/2015	CSP 64	18:00	18:05	711932	936065	711927	936070	2.36	315	R	89	1.75	7	15	
05/09/2015	CSP 65	09:33	09:38	711602	936444	711588	936464	8.14	325	R	87	1.75	8	15	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
05/09/2015	CSP 66	09:53	10:03	711276	936822	711241	936858	8.37	316	R	88	1.75	8	15	
05/09/2015	CSP 67	10:22	10:27	710943	937194	710895	937239	21.93	313	R	89	1.75	8	15	
05/09/2015	CSP 68	10:51	10:56	710618	937554	710605	937570	6.87	321	R	88	1.75	8	15	Fishing Activity
05/09/2015	CSP 69	11:03	11:09	710279	937936	710268	937952	5.39	325	R	89	1.75	8	20	
05/09/2015	CSP 70	11:24	11:30	709945	938313	709938	938317	2.24	300	R	89	1.75	7	20	
05/09/2015	CSP 71	11:41	11:47	709822	938450	709815	938455	2.39	306	R	89	1.75	7	20	
05/09/2015	CSP 72	12:00	12:06	709489	938827	709453	938861	13.75	313	R	88	1.75	7	20	
05/09/2015	CSP 73	12:19	12:27	709156	939203	709108	939252	14.29	316	R	88	1.75	7	15	
05/09/2015	CSP 74	13:04	13:10	708827	939575	708767	939645	25.61	319	R	89	1.75	8	15	
05/09/2015	CSP 75	13:34	13:39	708500	939955	708491	939965	4.48	318	R	88	1.75	8	15	
05/09/2015	CSP 76	15:54	16:03	708178	940347	708153	940376	7.09	319	R	89	1.75	8	15	
05/09/2015	CSP 77	16:15	16:20	707861	940726	707846	940750	9.43	328	R	88	1.75	8	15	
05/09/2015	CSP 78	16:35	16:38	707538	941110	707527	941121	8.64	315	R	87	1.75	7	15	
05/09/2015	CSP 79	16:48	16:52	707230	941501	707221	941514	6.59	325	R	89	1.75	8	15	
05/09/2015	CSP 80	17:03	17:09	706922	941895	706908	941931	10.73	339	R	89	1.75	8	15	
05/09/2015	CSP 81	17:19	17:23	706616	942291	706599	942305	9.18	309	R	88	1.75	8	15	

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Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
01/10/2015	CSP 01	13:26	13:31	734877	914450	734822	914487	22.10	304	R	110	0.75	8	15	
01/10/2015	CSP 02	13:41	13:49	734528	914695	734427	914768	25.96	306	R	112	0.75	8	20	
01/10/2015	CSP 03	13:50	13:59	734229	914908	734032	915035	43.41	303	R	109	0.75	8	20	
01/10/2015	CSP 04	14:05	14:10	733691	915284	733634	915323	23.02	304	R	110	0.75	8	20	
01/10/2015	CSP 05	14:20	14:25	733266	915594	733193	915642	29.12	303	R	108	0.75	8	20	
01/10/2015	CSP 06	14:35	14:40	732858	915891	732812	915921	18.31	303	R	109	0.75	8	20	
01/10/2015	CSP 07	14:50	14:55	732459	916188	732413	916211	17.14	297	R	110	0.75	8	20	
01/10/2015	CSP 08	15:02	15:12	732038	916486	731917	916588	26.38	310	R	107	0.75	8	20	
01/10/2015	CSP 09	15:18	15:23	731647	916769	731582	916814	26.35	305	R	106	0.75	8	15	
01/10/2015	CSP 10	15:28	15:33	731244	917063	731191	917103	22.13	307	R	110	0.75	8	20	
01/10/2015	CSP 11	15:40	15:45	730834	917356	730749	917421	35.67	307	R	110	0.75	8	20	
01/10/2015	CSP 12	15:53	15:58	730570	917552	730528	917586	18.01	309	R	110	0.75	8	20	
02/10/2015	CSP 13	8:02	8:07	730161	917858	730123	917880	14.64	300	R	109	0.75	8	20	
02/10/2015	CSP 14	8:23	8:28	729773	918142	729692	918204	34.00	307	R	110	0.75	8	27	
02/10/2015	CSP 15	8:35	8:40	729353	918441	729316	918470	15.67	308	R	110	0.75	8	27	
02/10/2015	CSP 16	8:53	8:58	728949	918709	728905	918737	17.38	302	R	110	0.75	8	27	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
02/10/2015	CSP 17	9:11	9:16	728562	919049	728524	919082	16.78	311	R	108	0.75	8	27	
02/10/2015	CSP 18	9:26	9:31	728181	919358	728144	919388	15.88	309	R	100	0.75	8	27	
02/10/2015	CSP 19	9:47	9:52	727781	919669	727729	919707	21.47	306	R	100	0.75	8	27	
02/10/2015	CSP 20	10:03	10:08	727383	919968	727336	920003	19.53	307	R	100	0.75	8	27	
02/10/2015	CSP 21	10:20	10:25	726989	920262	726910	920325	33.68	309	R	110	0.75	8	27	
02/10/2015	CSP 22	10:39	10:44	726601	920575	726558	920609	18.27	308	R	109	0.75	8	27	
02/10/2015	CSP 23	11:00	11:05	726198	920913	726156	920941	16.83	304	R	110	0.75	8	27	
02/10/2015	CSP 24	11:16	11:21	725638	921386	725592	921419	18.87	306	R	108	0.75	8	27	
05/10/2015	CSP 25	10:05	10:12	725419	921568	725339	921633	24.54	309	R	95	0.75	8	20	
05/10/2015	CSP 26	10:21	10:26	725032	921885	724874	921946	56.46	291	R	100	0.75	8	20	
07/10/2015	CSP 27	7:51	7:56	724648	922193	724572	922248	31.27	306	R	105	1.25	8	20	
07/10/2015	CSP 28	8:20	8:25	724250	922502	724104	922539	50.21	284	R	102	1.25	8	20	
07/10/2015	CSP 29	8:36	8:44	723855	922789	723724	922883	33.59	306	R	104	1.25	8	20	
07/10/2015	CSP 30	8:48	8:55	723466	923065	723340	923156	37.01	306	R	106	1.25	8	20	
07/10/2015	CSP 31	9:09	9:14	723047	923361	722986	923406	25.27	306	R	103	1.25	8	20	
07/10/2015	CSP 32	10:00	10:08	722635	923659	722527	923735	27.51	305	R	106	1.25	8	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
07/10/2015	CSP 33	10:28	10:34	722247	923936	722194	923968	17.20	301	R	107	1.25	8	20	
07/10/2015	CSP 34	10:38	10:43	721823	924204	721778	924218	15.71	287	R	105	1.25	8	20	
07/10/2015	CSP 35														Rocky area
07/10/2015	CSP 36	13:48	13:53	721115	924810	721092	924831	10.38	312	R	106	1.25	8	20	
07/10/2015	CSP 37	14:04	14:05	720809	925151	720778	925166	57.40	296	R	105	1.25	8	20	
07/10/2015	CSP 38	14:32	14:37	720603	925614	720591	925627	5.90	317	R	103	1.25	8	20	
07/10/2015	CSP 39														Rocky area
07/10/2015	CSP 40	15:03	18:08	719811	926384	719770	926409	16.01	301	R	102	1.25	8	20	
07/10/2015	CSP 41	15:34	15:41	718524	926889	718508	926896	4.16	294	R	102	1.25	8	15	
10/10/2015	CSP 42	9:43	9:47	718524	926889	718507	926900	8.44	303	R	100	1.25	9	10	
10/10/2015	CSP 43	9:56	10:00	717802	927539	717777	927550	11.38	294	R	95	1.25	8	10	
10/10/2015	CSP 44	10:06	10:10	717514	927901	717500	927921	10.17	325	R	100	1.25	7	10	
10/10/2015	CSP 45	10:24	10:30	717228	928527	717255	928598	21.10	21	R	95	1.25	9	10	
10/10/2015	CSP 46	10:39	10:42	717233	928881	717217	928923	24.97	339	R	100	1.75	8	10	
10/10/2015	CSP 47										90	1.75	9	10	Seawall
10/10/2015	CSP 48										95	1.75	8	10	Seawall

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
10/10/2015	CSP 49										100	1.75	9	10	Seawall
10/10/2015	CSP 50										100	1.75	9	10	Seawall
10/10/2015	CSP 51										100	1.75	9	10	Seawall
10/10/2015	CSP 52										95	2	8	10	Seawall
11/10/2015	CSP 53	12:33	12:37	715407	931913	715389	931959	20.58	339	R	100	2	8	10	
11/10/2015	CSP 54	12:50	12:55	715159	932249	715135	932286	14.70	327	R	105	1.75	8	10	
11/10/2015	CSP 55	13:07	13:12	714843	932660	714836	932676	5.82	336	R	110	1.75	8	10	
11/10/2015	CSP 56										95	1.25	8	10	Seawall
11/10/2015	CSP 57										100	1.25	8	10	Seawall
11/10/2015	CSP 58										95	1.25	8	10	Seawall
11/10/2015	CSP 59										100	1.75	8	10	Seawall
12/10/2015	CSP 60										95	1	8	15	Seawall
12/10/2015	CSP 61										100	1.5	8	20	Seawall
12/10/2015	CSP 62										95	1.5	8	20	Seawall
12/10/2015	CSP 63										95	1.5	8	20	Seawall
12/10/2015	CSP 64	9:21	9:25	711957	936048	711933	936076	15.37	319	R	100	1.5	9	25	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
12/10/2015	CSP 65	9:40	9:45	711618	936441	711584	936473	15.56	313	R	95	1.5	8	20	
12/10/2015	CSP 66	9:57	10:01	711279	936815	711241	936858	23.91	319	R	95	1.5	7	20	
12/10/2015	CSP 67	10:12	10:19	710941	937200	710909	937234	11.12	317	R	95	1.5	8	20	
12/10/2015	CSP 68	10:42	10:47	710610	937562	710550	937635	31.50	321	R	100	1.5	8	20	
12/10/2015	CSP 69	11:00	11:05	710280	937935	710215	938010	33.08	319	R	100	1.5	8	20	
12/10/2015	CSP 70	11:15	11:20	709951	938311	709887	938375	30.17	315	R	100	1.5	8	20	
12/10/2015	CSP 71	11:27	11:32	709826	938452	709760	938522	32.07	317	R	100	1.5	8	20	
12/10/2015	CSP 72	13:25	13:30	709482	938832	709408	938922	38.84	321	R	95	1.5	8	20	
12/10/2015	CSP 73	13:39	13:44	709151	939199	709092	939274	31.81	322	R	100	1.5	8	20	
12/10/2015	CSP 74	13:53	13:58	708823	939579	708801	939608	12.13	323	R	95	1.5	8	20	
12/10/2015	CSP 75	14:12	14:16	708502	939958	708467	940002	23.43	321	R	95	1.5	8	20	
12/10/2015	CSP 76	14:30	14:35	708178	940339	708143	940376	16.98	317	R	100	1.5	8	20	
12/10/2015	CSP 77	14:49	14:54	707857	940721	707829	940753	14.17	319	R	100	1.5	8	20	
12/10/2015	CSP 78	15:10	15:15	707450	941062	707422	941196	45.63	348	R	110	1.5	8	20	
12/10/2015	CSP 79	15:27	15:32	707194	941484	707111	941614	51.41	327	R	112	1.5	8	20	
12/10/2015	CSP 80	15:40	15:45	706882	941878	706795	942011	52.98	327	R	114	1.5	8	20	
12/10/2015	CSP 81	15:53	15:58	706590	942275	706511	942358	38.20	316	R	112	1.5	8	20	

LEO (October 2015)

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
01/11/2015	CSP 01	9:34	9:40	734838	914435	734807	914453	9.96	300	R	110	0.75	6	5	Seawall
01/11/2015	CSP 02	10:00	10:05	734491	914680	734435	914718	22.56	304	R	112	0.75	6	15	
01/11/2015	CSP 03	10:17	10:22	734037	915010	733990	915034	17.59	297	R	114	0.75	6	15	
01/11/2015	CSP 04	10:31	10:36	733654	915292	733605	915326	19.88	305	R	110	0.75	6	15	
01/11/2015	CSP 05	10:50	10:55	733223	915600	733155	915652	28.53	307	R	112	0.75	6	15	
03/11/2015	CSP 06	9:55	10:02	732828	915882	732776	915914	14.54	302	R	105	0.75	6	20	
03/11/2015	CSP 07	10:10	10:15	732436	916178	732369	916221	26.54	303	R	110	0.75	6	20	
03/11/2015	CSP 08	10:25	10:31	732020	916480	731898	916554	39.64	301	R	112	0.75	6	20	
03/11/2015	CSP 09	10:40	10:45	731604	916779	731535	916838	30.26	311	R	110	0.75	6	20	
03/11/2015	CSP 10	10:54	11:02	731201	917084	731101	917150	24.96	303	R	112	0.75	6	20	
03/11/2015	CSP 11	11:05	11:10	730821	917370	730749	917421	29.41	305	R	114	0.75	6	20	
03/11/2015	CSP 12	11:20	11:26	730556	917570	730468	917635	30.39	306	R	112	0.75	6	20	
03/11/2015	CSP 13	11:31	11:37	730151	917866	730061	917935	31.50	307	R	105	0.75	6	20	
03/11/2015	CSP 14	11:49	11:58	729753	918177	729628	918250	26.81	300	R	110	0.75	6	20	
03/11/2015	CSP 15	12:10	12:17	729345	918466	729280	918505	18.05	301	R	112	0.75	6	20	
03/11/2015	CSP 16	12:25	12:30	728925	918727	728846	918766	29.37	296	R	110	1	6	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
03/11/2015	CSP 17	13:49	13:51	728566	919074	728459	919165	117.05	310	R	110	1	8	20	
03/11/2015	CSP 18	14:09	14:14	728166	919390	728032	919483	54.37	305	R	112	1	8	20	
03/11/2015	CSP 19	14:20	14:26	727761	919684	727679	919744	28.22	306	R	110	1	8	20	
03/11/2015	CSP 20	14:36	14:40	727359	919984	727290	920035	35.75	306	R	112	1	8	20	
04/11/2015	CSP 21	12:15	12:21	726960	920281	726890	920334	24.39	307	R	113	1	8	20	
04/11/2015	CSP 22	12:00	12:05	726575	920597	726491	920655	34.03	305	R	110	1	8	20	
04/11/2015	CSP 23	13:45	13:50	726179	920920	726117	920960	24.59	303	R	108	1	8	20	
04/11/2015	CSP 24	14:30	14:35	725806	921238	725736	921284	27.92	303	R	110	1	8	20	
04/11/2015	CSP 25	14:45	14:50	725412	921556	725329	921616	34.14	306	R	112	1	8	20	
04/11/2015	CSP 26	11:00	11:05	725033	921870	724952	921928	33.21	306	R	112	1	8	20	
04/11/2015	CSP 27	10:48	10:53	724636	922188	724557	922247	32.87	307	R	110	1	8	20	
06/11/2015	CSP 28	15:00	15:05	724190	922501	724141	922524	18.04	295	R	110	1	8	20	
06/11/2015	CSP 29	15:12	15:17	723811	922790	723739	922827	26.98	297	R	112	1	8	20	
06/11/2015	CSP 30	15:18	15:23	723434	923060	723380	923088	20.28	297	R	110	1	8	20	
06/11/2015	CSP 31	15:31	15:36	723015	923366	722956	923405	23.57	303	R	112	1	8	20	
06/11/2015	CSP 32	15:45	15:50	722609	923653	722560	923679	18.49	298	R	113	1	8	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
06/11/2015	CSP 33	15:50	15:55	722224	923881	722171	923908	19.83	297	R	109	1	8	15	
06/11/2015	CSP 34	16:00	16:05	721748	924122	721685	924158	24.19	300	R	110	1	8	15	
06/11/2015	CSP 35										95	1	8	5	Rocky area
06/11/2015	CSP 36	16:45	16:50	721125	924784	721105	924809	10.67	321	R	112	1	8	15	Between bay
06/11/2015	CSP 37	16:50	16:55	720826	925122	720806	925138	8.54	309	R	110	1	8	15	
06/11/2015	CSP 38	17:00	17:05	720600	925602	720596	925624	7.45	350	R	112	1	8	15	Between bay
06/11/2015	CSP 39										95	1	8	5	Rocky area
06/11/2015	CSP 40	17:20	17:25	719857	926337	719814	926365	17.10	303	R	100	1	8	15	
06/11/2015	CSP 41	8:18	8:23	718520	926850	718490	926891	16.93	324	R	100	1	8	5	Between bay
06/11/2015	CSP 42	8:40	8:45	717984	927306	717907	927342	28.33	295	R	90	1	8	10	
06/11/2015	CSP 43	8:50	8:55	717781	927478	717733	927466	16.49	256	R	95	1	8	10	
06/11/2015	CSP 44	9:00	9:05	717513	927835	717486	927846	9.72	292	R	100	1	8	20	
06/11/2015	CSP 45	9:45	9:50	717223	928551	717233	928577	9.29	21	R	100	1	8	15	
06/11/2015	CSP 46	10:30	10:35	717226	928868	717215	928878	4.96	312	R	100	1	8	10	
06/11/2015	CSP 47	13:30									113	1	8	5	Seawall
06/11/2015	CSP 48	13:40									109	1	8	5	Seawall

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
06/11/2015	CSP 49	13:50									110	1	8	5	Seawall
06/11/2015	CSP 50	14:00									95	1	8	5	Seawall
06/11/2015	CSP 51	14:05									112	1	8	5	Seawall
06/11/2015	CSP 52	14:11									100	1	8	5	Seawall
07/11/2015	CSP 53	8:45	8:50	715367	932026	715325	932078	22.28	321	R	110	0.75	8	15	
07/11/2015	CSP 54	9:05	9:10	715171	932298	715136	932344	19.27	323	R	112	0.75	8	15	
07/11/2015	CSP 55	9:13	9:18	714864	932668	714824	932712	19.82	318	R	110	0.75	8	20	
07/11/2015	CSP 56	9:24									114	0.75	8	19	Seawall
07/11/2015	CSP 57	9:37									112	0.75	8	15	Seawall
07/11/2015	CSP 58	9:59									110	0.75	8	15	Seawall
07/11/2015	CSP 59	10:11									111	0.75	8	15	Seawall
07/11/2015	CSP 60	10:26									114	0.75	8	5	Seawall
07/11/2015	CSP 61	10:34									110	0.75	8	5	Seawall
07/11/2015	CSP 62	11:41									112	0.75	8	5	Seawall
07/11/2015	CSP 63	11:51									110	0.75	8	5	Seawall
07/11/2015	CSP 64	12:00	12:05	711924	936024	711876	936064	20.83	310	R	112	0.75	8	15	
07/11/2015	CSP 65	12:20	12:25	711593	936411	711567	936446	14.53	323	R	110	0.75	8	20	

Date	Location No	Start Time	End Time	UTM Co-ordinates				Speed Over Ground (cm/s)	Course over Ground (°)	Current direction (L/R)	Breaker angle (°)	Wave height (m)	Wave period (s)	Surf zone width (m)	Remarks
				Start Point		End point									
				Easting	Northing	Easting	Northing								
07/11/2015	CSP 66	12:35	12:40	711237	936812	711201	936853	18.19	319	R	112	0.75	8	20	
07/11/2015	CSP 67	12:43	12:48	710934	937137	710864	937249	44.03	328	R	110	0.75	8	20	
07/11/2015	CSP 68	12:59	13:04	710677	937469	710630	937519	22.87	317	R	113	0.75	8	20	
07/11/2015	CSP 69	13:07	13:13	710320	937864	710265	937915	20.84	313	R	110	0.75	8	20	
07/11/2015	CSP 70	13:20	13:25	709947	938273	709917	938307	15.11	319	R	115	0.75	8	20	
07/11/2015	CSP 71	13:29	13:34	709815	938443	709778	938491	20.20	322	R	112	0.75	8	20	
07/11/2015	CSP 72	13:42	13:47	709483	938811	709446	938849	17.68	316	R	110	0.75	8	20	
07/11/2015	CSP 73	13:53	13:57	709153	939175	709093	939234	35.06	315	R	112	0.75	8	20	
08/11/2015	CSP 74	11:00	11:05	708836	939532	708781	939590	26.64	317	R	112	1	8	20	
08/11/2015	CSP 75	10:42	10:46	708746	939634	708492	939935	164.10	320	R	113	1	8	20	
08/11/2015	CSP 76	10:24	10:29	708179	940294	708117	940382	35.88	325	R	110	1	8	20	
08/11/2015	CSP 77	10:05	10:10	707864	940689	707818	940745	24.16	321	R	108	1	8	20	
08/11/2015	CSP 78	11:50	11:55	707522	941074	707480	941130	23.33	323	R	110	1	8	20	
08/11/2015	CSP 79	12:10	12:15	707230	941459	707182	941516	24.84	320	R	112	1	8	20	
08/11/2015	CSP 80	12:30	12:35	706917	941856	706876	941911	22.87	323	R	112	1	8	20	
08/11/2015	CSP 81	12:47	12:52	706605	942247	706558	942318	28.38	326	R	100	1	8	20	

Annexure VI

CSP Locations - June 2015

Figure 01:- June_CSP 01

Figure 02:- June_CSP 02

Figure 03:- June_CSP 03

Figure 04:- June_CSP 04

Figure 05:- June_CSP 05

Figure 06:- June_CSP 06

Figure 07:- June_CSP 07

Figure 08:- June_CSP 08

Figure 09:- June_CSP 09

Figure 10:- June_CSP 10

Figure 11:- June_CSP 11

Figure 12:- June_CSP 12

Figure 13:- June_CSP 13

Figure 14:- June_CSP 14

Figure 15:- June_CSP 15

Figure 16:- June_CSP 16

Figure 17:- June_CSP 17

Figure 18:- June_CSP 18

Figure 19:- June_CSP 19

Figure 20:- June_CSP 20

Figure 21:- June_CSP 21

Figure 22:- June_CSP 22

Figure 23:- June_CSP 23

Figure 24:- June_CSP 24

Figure 25:- June_CSP 25

Figure 26:- June_CSP 26

Figure 27:- June_CSP 27

Figure 28:- June_CSP 28

Figure 29:- June_CSP 29

Figure 30:- June_CSP 30

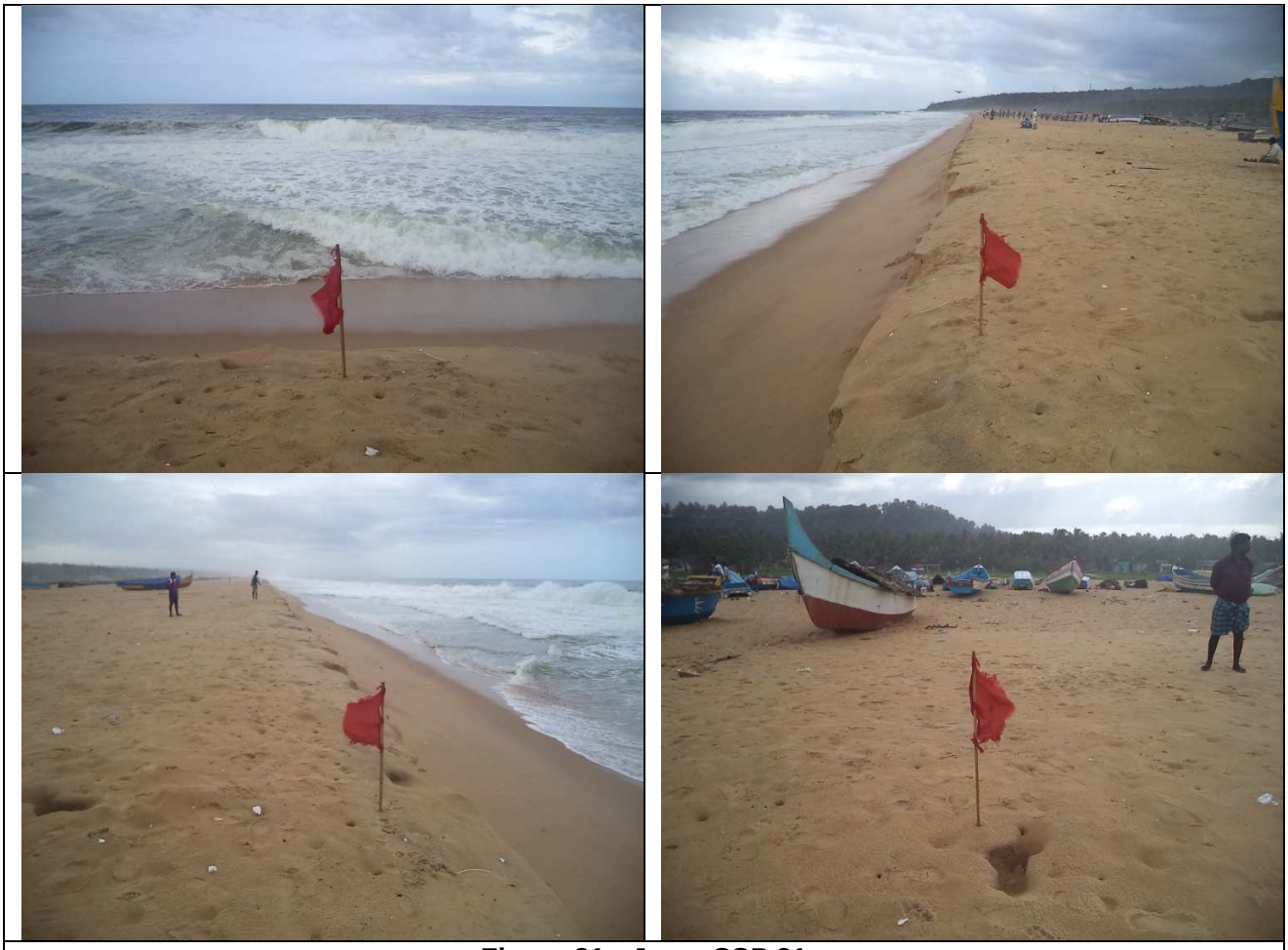


Figure 31:- June_CSP 31

Figure 32:- June_CSP 32

Figure 33:- June_CSP 33

Figure 34:- June_CSP 34

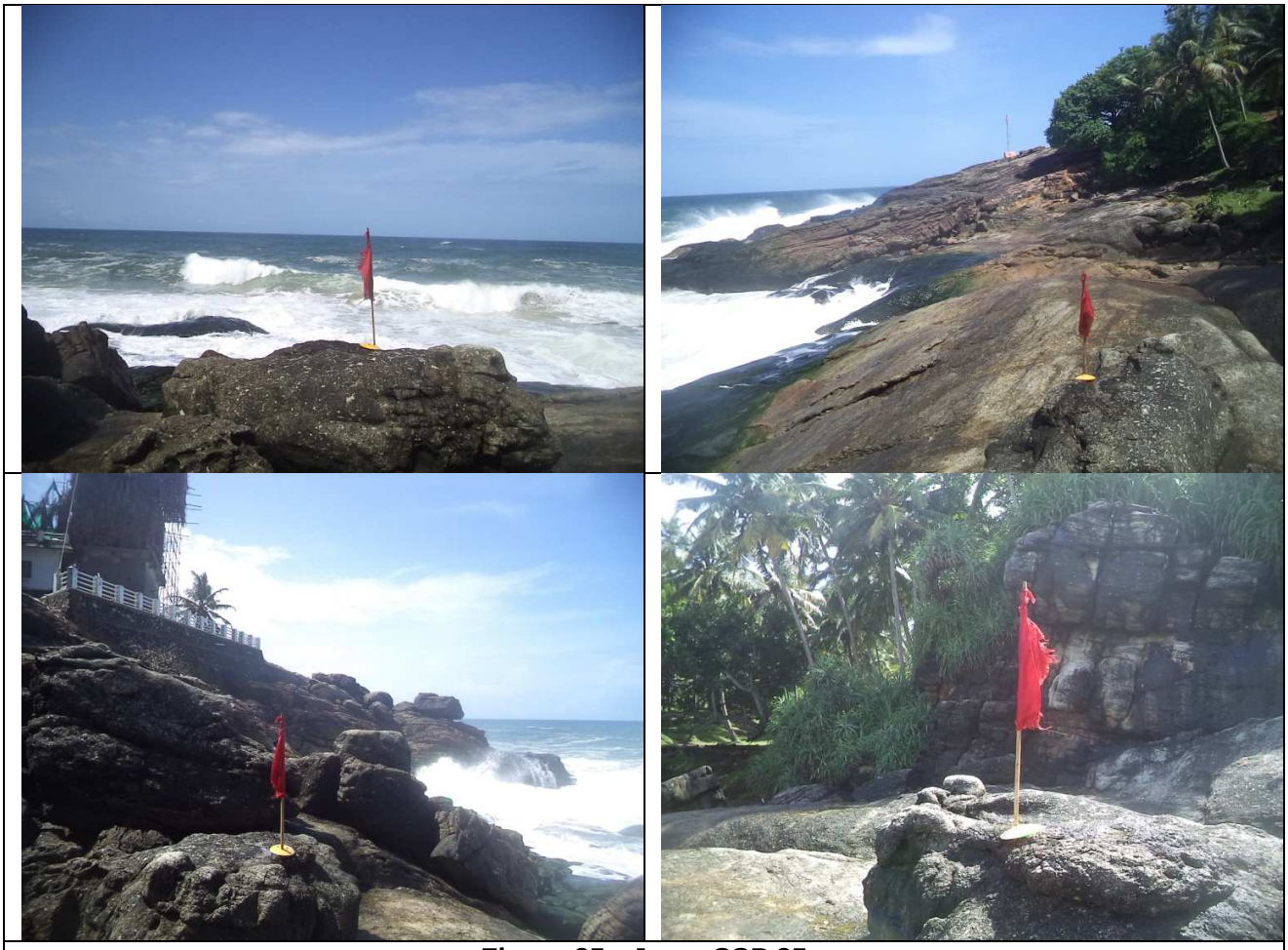


Figure 35:- June_CSP 35

Figure 36:- June_CSP 36

Figure 37:- June_CSP 37

Figure 38:- June_CSP 38

Figure 39:- June_CSP 39

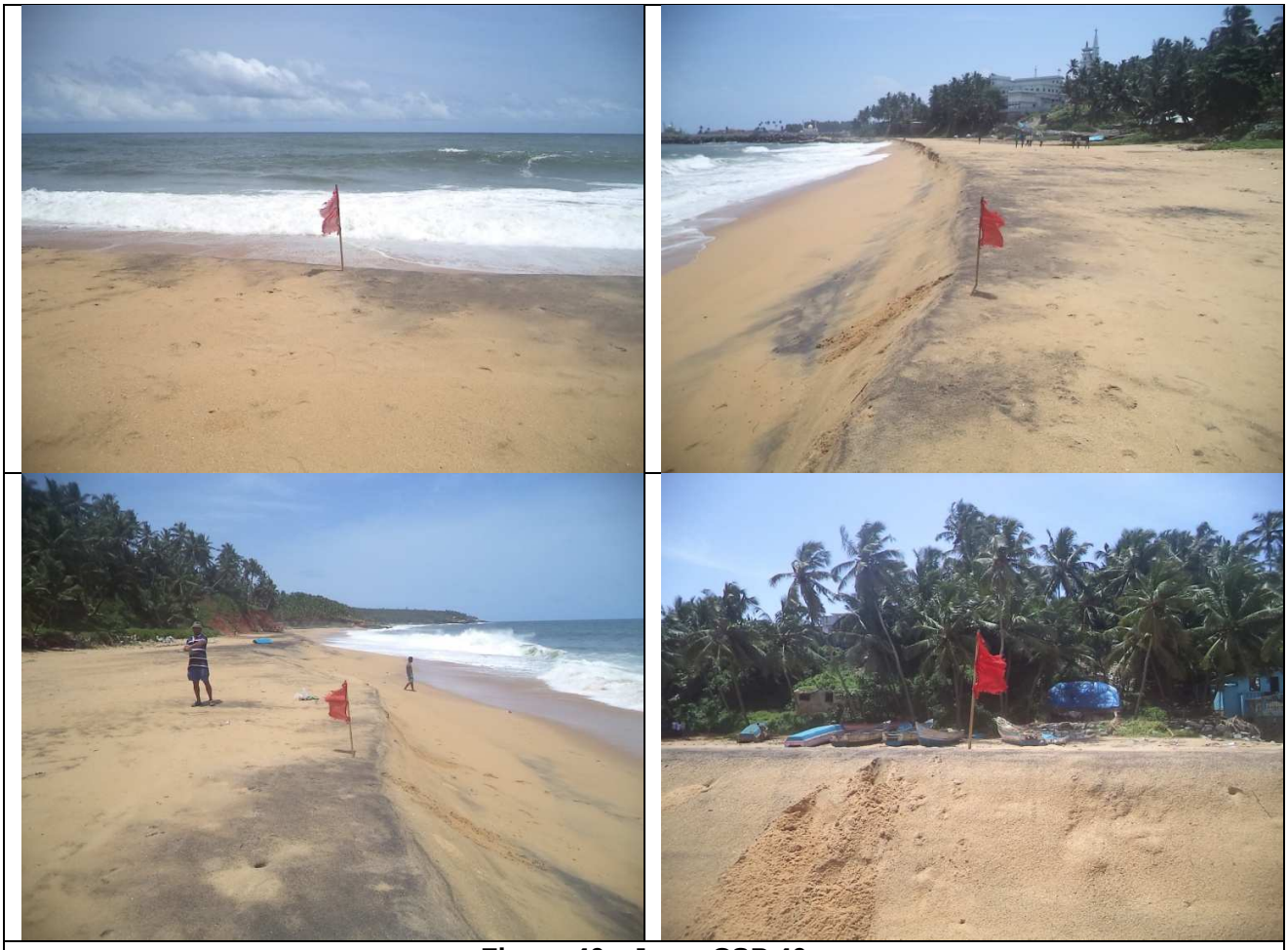


Figure 40:- June_CSP 40

Figure 41:- June_CSP 41

Figure 42:- June_CSP 42

Figure 43:- June_CSP 43

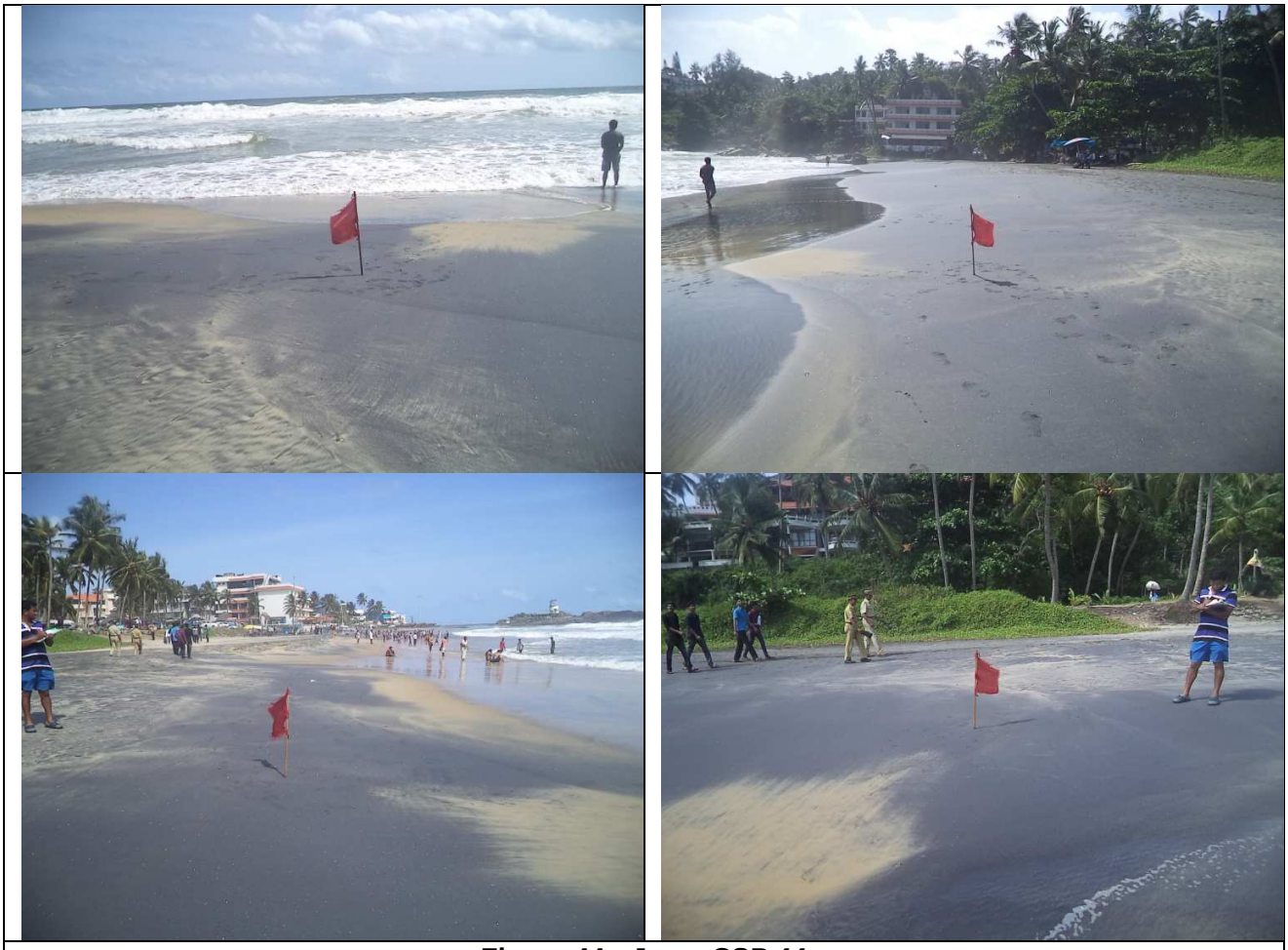


Figure 44:- June_CSP 44

Figure 45:- June_CSP 45

Figure 46:- June_CSP 46

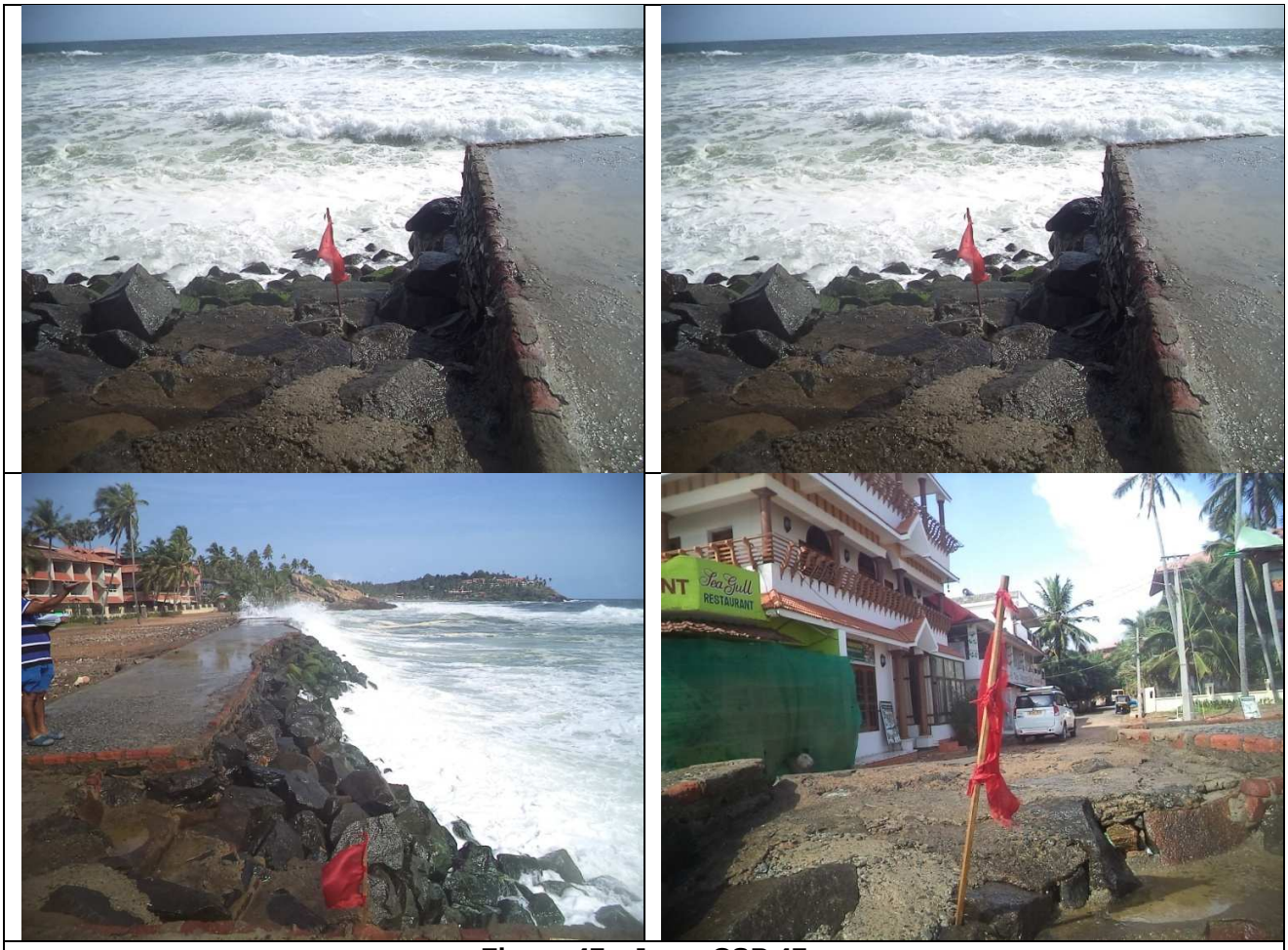


Figure 47:- June_CSP 47

Figure 48:- June_CSP 48

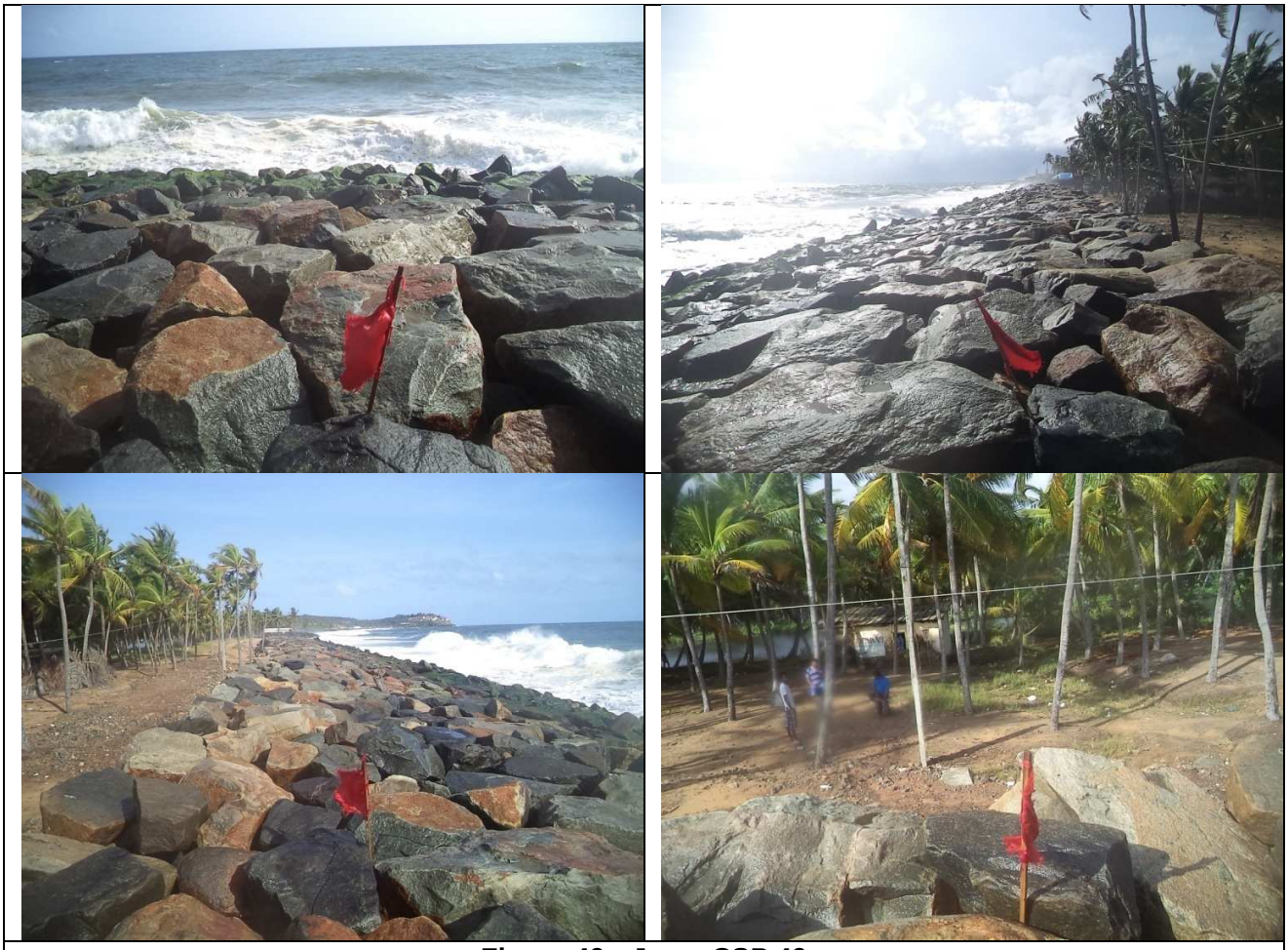


Figure 49:- June_CSP 49

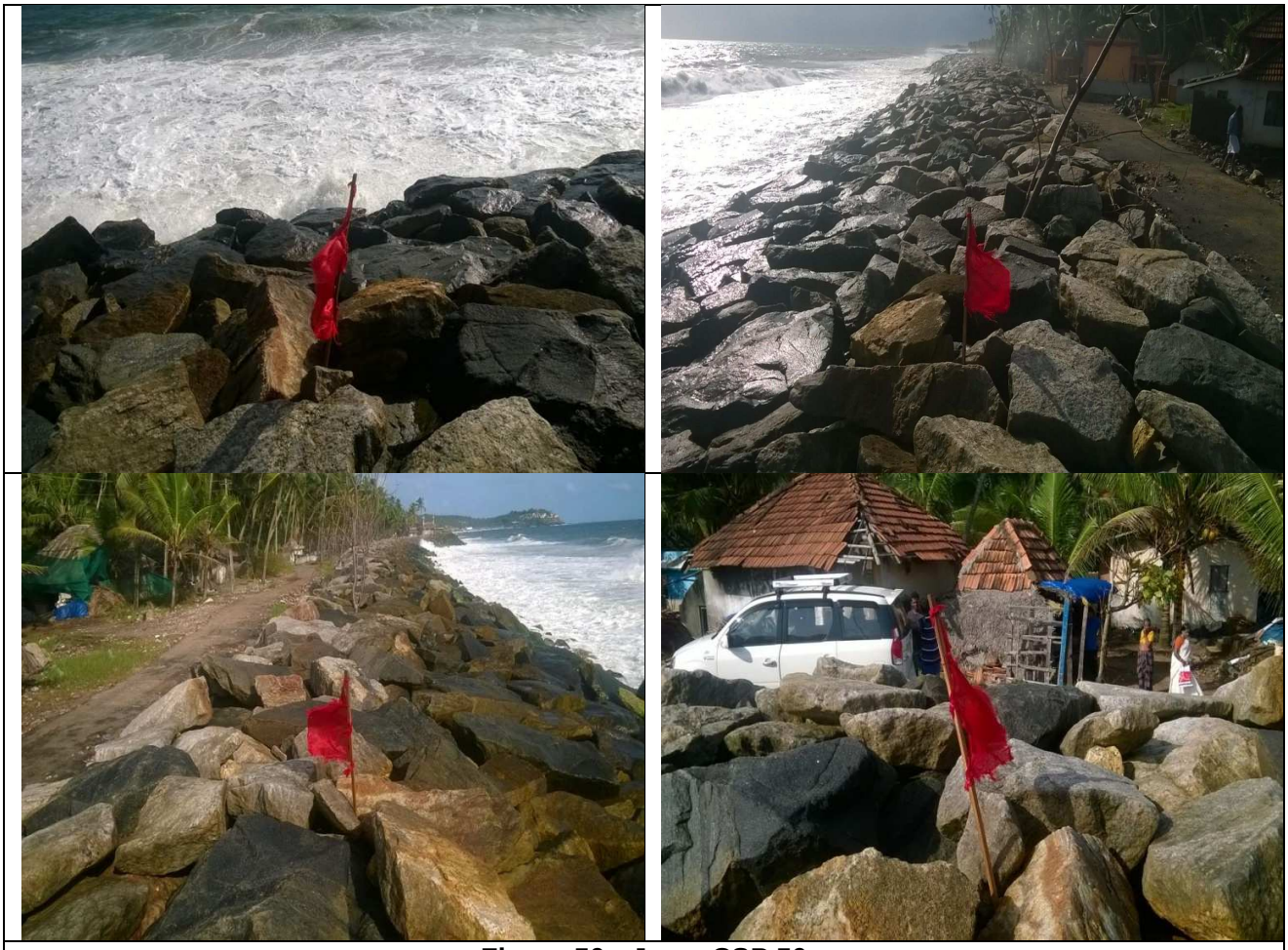


Figure 50:- June_CSP 50

Figure 51:- June_CSP 51

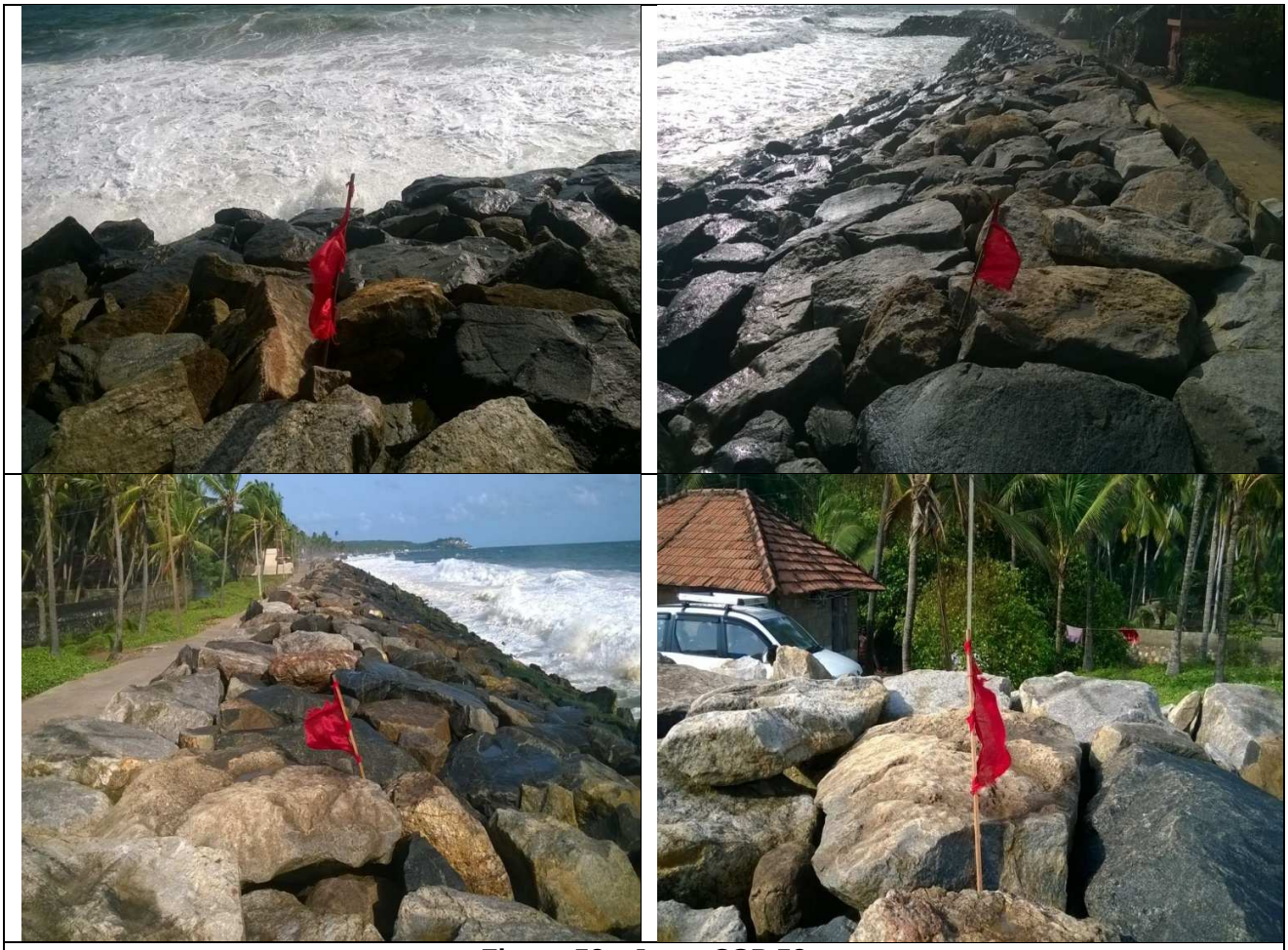


Figure 52:- June_CSP 52

Figure 53:- June_CSP 53

Figure 54:- June_CSP 54

Figure 55:- June_CSP 55

Figure 56:- June_CSP 56

Figure 57:- June_CSP 57

Figure 58:- June_CSP 58

Figure 59:- June_CSP 59

Figure 60:- June_CSP 60

Figure 61:- June_CSP 61

Figure 62:- June_CSP 62

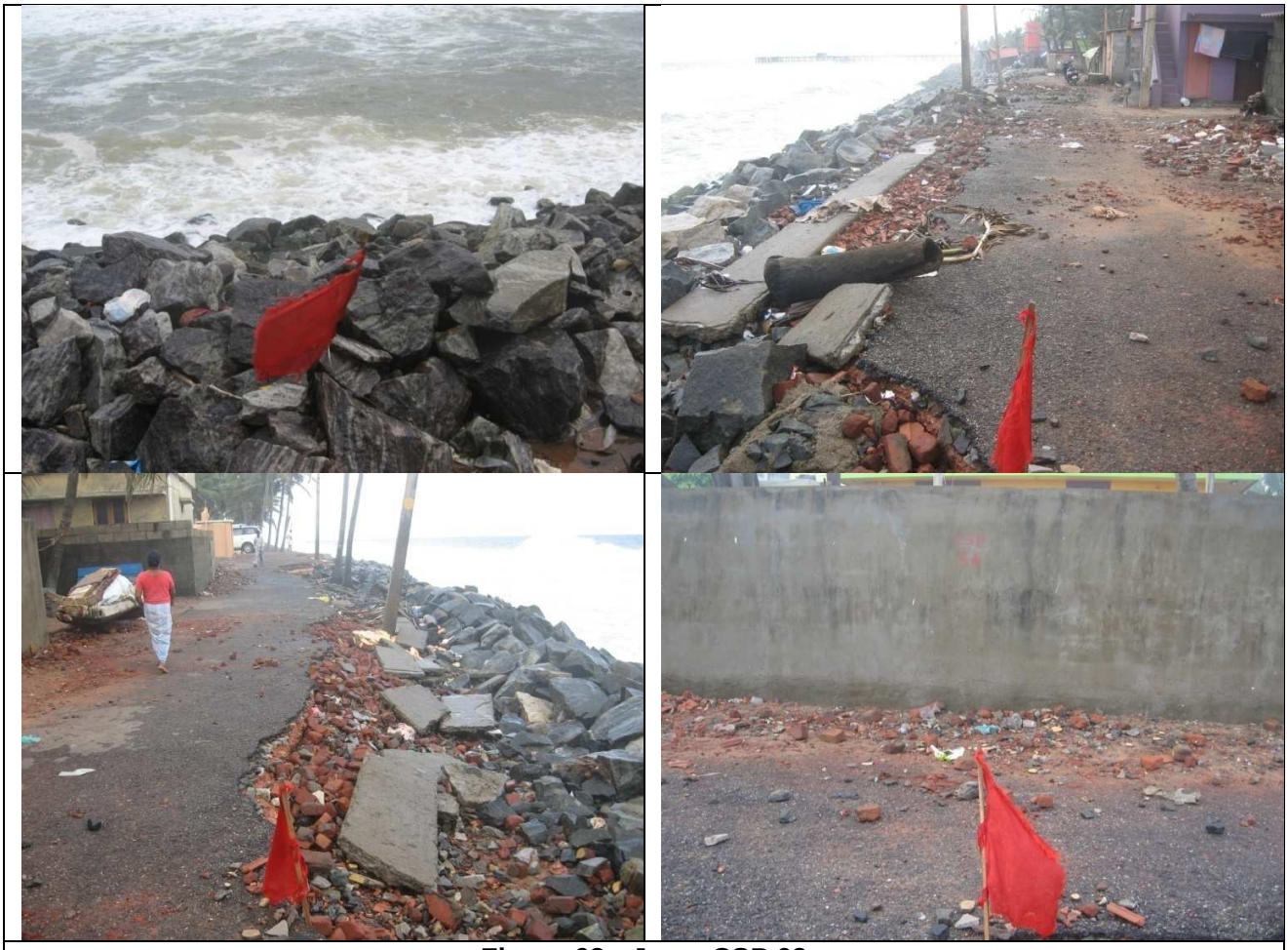


Figure 63:- June_CSP 63

Figure 64:- June_CSP 64

Figure 65:- June_CSP 65

Figure 66:- June_CSP 66

Figure 67:- June_CSP 67

Figure 68:- June_CSP 68

Figure 69:- June_CSP 69

Figure 70:- June_CSP 70

Figure 71:- June_CSP 71

Figure 72:- June_CSP 72

Figure 73:- June_CSP 73

Figure 74:- June_CSP 74

Figure 75:- June_CSP 75

Figure 76:- June_CSP 76

Figure 77:- June_CSP 77

Figure 78:- June_CSP 78

Figure 79:- June_CSP 79

Figure 80:- June_CSP 80

Figure 81:- June_CSP 81

Annexure VI

CSP Locations - July 2015

Figure 01:- July_CSP 01

Figure 02:- July_CSP 02

Figure 03:- July_CSP 03

Figure 04:- July_CSP 04

Figure 05:- July_CSP 05

Figure 06:- July_CSP 06

Figure 07:- July_CSP 07

Figure 08:- July_CSP 08

Figure 09:- July_CSP 09

Figure 10:- July_CSP 10

Figure 11:- July_CSP 11

Figure 12:- July_CSP 12

Figure 13:- July_CSP 13

Figure 14:- July_CSP 14

Figure 15:- July_CSP 15

Figure 16:- July_CSP 16

Figure 17:- July_CSP 17

Figure 18:- July_CSP 18

Figure 19:- July_CSP 19

Figure 20:- July_CSP 20

Figure 21:- July_CSP 21

Figure 22:- July_CSP 22

Figure 23:- July_CSP 23

Figure 24:- July_CSP 24

Figure 25:- July_CSP 25

Figure 26:- July_CSP 26

Figure 27:- July_CSP 27

Figure 28:- July_CSP 28

Figure 29:- July_CSP 29

Figure 30:- July_CSP 30

Figure 31:- July_CSP 31

Figure 32:- July_CSP 32

Figure 33:- July_CSP 33

Figure 34:- July_CSP 34

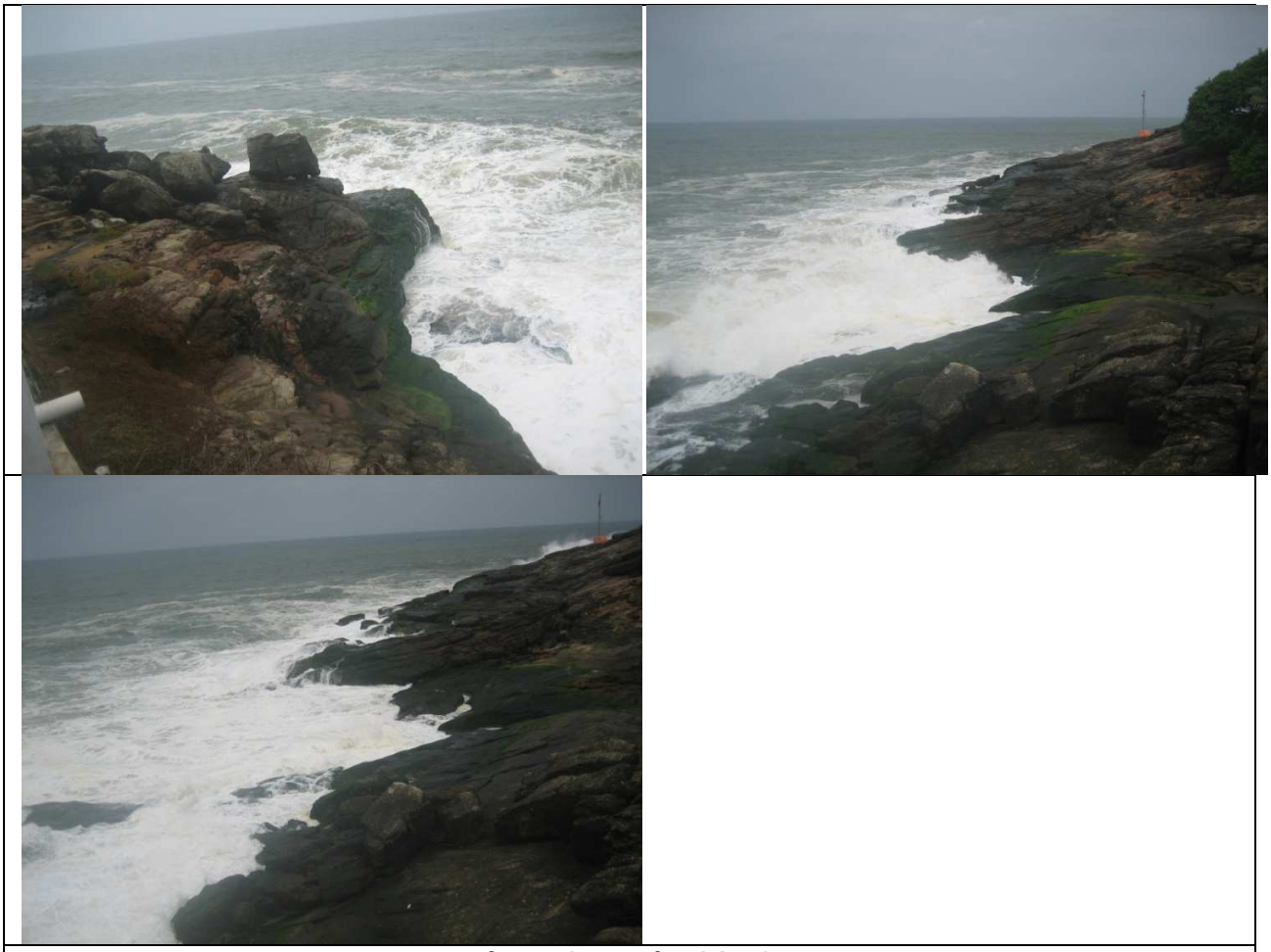


Figure 35:- July_CSP 35

Figure 36:- July_CSP 36

Figure 37:- July_CSP 37

Figure 38:- July_CSP 38

Figure 39:- July_CSP 39

Figure 40:- July_CSP 40

Figure 41:- July_CSP 41

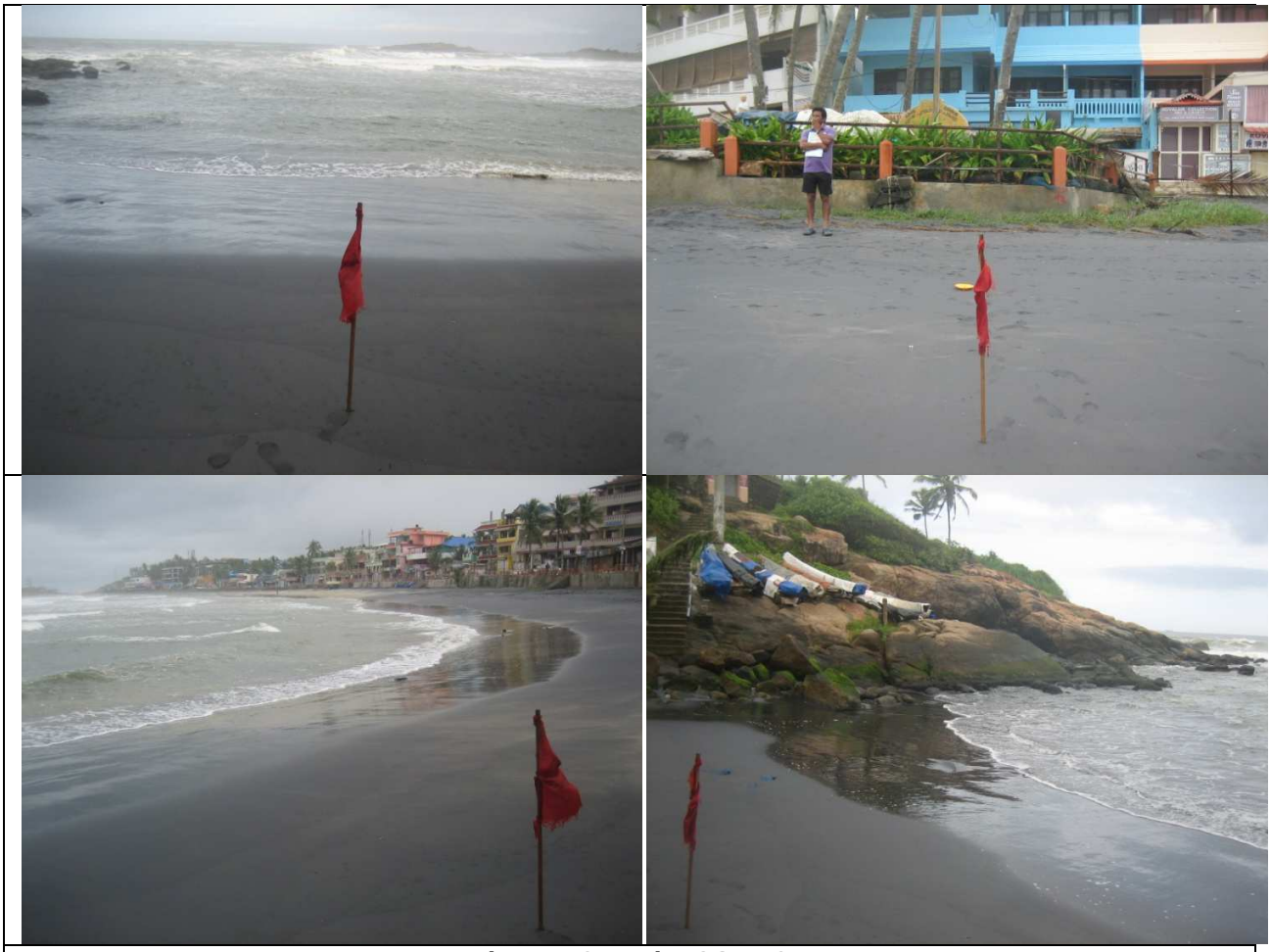


Figure 42:- July_CSP 42

Figure 43:- July_CSP 43

Figure 44:- July_CSP 44

Figure 45:- July_CSP 45

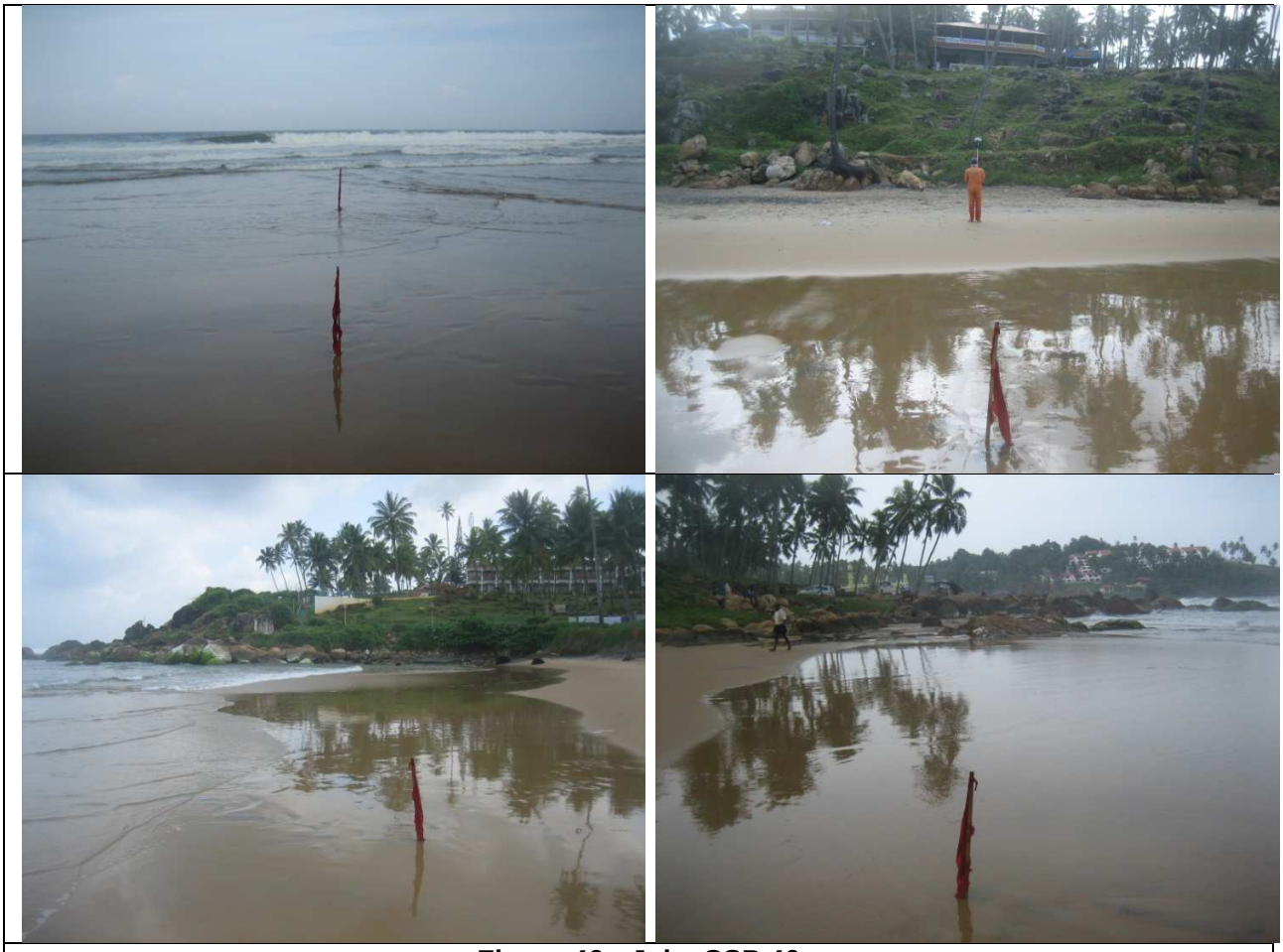


Figure 46:- July_CSP 46

Figure 47:- July_CSP 47

Figure 48:- July_CSP 48

Figure 49:- July_CSP 49

Figure 50:- July_CSP 50

Figure 51:- July_CSP 51

Figure 52:- July_CSP 52

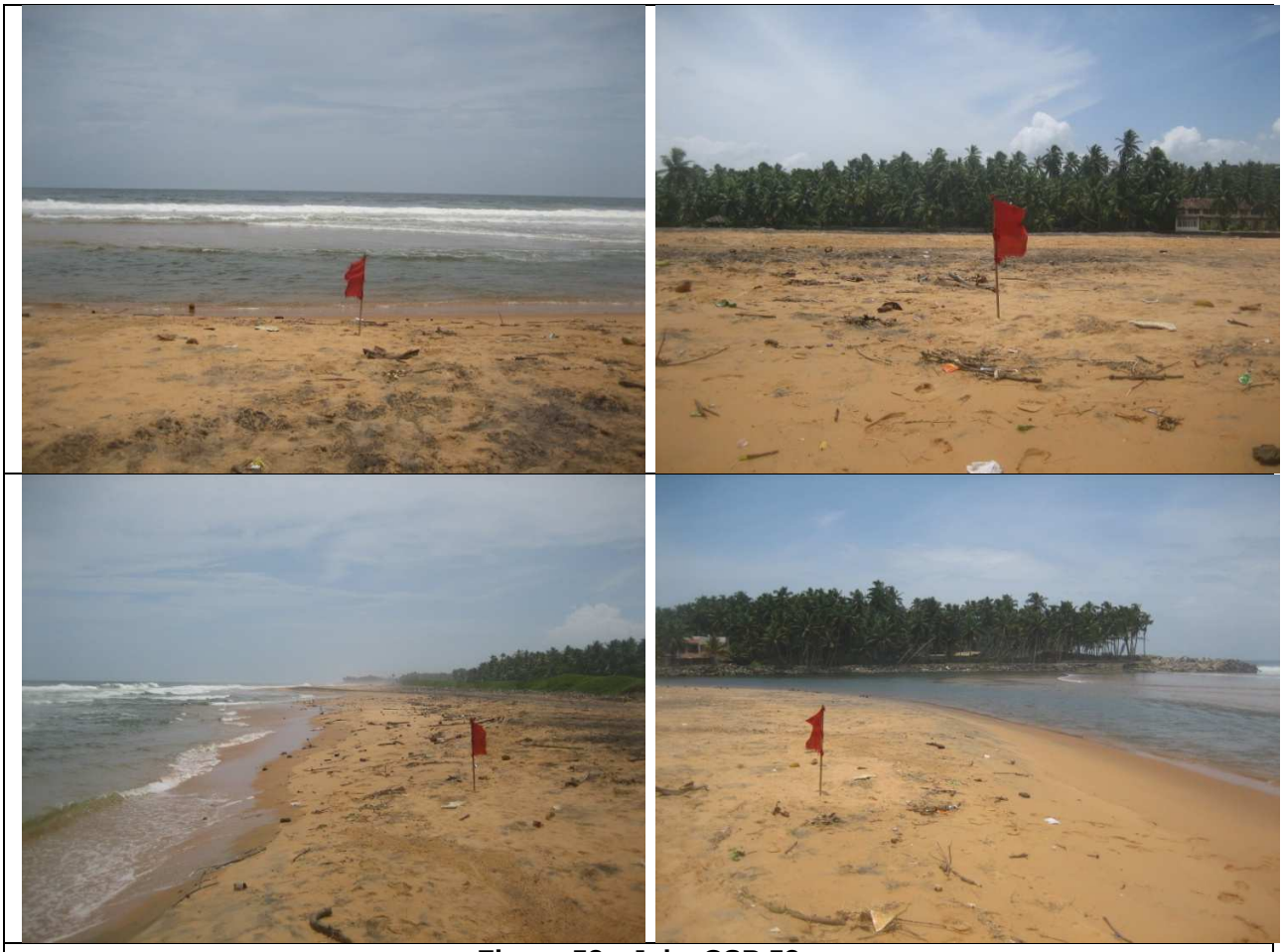


Figure 53:- July_CSP 53

Figure 54:- July_CSP 54

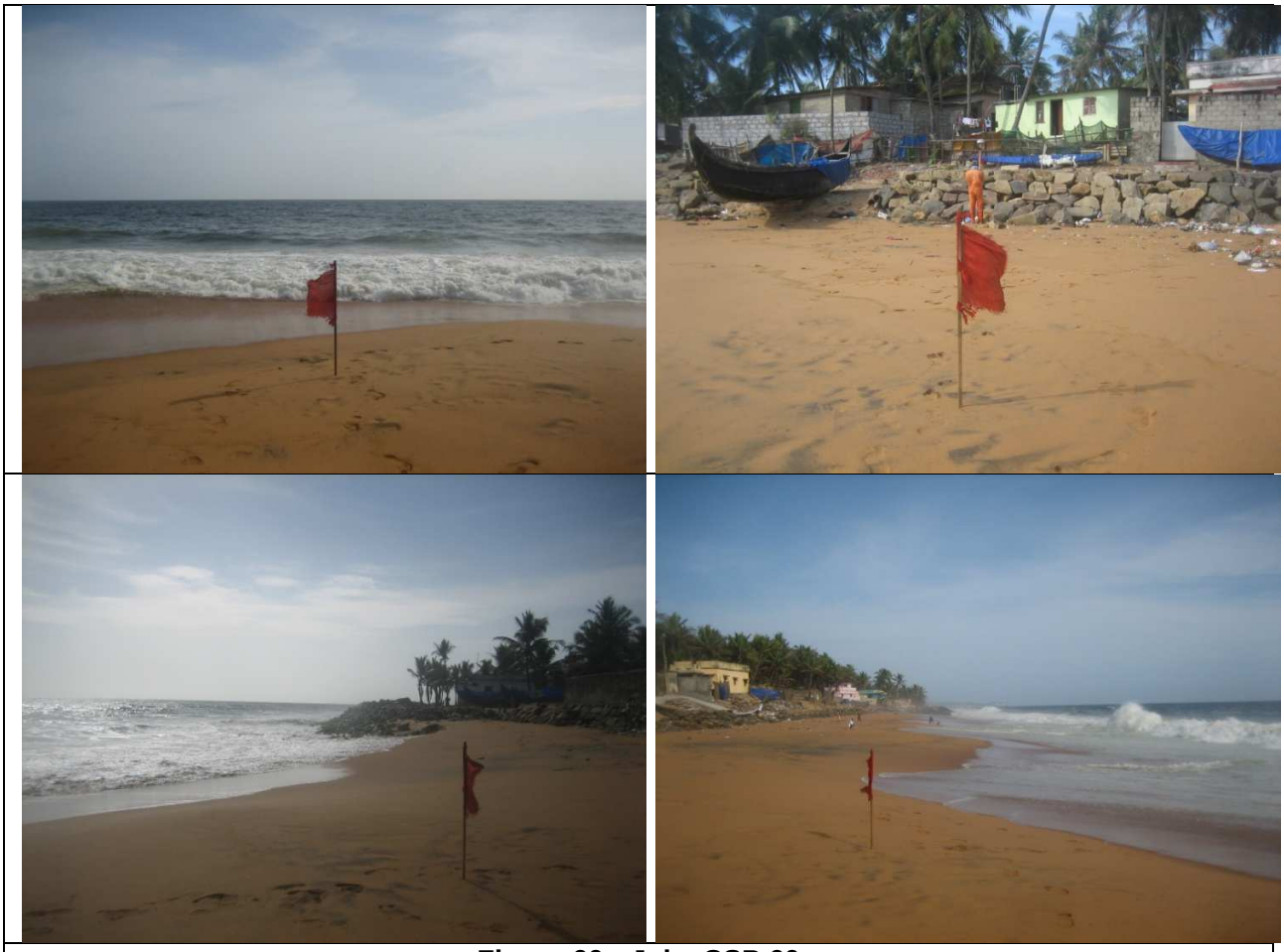
Figure 55:- July_CSP 55

Figure 56:- July_CSP 56

Figure 57:- July_CSP 57

Figure 58:- July_CSP 58

Figure 59:- July_CSP 59



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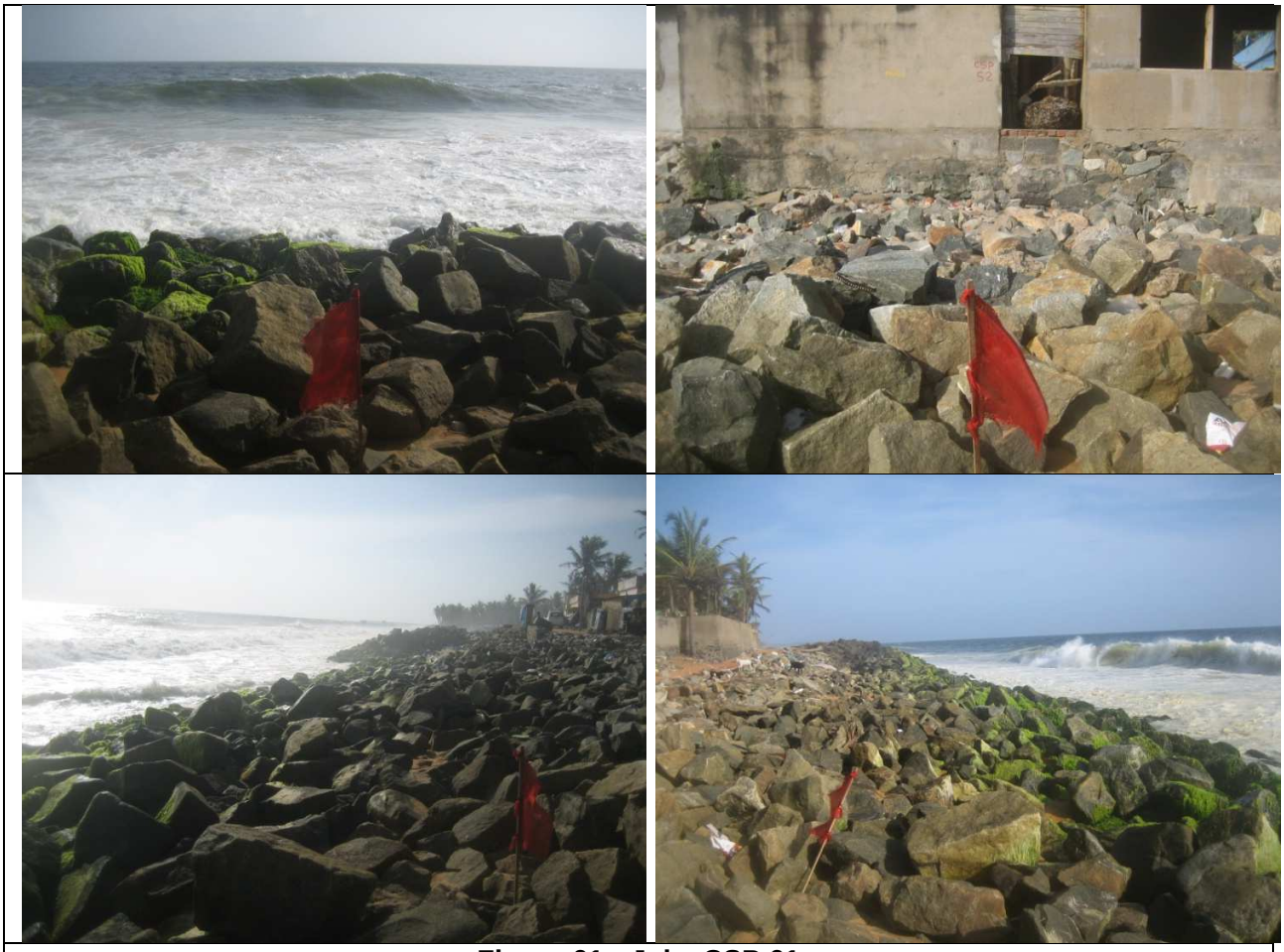


Figure 61:- July_CSP 61

Figure 62:- July_CSP 62

Figure 63:- July_CSP 63

Figure 64:- July_CSP 64

Figure 65:- July_CSP 65

Figure 66:- July_CSP 66

Figure 67:- July_CSP 67

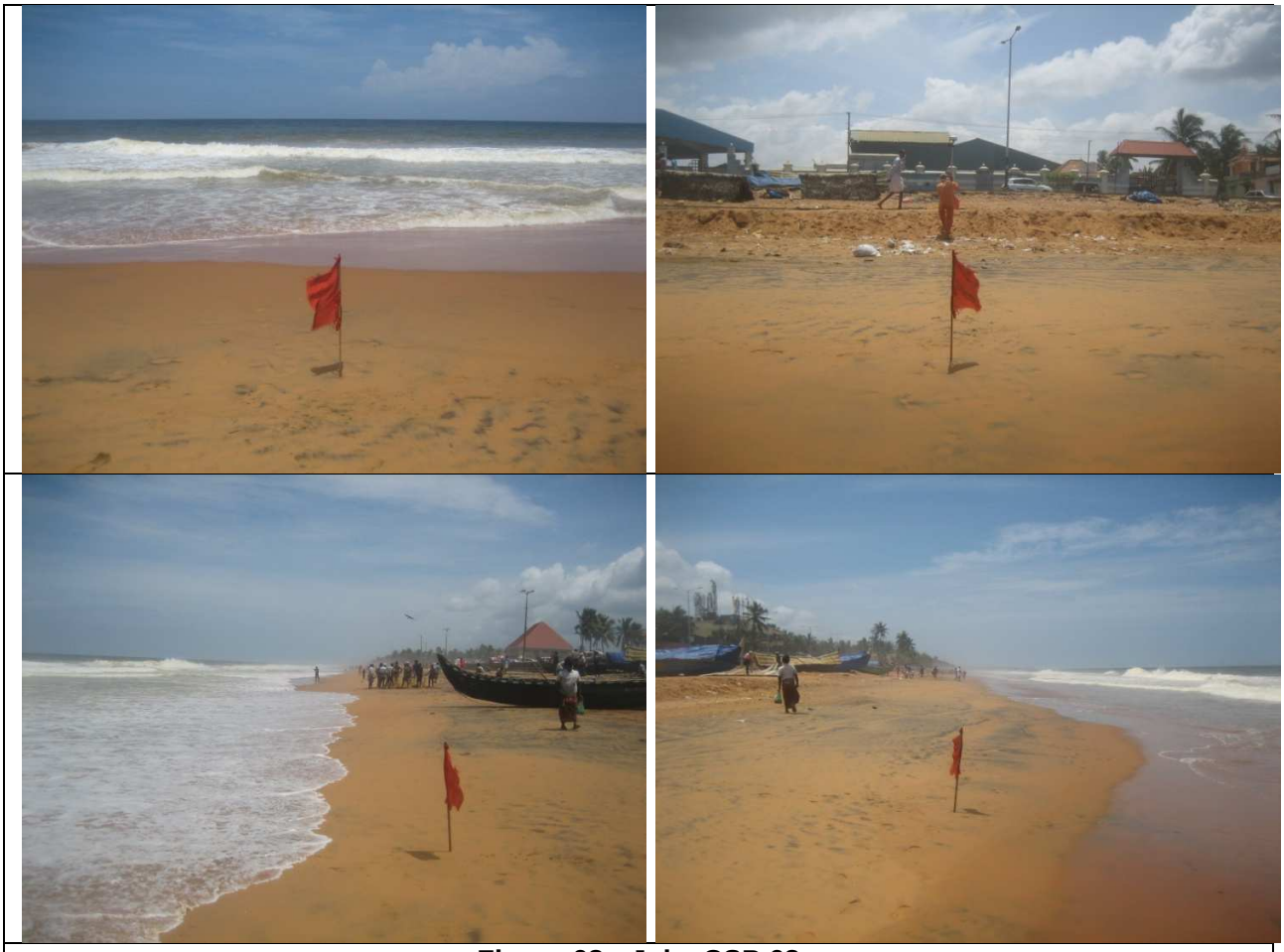


Figure 68:- July_CSP 68

Figure 69:- July_CSP 69

Figure 70:- July_CSP 70

Figure 71:- July_CSP 71

Figure 72:- July_CSP 72

Figure 73:- July_CSP 73

Figure 74:- July_CSP 74

Figure 75:- July_CSP 75

Figure 76:- July_CSP 76

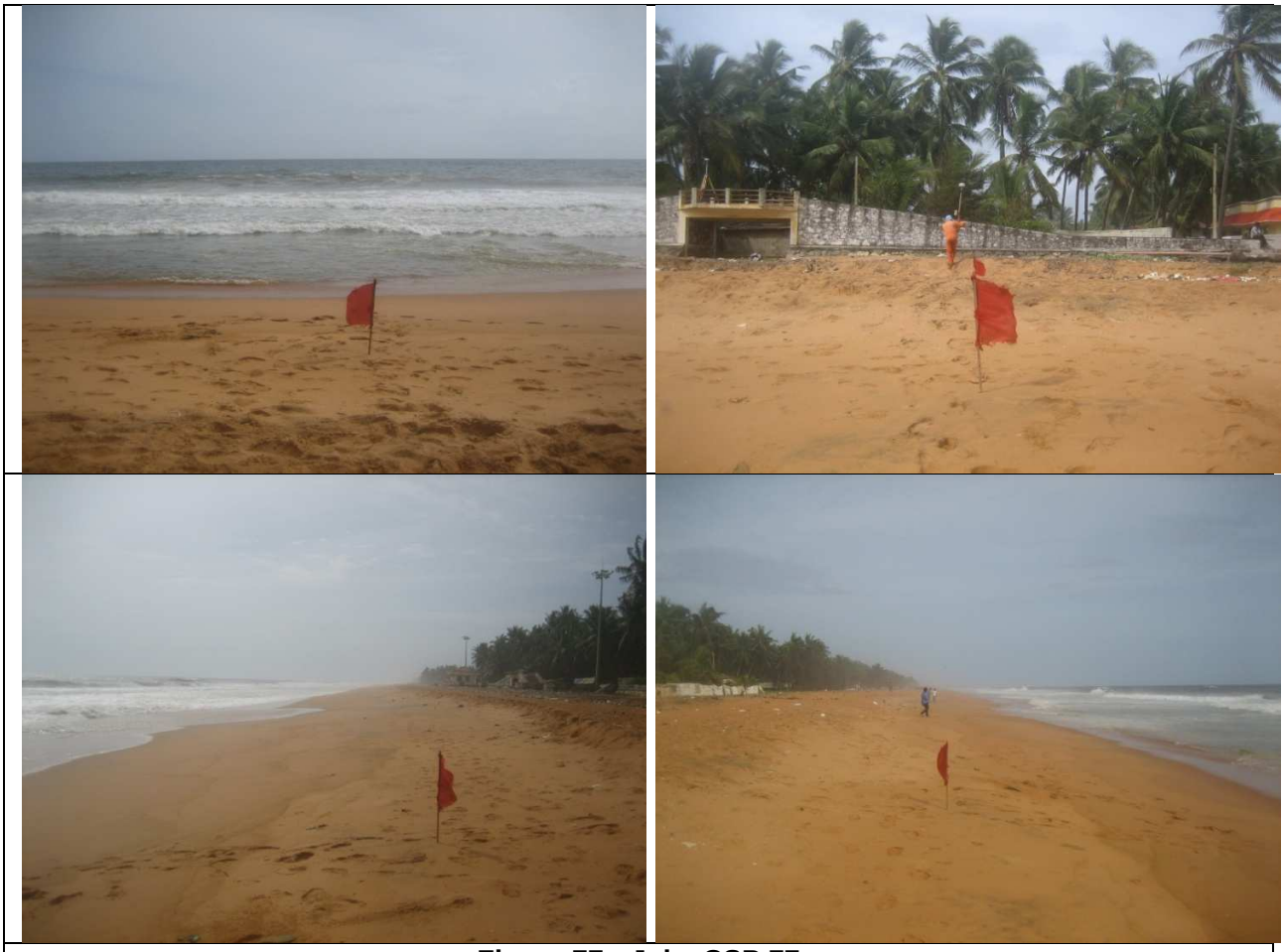


Figure 77:- July_CSP 77

Figure 78:- July_CSP 78

Figure 79:- July_CSP 79

Figure 80:- July_CSP 80

Figure 81:- July_CSP 81

Annexure VI

CSP Locations - August 2015

Figure 01:- August_CSP 01

Figure 02:- August_CSP 02

Figure 03:- August_CSP 03

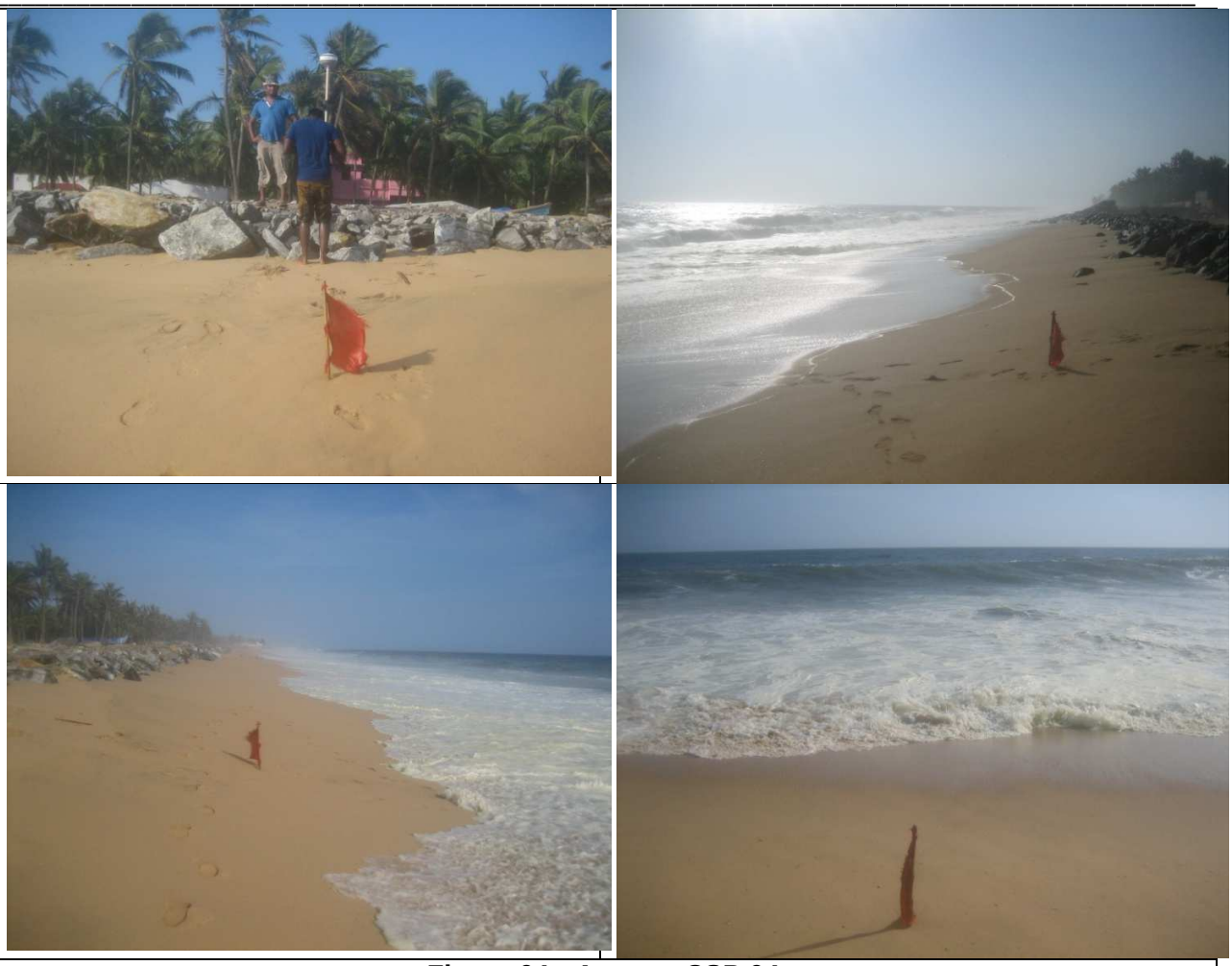
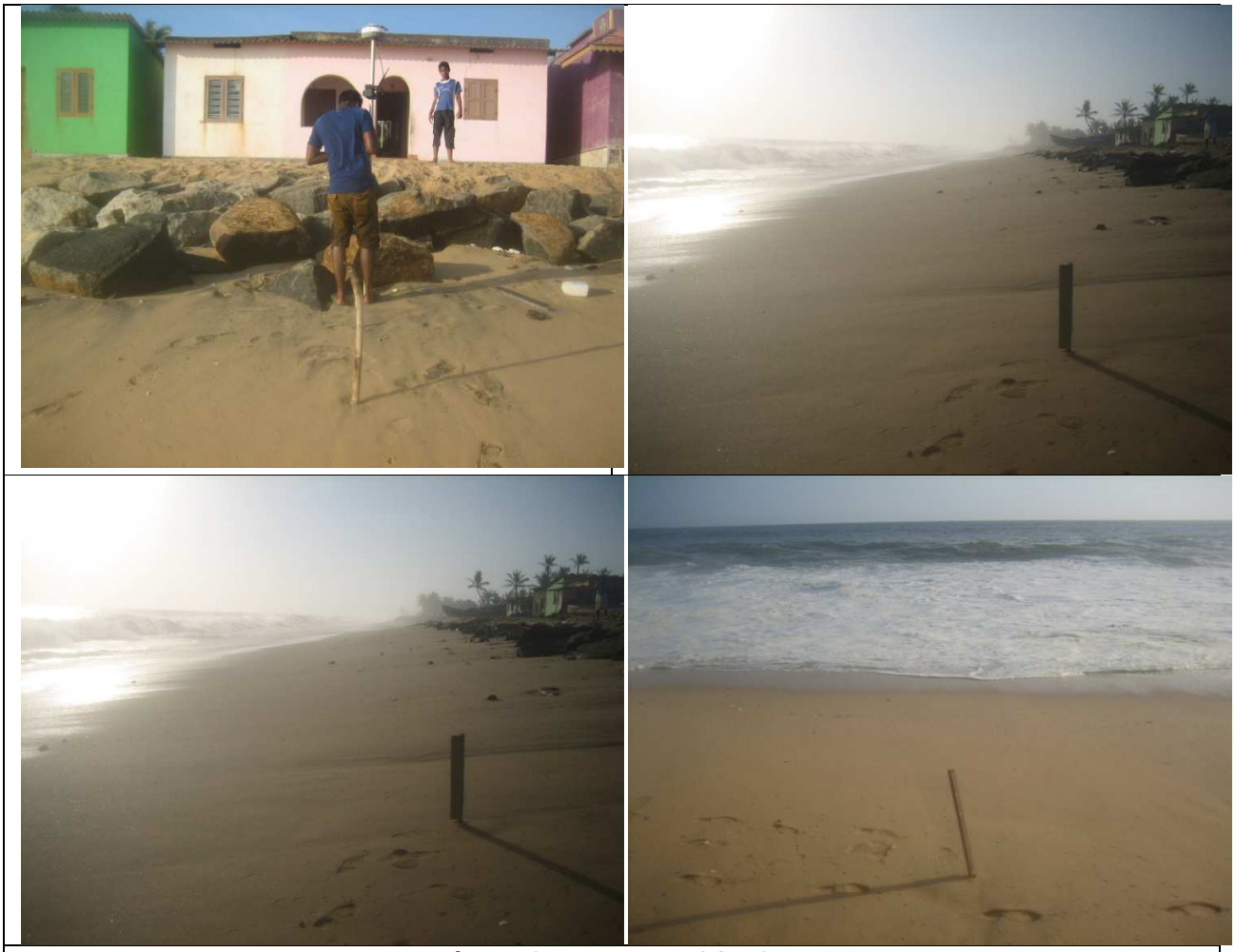


Figure 04:- August_CSP 04

Figure 05:- August_CSP 05

Figure 06:- August_CSP 06



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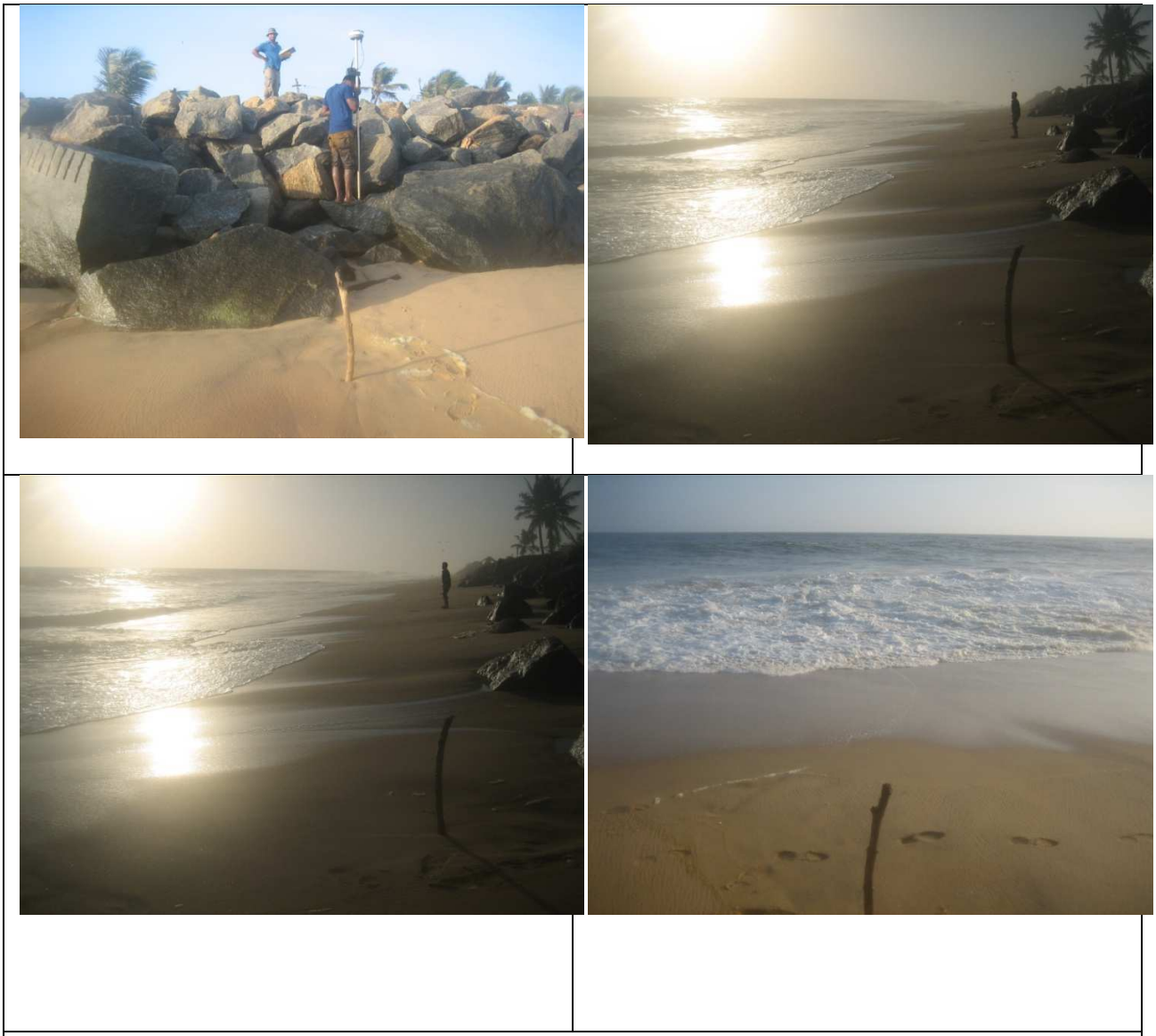


Figure 08:- August_CSP 08

Figure 09:- August_CSP 09

Figure 10:- August_CSP 10

Figure 11:- August_CSP 11

Figure 12:- August_CSP 12

Figure 13:- August_CSP 13

Figure 14:- August_CSP 14

Figure 15:- August_CSP 15

Figure 16:- August_CSP 16

Figure 17:- August_CSP 17

Figure 18:- August_CSP 18

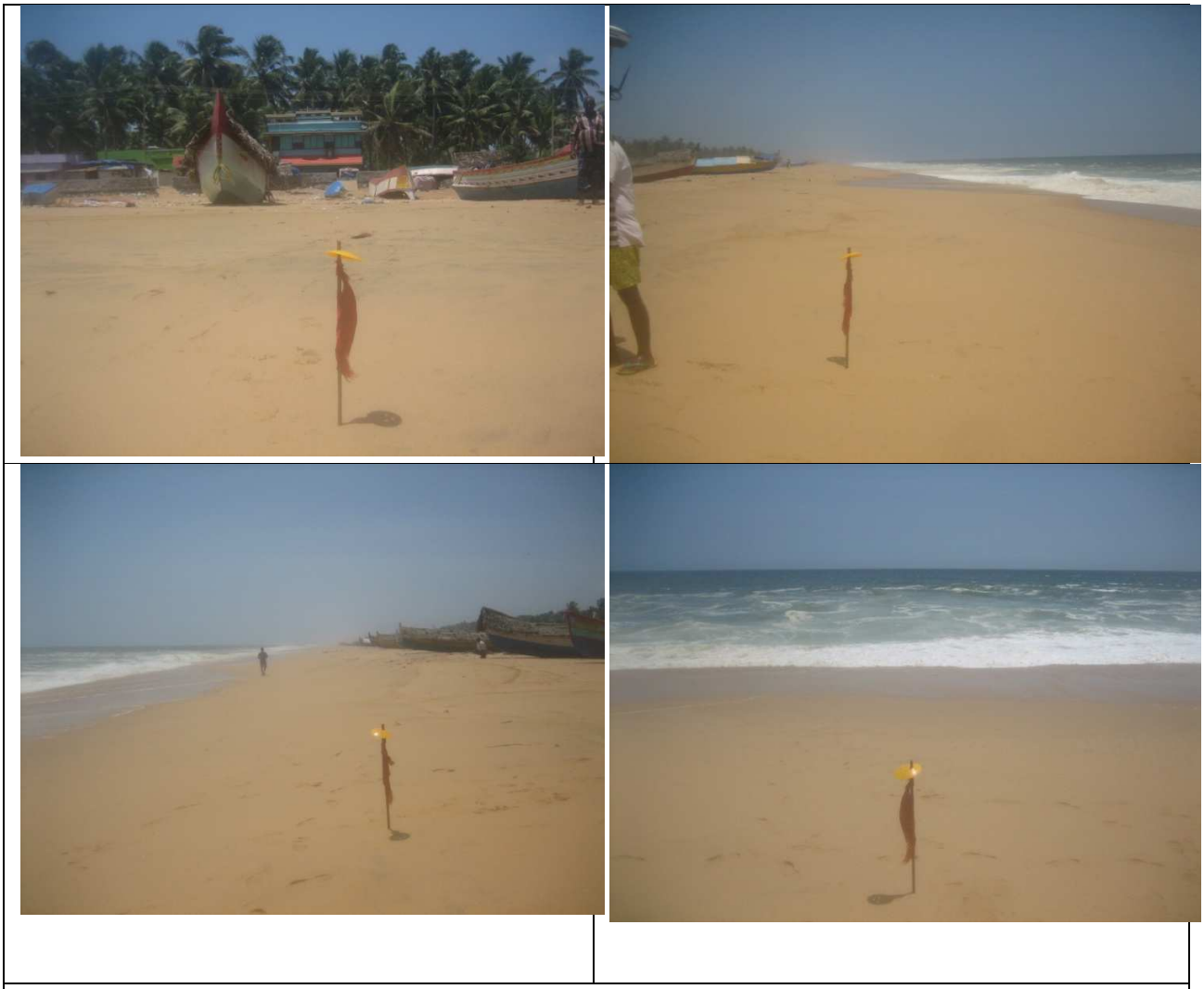


Figure 19:- August_CSP 19

Figure 20:- August_CSP 20

Figure 21:- August_CSP 21

Figure 22:- August_CSP 22

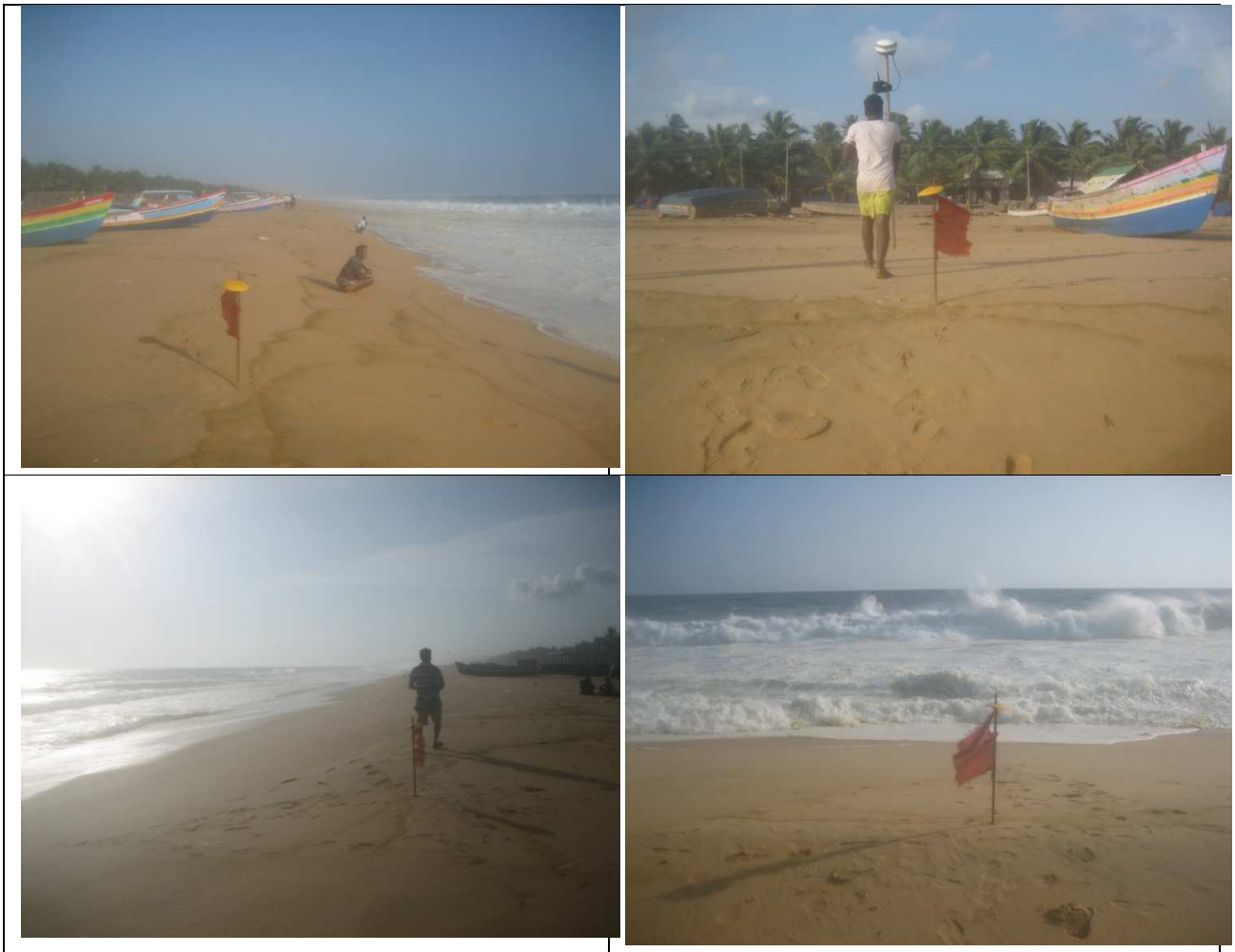


Figure 23:- August_CSP 23

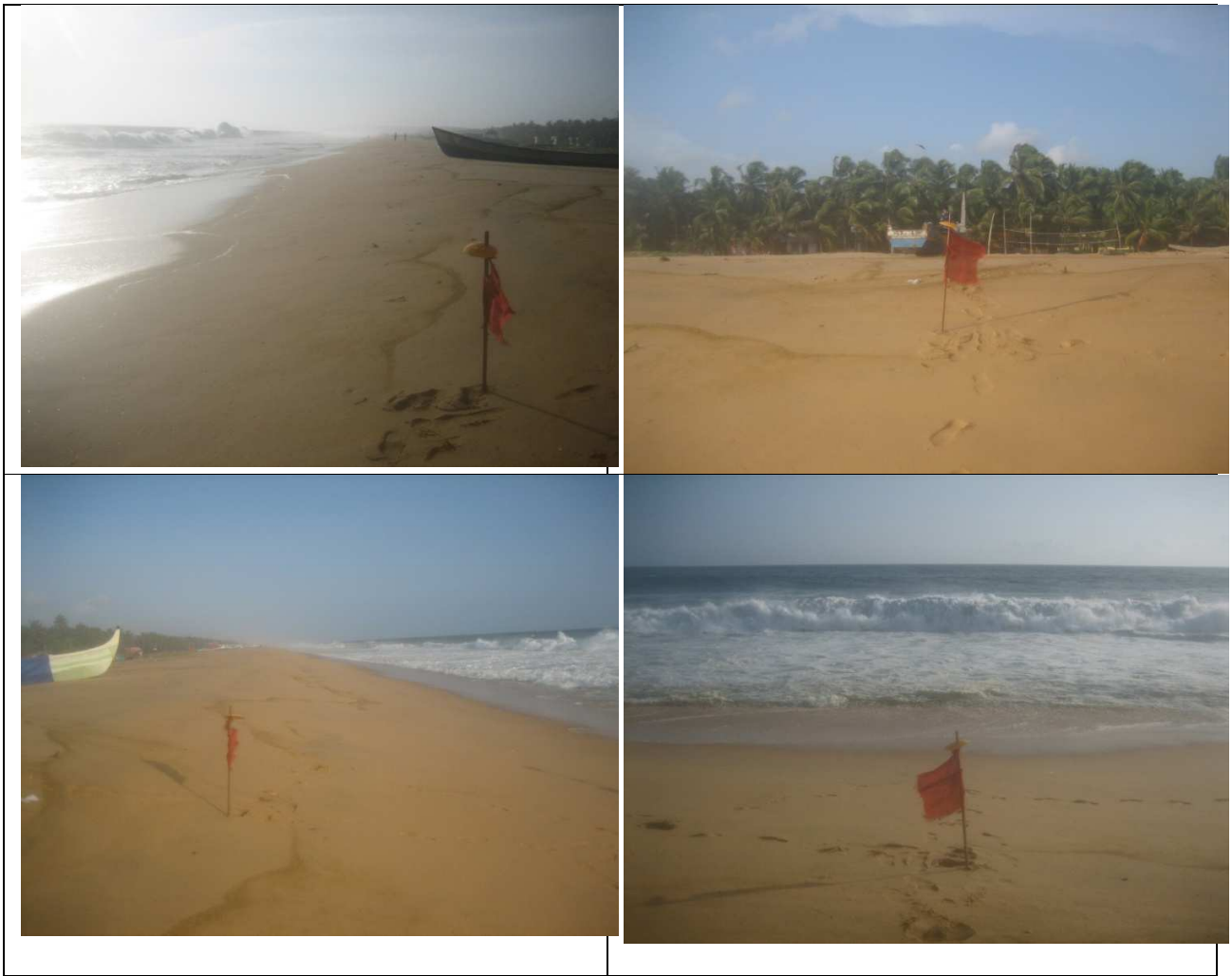


Figure 24:- August_CSP 24

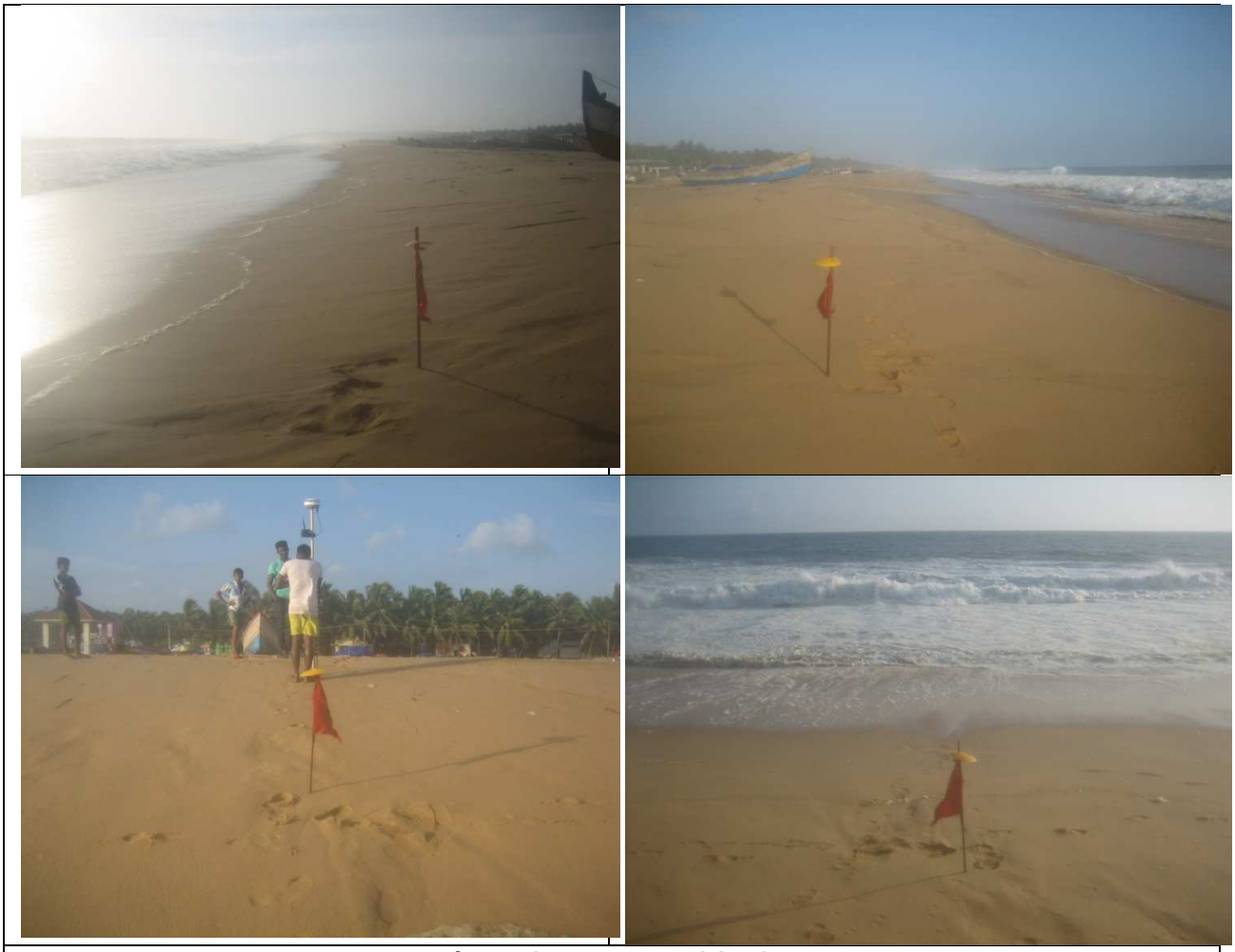


Figure 25:- August_CSP 25

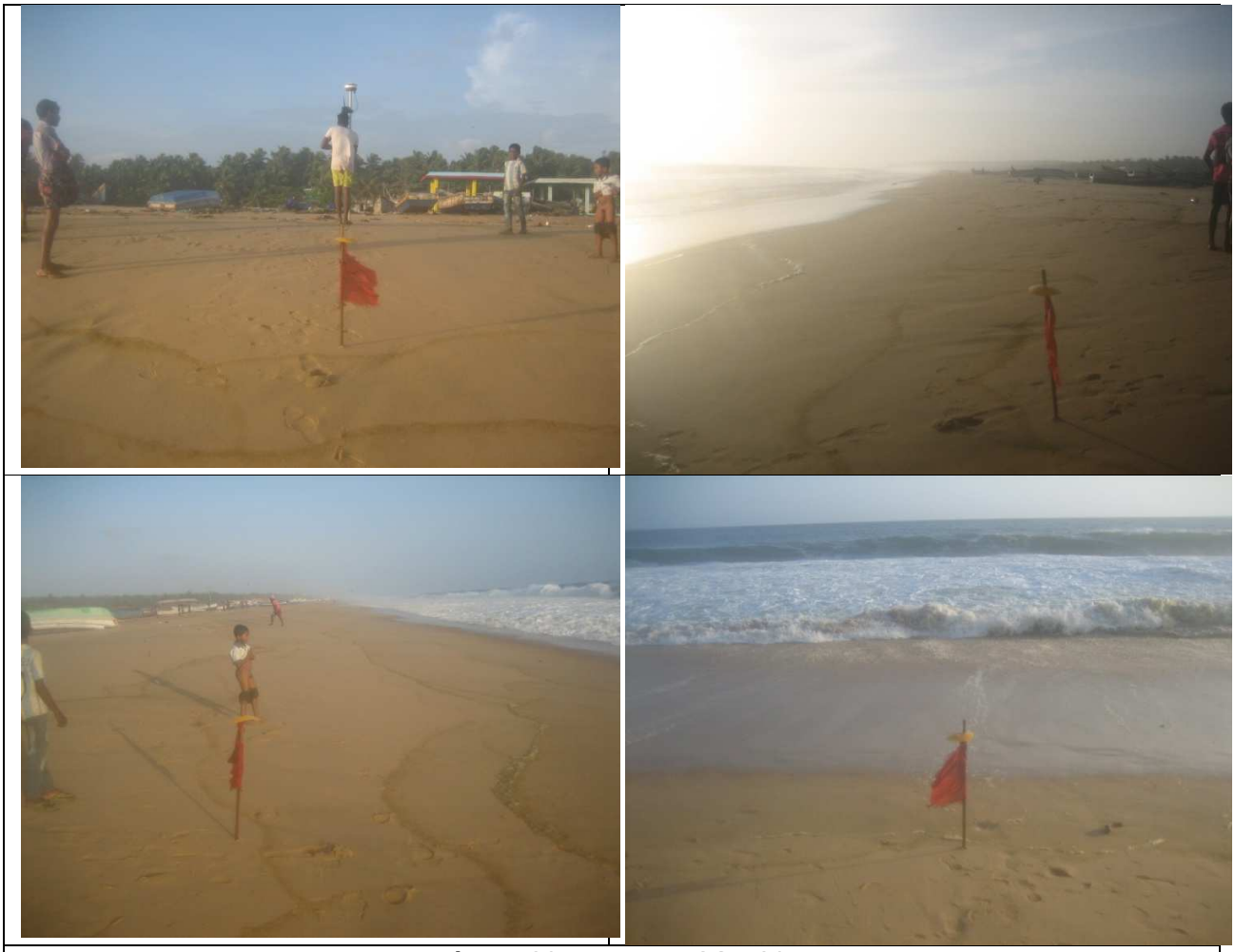


Figure 26:- August_CSP 26

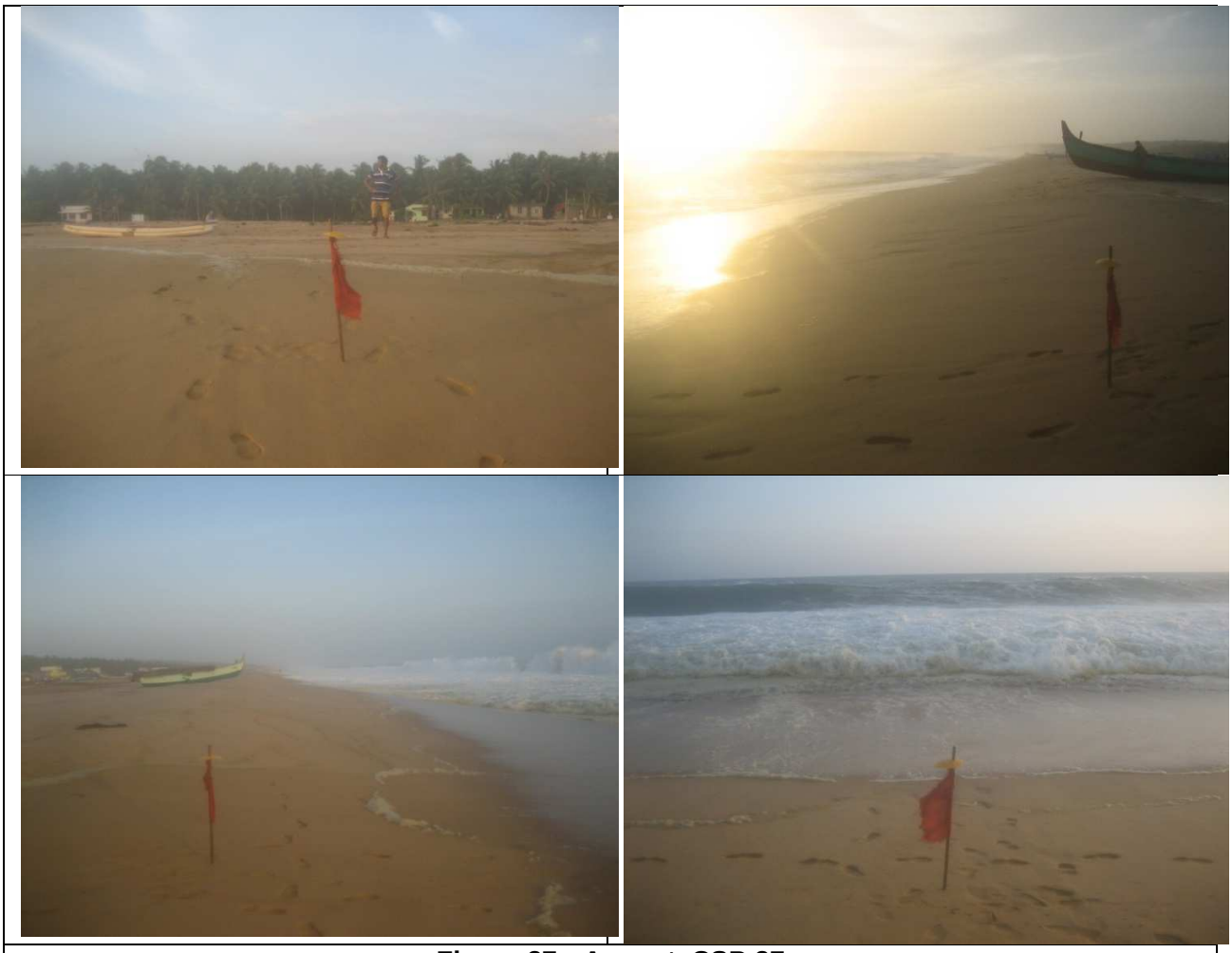


Figure 27:- August_CSP 27

Figure 28:- August_CSP 28

Figure 29:- August_CSP 29

Figure 30:- August_CSP 30

Figure 31:- August_CSP 31

Figure 32:- August_CSP 32

Figure 33:- August_CSP 33

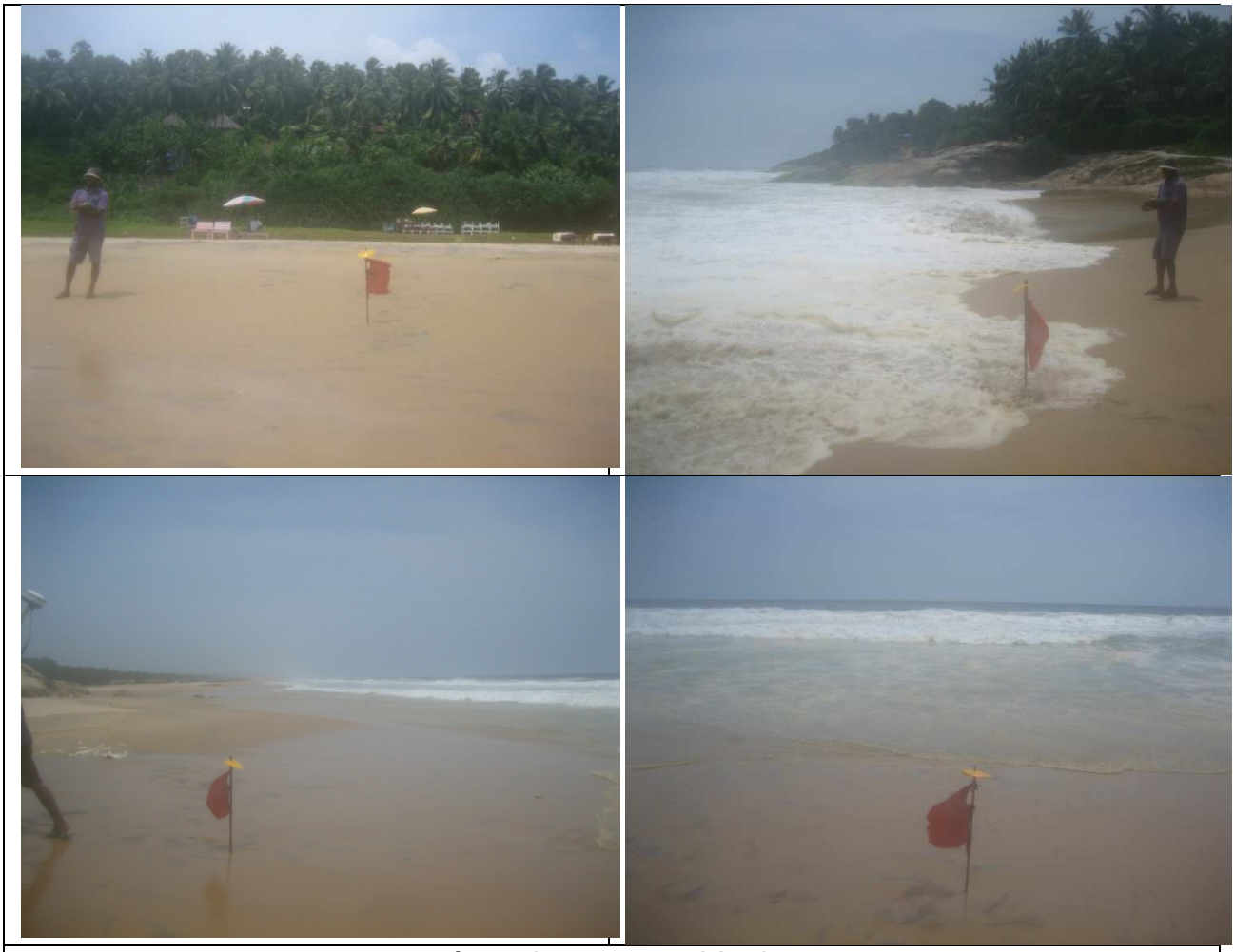


Figure 34:- August_CSP 34

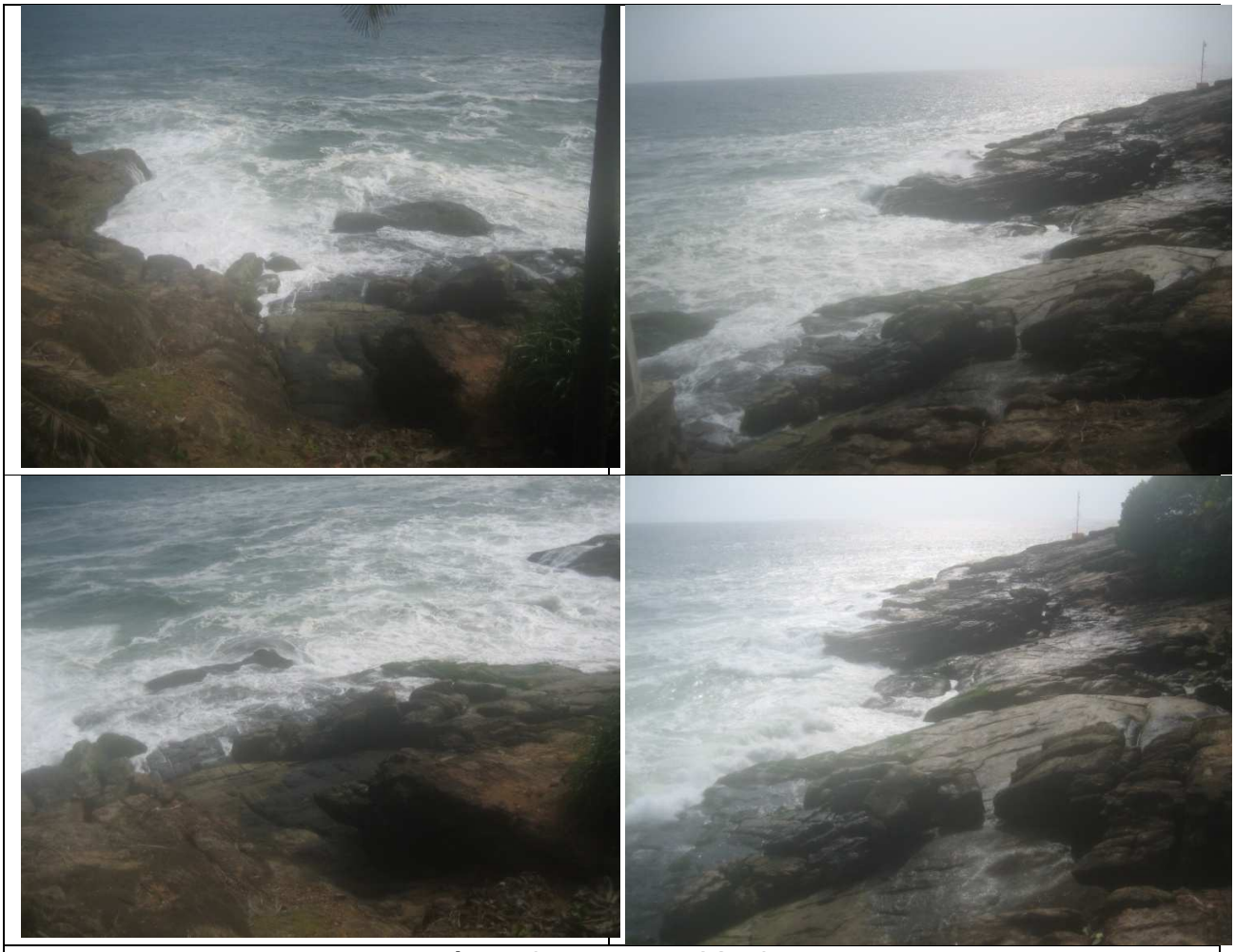


Figure 35:- August_CSP 35

Figure 36:- August_CSP 36

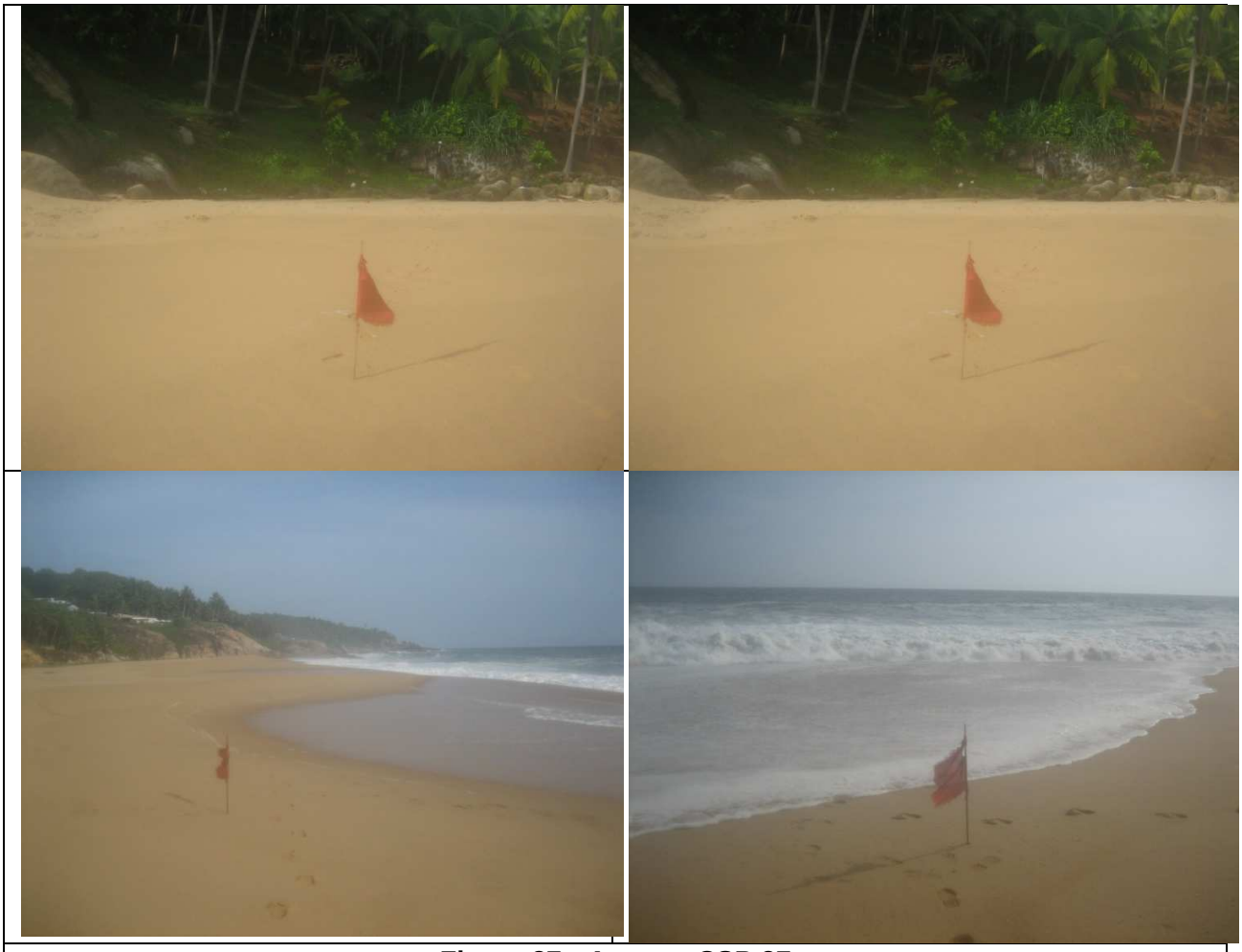


Figure 37:- August_CSP 37

Figure 38:- August_CSP 38

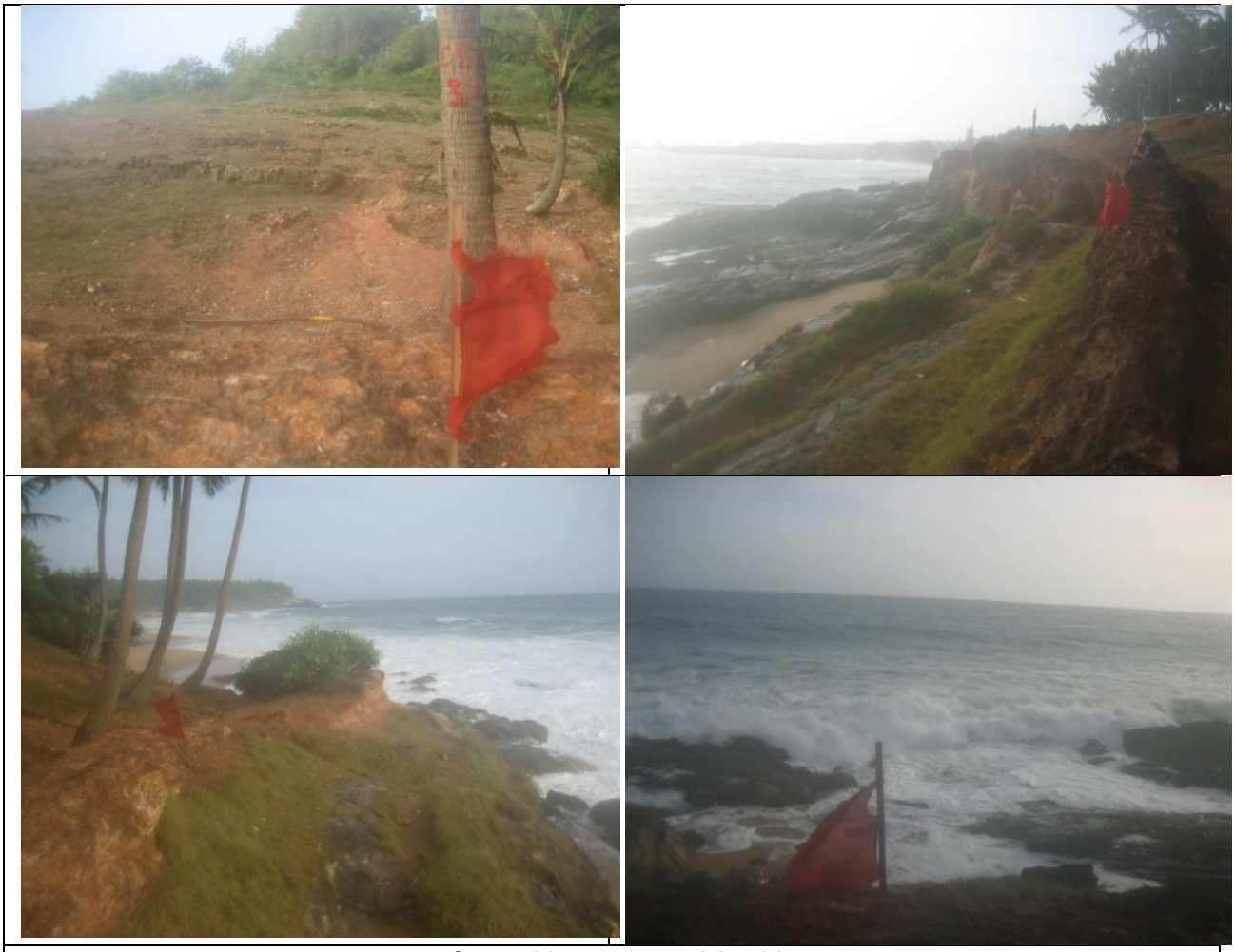


Figure 39:- August_CSP 39

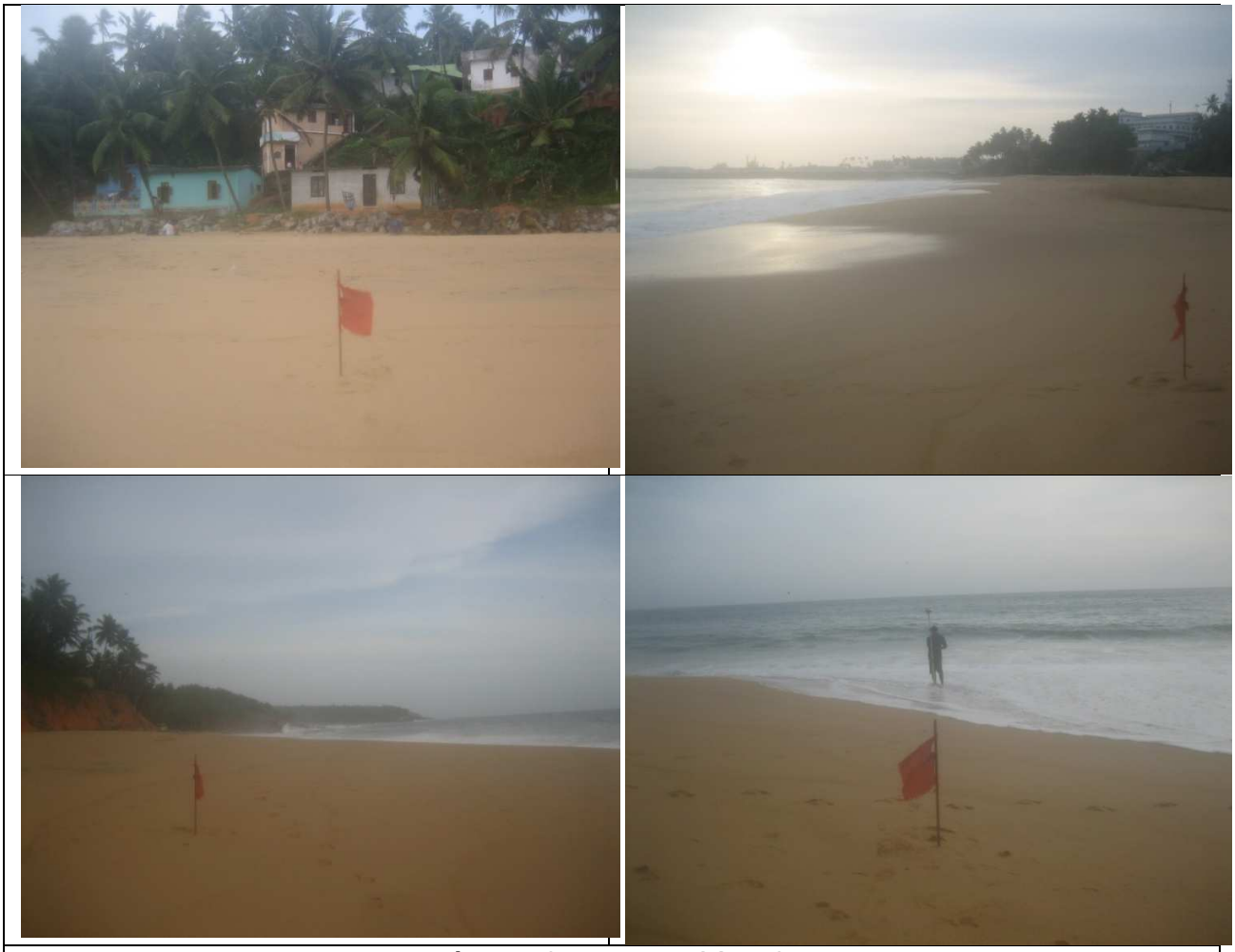


Figure 40:- August_CSP 40

Figure 41:- August_CSP 41

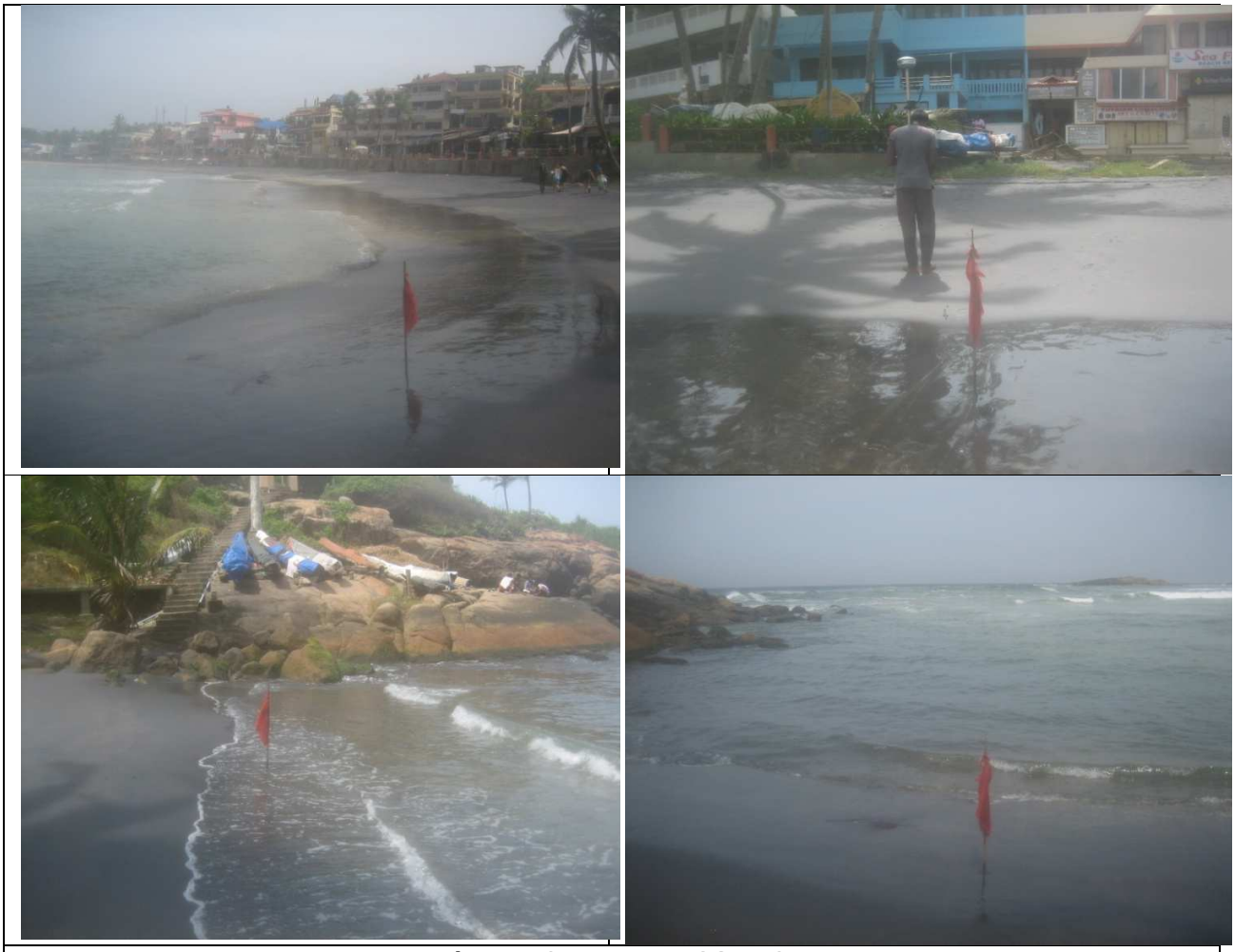


Figure 42:- August_CSP 42

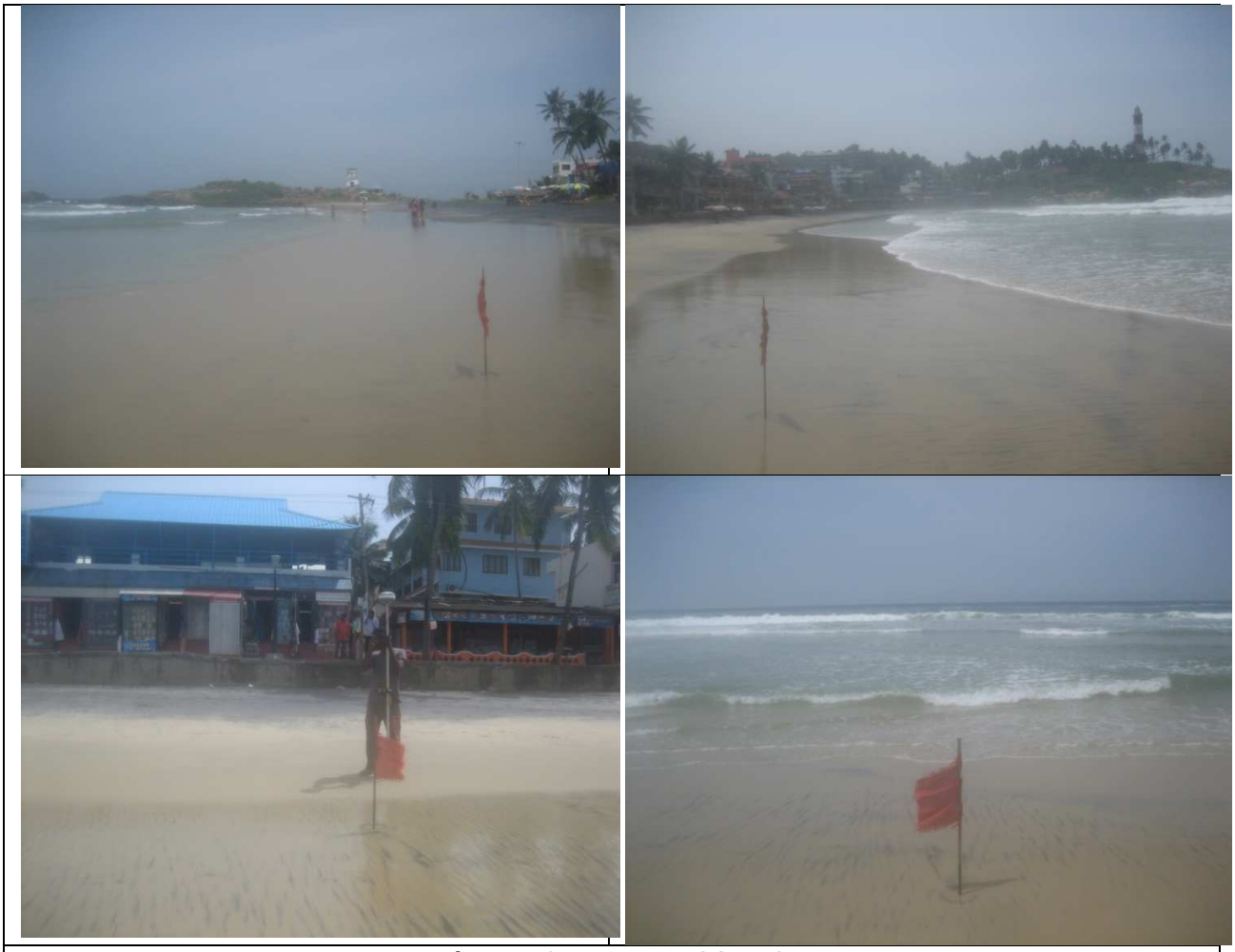


Figure 43:- August_CSP 43

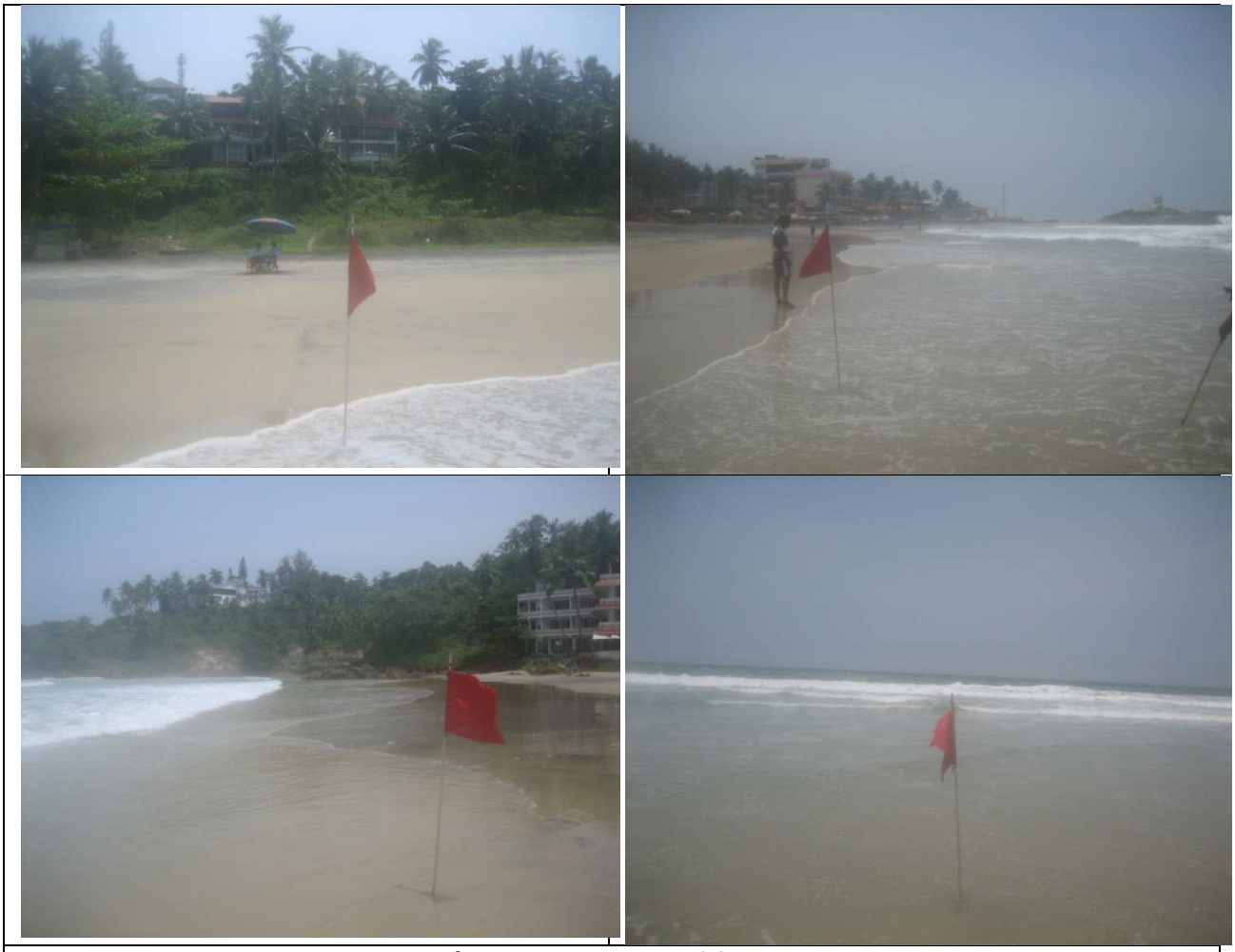


Figure 44:- August_CSP 44

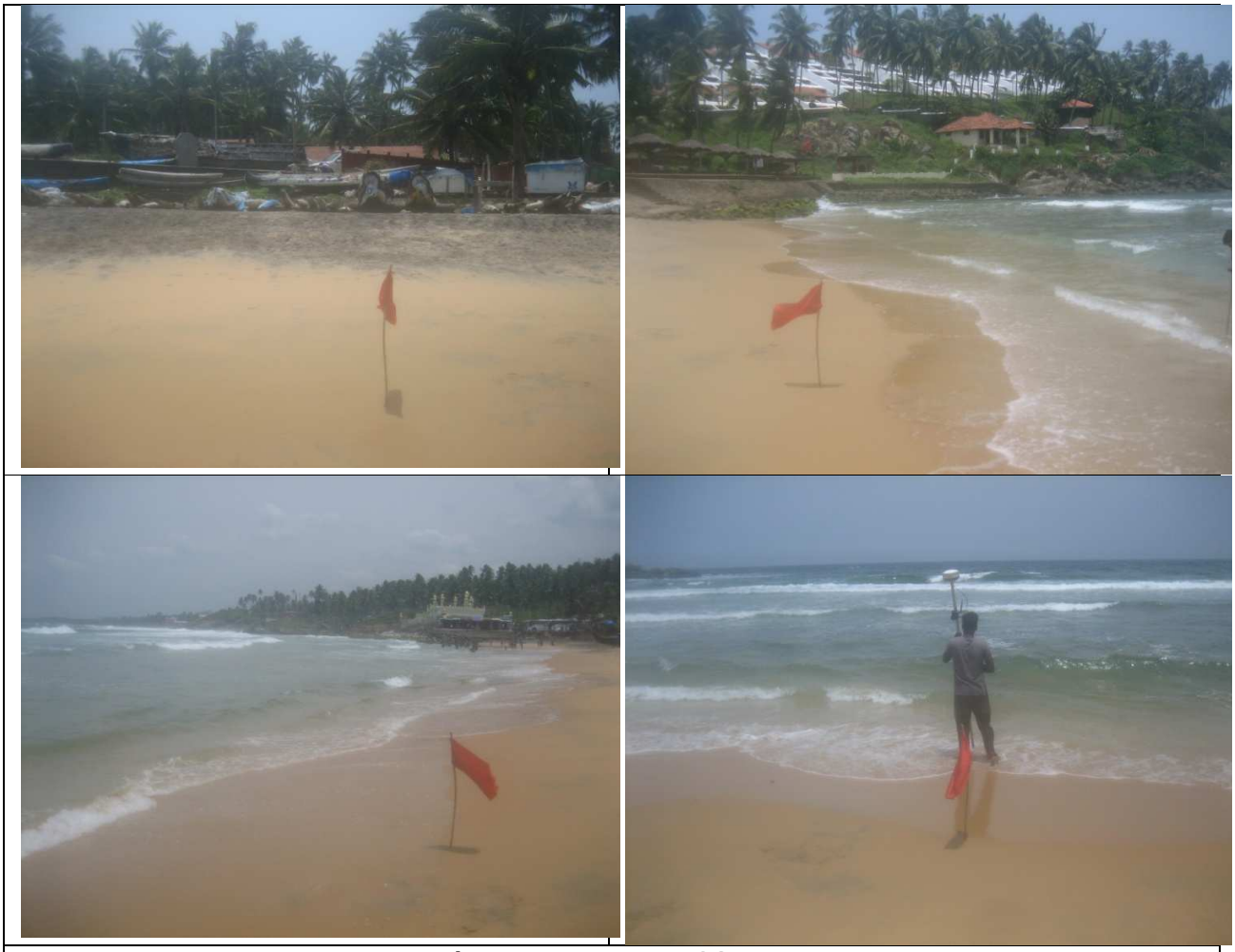


Figure 45:- August_CSP 45

Figure 46:- August_CSP 46

Figure 47:- August_CSP 47

Figure 48:- August_CSP 48

Figure 49:- August_CSP 49

Figure 50:- August_CSP 50

Figure 51:- August_CSP 51

Figure 52:- August_CSP 52

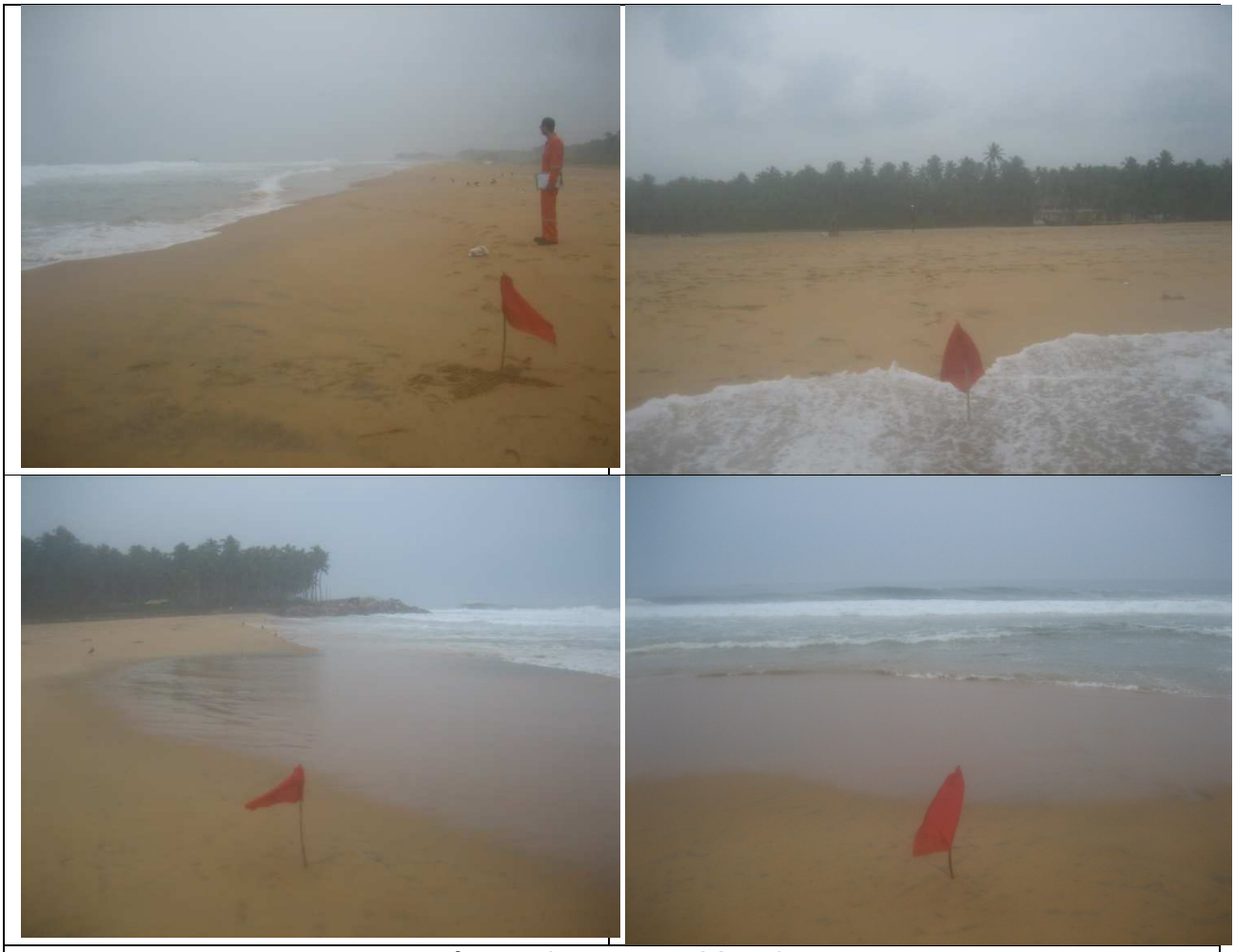


Figure 53:- August_CSP 53

Figure 54:- August_CSP 54

Figure 55:- August_CSP 55

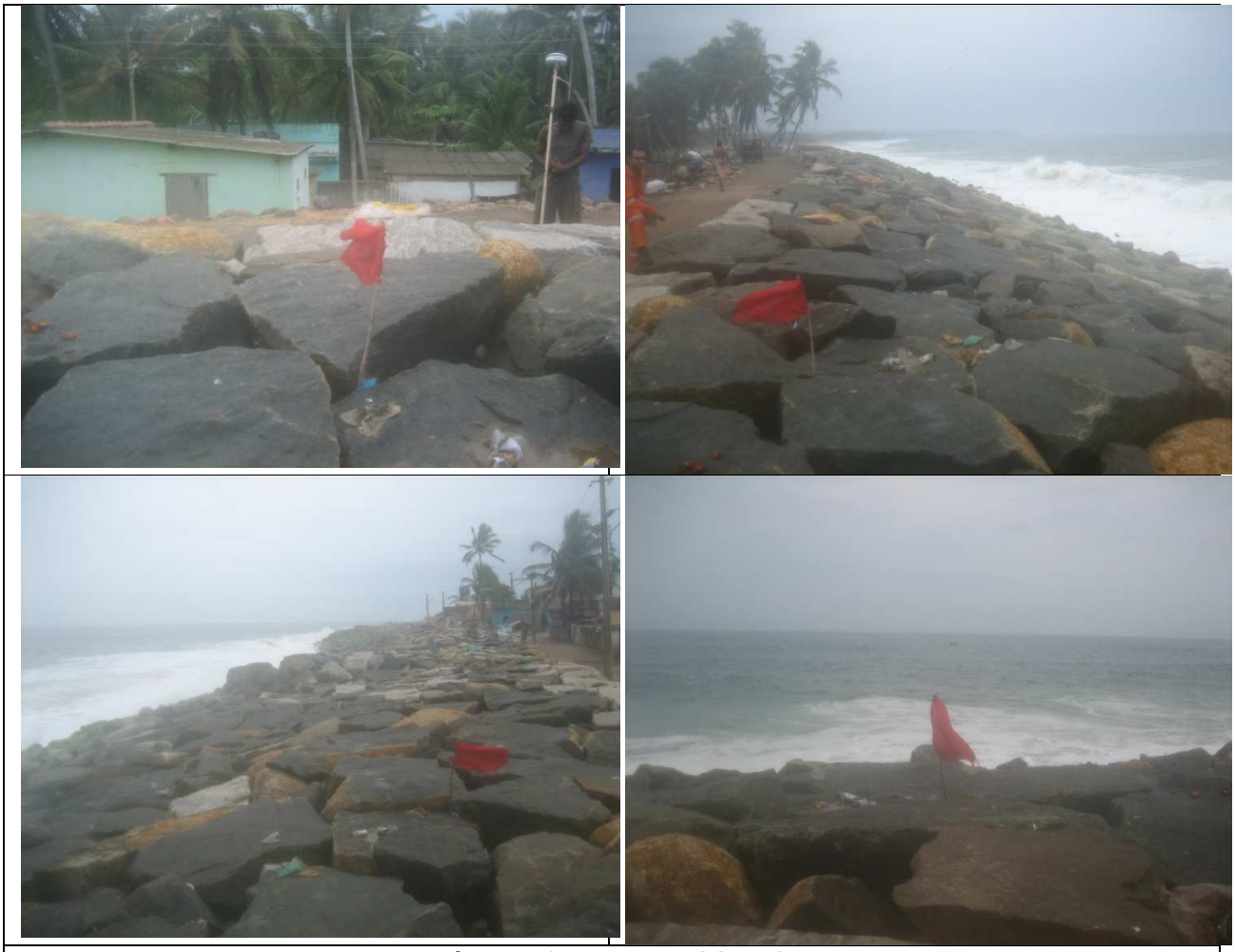


Figure 56:- August_CSP 56

Figure 57:- August_CSP 57

Figure 58:- August_CSP 58

Figure 59:- August_CSP 59

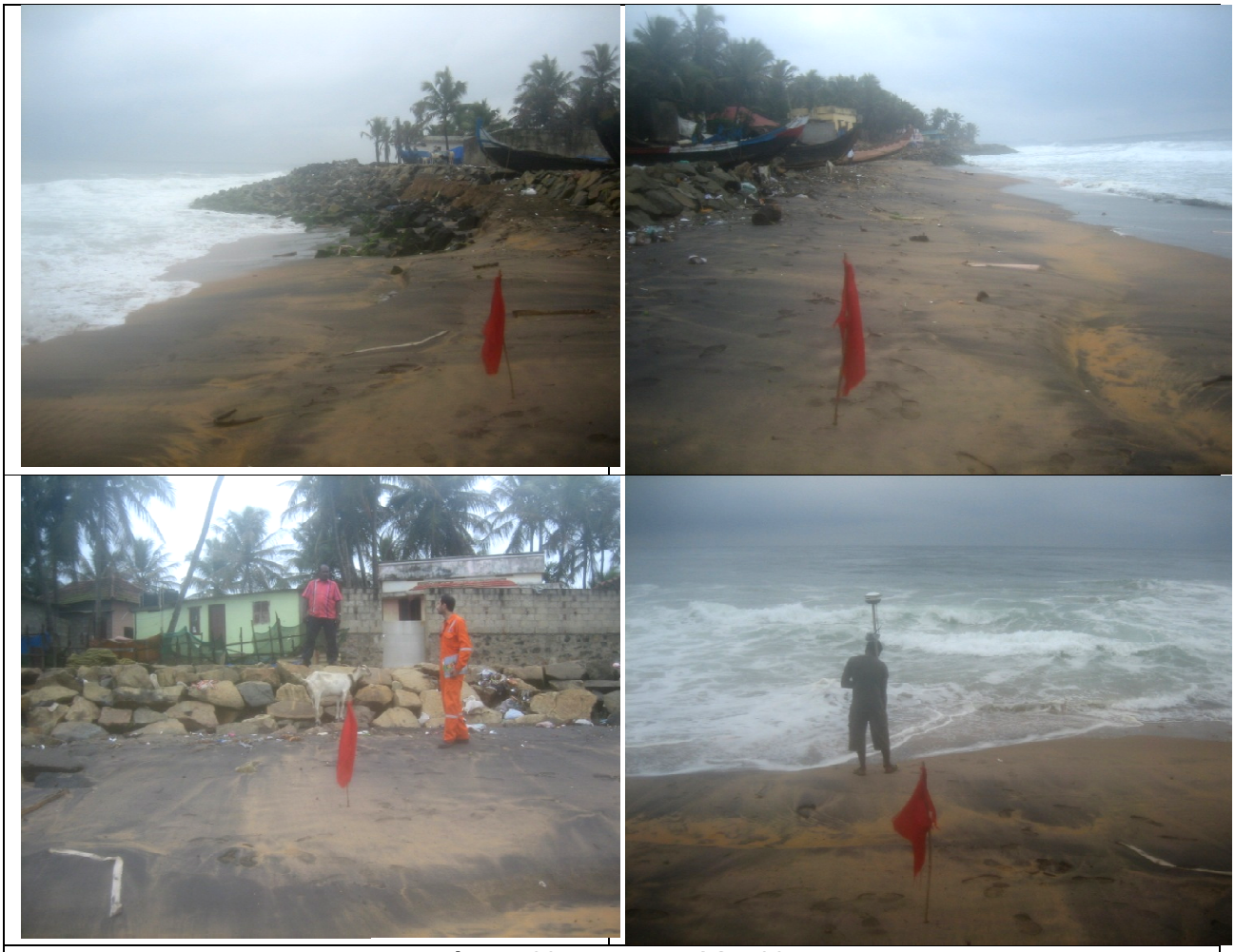


Figure 60:- August_CSP 60

Figure 61:- August_CSP 61

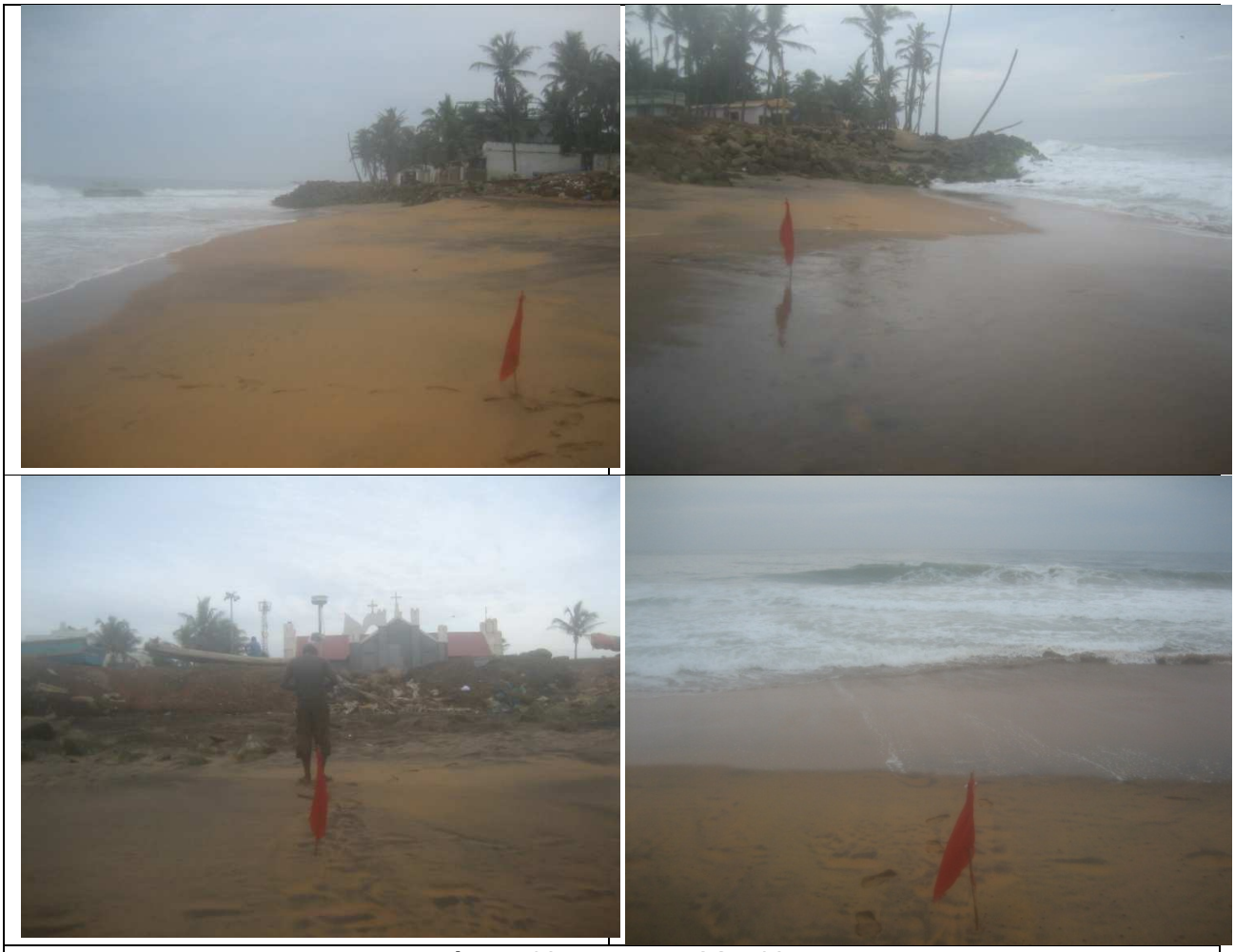


Figure 62:- August_CSP 62

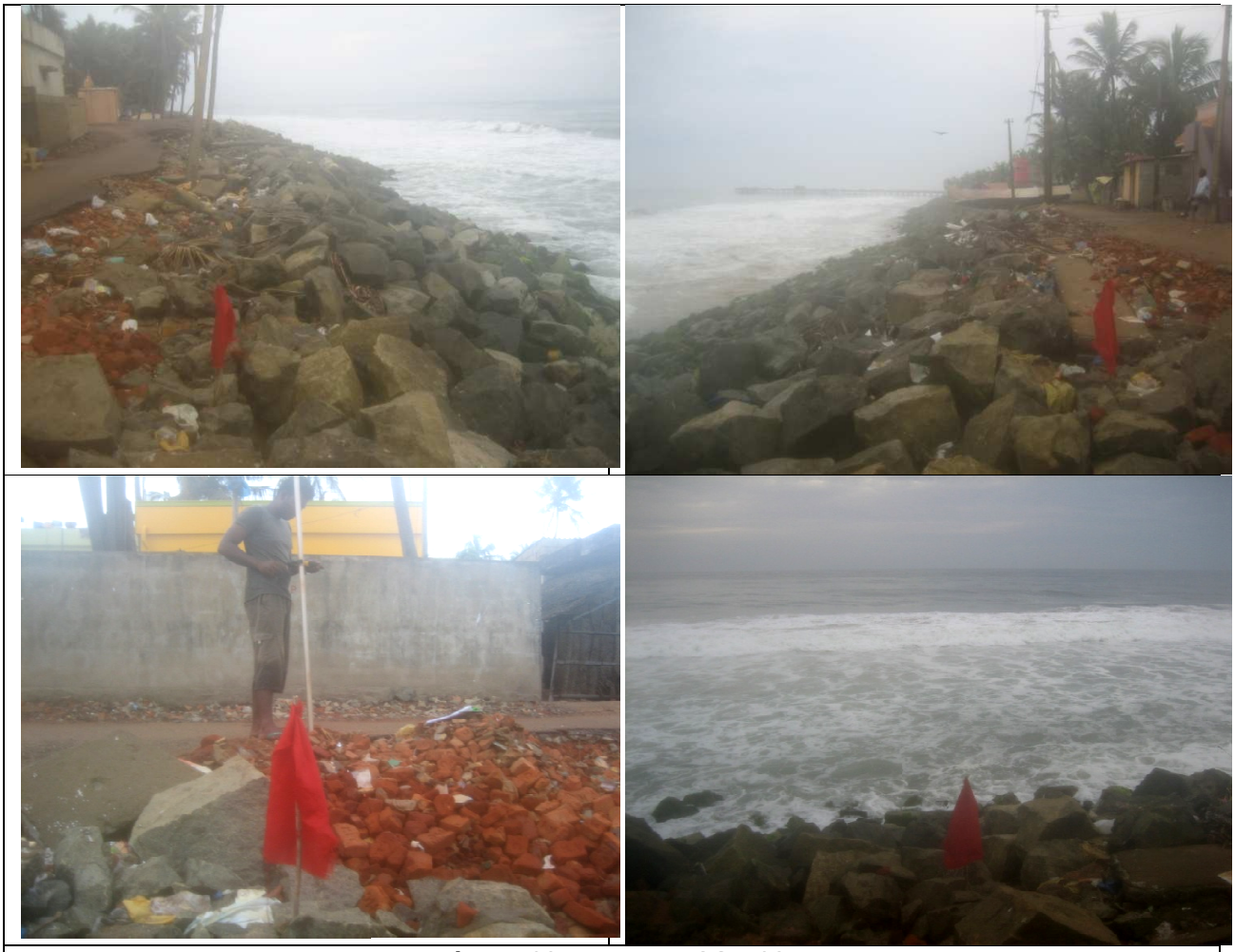


Figure 63:- August_CSP 63

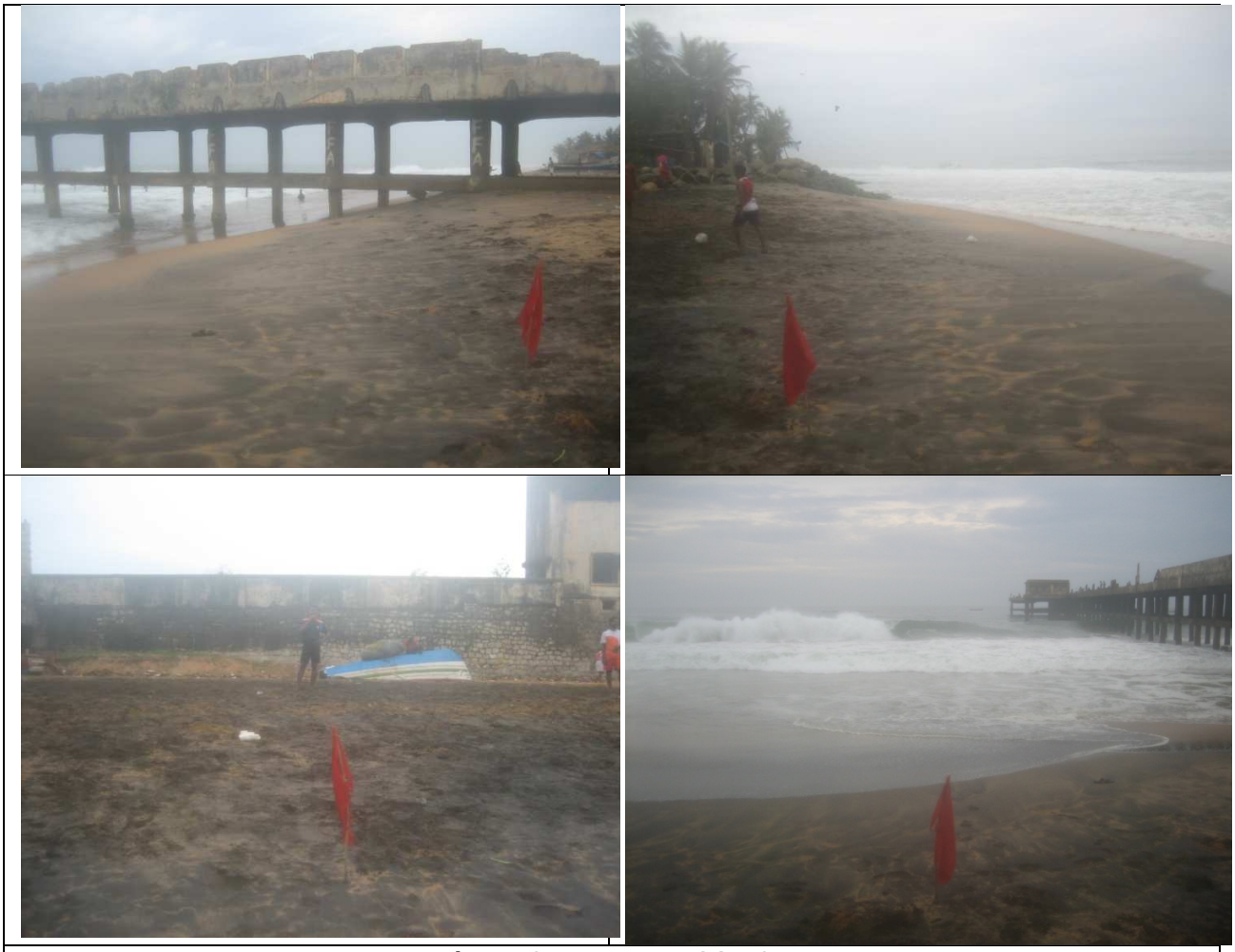


Figure 64:- August_CSP 64

Figure 65:- August_CSP 65

Figure 66:- August_CSP 66

Figure 67:- August_CSP 67

Figure 68:- August_CSP 68

Figure 69:- August_CSP 69

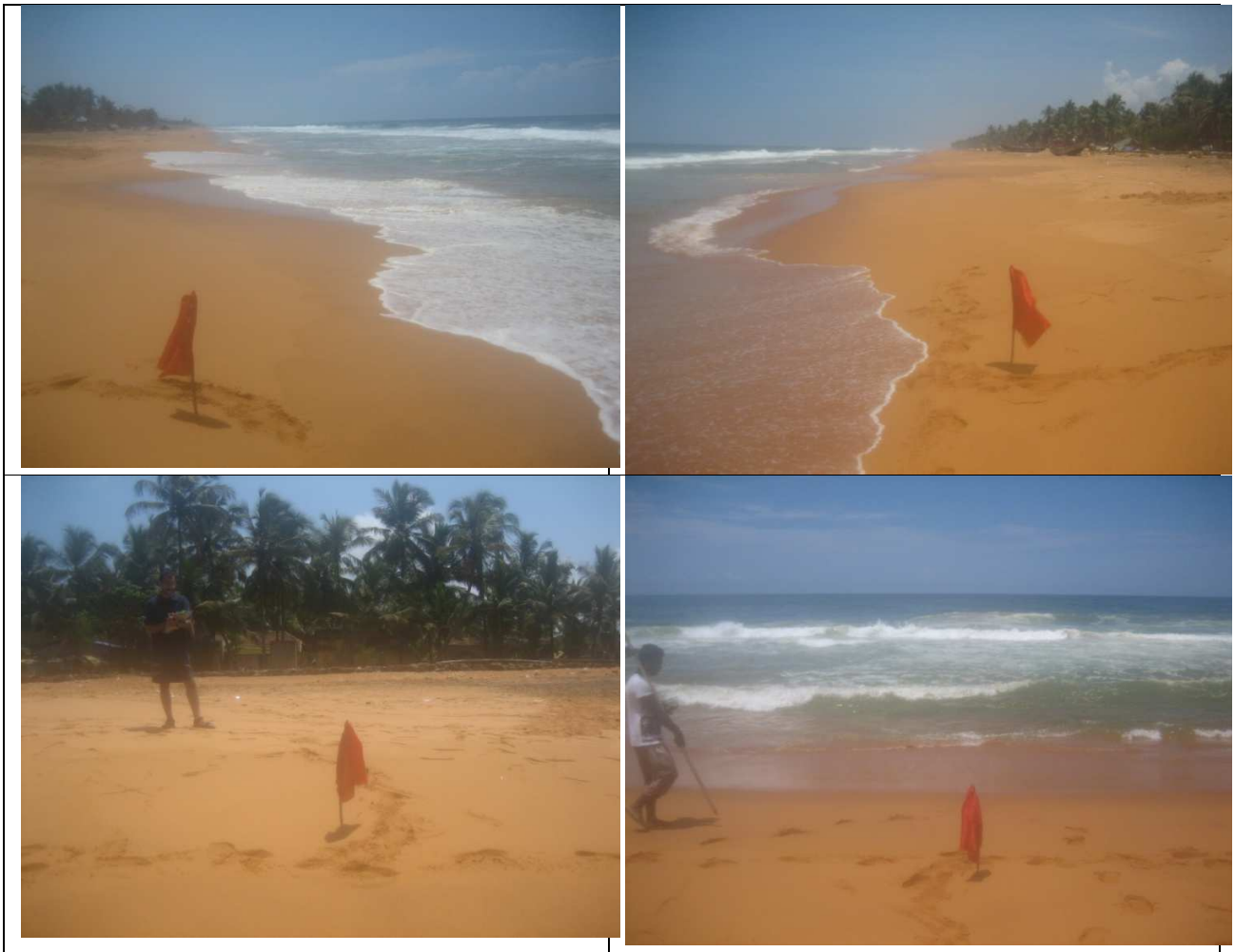


Figure 70:- August_CSP 70

Figure 71:- August_CSP 71

Figure 72:- August_CSP 72

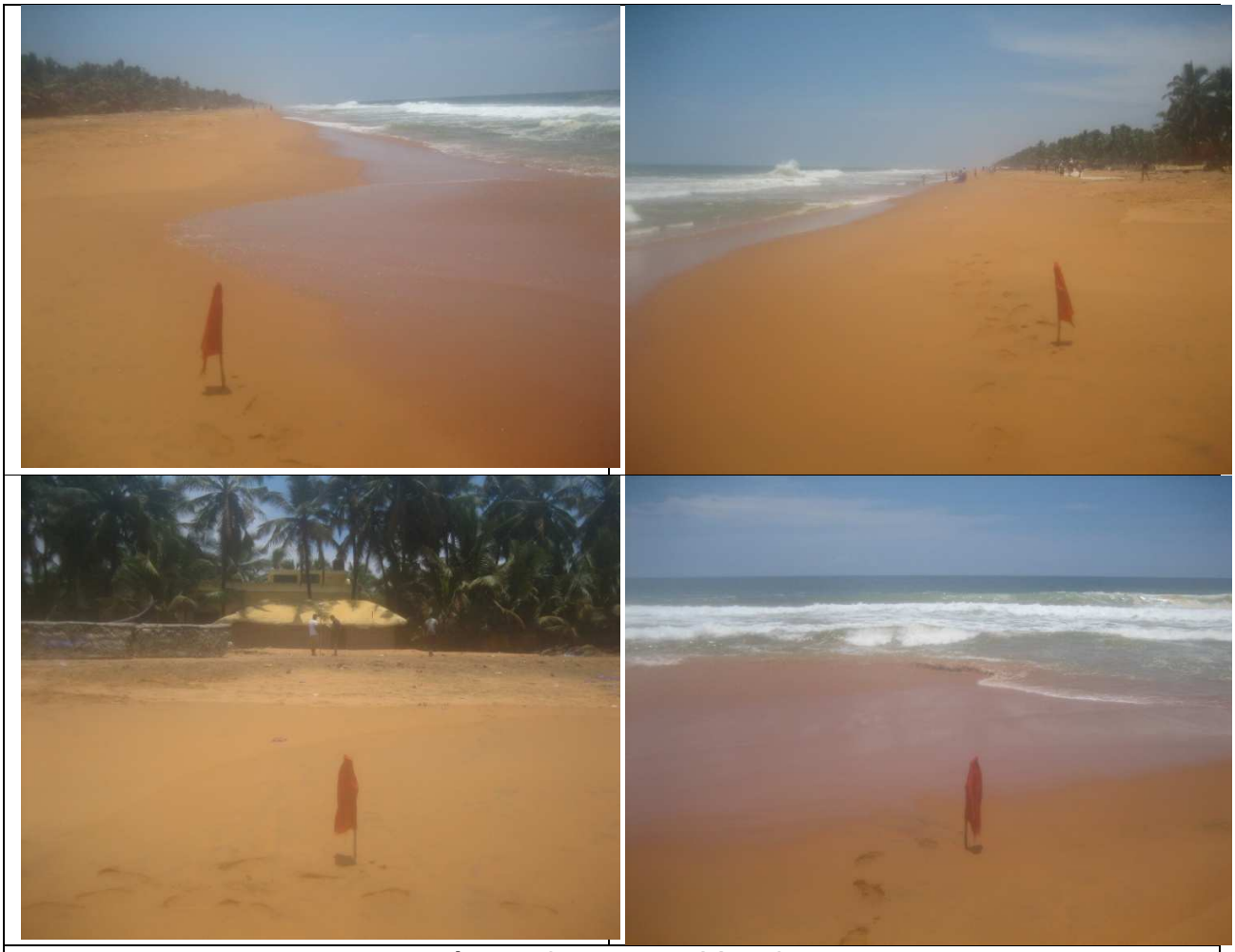


Figure 73:- August_CSP 73

Figure 74:- August_CSP 74

Figure 75:- August_CSP 75

Figure 76:- August_CSP 76

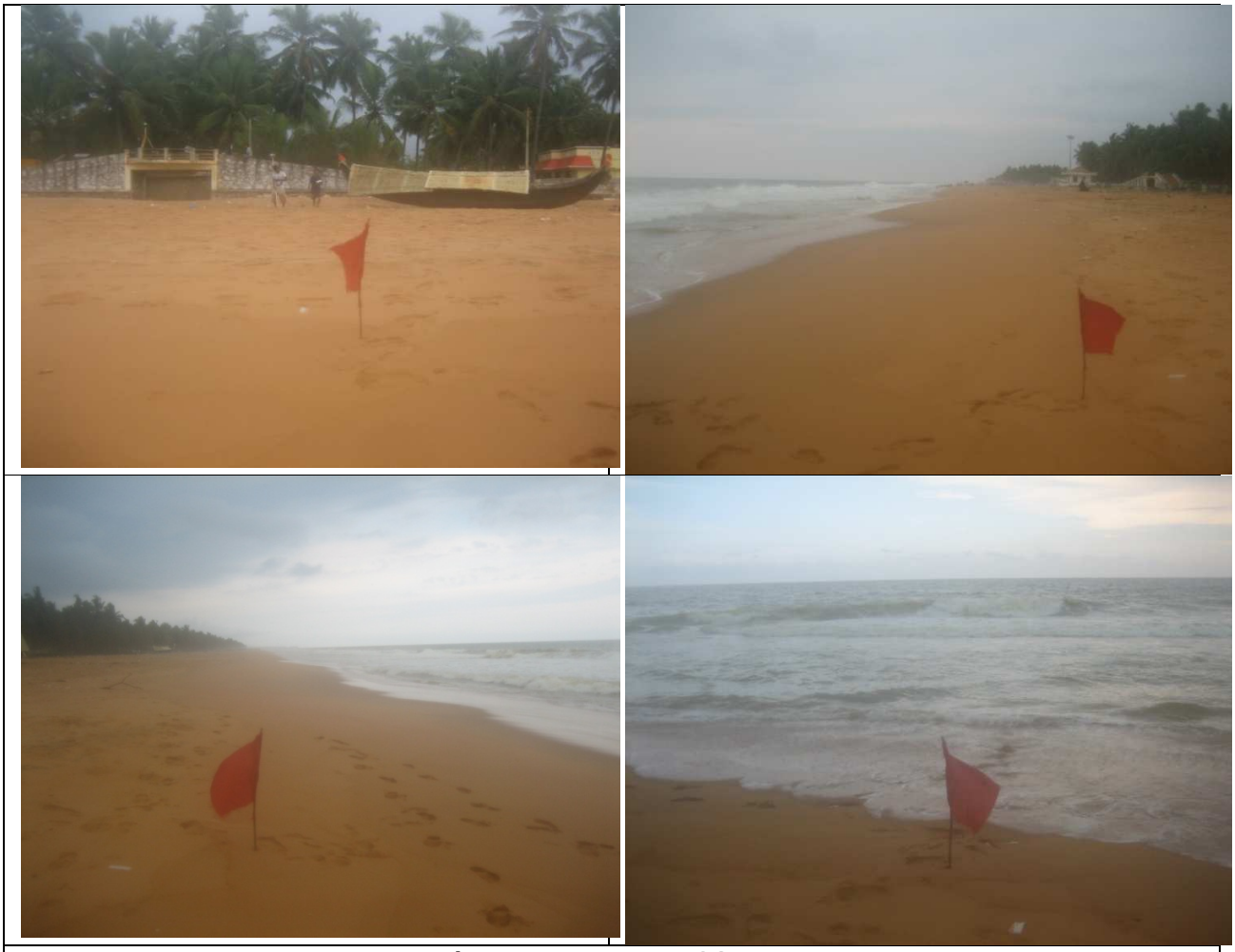


Figure 77:- August_CSP 77

Figure 78:- August_CSP 78

Figure 79:- August_CSP 79

Figure 80:- August_CSP 80

Figure 81:- August_CSP 81

Annexure VI

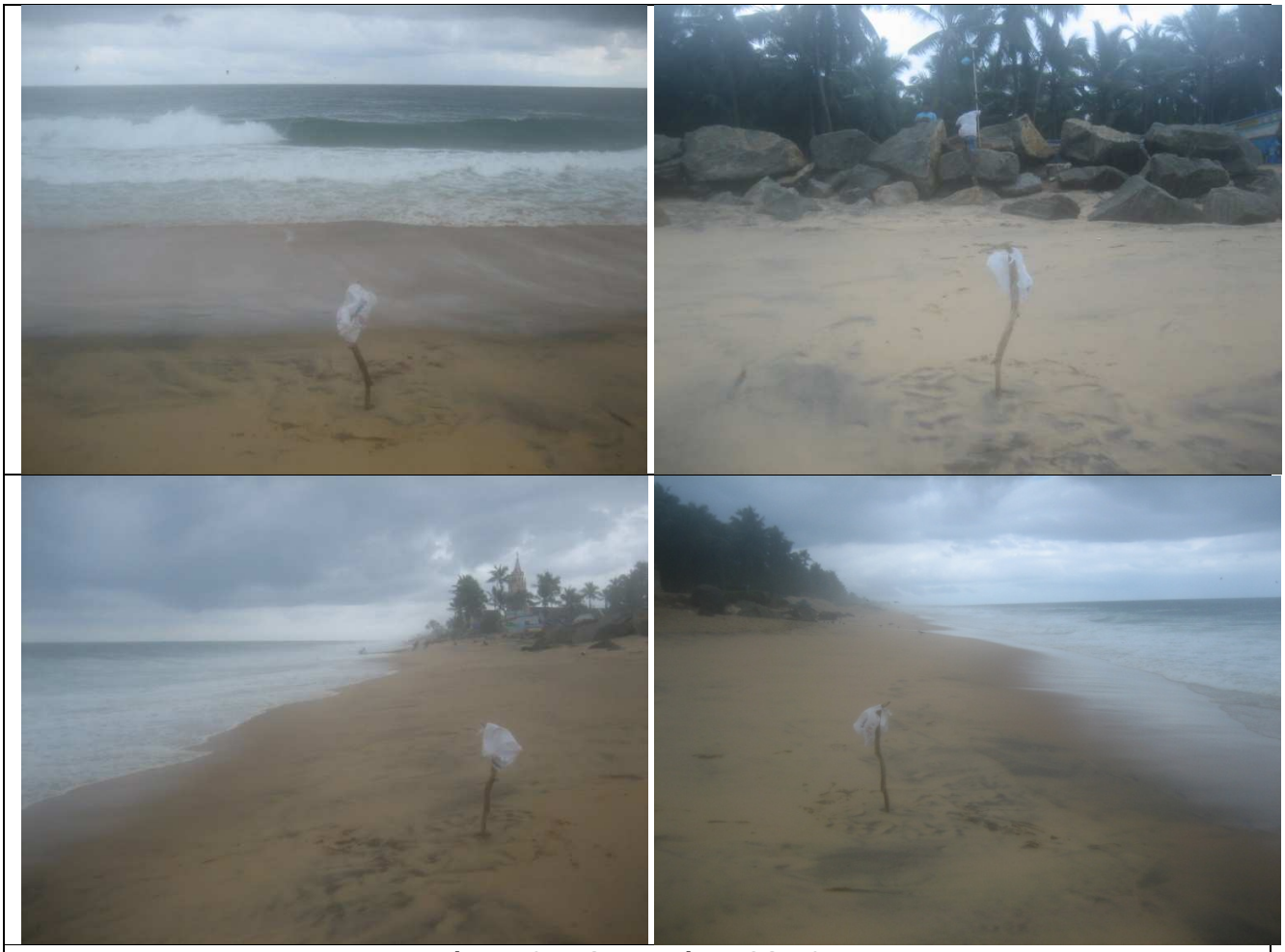
CSP Locations - September 2015

Figure 01:- September_CSP 01

Figure 02:- September_CSP 02

Figure 03:- September_CSP 03

Figure 04:- September_CSP 04



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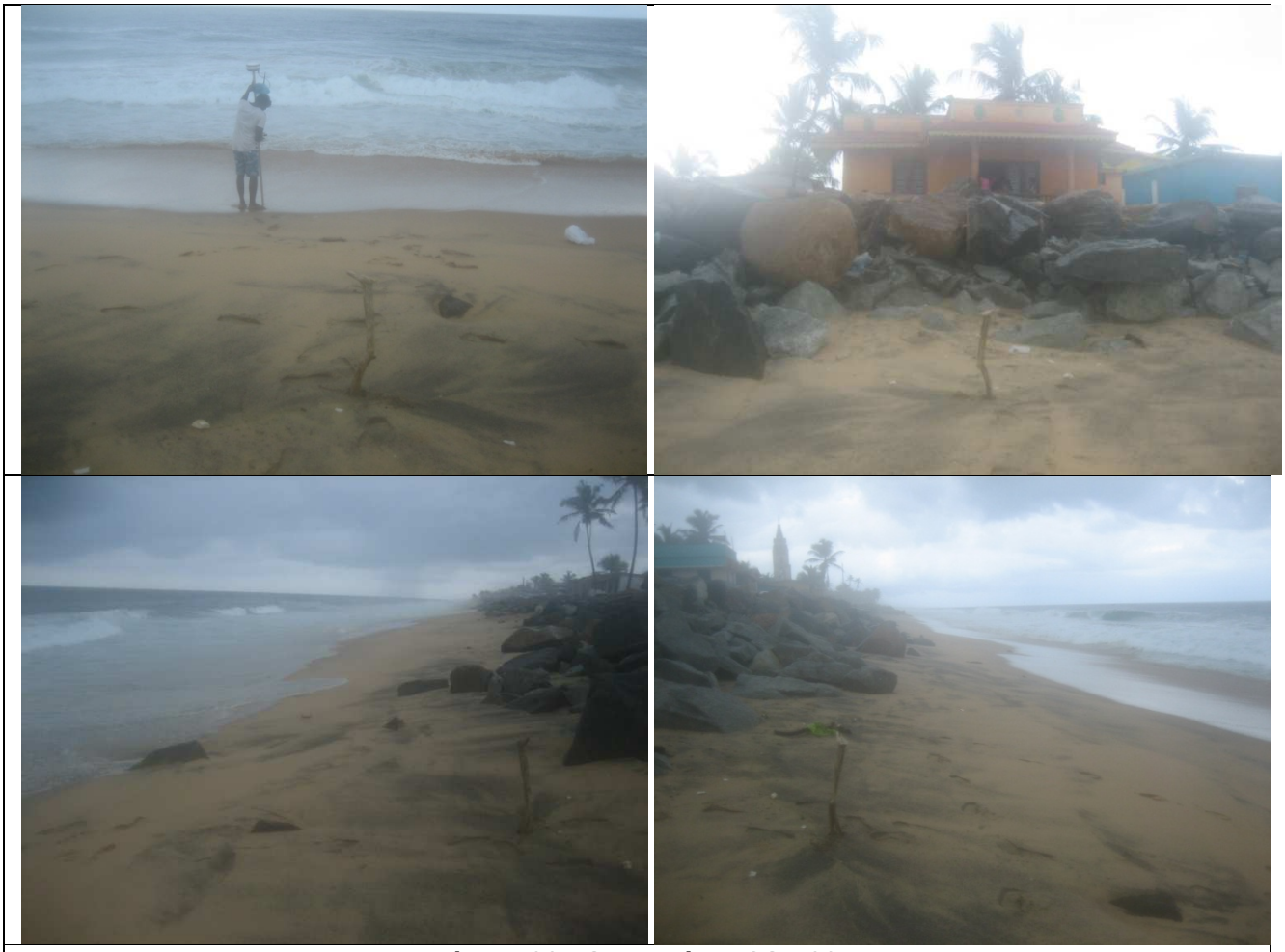


Figure 06:- September_CSP 06

Figure 07:- September_CSP 07

Figure 08:- September_CSP 08

Figure 09:- September_CSP 09

Figure 10:- September_CSP 10

Figure 11:- September_CSP 11

Figure 12:- September_CSP 12

Figure 13:- September_CSP 13

Figure 14:- September_CSP 14

Figure 15:- September_CSP 15

Figure 16:- September_CSP 16

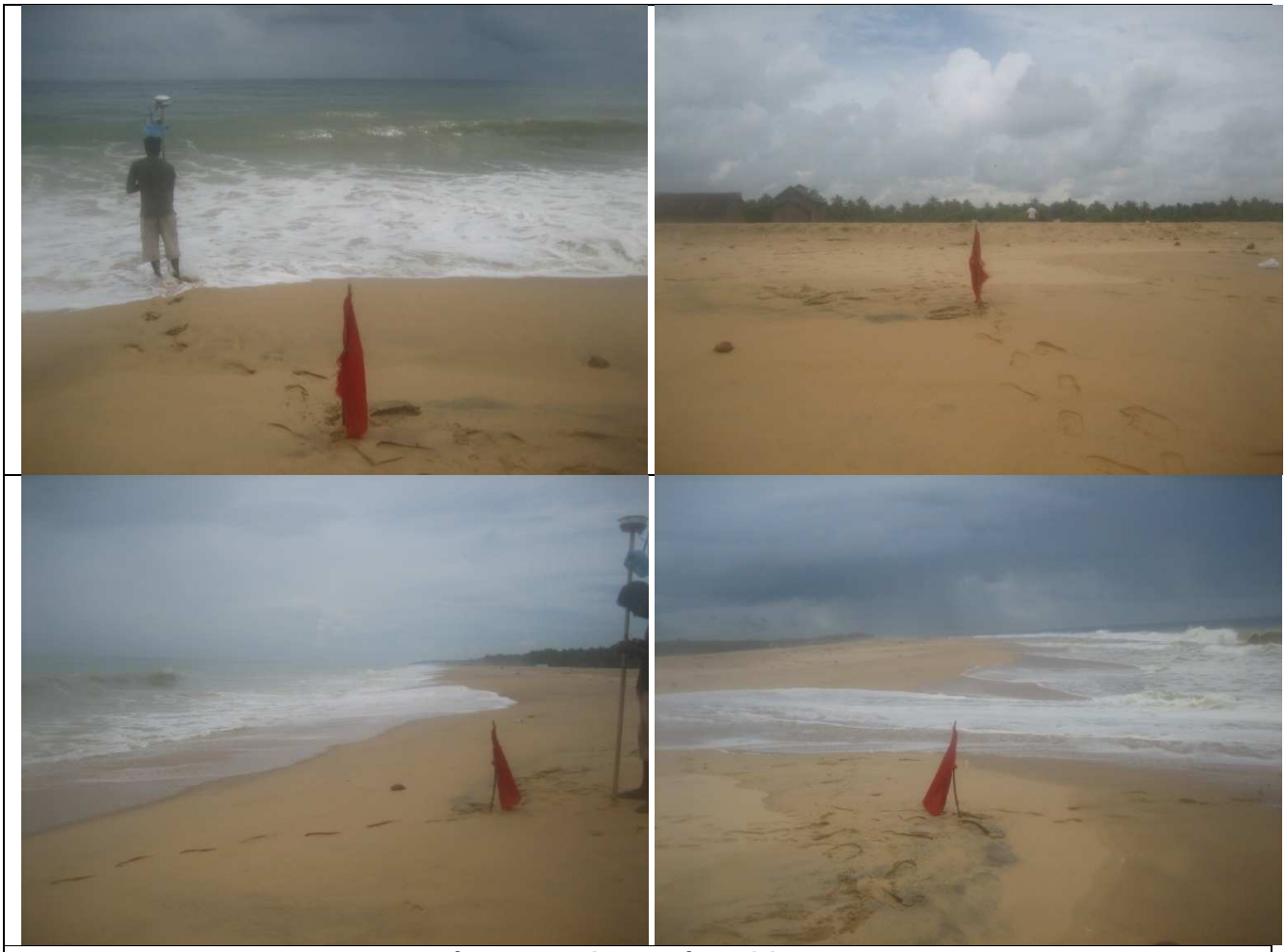


Figure 17:- September_CSP 17

Figure 18:- September_CSP 18

Figure 19:- September_CSP 19

Figure 20:- September_CSP 20

Figure 21:- September_CSP 21

Figure 22:- September_CSP 22

Figure 23:- September_CSP 23

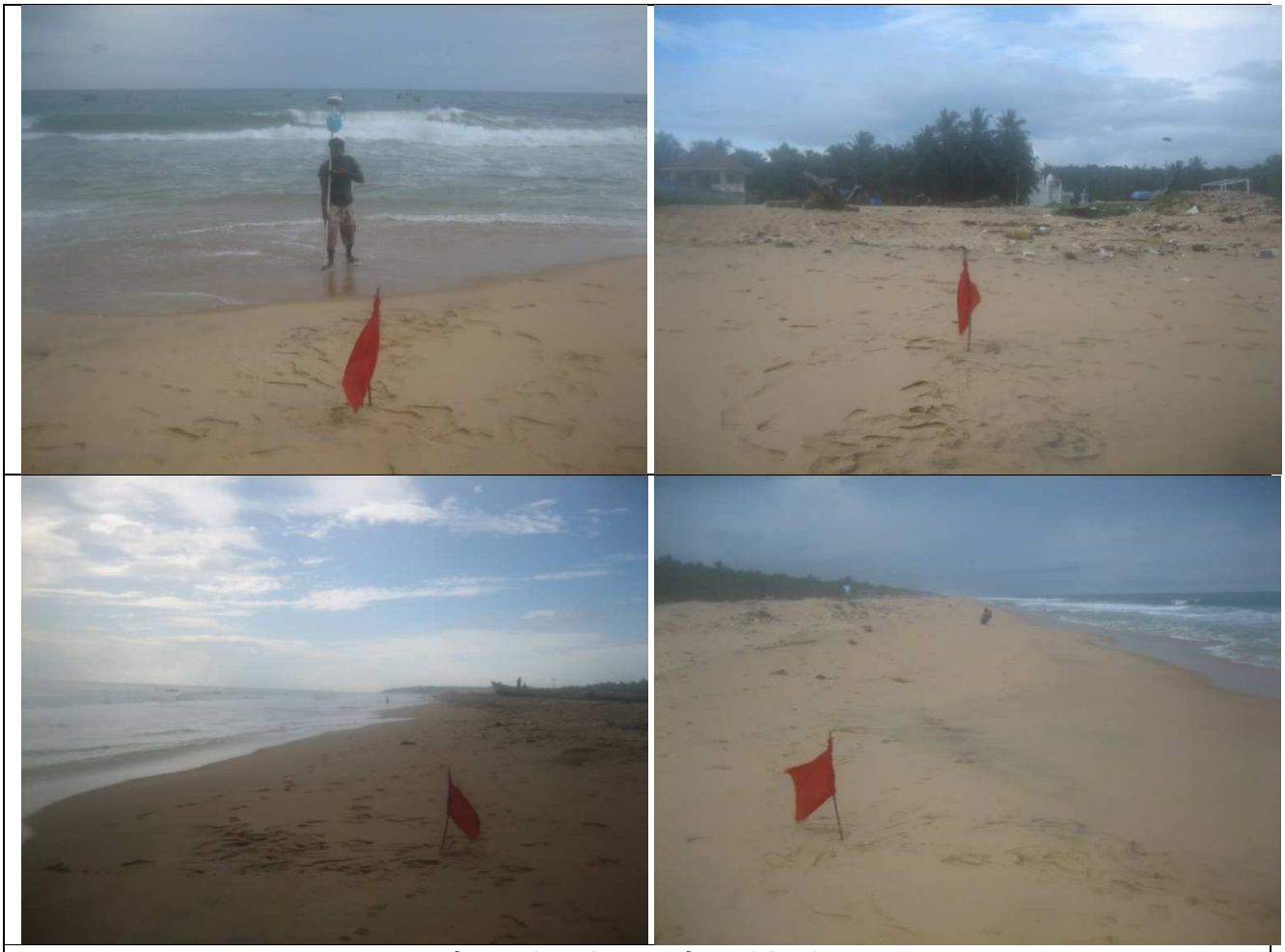


Figure 24:- September_CSP 24

Figure 25:- September_CSP 25

Figure 26:- September_CSP 26

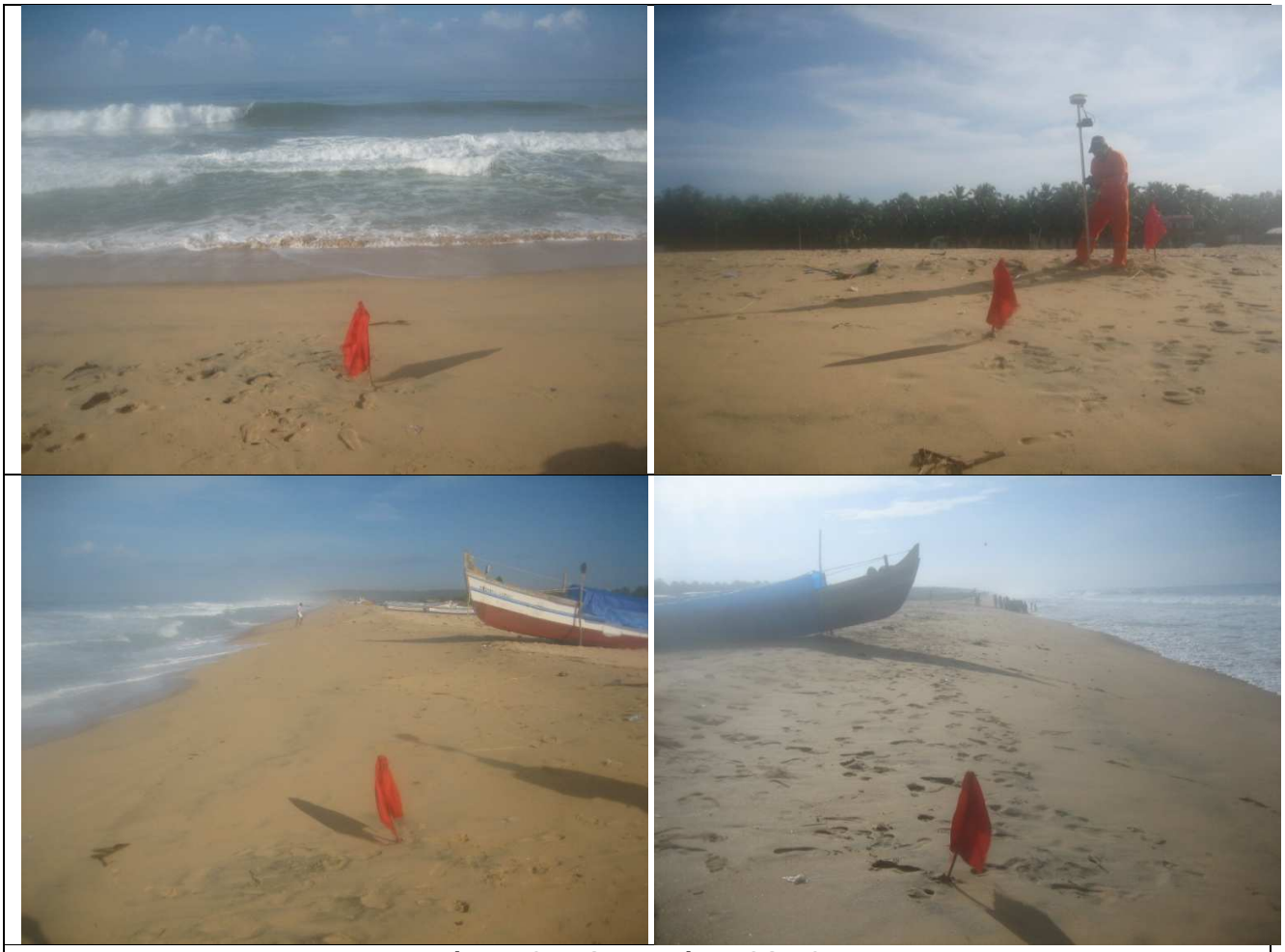


Figure 27:- September_CSP 27

Figure 28:- September_CSP 28

Figure 29:- September_CSP 29

Figure 30:- September_CSP 30

Figure 31:- September_CSP 31

Figure 32:- September_CSP 32

Figure 33:- September_CSP 33

Figure 34:- September_CSP 34

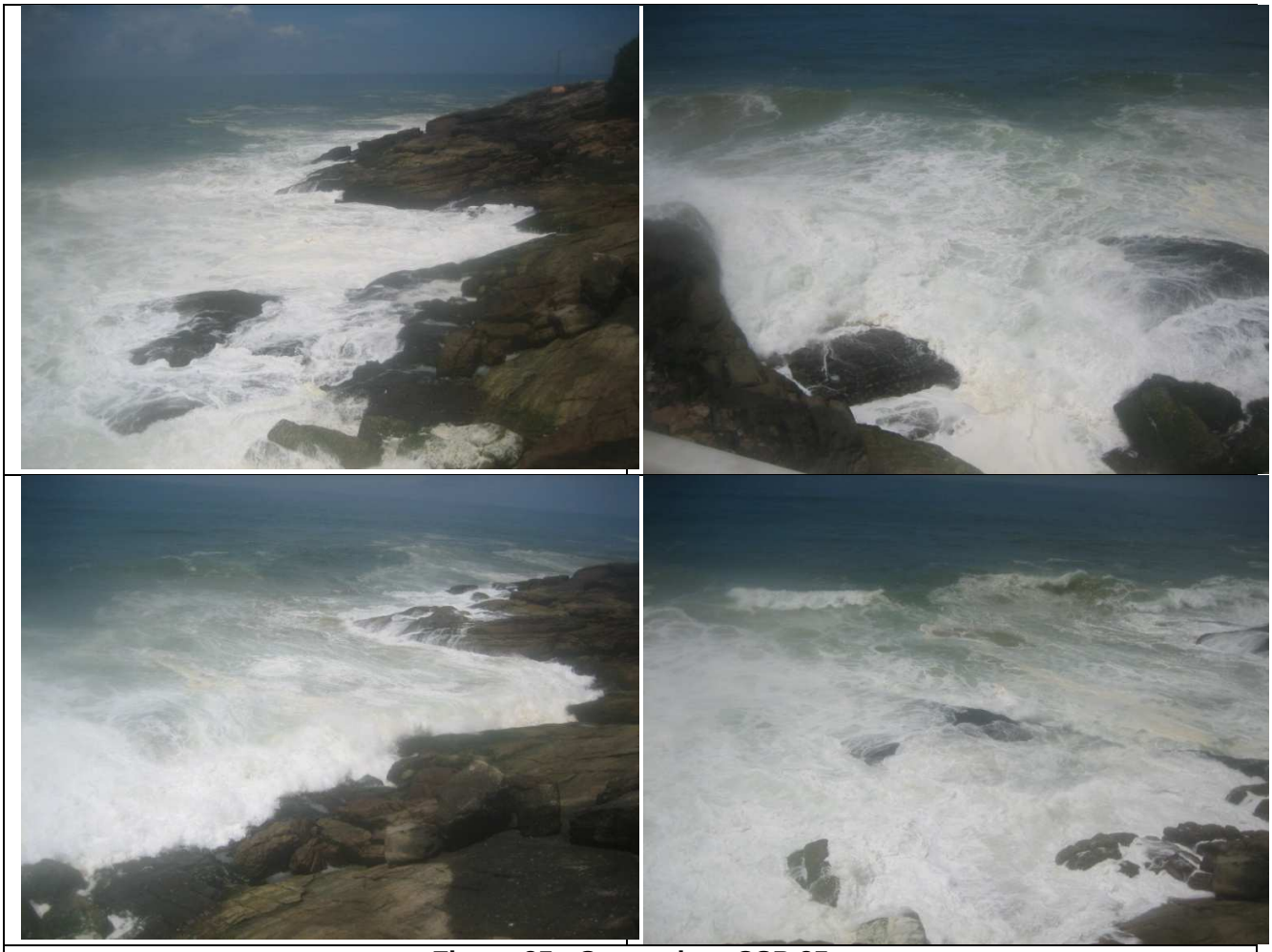


Figure 35:- September_CSP 35

Figure 36:- September_CSP 36

Figure 37:- September_CSP 37

Figure 38:- September_CSP 38

Figure 39:- September_CSP 39

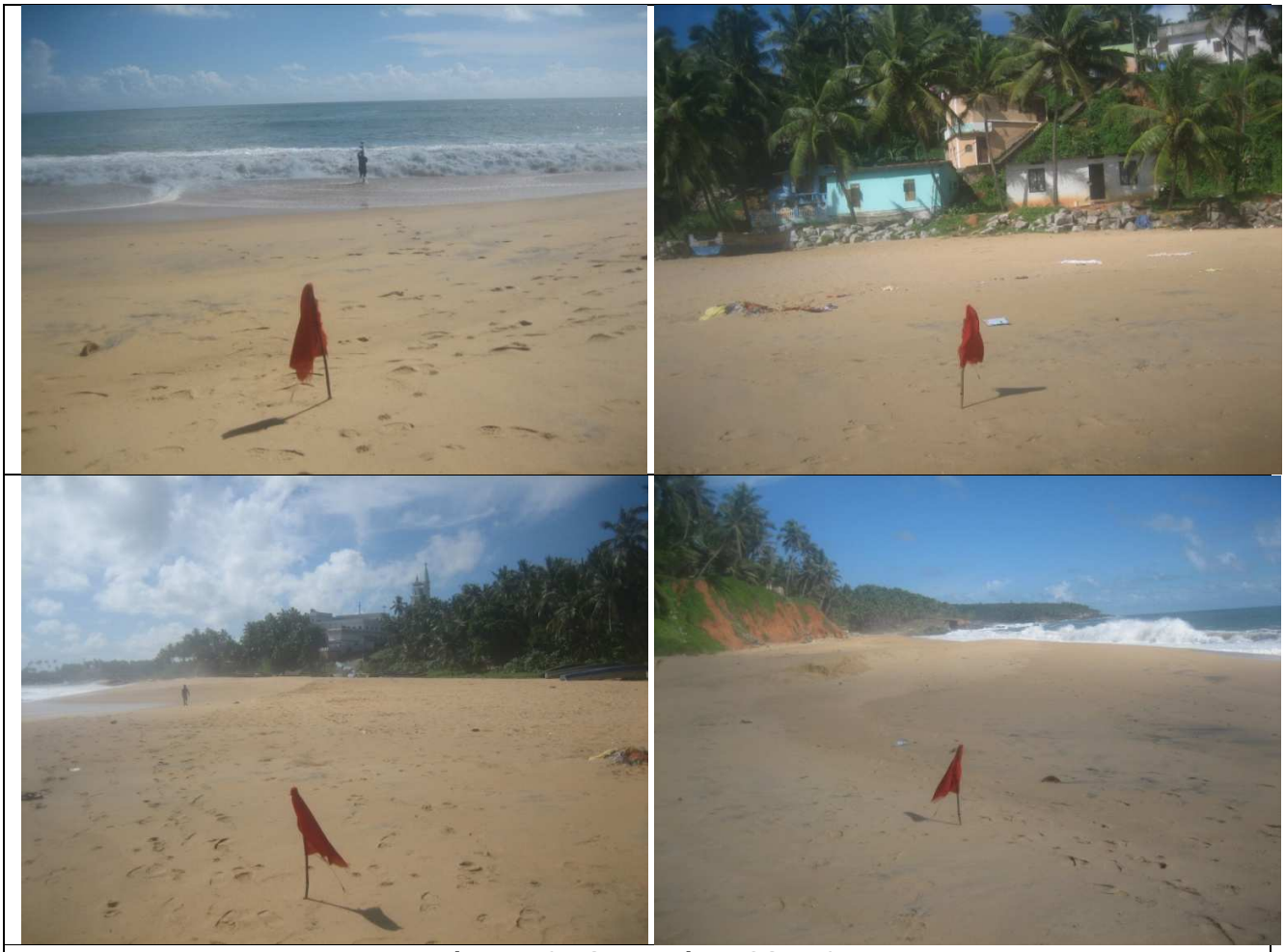


Figure 40:- September_CSP 40

Figure 41:- September_CSP 41

Figure 42:- September_CSP 42

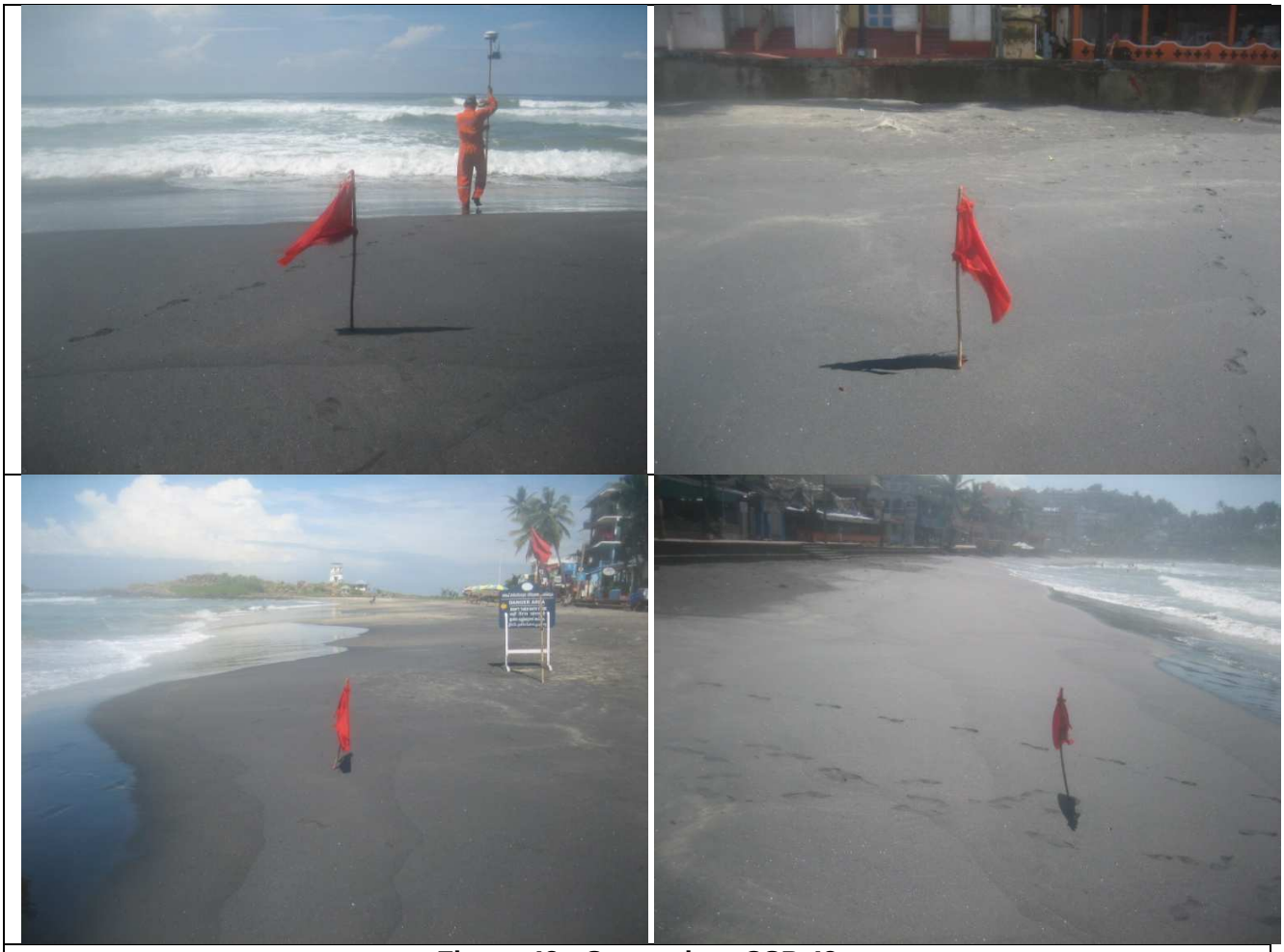


Figure 43:- September_CSP 43

Figure 44:- September_CSP 44

Figure 45:- September_CSP 45

Figure 46:- September_CSP 46

Figure 47:- September_CSP 47

Figure 48:- September_CSP 48

Figure 49:- September_CSP 49

Figure 50:- September_CSP 50

Figure 51:- September_CSP 51

Figure 52:- September_CSP 52

Figure 53:- September_CSP 53

Figure 54:- September_CSP 54

Figure 55:- September_CSP 55

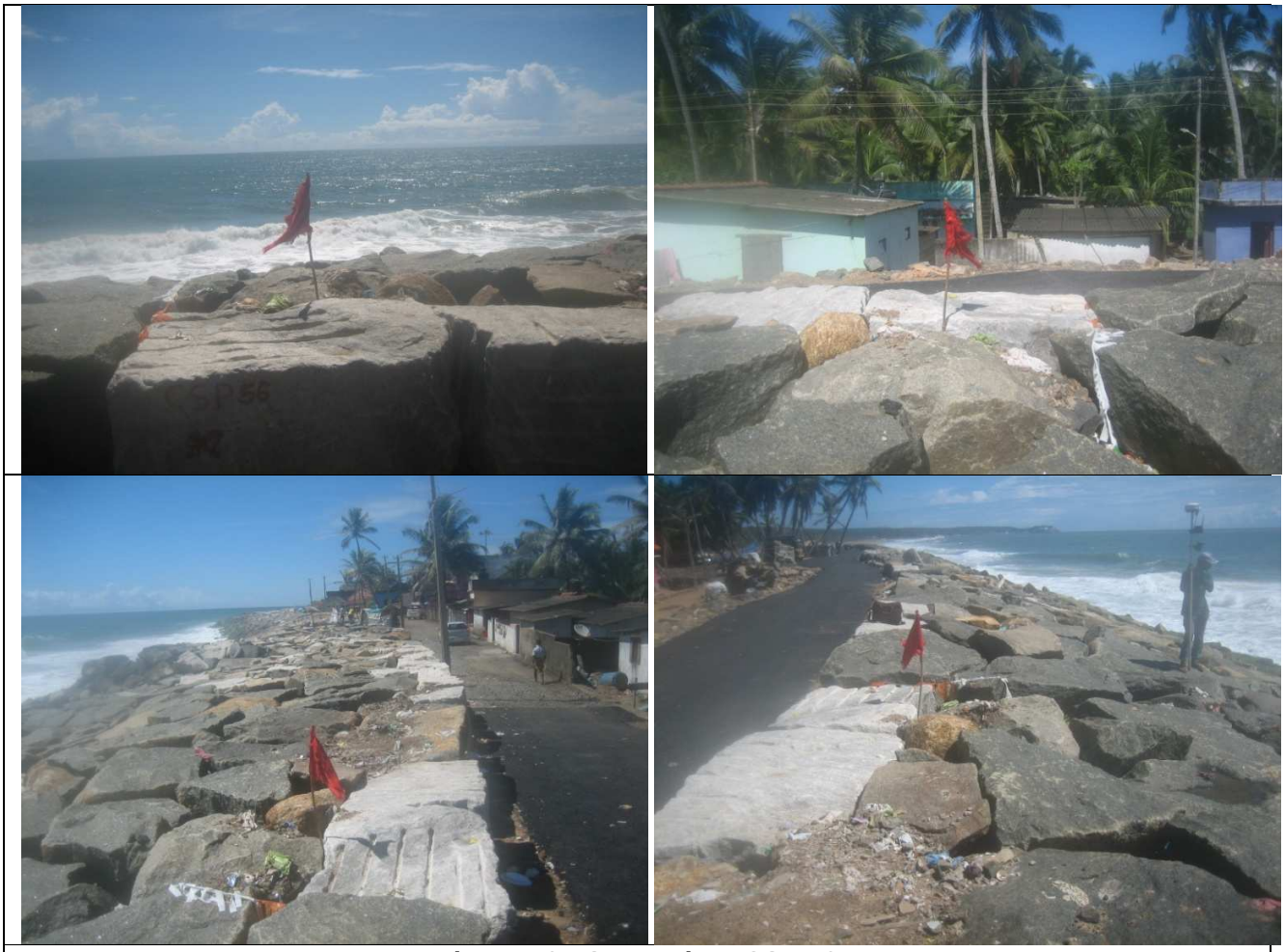


Figure 56:- September_CSP 56

Figure 57:- September_CSP 57

Figure 58:- September_CSP 58

Figure 59:- September_CSP 59

Figure 60:- September_CSP 60

Figure 61:- September_CSP 61

Figure 62:- September_CSP 62

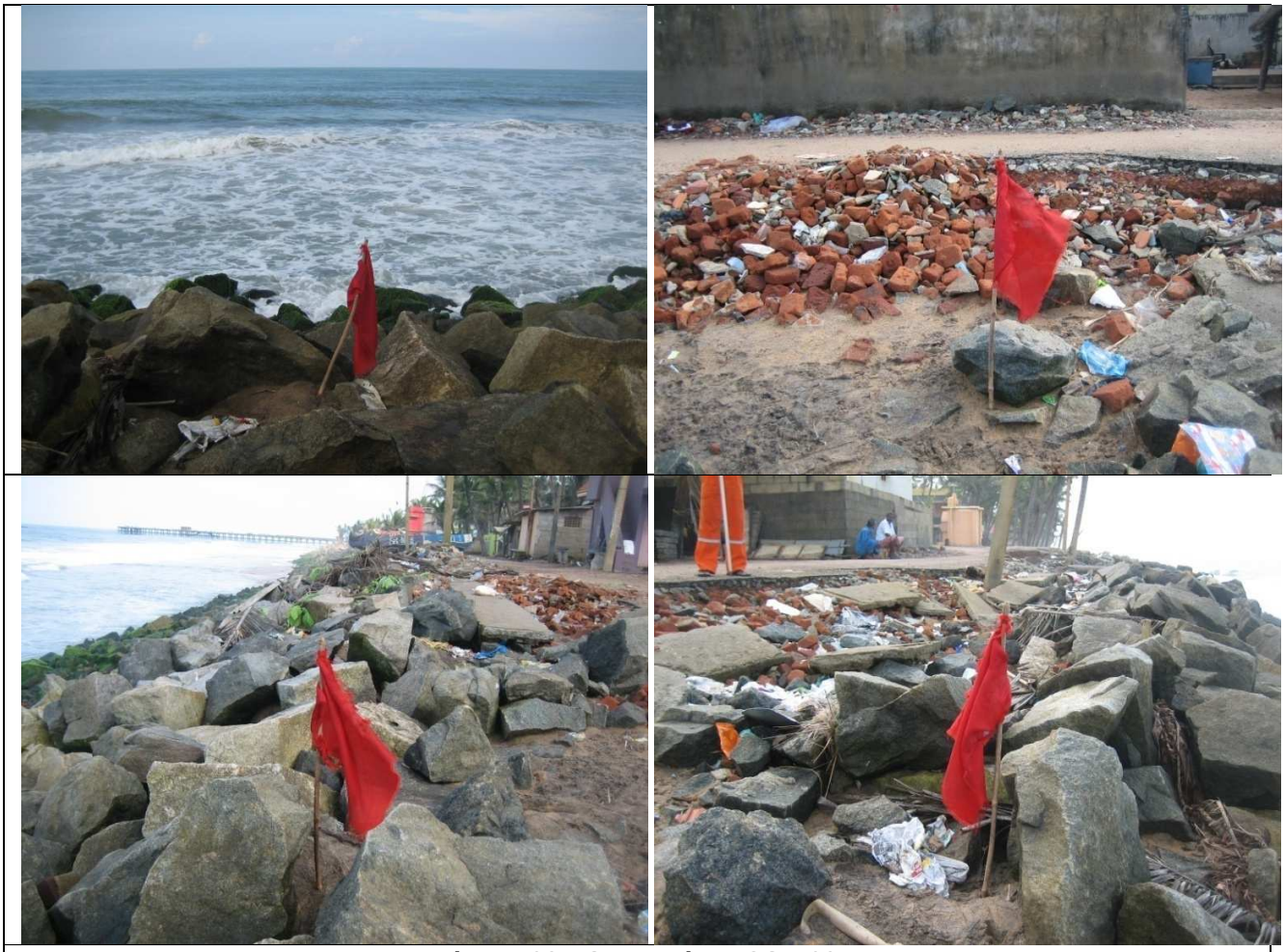


Figure 63:- September_CSP 63

Figure 64:- September_CSP 64

Figure 65:- September_CSP 65

Figure 66:- September_CSP 66

Figure 67:- September_CSP 67

Figure 68:- September_CSP 68

Figure 69:- September_CSP 69

Figure 70:- September_CSP 70

Figure 71:- September_CSP 71

Figure 72:- September_CSP 72

Figure 73:- September_CSP 73

Figure 74:- September_CSP 74

Figure 75:- September_CSP 75

Figure 76:- September_CSP 76

Figure 77:- September_CSP 77

Figure 78:- September_CSP 78

Figure 79:- September_CSP 79

Figure 80:- September_CSP 80

Figure 81:- September_CSP 81

Annexure VI

CSP Locations - October 2015

Figure 01:- October_CSP 01

Figure 02:- October_CSP 02

Figure 03:- October_CSP 03

Figure 04:- October_CSP 04

Figure 05:- October_CSP 05

Figure 06:- October_CSP 06

Figure 07:- October_CSP 07

Figure 08:- October_CSP 08

Figure 09:- October_CSP 09

Figure 10:- October_CSP 10

Figure 11:- October_CSP 11

Figure 12:- October_CSP 12

Figure 13:- October_CSP 13

Figure 14:- October_CSP 14

Figure 15:- October_CSP 15

Figure 16:- October_CSP 16

Figure 17:- October_CSP 17

Figure 18:- October_CSP 18

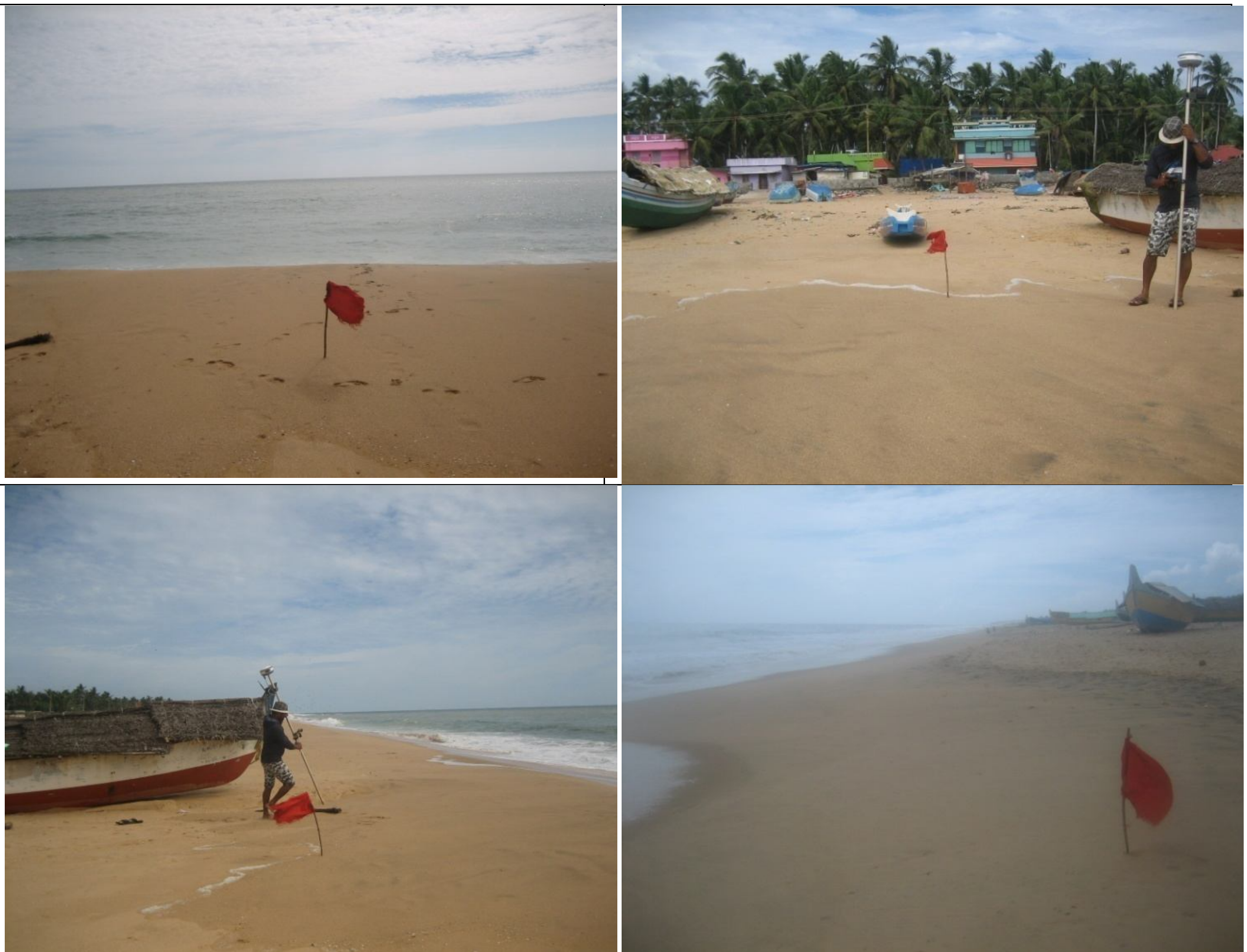


Figure 19:- October_CSP 19

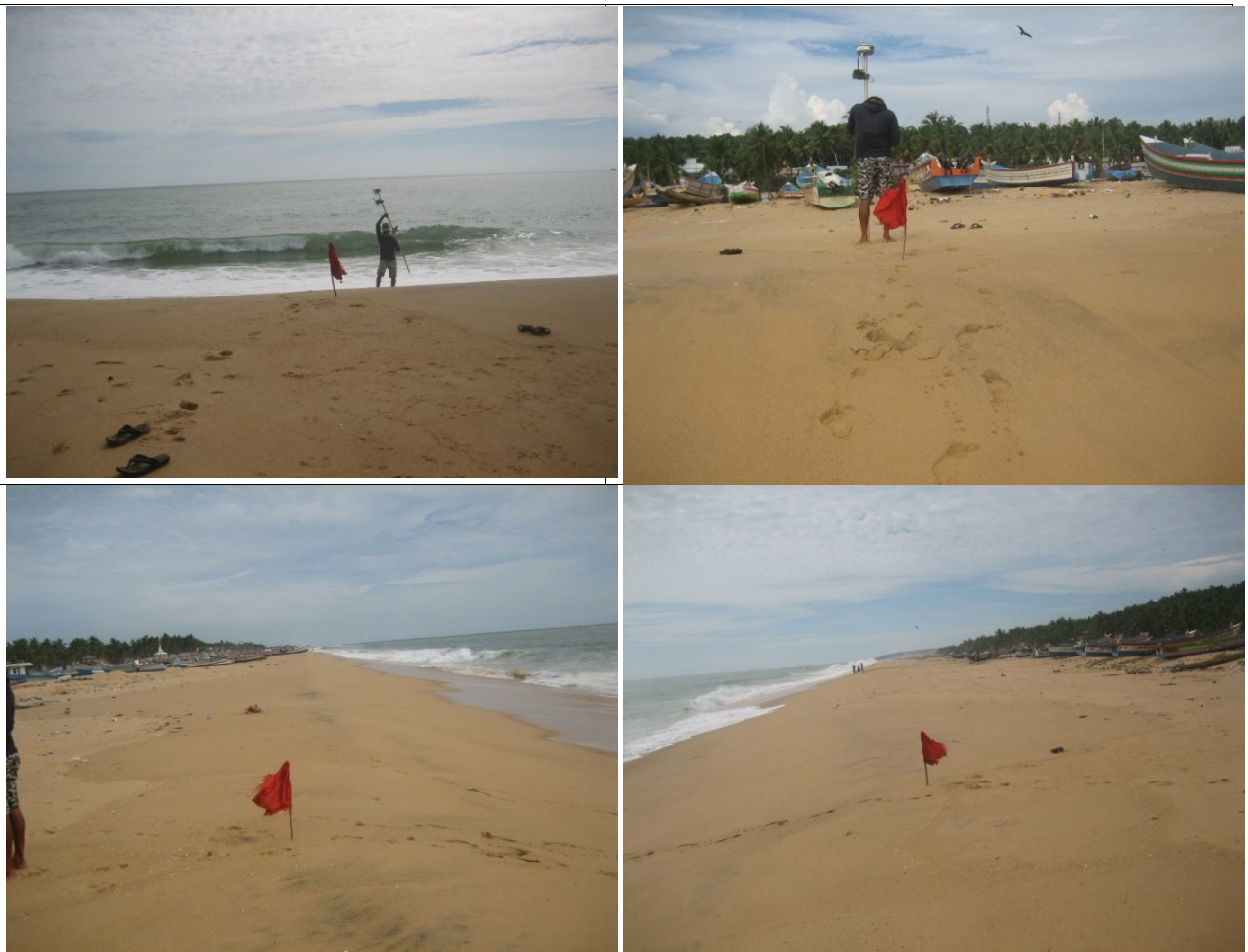


Figure 20:- October_CSP 20

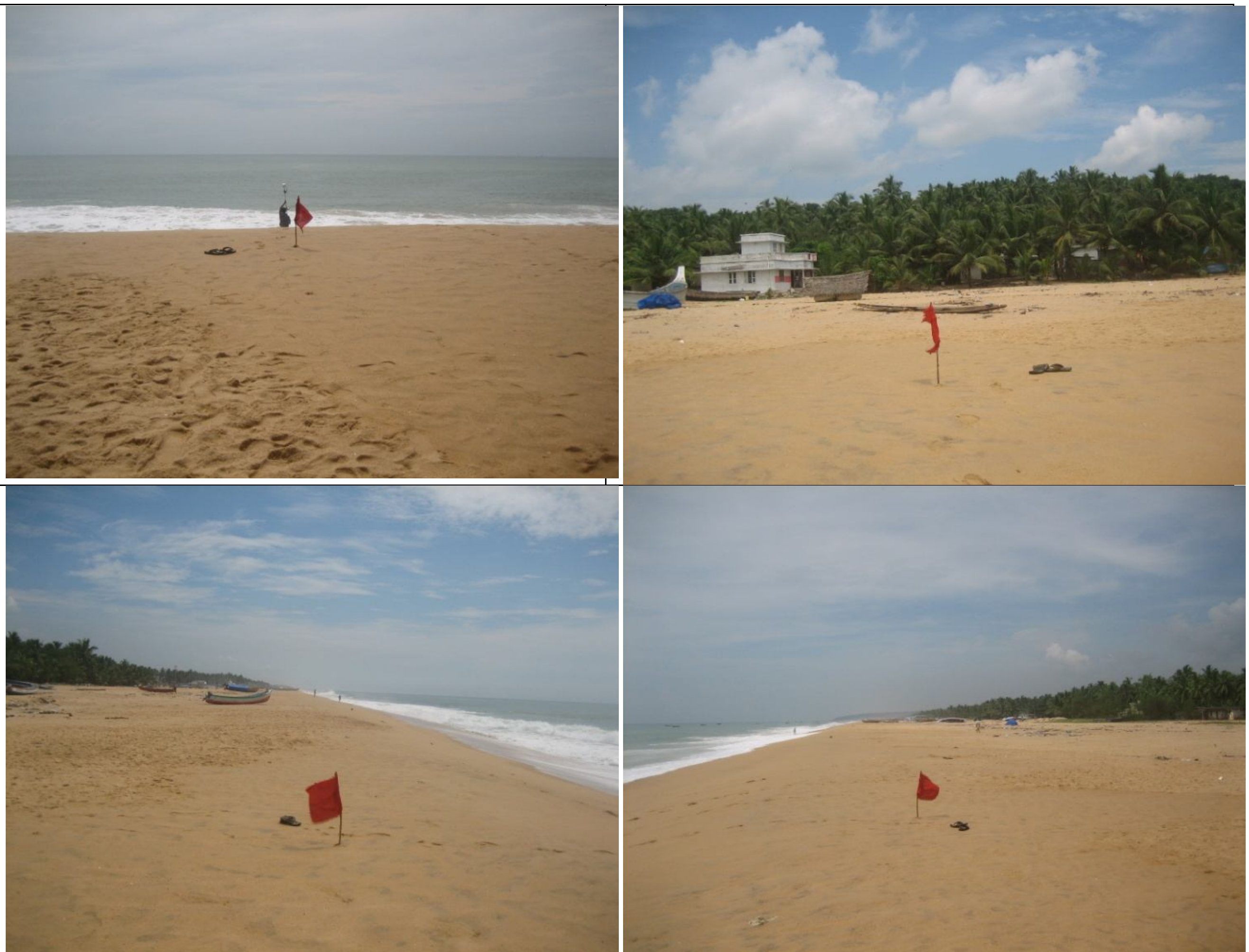


Figure 21:- October_CSP 21

Figure 22:- October_CSP 22

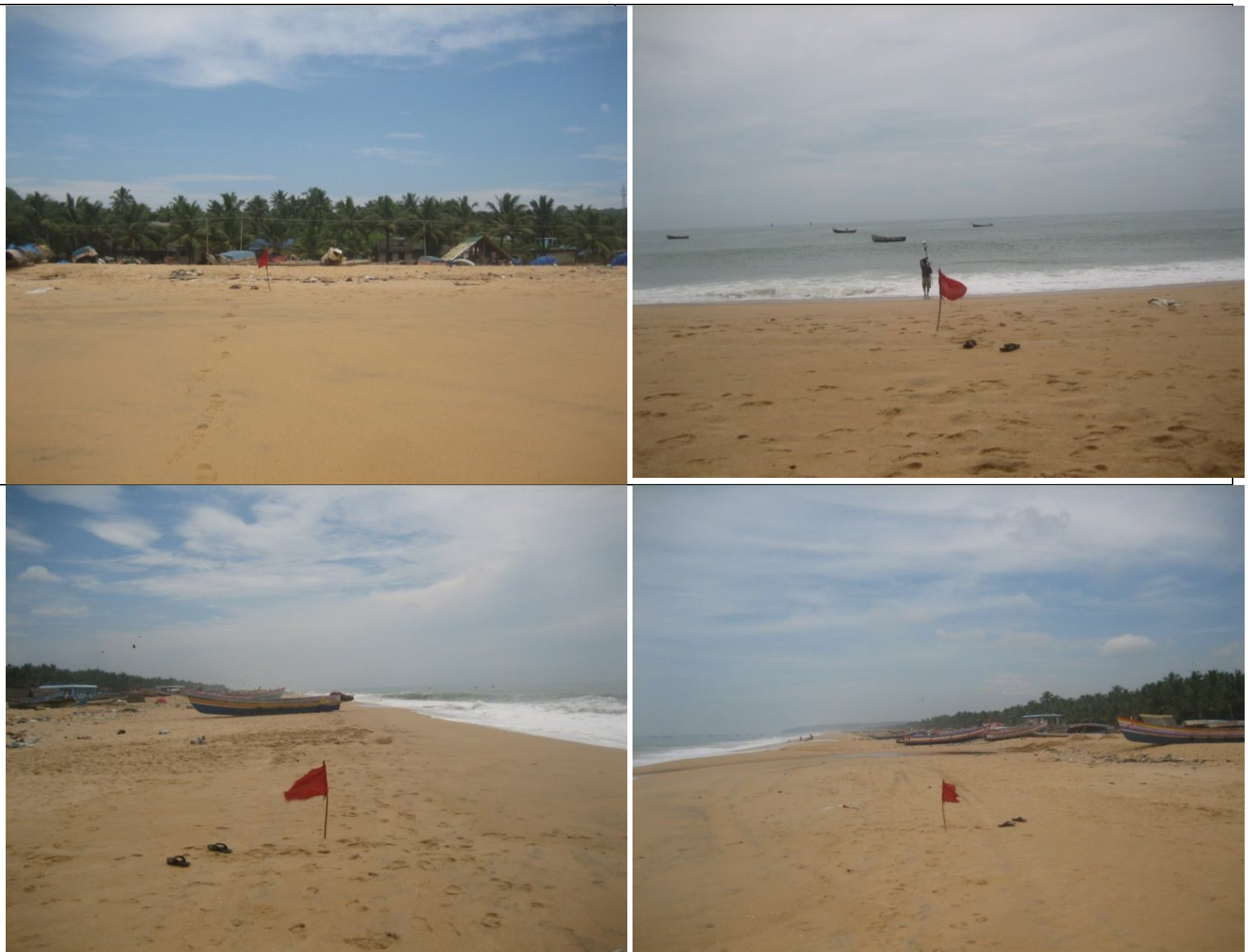


Figure 23:- October_CSP 23

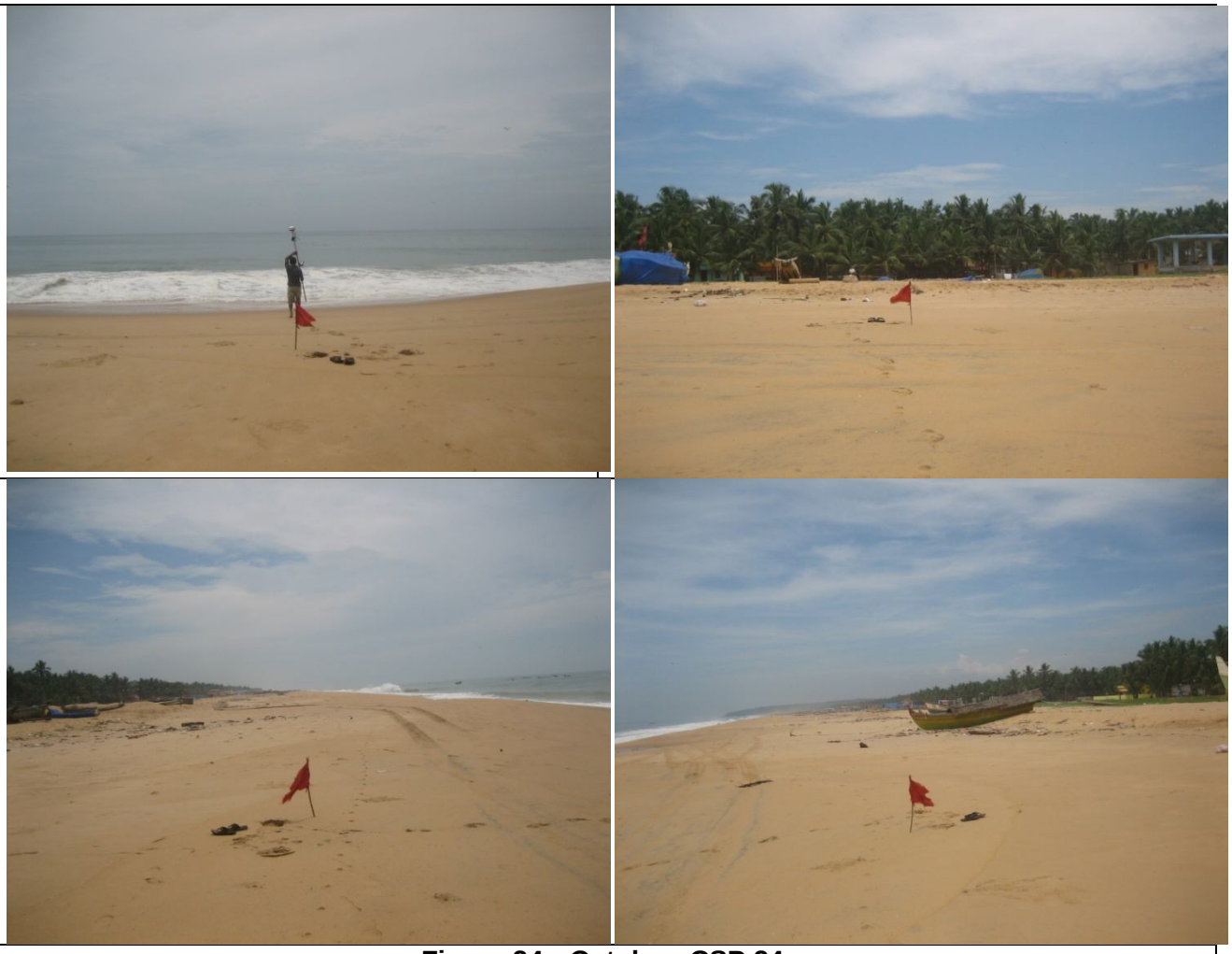


Figure 24:- October_CSP 24

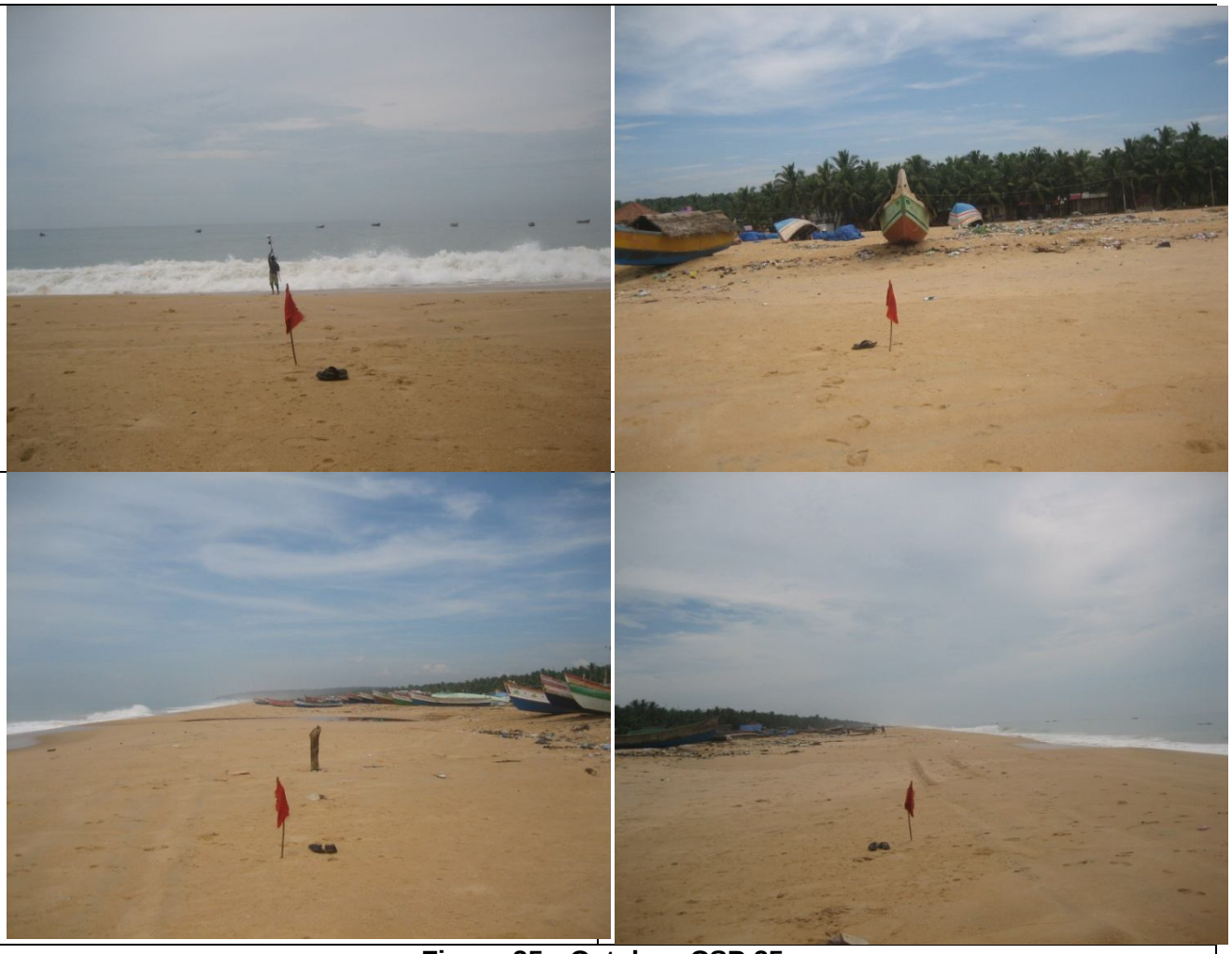


Figure 25:- October_CSP 25

Figure 026:- October_CSP 26

Figure 27:- October_CSP 27

Figure 28:- October_CSP 28

Figure 29:- October_CSP 29

Figure 030:- October_CSP 30

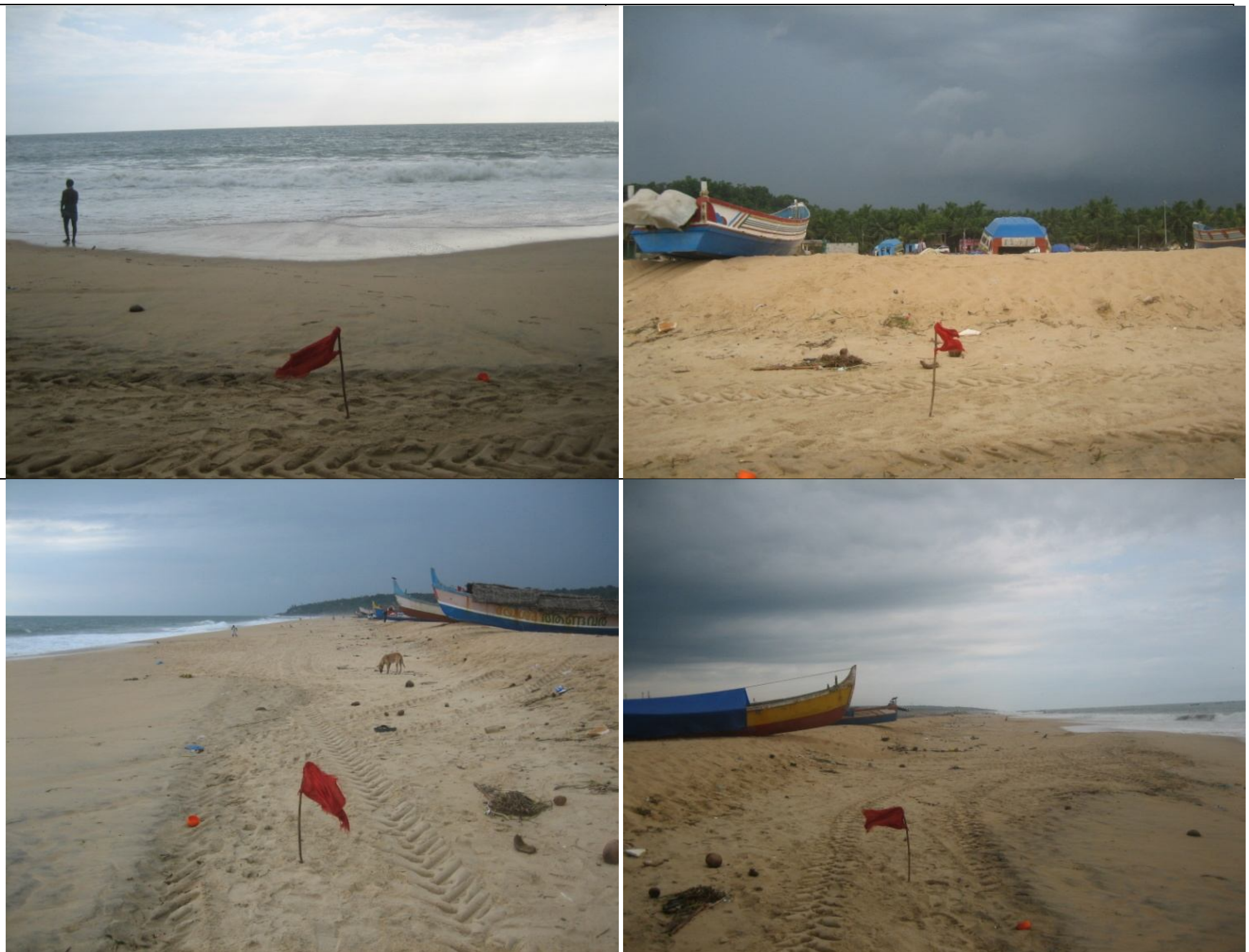


Figure 31:- October_CSP 31

Figure 32:- October_CSP 32

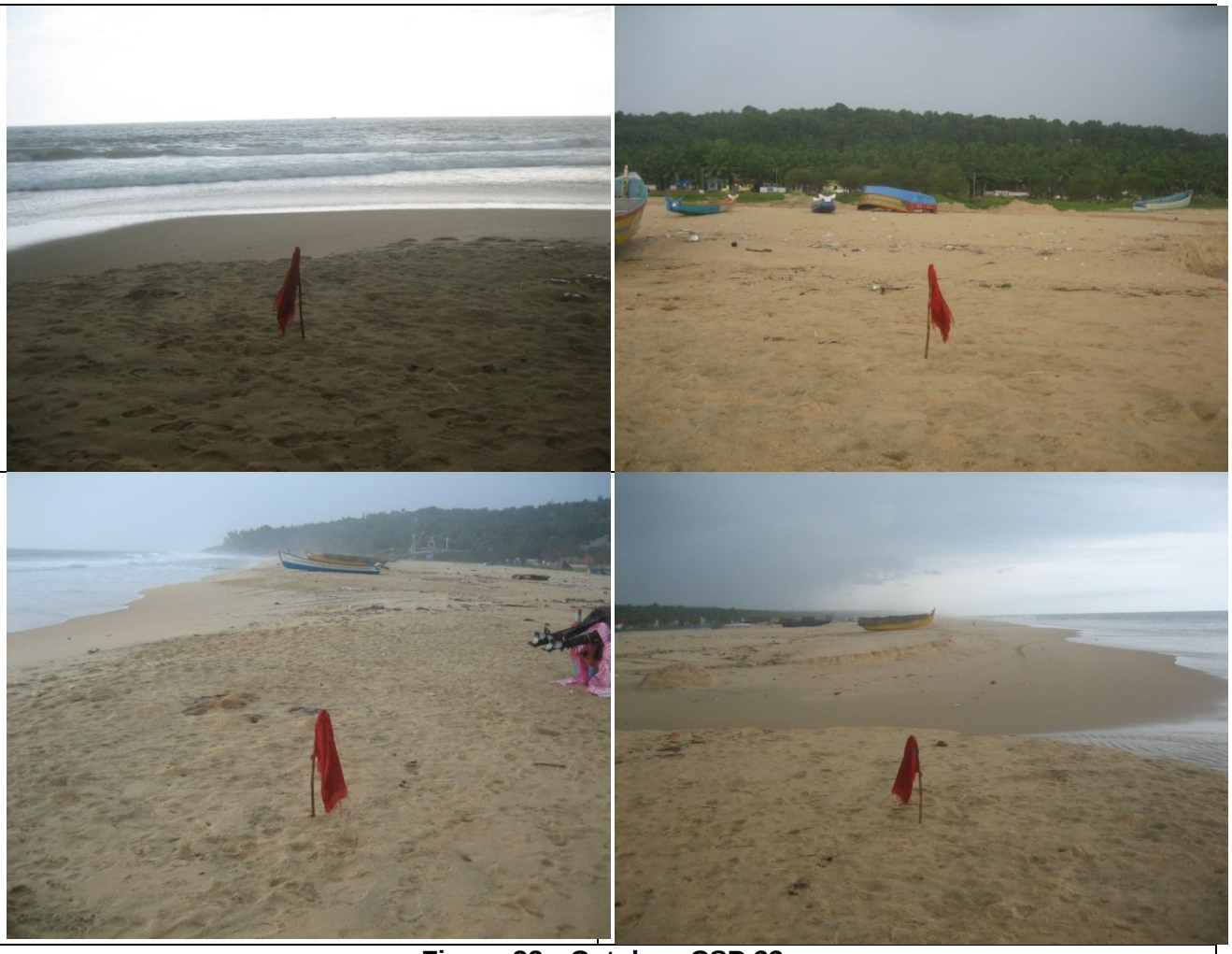


Figure 33:- October_CSP 33

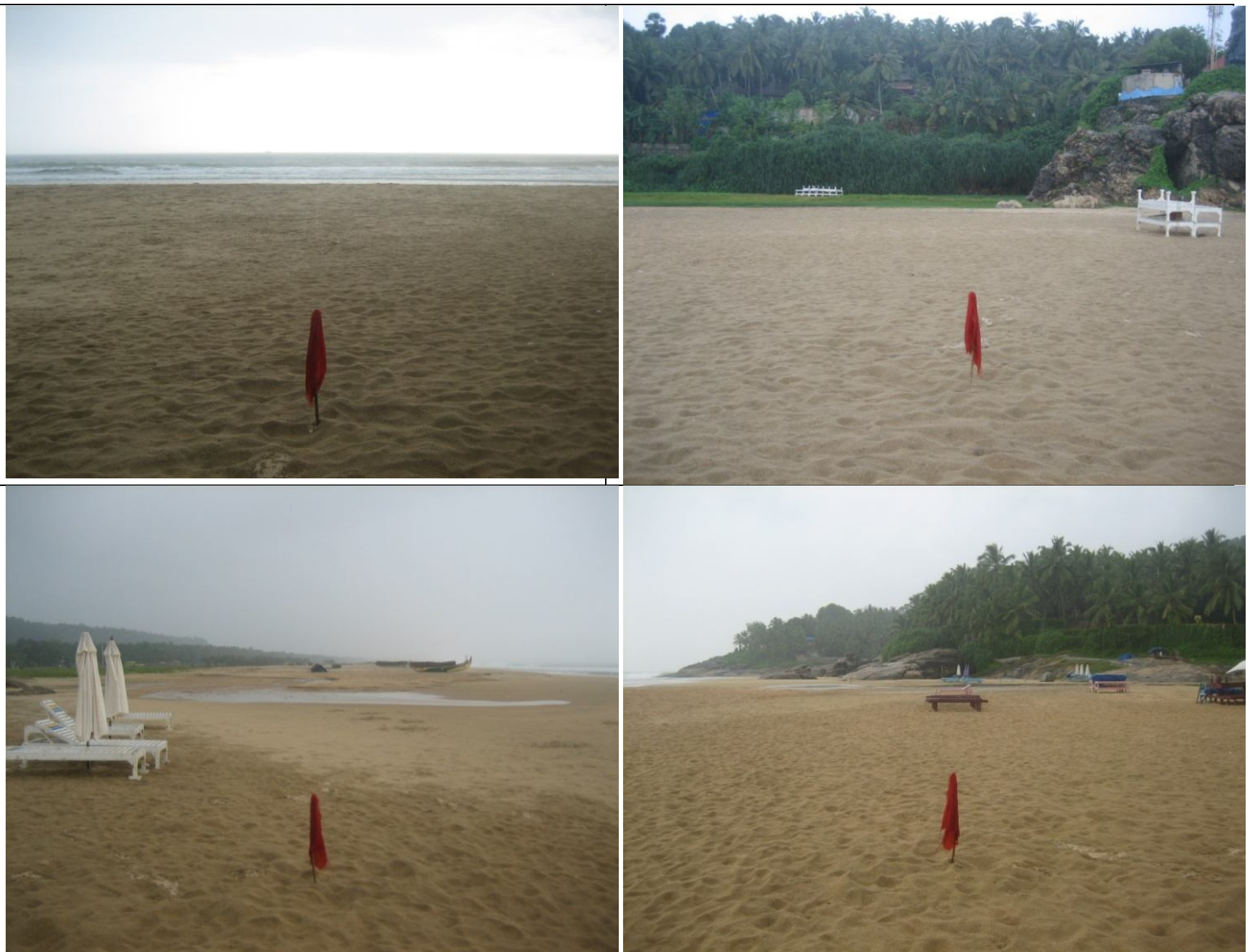


Figure 34:- October_CSP 34

Figure 35:- October_CSP 35

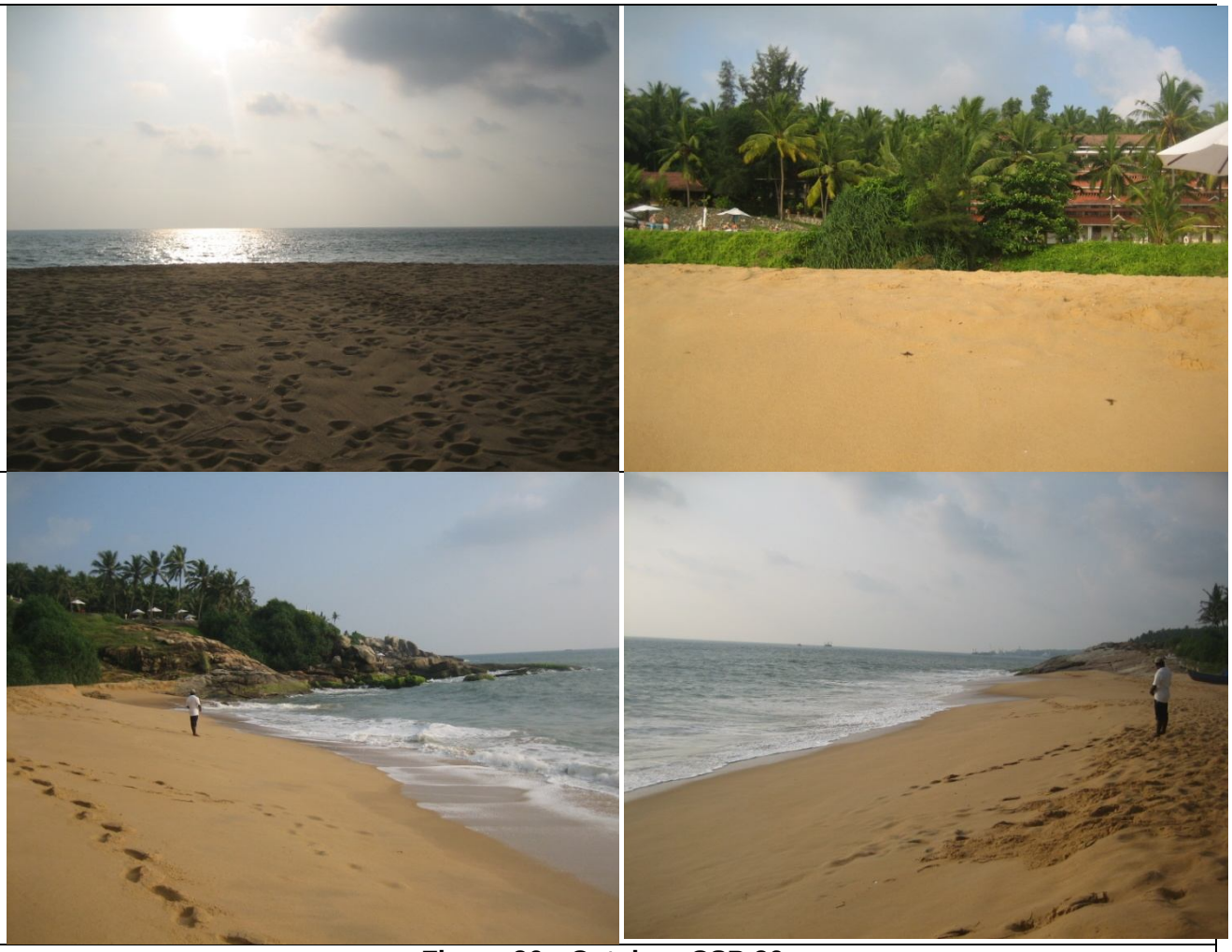


Figure 36:- October_CSP 36

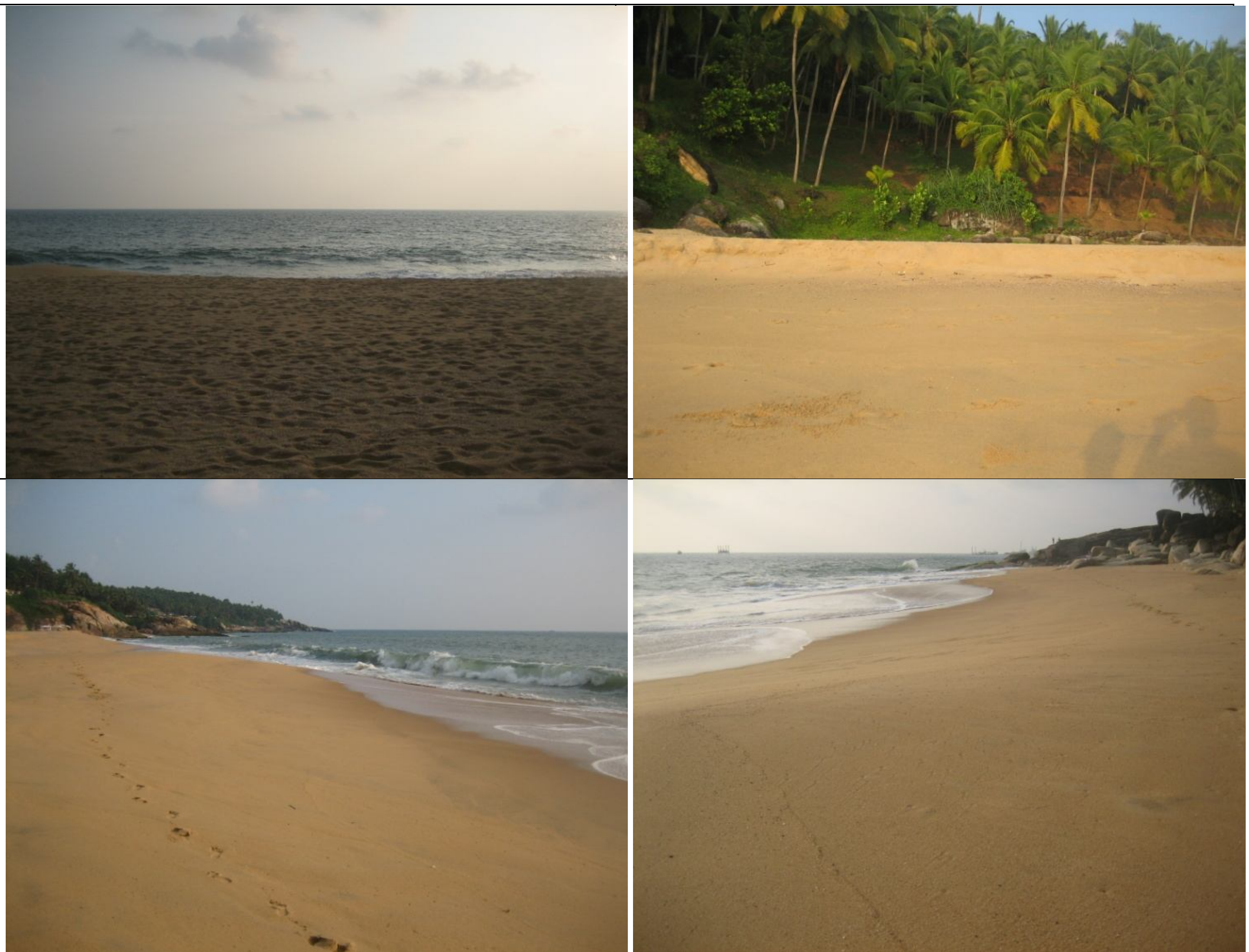


Figure 37:- October_CSP 37

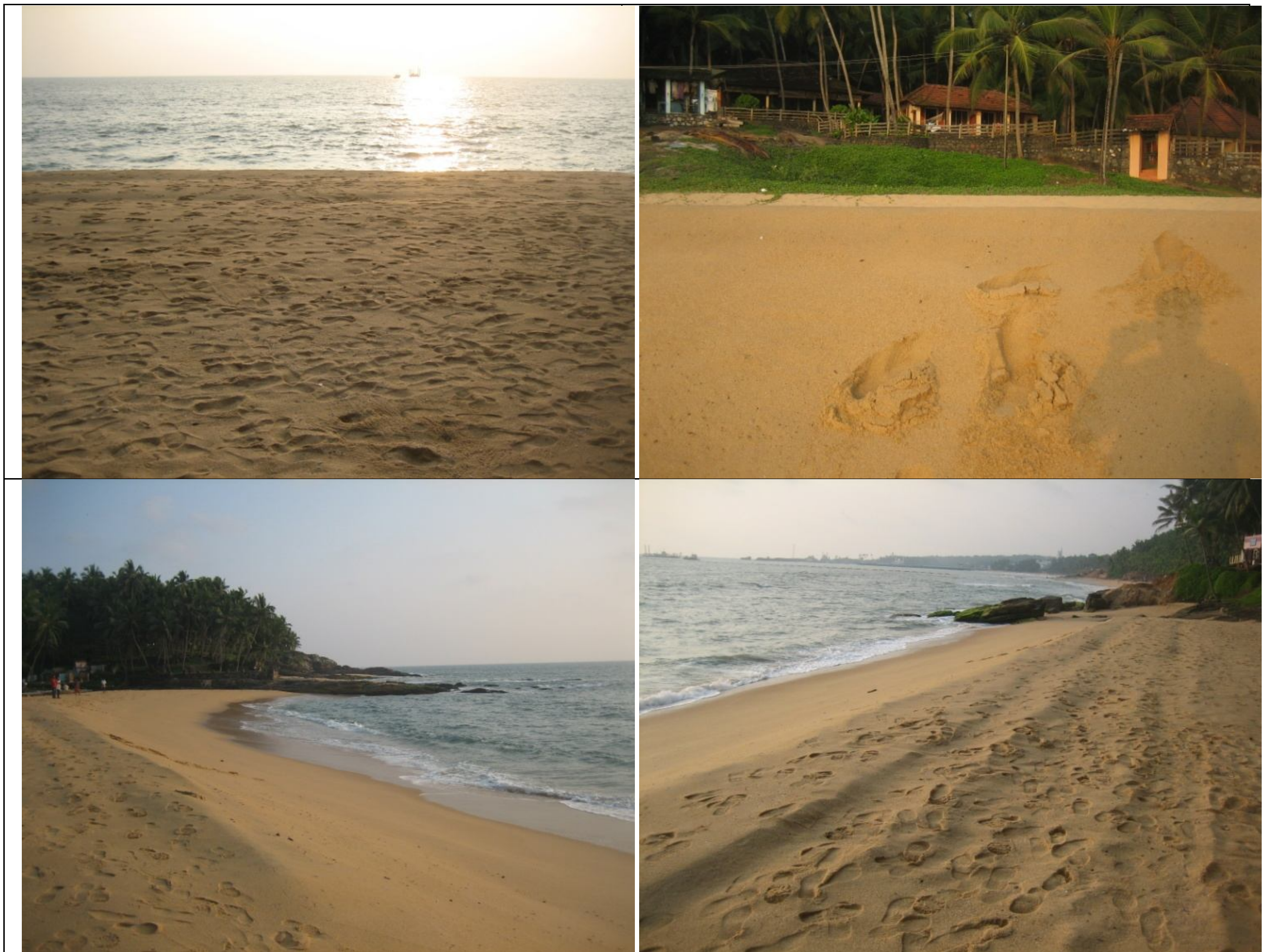


Figure 38:- October_CSP 38

Figure 39:- October_CSP 39

Figure 40:- October_CSP 40

Figure 41:- October_CSP 41

Figure 42:- October_CSP 42

Figure 43:- October_CSP 43

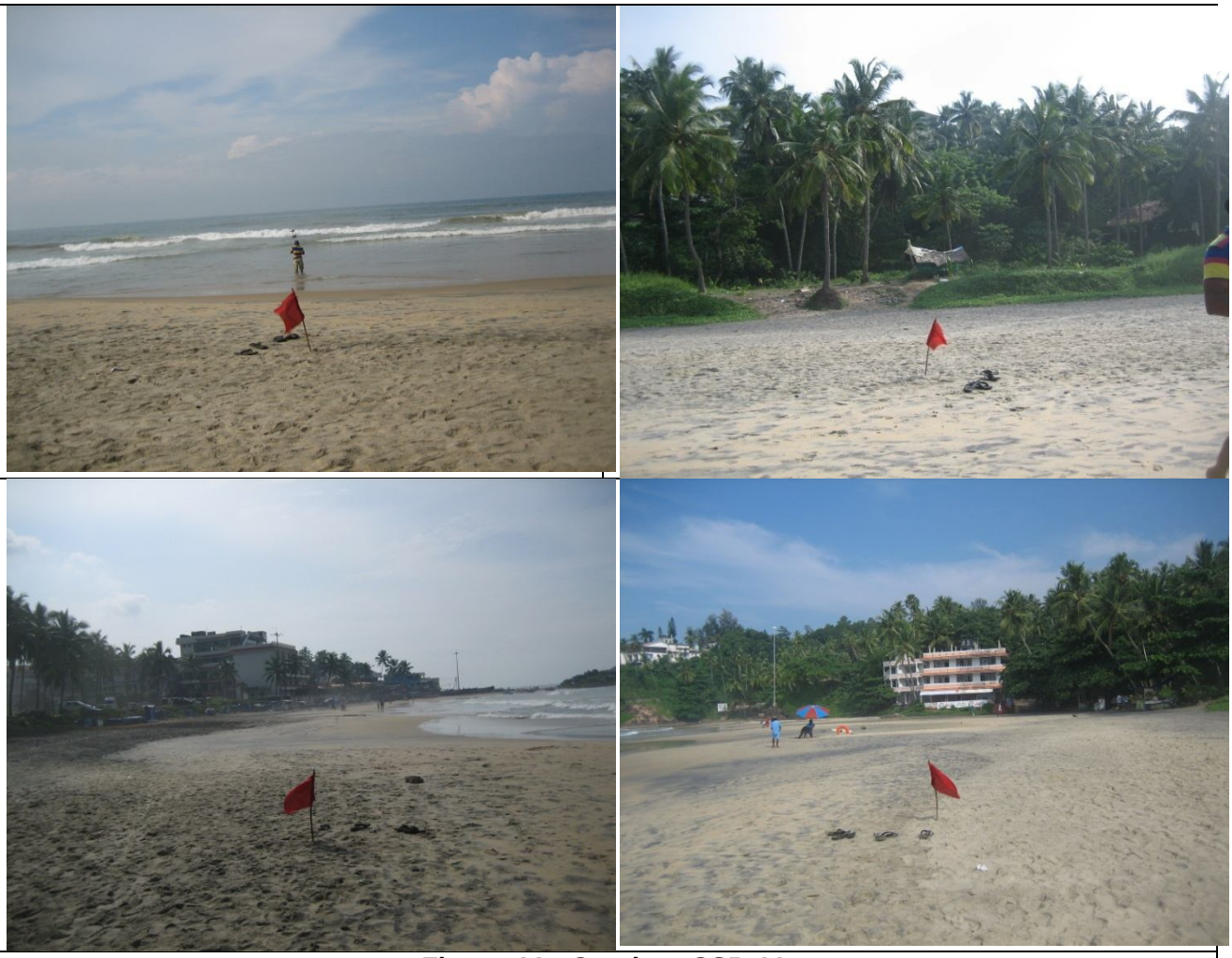


Figure 44:- October_CSP 44




Figure 45:- October_CSP 45

Figure 46:- October_CSP 46

Figure 47:- October_CSP 47

Figure 48:- October_CSP 48

Figure 49:- October_CSP 49

Figure 50:- October_CSP 50

Figure 51:- October_CSP 51

Figure 52:- October_CSP 52

Figure 53:- October_CSP 53

Figure 54:- October_CSP 54

Figure 55:- October_CSP 55

Figure 56:- October_CSP 56

Figure 57:- October_CSP 57

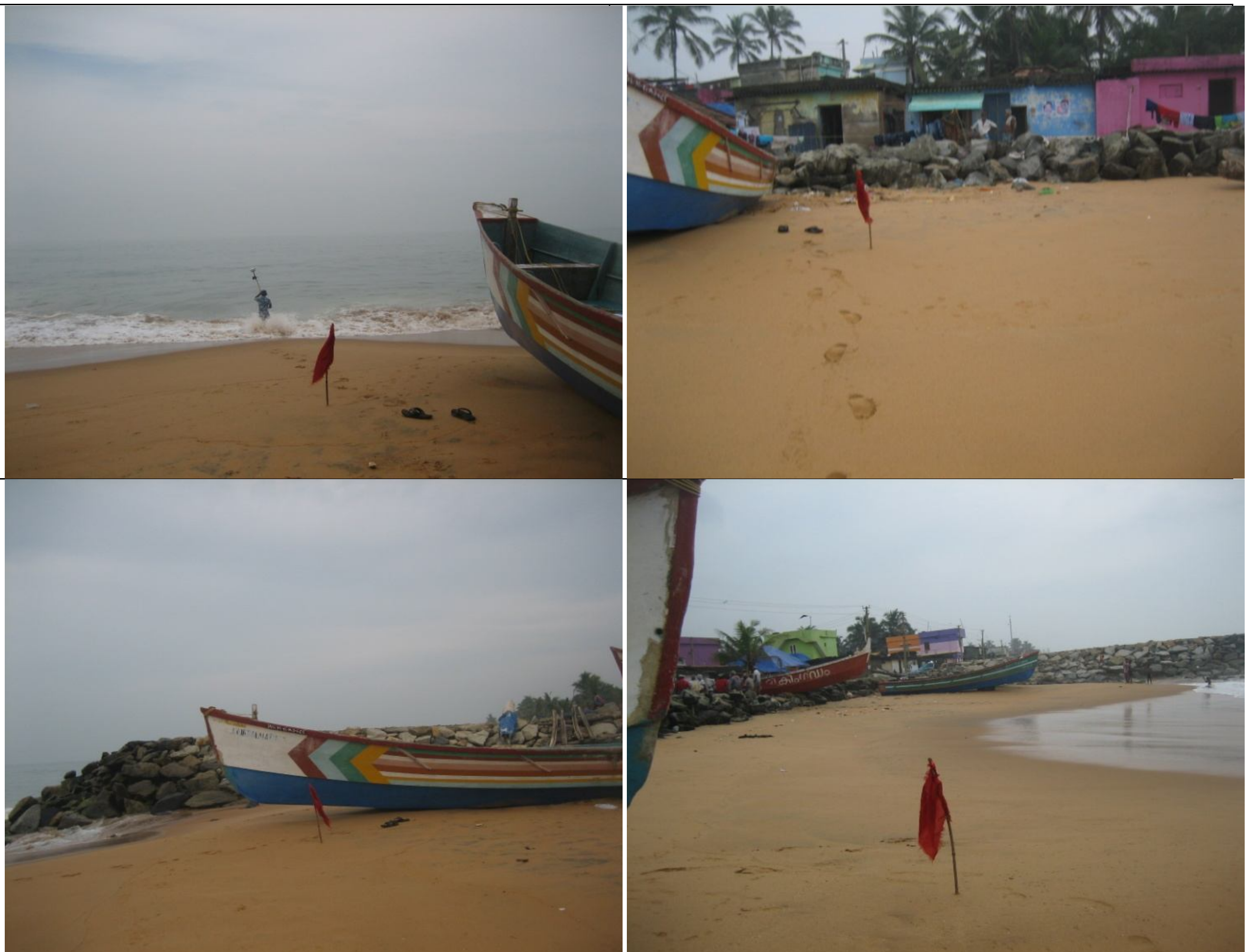


Figure 58:- October_CSP 58

Figure 59:- October_CSP 59

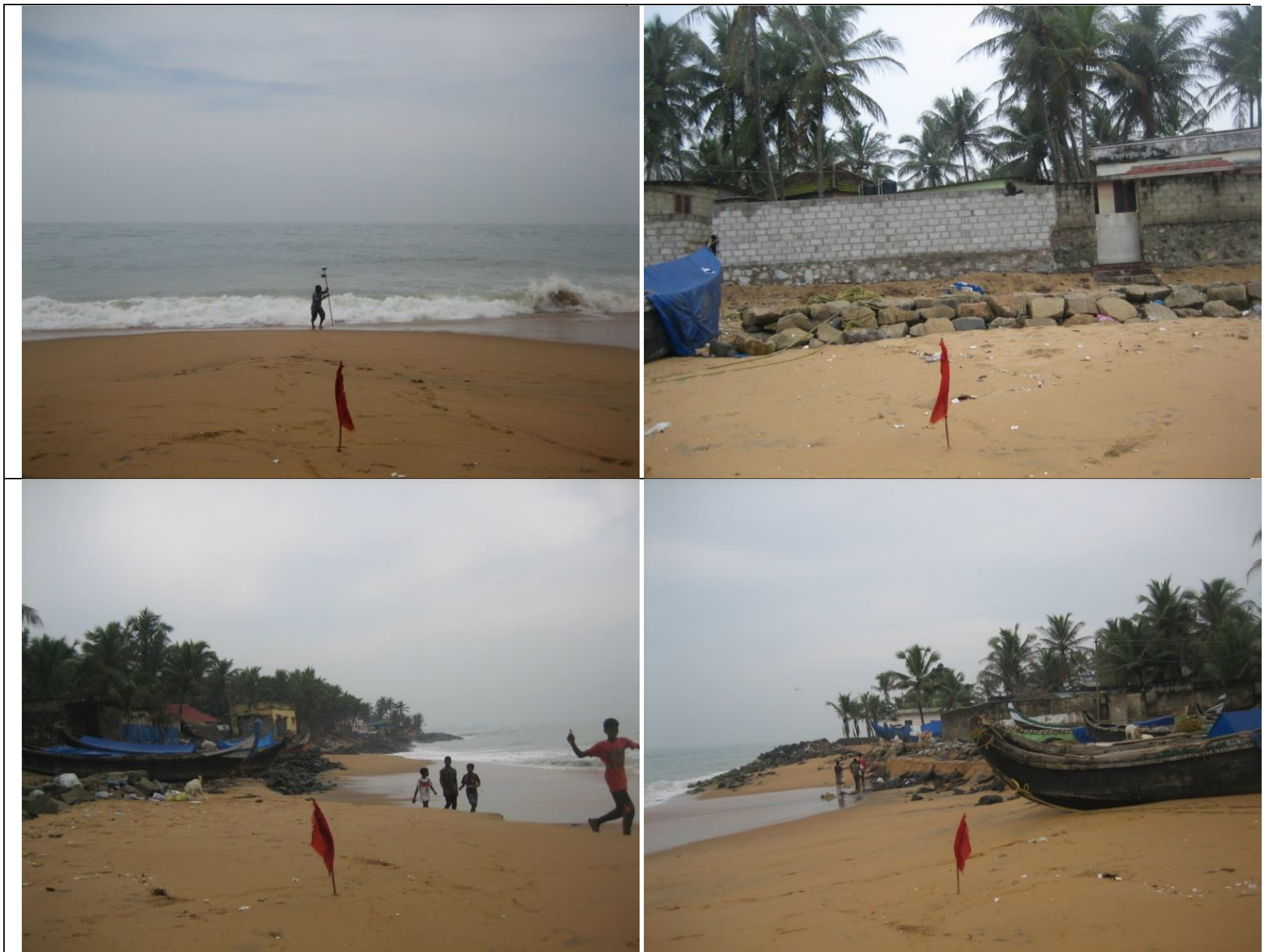
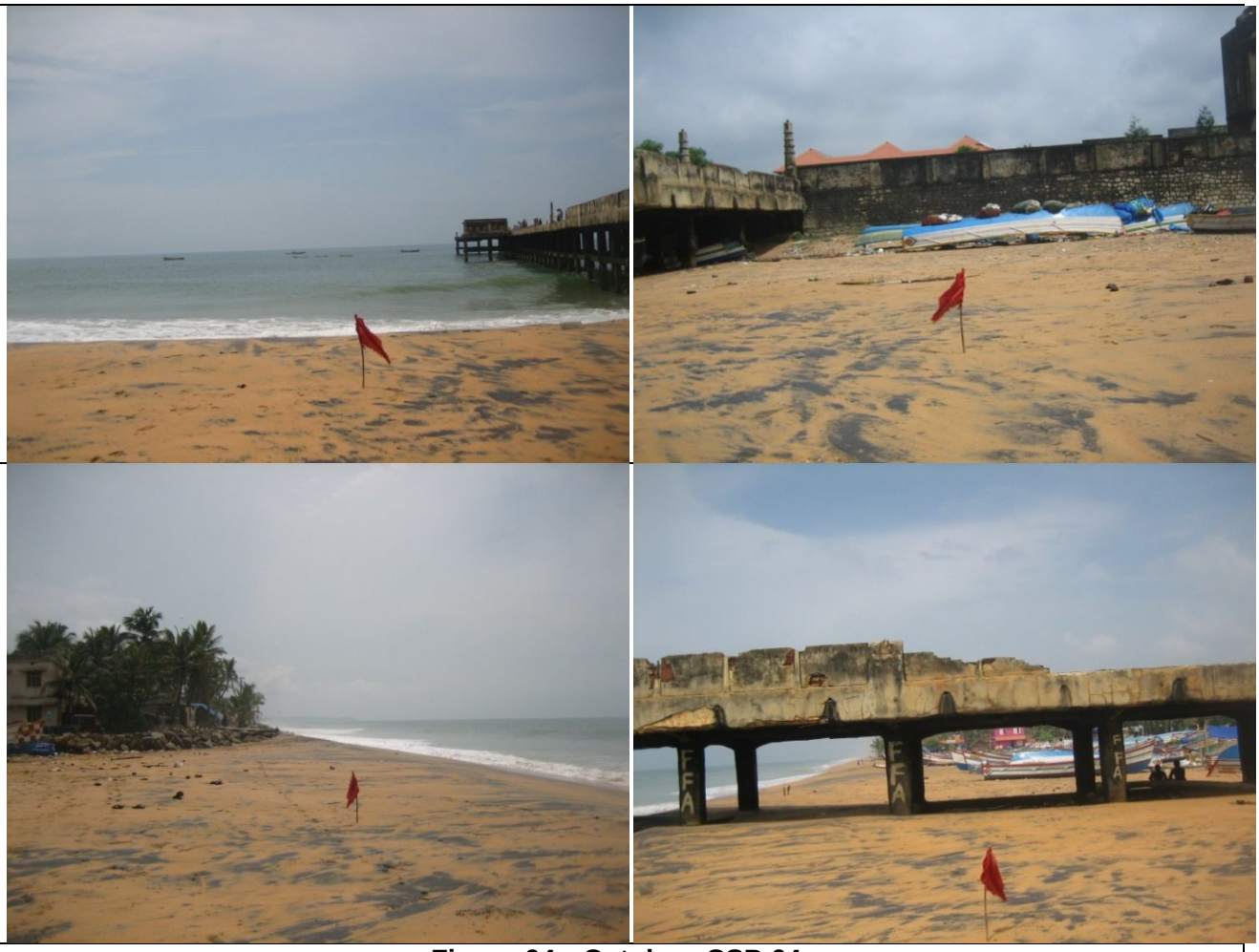


Figure 60:- October_CSP 60

Figure 61:- October_CSP 61

Figure 62:- October_CSP 62

Figure 63:- October_CSP 63



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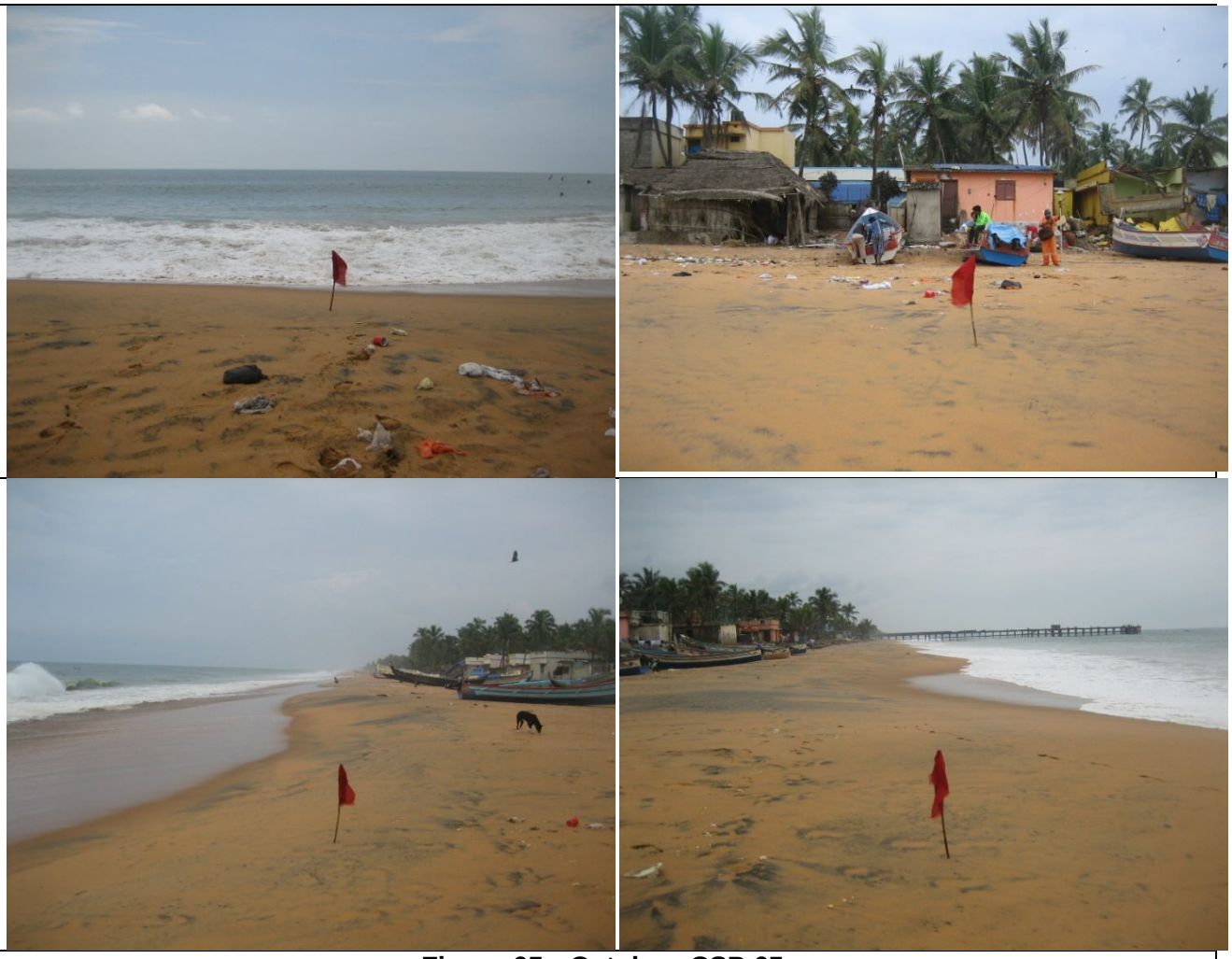


Figure 65:- October_CSP 65

Figure 66:- October_CSP 66

Figure 067:- October_CSP 67

Figure 68:- October_CSP 68

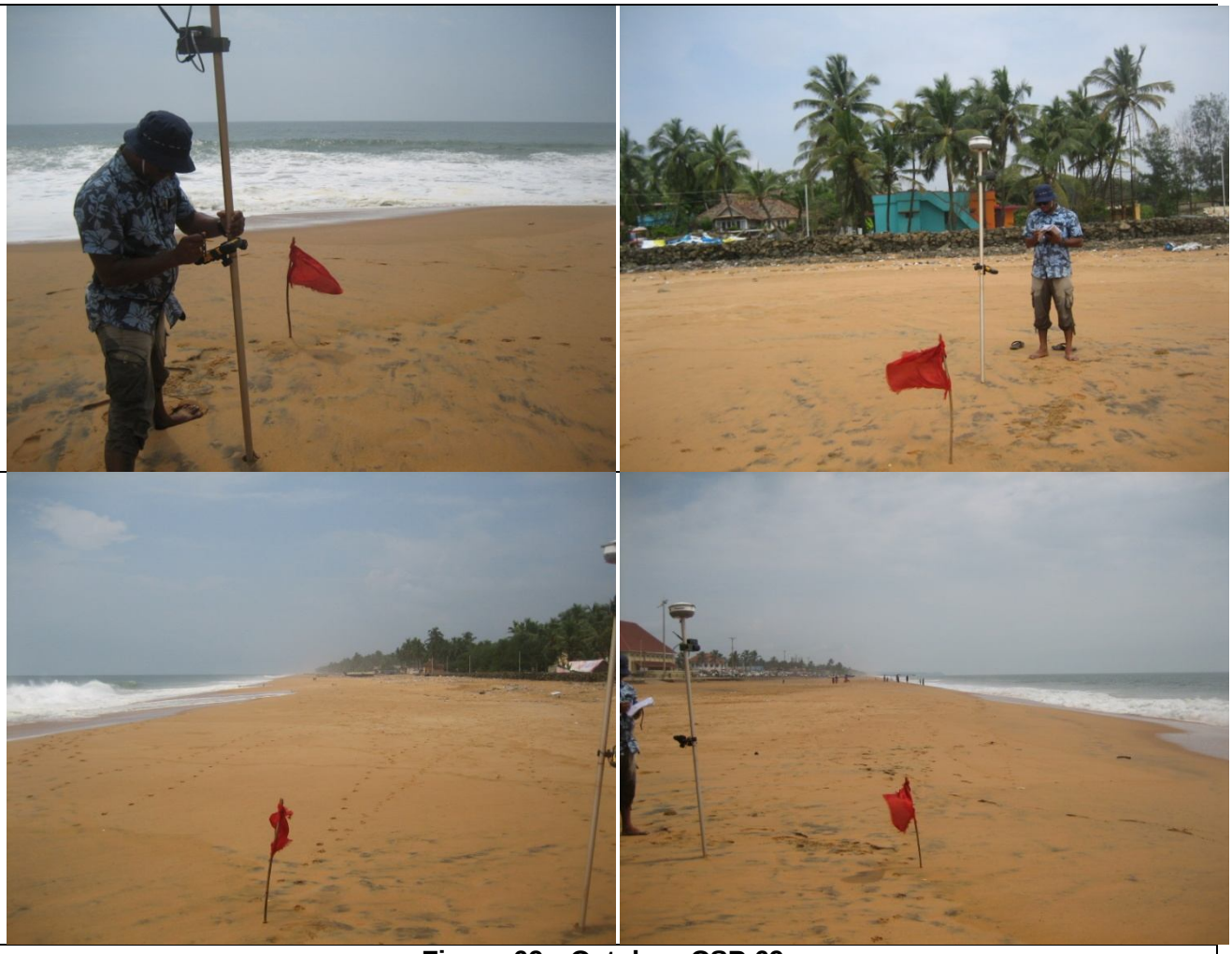


Figure 69:- October_CSP 69

Figure 70:- October_CSP 70

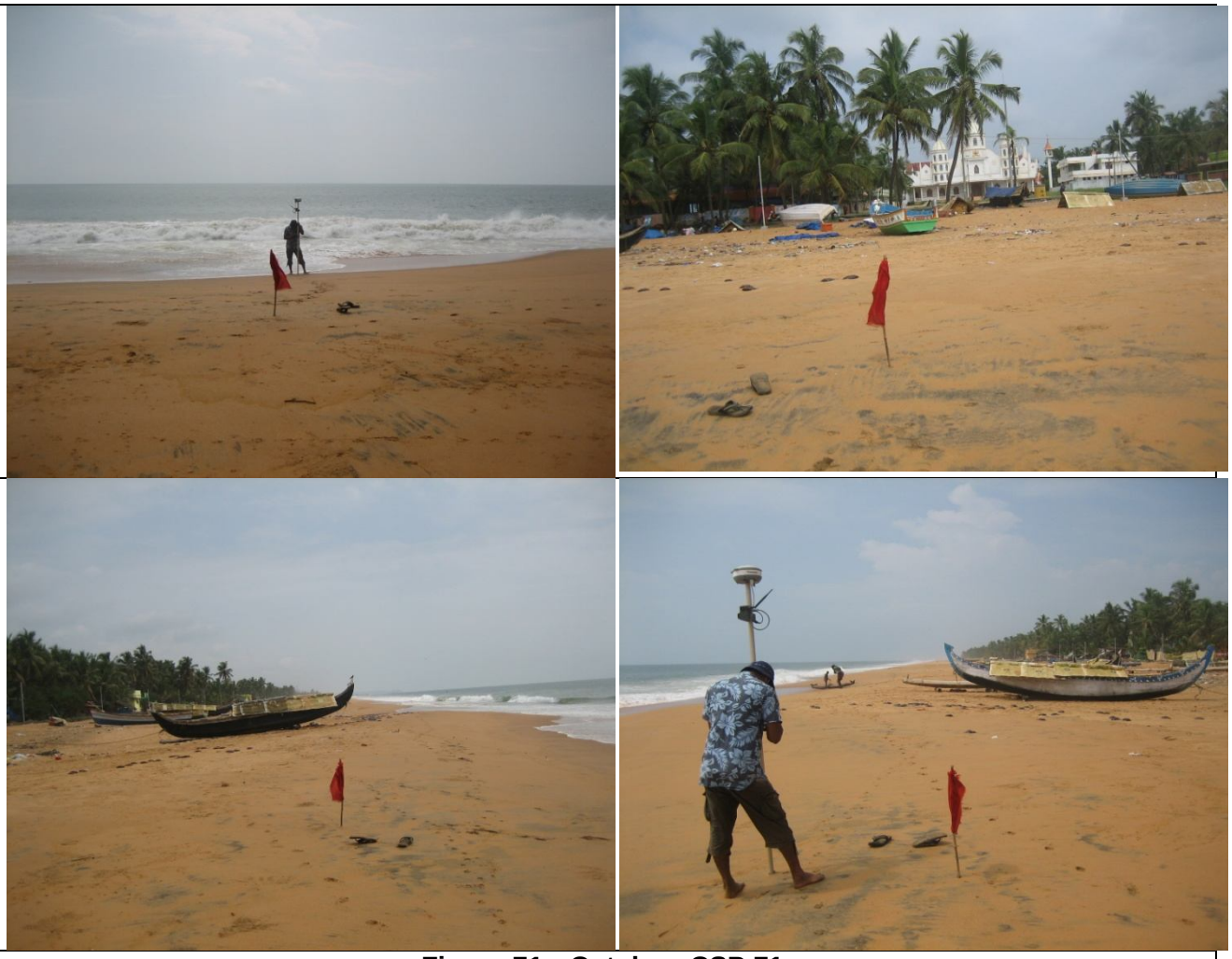


Figure 71:- October_CSP 71

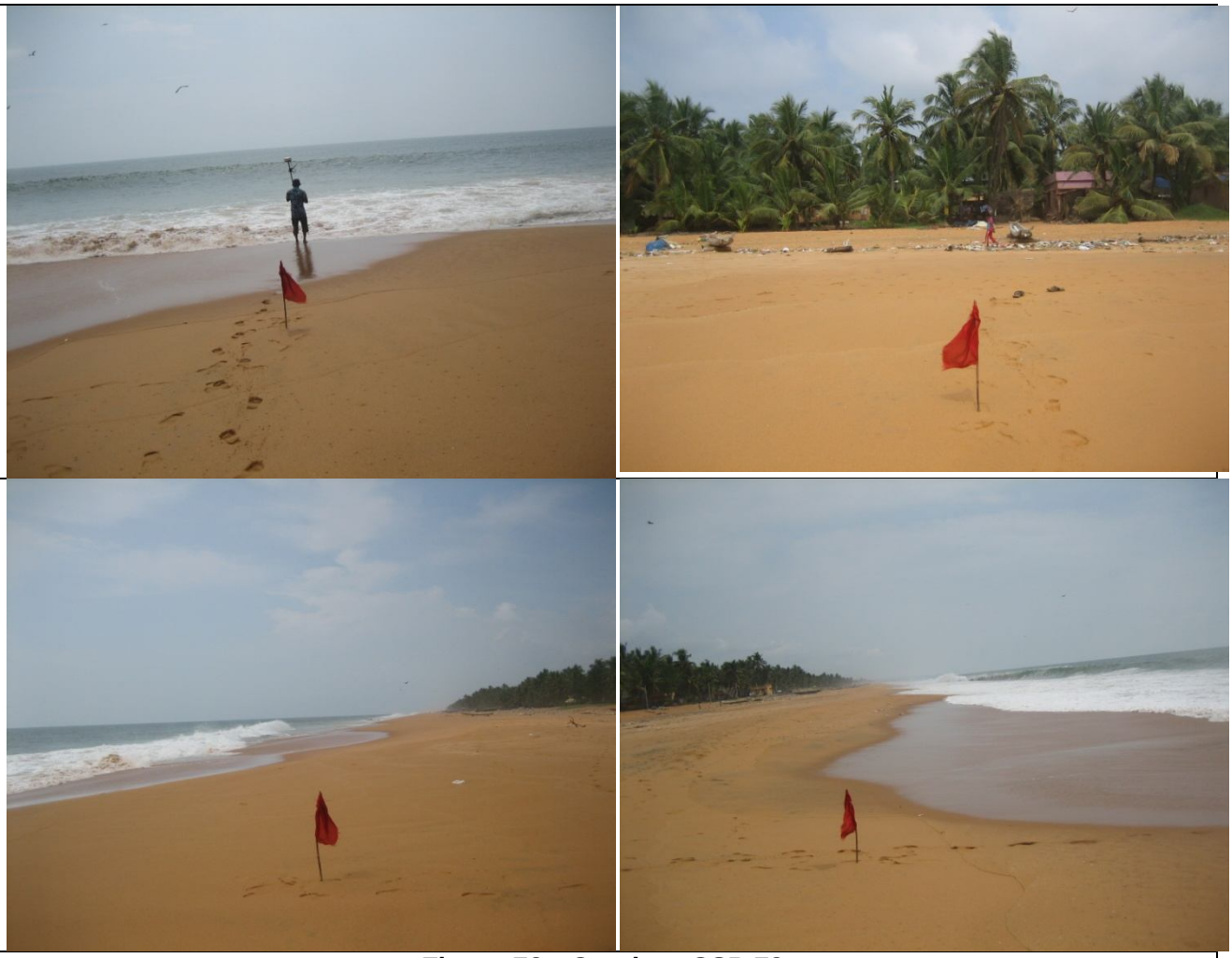
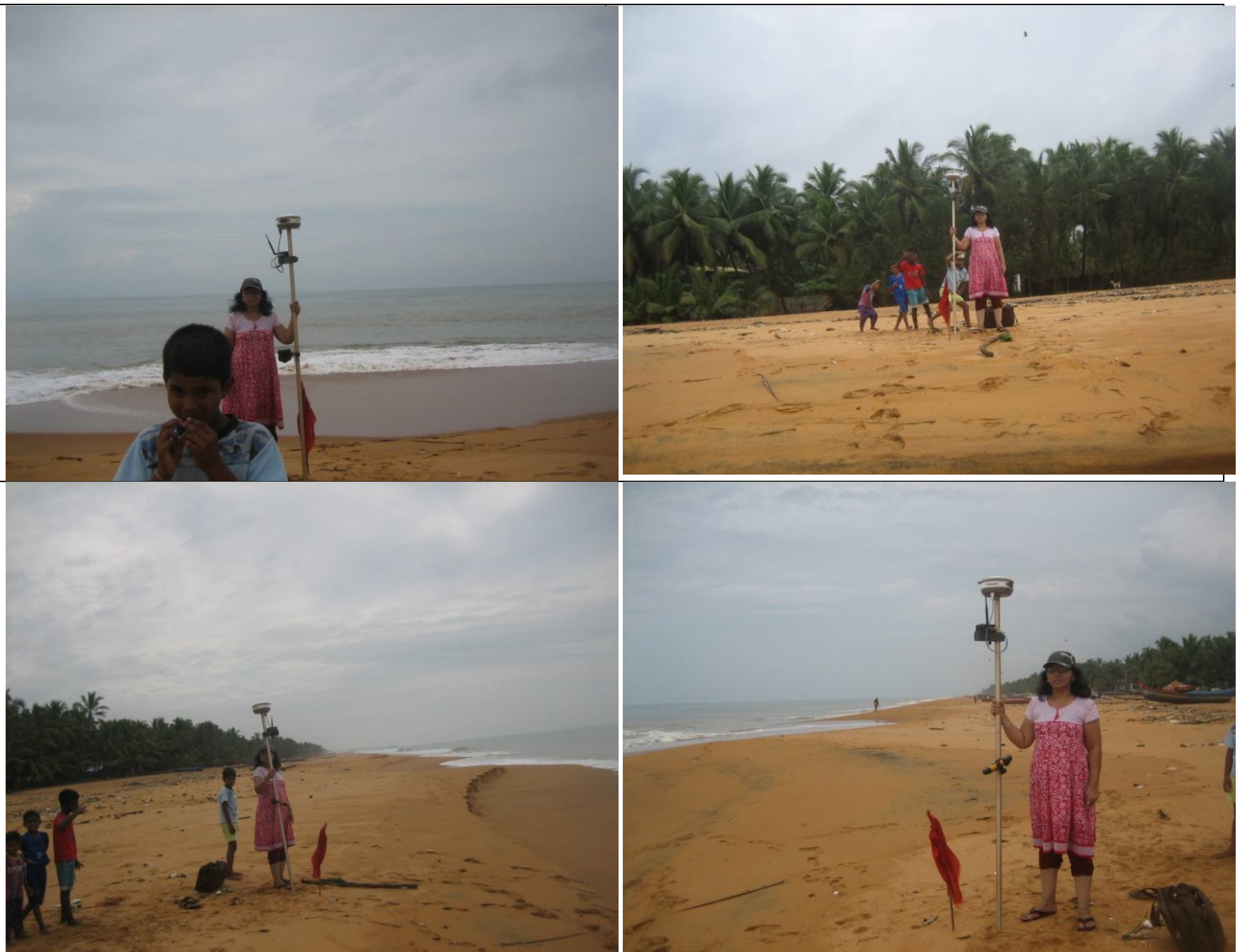


Figure 72:- October_CSP 72

Figure 73:- October_CSP 73

Figure 74:- October_CSP 74



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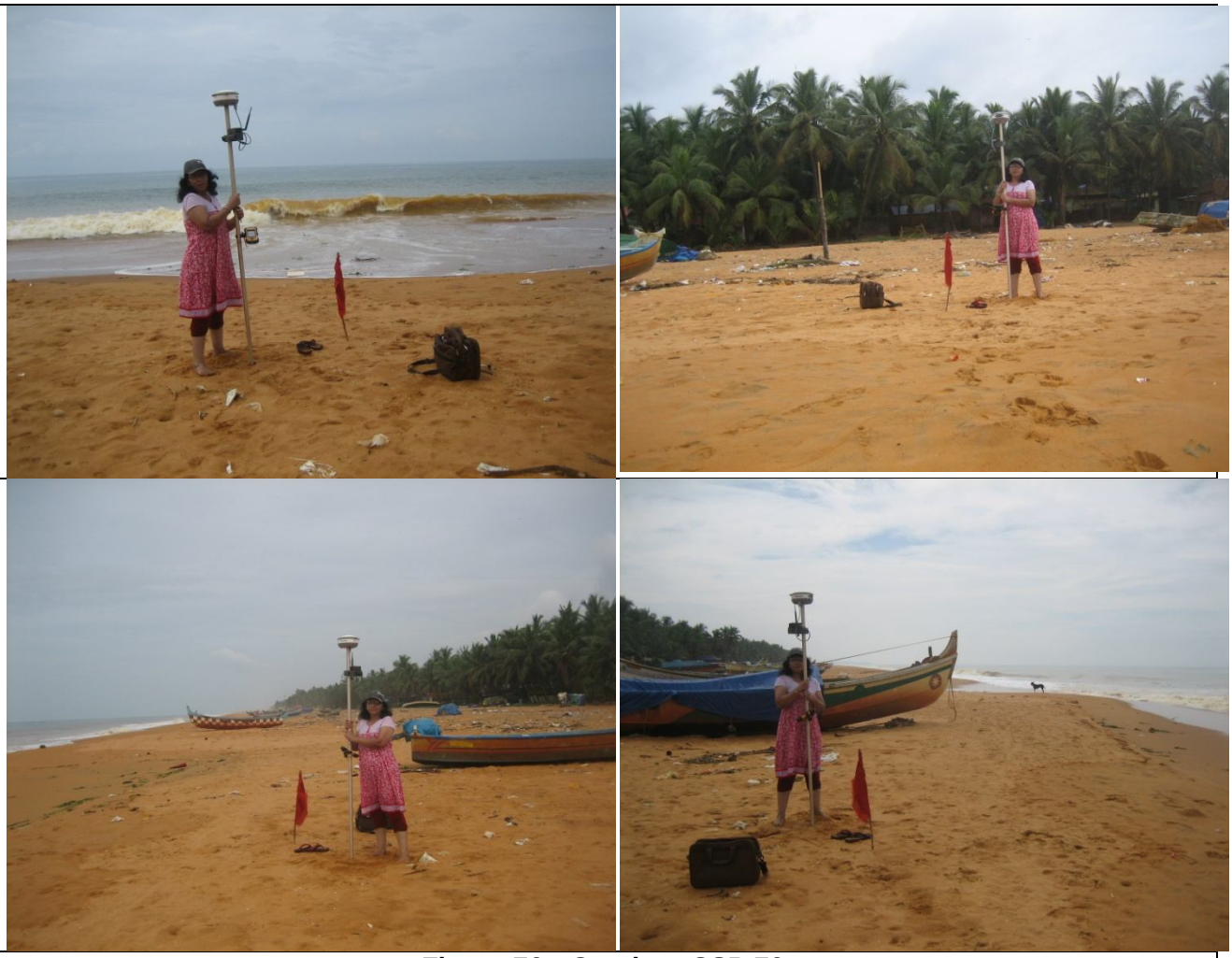

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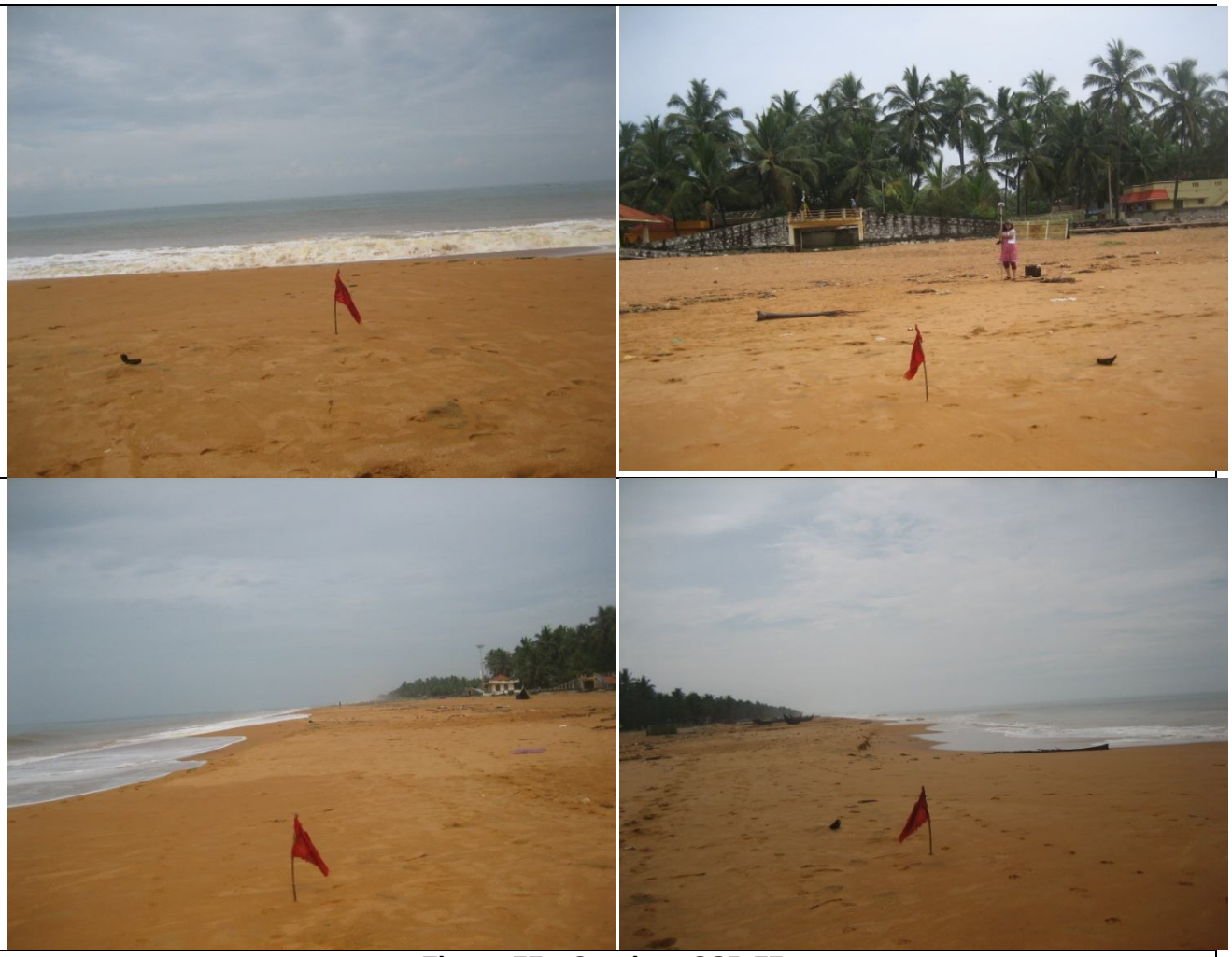


Figure 77:- October_CSP 77

Figure 78:- October_CSP 78

Figure 79:- October_CSP 79

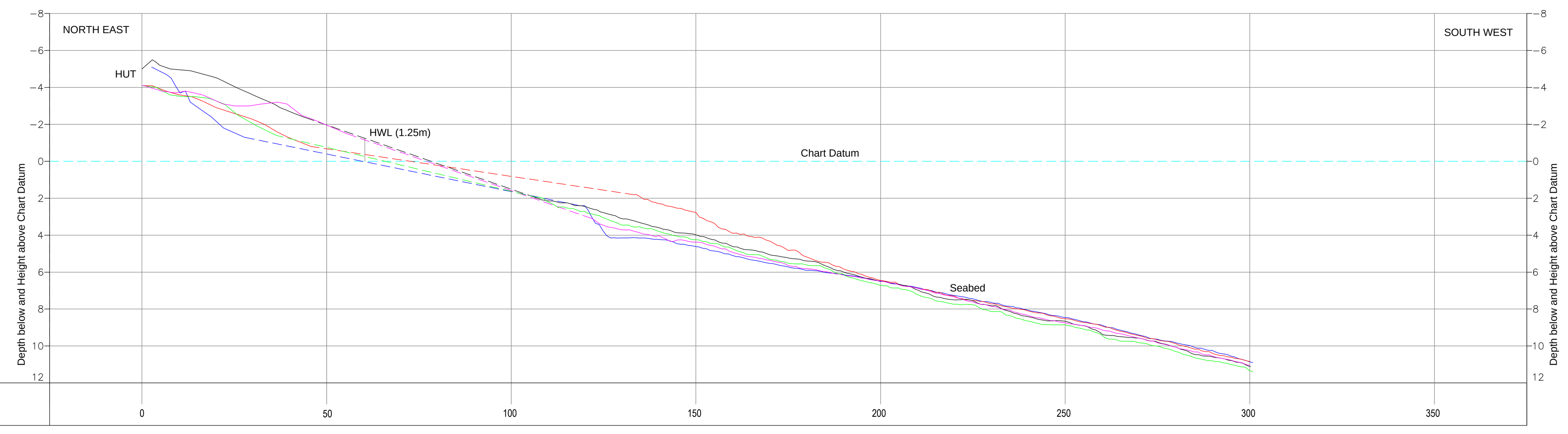
Figure 80:- October_CSP 80

Figure 81:- October_CSP 81

Cross Section Line No.CSP-73

Cross Shore Profile

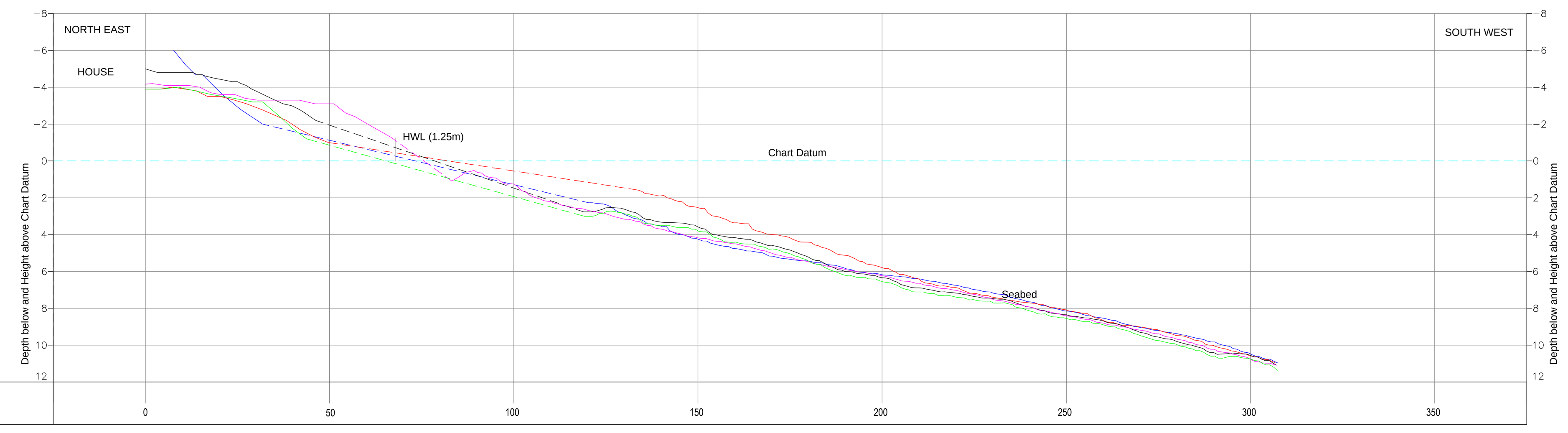
SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Section Line No.CSP-74

Cross Shore Profile

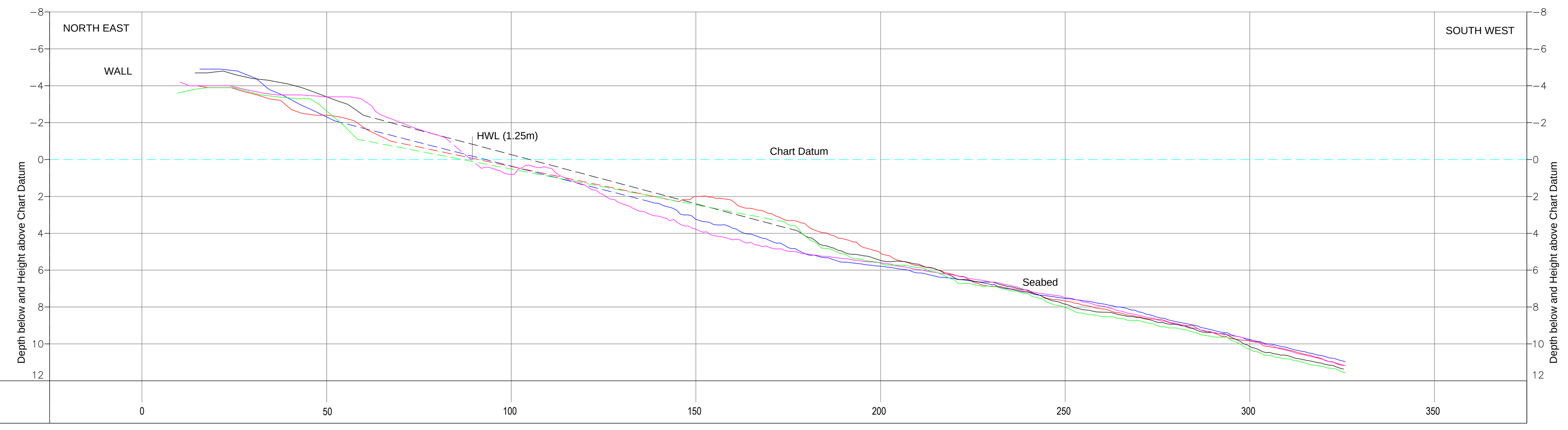
SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Section Line No.CSP-75

Cross Shore Profile

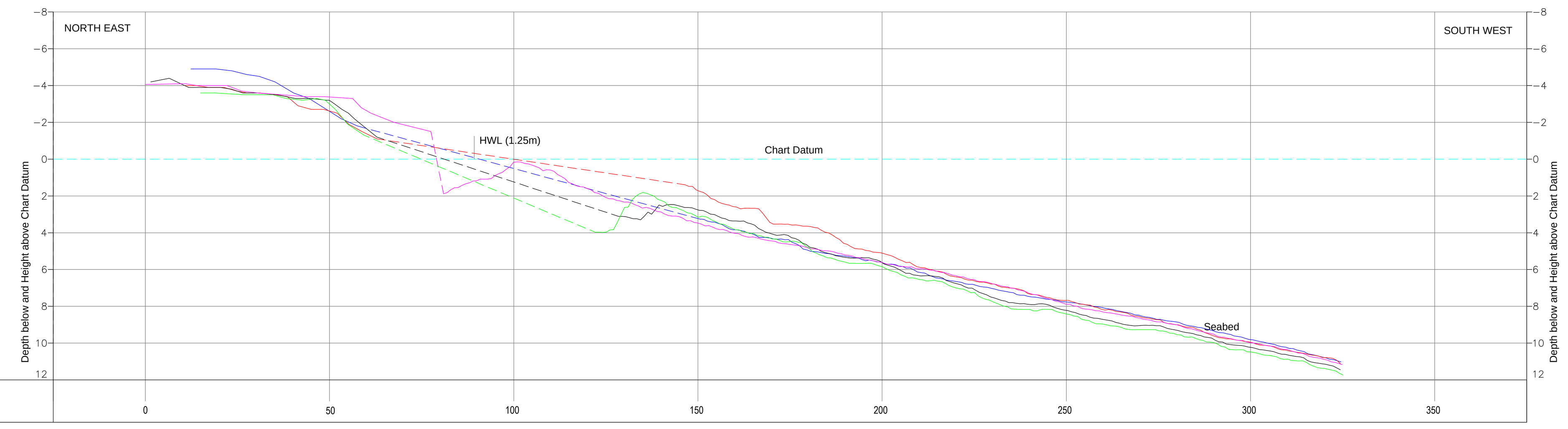
SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Section Line No.CSP-76

Cross Shore Profile

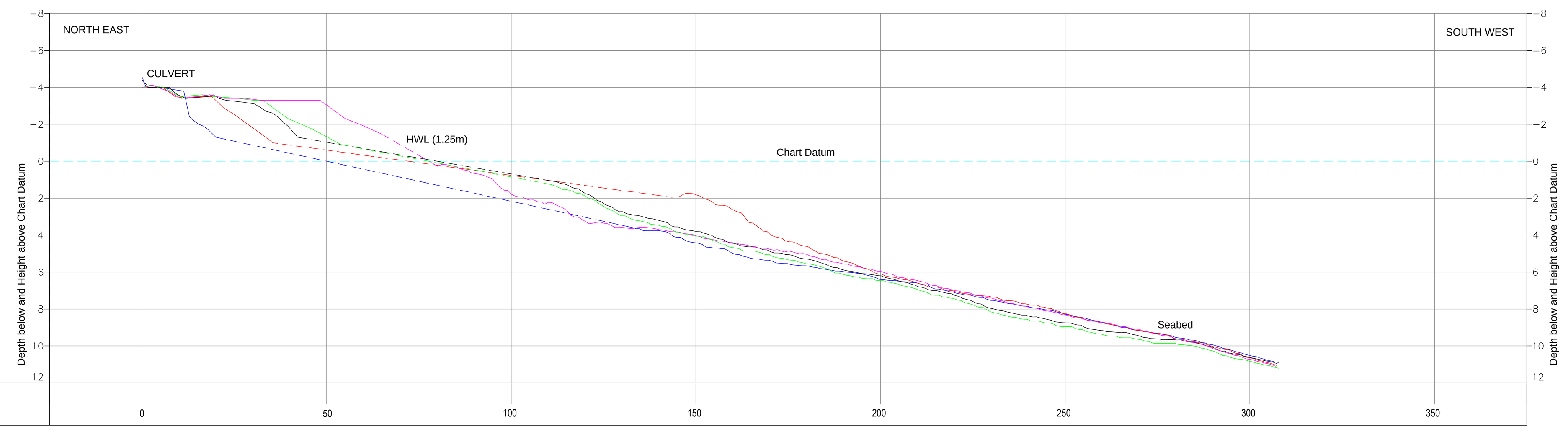
SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Section Line No.CSP-77

Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Section Line No.CSP-78

Cross Shore Profile

SCALE
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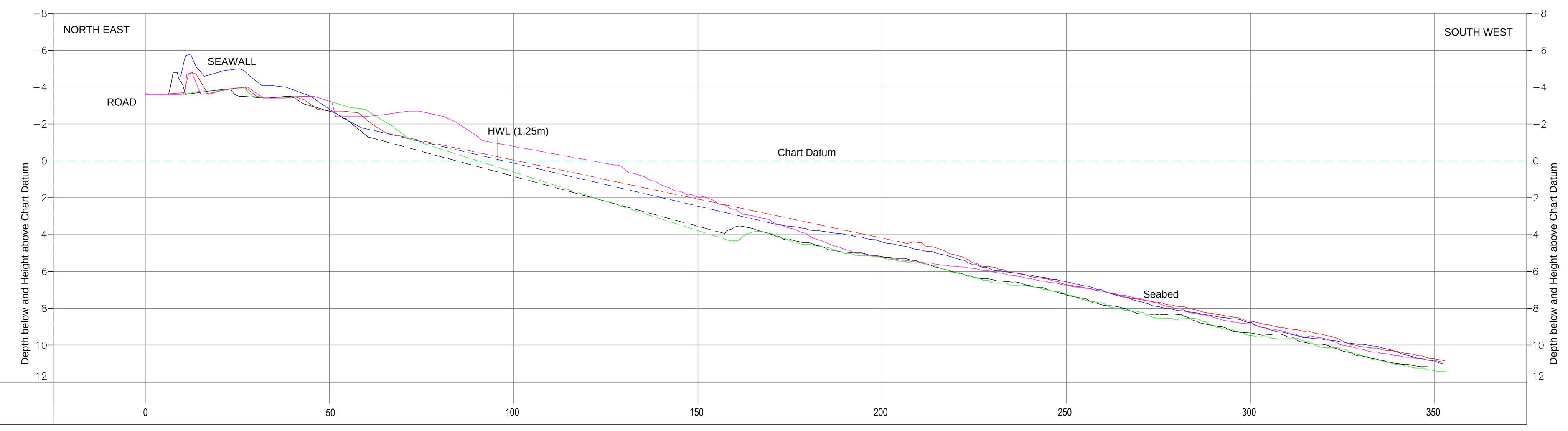
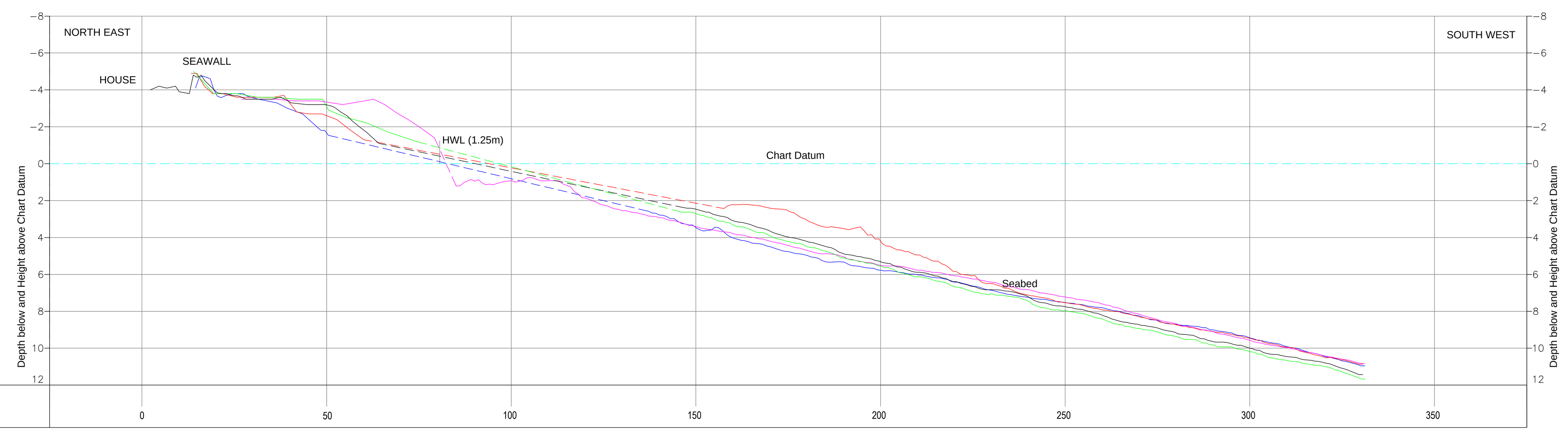
VERTICAL 1: 200



Cross Section Line No.CSP-79

Cross Shore Profile

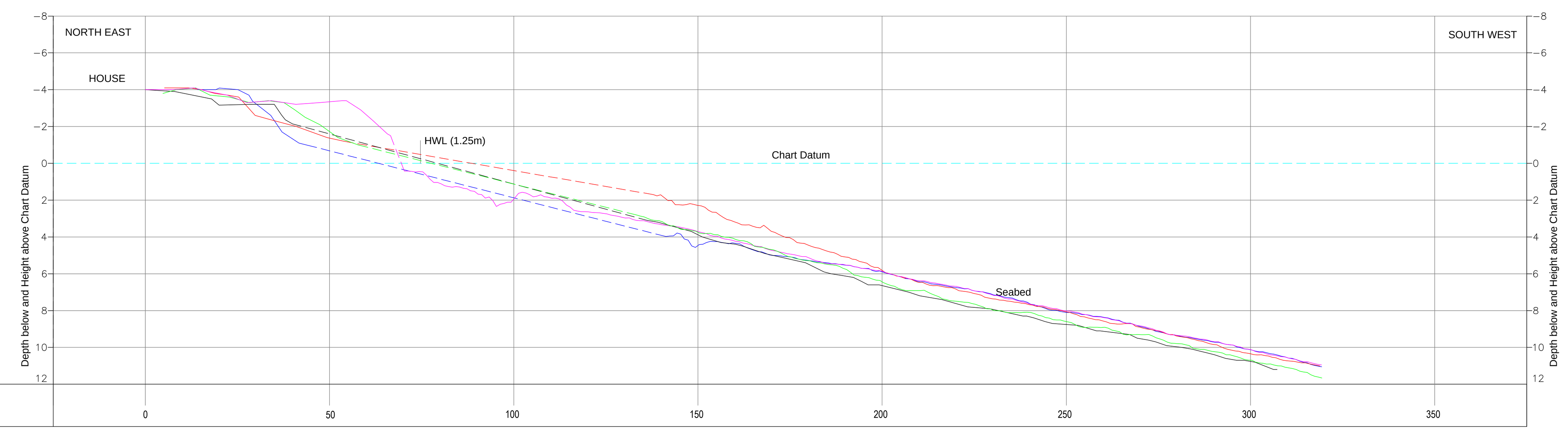
SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Section Line No.CSP-80

Cross Shore Profile

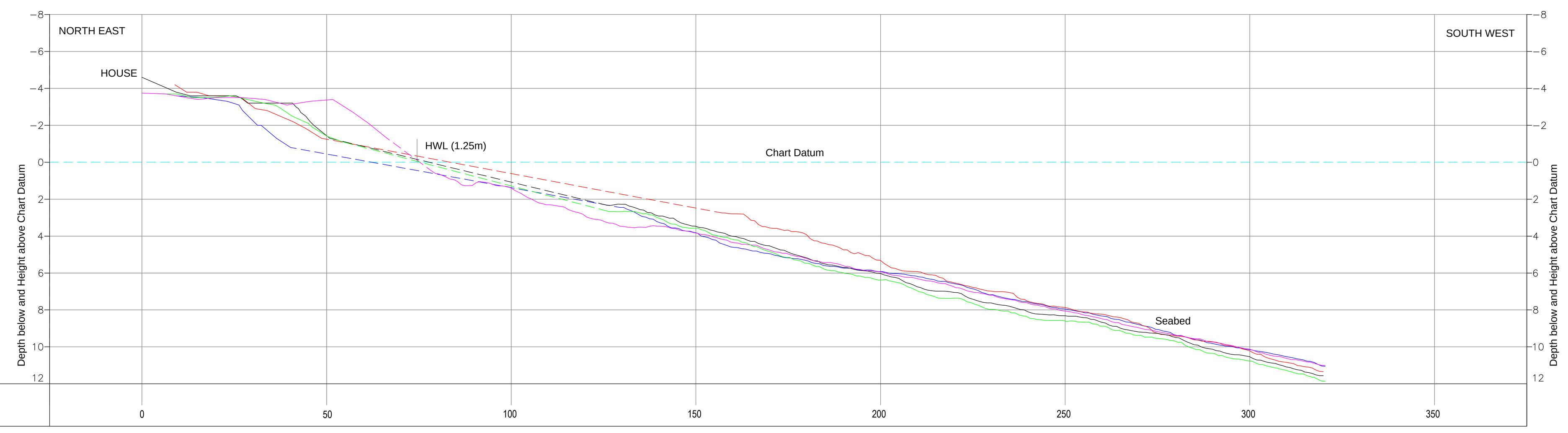
SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Section Line No.CSP-81

Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at vizhinjam Harbour is used to reduce the raw bathy to chart datum.

LEGEND

- Cross Shore Profile June 2015
- Cross Shore Profile July 2015
- Cross Shore Profile August 2015
- Cross Shore Profile September 2015
- Cross Shore Profile October 2015
- Breaker Zone

Survey Notes :

Survey dates	:	June to October 2015
Survey boats	:	Bethel
Surface positioning	:	Leica MX 420 series DGPS
RTK System	:	Hemisphere GPS R320 GNSS base and rover
Bathymetry acquired using	:	Geo swath plus MBES

Geodetic parameters :

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

Scale

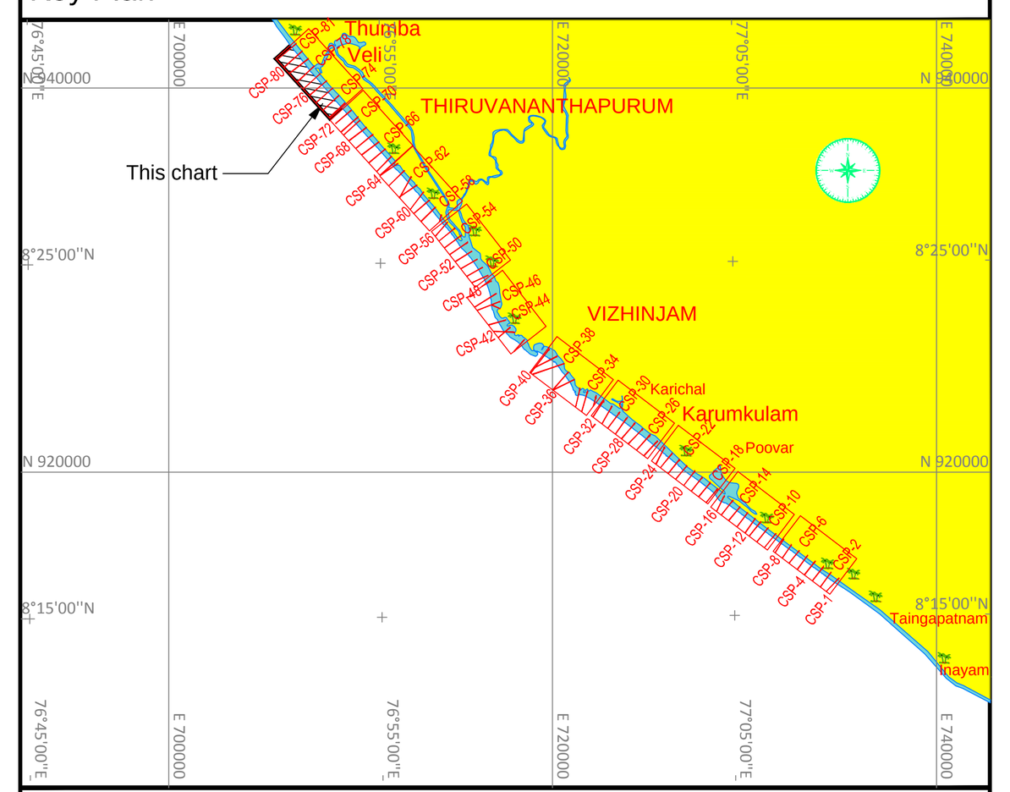
HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres

4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan



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(Formerly known as EGS SURVEY PVT. LTD.)
C005/006, Platform Floor,
Tower No.8, Railway Station Complex,
CBD Belapur, Navi Mumbai - 400 614
Maharashtra, India.

Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

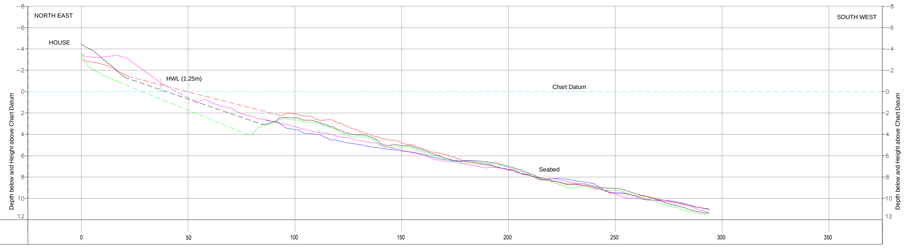
Drawing Title

Cross Shore Profiling at Vizhinjam
(June - October 2015)

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	04.01.2016

Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip
Dwg No. : OSaS_P18115_VISL_CSP73-CSP81_10		Sheet No. 10 of 10

Cross Section Line No.CSP-65

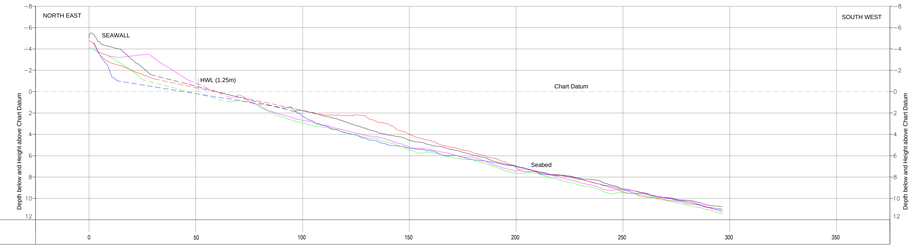


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-66

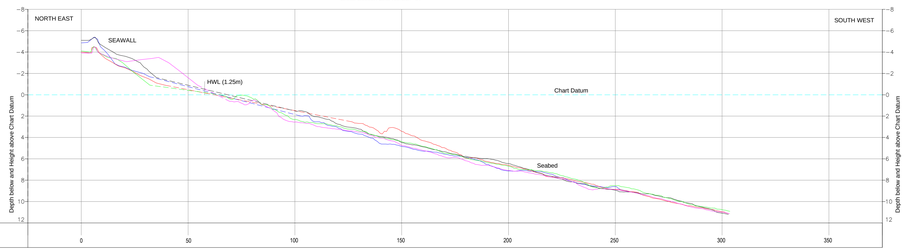


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-67

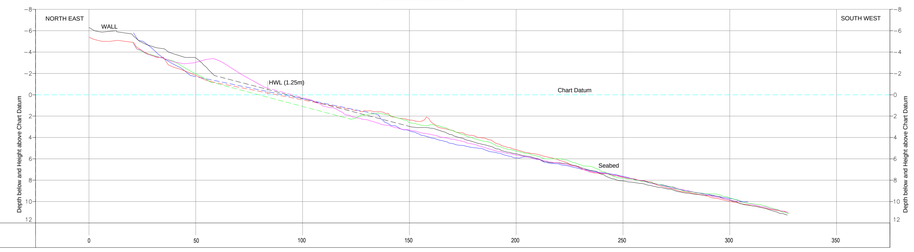


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-68

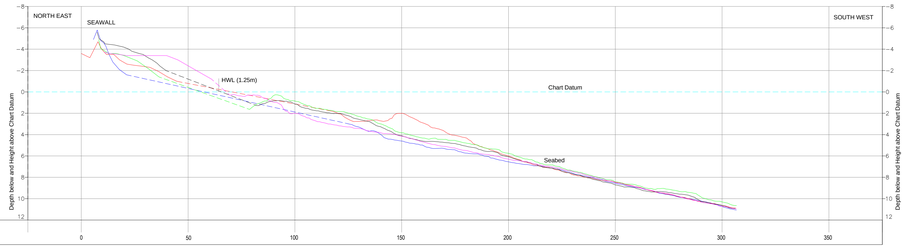


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-69

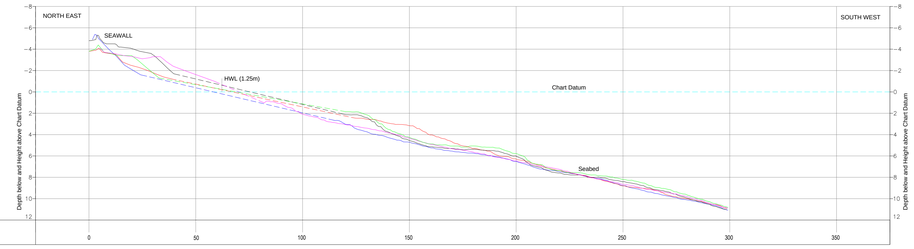


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-70

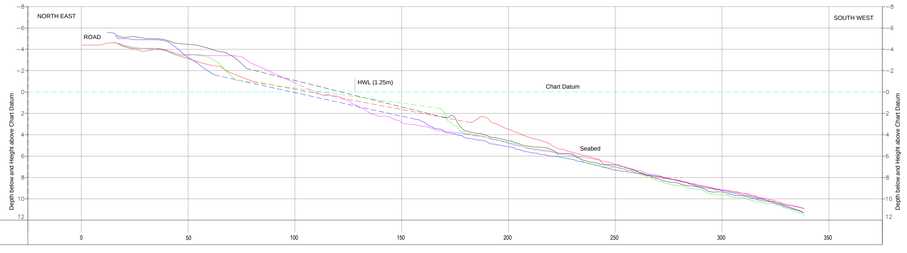


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-71

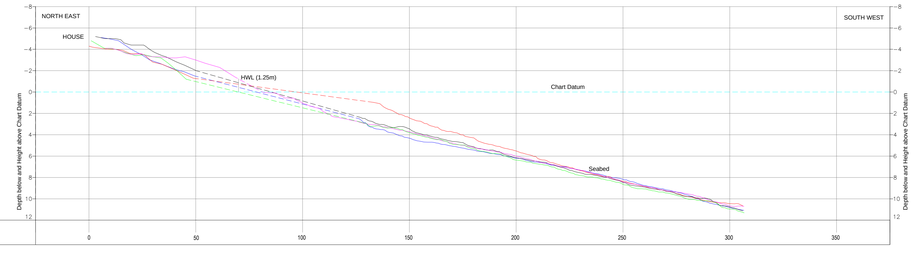


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-72



Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at vizhinjam Harbour is used to reduce the raw bathy to chart datum.

LEGEND

- Cross Shore Profile June 2015
- Cross Shore Profile July 2015
- Cross Shore Profile August 2015
- Cross Shore Profile September 2015
- Cross Shore Profile October 2015
- Breaker Zone

Survey Notes :

Survey dates	:	June to October 2015
Survey boats	:	Bethel
Surface positioning	:	Leica MX 420 series DGPS
RTK System	:	Hemisphere GPS R320 GNSS base and rover
Bathymetry acquired using	:	Geo swath plus MBES

Geodetic parameters :

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

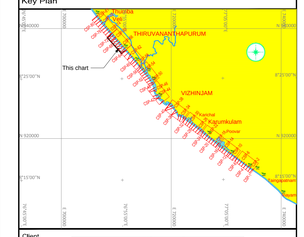
Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres
4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan



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NIOT Campus, Velachery - Tambaram Main Road,
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Project

Oceanographic & Bathymetric Data Collection
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For
Vizhinjam International Seaport Limited

Drawing Title

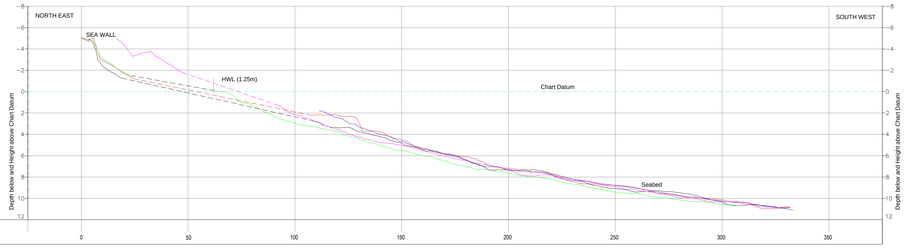
Cross Shore Profiling at Vizhinjam
(June - October 2015)

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	04.01.2016

Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip

Dwg No. : OSaS_P18115_VISL_CSP65-CSP72_09 — Sheet No. 9 of 10

Cross Section Line No.CSP-57

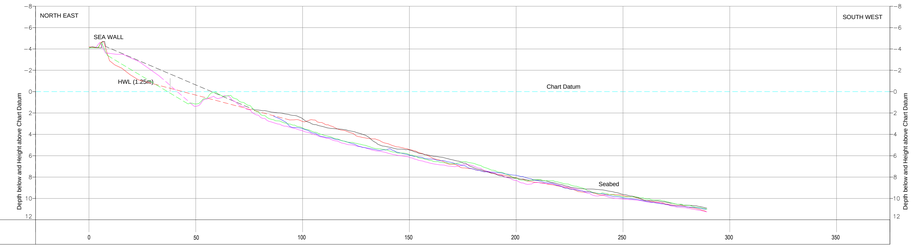


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-58

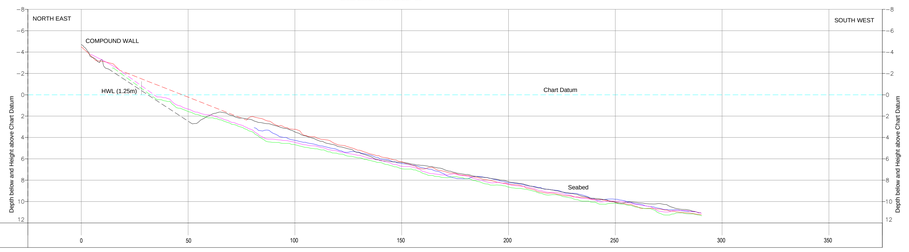


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-59

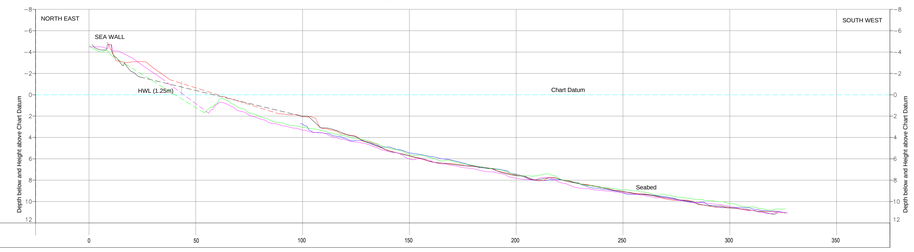


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-60

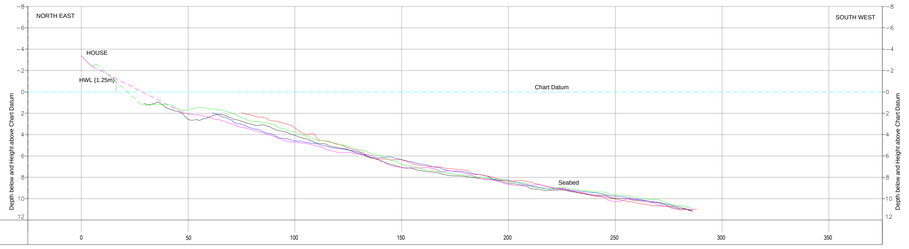


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-61

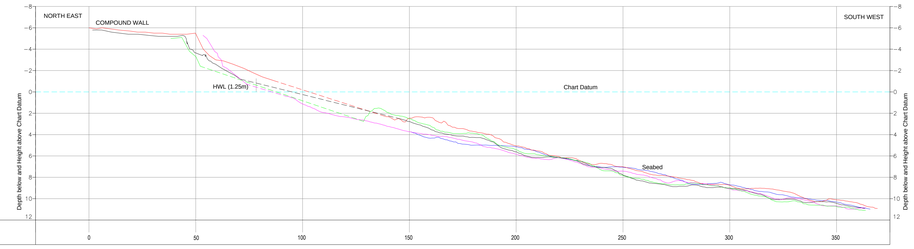


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-62

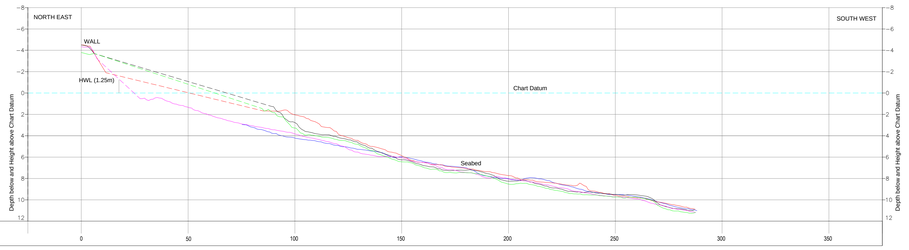


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-63

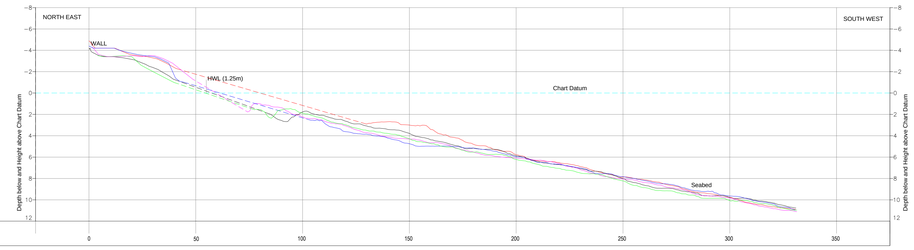


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-64



Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at vizhinjam Harbour is used to reduce the raw bathy to chart datum.

LEGEND

- Cross Shore Profile June 2015
- Cross Shore Profile July 2015
- Cross Shore Profile August 2015
- Cross Shore Profile September 2015
- Cross Shore Profile October 2015
- Breaker Zone

Survey Notes :

Survey dates	:	June to October 2015
Survey boats	:	Bethel
Surface positioning	:	Leica MX 420 series DGPS
RTK System	:	Hemisphere GPS R320 GNSS base and rover
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Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

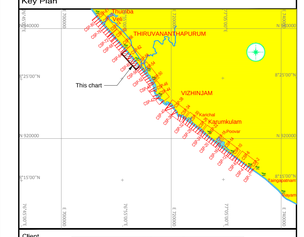
Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres
4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan



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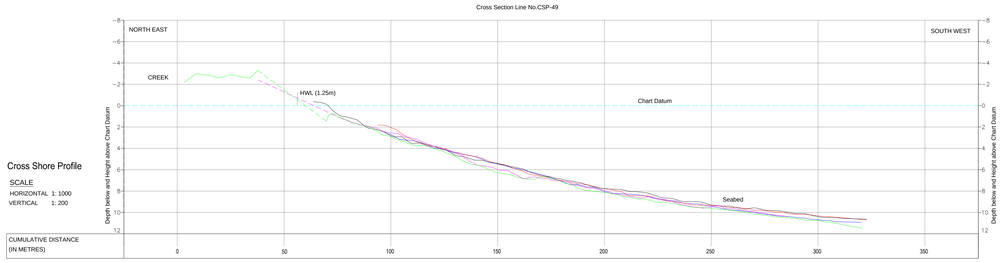
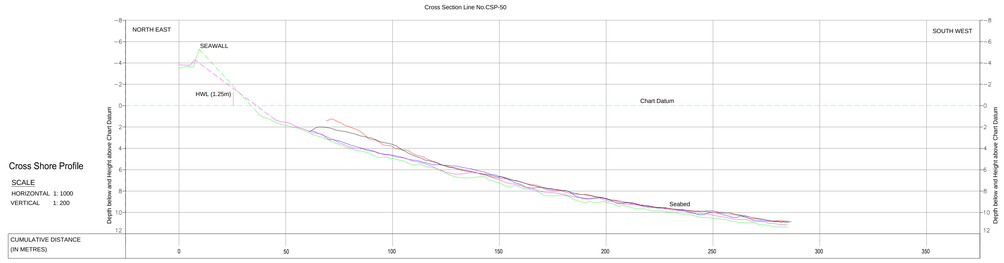
Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip
Dwg No. : OSaS_P18115_VISL_CSP57-CSP64_08		Sheet No. 8 of 10



Cross Shore Profile

SCALE

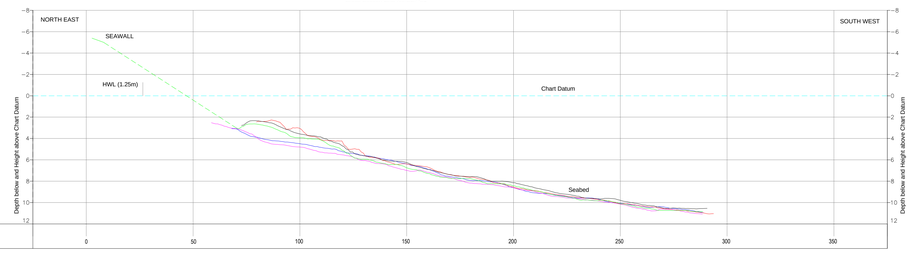
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

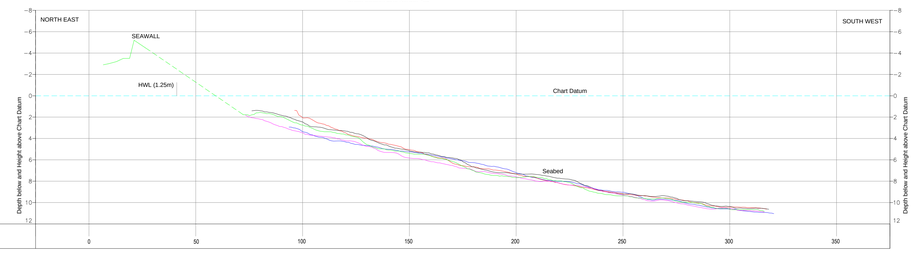
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

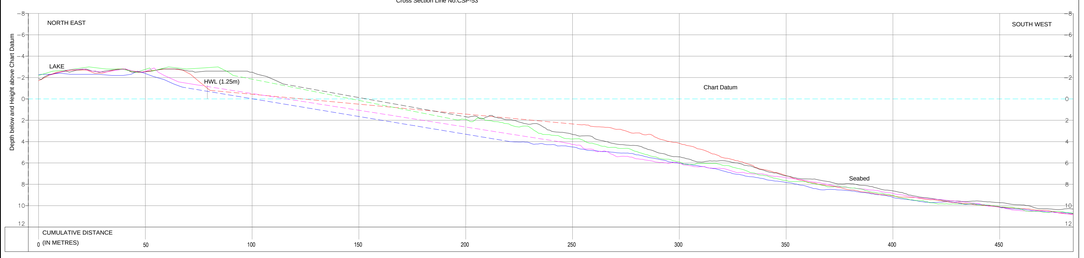
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

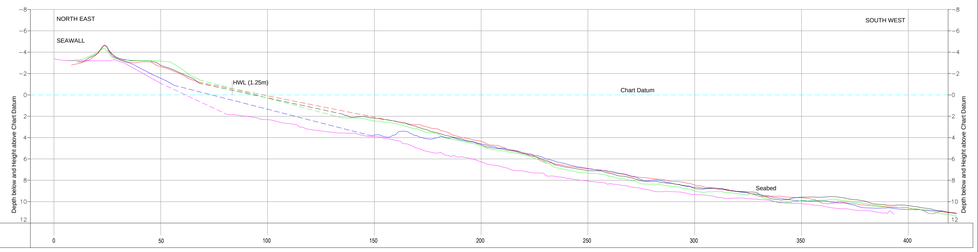
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

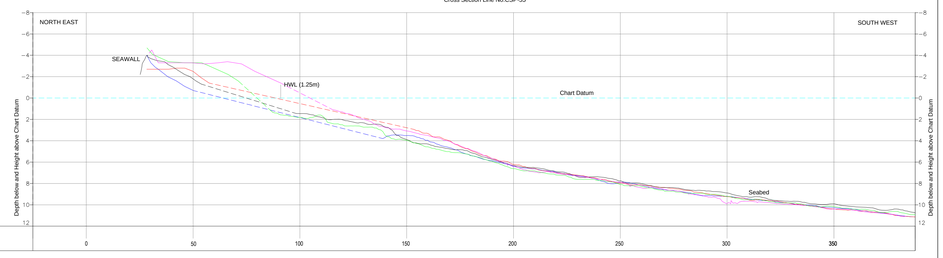
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

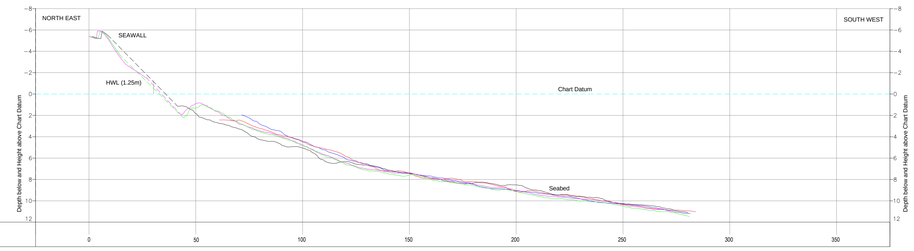
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at vizhinjam Harbour is used to reduce the raw bathy to chart datum.

LEGEND

- Cross Shore Profile June 2015
- Cross Shore Profile July 2015
- Cross Shore Profile August 2015
- Cross Shore Profile September 2015
- Cross Shore Profile October 2015
- Breaker Zone

Survey Notes :

Survey dates	:	June to October 2015
Survey boats	:	Bethel
Surface positioning	:	Leica MX 420 series DGPS
RTK System	:	Hemisphere GPS R320 GNSS base and rover
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Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
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Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

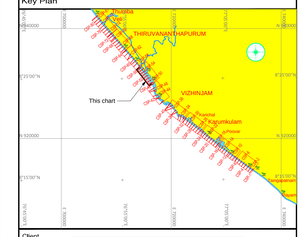
Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres
4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan



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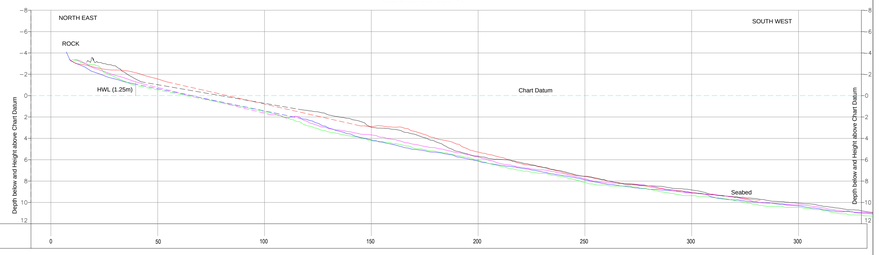
Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip
Dwg No. : OSaS_P18115_VISL_CSP49-CSP56_07		Sheet No. 7 of 10

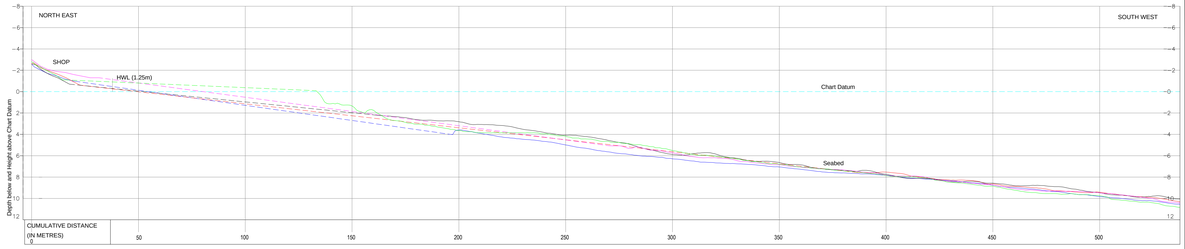
Cross Section Line No.CSP-41



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

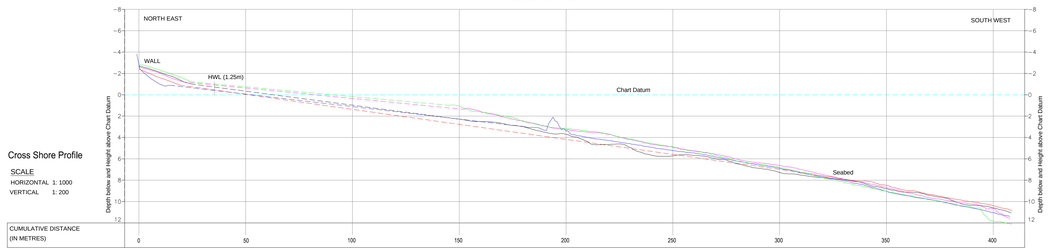
Cross Section Line No.CSP-42



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

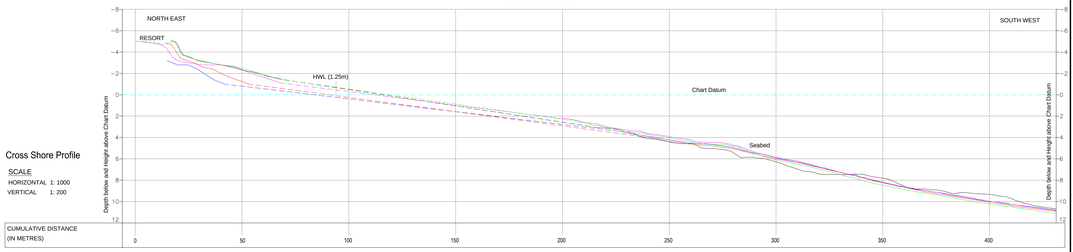
Cross Section Line No.CSP-43



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

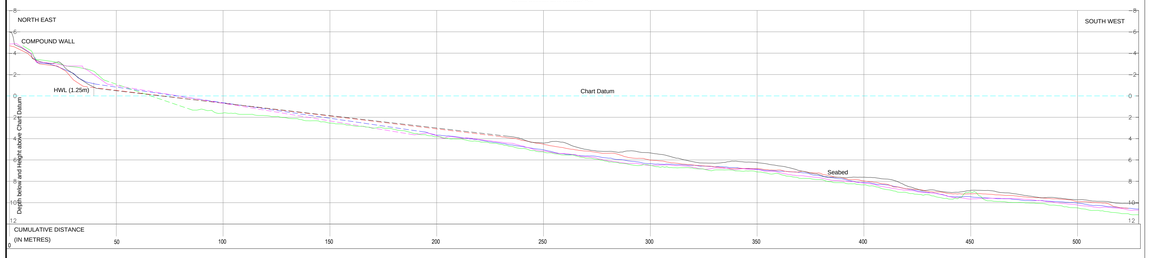
Cross Section Line No.CSP-44



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

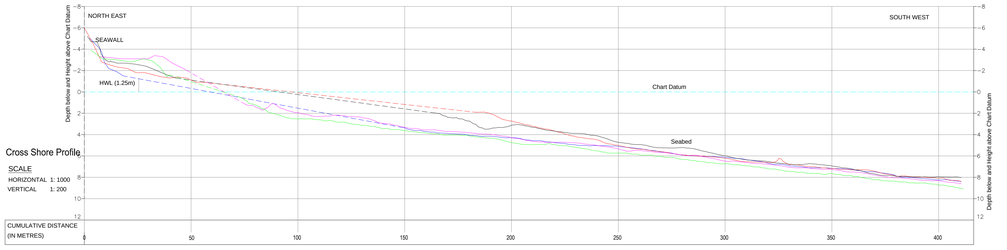
Cross Section Line No.CSP-45



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

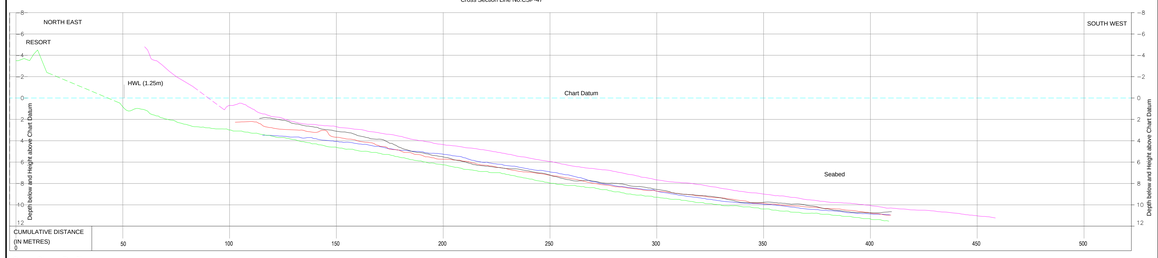
Cross Section Line No.CSP-46



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

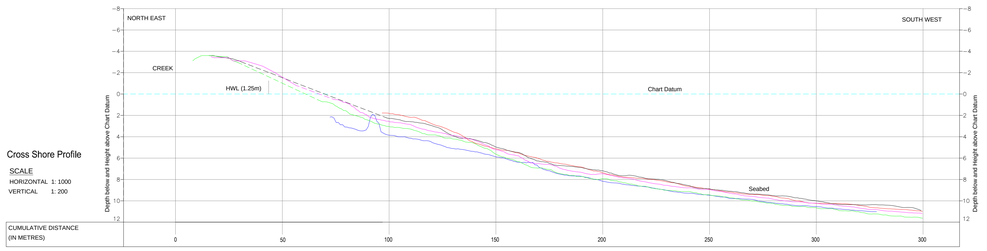
Cross Section Line No.CSP-47



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-48



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

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False Northing	:	0 m
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Units	:	Metres

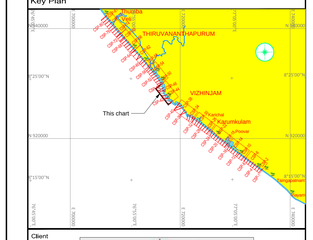
Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres
4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan



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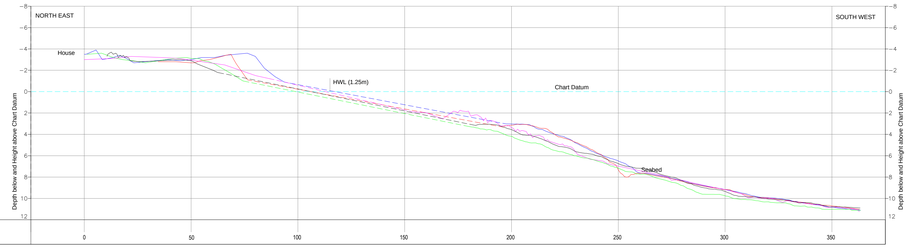
Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip
Dwg No. : OSaS_P18115_VISL_CSP41-CSP48_06		Sheet No. 6 of 10

Cross Section Line No.CSP-33

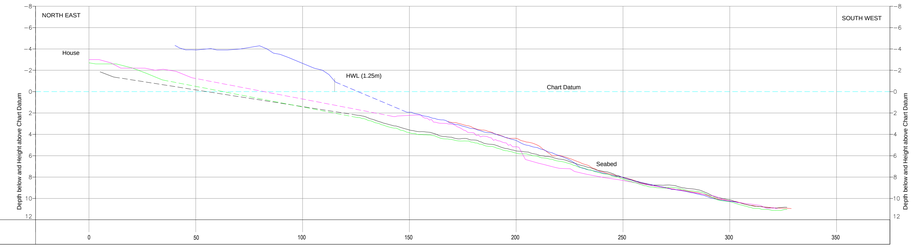


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-34

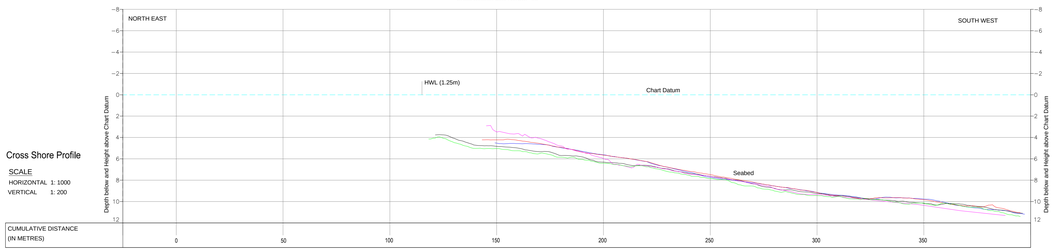


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-35

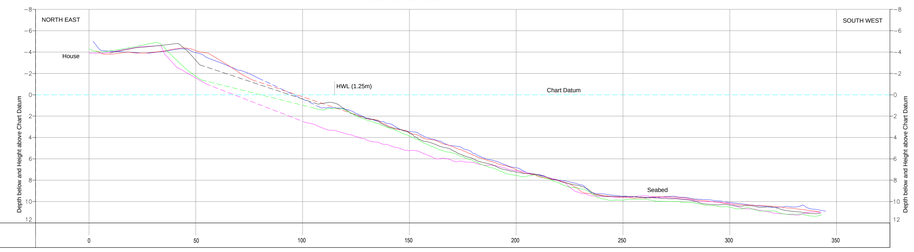


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-36

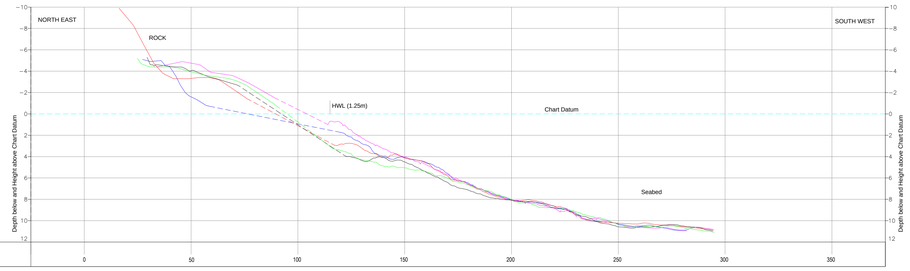


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-37

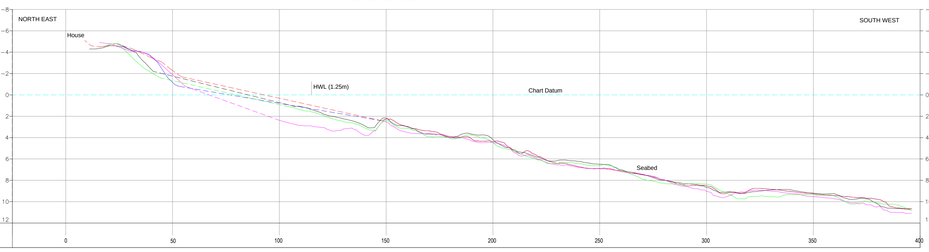


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-38

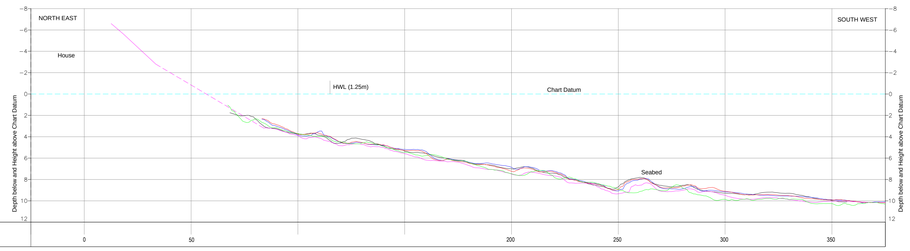


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-39

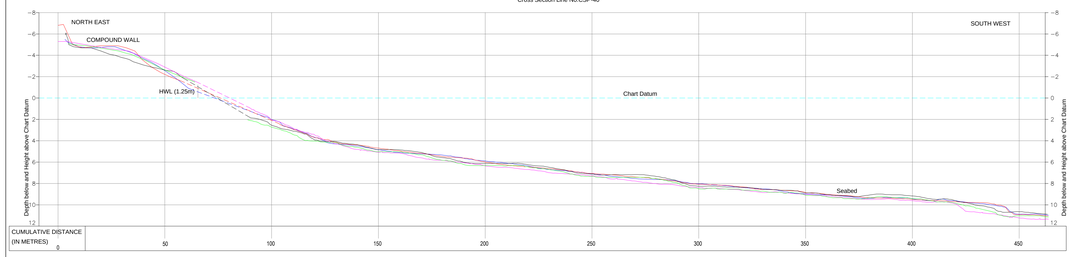


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-40



Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Notes :

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2. Observed tides at vizhinjam Harbour is used to reduce the raw bathy to chart datum.

LEGEND

- Cross Shore Profile June 2015
- Cross Shore Profile July 2015
- Cross Shore Profile August 2015
- Cross Shore Profile September 2015
- Cross Shore Profile October 2015
- Breaker Zone

Survey Notes :

Survey dates	:	June to October 2015
Survey boats	:	Bethel
Surface positioning	:	Leica MX 420 series DGPS
RTK System	:	Hemisphere GPS R320 GNSS base and rover
Bathymetry acquired using	:	Geo swath plus MBES

Geodetic parameters :

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

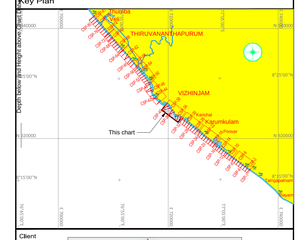
Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres
4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan



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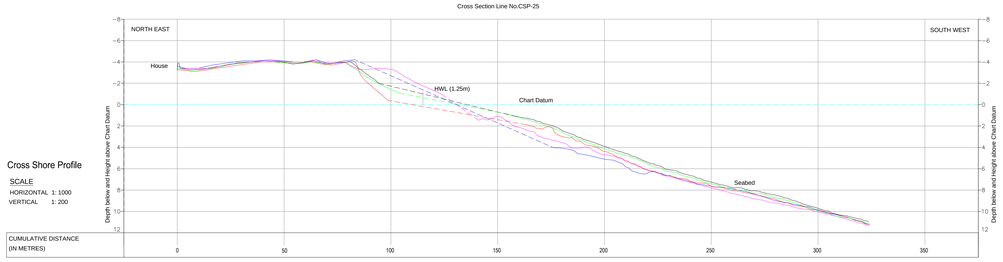
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Cross Shore Profiling at Vizhinjam
(June - October 2015)

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	04.01.2016

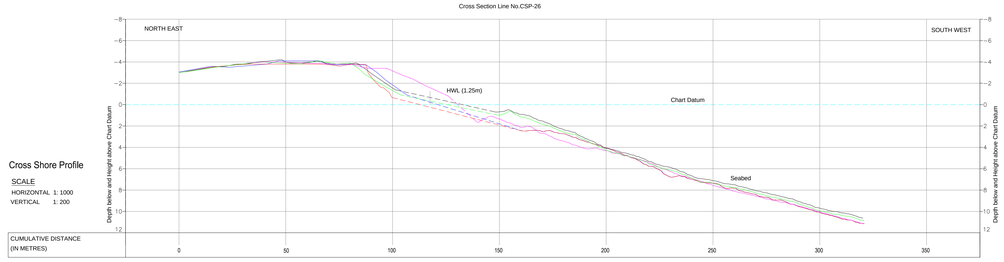
Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip
Dwg No. : OSaS_P18115_VISL_CSP33-CSP40_05		Sheet No. 5 of 10



Cross Shore Profile

SCALE

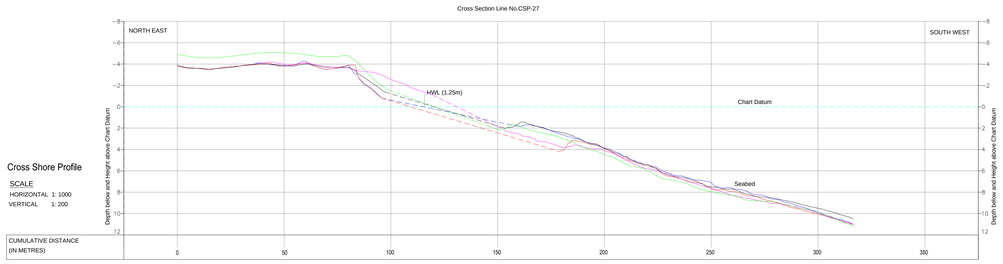
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

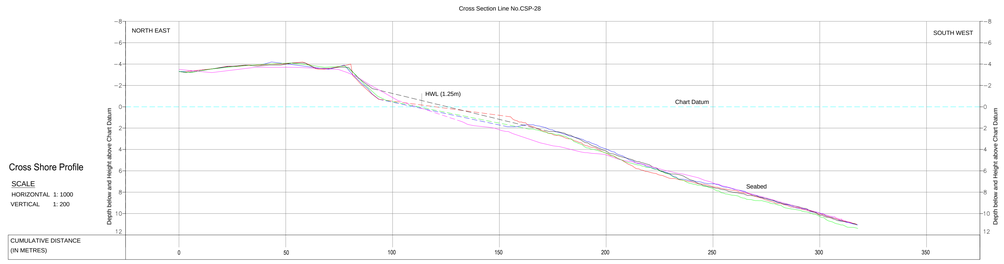
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

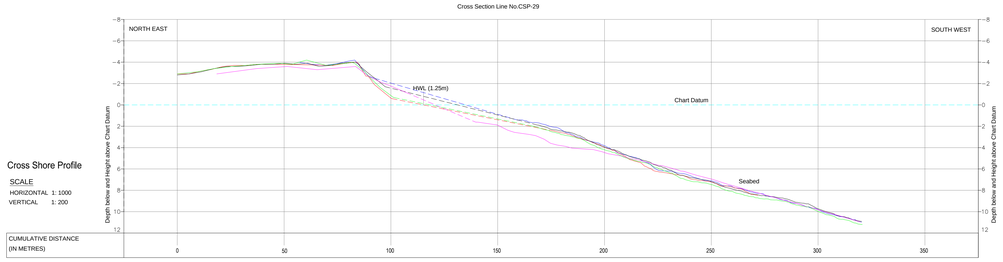
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

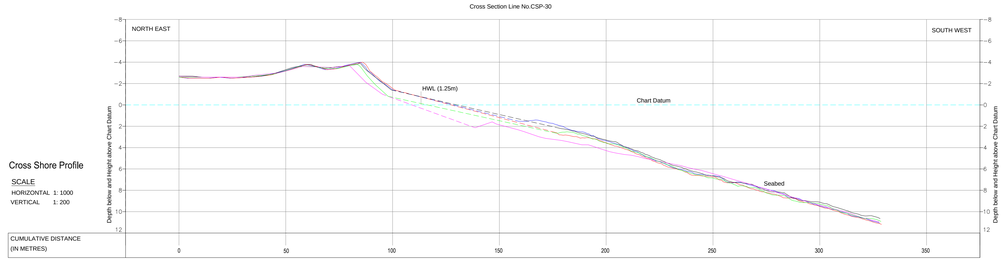
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

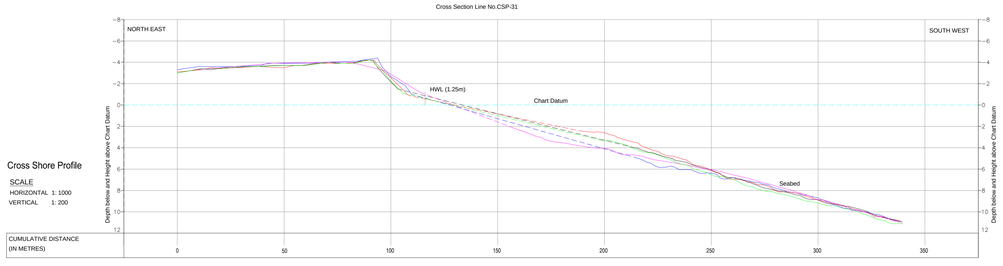
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

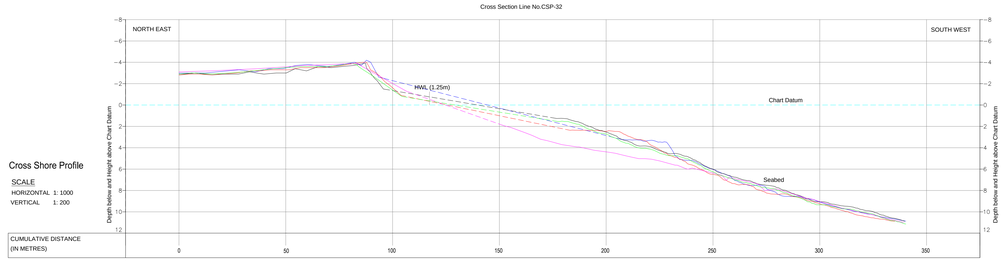
HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200



Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Notes :

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LEGEND

- Cross Shore Profile June 2015
- Cross Shore Profile July 2015
- Cross Shore Profile August 2015
- Cross Shore Profile September 2015
- Cross Shore Profile October 2015
- Breaker Zone

Survey Notes :

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Survey boats	:	Bethel
Surface positioning	:	Leica MX 420 series DGPS
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Semi-Minor Axis	:	6356752.314245m
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Projection	:	Universal Transverse Mercator
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Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres
4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan

Client

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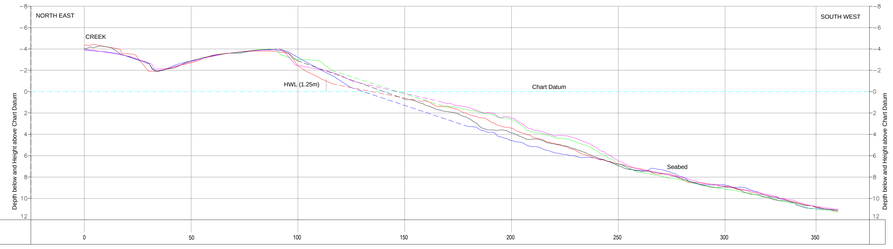
(June - October 2015)

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	04.01.2016

Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip
Dwg No. : OSaS_P18115_VISL_CSP25-CSP32_04		Sheet No. 4 of 10

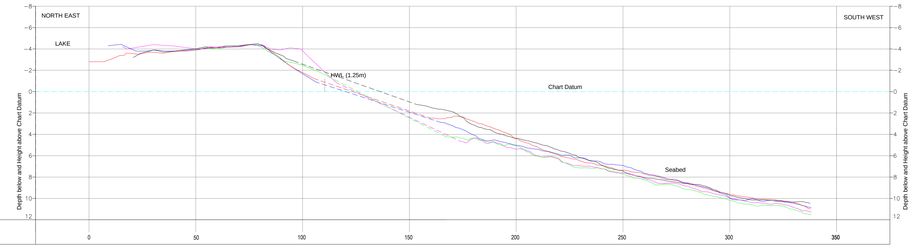
Cross Section Line No.CSP-17



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

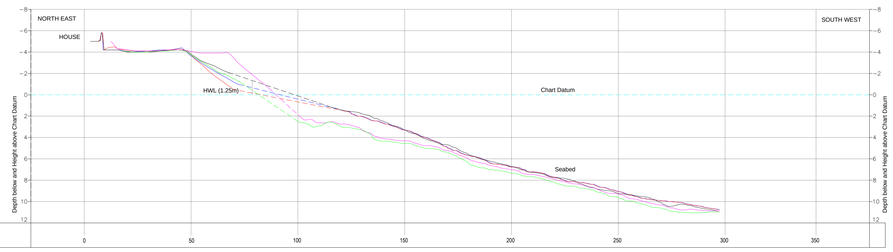
Cross Section Line No.CSP-18



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

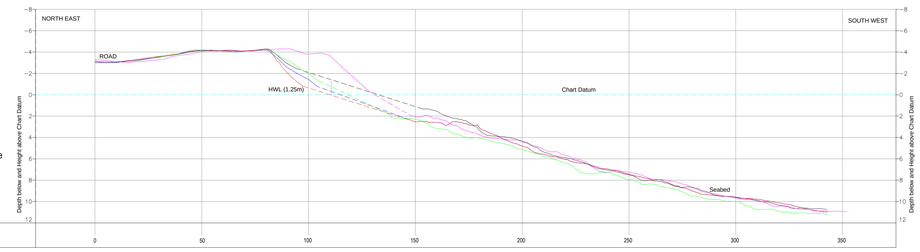
Cross Section Line No.CSP-19



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

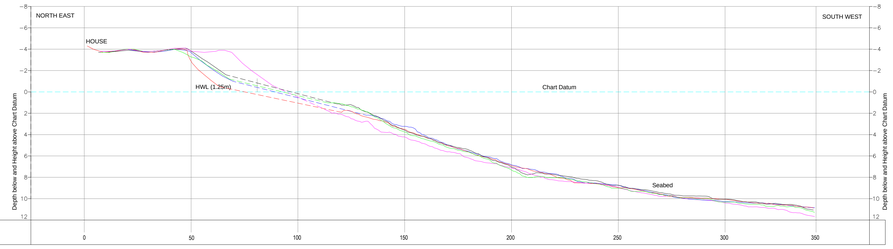
Cross Section Line No.CSP-20



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

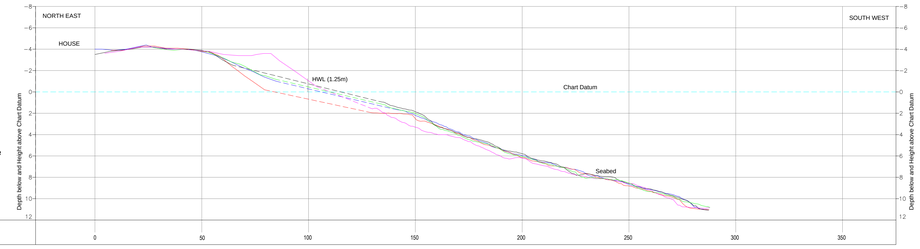
Cross Section Line No.CSP-21



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

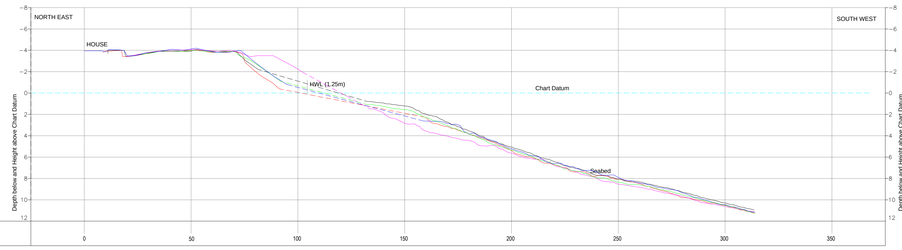
Cross Section Line No.CSP-22



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

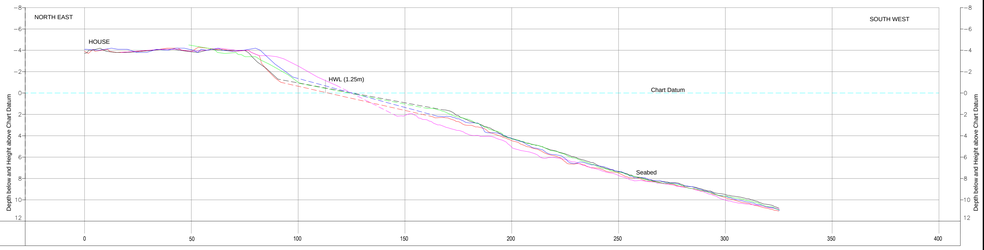
Cross Section Line No.CSP-23



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-24



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

Notes :

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LEGEND

- Cross Shore Profile June 2015
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Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

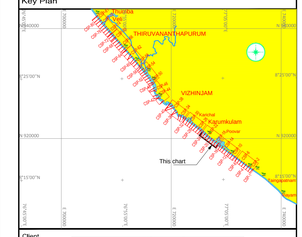
Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres
4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan



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Rev No.	Description	Date
1	Final	22.02.2016
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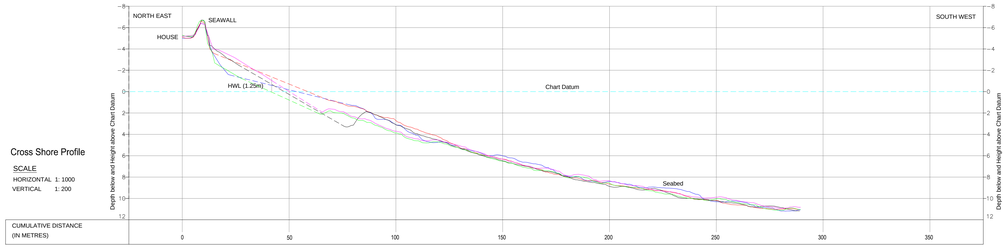
Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip
Dwg No. : OSaS_P18115_VISL_CSP17-CSP24_03		Sheet No. 3 of 10

Cross Section Line No.CSP-09

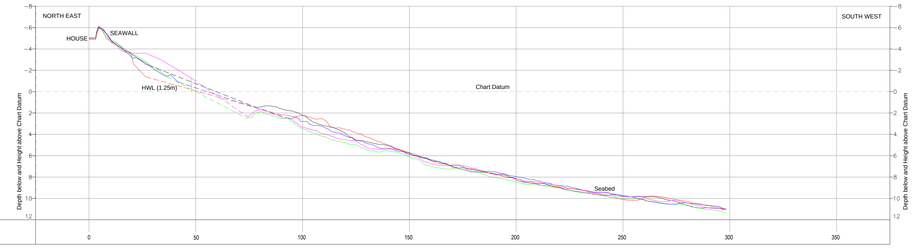


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-10

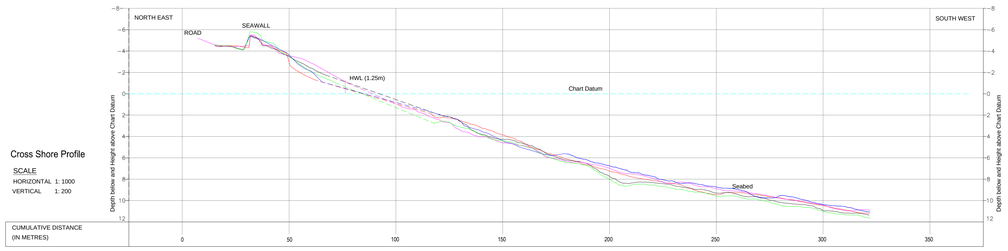


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-11

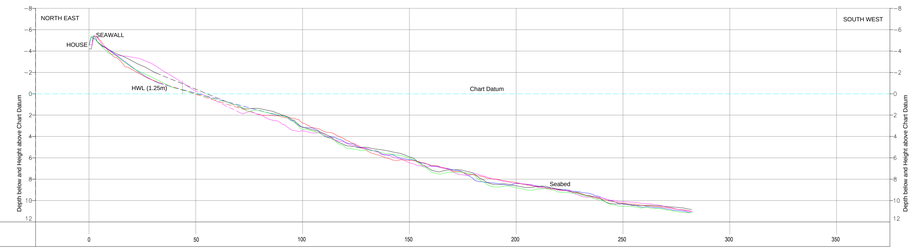


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-12

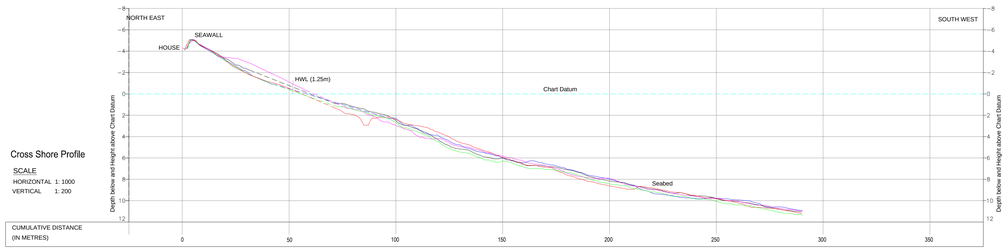


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-13

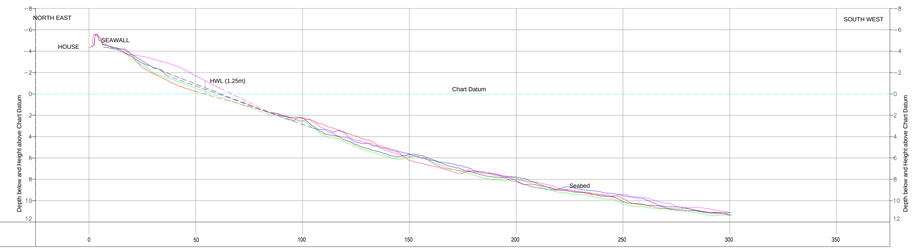


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-14

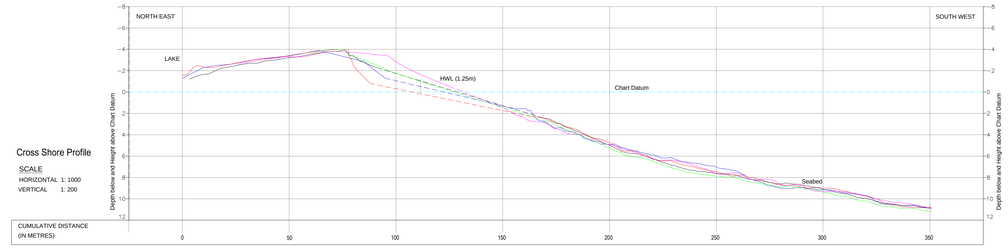


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-15

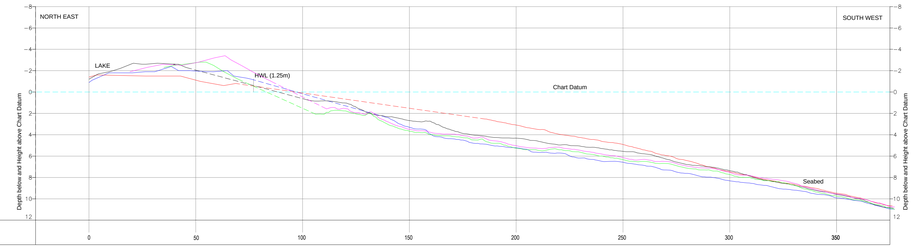


Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-16



Cross Shore Profile

SCALE

HORIZONTAL 1: 1000
VERTICAL 1: 200

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- Breaker Zone

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Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

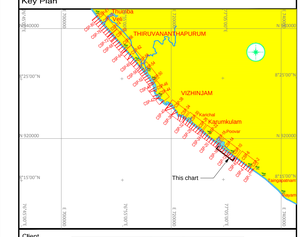
Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres
4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan



Client

VIZHINJAM INTERNATIONAL SEAPORT LIMITED

1st Floor, Vipanchika Towers,
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Tel : +91 471 2328614 Tel/Fax: +91 471 2328616
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(Formerly known as EGS SURVEY PVT. LTD.)
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CBD Belapur, Navi Mumbai – 400 614
Maharashtra, India.

Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

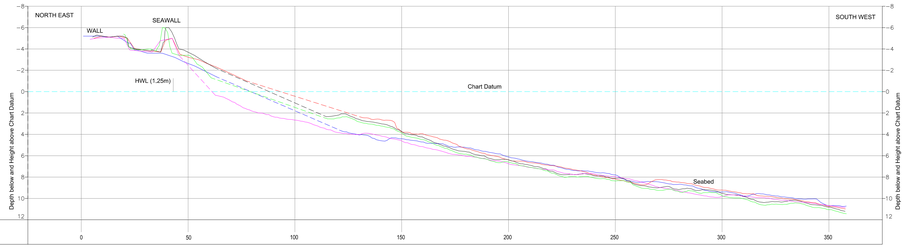
Cross Shore Profiling at Vizhinjam
(June - October 2015)

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	04.01.2016

Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip

Dwg No. : OSaS_P18115_VISL_CSP9-CSP16_02 — Sheet No. 2 of 10

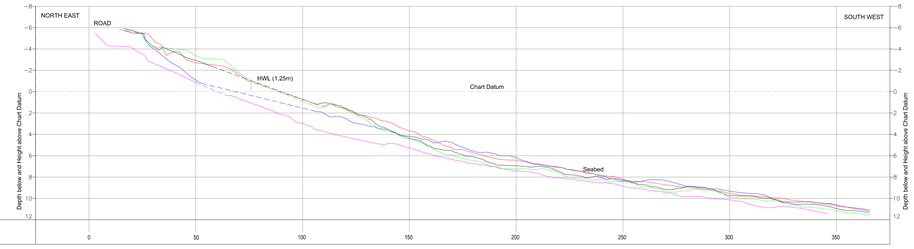
Cross Section Line No.CSP-01



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

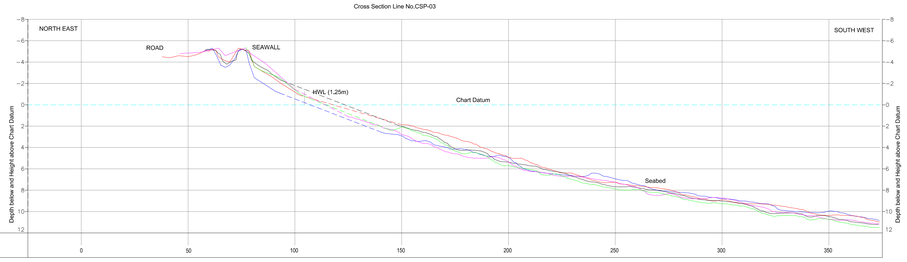
Cross Section Line No.CSP-02



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

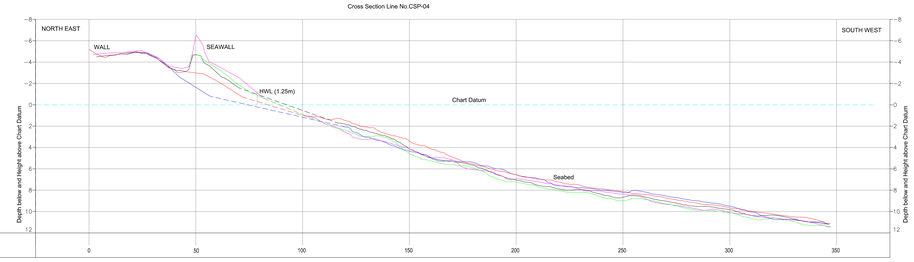
Cross Section Line No.CSP-03



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

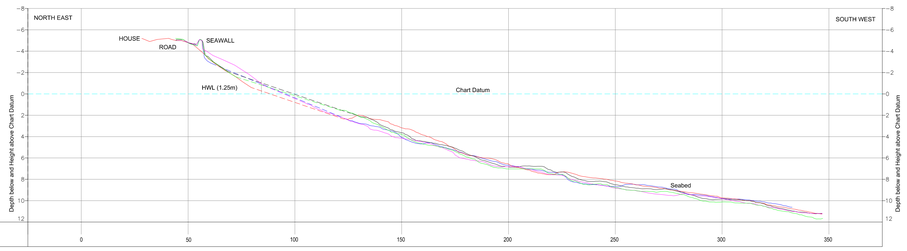
Cross Section Line No.CSP-04



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

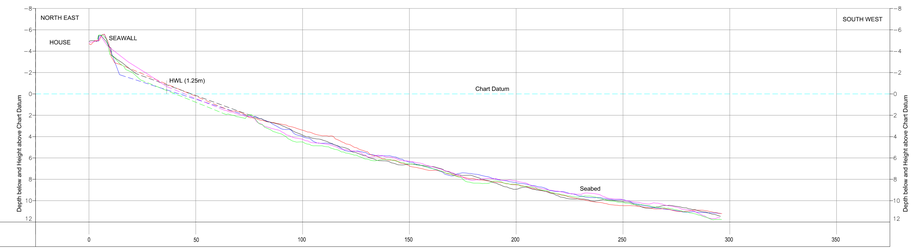
Cross Section Line No.CSP-05



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

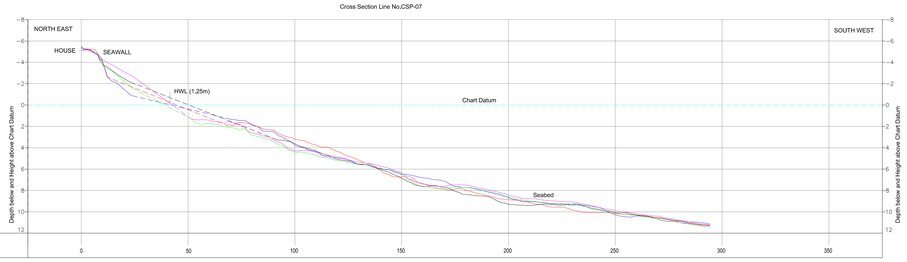
Cross Section Line No.CSP-06



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

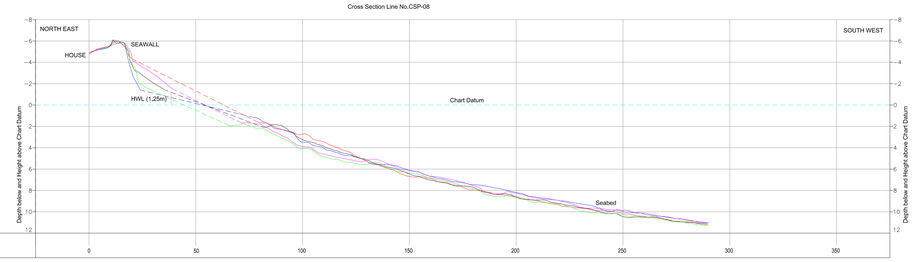
Cross Section Line No.CSP-07



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

Cross Section Line No.CSP-08



Cross Shore Profile

SCALE
HORIZONTAL 1: 1000
VERTICAL 1: 200

Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at vizhinjam Harbour is used to reduce the raw bathy to chart datum.

LEGEND

- Cross Shore Profile June 2015
- Cross Shore Profile July 2015
- Cross Shore Profile August 2015
- Cross Shore Profile September 2015
- Cross Shore Profile October 2015
- Breaker Zone

Survey Notes :

Survey dates	:	June to October 2015
Survey boats	:	Bethel
Surface positioning	:	Leica MX 420 series DGPS
RTK System	:	Hemisphere GPS R320 GNSS base and rover
Bathymetry acquired using	:	Geo swath plus MBES

Geodetic parameters :

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

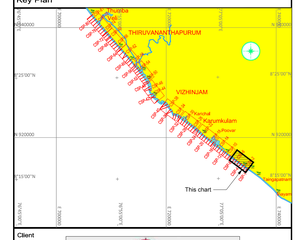
Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres
4 0 4 8 12 16 20

VERTICAL 1 : 200

Key Plan



Client

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Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Cross Shore Profiling at Vizhinjam
(June - October 2015)

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	04.01.2016

Drawn : U.M. Kadam	Interpreted : S. Behera	Approved : S. Philip
Dwg No. : OSaS_P18115_VBL_CSP1-CSP8_01		Sheet No. 1 of 10

Thumba
Veli
THIRUVANANTHAPURUM
P18115_OSaS_VISL_01
P18115_OSaS_VISL_03
P3
P18115_OSaS_VISL_02
P18115_OSaS_VISL_07
P18115_OSaS_VISL_04
VIZHINJAM
P1
P4
Karichal
P18115_OSaS_VISL_05
Karumkulam
Poovar
P2
P18115_OSaS_VISL_08
P18115_OSaS_VISL_09
P18115_OSaS_VISL_10
P18115_OSaS_VISL_06
Taingapatnam
Inayam
P18115_OSaS_VISL_11
P18115_OSaS_VISL_12
P18115_OSaS_VISL_13
N
W
E
S

Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

N 2098500 — UTM Grid Line & Text

18°58'00"N — Lat/Long Grid Line & Text

P2 — Water Sample / Current meter Locations

Survey Notes :

Survey dates	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

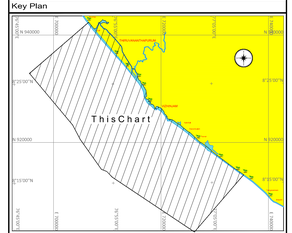
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.3142/45m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 50,000

1000 0 1000 2000 3000 4000 5000metres

Key Plan



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Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Control Chart
(Monsoon)

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam | Interpreted : U.M. Kadam | Approved : S. Philip

Dwg. No. OSaS_P18115_VISL_Control Chart_01

Match Line Dwg. No. : OSdS_P18115_VISL_BATHY_11

Match Line Dwg. No. : OSdS_P18115_VISL_BATHY_12

Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

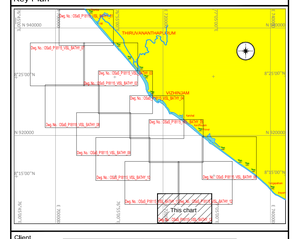
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



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Project

Oceanographic & Bathymetric Data Collection
For
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For
Vizhinjam International Seaport Limited

Drawing Title

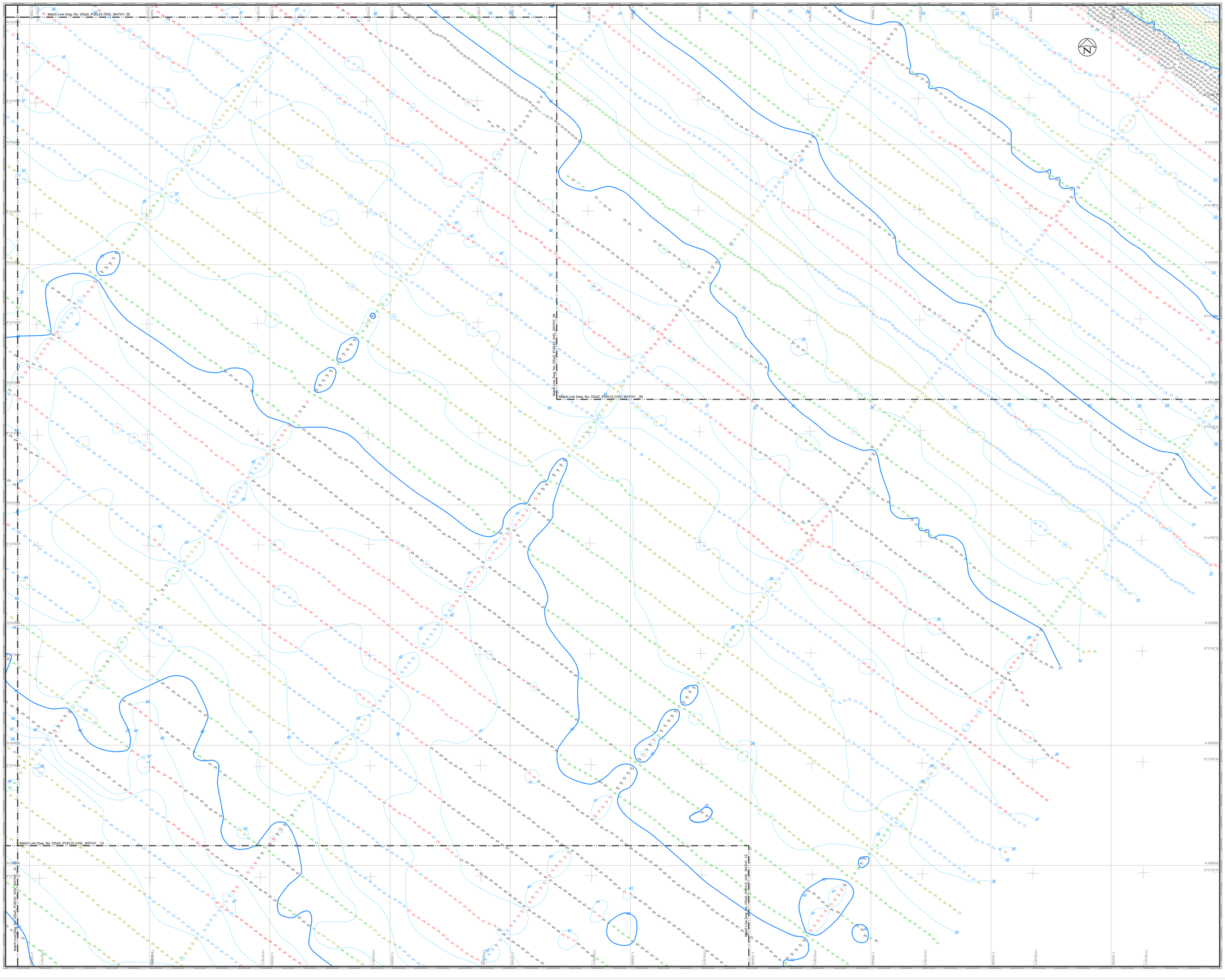
Bathymetric Chart (Monsoon)

Sheet No. 13 of 13

Rev.No.	Description	Date
1	Final	22.02.2016
0	First Issue	06.01.2016

Drawn : U.M. Kadam | Interpreted : Hebin C / S.Behera | Approved : S. Philip

Dwg. No. : OSdS_P18115_VISL_BATHY_13



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

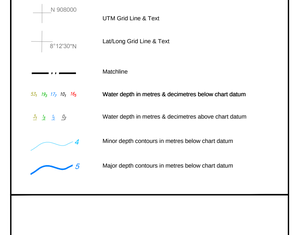
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000 metres

Key Plan



Client

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Project

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For
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Drawing Title

Bathymetric Chart (Monsoon)

Sheet No. 12 of 13

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam | Interpreted : Hebin C / S.Behera | Approved : S. Philip

Dwg. No. : OSaS_P1811S_VISL_BATHY_12

Match Line Dwg. No. OSaS_P18115_VISL_BATHY_05

Match Line Dwg. No. OSaS_P18115_VISL_BATHY_10

Match Line Dwg. No. OSaS_P18115_VISL_BATHY_13

Match Line Dwg. No. OSaS_P18115_VISL_BATHY_12

Notes :

1. Background details shown in the charts are extracted from *NHO navigation* chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

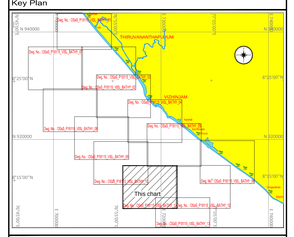
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



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Project

Oceanographic & Bathymetric Data Collection
For
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Drawing Title

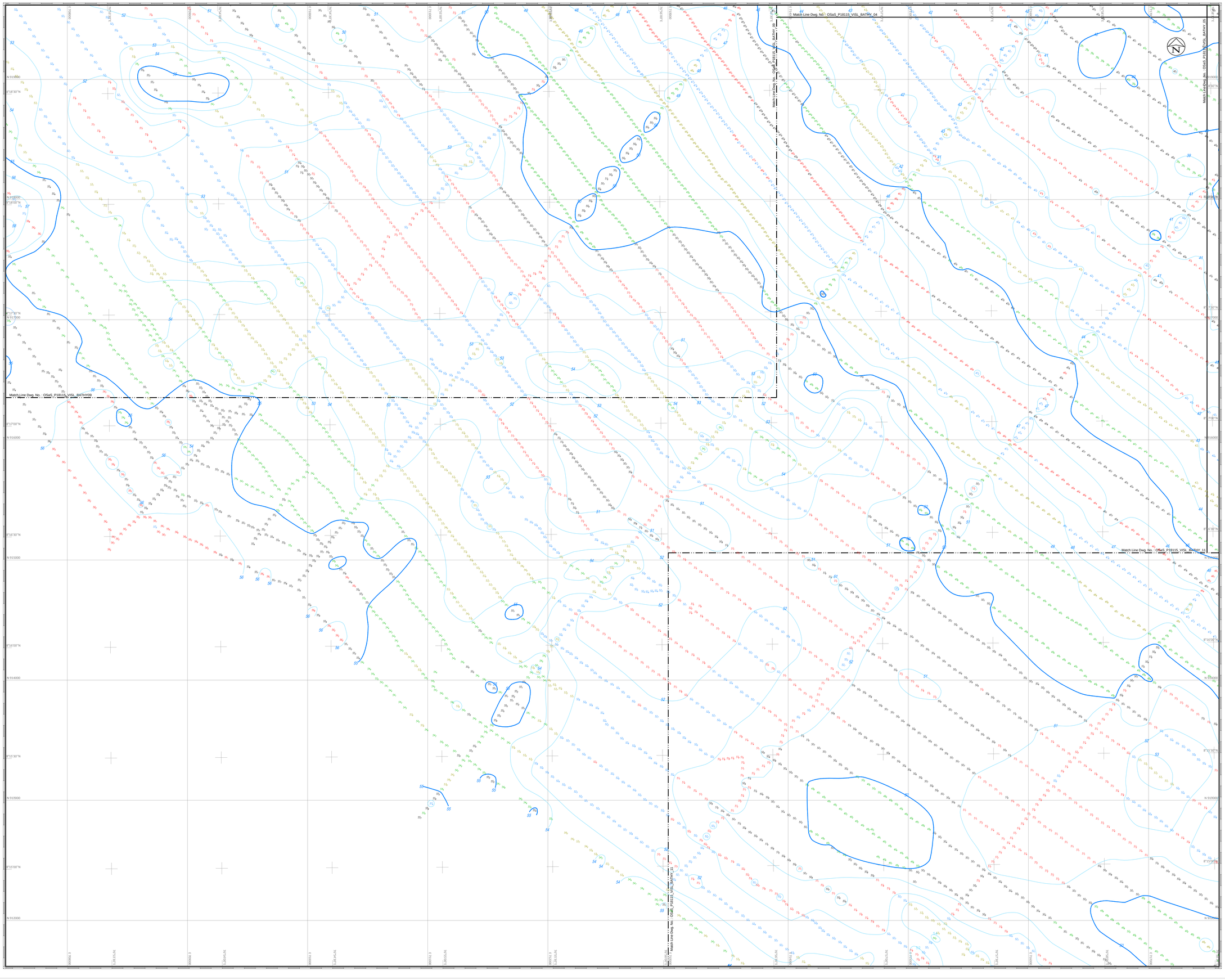
Bathymetric Chart (Monsoon)

Sheet No. 11 of 13

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam | Interpreted : Hebin C / S.Behera | Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_11



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

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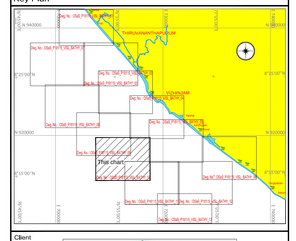
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



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Survey contractor

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CBD Belapur, Navi Mumbai - 400 614
Maharashtra, India.

Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart (Monsoon)

Sheet No. 10 of 13

Rev.No.	Description	Date
1	Final	22.02.2016
0	First Issue	06.01.2016

Drawn : U.M. Kadam | Interpreted : Hebin C / S.Behera | Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_10

Match Line Dwg. No. : OSdS_P18115_VISL_BATHY_03

Match Line Dwg. No. : OSdS_P18115_VISL_BATHY_08

Match Line Dwg. No. : OSdS_P18115_VISL_BATHY_04

Match Line Dwg. No. : OSdS_P18115_VISL_BATHY_10

Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

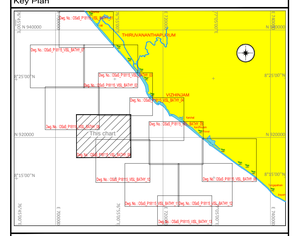
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



Client

VIZHINJAM INTERNATIONAL SEAPORT LIMITED

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Project

Oceanographic & Bathymetric Data Collection
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For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart (Monsoon)

Sheet No. 09 of 13

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	05.01.2016

Drawn : U.M. Kadam | Interpreted : Hebin C / S.Behera | Approved : S. Philip

Dwg. No. : OSdS_P18115_VISL_BATHY_09

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_07

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_09

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_10

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_03

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_08

Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- N 908000 — UTM Grid Line & Text
- 8°12'30"N — Lat/Long Grid Line & Text
- Matchline
- 55, 45, 35, 25, 15, 05 — Water depth in metres & decimetres below chart datum
- 1, 2, 3, 5 — Water depth in metres & decimetres above chart datum
- 4 — Minor depth contours in metres below chart datum
- 5 — Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

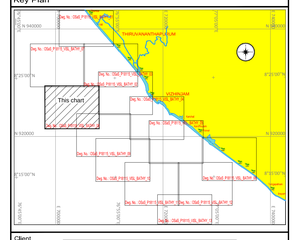
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.257223563D
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0.9996
Units	:	Metres

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



Client

Vizhinjam International Seaport Limited

1st Floor, Vipanchika Towers,
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Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart (Monsoon)

Sheet No. 08 of 13

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam | Interpreted : Hebin C / S.Behera | Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_08

Match Line Dwg. No. : OSaS_P18115_VISL_BATHY_01

Match Line Dwg. No. : OSaS_P18115_VISL_BATHY_02

Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

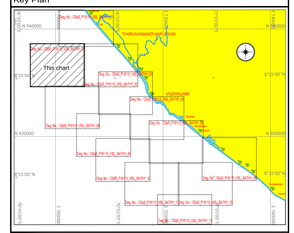
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



Client

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Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

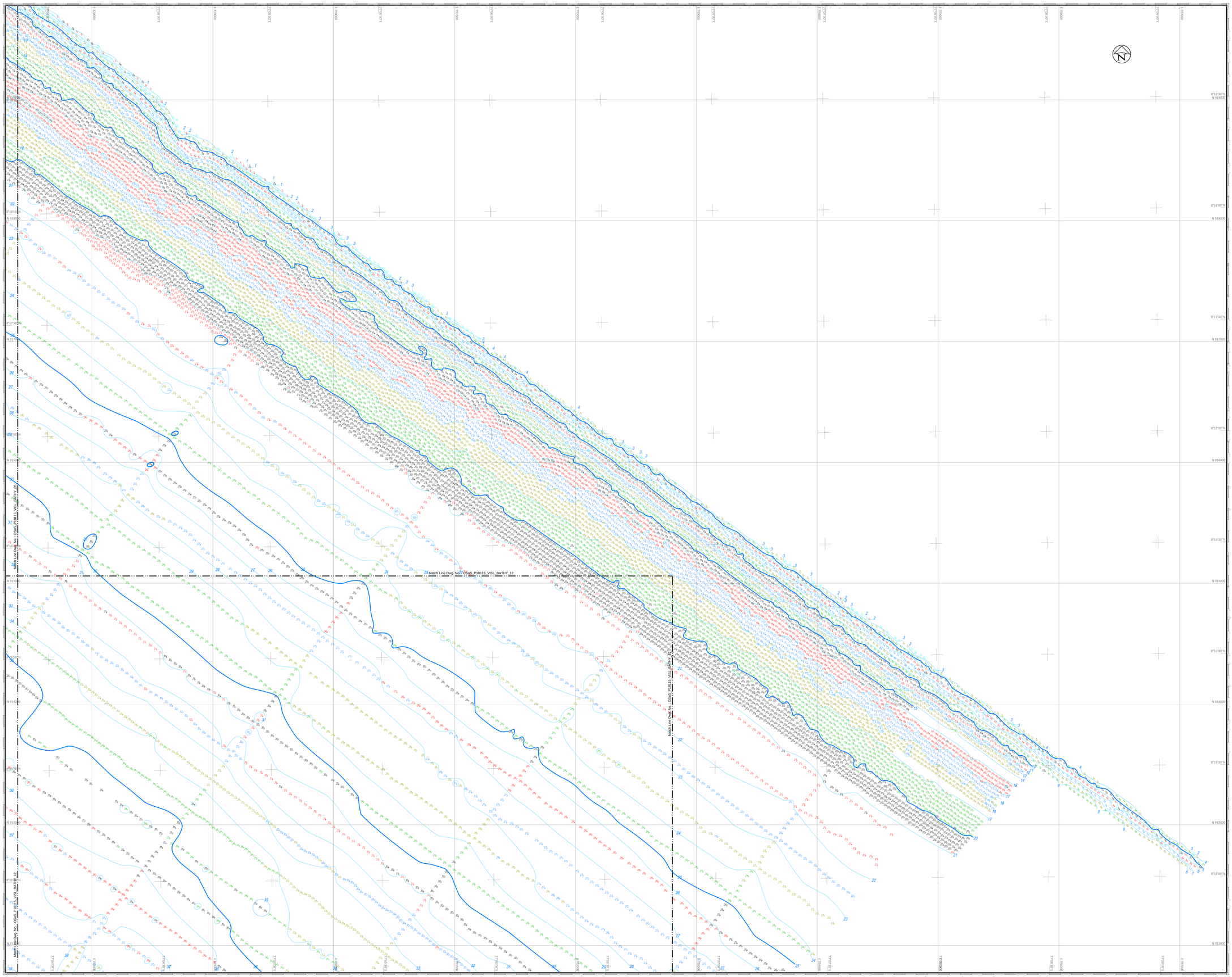
Bathymetric Chart (Monsoon)

Sheet No. 07 of 13

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam	Interpreted : Hebin C / S.Behera	Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_07



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

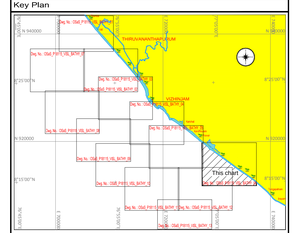
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



Client

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Project

Oceanographic & Bathymetric Data Collection
For
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Drawing Title

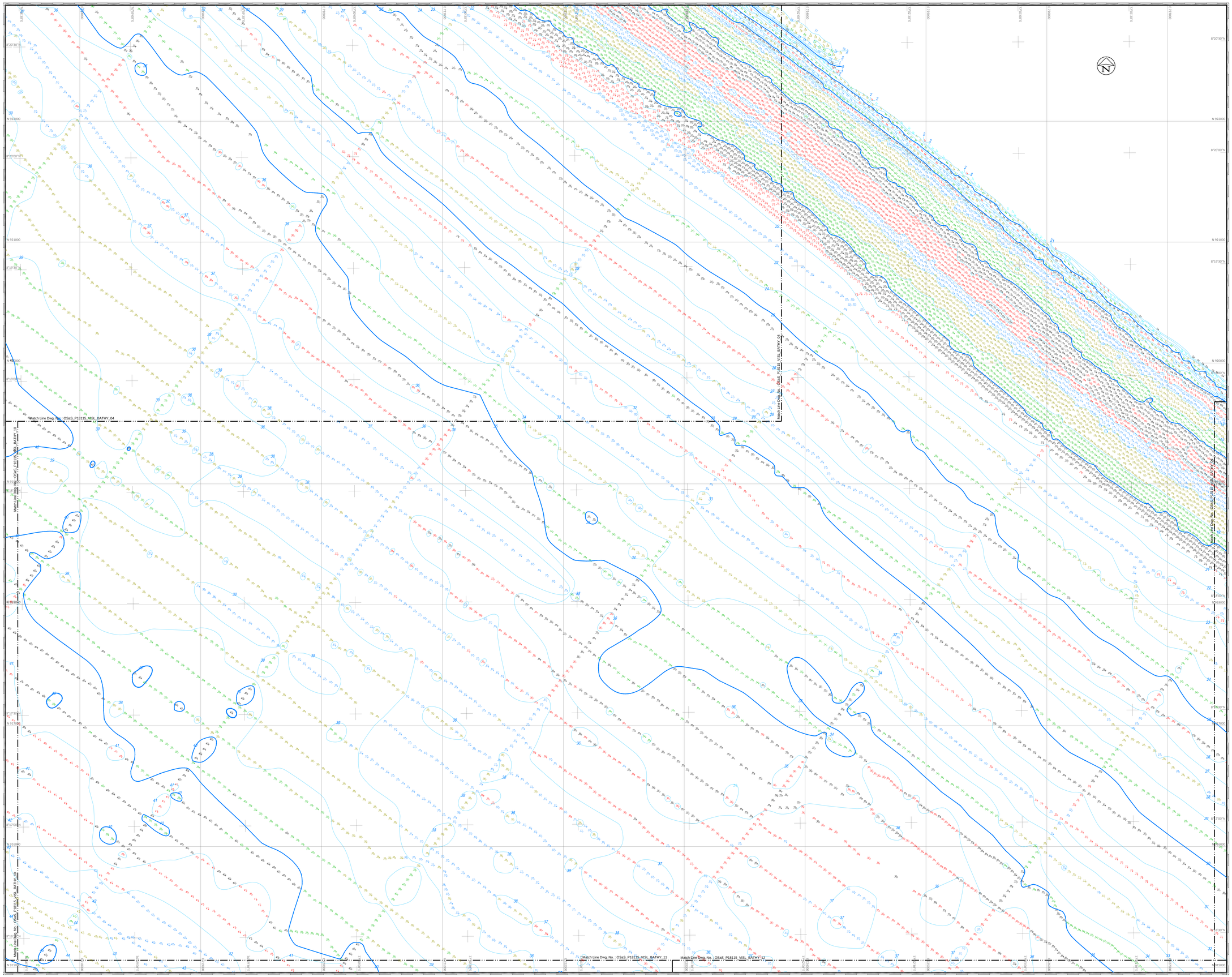
Bathymetric Chart (Monsoon)

Sheet No. 06 of 13

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam	Interpreted : Hebin C / S.Behera	Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_06



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

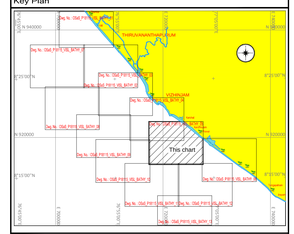
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000 metres

Key Plan



Client

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Project

Oceanographic & Bathymetric Data Collection
For
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For
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Drawing Title

Bathymetric Chart (Monsoon)

Sheet No. 05 of 13

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam	Interpreted : Hebin C / S.Behera	Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_05

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_03

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_05

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_09

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_10

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_06

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_07

Match Line Dwg No. : OSaS_P18115_VISL_BATHY_08

Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

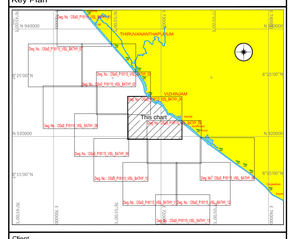
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



Client

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Project

Oceanographic & Bathymetric Data Collection
For
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Drawing Title

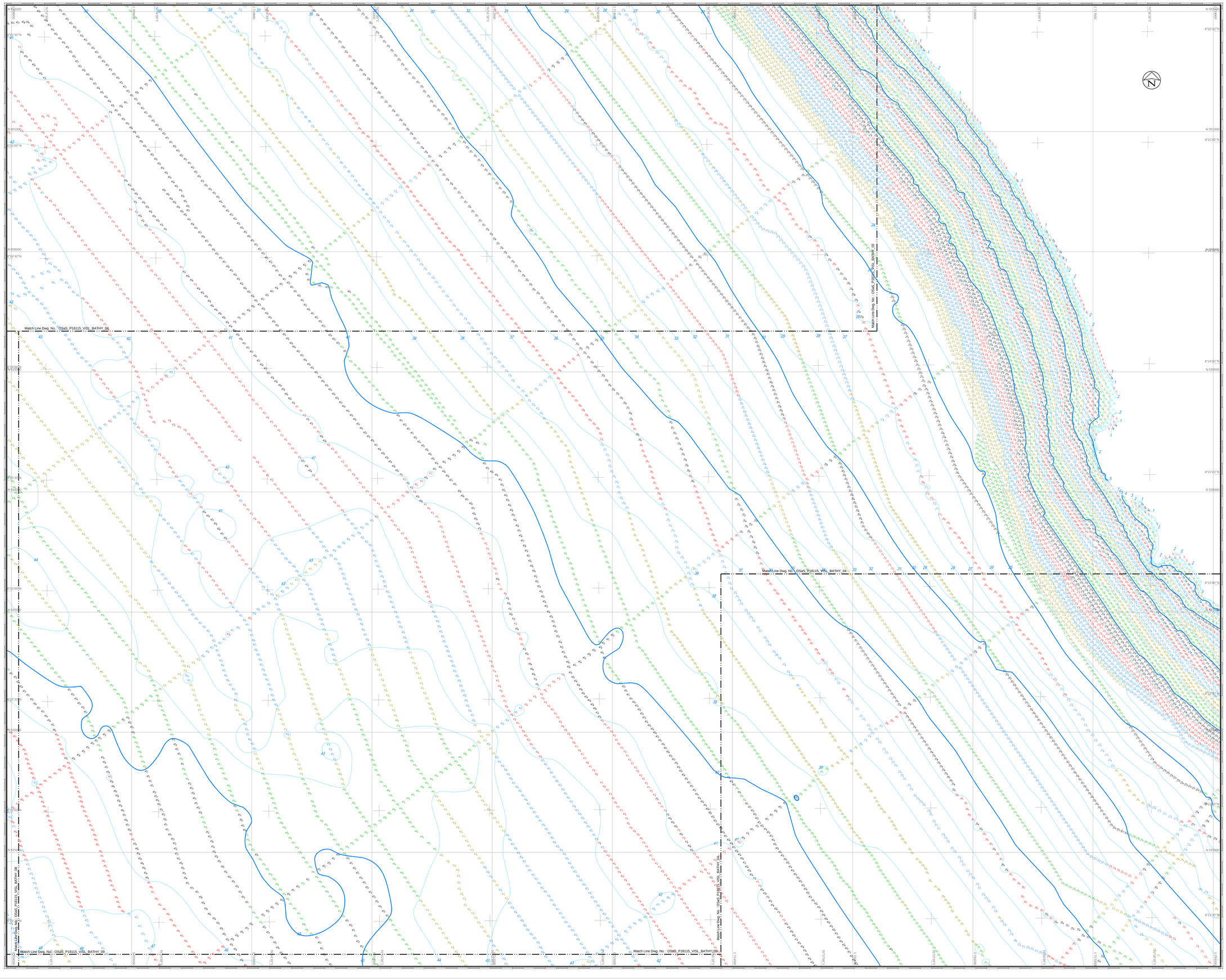
Bathymetric Chart (Monsoon)

Sheet No. 04 of 13

Rev.No.	Description	Date
1	Final	22.02.2016
0	First Issue	06.01.2016

Drawn : U.M. Kadam | Interpreted : Hebin C / S.Behera | Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_04



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- N 908000 — UTM Grid Line & Text
- 8°12'30"N — Lat/Long Grid Line & Text
- Matchline
- 15, 25, 35, 45 — Water depth in metres & decimetres below chart datum
- 1, 2, 3, 5 — Water depth in metres & decimetres above chart datum
- 4 — Minor depth contours in metres below chart datum
- 5 — Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

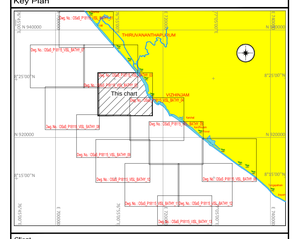
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



Client

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Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

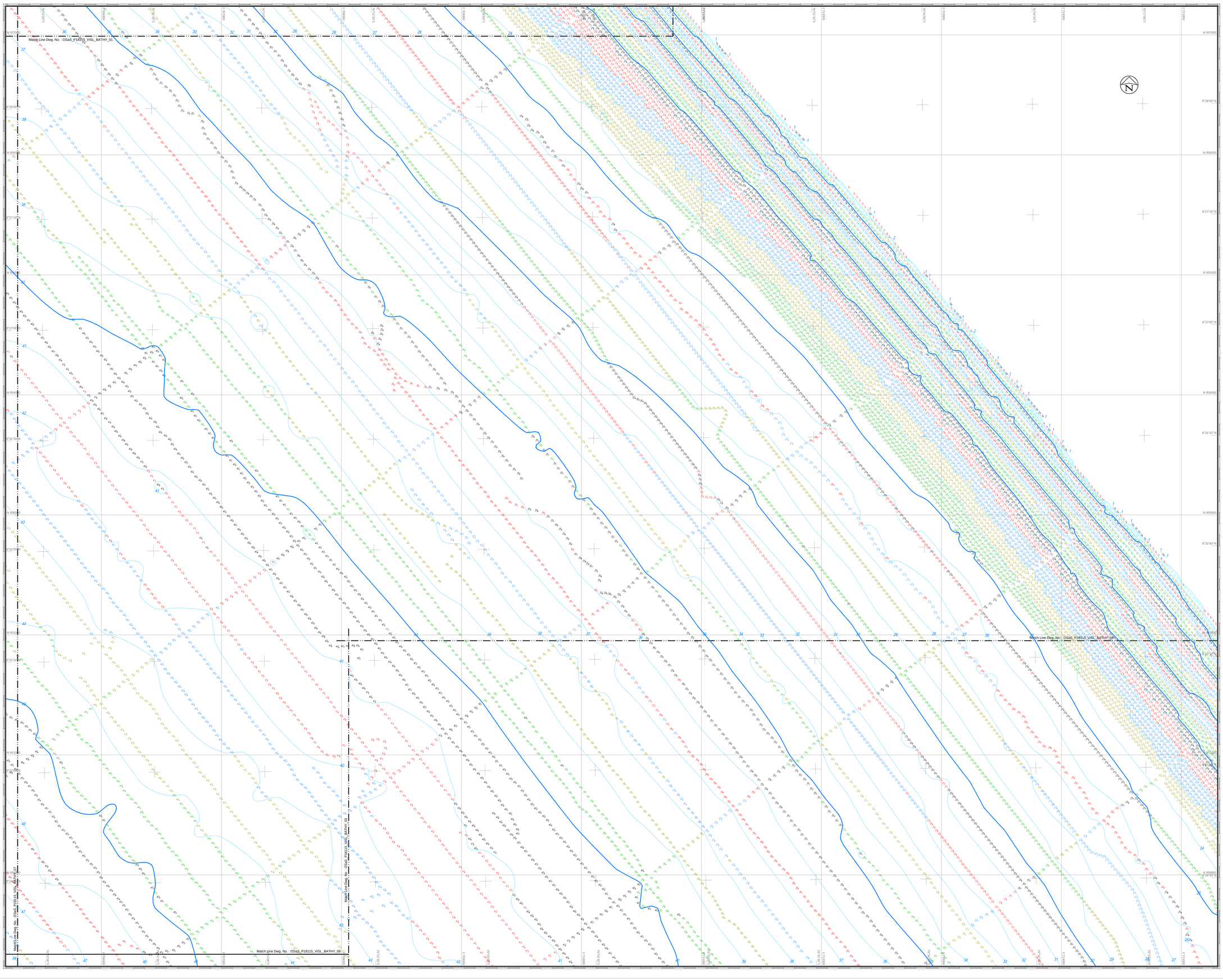
Bathymetric Chart (Monsoon)

Sheet No. 03 of 13

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam	Interpreted : Helbin C / S.Behera	Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_03



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

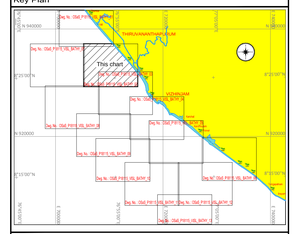
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL : 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



Client

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Maharashtra, India.

Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

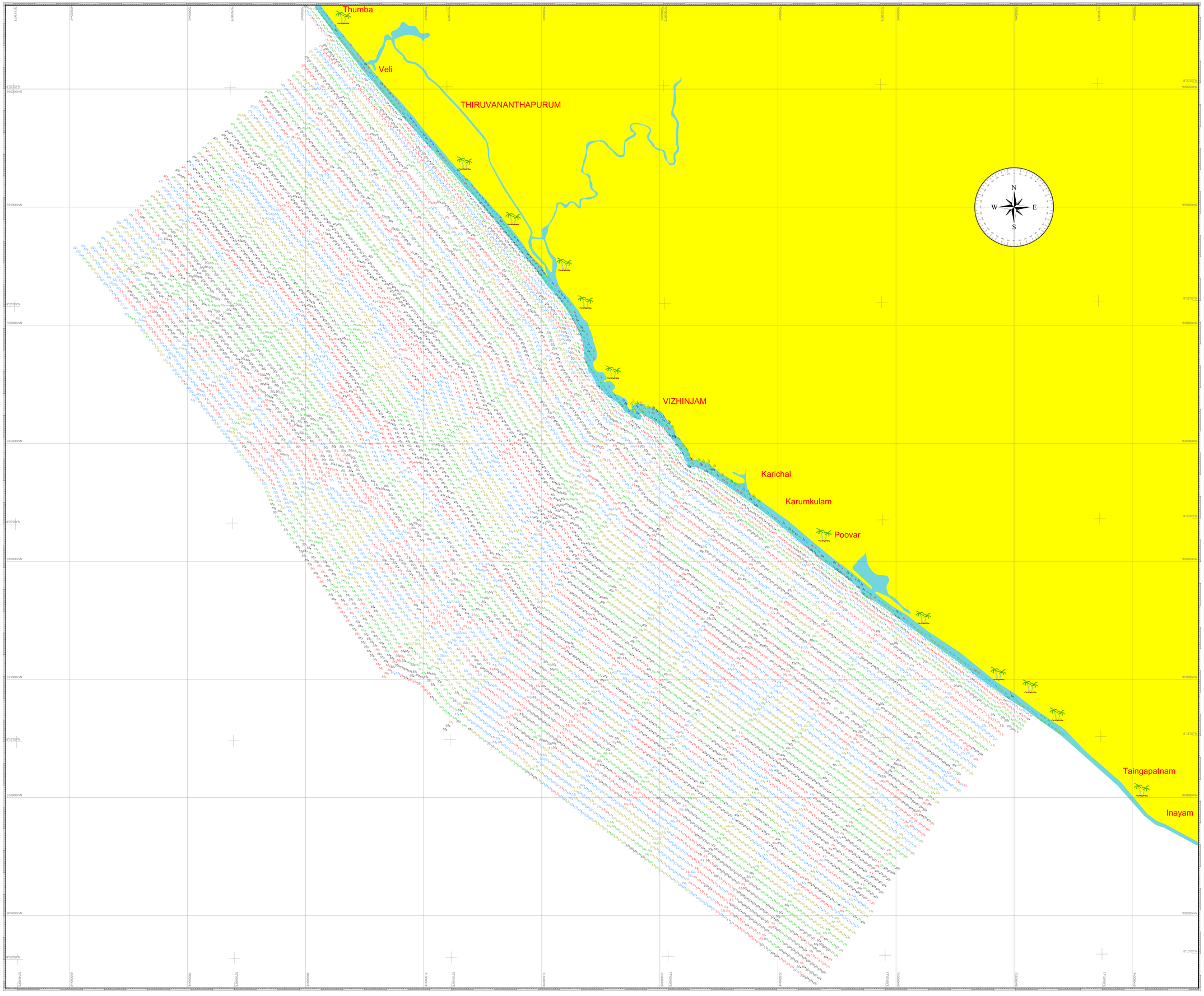
Bathymetric Chart (Monsoon)

Sheet No. 02 of 13

Rev No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam	Interpreted : Hebin C / S.Behera	Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_02



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- N 2098500 — UTM Grid Line & Text
- 18°58'00"N — Lat/Long Grid Line & Text
- M1 M2 M3 M4 M5 — Water depth in metres & decimetres below chart datum
- 1ft 2ft 3ft 4ft 5ft — Water depth in metres & decimetres above chart datum

Survey Notes :

Survey dates	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

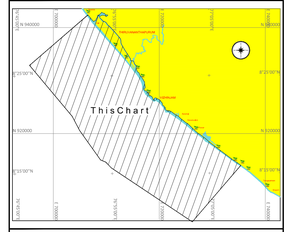
Horizontal Coordinate System	:	WGS84
Geodetic Datum (Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 50,000

1000 0 1000 2000 3000 4000 5000metres

Key Plan



Client

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Project

Oceanographic & Bathymetric Data Collection
For
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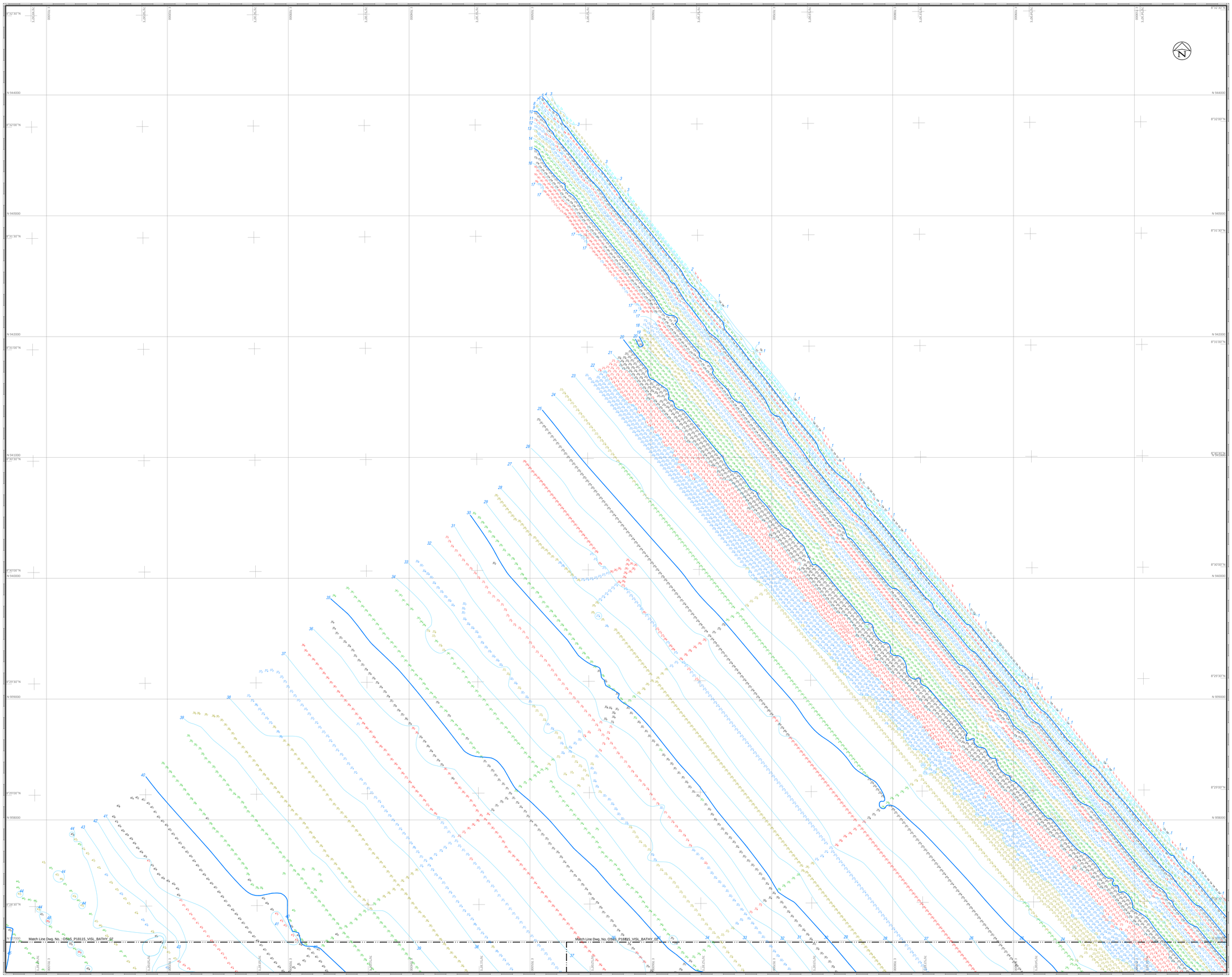
Drawing Title

BATHYMETRIC CHART
(Monsoon)

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam	Interpreted : U.M. Kadam	Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_01_50k



Notes :

1. Background details shown in the charts are extracted from NHO navigation chart No. 222
2. Observed tides at Vizhinjam Harbour are used to reduce raw soundings to chart datum.

LEGEND

- UTM Grid Line & Text
- Lat/Long Grid Line & Text
- Matchline
- Water depth in metres & decimetres below chart datum
- Water depth in metres & decimetres above chart datum
- Minor depth contours in metres below chart datum
- Major depth contours in metres below chart datum

Survey Notes :

Survey period	:	September 2015 - January 2016
Survey boats	:	Bethel and Samuel
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Odom Echotrac MK III

Geodetic parameters :

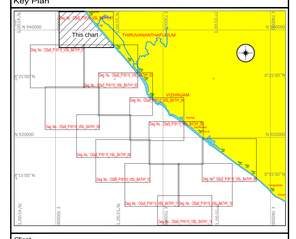
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 10,000

200 0 200 400 600 800 1000metres

Key Plan



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Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart (Monsoon)

Sheet No. 01 of 13

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	06.01.2016

Drawn : U.M. Kadam	Interpreted : Hebin C / S.Behera	Approved : S. Philip

Dwg. No. : OSaS_P18115_VISL_BATHY_01

Notes :

1. Background details shown in the chart are extracted from google earth image.
2. Tide is not applied to the raw depth.
   The depth given is the actual observed water level from surface.

LEGEND

N 908000	UTM Grid Line & Text
8°12'30"N	Lat/Long Grid Line & Text
2_1 1_3 2_7 1_1	Water level measured from surface
1_5 2_1 2_3 1_5	Height above chart datum recorded using RTK system
1 / 0	Depth contours in metres

Survey Notes :

Survey dates	:	July 2015
Survey boats	:	MV Ali
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Knudsen 320 M echo sounder

Geodetic parameters :

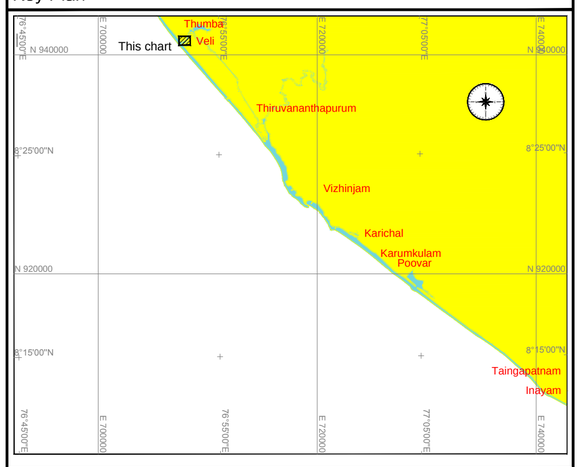
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres

Key Plan



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Maharashtra, India.

Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart
(Veli River)

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	10.11.2015

Drawn : U.M. Kadam	Interpreted : Unnikrishnan	Approved : S. Philip

Dwg No : OSas_P18115_VISL_Veli River_Bathy_01

Notes :

1. Background details shown in the chart are extracted from google earth image.
2. Tide is not applied to the raw depth.
   The depth given is the actual observed water level from surface.

LEGEND

N 908000	UTM Grid Line & Text
8°12'30"N	Lat/Long Grid Line & Text
2_1 1_3 2_7 1_1	Water level measured from surface
1_5 2_1 2_3 1_5	Height above chart datum recorded using RTK system
1 / 0	Depth contours in metres

Survey Notes :

Survey dates	:	July 2015
Survey boats	:	MV Ali
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Knudsen 320 M echo sounder

Geodetic parameters :

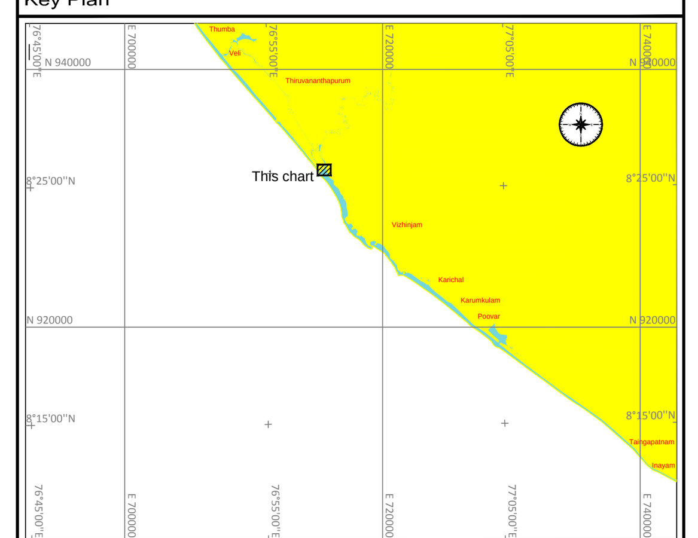
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres

Key Plan



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Maharashtra, India.

Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart (Thiruvallam River)

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	10.11.2015

Drawn : U.M. Kadam | Interpreted : Unnikrishnan | Approved : S. Philip

Dwg No : OSas_P18115_VISL_Thiruvallam River_Bathy_02

Notes :

1. Background details shown in the chart are extracted from google earth image.
2. Tide is not applied to the raw depth.
   The depth given is the actual observed water level from surface.

LEGEND

N 908000	UTM Grid Line & Text
8°12'30"N	Lat/Long Grid Line & Text
z_1 l_3 z_7 l_1	Water level measured from surface
l_5 z_1 z_3 l_5	Height above chart datum recorded using RTK system
1 / 0	Depth contours in metres

Survey Notes :

Survey dates	:	July 2015
Survey boats	:	MV Ali
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Knudsen 320 M echo sounder

Geodetic parameters :

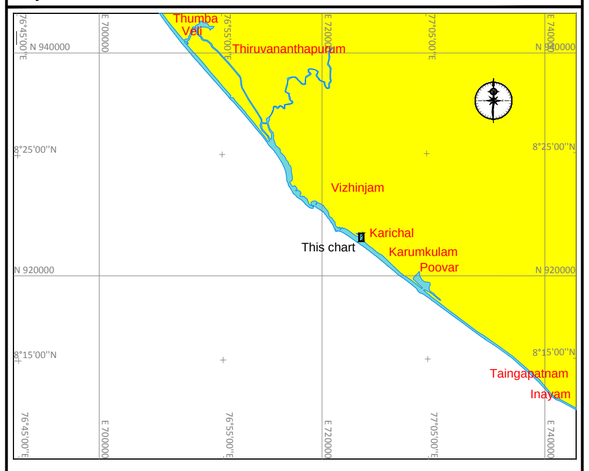
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 1,000

20 0 20 40 60 80 100metres

Key Plan



Client

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Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart
(Chovara River)

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	10.11.2015

Drawn : U.M. Kadam	Interpreted : Unnikrishnan	Approved : S. Philip

Dwg No : OSas_P18115_VISL_Chovara River_Bathy_03

Notes :

1. Background details shown in the chart are extracted from google earth image.
2. Tide is not applied to the raw depth.
   The depth given is the actual observed water level from surface.

LEGEND

- N 908000 — UTM Grid Line & Text
- 8°12'30"N — Lat/Long Grid Line & Text
- Water level measured from surface
- Height above chart datum recorded using RTK system
- Depth contours in metres

Survey Notes :

Survey dates	:	July 2015
Survey boats	:	MV Ali
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Knudsen 320 M echo sounder

Geodetic parameters :

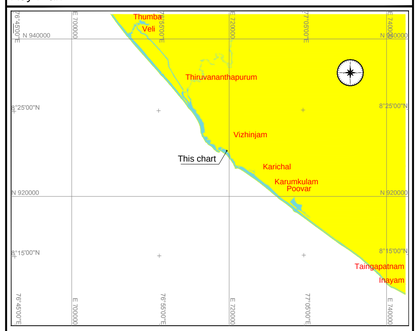
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 250

5 0 5 10 15 20 25metres

Key Plan



Client

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Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart
(Karimpallickara Stream)

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	10.11.2015

Drawn : U.M. Kadam	Interpreted : Unnikrishnan	Approved : S. Philip

Dwg No : OSas_P18115_VISL_Karimpallickara Stream_Bathy_05

Notes :

1. Background details shown in the chart are extracted from google earth image.
2. Tide is not applied to the raw depth.
   The depth given is the actual observed water level from surface.

LEGEND

- N 908000 — UTM Grid Line & Text
- 8°12'30"N — Lat/Long Grid Line & Text
- z_1 z_2 z_3 z_4 — Water level measured from surface
- $-_5$ z_1 z_2 z_3 $-_5$ — Height above chart datum recorded using RTK system
- 1 / 0 — Depth contours in metres

Survey Notes :

Survey dates	:	July 2015
Survey boats	:	MV Ali
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Knudsen 320 M echo sounder

Geodetic parameters :

Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)
Hemisphere	:	North
False Easting	:	500 000 m
False Northing	:	0 m
Scale Factor at CM	:	0,9996
Units	:	Metres

Scale

HORIZONTAL 1 : 250

5 0 5 10 15 20 25metres

Key Plan

Client

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Maharashtra, India.

Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart
(Mullur Stream)

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	10.11.2015

Drawn : U.M. Kadam	Interpreted : Unnikrishnan	Approved : S. Philip

Dwg No : OSas_P18115_VISL_Mullur Stream_Bathy_06

Notes :

1. Background details shown in the chart are extracted from google earth image.
2. Tide is not applied to the raw depth.
   The depth given is the actual observed water level from surface.

LEGEND

N 908000	UTM Grid Line & Text
8°12'30"N	Lat/Long Grid Line & Text
1_5 2_1 2_3 1_5	Height above chart datum recorded using RTK system
1 / 0	Depth contours in metres

Survey Notes :

Survey dates	:	July 2015
Surface positioning	:	Leica MX 420 series DGPS
Bathymetry acquired using	:	Knudsen 320 M echo sounder

Geodetic parameters :

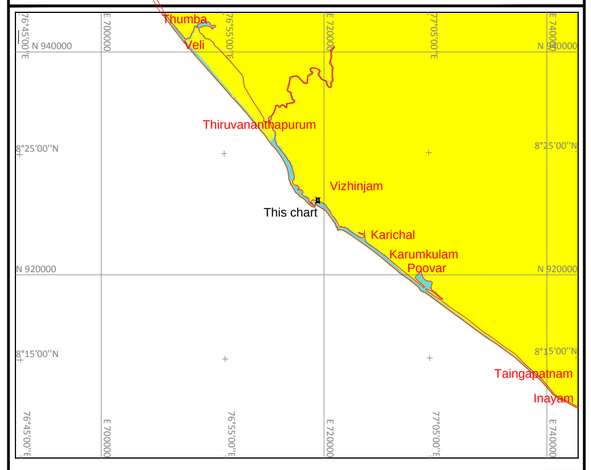
Horizontal Coordinate System	:	WGS84
Geodetic Datum / Spheroid	:	WGS84
Semi-Major Axis (a) (meters)	:	6378137.000m
Semi-Minor Axis	:	6356752.314245m
Inverse Flattening	:	298.2572235630
Projection	:	Universal Transverse Mercator
Longitude of Origin (CM)	:	75° E (Zone 43)
Latitude of Origin	:	0° N (Equator)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

Scale

HORIZONTAL 1 : 500

10 0 10 20 30 40 50metres

Key Plan



Client

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Survey contractor

OCEAN SCIENCE & SURVEYING PVT LTD
(Formerly known as EGS SURVEY PVT. LTD.)
C005/006, Platform Floor,
Tower No.8, Railway Station Complex,
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Maharashtra, India.

Project

Oceanographic & Bathymetric Data Collection
For
Assessment of Shoreline Changes
For
Vizhinjam International Seaport Limited

Drawing Title

Bathymetric Chart
(Gangayattumkara Canal)

Rev.No.	Description	Date
1	Final	22.02.2016
0	First issue	10.11.2015

Drawn : U.M. Kadam	Interpreted : Unnikrishnan	Approved : S. Philip

Dwg No : OSas_P18115_VISL_Gangayattumkara Canal_Bathy_07

Annexure X

WATER SAMPLE REPORT

Standard^{S}
Environmental Monitoring

TEST REPORT

TEST CERTIFICATE NO: SEANN/1507/R360

Date: 23.07.2015

Customer Name & Address		M/s Ocean Science & Surveying (P) Ltd Railway Station Complex, CBD Belapur, Navi Mumbai.	
Sampling Site	Proposed Vizhinjam Port	Sample Drawn by	Customer
Description of Sample	Water	Date of Analysis Started	10.07.2015
Date of Sample Received	10.07.2015	Date of Analysis Completed	20.07.2015

Location	Sample Name	Date & Time	Parameters			
			Turbidity (NTU)	Total Suspended Solids (mg/L)	Salinity (ppt)	Temperature (°C)
Dredge dumping/Kovalam	WS-DD-SUR-133	07.06.2015 07.00 Hrs	2.8	10.7	36.85	25.74
Dredge dumping/Kovalam	WS-DD-MID-134	07.06.2015 07.00 Hrs	2.7	9.8	38.70	25.72
Dredge dumping/Kovalam	WS-DD-BOT-135	07.06.2015 07.00 Hrs	3.3	13.2	36.85	25.80
Dredge dumping/Kovalam	WS-DD-SUR-136	07.06.2015 08.00 Hrs	1.9	8.1	38.42	25.85
Dredge dumping/Kovalam	WS-DD-MID-137	07.06.2015 08.00 Hrs	1.5	7.2	36.85	25.77
Dredge dumping/Kovalam	WS-DD-BOT-138	07.06.2015 09.00 Hrs	2.5	11.2	36.81	25.67
Dredge dumping/Kovalam	WS-DD-SUR-139	07.06.2015 09.00 Hrs	2.1	10.4	38.45	25.59
Dredge dumping/Kovalam	WS-DD-MID-140	07.06.2015 09.00 Hrs	1.2	6.8	36.98	25.57
Dredge dumping/Kovalam	WS-DD-BOT-141	07.06.2015 09.00 Hrs	1.9	8.3	38.48	25.62
Dredge dumping/Kovalam	WS-DD-SUR-142	07.06.2015 10.00 Hrs	1.0	5.2	38.64	25.60
Dredge dumping/Kovalam	WS-DD-MID-143	07.06.2015 10.00 Hrs	2.2	8.8	38.27	25.48
Dredge dumping/Kovalam	WS-DD-BOT-144	07.06.2015 10.00 Hrs	1.5	7.0	36.85	25.42
Dredge dumping/Kovalam	WS-DD-SUR-145	07.06.2015 11.00 Hrs	1.3	6.8	38.45	25.33
Dredge dumping/Kovalam	WS-DD-MID-146	07.06.2015 11.00 Hrs	2.2	7.8	37.02	25.25
Dredge dumping/Kovalam	WS-DD-BOT-147	07.06.2015 11.00 Hrs	1.8	7.4	36.70	25.20

For and on behalf of
Standard^{S} Environmental & Analytical Laboratories

Authorized Signatory

End of Report

Standard^{S} Environmental & Analytical Laboratories
'B' Grade Laboratory - Approved by Kerala State Pollution Control Board
K. J. Tower (above SBI Eloor Branch), Kuttikattukara P.O., Udyogamandal, Ernakulam - 683 501
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Standard^{S}
Environmental Monitoring

TEST REPORT

TEST CERTIFICATE NO: SEANN/1507/R361

Date: 23.07.2015

Customer Name & Address		M/s Ocean Science & Surveying (P) Ltd Railway Station Complex, CBD Belapur, Navi Mumbai.	
Sampling Site	Proposed Vizhinjam Port	Sample Drawn by	Customer
Description of Sample	Water	Date of Analysis Started	10.07.2015
Date of Sample Received	10.07.2015	Date of Analysis Completed	20.07.2015

Location	Sample Name	Date & Time	Parameters			
			Turbidity (NTU)	Total Suspended Solids (mg/L)	Salinity (ppt)	Temperature (^{0}C)
Dredge dumping/Kovalam	WS-DD-SUR-148	07.06.2015 12.00 Hrs	1.8	7.2	38.17	25.20
Dredge dumping/Kovalam	WS-DD-MID-149	07.06.2015 12.00 Hrs	1.6	7.7	38.42	25.14
Dredge dumping/Kovalam	WS-DD-BOT-150	07.06.2015 12.00 Hrs	1.6	7.2	38.42	25.08
Dredge dumping/Kovalam	WS-DD-SUR-151	07.06.2015 13.00 Hrs	1.5	6.9	37.02	25.08
Dredge dumping/Kovalam	WS-DD-MID-152	07.06.2015 13.00 Hrs	1.0	5.2	38.60	25.02
Dredge dumping/Kovalam	WS-DD-BOT-153	07.06.2015 13.00 Hrs	3.6	13.9	38.30	25.01
Dredge dumping/Kovalam	WS-DD-SUR-154	07.06.2015 14.00 Hrs	1.3	5.9	38.30	24.99
Dredge dumping/Kovalam	WS-DD-MID-155	07.06.2015 14.00 Hrs	0.9	4.8	38.45	24.97
Dredge dumping/Kovalam	WS-DD-BOT-156	07.06.2015 14.00 Hrs	1.5	6.2	38.30	24.95
Dredge dumping/Kovalam	WS-DD-SUR-157	07.06.2015 15.00 Hrs	0.4	4.2	38.42	24.92
Dredge dumping/Kovalam	WS-DD-MID-158	07.06.2015 15.00 Hrs	0.4	4.9	38.48	24.93
Dredge dumping/Kovalam	WS-DD-BOT-159	07.06.2015 15.00 Hrs	0.9	5.1	38.45	25
Dredge dumping/Kovalam	WS-DD-SUR-160	07.06.2015 16.00 Hrs	0.9	4.1	37.03	24.98
Dredge dumping/Kovalam	WS-DD-MID-161	07.06.2015 16.00 Hrs	0.3	3.8	36.92	24.95
Dredge dumping/Kovalam	WS-DD-BOT-162	07.06.2015 16.00 Hrs	1.3	6.1	38.62	24.98

For and on behalf of
Standard^{S} Environmental & Analytical Laboratories

Authorized Signatory

End of Report

Standard^{S} Environmental & Analytical Laboratories
'B' Grade Laboratory - Approved by Kerala State Pollution Control Board
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Standard[S] Environmental Monitoring

TEST REPORT

TEST CERTIFICATE NO: SEANN/1507/R362 Date: 23.07.2015

Customer Name & Address		M/s Ocean Science & Surveying (P) Ltd Railway Station Complex, CBD Belapur, Navi Mumbai.	
Sampling Site	Proposed Vizhinjam Port	Sample Drawn by	Customer
Description of Sample	Water	Date of Analysis Started	10.07.2015
Date of Sample Received	10.07.2015	Date of Analysis Completed	20.07.2015

Location	Sample Name	Date & Time	Parameters			
			Turbidity (NTU)	Total Suspended Solids (mg/L)	Salinity (ppt)	Temperature (°C)
Dredge dumping/Kovalam	WS-DD-SUR-163	07.06.2015 17.00 Hrs	0.2	4.2	38.62	25
Dredge dumping/Kovalam	WS-DD-MID-164	07.06.2015 17.00 Hrs	0.8	5.1	38.70	24.97
Dredge dumping/Kovalam	WS-DD-BOT-165	07.06.2015 17.00 Hrs	1.4	6.7	38.70	25.02
Vizhinjam Harbour	WS-VH-SUR-166	07.06.2015 7.00 Hrs	1.3	6.1	38.45	24.66
Vizhinjam Harbour	WS-VH-MID-167	07.06.2015 7.00 Hrs	0.3	4.1	38.62	24.68
Vizhinjam Harbour	WS-VH-BOT-168	07.06.2015 7.00 Hrs	BDL	2.8	36.84	24.71
Vizhinjam Harbour	WS-VH-SUR-169	07.06.2015 8.00 Hrs	0.7	3.3	38.63	24.74
Vizhinjam Harbour	WS-VH-MID-170	07.06.2015 8.00 Hrs	0.4	2.4	38.48	24.83
Vizhinjam Harbour	WS-VH-BOT-171	07.06.2015 8.00 Hrs	0.5	2.8	38.63	24.92
Vizhinjam Harbour	WS-VH-SUR-172	07.06.2015 9.00 Hrs	1.5	4.1	38.64	25.04
Vizhinjam Harbour	WS-VH-MID-173	07.06.2015 9.00 Hrs	1.3	3.8	36.84	25.13
Vizhinjam Harbour	WS-VH-BOT-174	07.06.2015 9.00 Hrs	0.1	2.4	36.92	25.12
Vizhinjam Harbour	WS-VH-SUR-175	07.06.2015 10.00 Hrs	1.1	4.2	38.48	25.14
Vizhinjam Harbour	WS-VH-MID-176	07.06.2015 10.00 Hrs	1.1	4.0	38.70	25.06
Vizhinjam Harbour	WS-VH-BOT-177	07.06.2015 10.00 Hrs	0.1	2.9	38.45	24.98

For and on behalf of
Standard[S] Environmental & Analytical Laboratories

Authorized Signatory

End of Report

Standard[S] Environmental & Analytical Laboratories
'B' Grade Laboratory - Approved by Kerala State Pollution Control Board
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Standard^{S} Environmental Monitoring

TEST REPORT

TEST CERTIFICATE NO: SEANN/1507/R363

Date: 23.07.2015

Customer Name & Address		M/s Ocean Science & Surveying (P) Ltd Railway Station Complex, CBD Belapur, Navi Mumbai.	
Sampling Site	Proposed Vizhinjam Port	Sample Drawn by	Customer
Description of Sample	Water	Date of Analysis Started	10.07.2015
Date of Sample Received	10.07.2015	Date of Analysis Completed	20.07.2015

Location	Sample Name	Date & Time	Parameters			
			Turbidity (NTU)	Total Suspended Solids (mg/L)	Salinity (ppt)	Temperature (^{O}C)
Vizhinjam Harbour	WS-DD-SUR-178	07.06.2015 11.00 Hrs	1.5	5.2	38.64	24.93
Vizhinjam Harbour	WS-DD-MID-179	07.06.2015 11.00 Hrs	1.7	5.8	38.48	24.92
Vizhinjam Harbour	WS-DD-BOT-180	07.06.2015 11.00 Hrs	BDL	2.7	36.84	24.92
Vizhinjam Harbour	WS-VH-SUR-181	07.06.2015 12.00 Hrs	1	3.9	38.62	24.76
Vizhinjam Harbour	WS-VH-MID-182	07.06.2015 12.00 Hrs	0.3	2.8	38.70	24.76
Vizhinjam Harbour	WS-VH-BOT-183	07.06.2015 12.00 Hrs	0.5	3.1	37.03	24.75
Vizhinjam Harbour	WS-VH-SUR-184	07.06.2015 13.00 Hrs	1.4	4.2	36.85	24.73
Vizhinjam Harbour	WS-VH-MID-185	07.06.2015 13.00 Hrs	1.1	4.1	36.79	24.71
Vizhinjam Harbour	WS-VH-BOT-186	07.06.2015 13.00 Hrs	0.7	4.0	37.55	24.71
Vizhinjam Harbour	WS-VH-SUR-187	07.06.2015 14.00 Hrs	1.2	4.1	37.56	24.65
Vizhinjam Harbour	WS-VH-MID-188	07.06.2015 14.00 Hrs	0.8	4.9	37.21	24.57
Vizhinjam Harbour	WS-VH-BOT-189	07.06.2015 14.00 Hrs	0.5	4.2	37.61	24.49
Vizhinjam Harbour	WS-VH-SUR-190	07.06.2015 15.00 Hrs	0.9	5.2	37.23	24.54
Vizhinjam Harbour	WS-VH-MID-191	07.06.2015 15.00 Hrs	0.7	4.8	37.46	24.67
Vizhinjam Harbour	WS-VH-BOT-192	07.06.2015 15.00 Hrs	0.6	4.2	36.85	24.8

For and on behalf of
Standard^{S} Environmental & Analytical Laboratories

Authorized Signatory

End of Report

Standard^{S} Environmental & Analytical Laboratories
'B' Grade Laboratory - Approved by Kerala State Pollution Control Board
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Tel: 0484-2546660, 93 87 27 24 02, E-mail: seaalab@gmail.com

Standard^{S}
Environmental Monitoring

TEST REPORT

TEST CERTIFICATE NO: SEANN/1507/R364 Date: 23.07.2015

Customer Name & Address		M/s Ocean Science & Surveying (P) Ltd Railway Station Complex, CBD Belapur, Navi Mumbai.	
Sampling Site	Proposed Vizhinjam Port	Sample Drawn by	Customer
Description of Sample	Water	Date of Analysis Started	10.07.2015
Date of Sample Received	10.07.2015	Date of Analysis Completed	20.07.2015

Location	Sample Name	Date & Time	Parameters			
			Turbidity (NTU)	Total Suspended Solids (mg/L)	Salinity (‰)	Temperature (^{O}C)
Vizhinjam Harbour	WS-DD-SUR-193	07.06.2015 16.00 Hrs	1.1	4.8	36.88	25.01
Vizhinjam Harbour	WS-DD-MID-194	07.06.2015 16.00 Hrs	0.9	4.7	36.79	25.23
Vizhinjam Harbour	WS-DD-BOT-195	07.06.2015 16.00 Hrs	0.6	3.9	37.46	25.21
Vizhinjam Harbour	WS-VH-SUR-196	07.06.2015 17.00 Hrs	1.1	4.9	37.04	25.23
Vizhinjam Harbour	WS-VH-MID-197	07.06.2015 17.00 Hrs	0.5	4.6	37.21	25.4
Vizhinjam Harbour	WS-VH-BOT-198	07.06.2015 17.00 Hrs	0.4	3.9	37.46	25.54
Pachallor	WS-PA-SUR-199	07.07.2015 7.00 Hrs	1.3	6.3	37.25	25.06
Pachallor	WS-PA-MID-200	07.07.2015 7.00 Hrs	0.7	4.9	37.69	25.09
Pachallor	WS-PA-BOT-201	07.07.2015 7.00 Hrs	0.5	5.1	36.88	25.12
Pachallor	WS-PA-SUR-202	07.07.2015 8.00 Hrs	0.4	4.8	37.02	25.17
Pachallor	WS-PA-MID-203	07.07.2015 8.00 Hrs	0.1	BDL	37.10	25.21
Pachallor	WS-PA-BOT-204	07.07.2015 8.00 Hrs	1.3	7.0	36.83	25.34
Pachallor	WS-PA-SUR-205	07.07.2015 9.00 Hrs	1.9	6.8	36.57	25.54
Pachallor	WS-PA-MID-206	07.07.2015 9.00 Hrs	0.5	4.8	37.29	25.52
Pachallor	WS-PA-BOT-207	07.07.2015 9.00 Hrs	0.3	3.9	37.10	26.17

For and on behalf of
Standard^{S} Environmental & Analytical Laboratories

Authorized Signatory

End of Report

Standard^{S} Environmental & Analytical Laboratories
'B' Grade Laboratory - Approved by Kerala State Pollution Control Board
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Standard[S] Environmental Monitoring

TEST REPORT

TEST CERTIFICATE NO: SEANN/1507/R365 Date: 23.07.2015

Customer Name & Address		M/s Ocean Science & Surveying (P) Ltd Railway Station Complex, CBD Belapur, Navi Mumbai.	
Sampling Site	Proposed Vizhinjam Port	Sample Drawn by	Customer
Description of Sample	Water	Date of Analysis Started	10.07.2015
Date of Sample Received	10.07.2015	Date of Analysis Completed	20.07.2015

Location	Sample Name	Date & Time	Parameters			
			Turbidity (NTU)	Total Suspended Solids (mg/L)	Salinity (ppt)	Temperature (^{0}C)
Vizhinjam Harbour	WS-DD-SUR-208	07.06.2015 16.00 Hrs	1.1	4.8	36.90	26.06
Vizhinjam Harbour	WS-DD-MID-209	07.06.2015 16.00 Hrs	0.9	4.7	37.47	25.99
Vizhinjam Harbour	WS-DD-BOT-210	07.06.2015 16.00 Hrs	0.6	3.9	37.29	25.76
Vizhinjam Harbour	WS-VH-SUR-211	07.06.2015 17.00 Hrs	1.1	4.9	37.47	25.47
Vizhinjam Harbour	WS-VH-MID-212	07.06.2015 17.00 Hrs	0.5	4.6	36.96	25.2
Vizhinjam Harbour	WS-VH-BOT-213	07.06.2015 17.00 Hrs	0.4	3.9	36.96	25.15
Pachallor	WS-PA-SUR-214	07.07.2015 12.00 Hrs	1.3	6.3	37.24	25.01
Pachallor	WS-PA-MID-215	07.07.2015 12.00 Hrs	0.7	4.9	36.55	24.91
Pachallor	WS-PA-BOT-216	07.07.2015 12.00 Hrs	0.5	5.1	37.21	24.9
Pachallor	WS-PA-SUR-217	07.07.2015 13.00 Hrs	0.4	4.8	37.12	24.9
Pachallor	WS-PA-MID-218	07.07.2015 13.00 Hrs	0.1	BDL	36.92	24.9
Pachallor	WS-PA-BOT-219	07.07.2015 13.00 Hrs	1.3	7.0	36.92	24.78
Pachallor	WS-PA-SUR-220	07.07.2015 14.00 Hrs	1.9	6.8	36.75	24.75
Pachallor	WS-PA-MID-221	07.07.2015 14.00 Hrs	0.5	4.8	37.56	24.78
Pachallor	WS-PA-BOT-222	07.07.2015 14.00 Hrs	0.3	3.9	36.96	24.76

For and on behalf of
Standard[S] Environmental & Analytical Laboratories

Authorized Signatory

End of Report

Standard[S] Environmental & Analytical Laboratories
'B' Grade Laboratory - Approved by Kerala State Pollution Control Board
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Standard^{S} Environmental Monitoring

TEST REPORT

TEST CERTIFICATE NO: SEANN/1507/R366 Date: 23.07.2015

Customer Name & Address		M/s Ocean Science & Surveying (P) Ltd Railway Station Complex, CBD Belapur, Navi Mumbai.	
Sampling Site	Proposed Vizhinjam Port	Sample Drawn by	Customer
Description of Sample	Water	Date of Analysis Started	10.07.2015
Date of Sample Received	10.07.2015	Date of Analysis Completed	20.07.2015

Location	Sample Name	Date & Time	Parameters			
			Turbidity (NTU)	Total Suspended Solids (mg/L)	Salinity (ppt)	Temperature (^{o}C)
Pachallor	WS-DD-SUR-223	07.07.2015 15.00 Hrs	0.2	4.1	36.96	24.74
Pachallor	WS-DD-MID-224	07.07.2015 15.00 Hrs	0.3	BDL	36.92	24.8
Pachallor	WS-DD-BOT-225	07.07.2015 15.00 Hrs	BDL	2.9	37.58	24.81
Pachallor	WS-VH-SUR-226	07.07.2015 16.00 Hrs	0.9	4.2	37.24	24.84
Pachallor	WS-VH-MID-227	07.07.2015 16.00 Hrs	BDL	BDL	37.24	24.95
Pachallor	WS-VH-BOT-228	07.07.2015 16.00 Hrs	0.7	3.8	36.92	25.22
Pachallor	WS-PA-SUR-229	07.07.2015 17.00 Hrs	0.3	6.1	36.90	25.17
Pachallor	WS-PA-MID-230	07.07.2015 17.00 Hrs	BDL	BDL	37.24	25.21
Pachallor	WS-PA-BOT-231	07.07.2015 17.00 Hrs	BDL	BDL	36.75	25.04
Poovar	WS-PO-SUR-232	07.07.2015 7.00 Hrs	0.3	5.8	36.33	24.27
Poovar	WS-PO-MID-233	07.07.2015 7.00 Hrs	4.5	6.2	36.49	24.27
Poovar	WS-PO-BOT-234	07.07.2015 7.00 Hrs	1.5	3.8	36.75	24.29
Poovar	WS-PO-SUR-235	07.07.2015 8.00 Hrs	2.2	4.9	37.47	24.3
Poovar	WS-PO-MID-236	07.07.2015 8.00 Hrs	1.7	5.2	36.92	24.33
Poovar	WS-PO-BOT-237	07.07.2015 8.00 Hrs	4.7	6.8	37.56	24.31

For and on behalf of
Standard^{S} Environmental & Analytical Laboratories

Authorized Signatory

End of Report

Standard^{S} Environmental & Analytical Laboratories
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Standard^{S} Environmental Monitoring

TEST REPORT

TEST CERTIFICATE NO: SEANN/1507/R367 Date: 23.07.2015

Customer Name & Address		M/s Ocean Science & Surveying (P) Ltd Railway Station Complex, CBD Belapur, Navi Mumbai.	
Sampling Site	Proposed Vizhinjam Port	Sample Drawn by	Customer
Description of Sample	Water	Date of Analysis Started	10.07.2015
Date of Sample Received	10.07.2015	Date of Analysis Completed	20.07.2015

Location	Sample Name	Date & Time	Parameters			
			Turbidity (NTU)	Total Suspended Solids (mg/L)	Salinity (ppt)	Temperature (^{0}C)
Pachallor	WS-DD-SUR-238	07.07.2015 9.00 Hrs	0.6	6.1	37.10	24.3
Pachallor	WS-DD-MID-239	07.07.2015 9.00 Hrs	1	7.1	36.57	24.41
Pachallor	WS-DD-BOT-240	07.07.2015 9.00 Hrs	8.3	10.9	37.10	24.47
Pachallor	WS-VH-SUR-241	07.07.2015 10.00 Hrs	3	8.6	36.75	24.52
Pachallor	WS-VH-MID-242	07.07.2015 10.00 Hrs	0.9	4.3	36.96	24.55
Pachallor	WS-VH-BOT-243	07.07.2015 10.00 Hrs	5.4	9.8	37.24	24.51
Pachallor	WS-PA-SUR-244	07.07.2015 10.00 Hrs	2.5	18.4	36.49	24.52
Pachallor	WS-PA-MID-245	07.07.2015 11.00 Hrs	10.7	19.8	36.75	24.43
Pachallor	WS-PA-BOT-246	07.07.2015 11.00 Hrs	7.8	8.3	36.75	24.38
Poovar	WS-PO-SUR-247	07.07.2015 11.00 Hrs	2.8	10.1	36.49	24.28
Poovar	WS-PO-MID-248	07.07.2015 12.00 Hrs	4.3	20.2	37.02	24.25
Poovar	WS-PO-BOT-249	07.07.2015 12.00 Hrs	8	6.9	37.29	24.21
Poovar	WS-PO-SUR-250	07.07.2015 13.00 Hrs	2.8	5.3	36.75	24.2
Poovar	WS-PO-MID-251	07.07.2015 13.00 Hrs	1.1	3.6	36.96	24.2
Poovar	WS-PO-BOT-252	07.07.2015 13.00 Hrs	0.2	4.1	36.83	24.18

For and on behalf of
Standard^{s} Environmental & Analytical Laboratories

Authorized Signatory

End of Report

Standard^{S} Environmental & Analytical Laboratories
'B' Grade Laboratory - Approved by Kerala State Pollution Control Board
K.J. Tower (above SBI Eloor Branch), Kuttikattukara P.O., Udyogamandal, Ernakulam - 683 501
Tel: 0484-2546660, 93 87 27 24 02, E-mail: seaalab@gmail.com

Standard^{S} Environmental Monitoring

TEST REPORT

TEST CERTIFICATE NO: SEANN/1507/R367

Date: 23.07.2015

Customer Name & Address		M/s Ocean Science & Surveying (P) Ltd Railway Station Complex, CBD Belapur, Navi Mumbai.	
Sampling Site	Proposed Vizhinjam Port	Sample Drawn by	Customer
Description of Sample	Water	Date of Analysis Started	10.07.2015
Date of Sample Received	10.07.2015	Date of Analysis Completed	20.07.2015

Location	Sample Name	Date & Time	Parameters			
			Turbidity (NTU)	Total Suspended Solids (mg/L)	Salinity (ppt)	Temperature (^{0}C)
Pachallor	WS-DD-SUR-253	07.07.2015 14.00 Hrs	0.8	4.1	36.83	24.15
Pachallor	WS-DD-MID-254	07.07.2015 14.00 Hrs	0.7	4.0	37.24	24.18
Pachallor	WS-DD-BOT-255	07.07.2015 14.00 Hrs	0.7	4.0	36.96	24.15
Pachallor	WS-VH-SUR-256	07.07.2015 15.00 Hrs	0.8	4.2	36.99	24.12
Pachallor	WS-VH-MID-257	07.07.2015 15.00 Hrs	0.3	3.9	36.90	24.12
Pachallor	WS-VH-BOT-258	07.07.2015 15.00 Hrs	0.9	5.1	36.83	24.12
Pachallor	WS-PA-SUR-259	07.07.2015 16.00 Hrs	0.9	5.2	36.41	24.14
Pachallor	WS-PA-MID-260	07.07.2015 16.00 Hrs	0.4	4.2	37.56	24.16
Pachallor	WS-PA-BOT-261	07.07.2015 16.00 Hrs	2.1	2.1	37.10	24.27
Poovar	WS-PO-SUR-262	07.07.2015 17.00 Hrs	1.8	1.8	36.92	24.27
Poovar	WS-PO-MID-263	07.07.2015 17.00 Hrs	0.4	0.4	36.33	24.34
Poovar	WS-PO-BOT-264	07.07.2015 17.00 Hrs	8.5	8.5	36.70	24.28

For and on behalf of
Standard^{s} Environmental & Analytical Laboratories

Authorized Signatory

End of Report

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Annexure 3

Status of the commitments made during Public Hearing

Annexure 3

Status Commitments made during Public Hearing

Sl No	Responses/Commitments	Status
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	In consultation with the fishermen, an enhanced livelihood compensation package amounting to Rs. 23.80 crores was sanctioned by GoK, instead of Rs.7.1 crores suggested earlier in the EIA stage. Out of this amount, Rs.11.70 crores have been disbursed till 21st May 2016 for a total number of 183 livelihood affected PAP's whose verification were complete in all respects. Verification of the documents of balance PAP's is in progress.
2	Land under the Jamaath which includes Karimppaly, Magham, Varuthari Pally, etc. need to be protected and should not be acquired.	Complied
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.	Compensation for all the procured land has been disbursed along with R&R package. Compensation for balance land to be acquired will also be disbursed promptly.
4	Additional fish landing centre will be constructed	The work for construction of the fish landing centre (Rs.16 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.
5	Existing harbour will be improved under the CSR provisions of the project	Action for modernization of the existing fishing harbour is being initiated through the harbour engineering department.
6	Fisherman will get first preference to cross the ship channel	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.	Baseline year round status of the shoreline has been mapped from Feb 2014 to Jan 2015 for a stretch of 40km. Change monitoring is being continued for the construction phase.
8	Water supply provision to the Vizhinjam fishing village	Scheme has been commissioned in April, 2013 by VISL by expending an amount of Rs. 7.33 crores. For O&M of the same an amount of Rs.2.94 crores

		has been spent till date by VISL. AVPPL have installed 16 water tanks in the water scarce areas in the project neighbourhood and water is being supplied on a daily basis on mobile water tankers. An amount of Rs.8.14 lakhs has been spent by AVPPL on this account till date.
9	Construction of the new fishing harbour will be simultaneously completed with the port project	The work for construction of the fish landing centre (Rs.16 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
10	Railway work will be initiated after Environment Clearance (EC)	Action being taken through M/s Rail Vikas Nigam Ltd (RVNL)
11	Job Opportunity - Preference will be given to local people during construction stage	Being complied
12	Rehabilitation measures ensures employment opportunities for fishermen	R&R package for fishermen has been finalised in consultation with the affected PAP's & is being disbursed
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 considered with appropriate planning.
14	Appropriate action like providing compensation or alternate employment etc to fishermen will be implemented wherever applicable after the Environment Clearance	R&R package for fishermen has been finalised in consultation with the affected PAP's & is being disbursed
15	Compensation, Resettlement and Rehabilitation benefits to all the livelihood affected and displaced fisherman will be implemented after the Environment Clearance	R&R package for fishermen has been finalised in consultation with the affected PAP's & is being disbursed
16	Waste management is included in the EMP and E&E waste management is part of the SWMP.	A budgetary provision has been included for waste management. Action is being initiated by Adani Foundation, the CSR wing of AVPPL for sanitation and solid waste management in Vizhinjam, Kottappuram and Harbour wards of Thiruvananthapuram corporation
17	Upgradation of PHC at Vizhinjam will be carried out	Action is being initiated by Adani Foundation, the CSR wing of AVPPL
18	New fishing harbour with all the infrastructural facilities will be constructed with reserved rights to mooring/berthing the boats	The work for construction of the fish landing centre (Rs.16 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
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	Discussion for fixing of compensation packages for the affected resort owners have been initiated by the District level Planning Committee (DLPC) headed by the District Collector and is in progress
20	Rail, Road, Coastal and Inland Waterways connectivity will be ensured to the rest of Kerala and other Indian Peninsula Ports	This is one of the objectives of the project and this will be fully materialised once all phases of the project are implemented.
21	Waste Management, Water Treatment plants, etc. will be part of an operational EMP	Decentralized waste water management techniques as per EMP will be carried out.
22	Shoreline monitoring on 15 km both sides on regular basis during construction and operation as suggested in EIA report will be carried out	Baseline year round status of the shoreline has been mapped from Feb 2014 to Jan 2015 for a stretch of 40km. Change monitoring is being continued for the construction phase.
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
24	Appropriate measures relating to maintenance of health, hygiene, safety and security will be implemented as per EIA report	Being complied. An officer of VISL has been designated as Head (EHS & CSR) for effective implementation of the stipulated EHS safeguards & CSR activities. AVPPL, the concessionaire executing the project has also appointed officers for EHS & CSR. In addition to the above, independent environment, health and safety consultants are being appointed as required in the concession agreement signed with AVPPL.
25	VISL will ensure that livelihood issues of Mussel collectors are addressed as per the EIA report	R&R package for fishermen has been finalised in consultation with the affected PAP's & is being disbursed
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

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
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 to the extent possible, but in line with the technical requirements of the project
29	The livelihood restoration measures for fisherman affected during construction phase as reported in the EIA has to be implemented	R&R package for fishermen has been finalised in consultation with the affected PAP's & is being disbursed
30	Dredging materials will be used for reclaiming (filling) the sea and additional materials are not required	Being complied
31	The number of fisherman who will be temporarily affected in the Adimalathura stretch have been assessed and livelihood restoration measures have been framed for the construction period	As and when the works in this stretch is initiated, appropriate compensation will be disbursed during the affected period
32	There will be no erosion on the shoreline on account of dredging the deep sea at (-) 18m to (-) 20m	Baseline year round status of the shoreline has been mapped from Feb 2014 to Jan 2015 for a stretch of 40km. Change monitoring is being continued for the construction phase.
33	An Area Development Plan is being prepared by CEPT University (Ahmedabad) for planned development of the region to avoid haphazard development.	Being followed up for finalisation, including the inputs from AVPPL, the concessionaire for the project.
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 in the operation phase
35	An additional fish landing centre has been suggested at Vizhinjam to decongest the existing harbour, and to cater to the needs of the fisherman in the 15 km vicinity including Pozhiyur&Poovar, considering the suitability of the site having natural bay, increased tranquillity and operational / infrastructural convenience than location like Pozhiyur–Poovar estuary	The work for construction of the fish landing centre (Rs.16 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
36	Implementation of CSR measures and planned development of the region through well designed area development plan will arrest the	Refer point 33 above

	formation of slums and the like.	
37	"Inconvenience Allowances" during construction period of three years to the fisherman of 15km both side of Vizinjam (As per EIA Report)	As and when the works in this stretch is initiated, appropriate compensation will be disbursed during the affected period
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	The District labour Officer, Trivandrum has been assigned with the task of verification of the documents of resort workers and to fix compensation. This is under progress
39	During the construction period of three years livelihood assistance to the shore seine fisherman in the 2km ship channel foot print beach has been suggested although they can move further southward and continue with their activity.	As and when the works in this stretch is initiated, appropriate compensation will be disbursed during the affected period
40	Ensure that all EMP related aspects are properly implemented during construction and operational phase	Will be complied
41	A dedicated port road directly connecting to NH-47 bypass is envisaged.	This is part of the concession agreement signed with AVPPL
42	Rail connectivity is proposed along the outer side of the stream running parallel to the harbour road and that too on elevated structures without affecting the entry to the fishing harbour	Will be complied
43	The port project will not affect the inflow of Neyyar river and AVM canal	This is a fact, 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	Scope of providing connectivity for the local residents to the nearest Vizhinjam-Poovar road will be considered subject to surrendering of adequate land by the beneficiaries
45	The Master Plan has already included a reservoir/ground water recharge facility adjoining the road for water-shed management	Will be complied
46	Where ever possible and based on eligibility, local people will be employed	Will be complied
47	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	Will be complied
48	The development of the warehouse area will be taken up	This is part of the proposed port estate development

49	Livelihood Compensation considered for those who were affected at Adimalathura during construction phase and those affected in the project foot print area at Mulloor and Valiyakadappuram during construction/ operation phase	R&R package for fishermen has been finalised in consultation with the affected PAP's & is being disbursed. As and when the works in Adimalathura stretch is initiated, appropriate compensation will be disbursed during the affected period
50	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	Will be complied
51	Loss of livelihood to the traditional fisherman who do shell fishing in the Mulloor beach area is a real issue/impact. All necessary provisions for livelihood assistance have been considered in the EIA Report.	R&R package for fishermen has been finalised in consultation with the affected PAP's & is being disbursed
52	Only prohibited area for fishing is inside the breakwater. However fishing will be restricted along ship channel and port limits subject to safety norms and operational requirements.	Will be complied during operation phase
53	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.	Revised port limits for (i) fishing harbour/minor port and (ii) Vizhinjam seaport will be notified. Restrictions on fishing will be as per the applicable laws.
54	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.	Inconvenience, if any to fishing will be monitored during the construction phase.
55	The maximum rate of accretion at southern side of the harbour will be 21.6 m/year in the 1st year and by the end of tenth year it reduces to 0.5 m/year. The shoreline evolution along the south side of the port will get stabilized in the initial years. On stabilization, the maximum net	Baseline year round status of the shoreline has been mapped from Feb 2014 to Jan 2015 for a stretch of 40km. Change monitoring is being continued for the construction phase.

	increase in the shoreline accretion would be around 27m immediately south of the port which reduces to negligible levels within 2.3km alongshore. There will not be any impact on the shoreline along Poovar-Pozhiyar sector which is about 7km away from the proposed port.	
56	The 8 resorts affected will be compensated in line with R&R package in place but subject to the advice of the KCZMA/MoEF considering that all these resorts are in NDZ as per CRZ Notification, 2011	Discussion for fixing of compensation packages for the affected resort owners have been initiated by the District level Planning Committee (DLPC) headed by the District Collector and is in progress
57	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	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
58	CSR activity considers training the local people to adapt to the new economic development of the area	Action will be initiated
59	The Coast Guard & Navy Berth are as per the needs of the Ministry of Defence on national security	Specific conditions have been included in the concession agreement relating to use of berths by Navy/Coast Guard

Annexure 4

Status of compliance of Environmental Management Plan

Annexure 4

Status of compliance of Environmental Management Plan-

Potential Impacts and Mitigation Measures of Various Project Activities

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
Construction Phase					
1	Capital dredging	Marine water quality	o Increase in turbidity o Change in marine water quality due to aqueous discharges (oily waste, sanitary wastes) from dredgers, barges and workboats	o Check turbidity levels with baseline levels as reference during entire monitoring programme o Preparation of Dredge/reclamation Management plan o Discharge of waste into sea will be prohibited o Oil Spill control measures will be adopted o Ensure that slop tanks will be provided to barges/ workboats for collection of liquid/ solid waste o Marine environmental monitoring as per environmental monitoring programme	o Capital dredging has started in a limited way since Dec 2015 with the use of a cutter suction dredger. Turbidity level during the dredging was monitored at three locations and found to be within the permissible limits
		Marine ecology	o Decrease in DO levels o Increase in noise levels o Removal of benthic communities o Increase in species diversity and density in areas adjoining dredging site o Smothering or blanketing of sub-tidal communities		o Marine Environmental Monitoring will start with commencement of other port construction activities.
2	Material transport and construction activities	Air Quality	o Exhaust emissions from vehicles o Windblown dust during material movement o Fugitive dust during material unloading o Dust suspension during site preparation, construction	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	o Construction material will be obtained from approved quarries only. Proper care shall be taken to mitigate the fugitive emission during transportation once such activities are initiated.

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
				Phase thereby minimizing impact on Air and Noise Quality in the project region. o To reduce impacts from exhausts, emission control norms will be enforced / adhered. o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt o Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment etc o Provide enclosures on all sides of construction site o Movement of material will be mostly during non-peak hours. o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic o Water sprinkling will be carried out to suppress fugitive dust	

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
				o Environmental awareness program will be provided to the personnel involved in developmental works o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation	
		Noise	Noise from following activities o Vehicles transporting construction material o Diesel run engines of construction machinery and dredgers o Pile driving activities during construction of cargo berths	o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB o Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A) o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors o Noise attenuation will be practiced for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers	o Mitigation measures as mentioned will be taken as and when such construction activities are initiated.

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
				o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10pm) to minimise noise impacts o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. o Ambient noise levels will be monitored at regular intervals	
		Disturbance to Natural Drainage pattern	o Impact to natural flow of runoff due to blockage and change of drainage course	o Port development is mostly on reclamation o Rainwater/surface water harvesting pond included in design o Existing drainage near port boundary (backup area) will be integrated with port storm water drainage & management plan o Existing drains / Streams that are passing in ware house area will not be closed/ diverted. And these streams will be de-silted and enhanced to improve their carrying capacities	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. A mix of water harvesting pond with appropriate drains are planned for the operational phase
		Vegetation and Strain on existing infrastructure	o Loss of vegetation and strain on existing infrastructure.	o Port development is planned mostly on reclaimed land; o Land use at backup area, PAF Zone and warehouse area will be mostly coconut	o Care is taken to limit the felling of trees to the bare minimum. Plantation of saplings along the road margins and port boundary are planned as part of the

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
				plantation and low mixed plantation o Adequate green belt will be developed in port and its associated (backup area, PAF, warehouse and road & rail connectivity). o Temporary workers camp with self-sufficient infrastructure facilities.	master plan development
		Existing Traffic	o Traffic addition	o NH-47 bypass under construction around 2.0 km m from the proposed Port site and the Transportation of construction materials will be carried out during non- peak hours. Hence a dedicated road of 45 M RoW is proposed to connect site with NH Bypass o Regularization of truck movement o Majority of rock for breakwater construction will be transported through sea route via barges from nearby quarry sites o A dedicated rail network of approximately 15 km is proposed from port to Nemom railway station	Traffic monitoring & regularisation will be carried out once construction activity starts.
3.	Land Reclamation	Existing Water Resources like Groundwater	o The surface water drainage system may get affected	o Land to be reclaimed will be separated from adjoining land by creating containment bund. o Return sea water will be sent back to sea	o The existing drains are maintained for unhindered disposal of surface drainage water.

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
		and surface water		through appropriate channels.	
4.	Solid Waste Management	Soil quality	o Impacts due to disposal of solid waste on ground without treatment	o Construction waste will be used within port site for filling of low lying areas. o Composted bio-degradable waste will be used as manure in greenbelt. o Other recyclable wastes will be sold. o Excavated soil at backup, PAF Zone and ware house area will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. o General refuse generated on-site will be collected in waste skips and separated from construction waste. o Burning of refuse at construction sites will be prohibited. o All control measure will be taken to avoid the contamination of groundwater during construction phase	o Construction waste will be used within port site for filling of low lying areas. o Burning of refuse at construction sites will be prohibited. o All control measure will be taken to avoid the contamination of groundwater during construction phase
5.	Handling of hazardous wastes	Human safety and property loss	o Fire accidents due to hazardous material handling	o Adequate safety measures as per OSHA standards will be adopted o Construction site will be secured by fencing with controlled/limited entry points. o Hazardous materials such as lubricants, paints, compressed gases, and varnishes	Presently no hazardous waste is being handled as the present construction activities are of preliminary nature. However the following will be practised during construction phase, a. Adequate safety measures as per OSHA standards will be adopted

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
				etc., will be stored as per the prescribed/approved safety norms. o Construction site will be secured by fencing with controlled/ limited entry points o Medical facilities including first aid will be available for attending to injured workers. o Handling and storage as per statutory guidelines. o Positive isolation procedures will be adhered o Hazardous wastes will be disposed through approved KSPCB/CPCB vendors.	b. Construction site will be secured by fencing with controlled/limited entry points c. Medical facilities including first aid will be available for attending to injured workers. d. Handling and storage as per statutory guidelines. e. Hazardous wastes will be disposed through approved KSPCB/CPCB vendors.
6.	Water Resources	Water scarcity / Pollution	o Impacts to the surface water body	o Water requirement during the construction is expected to be around 0.10 MLD o Water will be sourced from Vellayani lake o Avoid/minimise the loss during conveyance o Optimized utilization of the water o Care will be taken to prevent the runoff from the construction site to the nearby natural streams, if any	o A water treatment plant of 3mld capacity is already commissioned. Source of the water is Vellayani lake.
7.	Fishing	Fisherme	o Impact on fishing due to Construction	o Signboards will be placed at the	o Signboards &Marker buoys has been

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
		n and fishing villages	works	construction activities in order to make fishermen aware of the ongoing construction activities o Necessary marker buoys will be installed o Interactions will be initiated with the fishing community before commencement of construction works	placed for demarcation of construction area. o Continuous interaction being done with fishing community for mutual understanding of construction activity.
8.	Tourism	Effect on tourism	Loss of Pocket beach/access/expose to beach / loss of resorts and other tourist facilities in the acquired area	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 and given as Appendix 5.4. o A cruise terminal and related facilities is part and parcel of the project. This is to largely compensate the losses made o For all acquired properties and land adequate compensation will be provided based on legally valid documents	o The tourism activity in the nearby Kovalam area is not impacted by the construction of the port. 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 o Discussion for fixing of compensation packages for the affected resort owners have been initiated by the District level Planning Committee

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
					(DLPC) headed by the District Collector and is in progress
9	Breakwater	Change in shoreline	Erosion and accretion along the coast	o Shoreline monitoring shall be carried out o Suitable Shoreline protection measures will be implemented based on the observations	o Shoreline monitoring of 40 km area along the shore (20 km each on either side of project area) is being done. Proper mitigation measures if required will be implemented.
10	Effect on existing fishing harbour	Movement of fishing boats	o Restriction on free movement of fishing boats to/ from fishing harbour o Tranquillity in fishing harbour o Loss of livelihood	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 o Traffic of Marine vessel/ fishing boats will be planned without affecting each other o Adoption of fishing harbour to manage it to perform as per International standard o A new fishing harbour provided under CSR initiatives because of additional tranquillity creator. o Loss of livelihood will be either taken care of in the new port	o Wave, current and tide data are being monitored along with the shoreline monitoring of 40 k stretch. Based on the above, the modelling studies done at the EIA stage will be further evaluated and related to the shoreline evolution. o Traffic of Marine vessel/ fishing boats will be planned without affecting each other o The work for construction of the fish landing centre (Rs.16 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 o In consultation with the fishermen, an enhanced livelihood compensation package amounting to Rs. 23.80 crores was sanctioned by GoK,

S.No	Activity	Relevant Environmental Components likely to be impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Status as on 31st March 2016
				premises or adequately compensated mostly in the form of employment	instead of Rs.7.1 crores suggested earlier in the EIA stage. Out of this amount, Rs.11.70 crores have been disbursed till 21st May 2016 for a total number of 183 livelihood affected PAP's whose verification were complete in all respects. Verification of the documents of balance PAP's is in progress.
11	Shoreline changes	erosion/accretion	Loosing of beach area Impact on houses/ structures along the coast	Final shoreline Impact management plan will be prepared in consultation with agencies like CESS/INCOIS, NGO and local bodies and will implemented. The draft shoreline impact management plan is given in Appendix 6.6.	o Shoreline monitoring of 40 km length is being done under the technical guidance of National Institute of Ocean Technology (NIOT), Chennai.

Environmental Management Plan - Road/Rail Corridors*

***Construction work has not commenced in this area**

Sl.No.	Environmental Impacts and Issues	Mitigation Measures	Time Frame	Contractual Clause	Current Status
1	Environmental Management and Monitoring Facility Equipment for EMP (Meters, Vehicles and Buildings)	This will include institutional requirements, training, environmental management and monitoring. Provision for purchasing required equipment.	During and after construction (Five Years)	As a Project specific action this will have to be incorporated	o An Environment Management Cell will be established to look after day to day affairs like Monitoring, Training o An officer of VISL has been designated as Head (EHS & CSR) for effective implementation of the stipulated EHS safeguards & CSR activities. AVPPL, the concessionaire executing the project has also appointed officers for EHS & CSR. In addition to the above, independent environment, health and safety consultants are being appointed as

Sl.No.	Environmental Impacts and Issues	Mitigation Measures	Time Frame	Contractual Clause	Current Status
					required in the concession agreement signed with AVPPL. o Necessary equipment will be purchased. o Third party environmental monitoring will start on commencement of construction activity in a full swing..
2	Altered Road embankments	Retaining walls and gabions should be provided	During construction	Design standard requirement	Will be complied as and when required
3	Dust	o Water should be sprayed during the construction phase, at mixing sites, and temporary roads. o In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to prevent dust. o Vehicles delivering materials should be covered to reduce	During the Construction phase	Design standard requirement	Will be complied

Sl.No.	Environmental Impacts and Issues	Mitigation Measures	Time Frame	Contractual Clause	Current Status
		spills and dust blowing off the load.			
4	Air Pollution	o Vehicles and machinery are to be maintained so that emissions conform to National and State standards. o All vehicles and machineries should obtain Pollution Under Control Certificates (PUC).	Beginning with and continuing throughout construction phase	MORTH's Specifications	Will be complied
5	Noise	o Machinery and vehicles will be maintained to keep their noise to a minimum. o Construction of noise barriers of an average length of 100m and eight feet height where ever necessary. o Proper maintenance of the rail track and rail wagon, by frequent lubrication to avoid frictional noise. o Regular monitoring shall be carried out as per the Environmental Monitoring Plan.	Beginningand throughout construction phase	MORTH's Specifications	Will be complied
6	Loss of low lying land and ponds	o Impacted ponds can be enhanced by constructing bridged structures like Gabions to avoid plugging of springs. o Mitigation/Compensation shall	During Construction phase	MORTH's Specifications	Will be complied

Sl.No.	Environmental Impacts and Issues	Mitigation Measures	Time Frame	Contractual Clause	Current Status
		be affected for the completely impacted ponds. o At Chainage km 6.500 the Railway alignment goes below the Existing NH and then at km 6.600 it will hit pond. The pond will be excavated partially and the soil material shall be used to fill in the western part and an equivalent area lost may be excavated to compensate the loss of effective pond area.			
7	Flood Impacts and Cross Drainage Structures	Formation level should be raised according to the design and the cross drainage structures suitably planned for the flood events.	During construction phase	MORTH's Specifications	Will be 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. 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	During construction phase	MORTH's Specifications	Will be complied

Sl.No.	Environmental Impacts and Issues	Mitigation Measures	Time Frame	Contractual Clause	Current Status
		to the Contractors visual integration and management plan and EMP.			
9	Contamination from Wastes	All justifiable measures will be taken to prevent the wastewater produced during construction from entering directly into rivers and irrigation systems	Throughout construction phase	MORTH's Specifications	Will be complied
10	Borrow pits	Borrow pits are to be identified, opened and closed after consultations and proper documentation	During construction phase	MORTH's Specifications	Will be complied as and when required
11	Quarrying and Material sources	o Quarrying will be carried out at approved and licensed quarries only. o Details of Quarrying material sources are given in Chapter 4.	During construction phase	MORTH's Specifications	Will be complied
12	Soil Erosion and Soil Conservation	o On slopes and other suitable places along the two proposed corridors, trees and grass should be planted. o On sections with filling and deep cutting their slopes should be covered by sod, or planted with grass, etc. o If existing irrigation and drainage system, ponds are damaged, they will be suitably	During construction and upon completion of construction activities at these sites.	MORTH's Specifications	Will be complied

Sl.No.	Environmental Impacts and Issues	Mitigation Measures	Time Frame	Contractual Clause	Current Status
		repaired. o Retaining walls and gabions shall be suitably provided.			
13	Loss of agricultural topsoil	o Arable land should not be used for topsoil borrowing. o Topsoil will be kept and reused after excavation is over. o Any surplus to be used on productive agricultural land.	During construction phase	MORTH's Specifications	Will be complied
14	Compaction of Soil and Damage to Vegetation	Construction vehicles should operate within the Corridor of Impact avoiding damage to soil and vegetation.	During construction	MORTH's Specifications	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. o Landscaping shall be done at major junctions.	After completion of construction activities	MORTH's Specifications	Will be complied alongside the road and port boundaries
16	Vegetation clearance	Tree clearing within the ROW should be avoided beyond that which is directly required for construction activities and/ or to reduce accidents. Especially in plantation and house garden areas both along road and rail alignment.	During cleaning operations	MORTH's Specifications	Will be complied

Sl.No.	Environmental Impacts and Issues	Mitigation Measures	Time Frame	Contractual Clause	Current Status
17	Fauna	Construction workers should protect natural resources and animals. Hunting of birds and other local animals is prohibited.	During construction phase	MORTH's Specifications	Will be complied
18	Traffic Jams and congestion	If there is traffic congestion during construction, measures should be taken to relieve it as far as possible with the co-operation of the traffic police.	During construction phase	MORTH's Specifications	Will be complied
19	Health and Safety	All contractors' staff and workers must wear high visibility purpose made overalls or trousers/a 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.	Health and Safety	MORTH's Specifications	Will be complied
20	Pollution of Streams parallel or along the alignments	Construction material /waste should be disposed of properly so as not to block or pollute streams or ponds with special attention to confining concrete work.	During construction phase	MORTH's Specifications	Will be complied
21	Cultural Remains	Construction should be stopped until authorised department assess the remains to preserve Archaeological relics and cultural structures like Temples, mosques and churches. Archaeologists will supervise the	Throughout Construction phase	ASI Acts	Will be complied

Sl.No.	Environmental Impacts and Issues	Mitigation Measures	Time Frame	Contractual Clause	Current Status
		excavation to avoid any damage in the relics.			

Environment Management Plan – Warehouse Area* (Construction Phase)

***Construction work has not commenced in this area**

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
	WAREHOUSE AREA				
	Construction Phase				
1	Material transport and construction activities	Air Quality/Dust	o Exhaust emissions from vehicles o Windblown dust during material movement o Fugitive dust during material unloading o Dust suspension	o To reduce impacts from exhausts, emission control norms will be enforced / adhered. o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards. o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt. o Providing adequately sized construction yard for storage of construction materials, equipment,	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			during site preparation, construction and trenching	tools, earthmoving equipment, etc. o Provide enclosures on all sides of construction site o Movement of material will be mostly during non-peak hours. o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic o Water should be sprayed during the construction phase, at mixing sites, and temporary roads. o In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to prevent dust. o Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. o Environmental awareness program will be provided to the personnel involved in developmental works. o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation.	
		Noise	Noise from	o Noise levels will be maintained below	Being complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			following activities o Vehicles transporting construction material o Diesel run engines of construction machinery	threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB. o Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A). o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors. o Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimise noise impacts. o Personnel exposed to noise levels beyond threshold limits will be	

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
				provided with protective gear like earplugs, muffs, etc. o Ambient noise levels will be monitored at regular intervals	
2	Construction of Buildings, Roads, Sheds, etc.	Vegetation and Strain on existing infrastructure	Loss of vegetation and strain on existing infrastructure	Most of the land is covered with coconut trees and few other trees. Trees that are cut down will be accounted for and the same no. of trees of the same or some other species will be replanted at another location to compensate for the loss of greenery.	Will be complied alongside the road and port boundaries
		Water Environment	There are several streams that pass through the warehouse area and will be affected with the construction of new infrastructure on the land	o The streams 1 and 2 will be made to avoid entering the warehouse area by diverging them into the Karichal River. o A tunnel like arrangement with RCC structures will be used so as to not affect the streams (3 and 4) that will go through the warehouse area. The streams will be made to go under the warehouse areas through the tunnel. Another option is to divert through the boundary wall- an application was filed with the irrigation dept. o Another option is to divert the stream through the boundary o An application has been filed with the	Will be appropriately planned in consultation with the concerned departments

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
				irrigation department for permission.	
			o Loss of low lying area	o The low lying area in the region is already made use by the local people, and has been degraded. There are no active ecological systems in the area. As far as possible, during operation phase the network of streams that add to the low lying area of the region will be diverted or channeled under the constructed buildings to avoid impact to the low lying area. o Filling of low lying areas (if required) shall be done	Will be appropriately planned in consultation with the concerned departments
			o Impact to the downstream due to pollution of the streams	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 Impact to natural flow of runoff due to blockage and change of	o As mentioned above, formidable measures will be taken to avoid the disturbance to the natural flow of water. If some structure or building	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			drainage course	comes in the way of the existing flow of water, the flow will be redirected to the closest stream in the drainage pattern. o In sections along watercourses, earth and stone will be properly disposed of so as not to block rivers and streams, thereby preventing any adverse impact on water quality. o All necessary measures shall be taken to prevent earthworks and stone works from impeding cross drainage at streams and canals or existing irrigation and drainage systems in conformity EMP.	
		Existing Traffic	Traffic addition	o Transportation of construction materials will be carried out during non- peak hours. o Regularization of truck movement. 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 Impacts due to disposal of solid waste on ground without treatment	o Construction waste will be used within warehouse site for filling of low lying areas. o Composted bio-degradable waste will be used as manure in greenbelt.	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
				Other recyclable wastes will be sold. o Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. o General refuse generated on-site will be collected in waste skips and separated from construction waste. o Burning of refuse at construction sites will be prohibited.	
	Project Auxiliary Facility (PAF)* ZONE ***Construction work has not commenced in this area**				
	Construction Phase				
1	Material transport and construction activities	Air Quality/Dust	o Exhaust emissions from vehicles o Windblown dust during material movement o Fugitive dust during material unloading o Dust suspension during site preparation,	o To reduce impacts from exhausts, emission control norms will be enforced / adhered. o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards. o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt. o Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc.	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			construction and trenching	o Provide enclosures on all sides of construction site o Movement of material will be mostly during non-peak hours. o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic o Water should be sprayed during the construction phase, at mixing sites, and temporary roads o In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to prevent dust. o Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. o Environmental awareness program will be provided to the personnel involved in developmental works. o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation.	
		Noise	Noise from following activities	o Noise levels will be maintained below threshold levels stipulated by	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			o Vehicles transporting construction material o Diesel run engines of construction machinery	Central/Kerala State Pollution Control Board (CPCB)/KSPCB. o Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A). o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors. o Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimise noise impacts. o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like	

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
				earplugs, muffs, etc. o Ambient noise levels will be monitored at regular intervals	
	Construction of Buildings, Roads, Parking features, etc.	Vegetation and Strain on existing infrastructure	Loss of vegetation and strain on existing infrastructure.	o Most of the land is covered with coconut trees and few other trees. Trees that are cut down will be accounted for and the same no. of trees of the same or some other species will be replanted at another location to compensate for the loss of greenery. o There are very few existing buildings and infrastructure on the PAF zone area land which will be acquired and people in that area will be rehabilitated.	Will be complied alongside the road and port boundaries
		Existing Traffic	Traffic addition	o Transportation of construction materials will be carried out during non- peak hours. o Regularization of truck movement. o The existing roads shall be strengthened and shall be used for the construction material transportation.	Will be complied
		Solid Waste Management	Impacts to Soil quality due to	o Construction waste will be used within port site for filling of low lying	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			disposal of solid waste on ground without treatment	areas. o Composted bio-degradable waste will be used as manure in greenbelt. Other recyclable wastes will be sold. o Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. o General refuse generated on-site will be collected in waste skips and separated from construction waste. o Burning of refuse at construction sites will be prohibited.	
	BACK UP AREA* – Construction Phase				
	***Construction work has not commenced in this area**				
1	Material transport and construction activities	Air Quality	o Exhaust emissions from vehicles o Windblown dust during material movement o Fugitive dust during material unloading o Dust	o To reduce impacts from exhausts, emission control norms will be enforced / adhered. o All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards o Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt o Providing adequately sized construction yard for storage of	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			suspension during site preparation, construction and trenching	construction materials, equipment tools, earthmoving equipment, etc. o Provide enclosures on all sides of construction site o Movement of material will be mostly during non-peak hours. o On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic o Water sprinkling will be carried out to suppress fugitive dust o Environmental awareness program will be provided to the personnel involved in developmental works o Use of tarpaulin covers and speed regulations for vehicles engaged in transportation	
		Noise	Noise from following activities o Vehicles transporting construction material	o Noise levels will be maintained below threshold levels stipulated by Central/Kerala State Pollution Control Board (CPCB)/KSPCB o Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A)	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			o Diesel run engines of construction machinery	o Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used o Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors o Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers o High noise generating activities such as piling and drilling will be scheduled at daytime (6.00 am to 10 pm) to minimise noise impacts o Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. o Ambient noise levels will be monitored at regular intervals	
2	Construction Activities	Water Environment	Flood Impacts and Cross Drainage Structures	Formation level should be raised according to the design and the cross drainage structures suitably planned for the flood events.	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			Contamination from Wastes	All justifiable measures will be taken to prevent the wastewater produced during construction from entering directly into the water bodies.	
		Land Environment	Soil Erosion and Soil Conservation	o On slopes and other suitable places along the two proposed corridors, trees and grass should be planted. o On sections with filling and deep cutting their slopes should be covered by sod, or planted with grass, etc. o If existing irrigation and drainage system, ponds are damaged, they will be suitably repaired. o Retaining walls and gabions shall be suitably provided.	Will be complied
			Loss of agricultural topsoil	o Arable land should not be used for topsoil borrowing. o Topsoil will be kept and reused after excavation is over. o Any surplus to be used on productive agricultural land.	Will be complied
			Compaction of Soil and Damage to Vegetation	o Construction vehicles should operate within the Backup Areas avoiding damage to soil and vegetation.	Will be complied

Sl.No.	Activity	Relevant Environmental & Social Components likely to be impacted	Likely Impacts and their Significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Current Status
			Loss of trees and Avenue Planting	Areas of trees cleared will be replaced according to Compensatory Afforestation Policy under the Forest Conservation Act - 1980. Landscaping shall be done at major junctions.	Will be complied alongside the road and port boundaries
			Vegetation clearance	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 5

NOC from Airport Authority of India

(No. AAI/SR/NOC/RHQ dated 7.12.2015)

भारतीय विमानपत्तन प्राधिकरण
AIRPORTS AUTHORITY OF INDIA

ISO 9001:2008 VEXIL BPS MS Q9115251.01 / Q9115251.02 JAS-ANZ

संदर्भ सं. / Ref. No. :

दिनांक / Dated :

No. AAI/SR/NOC/RHQ Date: 7/12/2015

ADANI VIZHINJAM PORT PVT LTD

C/o VIZHINJAM INTL. SEA PORT LTD,
Ist FLOOR, VIPANCHIKA TOWER,
NEAR GOVT. GUEST HOUSE,
THYCAUD - PO,
THIRUVANANTHAPURAM-695014

NO Objection Certificate for Height Clearance

This NOC is issued by Airports Authority of India (AAI) in pursuance of responsibility conferred by and as per the provisions of Govt. of India (Ministry of Civil Aviation) order SO84 (E) dated 14th Jan. 2010 for Safe and Regular Aircraft Operations.

1. References:

NOCID	THIR/SOUTH/B/111115/219720
Applicant Letter	
AAI Reference	MM501/2015[TV79/2015]

2. NOC Details for Height Clearance:

Applicant Name	ADANI VIZHINJAM PORT PVT LTD
Type of Structure	Other
Site Address	SURVEY NO:756/21, BERTHTHIRUVANANTHAPURAM-MULLUR -PO/ VIZHINJAM/TRIVANDRUM
Site Cordinates	8 22 4.26N -77 0 12.65E
Site Elevation AMSL in Mtrs	-- Mtrs
Permissible height above Ground Level in Mtrs	-- Mtrs
Permissible Top Elevation AMSL in Mtrs	153.951Mtrs ONE FIVE THREE DECIMAL NINE FIVE ONE

3. This NOC is subject to the terms and conditions as given below:

a. The site-elevation **and site coordinates** provided by the applicant are taken for calculation of the permissible top elevation for the proposed structure. If,however, at any stage it is established that the actual data is different from the one, provided by the applicant, this NOC will be invalid.

b. The issue of the 'NOC' is further subject to the provisions of Section 9-A of the Indian Aircraft Act, 1934 and those of any notifications issued there under from time to time including the Aircraft(Demolition of Obstruction caused by buildings and trees etc.) Rules,1994.

c. No radio/TV Antenna, lighting arresters, staircase, Mumtee, Overhead water tank and attachments of

fixtures of any kind shall project above the **Permissible Top Elevation 153.951 Mtrs**, indicated in para 2.

d. The use of oil fired or electric fired furnace is mandatory, within 8 KM of the Aerodrome Reference Point.

e. The certificate is valid for a period of 7 years from the date of its issue. If the building/structure/Chimney is not constructed & completed within the period, the applicant will be required to obtain a fresh 'NOC' from the Designated Officer of Airports Authority of India. The date of completion of Building/Structure/Chimney should be intimated to this office of AAI. Request for revalidation of NOC will not be entertained after the expiry of its validity period.

f. No light or a combination of lights which by reason of its intensity, configuration or colour may cause confusion with the aeronautical ground lights of the Airport shall be installed at the site at any time, during or after the construction of the building.

g. The applicant will not complain/claim compensation against aircraft noise, vibrations, damages etc. caused by aircraft operations at or in the vicinity of the airport.

h. Day markings & night lighting with secondary power supply shall be provided as per the guidelines specified in chapter 6 and appendix 6 of Civil Aviation Requirement Series 'B' Part I Section 4, available on DGCA India website: **www.dgca.nic.in**

i. The applicant is responsible to obtain all other statutory clearances from the concerned authorities including the approval of building plans as this NOC for height is for the purpose of 'to ensure the safe and regular aircraft operations' and shall not be used as document for any other purpose/claim whatsoever, including ownership of land etc

j. This NOC has been issued w.r.t. the Civil Airportsas notified in S0 84(E). Applicant needs to seek separate NOC from Defence, if the site lies within jurisdiction of Defence Airport.

This certificate is issued for **"HEIGHT CLEARANCE ONLY"** with the approval of Competent Authority for **Permissible Top Elevation 153.951 Mtrs.**

07/12/2015

(P.V.Muraleekrishnan)
Dy. General Manager(ATM-NOC)
for General Manager(ATM-SR)

Airports Authority Of India

Copy to :

1. The Executive Director(ATM), AAI, Rajiv Gandhi Bhavan, Safdarjung Airport, New Delhi-110003
2. GM(NOC)/Airport Director(Bundle).
3. Guard File
4. **The Airport Director, AAI , Trivandrum Airport, Trivandrum. 695 008.**
5. **The Secretary, Corporation of Trivandrum, Pulimood junction, Trivandrum- 695 001.**

General Letter | Issue | Print

Annexure 6

Approval of port layout issued by Government of Kerala

(No.308799/E1/15/F&PD dated 30-10-2015)

GOVERNMENT OF KERALA

No. 308799/E1/15/F&PD

Fisheries & Ports (E) Department
Thiruvananthapuram
Dated: 30-10-2015

From

Principal Secretary to Government

To

The Director and Chief Executive Officer,
Adani Vizhinjam Port Private Ltd,
Vizhinjam, Thiruvananthapuram- 695521

(Adani House,
Nr. Mithakhali Circle,
Navrangpura, Ahmedabad – 380009
Gujarat)

Sir,

Sub:- Ports Department – Vizhinjam International Deepwater Multipurpose Seaport Project – Layout approval - reg.

Ref:- Your letter No. AVPPL/GoK/2015-16/014 dated 08-10-2015

In inviting your attention to the reference cited, I am to convey the layout approval of the Vizhinjam International Deepwater Multipurpose Seaport Project , which has already been approved by Government and enclosed as schedule B of the Concession Agreement.

Yours faithfully,

1326
31/10/15

C.JYOTHIKUMAR,
Under Secretary to Government,
For Principal Secretary to Government.

Approved for issue,

Section Officer.

31/10/2015

Annexure 7

Copy of advertisement relating to grant of EC in newspaper(s) and intimation to MoEF, RO(SZ), Bangalore

Vizhinjam International Seaport Limited

(A Government of Kerala Undertaking)

VISL/EC/MoEF/2013/78 20-01-2014

Chief Conservator of Forests (C),
Ministry of Env. and Forests,
Regional Office(SZ),
Kendriya Sadan, IVth Floor,
E&F Wings, Koramangala II Block,
Bangalore-560034

Dear Sir,

Sub: Environmental and CRZ clearance for Development of Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam in Thiruvananthapuram District, Kerala by M/s Vizhinjam International Seaport Ltd.-Reg.

The Ministry of Environment & Forests (MoEF), Govt of India have accorded Environmental Clearance (EC) & Coastal Regulation Zone (CRZ) Clearance to the proposed Vizhinjam International Deepwater Multipurpose Seaport Project, proposed to be developed by Vizhinjam International Seaport Ltd (VISL), vide letter F.No.11-122/2011-IA.III dated 3rd January 2014. As per para 15 of the above letter 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 MoEF at Bangalore.

Accordingly, copy of the advertisement issued by VISL in The New Indian Express, Mathrubhoomi and Malayala Manorama on 11.01.2014 are enclosed herewith for your information and records.

Yours faithfully
For Vizhinjam International Seaport Ltd.

Managing Director & CEO

Encl:- Copy of advertisement

Copy to:- The Director, IA-III, Ministry of Environment & Forests, Paryavaran Bhawan, CGO Complex, Lodhi Road, New Delhi Pin 110003

1st Floor, Vipanchika Tower, Near Government Guest House, Thycaud P.O., Thiruvananthapuram 695 014, Kerala, India
Tel/fax: +91-471-2328616, Email: mail@vizhinjamport.in www.vizhinjamport.in

T'Puram North Wins Revenue Dist Youth Fest

Palmolein Case: A Pol

by Mathew A Thomas

T'Puram: At a time when a general impression has come to stay that the two decade-long Palmolein case is poised to have a natural death, the Thrissur Vigilance Court's verdict on Friday rejecting the plea of the UDF Government to withdraw the case has, by all means, is a political setback to the ruling dispensation.

As the case is refusing to die, it also brings out the shortcomings or callousness of the government in handling the case, even when it is clear that the political offshoots of it were always having a larger dimension in the public domain for quite a long time.

Government is trying to gain a new face after the induction of Ramesh Chennithala as Home Minister, the Vigilance Court verdict is also a litmus test. Opposition leader V S Achuthanandan, the diehard plaintiff in the case, has already snipped political shots and claimed victory on the verdict.

"Oommen Chandy is panicked that he will be included as an accused in the case," he said, while pointing out that his demand to list Chandy as an accused is pending before

With Lok Sabha election round the corner, any a verse twist to the case is su to spell political doom for t ruling front.

Chief Minister Oomm Chandy remained cautio on the turn of events. "

With Lok Sabha elections round the corner, any adverse twist to the case is sure to spell political doom for the ruling front

comment after going throu the verdict in detail," he sa Home Minister Rame Chennithala announced th the government will go appeal against the verdict the High Court.

Both of them were clos ted for more than an hour

The heavy rush witnessed at Sabarimala temple on Friday

SUDHIKRIYAS ON JAN 12, 13

Sabarimala: 'Sudhikriyas' (purification rites), as part of the Makaravilakku ceremony, will be held at the Lord Ayyappa temple here on January 12 and 13.

TODAY IN SANNIDHANAM	
AM	
03.00	Nada opens
03.05	Nirmalyam
03.10	Neyyabhisheka
03.20	Ganapathi hom
07.30	Usha pooja
PM	
12.30	Uchcha pooja
01.30	Nada closes
03.00	Nada re-open
06.30	Deeparadhan
07.00	Pushpabhishe
09.30	Athazhapooja
11.20	Harivarasana
11:30	Nada closes

January 12. The procession carrying the Thiruvabharanam, to be kept in three sandalwood boxes, will leave the Pandalam temple at 1 pm after sighting the 'Krishna Parunthu'.

On January 14, the concluding day of the procession, receptions will be accorded to the procession at Plappally, Nilackal, Attathode and Pampa-Valiyanavattom. After leaving Valiyanavattom, the procession will be given a reception at Saramkuthi by a Devaswom team led by Sabarimala executive officer Mohandas and administrative officer Subhash at 5.30 pm.

On reaching the Sopanam at 6 pm, Trayancore Devaswom Board president M P Govindan Nair and members Subhash Vasu and P K Kumaran will receive the Thiruvabharanam in front of the golden flag mast. In front of the Sreekovil, Thantri Kandararu Maheswararu and Melsanthi Narayanan Nampoothiri will receive the Thiruvabharanam, and deeparadhana will be conducted after adorning the golden attire on the idol of Lord Ayyappa at 6.30

ക്ഷേത്രമുറ്റത്തും ഹൃദയചികിത്സ

ക്ഷേത്രമുറ്റത്ത് കൊടിമരച്ചുവട്ടിൽ ഹൃദയചികിത്സ തുടങ്ങി. 18-ാം പടി കയറിവരുമ്പോഴേ ഹൃദയസംബന്ധമായ പ്രശ്നങ്ങളും അവശതകളും ഉള്ളവർക്കായി സഹാസ് കാർഡിയോളജി സെന്ററിന്റെ നേതൃത്വത്തിലാണിത്.

ശബരിമല വിശേഷം

മൂന്നുദിവസത്തിനുള്ളിൽ ആയിരത്തിലധികം പേർക്ക് പ്രാഥമിക ചികിത്സ നൽകിയ സഹാസ് എട്ടുപേരെ കാർഡിയോളജി സെന്ററിൽ എത്തിച്ച് രക്ഷിച്ചു. സഹാസ് വൈസ് പ്രസിഡന്റുകൂടിയായ ചീഫ് മെഡിക്കൽ ഓഫീസർ ഡോ. ഒ. വാസുദേവന്റെ നേതൃത്വത്തിലാണ് ഇവിടെ ചികിത്സ.

ശബരിമലയിൽ ഇന്ന്		മാളികപ്പുറത്ത് ഇന്ന്	
നടതുറക്കൽ	3.30	നടതുറക്കൽ	3.30
നിർമാല്യദർശനം	3.35	നിർമാല്യദർശനം	3.35
നെയ്യഭിഷേകം	3.40	അഭിഷേകം, മലർനിവേദ്യം	4.15
ഗണപതിഹോമം	4.30	ഗണപതിഹോമം	5.00
ഉഷഃപൂജ	7.30	ഉഷഃപൂജ	7.30
ഉച്ചപ്പൂജ,നടയടയ്ക്കൽ	1.00	ഉച്ചപ്പൂജ	12.30
വൈകിട്ട് നടതുറക്കൽ	4.00	നടയടയ്ക്കൽ	1.00
ദീപാരാധന	6.30	വൈകിട്ട് നടതുറക്കൽ	4.00
പുഷ്പാഭിഷേകം	7.30	ദീപാരാധന	6.30
അത്താഴപൂജ	10.30	ഭഗവതിസേവ	7.00
ഹരിവരാസനം	11.20	അത്താഴപൂജ	10.00
നടയടയ്ക്കൽ	11.30	നടയടയ്ക്കൽ	11.30

വെള്ളായണിയിൽ തങ്കത്തിരുമുടി

വിവേക് ആർ.ചന്ദ്രൻ

തിരുവനന്തപുരം: ശ്രീപദ്മനാഭസ്വാമി ക്ഷേത്രത്തിൽ പതിറ്റാണ്ടുകൾക്കുശേഷം ഒരു ആനകൂടി എത്തുന്നു. അസമിൽ നിന്ന് വാങ്ങിയ എട്ടു വയസുള്ള ആനയെയാണ് ലക്ഷദീപത്തിന്റെ ഭാഗമായി നടയ്ക്കുവെയ്ക്കുന്നത്. ലക്ഷദീപത്തിന്റെ തൊട്ടടുത്ത ദിവസമാണ് 'ആനയെ ഉരുവിരുത്തൽ' ചടങ്ങ് നടക്കുന്നത്. ദർശനി എന്ന ആനയാണ് ഇപ്പോൾ ശ്രീപദ്മനാഭസ്വാമി ക്ഷേത്രത്തിലുള്ളത്. ലക്ഷദ്വീപത്തിനുള്ള മുന്നോടിയായുള്ള അവസാന ശ്രീവേലിയാണ് ശനിയാഴ്ച വൈകിട്ട് നടക്കുന്നത്. ക്ഷേത്രത്തിനകത്തെ എല്ലാ വിളക്കുകളും തെളിയിക്കും.

ആറ് വർഷത്തിലൊരിക്കൽ നടക്കുന്ന മുറജപവും ലക്ഷദീപവും സമാപിക്കുന്നതിന്റെ തൊട്ടടുത്ത ദിവസം തിരുവിതാംകൂർ രാജകുടുംബത്തിലെ സ്ഥാനി ആനയെ ക്ഷേത്രത്തിൽ നടയ്ക്ക് വെയ്ക്കുന്ന ചടങ്ങുണ്ട്. കഴിഞ്ഞ കുറേ പതിറ്റാണ്ടുകളായി പ്രതീകാത്മക

ആന അസ

കൃതരുടെ തീരുമാനം. അസമിൽ നിന്ന് വാങ്ങിക്കൊണ്ടുവരുന്ന ആനക്കുട്ടി തിങ്കളാഴ്ച തിരുവനന്തപുരത്തെത്തും.

15 നാണ് ആനയെ നടയ്ക്കിരുത്തുന്ന ചടങ്ങ്. രാവിലെ എഴരയോടെ രാജകുടുംബ സ്ഥാനിയുടെ പതിവ് കോവിലെഴുന്നള്ളത്ത് സമയത്താണ് നടയ്ക്കിരുത്തൽ ച

ഇന്ന് സ്വർഗ ഏകാ

തിരുവനന്തപുരം: ശ്രീപദ്മനാഭസ്വ
വാതിൽ ഏകാദശി ചടങ്ങുകം ശ
തിൽ കടക്കുന്ന ചടങ്ങും. വടക്കേ
ത്തുള്ള സ്ഥലം അലങ്കരിച്ച് ഒരുക്കി
കുടുംബസ്ഥാനി കടക്കുന്നതോടെ
ന്നത്. വടക്കേ നടയിലെ വാതിലി
ഹനങ്ങളിൽ ശീവേലി വിഗ്രഹങ്ങ
തുറന്ന ഉടനെ പെരിയ നമ്പി ദീപാര
ക്ഷേത്രം മുഴുവൻ ദീപങ്ങളാൽ പ്രകാശ
ടങ്ങുകൾക്ക് നടക്കുന്നതു പോലുള്ള
തി തിരുനാൾ കീർത്തനങ്ങളുടെ ആ

വർഷം ഇല്ല

ക്കു മാറ്റാനായിരുന്നു ആലോചിച്ചി
ി. ഈ ക്ലാസിലെ മറ്റു വിഷയങ്ങളു
ാപുസ്തകങ്ങൾ പുതിയ ലിപിയി
രുന്നു. പഴയ ലിപിയും പുതിയ ലി
കൂടിക്കലരുന്നതു വിദ്യാർഥികളെ
ുമെന്നതിനാൽ ഒന്നു മുതൽ 10 വ
ാസുകളിലെ മുഴുവൻ പുസ്തകങ്ങ

സൗജന്യ സ്കൂൾ യൂണിഫോം: അധ്യാപക സംഘടനകളുടെ

... പ്രവേശനങ്ങളിൽ ലഭ്യമായിട്ടുള്ള മൂന്ന് ആർച്ചുകളിൽ 5 വർഷക്കാലത്തേക്ക് വാണിജ്യ പരസ്യങ്ങളുടെ ഡിസ്പ്ലേ

4. **U/C 42 /CGDB** തീയതി 07–01–14.
മധുര, വിരുദുനഗർ, തിരുനൽവേലി, ദിൻഡിഗൽ, രാമേശ്വരം, കോവിൽപട്ടി, തൂത്തുക്കുടി സ്റ്റേഷനുകളിൽ എൽഇഡി കോച്ച് ഇൻഡിക്കേഷൻ ബോർഡുകൾവഴി വാണിജ്യ പരസ്യങ്ങളുടെ പ്രദർശനം– 3 വർഷക്കാലത്തേക്ക് അതിനുശേഷം 2 വർഷക്കാലം എക്സ്റ്റൻഷൻ സഹിതം – എൽഇഡി ബോർഡുകളുടെ ഇൻസ്റ്റലേഷൻ, ഓപ്പറേഷൻ, മെയ്ന്റനൻസ് എന്നിവ

5. **U/C300/CSC/Tender/01/2014** തീയതി 09–01–14.
തിരുമംഗലം, പരമകുടി, കൊട്ടാരക്കര, മധുര ഈസ്റ്റ് എൻട്രി, മധുര വെസ്റ്റ് എൻട്രി എന്നിവിടങ്ങളിൽ വെഹിക്കിൾ പാർക്കിംഗ് സ്റ്റാൻഡുകളിൽ ആളെ ഏർപ്പെടുത്തുക.

ദർഘാസ് ഫോറം സ്വീകരിക്കുന്ന/ ഡൗൺലോഡ് ചെയ്യുന്ന അവസാന തീയതി	12.02.2014 – 17.00 മണിവരെ
സീനിയർ ഡിവിഷണൽ കാഷ്യർ (പെയ്), ദക്ഷിണ റെയിൽവേ, മധുര എന്നിവരുടെ പക്കൽ ഇഎംഡി അടയ്ക്കേണ്ട അവസാന തീയതി	13.02.2014 – 14.00 മണിവരെ
ദർഘാസ് സമർപ്പിക്കേണ്ട അവസാന തീയതിയും സമയവും	13..02.2014 10.00 മണിക്കും 15.00 മണിക്കും മധ്യേ
ദർഘാസുകൾ തുറക്കുന്ന തീയതിയും സമയവും	13.02.2014 – 15.30 മണി.

ദർഘാസ് ഫോറങ്ങളും മറ്റ് വിശദാംശങ്ങളും താഴെപ്പറയുന്ന വെബ്സൈറ്റിൽനിന്നും ലഭിക്കും: **www.sr.indianrailways.gov.in**

ഡിവിഷണൽ റെയിൽവേ മാനേജർ (കൊമേഴ്സ്യൽ), മധുര–625 016

ദി കേരളാ മിനറൽസ് ആന്റ് മെറ്റൽസ് ലിമിറ്റഡ്

(ഒരു കേരളാ ഗവൺമെന്റ് സംരംഭം)
(An ISO 9001, ISO 14001 & OHSAS 18001 & SA 8000 Certified Company)
ശങ്കരമംഗലം, ചവറ,
കൊല്ലം–691 583, കേരള, ഇന്ത്യ
Telephone: 0476-2686722 - 33 (12 Lines)
Fax: 91-0476-2680101, 2686721
E-mail: kmml@md3.vsnl.net.in, URL: www.kmml.com

SHORT E-TENDER NOTICE

കൊല്ലം, ചവറയിലെ കേരള മിനറൽസ് ആന്റ് മെറ്റൽസ് ലിമിറ്റഡിന്റെ ടൈറ്റാനിയം ഡയോക്സൈഡ് പിഗ്മെന്റ് യൂണിറ്റിലേക്ക് താഴെപ്പറയുന്ന പ്രവർത്തികൾക്കു വേണ്ടി മത്സരാധിഷ്ഠിത ദർഘാസുകൾ ക്ഷണിച്ചു കൊള്ളുന്നു. കൂടുതൽ വിവരങ്ങൾക്ക് ദയവായി e-tendering portal https://etenders.kerala.gov.in സന്ദർശിക്കുക

ക്രമ നം.	ജോലിയുടെ പേര്	ദർഘാസ് ID	ദർഘാസ് പ്രമാണത്തിന്റെ വില
1.	Supply and Application of Castables and Application of Mullite Bricks on Spray Roaster (2R101) in Acid Regeneration Plant.	2014_KMML_12575_1	Rs.9,200/- inclusive of VAT
2.	Supply and Application of Castables / Bricks and connected works for A-Stream Pigment Seperator at Oxidation Plant	2014_KMML_12578_1	Rs.5,500/- inclusive of VAT
3.	Supply, fabrication and replacement of A-Stream Pigment Seperator bottom conical portion, top dome and brick supporting ring with Inconnel-600 Plates in Oxidation Plant.	2014_KMML_12580_1	Rs.17,300/- inclusive of VAT

ദർഘാസ് സമർപ്പിക്കേണ്ട അവസാന തീയതി: **10/02/2014, 5 PM.**

തീയതി: 11.01.2014

Sd/- ജോയിന്റ് ജനറൽ മാനേജർ (T)
കേരള മിനറൽസ് ആന്റ് മെറ്റൽസ് ലിമിറ്റഡിനു വേണ്ടി

LDCL invites sealed quotations for Hull & Machinery and Protection & Indemnity Insurance for our 25 vessels for the year 2014-15. Interested parties may submit their quotations on or before 24.01.14 at 2.00 PM to LDCL, 27/1038 B, Panampilly Nagar, Kochi - 682 036. Tender documents may be downloaded from our website **www.ldcl.gov.in.** For any clarification, kindly contact Officer (Administration) Land no. 0484-2323448 mobile: 09446073122.

Sd/-
Secretary UTL & MD (LDCL)

INS ZAMORIN, EZHIMALA
TENDER NOTICE FOR AMC OF GALLEY EQUIPMENTS OF KATARI CADET'S MESS

1. INS Zamorin, Ezhimala intends to hiring services for annual maintenance contract of Galley Equipments held at Katari Cadet's Mess, Indian Naval Academy, Ezhimala, Kannur Dist., Kerala - 670 310 for a period of twelve months from the date of signing of agreement.

2. Sealed Tenders are invited from Agencies/Individuals having expertise in maintenance of Galley Equipments. Tender forms can be collected from LP Section, Logistics Complex, INS Zamorin, Ezhimala between 1000H To 1700 H from 13 Jan 14 To 27 Jan 14 on cash payment of ₹100/- (Rupees One Hundred only) in cash. Agencies/Individuals collecting the Tender forms will be given a guided tour of the equipments at 1000 H on 24 Jan 14. Tenders are to be submitted latest by 1200H on 28 Jan 14. Detail of the same is available on the website www.eprocure.gov.in. EMD for ₹23,600/- (Rupees Twenty Three Thousand Six Hundred only) has to be submitted with Tenders form. Tender opening will be done on 28 Jan 14 at 1500 H in presence of the Tenderers.

COMMANDING OFFICER, INS ZAMORIN.

വിഴിഞ്ഞം ഇന്റർനാഷണൽ സീ പോർട്ട് ലിമിറ്റഡ്

(ഒരു കേരള സർക്കാർ സ്ഥാപനം)
ഫസ്റ്റ് ഫ്ളോർ, വിപഞ്ചിക ടവർ, ഗവൺമെന്റ് ഗസ്റ്റ് ഹൗസിനു സമീപം, തൈക്കാട് പി.ഒ, തിരുവനന്തപുരം- 695014

VISL/EC/MoEF/2013 /52 09.01.2014

അറിയിപ്പ്

വിഴിഞ്ഞം അന്താരാഷ്ട്ര തുറമുഖ കമ്പനി നടപ്പിലാക്കാനുദ്ദേശിക്കുന്ന വിഴിഞ്ഞം അന്താരാഷ്ട്ര ആഴക്കടൽ വിവിധോദ്ദേശ്യ തുറമുഖ പദ്ധതിക്ക് ഇന്ത്യാ ഗവൺമെന്റിന്റെ വനം-പരിസ്ഥിതി മന്ത്രാലയം 2014 ജനുവരി മൂന്നാം തീയതിയിലെ F. No11-122/2011-IA.III കത്ത് പ്രകാരം 2006-ലെ EIA Notification-ന്റെയും, 2011-ലെ CRZ Notification-ന്റെയും തുടർ ഭേദഗതികളുടെയും അടിസ്ഥാനത്തിൽ പാരിസ്ഥിതിക അനുമതി (EC & CRZ) നൽകുകയുണ്ടായി. പ്രസ്തുത അനുമതി നൽകികൊണ്ടുള്ള കത്തിന്റെ പകർപ്പ് കേന്ദ്ര വനം-പരിസ്ഥിതി മന്ത്രാലയത്തിലെ ഡൽഹിയിലുള്ള ഓഫീസിലും, കേരള സംസ്ഥാന മലിനീകരണ നിയന്ത്രണ ബോർഡ്, വിഴിഞ്ഞം അന്താരാഷ്ട്ര തുറമുഖ കമ്പനി (VISL) തിരുവനന്തപുരം എന്നീ ഓഫീസുകളിലും www.envfor.nic.in, www.keralapcb.org, www.vizhinjamport.in, എന്നീ വെബ്സൈറ്റുകളിലും ലഭ്യമാണ്. ഈ അറിയിപ്പ് മേൽ സൂചിപ്പിച്ച കത്തിലെ 15-ാം ഖണ്ഡിക പ്രകാരമാണ്.

Sd/-
മാനേജിങ് ഡയറക്ടർ & സി.ഇ.ഒ

Annexure 8

Intimation of compliance to MoEF, RO(SZ), Bangalore

during the pre-construction period

Vizhinjam International Seaport Limited
(A Government of Kerala Undertaking)

VISL/2014-15/EE&EI-9/1047 27.11.2015

Dr. U. Sridharan
Additional Director (S)
Ministry of Environment, Forests &Climate Change,
Regional Office (Southern Zone)
Kendriya Sadan, IV Floor, E&F Wings 17th Main Road,
11nd Block, Koramangala, Bangalore- 560034

Dear Sir,

Sub : Vizhinjam International Deepwater Multipurpose Seaport - Environmental Clearance- Compliance

Ref : 1) F.No. 11-122/2011-IA.III dated 3rd Jan 2014 of MOEF issuing Environmental Clearance
2) Our Letter No. VISL/2014-15/EE&EI-9 dated 19-11-2014 &30.05.2015

This has reference to the Environmental &CRZ Clearance (EC) issued on 3rd Jan 2014 by the Ministry of Environment, Forests &Climate Change (MoEF &CC) to the proposed Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam in Thiruvananthapuram District in Kerala State (ref 1).

Connected with the same, the copy of the shoreline monitoring report for the period from Feb 2015 to May 2015 is enclosed herewith, along with soft copy in CD. The soft copy has been uploaded in VISL website. In this respect it is informed that the port development and operation has been entrusted with Adani Vizhinjam Port Private Ltd (AVPPL) and they have commenced the construction works at site on 16/11/2015. Henceforth M/s AVPPL will forward the periodic compliance reports to MoEF.

Regarding the petitions filed against the Environmental Clearance, it is informed that the Hon'ble Supreme Court has stayed on 21st Jan 2015, the order of the Principal Bench of NGT dated 17th July 2014. Accordingly the Principal Bench of NGT on 27th Jan 2015 adjourned the matter sine die.

1st Floor, Vipanchika Tower, Near Government Guest House, Thycaud P.O., Thiruvananthapuram 695 014, Kerala, India
Tel/fax: +91-471-2328616, Email: mail@vizhinjamport.in www.vizhinjamport.in
CIN: U45309KL2004SGC017685

This is for your information and records.

Yours Faithfully
For Vizhinjam International Seaport Ltd

Managing Director & CEO

Encl: Shoreline monitory report Feb 2015 to May 2015(2 volume hardcopy &CD)

Copy to :

1) Scientist D & in charge, Central Pollution Control Board (CPCB), Zonal Office, 1st & 2nd Floors, Nisarga Bhavan, A Block, Thimmaiah Main Road, 7th D Cross, Shivanagar, Opp. Pushpanjali Theatre, Bengaluru- 560010 (Report in CD)

2) Chief Environmental Engineer, Thiruvanathapuram Regional Office, Kerala State Pollution Control Board Pattom P.O, Thiruvananthapuram- 695004, Kerala, Phone 0471-2318153,54,55, Mob: 9447975710, Email: kspcbproject2011@yahoo.co.in (Report in CD)

3) Environmental Engineer, Thiruvanathapuram District Office, , Kerala State Pollution Control Board, TC 12/96 (4,5), Plamoodu. Pattom P.O. Thiruvananthapuram- 695004, Phone: 0471 2303844, Mob: 9447975714 Email. kspcbdottvpm@gmail.com (Report in CD)

4) Member Secretary
Coastal Zone Management Authority,
Shasthra Bhavan, Pattom, Tvpm. (Report in CD)

5) Shri. Santhoshkumar Mohapatra, Director &CEO, AVPPL, 2nd Floor, Vipanchika Tower, Near Gvt Guest House, Thaycaud, Tvpm-14 (Report in CD)

(Report in CD)

Report on Oceanographic & Bathymetric Data Collection for Assessment of Shoreline changes for Vizhinjam International Seaport ltd (Feb 2015 - May 2015)

Vizhinjam International Seaport Limited
(A Government of Kerala Undertaking)

VISL/2014-15/EE&EI-9 /526

30.05.2015

Er.K.G. Viju, Chief Enviornmental Engineer,
Thiruvananthapuram Regional Office,
Kerala State Pollution Control Board,
Pattom P.O, Thiruvananthapuram – 695004,
Kerala, Phone 0471-2318153,54,55,
Mob: 9447975710; e mail:kspcbproject2011@yahoo.co.in

Dear Sir,

Sub: Vizhinjam International Deepwater Multipurpose Seaport – Environmental Clearance-Compliance

Ref: 1) F.No.11-122/2011-IA.III dated 3rd Jan 2014 of MOEF issuing Environmental Clearance
2) Our Letter No VISL/2014-15/EE&EI-9 dated 19-11-2014

This has reference to the Environmental & CRZ Clearance (EC) issued on 3rd Jan 2014 by the Ministry of Environment, Forests & Climate Change (MoEF&CC) to the proposed Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam in Thiruvananthapuram District in Kerala State (ref 1). As stated in the compliance report submitted (vide ref 2) above, the construction activities of the project are yet to commence at the site. The tender process for selection of the concessionnaire for the development and operation of the port is in the final stages. Once the construction activities are initiated, periodic monitoring and compliance reports as required in the EC order will be submitted to the MoEF &CC.

Regarding the petitions filed against the Environmental Clearance mentioned in ref (2) it is informed that the Hon'ble Supreme Court has stayed the order of the Principal Bench of NGT dated 17th July 2014. The Hon'ble Supreme Court is expected to consider the matter after the vacation.

1st Floor, Vipanchika Tower, Near Government Guest House, Thycaud P.O., Thiruvananthapuram 695 014, Kerala, India
Tel/fax: +91-471-2328616, Email: mail@vizhinjamport.in www.vizhinjamport.in
CIN: U45309KL2004SGC017685

Meanwhile VISL has initiated documentation of shoreline status of the project site & vicinity in association with NIOT.

This is for your information and records.

Yours faithfully
For VISL

Managing Director & CEO

Copy to :

1) Shri. S.Suresh, Scientist D &in charge, Central Pollution Control Board (CPCB), Zonal Ofice, 1st & 2nd Floors, Nisarga Bhavan, A Block, Thimmaiah Main Road, 7th D Cross, Shivanagar, Opp. Pushpanjali Theatre, Bengaluru – 560 010

2) Er.K.G. Viju, Chief Enviornmental Engineer, Thiruvananthapuram Regional Office, Kerala State Pollution Control Board, Pattom P.O, Thiruvananthapuram – 695004, Kerala, Phone 0471-2318153,54,55, Mob: 9447975710; e mail:kspcbproject2011@yahoo.co.in

3) Er. K.R.Santhosh Kumar, Thiruvananthapuram District Office, Enviornmental Engineer, Kerala State Pollution Control Board, TC 12/96 (4,5), Plamoodu. Pattom.P.O., Thiruvananthapuram- 695 004, Phone: 0471 2303844, Mob: 9447975714; e mail kspcbdotvpm@gmail.com

Vizhinjam International Seaport Limited
(A Government of Kerala Undertaking)

VISL/2014-15/EE&EI-9 19-11-2014

Dr. U. SRIDHARAN
Additional Director (S)
Ministry of Environment, Forests & Climate Change, Regional Office (Southern Zone)
Kendriya Sadan, IV Floor, E & F Wings 17th Main Road, IInd Block, Koramangala,
BANGALORE-560 034,
PH :080-25532577. Fax: 080-25537184, sridhar-mef@nic.in ,yousridharan@hotmail.com

Dear Sir,

Sub: Vizhinjam International Deepwater Multipurpose Seaport - Environmental Clearance – Compliance

Ref: 1) F.No. 11-122/2011-IA.III dated 3rd Jan 2014 of MoEF issuing Environmental Clearance
2) Site visit by Dr. U. Sreedharan, Additional Director (S), MoEF on 12th Nov 2014

This has reference to the Environmental & CRZ Clearance (EC) issued on 3rd Jan 2014 by the Ministry of Environment, Forests & Climate Change (MoEF&CC) to the proposed Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam in Thiruvananthapuram District in Kerala State (ref 1) and the subsequent site inspection carried out by Dr.U.Sreedharan, Additional Director (S) on 12th Nov 2014.

As informed and observed during the site visit, the construction activities of the project are yet to commence. The tender process for the selection of the concessionaire for development and operation of the project is in the final stages. Once the construction activities are initiated after finalisation of the concessionaire, periodic monitoring and compliance reports as required in the EC order will be submitted to the MoEF & CC.

In this respect, it is also brought to notice that, two appeals (under section 16 of NGT Act,2010) *challenging the EC* were filed at the National Green Tribunal (NGT), Southern bench, Chennai. Further, another appeal (under section 16 of NGT Act,2010) *challenging the EC* and one application (under section 14 of NGT Act, 2010) *to protect areas of outstanding natural beauty and areas likely to be inundated due to rise in sea level consequent upon global warming* (and clubbing the same with the appeal) were filed at NGT Principal Bench, New Delhi. The NGT Principal Bench vide its order dated 17th July 2014, stated that it has limited powers for judicial

review (relating to the subject in the application) and also has powers to transfer appeals from one bench to any other bench. Accordingly transferred the appeals pending at the Southern Bench to the Principal Bench, New Delhi.

Vizhinjam International Seaport Ltd., (VISL) challenged the above order of the NGT, Principal Bench before the Hon.Supreme Court.

Meanwhile, VISL is in the process of initiating the activities for intense shoreline monitoring in association with NIOT.

This is for your information and records.

Yours faithfully
For Vizhinjam International Seaport Ltd.

Managing Director & CEO

Copy to:

(1) Shri. S.Suresh, Scientist D & in charge, Central Pollution Control Board (CPCB), Zonal Office, 1st & 2nd Floors, Nisarga Bhavan, A Block, Thimmaiah Main Road, 7th D Cross, Shivanagar, Opp.Pushpanjali Theatre, Bengaluru -560 010

(2) Er.K.G. Viju, Chief Environmental Engineer, Thiruvananthapuram Regional Office. Kerala State Pollution Control Board, Pattom P.O., Thiruvananthapuram-695004, Kerala , Phone 0471-2318153,54,55, Mob: 9447975710; e mail:kspcbproject2011@yahoo.co.in

(3) Er. K.R. Santhosh Kumar, Thiruvananthapuram District Office, Environmental Engineer, Kerala State Pollution Control Board, TC 12/96 (4,5), Plamoodu. Pattom P.O., Thiruvananthapuram- 695 004 , Phone: 0471 2303844, Mob: 9447975714; e mail: kspcbdotvpm@gmail.com

Annexure 9

Copy of EC issued by MoEF (F.No.11-122/2011-IA.III dated 3rd Jan 2014)

F.No.11-122/2011-IA.III
Government of India
Ministry of Environment & Forests
(IA Division)

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi - 110 003

Dated:03rd January, 2014

To
The Managing Director & Chief Executive Officer,
Vizhinjam International Seaport Limited,
1st Floor, Vipanchika Tower, Near Govt. Guest House,
Thycaud, P.O. Thiruvananthapuram-695014, Kerala

Contact Person Details:
Shri A.S. Suresh Babu,
Tel/Fax: 471-2328616,
Email: mail@vizhinjamport.in

Subject: **Environmental and CRZ clearance for Development of Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam in Thiruvananthapuram District, Kerala by M/s. Vizhinjam International Seaport Ltd. – Reg.**

***

This has reference to your application No: VISL/EC/MoEF/2013 dated 29.08.2013 and subsequent letters dated 21.10.2013, 29.10.2013 and 23.11.2013 seeking prior clearance for the above project under the EIA Notification, 2006 and CRZ Notification, 2011. The proposal has been appraised as per prescribed procedure in the light of provisions under the EIA Notification, 2006 and CRZ Notification, 2011 on the basis of the mandatory documents enclosed with the application viz., the Questionnaire, EIA, EMP, HTL/LTL & CRZ demarcation report, Recommendation from Kerala Coastal Zone Management Authority (KCZMA) and specific study reports on long term shoreline changes, mathematical modelling and the additional clarifications furnished in response to the observations of the Expert Appraisal Committee constituted by the competent authority in its meetings held on 19th - 21st September, 2013, 28th - 30th October, 2013 and 20th - 23rd November, 2013.

2. It is inter-alia, noted that the Port is proposed to be developed by Vizhinjam International Seaport Ltd. (VISL), a fully owned Company of the Government of Kerala. The proposal involves the development of an all-weather, multi-purpose, deep-water, mechanized, greenfield port at Vizhinjam (Latitude $08^0$22'20"N and Longitude $77^0$00'00"E) in Thiruvananthapuram District. The Port having a natural deep draft of (-) 18m, located hardly 18 Km from the international shipping route is primarily intended to attract the largest container vessels (18000 TEU/165,000 DWT) to tap the lionshare of the Indian transhipment cargo now being handled by the nearby foreign ports and is envisioned as the future transshipment hub of the Country. The dedicated cruise terminal has been designed to become the Country's tourism gateway. Considering the strategic importance of the Port located at the tip of Indian peninsula, berths for Indian Navy and Coast Guard are also planned under the National & Coastal security perspectives, as required by the Ministry of Defence, Government of India. Berths for multipurpose cargo like timber and raw cashew and fishery berth are also planned.

3. The project is proposed to be developed in three phases; Phase I, Phase II and Phase III. Phase I consists of 800 M Container Terminal, 300M Cruise cum Multipurpose Terminal, 500M Navy berth, 120M Coast Guard berth, 100M Port craft berth and 500M Fish landing berth. Phase II consists of additional 400M Container Terminal, Phase III consists of additional 800M Container Terminal, additional 200M Cruise cum Multipurpose Terminal and 250M Liquid Terminal. The length of breakwater in Phase I is 3180 M, to be extended by 200 M in Phase II (making the overall length to 3380 m) and to be extended further by 700M in Phase III (making the overall length to 4080M).The total area to be developed for all three phases is estimated at 450.59 Ha. This includes the harbour area within breakwater including water spread area (167 Ha), port infrastructures & ancillaries in land including road & railways (140.42 Ha) and port infrastructure in reclaimed land (143.17 Ha). The reclamation requirement in Phase I is 66.00 Ha, Phase II is 16.00 Ha and Phase III is 40.00 Ha totalling to 122 Ha, with a provision for future reclamation of 21.17 Ha. Phase I development is planned during 2014-17, Phase II in 2024-2027 and Phase III in 2034-37. Accordingly the project proponent has sought the environmental clearance for Phase I only considering the clearance validity limitations of 5 years, even though the shoreline, modeling and related studies have been done for the full Phase development.

4. The whole land required for port infrastructure in the landward side for all the three Phases (140.42 Ha) is proposed to be procured in Phase I itself. Thus the Phase I land requirement is 206.42 Ha including 140.42 Ha of backup and ancillary land and 66.00 Ha reclaimed land. The Phase I reclamation quantity of 7.6 million m^3 is proposed to be dredged from the Port basin and the approach channel by deepening it to (-)18.4M and to (-) 20.8M respectively. No routine maintenance dredging or disposal is anticipated as per the modelling & sedimentation studies.

5. The other port infrastructure include container yards, cargo handling equipment, port crafts, navigational aids, operations building, workshops, fire station, weigh bridge, gate houses, water, power, sub-station, lighting, road/rail connectivity, truck terminal, ware house, IT system, security system, administration building, staff colony, facilities for Cruise, Navy, Coast Guard, Fishing berth, dispensary, Guest house, canteen, storm water drainage system, pond for water harvesting, pollution control system, dust suppression system, greenbelt etc. The water requirement is 0.5 MLD in Phase I and 1.0 MLD in masterplan. A 3.3 MLD water treatment plan has already been commissioned and the source is Vellayani Lake. From the net availability of 2.49 MLD after treatment, 1.49 MLD is being distributed to the Vizhinjam fishing village as part of the Corporate Social Responsibility (CSR) activities of VISL. The power requirement of the operation Phase of 33.3 MVA is proposed to be met from the Kerala State Electricity Board grid through a dedicated 220/110 KV supply line with GIS substation. Block capital cost estimate for development of Phase I is about Rs. 5,187 Crores.

6. The project was earlier appraised by the EAC in its meeting held during 18th - 20th Jan 2011 and 23rd - 24th June 2011 and the TOR for the EIA study was approved. Based on the approved ToR, a comprehensive EIA study has been performed including long term shore line change and modeling studies through M/s L&T Ramboll Consulting Engineers Ltd, a NABET accredited consultant. The draft EIA report was published and the Public Hearing was conducted through the Kerala State Pollution Control Board on 29th June 2013 at the project site. The State Pollution Control Board forwarded the proceedings of the Public Hearing to MoEF vide their letter dated 6th July 2013. Subsequently VISL submitted the final

EIA report, presented the TOR compliance and response to the points raised during public hearing to MoEF vide letter dated 29th August 2013.

7. The project falls under activity 7(e) - Port and Harbours - of EIA Notification, 2006 and also attracts CRZ Notification, 2011. The Kerala State Coastal Zone Management Authority (KCZMA) has recommended the project for clearance under the CRZ Notification, 2011 vide their letter dated 24th August 2013, based on the EIA report and the CRZ report from the Centre for Earth Science Studies (CESS), Thiruvananthapuram, which stated that port development at the proposed location is a permissible activity as per the CRZ Notification, 2011.

8. Numerous representations for and against the project were received. The major issues raised in the various representations are false data in Form-I, presence of endangered species not given, site is in CRZ-I area, Shoreline study focus on impacts after 1980 but needs to assess the changes in 1969-73 also, fishery and tourism related impacts not addressed /mitigated in final CEIA, Difficulties in crossing the ship channel and to fish in deep sea, Dredging might cause extensive damage & pollution, no specific parameters in ToR on tourism and impact on tourist was not studied, EIA study area was taken as 10 against 15 km, unscientific site selection, violation of CRZ/MoEF, ToR compliance, Pollution & social relevant impacts already being felt. The Additional Chief Secretary, Government of Kerala provided comments on the various representations vide letter dated 17th October 2013. Project Proponent provided and presented before the EAC the information / clarification along with the references on each of the issues raised.

9. The EAC Noted that Vizhinjam International Seaport Limited (VISL), purchased land for the development of the project including land for a 2 Km long and 45 m wide port road. As part of the Kerala State Transport Project works of the Kovalam-Kaliyikkavila stretch, adjoining the proposed port road, the State Government initiated construction of a temporary service road of 670 M length and 10 m width through the land in possession of VISL, without clearance. The construction initiated on 16th August 2010 was stopped on 4th July 2012 after completing 550m, based on the revelation that part of the above stretch of road fell in the 200m/500m landward zone of the HTL as per the CRZ Notification, 1991/2011. According to OM dated 12.12.2012 and its amendments, PP has submitted Board resolution vide letter No. 21.11.2013. The State Govt. was addressed to initiate credible action on the violation by invoking powers under Section 19 of the Environment (Protection) Act, 1986 for taking necessary legal action under Section 15 of the Act for the period for which the violation has taken place and provide evidence to MoEF of the credible action taken before grant of clearance. The Additional Chief Secretary, Government of Kerala vide letter dated 01.01.2014 has informed that a complaint (CMD No.22/2014) was filed in the Court of the Chief Judicial Magistrate, Thiruvananthapuram on 01.01.2014 against M/s Vizhinjam International Seaport Ltd for the violation.

10. The Expert Appraisal Committee, have noted that the project proponent has assessed all likely impacts due to the project comprehensively and arrived at suitable EMP's. Also responded properly to all the issues raised in the Public hearing as well as in various representations made against the project. The Expert Appraisal Committee, after due consideration of the relevant documents submitted by the project proponent and additional clarifications furnished in response to its observations, have recommended for the grant of EC and CRZ Clearance for the project. Accordingly, the Ministry hereby accords necessary EC and CRZ Clearance for the above project as per the provisions of as per the provisions of

Environment Impact Assessment Notification, 2006 and CRZ Notification, 2011 and its subsequent amendments, subject to strict compliance of the terms and conditions as follows:

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.

(ii) Project Proponent shall carry out intensive monitoring with regulatory reporting six monthly on shore line changes to the Regional Office, MoEF.

(iii) The capital dredged material (7.6 Mm^3) shall be utilised for reclamation of berths.

(iv) Additional fish landing centre shall be developed as part of the proposed Vizhinjam port for upliftment of fisheries sector.

(v) The project shall be executed in such a manner that there is minimum disturbance to fishing activity.

(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 Plan (IFCMP), namely a component of Rs.7.1 crores as part of the compensation package for the fisheries sector, as livelihood restoration measures for mussel collectors, shore seine fishermen and others. Rs.41.30 crores as part of CSR activities in the fisheries sector under (i) water supply scheme (7.3crores) (ii) new fishing landing centre (16crores) (iii) adoption of existing fishing harbor (5crores) (iv) sea food park (4crores) (iii) skill development centre (4crores) (iv) environmental sanitation (3crores) and (v) solid waste management (2crores).

(vii) Rail connectivity shall be parallel to the harbour road on elevated structures at +4/5.00 m level without affecting the entry to the existing harbor.

(viii) Compensation packages in accordance with the Central/State Government norms shall be given to all the authorised-cum-affected (having valid clearances as applicable) resort owners.

(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 and SOx shall remain within permissible limits

(x) CSR activities shall cover villages within 10 km radius of the project.

(xi) Oil Contingency Management Plan shall be put in place.

(xii) All the recommendations/conditions stipulated by Kerala Coastal Zone Management Authority (KCZMA) shall be complied with.

(xiii) The responses/commitments made during public hearing shall be complied with in letter and spirit.

(xiv) All the recommendation of the EMP shall be complied with in letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF along with half yearly compliance report to MoEF-RO.

(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.

(xvi) The project proponent shall place on its web site 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.

(xvii) There shall be no withdrawal of groundwater in Coastal Regulation Zone area, for this project. In case any ground water 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.

(xviii) The Hazardous waste generated shall be properly collected and handled as per the provisions of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.

(xix) No hazardous chemicals shall be stored in the Coastal Regulation Zone area.

(xx) The waste water generated from the activity shall be collected, treated and reused properly.

(xxi) Sewage Treatment facility should be provided in accordance with the CRZ Notification.

(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.

(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.

(xxiv) No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area

(xxv) The approach channel shall be properly demarcated with lighted buoys for safe navigation and adequate 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

(xxvii) The funds earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes

(xxviii) The project proponent shall set up an organisational 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.

(xxix) Staff Colony should 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.

(ii) Adequate provision for infrastructure facilities including water supply, fuel and sanitation must be ensured for construction workers during the construction phase of the project to avoid any damage to the environment.

(iii) Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.

(iv) Borrow sites for each quarry sites for road construction material and dump sites must be identified keeping in view the following:

(a) No excavation or dumping on private property is carried out without written consent of the owner.

(b) No excavation or dumping shall be allowed on wetlands, forest areas or other ecologically valuable or sensitive locations.

(c) Excavation work shall be done in close consultation with the Soil Conservation and Watershed Development Agencies working in the area, and

(d) Construction spoils including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump sites for such materials must be secured so that they shall not leach into the ground water.

(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.

(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.

(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.

(viii) Adequate precautions shall be taken during transportation of the construction material so that it does not affect the environment adversely.

(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.

(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.

(xi) The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied to the satisfaction of the Ministry.

(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 and Forests.

(xiii) The project proponents 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.

(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.

13. These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 2006, including the amendments and rules made thereafter.

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.

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 Environmental Clearance and copies of clearance letters are available with the Kerala State Pollution Control Board and may also be seen on the website of the Ministry of Environment and Forests 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.

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.

17. Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

18. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parisad/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.

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.

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.

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.

(Lalit Kapur)
Director (IA.III)

Copy to:

(i) The Additional Chief Secretary, Department of Environment, Government Of Kerala, Thiruvananthapuram, Kerala

(ii) The Chairman, Kerala Coastal Zone Management Authority and Ex-Officio-Principal Secretary, Science & Technology Department, Sastra Bhavan, Pattom Palace.P.O., Thiruvananthapuram-695004, Kerala

(iii) The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD- cum- Office Complex, East Arjun Nagar, Delhi -110032

(iv) The Member Secretary, Kerala State Pollution Control Board, Plamoodu Jn. , Pattom Palace P O, Thiruvananthapuram-695004, Kerala

(v) The CCF, Regional Office, Ministry of Environment & Forest(SZ), Kendriya Sadan, IVth floor, E&F wings, 17th Main Road, Koramangala II Block, Banglore-560034

(vi) IA – Division, Monitoring Cell, MoEF, New Delhi- 110003

(vii) Guard file

(Lalit Kapur)
Director (IA.III)

Annexure 10

Copy of recommendation by KCZMA

(No.1285/A3/13/KCZMA/S&TD dated 24-08-2013)

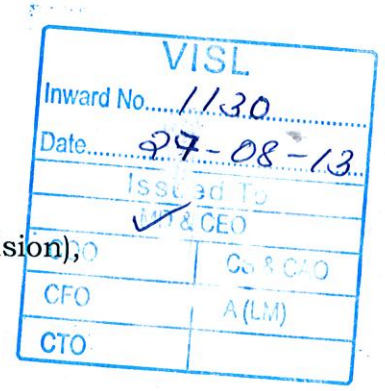
KERALA COASTAL ZONE MANAGEMENT AUTHORITY

No: 1285/A3/13/KCZMA/S&TD

Science & Technology (A) Dept.
Sasthra Bhavan, Pattom,
(Ph: 0471-2548 216, 258)
Thiruvananthapuram-4, Dated: 24.08.2013.

From

The Member Secretary, KCZMA.



To

Shri. Lalith Kapoor,
Director,
Ministry of Environment & Forests (1A-III Division),
Paryavaran Bhavan, CGO Complex,
Lodhi Road, New Delhi – 110 003.

Sir,

Sub:- S&T Department - KCZMA – Environment/CRZ clearance for the Development of Vizhinjam International Deepwater Multipurpose Seaport at Vizhinjam, Trivandrum district – recommendations forwarded - Reg.

Ref:- 1) Lr. No.VISL/CRZ/2013/619 dated 21.6.13 from the Managing Director and CEO, Vizhinjam International Seaport Ltd, Thiruvananthapuram, Kerala.
2. Decision of KCZMA in the meeting held on 27.07.2013 on item No.58.3.7

The Managing Director and CEO of Vizhinjam International sea port Ltd has furnished a proposal for Environmental /CRZ clearance under the Provisions of CRZ Notification,2011 for the development of Vizhinjam International Deep Water Sea Port Project. An earlier proposal was considered under CRZ Notification 1991 and recommended to MoEF. Being on the Sea Coast, the area has a CRZ of 500m landward from the HTL in addition to the area between the HTL and LTL, the sea and sea bed upto 12 nautical miles. The proposed construction of break waters and harbor development are permissible activities subject to the conditions in the CRZ Notification 2011. The 58th meeting of KCZMA held on 27.07.2013 discussed the proposal in

detail and decided to recommend the proposal to MoEF. Hence the proposal is hereby recommended subject to the following conditions.

(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.

(ii) Since the project envisages development of roads, infrastructural facilities, dredging of the lake and kayals proper environmental safety measures must be ensured.

(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.

(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.

(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.

(vi) The project proponent should provide necessary facilities for official of the Kerala Coastal Zone Management Authority(KCZMA) for inspection of the project site and its premises at any time.

(vii) The KCZMA may be duly informed of any construction/developmental works/major activities undertaken in the CRZ area of the project.

(viii)Environmental clearance must be obtained from the Ministry of Environment and Forests.

(ix) Adequate financial provisions has to be made for environmental protection measures.

(x) Scrutiny fee of Rs.10,00,000/- (Rupees Ten lakh only)to be remitted under the head of 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 chalan receipt in original be forwarded to the Science & Technology Department quoting this letter.

A copy of the decision of the 58th meeting of KCZMA held on 27.07.2013 is enclosed herewith for favour of perusal reference and necessary action.

Yours faithfully,

Dr. K.K. RAMACHANDRAN
Member Secretary,KCZMA

Copy to : -

The Managing Director & CEO,
Vizhinjam International Seaport Ltd. (VISL),
1st Floor, Vipanchika Tower,
Near Govt. Guest House, Thycaud.P.O,
Thiruvananthapuram – 695 014.