1. ORGANISATIONAL SET UP

The Kerala Engineering Research Institute is under the Directorate of Fundamental & Applied Research, at Peechi headed by the Director in the rank of Superintending Engineer. The Institute is under I.D.R.B of Water Resources Department under the Chief Engineer, Investigation & Design (IDRB), Thiruvananthapuram. It has two Divisions functioning at Peechi, i.e. the Hydraulic Research & Construction Materials & Foundation Engineering Division and another division namely the Coastal Engineering Field Studies Division at Thrissur, each headed by a Joint Director, an officer in the rank of an Executive Engineer.

The organizational set up of each Division is as follows:

I. Joint Director, Hydraulic Research

1. Hydraulics Division
2. Sedimentation Division
3. Coastal Engineering Division

II. Joint Director, CM&FE

1. Construction Materials Division
2. Soil Mechanics and Foundations Division
3. Instrumentation Division
4. Publications Division

III. Joint Director, Coastal Engineering Field Studies

1. Coastal Erosion studies Subdivision, Kozhikkode
2. Coastal Engineering Studies Subdivision, Ernakulam
3. Coastal Engineering Studies Subdivision, Kollam

These divisions attend to research works, laboratory testing and collection of field data related to their respective fields and present valuable results/analyses having significant implications in different fields of Civil Engineering and Water Resources Management. Each subdivision has a Deputy Director in the rank of an Assistant Executive Engineer as its head

and one or two Assistant Directors in the rank of Assistant Engineer to assist in the research activities.

The Quality Control wing attached to this Directorate is constituted for the purpose of quality assurance of works of Irrigation Department. The jurisdiction of this wing is all over Kerala. There are two Divisions at Thrissur and Kottarakkara, nine Subdivisions at Kannur, Kozhikode, Palakkad, Thrissur, Moovattupuzha, Kottayam, Alappuzha, Kottarakkara and Thiruvananthapuram and 18 sections, at Thiruvananthapuram, Kollam, Kottarakkara, Pathanamthitta, Allappuha, Idukki, Kottayam, Aluva, Moovattupuzha, Koothattukulam, Angamaly, Thrissur, Palakkad, Malappuram, Kozhikode, Kalpetta, Kannur and Kasargod.

2. PERSONNEL

The Executive officers who headed the various offices under KERI during the financial year 2014-2015 are

DIRECTOR, F & A R	:	Er.P.V.Ajayakumar (JD,F.A.C from 01/04/14 to 25/05/14)
	:	Er.Lucy.M.Mampilly (JD, F.A.C from 26/05/14 to 14/07/14)
	:	Er.Flosy Paul K. (from 15/07/14 to 21/12/14)
	:	Er.P.V.Ajayakumar (JD, F.A.C from 22/12/14 to 27/01/15)
	:	Er. Flosy Paul K. from 28/01/15
JOINT DIRECTOR, CM&FE	:	Er. Jessy Ann Francis (DD, FAC upto 08/05/14)
	:	Er. Sheeja A.Andezhathu (DD, F.A.C. from 08/05/14 to 26/05/14)
	:	Er. Lucy M Mampilly (from 26/05/14)
JOINT DIRECTOR, HYDRAULIC RESEARCH	:	Er. Rukkia V. A. up to 30/04/14
	:	Er. Laila.N.R (F.A.C. from 01/05/14 to 10/08/14)
		Er. Rosey Mathew. K. from 11/08/14 to 29/10/14
		Er. Laila.N.R(F.A.C. from 30/10/14 to 05/11/14)
		Er. Rosey Mathew. K. from 06/11/14 to 27/02/15
		Er. Laila.N.R (F.A.C. from 28/02/15 to 13/03/15)
		Er. Rosey Mathew. K. from 14/03/15 to 01/04/15
JOINT DIRECTOR, CEFS	:	Er. Ajayakumar. P.V.

DEPUTY DIRECTORS		
CONSTRUCTION MATERIALS DIVISION	:	Er. Jessy Ann Francis (up to 08/05/2015) Er. V.R. Valsalakumari (AD, F.A.C from 09/05/2015 to 01/06/2015) Er. Jessy Ann Francis (from 02/06/2015)
SOIL MECHANICS & FOUNDATION DIVISION	:	Er. Sheeja. A. Andezhathu (F.A.C. up to 03/09/14)
	:	Er. Jaicy Joseph Palayakkara from 04/09/14
INSTRUMENTATION DIVISION	:	Er. Sheeja A Andezhathu.
PUBLICATION DIVISION	:	Er. K.L.Thomas up to 13/10/2014
	:	Er. Sheeja. A Andezhathu. (FAC from 14/10/14 onwards)
HYDRAULICS DIVISION	:	Er.Sudha. M.S.
SEDIMENTATION DIVISION	:	Er. Laila.N.R.
COASTAL ENGG. DIVISION	:	Er. Aji. K.B. (excluding leave period)
	:	Er. Sudha. M.S. (FAC from 02/07/14 to14/08/14 and from 15/12/14 to 28/01/15)
C.E. SUB DIVISION,KOZHIKODE	:	Er. Muhammed Mustafa. P.
C.E. SUB DIVISION,ERNAKULAM	:	Er.Rema.M.
C.E. SUB DIVISION,KOLLAM	:	Er.Najeeb. M.up to 12/09/14
	:	Er. Subairkutty.P.M. from 12/09/14
ASSISTANT DIRECTORS		
F & A.R. (DIRECTORATE)	:	Er. Deepa. R.
CM & FE		Er. Saju Varghese
HYDRAULIC RESEARCH	:	Er. Joy. C. C.
COASTAL ENGG.FIELD STUDIES	:	Er. A.B. Jisha up to 01/10/14
		Er. P.V. Bindu from 01/10/14
INSTRUMENTATION SECTION	:	Er. Saju Varghese (FAC up to 23/01/15 FN)
	:	Er. Lalitha.P.K. from (23/01/2015FN to 31/03/15 AN)
CONSTRUCTION MATERIALS DIVISION	:	Er. Sufeera O.B
	:	Er. V. R. Valsalakumary
SOIL MECHANICS & FOUNDATIONS DIVISION	:	Er. Geetha E.S.
PUBLICATION S DIVISION	:	Er. Mini T. M.
HYDRAULICS DIVISION	:	Er. Saji Samuel (from 19/07/14)
	:	Er. Subhash K.K. (upto 30/09/14)
	:	Er. Ajithkumar T.V. (from 01/10/14)
SEDIMENTATION DIVISION	:	Er.Shini K K
	:	Er. Joy.K. Mekkattukulam

COASTAL ENGINEERING DIVISION	:	Er. T. D. Amaji upto 30/06/14.
	:	Er. Divya .C.J.
	:	Er.Snisha T.B. from 31/10/14 onwards.
C.E.S. SECTION, KOZHIKODE.	:	Er.Sahadevan Chadayan up to 29/09/14
		Er.Sivadasan A from 29/09/14
C.E.S. SECTION,THALASSERY	:	Er. Pradeep Kinathi
C.E.S. SECTION, PARAPPANANGADI	:	Er. Girishkumar K
C.E.S. SECTION, ERNAKULAM		Er. Jisha A.
C.E. SECTION , CHERTHALA	:	Er. Joseph Nelson.P.J. up to 04/02/15
	:	Er. Clament Roy. K.R from 04/02/15
C.E. SECTION, CHAVAKKAD	:	Er. Sudha P.N.
C.E. SECTION,KOLLAM	:	Er. Nidhi.S. up to 20/07/14
		Er. Shoba. N.D. from 21/07/2014 to 31/08/14
		Er. Shibu.K.Chacko from 01/09/14
		Er. Anjana.S from 01/10/14
C.E. SECTION, THOTTAPPALLY		Er. Shobha.N.D. up to 05/09/14
		Er. Shibu Chacko(FAC) From 05/09/14 to 20/11/14
		Er. P.K.Lathika 21/11/14 to16/01/15
		Er. Nidhi.S. from 17/01/15

3. HUMAN RESOURCES

THE human resources of KERI comprise of both technical and nontechnical personnel. During its prime, majority of the engineers working in KERI were post graduates in different disciplines of Civil Engineering. The number of fundamental researches carried out during the period, bear witness to this. KERI was well known all over India and abroad for the research works and experimental studies carried out at the institute, especially in the field of Coastal engineering. In the past three decades, no significant fundamental studies have been carried out and the labs have gradually degenerated to the status of mere testing centers.

At present, out of the twenty five posts of engineers, six posts are lying vacant, and out of the nineteen engineers working in KERI, just five post graduates and eleven graduate engineers have been posted. Further, the number of supporting technical staff in the category of draftsman is just nine against a sanctioned strength of thirty. In the workers category, as it happens to be a vanishing category, just two workers are available at present. Workers are hired on contract basis or on daily wages as per requirement.

However, a sincere and commendable effort is being made by the staff to take up all the projects assigned to it. The vacancy position of KERI is attached as Appendix – I.

4. FUNCTIONING OF THE INSTITUTE

THE Kerala Engineering Research Institute consists of seven divisions functioning at Peechi as well as Coastal Engineering and Field studies division and Quality Control wing of the Irrigation Department. Generally the activities of each division can be categorized as falling under Routine activities, Fundamental studies and Revamping and Modernization. The routine activities and fundamental studies conducted by each division are enumerated in this chapter.

A. HYDRAULICS DIVISION

A.1 Introduction

Studies on various problems in Applied Hydraulics, Irrigation Engineering and Flood Control are taken up by this division and propose solutions for the same. The major Irrigation and Hydro-Electric Projects in the state are undertaken only after doing model studies/ research studies by this division on that project. A wide range of aspects related to spillways, sluices, chutes, energy dissipating arrangement, operation of gate, flow condition in tail-race, silt excluding arrangements, hydraulic behavior of canal structures, river training works etc., are studied here and solutions to their specific problems are recommended. In addition, this division attends the meteorological observations relating to Peechi.

A.2 Activities of the Division for 2014-15.

- Measurement of meteorological data and maintenance of a Meteorological Station at Peechi Dam site
- Land use pattern analysis using ERDAS Imagine in the command area of Meenkara Irrigation Project
- Revised the proposal for a new administration building for KERI to Delhi Schedule of Rates – 2014
- Renovation of Hydraulic lab
- Shifting of Director's office and Joint Director Hydraulics Research'soffice.
- Other routine works such Model Area 1 & Model Area 2

A.2.1 Meteorological Station, KERI, Peechi

Weather observations are necessary to improve Meteorological services in the state and enhance the predictive capability of short and long-term information for weather forecasts and climatic changes. For the collection of meteorological data an Automatic Weather Station and a Manual Weather Station are functioning in Peechi dam premises.

An abstract of the Weather data collected from Automatic Weather Station for the period from July 2014 to March 2015 is given in Appendix – II.

A.2.1.1 Automatic Weather Station

Time series observations are vital to improve the understanding of weather dynamics and its variability. The Automatic Weather Station plays an important role in providing short term and long-term time series weather observations. An automatic weather station is functioning in Meteorological Station since July 2014 with Remote transmission facility and a Solar Panel for uninterrupted power supply.

The Automatic Weather station collects data related to Air Temperature, Air Humidity, Barometric pressure, Ultrasonic Wind speed, Ultrasonic Wind Direction, Global radiation and Precipitation using different sensors. A Data Logger which is part of the Automatic Weather Station is collecting data in every 30 minutes and transferring it to a central server in every 2 hours using multiple protocols. These data can be accessed via internet using a software HYDRAS. The data collected can be used to gauge current weather conditions and to predict weather forecasts like temperature high/lows, cloud cover and the probability of precipitation.

Components of Automatic Weather Station

1. Ultrasonic Wind speed, Ultrasonic Wind Direction & Compass
2. Global Radiation Sensor
3. Temperature , Humidity, Barometric Pressure Sensor
4. Rain Gauge
5. Data Logger

A.2.1.2 Manual Weather Station

Measurements of meteorological data are done by the following instruments and the readings are taken every day at 8.30 am.

- Temperature – Max. & Min. Thermometers & Bimetallic Thermograph
- Relative Humidity – Psychrometer (Dry & Wet bulb) & Hair Hygrometer
- Rainfall – Standard Rain Gauge, Self Recording Rain gauge

- Evaporation – Land Pan Evaporimeter
- Wind Direction – Wind Vane
- Wind Speed – Cup Anemometer
- Bright Sunshine – Sunshine Recorder

Calibration of these instruments was done by India Meteorological Department (IMD) and as per their instruction following instruments were replaced with certified instruments from IMD.

- Maximum & Minimum Thermometers
- Dry & Wet Bulb Thermometers
- Cup Anemometer
- Self-Recording Rain gauge

A.2.2 Land use pattern analysis using ERDAS Imagine in the command area of Meenkara Irrigation Project

A.2.2.1 Purpose of Analysis

With the growth of population and socio-economic activities, natural land cover is being modified for various development purposes. Land use mapping is fundamental for getting information on the existing land use which is one of the prime pre-requisites for suggesting better management of irrigation water. The present land use pattern in the ayacut area of Meenkara Irrigation Project is analysed by the digital analysis and visual interpretation of satellite image of the area using ERDAS Imagine software.

A.2.2.2 Study Area

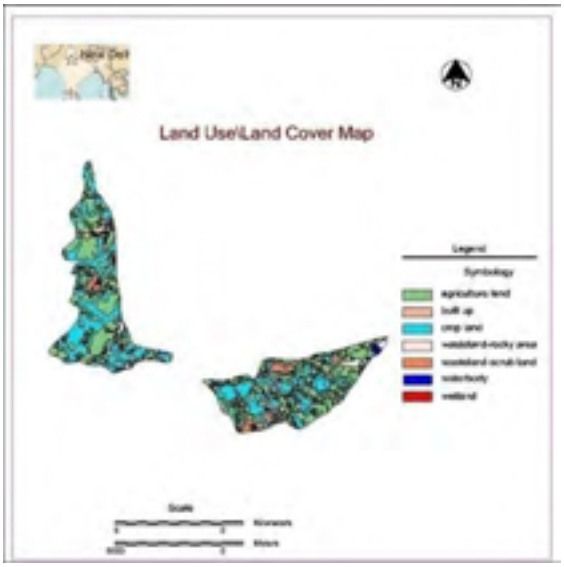
Work of Meenkara Dam comprising of stage I of the Gayathri Project commenced in the year 1956 and was partially commissioned in 1960 and completed in 1964. Agriculture is one of the main source of income of the inhabitants of this area. Paddy was being cultivated intensively in the ayacut of this project. The total benefited area of this project is 3035 ha.

A.2.2.3 Procedure

- Boundary of the study area is derived from the map of gross command area supplied by project authorities.
- Georeferenced the map.
- Downloaded Landsat Images from USGS link.
- Command area map is superimposed with satellite image
- Image Classification has been done with ERDAS Imagine and interpreted all land uses.
- Recoded all land uses as a separate image.
- Prepared Map.

A.2.2.4 Results

A mixture of land use/land cover classes like agriculture land, crop land, waste land, water body and wet land etc. were identified and mapped using visual interpretation keys such as color, tone, texture, pattern, size and shape. The land use pattern is shown in figure and their area is given in table.



Areal extend of different land use features.

Sl.No	Class	Area (Ha)
1	Crop Land (Paddy)	1383.4
2	Agricultural Land	1988.9
3	Waste Land – Rocky Area	63.4
4	Waste Land – Scrub	160.2
5	Water body	64.5
6	Built up area	195.4
7	Wetland	0.1

A.2.2.5 Limitations

- The satellite used is a free downloaded one and its accuracy is questionable
- The study area is identified and georeferenced from a line sketch provided by project authorities. It was not linked with GTS map.

A.2.2.6 Recommendations

- Field survey has to be conducted at least over 20% of the study area and based on the ground truth data, land use/land cover map to be corrected and finalized
- High resolution satellite maps to be used for more accurate results

A.3. Other Activities

- Er. Saji Samuel presented a paper on "DPR Preparation for WRD projects with the help of Remote Sensing Techniques" in the monthly seminar programme of KERI

B. COASTAL ENGINEERING DIVISION

B.1 Introduction

Coastal Engineering Division conducted has several research works on coastal protective works, experimental study of wave run up on beaches, experiments to evolve suitable artificial blocks, study on mud banks, wave action on beaches, waves and currents, littoral drifts, artificial nourishment etc. The model study of fishing gaps, design of fishing harbours like Mopla bay, Ponnani, Vizhinjam etc. were also conducted in this division during the late 70's and 80's. In order to understand the processes at work on Kerala Coast, collection of wave data and beach characteristics has been done all along the Kerala coast in the new moon day of all month. In KERI, simultaneous observations are conducted at two points at Padinjare Vemballore and Anchangadi in Kodungallur Taluk upto Dec 2013. As a part of the modernization of KERI a "Smart Station" equipment has been purchased in KERI and has been transferred to this division as per the order of the Chief Engineer (IDRB), Thiruvananthapuram. So in future this division will take up more investigation works using the newly procured instrument.

During the year 2014-15, this division has taken up the following works.

B.2 Routine activities of the Coastal Engineering Division for 2014-15.

B.2.1 Routine activities of the Coastal Engineering Division office

The above work has been included in the action plan for meeting the various requirements of this office. The provisions were for the maintenance and repairing of computer and related items, purchasing of computer related items, Replacing the damaged cable and casing pipe of BSNL broad band connection from Hydraulics office to Coastal Division office, Purchasing stationary items, Purchasing Electrical items and repairing works etc. Most works has been done using the allotted fund. The balance works will be done in the next financial year.

B.2.2 Routine activities of the office of the Director, F.& A.R. and Joint Director, Hydraulic Research

This project was for meeting the various requirements of the offices of the Director, F.&A.R. and Joint Director, Hydraulic Research for the routine activities. The provisions included in the estimate were the purchase of computer related items, maintenance and repairing of computer and related accessories, Purchasing of a 2KV Offline UPS and 12V 100AH Battery and Purchasing stationary items etc.

B.2.3 Maintenance of the model area of the Coastal Engineering Division

The surroundings of the model area of Coastal Engineering Division are full of light, thick and thorny jungle. So it is necessary to clear these jungles, so as to keep the model area clean. Routine cleaning and clearing the inside of model trays are also essential. Hence provision for clearing light jungles, thick and thorny jungles twice a year and cleaning of model trays are included in this work and has been done successfully. Shifting of the motor in the model area from the office to the store of the Hydraulics division has also been done.

B.3 Revamping and modernization of the Coastal Engineering Division for the year 2014-15.

B.3.1 Purchase of a new laptop for the Smart Station and a new software for the mapping of the measured data of the Smart Station.

The Smart Station equipment which has been purchased as a part of modernization of KERI has been transferred to the Coastal Engineering Division. Using Smart Station, the investigation works can be done effectively and fastly by using the GNSS satellite receivers and the Total Station. Using the acquisition software installed in the equipment, the data can be acquired more precisely by applying several conversions with respect to the WGS 1984 datum and the area and volume calculations also can be done.

By using the processing software supplied with the equipment, the data from the instrument can be processed to centimeter level accuracy. But for generating reports and maps, a mapping software is essential. By using this advanced surveying equipment, several investigation works of various departments can be taken up in future. Hence a software which can generate the plan, cross and longitudinal sections, 3D models at different angles,

contours and which can transfer data from one co-ordinate system to another, do triangulation at user defined scale, etc. has been purchased, which will be very much useful for complete utilization of the data from the instrument.

There was provision for a new laptop which is also essential for installing the software and for doing the processing of data in the field itself. But this could not be purchased due to non availability of fund.

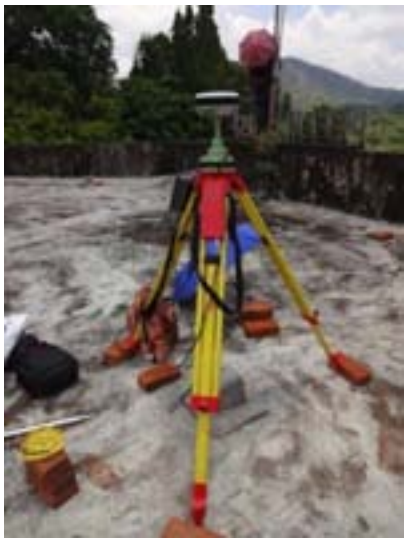
B.4 Fundamental Studies using Smart Station.

B.4.1 Investigation of Bharathapuzha River basin from Parali to Pattambi

Even though this work has been included in the action plan it could not be done due to various reasons.

B.4.2. Fundamental studies using Smart Station - Conducting Investigation using Smart station for determining the 3D profile of Peechi Dam and the road survey from Mannuthy to Peechi.

The Smart Station equipment which has been purchased as a part of modernization of KERI has been given to the Coastal Engineering Division. Using Smart Station the investigation works can be done efficiently by combining the conventional Total Station with GPS. So the work for determining the current profile of the dams Peechi, Meenkara, Pothundy, Chulliyar and Mangalam using the newly procured instrument has been included in the action plan for the year 2014-15 with. But the Chief Engineer (IDRB) has directed to do the survey work of Peechi Dam to find the 3D profile and the road survey from Peechi to Mannuthy. So the above work has been done and mapped. The 3D view of the Dam and the total plan of Dam, Garden and the roads in the KERI campus have been prepared.



Base Unit

Rover Unit

Total Station and Prism


DISTRICT TOURISM PROMO

C. SEDIMENTATION DIVISION

C.1 Introduction

The main function of this division is to conduct the sedimentation survey of dams and other water bodies using appropriate technology. In the past, the capacity of reservoirs used to be calculated by carrying out hydrographic surveys using sounding rods. Presently the sedimentation survey is being carried out using Integrated Bathymetric System. This system consists of DGPS Leica MX-400 (Mobile Station), NS-415 Echo-sounder, Sound Velocity Probe, Survey PC (Laptop), Survey software viz., Navisoft survey software and Surfer software.

C.2 Activities of the division during 2014-15

C.2.1. Sedimentation Survey of Peechi Reservoir (Pilot Study) Using Sub Bottom Profiler

BACK GROUND OF THE PROJECT

Sedimentation Division, of KERI conducts studies to compute the present capacity of reservoirs and other water bodies. Such studies are conducted using modern electronic equipment called 'Integrated Bathymetric System' (IBS). In 2004, KERI completed 21 studies with this IBS including Mullaperiyar and Vembanad Lake. In order to ascertain the availability of water and to estimate the siltation a new equipment called Sub Bottom profiler was purchased. As a pilot study using this equipment Peechi reservoir was selected.

The Chief Engineer, Irrigation Design and Research Board instructed Kerala Engineering Research Institute (KERI), Peechi to conduct Sedimentation survey of Peechi Reservoir (Pilot study) using Sub Bottom profiler.

KERI constituted a team consisting of

1.	N.R. Laila	Deputy Director
2.	Shini K.K	Assistant Director
3.	Joy.K. Mekkattukulam	Assistant Director
4.	Francy .V. Antony	Research Assistant

The work was started on 1/12/14 and completed within10 days.

Salient Features

Peechi Project

1.	Name	:	Peechi
2.	Location		
	Longitude	:	76^{o} 24' E
	Latitude	:	10^{o} 20' N
3.	Year of starting	:	1948
4.	Year of completion	:	1957
5.	Type of Dam	:	Gravity type with Rubble Masonry
6.	Maximum Water level(FRL)	:	79.25m
7.	Catchment area	:	107.09 Sq.km.
8.	Dead storage	:	$2.28Mm^3$
9.	Water spread area	:	12.95.Sq.km.
10.	Maximum Storage	:	110.436 M.Cum
11.	Maximum water level	:	26.52m from MSL
12.	Live Storage	:	108.150M.Cum
13.	Dead Storage level	:	53.34 m
14.	Length of Dam	:	213.360m
15.	Bed level of Dam	:	29.620m
16.	Crest level of Spill way	:	76.20m
17.	Top level of Dam	:	80.470m
18.	Top width of Dam	:	4.270m
19.	Size of Spillway	:	10.06m x 3.95m
20.	Type of Spillway	:	Ogee overflow type
21.	Purpose	:	Irrigation and drinking

Canal System

Irrigation Outlets	Sill Level	Size of Outlet	Discharge
Right Bank	+56.390.m	1.220m@	7.08 cum.
Left Bank	+67.060.m	0.910.m@	3.54 cum
Thrissur Water Supply	+53.340.m	0.610.m@	

Canal System

i)	Right Bank Canal		
	Total Length of Main Canal	:	37Km.
	Bed Width of Main Canal	:	3.66.m.
	Total Length of Branch Canal	:	75.64Km.
ii)	Left Bank Canal		
	Total Length of Main Canal	:	45.06Km.
	Bed Width	:	3.66 to 2.74.m
	Total Length of Branch Canal	:	65.98Km.

INTEGRATED BATHYMETRIC SYSTEM

i) The System

Traditionally reservoir sedimentation has been studied by carrying out bottom topographic survey using boat, sextant, ranging rods, echo-sounder etc. Naturally, this involved lot of time and the outcome was susceptible to human error because of monotony of work.

Integrated Bathymetric system has been found to be an ideal solution to all the above rigorous work. The system consists of modern sophisticated electronic equipments. Data collection, processing and calculations are done by means of computer software. The results are more accurate than the Conventional survey methods.

ii) Equipments used

a) **Sub Bottom Profiler**

The system SES-2000 sub-bottom profiler, which is a mobile parametric sediment sounder, was used for bathymetric and sub-bottom profiling survey. The SES - 2000 hardware component and transducers are shown in Figure. The compact design with a user-friendly control unit allows the survey even in small and shallow waters with all the advantages of the parametric acoustics, viz. small beam width at low frequencies, deep penetration with high resolution of layers and objects, and accurate depth measurements with high frequency. The system offers the possibility to store data digitally and also gives reliable results during

online data processing. The system is primarily designed for shallow geophysical surveys. The tolerance of the system for 100 kHz frequency is 0.02 m + 0.02% of water depth and for 10 kHz it is 0.04 m + 0.02% of water depth. The compact design without integrated industrial PC components results in an affordable and reliable instrument for sub bottom profiling applications.

Both the primary high frequency (HF) signal (100 kHz) and the secondary low frequency (LF) signal (6–12 kHz) are recorded. Penetration can reach up to 50 m in soft sediments. Advantages of the parametric acoustic system include: (i) narrow beam width at low frequencies; (ii) deep penetration with high resolution of sediment layers and objects, and (iii) accurate depth measurements with the high frequency signal. The variant SES-2000 compact is designed for shallow water depth applications near the shore and inland waters down to 400 m.

Top - side Unit

Transducer

b) **Differential Global positioning system (DGPS)- Leica MX 9525**

(Reference Station) with UHF transmitter link along with choke-ring Antenna forms stationary part of DGPS. It can track up to 12 satellites to achieve accurate position.

c) **DGPS Leica MX 420 (mobile station)**

DGPS Navigator (Refer Plate.2) is one such highly reliable, accurate, state of art device to get position by observing satellite. It can also track up to 12 satellites to achieve maximum positional accuracy. The DGPS receiver receives error correction from reference station and combines them with the received satellite signals to compute much more accurate self

position. The validity of error correction decreases with the distance from the reference stations, however they are valid up to 80 Km. The accuracy in position is less than 1m.

Plate-2 MX 420 Navigation System

d) **NS-415 Echo-sounder.**

Navitronic Echo-sounder NS 415 (Refer Plate- 3) is designed to measure under water depth up to 1200m. Accuracy of instrument is 1centi meter. A dual frequency echo-sounder is specified to distinguish between fluff top depth and the consolidated bottom. The high frequency (200 KHz) is used to detect the top of the mud/sediment. Under favorable conditions the low frequency signal (33 KHz) can penetrate into the bottom and reveal information about the bottom structure.

Plate-2. NS- 415 Echo-Sounder

e) **Mobile station**

The mobile station setup is mounted on 'Fibre Reinforced Plastic' (FRP) boat (Plate.5) having two 60 HP petrol out board engines. The boat has dimension of 7.5mX 2.66mX 1.20m and 8 person capacity with the equipments.

Plate- 5 Mobile Station (FRP Boat)

f) **Data Collection System**

The Data Collection system consists of a Laptop (DELL) loaded with Navisoft Survey software. The Navisoft survey module collects the depth data from the echo sounder which is linked with the position data. This is collected at every 100 meters interval and logged as ".PRD" format data for further analysis. Navisoft is the software used to plan and collect the data for data processing, which runs in the lap top and collects data through serial port at 9600 baud rate.

iii) Software

1. **Navisoft survey software**

This software is used for data collection and processing.

The Bathymetric software supports NMEA 0183 compatible devices. Local grid UTM (WGS-84) is the projection that is supported by the software.

2. **Surfer software**

Surfer is a graphic program used for calculating the volume based on the logged data.

3. **SESWIN for data acquisition in SES 2000**
4. **I.S.E. 2.9.2 Post Processing Software**

iv) Data Collection

The mobile station consisting of the GPS antenna, Echo sensor, UHF antenna is setup on FRP boat (Fig 5) with help of mechanical fixture. Proper connections are done to the GPS, Echo sounder and to the Laptop. The transducer of sub bottom profiler was fixed with help of mechanical fixture connected at the left side of the boat, which will allow the sensor to collect true depth, and away from wave noises. The boat was sailed along the track, wherever possible maintaining a speed of 3 to 4 knots. The depth of water and its corresponding position is recorded successively at each point. The software enables generation of depth profile and overviews using the data recorded. Fig 6 below shows the echo sounder along with the data being logged into the Laptop.

In this study, we used a new equipment the **SES-2000** parametric (non-linear) dual frequency echo- sounder. The instrument simultaneously transmits two signals of slightly different high frequencies; their interaction creates a new low frequency signal. It has a large bandwidth and a short signal length, which allows good use in very shallow water and results a high (~15 - 20 cm) vertical resolution at acceptable sub-bottom penetration up to 10 m or more. Some favourable near sub-bottom seismic and geological conditions permit to achieve a vertical resolution up to 10 cm. Parametric (non-linear) sound generation allows designing acoustical systems with small transducer dimensions and narrow sound beams at low frequencies. An Innomar SES-2000 parametric transducer has an active area of 20 by 20 cm and provides a beam width of less than four degrees (at 3dB), valid for all adjustable low frequencies between 5kHz and 15 kHz. The transmit directivity of the parametric sound beam does not show any significant side lobe characteristic, which reduces ambiguities during the interpretation of individual reflectors. Short transmit signals of single sinusoidal cycles without any ringing and high ping rates of up to 50 pings per second are further

advantages. They contribute to a high spatial resolution of this acoustical system and permit to apply it in a shallow basin. Innomar's software tool ISE provides near real-time processing of the collected SES data. The operation procedure can be tuned on-line. A value of the sound velocity in water is used to convert sound travel time to the depth. The depth values are screened online. Some advantage of the SES-2000 parametric (non-linear) dual frequency echo-sounder is the survey of small water reservoirs, which often requires the collection of sub-bottom data from small boats in water depths of down to one meter and to resolve thin layers of recent sedimentation due to damming. Furthermore, the determination of near surface structures, e.g. shallow fault zones, is of interest at the same time and can be achieved with the application of such a mobile parametric profiler system.

Fig.6 Data Collection Setup inside the boat

v) About the Study area

1. Location

The Peechi Reservoir is situated in Thrissur District of Kerala State, about twenty km towards east of Thrissur. The bearing of the dam site is 10^0 20`N and $76^0$ 24`E.

The investigation of the scheme was started in July 1944. The work of masonry gravity dam at Peechi was started in 1948 and formally commissioned in 1957, soon after the formation of the Kerala State.

The Peechi irrigation Project is one of the major irrigation project that utilizes the water of Manali River, one of the tributaries of Karuvannur River. It comprises of a storage reservoir at Peechi, two main canals, and a system of branch canals which criss-cross the ayacut.

Peechi Project

The location map of the area is shown in fig.

Location Map of Peechi Reservoir

2. The River

The Manali starts from the Vaniampara hills of the Western Ghats. The river flows for about 48km before joining the Kurumali River, near Arattupuzha. These two rivers together from

the Karuvannur River which drains into the Arabian Sea. The terrain in the upper reaches of the Manali river consists of six valleys, namely Cherayar Valley, Plachivakkom Valley, Pothumada Valley, Olakara valley, Thalikkuzhi Valley, and Pulakkal Valley which joins near Peechi.

3. The Catchment

The catchment of Manali River is comprised of a number of hills one behind the other. The major portion of the catchment area is forest land with abundant growth of trees and plants. The area of the catchment is 107.09sq.km. The catchment area map is shown as fig.3. The steepness of the terrain plays an important role in silt formation. The temperature is also an influencing factor in soil development of the catchment. The soil moisture varies with the season. During rainy season heavy rains are usual but floods do not occur usually. The soil developed under natural vegetation have been altered due to dense farming activities, encroachment into the catchment, cattle feeding etc., are some other reason for siltation.

4. Land Use Pattern

The tract, comprising of a number of islands, big and small is considered as a unique feature of the catchment. These lands get submerged at full reservoir level, but reappear on the depletion of the reservoir. Some of the portion of the hill sides and dry areas have already been encroached for cultivation and coconuts, areca-nuts and other fruit bearing trees have been raised and houses built. The scheme was expected to supply irrigation water for 4856 Ha of garden lands, 1618 Ha of single crop paddy fields to be converted to double crop paddy fields, 4647 Ha of existing double crop paddy fields and 8094 Ha of Kole lands.

5. Hydrology

The Manali River has its source in the Western Ghats and has a catchment area of 107.09 Sq. Km above the Peechi dam site. Both the South – West and North- East monsoon contribute to the rainfall and run-off in the catchment. However the bulk of the rainfall is from June to September during the period of South-West monsoon. More than 70 % of the annual rainfall is contributed by the South-West monsoon and the rest by the North- East monsoon rains. The rainfall is quite intense during July and August, the wettest months during South-West monsoon in most of the years. Heavy downpour causes soil erosion.

vi) Process of Sedimentation

During the monsoon, the run-off brings a portion of the loose top soil to the reservoir causing siltation. Steepness of the terrain also adds the silt formation Cultivation by encroachers; deforestation and fire in the catchment are other reasons for siltation.

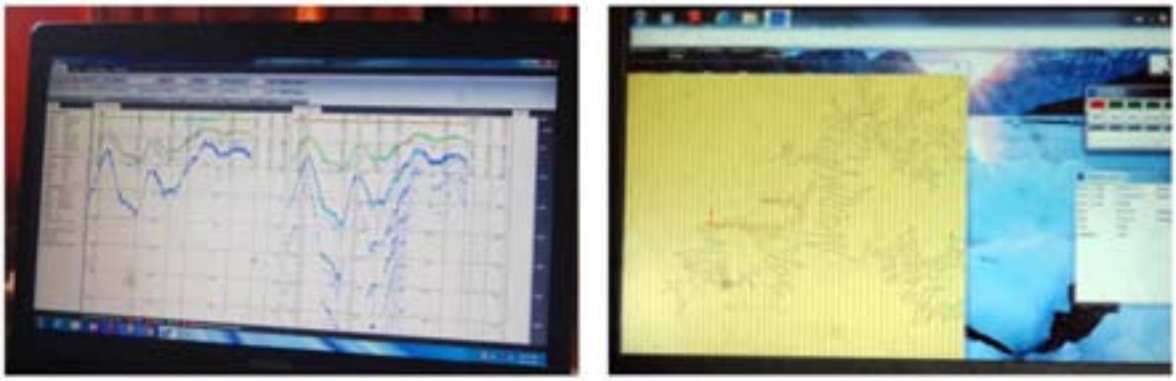
vii) Purpose of Sedimentation Studies

Erosion, transportation and deposition of sediment are natural process controlled by geologic, climatic, vegetative and other conditions through times. However, in this area man made problems are the main reasons for the silt formation. The main purpose of the Peechi reservoir is irrigation. A part of the storage is also utilized for supply of drinking water. Any reduction in the supply of water will affect the agricultural operations and drinking water supply. Therefore it is essential to conduct sedimentation surveys at regular intervals to ascertain the extent of damage caused by reservoir silting and to consider the methods available for computing the changing water holding capacity of reservoir.

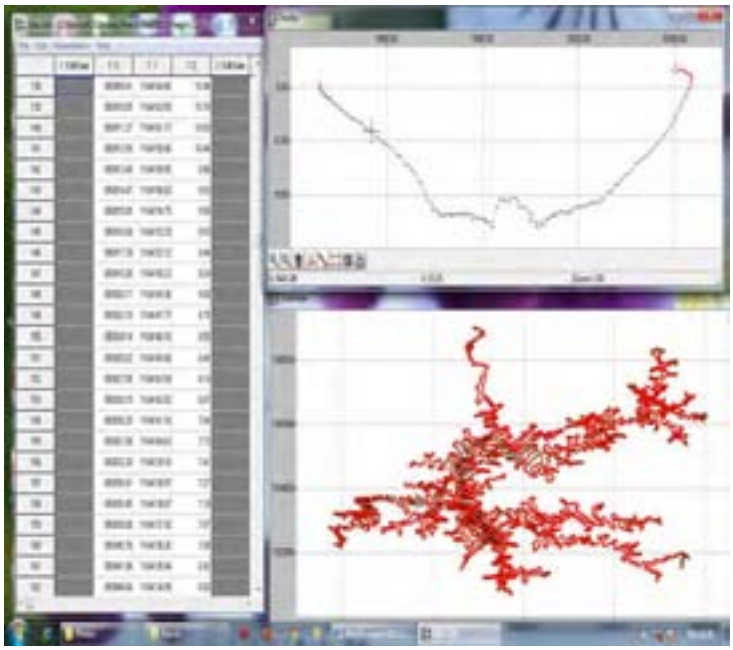
viii) Hydrographic Survey

The reference station was fixed at the Peechi House. All the settings were done in the mobile station for the survey.

Using survey module planning and presentation was done by entering the position as UTM (Universal Transverse Mercator:- A special transverse Mercator grid which divides the world in to 6^0 zones of Longitude.) co-ordinate, and drawn reference line, with respect to this reference line, parallel lines are drawn at an interval of 100m to cover the entire lake The survey was conducted along the predetermined segment lines after setting the data logging software to record the readings at 2m intervals. The boat was sailed along the track maintaining a speed of 3 to 4 knots. The depth of water and its corresponding position is recorded successively at each points. The software enables generation of depth profile and overviews using the data recorded. The data is then edited to eliminate spurious readings caused due to violent winds and waves.

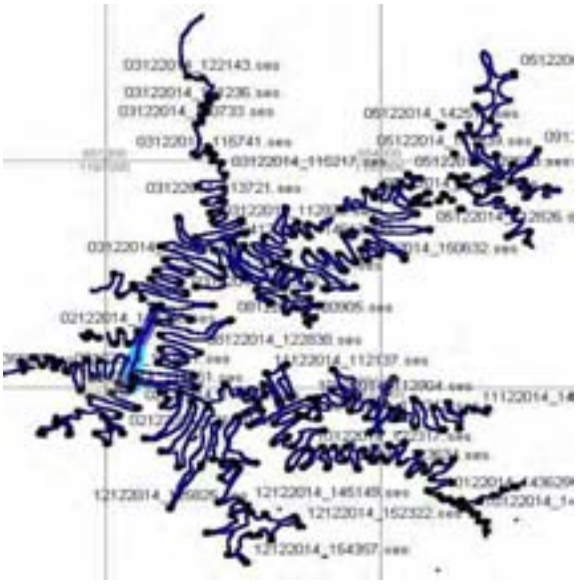


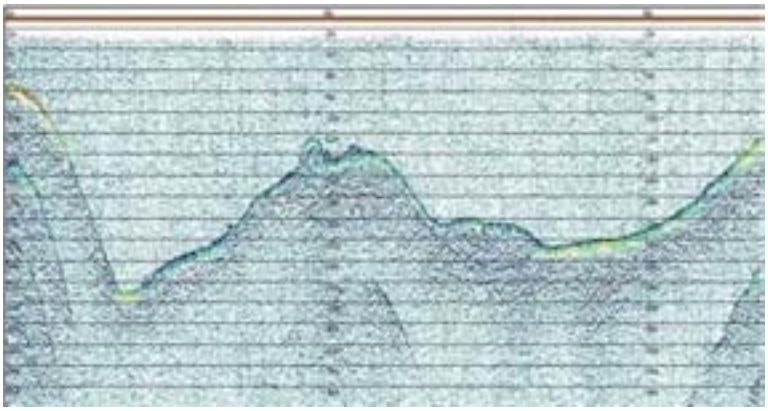
Data collection in Sub bottom profiler



Data logging in Survey Module

The edited data are then transferred to surfer using Data Exchange program. This exchanged data converts in to grid data by triangulation with linear interpolation method.





Sub bottom Profile of Marked portion

Report is under preparation

C.2.2 Sedimentation study of Malampuzha reservoir using Sub Bottom Profiler

The Malampuzha Irrigation Project is one of the major completed projects of Kerala having a net ayacut of 21,045 hectares. The main purpose of this project is Irrigation and drinking water supply for the Palakkad town. The reservoir is formed by the construction of a gravity type masonry dam across the Malampuzha, which is a tributary of the Bharathapuzha.

The original capacity of the reservoir is 226Mm^3 and dead storage capacity is 2.40 Mm^3. The water spread area of the reservoir is 22Km^2.

i) Location

The Malampuzha has its sources in the hills on north of Palakkad Taluk and extending up to the boundaries of Coimbatore District of Tamilnadu State. The reservoir lies in the longitude 76°40'9922"E and Latitude 10°50'0183"N in Palakkad District and reservoir is about 8 Km. North East of this town.

ii) History of the project

The Malampuzha Project was under the consideration of the erstwhile Madras Presidency since 1914. Hydrological data of the Malampuzha is available from 1916. The project was partially commissioned in 1955. Though the reservoir started impounding in 1955, the project as in the present form was completed in 1966. There are a number of big and small islands in the reservoir.

iii) The catchment

The catchment area of the reservoir is 147.6322 Km^2. The catchment is comprised of a number of folded hills one behind the other. A major portion of the catchment area is Reserve forest. The forest vegetation was expected to prevent both erosion of soil and weathering of rock, and to reduce the sediment loads coming to the reservoir. The catchment map is given in Appendix-4.

iv) Geology

Rocks forming the hills in the catchments area and its neighbourhood are of granitised compact type having few fissures and weak zones. In some parts of the catchment, alluvial rock is seen.

v) Hydrology

Both the South-West and the North-East monsoons contribute the rain fall and run off in the catchment. The major part of the rainfall is during the months June to September. About 70% of the total rainfall of the year is contributed by the South-West monsoon and the rest by the North-East monsoon. From the available data, it is seen that the rainfall is quite intense during July and August in most years. Heavy downpour enhance the risk of soil erosion in the catchment.

vi) Process of Sedimentation

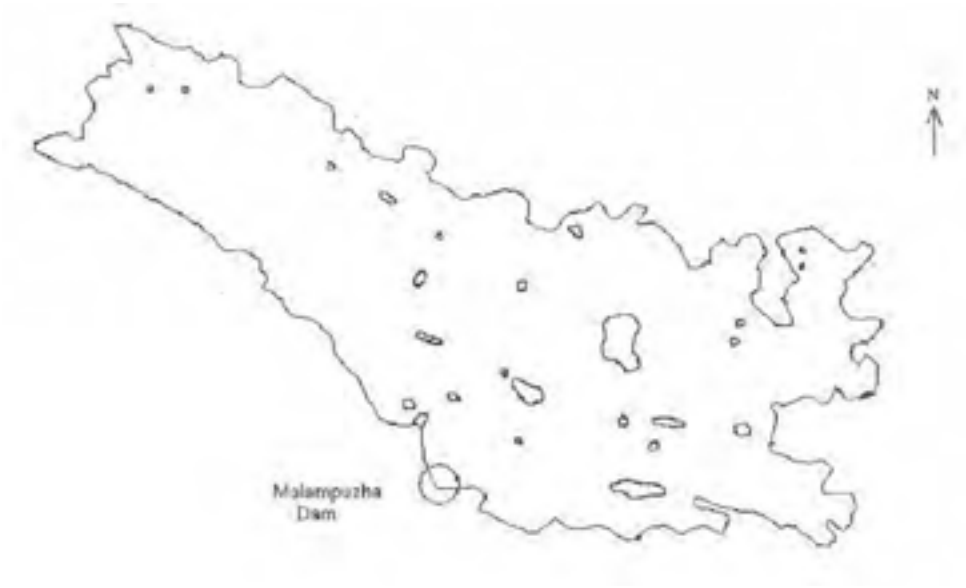
During monsoon, the run-off brings a good portion of loose top soil to the reservoir causing siltation. In addition, cultivation by encroachers and deforestation in the catchment adds to the sedimentation process. The wide gap in the Western Ghat mountain in Palakkad District allows the dry winds from the Deccan Plateau to sweep across the district. Malampuzha situated in the mouth of the gap has a greater impact due to the tunnel effect. These wind generate waves in the 22 km^2 lake which hit against the banks accelerating the erosion at the water's edge. High winds and waves were encountered during the survey. The fluctuating water levels of the reservoir cause the wave action to carve out the lake's edge at all the different levels.

Salient features

MALAMPUZHA PROJECT

1.	Name	:	Malampuzha
2.	Location	:	
	Longitude between	:	$76^o39'$ and 76^o 42'E
	Latitude between	:	$10^o40'$and 10^0 55'N
3.	Year of starting	:	1949
4.	Year of commissioning	:	1955
5.	Year of completion	:	1966
6.	Type of Dam	:	Straight gravity Masonry dam and Earthen dam of zonal type
7.	Length of Masonry Dam	:	1849m
8.	Length of Earthen Dam	:	222.20m
9.	Maximum height of Dam	:	38.10m
10.	Catchment area	:	147.63km^2
11.	Maximum Storage	:	226Mm^3
12.	Dead storage	:	2.40Mm^3
13.	Water spread area	:	22Sq.km
14.	Purpose	:	Irrigation and drinking water supply at Palakkad town.

Location Map



FRL Map of Malampuzha Reservoir

Report is under preparation

D. CONSTRUCTION MATERIALS DIVISION

D.1. Introduction

Construction Materials Division, functioning in K.E.R.I., is basically a material testing laboratory. In addition to conducting routine tests on building materials, the division has developed the capacity for conducting fundamental and applied research in related fields. This division takes up consultancy work such as concrete mix design and projects from clients and also imparts training for laboratory staff on request.

In addition to this an NDT lab has been set up. This lab is equipped with rebound hammer, Rebar locator and Ultra sonic pulse velocity meter. These non destructive tests are being conducted to check the strength and deformation characteristics of existing structure.

Hundred and twenty one test reports were produced from this division in the year 2014 collecting a revenue of Rs.4,72,000/-. These materials were brought by various governmental as well as private entities. Materials involved in testing were; cement, concrete, bricks, rocks, tiles, paver blocks, aggregates and steel. The work also involved designing of concrete mixes done for private and Government agencies.

A training programme for the staff of Engineering College had been arranged. Seven Staff of Department of Civil Engineering, Government Engineering College, Thrissur and two each from Amal Jyothi College of Engineering, Kanjirappally and Lourdes Matha College of Science & Technology, Thiruvananthapuram attended "Training for laboratory Experiments on Construction Materials" @ Rs.9000/- per head, conducted from 15/12/2014 to 20/12/2014. Rs. 48,400/- (11 X 4400) was remitted to Treasury as revenue.

Apart from these, a fundamental study is being conducted on the reliability of accelerated curing method for speedy design of concrete mixes.

D.2 Tests conducted

Details of tests conducted during the year 2014-15 are given in Appendix – III.

Ultrasonic Pulse velocitymeter

E. SOIL MECHANICS AND FOUNDATIONS DIVISION

E.1 Introduction

Soil, the most unpredictable of all engineering materials also happens to be the all important material in civil engineering because all structures need to be founded on earth. In addition to being the founding medium, soil is also used as a material of construction. As in the case of other materials, properties of soil cannot be generalized since basically soil is a combination of different constituents having different properties. Therefore the study of the technical and structural aspects of soil is all important.

Major difficulties encountered in foundation work are due to the nature of soil. The investigation for any foundation engineering problem may range from a simple examination of soil to a detailed study of the soil and ground water by means of bore holes and laboratory tests on the materials encountered. The extent of the work depends on importance and foundation arrangement of structures, the complexity of the soil conditions and already available information of existing foundations on similar type of soils.

The physical characteristics of soils can be investigated by means of laboratory tests on samples taken from boreholes or trial pits. Results from lab tests can be used to derive important parameters in the design of substructure. The results of shear strength tests can be used to calculate the ultimate bearing capacity. Soil parameters so obtained by means of investigations can be utilized to design safe structures.

Soil Mechanics Laboratory under K.E.R.I. is fully equipped to determine the index as well as the engineering properties of soil samples and the engineers in charge are trained to provide recommendations if all necessary structural details are given. It covers Soil Mechanics, Soil Dynamics, and Ground improvement Techniques. The soil mechanics laboratory undertakes work from Government agency and private agencies.

Analysis of engineering problems such as bearing capacity computations, settlement analysis, stability analysis of slopes etc. are taken up by this Division. Instrumentation and analysis of seepage data from various Irrigation Projects are also taken up.

The work is spread out into the following stages.

1. Pre-construction stage

During investigation, the soil samples are collected and tested in the laboratory, for index properties and engineering properties like MDD, OMC/FMC, Permeability, Shear parameters, Consolidation and Swelling characteristics and relevant parameters are furnished to design the proposed structures. The laboratory is assisted by the Instrumentation Division which is equipped with field testing equipment for boring to collect undisturbed soil samples. Field tests like Plate Bearing Test, Standard Penetration Test, and Dynamic Cone Penetration Test to assess the in-situ characteristics of sub-soil are also carried out.

2. Post construction stage

Measurement of seepage through earth dam, inspection and investigations of causes of slips and breaches of canal and dam embankments are taken up and remedial measures are suggested.

All the tests on soil samples received from various projects of Irrigation Department, Roads and Buildings, Panchayat Raj, Public Health, Kerala State Electricity Board, Housing Board and Non-Government bodies are being tested as per the codes of Bureau of Indian Standards.

E.2 Infrastructure

The important equipments available in the laboratory are

- Direct Shear Test apparatus (for both large & small boxes)
- Tri-axial Shear Apparatus
- Consolidation Apparatus
- Uni-axial testing Apparatus
- Constant head permeability test apparatus
- Variable head permeability test apparatus
- Laboratory CBR test apparatus
- Field CBR test apparatus

E.3 Trainings Attended

E.3.1 Smt. Geetha E.S., Assistant Director attended training/demonstration on Smart Station conducted by Coastal Engineering Division, KERI, Peechi on 3rd and 4th June, 2014.

E.3.2 Smt. Geetha E.S., Assistant Director attended training on ERDAS Software conducted by Hydraulics Division, KERI, Peechi on 6th and 7th March, 2015.

E.4 Training Conducted

E.4.1 Two days Training/Demonstration programme was conducted on "Engineering Seismograph" for the Engineers under the Division of CM&FE, KERI, Peechi, at Peechi campus from 5 to 6 of May, 2014.

E.4.2 Two days Training/Demonstration programme was conducted on Geo-physical surveying by Seismic refraction method by the support of Publications Division at Peechi&Mannannur from 10th to 11th of February, 2015.

E.5 Field Investigation

E.5.1 Establishment of Coast Guard Academy at Azhikkal in Kannur district

E.5.2 Construction of series of check dams across Panamaram and Mananthavady River in Wayanad District – Site inspection conducted.

E.6 Conducting Topographical Survey using Total Station

E.6.1 Topographical survey of D/S of Vazhany Dam was conducted.

E.6.2 Conducting topographical survey of Puzhakkalthodu at U/S and D/S of proposed Regulator using Total Station.

E.6.3 NABARD RIDF XIX – Construction of Regulator across Bharathappuzha at Chenganamkunnu in Ongallur Panchayathu in Palakkad District - Conducting Total Station Surveying

E.7 Conducting Pile Integrity Test Using Pile Echo Tester

E.7.1 Construction of Regulator cum Bridge across Payaswini River at Pandikandam in Bedadka Panchayath in Kasargod District - Conducting Pile Integrity Test

E.8 Conducting Geo-Physical Exploration Using Engineering Seismograph

E.8.1 KRP – Construction of Padinjaraveedu Branch Canal from Ch.740m to Ch.1410m - Investigation conducted using Engineering Seismograph.

E.8.2 Investigation of Subsoil strata using Engineering Seismograph–Construction of Check Dam across Bharathappuzha at Mannannur in Vaniyamkulam Panchayath.

E.9. Case Study

E.9.1 KRP-Construction of Padinjaraveedu Branch Canal from Ch.740m to Ch.1410m - Investigation conducted using Engineering Seismograph.

E.10 Fundamental Studies

E.10.1 One fundamental study, “Conducting a study on co-relation between grain size distribution/specific gravity, OMC and CBR value” has been proposed and data for the study were collected. Analysis is to be conducted

E.11 Laboratory investigation

Laboratory investigations on soil samples brought to the lab is a part of routine works in the division. The list of woks carried out in the lab during the current year is given in Appendix–IV.

E.12 Ongoing Works

1. Pambar Basin – Chengalar Scheme –Pattissery dam – Physical and Chemical Properties of Cement Sand Bentonite core Earth Dam
2. KSSDA – Construction of seed go down and processing plant – Kannara
3. NABARD RIDF XVI- Construction of Regulator across Payaswinin River at Pandikkandam in Bedadka Panchayathu in Kasaragod District – Testing of Soil Samples.
4. Soil stabilization using bagarse ash – Holy Grace Academy of Engineering, Mala.
5. Conducting Tri-axial Test – Part of Project of final year student from Royal College of Engineering & Technology, Akkikkavu.

F. INSTRUMENTATION DIVISION

F.1 Introduction

Instrumentation Division acts as the mobile unit of SM and conducts various field tests. Site investigation is essential for judging soil suitability for proposed engineering work and preparing adequate design. It also helps for selecting suitable and economic construction materials as well as methods. Site exploration reveals reliable information about soil and ground water which will help the Engineer for an intelligent planning.

Soil samples are taken from sites on request and are transferred to Soil Mechanics and Foundation Division for testing. The following field tests are conducted by this division.

1. Plate Load Test for finding out the bearing capacity of soil.
2. Pile Load Test for determining the bearing capacity of pile.
3. Standard Penetration Test.
4. Dynamic Cone Penetration Test.
5. Collection of disturbed and undisturbed soil samples by hand auger and machine boring.

F.2 Activities

The soil investigation works carried out by this division during the year 2014-2015 is given in Appendix–V.

DCPT work in progress at Azheekkal

Boring work at Puzhakkal Thodu

Boring work at Bhoothathankettu

F.3. Infrastructure

The important equipments and accessories available are

- Equipments for hand augering.
- Diesel boring plant
- Tractor with Trailer
- Pontoons
- Steel stools

G. PUBLICATIONS DIVISION

G.1 Introduction

This division acts as the information bureau of the Kerala Engineering Research institute and provides necessary technical information to all other divisions through its technical library. Around 10,000 books and a number of latest periodicals are available in the Library for reference. An Engineering Museum consisting of the models of various completed irrigation projects, important bridges etc is maintained by this division and these replicas are informative references for the technical persons and students. The three dimensional model of Kerala, known as the relief map of Kerala is a centre of attraction for people from any sector of life. This model is built to a scale of 1/16,000 horizontal and 1/1000 vertical and is

absolutely of a unique configuration and is being maintained by this division. Seminars and training programmes are being conducted by this division for the benefit of staff of the Institute. Trainings and refresher courses are conducted for the staff of the Irrigation department also.

G.2 Activities of the Division during the current year

During the financial year 2014-2015 the following works were attended by this division:

- Maintenance and Automation of Library.
- Publishing of Annual Report 2013-2014.
- Conducting Seminars for the technical staff of the institute.
- Conducting refresher course for the Engineers of the department
- Maintaining the Engineering Museum and Relief Map of Kerala

G.3 Library Service

This division has an excellent technical library attached to it. The books are arranged in different shelves according to the subjects. The library is being used by many technical persons in different Government Departments and also by a number of students from different Engineering Colleges and Polytechnics. As a part of modernization, Library is now fully automated including bar coding of books. Library facilities are extended to Engineers working in various departments and Institutions for referring the books.

G.3.1 Books

This year **52** numbers of new technical books were added to the Library.

G.3.2 Periodicals

A total of eight numbers of Indian periodicals were subscribed by this division. The following journals were purchased by subscription during the year.

G.3.2.1 Indian Periodicals

1. Indian Concrete Journal
2. Electronics for You
3. The bridge & structural Engineer
4. Indian Journal of Power & River Valley Development
5. Civil Engineering and Construction Review
6. Inside Outside
7. Master builder
8. Down to earth

G.4 Publication of Annual report

Annual Report for 2013-2014 was published and copies were despatched to important institutions and personnel.

G.5 Engineering Museum

Maintenance of Engineering Museum attached to the Kerala Engineering Research Institute is done by this Division. The working model of major completed Irrigation Projects in Kerala and models of some important bridges are exhibited in this museum.

G.6 The Relief Model of Kerala

The Relief model of Kerala is a three dimensional physical model of the state of Kerala. Constructed to a horizontal scale of 1/16,000 and vertical scale of 1/1,000, this model clearly shows rivers, roads, railways, location of Irrigation and power schemes, important places and district boundaries etc. in the state. In short, the model gives an idea about both geographical and physical features of Kerala.

The Relief Model of Kerala

G.7 Water a Divine Gift

This model gives a clear idea about the functioning of multipurpose project and the manifold uses to which water can be cheaply and conveniently put to.

G.8 Seminar Programme

A total number of four seminars were conducted during this year

Sl. No.	Title of paper	Name of speaker	Date
1	Case studies conducted by Soil Mechanics Division	Er. Jessy Ann Francis, Deputy Director, Construction Materials Division, KERI, Peechi.	25/08/2014
2	DPR preparation of Irrigation and Multipurpose Projects	Er. Saji Samuel, Asst. Director,Hydraulics Division, KERI, Peechi	29/09/2014
3	Introduction to MS Projects	Er. Saju Varghese., Assistant Director, CM&FE Division, KERI, Peechi	30/10/2014
4	Global Warming- a perspective	Er.Deepa R, Assistant Director, F&AR KERI, Peechi	25/11/2014

G.9 Refresher courses for Engineers

G.9.1 Refresher course on "Smart Station"

The course was conducted at KERI on 10th and 11th December, 2014 for the Assistant Engineers of the department. 25 Delegates participated in the training. The classes were taken by Sri.Thomas Joseph, Senior Application Engineer, Elcome Technologies Pvt. Ltd, Thiruvanathapuram.

All the participants who attended the training got the opportunity to have awareness and practical experience of modern surveying using smart station.

G.9.2 Refresher course on "State Finances" and "Delhi Schedule of Rate"

The training on "State Finances' was conducted on 19th January 2015 for the Engineers and staff of Irrigation department. 61 persons participated in the programme. The classes were taken by Sri. Manoharan K.B., Financial Officer, District Collectorate, Ernakulam.

Everyone in Government service deals with finance matters, the fundamentals and reasons of using different mechanisms can be brought in mind by attending such training and it was a grant success.

The training on "Delhi Schedule of Rate" was conducted on 20th January, 2015 for the Engineers and technical staff of Irrigation Department. 66 persons participated in the programme. The classes were taken Er. Radhakrishnan. S., Technical Assistant, O/o The Chief Engineer, Irrigation & Administration, Thiruvananthapuram.

The methods of using DSR and confusions while using DSR can be diminished to a great extend by attending this training and was grant success.

G.9.3 Refresher course on "Geophysical Surveying by Seismic Refraction Method"

The training was conducted on 10th and 11th February, 2015 for the Engineers of Irrigation Department. 18 persons participated in the programme. The classes were taken by Er. Jessy Ann Francis, Deputy Director, Construction Materials Division, KERI, Peechi.

By this training the trainees got a different experience of surveying by Seismic Refraction method.

G.9.4 Refresher course on "Motivation & Communication Skill"

The training was conducted on 6th March, 2015 for the staff of Kerala Engineering Research Institute. 62 persons participated in the programme. The classes were taken by Sri. C. Ummer Master, Vice Chairman, Thanalkoottu, Malappuram District Panchayath. The training gave a great motivation to the staff of this Institute regarding the wellbeing of society as a whole.

G.10 Upgradation of Library

The Library is computerized by installing library software. Barcode printer and reader are also installed for easy access of books.

G.11 Small Visuals on the activities of KERI

The visuals of various activities of KERI are taken with brief description of the Institute and are kept in Hard Disk.

H. COASTAL ENGINEERING FIELD STUDIES DIVISION

H.1 Introduction

The Coastal Engineering Field Studies was formed in 1973 and is engaged in the collection of data and field studies on Coastal Erosion along the Kerala Coast. The coast of Kerala extending 574.40 Km. in the south west coast of India, is Characterized by a narrow longitudinal barrier strip of low-lying land, sandwiched between the Arabian Sea and a continuous chain of lagoons and back waters with connection to sea at several points. This strip is formed of alluvial deposits. In considerable stretches, the space between the sea and the back waters is very narrow and even less than a few hundred meters at many places. Any break in this narrow strip would expose the back water to the fury of the waves and could endanger the entire disappearance of the barrier beaches.

The coastal zone has the maximum concentration of population and is even many times the State average at several places. Many of the foreign exchange earning industries, residential localities, a number of district headquarters, and good number of ports, fishing harbors and extensively cultivated land also exist along this narrow coastal zone.

The coastline of Kerala is subjected to severe erosion in a major portion of its length during the monsoons, when the sea becomes rough due to consistent attack of waves. The coastline is sometimes subject to tidal overflow also, when adjoining low lying lands get submerged. Erosion is very severe in the coastal areas during the south west monsoon period. During the

worst monsoon period, the highest waves average 2.5 meters and wave periods range from 13 to 15sec. and they come mostly from west. The normal tide range varies from 0.9 meter in the south to 1.8 m. in the north. Storm tides occur all along the coast during the monsoon season. During the monsoon, the high waves coupled with storm surges, cause overflow and flooding of the low lying backshore lands all along the coast, resulting in considerable loss of property, destruction of private and Government buildings, communications, dislocation of life of laths of population and disruption of other activities affecting economy. The influx of saline waters through mouths of rivers also affects agriculture and industry.

New CP stones have been planted throughout the Kerala Coast except about 25 km length of north extreme end of Kerala coast at Manjeswaram and GPS Co-ordinates were taken at all new CP stones. GPS Co-ordinates of sea wall near sea side also were collected and submitted to Chief Engineer, IDRB, and Thiruvananthapuram. The matter is informed to all Executive Engineers of Irrigation Department to take newly planted CP stones as reference points for all further constructions along sea coast.

Many experts who visited this State, to study the behavior of the coast and also for periodical evaluation of the performance of completed sea walls, were all of the same opinion that the sea wall damage, is mostly due to improper maintenance and is as important as the unscientific construction of sea wall.

For proper construction and to understand the performance of the sea wall during and after construction, proper monitoring is necessary. This requires consideration of the field staff with the staff engaged in coastal erosion studies. Whenever a new sea wall is to be constructed, the research staff must be informed of the different stages of construction, starting from alignment of the sea wall forming filter, core, armor layers, etc, so that the performance of it during construction and after construction can be watched.

The field staff also must keep a date-war record of construction details starting from alignment, excavation, putting filter, forming core, armor layer, etc, as per lines and level. The distance and levels of stones in front of sea wall also must be watched regularly with the

progress of construction of sea wall. All chainages of sea wall must be made with reference to the Km/C.P stone available at site.

The concerned Assistant Engineers must give all relevant details to the concerned Assistant Directors in charge of Coastal Erosion Studies from time to time, as per the above guideline and also keep a copy of the same for reference.

H.2 General Arrangements and Field Studies

For the detailed study of the characteristics and behavior of the beach, the 574.40 Km of the Kerala coast is divided into three regions viz., Southern region, Central region and Northern region. Each of these region is under the control of Deputy Directors and further sub divided into the control of Assistant Directors. The three regions come under the Coastal Engineering Field Studies, headed by Joint Director who works under the guidance of Director, Fundamental and Applied Research, Kerala Engineering Research Institute, Peechi and Chief Engineer, IDRB, Thiruvananthapuram. The extent of natural formation of beach, the position of protective dunes, the details of lagoons, inlets ie, azhis are observed. Assessment of variation in tides and winds, movements of waves, littoral drift etc, are made. Also the general study of the important structures in the coast, natural bed slope and depth of water as far as possible up to the depth of closure of sea are also carried out, (which are to be examined in detail before any protection work is taken up). Thus the programme of study can be summarized as,

1) **Investigation of present conditions of sea coast by means of surveys and observations.**
2) **Investigation of past history of coast from the available maps and records.**

The specific factors for which specific data are being collected and obtained are:

1) Shore History
2) Shoreline and shore depth changes
3) Accretion and erosion
4) Type of protection works installed and their effectiveness.
5) The direction, amount and character of littoral drift that produced the problem conditions.
6) Material characteristics composing the littoral zone.

7) Forces pertinent to the littoral zones:

   a) Waves
   b) Currents
   c) Tides

8) Effects of mud banks
9) Effects of inlets

H.2.1 Sub items of Study.

1) Fixing and maintaining Control Point Stones, K.M.Stones, Alignment stones and Benchmark Stones.

   a) Connecting levels of Control point Stones.
   b) Maintaining existing control point stones, K.M.stones, Alignment stones, and Benchmark Stones.
   c) Planting new and replanting missing CP Stones, KM Stones, Alignment stones and Benchmark Stones.

2) Study of shoreline and shore depth changes:

   a) By taking cross section profiles

3) Physical Surveys:

   a) Topographic surveys
   b) Periodical measurements of shorelines
   c) Photograph

4) Study of littoral drift
5) Study of beach samples
6) Studies on wind, wave and tides
7) Studies on coastal protection works
8) Mud banks studies
9) Details of specific studies

   a) Studies on sea walls

10) Other studies: Simultaneous Observations and daily observations.

H.3 Details of works under 13th FC Award

H.3.1 Planting of new control point stones, alignment stones, kilometer stones and benchmark stones along the sea coast

Control point stones and alignment Stones are the most important reference points for all the collection of data and for carrying out the protection works. The regions are referred by the Control Point stones. Shore line measurements, fixing of levels, taking CS profiles, topographic survey and similar important studies are based on these stones. Similarly, K.M. Stones are established to ear mark each region. BM stones are planted along the shore as permanent level marks. The levels on Control Point Stones are further checked on the basis of the B.M. stones. Many of the Control point stones and alignment stones are seen missing and damaged due to various reasons. Balance work of 13th FC Award for planting new CP stones, Alignment stones, KM stones and BM stones along the sea coast under the jurisdiction of Thalassery and Cherthala and investigation works under Thalassery, Kozhikode, Parappanangadi, Chavakkad, Ernakulam, Thottappally, Kollam and Thiruvananthapuram Sections have been completed this financial year.

H.3.2 Investigation works on protective measures to be adopted along the sea coast.

Field studies and collection of data on coastal erosion have been conducted on all Sections under this Division.

H.3.3 Works completed

Details of works completed are given in Appendix–VI.

H.4 Programme of Study

In coastal environment, waves, tides, currents and winds are the important parameters which need to be considered for any development. It is very much essential to understand the physics of these process. Coastal erosion is the wearing away of land by the action of waves, current and wind. Coastal erosion is accompanied with landward recession of the sea shore and loss of land area. It is a common problem faced in almost all coastal areas. Only the magnitude and nature of erosion changes from place to place. Along the most part of Kerala

coast, erosion observed is seasonal in nature, that is, beach gets eroded during monsoon and regains its original profile during fair weather season. However, at some places erosion is of permanent nature.

H.4.1 Simultaneous Wave Observations

Simultaneous wave observations are being conducted at 18 specified location along Kerala Coast on all new moon days to understand characteristics of wind, wave and tide details such as width of back shore, fore shore, slope of fore shore, composition of beach materials, characteristics of littoral drifts, shore history and they are recorded on standardized format.

H.4.1.1Study of littoral drift

Littoral transport is the movement of sediments in the near shore zone by waves and currents. This transport of suspend and bed load particles are both in parallel to the sea shore and perpendicular to sea shore. This transport of suspended materials is called littoral drift. It has been ascertained from the past studies that the dominant direction of littoral drift in Kerala coast is from north to south. Whatever be the direction, an annual quantity of sediments is important in developing shore protection arrangements. Now only the direction of drift is being studied at selected points along the shore.

H.4.1.2 Study of Wind, Wave and Tides

Winds are the natural generators of wave and their study is necessary. An understanding of the nature of the tidal phenomenon is necessary for the study of coastal behaviors. The top level of the coastal protection structures depend on the tidal level and their data must be collected.

Wave causes sand to move along the coast as well as on to or off of a beach. Due to refraction, wave energy is concentrated in certain reaches of the coast where erosion became naturally severe. Hence the design of coastal protection structures primarily depend on wave characteristics and hence these studies are essential. (Predominant direction of waves is from west or north west).

H.4.2 Model Studies conducted by CWPRS

The proposed Mathematical model studies entrusted with CWPRS, Pune is mainly to find out some permanent solutions to effective coastal protection along Kerala coast especially at highly vulnerable areas. Such a model study was conducted by CWPRS recently for resolving the crisis generated at Vadanappally beach in Thrissur District for suggesting a proper methodology to defend the severe sea attack at that area. The particular reach at Vadanappally specifically 8 km south of Chettuva estuary, is at present highly vulnerable and hence sea advanced to land portions at many places in that reach. The required available coastal data was supplied from this office to CWPRS for the successful completion of model study.

Our primary inference based on the study materials and ongoing periodical observations at that particular sea coast was that severe erosion started occurring at both sides of Chettuva estuary, ever since the construction of breakwaters started at both sides of estuary, in connection with the development of Chettuva fishing harbor. The break waters were constructed at the Azhi by Harbour Engineering Department based on a detailed model study conducted by the same CWPRS; probably they might have given a clean consent for the construction, based on the fact that the littoral drift at this area is so small and insignificant.

The draft report submitted by CWPRS on model study at Vadanappally recommend to construct 20 m length groyens at every 100 interval throughout the affected area along with sea wall as an effective remedial measure. As a suggestion on the draft report, Joint Director pinpointed out the drawbacks of breakwaters and groynes and also about the after effects of such a construction in the long run and specifically mentioned about the adverse effect caused by existing break waters at Chettuva Azhi based on the study materials of CEFS. It is alarming and considerably disastrous that CWPRS did not consider the valuable points raised from this office and instead the same draft report was submitted as their final report to Chief Engineer, Irrigation & Administration, Thiruvananthapuram.

It's crystal clear that similar report is expected to be delivered by CWPRS much after their laborious model study operation, irrespective of whatever data we provide, for this study also. I genuinely think that either their study is absolutely unscientific or they are too smart

to supply customer friendly reports. It's our experience and study result that any structure built into the sea creates innumerable problems to the adjacent sea coast. Shifting this problem from one place to another is the result. Hence the introduction of groynes as a permanent remedial measures as suggested by CWPRS cannot be entertained as an ultimate solution to coastal protection, along Kerala coast.

It's better to focus more on rehabilitating the affected people at the most vulnerable reaches and let the sea sing and dance in its natural way. It's high time to implement Coastal Regulatory Zone strictly all along Kerala coast; which will definitely put an end to the present crisis. Implementation of Coastal Regulatory Zone will of course make it possible to untie the existing rubble chain along the coast and the same rubble can be utilized for other construction activities, thus we can prevent unauthorized mining to certain extent and simultaneously enhance the tourism potential.

H.4.3 Study of Mud banks

Mud banks, a phenomenon peculiar to the coast of Kerala are those in shore region where wave energy is dissipated completely as a result of the colloidal mud suspension mud bank protect the coast immediately near it, but causes erosion in the down-drift side due to diffraction of waves.

During last week of June 2014 it was reported that two mud banks were formed at Koyilandi beach in Kozhilode District and Kurikuzhi beach in Thrissur District. Detailed investigation study was conducted on the matter the detailed drawing with report submitted to Chief Engineer, IDRB, Thiruvananthapuram during this financial year.

H.4.4 Periodical measurement of shore line changes

Periodical surveys are taken to determine the shore line changes of the coast. The offset measurement of the shore line with respect to Control point and Alignment stones are taken every month and recorded. It provides very important data to understand the shore line fluctuation of the coast.

H.4.5 Collection and Study of beach samples

Pre-monsoon (May) and post-monsoon(October) beach samples are collected from specified places for testing grain size distribution and specific gravity since erosion and accretion of coast depends up on the nature of beach material to a certain extent. Also for natural nourishment materials can be supplemented to the beach and thereby the erosion can be reduced. Beach samples are important variables determining the beach characteristics. Study of beach materials, characteristics and sources is essential for the evolution of a long term shore protection plan.

H.4.6 Report on Coastal damages and taking photographs

The details of damages at various places in the coastal beaches have been collected from time to time and photographs are taken to understand the details of erosion, coastal damages occurred during monsoon and drastic changes in the shore line. **The details of damages caused during the year 2014-2015 are listed and attached separately.**

H.4.7 Proposal for Eco-friendly measures

By the new technology, we intent to place a number of Geotextile tubes in the coast where protection is needed. We make use of poly propylene containers filled with beach sand. The empty bags are placed at the properly aligned segment and then only the filler material is dumped to it and carefully sealed with the supervision of the company engineers. In connection with the enquiry of this product, one of the marketing representatives had visited this office and explained about this technology. These tubes are filled with sea sand dredged from that locality where the tubes are decided to place. Two tubes are placed in the first layer and one in the next which forms a barrier to the sea waves. Cost of construction for 1 km protection work comes to approximately 4 to 5 crores as per the site condition. In some cases a layer of rubble covering with gabion is provided over the geotextile tube as per the site condition. In this case cost of construction for 1 km comes to approx 6 to 7 crores. The sea wall constructed with only geotextile tubes will not be water tight. It allows some water to pass through the tube with less force. If geotextile tube alone is used as protection work, it is more eco friendly. The sand at the same site is used as filler material. No rubble or other

external materials are using for this work. Chithari Kadappuram between CP No.2627 and 2632 of length 1 km in Ajanur panchayath under CES Section Thalassery is proposed to conduct this work as an experimental venture.

H.4.8 Topographic survey along the coast of Kerala

Topographic surveys are conducted to study the topographic changes of the beach.

H.4.9 Taking cross section profile of the beach

Cross-section profiles taken using leveling instrument and leveling staff. The survey of cross sectional profiles started from each CP stones and moved towards sea water upto a reach of ht. 1.5 mtr. Or 50 mtr from shore line.

H.4.10 Study of River outlets and Coastal inlets

Many rivers in Kerala exhibit a continuous migrating tendency. Such migration influences the beach characteristics in the adjacent areas considerably and hence to be studied in detail. Among these, periodical measurements of shoreline changes provide very important data of shoreline fluctuation of the coast.

H.4.11 Dates and places of observations

In order to have more detailed idea of the behavior of factors affecting the shore line changes, three consecutive points are taken for reference. At a particular study reach five readings are taken in all three points at definite timing. Nearly 20 to 25 Km apart straight reaches without much external disturbances are selected for taking these simultaneous observations. The dates in the year 2014-15 are given in Appendix-VII. The places of observations with timing and CP Nos. are listed in Appendix-VIII.

H.4.12 Alignment fixation of sea walls

The Joint Director, CEFS, Thrissur inspects the sites for fixing alignment of sea wall (construction and reformation) with the concerned Irrigation officials, Deputy Director and Asst. Director of the Coastal Sub Division & Sections concerned, and approve the alignments of sea walls along Kerala Coast, considering the last 10 year shore line measurements and the

alignment of the sea. Sea wall should be constructed at highly vulnerable reach. But proposal for alignment fixation is submitted this office after getting all Technical sanctions from higher authorities. Hence we are bound to fix the alignment even at stable beaches where protection is not necessary. In many cases, proposals for essentiality certificate are submitted along with the alignment fixation proposal which will make difficult to reject the proposals if it is not necessary. Reformation works also need alignment approval from this office. But Reformation works are being carried out without getting alignment approval from this office.

Alignment approval has been given to the following works by the Joint Director, Coastal Engineering Field studies, Thrissur during the year 2014-15.

Sl. No.	Name of Sub Division	Total No. of alignment approved during 2014-15	Essentiality Certificate issued during 2014-15
1	Kozhikode	5 Nos	4 Nos
2	Eranakulam	2 Nos	Nil
3	Kollam	Nil	Nil

H.5 Performance of the Division

Within the limitations of availability of funds, availability of field staff and modern instrument, this division has taken up all the possible studies in the year 2014-2015. The performance can be summarized as follows.

Types of works

1. Topographic survey conducted for Determining beach profiles : 20Km
2. Periodical measurement of shoreline changes : 4089.95 Km
3. Simultaneous observations : 201 set
4. Taking photograph : 15 Nos.
5. Soil sample collected : 58 Nos.
6. Study of Mud Bank : 2Nos
7. Cross section profiles : 1312Nos
8. Levels connected : 100.50 Km
9. C.P Stones planted : 214 Nos.
10. Alignment stones & guard stones planted : 254 Nos.
11. Kilometer stones planted : 45 Nos.
12. Bench mark stones planted : 10 Nos.
13. Alignment fixed by Joint Director : 10 Nos.
14. Details of damages at various places in the Coastal beaches collected : separately attached

Sub Division-wise Coastal studies performances are as follows

1. Topographic survey conducted
   - Kollam sub Division : Nil
   - Ernakulam Sub Division : 20 Km
   - Kozhikode Sub Division : Nil

2. Periodical measurement of shoreline changes
   - Kollam sub Division : 1500 Km
   - Ernakulam Sub Division : 1125.95Km
   - Kozhikode Sub Division : 1464.00 Km

3. Simultaneous observations
   - Kollam sub Division : 60Nos.
   - Ernakulam Sub Division : 72 Nos.
   - Kozhikode Sub Division : 69Nos

4. Taking photograph
   - Kollam Sub Division : 5Nos.
   - Ernakulam Sub Division : 5Nos.
   - Kozhikode Sub Division : 5Nos.

5. Soil sample collected
   - Kollam sub Division : 20Nos
   - Ernakulam Sub Division : 24Nos.
   - Kozhikode Sub Division : 14Nos.

6. Study of Mud bank
   - Kollam Sub division : Nil
   - Eranakulam Sub Division : 1No
   - Kozhikode Sub Division : 1No

7. Cross section profiles
   - Kollam sub Division : 154Nos
   - Ernakulam Sub Division : 548Nos
   - Kozhikode Sub Division : 610Nos

8. Levels connected
   - Kollam sub Division : Nil
   - Ernakulam Sub Division : 40.50 Km
   - Kozhikode Sub Division : 60 Km

9. C.P Stones planted
   - Kollam sub Division : Nil

Ernakulam Sub Division	:	101Nos
Kozhikode Sub Division	:	113Nos

10. Alignment stones planted

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	101Nos
Kozhikode Sub Division	:	113Nos

11.Kilometer stones planted

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	20Nos
Kozhikode Sub Division	:	25Nos

12.Bench mark stones planted

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	5Nos
Kozhikode Sub Division	:	5Nos

13.Guard stones planted

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	20Nos
Kozhikode Sub Division	:	20Nos

14. Details of damages at various places in the Coastal beaches collected (separately attached)

Kollam sub Division	:	Nos.
Ernakulam Sub Division	:	Nos.
Kozhikode Sub Division	:	Nos.

H.6 Details of important structures along the sea coast under the division of Coastal Engineering Field Studies, Thrissur

Sl. No.	Important Structures	Place	Between CP
1.	Nursury School	Kollamkode	C.P.08
2.	Kurishady	Kollamkode	C.P.10
3.	Police Aid Post and Mosque	Kollamkode	C.P.16
4.	Kurishady	Poovar	C.P.18
5.	Kurishady	Poovar	C.P.20
6.	Peeling Shed	Poovar	C.P.25
7.	Kurishady	Poovar	C.P.28
8.	Ele. Transformer	Poovar	C.P.30
9.	Ele. Transformer	Pulluvilla	C P 35
10.	Kurishadi &	Pulluvilla	C P 36

	Ele.Transformer		
11.	Vizhinjam Harbour, Light house, Temple	Adimalathura	C.P.44 – 54
12.	Tourism Police Aid post	Kovalam	C P 55
13.	Temple and Masjid	Kovalam	C P 56
14.	Temple and Masjid	Kovalam	C P 62
15.	Temple	Panathura	C P 63
16.	Temple	Panathura	C P 64
17.	Temple	Panathura	C P 65
18.	Pulimuttu	Panathura	C P 70
19.	Church	Punthura	C P 78
20.	Beemapally	Beemappally	C P 85
21.	Valiyathura Sea bridge And Harbour office	Valiyathura	C P 94
22.	Tvpm Domestic Airport Terminal	Shungumugam	C P 102
23.	Shungumugam Temple & palace	Shungumugam	C P 104
24.	Church	Shungumugam	C P 106
25.	Vettukkad Church	Vettukkad	C P 116
26.	Church and Cemetry	Kochuveli	C P 129
27.	Veli Tourism Village	Kochuveli	C P 131
28.	ISRO Compound	Thumba	CP 138-149
29.	Church & School	Puthenthope	C P 157
30.	Resort	Puthenthope	C P 168
31.	Resort	Shanthipuram	C P 175
32.	Kurishadi	Shanthipuram	C P 182
33.	Break water, Proposed fishing harbor & Bridge	Perumathura	C P 211
34.	Ele. Transformer & Post office	Perumathura	C P 212
35.	Kurishadi	Perumathura	C P 214
36.	Nursery School	Perumathura	C P 215
37.	Church	Puthura	C P 221
38.	Anchuthungu Light house and Port Court	Anchuthengu	C P 232
39.	Community Health Centre	Anchuthengu	C P 234
40.	Masjid	Mannarkulam	C P 246
41.	Masjid	Aruvalam	C P 250
42.	Masjid & Varkala Cliff	Thazhevettu, Varkala Beach	CP 259-260
43.	Masjid	Edava	C P 275
44.	Masjid 2 Nos	Thekkumbagam	C P 283
45.	Temple	Paravoor	C P 284
46.	PWD Kadavu	Mukkam	C P 292

47.	Temple	Tanni	C.P.302
48.	Church	Tanni	C.P.303
49.	Church	Eravipuram	C.P.315
50.	Pier of Port Department	Garfil nagar	C.P.317
51.	Gandhi Park	Kochupillamoodu	C.P.331
52.	Church	Pallithottam	C.P.336
53.	Kollam Port	Pallithottam	CP. 336
54.	Church	Vady	C.P.341
55.	Fishing harbour	Thangassery	C.P.343
56.	Light house	Thangassery	C.P.347
57.	Temple	Thiruvananthapuram	C.P.357
58.	Church	Thiruvananthapuram	C.P.359
59.	Church	Sakthikulangara	C.P.376
60.	G.T.S.B.M.	Sakthikulangara	C.P.377
61.	G.T.S.B.M	Neendakara	C.P.381
62.	Fishing harbour port break water and bridge	Neendakara	C.P.377-381
63.	PBM & MC Health Unit	Neendakara	C.P.393
64.	St.Fransis Church	Karithura	C.P.402
65.	Light house & IRE.Company	Karithura	C.P.408
66.	K.M.M.Ltd.	Kovilthottam	C.P.409
67.	Church	Kovilthottam	C.P.410
68.	St.Francis Church	Karithura	C.P.415
69.	Temple	Kattilkadavu	C.P.421
70.	Church	Parayakadavu	C.P.437
71.	Bridge	Parayakadavu	C.P.439
72.	Temple	Cheriazheekal	C.P.446
73.	Football Association Club	Cheriazheekal	C.P.452
74.	Govt. Homeo Dispensary	Kurithura	C.P.463
75.	Sree Amrithananda mayee Matt and Ayurveda Hospital	Parayakadavu	C.P.471
76.	Temple	Pachimeshwaram	C. P.477
77.	Govt. LP School	Sraikadu	C.P.490
78.	Fishing Harbour Port(Break Water)	Kayamkulam Pozhy	C.P.499
79.	Break Water	Valiyazheekal	C.P.500
80.	Church	Nallanickkal	C.P.535
81.	Corporation Bank	Arattupuzha	C.P.547
82.	Water tank	Mangalam	C.P.557
83.	Mosque	Pathiyankara	C.P.563
84.	Temple	Thrikkunnappuzha	C.P.573
85.	Mosque and Church	Cellakkad	C.P.578
86.	Spillway	Thottappally	C.P.605

87.	Coastal Engineering Section	Thottappally	C.P.612
88.	LP School	Anandeswaram	C.P.619
89.	Malsyafed building	Ambalapuzha	C.P.646
90.	Railway line	Kakkazham	C.P.651
91.	Auction Hall of Harbour Engineering	Valanjavazhi	C.P.656
92.	Industrial Unit/Khadi and Village Industries	Punnapra	C.P.676
93.	Chatholic Church	Punnapra	C.P.680
94.	Chatholic Church	Paravoor	C.P.687
95.	S.S.V.L.P.School	Vadeekal	C.P.697
96.	ESI Hospital	Alleppey	C.P.703
97.	Village office (Alleppey West Building)	Alleppey	C.P.706
98.	W&C Hospital	Alleppey	C.P.708
99.	Port Buildings and Godowns	Alleppey	C.P.710
100.	Pier Masters office	Alappuzha	BLS 87
101.	Visual Storn Warning Signal office	Alappuzha	BLS 87
102.	Light House	Alappuzha	BLS 87
103.	Bishops House	Alappuzha	BLS 87-88
104.	Recreation Club	Apappuzha	BLS 88-89
105.	Fish Landing centre	Katoor	BLS124
106.	Marari beach resort centre	Mararikulam	BLS132-133
107.	Arthunkal Church	Art hunkal	BLS161-162
108.	Fish Landing Centre	Arthunkal	BLS164-165
109.	Arthunkal Church	Arthunkal	BLS161-162
110.	Church	Ottamassery	BLS 177-178
111.	Church	Ottamassery	BLS 186-187
112.	Andhakaranazhi Light House	Andhakaranazhi	BLS198-CP4385
113.	Church	Andhakaranazhi	BLS 4383-4384
114.	Church	Pallithodu	C P 4380-4381
115.	Chellanam Fishing Habour	Chellanam	C.P.979-983
116.	Church	Kannamaly	C.P.1021
116(a).	Police Station	Kannamaly	C.P.1028
117.	INS Dronacharya	Fort Kochi	C.P.1057-1067
118.	Boilers	Fort Kochi	C.P.1070
119.	LNG Terminal	Puthuvype	C P.1073-1081
120.	Light House	Puthuvype	C.P1082
121.	BPC	Puthuvype	C.P.1083-1086
122.	Fisheries University	Njarackal	C.P.1108

	Building		
123.	Fish Landing Centre	Nayarambalam	C.P.1122
124.	Mosque	Kuzhippilly	C.P.1140
125.	Club Mahindra Resort	Cherai	C.P.1162
126.	Munambam Park	Munambam	C. P.1186
127.	Coastal Police Station	Azhikode	C.P-1188
128.	Light House	Azhikode	C.P-1201-1202
129.	Beach Park at Snehatheera	Thalikulm	C.P-1334-1336
130.	Groyen	Chettuva	C.P-1380
131.	Groyene	Chettuva(N)	C.P-1381
132.	Light House	Thottappu	C.P-1406-1407
133.	Multi-Storied lodge Building	Blangad	C.P-1419-1420
134.	Single Storied Building Of Fisheries Dept. (Damaged)		C.P.1499-1500
135.	Multi Storied Building Hatchery at for Fisheries	Veliancode	C.P1510-1512
136.	Beevi Mosque	Puduponnai	C.P-1514
137.	Light House	Ponnani	C.P-1548-1549
138.	Tourism Development project & Break water	Padinjarekkara	C P 1555
139.	Bird Sanctuary	Kadalundi	C P 1742
140.	Break water & Bepur port	Kozhikode	C P 1769
141.	Lions park & Marine water Aquarium	Kozhikode	C P 1826
141(a)	Fishing Harbour	Puthiyappa	C P 1856 -1865
142.	Tourism Development Project, Kappad	Kozhikode	C P 1910
143.	Thattil Harchery, Kolavipalam	Eringol	C P 2041
144.	Fishing Harbour	Azhiyoor	C P 2114
145.	Thalai-Gopal Petta Fishing harbor	Thalai	CP 2161-2162
146.	Tourism Development Project	Dharmadam	C P 2208
147.	Muzhappilangad Beach	Muzhappilangad	C P 2224
148.	Kannur Fort, DSC Centre	Kannur	C P 2270
149.	Burial Ground, Payyambalam	Kannur	CP 2302-2309
150.	Tourism Development project	Meenkunnu	C P 2339
151.	Naval Academy, Ezhimala	Ezhimala	C P 2430
152.	Bakel Fort	Bakel	C P 2657

H.7 Bottleneck Facing

Coastal Engineering Field Studies is the one and only institution entrusted with the collection of coastal field data and field studies connected with the erosion of the entire sea coast of Kerala, the functions assigned to which are vital & essential. But at present CEFS Division office is provided with bare minimum facilities. The office building of CEFS, Thrissur is in a pathetic condition and it is a Herculean task to protect the valuable records of collected data. Similarly it is very cumbersome to consolidate and process the valuable data collected for the last so many years manually and are being deteriorated .However the staff of Coastal Engineering Field Studies took great effort for modernization of CEFS and available maximum coastal data for the last 25 years are computerized.

The Chairman, Coastal Protection and Development Advisory Committee (CPDAC) had advised the Chief Secretaries of all Coastal States to create a separate department for dealing with the Coastal Engineering works of the respective states vide Lr.No:4(5)/2000 CED dated 9.6.2000 to organize a coordinated program of collection, compilation, evaluation and publication of coastal data. Hence this wing is to be made permanent.

The staff strength of the wing is insufficient even for the routine performance. The CEFS Division is not having the posts of PA/TA., DA., JS/HC. The only two posts of clerks were declared as supernumerary. Only an Asst. Director is available in Parappanangadi section, Thalassery section & Thottappally section for the last few years for meeting all the activities. There are 9 posts of overseers vacant at different sections under this division.

Coastal Engineering Section, Thalassery coming under the control of Deputy Director, Kozhikode Sub division extends from Mahe to Manjesweram with a length of148 km. At present only 90 km is under study reach. No study is being conducted in the remaining 58 km (excluding Naval Academy and Bakel Fort). Assistant Director of each section is collecting field data and doing survey works for an average length of about 60 km. Study is conducted in a length of 148 km except 25 km length where planting of new CP stones is not completed.

As far as Kerala Coast is concerned, the sea is turbulent, especially during monsoon and coastal erosion is a common phenomena along the sea coast for which continuous field study in all aspects is essential. At present the wing is collecting data on shoreline measurements, simultaneous observation, preparation of coastal damage reports with photographs and collecting soil samples, mud bank study Cross section profiles and Topography survey. Training programs on Coastal Engineering and allied subjects to update and train the technical personnel of the department regarding the latest development in this field is essential. No training has been conducted under this wing due to lack of funds. The study wing now follows old conventional method of observations like visual observations, tape measurements etc. High derivative modern instruments are now available in this field.

H.8 Suggestions/Recommendations

Sufficient fund has to be made available in time for conducting the entire study of coastal erosion. The coastal length coming under the jurisdiction of Thalassery section is 148 km, and for studying the entire reach an additional section is to be formed. For getting the sufficient staff strength and for their maximum efficiency this wing is to be made permanent, considering the importance of this Division. Sufficient fund should be allocated for the training of technical staff and for procuring the modern scientific equipments for the collection of coastal data. During last year planting of new CPS tones have been completed along seacoast throughout Kerala except 25 KM length at northern extreme end. Planting new CP Stones at this area is very essential. Necessary action has to be taken to make available sufficient fund for this work. There are no supervisory officers like DA/JS or HC in this office. During the inspection of AG, they pointed out the lack of supervisory officers, to audit internal check for the accounts wing and establishment matters. Necessary steps have to be taken to create a supervisory officers post and to fill the vacant post of Overseers in Section offices under this Division office.

I. LIST OF FIGURES

1. Map of Kerala state showing the location of simultaneous observation stations.

1.	KANNUVATHEERTHA	CPNO.103
2.	KASARAGODU	CP NO. 531
3.	KANJANGAD	CPNO. 727
4.	THALASSERY	CP NO.1067
5.	MELADY	CP NO. 2507
6.	CALICUT NORTH PIER	
7.	RAYAIRIMANGALAM	CPNO. 3613
8.	VELIYANKODE	CP NO. 3613
9.	PADINJARE VEMBALLUR	CP NO.973
10.	ANCHANGADY	CP NO. 3974

11.	KUZHUPPILLY	CP NO. 4047
12.	KANNAMALY	CP NO. 4329
13.	THANKI	BLS 485
14.	AMBALAPPUZHA	CP NO. 994
15.	ARATTUPUZHA	CP NO. 5185
16.	ERAVIPURAM	CP NO. 5550
17.	ANJENGO	CP NO. 5720
18.	KOVALAM	CP NO. 5927

2. Beach profile - related terms

5. FINANCE

In the budget for the financial year 2014-15 an outlay of Rs.85 lakh had been allotted under the Head of Account '4701-80-800-99-Development of KERI Stage II'. The proposal for the amount was grouped under three heads viz, Routine activities, modernization and revamping. The details of sanctioned amount and expenditure are given below. From the routine works carried out in the laboratories an amount of Rs.9,58,595/- has been collected as test charges and the amount was remitted in the treasury.

Details of sanctioned Amount and Expenditure

Sl. No.	Divisions	A.S. Amount
I	**Joint Director, C.M.&F.E., KERI, Peechi.**	
1	Construction Materials Division	5 lakh
2	Soil Mechanics and Foundations Division	3.3 lakh
3	Instrumentation Division	6.95 lakh
4	Publications Division	6.5 lakh
5	Instrumentation Division	19.5 lakh
	Total amount received	23,45,643/-
	Expenditure	17,95,583/-
II	**Joint Director, Hydraulic Research, KERI, Peechi.**	
1	Coastal Engineering Division	5.92 lakh
2	Hydraulics Division	2.95 lakh
3	Sedimentation Division	11.3 lakh
	Total amount received	18,79,357/-
	Expenditure	18,70,357/-

6. SUMMARY

In the annual report for the current financial year a general introduction about the institute, organization set up, division wise functioning of the institute, implementation of modernization scheme and details regarding budget allotment and expenditure have been explained in detail.

The bottlenecks or hindrance in the development of the institute as a full fledged research organization are

- Insufficient number of technical personnel.
- Lack of well qualified engineers.
- Lack of up-gradation of technical knowledge of engineers through training.
- Insufficient number of projects/under utilization of the facilities available at the institute.
- In the case of Field studies division, sufficient fund has to be made available in time for conducting the study of coastal erosion and high derivative modern equipments has to be made available.
- The building of CEFS, Thrissur which is in a dilapidated condition has to be modified.

All these require intervention from the part of the Government and it is hoped that the upgradation of the personnel of the institute will be taken up as a continuation of the modernization scheme.

Appendix – I

Vacancy Position as on 31/03/2015, KERI, Peechi

Sl. No	Designation	Sanctioned Strength					No of Posts Vacant					Remarks
		O/o Director	CM&FE	Hydraulic Research	CEFS	Total	O/o Director	CM& FE	Hydraulic Research	CEFS	Total	
1	Director	1				1	-	-	-	-	-	
2	Joint Director	-	1	1	1	3	-	-	-	-	-	
3	Deputy Director	-	4	3	3	10	-	1	-	-	1	
4	Assistant Director	1	7	7	10	25	-	2	-	-	2	
5	Divisional Accountant	-	-	1	-	1	-	-	-	-	-	
6	Junior Superintendent	-	1	1	-	2	-	-	-	-	-	
7	Fair Copy Superintendent	-	-	1	-	1	-	-	-	-	-	
8	Selection Grade Typist/ UD Typist	-	2	1	-	3	-	-	-	-	-	
9	Research Assistant	1	8	7	9	25	1	5	3	1	10	
10	2nd Grade Overseer	1	4	4	15	24	1	3	4	8	16	
11	3rd Grade Overseer	-	3	2	-	5	-	2	2	-	4	
12	Scientific Assistant	-	1	1	-	2	-	1	1	-	2	
13	Tracer	-	-	1	-	1	-	-	-	-	-	
14	Blue Printer	-	-	1	-	1	-	-	1	-	-	
15	Driver	-	1	1	3	5	-	-	-	-	-	
16	Boat Driver	-	-	1	-	1	-	-	-	-	-	
17	Lab Attender	-	2	1	-	3	-	2	1	-	3	
18	Modeller	-	-	1	-	1	-	-	1	-	1	
19	Mason	-	-	1	-	1	-	-	1	-	1	
20	Worker Grade I/II	-	8	8	-	16	-	6	8	-	14	
21	UD Clerk	3	1	4	4	12	-	-	-	-	-	
22	LD Clerk	1	7	3	9	20	-	1	-	2	3	1 No. Deployed to LSGD
23	LD Typist	1	-	1	4	6	-	-	-	-	-	
24	Typist Clerk	-	1	1	-	2	-	1	-	-	1	
25	Office Attendant	2	6	3	13	24	-	2	-	1	3	
26	Part Time Sweeper	-	4	1	3	8	-	1	-	-	1	
27	Lab Assistant	-	1	-	-	1	-	1	-	-	1	
28	Information Assistant	-	1	-	-	1	-	1	-	-	1	
29	Assistant Surgeon	-	1	-	-	1	-	-	-	-	-	
30	Pharmacist	-	1	-	-	1	-	-	-	-	-	
31	JPHN	-	1	-	-	1	-	-	-	-	-	
32	Hospital Attendant Gr.II	-	1	-	-	1	-	-	-	-	-	
33	Nursing Assistant	-	1	-	-	1	-	-	-	-	-	

Appendix – II

Abstract of the weather data (AWS) from July 2014 to March 2015

STATION: K.E.R.I., PEECHI.

Latitude: 10^{o} 31´ 30", Longitude: 76^{o} 21´ 59" MSL: +96.03 M.

Sl.No	Weather Elements	Range of the weather data
1.	Atmospheric pressure	Maximum Atmospheric Pressure observed was 1007.8 millibars on 22nd January and Minimum Atmospheric Pressure was 992.60 millibars on 22nd August.
2.	Temperature	The maximum temperature was 37.4°C on 29th March and the minimum temperature was 17.6°C on 14th January.
3.	Relative Humidity	Maximum relative humidity recorded was 100% in all the months and minimum relative humidity was 15.6% on 23rd February
4.	Precipitation	Annual rainfall was 1760.80mm and the maximum rainfall was 87.90mm on 1st August
5.	Wind-Direction	The main wind directions observed were from South West and North East directions.
6.	Wind Speed	Maximum daily mean wind speed was 3.60 km/hr on 4th February and minimum daily mean wind speed was 0.40 km/hr in August, October & November
7.	Global Radiation	Maximum Global Radiation was 1222.7 watts/m^2 on 9th September

Appendix – III

List of tests conducted in the CM laboratory

1. Testing of concrete cubes supplied by the Assistant Executive Engineer, KAU, Mannuthy.
2. Concrete mix design for the Senior Section Engineer, Southern Railway, Thrissur.
3. Testing of concrete cubes supplied by the principal KFS, Walayar.
4. Testing of concrete cubes supplied by the Assistant Executive Engineer, KAU, Vellanikkara.
5. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
6. Testing of concrete cubes supplied by the Assistant Executive Engineer, KAU, Vellanikkara.
7. Testing of steel rods supplied by the Assistant Engineer, PWD Buildings Section, Ayyanthole.
8. Testing of concrete cubes supplied by M/s. Blue chip constructions, Ernakulam.
9. Testing of tiles supplied by the principal, KFS, Arippa.
10. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
11. Testing of Steel rods supplied by the Assistant Engineer, PWD Building Section, Irinjalakkuda.
12. Testing of steel rods supplied by the Assistant Engineer, PLR Section, Aluva.
13. Concrete mix design conducted for the Assistant Engineer, PLR Section, Aluva.
14. Testing of concrete cubes & tiles supplied by the Principal, KFS, Walayar.
15. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
16. Testing of ball fender supplied by m/s Techno Exports, Pattanakkad, Cherthala, Alappuzha.
17. Testing of solid concrete blocks supplied by the Assistant Executive Engineer, KAU, Vellanikkara.
18. Testing of concrete cubes supplied by the Assistant Executive Engineer, RMU Subdivision, Poringalkuthu.
19. Testing of steel rods supplied by the Project Manager, KSEB, Chimmony Dam.
20. Testing of concrete cubes supplied by the Principal, KFS, Walayar.
21. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
22. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
23. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
24. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
25. Testing of manufactured sand supplied by the Assistant Engineer, TC Section, Pudukkad.

26. Testing of steel rods supplied by the Assistant Executive Engineer, RMU Subdivision, Poringalkuthu.
27. Testing of concrete cubes supplied by the project engineer, CSHEP, Chimmony dam.
28. Concrete mix design carried out for the Assistant Executive engineer, Irrigation Sub Division, Piravom.
29. Testing of concrete cubes supplied by the project engineer, CSHEP, Chimmony dam.
30. Testing of rock samples supplied by Sediment Soil Investigations, Kochi.
31. Testing of steel rods supplied by the Assistant Engineer, PLR Section, Aluva.
32. Concrete mix design carried out for the Assistant Engineer, PLR Section, Aluva.
33. Testing of concrete cubes supplied by the project engineer, CSHEP, Chimmony dam.
34. Testing of steel rods supplied by the Assistant Executive Engineer, RMU Sub division, Poringalkuthu.
35. Testing of concrete cubes supplied by the project engineer, CSHEP, Chimmony dam.
36. Testing of sand supplied by the Senior Section Engineer, Southern Railway, Thrissur.
37. Concrete mix design carried out for M/s. Fins Engineers and Contractors, Thrissur.
38. Testing of solid blocks supplied by the project engineer, CSHEP, Chimmony dam.
39. Testing of concrete cubes supplied by the project engineer, CSHEP, Chimmony dam.
40. Testing of concrete cubes, solid blocks and steel rods supplied by the Assistant Engineer, PWD Buildings Section, Kodungallur.
41. Testing of concrete cubes, solid blocks and steel rods supplied by the Assistant Engineer, PWD Buildings Section, Iringalakkuda.
42. Testing of concrete cubes, solid blocks and steel rods supplied by the Assistant Engineer, PWD Buildings Section-2, Ayyanthole
43. Testing of concrete cubes supplied by the project engineer, CSHEP, Chimmony dam.
44. Testing of concrete cubes supplied by M/s. Blue chip constructions, Ernakulam.
45. Testing of concrete cubes supplied by the Technical officer, M/s. Bharathi Cements, Thrissur.
46. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
47. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
48. Testing of concrete cubes supplied by the project engineer, CSHEP, Chimmony dam.
49. Testing of concrete cubes supplied by the Assistant Engineer, PWD Buildings Section, Chalakkudy.
50. Testing of steel rods supplied by the Assistant Engineer, PWD Buildings Section, Chalakkudy.
51. Testing of concrete cubes supplied by the assistant Engineer, P.W.D special Buildings section, Irinjalakkuda.
52. Testing of concrete cubes supplied by the Technical officer, M/s. Bharathi Cements, Thrissur.
53. Testing of solid blocks and concrete tiles supplied by the Assistant Engineer, PWD Buildings Section, Chalakkudy.
54. Testing of steel, aggregates, bricks and concrete mix design carried out for the Senior Section Engineer, Southern railway, Thrissur

55. Testing of steel, aggregates, bricks and concrete mix design carried out for the Senior Section Engineer, Southern railway, Thrissur
56. Testing of steel, aggregates, bricks and concrete mix design carried out for the Senior Section Engineer, Southern railway, Thrissur
57. Testing of steel, aggregates, bricks and concrete mix design carried out for the Senior Section Engineer, Southern railway, Thrissur
58. Testing of steel, aggregates, bricks and concrete mix design carried out for the Senior Section Engineer, Southern railway, Thrissur
59. Testing of steel, aggregates, bricks and concrete mix design carried out for the Senior Section Engineer, Southern railway, Thrissur
60. Testing of steel, aggregates, bricks and concrete mix design carried out for the Senior Section Engineer, Southern railway, Thrissur.
61. Testing of steel rods supplied by M/s. KMP Constructions, Press Club Road, Thrissur.
62. Concrete mix design carried out for M/s. KMP Constructions, Press Club Road, Thrissur.
63. Testing of concrete tiles supplied by the Assistant Engineer, PWD Buildings Section, Chalakkudy.
64. Testing of welded joints supplied by the Assistant Engineer, PLR Section, Aluva.
65. Testing of Manufactured sand supplied by the Assistant Engineer, TC Section, Pudukkad.
66. Testing of Paver blocks supplied by M/s. FINS Engineers & Contractors (P) Ltd, Thrissur.
67. Testing of concrete cubes supplied by the Assistant Engineer, PWD Buildings Section, Chalakkudy.
68. Testing of solid blocks supplied by the Assistant Engineer, PWD Buildings Section, Chalakkudy.
69. Testing of concrete cubes supplied by the Assistant Engineer, PWD Buildings Section, Kodungallur.
70. Testing of solid blocks supplied by the Assistant Engineer, PWD Buildings Section, Ayyanthole.
71. Testing of solid blocks and concrete bricks supplied by Sri. Nithin Jose, Myppan (H), Angamaly.
72. Testing of steel rods supplied by the assistant Engineer, RBC Section No.1, Chalakkudy.
73. Testing of steel rods supplied by the Project Manager supplied by the Project Manager, TBPL, Thrissur.
74. Testing of concrete cubes supplied by Sri.K.Balakrishnan, PWD Contractor, Cheruthuruthy.
75. Testing of concrete blocks supplied by the Project Manager, TBPL, Thrissur.
76. Testing of concrete cubes supplied by the Assistant Engineer, PWD Roads Section, Kodungallur.
77. Testing of steel rods supplied by the Assistant Executive Engineer, RMU Subdivision, Poringalkuthu.

78. Concrete mix design carried out for the Senior Section Engineer, Southern railway, Eranakulam.
79. Concrete mix design carried out for the Senior Section Engineer, Southern railway, Quilon.
80. Concrete mix design carried out for the Senior Section Engineer, Southern railway, Kottayam.
81. Concrete mix design carried out for the Senior Section Engineer, Special works, Southern railway, Quilon.
82. Testing of aggregates supplied by M/s.Poabs Granite Products, Angamaly.
83. Testing of aggregates supplied by Sri.Jaison Varghese, Perumbavur.
84. Testing of concrete cubes supplied by the Assistant Engineer, PWD Roads Section, Kodungallur.
85. Concrete mix design carried out for the Senior Section Engineer, Southern railway, Thrissur.
86. Testing of cement sample supplied by the Project Manager, TBPL, Thrissur.
87. Testing of cement sample supplied by the Project Manager, TBPL, Thrissur.
88. Testing of cement sample supplied by the Project Manager, TBPL, Thrissur.
89. Testing of cement sample supplied by the Project Manager, TBPL, Thrissur.
90. Testing of concrete cubes supplied by the Assistant Engineer, PWD Buildings Section, Kodungallur.
91. Testing of concrete cubes supplied by the Assistant Engineer, PWD Buildings Section, Chalakkudy.
92. Testing of concrete cubes supplied by the Assistant Engineer, PWD Buildings Section, Chalakkudy.
93. Testing of concrete cubes supplied by the Assistant Engineer, PWD Buildings Section, Chalakkudy.
94. Testing of concrete cubes supplied by the Assistant Executive Engineer, RMU Subdivision, Poringalkuthu.
95. Testing of Manufactured sand and concrete cubes supplied by the Assistant Engineer, TC Section, KSEB Chalakkudy.
96. Testing of aggregate sample supplied by the Project Manager, TBPL, Thrissur.
97. Testing of steel rods supplied by the Project Manager, TBPL, Thrissur.
98. Concrete mix design carried out for the Senior Section Engineer, Southern railway, Thrissur.
99. Testing of concrete cubes supplied by the Assistant Engineer, PWD Buildings Section, Irinjalakkuda.
100. Testing of concrete cubes supplied by the Assistant Engineer, PWD Buildings Section, Ayyanthole.
101. Testing of concrete cubes supplied by the Assistant Executive engineer, Engineering Subdivision, Vellanikkara.
102. Testing of paver blocks supplied by the Registrar, KFRI, Peechi.
103. Testing of concrete cubes supplied by the Assistant Executive engineer, Engineering Subdivision, Vellanikkara.

104. Testing of concrete cubes supplied by the Assistant Engineer, PWD Roads Section, Kodungallur.
105. Testing of concrete cubes supplied by the Assistant Engineer, PWD Roads Section, Kodungallur.
106. Testing of concrete cubes supplied by the Assistant Engineer, Irrigation Quality Control Section, Thrissur.
107. Testing of tiles supplied by the Senior section Engineer, Southern Railway, Kayamkulam.
108. Testing of concrete cubes supplied by the Assistant Executive engineer, Engineering Subdivision, Vellanikkara.
109. Testing of concrete cubes supplied by the Assistant Executive engineer, Engineering Subdivision, Vellanikkara.
110. Testing of concrete cubes supplied by the Assistant Engineer, KSEB, Annamanada.
111. Concrete mix design carried out for the Assistant Engineer, PLR Section, Aluva.
112. Testing of concrete cubes supplied by the Assistant Executive engineer, Engineering Subdivision, Vellanikkara.
113. Testing concrete cubes supplied by M/s. CEECON RMC, Pudukkad.
114. Testing concrete cubes supplied by M/s. K.M. Eliyas Constructions, Thrissur.
115. Concrete mix design carried out for the senior Section Engineer, Southern railway, Aleppey.
116. Testing of aconcrete cubes supplied by the Assistant Engineer, TC Section, Pudukkad.
117. Testing of steel rods supplied by the Project Engineer, KLDC, Thrissur.
118. Testing of concrete cubes supplied by the Assistant executive Engineer, Harbour Engineering Subdivision, Munambam.
119. Testing of concrete cubes supplied by the Assistant Executive engineer, Engineering Subdivision, Vellanikkara.
120. Testing manufactured sand supplied by M/s. K.M. Eliyas Constructions, Thrissur.
121. Testing of cement and aggregates supplied by M/s. CEECON RMC, Pudukkad.

Appendix – IV

List of tests conducted in the SM laboratory.

1. KRP-Rectification of the existing breach portion of RBMC - Conducting Plate Load Test - soil investigation

2. MRVP - Investigation for series of check dams and regulator cum bridge across Meenachil river from Panampuzha Timber Depot in Kottayam Municipality to Teekoy - conducting soil investigation

3. Soil Investigation of Manappattu chira at Malayattoor for stability Analysis

4. Investigation of Subsoil strata – Construction of Check Dam across Bharathappuzha at Mannannur in Vaniyamkulam Panchayath.

5. Sedimentnation survey of Peechi Reservoir using Integrated bathymetric system - Testing of soil and water samples

6. Establishment of Coast Guard Academy at Azhikkal in Kannur district - Soil Investigation works.

7. District Panchayath Project S0769/14 - Jalasamidhi (1^{st} Phase) - Construction of Check Dams at different locations in Puzhakkal Thodu for lift irrigation survey.

8. RRR - Improvement works to Valiyar Kulam in Ward No.2 of Pazhikkattiri Grama Panchayath

9. Thiruvillwamala Mini Civil Station - Thiruvillwamala Gramapanchayath - soil investigation.

10. KCAET Tavanur - B.Tech Project 2011 Batch - Providing data of

11. RRR - Improvement works to the Punchakuzhi Kulam in ward No.9 of Puzhakkattiri Panchayath

12. Construction of proposed ISW Hub at Palakkad

13. Conducting Tri-axial test - Project of final year students from Royal College of Engineering & Technology

14. Conducting Grain size analysis - Project of final year students from Royal College of Engineering & Technology

15. Conducting Grain size analysis - Project of final year students from Royal College of Engineering & Technology

16. PVIP-Proposal for constructing an alternate bridge and check dam at Bhoothathankettu – taking borehole details

Appendix – V

List of works conducted by the Instrumentation Division

1 Establishment of Coast Guard Academy at Azikkal in Kannur District-Soil investigation works

2. District Panchayath project S0769/14- Jalasamridhi (Ist Phase) - Construction Of Check Dams at different locations in PuzhakkalThodu for lift irrigation survey

3. KSSDA - Construction of seed Godown& Processing plant.

4. Soil Investigation Work – Construction of Proposed ISW Hub at Palakkad

5. Soil Investigation Work – Construction - PVIP-Proposal for constructing an alternate bridge and check dam at Bhoothankettu.

Appendix – VI

List of works completed by the Coastal Engineering Field Studies Division

Sl. No.	Sl No. in Action plan	Name of Work	Amount in the Approved Action Plan (in lakh)	Agreed PAC (R)	Cheque Amount	Remarks
1	5	13th FC Award-2012-13 CES- Planting Control point stones, Alignment stones, Kilometer stones and Benchmark stones along the coast under CE Section, Cherthala	6.60	5,83,766	5,39,296	Work completed
2		13th FC Award-2013-14 CES- Planting Control point stones, Alignment stones, Kilometer stones and Benchmark stones along the coast under CE Section, Cherthala	3.30	3,22,055	2,97,705	Work completed
3	1	13th FC Award- CES- Planting Control point stones, Alignment stones, Kilometer stones and Benchmark stones along the coast under CE Section, Thalassery	8.00	8,33,766	5,08,648	Work completed
4	1	13th FC Award-CES- Planting Control point stones, Alignment stones, Kilometer stones and Benchmark stones along the coast under CE Section, Thalassery.	11.00	10,04,120	0.00	Work was terminated at the risk and cost of contractor
5		13thFC works- Investigation on protective measures to be adopted along the sea coast under CE Section, Chavakkad for the year 2014-15	7.72	2,88,524	2,62,797	Work completed
6		13thFC works- Investigation on protective measures to be adopted along the sea coast under CE Section, Eranakulam for the year 2014-15	7.50	93,876	82,723	Work completed

7	8	13th FC Award- Investigation on Protective measures to be adopted along the Sea coast under CES Section, Thalassery	7.50	2,21,033	2,05,562	Work completed
8		13th FC Award- Investigation on protection measures to be adopted along the sea coast under CES Section, Kozhikode	7.50	2,50,938	2,20,697	Work completed.
9		13th FC Award- Investigation on protection measures to be adopted along the sea coast under CES Section, Parappanangadi	7.50	1,23,047	1,14,435	Work completed.
10		13th FC Award- Investigation on protection measures to be adopted along the sea coast under CE Section, Thottappally	7.72	1,26,128	1,21,201	Work completed.
11		13th FC Award- Investigation on protection measures to be adopted along the sea coast under CE Section, Kollam	7.72	1,26,804	1,22,028	Work completed.
12		13th FC Award- Investigation on protection measures to be adopted along the sea coast under CE Section, Thiruvananthapuram	7.72	1,56,673	1,45,143	Work completed.

Appendix-VII

Times and Places of observation

Month	Date	Day
1. April	29-04-2014	Tuesday
2. May	28-05-2014	Wednesday
3. June	27-06-2014	Friday
4. July	26-07-2014	Saturday
5. August	25-08-2014	Monday
6. September	24-09-2014	Wednesday
7. October	23-10-2014	Thursday
8. November	22-11-2014	Saturday
9. December	22-12-2014	Monday
10. January	20-01-2015	Tuesday
11. February	18-02-2015	Wednesday
12. March	20-03-2015	Friday

Appendix-VIII

Details of Simultaneous Observations

Sl. No.	Name of Station	Time and C. P. Nos.				
		9 AM	10 AM	11 AM	11.45 AM	12.30 PM
1	Vettukadu	112	114	116	114	112
2	Anjengo	223	228	233	228	223
3	Eravipuram	317	322	327	322	317
4	Thottappilly	597	600	602	600	597
5	Alapuzha	704	707	710	707	704
6	Thankay	926	930	935	930	926
7	Kannamaly	1025	1037	1047	1037	1025
8	Kuzhupilly	1140	1147	1149	1147	1140
9	Perinjanam	1269	1274	1279	1274	1269
10	Nattika	1323	1330	1333	1330	1323
11	.Blangad	1418	1421	1428	1428	1418
12	Vakkad	1595	1599	1605	1599	1595
13	Calicut	1830	1826	NCP	1826	1830
14	Melady	2013	2009	2004	2009	2013
15	Thalassery	Behind Bishop house	1067	1075	1067	Behind Bishop house
16	Kanhangad	2608	2603	2598	2603	2608
17	Kasargod	531	541	550	541	531
18	Kanwatheertha	103	111	121	111	103

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