KERALA ENGINEERING RESEARCH INSTITUTE

കേരള എഞ്ചിനീയറിംഗ് റിസർച്ച് ഇൻസ്റ്റിറ്റ്യൂട്ട്

An Institution of Irrigation Department Under Ministry of Water Resources, Govt of Kerala

Annual Report 2021-2022

ANNUAL REPORT

2021 – 22

Kerala Engineering Research Institute, Peechi

Publication No. 84

Kerala Engineering Research Institute, Peechi

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PREFACE

The Kerala Engineering Research Institute, established in 1960, is one of the pioneering institutes of its kind in our country. The first Prime Minister of India, Sri.Pandit Jawaharlal Nehru laid the foundation stone of the Institute and it was inaugurated by the then Governor of Kerala, Sri. Ramakrishna Rao, with a mandate for seeking solutions to Engineering problems which would arise at different stages of planning and execution of development projects in the field of Irrigation, Navigation, Roads and Bridges and Buildings as well. This is the only one Research Institute functioning under Kerala State Irrigation department. This Institute is publishing its Annual Report every year.

This report has been prepared to provide a brief record of the activities of the Institute during the Financial Year 2021-22. Details of the organizational set up, personnel, activities of each divisions and the abstract of Financial Statement are included.

This institute is a member of Higher Education Council and involving in the policy formulation decisions. Being a member, the Institute also supporting all technical guidance to coastal studies and protection works. This institute is also listed as a registered Institute for research studies of Calicut University. The institute facilitates training to Engineers and overseers from Irrigation department in Civil Engineering field. There are member participation of KERI in various technical committees such as CWRC(sub group member), Irrigation works under KIIFB funding-technical committee member, Desiltation of Higher Education Council-Governing body member, Kerala State Higher Educational council- Government body member, CWRDM-Technical advisory committee IRTC-Organizing committee member, CIMS (coastal information and management system) stake holder member, Implementation of KIFB Funded projects-advisory committee expert member, Highlevel commitee member-disaster management department.

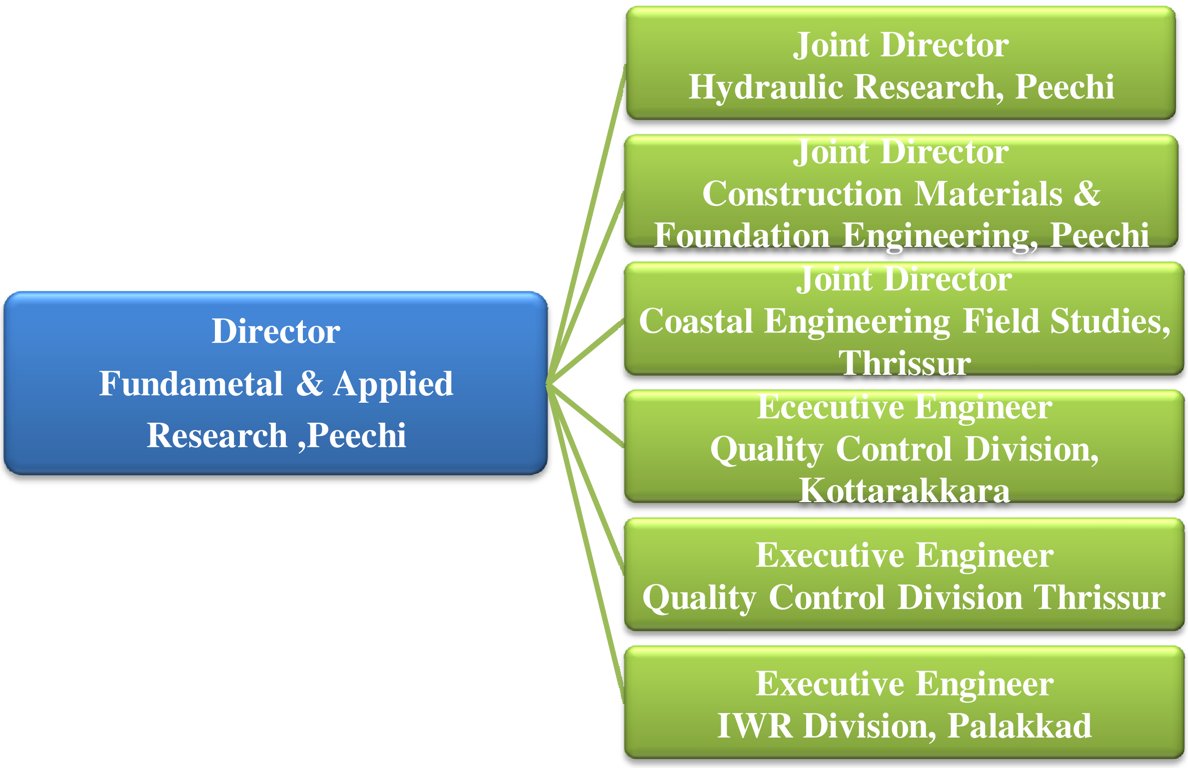
During the year 2021-22, an amount of Rs. 12,82,560/- has been collected as revenue. Out of the total outlay of Rs.150 lakh for the financial year 2021-22, an amount of Rs.141.39 lakhs has been utilized.

Peechi Director

1. ORGANISATIONAL SET UP

The Kerala Engineering Research Institute is under the Directorate of Fundamental and Applied Research, KERI, Peechi, which is headed by a Director in the rank of Superintending Engineer, with two divisions operating at Peechi, namely Hydraulic Research and Construction Materials & Foundation Engineering Division, and another division functioning at Thrissur, namely Coastal Engineering Field Studies Division, each office is headed by Joint Director, an officer in the rank of an Executive Engineer. The Institute is under the control of I.D.R.B which is a part of the Irrigation Department's, which reports to the Chief Engineer, Investigation & Design (IDRB), Thiruvananthapuram.

Each Division has the following organizational structure.



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, Thrissur

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

IV Executive Engineer, Quality Control Division, Thrissur

1. Quality Control Sub Division, Kannur
2. Quality Control Sub Division, Kozhikkode
3. Quality Control Sub Division, Palakkad
4. Quality Control Sub Division, Thrissur
5. Quality Control Sub Division, Muvattupuzha

V Executive Engineer, Quality Control Division, Kottarakkara

1. Quality Control Sub Division, Kottayam
2. Quality Control Sub Division, Alappuzha
3. Quality Control Sub Division, Kottarakkara
4. Quality Control Sub Division, Thiruvananthapuram

VI Executive Engineer, Investigation for Water Resources Division

1. Investigation for Water Resources Sub Division, Palakkad
2. Investigation for Water Resources Sub Division, Thrissur

The first three divisions are doing research works, laboratory testing and collection of field data related to their respective fields and present valuable results and also analyses results 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 has been constituted for the purpose of quality assurance of works of Irrigation Department. The jurisdiction of this wing is all over Kerala. There are 18 sections, under 9 Sub divisions, at Thiruvananthapuram, Kollam, Kottarakkara, Pathanamthitta, Allappuzha, Idukki, Kottayam, Aluva, Moovattupuzha, Koothattukulam, Angamaly, Thrissur, Palakkad, Malappuram, Kozhikode, Kalpetta, Kannur and Kasaragod.

Investigation Division for Water Resources Division, Palakkad is a newly formed office, under the control of Chief Engineer, IDRB and the Director, F & AR, KERI, Peechi, is functioning at Palakkad. There are two sub Divisions under this office, one is at Palakkad and other is at Thrissur. There are seven section offices under these two sub divisions.

2. PERSONNEL

The Executive officers who headed the various offices under KERI during the financial year 2021-22 are:

DIRECTORATE OF FUNDAMENTAL & APPLIED RESEARCH		
DIRECTOR		Er. Suprabha. N (from 01/04/2021 to 31/03/2022)
ASSISTANT DIRECTOR		Er. Naveen. C.L (from 01/04/2021 to 31/03/2022)
JOINT DIRECTOR, CONSTRUCTION MATERIALS & FOUNDATION ENGINEERING		
JOINT DIRECTOR	:	Er..Beena N (from 01/04/2021 AN to 31/03/2022)
ASSISTANT DIRECTOR	:	Er. Smitha V.R. (from 1/04/2021 to 31/03/2022)
CONSTRUCTION MATERIALS DIVISION		
DEPUTY DIRECTOR		Er. Ajith Kumar T.V. (01-04-2021 to 31-01-2022) Er. Sufeera O.B. (01-02-2022 to 31-03-2022)
ASSISTANT DIRECTOR I	:	Er. Siji T.V. (From 01.04.2021 to 31.03.2022)
ASSISTANT DIRECTOR II		Er. Rappai V.V. (From 01.04.2021 to 31.03.2022)
SOIL MECHANICS AND FOUNDATIONS DIVISION		
DEPUTY DIRECTOR	:	Rameshkumar T V From01/04/2021 to 31/03/2022
ASSISTANT DIRECTOR I	:	Er. Joyal Scaria (from 01/04/2021 to 31/03/2022)
ASSISTANT DIRECTOR II	:	Er. Jomy Joseph (from 30/04/2020 to 31/03/2022)
INSTRUMENTATION DIVISION		
DEPUTY DIRECTOR	:	Er. Saju Varghese (from 01/04/2021 to 31/03/2022)
ASSISTANT DIRECTOR	:	Er. Sreedev.M.S (from 01/04/2020 to 01/06/2021)
		Er. Rappai V.V. (from 02/06/2021 to 05/07/2021)
		Er .Arun K A (from 06/07/2021 to 31/03/2022)
PUBLICATIONS DIVISION	:	Post Abolished
HYDRAULIC RESEARCH		
JOINT DIRECTOR	:	Er.Suja.S.S (from 01/04/2021 to 24/01/2022)

		Er Shini K K (From 24/01/2022 to 31/03/2022
ASSISTANT DIRECTOR	:	Er. Nisha Antony (Full Addl charge 01/04/21 to 31/05/2021)
	:	Er. Saji George (From 01/06/21 to 31/03/2022)
HYDRAULICS DIVISION		
DEPUTY DIRECTOR	:	Er. Suhurban BeegumV (From 01/04/2021 to 31/03/2022)
ASSISTANT DIRECTOR I	:	Er .Sandeep M N (From 01/04/2021 to 30/11/2021) Er. Nisha Antony (Additional Charge) from 01.12.2021 to 31.03.2022
ASSISTANT DIRECTOR II	:	Er. Nisha Antony (from 01/04/2021AN onwards)
COASTAL ENGINEERING DIVISION		
DEPUTY DIRECTOR	:	Er.RajiThampan from 01.04.2021 onwards
ASSISTANT DIRECTOR I	:	Er.Sufeera O.B.from 01.04.2021 to 31.01.2022 dditional Charge) from 01.02.2022 to 31.03.2022
ASSISTANT DIRECTOR II	:	) from01.04.2021 to 04.07.2021) Er.Devarajan K. from 05.07.2021 to 31/03/2022
SEDIMENTATION DIVISION		
DEPUTY DIRECTOR	:	Er.Divya C J (From 01-04-2020 to 06/09/20)
ASSISTANT DIRECTOR I		Er.Francy V Antony (from 01/04/2021 to 31/05/2021) Er Roshni S S (Addl.charge from 01/06/2021 to 06/07/2021) Er .Jayasree K V (From 07/07/2021 to 31/04/2022)
ASSISTANT DIRECTOR II		Er.Roshni S S (From 01/04/2021 to 31/03/2022)
COASTAL ENGINEERING AND FIELD STUDIES		
JOINT DIRECTOR	:	Er. Ajmal. E (from 01/04/2021 to 31/03/2022)
ASSISTANT DIRECTOR		Er. Anusree A(FAC from 22/09/2021 to 18/04/2022)
		Er. Ajantha V.D. (Full additional charge from 18/04/2022 to 31/03/2022)

COASTAL ENGINEERING SUB DIVISION , KOLLAM		
DEPUTY DIRECTOR		Er. Raji.C.T (from 01/04/2021 to 13/12/2021)
		Er. Rajeena M (from 13/12/2021 to 31/03/2022)
COASTAL ENGINEERING SECTION, TRIVANDRUM		
ASSISTANT DIRECTOR		Er.Ajin Singh S (from 01/04/2021 to 31/03/22)
COASTAL ENGINEERING SECTION ,KOLLAM		
ASSISTANT DIRECTOR		Smt. Rajeena M (From 17/04/2021 to 31/03/2022)
COASTAL ENGINEERING SECTION, THOTTAPPALLY		
ASSISTANT DIRECTOR		Er. Sri.Jayaprakash. D. (From 01/04/2021 to 31/03/2021)
COASTAL ENGINEERING SUB DIVISION, ERNAKULAM		
DEPUTY DIRETOR	:	Er. T.K. Rajesh (from 01/04/2021 to 31/03/2022)
COASTAL ENGINEERING SECTION, ERNAKULAM		
ASSISTANT DIRECTOR	:	Er. Anusree A (from 01/04/2021 to 31/03/2022)
COASTAL ENGINEERING SECTION, CHERTHALA		
ASSISTANT DIRECTOR		Er. Clament Roy . K. R (from 01/04/2021 to 31/03/2022)
COASTAL ENGINEERING SECTION, CHAVAKKAD		
ASSISTANT DIRECTOR		Er. Ajantha V.D (from 01/04/2021 to 31/03/2022)
COASTAL EROSION STUDIES , SUB DIVISION, KOZHIKODE		
DEPUTY DIRECTOR	:	Er. Abbas M T .(from 01/04/2021 to 31/03/2022)
COASTAL EROSION STUDY SECTION, KOZHIKODE.		
ASSISTANT DIRECTOR		Er. Jithin.P (from 01/04/2021 to 31/03/2022)
COASTAL EROSION STUDIES SECTION, THALASSERY		
ASSISTANT DIRECTOR	:	Er. Sri. Ashraf. P P (01/04/21 to 31/03/2022)
COASTAL EROSION STUDIES SECTION, PARAPPANANGADI		
ASSISTANT DIRECTOR		Er. Ammad.P.C (from 01/04/2021 to 31/03/2022)
QUALTY CONTROL DIVISION, THRISSUR		
EXECUTIVE ENGINEER		Er. Sajeev Kumar V S (from 01/04/2021 to 31/03/2022)
ASSISTANT EXECUTIVE ENGINEERS		
Q.C. DIVISION, THRISSUR	:	Er. Deepa R (from 01/04/2021 to 31/03/2022)
Q.C. SUB DIVISION, MOOVATTUPUZHA	:	Er. Kamal Roy K V(from 01/04/2021 to 31/03/2022)
Q C SUB DIVISION , THRISSUR		Er. Babu M S (from 01/04/2021 to 31/03/2022)

QC SUB DIVISION , PALAKKAD	Er. Sudhakaran T.S (from 01/04/2021 to 28/02/2022) Er. Kamal Roy K V (from 01/03/2022 to 31/03/2022)
QC SUB DIVISION , KOZHIKOD	Er. Rajeev B ((from 01/04/2021 to 31/03/2022)
QC SUB DIVISION, KANNUR	Er. Sahadevan Chadayan (from 01/04/2021 to 31/03/2022).
Q.C SECTION-I, MOOVATTUPUZHA	Er. Gopu N (from 01/04/21 to 31/03/2022)
Q.C SECTION-II, KOOTHATTUKKULAM	Er. Anila K.T. (from 01/04/2021 to 26/04/2021)
	Er. Valsalakumari V.R (Full Addl Charge from 27/04/2021 to 16/05/2021)
	Er. Anila K.T. (from 17/05/2021 to 31/05/2021)
	Er. Gopu N (FAC from 01/06/2021 to 14/09/2021)
	Er. Valsalakumari V.R (Full Addl Charge from 15/09/2021 to 30/11/2021)
	Er. Gopu N (Full Addl Charge from 01/12/2021 to 31/03/2022)
Q.C SECTION-III, ANGAMALY	Er.Valsalakumari V.R (from 01/04/2021 to 30/11/2021)
	Er. Rahna U A (FAC from 01/12/2021 to 31/03/2022)
Q.C SECTION, THRISSUR	Er. Nirish P P (from FAC 01/04/2021 to 31/03/2022)
Q.C SECTION, ERNAKULAM	Er. Rahna U A (from 01/04/2021 to 31/03/2022)
Q.C SECTION, PALAKKAD	Er. Sulaiman M. (from 01/04/2020 to 13/11/2021)
	Er.Padmakumar C (FAC from 13/11/2021 to 31/03/2022)
Q.C SECTION, MALAPPURAM	Er. Sulaiman M. (from 01/04/2021 to 30/11/2021)
	Er. Girish Kumar.K (from 30/11/2021 to 10/02/2022)
	Pankajakshan AM (from 10/02/2022 to 31/03/2022)
Q.C SECTION, KOZHIKODE	Er. Girish Kumar . K (from 01/04/2021 to 10/02/2022)
	Pankajakshan AM (FAC from 11/02/2022 to 31/03/2022)
Q.C SECTION, WAYANAD	Er. Nirish P P (from 01/04/2021 to 31/03/2022)
Q.C SECTION, KANNUR	Er. Girish Kumar.K (from 01/04/2021 to 01/06/2021)
	Er. Jithin Vattapara (from 01/06/2021 to 31/03/2022)
Q.C SECTION, KASARAGOD	Pankajakshan AM(from 11/02/2022 to 31/03/2022)
QUALITY CONTROL DIVISION, KOTTARAKKARA	

EXECUTIVE ENGINEER	:	Er. Sindhu R (from 01/04/2021 to 12/10/2021)
	:	Er. Jolly Susan Cheriyan (from 12/10/2021 to 31/03/2022)
QUALITY CONTROL SUB DIVISION, KOTTARAKKARA		
ASSISTANT EXECUTIVE ENGINEERS	:	Er. Laly S S Cheriyan (from 01/04/2021 to 31/03/2022)
QUALITY CONTROL SECTION, KOTTARAKKARA		
ASSISTANT ENGINEER		Er. Sheeja Panicker (from 01/04/2021 to 31/03/2022)
QUALIYY CONTROL SUB DIVISION, THIRUVANANTHAPURAM		
ASSISTANT EXECUTIVE ENGINEER	:	Er.Leenakumari P. S. (from 01/04/2021 to 31/03/2022)
QUALITY CONTROL SUB DIVISION, KOTTAYAM		
ASSISTANT EXECUTIVE ENGINEER	:	Er. Merin Thomas (from 01/04/2021 to 31/03/2022)
QUALITY CONTROL SUB DIVISION, ALAPPUZHA		
ASSISTANT EXECUTIVE ENGINEER	:	Er. Jessy Thomas (from 01/04/2021 to 31/03/2022)
Q.C. SECTION , PATHANAMTHITTA	:	Er.Deepa B (from 01/04/2021 to 31/03/2022)
Q.C,SECTION , ALAPPUZHA		Er. Anjana S (from 01/04/2021 to 31/03/2022)
Q.C SECTION, TVPM		Er.Ambili I (from 01/04/2021 to 31/03/2022)
Q.C SECTION, KOLLAM		Er.Bindhu R (from 01/04/2021 to 31/03/2022)
Q.C SECTION, KOTTAYAM		Er. Usha D (from 01/06/21 to 01/10/21)
		Er. Joseph Nelson(addl charge) (from 01/10/21 to 10/10/21)
		Er. Jayadev P S (from11/10/21 to 31/03/22)
Q.C SECTION, IDUKKI		Er. Joseph Nelson P J (from 01/04/2020 to 31/10/2021)
		Er. Jayadev.P.S (full addl charge from 01/11/2021 to 20/01/2022)
		Er. Jomy.G.Jose (from 21/01/2022 to 31/03/2022)
INVESTIGATION FOR WATER RESOURCES DIVISION, PALAKKAD		
EXECUTIVE ENGINEER	:	Er.Unnikrishnan K V (from 01/04/2021 to 31/03/2022)

ASSISTANT EXECUTIVE ENGINEER	:	Er. Binni Sukumaran (from 01/04/2021 to 18/02/2022)
	:	Er. Sajitha M (from 19/02/2022 to 31/03/2022)
IWR SUBDIVISION NO.1, PALAKKAD		
ASSISTANT EXECUTIVE ENGINEER	:	Er. Deepa S (from 01/04/2021 to 31/03/2022)
IWR SUBDIVISION NO.2, THRISSUR		
ASSISTANT EXECUTIVE ENGINEER	:	Er. Rajashree R (from 01/04/2021 to31/03/2022)
ASSISTANT ENGINEERS		
IWR SECTION 1/1, PALAKKAD	:	Er.Hareesh K (Full addl Charge from 01/04/2021 to 07/07/2021)
	:	Er.Padmakumar C. (08/07/2021 to 31/03/2022)
IWR SECTION 2/1, NILAMBUR	:	Er.Hareesh K (from 01/04/2021 to 04/10/2021)
		Er.Padmakumar C (Full addl Charge from 05/10/2021 to 31/03/2022)
IWR SECTION 3/1, AGALI	:	Er.Hareesh K (Full addl Charge from 01/04/2021 to 04/10/2021)
		Er.Padmakumar C (Full addl Charge from 05/10/2021 to 31/03/2022)
IWR SECTION 4/1, KOZHIKODE	:	Er.Hareesh K (Full addl Charge from 01/04/2021 to 04/10/2021)
		Er.Padmakumar C (Full addl Charge from 05/10/2021 to 31/03/2022)
IWR SECTION 1/2, THRISSUR	:	Er.Hareesh K (Full addl Charge from 01/04/2021 to 04/10/2021)
	:	Er.Padmakumar C (Full addl Charge from 05/10/2021 to 31/03/2022)
IWR SECTION 2/2, PEECHI	:	Er.Hareesh K (Full addl Charge from 01/04/2021 to 04/10/2021)
	:	Er.Padmakumar C (Full addl Charge from 05/10/2021 to 31/03/2022)
IWR SECTION 3/2, MALAPPURAM	:	Er.Hareesh K (Full addl Charge from 01/04/2021 to 04/10/2021)
	:	Er.Padmakumar C (Full addl Charge from 05/10/2021 to 31/03/2022)

3.HUMAN RESOURCES

The human resources of KERI comprise of both technical and non-technical 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 was 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 in this 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 centres.

At present, out of the fourteen posts of Assistant Engineers, One post are lying vacant. The number of supporting technical staff in the category of draftsman is Twenty One against a sanctioned strength of twenty-five. 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 at Thrissur 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 HYDRAULICS DIVISION

.INTRODUCTION

Hydraulics Division works under the Joint Director, Hydraulic Research. Studies on various problems in Applied Hydraulics and Irrigation Engineering are taken up by Hydraulics division and solutions are proposed for the same. The division conducts the model studies for various hydraulic structures. The studies are conducted on a wide range of parameters related to spillways, sluices, chutes, energy dissipating arrangement, hydraulic behavior of canal structures, river training works etc. From these studies hydraulically sound and economically viable solutions are provided to various problems associated with projects.

There are two model areas under this division which accommodate a number of previous extensive project models. The maintenance of this model area is done by this division. The hydraulic models in these model areas help the students to study about dams and also increase possibility of tourism. The division also maintains a three-dimensional model of Kerala and it is a centre of attraction for the tourists in Peechi.

Hydraulics Division had the facility for calibration of the current meter and it was stopped long years ago due to damage of the testing facility. The renovation work of test facility of calibration of current meter is included in the action plan of the financial 2022-23 which will enable KERI to provide this service for the Irrigation department. The division has notch calibration facility also. The duty of operating internet infrastructure facilities of all offices in KERI is entrusted with this office.

Apart from the hydraulic studies, the division maintains a meteorological station. It is located on the west bank of Peechi dam, near Peechi House. From the station, measurements of weather parameters such as atmospheric pressure, temperature (Min.& Max), humidity, rainfall, evaporation, wind speed, wind direction and sunshine are observed using manual meteorological observations and automatic weather station. The monthly weather data as obtained is submitted to the Joint Director, Director and Superintending Engineer Hydrology, every month.

2. STAFF PATTERN

The division is headed by a Deputy Director and the technical cadre comprises of two Assistant Directors, two Research Assistants, one Second Grade Overseer and one Third

Grade Overseer. The total sanctioned strength of the office is 9. The present staff details are given below.

Deputy Director		Er. Suhurban BeegumV (from 23/11/2018 FN to 22/05/2022) Er. Divya C.J (Additional charge 23/05/2022 FN onwards)
Assistant Director		1. Er. Nisha Antony (from 25/01/2019AN onwards) 2 Vacant
Research Assistant		1. Smt. Nisa V P (from 16/11/2022 onwards) 2 Vacant
Second Grade Overseer		Vacant
Third Grade Overseer		Smt Prabini V K (from 17/02/2022 onwards)
Clerk cum Typist		Smt. Radha. M.V
Part time sweeper		Vacant

3. <u>ACTIVITIES OF THE YEAR 2021-22</u>

During the year 2021-22, with sanctioned budget of Rs.23.00 lakhs, following were the major activities of the division

1. Hydraulic studies

Model study of Kuttiyadi Dam Phase II

2. Lab Infrastructure

Maintenance of Instrumentation workshop building for using as a model lab Phase II

Renovation of Model Area I and II

Upgradation of Hydraulics Lab

3. Istrumentation

Providing wireless internet facility for Director Office and other Offices

4. Routine works of the division

Routine works of Hydraulic division office for the year 2021-22

Routine Maintenance of Kerala Model and building housing Model for the year 2021-22

Routine maintenance of Meteorological stations for the year 2021-22

Routine maintenance of Model area 1 and II for the year 2021-22

Maintenance and yearly charges of FTTH internet connection of KERI Offices for the year 2021 – 22

3.1 Initial setup and Physical Model Study of Kuttiyadi Dam

Based on the recommendation of the committee on dam safety it was decided to modify the spillway of the Kuttiyadi dam. Chief Engineer, IDRB, Thiruvananthapuram (Vide Lr.No. No:675/DAMS-AD6/1987/IDRB-Part File I dated 30.04.2018) directed KERI to undertake the physical modelling of the proposed modification of spillway of Kuttiyady dam. The study involves in verifying the flow characteristics of the proposed modification of spillway and stilling basin for energy dissipation. Based on their technical advice an initial set up for conducting the physical model study of dam was developed in the hydraulics lab. The initial setup included water proofing of overhead tank, setting up of water circulation system, underground sump for storing water etc.

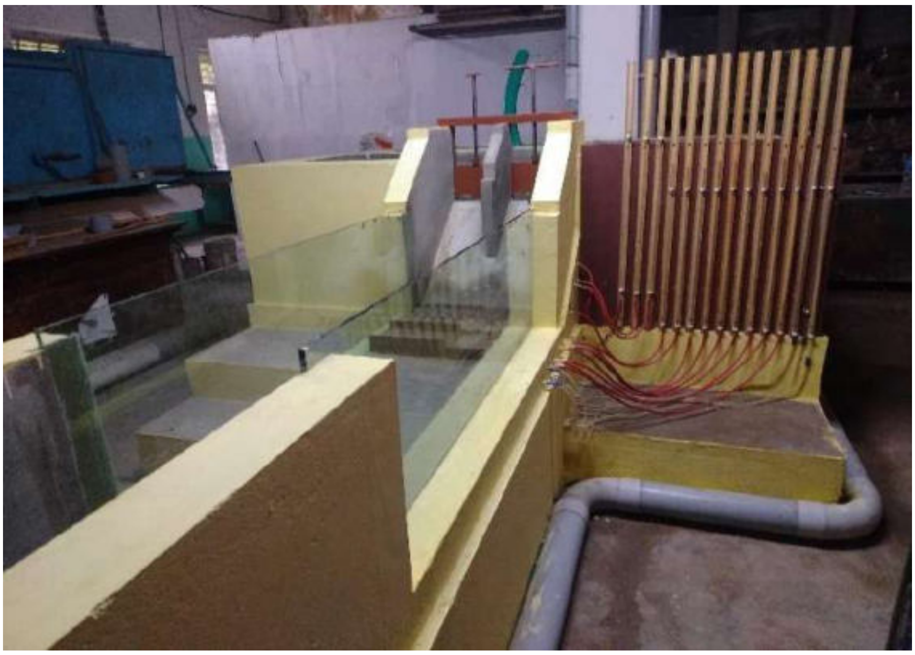
3.1.1 Details of Kuttiyadi Dam

It is a straight gravity masonry dam constructed across Kuttiyadi river in Kozhikode district. It utilizes the tailrace discharge of the Kuttiyadi power house at its upstream. The masonry dam has a length of 171 m. The spillway is located in the masonry dam and has 4 vents of size 12.20m x 6.10m with radial shutters. The Full Reservoir Level (FRL) is +44.41m and the crest level of spillway is +38.44m. The top level of the dam is +46.85m. The details of the dam is given below in table 1.

Description	Reduced Level
Maximum water level	+44.640 m
Full reservoir level	44.410 m
Crest level of dam	38.440m
Dam height	27.75 m
Length of dam	171 m
No of spillways	4
Maximum discharge	1584 m3/s

3.1.2 Details of the model

The model of the prototype spillway of the Kuttiyadi dam was constructed to a scale of 1: 60 in the Hydraulics laboratory of Hydraulics Division, KERI. Out of four bays, an undistorted model of two bays was constructed at two different downstream bed levels (having downstream bed level at +15.0 m and +16.5 m) as in prototype. Among the two bays, the centre bay is at +15.00 m and end bay is +16.50 m as in Fig. 1, following the Froude's model law, for scaling the parameters in order to achieve dynamic similarity between the model and prototype. An Ogee type of spillway model with stilling basin and energy dissipater corresponding to the prototype was constructed according to the scaled dimensions in model following the scale ratio. The spillway was also provided with shutters so as to control the flow of water from the reservoir to the downstream. The reservoir with head maintaining facility, facility for discharge measurement, pressure head measurement, flow profile plotting along the spillway flow path also exist in the model. The discharge measurement was done using a calibrated V - notch. The model set up along with elevation of the spillway is shown in Fig. 1, with the piezometer tapings (Sp1 to Sp15) provided to measure the pressure head when the flow occurs over the spillway. The design discharge adopted for the model building of spillway as supplied by IDRB is 1584 m3/s. Based on the details supplied by the Irrigation Design and Research Board (IDRB) on the modified design of the spillway, the physical model of the prototype spillway was simulated in the hydraulics laboratory of KERI, and the performance of the model was analysed. The details pertaining to the spillway model building, model observations, analysis are discussed.



Model details

The flow simulation through the Ogee spillway was carried out for different discharges between the minimum to the maximum corresponding to the maximum water level in the prototype. Several trials were done and flow characteristics were observed. The details of the pressure head values were recorded in the piezometer tapings. The actual discharge corresponding to different head water over the spillway crest was measured using the calibrated V notch. For the spillway having effective length 'Le 'and the head over the crest 'H', the discharge co-efficient 'C' in the discharge equation for the spillway $Q = C\ Le\ H^{3/2}$ were estimated for different discharges. Based on the theoretical and the actual discharge values corresponding to different water levels, the co-efficient of discharge of the spillway is estimated. The initial depth of flow and the sequent depth for the hydraulic jump were measured and the velocity and Froude number at the salient points of jump were estimated.

3.1.4 Discussion

By simulating site conditions, a physical observation of the jump in the stilling basin was done to see the flow pattern and energy dissipation.

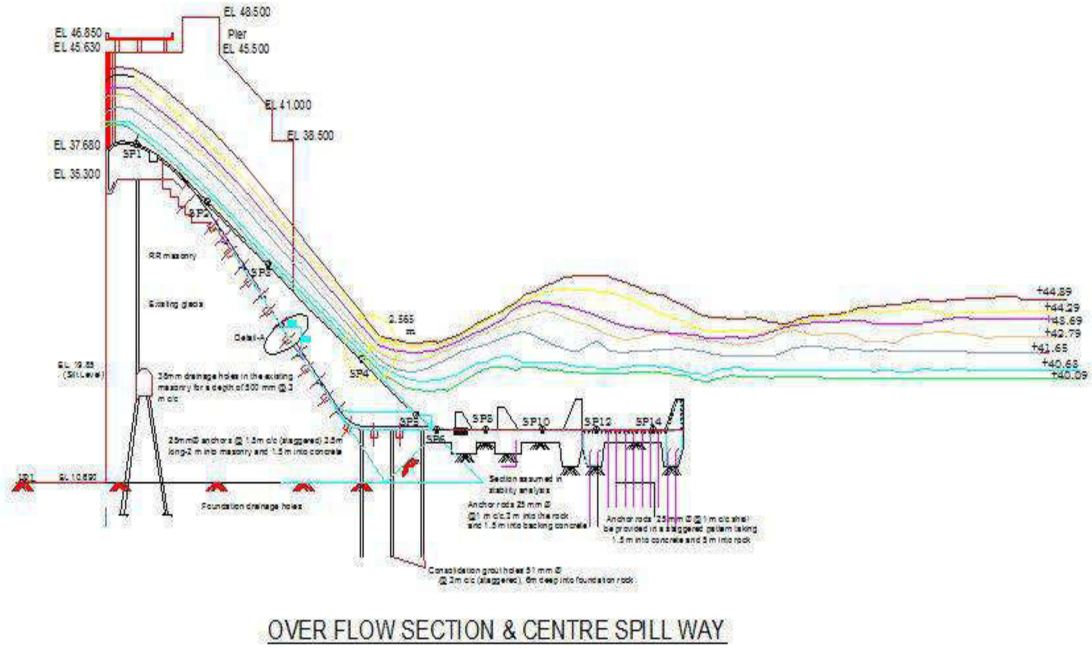


Figure1: showing hydraulic jump in centre spillways

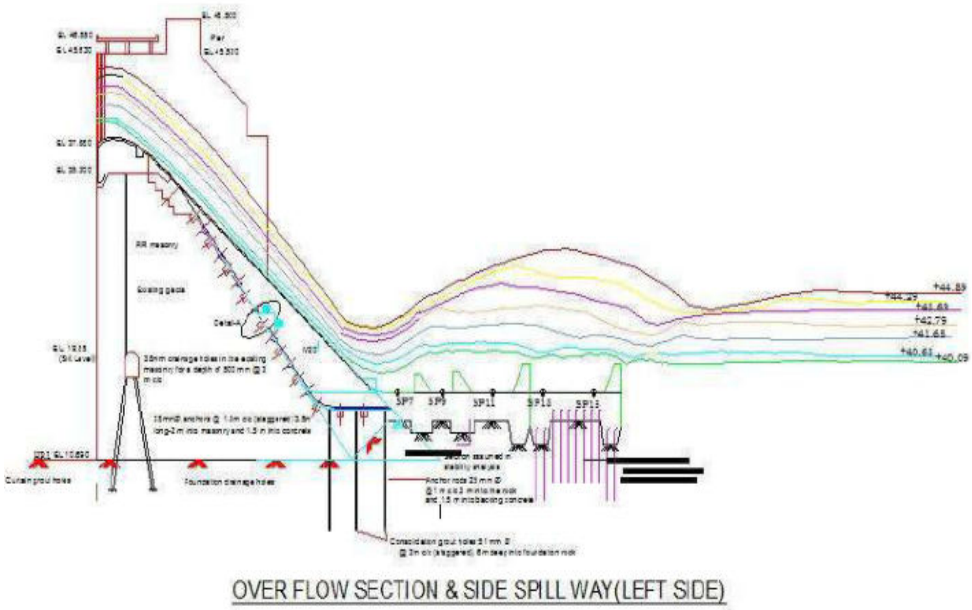


Figure 2: showing hydraulic jump in side spillways

3.2 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. The weather data is used for the real-time preparation of weather analysis, forecasts and severe weather warnings, for the study of climates, for local weather dependent operations, for hydrology and agricultural meteorology and for research in meteorology and climatology. The meteorological Station under K E R I, Peechi is located on the west bank of

Peechi Dam, near the Peechi House at a latitude of 10º 31’30’’ N, longitude 76º 21’ 59’’ E and height above MSL +96.03 m. The station is equipped with instruments for manual weather observations and an automatic weather station (AWS) for recording different weather parameters. The weather parameters are observed and recorded daily at 8.30 AM. The station is equipped with the instruments for measuring manually the weather parameters namely Atmospheric Pressure, Temperature, Humidity, Rainfall, Evaporation, Wind speed, Wind direction and Bright Sunshine.

3.2.1 Automatic Weather Station

As part of modernization, an automatic weather station was installed in June 2014. Time series observations are vital to improve the understanding of weather dynamics and its variability. The automatic weather station (AWS) plays an important role in providing short term and long-term time series weather observations. Automatic weather station is functioning with 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. These data can be accessed using a software HYDRAS. The data collected can be used to gauge current weather conditions and to make weather forecasts like temperature high/lows, cloud cover and the probability of precipitation.

Components of Automatic Weather Station:

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

Automatic Weather Station - Instruments

3.2.2 Manual Weather Station

Manual measurements of meteorological data are done using the following instruments.

- 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

PSYCHROMETER

HAIR HYGROMETER

BIMETALLIC THERMOGRAPH

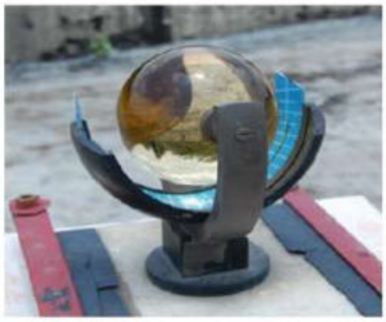
FLOAT TYPE SELF RECORDING RAIN GAUGE

STANDARD RAIN GAUGE

LANDPAN EVAPORIMETER

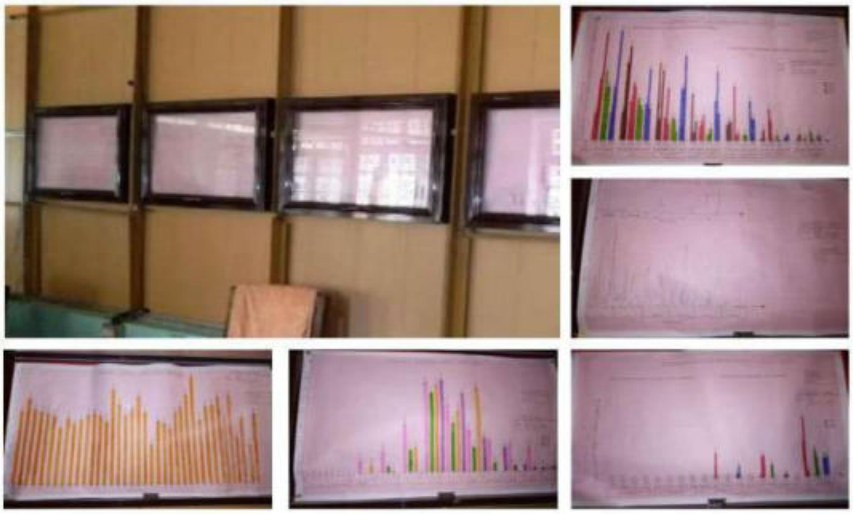
WIND VANE

CUP ANEMOMETER



SUNSHINE RECORDER

<u>Weather Station- Instruments for manual recordings of weather data</u>



<u>Graph for temperature, annual rainfall, 10 days chart for rainfall, monthly chart for rainfall etc.</u>

3.3 Maintenance of 3D model of Kerala and the building housing the model

The Relief map of Kerala (Kerala model) at K.E.R.I. is a three-dimensional model of Kerala and it is a centre of attraction of tourists in Peechi. Routine maintenance of the building had been done by this office regularly. In addition to this, artistic painting of model and building was done in this year by arranging a separate work departmentally. 3D model of Kerala has been painted with colorful paints for each district and markings for National Highway, State Highway, Railway Line and Rivers with suitable colours. Three display boards also placed on walls of the building displaying details of rivers, and dams in Kerala and National Highways passing through Kerala State. Now this building was rectified and beautified.

Kerala 3D Model after renovation

3.4 Maintenance and routine works of the Hydraulics division

The division conducted the routine works of Hydraulics division office, meteorological stations, routine maintenance of Kerala model & building housing model and routine maintenance of model area I & II for the year 2021-22. The routine works include office maintenance, maintenance and service of instruments at meteorological station, maintenance and repair works for 3D Kerala model and maintenance and clearing of model areas etc. As part of the development of lab infrastructure for model study, maintenance and repair works of the instrumentation building was done by the division.

Kerala Engineering Research Institute consists of various offices located in the KERI campus. High speed and stable internet connection is essential for smooth functioning of these offices and their activities as most of the processes of the Department are being switched over to the web platform. The payment of the annual charges for internet provided by BSNL and the routine maintenance and repair works of the internet facility is managed by this office.

3.5 Calibration of notches

Notches are used for measurement of discharge through open channels by placing or constructing them across the stream or channel. The discharge over notch is measured by measuring the head acting over the notch. The actual discharge and theoretical discharge will be equated using a suitable coefficient of discharge and a factor for the head of flow. The process of assessing these constants is called calibration. Once the equation relating discharge and head of flow over the notch is established by calibration experiment, the discharge at any point in a channel can be estimated by fixing the notch across the channel and measuring the head of flow.

Notch Calibration Facility

The notch calibration tank situated at outdoor Model Area I is generally used for the calibration of notches received from various irrigation projects of Kerala. In this year we have not received any new notches for calibration.

B. COASTAL ENGINEERING DIVISION, KERI,PEECHI

B *COASTAL ENGINEERING DIVISION, KERI,PEECHI*

1) INTRODUCTION

Coastal Engineering Division has been started functioning from the beginning of the Kerala Engineering Research Institute itself. This division was established for the purpose of conducting research works on behavior of Kerala Coast. Several researches on coastal protection measures, experimental study of wave run up on beaches, experiments to evolve suitable artificial blocks, study on waves and currents, mud banks, wave action on beaches, littoral drifts, artificial nourishment, model study of fishing gaps, design of fishing harbours like Mopla bay, Ponnani, Vizhinjam etc. had been conducted by this division during 70's and 80's. Collection of wave data and observation of beach characteristics have been carried out at several stations along the Kerala coast in the new moon day of all monthforassessing the changes of Kerala Coast over years.Among these stations, observations at two stations ie. at PadinjareVemballore and Anchangadi in KodungallurTalukhave been carried out by this division till December 2013.After wards these works have been transferred to Coastal Engineering Field Studies Division, Thrissur. Since then this division is engaged in **Topographical investigation with the aid of GNSS** for various irrigation structures.

As a part of modernization of Kerala Engineering Research Institute (KERI), a Smart Station from Leica Geosystems has been procured in the financial year 2013-14 and transferred to this division as per the order of the Chief Engineer (IDRB), Thiruvananthapuram. Smart station is a new revolutionary surveying system in which a high performance Total Station (TS11) and a powerful GNSS Receiver (GS14 satellite receiver) are perfectly integrated. The main components of Smart Station are Base station GNSS and Smart Antenna, RTK Rover GNSS with Pole, Antenna. CS10 Field Controller (Smart Pole) and Total station with back sight Tripod kit. Leica GS14 has been upgraded to Leica GS 18 T model in 2019-20.

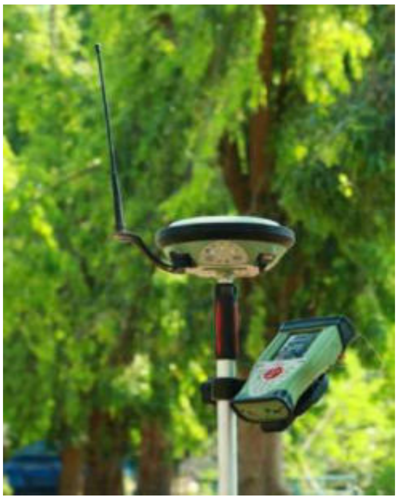
Presently this division is engaged in conducting topographical investigations of various works of Kerala Irrigation Department. Topographical investigation works of other departments are being carried out as Deposit works. Since most of the investigations are executed departmentally using most modern survey equipments with high precision and accuracy, we can assure quality of the work. Works entrusted to this division are being carried out under various Head of Accounts as per the nature of works and availability of funds. Apart from this, Investigation works under Head of account -4701-80-800-88-Formation of River Basin Organization, 4700-80-005-99-02-Investigation of major irrigation scheme and 4700-80-800-97-02 Dam safety organisation and Dam safety measures were also carried out in 2020-21.

2) FEATURES OF GS 18T SMART STATION

Leica GS 18T is GNSS RTK rover and is a part of the Leica Geosystems self-learning GNSS series with advanced signal tracking technologies. With more constellation and L band, GS18T will have more satellites in canopy area. GS18T is fitted with Inertial Measurement Unit (IMU) based tilt sensor, so that no magnetic field can affect the positioning. This can work close to bigger concrete structures with larger reinforcement, Electrical installations etc.Due to the tilt compensating function, it is not required to hold the survey pole in vertical position, that is there is no need to level the bubble for measuring and staking of points. In this the sensor accurately and reliably measures the pole tilt and together with RTK or Smart Link, provides an accurate tilt compensated position.There is savings up to 20 per cent over conventional surveying practices due to the fact that no time is wasted by levelling the bubble. The IMU-based tilt-compensating RTK is applicable at large tilt angles of more than 30 degrees, where a 3D positioning accuracy of 2 cm is still achievable.

Leica GS 18T is integrated with a new Cinterion cellular modem that supports LTE (4G) as well as all existing networks. In Leica GS 18T a self-learning GNSS sensor is being used, hence the best satellite signals and the best available correction data is chosen automatically thus achieving best possible position accuracy and quality. By incorporating sensor heading into 3D visualization of the surroundings, the user can easily orientate himself in the surveying environment, which improves productivity and user experience. The measurement engine in GS 18T is ME7 (measurement engine generation 7). This gives an ultimate performance in GNSS positioning.

GS14 Base



Rover Unit with Controller

Total Station

GS-18 T Base/Rover

Leica GS18 T GNSS RTK rover with CS20 Field controller.

It includes latest features such as 555 channels, Multi-frequency, Multi constellation, L-band service etc. This allows tracking more satellites compared to GS14 in parallel channels. This sensor is supplied with most modern controller of Leica CS20 with specialized package software called Captivate. Captivate is the most field worthy software with more land survey features compared to CS10 controller.

3) WORKS UNDER THE HEAD OF ACCOUNT-4701-80-800-99-34-03-V-DEVELOPMENT OF KERALA ENGINEERING RESEARCH INSTITUTE STAGE II

Works under the above head consists of two types of works viz Fundamental studies using smart station and Routine maintenance of offices, model area and survey equipment as action plan of Coastal Engineering Division for the financial year 2021-22.

3.1 Fundamental Studies using Smart Station for the year 2021-22- Various Investigation survey works in Irrigation Department and Coastal survey using Smart station

All topographical investigation works related to Kerala Irrigation Department carried out using Smart Station has been included in this category. Highlights of works taken up by this division during the year 2021-22 are as follows:

3.1.1 Topographical investigation allied with the obstruction to flow of Periyar river near Vallarpadam Railway bridge at Vaduthala-2021-22

Topographical investigation allied with the obstruction to flow of Periyar river near Vallarpadam railway bridge at Vaduthala for the year 2021-22 was taken up by this division as per the direction of Director, F&AR, KERI based on the request received from Executive Engineer, Irrigation Division, Ernakulam. The scope of this work comprises of quantifying the sediment depositions to be removed from the study area for allowing free flow of water as well as to check the quality of the sediments for effectively using the same for various purposes.

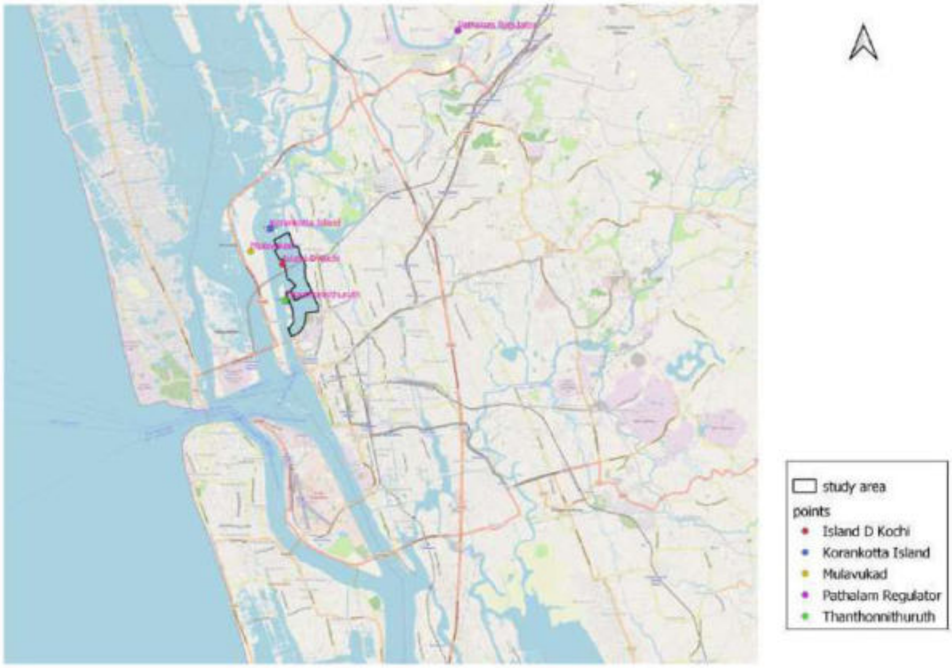
The preliminary inspection of the site has elucidated several features such as the deposition of remnants of concrete piers and drain pipes near the Railway bridge piers, mangrove plants grown around each bridge pier, presence of several small islands within 1 Km distance upstream and downstream of the bridge (Painadithuruth, Pazhampillithuruth, Thanthonnithuruth, Kurumkotta island and Mulavukadu island), Water Metro channel carrying passenger boats near Mulavukad island and the National Waterway (NW-3) carrying large ships to major ports of the state. During the low tide periods, the sediment depositions can be observed upstream and downstream of the Railway bridge. The preliminary inspection has also revealed that the sediment deposition is significant for a distance of 1 Km upstream and 2.20 Km downstream of the Railway bridge. Hence, detailed topographic investigations were conducted within this range of the study area.

The total station/DGPS surveying was done in a detailed manner from Pathalam Bridge Cum Regulator 17 Km upstream of the Railway bridge to Bolgatty island 4 Km downstream of the Railway bridge. The Bench Mark was transferred from Bhoothathankettu barrage to the work site using DGPS. The cross-sections were taken at 100 m interval and in each cross-section points were taken at an interval of 20 m for a distance of 1 Km upstream and 2.2 Km downstream of the bridge where significant deposition of sediments were identified during the preliminary inspection of the study area. High resolution data was taken near the Railway bridge (for a distance of 30 m upstream and downstream of the railway bridge) so as to accurately locate the coffer dam provided for the bridge construction. The river bed levels near the bridge were taken at a closer interval of 5m across the river and 2m along the flow direction of river. The river bed levels were then plotted in Autocad Civil 3D and cross-section details were taken at an interval of 100m upstream and downstream of the Railway bridge. In order to quantify the sediment deposition in the study area, original bed level (reference level) is necessary. The bed level of apron downstream of Pathalam Bridge Cum Regulator was considered as the reference level (-2.5m) since the original bed level was not duly obtained from the concerned authorities on request (Letter No. DB-890/2021/Vaduthala dated 15.07.2021 of the Director, F&AR, KERI to the Executive Engineer, Irrigation Division, Ernakulam). Moreover, a bed slope of 1/10000 was maintained along the river from 1 Km upstream to 2.2 Km downstream of the bridge for smooth flow of water. Further, the quantity of deposition around the bridge piers consisting of sediments, remnants of concrete piers and drain pipes was also exclusively determined.

Based on the inferences from topographic and soil investigations, following conclusions are obtained.

- The materials deposited around each bridge pier such as sediments, remnants of concrete piers and drain pipes should be removed with immediate effect and the respective quantity was determined to be 25769.03 m^3. Moreover, the mangrove plants grown around the bridge piers should also be removed to avoid the possible chocking conditions due to the deposition of debris carried from the upstream river reaches of the Railway bridge.
- Significant deposition of sediments were found from 1 Km upstream to 2.083 Km downstream of the Railway bridge and mainly comprises of clayey and silty contents which are unsuitable for either construction purposes or beach nourishment process.
- Due to the unavailability of reference bed level of the river from competent authorities, bed level of apron downstream of Pathalam Regulator Cum Bridge (15 Km upstream of the Railway bridge) was taken as the reference level for quantifying the sediment deposition

upstream and downstream of the Railway bridge. Considering 1 in 10000 as the natural bed slope of the river, the sediment deposition is quantified as 2515670.151m^3 which is spread for a distance of 1 Km upstream as well as 2.083 Km downstream of the Railway bridge. The removal of these sediment depositions is not permanent solution as it affects the present natural equilibrium of the river (sediment deposition-erosion pattern). Further, water surface slope of river upstream and downstream of the Railway bridge need to be determined from detailed hydraulic studies in a periodic manner so as to refine the above mentioned quantity accurately.



3.1.2 Load test on Attappally Regulator Cum Bridge- Measurement of deck slab deflection using total station for the year 2021-22

Measurement of deck slab deflection using total station as a part of load test on Attappilly Regulator Cum Bridge for the year 2021-22 was taken up by this division as per the instruction of Director, F&AR, KERI based on the direction received from Additional Chief Secretary, Water Resources Department, Government of Kerala (vide online meeting held on 16.08.2021). The scope of the work includes the determination of vertical deformation of deck slab of bridge during the load testing in order to assess the serviceability of the bridge. The estimate amount of the work comes to 27,000/-. The work site was connected with MSL by transferring the Reduced Level from Chimony dam. The total station surveying was adopted to measure the vertical deformation of the slab during the load testing. The deflection is measured on both sides of bridge.The maximum deflection is 1.4 mm and the minimum percentage recovery of deflection is 84.62 %. The maximum deflection obtained from the load testing is less than the actual deflection allowed as per IRC SP 51 (1.439 mm) and IRC 112 (span/800) respectively. Also, the percentage recovery aforementioned is greater than that given in point no. 2 of acceptance criteria (75%) of IRC SP 37 and IRC SP 51 respectively and hence acceptable. The Crack widths were measured using crack microscope. Maximum crack width obtained was 0.1 mm, for the slab at extreme left side (Mattathoor side) which was less than 0.3mm as per the conditions given in IRC SP 37 and IRC SP 51 respectively, and hence acceptable. Therefore, all the criteria related with serviceability of bridge were satisfied and bridge is safe for passing the vehicular traffic.

3.1.3 Topographic investigation of command area for implementation of Community Micro Irrigation Project in Dasanakkara in Pulppally Panchayath 2021-22

Topographic investigation of command area for implementation of Community Micro Irrigation Project in Dasanakkara in Pulppally Panchayath for the year 2021-22 was taken up by this division as per the instruction of Director, F&AR, KERI based on the request received from Executive Engineer, Minor Irrigation Division, SulthanBathery, Wayanad. Scope of the work was to conduct the total station surveying of command area including preparation of contour map, locating boundary corners of farmer's plots, determining the spacing of crops and locating other important features such as ponds, wells and survey stones. The total amount of estimate comes to Rs.1,50,000/-. Site has been connected with MSL by transferring the level of Bench Mark at Karapuzha dam. Boundary of survey area was fixed by the project authorities. The topographical survey was conducted in the hilly and flat terrains of the study area and a layout plan was prepared. Boundary of farmer's plots and other permanent features such as roads, buildings and wells were marked in the layout plan prepared. A contour map was prepared at an interval of 1m for the entire terrain of the area surveyed.




3.1.4 Cross checking the sill level of spillway of existing Mullaperiyar Dam with Mean Sea Level for the year 2021-22

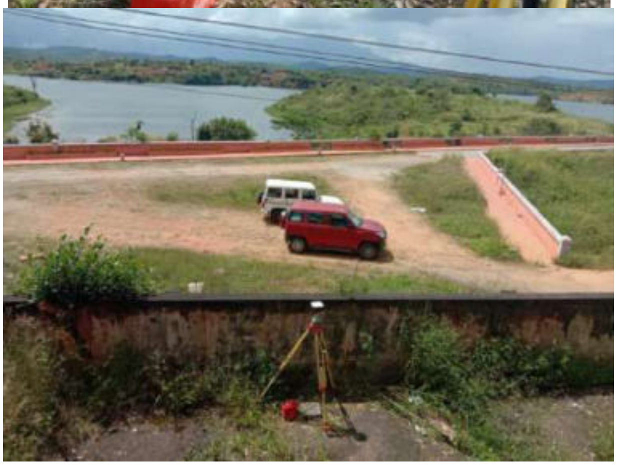
Cross checking the sill level of spillway of existing Mullaperiyar dam with Mean Sea Level for the year 2021-22 was taken up by this division as per the instruction of Director, F&AR, KERI based on the request received from Chief Engineer (I&D), IDRB, Thiruvananthapuram. The scope of the work consists of cross checking the sill level of spillway of Mullaperiyar dam based on the permanent Beanch Mark connected with MSL. As per the telephonic instruction from O/othe Chief Engineer, IDRB, it has been directed to take the value of existing permanent B.M inIdukki Dam as reference which is located near Kolumaban Samadhi in Thodupuzha- Puliyanmala Road and to start the work immediately by collecting the Bench Mark details from KSEB, Idukki.As the value of above benchmark was not available with KSEB office, existing bench mark connected with MSL in Cheruthoni dam top has been used as reference. Estimate amount for this work comes to Rs.1,50,000/-. A benchmark connected to MSL at Central Water Commission, Vandiperiyar, which has been taken as datum for transferring the levels to Mullaperiyar Dam during a study in the year of 2017-18 by this institute (Ref : Report of the work -Fundamental Studies using Smart Station for the year 2017-18 - Various Investigation survey works in Irrigation Department using Smartstation- Survey of site at Vandipperiyar for connecting to MSL) is considered for fixing the altitude of base station set up for the present study too. This bench mark has been established by transferring the levels from Idukki Dam as per the verb all information from CWC officials and the coordinates are N:1059842.34m, E:729016.98m, Z: +795.910m above MSL. Due to the uncertainty in getting consistent satellite signals in thick forest of Mullaperiyar and also by considering the practical difficulties pointed out by officials of New Mullaperiyar dam Investigation wing in setting up the base station for a long period in Mullaperiya rdam premise, instrument base station setup has been done at a nearby accessible point which is almost 100m away from CWC office and the value is +801.550m. Mile stone No.4 near CWC Vandiperiyar has been connected before proceeding to Idukki Dam and the value is +814.668m. Air distance between the base station at Vandiperiyar and Idukkidam is about 40km. The water level gauge pole of Idukki reservoir has been checked with base station at Vandiperiyar on 27.04.2021 at 6.30pm using RTK method, which is a common practice for transferring levels. Water level as per the gauge pole was 2339.28ft ie., +713.013m. The value obtained using RTK is +711.835m and th edifferenceis 1.178m. The survey team proceeded to Mullaperiyar dam for checking the sill level of spillway.Base station setup connected with CWC point has been done in the front yard of Christ CSI church near Idukki HEP Seismological observatory of KESB, Vallakkadavu and the value is +902.798m. This higher altitude base station near the Mullaperiyar dam could ensure level transferring using radio modem even if the GSM connections were lost. Weather station platform near Periyar Tiger Reserve check post was connected on the way and the value is +825.556m. As there occurred heavy protest from Tamil Nadu officials of Mullaperiyar Dam, sill level of spillway of the dam could not be cross checked. They demanded prior sanction fromDam authority before the commencement of work and the state of affairs became worst. Then and there the investigation team communicated the matter with higher officials and wind up further works in existing dam premises as per direction. Still certain key points in proposed New Mullaperiyar dam premises have been connected as per the request of officials of New Mullaperiyar dam Investigation wing. Right Bank platform top of new Mullaperiyardam was connected and the valueis +893.008m when connected from CSI Church, Vandiperiyar.

Identified Bore Hole No.6 of new Mullaperiyar dam and the value of top concrete is +882.215m when connected from CSI Church Vandiperiyar. Water level in Idukki reservoir has been once again checked on 29.04.2021 to avoid any errors in transferring. The same process was repeated for confirmation. The value obtained using RTK is +711.596 m against the gauge pole reading of 2338.46ft ie., 712.762 m. The difference is 1.166m. Another permanent BM at Cheruthoni dam top having a value of 2415ft. ie., 736.092m is also connected using RTK method. Value obtained is +734.917m and the difference is 1.175m. The above permanent BM at Cheruthoni Dam top was connected using static method which is the most accurate method for transferring levels and the value obtained is +734.932m and the difference is 1.160m. A variation of only 15mm is noted when the permanent BM at Cheruthoni dam top was connected with CWC Vandiperiyar using RTK method and Static method. Measurement accuracy of Leica GS18 T as per instrument catalogue is Hz 8 mm + 0.5 ppm & V15 mm+ 0.5ppm for RTK and Hz3 mm+ 0.1 ppm & V3.5 mm +0.4 ppm for Static (phase) with long observations. Considering the measurement accuracy of RTK method and static method, difference between actual values of Bench Marks of Idukki dam and machine values obtained when connected from CWC Vandiperiyar can be taken as 1.160m (static method).


Base station Vandiperiyar
Mile stone 4
CWC Vandiperiyar
Periyar
Vandiperiyar
BH6
Right Bank platform Top
Weather Station Platform
CSI church

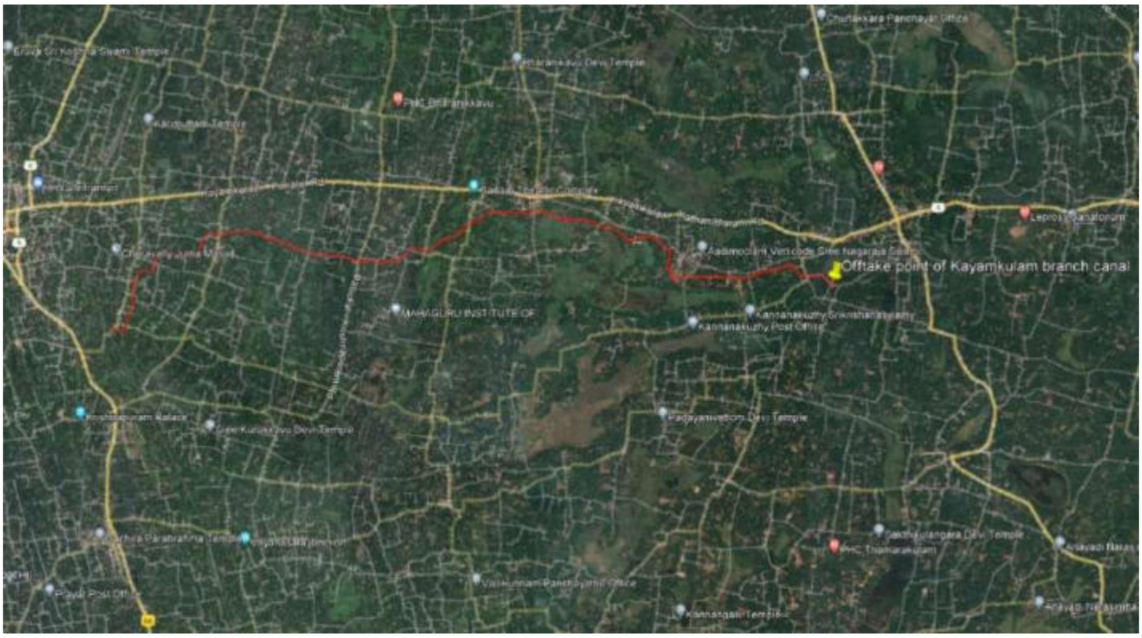
3.1.5 Topographic investigation of command area for implementing community micro irrigation at Vazhavatta-Cheepram in Muttil Panchayath of Wayanad District

Topographic investigation of command area for implementing community micro-irrigation at Vazhavatta-Cheepram in MuttilPanchayath of Wayanad District was taken up by this division based on the direction of Director, F&AR, KERI as per the request received from Superintending Engineer, Minor Irrigation Circle, Kozhikode. Scope of the work was to conduct the total station surveying of command area including preparation of contour map, locating boundary corners of farmer's plots, determining the spacing of crops and locating other important features such as ponds, wells and survey stones. Estimated cost of the work is Rs.3,35,000/-. Site has been connected with MSL by transferring the level of Bench Mark at Karapuzha dam. Boundary of survey area was fixed by the project authorities. The topographical survey was conducted in the hilly and flat terrains of the study area and a layout plan was prepared. Boundary of farmer's plots and other permanent features such as roads, buildings and wells were marked in the layout plan prepared. A contour map was prepared at an interval of 1m for the entire terrain of the area surveyed.



3.1.6 Topographical investigation of Kayamkulam Branch canal of Kallada Irrigation Project from Ch.0m to 11500m

Topographical investigation of Kayamkulam Branch Canal of Kallada Irrigation Project from ch. 0m to 11500m was taken up by this division as per the direction of Joint Director, Hydraulic Research, KERI based on the request received from Superintending Engineer, KIP (RB) Circle, Kottarakkara. The scope of the work comprises of investigation work of Kayamkulam Branch canal starting from the tail end of Right Bank Main Canal (RBMC) of KIP at Ch: 69752m for a length of 11.5 Km. The cross-sections were taken at every 30m interval and points at 3m spacing were taken along each cross-section. The total estimate amount for the work comes to Rs.2,00,000/-. The bed level of off take point of branch canal (given by the project authorities)is taken as the reference for starting the surveying. Bed level of off take point at ch: 69752m of Right Bank Main Canal (RBMC) of Kallada Irrigation Project is taken as the reference point for survey and its value is 18.925 m (provided by the project authorities). Layout plan showing the positions of survey stones, cross sections, existing roads, buildings, drains and other permanent structures was prepared. Another layout plan showing contour map at 0.5m interval, cross section lines and longitudinal section line is also plotted in 1:1000 scale.



3.1.7 Topographic surveying of Peechi Dam Campus including Vallikkayam saddle dam and allied features

Topographic surveying of Peechi dam campus including Vallikkayam saddle dam and allied features was taken up by this division as per the instruction of Director, F&AR, KERI based on the request of Superintending Engineer, Irrigation Central Circle, Thrissur. Scope of this work includes detailed topographic surveying of upstream and downstream premises of Peechi dam, Vallikkayam saddle dam and locating major trees as well as important features present in the campus. Estimate amount of the work comes to Rs.2,32,100/-. The study area was connected with MSL by transferring the level of Bench Mark at Peechi dam (top surface). Peechi dam campus was surveyed and a layout plan showing various features as well as contour map of 1m contour interval was prepared. Saddle dam present at the place called Vallikkayam is located and the details of its embankments on both sides are plotted in the layout plan. Profile of Peechi dam, associated structures, present conditions of quarters, major trees, pathway through forest from KSEB power house gate to Pavilion and various amenities such as Peechi House, Rest House, swimming pool, gardens, existing office buildings, shops, hospital, canteen, post office and other available facilities are plotted in the layout plan.

3.1.8 Conducting Topographic investigation in Kurumali river in connection with rehabilitation of Attappilly Regulator cum Bridge

Topographic investigation in Kurumali river in connection with rehabilitation of Attappilly Regulator cum Bridge was taken up by this division as per the instruction of the Director, F&AR, KERI for properly designing the approach road, aprons and river side protection works. Scope of this work includes surveying work using Smart Station for plotting the profile of existing Regulator cum Bridge, approach road and retaining walls. Moreover, cross-sections of the river at regular intervals need to be taken for knowing the present conditions of aprons and for re-designing the same in the upstream and downstream reaches of the RCB.

The estimate cost of the work comes to Rs.1,29,100/-. The study area was connected with MSL by transferring the level of Bench Mark at Chimony dam (top surface). The river cross-sections were surveyed at every 5m interval for a distance of 100m upstream and downstream of RCB and at 100m interval for a distance of 1.50Km upstream and 500m downstream further. The profiles of existing RCB including foundation parts, pillar positions, approach roads, aprons and associated retaining walls on the sides of the river were surveyed and plotted in the layout plan. The Reduced Levels of foundation parts, aprons and approach road were taken in detail and plotted for the rectification design purposes.

3.1.9. Topographical investigation for finding out the variations in bed levels in the upstream 600m of Velliyamkallu Regulator at Thrithala - 2021-22

Topographical Investigation for finding out the variations in bed levels in the upstream 600m of Velliamkallu Regulator at Thrithala- 2021-22 has been taken up by this division as per the direction of the Joint Director, Hydraulic Research, KERI, Peechi based on the request of the Chief Engineer, Projects I, Calicut. Scope of the work was to conduct detailed topographical investigation to determine the present levels of depositions and depressions in the upstream 600m of Velliyamkallu Regulator at Thrithala. These informations can be used to compute the quantity of sediment deposition present in the upstream reach of Velliamkallu Regulator. Estimate amount of the work comes to Rs.1,60,000/-. The Survey of India Bench Mark was transferred from Shornur and Kuttippuram to Pattambi bridge. The work site was connected with MSL using this Reduced Level transferred to Pattambi bridge. Contour map (interval of 1m) of upstream 600m of Velliamkallu RCB and cross-sections of river were prepared. The contour plots indicated the presence of large depressions in the river bed between the coordinates (622389E, 1194832N) and (622484E, 1194761N). Contour plots also indicated sediment accumulation in the form of large islands in the middle of the river away from the RCB. Quantity of sediments accumulated in the surveyed area is 127714.965 m^3 and volume of depressions present in the surveyed area is quantified as 185132.668 m^3. The depressions or holes were found close to the Velliamkallu RCB whereas sediment depositions in the form of islands were found at some distance away from the structure.

3.1.10 Topographical investigationfor Chundampatta Branch Canal of Thathanampully Lift Irrigation Scheme in Palakkad District-2021-22

Topographical investigation for Chundampatta branch canal of Thathanampully Lift Irrigation Scheme in Palakkad District for the year 2021-22 was taken up by this division as per the direction of the Joint Director, Hydraulic Research, KERI, Peechi based on the request received from the Executive Engineer, Minor Irrigation Division, Palakkad. The scope of the work comprises of topographic surveying from pump house to the tail end of Chundampatta branch canal including one aqueduct of Thathanampully Lift Irrigation Scheme for commissioning the whole scheme. The prime objective of the work is to fix the ayacut area of the present Lift Irrigation Scheme. The length of the Chundampatta branch canal comes to 3Km. The significance of the present Lift Irrigation Scheme is for effectively using the water available at Thootha river for increasing the paddy and other crop cultivation in the Kulukkalloor panchayath of Pattambi constituency. The total estimate of the work comes to Rs.1,11,000/-. The Survey of India Bench Mark was transferred from previously from Kuttippuram to Pattambi bridge. The work site was connected with MSL using this Reduced Level transferred to Pattambi bridge. Topographic investigation using smart station was conducted in the work site to locate various features such as paddy fields, wells (open and tube wells), culverts, crossings, survey stones and other prominent landmarks. The cross-sections of existing canals and through the proposed alignment were taken at 25m interval for completion of the project. The general layout plan of the study area, cross-sections and longitudinal sections of the surveyed area were prepared and prominent features are located. The contour plan of the study area was prepared with an interval of 1m.

3.1.11 Topographic investigation of Kottoor branch canal from Ch. 16200m of LBMC and three distributaries for the year 2021-22

Topographic investigation of Kottoor branch canal from ch. 16200m of LBMC and three distributaries for the year 2021-22 was taken up by this division as per the instruction of the Director, F&AR, KERI based on the request received from the Superintending Engineer, Project Circle, Kannur. The scope of the work includes the topographic investigation of Kottoor branch canal starting from 16200m of LBMC of Karappuzha irrigation project and three distributaries off-taking from ch. 2100m, ch. 4170m and ch. 5250m respectively. The total estimate amount for the work comes to Rs.3,32,600/-. The cross-sections across the proposed alignment were taken at every 30m interval and points at spacing of 3m in each cross-section. The work site is connected with MSL using the known coordinate locations at Karappuzha dam.

3.2 Routine activities of the Coastal Engineering Division office and the Offices of the Director, F & AR and the Joint Director, Hydraulic Research for the year 2021-22

This work had been included in the action plan for meeting the routine activities of this office and offices of the Director, F & AR, KERI and the Joint Director Hydraulic Research, KERI. The items such as purchase and maintenance of computer and related accessories, purchase and maintenance of stationary items and maintenance of plumbing and electrical components were included in this particular work. These repair activities can come up at any time in an year.

3.3 Maintenance of the model area of the Coastal Engineering Division in 2021-22

The model area where physical model studies related to Kerala Coast has been conducted in the previous years is maintained by this division. All works such as clearing the bushes, routine cleaning of model trays and Engineering museum, overall upkeep of model sheds for keeping this area spick and span and also surroundings of the Director's office building etc. were included in this work.

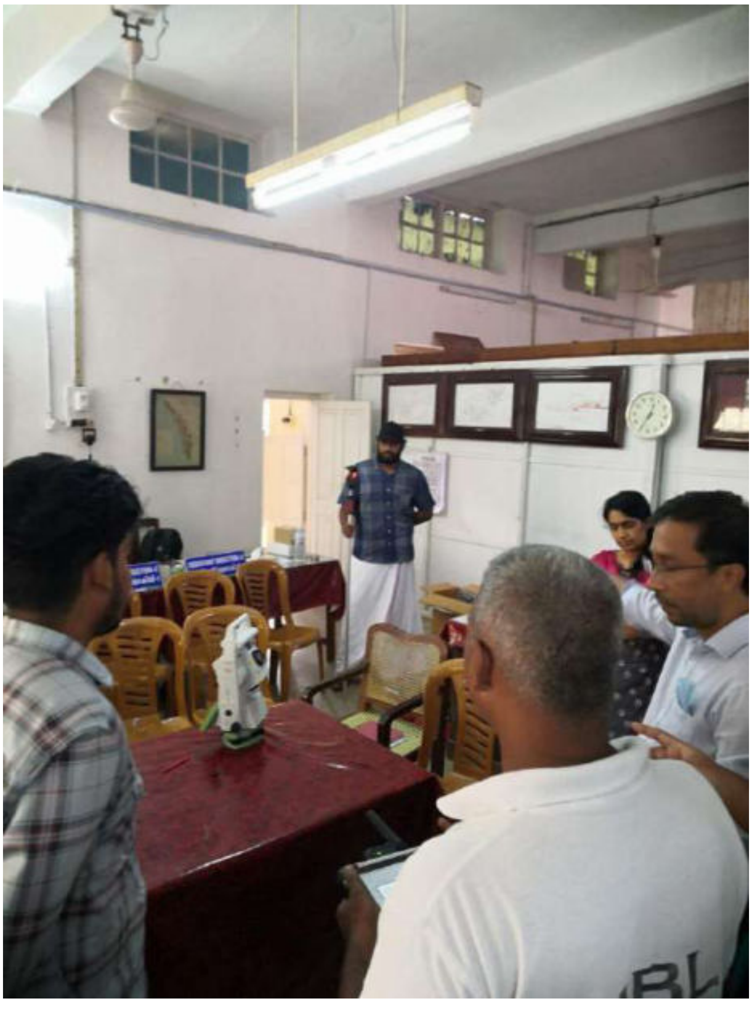
3.4 Annual Maintenance and purchase of accessories for Smart Station for the year 2021-2

This work is for the annual maintenance of Smart station and for the purchase of accessories and any spare parts if required. As the Smart station is sophisticated electronic equipment, annual calibration and maintenance are essential so as to ensure the accuracy of the position data given by the instrument. Provisions for these items are included in the estimate for Annual Maintenance Contract of the Total Station TS11. Items concerned with service and recalibration of PENTAX Total Station R-205 NE were also included. Batteries are one of the essential accessories for progressing the survey effectively. Any damage in batteries will delay the work. Hence as a precautionary measure, provision for purchase of additional batteries are included in this work. Provisions are included for the purchase of car battery charger, cables and any other consumables if required in emergency. A lumpsum provision is also given for the purchase and maintenance of any spare parts of the instrument, consumables and miscellaneous items for survey if required in emergency.

3.5 Purchase of Robotic Total station compatible with Leica GS-18 T DGPS and accessories

Coastal Engineering Division is carrying out topographical investigations of various works of Irrigation Department as well as of other departments using modern survey equipment called Smart Station. Smart station is a survey system in which a high performance Total Station and a powerful GNSS are perfectly integrated. Leica GNSS GS18 Base, GS18T Rover, Leica TS-11 Total station and its combination are effectively used for investigation works. Being a research institute, KERI is entrusted with various investigations related to rehabilitation of existing hydraulic structures. For conducting such investigations, it is necessary to take alignment of existing structures, measuring deformations and rotations of existing structural members and measuring relative settlement of foundations or supports. Robotic Total stations are highly beneficial for these types of works. The Stakeout app in this total station helps in locating a point with known coordinates and Auto height option helps in setting up the instrument without any errors. This upgraded version of Total station will give better performance and minimizes the time required for completion of an investigation work. This division will be able to undertake more investigation works in future with the aid of this advanced robotic total station. Only Leica Total stations will be compatible with already available DGPS of this office. Hence Quotation is invited from the distributor of Leica for robotic Total station and the estimate is prepared. There is no approved data within the department for this instrument. The total amount of the estimate comes to Rs.17,92,892/- including GST of 18%. Financial Sanction has been accorded for this work as per order no

DM-AD5/15(1)2021/IDRB Dated:09.11.2021 of the Chief Engineer, IDRB, Thiruvnanthapuram. Administrative Sanction has been accorded for this work as per ORDER No. HRKERIPi/2021/397/IDRB Dated: 26-11-2021 of the Director, F& AR, KERI, Peechi for an amount of Rs.17,92,892/-. The instrument and auxiliary parts were supplied and training on the usage of the same was also conducted by the suppliers to the officers in the division.



4) WORKS UNDER THE HEAD OF ACCOUNT-4701-80-800-88-FORMATION OF RIVER BASIN ORGANIZATION

4.1 Sand Budgeting in Chaliyar River Basin

The Director, KERI has submitted a proposal specifying the technical method for the assessment of quantity of sand which can be safely mined from a river as per the direction of the Chief Engineer, IDRB during the year 2017-18. The objectives of this study are: (i) to ensure that the sand and gravel extraction is carried out in a sustainable way and (ii) to maintain the river equilibrium with the application of sediment transport principles which elucidate the locations, period and quantity of sediments to be extracted. Chaliyarriver is considered for the pilot study since it doesn't get dried up even during the drought seasons.

Many other rivers in Kerala get dried up during the summer seasons. Methodology followed for sand auditing includes modelling of watershed, ascertaining the pristine conditions of river channels, sediment sampling, development of sediment transport models and analysis of the model results. The results comprises of spatial variation of sediment deposits, time series plots of sediment deposits and variation of cross-sections of river channels.

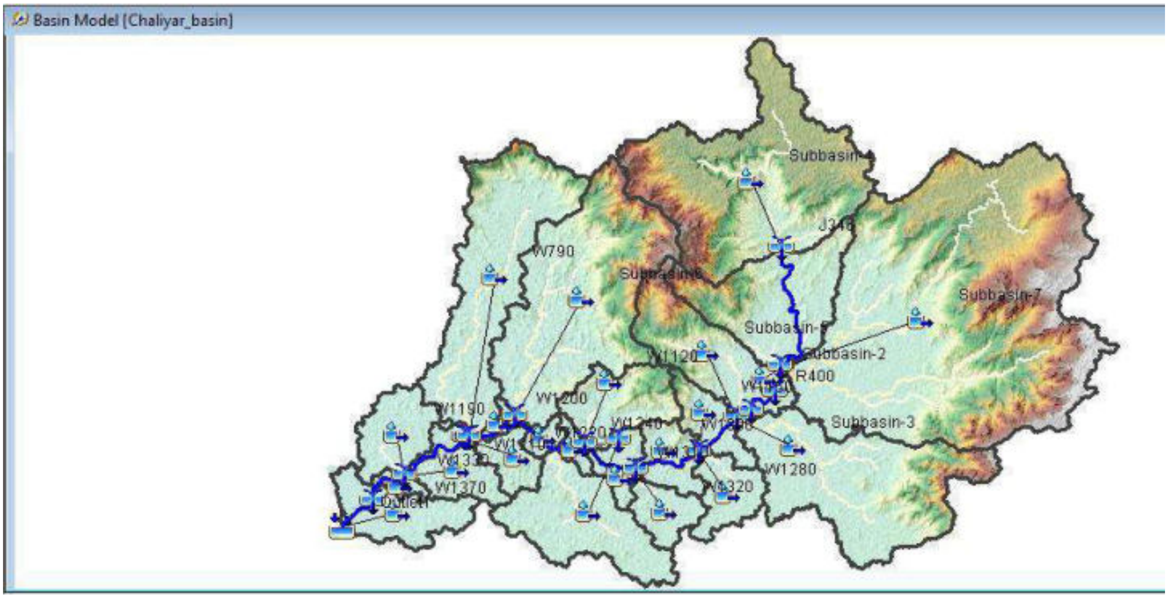

Since KERI is new to the field of Sediment Transport Modelling, this portion of the proposal is decided to outsource. NIT Calicut has already been involved in sediment transport modelling works. KERI has discussed this matter with NIT Calicut and they expressed their willingness to collaborate with our Institution for a pilot study, which includes capacity building of our Engineers. MoU has been signed between the Director, KERI and the Director, NIT Calicut on 28th November 2019. Hydro-meteorological data, land use map, soil map pertaining to the study area etc. were collected and made available to NIT Calicut. Shape files marked with tentative locations for taking cross sections of river along with the locations of sand mining kadavu of Chaliyar River were prepared by this division after conducting a reconnaissance survey.

Numerical modelling part of the study has been started using the above data. Survey work for taking cross sections of Chaliyar river has been completed. Bench mark is transferred to the work site from GTS bench mark at Kuttippuram. The outputs from sediment transport model include estimates of suspended sediment concentrations, rates of sediment erosion and deposition and sediment transport pathways.

Suspended sediment sampling was started on 06.09.2021 and presently going-on in the field. Two stations (locations) were selected for the suspended sampling process. One station is at Edavanna and another one is at Karimpuzha. The samples are collected weekly and tested in the laboratory of NIT Calicut for grain size analysis. A temporary gauging station for measuring water level and discharge was established at Edavanna. Whereas, monitoring station of Hydrology wing is already present in the Karimpuzha river from which the necessary data can be collected. The water levels were taken on daily basis from the two stations. The water levels, discharge and sediment characteristics are used for modelling the flow and sediment transport in the Chaliyar river.

As a part of capacity building of engineers of KERI in numerical modelling of flow and sediment transport processes, physical and online training programmes were conducted by this division with the principal investigator of this project from NIT Calicut (Prof. SantoshThampi, the Head of Department, Department of Civil Engineering) as the resource person. Physical training was conducted from 27/12/2021 to 29/12/2021 and online training sessions were conducted on 02/11/2021, 04/12/2021 and17/02/2022 respectively. In the training programmes, basic modules of Arc GIS and Hydrologic Engineering Centre-Hydrologic Modelling Software (HEC-HMS) were taught.

During the series of training programmes with guidance from the resource persons, a hydrologic model for the Chaliyar river basin was developed using Arc GIS and HEC-HMS software. The watershed was delineated in Arc GIS software and converted the basin and river networks into the format suitable for HEC-HMS package using Hecgeohms plug-in available in Arc GIS software. The rainfall run-off model was developed in HEC-HMS software using the water shed exported from Arc GIS, rainfall, river cross-sections, evapotranspiration and water level data. The model needs to be calibrated further to obtain reliable and accurate results from the HEC-HMS software. The model calibration process is presently going-on.


Basin Model [Chaliyar_basin]
Subbasin-4
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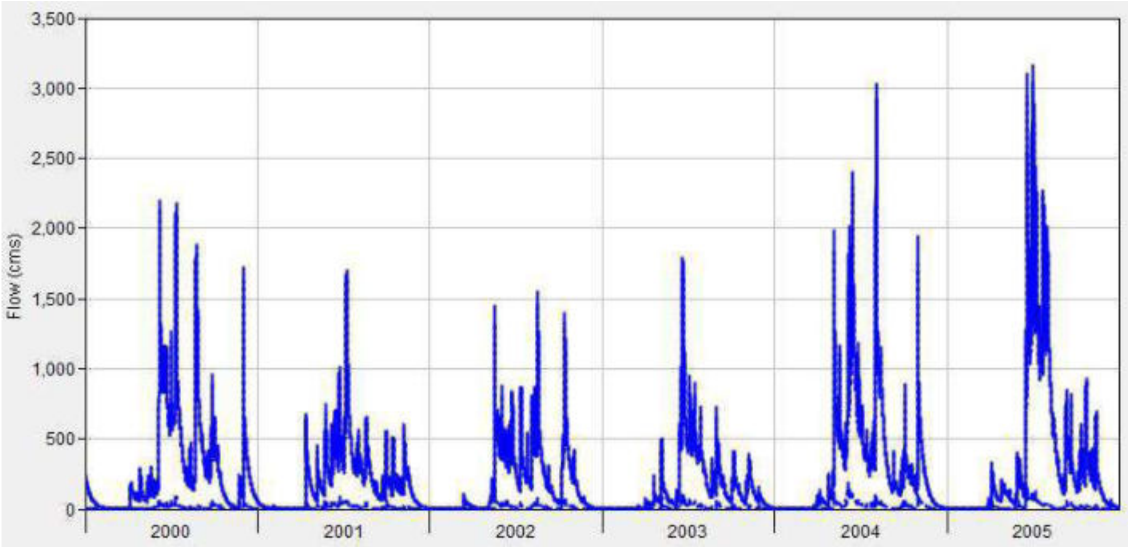
W790
Subbasin-7
Subbasin-2
R400
Subbasin-3
W1280
W1190
W1200
W1370


3,500
3,000
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Flow (cms)
2000
2001
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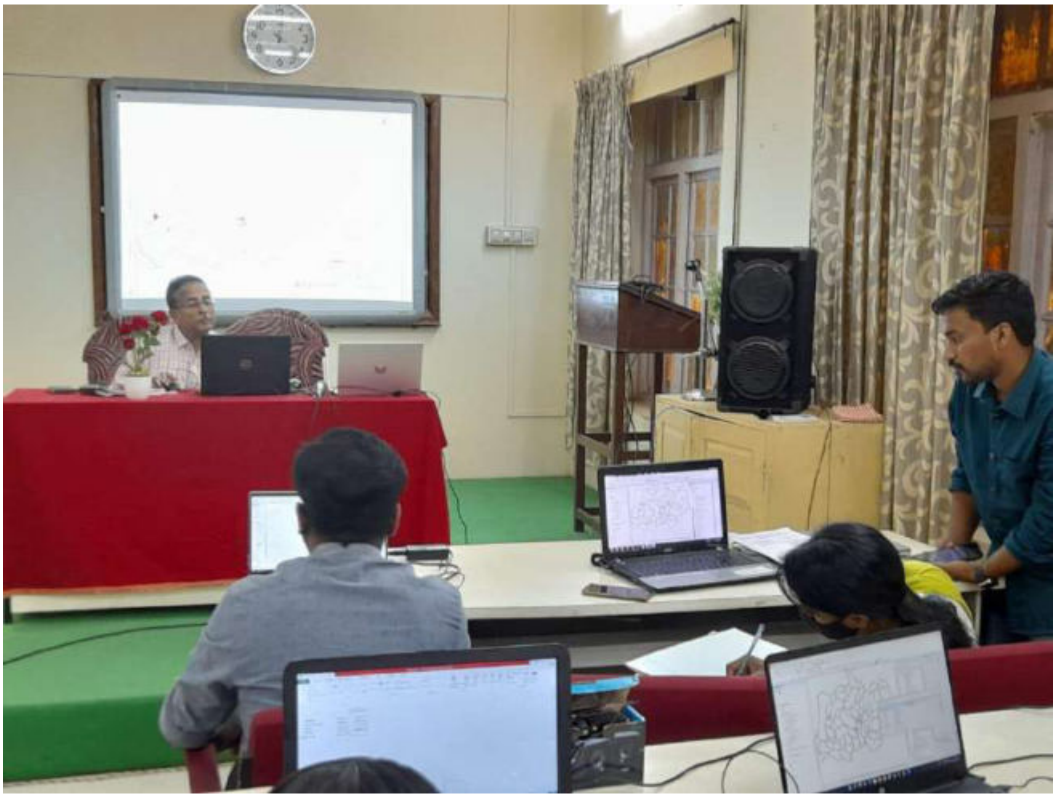
2005

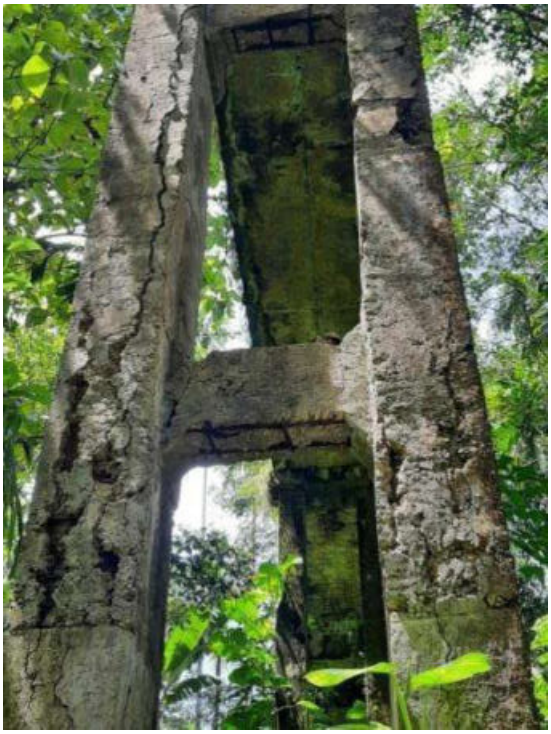


5) WORKS UNDER THE HEAD OF ACCOUNT 4700-80-005-99-02-00-V INVESTIGATION OF MAJOR IRRIGATION SCHEMES

Works under this category are mainly devoted for engineering investigations for rehabilitation of existing structures under Kerala Irrigation Department. The highlights of works conducted under this category during the year 2021-22 by the Coastal Engineering division are given below:

5.1 KIP(RBMC) – Koduman distributary – Deflection measurement of aqueduct from Chainage 7650m to 7850m

This division has been entrusted to conduct total station survey of aqueduct portion of Kodumon distributary of Kallada Irrigation project for a length of 200m from Ch. 7650m to 7850m for assessing deflection/sagging of aqueduct barrel as per the direction of the Director, F&AR, KERI, Peechi based on the request received from the Executive Engineer, Kallada Irrigation Project (RB) Division No.2, Kottarakkara. Joint site inspection was conducted by the officers of KERI and officers of KIP and estimate was submitted for Rs.1,17,000/-. Scope of the work includes total station survey of aqueduct portion of Kodumon distributary of Kallada Irrigation project for a length of 200m from Ch. 7650m to 7850m for assessing the deflection/sagging of aqueduct barrel. Drawings and levels of original structure was requested from project authorities as the drawing with original levels of existing structure is essential for assessing deflection/sagging occurred to the original structure. But the same was not received. The project authorities orally informed that such drawings are not available in their office. Temporary bench mark on top of shutter platform at the off take point of Kodumon distributary was taken as the reference benchmark and its value is assumed as 100.000m. Bed level at the off take point of canal is 96.294 m. Levels were taken at bottom edge of slab at each support as well as bottom edge at mid span of the aqueduct. The maximum value of deflection obtained is 70.5 mm. As per IS 456:2000 Clause 23.2 the deflection should not exceed span/350 or 20 mm whichever is less. Considering 9 m span of aqueduct permissible deflection is 20mm. Out of seventeen spans deflection in 11 spans exceeds the permissible limit. Extensive spalling of concrete has occurred in almost all columns, bracings and base slabs of the aqueduct. Rebars in all the structural members are exposed and are under severe stage of corrosion. Reconstruction of aqueduct from Ch: 7650m to 7850m of Kodumon Distributory is advisable.

5.2 Engineering Investigations allied with the rehabilitation of existing hydraulic structures and various water resources related problems

Kerala Engineering Research Institute (KERI) is entrusted with various works related to rehabilitation of existing hydraulic structures (for eg. investigation works allied with Attappillykkadavu RCB, Idiyanchira RCB, Kodumon aqueduct etc.) and various critical issues connected with the water resources sector of the State (Topographical investigation near Railway bridge to Vallarpadam Terminal at Vembanadlake). As a part of these investigations, it is necessary to determine the alignment or profile of structures, relative settlement of foundation of the structures, measurement of deformations or rotations of structural members and topographical features of the study area. The analysis and inference of the investigated data require expert guidance and suggestions from the faculty of other institutions and various Engineering colleges. Moreover, provision should be made for accommodating taxi charges for the site visit of officers. Therefore, an estimate of Rs.2,00,000/- was prepared for meeting expenses of engineering investigations, honorarium for expert guidance and taxi charges for field visit of the officers. The Administrative and Technical Sanctions were accorded for this estimate and presently the work is going-on.

6) DEPOSIT WORKS

The highlights of works conducted under this category during the year 2021-22 by the Coastal Engineering division are given below:

6.1 Topographical Investigation in connection with "Flood Investigation for preparation of flood mitigation plans for Poonoorpuzha by CWRDM

Topographical Investigation in connection with "Flood Investigation for preparation of flood mitigation plans for Poonoorpuzha by CWRDM"- was undertaken by this division as per ToR signed between the Director, CWRDM and the Director, F&AR, KERI, Peechi. The scope of the work includes hydrographic survey along the river course for taking cross-sections at 300m interval from the river stretch that extends from Poolakkadavu to Pooladikkunnu (9.50 km) in Poonoorpuzha River. Moreover, topographic survey along the river bank at 100m on both sides of the river needs to be taken including the existing flood banks along the river, roads and buildings for plotting river profile, longitudinal central line, left and right banks of the river and high flood level of 2018 and 2019. Poonoorpuzha is a perennial river in Kozhikode district which is a tributary of Korapuzha.

The work site was connected with MSL from the benchmark available at CWC station Kuniyil. Reduced level of BM with respect to MSL is 11.01m. Topographic survey along the river bank at 100m on both sides of the river was conducted. Cross sections of the river were taken at 300m interval. Longitudinal sections along the centre line of the river, left and right banks of the river were surveyed and plotted. Layout plan showing existing flood banks, roads, buildings, drains and other permanent structures was prepared. Another layout plan showing contour map at 1m interval was also plotted in 1:2000 scale. High flood level was marked on each cross section surveyed.

LIST OF PERSONNELS- 2021-22

1.	RajiThampan	:	Deputy Director from 01.04.2021 onwards
2.	Sufeera O.B.	:	Assistant Director I from 01.04.2021 to 31.01.2022
3.	Sufeera O. B.	:	Assistant Director II (Additional Charge) from 01.04.2021 to 04.07.2021
4.	Devarajan K.	:	Assistant Director II from 05.07.2021onwards
5.	Jayasree K. V.	:	Assistant Director I (Additional Charge) from 01.02.2022 to 31.03.2022
6.	Jaisree .P.P.	:	Research Assistant-I from 01.04.2021 onwards
7.	Gopi A. K	:	Research Assistant-II from 01.04.2021 to 31.05.2021
8.	Sabarinath S	:	Overseer Grade II from 01.04.2021 to 21.12.2021
9.	Biji.C.J.	:	Overseer Grade III from 01.04.2021 onwards

C .SEDIMENTATION DIVISION

C SEDIMENTATION DIVISION

1.0 INTRODUCTION

Sedimentation Division conducts studies to compute the present capacity of reservoirs and other water bodies. Such studies are conducted using modern electronic method called 'Integrated Bathymetric System'(IBS).In order to ascertain the underwater profile of the sediment layer anothersophisticated instrument called 'Sub Bottom Profiler' is used. From 2004 onwards, this division has completed52 studies using IBS which includes Kallada Reservoir, MalampuzhaReservoir, Neyyar Reservoir Mullaperiyar, Vembanad Lake and Kattampally Wetland etc. Sub Bottom profiler was used for28of the above studies.

Relevance of the study

- *To estimate the present capacity of the reservoirs*
- *To manage the reservoir operations based on the present actual capacity*
- *Vital role in the ongoing Desiltation work of reservoirs for the capacity improvement*
- *To observe the influence of the heavy flood in 2018 and 2019 in the reservoir sedimentation*

THE SURVEY TEAM OF THE YEAR 2021-22

Director	Er. Suprabha N
Joint Directors	Er Suja S S Er.Shini K K
Deputy Director	Er.Divya C J
Technical Team	
Er Francy V Antony	Assistant Director
Er.Roshni S S	Assistant Director
Er. Jayasree K V	Assistant Director
Salini S S	Research Assistant
Anusha Das	Research Assistant
Money K K	Research Assistant
Divyesh V B	Third Grade Overseer

Crew	
Jayakumar T R	Boat Driver (on HR basis)
Sudheesh K C	Departmental Driver
Anitha M M	Office Attendant

Equipments of survey

2.1 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 Fig 1 & 2. High frequency signal (HF -100 kHz) and the secondary low frequency signal (LF -6 to 12kHz) are used. The spatial distribution of sediment in each cross section can be analyzed.

Fig 1 Top- side Unit

Fig 2 Transducer

B. INTEGRATED BATHYMETRIC SYSTEM (IBS)

The components of IBS are

- FRP boat
- DGPS –MX-610
- Echosounder
- Survey P C
- Helms man display

FRP BOAT

Fiber reinforced Plastic (FRP) boat (Fig 3) having two 60 HP petrol out board engines, dimension of 7.5m X 2.66m X 1.20m and 8persons capacity with the equipment is used for the survey.For the power supply, two solar panels of 80Watt each are mounted on the roof of the boat.

Fig 3 FRP Boat

DGPS SIMRAD MX-610

DGPS SIMRAD MX- 610 (Fig 4) is highly reliable and it receives correction from a permanent reference station, which is approved by Govt. of India, Dept. of Light house and Light ship. It can also track up to 12 satellites to achieve maximum positional accuracy. The received position is transferred to Echo Sounder and Sub Bottom Profiler data collection laptop.

Fig 4 MX610 Navigation System

MIDAS SURVEYOR - ECHO-SOUNDER

The MIDAS Surveyor is a revolution of small boat survey work with an integral GPS receiver (Fig 5). It logs and displays DGPS position data in WGS 84 or Local Grid. This Echo-sounder is designed to measure under water depth up to 1200m. Accuracy of instrument is 1centi meter. The 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.

Fig 5 MIDAS Surveyor Echo Sounder

SURVEY PC

The Qinsy survey software is installed in the laptop for data collection and processing.

All the position data collected using DGPS and the depth of water collected using echo-sounder are recorded in computer and are further processed.

HELMS MAN DISPLAY

This is an extension monitor of the survey PC for guidance of boat driver.

Mobile station set up for data collection is shown in Fig6

Fig.6 Equipment Set up inside the Boat

Softwares Using For the Survey

- **QINSY SOFTWARE**

  This software is used for data collection and processing in IBS survey. The Bathymetric software supports NMEA 0183 compatible devices. Local grid UTM (WGS-84) is the projection supported by this software.

- **SESWIN**

  This software is used for the data collection in Sub Bottom Profiler.

- **I.S.E. 2.9.2**

  This is the post processing software used for analyzing the data collected from Sub Bottom Profiler.

- **Surfer software**

  Surfer is a graphic program used for calculating the volume based on the logged data from the IBS and Sub Bottom Profiler.

3.0 DATA COLLECTION

The mobile station consists of the DGPS and its antenna, Echo sounder, Sub Bottom Profiler and the transducers etc which are mounted on the FRP boat.The transducer of Sub Bottom Profiler is permanently fixed at the center of the boat. The transducer of Echo sounder is connected to the left side of the boat and is detachable. Proper connections are made between these equipment and the laptops for the data collection.Byusing the **Planning and**

presentation menu in **Qinsysoftware,** chart is prepared by taking UTM co-ordinate at two known points. With these co-ordinates of two points reference lines are drawn. Segment lines are drawn parallel to this reference line at a particular interval such that the entire reservoir area can be covered.The boat is sailed along the planned trackwith a speed of 3 to 4 knots. The data from the Echo sounder and Sub Bottom Profiler is collected simultaneously through two laptops as shown in Fig.7.For IBS Survey, the laptop loaded with QINSY survey software is used.For Sub Bottom Profiler, the data is collected using laptop installed with Seswin software.There are three modules in the QINSY Software. Data Acquisition, Data Processing and Data export/ import.

Fig.7 Data Collection set up inside the Boat

The system **SES-2000**(Sediment Echo Sounder)Sub Bottom Profiler is aparametric (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 favorable 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 x 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.

4.0 ACTIVITIES OF THE DIVISION DURING THE YEAR 2021-22

- The reports of the bathymetric studies of Meenkara, Pothundy, Malankara, Pazhassi, KarappuzhaReservoirswhich were conducted during the financial year2020-21, has been completed during this year.
- The hydrographic surveys of Kallada and Maniyarreservoirs have been conducted during the year 2021-22.
- Apart from that the routine upkeep of the office, survey equipment etc has been done in this financial year too.
- Agreement has been executed for the purchase of a small boat and trailer for conducting the sedimentation studies of small rivers, lakes and ponds. The construction of the same is ongoing.
- Anechosounder and laptop etchas been purchased for conducting the surveys using thenewly purchasing boat.
- The awareness training for the ISO certification process has been conducted.

The details of the completed reports are as follows:

4.1 Sedimentation study of Meenkara reservoir using Integrated Bathymetric System (IBS) & Sub Bottom profiler

Sedimentation study of Meenkara reservoir was conducted previously in 2011 and 2016. The repeat study of Meenkara reservoir using IBS & Sub bottom profiler has been conducted in the year 2020-21 in order to assess the effect of the extra ordinary floods occurred in the year 2018 and 2019.

Results and Discussion

ESTIMATION OF CAPACITY

The present survey is carried out at the water level of 155.59 m. The original water holding capacity at this level is 9.122 Mm^3. As per the current IBS study the capacity at the same level is estimated as 7.497$Mm^3$and the corresponding water spread area is 1.666 Sq.km. Total capacity reduction of the reservoir at this level is 1.625 Mm^3in 56 years, i.e. the reduction in capacity at the specified level is 17.81% (0.32% per year).Table 1 shows the comparison of reservoir capacity.

If we consider the three consecutive studies in 2009, 2015 and 2020, the commonly available higher water level for comparison is154.53m. So the capacities obtained from the studies at this water level are compared with the original capacity and is graphically represented in Fig 8. The capacity reduction is due to sediment deposit.

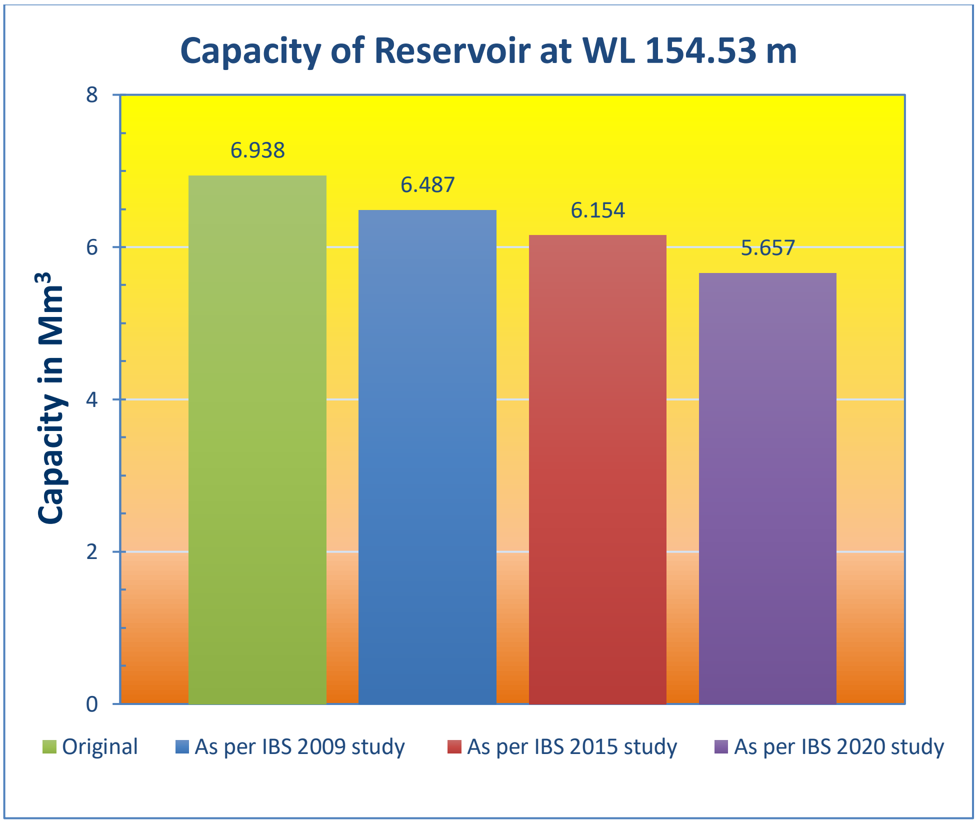


Fig 8 Decrease in Reservoir Capacity

Table 1 Capacity reduction of the reservoir

Year of Study	Water Level (m)	Capacity Mm^3	Reduction in Capacity w.r.t Original Volume (9.122 Mm^3)	
			Mm^3	Percentage
2020	155.59	7.497	1.625	17.81

The contour map of water spread area is shown below at an interval of 1 m.

N ↑

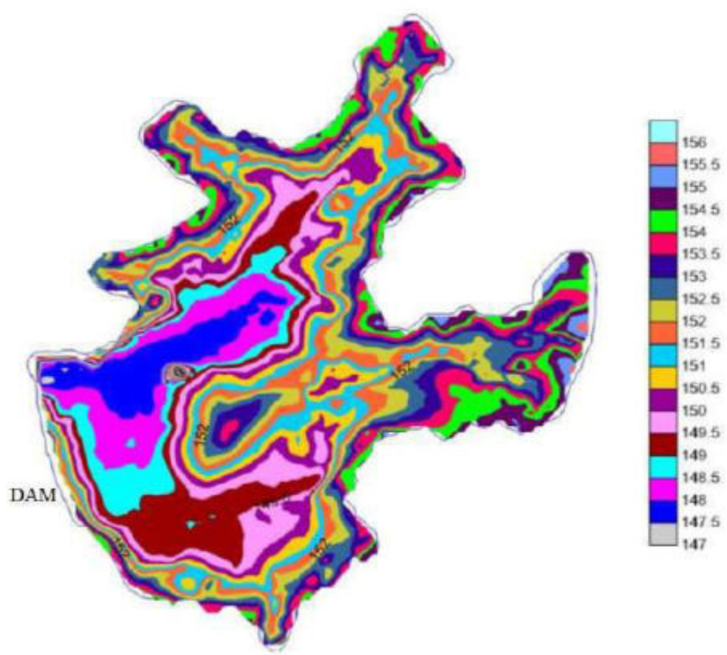


Fig 9 Contour Map based on IBS Survey

CAPACITY AT DIFFERENT WATER LEVELS

Reservoir volume at different water levels can be found out from the IBS data collected through QINSY software by using Surfer software. The present capacity at different level is compared with the original and IBS study results obtained in 2009 and 2015 and is shown in Table 2.The original storage capacity curve is compared with the same obtained from the IBS surveys in 2009, 2015 and the present study as shown in Fig 10.

Table 2 Reservoir capacity at different water levels

Sl No	Water Level	Water Holding Capacity				Percentage Reduction in Capacity w r t original
		Original	IBS Survey 2009	IBS Survey 2015	IBS Survey 2020	
	m	M. Cub. m	M. Cub. m	M. Cub. M	M. Cub m	%
1	155.590	9.122			7.497	17.81
2	155.450	8.779	8.157		7.252	17.39
3	154.530	6.938	6.487	6.154	5.657	18.46
4	153.630	5.324	4.997	4.880	4.224	20.66
5	152.710	4.050	3.653	3.634	2.973	26.59
6	151.710	2.970	2.553	2.553	1.955	34.18
7	150.880	2.109	1.642	1.642	1.177	44.19
8	149.960	1.416	0.949	0.949	0.591	58.26
9	149.350*	1.076	0.593	0.593	0.317	70.54
10	148.740	0.793	0.329	0.329	0.138	82.60
11	147.520	0.368	0.036	0.036	0.000	100.00
12	146.310	0.170	0.000	0.000	0.000	100.00

*Dead Storage Level

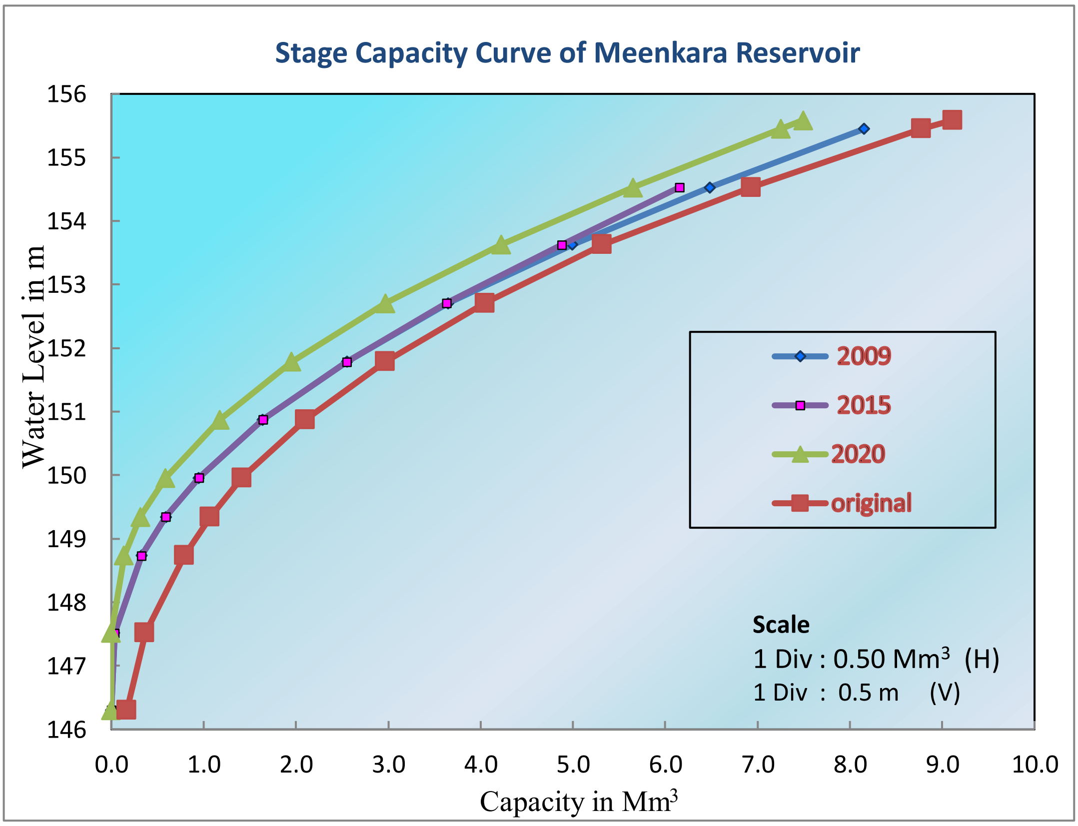


Fig 10 Water level V/S water holding capacity curve

WATER SPREAD AREA AT DIFFERENT WATER LEVEL

The present water spread area at different level is compared with the IBS result in 2009 and 2015 and is shown in Table3. Fig shows its graphical representation.

Table3Water spread area at different water levels

Sl. No.	Water Level	Water Spread Area		
		IBS Survey 2009	IBS Survey 2015	IBS Survey 2020
	M	Sq.km	Sq.km	Sq.km
1	155.590			1.666
2	155.450	1.740		1.665
3	154.530	1.610	1.350	1.621
4	153.630	1.480	1.320	1.457
5	152.710	1.300	1.250	1.227
6	151.790	1.080	1.060	0.972
7	150.880	0.860	0.840	0.738
8	149.960	0.640	0.600	0.525
9	149.350	0.510	0.510	0.377
10	148.740	0.370	0.370	0.232
11	147.520	0.130	0.140	0.000
12	146.310	0.000	0.000	0.000

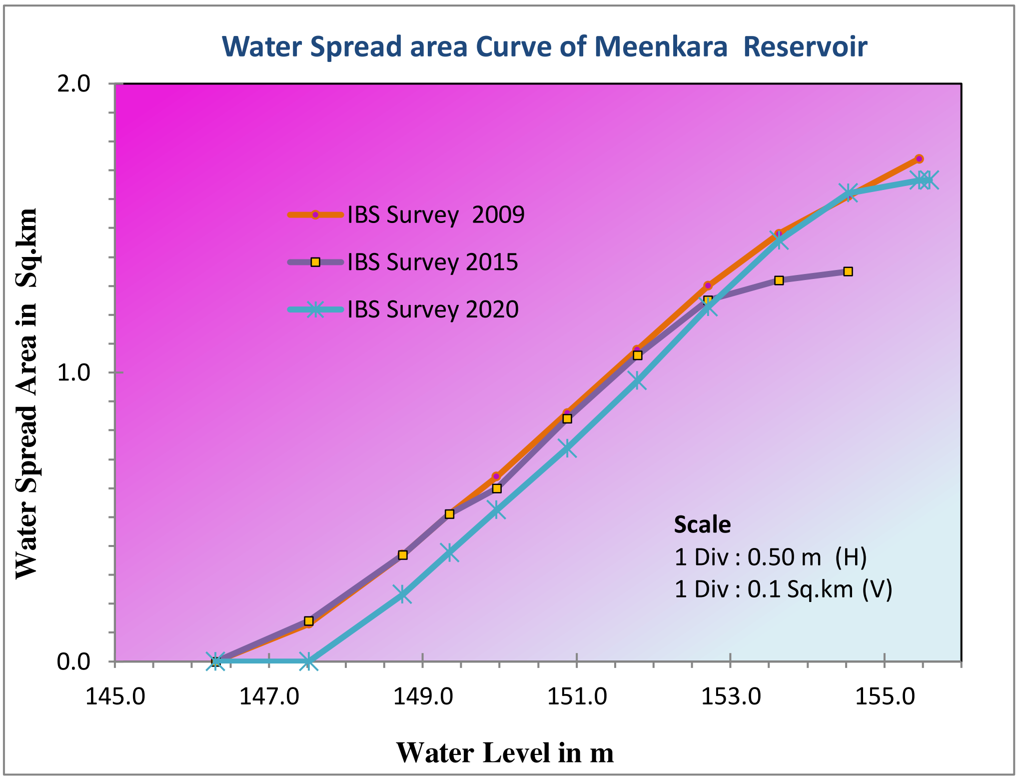


Fig 11 Water level v/s water spread area curve

ANALYSIS OF SOIL SAMPLE

In the sedimentation study conducted in 2009, 6 Nos of disturbed soil samples were analyzed. In the present study 4 No of soil samples are analyzed. The samples for the two studies are collected from different locations. The result of the present soil sample analysis is shown in Table 4. By comparing the results, remarkable variations are observed in the average percentage of Silt, Sand and Clay. The details are shown in the bar chart (Fig 12).

Table 4 Soil Sample Analysis Result

Sl no	Sample Position	Depth of Sample taken in m	Nature of Sample	Soil Texture	Colour	Specific Gravity	% of Various Size of Soil Particle			
1	N - 1174552 E -697294	5.9	Disturbed	Silty Sand	Ash Gray	2.48	3	8	89	0
2	N - 1174887 E - 698227	1.2	Disturbed	Silty Sand	Light Brown	2.18	19	38	43	0
3	N - 1175543 E – 697396	6.7	Disturbed	Silty Sand	Gray	2.23	20	72	8	0
4	N - 1175859 E - 696997	4.2	Disturbed	Silty Sand	Ash Gray	2.47	5	10	85	0

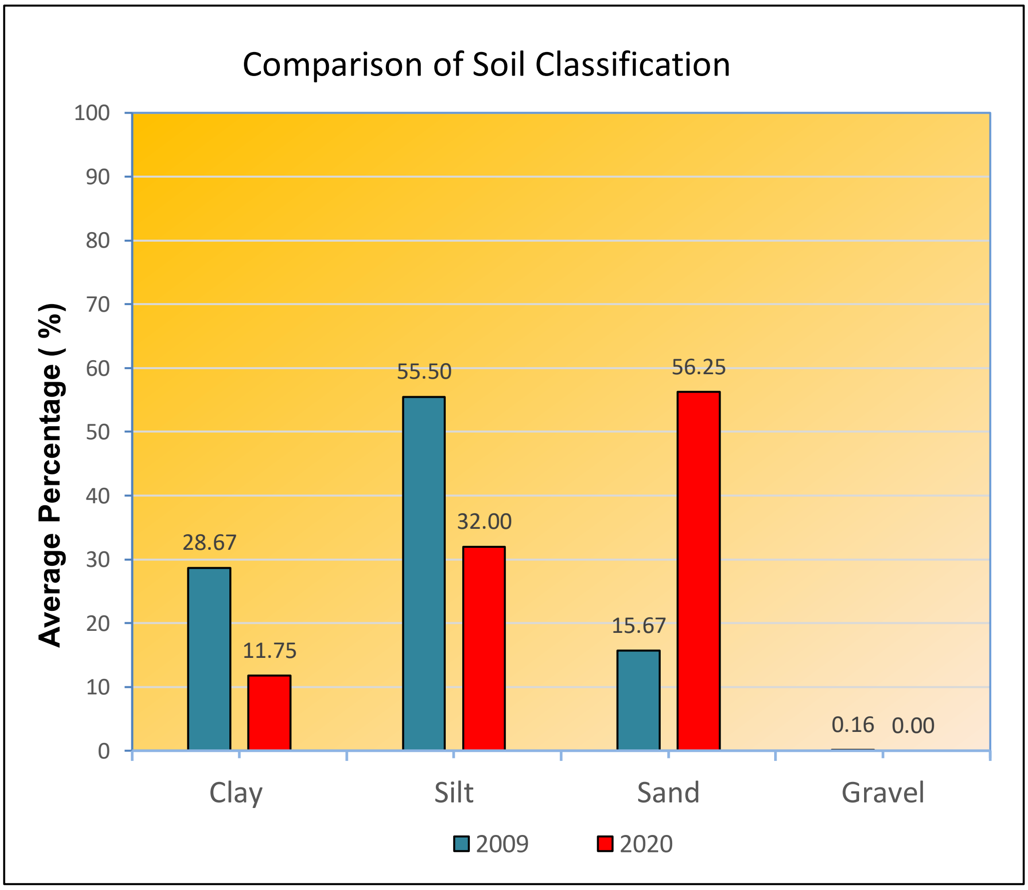


Fig 12 Comparison of Soil particle distribution as per the consecutive sedimentation studies conducted in 2009 and 2020

The percentages of soil particles are only indicative and not accurate. For accurate assessment of contents in the soil, core sample analysis must be done.

RESULTS AND DISCUSSIONS

The present survey is conducted at the water level 155.59 m. The original capacity corresponding to this level is 9.122 Mm^3 and the present capacity is 7.497 Mm^3.

- The IBS Survey in 2009 has been carried out at FRL (156.36m). The corresponding reservoir capacity was 9.846 Mm^3 against the original capacity of 11.30Mm^3. The capacity reduction was 1.454Mm^3 ie reduction percentage is 12.87% in 45 years. Rate of sedimentation is 0.032 Mm^3 (0.286%) per year.
- The IBS Survey in 2015 has been carried out at the level 154.53m. The corresponding reservoir capacity was 6.154 Mm^3 against the original capacity of 6.938 Mm^3. There is a loss in capacity of 0.784 Mm^3 in 51 years at this level.The capacity at this waterlevel during 2009 survey was 6.487Mm^3.So the reduction in capacity during 6 years (from 2009 to 2015) is 0.333Mm^3ie rate of sedimentation is 0.056Mm^3(0.80%) per year.
- The present study is conducted at water level 155.59m. The capacity reduction of the reservoir is 1.625Mm^3 in 56 years at this level.ie reduction is 17.81% of the original capacity. The reduction rate is .029Mm^3 per year (0.32% per year).
- Original capacity at dead storage level (149.35m) is 1.076 Mm^3 and the present capacity at this level is 0.317Mm^3. The reduction in dead storage is 0.759Mm^3ie 70.54 % in 56 years. The dead storage capacity as per the previous studies was 0.593Mm^3. Within the last 5 years after the second study in 2015, the dead storage capacity is reduced by 0.276Mm^3. The percentage reduction in dead storage is 25.65% in last 5 years.
- Sediment layer profile of the reservoir area at an interval of 60m is obtained from the Sub Bottom profiler.

The following conclusions are made based on the capacities at water level 154.53m. As per the first study conducted in 2009, the capacity reduction rate was ***0.14 %***per year during the first 45 years of the dam life. From the next study in 2015, the capacity reduction rate was estimated as ***0.80%*** per year for the next 6 years after the first study. From the present study conducted in 2020, the capacity reduction rate is ***1.43%*** for the next5 years after the second study. i.e., ***There is a huge increase in rate of sedimentation and this is the outcome of the unusual heavy flood occurred in 2018 and 2019.***

The chronological capacity reduction rate corresponding to WL83.5m is graphically represented in Figure 13 below.

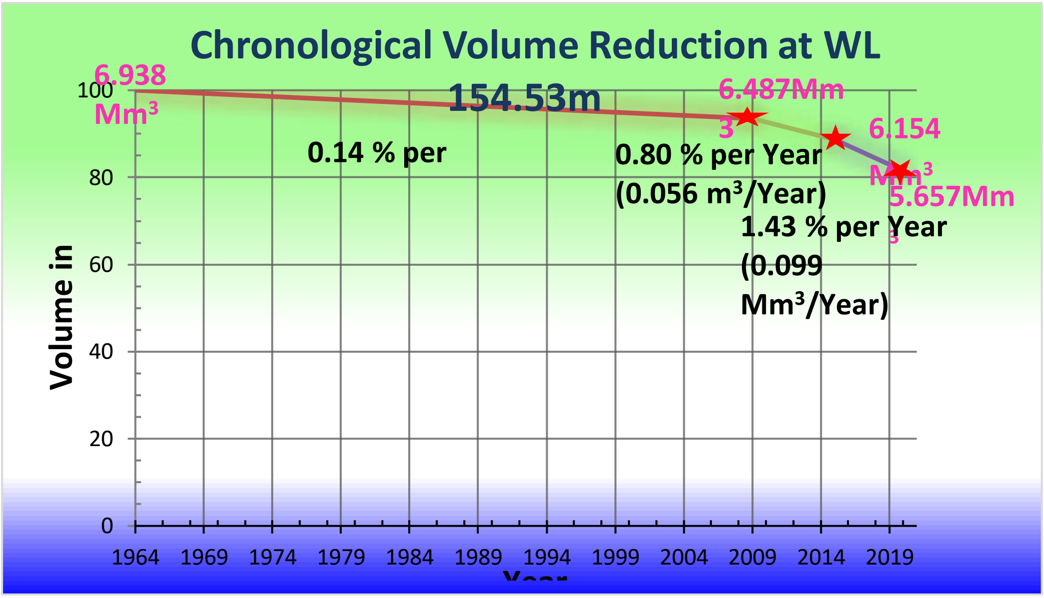


Fig 13 Chronological Volume Reduction

4.2 BATHYMETRIC STUDY OF POTHUNDY RESERVOIR USING INTEGRATED BATHYMETRIC SYSTEM (IBS) & SUB BOTTOM PROFILER

Sedimentation study of Pothundy reservoir was previously conducted in 2009 and 2017. The repeat study of Pothundyreservoir using IBS & Sub bottom profiler has been conducted during the year 2020-21 in order to assess the effect of the extra ordinary floods occurred in the year 2018 and 2019 as per the direction of the Chief Engineer, Projects-1.

Results and Discussion

ESTIMATION OF CAPACITY

The survey is carried out at the water level of 106.99 m. The original water holding capacity at this level is 47.06 Mm^3. As per the current IBS study the volume at the same level is estimated as 43.276 Mm^3 and the corresponding water spread area is 2.83 Sq.km. Total capacity reduction of the reservoir at this level is 3.784 Mm^3 in 49 year, i.e. the reduction in capacity at the specified level is 8.04%. Table 5 shows the comparison of reservoir capacity.

Figure14 shows its graphical representation. The capacity reduction is due to sediment deposit.

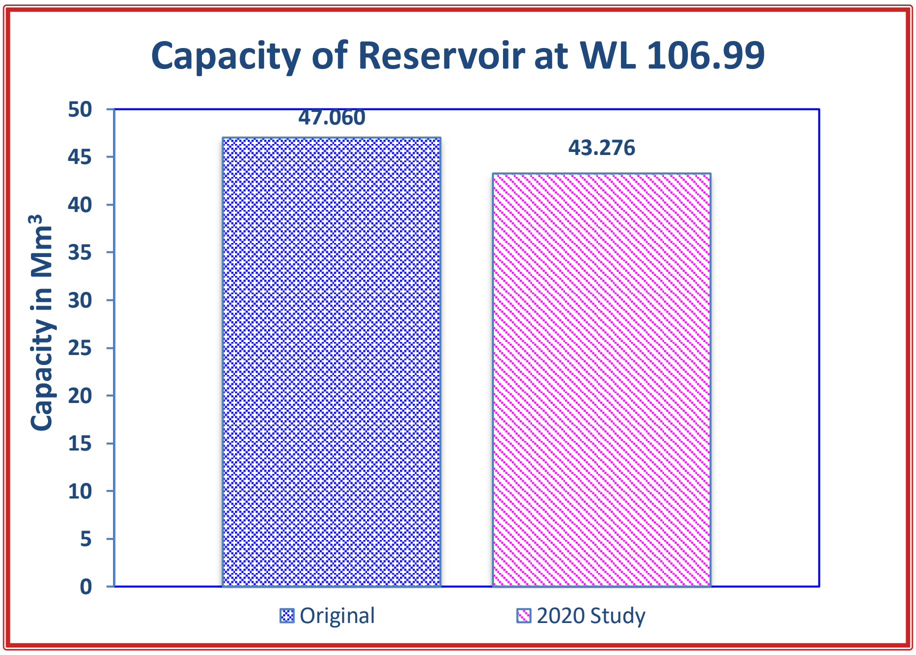


Fig 14Decrease in Reservoir Capacity

Table 5 Capacity reduction of the reservoir

Year of Study	Water Level (m)	Capacity Mm^3	Reduction in Capacity w.r.t Original Volume ($47.06Mm^3$)	
			Mm^3	Percentage
2020	106.99	43.276	3.784	8.04

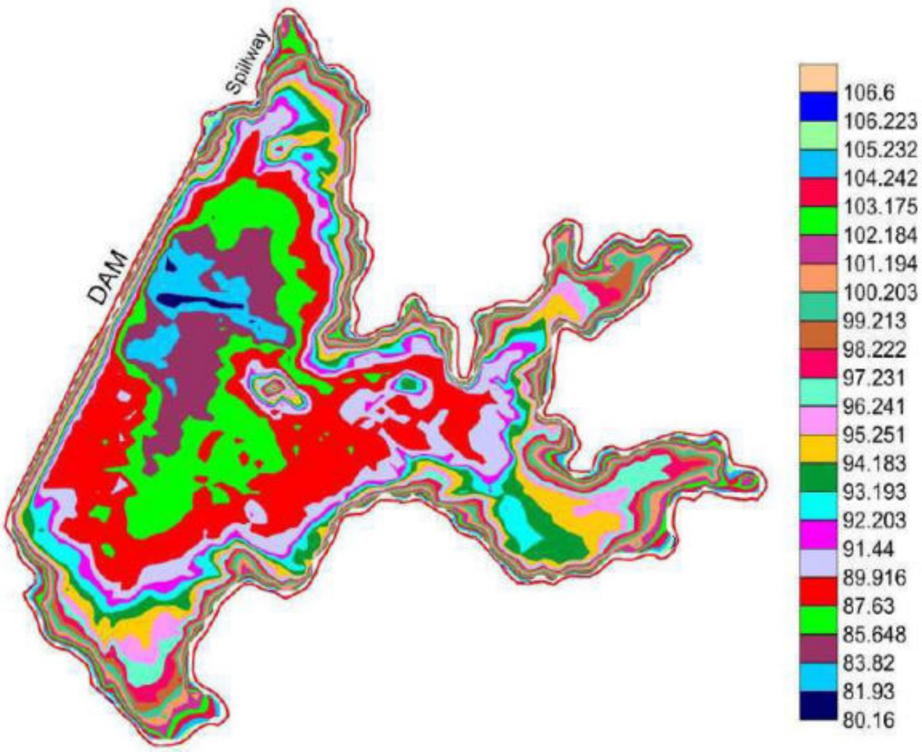


Fig 15 Contour Map based on IBS Survey

CAPACITY AT DIFFERENT WATER LEVEL

Reservoir volume at different water levels can be found out from the IBS data collected through QINSY software by using Surfer software. The present capacity at different level is compared with the original and IBS study results obtained in 2009 and 2017 and is shown in Table 6.

Table 6 Reservoir capacity at different water levels

Sl. No.	Water Level	Water Holding Capacity				Percentage Reduction in Capacity (IBS 2020)
		Original	**IBS Survey 2009**	**IBS Survey 2017**	**IBS Survey 2020**	
	m	M. Cub. M	M.Cub. m	M. Cub. m	M. Cub. m	%
1	106.99	47.06			43.276	8.04
2	106.60	45.859	44.068	43.238	42.101	8.19

3	106.223	44.657	42.884	42.126	40.964	8.27
4	105.232	41.549	39.775	39.174	37.975	8.60
5	104.242	38.511	36.715	36.288	35.000	9.12
6	103.175	35.241	33.516	33.113	31.827	9.69
7	102.184	32.281	30.649	30.328	28.968	10.26
8	101.194	29.393	27.882	27.559	26.217	10.81
9	100.203	26.547	25.208	24.878	23.576	11.19
10	99.218	23.823	22.627	22.3	21.057	11.61
11	98.222	21.259	20.138	19.826	18.618	12.42
12	97.231	18.803	17.750	17.454	16.297	13.33
13	96.241	16.423	15.467	15.182	14.093	14.19
14	95.251	14.283	13.292	13.292	12.013	15.89
15	94.183	12.092	11.804	10.825	9.931	17.87
16	93.193	10.166	9.185	8.955	8.165	19.68
17	92.203	8.340	7.456	7.249	6.557	21.38
18	91.44*	7.023	6.234	6.033	5.441	22.53

*Dead Storage Level

The original storage capacity curve is compared with the same obtained from the IBS surveys in 2009 and 2017 as shown in Figure below.

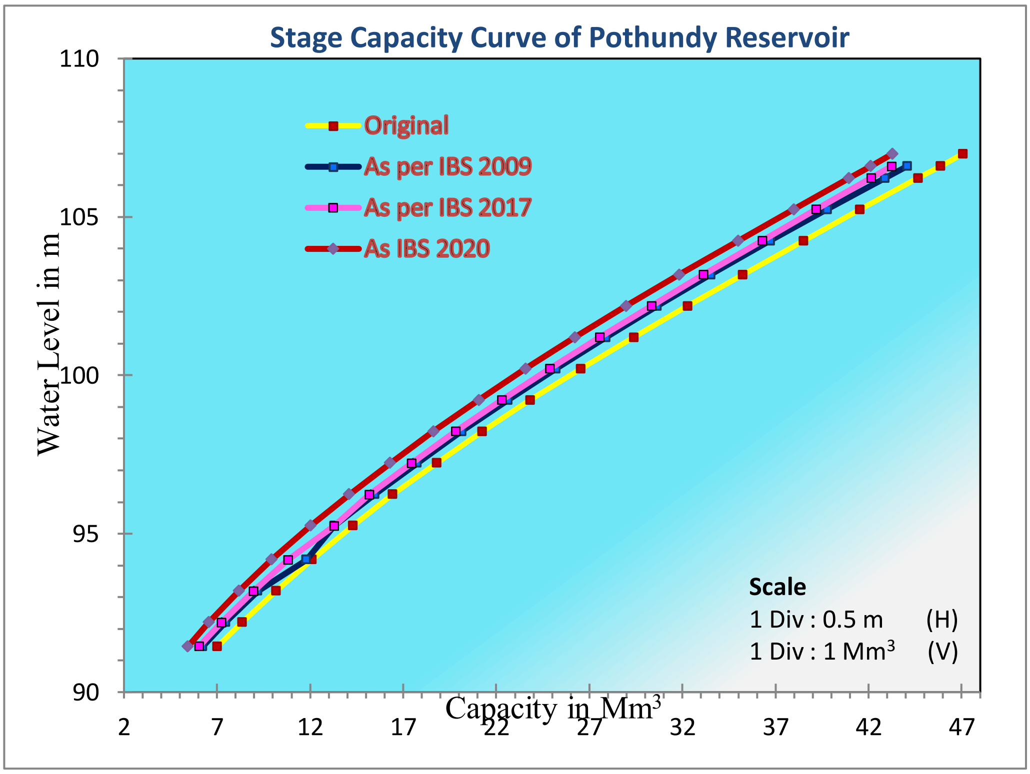


Fig 16 Stage - Capacity curve

WATER SPREAD AREA AT DIFFERENT WATER LEVEL

The present water spread area at different level is compared with the IBS result in 2009 and 2017 and is shown in Table 7. Fig 17 shows its graphical representation.

Table 7 Water spread area at different water levels

Sl. No.	Water Level	Water Spread Area		
		IBS Survey 2009	IBS Survey 2017	IBS Survey 2020
	m	Sq.km	Sq.km	Sq.km
	106.99			2.83
1	106.6	3.17	3.1	2.82
2	106.223	3.14	3.06	2.81
3	105.232	3.05	2.98	2.8
4	104.242	2.96	2.90	2.79
5	103.175	2.86	2.82	2.78
6	102.184	2.77	2.74	2.72
7	101.194	2.68	2.67	2.65
8	100.203	2.6	2.58	2.56
9	99.218	2.52	2.48	2.46
10	98.222	2.43	2.40	2.36
11	97.231	2.33	2.31	2.26
12	96.241	2.23	2.21	2.15
13	95.251	2.12	2.10	2.02
14	94.183	1.98	1.96	1.86
15	93.193	1.83	1.81	1.70
16	92.203	1.65	1.65	1.55
17	91.44	1.55	1.54	1.45

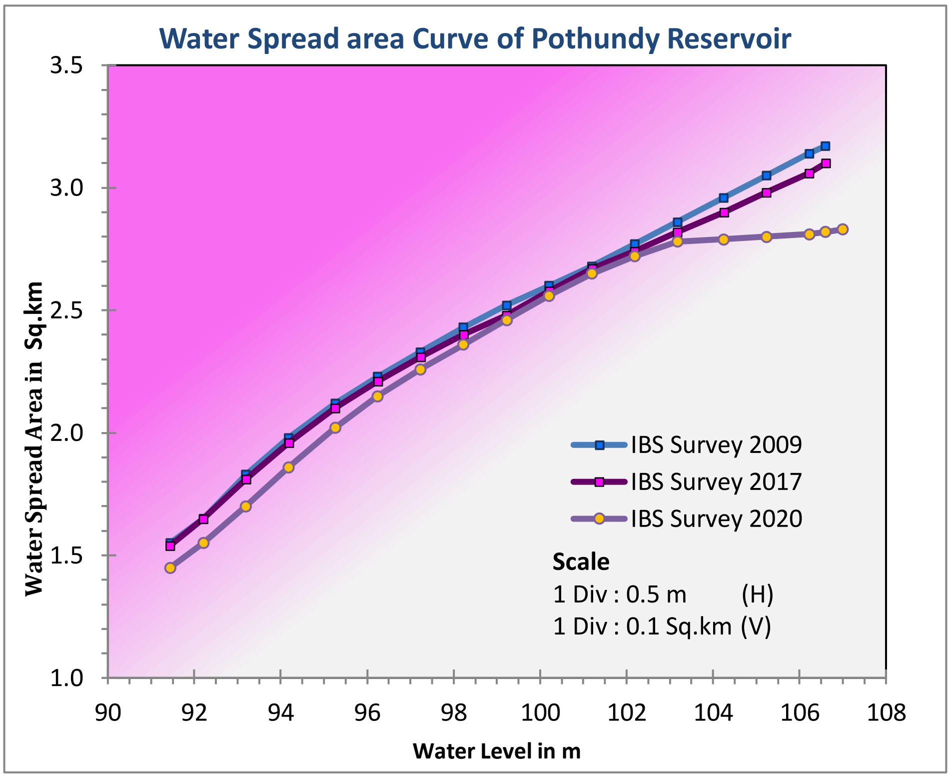


Fig 17 Water level v/s water spread area curve

ANALYSIS OF SOIL SAMPLE

In the sedimentation studies conducted in 2009 and 2017, 8 Nos and 10 Nos of disturbed soil samples were analyzed respectively. In the present study 5 No of soil samples are analyzed. The samples for the three studies are collected from different locations. The result of the present soil sample analysis is shown in Table 8. By comparing the results, remarkable variations are observed in the average percentage of Silt and Sand. The details are shown in the bar chart given in Figure 18 below.

Table 8 Soil Sample Analysis Result

Sl. No.	Sample (Position)	Depth of Sample taken in m	Nature of sample	Soil texture	Colour	Specific gravity	% of Various size of Soil Particle			
							Clay	Silt	Sand	Gravel
1.	N-1165655 E- 680036	9.1	Disturbed	Silty soil	Lead Gray	2.08	8	40	52	0
2.	N-1166289 E- 679754	9.7	Disturbed	Silty sand	Slate Gray	2.45	4	22	74	0

3.	N-1166524 E-680101	1.7	Disturbed	Sandy soil	Light Brown	2.62	2	4	84	10
4.	N-1164876 E-678132	9.4	Disturbed	Silty soil	Lead Gray	2.30	8	41	41	10
5.	N-1166928 E-678676	13.0	Disturbed	Silty soil	Lead Gray	2.36	13	61	26	0

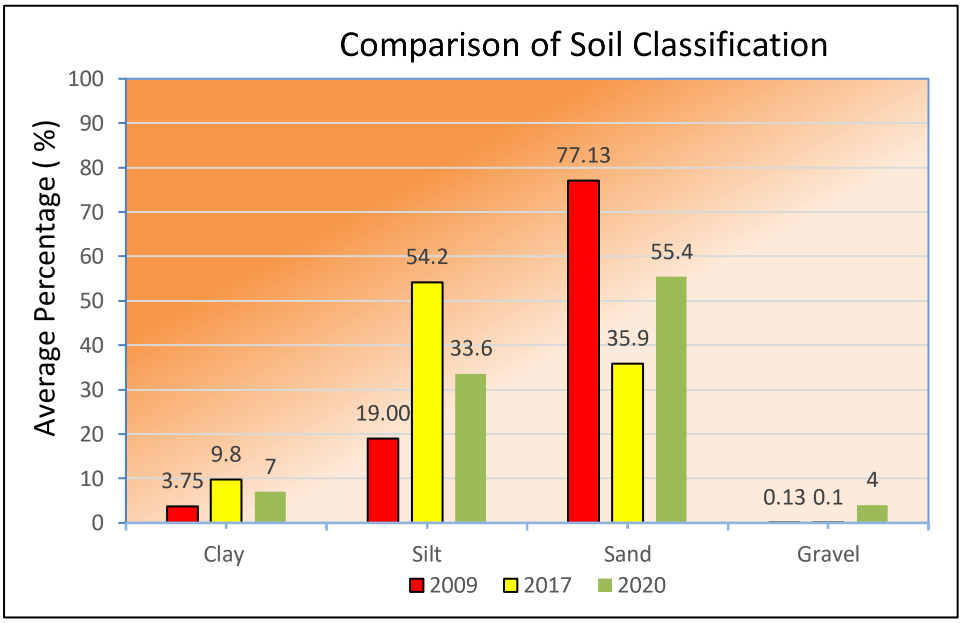


Fig 18 Comparison of Soil particle distribution as per the consecutive sedimentation studies conducted in 2009, 2017 and 2020

The percentages of soil particles are only indicative and not accurate. For accurate assessment of contents in the soil, core sample analysis must be done.

The original Capacity of Pothundy Reservoir at 106.99m level is 47.06 Mm$^{3.}$ The present capacity is 43.276 Mm^3. The capacity reduction of the reservoir is 3.784 Mm^3 in 49 years at the same level.

- The previous IBS **Surveys in 2009 and 2017** were conducted at water level 106.6m, the reservoir capacity obtained was 44.068 Mm^3 and 43.238 Mm^3 respectively against the original capacity of 45.859 Mm^3 at106.6m. The capacity was reduced by 1.791 Mm^3 in 38 years and 2.621 Mm^3 in 46 years
- The reduction percentage is 3.91% and 5.72% respectively against the studies in 2009 & 2017.
- The original volume at dead storage level (91.44m) was 7.023 Mm^3. The dead storage capacity reduced to 6.234 Mm^3 in 38 years and 6.033 Mm^{3}in 46 years based on the studies conducted in 2009 and 2017 respectively. Reduction percentages are 11.23 % and 14.1%. Within the last 9 years from 2009 to 2017 the capacity reduction at dead storage level is 2.87%.

- The **present study**is conducted at water level 106.99m. The original reservoir capacity at this level is 47.06 $Mm^3$and it is reduced to 43.276 Mm^3 in 49 years. The capacity is reduced by 3.784Mm^3. The reduction percentage is 8.04%.
- The present capacity corresponding to water level 106.6m is 42.101Mm^3ie within the last 3 years the capacity reduced by 1.137$Mm^3$and within the 49 years total reduction in capacity is 3.758Mm^3. and the percentage reduction is 8.19%.
- Volume at dead storage level is 5.441 Mm^3, percentage reduction in dead storage is 22.53 %. Within the last 3 years after the second study, the dead storage capacity is reduced by 8.43%.
- Sediment layer profile of the reservoir area at an interval of 60 m is obtained from the Sub Bottom profiler.

The study results may be compared at water level **106.6m**. During the first 38 years of the dam life the capacity reduction rate was 0.10 % per Year. Within the next 8 year, the reduction rate is 0.23 % per year. Based on the present study conducted after the heavy floods in 2018 and 2019, it is observed that the capacity reduction rate is 0.83 % within the last 3 years. This much huge rate of sedimentation may due to the effect of the heavy floods in the previous years.

The capacity reduction obtained from the IBS is comparable with the sediment volume calculated from the Sub Bottom Profiler.

The graphical representation of reduction rate is shown in Figure 19.

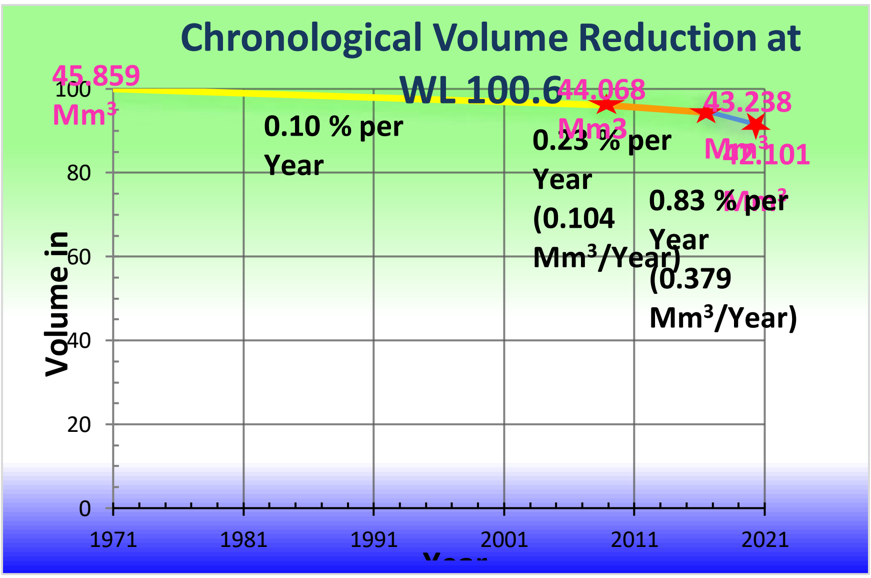


Fig 19 Chronological Volume Reduction

4.3 BATHYMETRIC STUDY OF MALANKARA RESERVOIR USING INTEGRATED BATHYMETRIC SYSTEM (IBS) & SUB BOTTOM PROFILER

Sedimentation study of Malankara reservoir was not conducted yet and has been done for the first time during the year 2020-21 using IBS & Sub bottom profiler in order to assess the present storage capacity at different elevations.

Results and Discussion

ESTIMATION OF CAPACITY

The survey is carried out at the water level of 41.84 m. The original water holding capacity corresponding to this level is 36.36Mm^3. As per the current IBS study the volume at the same level is estimated as 18.561Mm^3 and the corresponding water spread area is 3.84Sq.km. Total capacity reduction of the reservoir at this level is 17.799Mm^3 in 27years, i.e. the reduction in capacity at the specified level is 48.95%. Table 9 shows the comparison of reservoir capacity. Fig 20 shows its graphical representation. This much huge reduction in capacity may be due to the heavy floods occurred in 2018 and 2019.

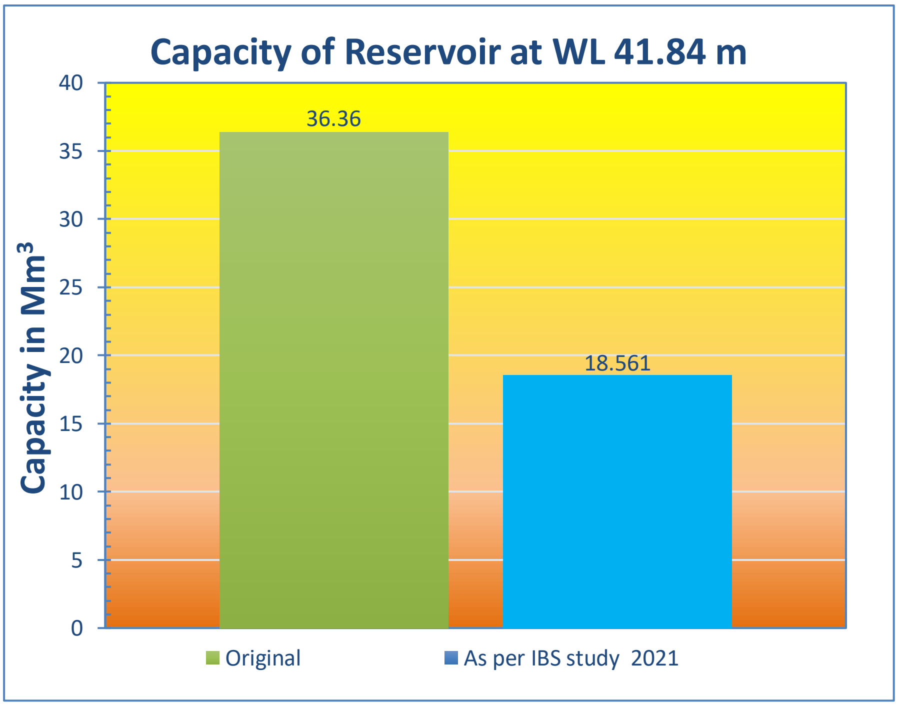


Fig 20 Decrease in Reservoir Capacity

Table 9 Capacity reduction of the reservoir

Year of Study	Water Level (m)	Capacity Mm^3	Reduction in Capacity w.r.t Original Volume ($36.36Mm^3$)	
			Mm^3	Percentage
2021	41.84	18.561	17.799	48.95%

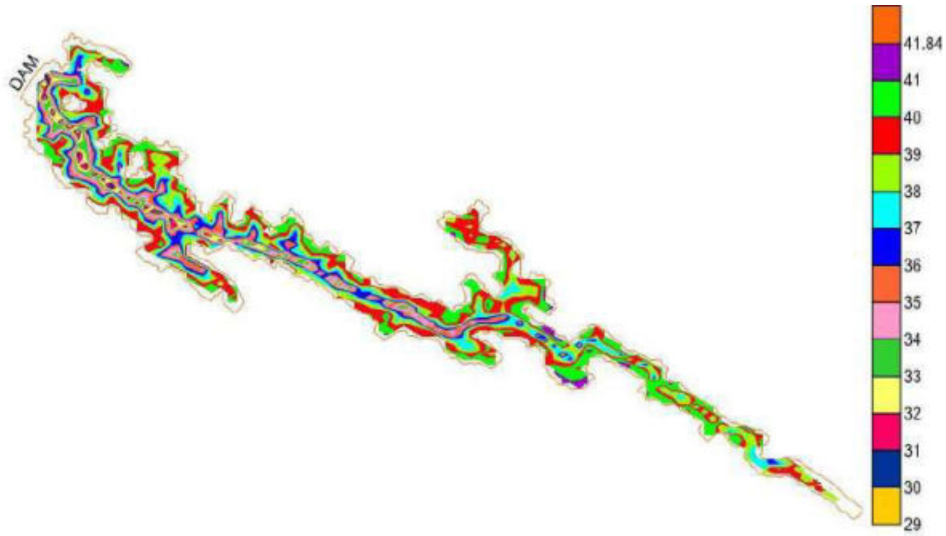


Fig 21Contour Map based on IBS Survey

CAPACITY AT DIFFERENT WATER LEVEL

Reservoir volume at different water levels can be found out from the IBS data collected through QINSY software by using Surfer software. The present capacity at different level is compared with the original capacity given by the project authorities and is shown in Table 10.

Table 10 Reservoir capacity at different water levels

Sl No	Water Level (m)	Water Holding Capacity in Mm^3		Percentage Reduction
		Original	IBS Survey 2021	
1	41.84	36.36	18.561	48.95
2	41.50	35.000	16.907	51.69
3	41.00	33.300	14.494	56.47
4	40.50	31.400	12.166	61.25
5	40.00	30.000	10.066	66.45
6	39.50	28.400	8.279	70.85
7	39.00	26.900	6.798	74.73
8	38.50	25.400	5.588	78.00
9	38.00	24.000	4.591	80.87

10	37.50	22.900	3.765	83.56
11	37.00	21.600	3.076	85.76
12	36.50	20.400	2.495	87.77
13	36.00	19.200	2.004	89.56
14	35.50	18.250	1.593	91.27
15	35.00	17.100	1.254	92.67
16	34.50	16.100	0.977	93.93
17	34.00	15.100	0.747	95.05
18	33.50	14.100	0.558	96.04
19	33.00	13.000	0.407	96.87
20	32.50	12.000	0.287	97.61
21	32.00	11.000	0.194	98.24
22	31.50	10.000	0.124	98.76
23	31.00	8.900	0.074	99.17
24	30.50	7.900	0.040	99.49
25	30.00	7.000	0.020	99.71
26	29.50	6.000	0.009	99.85
27	29.00	5.200	0.004	99.92

The original storage capacity curve is compared with the same obtained from the IBS survey and is shown in Figure 22 below.

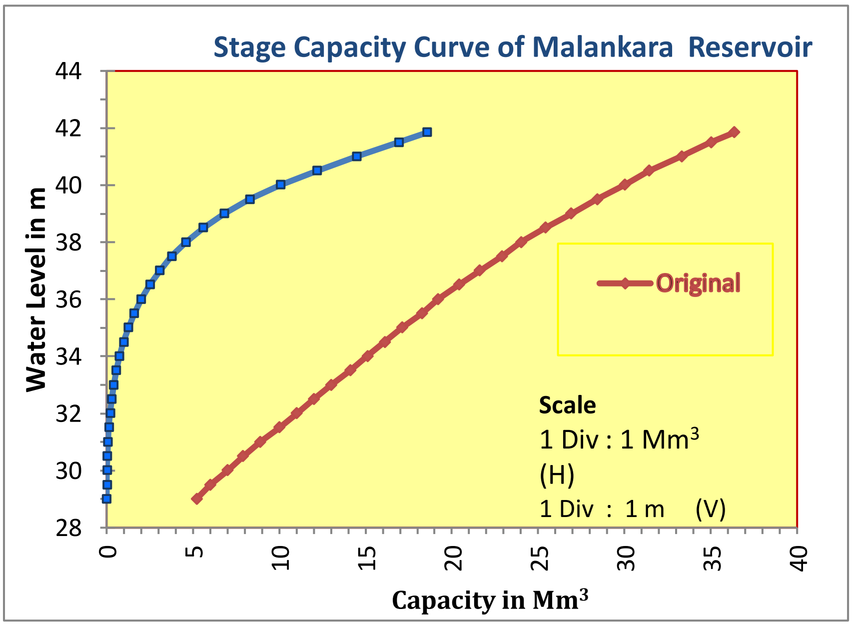


Fig 22 Stage - Capacity curve

WATER SPREAD AREA AT DIFFERENT WATER LEVEL

The present water spread area at different level is compared with the original given by the project authorities and is shown in Table 11. Fig 23 shows its graphical representation.

Table 11 Water spread area at different water levels

Sl. No.	Water Level (m)	Water Spread Area in Sq. Km.		Percentage Reduction
		Original	IBS Survey 2021	
1	41.84	4.64	3.84	17.24
2	41.50	4.52	3.835	15.15
3	41.00	4.32	3.802	11.99
4	40.50	4.13	3.647	11.69
5	40.00	3.95	3.335	15.57
6	39.50	3.79	2.888	23.80
7	39.00	3.61	2.448	32.19
8	38.50	3.44	2.057	40.20
9	38.00	3.28	1.738	47.01
10	37.50	3.1	1.46	52.90
11	37.00	2.93	1.23	58.02
12	36.50	2.75	1.04	62.18
13	36.00	2.6	0.88	66.15
14	35.50	2.45	0.73	70.20
15	35.00	2.3	0.59	74.35
16	34.50	2.14	0.49	77.10
17	34.00	1.99	0.41	79.40
18	33.50	1.84	0.33	82.07
19	33.00	1.7	0.26	84.71
20	32.50	1.57	0.2	87.26
21	32.00	1.43	0.15	89.51
22	31.50	1.32	0.11	91.67
23	31.00	1.18	0.08	93.22
24	30.50	1.05	0.05	95.24
25	30.00	0.92	0.03	96.74
26	29.50	0.79	0.01	98.73
27	29.00	0.67	0.006	99.10

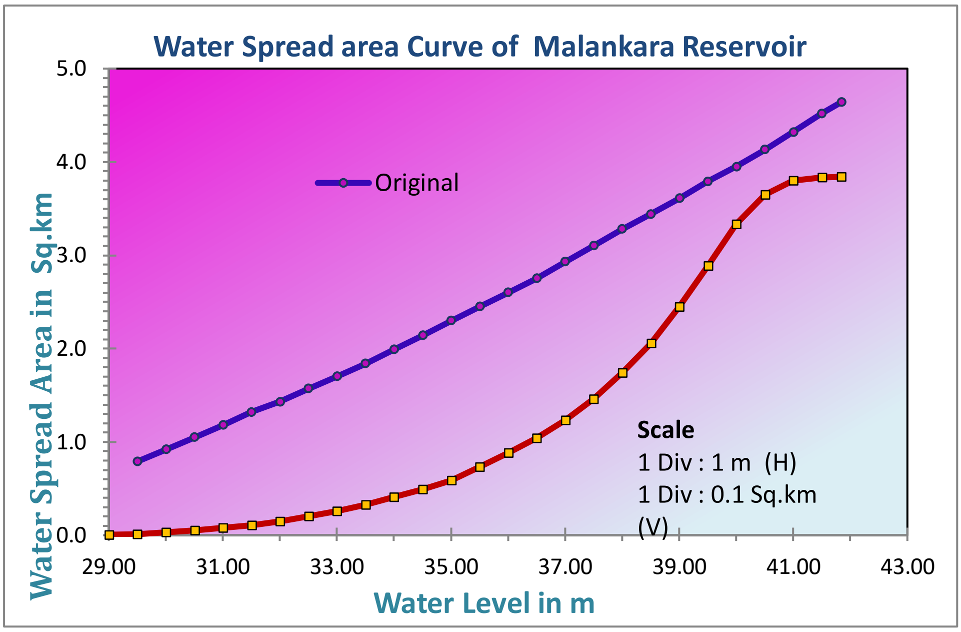


Fig 23 Water level v/s water spread area curve

ANALYSIS OF SOIL SAMPLE

The result of soil sample analysis is shown in Table 12. The average percentage of clay, silt, sand and gravel are estimated and the details are shown in the bar chart given in Figure.

Table 12 Soil Sample Analysis Result

Sl no.	Sample Position	Depth of Sample taken in m	Nature of sample	Soil Texture	Colour	Specific gravity	% of Various size of Soil Particle			
							Clay	Silt	Sand	Gravel
1	N-1089424 E- 691398	9.30	Disturbed	Silty soil	Light orange	2.44	16	41	42	1
2	N-1088882 E- 691816	9.50	Disturbed	Silty soil	Light orange	2.29	19	78	3	0
3	N-1088364 E- 692398	9.00	Disturbed	Silty soil	Light orange	2.27	18	75	7	0

4	N-1087653 E- 693030	9.00	Disturbed	Silty soil	Light brown	2.25	9	64	27	0
5	N-1087506 E- 694604	4.50	Disturbed	Silty soil	Light brown	2.41	9	59	32	0
6	N-1087154 E- 696055	5.60	Disturbed	Silty soil	Light brown	2.42	8	46	46	0
7	N-1086699 E- 696748	3.00	Disturbed	Silty soil	Light brown	2.34	9	70	21	0
8	N-1088535 E- 692597	7.80	Disturbed	Silty soil	Light brown	2.2	20	64	16	0
9	N-1089183 E- 691879	8.90	Disturbed	Silty soil	Light brown	2.27	18	77	5	0
10	N-1089838 E- 692000	3.80	Disturbed	Silty soil	Light orange	2.23	23	52	25	0

Fig 24 Percentage soil particle Distribution

The percentages of soil particles are only indicative and not accurate. For accurate assessment of contents in the soil, core sample analysis must be done.

4.4 SEDIMENTATION STUDY OF PAZHASSI RESERVOIR USING INTEGRATED BATHYMETRIC SYSTEM (IBS) & SUB BOTTOM PROFILER

Sedimentation study of Pazhassi reservoir was conducted previously in 2011 and 2016. The repeat study of Pazhassi reservoir using IBS & Sub bottom profiler has been conducted in the year 2020-21 in order to assess the effect of the extra ordinary floods occurred in the year 2018 and 2019.

Results and Discussion

ESTIMATION OF CAPACITY

The survey is carried out at the water level of 26.52 m. The capacity at the same level is estimated as 44.167 Mm^3 and the corresponding water spread area is 6.00 sq km. Total capacity reduction of the reservoir at this level with respect to the 2011 study is 4.917 Mm^3 in 10 years, i.e., the reduction in capacity at the specified level is 10.02 %. Table 13 shows the comparison of reservoir capacity at water level 26.52m. Fig 25 shows its graphical representation. The capacity reduction is due to sediment deposit.

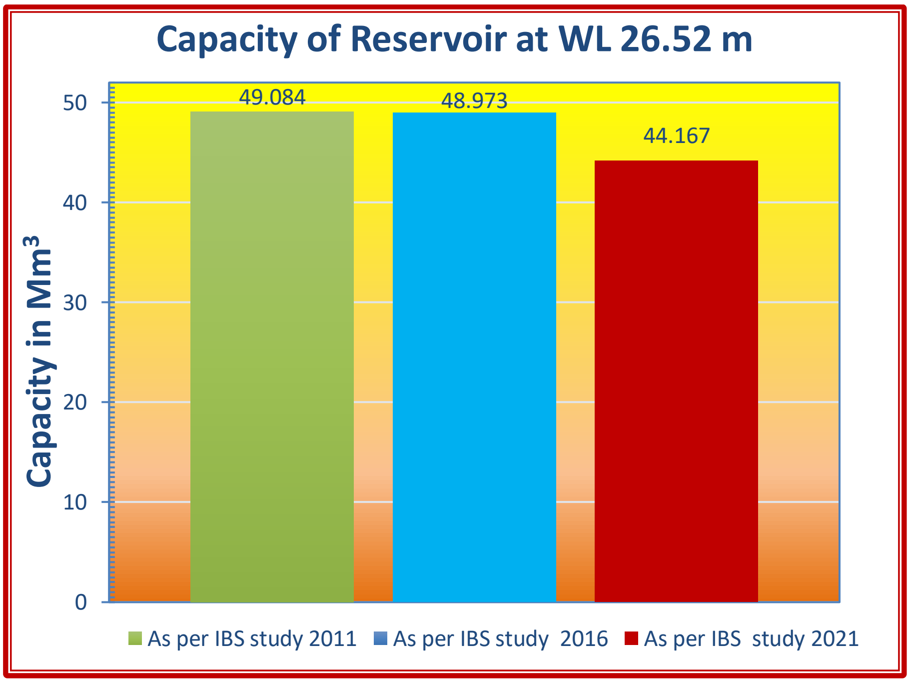


Fig 25 Decrease in Reservoir Capacity

Table 13 Capacity reduction of the reservoir

Year of Study	Water Level (m)	Capacity Mm^3	Reduction in Capacity w.r.t 2011 IBS study ($49.084Mm^3$)	
			Mm^3	Percentage
2021	26.52	44.167	4.917	10.02

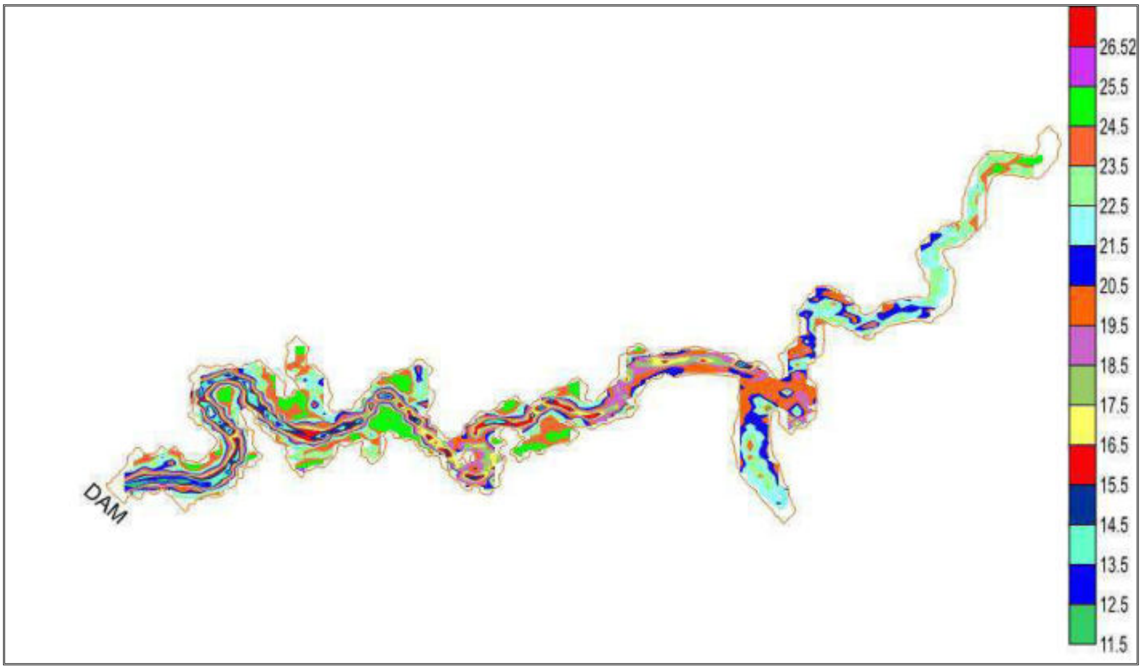


Fig 26 Contour Map based on IBS Survey

CAPACITY AT DIFFERENT WATER LEVELS

IBS data is collected through QINSY software and the reservoir volume at different water levels can be found out from thatby using Surfer software. The present capacity at different level is compared with the IBS study results obtained in 2011 and 2016 and is shown in Table 14 below.

Table 14 Reservoir capacity at different water levels

	Water Level (m)	Water Holding Capacity (Mm^3)			Percentage decrease in present Capacity w r t 2011 study (%)
		IBS Survey 2011	IBS Survey 2016	IBS Survey 2021	
1	26.52	49.084	48.973	44.167	10.02

2	26.50	48.923	46.230	44.009	10.04
3	26.00	44.888	42.866	40.072	10.73
4	25.50	40.853	39.497	36.135	11.55
5	25.00	36.840	36.134	32.262	12.43
6	24.50	32.957	32.829	28.606	13.20
7	24.00	29.277	29.261	25.168	14.03
8	23.50	25.809	25.789	21.966	14.89
9	23.00	22.578	22.578	19.042	15.66
10	22.50	19.580	19.580	16.406	16.21
11	22.00	16.839	16.839	14.059	16.51
12	21.50	14.350	14.35	11.976	16.54
13	21.00	12.143	12.143	10.129	16.59
14	20.50	10.172	10.172	8.496	16.48
15	20.00	8.407	8.407	7.095	15.61
16	19.50	6.868	6.868	5.920	13.80
17	19.00	5.562	5.562	4.916	11.61
18	18.50	4.445	4.445	4.052	8.84
19	18.00	3.507	3.507	3.312	5.56
20	17.50	2.093	2.093	2.674	-27.76
21	17.00	1.792	1.792	2.134	-19.08
22	16.50	1.490	1.490	1.650	-10.74
23	16.00	1.189	1.189	1.250	-5.13
24	15.50	0.868	0.868	0.920	-5.99
25	15.00	0.618	0.618	0.654	-5.83
26	14.50	0.429	0.429	0.448	-4.43
27	14.00	0.291	0.271	0.294	-1.03
28	13.50	0.191	0.189	0.183	4.19

29	13.00	0.119	0.119	0.106	10.92
30	12.50	0.068	0.068	0.058	14.71
31	12.00	0.035	0.035	0.032	8.57
32	11.50	0.017	0.017	0.018	-5.88

The stage capacity curves obtained from the IBS surveys in the years 2011, 2016 and 2021 are compared as shown in Figure.

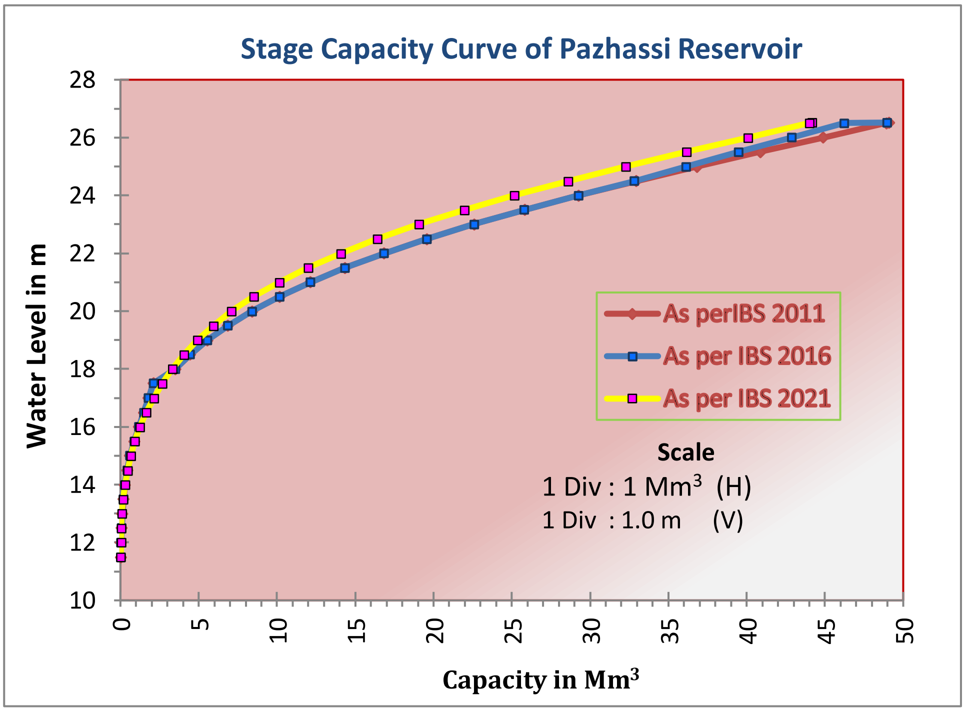


Fig 27 Stage - Capacity curve

WATER SPREAD AREA AT DIFFERENT WATER LEVELS

The present water spread area at different level is compared with the IBS result in 2009 and 2017 and is shown in Table 15. Fig 28 shows its graphical representation

Table 15 Water spread area at different water levels

Sl No	Water Level (m)	Water Spread Area(Sq Km)		
		IBS Survey 2011	IBS Survey 2016	IBS Survey 2021
1	26.52	6.49	6.10	6.00
2	26.50	---	6.00	5.98
3	26.00	6.09	5.95	5.94

4	25.50	6.06	5.80	5.90
5	25.00	6.03	5.74	5.79
6	24.50	5.91	5.56	5.50
7	24.00	5.56	5.19	5.23
8	23.50	5.20	4.90	4.89
9	23.00	4.90	4.74	4.49
10	22.50	4.63	4.65	4.05
11	22.00	4.25	4.22	3.64
12	21.50	3.84	3.74	3.30
13	21.00	3.45	3.42	2.98
14	20.50	3.13	3.13	2.67
15	20.00	2.82	2.82	2.32
16	19.50	2.45	2.45	2.01
17	19.00	2.14	2.14	1.75
18	18.50	1.83	1.83	1.51
19	18.00	1.28	1.28	1.31
20	17.50	1.04	1.04	1.13
21	17.00	----	0.98	0.98
22	16.50	----	0.85	0.84
23	16.00	0.68	0.68	0.69
24	15.50	0.54	0.54	0.57
25	15.00	0.41	0.41	0.45
26	14.50	0.31	0.31	0.34
27	14.00	0.22	0.22	0.24
28	13.50	0.15	0.15	0.17
29	13.00	0.11	0.11	0.11
30	12.50	0.07	0.07	0.06
31	12.00	0.04	0.03	0.03
32	11.50	0.02	0.02	0.02

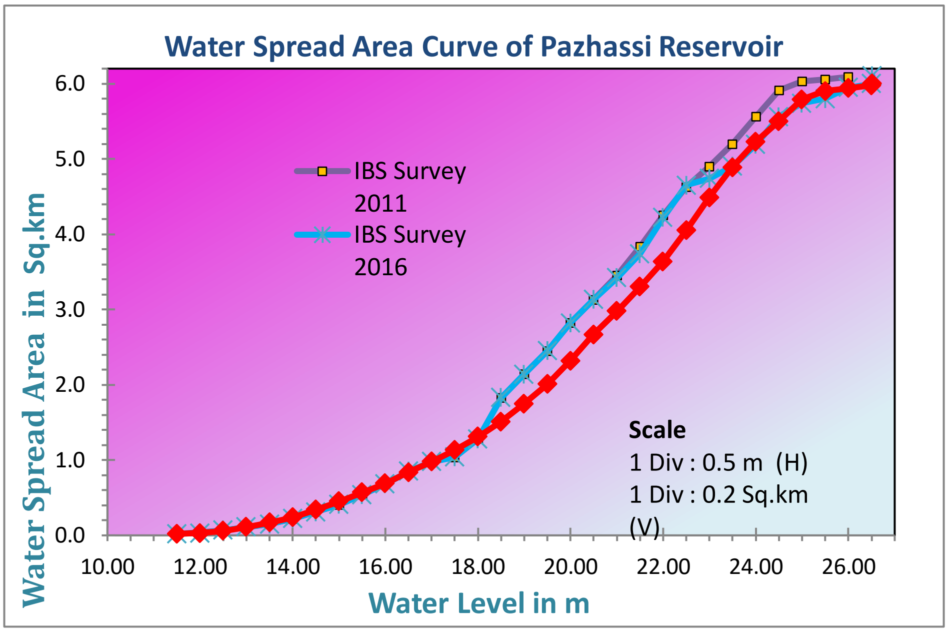


Fig 28Water level v/s water spread area curve

ANALYSIS OF SOIL SAMPLE

In the sedimentation studies conducted in 2011 and 2016, 12 no and 11 no of disturbed soil samples were collected and analyzed. In the present study 14 no of soil samples are analyzed. The samples for the three studies are collected from different locations. The result of the present soil sample analysis is shown in Table 16. By comparing the results, remarkable variations are observed in the average percentage of Silt and Sand. The details are shown in the bar chart given in Fig 30.

Table 16 Soil Sample Analysis Result

Sl No.	Sample Position	Depth of Sample taken in m	Nature of sample	Soil Texture	Colour	Specific gravity	% of Various size of Soil Particle			
							Clay	Silt	Sand	Gravel
1	N- 1324549 E- 566910	10.60	Disturbed	Sandy soil	Slate Gray	2.51	4	15	81	0
2	N-1324925 E- 567800	7.30	Disturbed	Silty soil	Golden Brown	2.36	11	34	47	8

3	N-1325533 E- 567924	16.10	Disturbed	Sandy soil	Ash Gray	2.59	1	2	97	0
4	N-1325444 E- 569509	11.50	Disturbed	Sandy Soil	Ash Gray	2.23	1	2	97	0
5	N-1324859 E- 570479	10.40	Disturbed	Sandy Soil	Ash Gray	2.65	1	4	92	3
6	N-1325184 E- 571381	8.70	Disturbed	Sandy Soil	Light Brown	2.47	4	20	75	1
7	N-1325784 E- 572790	7.00	Disturbed	Sandy Soil	French Grey	2.66	2	5	93	0
8	N-1324273 E- 574350	3.00	Disturbed	Silty Soil	Light Orange	2.32	14	53	33	0
9	N-1325233 E- 574141	6.50	Disturbed	Gravel + Sand	Light Brown	2.62	4	16	49	31
10	N-1325253 E- 574465	3.80	Disturbed	Sandy Soil	Ash Gray	2.64	2	9	89	0
11	N-1326024 E- 574551	11.80	Disturbed	Sandy Soil	Ash Gray	2.72	2	1	97	0
		4.30				2.43	3	18	79	0

12	N-1326441		Disturbed	Sandy Soil	Ash Gray					
	E- 575114									
13	N-1326558	4.60	Disturbed	Sandy Soil	Ash Gray	2.44	2	11	87	0
	E- 576144									
14	N-1327333	5.10	Disturbed	Sandy Soil	Ash Gray	2.51	1	2	97	0
	E- 576251									

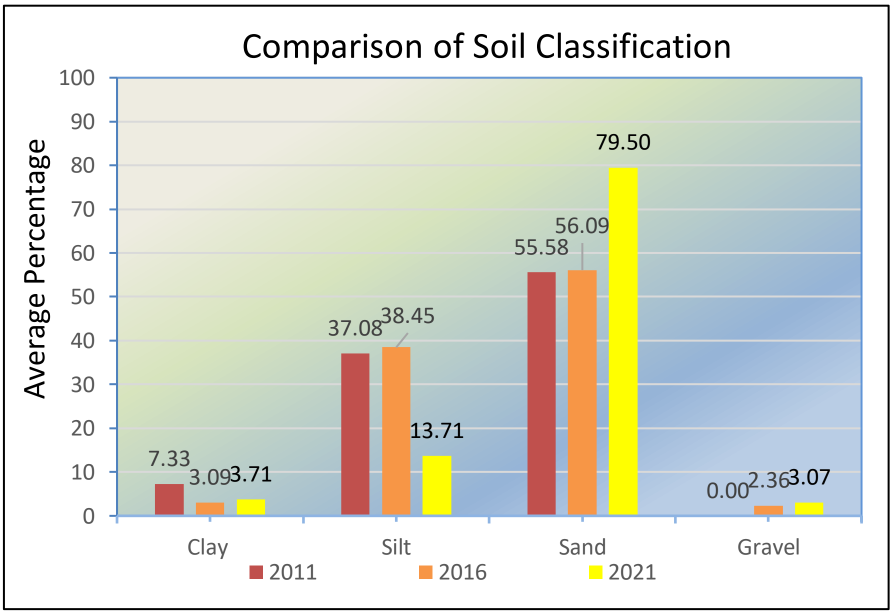


Fig 29Comparison of Soil particle distribution as per the consecutive sedimentation studies conducted in 2011, 2016 and 2021

The percentages of soil particles are only indicative and not accurate. For accurate assessment of contents in the soil, core sample analysis must be done.

RESULTS AND DISCUSSIONS

- The present bathymetric study of Pazhassi Reservoir has been conducted at a water level of 26.52m. The capacity obtained is 44.167 Mm^{3}. As theoriginal capacity curve of the reservoir is not available with the project authorities, the present capacity can be compared with the sedimentation study result in the year 2011. Then it is found that the capacity is reduced by 4.917 Mm^3 in the last 10 years. ie the reduction percentage is 10.02%.

- The previous IBS **Surveys in 2011 and 2016** were conducted at a water level 26.52 m and the reservoir capacity obtained was 49.084 Mm^3 and 48.973 Mm^3 respectively. From these consecutive studies, it has been observed that the capacity has been reduced only by a small quantity of 0.111 Mm^3 in 5 years ie percentage reduction is 0.23 %. The rate of sediment deposition was 0.02Mm^3 per year (0.05% per year). The rate of sedimentation was very low from 2011 to 2016.

- At the prevailing rate of 0.05% per year from 2011 to 2016, the reservoir capacity might be reduced to 48.873 Mm^3 in the year 2021. But from 2016 to 2021, the capacity has been reduced from 48.973 Mm3 to 44.167Mm^3. The reduction is 4.806 Mm^3 in 5 years. ie the reduction percentage is 9.81%. The rate of sediment deposition was 0.96 Mm^3 per year (1.96 % per year). The rate of sedimentation is extremely high from 2016 to 2021 and it is an alarming trend of sedimentation. This may be due to the effect of heavy floods and landslides in 2018 and 2019

- The water spread area of the reservoir as per the previous studies in 2011 and 2016 was 6.49 sq km and 6.1sq km respectively. The present water spread area corresponding to the water level 26.52m is 6.0 Sq km. There is only a slight reduction in water spread area compared to the result of 2016

- Sediment layer profile of the reservoir area at an interval of 100 m is obtained from the Sub Bottom profiler.

The storage capacity between two consecutive levels from the WL 26.52m to 11.5m were compared for the surveys in 2016 and 2021 and it is shown in Fig 30.

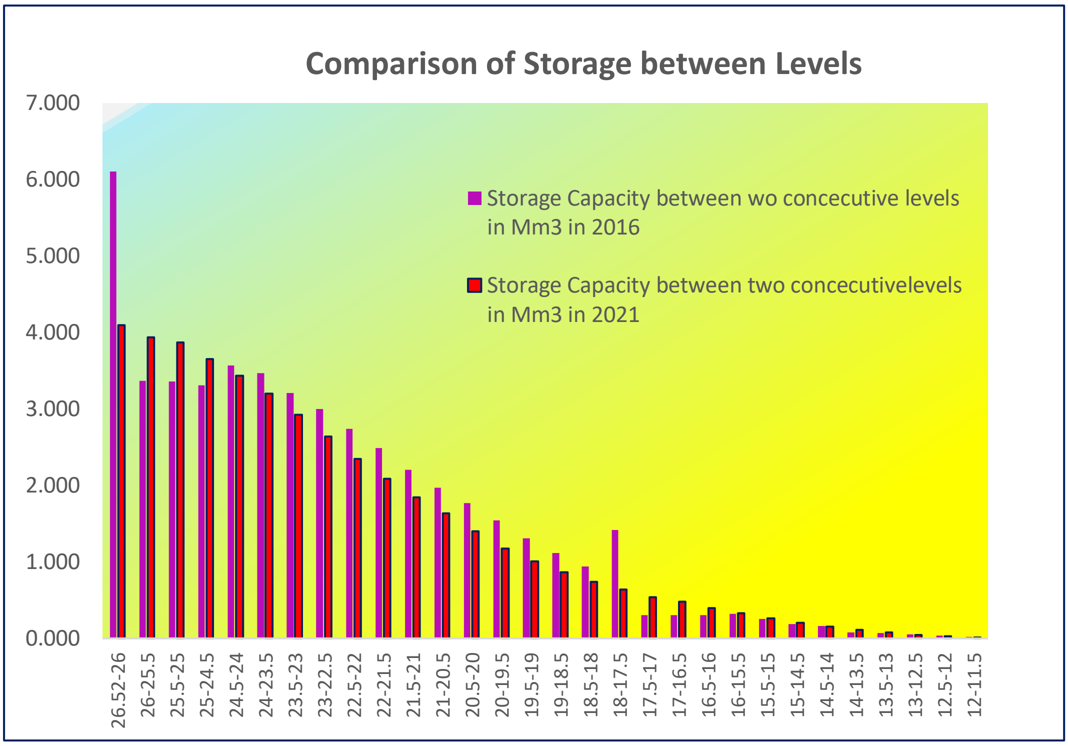


Fig 30 Comparison of storage between consecutive levels

From the above figure it is clear that the capacities between two consecutive levels from 26.0 m to 24.5m shows an increase in the present study by comparing with the same in the year 2016.Similarly the water spread area also shows an increase in the top levels with respect to the previous study which supports the increase in capacity between the above levels. ie increase in area at top levels may be due to erosion at top levels. From level 24.50 m to 17.5m show a decrease in capacity and water spread area. This is due to the sedimentation. In the bottom levels from 17.5 m to 14.0m the capacity shows an increase and correspondingly the water spread area. This needs an explanation. The sill level of shutter is at 13.72m and the top level of shutter is 18.90m. When the shutter had been opened during the heavy floods of 2018 and 2019, a large quantity of sediment might have been washed away and that may be the reason for the capacity increase in these levels. **The capacity reduction obtained from the IBS wrt to 2011 result is comparable with the loose sediment volume calculated from the Sub Bottom Profiler.**

4.4 SEDIMENTATION STUDY OF KARAPPUZHA RESERVOIR USING INTEGRATED BATHYMETRIC SYSTEM (IBS) & SUB BOTTOM PROFILER

Sedimentation study of Karapuzha reservoir was conducted in 2016 using IBS and Sub Bottom Profiler. As per direction of Chief Engineer, Projects-1, the study is again included in the action plan of the financial year 2020-21 in order to assess the effect of heavy floods of 2018 and 2019 in reservoir sedimentation.

CAPACITY ESTIMATION

The survey is carried out at the water level of 758.65 m. The original water holding capacity at this level is 44.306 Mm^3. As per the current IBS study the volume at the same level is estimated as 38.741Mm^3 and the corresponding water spread area is 4.395 Sq.km. Total capacity reduction of the reservoir at this level is 5.565 Mm^3 in 16 years, i.e the reduction in capacity at the specified level is 12.56%. In 2016 the survey has been conducted at 757.40m. Fig 31 shows its graphical representation of the original capacity and the capacities in 2016 and 2021 at a water level of 757.40 m. Table 17 shows the comparison of reservoir capacity at WL 758.65m. The capacity reduction is due to sediment deposit.

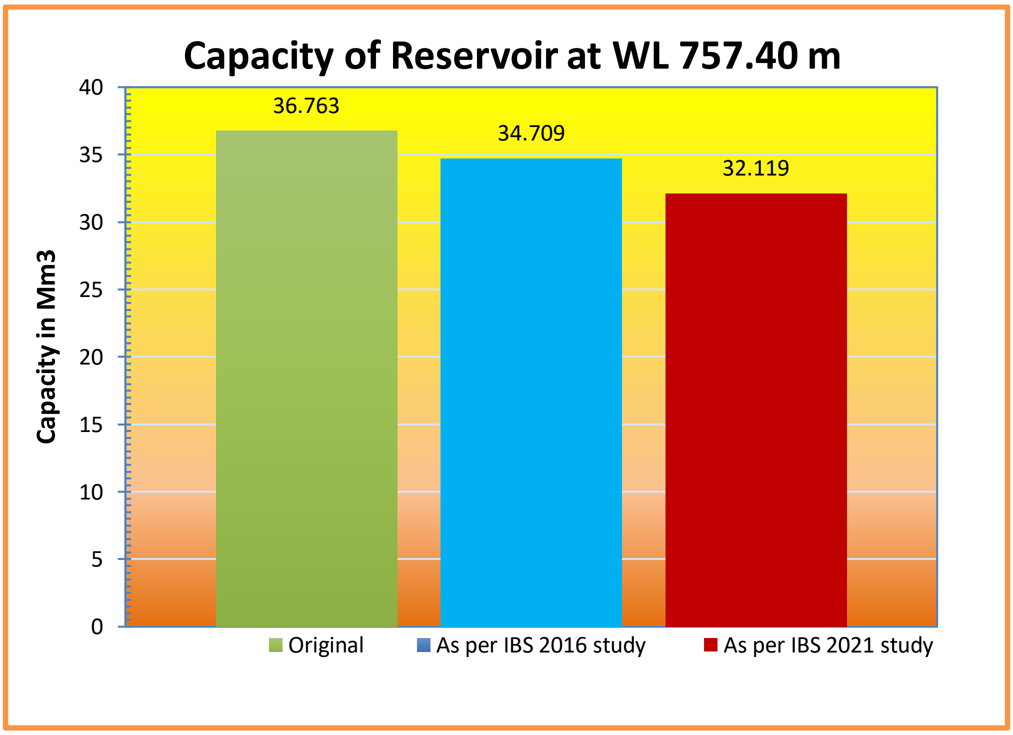


Fig 31 Decrease in Reservoir Capacity

Table 17 Capacity reduction of the reservoir at WL 758.65m

Year of Study	Water Level (m)	Capacity Mm^3	Reduction in Capacity w.r.t. Original Volume (44.306 Mm^3)	
			Mm^3	Percentage
2021	758.65	38.741	5.565	12.56

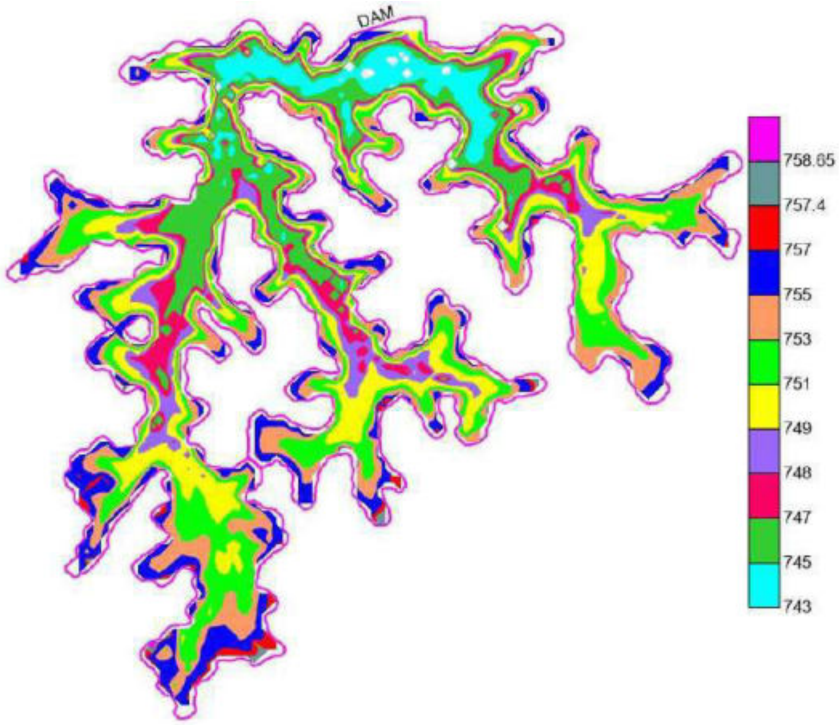


Fig 32 Contour Map based on IBS Survey

CAPACITY AT DIFFERENT WATER LEVEL

Reservoir volume at different water levels can be found out from the IBS data collected through QINSY software by using Surfer software. The present capacity at different level is compared with the original and IBS study results obtained in 2016 and is shown in Table 18.

Table 18 Reservoir capacity at different water levels

Sl. No.	Water Level	Water Holding Capacity			Percentage Reduction in Capacity (IBS 2021)
		Original	IBS Survey 2016	IBS Survey 2021	
	m	M. Cub. m	M. Cub. m	M. Cub m	%

1	758.65	44.306		38.741	12.56
2	757.40	36.763	34.709	32.119	12.63
3	757.00	34.297	32.848	30.029	12.44
4	755.00	24.099	23.552	20.460	15.10
5	753.00	15.895	14.645	13.010	18.15
6	751.00	9.659	8.329	7.640	20.90
7	749.00	5.146	4.355	3.940	23.44
8	*748.00	4.500	2.941	2.614	41.91
9	747.00	2.284	1.854	1.610	29.51
10	745.00	0.749	0.520	0.439	41.39
11	743.00	0.148	0.044	0.006	95.95

*Dead Storage Level

The original storage capacity curve is compared with the same obtained from the IBS surveys in 2016 and 2021 as shown in Fig 33.

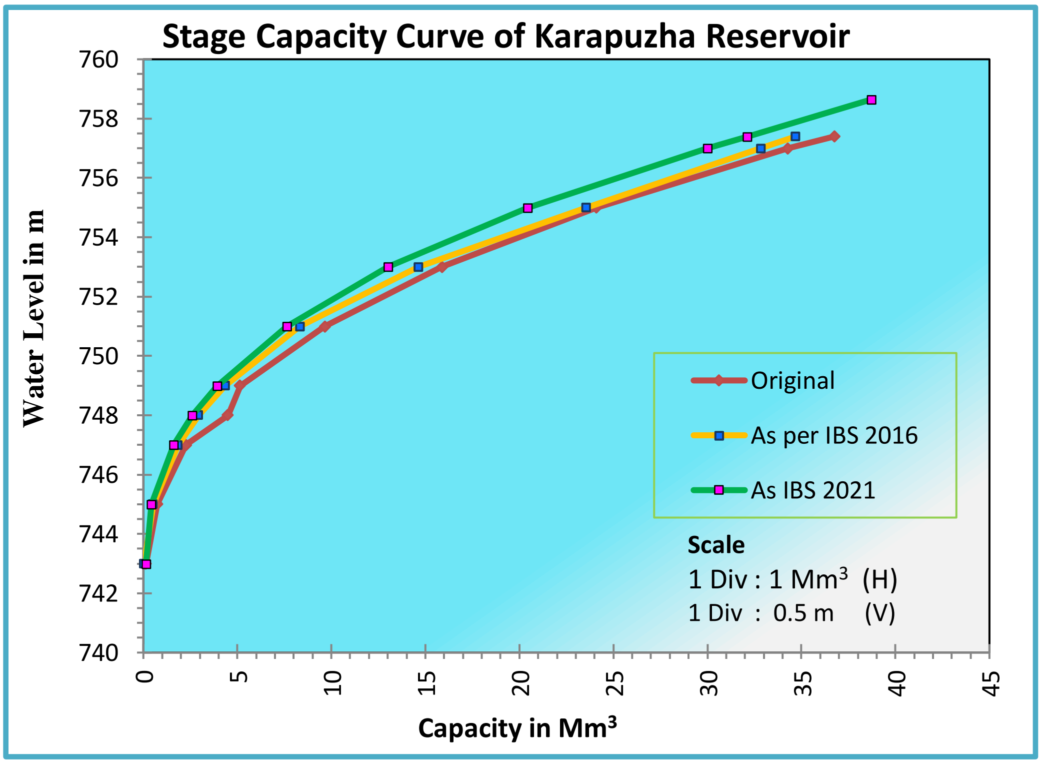


Fig 33 Stage - Capacity curve

WATER SPREAD AREA AT DIFFERENT WATER LEVEL

The present water spread area at different level is compared with the original area and the IBS result in 2016 and is shown in Table 19. Fig 34 shows its graphical representation.

Table 19 Water spread area at different water levels

Sl. No.	Water Level	Water Spread Area		
		Original	IBS Survey 2016	IBS Survey 2021
	m	Sq.km	Sq.km	Sq.km
1	758.65	6.386		4.395
2	757.40	5.770	4.890	4.389
3	757.00	5.570	4.400	4.35
4	755.00	4.625	3.870	3.902
5	753.00	3.578	3.290	3.083
6	751.00	2.657	2.310	2.218
7	749.00	1.857	1.520	1.492
8	748.00	1.541	1.200	1.162
9	747.00	1.004	0.900	0.855
10	745.00	0.531	0.480	0.324
11	743.00	0.069	0.035	0.017

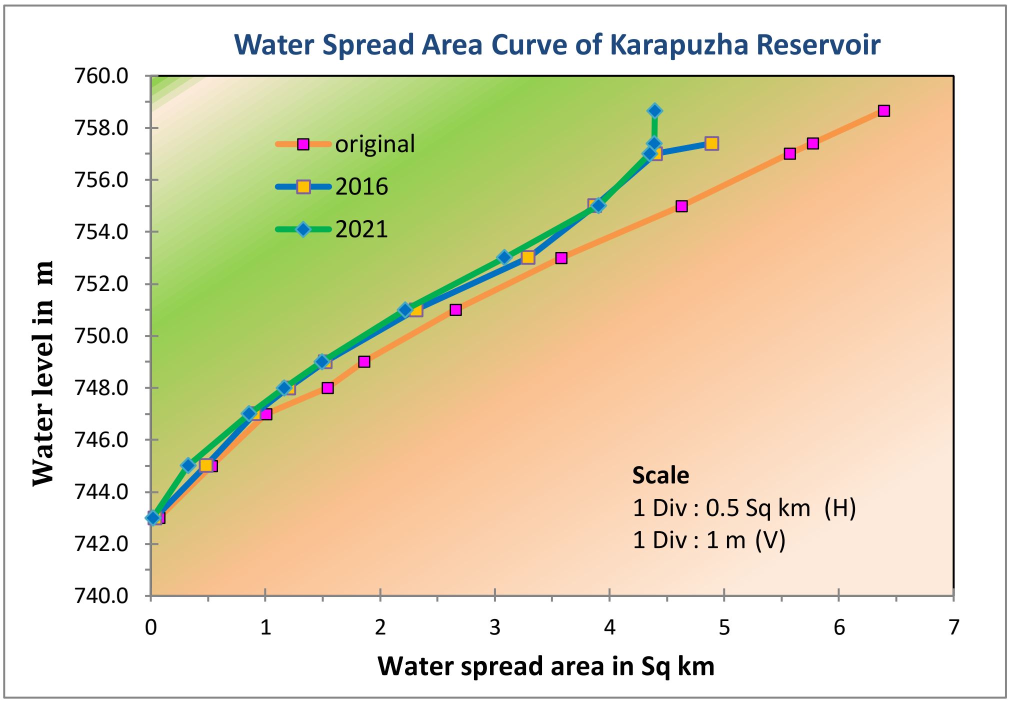


Fig 34 Water level v/s water spread area curve

ANALYSIS OF SOIL SAMPLES

In the sedimentation study conducted in 2016, 11 Nos of disturbed soil samples were analyzed respectively. In the present study 10 No of soil samples are analyzed. The samples for the two studies are collected from different locations. The result of the present soil sample analysis is shown in Table 20. By comparing the results, remarkable variations are observed in the average percentage of Clay and Sand. The details are shown in the bar chart given in Fig35.

Table 20 Soil Sample Analysis Result

Sl No.	Sample Position	Depth of Sample taken in m	Nature of sample	Soil Texture	Colour	Specific gravity	% of Various size of Soil Particle			
							Clay	Silt	Sand	Gravel
1	N-1283648 E- 628794	12.30	Disturbed	Silty soil	Lead Gray	2.71	32	41	27	0
2	N-1283448 E- 629354	8.40	Disturbed	Silty soil	Lead Gray	2.75	31	50	19	0
3	N-1282838 E- 629097	8.00	Disturbed	Silty sand	Lead Gray	2.41	18	30	50	2
4	N-1283390 E- 628566	11.60	Disturbed	Silty sand	Lead Gray	2.23	12	30	58	0
5	N-1283865 E- 626913	14.00	Disturbed	Silty clay	Lead Gray	2.33	37	50	13	0
6	N-283130	12.20	Disturbed	Silty soil	Lead Gray	2.32	26	43	31	0
	E- 627479									

7	N-282562 E- 627989	10.10	Disturbed	Silty clay	Lead Gray	2.49	36	48	16	0
8	N-283408 E- 626774	13.00	Disturbed	Silty clay	Lead Gray	2.39	35	44	21	0
9	N-282399 E- 626609	10.70	Disturbed	Silty clay	Lead Gray	2.42	42	45	13	0
10	N-281659 E- 626795	6.30	Disturbed	Silty sand	Lead Gray	2.36	13	31	55	1

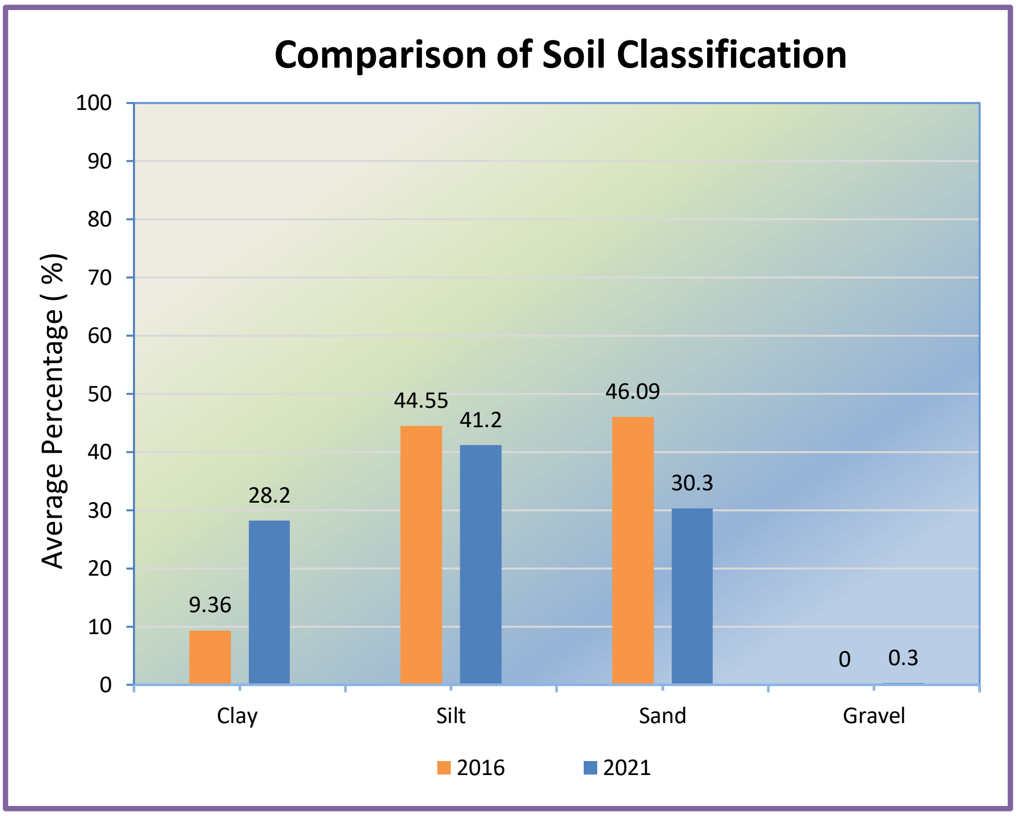


Fig 35 Comparison of Soil particle distribution as per the consecutive sedimentation studies conducted in 2016 and 2021

The percentages of soil particles are only indicative and not accurate. For accurate assessment of contents in the soil, core sample analysis must be done.

RESULT AND DISCUSSION

The original Capacity of Karapuzha Reservoir at 758.65 m level is 44.306 $Mm^{3.}$ The present capacity is 38.741 Mm^3. The capacity reduction of the reservoir is 5.565 Mm^3in 16 years at the same level. The reduction percentage is 12.56 %.

- The previous IBS **Survey in2016**was conducted at water level 757.40 m,the reservoir capacity obtained was 34.709 Mm^3 against the original capacity of 36.763 Mm^3. Thecapacity was reduced by 2.054 Mm^3 in 11years and the reduction percentage was5.59% against the study in 2016.
- The present capacity corresponding to water level 757.40 m is 32.119 Mm^3 i.e. within the last 5 years the capacity reduced by 2.590 $Mm^3$and within the 16 years total reduction in capacity is 4.644 $Mm^{3.}$and the percentage reduction is 12.63%.
- The original capacity at dead storage level (748.00 m) was 4.50 Mm^3. Thedead storage capacity reduced to 2.941 Mm^3 in 11 yearsbased on the study conducted in 2016. Reduction percentage is34.64%. Within the last 5 years from 2016 to 2021 the capacity reduced to 2.614Mm^3 and reduction at dead storage level compared to the original capacity at that level is 41.91%.

- The original water spread area at the WL of 758.65m was 6.386 sq km. The present water spread area at the same level is 4.395 sq km. The original water spread area at 757.40m was 5.77 sq. km. Area reduced to 4.89 sq.km (as per 2016 study) and 4.389 sq. km (as per 2021 study).
- Sediment layer profile of the reservoir area at an interval of 75m is obtained from the Sub Bottom profiler.

The study results have been compared at a water level of 757.40 m. During the first 11 years of the dam life the capacity reduction rate was 0.51 % per year (0.187 Mm^3/year). At this prevailing rate we are expecting a volume reduction of 0.935 Mm^3 in the next five years. But as per the present survey, the capacity has been reduced by 2.59 Mm^3 from 2016 to 2021.The reduction rate is 1.49% per year (0.518 Mm^3/year). This much huge capacity reduction may be due to the effect of the heavy flood occurred in 2018 and 2019. The dead storage capacity of the reservoir has been filled up by 41.91% in a short period of 16 years. Hence this is an alarming trend of reservoir sedimentation which has to be taken in to account seriously. Particularly the sedimentation rate of Karapuzha reservoir is much higher than the average value of sedimentation rate of 0.20% per year in USA.

The capacity reduction obtained from the IBS is comparable with the sediment volume calculated from the Sub Bottom Profiler. The graphical representation of reduction rate is shown in Fig 36.

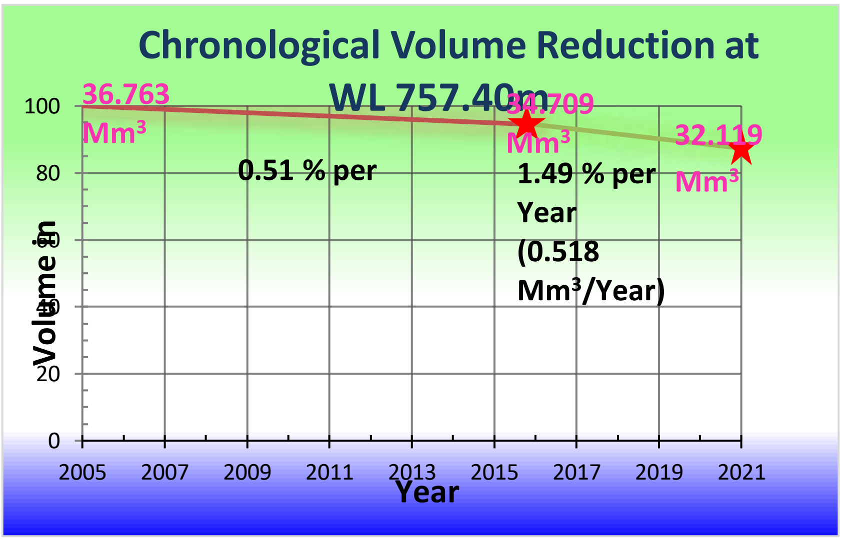


Fig 36 Chronological Volume Reduction

5.0 DETAILS OF THE BATHYMETRIC SURVEYS CONDUCTED DURING THE YEAR 2021-22

The objectives of the studies were:

- ***To quantify or determine the present capacity of the reservoir using IBS***
- ***Prepare the present Elevation – Storage curve of the reservoir to regulate the outflow of the reservoir***
- ***Prepare the present Elevation – Area curve of the reservoir***
- ***To find the quantity of sediment and its Distribution in the reservoir using Sub Bottom Profiler***
- ***To observe the influence of the heavy flood in 2018 and 2019 in the reservoir sedimentation***
- ***Study the soil particle distribution of sediment deposit in the reservoir area***

5.1 SEDIMENTATION STUDY OF KALLADA RESERVOIR USING INTEGRATED BATHYMETRIC SYSTEM&SUB BOTTOM PROFILER

The survey of Kallada reservoir has been done in the year 2018. The survey has been again conducted during this year mainly to assess the storage capacity changes after the floods in 2018 and 2019. Survey has been done with IBS and Sub Bottom Profiler and the data has been collected along different profiles 100m apart. 23nos of soil samples have been collected and analysed. Data collection has been completed and data validation is ongoing. Report is under preparation.

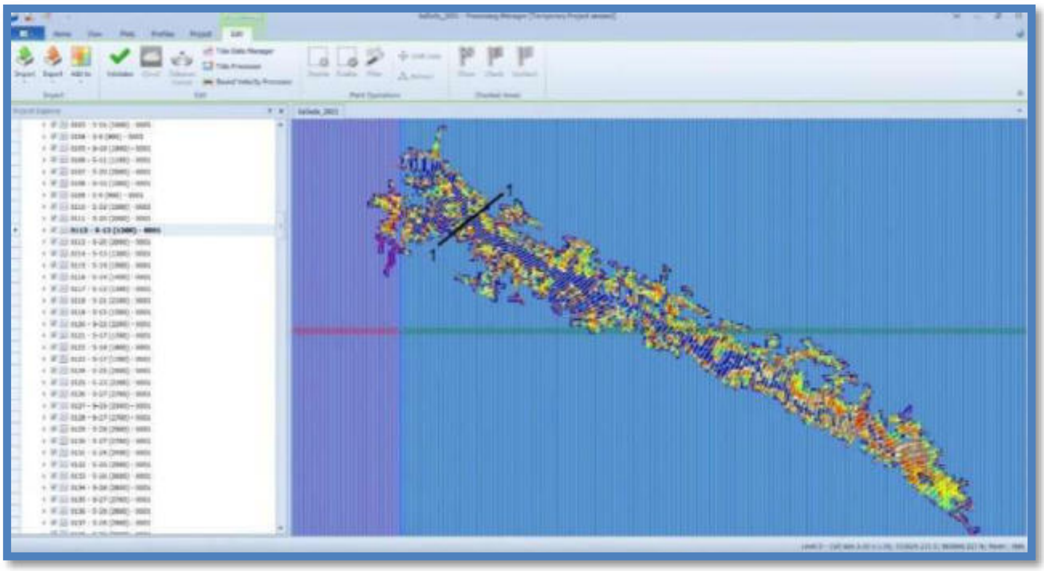


Fig 37 Plan of Kallada reservoir showing the sections surveyed

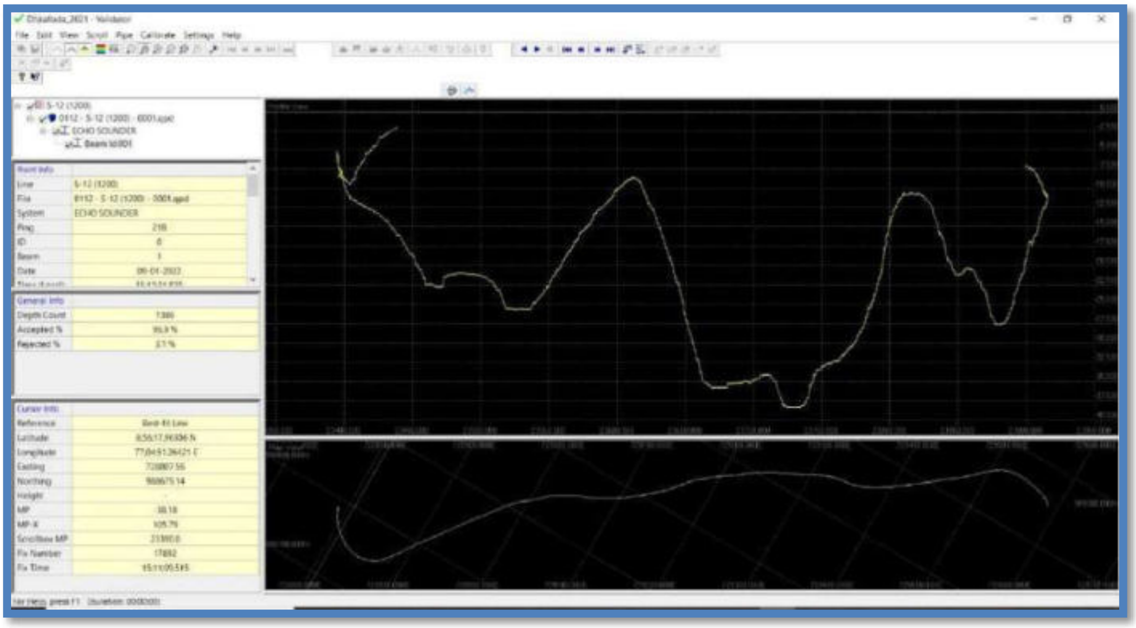


Fig 38Kallada_Profile 1-1 in IBS{(E 728779.55, N988798.22) (E729582.92, N989244.77)}

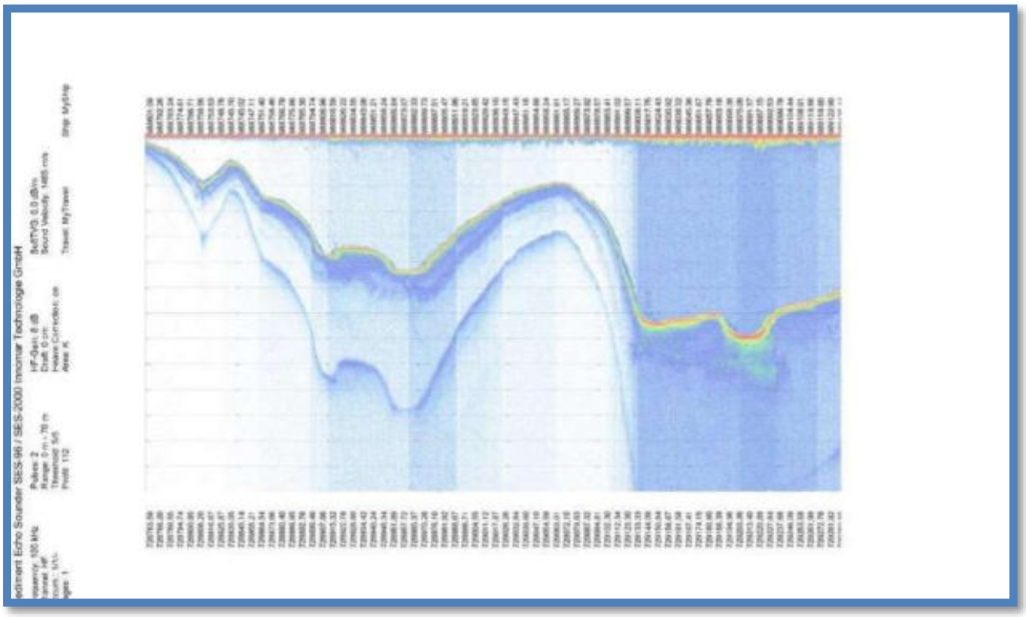


Fig 39Kallada_Profile 1-1 in SBP{(E 728779.55, N988798.22) (E729582.92, N989244.77)}

5.2SEDIMENTATION STUDY OF MANIYAR RESERVOIR USING INTEGRATED BATHYMETRIC SYSTEM & SUB BOTTOM PROFILER

The survey of Maniyar reservoir has not been conductedyet. The survey has been conducted during this year mainly to assess the present storage capacity. Survey has been done with IBS and Sub Bottom Profiler and the data has been collected along different profiles 30m apart.5nos of soil samples have been collected and analysed. Data collection and data validation has been completed. The present storage capacity, water spread area and the stage capacity curve has been found out. Report is under preparation.

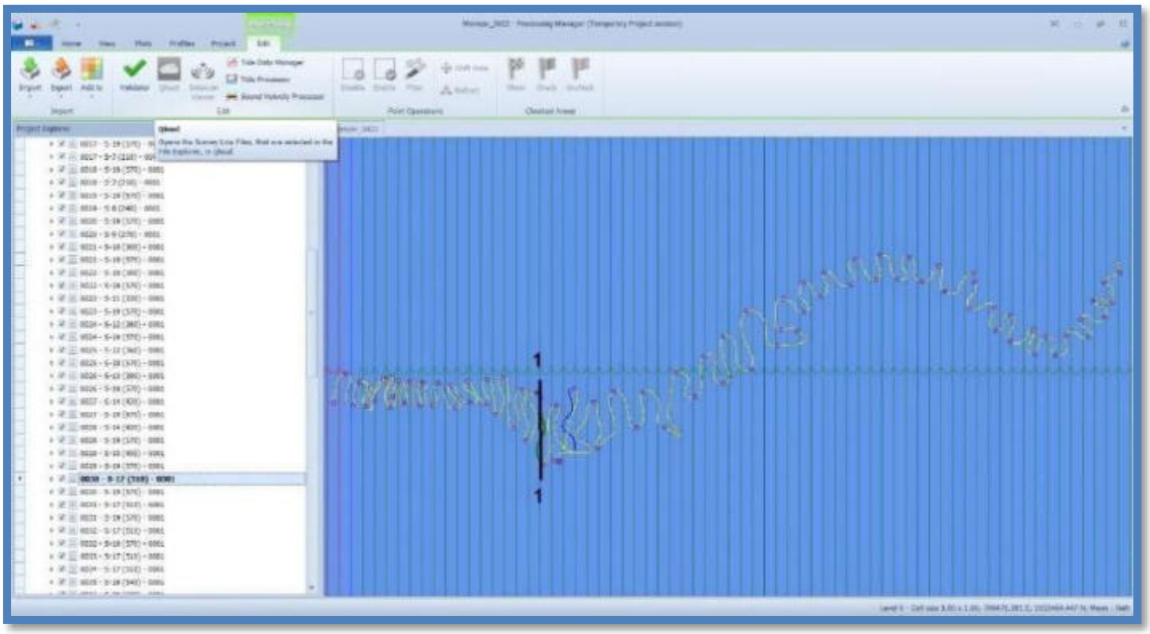


Fig 40 Plan of Maniyar reservoir showing the sections surveyed

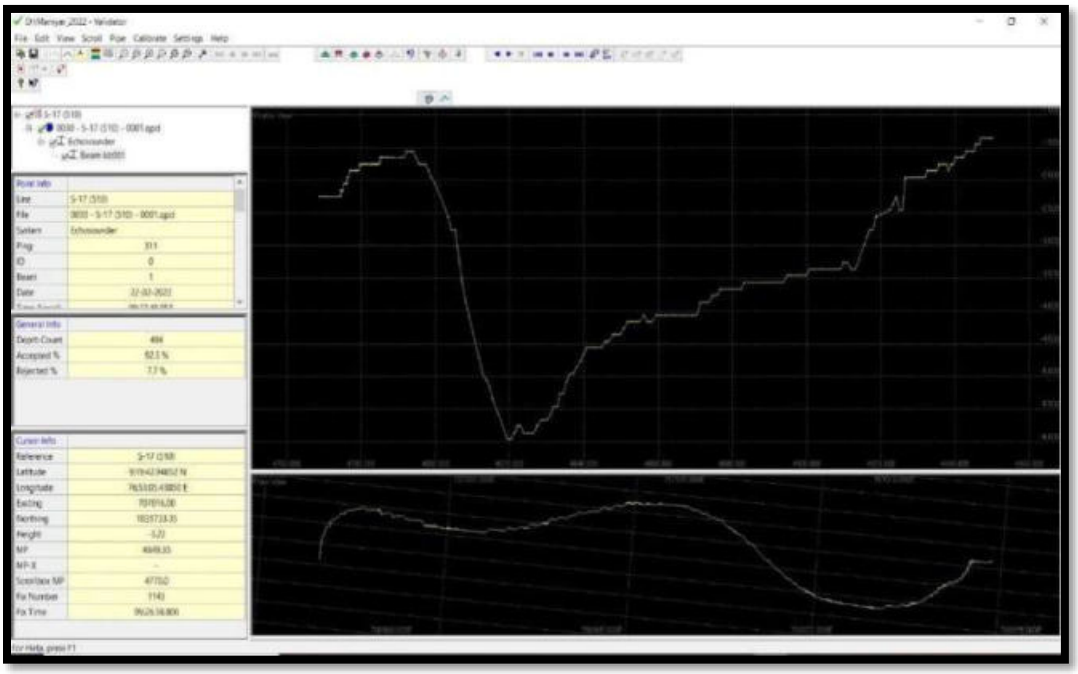


Fig 41Maniyar_Profile 1-1 in IBS{(E706973.99, N1031832.31) (E706992.44, N1031650.81)}

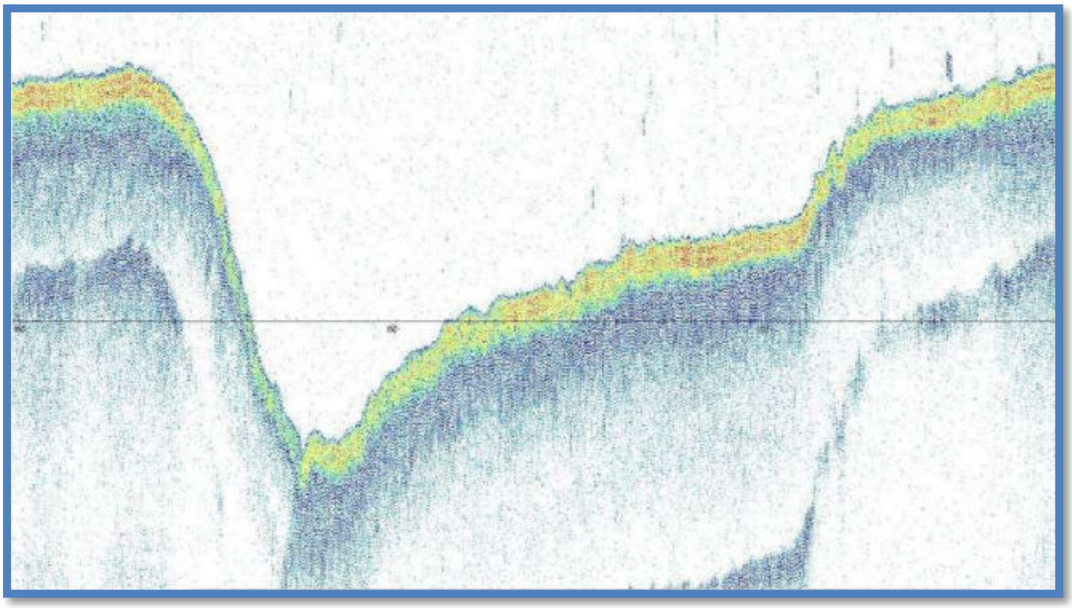


Fig 42Maniyar_Profile 1-1 in SBP{(E706973.99, N1031832.31) (E706992.44, N1031650.81)}

D CONSTRUCTION MATERIALS DIVISION

D. CONSTRUCTION MATERIALS DIVISION

TECHNICAL PERSONNEL

Deputy Director

3) Er. Ajith Kumar T.V. (01-04-2021 to 31-01-2022)
4) Er. Sufeera O.B. (01-02-2022 to 31-03-2022)

Assistant Director I

Er. Siji T.V. (From 01.04.2021 to 31.03.2022)

Assistant Director II

Er. Rappai V.V. (From 01.04.2021 to 31.03.2022)

1. INTRODUCTION

Construction Material Division is one of the sub units of Kerala Engineering Research Institute (KERI) basically engaged in material testing. Testing of construction materials is an essential part for ensuring quality in construction. In addition to the testing of Irrigation dept works, other Government Departments, Central Government Departments, Public Undertakings and various Private agencies are utilizing the facilities of lab for ensuring quality construction. The CM Lab continued to contribute healthy revenue every year to the Government through various tests conducted for clients. The Lab is also functioning as a training centre of the Irrigation Department and providing training programmes and refresher courses for the benefit of department engineers. The training facility extends to other department engineers also. Now the CM Lab is on the process of getting assessment and accreditation of Testing and Calibration Laboratories by the National Accreditation Board Testing and Calibration Laboratories (NABL) in accordance with the international standards. The accreditation from NABL will boost up the status of the Lab and likely to increase the revenue to Govt.

2. REPORT OF TESTS CONDUCTED IN CM LAB

Construction materials division of KERI deals with testing of construction materials such as cement, aggregates, steel, tiles, bricks, rock, concrete etc and design of concrete mixes. The essentials tests for getting the physical properties of above materials are carrying out at this lab. During the year 2021-22, tests were conducted for 516 samples of concrete cubes, 249 samples of steel rods, 18 samples of coarse aggregates, 11 samples of fine aggregates, 152 core samples, 26 samples of solid blocks, 47 samples of paver blocks, 24 samples of cement, 3 samples of laterite blocks, 3 samples of Geo-bags, 1 sample of granite, 14 samples of clay tiles, 18 samples of structural steel sections, 23 nos HT stay wires, 8 samples of sheet piles, 1 sample of WMM & GSB and 15 samples of wood-cement composite cylinders in this lab. 7 no's Mix designs were carried out for various agencies.

The lab is equipped with NDT instrument for Pile Integrity Test and has done tests on 142 Piles. Nondestructive tests like core compressive strength are being conducted to check the strength of concrete of the existing structures.

Two Hundred and Fifty Four test reports were generated from this division during the Financial year 2021-2022 earning a revenue of **Rs.9,47,434**/- (Rupees Nine lakh forty seven thousand four hundred and thirty four).

3. OTHER ACTIVITIES

3.1 Non Destructive Tests

Pile Integrity testing is a nondestructive testing conducted on piles as per IS 14893:2001. This is a method usually employed for the evaluation of the physical dimensions such as cross sectional variations, length, discontinuity etc. Impulses or vibrations are applied to the pile and converted using transducers and wave arrival times are used for computing the length and the wave shape gives an indication of the shape of the shaft. The equipment being used by KERI is PET (USB version).

The lab is equipped with NDT instrument for Pile Integrity Test and has done following Pile Integrity Tests.

TESTS CONDUCTED 2021-22

a. The Superintending Engineer, Thiruvananthapuram Corporation has requested to conduct Pile Echo Test (PET) on the pile group pertaining to the work ***Residential Training Centre at Attukal, Thiruvananthapuram Corporation.*** There are 124nos piles were trimmed cleaned and the site was equipped for testing. Accordingly, the test was performed on 17.12.2021 and 18.12.2021. 124 no. of piles as per drawing given by the Superintending Engineer, Thiruvananthapuram Corporation vide Lt. E13/UPA/214/03 dated 07.10.2021 were tested.

These identification numbers are as per the above drawing available at site. The grade of concrete was reported as 1:2:4 as per Lt. E13/UPA/214/03 dated 11.03.2019. The casting of piles was carried out during the period 28.04.2007 to 12.01.2008. A velocity of 3300 m/s was chosen from the software.

b. The Executive Engineer, Karappuzha Project Division, Kalppetta, Wayanad vide letter no D1-1874/18 dated 27.03.2021 has requested to conduct Pile Echo Test (PET) on the pile group pertaining to the work ***KRP Flood Damage 2018 – Urgent Rectification works of breach at LBMC near Ch:4800m.*** Nine no. of piles namely P2-1, P3-1, P3-4, P4-1, P4-3, P5-1, P5-2, P5-5, P6-1, P7-1, P8-1.These identification numbers are as per drawings available at site. Since the grade of concrete was M30, a velocity of 4000 m/s was chosen from the software

c. The Assistant Engineer, Minor Irrigation Section, Tirurangadi vide letter no AE/TGD1/2019/174/IA dated 22.03.2021 has requested to conduct Pile Echo Test (PET) on the pile group pertaining to the work LAC-ADS-Construction of a SWE/VCB cum Tractor path across Poorapuzha at Parayil in Parappanangadi Municipality in Malappuram District. Nine no. of piles namely A1-3, P1-2, P2-2, P3-3, P4-4, P5-4, P6-1, P7-2, A2-2. These identification numbers are as per drawings available at site. Since the grade of concrete was M30, a velocity of 3750 m/s was chosen from the software.

3.2 <u>Concrete and Rock Core Testing</u>

Testing of existing concrete at the site Regulator cum Bridge at Attappilly, Thrissur

Core samples are taken from the RCB components like left abutment, weir and apron and tested its compressive strength. The concrete core samples collected from weir having extensive voids and honeycombing. But the tested core samples have compressive strength in the range of 21N/mm2 to 33N/mm2. Core samples from left abutment have compressive strength in the range 23N/mm2 to 27N/mm2. The compressive strength of rock samples from BH1, BH2, BH3, BH4 having the range 29 to 219 N/mm2.

As part of soil investigations, rock core samples were collected from the subsurface by Instrumentation Division and tested at Construction Materials Testing Lab for compressive strength. Concrete core specimens were also drilled out during the exploration in the apron portion. The concrete core samples collected from BH7 (upstream apron) have compressive strength ranging from 14N/mm2 to 20N/mm2 whereas the samples from BH5B ranges from 26N/mm2 to 34N/mm2. The compressive strength of rock samples from BH5B, BH6, BH7 having the range 46 to 115 N/mm2.

Concrete core samples collected from Attappilly RCB and preparing for testing

3.3 Study of Suitability Of Fine Aggregates Collected From Eri, Palakkad For Concreting Purposes

Eri'the word derived from Tamil, which means large pond having a greater area. There are three Eris associated with the Chitturpuzha project viz. Kambalathara, Venkalakkayam and Kunnampidari. Palakkad District is one of the major districts in Kerala facing severe water crisis in the summer season every year. Most of the years, the district faces drinking water scarcity andagricultural loss due to non-availability of water and experiences drought-like situation. The Eris plays a significant role in the entire water distribution system of Chitturpuzha Irrigation project. The impounded water stored in these Eris reduces severity of drought and scarcity of drinking water. By enhancing the storage capacity of the above Eri's through desilting, the capacity will be raised for stabilizing the discharge of water to left bank canal for irrigation and drinking purpose without any major environmental problems. The individual components extracted from sediments such as sand, gravel and clay residue can be sold to generate revenue to Government.

Two samples of sand soil collected from Palakkad Eri's were brought to the Construction Materials Laboratory by the Deputy Director, Instrumentation Division, KERI, Peechi to conduct necessary tests of fine aggregates and to assess the suitability of these samples for using concrete mixes.

a. Grading of fine aggregates

Grading is the particle-size distribution of an aggregate as determined by sieve analysis. If all the particles of an aggregate are of uniform size, the compacted mass will contain more voids whereas aggregate comprising particles of various sizes will give a mass with lesser voids.

The particle size distribution of a mass of aggregate should be such that the smaller particles fill the voids between the larger particles. The whole procedure of sieve analysis is to determine the particle size distribution of the fine aggregates and determine whether it is suitable to use in concrete mixing.

As per IS 383:2016, fine Aggregates used for Concrete can be categorized into following types based on sizes as below: Grading zone - Zone I / Zone II/ Zone III/ Zone IV. Fine aggregates grading becomes progressively finer from zone I to zone IV. It is recommended that fine aggregate conforming to Grading Zone IV should not be used in reinforced concrete unless tests have been made to ascertain the suitability of proposed mix proportions.
The tests for gradation have been conducted as per IS 383-2016 and IS 2386-1963 (Part I&III).

b. Specific gravity of fine aggregates

The specific gravity of an aggregate is considered as the measure of strength or quality of the material. Specific gravity is defined as the ratio of weight of a given volume of aggregate to the weight of equal volume of water. Aggregates having low specific gravity are generally weaker than those with aggregates having high specific gravity. This property helps in a general identification of aggregates. The specific gravity of aggregates normally used in construction ranges from about 2.5 to 3.0 with an average value of about 2.68. The tests for specific gravity have been conducted as per IS 2386-1963 (Part III).

c. Compressive Strength of Concrete cubes

The suitability of the fine aggregates collected from Eri's were tested by preparing design mixes and the 28th day compressive strength was checked. The design mixes are prepared based on IS 10262 -2019

The results of various tests conducted on the two samples shows that the samples brought to the lab after washing and cleaning indicate the properties of fine aggregates and can be used for concreting. The compressive strength of concrete cubes prepared by using the above sand samples as fine aggregates indicates strength more than the required target strength.

3.4 Engineering Investigations for the Rectification of Existing Regulator cum Bridge at Idiyanchira

This division was entrusted to carry out investigation works of Regulator cum Bridge located at Idiyanchira to upgrade the structure in terms of structural and hydraulic aspects so as to meet the current requirements. The various investigations including underwater inspection by surface supplied air diving method were carried out to confirm as-built conditions of the components and submitted the report.

Upstream and downstream view of Structure

Preparation for underwater inspection at Upstream side

4. PROCESS OF NABL ACCREDIATION

Training in Laboratory Quality Management System and Internal Audit as per IS/ISO/IEC 17025:2017

This Division has already applied for NABL accreditation and the assessment process is going on. Acquiring trained personalities are essentially required in NABL accredited labs. Selected a NABL facilitator and continuous trainings were arranged to all the technical staffs in the Lab to get familiarize with procedures of accreditation.

5. TRAININGS

This Division has been actively participated in designing course syllabus and schedule of various trainings and refresher courses for engineers and overseers of the department.

Induction Training Programme to Newly Recruited Assistant Engineers of Irrigation Department in the Year 2021:

In the year 2021, a new batch of 75 Assistant Engineers was inducted into the Irrigation Department. Kerala Engineering Research Institute planned and conceived induction training for new Engineers in accordance with the directions of Hon'ble Additional Chief Secretary, and the order no.PL6 (B) 17308/2021 dated 16/08/2021 of Chief Engineer, Irrigation & Administration, Thiruvananthapuram. The induction training was held on August 17th, 2021 to September 14th 2021, with a total of 42 sessions using the Zoom platform in order to provide newly recruited assistant engineers in the irrigation department with an opportunity to learn about their new role in the department.

Induction training programme for new Assistant Engineers on online Platform

This division is actively participated in every stages of training for making the training a successful event.

Training Programme on Significance of Quality Control and Quality monitoring of Irrigation works:

Kerala Engineering Research Institute organized state wide trainings for Quality monitoring and Quality control of irrigation works and related IS codes for all technical field staffs (Overseers to Assistant Executive Engineers) under the department. KERI has identified 2 internal resource persons for conducting these trainings. The identified resource persons are Er.Babu M.S, AEE, Quality Control Sub Division Thrissur and Er. Merin Thomas, AEE, Quality Control Sub Division, Kottayam were given an orientation training arranged by KERI. Total 13 training programs were conducted within a span of 4 months. Each training was of one day duration and on completion 1988nos participants were trained.

This division is actively participated in every stages of training for making the training a successful event.

6. Forensic Engineering Investigations And Proposals For Rectification of Attappillikkadavu Regulator Cum Bridge

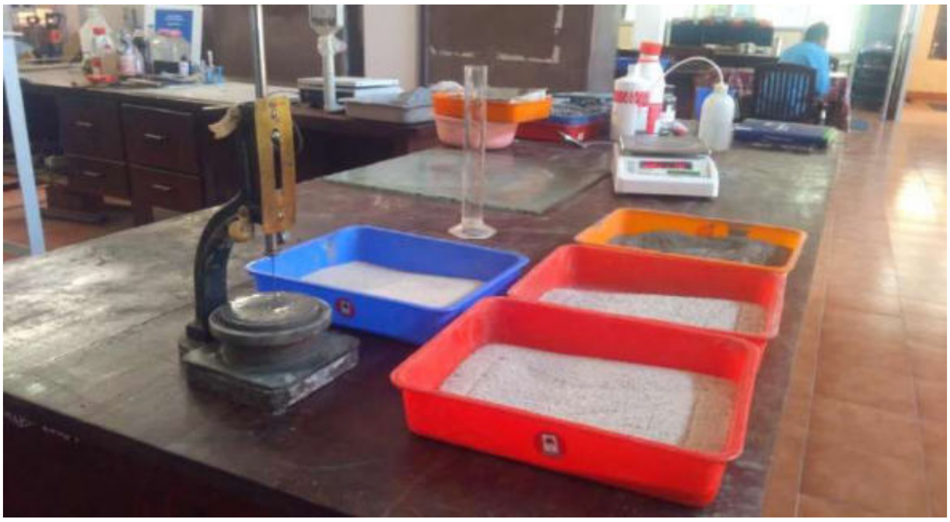
Considering the concerns at Attappilly RCB site which aroused due to the formation of sinkholes at the approach road and thereby stoppage of traffic through bridge, a meeting was held at Government level on 16.08.2021, the Additional Chief Secretary, Water Resources Department, Govt. of Kerala has directed Kerala Engineering Research Institute (KERI), Peechi to conduct load test of Attappilly Bridge to ensure the serviceability of existing bridge portion of RCB. KERI was also entrusted to conduct necessary investigations for making the RCB functional. Accordingly various forensic engineering investigation studies were conducted by different divisions of KERI. The underwater investigations and core compressive strength tests were carried out under this lab.

This division is actively participated in every stage of investigations especially analyzing, interpreting results and preparation of rectification proposal.

7. SNAPS OF ROUTINE LAB ACTIVITIES

Inside CM Lab

Mix Design



Testing of Cement

E. SOIL MECHANICS AND FOUNDATIONS DIVISION

E .SOIL MECHANICS AND FOUNDATIONS DIVISION

.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. The soil mechanics laboratory undertakes work from Government agency and private agencies.

During investigation, the soil samples are collected and tested in the laboratory, for finding out index properties and engineering properties like Maximum Dry Density, Optimum MoistureContent, Permeability, Shear strength 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. .

Soil samples received from various projects of Irrigation Department,PWD Roads and Buildings, Panchayati Raj institutions, CPWD, Power Grid, Kerala State Electricity Board, Housing Board and Non-Government bodies are being tested as per the codes of Bureau of Indian Standards.

The Lab contributes healthy revenue every year to the Government through various tests conducted for clients. The Lab is also functioning as a training centre of the Irrigation Department and providing training programmes and refresher courses for the benefit of department engineers. Now the Lab is on the process of getting assessment and accreditation of Testing and Calibration Laboratories by the National Accreditation Board Testing and Calibration Laboratories (NABL) in accordance with the international standards.Also research activities are being conducted at this division.

Tests conducted in the Lab

Soil samples were tested from various projects of Irrigation department, other departments and private agencies.During the year 2021-22, more than 1000 samples were tested in 30 different works for revenue ofRs.1889325 /- (Rupees Eighteen Lakh Eighty Nine Thousand Three Hundred and Twenty Five Only) and the details of works are appended.

Fig - Snaps of soil testing

Fig - Snaps of soil testing

.2 INFRASTRUCTURE

The important equipment's available in the laboratory are:

i) Hydrometer test with accessories

ii) Atterberg's limit devices

iii) Direct Shear apparatus

iv) Automatic Compactor

v) Light and Heavy compaction testing apparatus

vi) Laboratory CBR test apparatus

vii) Digital soil cone penetrometer

viii) Constant head permeability test apparatus

ix) Variable head permeability test apparatus

x) Static Tri-axial Testing Apparatus

xi) Unconfined Compression Test Apparatus

xii) Consolidation Apparatus

xiii) Sample extruder

xiv) Standard set of sieves

Modernizing the lab will come true with the addition of modern Instruments. This lab is equipped with Engineering Seismograph and is used for subsurface characterization by seismic refraction method.Seismograph is also used for Seismic Tomography Survey to determine compactness in dams.

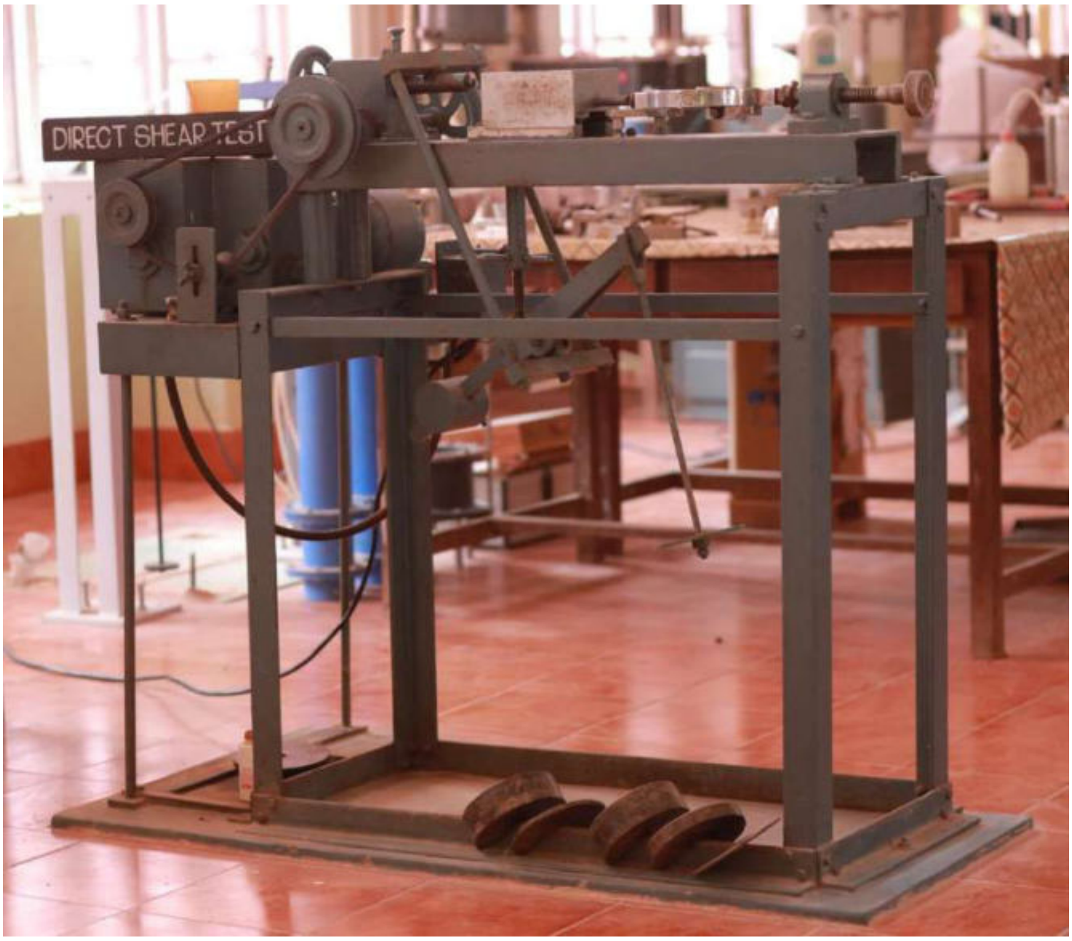


Fig 5. Direct Shear Apparatus

Fig. StaticTriaxial Testing Apparatus

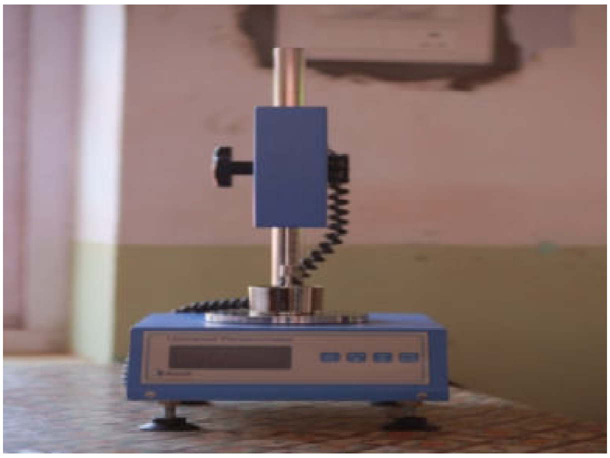


Fig 5. Digital Soil Cone Penetrometer

Fig4. Consolidation Test Apparatus

Fig 1. Unconfined Compression Test Apparatus

Fig. Compaction Test Apparatus

3 CONDUCTING SEISMIC REFRACTION SURVEY USING ENGINEERING SEISMOGRAPH

Seismic refraction survey isa reconnaissance survey used to determine wave propagation velocities through various soil layers in the field and to obtain the thickness of each layer. This method is based on the fact that seismic waves have different velocities in different types of soils (or rock). In this method, seismic waves are produced by mechanical blow with a sledge hammer at ground surface. These waves travel deep into the ground and get refracted at the interface of two different materials and to the ground surface. The time of arrival of these waves at different locations on the ground surface are recorded by geophones, which pick up the refracted waves. The geophones convert the ground vibrations into electrical impulses and transmit them to a recording apparatus (seismograph). Finally seismic refraction data were analysed using PS Lab software. It is a widely used method for the determination of bedrock depth.

Equipments Used For Seismic Refraction Survey

1. X610S 24 bit Seismograph
2. Vertical geophones – 12 nos
3. Sledge Hammer
4. Battery
5. Plate for seismic energization
6. Cable/array
7. Starter geophone
8. Starter extension cable 220m

Fig 8. Apparatus used for Seismic Refraction Survey

Seismic refraction survey was conducted on a study basis using Engineering Seismograph at following places during 2020-21.

1. Thathanampully
2. Moolathara
3. Attapilly
4. Kanjirapuzha earthen dam

.

Fig 6. Engineering seismograph

Fig.Seismic refraction survey at Attapilly

Fig.Seismic refraction survey at Thathanampully

4 CONDUCTING SEISMIC TOMOGRAPHY SURVEY AT CHIMONI DAM

The ageing and degradation of dam structures is an inevitable problem and its consequences on the safety of the structure are important.Seismic Tomography technique is generally used for detecting the deteriorated zones inside the dam (masonry and concrete) body. Seismic tomography surveys are generally conducted across vertical upstream-downstream cross sections. Seismic signals are generated with a sledge hammer, by hitting directly on the dam body. Hydrophones and geophones are arrayed in vertical on upstream side of the Dam and shot position fixed on downstream face of the Dam. Typically, tomography images are analysed to look at the velocity changes within the masonry or concrete. Areas with lower velocity correspond to weaker, less dense concrete, while those with higher velocities are considered to be sound concrete. The results also can show areas with cracking damage or other discontinuities.

Seismic tomography survey was conducted at Chimoni Dam on a study basis during March 2022.

Fig 19. Sesismic Tomography study at Chimoni Dam

5 OTHER ACTIVITIES

5.1 Field work conducted

1. SiteVisit was carried out along with other officials of KERI for the investigation work to determine obstructions to flow of Periyar River at Vaduthala, Eranakulam

5.2 Completed Courses

1. Er. TV Rameshkumar, Deputy Director & Er Jomy Joseph, Assistant Director have completed the online course in “Laboratory Quality Management System and Internal Audit” organised by Bureau of Indian Standards(BIS), held during 7th December 2021 to 10th December 2021.

5.3Internship programmes

Internship trainings were given to B.Tech students from College of Engineering, ThiruvananthapuramandM.Tech students from IES Collegeof Engineering, Chittilapilly, Thrissur as part of their curriculum.

Fig 22. Internship training to students of College of Engineering, Thiruvananthapuram

Fig 22. Internship training to students of IES Collegeof Engineering, Chittilapilly

5.4Infrastructure work

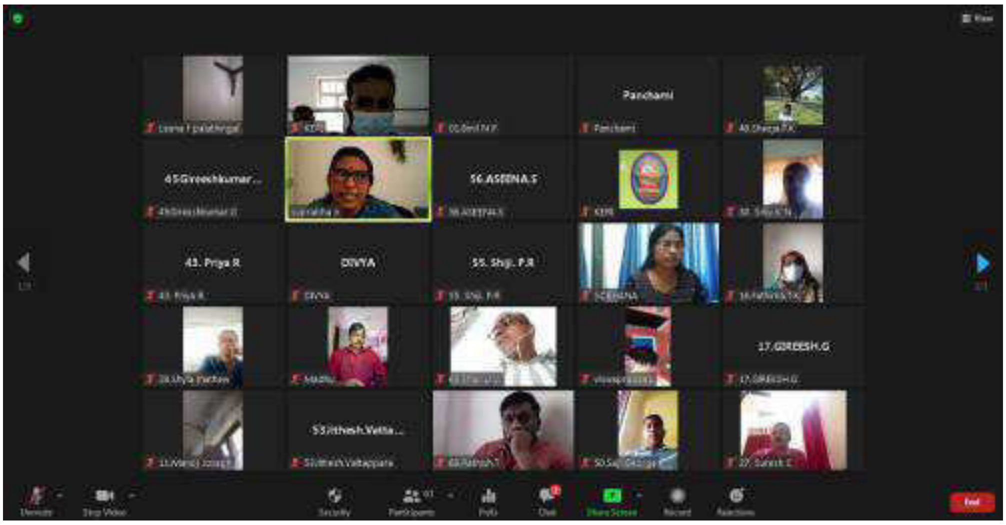
1. An amount of Rs.1.5 lakhs was sanctioned in the year 2021-22 for the painting of the laboratory and was completed on time.

5.5Trainings

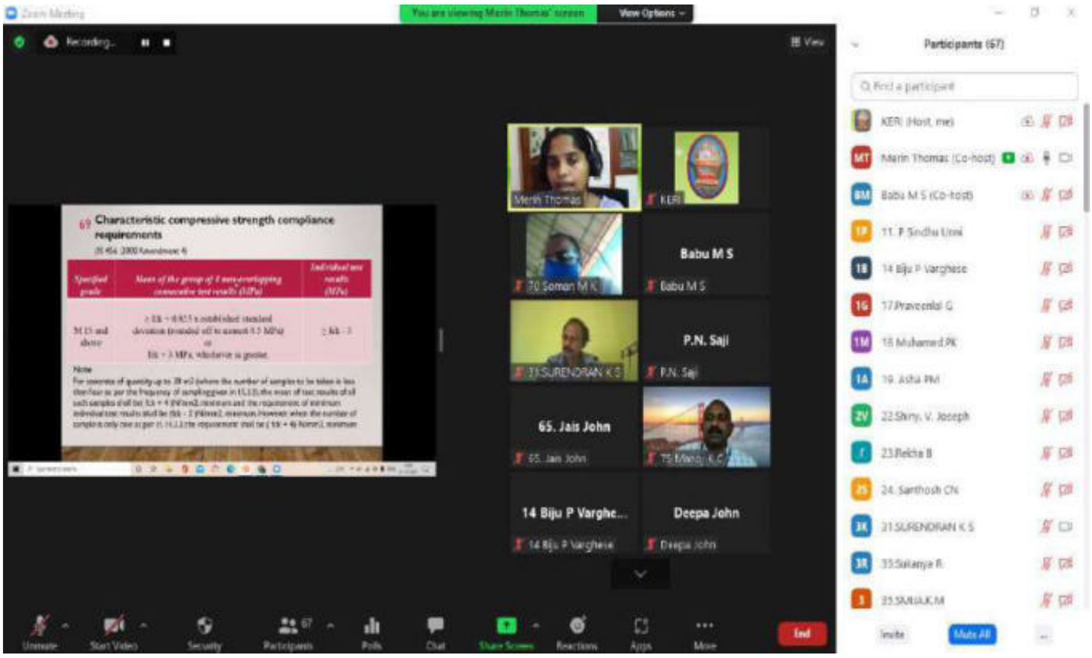
This division has actively participated in various stages of training programmes*(Design of Syllabus, Preparation of Schedule, Conducting Training in Zoom Platform, Issue of Certificates etc.)* given below.

a. Induction training programme to newly Recruited assistant engineers in the year 2021 of Irrigation department.

b. Training for promoted assistant engineers of irrigation department (2021).



c. Training programme on Significance of Quality Control andQuality monitoring of Irrigation works


Characteristic compressive strength compliance requirements
Participants (67)
Babu M S
P.N. Saji
65. Jais John
14 Biju P Varghe...
Deepa John

E.INSTRUMENTATION DIVISION

E.INSTRUMENTATION DIVISION

INTRODUCTION

Instrumentation Division acts as a mobile unit to conducts various soil investigation works under the Construction Materials and Foundation Engineering (CM&FE) Division, KERI Peechi. The most important part of any building or hydraulic structure is foundation which is the lowest part of a structure. It transmits the load to the soil below. So the quality of the soil on which the foundation is resting need to be determined precisely. To understand the soil, soil exploration is need. 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.

Bore hole drilling – Making Bore holes is commonly used method for field investigations and they are executed by various devices ranging from simple hand operated augers to drilling machines. Instrumentation division is in possession of two rotary type, clayx type drilling machines. These machines are used for drilling in soil, soft rock and hard rocks for a depth of 50 m to 60 m. The samples collected are transferred to SM & F Division for carrying out various tests in soil for finding the engineering properties.

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

1. Standard Penetration Test.
2. Collection of disturbed and undisturbed soil samples by hand auger and machine boring.
3. In situ Vane Shear test

The important equipments available in the Division are

- Equipments for hand augering.
- In situ Vane shear test apparatus
- Rotary type Diesel boring plant - 2 Nos.

Fig 1. Boring Using Rotary Calyx Drilling Machine

Fig 2 - Insitu Vane shear Apparatus

SOIL INVESTIGATION WORKS EXECUTED DURING THE YEAR 2021-2022

1. Investigation Works At Thottapally Pozhi Mouth

The Director, KERI was instructed by the Additional Chief Secretary , to conduct analysis for the mineral sand in the samples received from the Thottapally Pozhi . Sand bar formed at the mouth of Pozhi Samples were collected from the different locations, from pozhi such that representative samples of the area was collected and transferred to IREL Labs for testing to find the mineral content and percentage composition of the following minerals Ilemenite, Rutile, Zircon, Silimanite.

2. Soil Investigation Works of Obstructions to flow of Periyar River at Railway Bridge to Vallarpadam container terminal near Vaduthala Ernakulam.

To determine the quality of the sediments obstructing the flow of river on either side of Railway bridge to Vallarpadam container terminal near Don Bosco boat jetty at Vaduthala. The samples were collected from an area of 1 Km upstream and 2.20 Km downstream of the Railway bridge. The undisturbed soil samples were collected in sampler tube of 5m length with end attachments. Out of 30 bores holes, 13 nos. of boreholes were explored in the upstream side and other 17 nos. of bore holes in the downstream side of the river with reference to the railway bridge. One Bore hole using Rotary Calyx drilling machine was carried at the prescribed bund position, which was laid for the construction of railway bridge. The boring was extended up to a depth of 17m. Soil samples were transferred to SM Lab for testing. Work was undertaken using amount in the Action Plan , which was reserved for the soil Investigation of various works for Irrigation department – Rs.1,85,058/-

3. Soil Investigation for Reconstruction of Sunken Portion of Left Bank Retaining Wall of Chamravattam RCB.

As per the request of the Executive Engineer, Project division, Eswaramangalam dtd. 30/10/2021, Soil investigation work was carried out at the left side downstream of the Chamravattam RCB to investigate the causes of tilt and sink to the existing retaining wall. The retaining wall failure was seen in the left bank (downstream) to an extent of 89.30m from the regulator. Three boreholes at a 30m interval (Approximately) are suggested to be excavated near the sunken retaining wall.Works was taken in action plan of KERI – Soil Investigation of various works of Irrigation department – Rs.1,35,560/- .

4. Soil Investigation for Attappilly RCB

Attappilly Kadavu regulator cum bridge across Kurumali river connects Mattathur and Varandarappilly Grama Panchayaths of Thrissur district. Road near the left bank approach road of subject work has subsided on 04.06.2021 and subsequently, the bridge was closed for traffic. As per the instructions of the Director, KERI vide email dated 3/11/2021, Soil Investigation works were entrusted to this division. 8 bore holes were located along the various areas along the regulator to investigate the nature of the soil profile. Work was undertaken in Action plan of KERI. Soil Investigation works of irrigation department – Rs.1,78,668/-.

5. Soil Investigation for aqueduct of Thathanampully LIS in Kulukkallur GP ,Palakad District .

As per the request of The Executive Engineer, MI Division, Palakkad vide Lr. No.D3-General/2019-20, the estimate is prepared for the soil investigation for the aqueduct of Chundampetta branch canal of the scheme.In the site there are existing 23 pillars of spacing 4.10 m each. New set of pillars are to be constructed for the new aqueduct proposed between the two canals .19 no of Bore Holes were drilled and soil samples were transferred to SM &FE Division for testing .Work was carried in the head Investigation of major Irrigation Schemes – 4700-80-005-99-02-00-V and total amount expended as Rs.6,31,258/-

6. Desiltation of Muvattupuzha River.

Muvattupuzha River is one of the important rivers in Ernakulam District of Kerala. This river is the union of three rivers - Thodupuzha, Kaliyar and Kothamangalam at Thrivenisangamam at Muvattupuzha. Sediment deposits were found in the Kaliyar river in the following locations, Purapuzha location of Kodikulam Panchayath, Thennathoor Chelakkadavu Bridge of Kodikulam Panchayath. Muvattupuzha town was flooded during the last to floods of 2018 and 2019. Crossection survey of the rivers was carried from Thriveni sangamam to Kayanad check dam. Upstream portion from Thrivenisangamam towards Kaliyar river and Thodupuzha river Total length of the stretch under study is 8.704 km. Area was surveyed and representative samples were collected and tested for analysis.

7. Investigation works to the reconstruction of Chakkamkandam salt water exclusion sluice in Chavakkad Muncipality under supervision of KERI

Supervision works were carried by KERI, for the reconstruction of Chakkamkandam salt water exclusion sluice. The old sluice has to be demolished and the 4 bore holes were drilled near the existing sluice to get the soil profile of the area. Soil samples were transfeered to SM &FE Division for further testing and analysis.

8. POSSIBILITY OF USING BOTTOM SEDIMENTS FROM PERIYAR RIVER AT VADUTHALA FOR AGRICULTURAL APPLICATIONS

The purpose of this study is to assess the viability of using bottom sediment collected from the Vaduthala river for agricultural purposes. Laboratory tests such as pH, electrical conductivity and heavy metal (Cd, Cr, Pb, and Ni) analysis were performed to investigate the agricultural feasibility of the aforementioned soil at Radiotracer Laboratory, College of Agriculture, Kerala Agriculture university, Thrissur. The present study aimed to conduct the feasibility study of collected samples for the use of agricultural purposes as it is a relatively simple approach to deposit sediments on land. The presence of heavy metal could be a deterrent to its use in agriculture. Metals commonly utilised in industry, such as zinc, copper, chromium, cadmium, lead, and nickel, are the most prevalent metals detected in sediment. The parameter like pH Electrical conductivity and the heavy metal were tested. Mainly Inductively Coupled Plasma (ICP) Emission Spectrophotometer were used to detect the parameters.

9. ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE DESILTATION OF KAMBALATHARA, VENGALAKKAYAM & KUNNAMPIDARI ERI

This division is also associated in the preparation of environmental management plan (EMP) of the three eris namely of Kambalathara, Vengalakkayam & Kunnampidari eri for the desiltation.

F.PUBLICATION WING

The Kerala Engineering Research Institute's information bureau is sited in a technical library operated by the publication wing. The library which houses roughly 10,000 (ten thousand) books and a handful of latest periodicals, this wing delivers essential technical knowledge to all staffs of this Institute. This department organizes lectures and training programmes for the benefit of staff of the Institute. The wing also organizes training and refresher courses for the Irrigation Department's employees as well.

The technical library is kept up to date by adding new publications on topics of interest to researchers, students, and employees, among others. 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. Books are issued to officers attached to KERI using Library software.The card system is also being maintained.Facilities are also extended to Engineers working in various Departments and Institutions for referring the books. Aparts from theses, Many Indian periodical such as Indian Geotechnical Journal, Concrete Journal, Electronics for You, Indian Journal of Power & River Valley Development, Civil Engineering and Construction Review, Down to earth

Fig. View of Library

Various trainings have been conducted in the financial year 2021-2022 under the purview of technical library to improve the skills and technical knowledge of engineers and other technical staff . The List of various trainings conducted is listed as below.

Sl. No.	Date of training	Topic	Presenter	Target audience	No of partci-pants
1	24-02-2021	Coastal Structure Design & Contruction.	Chief Engineering Manager & Head, Engineering Design & Research Centre - Ports and Harbours , L&T ,Construction , Chennai	Engineers of Major Irrigation Division's and (Coastal Engineering & Field Studies (CEFS),	90
2	14-05-2021	Subsoil investigation for irrigation structures	Sri. Saju Varghese. DD, Instrumentation division, KERI, Peechi. Sri. Sreedev. M. S AD, Instrumentation division, KERI, Peechi.	IWR Engineers/ Overseers /KERI Engineers	76
3	03-06-2021	Basics on Coastal Engineering	Mrs Paravathi MM , Assistant Director , IDRB , Tvm	online training for the departmental Engineers of Coastal Engineering & Field Studies (CEFS)	37
4	07-06-2021	Oceanographic Field Instruments	Neeraj Prakash Project Scientist ,NIOT ,Chennai	CEFS,KERI	30
5	09-06-2021	Introduction to Ocean Engineering	Prof. Balaji Ramakrishnan, Department of Civil Engineering, IIT Bombay	CEFS. KERI , MAJOR IRRIGATION DIVISIONS	75
6	11-06-2021	Discussion on Coastal Protection using Tetrapots	Discussion with KFRI	KERI, CEFS	60
7	25-06-2021	Coastal Erosion and the Impact of Anthropegenic Activities	Dr L Sheela Nair, Head Marine Geoscience group, NCESS	KERI, CEFS	64
8	30-06-2021	Introduction to PWD Quality Control Maual and related IS Codes	Baiju P B, AEE Bridges Sub Div, Kozhikhode	Quality control, KERI Engineers	60
9	17-08-2021	Inaugural Session	Shri. Roshy Augustine, Hon. Minister for Water Resources	Newly appointed AE's	84
10	17-08-2021	Special Session	Dr.V.P.Joy (IAS), Chief Secretary, Government of Kerala	Newly appointed AE's	84
11	17-08-2021	Special Session - Qualities of a Professional Engineer	Dr. E. Sreedharan, The Metro Man	Newly appointed AE's	84
12	17-08-2021	State of the art in Project Management - Sharing strategies and techniques of successful practices in Project Management	Shri.Jose P Philip, National Vice President, Indian Institute of Welding, Kolkata	Newly appointed AE's	84

13	18-08-2021	Overview of Kerala Irrigation Department	Er. Alex Varghese, Chief Engineer (Irrigation & Administration)	Newly appointed AE's	84
14	24-08-2021	Planning & Execution of Major Irrigation structures	Er.Binu Baby, Executive Engineer, Irrigation Division, Alappuzha	Newly appointed AE's	84
15	24-08-2021	Planning & Execution of Minor Irrigation structures	Er.Susheela R, Executive Engineer, MI Division, Kottayam	Newly appointed AE's	84
16	25-08-2021	Planning of Sustainable Coastal protection strategies	Dr.Joseph Mathew, ADB Consultant	Newly appointed AE's	84
17	25-08-2021	Overview of Project Wings (Project I & II)	Er.Sandheep V, Executive Engineer Karapuzha Irrigation Project Division, Kalpetta, Wayanad & Er.Balasankar K, Superintending Engineer, Project Circle, Piravom	Newly appointed AE's	84
18	26-08-2021	Overview of Irrigation Design and Research Board (IDRB)	Er.Biju D, Chief Engineer, IDRB	Newly appointed AE's	84
19	27-08-2021	Applications of Hydrology in Irrigation	Er.Sandhya S G, Joint Director, Hydrology & Investigation, IDRB	Newly appointed AE's	84
20	27-08-2021	Applications of Hydrology in Irrigation	Er.Shibu George, Assistant Executive Engineer, Hydrology Division, Thrissur	Newly appointed AE's	84
21	28-08-2021	Engineering Investigations and Design of Hydraulic Structures	Er.Shamsudheen K H, Chief Engineer (Retd), Irrigation Department	Newly appointed AE's	84
22	28-08-2021	Guidelines on Finanacial Aspects in Irrigation Works	Shri.Salil T B, Divisional Accountant, Harbour Engg, Kozhikkode	Newly appointed AE's	84
23	28-08-2021	Art of Professionalism in Engineering	Er.Jose Andrews, Assistant Engineer(Retd), Irrigation Department	Newly appointed AE's	84
24	30-08-2021	An outline to Kuttanad Package	Er.Syam Gopal, Chief Engineer, Kuttanad Package & Inland Navigation	Newly appointed AE's	84
25	30-08-2021	Perspectives of Inland navigation waterways in Kerala	Er. Arun K Jacob, Director, Inland Navigation Directorate, Kollam	Newly appointed AE's	84
26	30-08-2021	An awareness on the activities of Harbour Engineering Department	Er.Kunhimammu P, Superintending Engineer, Harbour Engg. North Circle, Puthiappa, Kozhikkode	Newly appointed AE's	84
27	30-08-2021	Ventures of Kerala Public Works Department	Er. Baiju P.B, Assistant Executive Engineer, PWD Bridges Sub Division, Kozhikode	Newly appointed AE's	84

28	31-08-2021	Introduction to KSR	Shri.K.Sundaran, Administrative Assistant (Retd), Agriculture Department	Newly appointed AE's	84
29	31-08-2021	Significance of quality control in Irrigation works	Er.Babu M S, Assistant Executive Engineer, Quality Control Subdivision, Thrissur	Newly appointed AE's	84
30	01-09-2021	Overview on PWD Manual	Shri.K B Manoharan,Senior Finance Officer(Retd), Finance (Estt. B) Irrigation Department	Newly appointed AE's	84
31	01-09-2021	Law aspects related to Irrigation Department	Shri.Mohanachandran M S, Deputy Secretary to Govt, Law Department	Newly appointed AE's	84
32	02-09-2021	Concepts of Micro Irrigation	Dr.Sushanth, Scientist (Retd),CWRDM	Newly appointed AE's	84
33	02-09-2021	Office Administration Procedures	Sri. B. Madhusoodanan Pillai, Senior Superintendant (Retd.), Irrigation Department	Newly appointed AE's	84
34	03-09-2021	Introduction to QGIS and Mapping	Er.Chanchal Mary Peter, Assistant Engineer, Irrigation Section, Tirur	Newly appointed AE's	84
35	04-09-2021	Departmental Procedures for Execution of works	Er. N. Pradeep Kumar, Assistant Engineer (Retd) LSGD (Pradeepan Thoolika) & Er. Shamsad U C, Assistant Executive Engineer, Minor Irrigation Circle, Kozhikkode	Newly appointed AE's	84
36	04-09-2021	Conflicts Management of Works	Shri. Harilal M, Divisional Accountant, Kerala State Transport Project, Kottarakkara	Newly appointed AE's	84
37	06-09-2021	Soft Solutions in Coastal Protection	Dr. T V Sajeev, Scientist E-1, Kerala Forest Research Institute, Peechi	Newly appointed AE's	84
38	07-09-2021	Implementation of River Basin Management plans	Dr. E J James Pro Vice Chancellor, Karunya Institute of Technology and Sciences(Deemed university), Coimbatore	Newly appointed AE's	84
39	07-09-2021	Disaster Management- Case Studies	Er. Sunil Raj D, Superintending Engineer, Irrigation South Circle, Thiruvananthapuram	Newly appointed AE's	84
40	08-09-2021	Harithakeralam Mission	Shri.Renukumar, Programme Coordinator, KILA, Thrissur	Newly appointed AE's	84
41	09-09-2021	Basic awareness of Mechanical components in Irrigation schemes	Er. Satheesh Chandran, Assistant Engineer (Mechanical), Malampuzha/ Er. Nibu Andrews, Asst. Executive Engineer, PWD,Mechanical Sub Division, Thiruvanathapuram	Newly appointed AE's	84
42	09-09-2021	Basic awareness of Electrical components in Irrigation schemes	Er. Seeja K.R, Assistant Executive Engineer, Elecrical Wing, Aluva	Newly appointed AE's	84

43	10-09-2021	Catch a Glimpse of KERI	Er.Suprabha N, Director, KERI & Team	Newly appointed AE's	84
44	10-09-2021	Role of Irrigation Department in Agricultural Sector	Smt. Sherly Zacharia, Assistant Director, Agricultural Department, Kottayam	Newly appointed AE's	84
45	10-09-2021	Monitoring softwares in Irrigation Department	Sri. Alex H.T, HOD, Automation Department, C DIT	Newly appointed AE's	84
46	11-09-2021	Dam Management under KSEB	Er. M K Parameswaran Nair, Member Civil (Retd), KSEB (Ex Chairman, Mullapperiyar Special Cell,Govt of Kerala)	Newly appointed AE's	84
47	11-09-2021	Concept of Environmental Flow	Dr. Sudheer Padikkal, Superintending Engineer (Retd), Irrigation Department	Newly appointed AE's	84
48	11-09-2021	Strategies for Reservoir Operation	Dr.Jasmine I, Assistant Director, IDRB	Newly appointed AE's	84
49	11-09-2021	Projects in collaboration with Engineering Colleges	Dr.Priya K L, Asst Professor, TKM College of Engineering, Kollam	Newly appointed AE's	84
50	12-09-2021	Chronological Review of ongoing Dam construction - Pattissery Dam	Er. Isaac P George, Assistant Engineer, Pampar Project Section-3, Marayoor	Newly appointed AE's	84
51	13-10-2021	Office Administration Procedures	Sri. B. Madhusoodanan Pillai, Senior Superintendant (Retd.), Irrigation Department	Promoted AE's	74
52	22-10-2021	Overview on PWD Manual	Er. Shamsad U C, Assistant Executive Engineer, Minor Irrigation Circle, Kozhikkode	Promoted AE's	74
53	26-10-2021	Overview of Minor Irrigation structures	Er.Susheela R, PA to SE, KD Circle, Kottayam	Promoted AE's	74
54	27-10-2021	Basic awareness of Mechanical components in Irrigation schemes	Er. Satheesh Chandran, Assistant Engineer (Mechanical), Malampuzha & Er. Nibu Andrews, Asst. Executive Engineer, PWD,Mechanical Sub Division, Thiruvanathapuram	Promoted AE's	74
55	28-10-2021	Overvirew of Irrigation projects .	Er.Balasankar K, Superintending Engineer, Project Circle, Piravom & Er.Sandheep V, Executive Engineer Karapuzha Irrigation Project Division, Kalpetta, Wayanad	Promoted AE's	74
56	29-10-2021	Strategies for Reservoir Operation	Dr.Jasmine I, Assistant Director, IDRB	Promoted AE's	74

57	30-10-2021	Familirisation of Design Indent and IS Codes .	Er. Athulya Das A S, Asst Director, Canals, IDRB	Promoted AE's	74
58	01-11-2021	Investigation works for Irrigation structures .	Er. Saju Varghese, Deputy Director, Instrumentation Division, KERI, Peechi & Er. Suffera O B, Asst . Director, Coastal Engineering Division , KERI, Peechi	Promoted AE's	74
59	02-11-2021	Applications of water resources in Hydrological perspective .	Er.Jigi M.O, Executive Engineer , Hydrology Div ,Thrissur & Er.Shibu George, Assistant Executive Engineer, Hydrology Division, Thrissur	Promoted AE's	74
60	03-11-2021	Basic awareness of Electrical components in Irrigation schemes	Er. Younas M S, Assistant Engineer, Electrical Lift Irrigation Section, Ramamangalam	Promoted AE's	74
61	05-11-2021	Introduction to QGIS and Mapping ,Hands on session on QGIS and Mapping	Er.Bismi Shafna, Asistant Engineer, Irrigation Investigation Section No.2, Aluva & Er.Raji Thampan, Deputy Director , Coastal Engineering Division, KERI, Peechi	Promoted AE's	74
62	21-10-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	AE's & AEE's	73
63	23-10-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	Overseers	96
64	25-10-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	Overseers	91
65	15-11-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	AE's & AEE's	70
66	17-11-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	Overseers	67

67	19-11-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	Overseers	77
68	24-11-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	AE's & AEE's	83
69	29-11-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	Overseers	51
70	30-11-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	Overseers	78
71	22-12-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	AE's & AEE's	171
72	28-12-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	Overseers	419
73	09-02-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	AE's & AEE's	183
74	11-02-2021	Online Training Programme for Quality Monitoring and Quality Control of Irrigation Works	Er. Babu M S, AEE, QC Subdivision, Thrissur & Merin Thomas,AEE, QC Subdivision, Kottayam	Overseers	322

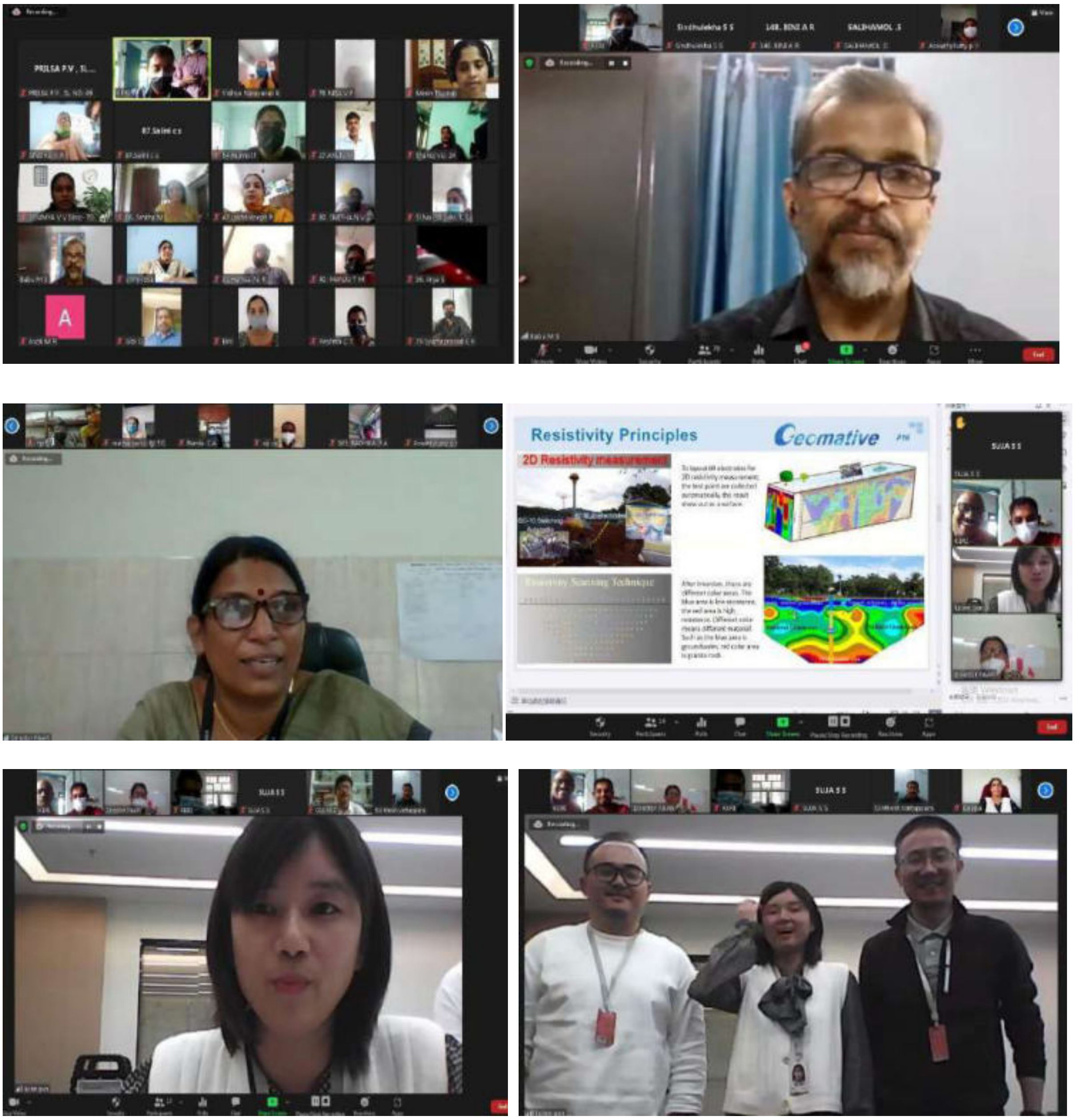


Fig. Photos of online training programmes

The technical library disseminates information through technical books, e-journals, printed journals, previous study reports, and other means. The training also provides an opportunity to advance the knowledge of employees in the department. As part of the library's upgrade, it is proposed that it operate in a digitilised mode, so that the entire department can take advantage of the technical abilities at their finger tips.

INDUCTION TRAINING FOR NEWLY RECRUITED ASSISTANT ENGINEERS FOR THE YEAR 2021-22

In the year 2021, a new batch of 75 Assistant Engineers was inducted into the Irrigation Department. Kerala Engineering Research Institute planned and conceived induction training for new Engineers in accordance with the directions of Hon'ble Additional Chief Secretary, and the order no.PL6 (B) 17308/2021 dated 16/08/2021 of Chief Engineer, Irrigation & Administration, Thiruvananthapuram. The induction training was held in order to provide newly recruited assistant engineers in the irrigation department with an opportunity to learn about their new role in the department. The induction training began on August 17, 2021, and ended on September 14, 2021, with a total of 42 sessions using the Zoom platform. The training curriculum covers a wide range of topics, including irrigation project research, hydraulic structures, hydrology, coastline protection, and the Harithakeralam Mission. This training also covers a variety of general topics, such as department procedures, office management, and personality development. The training also aims to create awareness and understanding of the various activities of the department and government procedures required for project implementation. Accordingly a comprehensive curriculum covering all these aspects was prepared by KERI and suitable resource persons were assigned for delivering the sessions. It was also planned to create a basic awareness about the various other departments, the role of irrigation department in various other sectors and collaborative projects etc.

The training programme was delivered online through the Zoom Platform. Shri. Roshy Augustine, Hon'ble Minister for Water Resources, inaugurated the induction training on August 17, 2021, in the presence of Chief Secretary Shri. V P Joy, IAS, and Additional Chief Secretary Shri. T K Jose, IAS. Dr.V P Joy, IAS, Hon'ble Chief Secretary, was welcomed by Shri. Alex Varghese, Chief Engineer, I & A, to address the trainees and gave an encouraging discourse to the young engineers. The department was lucky to have Dr. E Sreedharan, "Metro man," communicate with the trainees on the first day. Dr. E. Sreedharan was introduced to the session by Shri. Biju D., Chief Engineer, IDRB.

The Chief Engineer, Kuttanad Package & Inland Navigation, also conducted a session. Another session on "Overview and Activities Undertaken by KERI, various facilities, etc." was held by the Director of KERI and team. The various sessions of the induction training were conducted by 22 resource persons from the irrigation department and 28 external resource individuals. On the 14^{th} of September 2021, a Valedictory session of the training programme was held with special sessions by Sri. K Jayakumar IAS (Rtd.), Director, IMG on the topic "Reading - A Gateway to Personal and Professional Development" and Sri. Dr. Alexander Jacob IPS (Rtd) on the topic "Engineering – Lessons From History."

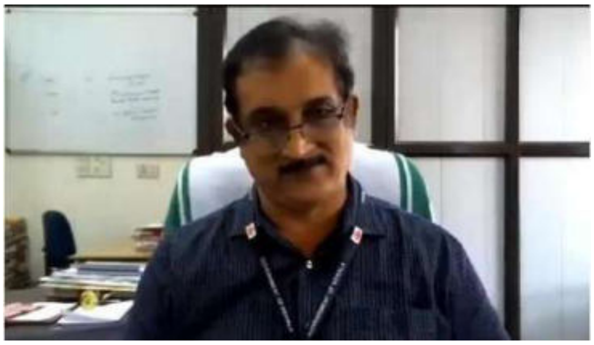
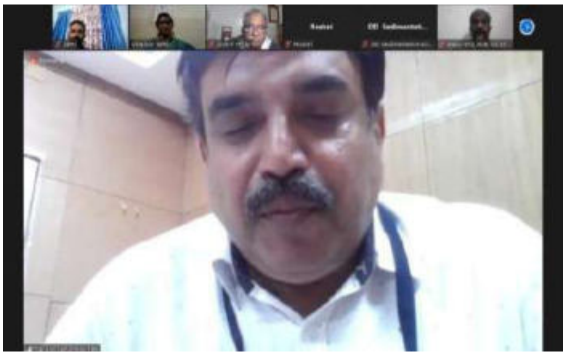
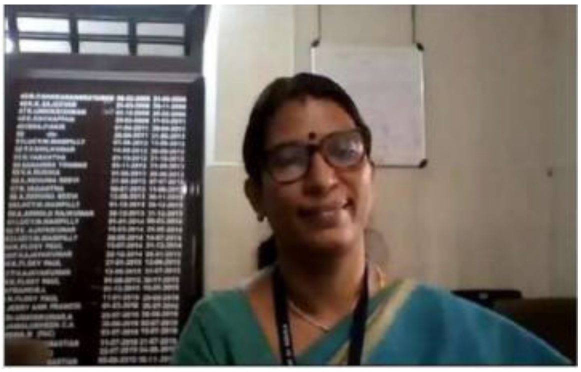
To assess the effectiveness of the sessions, an online evaluation was conducted on daily basis, and participants' feedback on the sessions was also collected. The trainees were instructed to attend the three online courses (Financial Engineering, Data Analysis, and Python) and all have undergone the same. Certificates were awarded to those who successfully completed the training programme based on evaluation and attendance. 74 certificates were distributed.

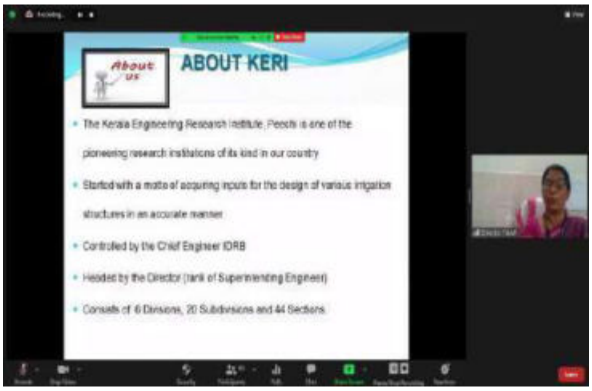
As part of the programme, district-wise site visits were also held to provide the engineers with hands-on experience in the field. On 13th September 2021(Kasargod, Palakkad, Thrissur, Ernakulam, Idukki, and Kollam) and 3rd November 2021 (Kozhikode) as part of the induction training, site visits were conducted on a district basis to give the trainees practical experience on the execution and operation of major irrigation projects such as dams and other irrigation structures. Candidates got the opportunity to visit and inspect the key irrigation structures in their area, as well as their areas of interest. Due to Covid 19 pandemic situations the site visit was arranged in 7 groups . The following paragraph describe about the site visit.

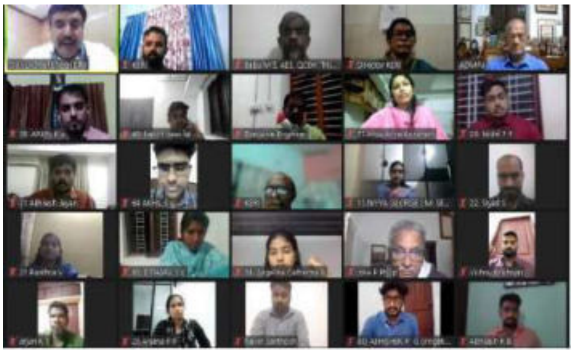
The first group of 13 people went to the Kallada (Parappar) dam on September 13, 2021. The second batch, made up of 17 persons (11 freshly appointed Assistant Engineers and 6 coordinators from the Quality Control Subdivision in Kottayam), was assigned to two locations in the Idukki district. Munnar Check Dam and the Pattissery Dam construction site. The next team consisted with 7 participants and 4 departmental staffs visited Boothathankettu barrage and Malankara dam on the same day. The other group visited Chimoni dam as part of their site visit during induction training programme with eight number of participants. Further, Palakkad district team visited two destinations; Malampuzha dam in Palakkad district and a Community Micro irrigation project at Karadippara, Chittur, Palakkad. A team of 14 new Assistant Engineers from Palakkad and Malappuram districts joined in the visit. Then another team Visited to Peruvannmuzhi Dam Site, Koovapoyil UT & Chittarikadavu RCB. The team consisted of 16 people, 13 newly appointed Assistant Engineers and 3 coordinators from Quality Control Subdivision Kozhikode. Kasargod district team had visited to irrigation structures in Kasargod district, consisted of 6 participants from Kannur and Kasargod district.

With the help of an online induction training programme organized by Kerala Engineering Reasearch Institute, 75 Assistant Engineers were inducted into the Irrigation Department. Based on the feedback received, it was comprehensible that the training was extremely beneficial in raising awareness and understanding of the department's various activities as well as the government procedures required for project implementation in the department. Continuous training on modern methodology and trends in the construction field has to be regularly carried out. Furthermore, the site visits conducted during the programme was an opportunity to get an extensive knowledge that will be extremely useful in their field practices in the coming days.





Figures. Photos of Induction training programme on online Platform

G.COASTAL ENGINEERING FIELD STUDIES, THRISSUR

Contents

CHAPTER - 1

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 576.432 Km. in the south west coast of India, is Characterized by a narrow longitudinal barrier strip of low-lying land, sand-witched 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, several district headquarters, 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 2,3meters and wave periods range from 9 to 12 sec. and they come mostly from west. 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 lakhs of population and disruption of other activities affecting economy. The influence of saline water through mouth of rivers also affects agriculture and industry.

New CP stones have been planted throughout the Kerala coast except about 25km length of north extreme end at Manjeswaram. The GPS Co-ordinates of all CP stones and seawalls have been recorded.

All aspects of the coastal erosion problems of the State, the necessity for immediate protection of vulnerable stretches, efforts made in collection of coastal data for long periods in conducting studies and in getting expert advice from all over the world and achievements made so far in tacking the erosion problem.

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, mostly due to improper maintenance is as important as the 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 Irrigation Wing under the Kerala Govt. has constituted a separate division (headed by the Joint Director) for studying shore changes in the Kerala coast under Chief Engineer, Investigation & Design (IDRB), Thiruvananthapuram. Coastal Engineering field studies Thrissur is now working under the Director, Kerala Engineering Research Institute (K.E.R.I.), Peechi, Thrissur. Kerala coast divided into 3 regions, Southern region (Kollam) Central region (Ernakulam) and Northern region (Kozhikode). Each of these region is under the control of the Deputy Director and further divided into the control of Assistant Directors.

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

CHAPTER 2

GENERAL ARRANGEMENTS AND FIELD STUDIES

For the detailed study of the characteristics and behavior of the beach, the 576 Km of the Kerala coast is divided into three regions viz. Southern region, Central region and Northern region. Each of these regions 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.

1. Coastal Engineering Sub Division Kollam

a) Coastal Engineering Section, Thiruvananthapuram: The jurisdiction of coastal area comprises of Kollamkode to Paravoor pozhi (CP 0000 to CP 0287)

b) Coastal Engineering Section, Kollam: Jurisdiction of coastal area comprises of Paravoor pozhi to Kayamkulam pozhi (CP 0288 to CP 0499)

c) Coastal Engineering Section, Thottappally: Jurisdiction of coastal area comprises of Kayamkulam pozhi to Alapuzha pier. (CP 0500 to CP 0710)

The total coastal area of Kollam Sub Division is **164.702 Km.**

2. Coastal Engineering Sub Division Ernakulam

a) Coastal Engineering Section, Cherthala: Jurisdiction of coastal area comprises of Alappuzha pier to Ponnani. (CP 810 to CP 975)

b) Coastal Engineering Section, Ernakulam: Jurisdiction of coastal area comprises of Chellanam to Munambam. (CP 975 to CP 1187)

c) Coastal Engineering Section Chavakkad: Jurisdiction of coastal area comprises of Azhikode to Ponnani. (CP 1188 to CP 1549)

The total coastal area of Ernakulam Sub Division is **151.6311 Km.**

3. Coastal Erosion Studies Sub Division Kozhikode

a) Coastal Erosion Studies Section, Parappanangadi: Jurisdiction of coastal area comprises of Padinjarekkara to Kadalundi (CP No. 1555 to CP 1743)

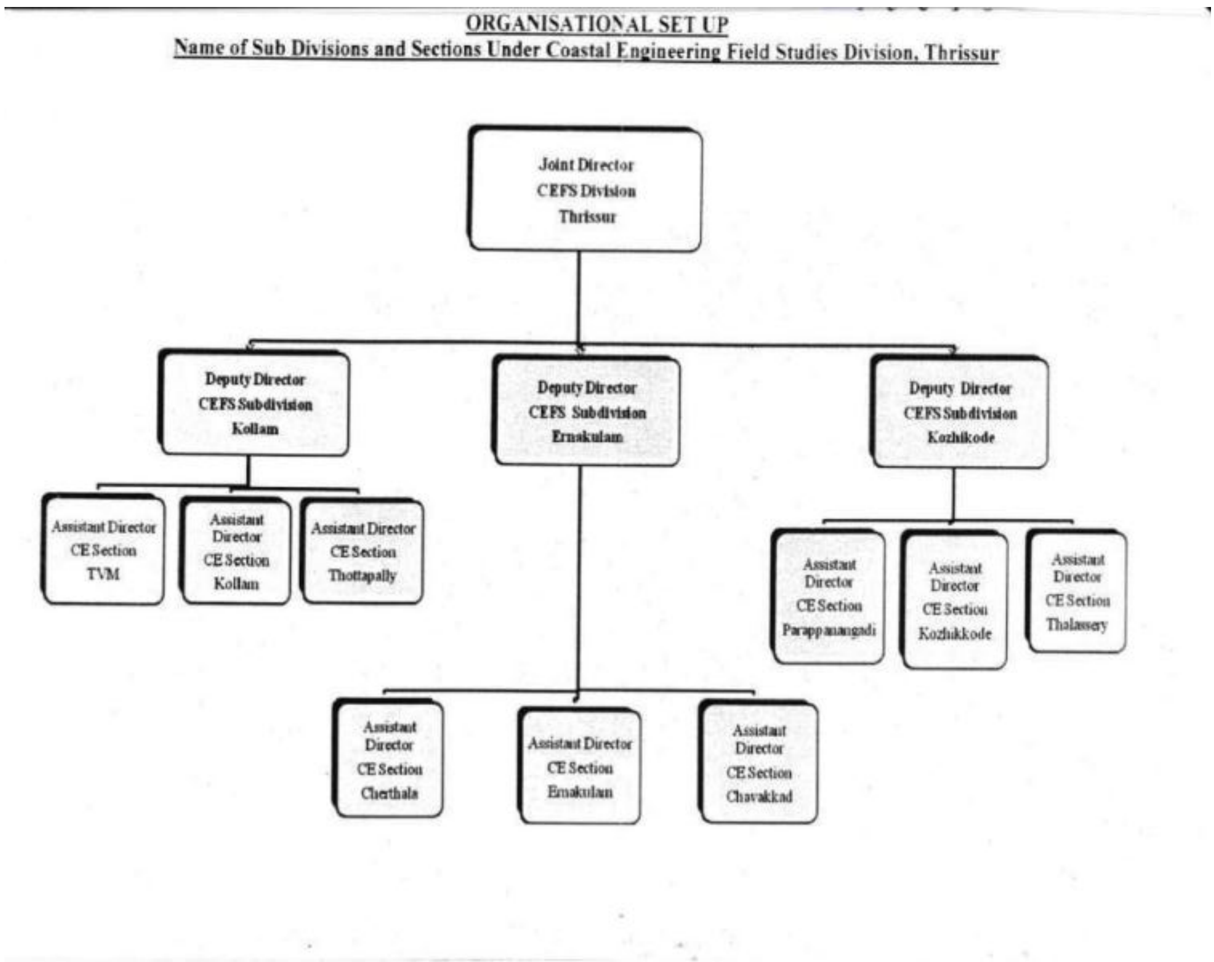
b) Coastal Erosion Studies Section, Kozhikode: Jurisdiction of coastal area comprises of Kadalundi to Poozhithala Mahipalam. (CP 1745 to CP 2120)

c) Coastal Erosion Studies Section, Thalassery: Jurisdiction of coastal area comprises of Mahi River to Thalapady river Manjeswaram. (CP 2140 to CP 2412 in Kannur District and CP 2507 to 2750 of old CP in Kasargode District).

The total coastal area Kozhikode Sub Division is **260.1 Km.**

CHAPTER 3

ORGANIZATION SETUP



CHAPTER 4

INCUMBENCY DETAILS

COASTAL ENGINEERING FIELD STUDIES THRISSUR

1.	Joint Director	:	Sri. Ajmal.E
2.	Assistant Director	:	Smt. Anusree A (Full additional charge from 22/09/2021 to 18/04/2022) Smt. Ajantjha V.D (Full additional charge from18/04/2022 onwards)
3.	Ist Gr.Draftsman	:	Smt. Bindu.K.C Smt. Beena.K.D Smt. Rajitha.K.K(From 18/08/2021 onwards)
4.	Head Clerk	:	Sri. Yesudas.P.T (From 01/08/2019 to 20/09/2021 onwards) Smt. Amrita Sekhar (From 20/09/2021 onwards)
5.	Clerk	:	Smt. Rinny.M.D Sri. Vasudevan.K.M (From 25/02/2017 to 16/01/2021) Smt. Mumthas A.A (From 01/10/2021 onwards)
6.	Senior Grade Typist	:	Smt. Seema Jose
7.	Driver	:	Sri. Denny. N.J
8.	Office Attendant	:	Smt.Nigi T.K

Coastal Engineering Subdivision,Kollam

1.	Deputy Director	:	Smt.Raji.C.T(Leave from 13-12-2021) Smt. Rajeena.M (Additional in charge from 13-12-2021)
2.	First Grade	:	Smt. Aseena . S (Promoted as Assistant Engineer as

	Draftsman		on 31.05.2021) Sri.SibiVarghese(From 27/08/2021and continuing)
3.	Senior Clerk	:	Smt. Jaya D (Promoted as Head Clerk as on 30-09-2021) Sri. Anil Raj K (1.11.2018 onwards)
4.	Clerk	:	Smt. Priya.M.D(From 25/11/2021and continuing)
5.	Typist	:	Sri.GopakumaranNair.C
6.	.Driver	:	Sri.Ajipushpangathan
7.	Office Attendant	:	Sri.Vickraman.P

Coastal Engineering Section ,Thiruvananthapuram

1.	Assistant Director	:	Sri.Ajin Singh S
2.	Second Grade Draftsmen	:	Sri.Godlin.J.J Sri.Salin Kumar R.S
3.	L. D. Clerk	:	Sri.Salin. S.S

Coastal Engineering Section, Kollam

1.	Assistant Director	:	Smt. Rajeena M (From 17/04/2020 and continuing)
2.	I Grade Overseers	:	Smt: Shiji P.R (Promoted as Assistant Engineer as on 31.05.2021) Smt: Smitha.R(From 25/08/2021and continuing)
3.	II Grade Overseers	:	Smt. Anithakumari . S (From 28/01/2021 and continuing)
4.	Office Attendant	:	Sri.J.SanilKumar (Relieved on 31-01-2022) Smt.Shamina.S from 31/01/2022 and continuing

Coastal Engineering Section, Thottappally

1.	Assistant Director	:	Sri.Jayaprakash. D. (24/07/2020 Onwards)
2.	Second Grade Overseer	:	Sri.Raju.T (24/07/2020 Onwards) Sri.Jaimon.T.J (15/02/2021 Onwards)
3.	Clerk	:	Smt.S. Rejani (24/02/2006 Onwards)
4.	Office Attendant	:	Sri.Pramesh.G(Relieved on 31-1-2022) Sri.Reji. G (01/02/2022 Onwards)

Coastal Engineering Sub Division Ernakulam

1.	Deputy Director	:	Sri. T.K. Rajesh (From 06.08.2019 continuing)
2.	First Grade Draughtsman	:	Smt. Letha K V (From 27.08.2020 continuing)

3.	. Senior Clerk	:	Smt. Nisha K N (From 07.09.2019 continuing)
4.	Clerk	:	Smt. Suja K S (From 07.03.2017 continuing)
5.	Selection Gr.Typist	:	Sri. Vinodkumar K (13.07.2017 to 30.09.2021)
6.	Selection Gr.Typist	:	Smt. Latha K M (From 10.01.2022continuing)
7.	Driver SeniorGrade	:	Sri. Anoop P G(From 16.05.2013continuing)
8.	OfficeAttendant	:	Smt. Alphonsa K X (05.11.2020continuing)
9.	Part TimeSweeper	:	Smt. Rugmini N T (From18.06.2001continuing)

Coastal Engineering Section Cherthala

1.	Assistant Director	:	Sri. Clement Roy K R(From 17/01/2020 continuing)
2.	Second GradeD'Man/Overseer	:	Sri. Kunjumon P (06.04.2017 to 10.11.2021)
3.	Second GradeD'Man/Overseer	:	Smt. Anjana Prakash (From 21.08.2018 continuing)
4.	Second GradeD'Man/Overseer	:	Smt. Preethimol C M (From 04.01.2022continuing)
5.	Senior Clerk(HG)	:	Sri. Ajayakumar P(From 06.06.2018continuing)
6.	OfficeAttendant (HG)	:	Smt. Sali P V (From 01.03.2021continuing)

Coastal Engineering Section Ernakulam \

1.	Assistant Director	:	Smt. Anusree A (From 17.08.2019continuing)
2.	First Grade Draughtsman		Sri. Binu K (02.02.2021to 01.09.2021)
3.	First GradeDraughtsman		Sri. Manoj Antony K (From 01.09.2021continuing)
4.	. Second GradeD'Man/Overseer		Smt. Kamalamma K (08.02.2021 to 07.01.2022)
5.	OfficeAttendant (HG)		Sri. Saji T T (From 17.02.2014continuing)

Coastal Engineering Section Chavakkad

1.	Assistant Director	:	Smt. Ajantha V D (From 01.11.2018 continuing)
2.	Second GradeD'Man/Overseer	:	Sri. Babunath S (From 21.01.2019continuing)
3.	Second Grade D'Man/Overseer	:	Smt. Thulasi E C(27.06.2017 to 15.11.2021)
4.	Senior Clerk	:	Smt. Rose Johny Senior Clerk (From 06.06.2018 Continuing)
5.	Office Attendant (HG)	:	Sri. Shaji M K (From 04.02.2009 continuing)

Coastal Erosion Studies Subdivision,Kozhikode

1.	Deputy Director	:	Sri. Abbas M T
2.	First Grade Draftsman	:	Smt . Usha K.C
3.	Senior Clerk	:	Smt. Preetha T.K Smt. Hameeda.M.A
4.	Senior Typist	:	Smt. Prameela.K
5.	Driver	:	Sri.Mohammed Iqbal.P
6.	Office Attendant	:	Sri.Logesh. N.P

Coastal Erosion Studies Section ,Parappanangadi

1.	Assistant Director	:	Sri. Ammad P.C
2.	Second Grade Draftsman/Overseer	:	Smt. Rehna Sulthana.K Smt. Shajna.P.
3.	Office Attendant	:	Sri.Vipin.D

Coastal Erosion Studies Section, Kozhikode

1.	Assistant Director	:	Sri. Jithin.P
2.	First Grade Overseer	:	Sri.Sakkeer Ali. A (up To 31-05-2021) Smt. Nishida N.P (from 8.11.2021)
3.	Second Grade Draftsman/Overseer	:	Smt. Rejula.K
4.	Office Attendant	:	Smt. Seema Mol K.C

Coastal Erosion Studies Section, Thalassery

1.	Assistant Director	:	Sri. Jithin.P (15-02-2021 to 31.05.21 in charge) Sri. Ashraf. P P (15-02-2021 to 31.03.22)
2.	Second Grade overseer	:	Smt. Seena P.P Sri. Haneefa. K (From 01-03-2021)
3.	L. D. Clerk	:	Sri. Siju N
4.	Office Attendant	:	Smt. Remani.P

CHAPTER 5

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 awayof 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, the 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.

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 each materials, characteristics of littoral drifts, shore history and they are recorded on standardized format.

Study of littoral drift

Littoral transport is the movement of sediments in the near shore zone by wavesand 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. However the directions, an annual quantity of net and gross quantity are important in developing shore protection arrangements.Now only the direction of drift is being studied at selected at points along the shore.

Study of Wind and Waves

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 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 since these studies are essential.(Predominant direction of waves is from west or north west)

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 places of observations with timing and CP Nos. are listed below. The dates in the year 2020 are as follows:

The table showing above observations were shown in appendix V & VI respectively.

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.

Many rivers in Kerala exhibit a continuous migrating tendency. Such migration influences the beach characteristics in the adjacent areas considerably.

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.

Collection and Study of beach samples

Pre-monsoon (May) and post-monsoon (November), beach samples are collected from specified places for testing grain size distribution and specific gravity since the 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.

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.

Taking cross section profile of the beach

Cross section profiles taken using leveling instrument and leveling staff (Taken up to wading depth of waters)

Alignment fixation of sea walls:

The Joint Director inspected the sites for fixing alignment of sea wall (construction and reformation) with the concerned Irrigation officials, Deputy Director and Asst.Director of the Coastal Subdivision& Sections concerned, and approved the alignments of sea walls along Kerala Coast, considering the last 5 year shore line measurements and the alignment of the sea. Alignment approval has been given to the following works by the Joint Director, Coastal Engineering Field studies, Thrissur during the year 2021

Sl.No.	Name of sub Division	Alignment approved during 2021	Essentiality certificate issued during 2021
1	CE Subdivision, Kozhikode	Nil	Nil
2	Ernakulam CE Subdivision	Nil	Nil
3	Kollam CE Subdivision	2	Nil

CHAPTER 6

PERFORMANCE OF THE DIVISION IN THE YEAR -2021

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 2020. The performance can be summarized as follows.

Types of works

1.	Topographic survey conducted for Determining beach profiles	:	6Nos.
2.	Periodical measurement of shoreline changes		3645.34Km
3.	Simultaneous observations		202 Set
4.	Soil sample collected		59Set.
5.	Cross section profiles		Nil
6.	Levels connected		Nil
7.	C.P Stones planted	:	81
8.	Alignment stones planted		62
9.	Kilometer stones planted		8
10.	Bench mark stones plant		2
11.	Guard Stones planted		12
12.	Alignment fixed by Joint Director		2No
13.	Details of damages at various places in the Coastal beaches collected		1 Nos
14.	Mud bank study		Nil

Sub Division-wise Coastal studies performance are as follows”

1. Topographic survey conducted

Kollam sub Division	:	1No.
Ernakulam Sub Division	:	1No.
Kozhikode Sub Division	:	4 Nos

2. Periodical measurement of shoreline changes

Kollam sub Division	:	1479.00 Km
Ernakulam Sub Division	:	893.34Km
Kozhikode Sub Division	:	1273 Km

3. Simultaneous observations

Kollam sub Division	:	58 Set.
Ernakulam Sub Division	:	67 Set
Kozhikode Sub Division	:	77 Nos

4. Taking photograph

Kollam Sub Division	:	15Nos
Ernakulam Sub Division	:	29Nos
Kozhikode Sub Division	:	37Nos.

5. Soil sample collected

Kollam sub Division	:	8 Set
Ernakulam Sub Division	:	10 Set
Kozhikode Sub Division	:	14 Set

6. Cross section profiles

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

7. Levels connected

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

8. C.P Stones planted

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	60

Kozhikode Sub Division	:	21

9. Alignment stones planted

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	51
Kozhikode Sub Division	:	11

10.Kilometer stones planted

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	3
Kozhikode Sub Division	:	5

11.Bench mark stones planted

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	2
Kozhikode Sub Division	:	Nil

12.Guard stones planted

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	8
Kozhikode Sub Division	:	4

13. Details of damages at various panchayath in the Coastal beaches

Kollam sub Division	:	15 Nos.
Ernakulam Sub Division	:	29Nos.
Kozhikode Sub Division	:	37Nos.

1. Study of Mudbank

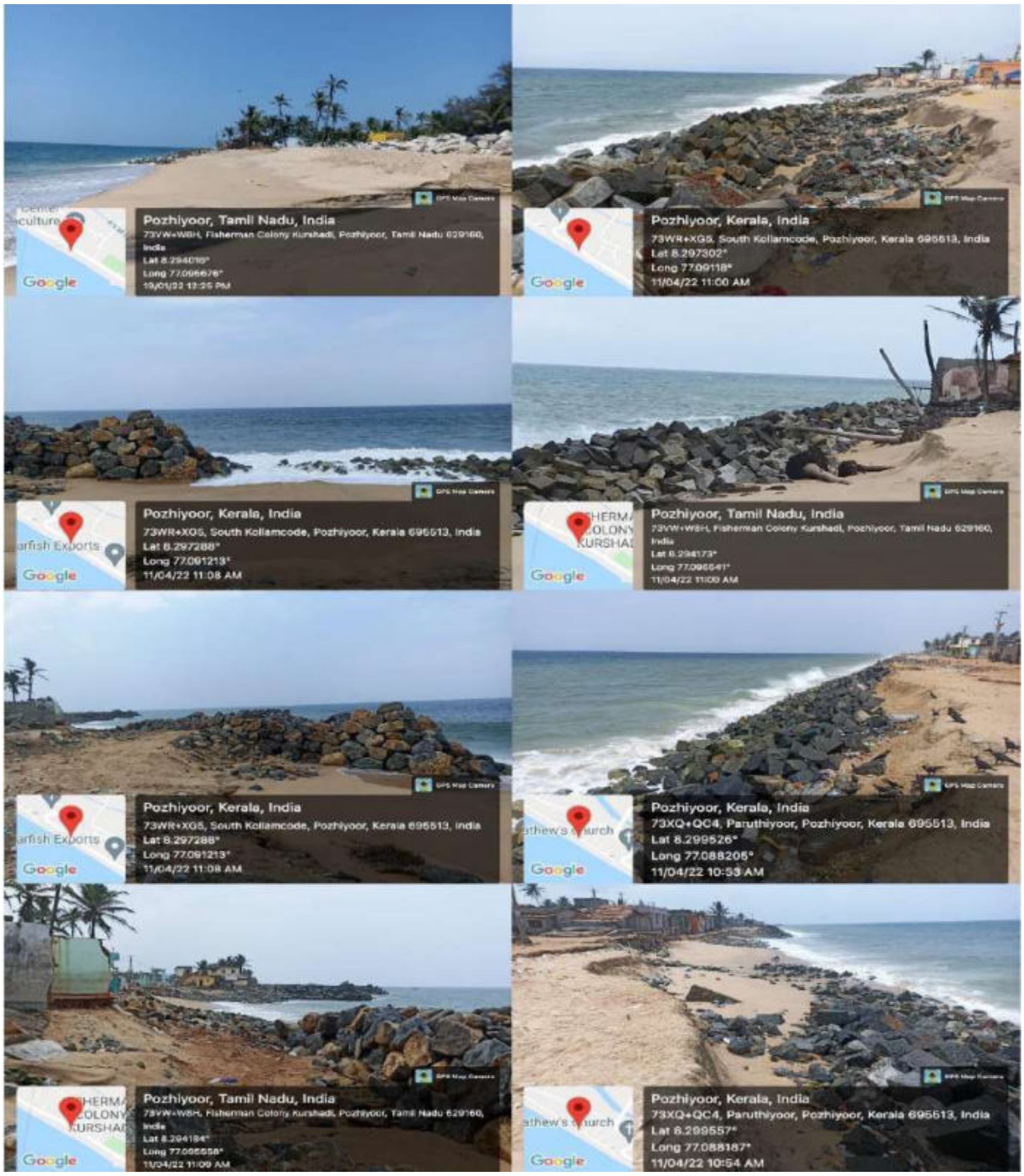
Kollam sub Division	:	Nil
Ernakulam Sub Division	:	Nil
Kozhikode Sub Division	:	Nil

The coastal data of Periodical measurements which backs to 1990 has been digitized and the digitization of available data of sled survey.

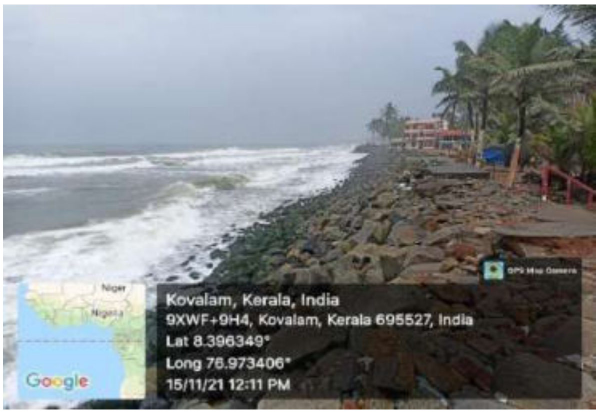
CHAPTER 7

Damages under Kollam SubDivision

Reach1-Kollamkode to Panathura(CPNo.0000 to 0070)



Damages at KollamcodeCP0000-CP0008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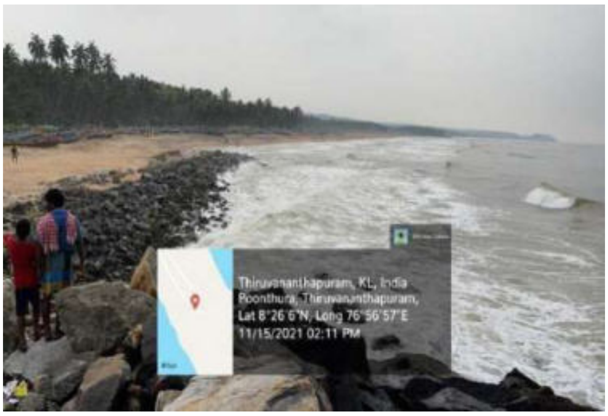
Long 76.973406°
15/11/21 12:11 PM
Google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Poonthura, Thiruvananthapuram,
Lat 8°26'6"N, Long 76°56'57"E
11/15/2021 02:11 PM


Kovalam, Kerala, India
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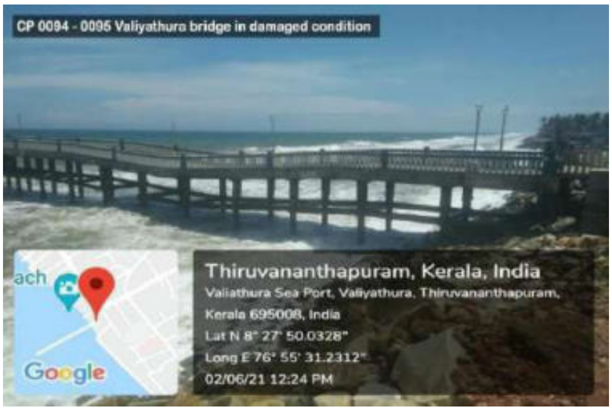
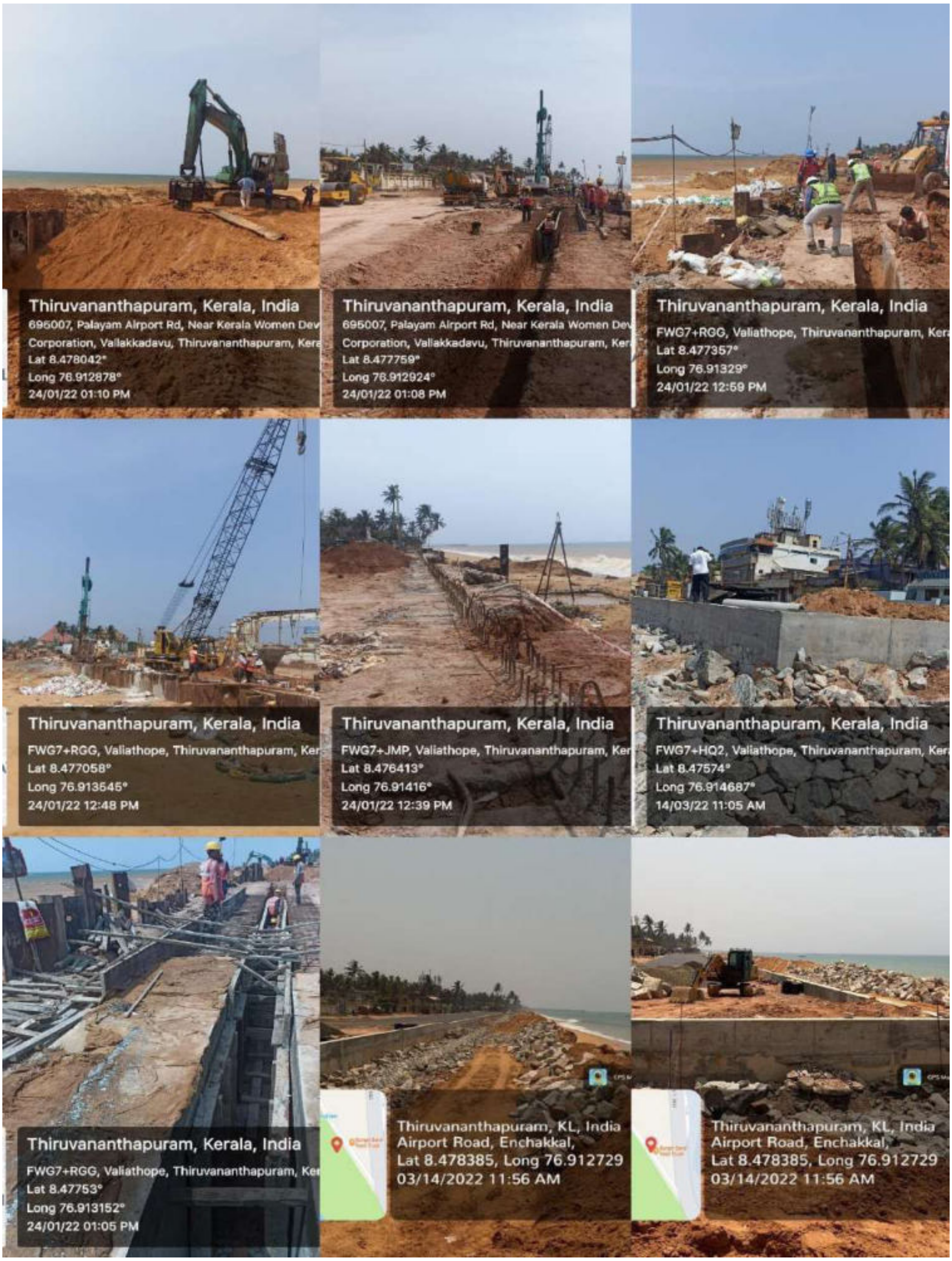
Long 76.973406°
15/11/21 12:11 PM
Google


CP 0094 - 0096 Valiyathura bridge in damaged condition
Thiruvananthapuram, Kerala, India
Valiathura Sea Port, Valiyathura, Thiruvananthapuram, Kerala 695008, India
Lat N 8° 27' 50.0328"
Long E 76° 55' 31.2312"
02/06/21 12:24 PM
Google


Thiruvananthapuram, KL, India
Valiathura, Thiruvananthapuram, 695008, KL, India
Lat 8°27'36"N, Long 76°55'42"E
07/26/2021 10:42 AM



Construction of diaphragmwall goingon photos at Sangumukham

Sangumukham Beach Road-Before&After construction of RCC DiaphragmWall

Reach3-ThumbatoPerumathura(CPNo0137to0211).

Perumathura Breakwater BetweenCP0210-0211

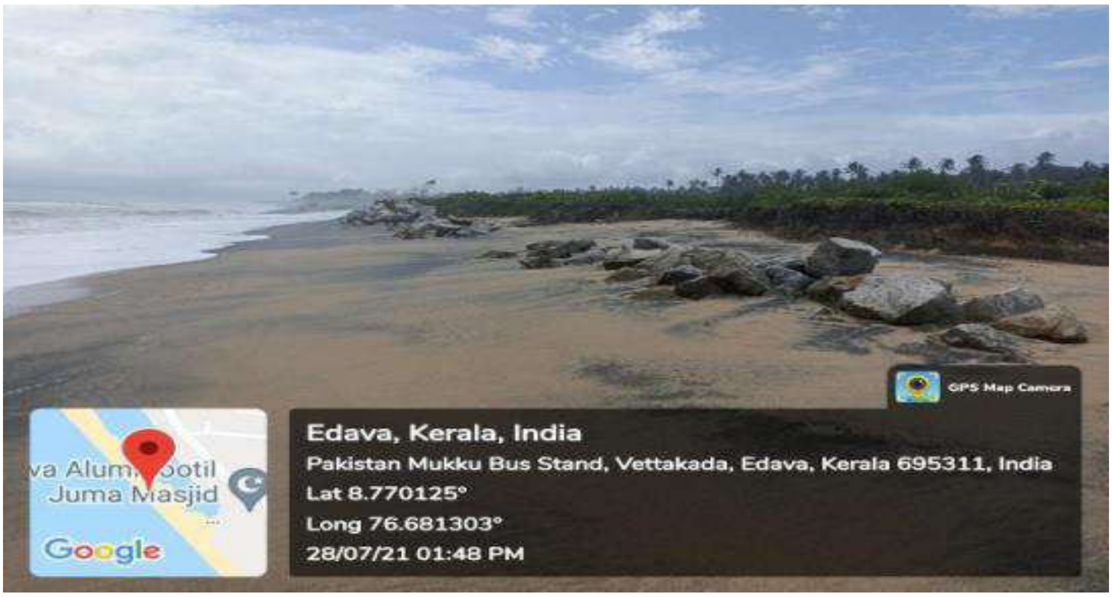
Since the distanceof CP between 137 to 150 (about 2.6 km) are under the control of ISRO and has been declared as Restricted area, the details of coast of this area is unknown. The area under this reach is very calm andmaintains good beach in all the seasons. Between CP No 0210 & 0211, the harbor engineering department has constructed the breakwater at Perumathura. Hence, very large shore was created between CP No 0195 to 0211.

Reach4-Perumathura to Paravoorpozhi(0211to0288)

The harbour engineering department has constructed breakwater forfishing harbor and also constructed a groyne between CP No.0211 and 0212. Another most vulnerable areas such as Poothura and Anjuthengu are comes under this reach. The coastal area between CP0211 to CP223 is protected by sea wall. But the sea wall between 0211 to 0215 is partially damaged and between 0215 to 0223 is heavily damaged and treated asmost vulnurablereach. This portion occuresheavy sea attack and also have thick populated area.Hence special attention has to be given to this area and also to be taken the advanced coastal protection methods.The CP stones have not been planted in between CP No 0259 to 0260 (approx 8.4 km) at Varkala. TheVarkala cliff, abeautiful place, is slowly disappearing due to severe seaattacks. The above places are incliffs and some protection work is needed since sometimes the soil erosion has been occurred in the cliff are during the heavy rainy season and due to the heavy sea attack Hence the portion ofcliff is also treated as vulnerable. The portion between CP 0262 to 0267 at Edava, the seawall is fully damaged and in collapsed condition and this location is also treated as vulnerable.

Damaged seawall at Poothura

Damaged housesatAnjuthengu



Damaged and collapsed seawall at Edava

<u>Coastal Damages from CP 288 to CP499</u>

CP 289 (Paravoor)

Damaged and collapsed seawall at Paravoor

Between CP 290 & CP 291(Mukkam Bund)

CP 310 (Eravipuram) Between CP 312 & 313 (Kakkathoppu)

CP 330 (Kollam Beach) CP 371 Shakthikulangara

CP 371 Shakthikulangara

CP 455 Alappad

Between CP 464 & CP 465 Kuzhithura

Between CP 476 & CP 477 Srayikkad

CP 495 (Azheekkal)

Coastal Engineering Sub Division Ernakulam

Details of coastal Damages

Coastal Damages occurred within the jurisdiction, were closely monitored and were reported every week during the monsoon. Details of coastal damages are reported once every month during off-monsoon months. During this year severe coastal damages and heavy coastal beach erosions were reported from Thanky(Ottamassery) (921-929).Near Thanky in Ottamassery, one building fully collapsed and more than ten houses partially damaged. Coastal road from CP 924 to 926 fully damaged and more than 32 coconut trees overturned and fell down as the result of cyclone 'Tauktae'. Due to heavy wave attack, beach eroded fora width of about more than 15m from CP921 to 922 and CP 928 to 929 .Severe water logging experienced in almost all houses in the nearby area.In Kattoor, More than 5 previously damaged buildings collapsed between CP842 and CP 845 dumped stones and S/W settled down as the result of cyclone 'Tauktae'. In Chennaveli, Two houses partially damaged and more than 15 coconut trees fell down. As a result of the heavy wave attack, the beach eroded for a width of about more than 15m.


Latitude : 9° 42' 17.63" N
Longitude : 76° 17' 18.92" E
Date : 22/07/21 03:16 PM
Note : CP 928

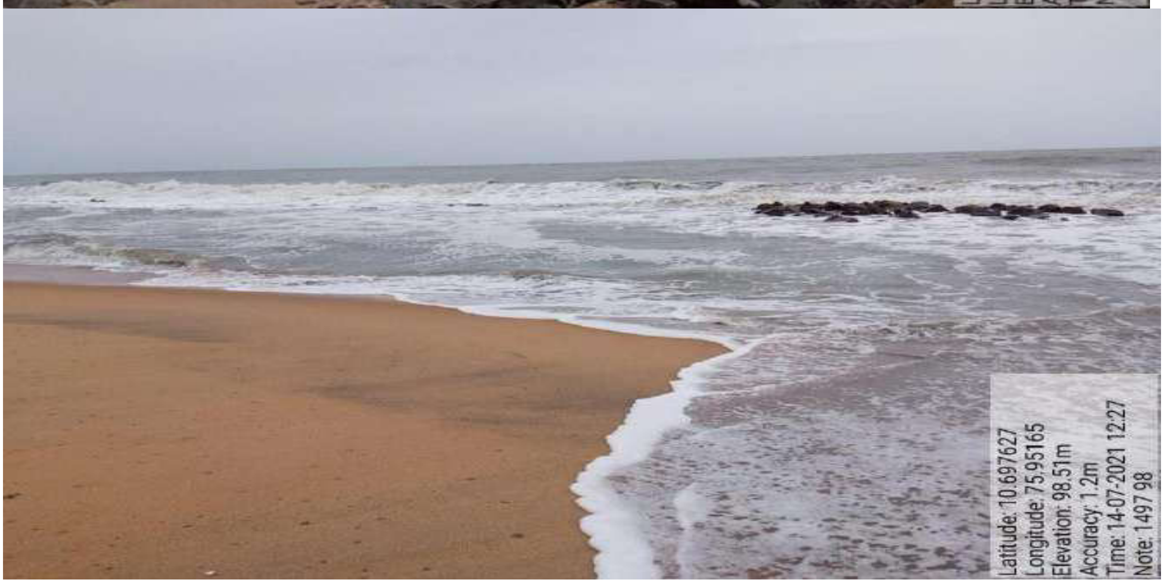

Latitude: 10°4.551'
Longitude: 76°11.761'
Elevation: 6.32m
Accuracy: 4.1m
Time: 22-07-2021 14:03
Note: CP 1127


Latitude: 10°4.876'
Longitude: 76°11.683'
Elevation: 6.62m
Accuracy: 3.0m
Time: 22-07-2021 14:23
Note: CP 1130


Latitude: 10.209865
Longitude: 76.15353
Elevation: 104.17m
Accuracy: 1.7m
Time: 12-07-2021 11:24
Note: 1206


Latitude: 10.220658
Longitude: 76.150013
Elevation: 101.8m
Accuracy: 1.7m
Time: 12-07-2021 12:27
Note: 1212


Latitude: 10.529978
Longitude: 76.027063
Elevation: 95.51m
Accuracy: 1.5m
Time: 19-07-2021 15:05
Note: 1393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Longitude: 75.95165
Elevation: 98.51m
Accuracy: 1.2m
Time: 14-07-2021 12:27
Note: 1497 98


Latitude: 10.71688
Longitude: 75.942972
Elevation: 95.46m
Accuracy: 1.6m
Time: 14-07-2021 12:59
Note: 1509 south


Latitude: 10.723682
Longitude: 75.939995
Elevation: 95.64m
Accuracy: 1.5m
Time: 14-07-2021 13:21
Note: 1513 south


Latitude: 10.761095
Longitude: 75.9236
Elevation: 98.58m
Accuracy: 1.5m
Time: 14-07-2021 15:14
Note: 1535


Latitude: 9°48.297'
Longitude: 76°16.469'
Elevation: 13.02m
Accuracy: 4.9m
Time: 26-07-2021 12:08
Note: cp 983


Latitude: 9°48.377'
Longitude: 76°16.446'
Elevation: 13.84m
Accuracy: 4.9m
Time: 26-07-2021 12:22
Note: cp 984


Latitude: 9°49.211'
Longitude: 76°16.283'
Elevation: 21.76m
Accuracy: 4.9m
Time: 26-07-2021 13.02
Note: cp 991


Latitude: 9°49.31'
Longitude: 76°16.278'
Elevation: 14.59m
Accuracy: 4.7m
Time: 26-07-2021 13:10
Note: cp 992


Latitude: 9°50.489'
Longitude: 76°16.072'
Elevation: 48.65m
Accuracy: 4.9m
Time: 26-07-2021 13:33
Note: cp 1003 chalakadav


Latitude: 9°50.725'
Longitude: 76°16.094'
Elevation: 11.59m
Accuracy: 4.4m
Time: 26-07-2021 14:06
Note: kandakadav


Latitude: 9°53.12'
Longitude: 76°15.578'
Elevation: 3.27m
Accuracy: 4.9m
Time: 26-07-2021 14:47
Note: cp 1028


Latitude: 9°55.176'
Longitude: 76°15.07'
Elevation: 10.48m
Accuracy: 4.9m
Time: 26-07-2021 15:13
Note: cp 1047


Latitude: 9°55.792'
Longitude: 76°14.829'
Elevation: 10.27m
Accuracy: 4.9m
Time: 26-07-2021 15:18
Note: cp 1061


Latitude: 9°57.818'
Longitude: 76°14.271'
Elevation: 4.1m
Accuracy: 4.9m
Time: 26-07-2021 15:30
Note: cp 1067


Latitude: 10.691833
Longitude: 75.954347
Elevation: 100.12m
Accuracy: 1.2m
Time: 14-07-2021 12:07
Note: 1494 north


Latitude: 10°2.357'
Longitude: 76°12.45'
Elevation: -12.97m
Accuracy: 4.7m
Time: 23-07-2021 11:45
Note: cp1106


Eriyad, Kerala, India
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Long 76.150341°
26/07/21 11:01 AM
Google


Eriyad, Kerala, India
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26/07/21 11:08 AM
Google


GPS Map Camera
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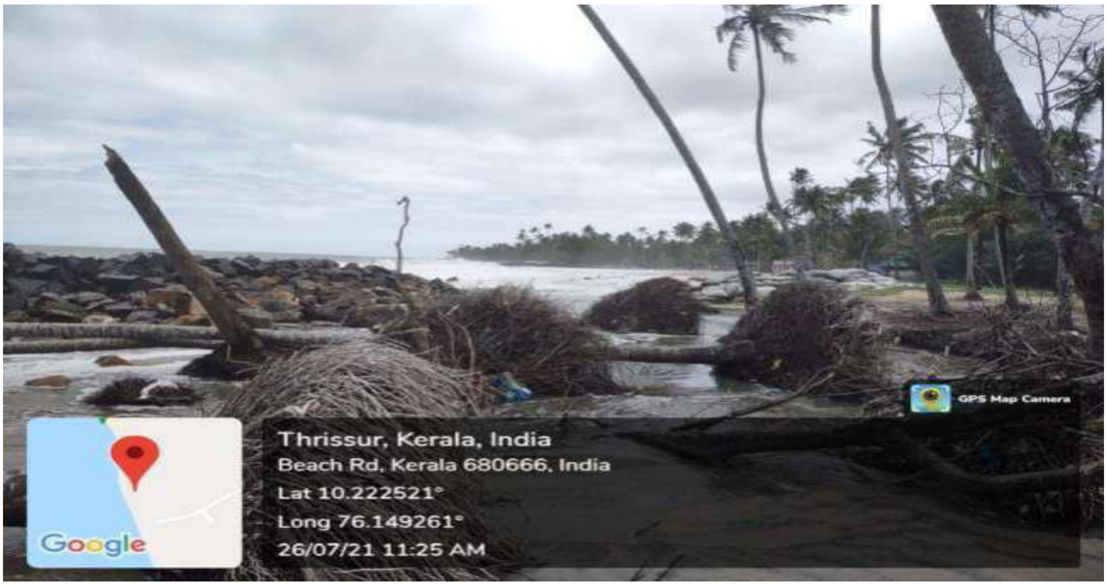
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Google

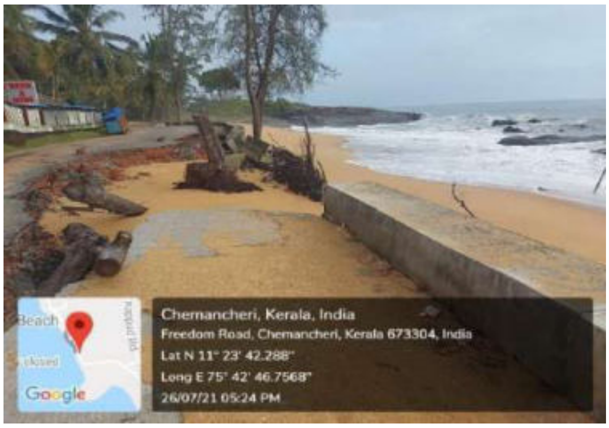
COASTAL DAMAGES UNDER KOZHIKODE SUB DIVISION

1. CES SECTION PARAPPANANGADI (MALAPPURAM DISTRICT)

CP 1636-CP 1638 PUTHIYAKADAPPURAMCP 1648 – CHEERAN KADAPPURAM

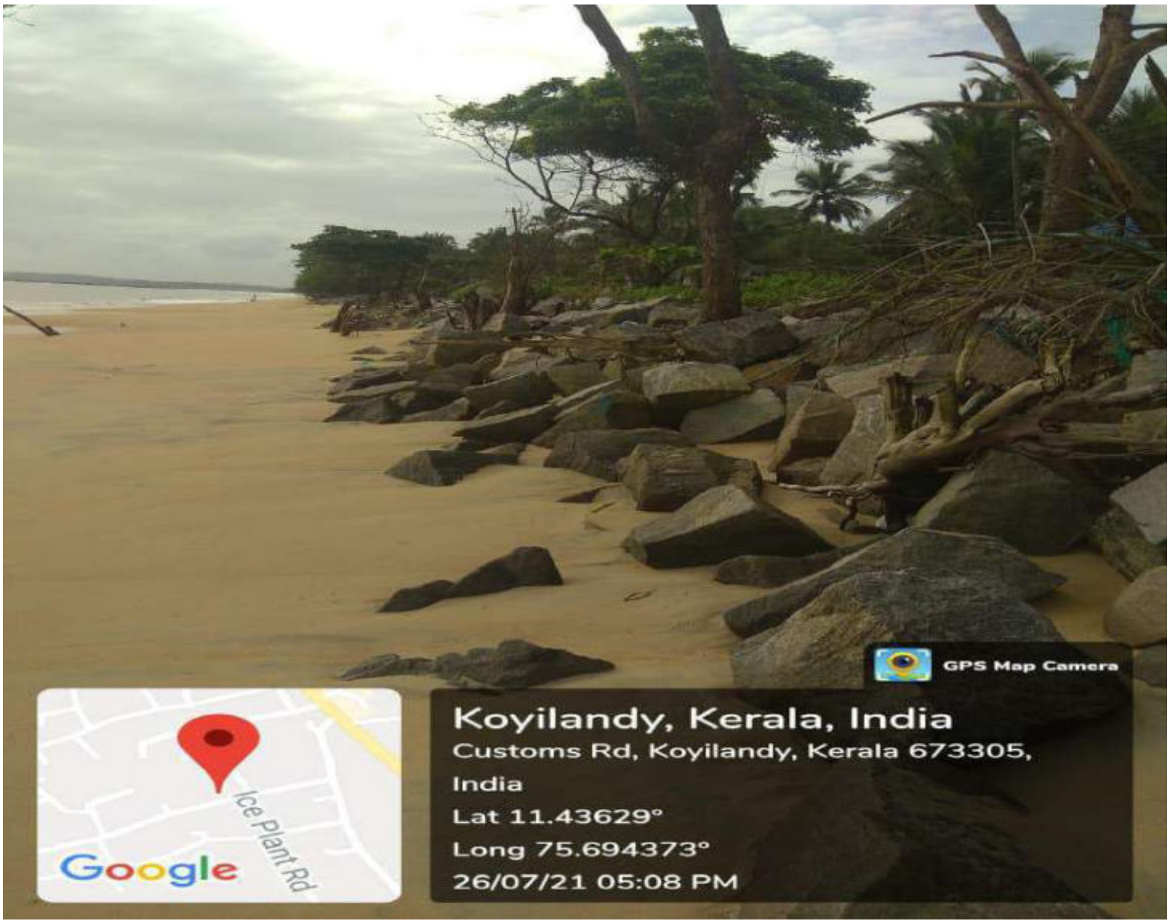
CP 1653 – EDAKADAPPURAMCP 1653 – EDAKADAPPURAM

2. CES SECTION KOZHIKODE (KOZHIKODE DISTRICT)

CP-1917 KAPPAD NORTH BEACHCP-1912 THUVAPPARA


CP-1875 MUNAMBATH BEACH



3. CES SECTION THALASSERY (KANNUR DISTRICT)

KAKKADANCHAL CP 2391 NEEROZHUKKUCHAL CP 2394

MATTOOL CP 2387

4. CES SECTION THALASSERY (KASARGOD DISTRICT)

CHAPTER 8

DETAILS OF DIFFERENT STONES

Sl. No.	Description	Thiruvanantha-puram	Kollam	Thottapally	Cherthala	Ernakulam	Chavakkad	Parappanangadi	Kozhikode	Thalassery	Total
1.	C. P. Stones	288	212	212	166	212	362	189	372	712	2725
2.	Alignment Stones	288	212	212	166	212	362	189	372	712	2725
3.	Guard Stones	48	36	32	28	36	52	32	64	100	428
4.	K. M. Stones	79	42	42	30	43	69	38	76	158	577
	B. M. Stones										

LIST OF IMPORTANT STRUCTURES

Coastal Engineering Section, Thiruvananthapuram

CHURCH

Sl. No.	CP Stone b/w	Name
1	0000 & 0001	KollamcodeKochupalli
2	0004& 0005	St.Mathew’s Church
3	0005 & 0006	St.Marry”sMagdelence Church
4	0019 & 0020	St.Berthodony Church
c	0024 & 0025	St.Andrews Church
6	0025 & 0026	Church of God
7	0029 & 0030	St. Anthonys Church kochuthura
8	0036 & 0037	
9	0078 & 0079	St.ThomasChuchPoonthura

10	0088 & 0089	St.AssemptionChuchCheriyathura
11	0094 & 0095	St.Antony'sForance Church
12	0110 & 0111	St.Peter's Church
13	0115 & 0116	Vettukadu Church
14	0122 & 0123	St.Joseph Church
15	0128 & 0129	St.Thomas Church Veli
16	0152 & 0153	Pallithura Church
17	0153 & 0154	St.Thomas Aquinas Church
18	0156 & 0157	
19	0160 & 0161	St.Dominic Church
20	0163 & 0164	St.Andrews Church
21	0171& 0172	Puthenthope Church
22	0187 & 0188	St.Joseph's Church
23	0197 & 0198	St.Micheal's Church
24	0220 & 0221	St.Roche's Church
25	0226 & 0227	St.Joseph Church
26	0233 & 0234	St.Antony's Church
27	0234 & 0235	Holy Sprit Church Mampally

Sl. No.	**CP Stone b/w**
1	0062 & 0063
2	0063 & 0064
3	0064 & 0065 (2 numbers)
4	0068 & 0069
5	0234 & 0235
6	0238 & 0239
7	0239 & 0240
8	0242 & 0243
9	0282 & 0283
10	0283 & 0284
11	0284 & 0285

MAZJID

Sl. No.	CP Stone b/w
1	0056 & 0057
2	0062 & 0063
3	0084 & 0085
4	0204 & 0205
5	0209 & 0210
6	0253 & 0254
7	0256 & 0257
8	0260 & 0261
9	0274 & 0275 (2 numbers)
10	0281 & 0282
11	0283 & 0284(2 numbers)

KURISADI

Sl. No.	CP Stone b/w
1	0009 & 0010
2	0018 & 0019
3	0027 & 0028
4	0036 & 0037
5	0038 & 0039
6	0042 & 0043
7	0093 & 0094
8	0123 & 0124
9	0157 & 0158
10	0163 & 0164
11	0210 & 0211

12	0213 & 0214
13	0218 & 0219
14	0228 & 0229

FISH LANDING SHED

Sl. No.	CP Stone b/w
1	0000 & 0001
2	0002 & 0003
3	0004 & 0005
4	0008 & 0009(2 no)
5	0018 & 0019
6	0019 & 0020
7	0020 & 0021
8	0024 & 0025
9	0025 & 0026
10	0026 & 0027
11	0027 & 0028 (2 no)
12	0028 & 0029
13	0030 & 0031 (2 no)
14	0031 & 0032 (2 no)
15	0032 & 0033 (2 no)
16	0033 & 0034 (2 no)
17	0034 & 0035 (3 no)
18	0035 & 0036 (2 no)
19	0037 & 0038
20	0039 & 0040
21	0040 & 0041 (2 no)
22	0041 & 0042 (3 no)

23	0042 & 0043
24	0043 & 0044 (4 no)
25	0183 & 0184
26	0189 & 0190 (2 no)
27	0193 & 0194
28	0194 & 0195 (2 no)
29	0223 & 0224
30	0253 & 0254
31	0256 & 0257
32	0257 & 0258

ANGANAVADI

Sl. No.	CP Stone b/w
1	0008 & 0009
2	0035 & 0036
3	0043 & 0044
4	0130 & 0131
5	0281 & 0282

Others

Sl. No.	CP Stone b/w	Name
1	0000 & 0001	Rajiv Gandhi centre for Aqua culture
2	0002 & 0003	V.R food enterprises Pvt. Ltd
3	0011 & 0012	Mini park
4	0012 & 0013	Coastal Police station
5	0020 & 0021	Foot ball ground

6	0029 & 0030	Foot ball ground
7	0031 & 0032	Foot ball ground
8	0036 & 0037	Matsyabhavan
9	0036 & 0037	St. Xavior's library & sports club
10	0037 & 0038	Kala Sagar Arts & sports club
11	0039 & 0040	Pulluvila fish market
12	0041 & 0042	Mini park
13	0044 &0055	Somatheerambeach,Vizhinjamport,Vizhinjam light house,Kovalambeach,Leela resort.
14	0055 & 0056	Kovalam beach
15	0056 & 0057	KTDC Resrot
16	0057 & 0059	Bait Resort
17	0057	Samudra beach
18	0062 & 0063	Coir factory
19	0094 & 0095	Valiyathura bridge
20	0103 & 0107	Sangumugam beach
21	0103 & 0107	Airport
22	0105 & 0106	Art museum
23	0106 & 0107	Sangumugam palace
24	0107 & 0108	Holy cross hospital &Pratheeksha De addiction centre
25	0118 & 0120	Titanium factory
26	0125 & 0127	VeliTouist villa
27	0131 & 0132	Primary health centre
28	0137 & 0149	ISRO (VSSC compound)
29	0152 & 0153	Pallithura higher secondary school
30	0157 & 0158	L P School
31	0161 & 0162	St. Xavior'scicket stadium
32	0162 & 0163	St. Xavior's college
33	0171 & 0172	Stella Marry's convent

34	0178 & 0179	Sea boy fisheries Pvt.Ltd.
35	0210 & 0211	Perumathura break water & bridge
36	0211 & 0212	Fishing harbor,Coastal police station,Harbour Engineering sub division.
37	0223 & 0224	Anjuthengu fort, Anjuthengu light house, community health centre,Sacret heat convent.
38	0225 & 0226	School
39	0226 & 0227	Foot ball ground
40	0227 & 0228	AnjuthenguPanchayath office
41	0228 & 0229	St. Thomas library
42	0229 & 0230	Anjuthengu service co-operative Bank
43	0233 & 0234	St.Antony's L P School
44	0238 & 0239	KayikkaraAsanSmarakam&Asan memorial L P School
45	0240 & 0241	Community health centre
46	0250 & 0251	Arivalam Tourist Park
47	0259 & 0260	Varkkala beach & cliff
48	0268 & 0270	Kappil beach
49	0273 & 0274	Mini park
50	0281 & 0282	Library
51	0287 & 0288	Mini park

Coastal Engineering Section Kollam.

Sl. No.		
1	PWD Kadavu at Mukkam	CP 0292
2	Temple at Thanni	CP 0302
3	Church at Thanni	CP 0303
4	Church near Eravipuram	CP 0315

5	Pier of Port Department at Garfill Nagar	CP 0317
6	Gandhi Park at Kochupilamoodu	CP 0331
7	Church at Pallithottam	CP 0336
8	Kollam Port	CP 0336
9	Church at Vadi (MoothakkaraPalli)	CP0341
10	Fishing Harbour at Thankasseri	CP 0343
11	Light House at Thankasseri	CP0347
12	Temple at Thirumullavaram	CP 0357
13	Church at Thirumullavaram	CP 0359
14	Church at Sakthikulangara	CP 0376
15	GTS Benchmark at Neendakara	CP 0381
16	Fishing Harbour Port (Breakwater and Bridge) at Neendakara	CP 0381
17	P.B.M and M.C Health Centre at Neendakara	CP 0393
18	St. Francis Church at Karithura	CP 0402
19	Light House and IRE Company at Karithura	CP 0408
20	KMML Ltd at Kovilthottam	CP 0409
21	Church at Kovilthottam	CP 0414
22	St. Francis Church at Karithura	CP 0415
23	Temple at Kattilkadavu	CP 0421
24	Parayakadavu Church	CP 0437
25	Parayakadavu Bridge	CP 0439
26	Temple at Cheriyazheekkal	CP 0446
27	Cheriyazheekkal Football Association Club	CP 0452
28	Govt. Homoe Dispensary at Kuzhithura	CP 0463
29	SreeAmruthanandamayee Matt and Ayurveda Treatment Centre	CP0470

30	Pachimeswaram Temple	CP 0477
31	Govt. LP School at Srayikadu	CP 0490
32	Fishing Harbour Port (Breakwater near KayamkulamPozhi)	CP 0499
33	PWD Kadavu at Mukkam	CP 0292
34	Temple at Thanni	CP 0302
35	Church at Thanni	CP 0303
36	Church near Eravipuram	CP 0315
37	Pier of Port Department at Garfill Nagar	CP 0317
38	Gandhi Park at Kochupilamoodu	CP 0331
39	Church at Pallithottam	CP 0336
40	Kollam Port	CP 0336
41	Church at Vadi (MoothakkaraPalli)	CP 0341
42	Fishing Harbour at Thankasseri	CP 0343
43	Light House at Thankasseri	CP0347
44	Temple at Thirumullavaram	CP 0357
45	Church at Thirumullavaram	CP 0359
46	Church at Sakthikulangara	CP 0376
47	GTS Benchmark at Neendakara	CP 0381
48	Fishing Harbour Port (Breakwater and Bridge) at Neendakara	CP 0381
49	P.B.M and M.C Health Centre at Neendakara	CP 0393
50	St. Francis Church at Karithura	CP 0402
51	Light House and IRE Company at Karithura	CP 0408
52	KMML Ltd at Kovilthottam	CP 0409
53	Church at Kovilthottam	CP 0414
54	St. Francis Church at Karithura	CP 0415
55	Temple at Kattilkadavu	CP 0421

56	Parayakadavu Church	CP 0437
57	Parayakadavu Bridge	CP 0439
58	Temple at Cheriyazheekkal	CP 0446
59	Cheriyazheekkal Football Association Club	CP 0452
60	Govt. Homoe Dispensary at Kuzhithura	CP 0463
61	SreeAmruthanandamayee Matt and Ayurveda Treatment Centre	CP0470
62	Pachimeswaram Temple	CP 0477
63	Govt. LP School at Srayikadu	CP 0490
64	Fishing Harbour Port (Breakwater near KayamkulamPozhi)	CP 0499

Coastal Engineering SectionThottappally

1	1. Port building at Alappuzha	CP 710
2	W&C Hospital	CP 708
3	Village office building	CP 706
4	ESI hospital	CP 703
5	SSV LP School Vadakkal	CP 697
6	Catholic church Paravoor	CP 687
7	Catholic church Punnapra	CP 680
8	Industrial unit Khadi and Village Industries-Punnapra	CP 676
9	Auction hall of Harbour Engineering -Valanjavazhi	CP 656
10	Railway line at Kakkazham	CP 651
11	Malsyafed building at Ambalappuzha	CP 646
12	LP School at Anandeswaram	CP 619

13	ThottappallyHarbour	CP 609
14	Health Centre at Thottappally	1. CP 60 9
15	Coastal Engineering Section at Thottappally	CP 604
16	Spillway at Thottappally	CP 605
17	Mosque and Church at Chelakkad	CP 578
18	Thrikkunnappuzha Temple	CP 573
19	Mosque at Pathiyankara	CP 563
20	Mangalam Water Tank	CP 557
21	Corporation Bank, Arattupuzha	CP 547
22	Nallanickkal Church	CP 535
23	Break water at Valiyazheekkal	CP 500

Coastal Engineering Cherthala Section

Sl.No	Name of important structures	Place	Between CP	
1	Light house	Alappuzha	CP810	
2	Bishop house	Alappuzha	CP811-812	
3	Recreation club	Alappuzha	CP810	
4	Fish landing centre	Pollethai	CP857-858	
5	Fish landing centre	Arthunkal	CP910-911	
6	Arthunkal church	Arthunkal	CP904-905	

7	Church	Ottamassery	CP926	
8	Church	Thankey	CP929-930	
9	Light house	Andhakaranazhi	CP951-952	
10	Church	South Chellanam	CP975	

Coastal Engineering Chavakkad Section

1.	Coastal Police Station at AzhikkodeNear CP. 1188
2	Light House AtAzhikkodeBetween CP .1201 – 1202
3	Beach Park At Snehathiram Near Thalikkulam Between CP. 1334 – 1336
4	Groyene At Chettuva Near CP.No. 1380
5	Groyene at Chettuva (N) Near CP. 1381
6	Light House at Thottappu Near Blangad Between CP. 1406 – 1407
7	A MultyStoryed Lodge Building AtBlangadBetween CP. 1419 – 1420
8	Single Storey Building Of Fisheries Department Between CP.1499 -1500 (Damaged)
8	MultyStorey Building Hatchery at Veliancode for Fisheries Between CP. 1510 – 1512
9	BeeviJaram At Puduponnani near CP.1514
10	Light House AtPonnaniBetween CP. 1548 -1549

Coastal Erosion Studies Section, Parappanangadi

1.Azhimugham CP 1555 2.Road and Mosque CP 1562 3. MMM HS Koottayi CP 1575
4. Koottayi School CP 1581
5. Kootaiyi Town CP 1585
6. Koottayi Badar Masjid CP 1595
7.Vakkad CP 1604
8. Malayalam Univercity CP 1606
9. Arikkanchira CP 1613
10 Paravanna Beach CP 1617
11. Unniyal Beach CP 1626
12. Puthiyakadappuram South CP 1631
13.Puthiya Kadappuram CP 1640
14. Puthiya Kadappuram North CP 1650
15. Tanur harbor CP 1660,1661,1662,&1663
16. Pandara Kadappuram CP 1668
17. Poorapuzha Azhi CP 1684
18. Parappanangadi CP 1705
19. Chettipadi CP 1711
20. Anangadi Turtle hatchery CP 1724
21.Kadalundy Nagaram CP 1730
22. Kadalundy CP 1743

Coastal Erosion Studies Section, Kozhikode

1.	Kadalundi CP 1745	42.	Cheriya-Mangad CP 1930
2.	Nechkkattu Paramba CP 1750	43.	Koyilandy CP 1935
3.	Kappalangadi CP 1755	44.	Valiyath Palli Beach CP 1940
4.	Anchukudikkal CP 1760	45.	Kollam Beach CP 1945
5.	Thai Kadappuram CP 1765	46.	Parappally Beach CP 1951
6.	Chaliyar CP1770	47.	Manda Mangalam CP 1955
7.	Chaliyar CP1771	48.	Urupunya Kavu Beach CP 1960
8.	Beypore Port CP 1772	49.	Moodadi Beach CP 1965
9.	Savakandy paramba CP 1775	50.	Muthayam Kadapuram CP 1970
10.	Gotheeswaram Beach CP1780	51.	Kunhi-Thayyil Palli CP 1975

11.	Kaithavalappu CP 1785	52.	Palliparmba ,Kadalur CP 1980
12.	Marad S Beach CP 1790	53.	Kodikkal South CP 1985
13.	Marad N Beach CP 1795	54.	Kodikkal CP 1990
14.	Payyanakkal Beach CP 1800	55.	Kodikkal UP School CP 1995
15.	Chamundi Valappil CP 1805	56.	Kodikkal North CP 2000
16.	Kothi Beach CP 1810	57.	Thokkodi CP 2005
17.	Mukhadar Beach CP 1815	58.	Melady Beach CP 2010
18.	Kozhikode South Beach CP 1820	59.	Bhagavan –Mukku-CP 2020
19.	Kozhikode Beach CP 1825	60.	Ayanikkad CP 2025
20.	Kozhikode North Beach CP 1830	61.	Kolavi –Palam Road CP 2030
21.	Thoppayil Beach CP 1835	62.	Kolavi Palam CP 2035
22.	Konad Beach CP 1840	63.	Iringal CP 2040
23.	Butt Road CP 1845	64.	Moorad CP2043
24.	Puthiyangadi Beach CP 1850	65	.Moorad CP2044
25.	Edakkal Beach CP 1855	66.	Moorad CP 2045
26.	Puthiyappa CP 1860	67.	Sandbanks Vadakara CP 2046
27.	Puthiyappa Harbour CP 1865	68.	Kottakkal CP 2050
28.	Narachal Beach CP 1850	69.	Vadakara CP 2055
29.	Elathur CP 1875	70.	Anati-Bhagam CP 2060
30.	Elathur Azhi CP 1880	71.	Mukachery CP 2065
31.	Korappuzha CP1883	72.	Kuriyadi CP 2070
32.	Korappuzha CP1884	73.	Thazhe Palli CP 2075
33.	Korappuzha CP 1885	74.	Muttungal Beach CP 2080
34.	Kannankadavu CP 1890	75.	Maliyekkal Beach CP2085
35.	Munambath Beach CP 1895	76.	Karuvachalil CP 2090
36	Kakkachikandi CP 1900	77.	Madakkara Beach CP 2095
37.	Kappad Beach CP 1905	78.	Mukkali Beach CP 2100
38.	Kappad North Beach CP 1910	79.	Avikkara Beach CP 2105
39.	Thuvappara CP 1915	80.	Erikkal Chalil CP 2110
40.	Parakkal Thazhe CP 1920	81.	Azhiyur Chungam CP 2115
41.	Ezhuku-dikkal CP 1925		

	82. Poozhithala Mahi CP 2120

CHAPTER 10

TOURISM DEVELOPMENT PROJECTS UNDER THIS DIVISION

Sl No	Particulars	District	Nearby Town/City	Old CP No	New CP No	Controlling Authority	Status (Existing or to be developed)	Remarks
1	Purathoor Azhimugham Beach	Malappuram	Padinjarekkara	3365	1555	Tourism Dept	Exising Tourism project	River Bharathapuzha & Tirur Puzha joins Arabian sea. Jankar service available to Ponnani
2	Poorapuzha Azhimugham Beach	Malappuram	Thanoor	3116	1682	Tourism Dept	Tourism to be developed	River Poorapuzha joins Arabian sea.
3	Kadalundi Beach	Malappuram & Kozhikode	Kadalundi	2997	1742	Tourism Dept	Exising Tourism project	River Kadalundi joins Arabian sea. This is a bird sanctuary with more than 60 species of migratory birds
4	Beypore Beach	Kozhikode	Kozhikode	2948	1769	Harbour Engineering & Toursim Dept	Exising Tourism project	walk way (Pulimuttu) constructed into the sea for 1 km. Has traditional Ship Building centre, famous for Beypore Uru . & Dolphin view point

5	Kozhikode Beach	Kozhikode	Kozhikode	2840	1826	Tourism Dept	Exising Tourism project	Famous for sunset view. Has light house and two damaged iron screw pile pier platform, ,run into the sea for 120m . Adjacent to beach is Lions Park and marine water aquarium
6	KorappuzhaEstuary	Kozhikode	Kozhikode	2727	1882		Tourism to be developed	Korapuzha backwaters joins sea. Offers a splendid and scenic view of natural beauty
7	Kappad Beach	Kozhikode	Kozhikode	2695	1910	Tourism Dept	Exising Tourism project	16 km from Kozhikode towards north. Portuguese explorer Vasco-Da Gama landed here in 1498. This is a rock studded beach
8	Velliyamkallu	Kozhikode	Payyoli	2483	2025		Tourism to be developed	A massive rock called Velliamkallu associated with Kunhali Marakkar situated 13km off sea cost (into the sea). This was the hiding ground for Marakkar to attack the invading Portuguese
9	Kolavipalam beach	Kozhikode	Iringal	2451	2041	Forest Dept	Tourism to be developed	Also called turtle beach. Every year olive ridley turtle comes from Pacific ocean to lay the eggs here. Turtle hatchery centre
10	Muzhippilangad Drive- in Beach	Kannur	Thalassery	1057/62	2224	Tourism Dept	Exising Tourism project	Largest drive in beach in Asia.15 km south of the town. Has beach festival

11	Dharmadam Island	Kannur	Dharmadam		2208	Private	Tourism to be developed	The island has backwaters covered with coconut groves and dense bushes .During low tide one can walk from the Muzhippilangad beach
12	Kizhunna Ezhara beach	Kannur	Kizhunna		2245		Tourism to be developed	11 km form kannur , Good tourist spot to spend vacations and relish beautiful surroundings
13	St Angelo's Fort	Kannur	Kannur cantonment		2282	Archeological survey	Exising Tourism project	Francisco de Almeida, the first portuguese viceroy of India. important historical monument and beautiful tourist spot
14	Payyambalam Beach	Kannur	Kannur	1046 to 1031	2302 to 2309		Tourism to be developed	Has approx. 4 km of shore line, a flat laterite cliff and beautifully landscaped sculpture of mother and child .Mappila bay, the harbor, has boat rides which offers spectacular view
15	Meenkunnu beach	Kannur	Meenkunnu		2339		Tourism to be developed	located in Azhikode village. Got vast stretch of golden sand and coconut trees. Famous for fish (meen -fish kunnu -small hill)
16	Ezhimala beach	Kannur	Ezhimala		2430	Naval Academy	Tourism to be developed	about 55 km from Kannur. Between Payannur and Payangadi route . Serene environment and good for peace loving visitors
17	Bekal Fort	Kasaragode	Bekal		2657	Archeological survey	Exising Tourism project	Fort spread over 40 acres has massive walls of 12 m height runs into the sea with fine bay towards south. Voids in walls were used for placing cannons

CHAPTER 11

DETAILS OF WORKS

1. CIVIL WORKS (MAINTENANCE)

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. In most area, levels are also established on those stones. The regions are referred by the Control Point stones. The references in certain reaches are made on BLS ie Base Line Stones. Shore line measurements, fixing of levels, topographic survey and similar important factors 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.Sanction for taking up maintenance work for Re-planting CP Stones and Alignment stones in place of missing stones were obtained during this year and the work has been completed. The works are: 1. CES replanting the new Control Point stones, Alignment stone, KM Stone and Bench Mark stone in place of missing stone and establishing connecting reduced level along the seacoast area from CP 1381 to CP 1549 and CP 1341 to 1351 under the jurisdiction of Coastal Engineering Section Chavakkad.

2. CES replanting new control point stones, Alignment stones, KM stones and Guard stones in place of missing stones between CP 1555 and CP 1743 under the jurisdiction of CES Section Parappanangadi.
3. CES maintenance of existing CP stones, AS stones, BM stones and Guard stones including repainting the Numbers and names etc and plastering the stones wherever necessary under the jurisdiction of Coastal Engineering Section Kollam.
4. CES maintenance of existing CP stones, AS stones, BM stones and Guard stones including repainting the Numbers and names etc and plastering the stones wherever necessary under the jurisdiction of Coastal Engineering Section Thiruvananthapuram.
5. CES maintenance of existing CP stones, AS stones, BM stones and Guard stones including repainting the Numbers and names etc and plastering the stones wherever necessary under the jurisdiction of Coastal Engineering Section Thottappally.

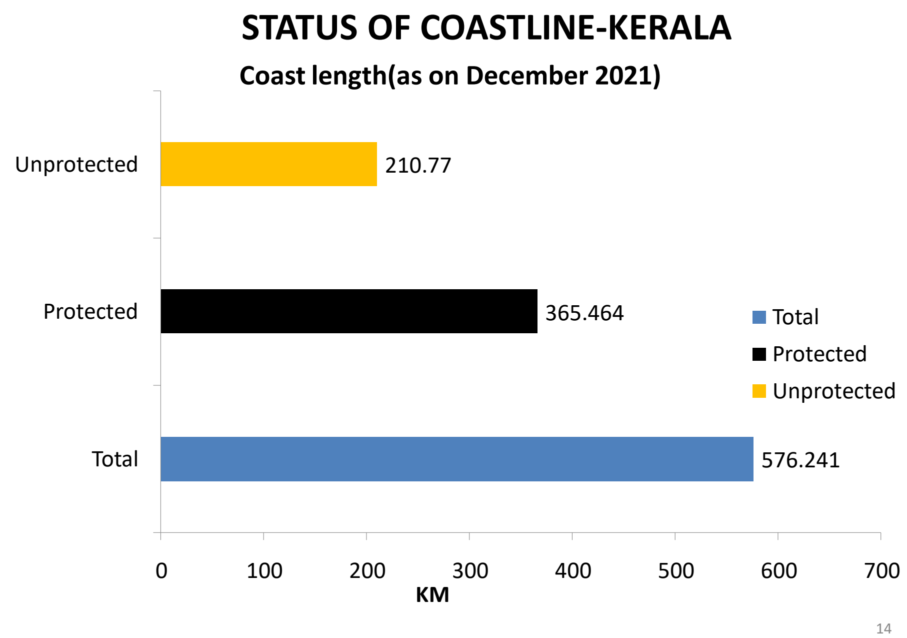
2. INVESTIGATION WORKS

Field studies and collection of data on coastal erosion have been conducted on all Sections under this Division and the details of studies conducted during this year are

1. **Periodical measurement of shoreline.**The measurements of shoreline changes with respect to control points were taken every month and the observations were submitted monthly..
2. **Simultaneous observations**:The simultaneous observations (SO) are taken every month on predetermined dates (Newmoon day).
3. **Collection of soil samples**: Soil samples were taken during the months May-2021 and November-2021 from the SO points and were tested for specific gravity and grain size distribution.

4. Details of Coastal Damages: Coastal Damages occurred within the jurisdiction, were closely monitored and were reported every week during the monsoon. Details of coastal damages are reported once every month during off-monsoon months.
5. Status of Coast:The status of coast from Thiruvananthapuram to Kasargode as on

August 2021 was ascertained. The vulnerable and stable reaches have been identified and report was submitted.



Data

collection of Design Parameters for urgent coastal protection works at Erosion hotspot along Kerala coast

As per direction received from CE, IDRB via letter No.IDRB/3641/2021/Cs/PBD, Dated 30.10.2021:

1. Conducted topographic survey including beach profiling for studying the seacoast from CP.1188 to CP.1235 at Kodungallur in Kaipamangalam Constituency in Thrissur district.
2. Conducted topographic survey including beach profile at Alapad region (between Pandanathuruth to Azheekal (CP 0434 and CP 499) at Karunagappally constituency of Kollam District under the jurisdiction of CE Section Kollam.
3. Conducted topographic survey including beach profiling for studying the seacoast from CP 1491 to CP 1549 at Ponnani LA Constituency in Malappuram district.
4. Conducted topographic survey including beach profiling at Thalassery between CP 2140 and CP 2191 in Thalassery Constituency in Kannur district.
5. Conducted topographic survey including beach profiling at Valiyaparamba between North end of Ezhimala Naval Academy Compound and CP 2545 in Thrikkarippur Constituency in Kasargode district.
6. Conducted topographic survey including beach profiling at Kappad region (Korappurzha to Koyilandy Harbour area CP1886 to CP 1933) at Koyilandy Constituency under the jurisdiction of CE Section Kozhikodet.
7. Bed sediment samples(wet sample), suspended sediment samples at onshore/ breaker zone, 5m and 10m depth for every 5km transects along Kodungallur(CP 1188 to CP 1235) and Alapad region(CP 0434 and CP 499 were collected by this office from the Hydrographic Survey wing. As this office's lab facilities was not sufficient for wet analysis, the samples were handed over to the Soil Mechanics and Foundation Division ,KERI and collected & submitted the report to higher authorities. Moreover onshore samples at the same locations were collected and conducted grain size analysis by this office.
8. Hydrographic Survey Wing Kottappuram and Kollam, Bathymetric survey from "LTL- 2m to 30m water depth,200m spacing" were conducted by them and informed that all related data to be submitted directly to the Director KERI, Peechi in due course.

CHAPTER 12

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. 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., The only two posts of clerks were declared as supernumerary.Coastal Engineering Section, Thalassery coming under the control of Deputy Director, Kozhikode Sub division extends from Mahe to Manjesweram with a length of 148 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 60Km with the assistance of 2 Draftsman/Overseer.

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. But it is regretted to state that the budget provision, which was around 100 lakhs during the nineteen nineties, has got reduced considerably in the recent years to 5 lakhs bringing the survey works to almost stand still. At present the wing is collecting data on shoreline measurements, simultaneous observation, preparation of coastal damage reports with photographs and collecting soil samples only. 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.

25 Kms of stones are not planted on the Northern Side of Kerala ie, in North of Kasargode District. So no details of sea have been taken in that area. That is to be rectified immediately. Also some stones are missing in the rest of the area, and it should be replanted immediately. Maintenance of the stones are not done till date. It is also to be done urgently. As per the direction of Chief Engineer, I&A, TVM, the Jeep under CEFS Division has been transferred to MI Division Thrissur, the non-availability of vehicle affects the inspection of the sites.

CHAPTER 13

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 148km,and for studying the entire reach an additional section is to be formed.

The location of new International Port at Vizhinjam is betweenCP45 to55 and the construction work is in progress.The construction authority has formed artificial shore and road by using materials drilled from the sea and breakwater construction is in progress.This area needs some specific studies for shoreline charecteristics before and after the construction of Vizhinjam Port..Here due to terrain of land CP Stones have not been planted.

Some of the CP stones have been swallowed by the sea waves and some got destroyed by the weathering actions.As the new CP stones have not been planted for the continuous stretch, that profile could not be adopted for aligning sea walls etc. Hence CP stone planting and its timely maintenance is essential.

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.

CHAPTER 14

CONCLUSION

Specific studies are necessary for studying the behaviour of shore protection works like seawall, groynes and break water.The study has to be conducted for analyzing the shore particulars before and after the construction of the groyne field. The construction of new international Vizhinjam harbour was started in between CP No. 0044 to 0055 and the construction work is in progress. This area needs some specific studies.

The main constrains is the lack of modern equipments and the shortage of fund for the study work of Coastal Engineering Department. It is also required to study the possibility of artificial nourishment and other protection works like geotube construction. The existing coastal protection works are being watched. The general behaviour including its failure if any, is studied for modification.

Since the study of the coastal characteristics is the base for all constructions of anti-sea erosion structures and also for the other construction work, the data collection could not be stopped. If it is stopped the entire data collected till date will be futile. Now many numbers of CP &AS stones are missing /damaged and hence these are to be replanted and also to be reestablished the Reduced Level (RL) and their locations (Latitude & Longitude).

The studies and data collection on coastal erosion are being continued during 2019-2020 possible erosion causes are wave action, tidal action , storm surge and manmade causes. Latitude and Longitude of all Control Point Stones and Alignment Stones and Seawall are taken for Coastal Atlas Preparation. Special studies if any required shall be done as directed. Hence Coastal Engineering and Field studies take inevitable part for the developing of coastal region of Kerala.

Joint Director

H.Quality control Division, Thrissur

Quality control Division, Thrissur

The quality control wing under Irrigation Department was formed in 1995 as per G.O.(MS)No. 87/1995/Irrgn dated 13.06.1995 to ensure quality of the works executed by Irrigation Department (WRD)There are two Division offices under the wing one at Thrissur with jurisdiction extending from Ernakulam to Kasargod (8 districts) and the other at Kottarakkara with jurisdiction extending from Thiruvananthapuram to Kottayam (6 districts).

Quality Control Division, Thrissur.

Quality Control Division, Thrissur was formed with effect from 15-11-2000 for Checking and maintaining the quality of works under taken by the Irrigation Department, after abolishing KIP (MCS Division) 2 at Charumoodu as per Govt. order (RE) No.891/2000/IRD Dated: 12-07-2000. Up to 04-03-2010, this division was functioning under the control of Superintending Engineer, I&P Circle, Thrissur. From 05-03-2010 onwards this division is functioning under the direct control of the Director, F& AR,KERI Peechi as per the Govt. Order No. 10 /2010 Dated: 1-2-2010.

The Quality Control Division, Thrissur comprises of a division office at Thrissur and 5 Sub Division Offices at Muvattupuzha, Thrissur, Palakkad, Kozhikode and Kannur. Monitoring of works executed by the Irrigation Department in Ernakulam, Thrissur, Palakkad, Malappuram, Kozhikode, Wayanad, Kannur and Kasargod are carried out by Quality Control Division, Thrissur.

The main objects of the formation of 5 Subdivisions under the Quality control Division, Thrissur and its functions.

- **Muvattupuzha** Sub Division was formed on deploying the Chimoni Dam Project in Thrissur District on 1-1-1992 as per GO(Rt) 717/91 Dt. 07-10-1991. The main object of this sub division is to check the quality of works in two divisions of MuvattupuzhaVallley Irrigation Project and two divisions of Idamalayar Irrigation Project. There are three sections at Muvattupuzha, Koothattukulam, and Angamaly for this purpose. The quality of works of Muvattupuzha division of Muvattupuzha Valley Irrigation project and Pattissery Dam in Kanthalloor is checked by the Muvattupuzha Quality Control Section. The quality works under taken by the Piravam Division of Muvattupuzha Valley Project is done by the Koothattukulam Quality Control. Quality Control Section Angamaly is checking the quality of works undertaken by the Angamaly Division and Chalakudy Division of Idamalayar

Irrigation Project. The jurisdiction of the subdivision is covering four districts - Idukki, Ernakulam, Kottayam and Thrissur

- **Thrissur** Sub Division and its two sections at Thrissur and Ernakulam are envisaged to check the quality of works under taken by the various Execution divisions and subdivisions of the irrigation department in Thrissur and Ernakulam Districts. 2nd tier quality control activities of all 9 Nos major and minor Irrigation divisions, except works under Muvattuuzha, Idamalayar and Chalakkudy Irrigation projects, are coming under this office.
- **Palakkad** Sub Division and its two sections at Palakkad and Malapuram are intended to check the quality of works under taken by the various 9 Divisions and sub divisions of the Irrigation Department in Palakkad and Malapuram Districts.
- **Kozhikode** Sub Division and its sections namely Kozhikode and Kalppetta are intended to check the quality of works under taken by the various Divisions and sub divisions of the Irrigation Department in Kozhikode and Wyanad Districts.
- **Kannur** sub division and its two sections at Kannur and Kasargod are intended to check the quality of works undertaken by the various Divisions and subdivisions of Irrigation department in Kannur and Kasargod districts.

Division office at Thrissur

Apart from compiling monthly and quarterly inspection reports received from the five subdivisions, comparing test results with IS and other approved standards, recommending necessary suggestion if any are the duties of Division office. Random inspections of major and important woks are to be done by the Division office.

Duties of the Division office also include effective coordination and supervision of these sub divisions which have such a vast area of operation in the field of quality maintenance of works under Irrigation Department and smooth functioning of the day to day activities such as personnel and official needs of the staff of the sub divisions, especially at the present scenario of introducing the new scheme ‘Modernization of Quality Control Wing’.

Present functional activities of the Division and Sub divisions

Apart from inspections conducted by the Quality Control sections and Quality Control Sub Division offices, random inspection in major and important works are also being conducted by the Division Office. Irregularities noticed are brought into the notice of the execution wing with clear direction to rectify the same.

One of the major projects coming under WRD is Dam Rehabilitation and Improvement Project (DRIP) of major dams of Kerala. Since 2013, the wing is engaged in the Quality Control testing of DRIP works also. DRIP is implementing with financial assistance of World Bank. As per the direction of the Chief Engineer (I & D) IDRB, we are participating in the discussions conducted by CWC Consultant at DRIP sites. As per the norms of DRIP, KWRD is to conduct timely inspection and certify the quality of work executed under the projects.

The list of dams that are coming under the Dam Rehabilitation and Improvement Project (DRIP) are as follows.

Sl. No.	DAM	Name of District
1	Pothundy	Palakkad
2	Malankara	Muvattupuzha
3	Vazhani	Thrissur
4	Peechi	Thrissur
5	PeriyarVallyBerrage	Ernakulam
6	Chulliar	Palakkad
7	Meenkara	Palakkad
8	Walayar	Palakkad
9	Pazhassi	Kannur
10	Kanhirapuzha	Palakkad
11	Chimoni	Thrissur
12	Kuttiadi	Kozhikode
13	Malampuzha	Palakkad
14	MoolatharaRegulater	Palakkad (Chitturpuzha)

As part of modernization of quality control wing, setting up of full-fledged laboratories with most modern equipments and machineries etc. under H/A 2701-80-005-93-00-00-V (Modernization of Design wing) is in progress.

Various facilities are available in the Thrissur Quality Control lab for compressive strength testing of concrete cubes, rocks and bricks, various tests on soil etc. Facilities are also available in the lab for Rebound hammer tests and concrete core drilling cutting and its testing.

As the part of setting up of a mini quality control lab at Aluva under Ernakulam section office, some of the essential lab equipments such as hand operated sieve shaker, digital weighing balance, cubical and cylindrical moulds for making concrete specimens, Le-Chatlier apparatus, slump cone etc were already procured and lab setting activities in the existing room of quality control section, Ernakulam is under progress. A proposal for setting up of a mini QC Lab including construction of a new buiding at Aluva, under QC section, Ernakulam has been proposed in the five year plan.

Quality control inspections were carried out for works amounting to Rs. 7250.54 lakhs for both sections under the jurisdiction of this office in the financial year 2021-22. Quality control inspections were carried out on the basis of actual intimation received from the executions offices and 267 numbers of inspection were carried out in the financial year 2021-22 including past years of agreement schedules received. **T**he lab tests for concrete and other material samples collected for works under the jurisdiction of Quality Control Section, Thrissur was conducted in the Quality Control Lab, Thrissur. Also the lab test for concrete samples collected under the Jurisdictions, of Quality Control Section, Ernakulam was tested in the Quality Control Lab, Angamaly under the Quality Control Sub Division, Muvattupuzha.

In addition to above 10 numbers of outside tests for samples as the part of first tier quality control tests for works were also carried out in the Quality control lab, Thrissur in the financial year 2021-22.

All inspection and test report were given to the concerned execution offices immediately after its scrutiny in this office. More over any defects in execution noticed during site inspections were also brought to the notice of the field officers present at the time of inspections. The hard copies of inspection report for major defects noticed were also sent to the concerned execution offices.

The work for procuring table vibrator (compacting 6 numbers of 150mm concrete cube mould) and pan type mixer machines (40L capacity) under Quality Control Lab Thrissur for the purpose of concrete mix design were also proposed and completed in the financial year 2021-22. Also the work for constructing working platform, machine foundation for CTM and wall mounted shelves etc. for setting mini quality control lab under quality control section, Ernakulam were proposed and completed in the financial year 2021-22. The work for procuring automatic leveling instrument with staff and tripod, aggregate impact testing machine, cylindrical mould 150mmx300mm size etc. to the mini quality lab under Ernakulam section were also proposed and completed and in the financial year 2021-22 itself. In addition to above, work for hiring vehicle for site inspections, sample collections and other departmental use for quality control section, Ernakulam were carried out in the financial year 2021-22 and progressing now.

A Quality Control Lab has also been partially functioning under Palakkad Sub division from 30.09.2021onwards and awaiting for the official commissioning of the Lab.

Construction of a new Quality Control Lab is proposed at Pallikkunnu Village in R.S.No.72/12. 23 cent land under Pazhassi Irrigation Project was sanctioned as per G.O.(MS) No. 8/2019/WRD dated.,28/03/2019 Thiruvananthapuram. But the handing over the site is not completed. Detailed estimate for the construction and setting up lab will be prepared and submitted soon after taking charge of the land. Now the various tests are conducted at Engineering Colleges and Polytechnic Colleges for works costing up to Rs.2.00 Crores and tests are conducted at QC Lab set up at the site by contractor for works costing above Rs. 2.00 Crores

The details of Agreement schedule received, quality control inspection conducted, sample collected and test details during the period 2021-2022 is given below.

Name of Office	Total no of Agreement schedules received	Total Nos of actual intimation received	Total no of site inspections carried out	No of samples collected							Total no of tests conducted	Total No of tests not found satisfactory	Total no of outside tests conducted	Remarks
				Concrete	Steel	Cement	Coarse aggregate	Fine aggregate	other materials if any	Total samples collected				
Quality control Section 1 , Muvattupuzha	46	90	90	97	Nil	Nil	16	16	Nil	129	1	Nil	Nil	

Quality control Section , Kozhikode	Quality control Section , Malappuram	Quality control Section , Palakkad	**Control Sub Division Thrissur**	Quality control Section , Ernakulam	Quality control Section , Thrissur	**Quality Control Sub Division Muvattupuzha Total**	Quality control Section 3 , Angamaly	Quality control Section 2 , Koothattukulam
128	56	55	**273**	140	133	**224**	129	49
128	36	211	**267**	122	145	**345**	198	57
170	36	211	**267**	122	145	**338**	190	58
105	31	110	**264**	117	147	**338**	184	57
Nil	0	0	**2**	0	2	**Nil**	Nil	Nil
Nil	0	0	**4**	0	4	**Nil**	Nil	Nil
Nil	0	0	**2**	0	2	**16**	Nil	Nil
Nil	0	0	**5**	0	5	**16**	Nil	Nil
Nil	0	0	**0**	0	0	**Nil**	Nil	Nil
105	31	110	**277**	117	160	**370**	184	57
69	31	110	**277**	117	160	**370**	Nil	2
0	0	2	**20**	7	13	**3**	Nil	Nil
Nil	31	74	**10**	0	10	**Nil**	Nil	Nil
		concrete compression Test started at 30/09/2021 at our Labs		Out of 122, 9 nos of site inspection are general inspection	Out of 145, 29 nos of site inspection are general inspection			

Quality control Section , Kalpetta	127	127	168	126	Nil	Nil	Nil	Nil	Nil	126	110	0	Nil
Quality control Section , Kannur	71	112	176	92	Nil	Nil	Nil	Nil	Nil	92	92	0	0
Quality control Section , Kasargode	40	107	200	67	Nil	Nil	Nil	Nil	Nil	67	67	0	0

Budget Allotments and expenditure

The needs of this division is met with the provisions allotted under the head of account 2701-80-005-97 Investigation & Design & 2701-80-005-93(Modernisation of Design Wing) under Plan and from 2701-80-004-96 for Non Plan wing.

Expenditure (For Thrissur Division)

Plan / Non Plan	Heads of A/c	2020-21
Plan	2701-80-005-97	Rs 10 Lakhs
	2701-80-005-93	Rs 45.6 Lakhs
Non Plan	2701-80-004-96	Rs 530 Lakhs

<u>Various Test facilities available in the QC Lab Muvattupuzha</u>

SI No.	Name of Test	Remarks
1	Compressive strength test (Concrete)	
2	Compressive strength test (Mortar)	
3	Slump test	

<u>Various Test facilities available in the QC Lab Thrissur</u>

SI No.	Name of Test	Remarks
	CEMENT	
1	Fineness by seiving	
2	Test for consistency	
3	Setting time (Initial & Final)	
4	Determination of compressive strength	
	Testing of Aggregates	
5	Sieve Analysis of fine/ Coarse aggregates	
6	Unit weight, Bulk Density and Voids	
7	Water Absorption	
8	Specific gravity	
9	Aggregate Impact value	
10	Aggregate Crushing value	
11	Bulking of sand	
	Testing of Concrete and Mortar Cubes (Where material is supplied)	
12	Testing of 70.6mm cubes for compressive strength test	
13	Testing of 100mm cubes for compressive strength test	
14	Testing of 150mm cubes for compressive strength test -	
	Tests on Bricks and Tiles	
15	Water Absorption for bricks/tiles	
16	Compressive strength of bricks of all kind	
17	Effective length and width of tiles	
18	Efflorescence test	
	Tests on Steel	
19	Finding the diameter and weight per meter length	
	Tests on Building Stones	
20	Compressive strength test of building stones of 5 cm or nearest size cubes	
21	True Specific gravity	

22	Water Absorption test (stone blocks)	
23	Compressive strength of building stones, cutting and sizing the specimen in rock cutting machine	
24	Compressive strength of building stones, 50mm cutting and sizing the specimen in rock cutting machine and grinding uneven surfaces to line and level	
25	**NDT Test** --Rebound hammer test	
26	Concrete core Drilling ,Cutting and its compressive test	
	SOIL TEST	
27	Specific gravity test	
28	Moisture content determination	
29	Bulk density, void ratio & porosity	
30	Atterberg limits, LL,PL,ws	
31	Atterberg limits LL,PL	
32	Light Compaction test	
33	Heavy compaction	

Details of test/ Services available in QC Lab Palakkad

SI No.	Name of Test	Remarks
1	Compression Test of Concrete Cube/ Brick Etc	
2	Sieve analysis/ Grading	
3	Initial and Final Setting of Cement	
4	Soundness of Cement	
5	Slump Test	
6	Aggregate Impact Test	
7	Tensile Strength of Cement	

Details of test/ Services available in QC Lab Kozhikode

Sl No	**Name of Test/Services**	Remarks
1	Compression Test / Cube test on concrete blocks	
2	Sieve Analysis of sand (using Electrical , Manual sieve shaker)	

3	Slump Test	
4	Vicat Apparatus -Initial Setting Time, Final Setting Time of cement	
5	Le-Chatlier Apparatus- for soundness of cement	
6	Liquid Limit ,Plastic Limit & Shrinkage Limit for soil	
7	Compaction Factor Test	
8	Specific Gravity Test (Pycnometer & Specific Gravity Bottle) for soil	
9	Cone Penetro Meter (Digital) Test for soil	
10	Aggregate Impact Test	
11	Crushing value - coarse aggregate	
12	Hydrometer analysis	
13	Tensile Test cement	

Staff strength

1.Muvattupuzha Sub Division

Sl. No.	Category	Sanctioned strength	Remarks
1	Asst. Exe. Engineer	1	
2	Asst. Engineer	3	
3	1st Grade D'man	2	
4	2nd Grade D,man	3	
5	3rd Grade D'man	3	
6	Head Clerk	1	
7	Senior Clerk/Junior Clerk	3	
8	Typist	2	
9	Driver	1	
10	Office Attendant	3	
11	Lascar	0	
12	Worker	1	
13	Part Time Sweeper	0	
14	Total	23	

Quality Control Sub Division, Thrissur

Sl. No.	Category	Sanctioned Strength	Remarks
1	Assistant Executive Engineer	1	
2	Head Clerk	1	
3	Clerks	2	
4	Typist	1	
5	Office Attendants	2	
6	First Grade D’Man	1	

7	Second Grade D'Man	1	
8	Driver	1	
9	Part time Sweeper	1	
Quality Control Section, Thrissur			
1	Assistant engineer	1	
2	Second Grade D'Man	1	
3	Third Grade Overseers	2	
4	Lascar	1	
Quality Control Section, Eranakulam-Aluva			
1	Assistant Engineer	1	
2	Second Grade D'Man	1	
3	Third Grade Overseers	1	
4	Lascar	1	

Quality Control Sub Division, Palakkad

Sl.No.	Post	Sanctioned Strength	
1.	Assistant Executive Engineer	1	
2	Head clerk	1	
3	Clerks	3	
4	Typist	1	
5	Overseer Grade I	1	
6	Overseer Grade II	1	
7	Office Attendant	1	
8	Driver	1	
9	Part Time Sweeper	1	
Quality Control Section, Palakkad			
1.	Assistant Engineer	1	
2.	Overseer Grade II	1	

3.	Overseer Grade III	1	
4.	Lascar	1	
Quality Control Section, Malappuram			
1.	Assistant Engineer	1	
2.	Overseer Grade II	1	
3.	Overseer Grade III	1	
4.	Lascar	1	

Quality Control Sub division Kozhikode

Sl. No.	Category	Sanctioned strength	
1	Assistant Executive Engineer	1	
2	Ist Grade Draftsman	2	
3	Head Clerk	1	
4	LD/UD Clerk	3	
5	Typist	1	
6	Office Attendant	2	
7	Part Time Sweeper	1	
Quality Control Section Kozhikode			
1	Assistant Engineer	1	
2	IIst Grade Draftsman	1	
3	IIIrd Grade Draftsman	1	
Quality Control Section Kalpetta			
1	Assistant Engineer	1	
2	IIst Grade Draftsman	1	
3	IIIrd Grade Draftsman	1	

Quality Control Sub Division, Kannur

Sl. No.	Category	Sanctioned Strength	
1.	Assistant Executive Engineer	1	

2.	Ist Grade Draftsman	1	
3.	Head Clerk	1	
4.	LD/UD Clerk	3	
5.	Typist	1	
6.	Office Attendant	2	
7.	Driver	1	
Quality Control Section, Kannur			
1.	Assistant Engineer	1	
2.	III Grade Overseer	1	
Quality Control Section, Kasargod			
1.	Assistant Engineer	1	
2.	Ist Grade Overseer	1	
3.	III Grade Overseer	1	

Thrissur Division

Sl. No.	Category	Sanctioned strength	Remarks
1	Exe. Engineer	1	
2	Asst. Exe.Engineer/Tech. Asst.	1	
3	1st Grade D'man	1	
4	2nd Grade D,man	2	
5	Blue Printer	1	
6	Divisional Accountant	1	
7	Junior Supdt	2	
8	Senior Clerk/Junior Clerk	8	
9	Typist	1	
10	Office Attendant	3	
11	Watchman	1	
12	Part Time Sweeper	1	
		23	

Additional staff requirement in the newly set up QC Labs

1.Quality control lab at Thrissur

Sl. No.	Category	Required strength
1	First Grade D'man	1
2	Third Grade Overseer	1
3	Worker Grade I/Lascar	2

2.Mini quality control lab at Aluva, Ernakulam

Sl. No.	Category	Required strength
1	Third Grade Overseer	1
2	Worker Grade I/Lascar	1

3.Quality control lab at Palakkad

Sl. No.	Category	Required strength
1	First Grade Overseer	1
2	Worker Grade I/Lascar	1
3	Night Watchman	1
4	Sweeper	1

4.Quality control lab at Kozhikode

Sl. No.	Category	Required strength
1	First Grade Dman/Lab in charge	1
2	Worker Grade I/Lascar	2

Moreover the offices has a shortage of staffs. These vacancies should be filled at the earliest for the smooth functioning of the said offices.

Measures taken for quality improvement awareness

As a part of enhancing the quality monitoring skills of field offices under both execution and quality control wing, Assistant Executive Engineer, Quality control Sub Division, Thrissur has shared his valuable knowledge as a resource person in the state level online training program on Quality monitoring and Quality control of works conducted on 13/10/2020, 03/12/2020 and 04/12/2020, organized by KERI Peechi.

Conclusion

The testing of materials and concrete etc. as the part of routine first tier quality control process by the execution wing are now done in the outside laboratories. Such test results can be more credible, authoritative and trustworthy if these are done in Quality Control Labs under our control. After posting necessary Lab staff, additional revenue can be generated, through consultancy works and doing tests of private agencies, other Departments and for contractors conducting tests as per agreement .

I. QUALITY CONTROL DIVISION, KOTTARAKKARA

I.QUALITY CONTROL DIVISION, KOTTARAKKARA

DURING 2021-22.

INTRODUCTION

At Present Quality Control Division Kottarakkara have Four Sub Divisions at Thiruvananthapuram, Kottarakkara, Alappuzha and Kottayam and Seven sections which are Thiruvananthapuram, Kollam, Kottarakkara,Alappuzha, Pathanamthitta , Kottayam and Idukki under its control. This Division has jurisdiction over six districts namely, Thiruvananthapuram, Kolam, Alappuzha, Pathanamthitta, Kottayam and Idukki.

1. Irrigation Quality Control Sub Division, Thiruvananthapuram

Irrigation Quality Control Sub Division, Thiruvananthapuram Office is under the control of IDRB Chief Engineer, and Headed by the Director, Kerala Engineering Research Institute, Peechi. Our Division office is at Kottarakkara and Sub Division consists of two section at Thiruvananthapuram and Kollam. All Minor Irrigation, Major Irrigation, Inland Navigation works in Thiruvananthapuram District and Kollam are to be monitored by each section. As per the Department Quality Manual Second Tier Quality Tests are conducted by these section offices on random basis. It includes site inspection, monitoring the method of construction as per norms, sample collections, testing and analysis the test result with Indian Standard Codes, and records it on test result register. Then inform the concerned execution wings to take necessary corrective measures if needed and also submit the details to higher authority for information.

1.1 The main objects of formation of Sub Division

The main objects of forming this sub division is to be monitoring and ensure the quality of works executed under its jurisdiction are as per Specification and standards. If any deviation from test result values as per manual were obtained can be informed to the execution wing for rectification.

1.2 Present Functioning Activities and Achievements

As per the department quality manual our office done the second tier quality tests on random basis.It includes site inspection, monitoring the work as per specifications and standards, Sample collection, Testing, Analysis the test result with relevant Indian standardsand submit quality inspection report to higher offices.

Mainly Samples of M15 and above strength concrete works were taken for testing compressive strength of 28 days. Minimum three samples cubes were collected from different batches. During inspection brand and grade of cement used for the work and the physical appearance of other construction materials used for the work were noted and reported. After the site inspection the quality report in prescribed format will submitted to higher office along with test results.

In connection with Modernization of Quality Control Lab Technical Sanction for Rs.30,08,200/- was obtained for 8 numbers of works and of which 3 works were completed and 2 work is ongoing. Agreement was executed for two of them and will start soon. One work from Thiruvananthapuram section was transferred to Kollam Section due to delay in starting the lab building. Electrification and Plumbing work of Kollam section is to be done in the next phasefor proper functioning of lab. After setting up of new lab we can avoid the dependency of other agencies for testing Concrete Cube samples and other construction materials. It will also generate the source of income to our department.

1.3 Number of Inspections and Tests Conducted During this Period

During the Financial Year 2021-2022, Thiruvananthapuram section conducted 91 Site Inspections and 60 cube samples were tested of which 46 passed and 14 failed. Kollam section conducted 83 site inspection and74 cube samples were tested of which 71 passed and 3 failed. All test results details are reported to concerned execution division, sub division and section offices. And give instruction to take necessary corrective measures.

1.4 Pictures of test conducted on major and important works at Thiruvananthapuram Section.

Pile cap for adjustable bridge at Karikkakom of Inland Navigation Section No. 3

Drip Building Site- *Grade slab and roof slab Irrigation Section No: 2* 	*Cube samples From side protection wall of Killiyar Irrigation Section, Thiruvananthapuram* 

Quality Control Section, Kollam ***Compression Testing Machine***

Sample collected from the Different Batches from Punalurcheckdam site

Rennovation of Pond – M.I. section Chathannur

Pre- cast Pile concreting For Munroe Island Village Tourism Project.Irrigation Section Sasthamcotta.

Covering Slab to the leading channel – M.I. section Kundara.

2. Irrigation Quality Control Sub Division, Kottarakara

Quality Control Wing was formed in the Irrigation department in the year 1995. The control of the Sub Division is attached to the Quality Control Division, Kottarakara. There are one section office and Quality Control Lab under this Sub Division i.e, Quality Control Sub Division, Kottarakara covering the areas under Kallada Irrigation Project which is distributed in Kollam, Pathanamthitta and Alappuzha districts about 915 km.

2.1 Functional Activities

The main function of the Quality Control Section office is to inspect the quality of concrete and construction materials (coarse & fine aggregates, cement) used in the construction of work sites in the offices under the KIP and to give necessary instructions on site. Sieve analysis of coarse and fine aggregates used for construction and compressive strength of concrete samples after 28 days of curing and reporting is done by the section office. The main works are to inspect the quality of lining works, road works, side wall and protection wall of the left and right bank canals of the KIP and submitting of site Investigation report and Test results regulating to the execution office. In addition, the quality of the concrete samples collected from the Quality Control Offices, Kollam and Pathanamthitta and other department is tested and the test result is given to respective Assistant Engineers.

2.2 Functional Achievements

During the financial year 2021-22, 97 intimations were received, 97 inspections were conducted and 49 concrete samples were collected. Results of 49 samples were submitted. 160 samples brought from the Quality Control offices at Pathanamthitta and Kollam were tested and the result were given to the respective Assistant Engineers. 9 samples were obtained from other department and test results were given to respective Assistant Engineers. Rs.6782/- in fees has been received and paid in treasury. Lab equipment's worth Rs.229217 has been procured during the Financial Year 21-22 for the smooth running of the lab. In addition, through CPRCS has placed an order for the purchase of a Laptop and a desktop with UPS required for the operation of the division and sub division offices. They are expected to be available in May.

2.3 Aims for the year 2022-23

Aims to inspect all intimations received from KIP offices during financial year 2022-23. With CTM, the compressive strength of concrete samples can be tested. In addition samples brought from Pathanamthitta and Kollam Quality Control offices, other departments and private agencies can be tested. Quality Control lab also has aggregate Impact Testing machine, Aggregate crushing value apparatus sieve shutter for coarse and fine aggregates machines installed. The result can be tested on the respective machines as per the requirement. It is hoped that this will increase Government Revenue.

3. Irrigation Quality Control Sub Division, Alappuzha

Irrigation Quality Control Subdivision, Alappuzha was formed in 1995 with two section offices one at Alappuzha and the other at Pathanamthitta Districts. Irrigation Quality Control Section, Alappuzha conducts inspection of irrigation works under Alappuzha district which includes Major, Minor , PIP and some works under Kuttanad Package. Irrigation Quality Control Section Pathanamthitta conducts inspection of irrigation works under Pathanamthitta district which includes works under Major, minor and PIP.

Irrigation Quality Control Section Alappuzha office functioned at Mini Civil staion Alappuzha which has a Mini lab in which sieve analysis of aggregates carried out Concrete cube samples are tested in Quality control Lab in Thannermukkom under Inland Navigation and Kuttanadu Package. Irrigation Quality Control Section, Pathanamthitta office situated on Pathanamthitta Civil station compound. It has a lab in which sieve analysis of aggregates are carried out Concrete cube samples are tested in the lab of Quality control Section, Kottarakkara water samples are tested in Water Authority lab in each districts.

Proposal for new lab under Irrigation Quality Control Subdivision, Alappuzha at Alappuzha is pending due to some issues related to the transfer of land from revenue department.

3.1 Activities

Works carried out in the above offices in Alappuzha and Pathanamthitta district ares inspected by the sections and collected samples of Coarse aggregate fine aggregate, concrte and water.

Concerete cube samples collected by Irrigation Quality Control Section Pathanamthitta were initially tested at Musaliyar Engineering College Malayalappuzha. Now they are tested at Quality control lab at Kottarakkara.

Results of the samples collected from the 43 section offices are tested and submitted to this office. They are verified in this office and submitted to Quality Control Division, Kottarakkara. Results not satisfied are intimated to the execution sub divisions for necessary action.

Due to Covid 19 pandemic and lockdown number of inspections conducted reduced and achieved only 185 nos.

1. **Activities under Irrigation Quality Control Section Lab , Alappuzha**

Inspection conducted by Irrigation Quality Control Section, Alappuzha

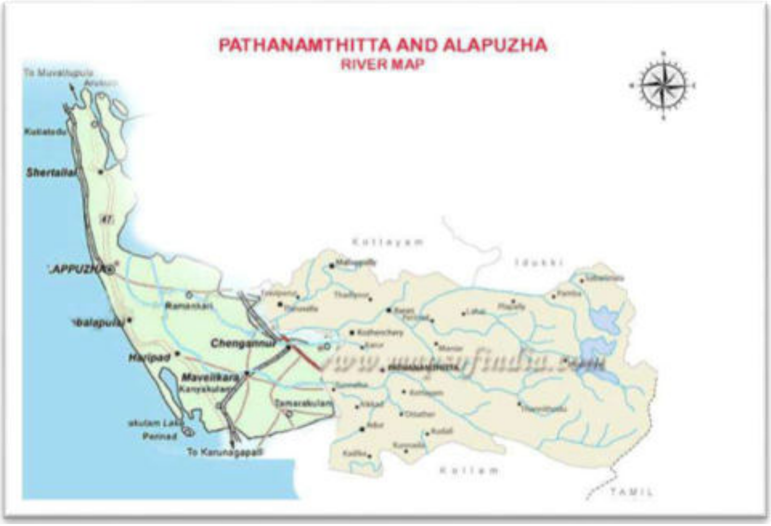
3.3 Activities under Irrigation Quality Control Section, Pathanamthitta

3.4 Inspection conducted by Irrigation Quality Control Section, Pathanamthitta

Irrigation Section, Ranni

Rivers

There are 4 rivers namely Achencovil, Pampa, Manimala and Kallada flows through the jurisdiction of this office



Additional Work

Staff of Irrigation Quality Control Section, Pathanamthitta participated in the work WRD – Kuttanad Desilting of River Coarse held by KERI, PEECHI. The team collected the soil in various area of Rivers.

Due to non availability of Department Vehicle, two vehicles are hired for Irrriation Quality Control Sub Division and Section Alappuzha and Quality Control Section, Pathanamthitta for conduction inspection

Haritha Keralam

Haritha Keralam Mission certified our Alappuzha office as Grade C in Green Protocol.

4. Irrigation Quality Control Sub Division, Kottayam

Quality Control Subdivision, Kottayam conducts regular quality tests for all irrigation works of Kottayam and Idukki districts. The work of this office helps to improve the quality of irrigation works in these two districts and thus benefit the public. The object of Quality Control management is to collect, process and then communicate the data related to the quality of materials and wokmanship, as well as the finalized items of the work to the competent authorities. Sub division is responsible for approving the results of tests conducted in the section laboratories and forwarding it to the Executive Engineer of the Quality Control wing and the field Engineers. Random site inspections are done by the subdivision to monitor the quality control process and any short fall in the quality of works is brought to the notice of field officers. There are two sections under this Subdivision, one at Kottayam for Kottayam District and another at Muttom for Idukki District.

4.1 Kottayam Section

The quality monitoring of 6 sections under 2 subdivisions of Minor irrigation division Kottayam and 6 sections under 2 subdivisions of Major irrigation division Kottayam comes under this office. In addition to that monitoring of works under MRVS and other projects in Kottayam district also comes under this office.

4.2 Idukki Section

The quality monitoring of 12 sections under 4 subdivisions of Minor irrigation division Kattappana and 4 sections under 2 subdivisions of Major irrigation division Kottayam comes under this office. The ongoing work of Pattissery Dam under Pampar Project Section No.3, Marayoor was handed over to Muvattupuzha Quality Control Section on 12-11-2021.

4.3 Present Functional Activities And Achievements

The main functional activities of this office include quality monitoring of Irrigation works in Kottayam and Idukki districts and conduct second tier test for these works. Testing and report preparation is done as per the new and updated Indian standards. The main tests conducted through this office are compressive strength of concrete, sieve analysis of fine and coarse aggregates etc. Field tests such as slump test, bulking of fine aggregate, PH of water etc are tested whenever needed.

4.3.1 Quality Achievements

We have monitored the quality aspects of works amounting 83 crores in this year under our jurisdiction. In this financial year number of sites visited by the quality control wing is increased when compared to the previous years. In Kottayam section, out of 76 intimations received 75 sites are attended and in Idukki section out 86 intimations received 84 sites are attended. Compressive strength tests of concrete cubes gave unsatisfactory results for 10 works under Kottayam section and 2 works under Idukki Section during this year. Testing and report submission were done by incorporating the latest Indian standard codal provisions. For all site inspections, a detailed inspection report explaining the nature of work, material quality, specification of work and other various quality parameters including any faulty construction practices noticed at site were submitted to Assistant Executive Engineer, which are being forwarded to the agreement authorities from the Subdivision for their early attention in this regard. In this year first tier test by contractors has been started for various works as per our directions according to Quality Control manual.

During this year KERI conducted an “Online Training Program for Quality monitoring and Quality control of works”. Sri Babu M S, AEE QC Subdivision Thrissur and Smt. Merin Thomas, AEE QC Subdivision Kottayam were the trainers. All technical staffs in this office attended the training program and recieved training certificate from KERI. Also a remarkable change is noticed at various sites as an outcome of the training.

4.3.2 Financial Achievements

In this financial year testing facilities for public and other departmental works has been started in our labs. Currently limited testing facilities such as concrete compressive strength tesing, sieve analysis of coarse and fine aggregates, setting time and consistency of cement are available in our lab. Through these facilities, we have generated a revenue of Rs.29,060/- in this year from Kottayam Section. For this purpose we are utilizing E treasury platform so that public can easily pay testing fees directly to the concerned head of account by remitting challan through the account of Assistant Executive Engineer Quality Control Subdivision Kottayam.

4.3.3 Physical Achievements

In this year Acer desktop computer, Almarah, Steel table, Steel full arm chair, Anjili wood armed chair etc were purchased for Sub division and Section offices. In addition to that for improving the testing facilities of materials, equipments such as Vicat apparatus, Cylindrical mould, tamping rod, curing box, PH meter pen type, Bulk density cylinder, Flakiness gauge, Elongation gauge etc were purchased for both the sections. Site for constructing a new quality control lab was sanctioned at MVIP compound Muttom for Idukki Section and at Kodimatha for Kottayam Section.

4.3 Photos of Site Inspections, Kottayam Section

Lining work of Moonganicheckdam under Irrigation section Kanjirappally

Sample collection from intermediate belt concrete of side protection wall under Irrigation section Changanasseri

4.4 Photos of Site Inspections, Idukki Section

Construction of Pattissery dam

Construction of Pallivasal Checkdam

a. Bottlenecks

Since irrigation development project / works amounting to several crores under various schemes are being carried out every year, quality control checking of works at various stages of construction are inevitable to ensure the quality and standards of the works.

In order to conduct proper quality control tests in time, a laboratory with most modern equipments and machinery are very essential and inevitable .Due to insufficient infrastructure and testing facilities, the scope and objective of the quality control wing cannot be achieved properly at present. Paucity of funds and non availability of own and spacious laboratory facilities are the constraints to the office from exercising the envisaged objectives. Hence modernization and strengthening of quality control wing is very essential. At present the quantum of works approaching for quality test substantiate the need for modernization and upliftment of testing laboratory facilities of the office.

4.6 Future Plans

1. Conducting frequent surprise visits for major works under the jurisdiction
2. Establishing quality control laboratory at Kottayam and Idukki Districts
3. Setting up concrete mix design facilities and soil testing facilities in the labs.
4. Executing field tests such as Non Destructive Testing , field density tests etc for Irrigation works and outside works

Conducting training programmes for overseers

J.IWR DIVISION PALAKKAD

J .IWR DIVISION PALAKKAD FOR THE YEAR 2021-2022

The following are the activities carried out by IWR Division Palakkad during 2021 – 2022

1. PREPARATION OF PREFEASIBILITY REPORT ON SEETHARGUNDU DIVERSION SCHEME

The Chulliyar dam is constructed across Chulliyar river, 2.4 km upstream of its confluence with Meenkara river. The water spread area of Chulliyar Reservoir is 165Ha and live Capacity is 13.70 Mm^3 at FRL 154.08m.

Chulliyar Dam

The project receives water from:

1) Direct rainfall from South West and North East Monsoon
2) The surplus water from Meenkara Reservoir (which is connected to Chulliyar reservoir by a link canal of length 4.2Km) and
3) Water from Palakappandy Diversion Scheme which was commissioned in 2016

Out of 35 years data available (from 1977 to 2021), the reservoir was filled to its maximum capacity only in 9years. It is shocking to note that only 10% and 33% capacity of the reservoir was filled in the consecutive years of 2016 and 2017, even after the commissioning of Palakappandy diversion scheme. Palakappandy diversion scheme was also not successful as expected and it failed to meet the water requirement of Chulliyar reservoir. Hence, Seethargundu diversion scheme is envisaged to utilize the water availability in the catchment of Seetharkundu river especially during the south west monsoon to augment the Chulliyar project.

The average 10 daily discharge series for the months of June, July and August, provide an approximate yield of 12 Mm^3, though the 75% dependable flow is 1.4 Mm^3.

The proposed project has three major components namely weir, ductile iron pipe line and sedimentation tanks. The weir of height 2m, length 30m and top width 2m is proposed at Athikundu to divert water from Seethargundu catchment area. The pipe line of diameter 800mm is provided from Athikundu weir to Palakappandy canal for a distance of 3390m. The system is designed to convey a daily discharge of 0.04Mm^3. The anticipated expenditure for the project is 8.90Cr.

CONCERNS / UNCERTAINITIES

1) From the time of commissioning of the Chulliyar dam, it was completely filled only in 9years (from the available data).

2) The Palakapandy Diversion Scheme claimed to have an effective runoff of 22.08 Mm^3 from its catchment, whereas the maximum storage capacity of the Chulliyar dam is 13.7 Mm^3 only. But, even after the commissioning of this scheme in 2016, the dam is not completely filled till date (even in 2018).

3) Seethargundu is an ungauged catchment, hence the rainfall data selected for Hydrometeorological studies is from rain gauge station in Manalaroo estate of nearby sub catchment in Bharathappuzha basin. This may not be a true representation of Seethargundu catchment.

4) Though the 10 daily flow for the months June, July and August shows a yield of 12 Mm^3, the 75% dependable flow for these months is only 1.4 Mm^3.

5) Athikundu area has a very steep terrain, hence storage provided is very low. So the project is designed as Diversion Scheme. Hence the maximum utilization of the monsoon flow may not be feasible.

6) The daily designed discharge is 0.04 Mm^3. The maximum water that could be conveyed during the months of June, July and August is only 3.68 Mm^3 (provided 0.04 Mm^3 is available daily)

7) Though the project is "need of the hour" for the farmers, BC ratio may not be justifiable (Rough estimated cost of the project is 8.90 crores)

2. QUANTITATIVE AND QUALITATIVE ASSESSMENT OF SEDIMENT DEPOSITS IN RIVERS DRAINING INTO VEMBANAD LAKE

Five rivers namely, Pamba, Meenachil, Manimala, Achancovil and Muvattupuzha enter the Vembanad Lake before emptying into the Arabian Sea.Among the five, Pamba, Meenachil and Manimala have a major role in causingflooding in Kuttanad region. 2018 flood in Pamba, four consecutive floods (2018 to 2021)in Manimala & Meenachil and 2021 land slide in Manimala have significantly reduced the carrying capacity of these rivers.Big rock pieces, boulders, debris and soil particles are deposited in the rivers. The river course has changed in some reaches. The bed level has gone up. Deltas are formed. The river has become more prone to flooding. People who live near the river and its tributaries indeed are deeply concerned about the decline in the river's water retention capacity. There is now acute shortage of water in summer. The mighty rain-fed river turns almost completely dry in summer. Unless some serious and immediate efforts are taken, frequent floods and droughts will occur in these catchments, affecting lakhs of people who depend on these rivers.

Desilting is done to remove the fine silt and sediment that has accumulated in the river in order to restore its natural capacity, without widening or deepening of the river. Desiltation works have the potential to improve the hydraulic performance of a river and to reduce the chance of flooding.

Topographical survey by RTK method has been conducted in the critical locations, which were identified by the Executive Engineers in charge of these rivers. The quantity of the sediment deposit has been computed as follows:

Sl No.	Name of the river	Quantity in m^3
1	Pamba	13,92,134
2	Meenachil	2,49,889
3	Manimala	1,67,092

Soil samples were collected from the critical locations in Pamba and Meenachil and tested the composition and gradation of the sample in the Soil laboratory of KERI, Peechi.

3. PREPARATION OF ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE DESILTATION OF ERIS IN CHITTUR TALUK

There are three Eris associated with the Chitturpuzha project viz. Kambalathara, Venkalakkayamand Kunnampidari. The Moolathara Regulator diverts the PAP water received from Manakkadavu weir to left bank, right bank and other river systems. The storage capacity of the regulator is only 0.5488 Mm3. Water diverted to Left Bank Canal system flows through a feeder canal (referred as High Level Canal) for about 7 km to reach the Kambalathara Eri and gets stored. Kambalathara Eri is act as a balancing reservoir for the left bank canal system, having an ayacut area of 8210 Ha. This Eri has a storage capacity of 3.00 Mm^3 spread in an area of 81 Ha. Water stored in this Eri is released to Venkalakkayam Eri and to the Left Bank Canal system as per demand of ayacut. Water stored in Venkalakkayam Eri is used to cater the needs of ayacut of Thembaramadakku which accounts to 3221 ha. The storage capacity of Venkalakkayam Eri is about 3.08 Mm3 and having a water spread area of 62 ha.

In due course, the eris got silted up, thus reducing the capacity of the reservoirs. Proposal for desilting of the eris is taken up by the Siruvani Project Circle Palakkad. The most important advantage of de-silting of reservoirs / Eris is that, it enhances the water holding capacity of the water bodies and thereby contributes to augmentation of water resource and ensures water security. It enhances the life of the reservoir / Eri and avoids the requirement of storage enhancement methods such as increasing the dam height.

As directed by the Empowered Committee meeting held on 7/10/2021, Superintending Engineer, Siruvani Project Circle, Palakkad has requested KERI to prepare the Environmental Management Plan vide letter no D6-1277/2017/Eri's dated 7/10/2021.

Scope of the EMP

1) Conducting Environmental Impact Assessment Study, which includes data collection of parameters related to air, water and noise environment, soil characteristics, aquatic life, flora and fauna, etc and prediction of probable impacts on the environment and ecology due to the entire desiltation, separation and transportation operations.

2) Preparation of Environment Management Plan (EMP) based on the Comprehensive EIA study which includes the recommendations of mitigation measures to minimize the adverse

impacts of pollution on environment and ecology due to entire desiltation, separation and transportation operations, disposal of separated material etc.

Objectives of the EIA Study

1) Assessment of the existing status of air, water, land, biological, climatic, socioeconomic, health and cultural component of environment.

2) Identification of potential impacts on various environmental components due to activities envisaged during the desilting operations

4. RECTIFICATION OF ATTAPPILLY REGULATOR CUM BRIDGE

Attappilly Regulator Cum Bridge is constructed across Kurumali River linking Varandarappilly and Mattathur Gramapanchayaths of Pudukkad Constituency to store water for irrigation and drinking water purposes. The work is not completed in all respect yet. Meanwhile, the left bank approach road of Attappilly Bridge has subsided on 04.06.2021 and subsequently, the bridge was closed for traffic.A further subsidence occurred in the left bank on 25.06.2021.

With a view to improve the performance / life of the Attappilly Regulator cum Bridge structure, the following examinations are performed by Kerala Engineering Research Institute

Investigation/Test	**Inferences**
Load Test (25.08.2021)	The bridge satisfies all the acceptance criteria as per the clause 6.8 of IRC SP 51 Measured deflection (1.4mm) is less than the theoretical deflection (1.439mm) Crack width formed (0.10mm) is less than 0.30mm (normal/moderate exposure) and 0.20mm (severe conditions of exposure) Min. percentage recovery of deflection (84.62%) is more than codal provision of 75%.
Review of M. Books (25.10.2021 – 24.11.2021)	Assessed the present status of the construction based on the available MBs
Reconnaissance survey/Transit walk (19.08.2021, 17.01.2022)	There is a great demand for water - for agricultural, drinking and domestic purposes in the panchayaths surrounding the Attappilly RCB. Temporary bunds can be avoided for heading up the water if the RCB is made operational.
Soil Investigation (01.10.2021 to 03.11.2021)	The rock formation exhibits a downward slope from left to right at the weir portion. Downstream portion of the

	RCB also shows a variation in rock level, i.e. -1.73 at the left side and -2.85 at the right.
Seismic Refraction Survey (12.11.2021)	The results of seismic refraction survey at Attappilly are somewhat matching with the bore-log chart
Soil Testing (05.11.2021)	From the grain size analysis, it is observed that 14 soil samples contains more than 50% of coarser particles
Concrete and Rock core Test (25.11.2021, 15.12.2021)	Extensive voids and honeycombing are observed in the concrete core samples collected from weir. But the tested core samples have compressive strength in the range of 21N/mm2 to 28N/mm2. Core samples from left abutment have compressive strength in the range 23N/mm2 to 27N/mm2. The compressive strength of rock samples from BH1, BH2, BH3, BH4 are in the range of 29 to 219 N/mm2 and from BH5B, BH6, BH7 are in the range of 46 to 115 N/mm2.
Topographical Investigations (07.12.2021-14.12.2021)	
Hydrological investigations (20.10.2021-30.11.2021)	
Underwater investigations (20.12.2021, 23.01.2022)	Present condition of the structures under water is examined.

Based on the investigation results, it is concluded that the bridge is safe for the serviceability criterion. The design for the approach road is submitted as an immediate solution and the rectification of the regulator as the permanent solution.

5. SUPPLY AND DEMONSTRATION OF SMART STATION FOR IWR DIVISION PALAKKAD

Investigation for Water Resources (IWR) Division Palakkad is one of newly formed sub unit of KERI for conducting Investigation of various projects proposed in Irrigation department and to prepare Detailed Project Reports. For the feasibility study of any project, it is very essential to conduct an efficient and expeditious survey, for which sophisticated instruments like smart station is inevitable. Hence an estimate was prepared for the procurement of a Smart station and supply and demo was completed on 17.03.2022.

Smart station proposed here is a combination of GNSS (a base and rover with GPS, GLonas, BeiDOu, Galileo receivers), Disto Controller and a motorized Total Station. The purpose of the equipment is to determine the position of a point on the earth accurately and then to carry out the detailed survey of the area of interest. Integrated GSM/GPRS facility with 4G supporting module would enhance the scope of survey even in forest land. Disto Controller which has an inbuilt app for measuring the distance of inaccessible points up to 100m. Stakeout app which helps in locating a point with known coordinates on the ground will be of great help.

L.TECHNICAL COLLABORATIONS WITH OTHER INSTITUTE

L.TECHNICAL COLLABORATIONS WITH OTHER INSTITUTE

L.1 INTRODUCTION

The major technical collaboration namely Sand Budgeting study with National Institute of Technology, Kozhikode; Hydraulic Model Study with College of Engineering, Thiruvananthapuram; Conducting physical and mathematical model studies for computation of discharge through river sluices and spillways in 8 designated dams in Cauvery Basin The details regarding the activites are explained below.

L.1.1 Sand Budgeting study with National Institute of Technology

Unscientific sand mining has been one of the burning issues in the state Kerala which has caused ecological/environmental imbalances. As sand is used extensively in construction, the amount being mined is increasing exponentially.Lack of proper scientific methodology for river sand mining, monitoring systems, regulatory policies and environmental impact assessments have led to indiscriminate mining, triggering severe damage to the environment and related ecosystem services.

Sand Auditing is the procedure to evaluate the process of sand mining in a river or part of the river after a specific period of mining- with an aim to maintain the overall environmental quality of the river. The sand auditing being conducted by the NGOs for Department of Revenue is not scientific as it is based merely on the level of water without taking into consideration the reduction in bed levels. Hence the volume of sand accounted for mining is not correct. Under these circumstances, Director, KERI had issued orders to submit a proposal specifying the technical method by which an assessment of the quantity of sand available in the river bed, the quantity of sediments being deposited and hence the quantity that can be allowed for mining.

The Chaliyar River Basin has been selected for a pilot study.It is the fourth longest river in Kerala having a length of 169 km and a total drainage area of 2,923 sq km. The objectives of this study are:

1) To ensure that sand and gravel extraction is carried out in a sustainable way
2) To maintain the river equilibrium with the application of sediment transport principles in determining the locations, period and quantity to be extracted.

Detailed Project Report has been submitted and financial sanction has been accorded by Chief Engineer, IDRB for an amount of Rs.28Lakhs.

The methodology followed for sand auditing in these rivers includes Mapping of the river channel,Ascertaining Pristine Condition of the Rivers, Sediment Sampling, Sediment Transport Model, Model Simulation, Result Analysis includes Sediment Spatial Plot, Sediment Time Series, Sediment Cross section Plot and Monitoring Plan.

Since KERI is new to the field of Sediment Transport Modelling, this portion of the proposal was decided to be outsourced. NIT Kozhikode has already been involved in such studies using HEC/MIKE software. Our Institute had discussed with NIT Kozhikode and they expressed their willingness to collaborate with our Institution for a pilot study, which includes capacity building of our Engineers. MoU has been signed with NIT Calicut to undertake the study using HEC and ArcGIS software.

There are two model areas under this division which accommodate a number of previous extensive project models. The maintenance of this model area is done by this division. The hydraulic models in these model areas help the students to study about dams and also increase possibility of tourism. The division also maintains a three-dimensional model of Kerala and it is a centre of attraction for the tourists in Peechi.

Hydraulics Division had the facility for calibration of the current meter and it was stopped long years ago due to damage of the testing facility. The renovation work of test facility of calibration of current meter is included in the action plan of the financial 2022-23 which will enable KERI to provide this service for the Irrigation department. The division has notch calibration facility also. The duty of operating internet infrastructure facilities of all offices in KERI is entrusted with this office.

Apart from the hydraulic studies, the division maintains a meteorological station. It is located on the west bank of Peechi dam, near Peechi House. From the station, measurements of weather parameters such as atmospheric pressure, temperature (Min.& Max), humidity, rainfall, evaporation, wind speed, wind direction and sunshine are observed using manual meteorological observations and automatic weather station. The monthly weather data as obtained is submitted to the Joint Director, Director and Superintending Engineer Hydrology, every month.

L.1.2 HYDRAULIC MODEL STUDY WITH COLLEGE OF ENGINEERING, TRIVANDRUM

Kuttaydi Dam is built across Kuttyadi river at Peruvannamoozhi in Chakkittapara Grama Panchayath in Kozhikkode District. It was constructed as part of Kuttyadi Irrigation Project.The project consists of a masonry dam across Kuttiyady River and 13 earth dams to maximize the storage of the reservoir. The construction of this project started in 1962 and was commissioned in 1973. Based on the recommendation of the committee on dam safety it was decided to modify the spillway and stilling basin of Kuttiyadi dam.The Chief Engineer, IDRB,Thiruvananthapuram (Vide Lr.No. No:675/DAMS-AD6/1987/IDRB-Part File I dated 30.04.2018) directed KERI to undertake the physical modelling of the proposed modification of spillway of Kuttiyadi dam.

The physical model study of Kuttyadi dam was accomplished through collaboration with College of Engineering, Trivandrum. The technical collaborations are relationships of great mutual benefits which foster the academic and institutional development. These eminent alliances with renowned academic institutions will help to acquire knowledge, exposure skills and aptitude in the relevant field. The comprehensive application of conceptual with practical aspects of technology will inculcate the culture of rapid problem-solving and innovative thinking.

A mutual agreement (MOU No.02/2018-19/DIR/ KERI dated 16.5.2019) was executed between KERI and ITC &SR (Centre for Industrial training consultancy and sponsored research), CET. The model formulation, simulation of experiments was done under the guidance ofProf. Dr.Jairaj P G and Prof.Thulasidharan Nair, Department Civil

Engineering, College of Engineering Trivandrum. The study involves in verifying the flow characteristics of the proposed modification of spillway and stilling basin for energy dissipation in the dam.

A comprehensive and geometrically similar model of Kuttyadi dam project and its spillway was constructed in the hydraulics lab. Spilling part of the model was constructed with pressure points to measure piezometric heads. The model was performed under different operating conditions of the spillways.

Based on the details supplied by the Irrigation Design and Research Board (IDRB) on the modified design of the spillway, the physical model of the prototype spillway was simulated in the hydraulics laboratory of KERI, and the performance of the model was analysed.

L.1.3 CONDUCTING PHYSICAL AND MATHEMATICAL MODEL STUDIES FOR COMPUTATION OF DISCHARGE THROUGH RIVER SLUICES AND SPILLWAYS IN 8 DESIGNATED DAMS IN CAUVERY BASIN

Director KERI, is a member of subgroup constituted for conducting physical and mathematical model studies for computation of discharge through river sluices and spillways in 8 designated dams in Cauvery Basin. Several meetings and brainstorming sessions were conducted by CWRC and standard format for submission of proposal by the designated institutes was identified with the help of subgroup member. Finalisation in selecting the competent institute for conducting model study will be done after the review of standard proforma submitted by individual institutes.

M. START UP PROJECT

M. START UP PROJECT WITH SIMAT

M. 1 INTRODUCTION

India has designated the years 2010-2021 as the "Decade of Innovation." Kerala towards the end of this decade is witnessing a wave of innovative and entrepreneurial efforts from discrete sectors. Startups in Kerala are creating solutions in new and better ways than ever before as they experiment with futuristic technology. In order to address the needs of the irrigation department, the Kerala Engineering Research Institute (KERI) has committed to promote startups. The institute plans to construct an autonomous water level prediction system in canal water distribution system to the irrigation department's needs.

M.1.1 METHODOLOGY

A preliminary discussion to provide viable solutions to the problems faced by the irrigation department was conducted between the officials of Innovation & Entrepreneurship Development Center, Sreepathy Institute of Management and Technology (SIMAT), Vavanoor during the first week of January 2022. As an initial step a prototype to monitor the water level of Peechi dam in real time was designed by the students of the EEE department, SIMAT. The prototype was submitted to Er. Suprabha N (Director, Fundamental & Applied Research, KERI) on 10th March 2022. The prototype needs to be modified for canal automation and to deploy the same in any one canal branch of Peechi irrigation system. If the pilot deployment is successful, the project will be developed for the entire canal branches under the Peechi irrigation system.An android application for the real time monitoring was developed and the working view of the application can be shown as below.

As part of KERI's startup initiative, a prototype for automated real-time water level monitoring was developed. After the prototype has been corrected through regular checks, it can be used to monitor water levels in canal systems in real case.

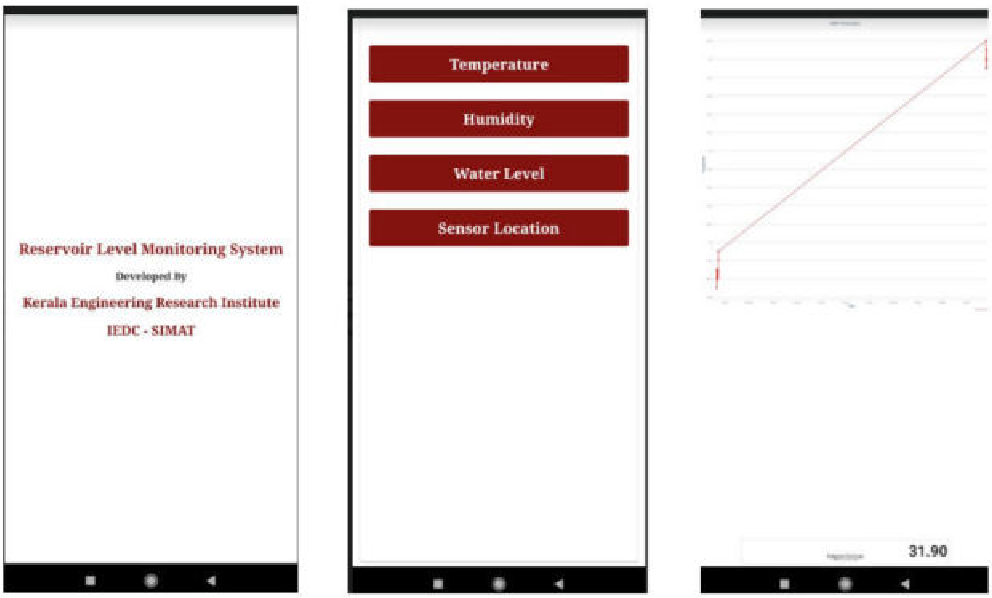


Figure. Android application for real time monitoring

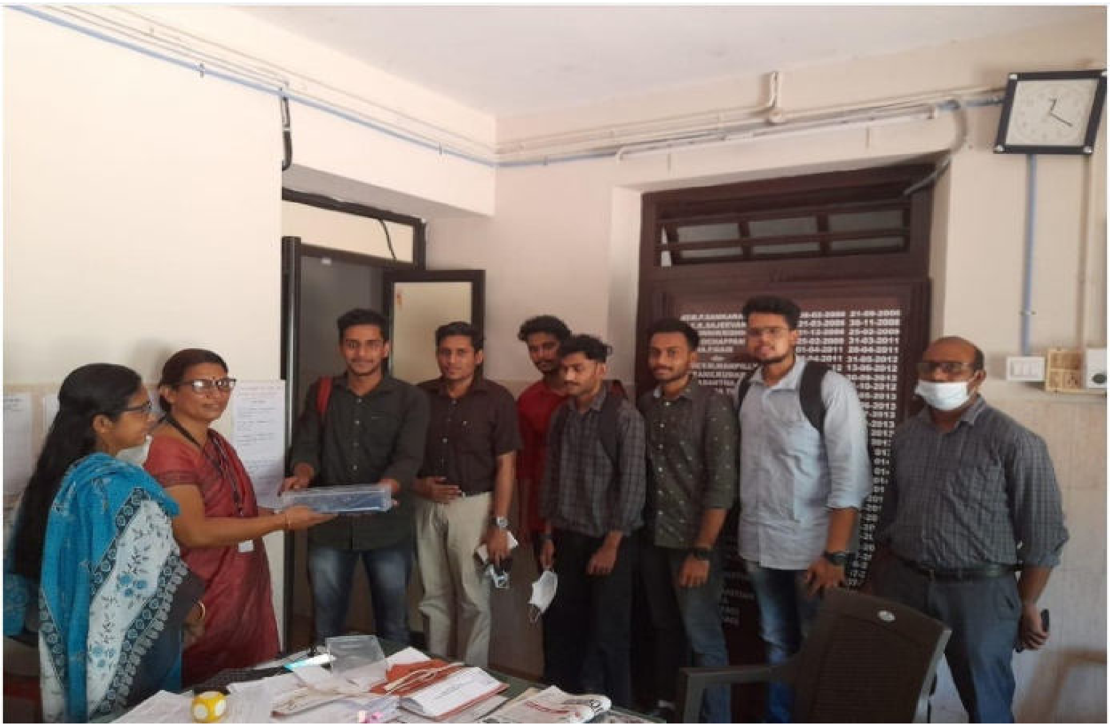


Figure. SIMAT students submitting Real Time Reservoir Water Level Monitoring System to Director, KERI

5. FINANCE

In the budget for the financial year 2021-22 an outlay of Rs. 150 Lakh (Rupees One Fifty Lakhs Only) 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. 28,36,759/- (Rupees Twenty Eight lakh Thirty Six thousand Seven hundred & Fifty Nine only) 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.**	
	Total Amount Received	**55.37 Lakhs**
	Expenditure	
1	Construction Materials Division	15.83 lakhs
2	Soil Mechanics and Foundations Division	21.11 lakhs
3	Instrumentation Division	12.28 lakhs
	Expenditure	**49.22 lakhs**
II	**Joint Director, Hydraulic Research, KERI, Peechi.**	
	Total Amount Received	**94.63 lakhs**
1	Coastal Engineering Division	41.77akhs
2	Hydraulics Division	21.29 lakhs
3	Sedimentation Division	29.11 lakhs
	Expenditure	**92.16 lakhs**
	Total Amount allocated	**150 lakhs**
	Total Expenditure	**141.3858 lakhs**

Details of Expenditure statement for the year 2021 – 22 had been allotted under the Various Head of Account are given below.

Sl. No.	Head of Account	Division	A.S Amount (In Lakhs)	Expenditure (In Lakhs)
I	**Joint Director, C.M.&F.E., KERI, Peechi**			
1	Head of Account: 2701-80-005-93-00-00-00-PV Modernization of Design Wing	Instrumentation Division & Construction Materials Division	**3.55**	**1.86**
2	Head of Account: 4700-80-00-5-99-02 Investigation of Irrigation Schemes	Instrumentation Division & Construction Materials Division	**18.31**	**7.08**
II	**Joint Director, Hydraulic Research, KERI, Peechi.**			
1	Head of Account: 2701-80-005-93-00-00-00-PV Modernization of Design Wing	Sedimentation Division	**0.50**	**0.1475**
2	4701-80-800-88 -00-00 Formation of River Basin Organization)	Sedimentation Division	**10**	**1.18**
3	Head of Account: 4700-80-00-5-99-02 Investigation of Irrigation Schemes	Coastal Division	**7.82**	**0.92**
	Spill Over			
	Joint Director, C.M.&F.E., KERI, Peechi			
1	Head of Account: 2701-80-005-93-00-00-00-PV Modernization of Design Wing	Instrumentation Division	**11.50**	**10.25**
	Joint Director, Hydraulic Research, KERI, Peechi.			
2	4701-80-800-88 -00-00 Formation of River Basin Organization)	Coastal Division	**76 .00**	**17.09**

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/underutilizations 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 up gradation of the personnel of the institute will be taken up as a continuation of the modernization scheme.

APPENDIX – I

VACANCY DETAILS OF TECHNICAL STAFF FOR THE MONTH OF MARCH 2022
Fundamental and Applied Research, KERI, Peechi

Sl. No.	Name of Post	Sanctioned Strength	Present Strength	Place of Vacancy
1	Director	1	1	
2	Joint Director/Executive Engineer	6	6	
3	Deputy Director/ Assistant Executive Engineer	21	20	
4	Assistant Director/Assistant Engineer	49	34	IWR Section 3/1 Agly-1, I WR Section 4/1 Kozhikode-1 Quality Control Section Thrissur-1 Quality Control Section,palakkad-1 Quality Contol Section,Aluva,Ernakulam-1 Quality Control Section,No.2,Koothattukulam-1 JD:Coastal Engineering Field Studies,Thrissur-1 IWR Section 1/2Thrissur-1 IWR Section 2/2Peechi-1 IWR Section 3/2 Malappuram-1 IWR Section 3/1 Agly-1 IWR Section 4/1 Kozhikode-1
5	Research Assistant/1st Gr. D'man	53	40	F&AR,KERI,Peechi-1 Deputy Director Hydraulic Division KERI,Peechi-2, Deputy Director,Coastel Engineering Division-1 Deputy Director Sedimentation Division-2 Deputy Directoor,S M & F Dividion,KERI Peechi-2 Deputy Directoor,C M Dividion,KERI Peechi-1 Deouty Director,Instrumentation Division KERI Peechi-1 Coastal Erosion Studies Section , Kozhikode -1 Coastal Engineering Sub Division Kollam-1 Coastal Engineering Section Kollam-1 QC Sub division,Alappuzha-1 QC Sub division,kottayam-1 QC Sub division,Muvattupuzha-1

				QC;Sub Division Kozhikkode-1 QC:Section,Kozhikkode-1 QC:Section,Kollam-1 QC:SubDivision Kottarakkara-1 IWR Division Palakkad-1 IWR Sub Division No.1 Palakkad-2 IWR Sub Division No.2 Thrissur-1

Sl.No	Weather Elements	Range of the weather data

6	2nd Grade D'man/Overseer	49	33	F & A R,KERI Pechi-1 Deputy Director,Sedimentation Division KERI,Peechi-1 Quality Control Section Kalpetta-1 Qualiyt Control Division Thrissur-2 Quality Control Section No.2,Koothattukulam-1 JD:CM & FE KERI Peechi-1 DD:CM,Division,KERI,Peechi-1 IWR Division Palakkad-1 IWR Sub division No 1 Palakkad-2 IWR Sub diviosion no 2 Thrissur-1
7	3rd Grade Overseer	44	29	Deputy Director,CM Division, KERI, Peechi-1 QC:Section Kasargode-1 QC: Section No.3,Angamaly-1 QC:Section,Palakkad-1 QC:Section,Kalpetta-1 IWR section 1/2 Thrissur-2 IWR section 2/2 Peechi-1 IWR section 3/2 Malappuram-1 IWR section 1/2 Thrissur-1
8	Scientific Assistant	2	0	Deputy Director,SM&F Division, KERI, Peechi-1 Deputy Director,Hydraulic Division, KERI, Peechi -1
9	Lab Attender	2	0	Deputy Director,,Hydraulic Division, KERI, Peechi -1 Deputy Director C M Division KERI Peechi-1
10	Tracer	2	1	Joint Director,Hydraulic Research, KERI, Peechi -1
11	Blue Printer	3	1	Joint Director,Hydraulic Research, KERI, Peechi -1 IWR Division Palakkad-1

Appendix II

1	Temperature	The maximum temperature was 39.5^{0}C in February 2022 and the minimum temperature was 20^{0}C in January and February 2022.
2	Relative Humidity	The maximum relative humidity recorded was 100% in January and august 2021 and the minimum relative humidity was 62% on January 2022.
3	Precipitation	Annual rainfall (2021) was 3585.4mm and the maximum monthly rainfall was 98.4mm in June 2021 and minimum monthly rainfall was 0.20mm in August 2021.
4	Wind Direction	The main wind direction observed from north west and south east directions.
5	Wind Speed	The maximum daily mean wind speed was 8.60 km/hr in February 2022 and minimum daily mean wind speed was 0.11 km/hr in March 2022.
6	Evaporation	Maximum evaporation was 7.9 mm in March 2022 and minimum of 0.2 mm in June 2021.
7	Sunshine Recorder	The maximum duration of bright sunshine was 10hr in December 2021 and January 2022.

Abstract of the weather data from April 2021-March 2022
Station K E R I Peechi

APPENDIX – III

List of Tests conducted in CM Division during the financial year 2021-22

Report No	Details of Client	Description of test	Description of tests
CM 01/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, IRINJALAKUDA	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 02/21-22	WAPCOS LTD, (NISSY ENTERPRISES)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 03/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, KODUNGALLUR	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 04/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, KUNNAMKULAM	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 05/21-22	Assistant Executive Engineer, TransGrid TC Sub Division, Chalakudy (M/s tritech RMC, Mannuthy)	Tests on Coarse & Fine Aggregates	***Coarse Aggregates – 20mm***
			Sieve Analysis
			Flakiness/Elongation index
			Coarse Aggregates - 12.5mm
			Sieve Analysis
			Flakiness/Elongation

			index
			Fine Aggregate-Msand
			Sieve Analysis
CM 06/21-22	Assistant Executive Engineer, TransGrid TC Sub Division, Chalakudy (M/s tritech RMC, Mannuthy)	Tests on Cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM07/21-22	Assitant Executive Engineer, Irrigation project section, Velliyankallu, Thrithala	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 08/21-22		Tests on Cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 09/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, IRINJALAKUDA	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 10/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 11/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes

CM 12/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 13/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 14/21-22	Section Engineer, Office of SSE/W, TCR	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 15/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 16/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 17/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, KODUNGALLUR	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 18/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD	Tests on Steel-Unit weight	Unit weight
CM 19/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, KODUNGALLUR	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 20/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION,	Tests on Concrete	Compressive strength of Concrete Cubes

	IRINJALAKUDA	Cubes	
CM 21/21-22	Chief Executive Officer, Thrissur District Labour Contract Co-Operative Society Ltd.	MIX DESIGN	Sieve analysis
			Specific gravity
			Loose density
			Cement test
			Mix Trials
CM 22/21-22	Executive Engineer, Karapuzha project Division, kalpatta, Wayanad	PILE ECHO TEST	FIELD – PILE ECHO TEST
CM 23/21-22	ASSISTANT ENGINEER, PWD Buildings Section,Kodungallur	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 24/21-22	ASSISTANT ENGINEER, Irrigation Project Section, Velliyankallu, Thrithala	Test on Z type hot rolled sheet piles	Strength and dimensions
CM 25/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 26/21-22	ASSISTANT ENGINEER, Minor Irrigation Section,	PILE ECHO TEST	FIELD – PILE ECHO TEST

	Tirurangadi		
CM 27/21-22	ASSISTANT ENGINEER, PWD Buildings Section, Kunnamkulam	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 28/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 29/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 30/21-22	ASSISTANT ENGINEER, Irrigation Project Section, Velliyankallu,Thrithala	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 31/21-22	Secretary, Peechi Service Co-Operative bank Ltd, pattikkad	Tests on Paver Blocks	compressive strength
CM 32/21-22	MAGTECH ENGINEERS & CONSTRUCTIONS	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 33/21-	MAGTECH ENGINEERS &	Tests on	Compressive strength of

22	CONSTRUCTIONS	Concrete Cubes	Concrete Cubes
CM 34/21-22	ASSISTANT ENGINEER, Irrigation Project Section, Velliyankallu,Thrithala	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 35/21-22	ASSISTANT ENGINEER, Irrigation Project Section, Velliyankallu,Thrithala	Tests on Steel bars	Tensile test, Dimension
CM 36/21-22	Assistant Engineer Quality Control Section,Palakkad	Tests on Steel bars	Tensile test, Dimension
CM 37/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 38/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 39/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 40/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 41/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes

CM 42/21-22	ASSISTANT ENGINEER, Chamravattam project Section III, Eeswaramangalam	Tests on Sheet Pile	Strength test & Dimension
CM 43/21-22	ASSISTANT ENGINEER, Pmpar Project Section 3, Marayoor	Tests on rock core samples	Compressive strength of Concrete Cubes
CM 44/21-22	Project Engineer -24, KIIDc, Thiruvananthapuram	Tests on Steel bars	Tensile test, Dimension
CM 45/21-22	ASSISTANT ENGINEER, Minor Irrigation Section, Mala	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 46/21-22	ASSISTANT ENGINEER, Minor Irrigation Section, Kodakara	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 47/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 48/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 49/21-22	ASSISTANT ENGINEER, Minor Irrigation Section, Shornur	Tests on Sand	Bulking of sand
CM 50/21-22	Deputy Director, Instrumentation Division, KERI,	Tests on rock core	Compressive strength of rock

	Peechi	samples	
CM 51/21-22	M/s. Mahalakshmi Tiles,Elanthuruthy, Kutanellur	Test on clay tiles	
CM 52/21-22	ASSISTANT ENGINEER, MI SECTION, CHALAKUDY	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 53/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 54/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, KODUNGALLUR	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 55/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, IRINJALAKUDA	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 56/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, IRINJALAKUDA	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 57/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 58/21-22	M/s. Global Constructions, Room No. 1, St. Mary's Complex, Chalakudy	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 59/21-22	ASSISTANT ENGINEER, PWD BUILDING	Tests on Concrete	Compressive strength of Concrete Cubes

	SECTION,CHALAKUDY	Cubes	
CM 60/21-22	Sri. Lawrance Chummar, Padinjarathala(H), Karuvannur, Thrissur	Tests on granite paver tile	Compressive strength
CM 61/21-22	ASSISTANT ENGINEER III, PROJECT DIVISION, KERALA WATER AUTHORITY,NATTIKA	Tests on STEEL BARS	Tensile test
CM 62/21-22	Eri- Research on the suitability of fine aggregates in construction-mix design		
CM 63/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 64/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 65/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD(M/s. SOUTH INDIAN CONSTRUCTIONS,KOLLAM)	Tests on granite	Water absorption and specific gravity
CM 66/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD(M/s. SOUTH INDIAN CONSTRUCTIONS,KOLLAM)	Tests on cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 67/21-	PROJECT SPECIFIC ENGINEER, KITCO LTD(M/s.	Tests on Concrete	Compressive strength of

22	HiLite Projects Ltd)	Cubes	Concrete Cubes
CM 68/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM69/21-22	ASSISTANT EXECUTIVE ENGINEER, IDAMALAYAR IRRIGATION PROJECT, ANGAMALI	Steel Test	Compressive strength of Concrete Cubes
CM 70/21-22	ASSISTANT EXECUTIVE ENGINEER, IDAMALAYAR IRRIGATION PROJECT, ANGAMALI	Tests on Coarse Aggregates	**Coarse Aggregates – 12,20&40mm**
			Sieve Analysis
			Specific gravity
			Bulk Density
			Water Absorption
			Aggregate Crushing value
CM 71/21-22	ASSISTANT EXECUTIVE ENGINEER, IDAMALAYAR IRRIGATION PROJECT, ANGAMALI	Tests on Fine Aggregates	**M SAND-**
			Sieve Analysis of fine aggregates
			Specific gravity
			Water Absorption
CM 72/21-22	ASSISTANT EXECUTIVE ENGINEER, IDAMALAYAR IRRIGATION PROJECT, ANGAMALI	Tests on Cement	Fineness
			Consistency
			Setting times
			Compressive strength

			tests
CM 73/21-22	ASSISTANT EXECUTIVE ENGINEER, IDAMALAYAR IRRIGATION PROJECT, ANGAMALI	MIX DESIGN	Sieve analysis
			Specific gravity
			Loose density
			Cement test
			Mix Trials
CM 74/21-22	ASSISTANT ENGINEER, CDP SECTION No. 2, Echippara	Tests on Coarse Aggregates	**Coarse Aggregates – 20&40mm**
			Sieve Analysis
			Specific gravity
			Aggregate Crushing value
CM 75/21-22	ASSISTANT ENGINEER, CDP SECTION No. 2, Echippara	Tests on Fine Aggregates	**M SAND-**
			Sieve Analysis of fine aggregates
			Specific gravity
CM 76/21-22	ASSISTANT ENGINEER, CDP SECTION No. 2, Echippara	Tests on Cement	**Fineness**
			Consistency
			Setting times
			Compressive strength tests
CM 77/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Fine Aggregates	**M SAND-**
			Sieve Analysis of FA
			Specific gravity

			Bulking of sand
CM 78/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 79/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 80/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 81/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 82/21-22	ASSISTANT ENGINEER, PWD CDP SECTION No.1, ECHIPPARA	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 83/21-22	ASSISTANT ENGINEER, PWD CDP SECTION No.1, ECHIPPARA	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 84/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 85/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS	Tests on Concrete	Compressive strength of Concrete Cubes

	ENGINEERS & CONTRACTORS)	Cubes	
CM 86/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 87/21-22	M/s Uniq Contracting	Tests on Geobags	Geobag's GSM
CM 88/21-22	ASSISTANT ENGINEER, CDP SECTION No. 2, Echippara	Tests on Coarse Aggregates	**Coarse Aggregates – 20&40mm**
			Elongation Index
			Flakiness Index
			Bulk density
			Aggregate Crushing Strength
			Aggregate Impact Value
CM 89/21-22	ASSISTANT ENGINEER, CDP SECTION No. 2, Echippara	Tests on Fine Aggregates	**M SAND-**
			Bulk density
CM 90/21-22	ASSISTANT ENGINEER, PWD BUILDING SECTION, IRINJALAKUDA	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 91/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes

CM 92/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 93/21-22	ASSISTANT ENGINEER, CDP SECTION 1, ECHIPPARA	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 94/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 95/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 96/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 97/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 98/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 99/21-	TEAM LEADER, CENTRAL	Tests on	Compressive strength of

22	ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Concrete Cubes	Concrete Cubes
CM 100/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 101/21-22	WAPCOS, NISSY ENTERPRISES	TEST ON STEEL BARS	Unit weight
			yield Strength
			Ultimate Strength
			Elongation
CM 102/21-22	ASSISTANT ENGINEER, PWD Buildings Section, Chalakudy	TEST ON CONCRET E CUBES	Compressive strength of Concrete Cubes
CM 103/21-22	Assistant Executive Engineer, Sub Regional Store, Electrical Circle, KSEB Ltd.	TEST ON HT Stay wire	Break Load of Ht Stay wires
CM 104/21-22	ASSISTANT ENGINEER, PWD Buildings Section, Kunnamkulam	TEST ON PAVER BLOCKS	Compressive strength of Paver Blocks
CM 105/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	TEST ON CONCRET E CUBES	Compressive strength of Concrete Cubes
CM 106/21-22	ASSISTANT ENGINEER, PWD Buildings Section, Irinjalakuda	TEST ON CONCRET E CUBES	Compressive strength of Concrete Cubes

CM 107/21-22	MAGTECH ENGINEERS & CONTRACTORS	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 108/21-22	MAGTECH ENGINEERS & CONTRACTORS	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 109/21-22	MAGTECH ENGINEERS & CONTRACTORS	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 110/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	TEST ON CONCRETE CUBES	Compressive strength test of concrete cubes
CM 111/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	TEST ON CONCRETE CUBES	Compressive strength test of concrete cubes
CM 112/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD(M/s. SOUTH INDIAN CONSTRUCTIONS,KOLLAM)	Tests on cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 113/21-22	Assistant Engineer, Peechi project Section,	Tests on cement	Fineness
			Consistency

	Mannamangalam		Setting times Compressive strength tests
CM 114/21-22	MAGTECH ENGINEERS & CONTRACTORS	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 115/21-22	MAGTECH ENGINEERS & CONTRACTORS	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 116/21-22	ASSISTANT ENGINEER, PWD Buildings Section, Irinjalakuda	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 117/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD (M/s. HiLite Projects Ltd)	Tests on Concrete Cubes	Compressive strength of Concrete Cubes
CM 118/21-22	ASSISTANT ENGINEER, PWD Buildings Section, Irinjalakuda	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 119/21-22	ASSISTANT ENGINEER, MI Section, Thrissur	TEST ON Inter Lock & terrazzo Tiles	Compressive strength of Inter Lock & terrazzo Tiles
CM 120/21-22	ASSISTANT ENGINEER, Chimmony Dam Project Section No.1	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 121/21-22	ASSISTANT ENGINEER, PWD Buildings Section No.2, Ayyanthole	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 122/21-	ASSISTANT ENGINEER,	TEST ON	Compressive strength of

22	PWD Buildings Section No.2, Ayyanthole	CONCRETE CUBES	Concrete Cubes
CM 123/21-22	MELETH CONSTRUCTIONS	TEST ON CONCRETE CUBES	Compressive strength test of concrete cubes
CM 124/21-22	ASSISTANT ENGINEER, PWD Buildings Section, Chalakudy	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 125/21-22	MAGTECH ENGINEERS & CONTRACTORS	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 126/21-22	ASSISTANT ENGINEER, PWD Buildings Section, Irinjalakuda	TEST ON CONCRETE CUBES	Compressive strength of Concrete Cubes
CM 127/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 128/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 129/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes

CM 130/21-22	Assistant Engineer, Peechi project Section, Mannamangalam	Tests on cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 131/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD(M/s. HILITE PROJECTS PVT LTD)	Tests on cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 132/21-22	Assistant Executive Engineer, IIP Irrigation SubDivision No.2, Angamaly	Cement test	Cement test
CM 133/21-22		Mix Trials	Additional Mix Trials
CM 134/21-22	ASSISTANT ENGINEER, Chamravattam project Section III, Eeswaramangalam	Dimensions	Thickness of Z Type sheet pile
CM 135/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 136/21-22	Assistant Executive Engineer, Irrigation SubDivision No.II	MIX DESIGN	Sieve analysis
			Specific gravity &

	Chalakudy		Water Absorption
			Loose density
			Cement test
			Mix Trials
CM 137/21-22	CEECON READY MIX CONCRETE PVT., LTD.	Test on Coarse Aggregates	Sieve Analysis of aggregates
			Specific Gravity
			Water Absorption
			Crushing Value
			Impact value
			Flakiness/Elongation Index
			Bulk Density
CM 138/21-22	CEECON READY MIX CONCRETE PVT., LTD.	Test on Coarse Aggregates	Sieve Analysis of aggregates
			Specific Gravity
			Water Absorption
			Crushing Value
			Impact value
			Flakiness/Elongation Index
			Bulk Density
CM 139/21-22	CEECON READY MIX CONCRETE PVT., LTD.	Test on Fine Aggregates	Sieve Analysis o f Fine aggregates
			Bulk Density

			Water Absorption
			Specific gravity
CM 140/21-22	Sri. Nabeel Ahmad, Thrissur	Test on Laterite blocks	Strength of Laterite blocks
CM 141/21-22	EXECUTIVE ENGINEER, PAMPA IRRIGATION PROJECT DIVISION, CHENGANNOOR	Steel Test	Yield & ultimate strength , and percentage elongation
CM 142/21-22	EXECUTIVE ENGINEER, PAMPA IRRIGATION PROJECT DIVISION, CHENGANNOOR	Tests on Coarse Aggregates	**Coarse Aggregates – 20mm**
			Sieve Analysis of aggregates
			Water Absorption
			Specific Gravity
			Bulk density
CM 143/21-22	EXECUTIVE ENGINEER, PAMPA IRRIGATION PROJECT DIVISION, CHENGANNOOR	Tests on Fine Aggregates	**M SAND-**
			Sieve Analysis o f Coarse aggregates
			Water Absorption
			Specific gravity
CM 144/21-22	EXECUTIVE ENGINEER, PAMPA IRRIGATION PROJECT DIVISION, CHENGANNOOR	Tests on Cement	Fineness
			Consistency
			Setting times
			Compressive strength

			tests
CM 145/21-22	EXECUTIVE ENGINEER, PAMPA IRRIGATION PROJECT DIVISION, CHENGANNOOR	MIX DESIGN	Sieve analysis
			Specific gravity
			Loose density
			Cement test
			Mix Trials
CM 146/21-22	EXECUTIVE ENGINEER, PAMPA IRRIGATION PROJECT DIVISION, CHENGANNOOR	MIX DESIGN	Sieve analysis
			Specific gravity
			Loose density
			Cement test
			Mix Trials
CM 147/21-22	Project Specific Engineer, KITCO LTD, KOCHI (M/s HiLite Projects Pvt. Ltd.	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 148/21-22	AE, PWD BUILDINGS SECTION, IRINJALAKUDA	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 149/21-22	AE, PWD BUILDINGS SECTION, Kunnamkulam	Tests on STEEL BARS	Yield & ultimate strength , and percentage elongation
CM 150/21-22	WAPCOS LTD, (NISSY ENTERPRISES)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 151/21-22	AE, PWD BUILDINGS SECTION, Kunnamkulam	Tests on Solid	Compressive strength test of solid blocks

		Blocks	
CM 152/21-22	ASSISTANT ENGINEER, IRRIGATION QUALITY CONTROL SECTION, THRISSUR	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 153/21-22	ASSISTANT ENGINEER, IRRIGATION QUALITY CONTROL SECTION, THRISSUR	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 154/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 155/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 156/21-22	ASSISTANT EXECUTIVE ENGINEER, SRS THRISSUR, KSEB LTD	Tests on STAY WIRE & ROD	Break load tests on stay wire and stay rod
CM 157/21-22	AE, PWD BUILDINGS SECTION, Kunnamkulam	Tests on Paver Blocks	Compressive strength test of Paver Blocks
CM 158/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 159/21-22	NIRMITHI KENDRA , THRISSUR	Tests on Concrete	Compressive strength test of concrete cubes

		Cubes	
CM 160/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 161/21-22	ASSISTANT MANAGER, TECHNICAL CELL, PENNA CEMENT INDUSTRIES LTD.	MIX DESIGN	cancelled
CM 162/21-22	SASTHA CEMENT INDUSTRIES, KANNARA, COMPANYPADY, THRISSUR	Tests on Paver Blocks	Compressive strength test of Paver Blocks
CM 163/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 164/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (NISSY ENTERPRISES)	Tests on CEMENT	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 165/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (NISSY ENTERPRISES)	Tests on CEMENT	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 166/21-22	Deputy Director, Instrumentation Division, KERI,	Tests on rock samples	Compressive strength test of Rock core samples

	Peechi		
CM 167/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD(M/s. HILITE PROJECTS PVT LTD)	Tests on cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 168/21-22	INVESTIGATION WORK, ATTAPPILLY CORE SAMPLES	CORE TESTING	CORE TESTING
CM 169/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 170/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 171/21-22	Rabeesh Kumar, Quality/Materials Engineer, CPCPL	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 172/21-22	Rabeesh Kumar, Quality/Materials Engineer, CPCPL	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 173/21-22	Rabeesh Kumar, Quality/Materials Engineer, CPCPL	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 174/21-22	WAPCOS LTD , (NISSY ENTERPRISES)	Tests on Concrete	Compressive strength test of concrete cubes

		Cubes	
CM 175/21-22	ASSISTANT ENGINEER, PUBLIC HEALTH SECTION, KERALA WATER AUTHORITY, PEECHI	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 176/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD(M/s. HILITE PROJECTS PVT LTD)	Tests on cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 177/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD(M/s. HILITE PROJECTS PVT LTD)	Tests on cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 178/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 179/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 180/21-22	ASSISTANT ENGINEER, PUBLIC HEALTH SECTION, KERALA WATER	Tests on Concrete Cubes	Compressive strength test of concrete cubes

	AUTHORITY, PEECHI		
CM 181/21-22	Assistant Executive Engineer, SRS Thrissur, KSEB LTD	Tests on HT Stay rods	Break load test on HT Stay rods
CM 182/21-22	Sri. Jose P.K, Padayattil House, Okkal P.O	Cement test	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 183/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 184/21-22	ASSISTANT ENGINEER III, TRICHUR PROJECT DIVISION, CPWD	Tests on WMM	Aggregate Impact value
			Flakiness/Elongation index
			Water Absorption
			Sieve Analysis of Coarse aggregates
CM 185/21-22	ASSISTANT ENGINEER III, TRICHUR PROJECT DIVISION, CPWD	Tests on GSB	Aggregate Impact value
			Water Absorption
			Sieve Analysis of Coarse aggregates
CM 186/21-22	Deputy Director, Instrumentation Division, KERI, Peechi	Rock &Concrete core testing	Compressive strength of rock and concrete core samples
CM 187/21-	Deputy Director,	Rock core	Compressive strength of

22	Instrumentation Division, KERI, Peechi	testing	rock core samples
CM 188/21-22	General Manager, WAPCOS cochin Special Economic Zone project Office, CSEZ Administrative Building, Kakkanad, Kochi	Concrete core testing	Compressive strength of concrete core samples
CM 189/21-22	Reo Rinson A, Associate Manager, Lahanti Homes & Infrastructure Pvt. Ltd., Mannuthy.	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 190/21-22	Reo Rinson A, Associate Manager, Lahanti Homes & Infrastructure Pvt. Ltd., Mannuthy.	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 191/21-22	Assistant Engineer, Irrigation Section, Kunnamkulam	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 182/21-22	Assistant Engineer, Irrigation Section, Kunnamkulam	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 193/21-22	Team Leader, Central Zone (Nissy Enterprises)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 194/21-22	Sri. SanthoshKumar K.M, QC Lab, Sobha Ltd. Thrissur	Rock core testing	Compressive strength of concrete core samples
CM 195/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes

CM 196/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 197/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 198/21-22	Sri. Arjun M.S, MSc Forestry, KAU,	Tests on WOOD CEMENT COMPOSITE SPECIMENS	Compressive strength test of WOOD CEMENT COMPOSITE SPECIMENS
CM 199/21-22	Registrar, KSCSTE- Kerala Forest Research Institute	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 200/21-22	Project Specific Engineer, KITCO LTD, KOCHI (M/s HiLite Projects Pvt. Ltd.	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 201/21-22	PROJECT SPECIFIC ENGINEER, KITCO LTD(M/s. HILITE PROJECTS PVT LTD)	Tests on cement	Fineness
			Consistency
			Setting times
			Compressive strength tests
CM 202/21-	ASSISTANT ENGINEER, MI	Tests on	Yield & ultimate

22	SECTION, CHALAKUDY	STEEL BARS	strength , and percentage elongation
CM 203/21-22	ASSISTANT ENGINEER, PUBLIC HEALTH SECTION, KERALA WATER AUTHORITY, PEECHI	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 204/21-22	THIRUVANANTHAPURAM CORPORATION	Test on Piles	PILE ECHO TEST
CM 205/21-22	Sri. Sojan M.D, Meleth Constructions	Tests on STEEL BARS	Yield & ultimate strength , and percentage elongation
CM 206/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 207/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 208/21-22	Assistant Engineer, Pampar Project Section No.3, Marayoor	Tests on STEEL BARS	Yield & ultimate strength , and percentage elongation & Bend Rebend test
CM 209/21-22	ASSISTANT ENGINEER, PUBLIC HEALTH SECTION, KERALA WATER AUTHORITY, PEECHI	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 210/21-22	ASSISTANT ENGINEER, PWD BUILDINGS SECTION,	Tests on Concrete	Compressive strength test of Solid Blocks

	CHALAKUDY	Solid Blocks	
CM 211/21-22	ASSISTANT ENGINEER, PWD BUILDINGS SECTION, CHALAKUDY	Tests on STEEL BARS	Yield & ultimate strength , and percentage elongation
CM 212/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 213/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 214/21-22	ASSISTANT ENGINEER, CHIMMONI DAM PROJEST SECTION No.1	Tests on STEEL BARS	Yield & ultimate strength , and percentage elongation
CM 215/21-22	ASSISTANT ENGINEER, CHIMMONI DAM PROJEST SECTION No.1	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 216/21-22	ASSISTANT ENGINEER, CHIMMONI DAM PROJEST SECTION No.1	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 217/21-22	M/s NAVERA Builders Pvt Ltd, 1st Floor Tharappel Complex, Kolazhy, Thrissur	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 218/21-22	ASSISTANT ENGINEER, PUBLIC HEALTH SECTION, KERALA WATER AUTHORITY, PEECHI	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 219/21-	Project Engineer-39, KIIDC	MS Sheet	Thickness and unit

22	(M/s Paulose George Constructions)		weight of MS sheet
CM 220/21-22	ASSISTANT ENGINEER, LSGD SECTION, MURIYAD GP	Tests on Paver Blocks	Compressive strength test of Paver Blocks
CM 221/21-22	ASSISTANT ENGINEER, MI SECTION, TRIPUNITHURA	Tests on STEEL BARS	Yield & ultimate strength , and percentage elongation & Bend Rebend test
CM 222/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 223/21-22	ASSISTANT ENGINEER, PWD BUILDINGS SECTION, MG KAVU	Tests on STEEL BARS	Yield & ultimate strength , and percentage elongation & Bend Rebend test
CM 224/21-22	Registrar, KSCSTE- Kerala Forest Research Institute	Tests on Concrete Cubes	7TH DAY Compressive strength test of concrete cubes
CM 225/21-22			28TH DAY Compressive strength test of concrete cubes
CM 226/21-22	ASSISTANT ENGINEER, PUBLIC HEALTH SECTION, KERALA WATER AUTHORITY, PEECHI	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 227/21-	ASSISTANT ENGINEER,	Tests on	Fineness

22	IRRIGATION SECTION, ENAMAKKAL	Cement	Consistency Setting times Compressive strength tests
CM 228/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 229/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Solid Blocks	Compressive strength, water absorption and density test of concrete cubes
CM 230/21-22	M/s NAVERA Builders Pvt Ltd, 1st Floor Tharappel Complex, Kolazhy, Thrissur	Tests on STEEL BARS	Yield & ultimate strength , and percentage elongation & Bend Rebend test
CM 231/21-22	ASSISTANT ENGINEER, PUBLIC HEALTH SECTION, KERALA WATER AUTHORITY, PEECHI	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 232/21-22	Deputy Director, Instrumentation Division, KERI, Peechi	Rock core testing	Compressive strength test of Rock Samples
CM 233/21-22	M/s Builtech gateway Ventures LLP, Builtech Foundation, Chittur Road, Palakkad	Tests on STEEL BARS	Yield & ultimate strength , and percentage elongation

			& Bend Rebend test
CM 234/21-22		Coarse Aggregates	Sieve Analysis of coarse aggregates,
			Water Absorption
			Specific Gravity
			Aggregate Crushing Value
			Flakiness Index
			Bulk Density
			Los Angeles Abrasion test
CM 235/21-22		Fine aggregates	Sieve Analysis o f Fine aggregates
			Water Absorption
			Specific gravity
			Bulking of sand
			Bulk Density
CM 236/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 237/21-22	ASSISTANT ENGINEER, PWD BUILDINGS SECTION, KODUNGALLUR (AP Constructions)	Tests on Paver Blocks	Compressive strength test of Paver Blocks
CM 238/21-22	M/s Asian Designer Tiles, Pavers & Flyaash Bricks,	Tests on Paver	Compressive strength & water 324bsorption test

	Coimbatore	Blocks	of Paver Blocks
CM 239/21-22	M/s Asian Designer Tiles, Pavers & Flyaash Bricks, Coimbatore	Tests on Paver Blocks	Compressive strength & water 325bsorption test of Paver Blocks
CM 240/21-22	M/s Asian Designer Tiles, Pavers & Flyaash Bricks, Coimbatore	Tests on Paver Blocks	Compressive strength, water 325bsorption and abrasion test of Paver Blocks
CM 241/21-22	Assistant Engineer, Kuttyadi Irrigation Project operation & Maintenanance Section-A, Peruvannamuzhy	Tests on Steel bars	Yield & ultimate strength , and percentage elongation
CM 242/21-22	Assistant Engineer, PWD Bridges Section, Thrissur (Contractor: Joji Joseph)	Tests on Steel bars	Yield & ultimate strength , and percentage elongation
CM 243/21-22	Assistant Engineer, PWD Bridges Section, Thrissur (Contractor: Joji Joseph)	Mix Design	Sieve analysis
			Specific gravity
			Loose density
			Cement test
			Mix Trials
CM 244/21-22		Mix Design	Sieve analysis
			Specific gravity
			Loose density
			Cement test
			Mix Trials
CM 245/21-22	Nabeel Ali,	Tests on Concrete	Compressive strength test of concrete cubes

	Site Engineer, PMR Constructions	Cubes- 7th day	
CM 246/21-22		Tests on Concrete Cubes- 28th day	Compressive strength test of concrete cubes
CM 247/21-22	Nabeel Ali, Site Engineer, PMR Constructions	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 248/21-22	The Project Engineer-39, KIIDC, Knnur (M/s Paulose George Constructions)	Tests on sheet piles	Tensile strength and Dimensions of Z Type Hot Rolled sheet pile
CM 249/21-22	The Assistant Engineer, Irrigation Quality Control Section, Thrissur	Tests on Steel bars	Yield & ultimate strength , and percentage elongation
CM 250/21-22	Sri Ibrahimkutty, Star Plaza Site, Shornur road, Thrissur	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 251/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 252/21-22	TEAM LEADER, CENTRAL ZONE, WAPCOS LTD, (FINS ENGINEERS & CONTRACTORS)	Tests on Concrete Cubes	Compressive strength test of concrete cubes
CM 253/21-22	Assistant Engineer, PWD Special Buildings Section, M.G Kavu, Thrissur	Tests on Concrete Cubes	Compressive strength test of concrete cubes

CM 254/21-22	Assistant Engineer, Minor Irrigation Section, Kodungalloor	Tests on Concrete Cores	Compressive strength test of concrete cores

Appendix – IV

List of tests conducted in the SM Laboratory
LABORATORY INVESTIGATION

Soil samples analysis for undisturbed and disturbed samples were tested for the following works:-

C.7.1 Testing of Sand Samples – Greenline Constructions.

C.7.2 Soil Investigation for the proposed protection works at Shanmugham Canal in Poommangalam Panchayath, Thrissur Dt.- Handling over soil samples for lab Test.

C.7.3 Soil Investigation work for the construction of footbridge to Vattamala Murugan Temple on Kalpathy River in Palakkad Muncipality Ward No.1

C.7.4 Desitation in PC Canal from Orumanayoor to Chavakkad Reach

C.7.5 IWT-Desilting and side protection of Thiruvanchikulam canal from Ch.0 to 300m in Kodungallur taluk PC canal Ch.243.50 km

C.7.6 Soil Investigation work of obstructions to flow of Periyar River at Railway Bridge to Vallarpadam container terminal near Vaduthala, Ernakulam

C.7.7 Creation of Basic Infrastructure Facilities for Arts & Science Colleges-reg — Performing various soil tests for Sri. Achutha Menon College, Thrissur

C.7.8 Peechi Scheme - A Permanent solution at breached portion of Left bund main canal bund between ch.19/600 km and 20/600 km -reg (Mannamangalam)

C.7.9 Augmentation of infrastructure facilities at Kerala Varma College, Thrissur - Testing of soil sample

C.7.10 Soil Investigation for various works of irrigation Department – Soil Investigation for RCB at Attapilly

C.7.11 Testing for Geotechnical parameters of Soil Samples – KFRI, Peechi

C.7.12 Testing of Sand Samples – Greenline Constructions

C.7.13 Desilting Peringad puzha at the downstream of Idiyanchira regulator cum bridge in Thrissur District

C.7.14 Testing of soil samples for the construction of Zoological Park at Puthur, Thrissur

C.7.15 Soil Investigation for various works of Irrigation Department – Soil Investigation work at Chamravattom

C.7.16 Analysing of Geotechnical properties of soil sample collected from Idukki region

C.7.17 Testing of dynamic properties of soil samples – KAU – ARS, Chalakkudy

C.7.18 Soil Investigation for Pamba River

C.7.19 Desiltation of Manimalayar - Topographical Investigation and Soil Investigation

C.7.20 Soil Investigation for Meenachilar

C.7.21 Soil Investigation for Achankovilar

C.7.22 Soil Investigation for Muvattupuzha

C.7.23 Soil Investigation for Thatanampully LIS in Kulukkallur GP, Palakkad

C.7.24 Soil Testing for dredged material from the premises of IWT Terminal at Maradu

C.7.25 Sedimentation study of Maniyar Reservoir using IBS and Sub bottom Profiler – Testing of Soil Samples

C.7.26 Sedimentation study of Kallada Reservoir using IBS Sub bottom Profiler – Testing of Soil Samples

C.7.27 CEFS- Data Collection of Design Parameters for urgent protection works at Erosion Hotspots along Kerala Coast – Hotspot Kodungallur

C.7.28 Soil loss estimation and monitoring in the highland ecosystems of Kerala for effective conservation Planning - Testing of Soil Samples from Thrissur Region

C.7.29 Cluster Number – Creation of Basic Infrastructure Facilities for Arts & Science Colleges-reg – Performing Field Density test of Soil. Panambilly Memorial Govt College Canteen Block reg:-

C.7.30 Soil Investigation works to the Reconstruction of Chakkumkandam salt water exclusion sluice in Chavakkad Municipality

APPENDIX – V

Times and Places of observation

Serial No.	Month	Date of observation
1.	April	11/04/2021
2.	May	11/05/2021
3.	June	10/06/2021
4.	July	09/07/2021
5.	August	08/08/2021
6.	September	06/09/2021
7.	October	06/10/2021
8.	November	04/11/2021
9.	December	04/12/2021
10.	January	02/01/2022
11.	February	01/02/2022
12.	March	02/03/2022

Appendix-VI

Sl:No:	Name of Station	Time and CP Nos.				
		9.00 AM	10.00 AM	11.00 AM	11.45 AM	12.30 AM
1.	Vettukkad	0112	0114	0116	0114	0112
1. 2.	Anjengo	0223	0228	0233	0228	0223
3.	Eravipuram	0324	0327	0329	0327	0324
4.	Thottappally	0597	0600	0602	0600	0597
5.	. Alapuzha	0704	0707	0710	0707	0704
6.	Thanki	935	930	926	930	935
7.	Kannamali	1047	1037	1025	1037	104
8.	Kuzhuppilly	1140	1147	1149	1147	1140
9.	Perinjanam	1269	1274	1279	1274	1269
10.	Nattika	1323	1330	1333	1330	1323
11.	Blangad	1418	1421	1428	1421	1418

12.	Vakkad	1595	1599	1605	1599	1595
13.	Calicut	1830	1826	1821	1826	1830
14.	Melody	2013	2009	2004	2009	2013
15.	Thalassey	2188	2176	2171	2176	2188
16.	Kanhangad	2608	2603	2598	2603	2608
17.	Kasargod	2730	2725	2720	2745	2730
18.	Kannuvatheertha	103	111	121	111	103