SERVICE THROUGH RESEARCH
Established in 1916 at Pune
Premier Hydraulic Research Laboratory
UN recognized Regional Laboratory for ESCAP
Serves three major sectors:
  Water Resources
  Power
  Surface Transport
Applied and basic research to provide sound and economic solutions for
  River Engineering
  Reservoir and appurtenant Structures
  Hydraulic Machinery
  Coastal Engineering
  Earth Sciences
  Foundation and Structures
Research through physical and mathematical modelling
Calibration of flow meters and current meters
Excellent Infrastructure: land, water, power, equipment, human resources
केंद्रीय जल और विद्युत अनुसंधान शाला के बारे में

20 वीं सदी के आरम्भ में, सिंचयाँ और जलविद्याक की दौरान समस्याओं के लिए लघु रैगाृण पर प्रायोगिक अनुभवों का उपयोगकरण का आवश्यकता महसूस हुआ। केंद्रीय जल और विद्युत अनुसंधान शाला (केनजिसा), पूर्वोत्तर के नाम से, अत्युक्ति यह संस्था, कृति संबंधी आवश्यकताओं की दृष्टि हेतु सिंचाई पद्धतियों में उत्तरदायक करने के लिए सीमित उद्देश्य से, बौद्धिक प्रतिभा द्वारा एक बिश्वविद्यालय सेवा के रूप में 1916 में स्थापित हुई। जल संस्थान परीक्षाओं के सिद्धांत के साथ, इसकी कार्यवाहिकी में आई उद्देश्य के कारण 1925 में अनुसंधान शाला रुपो राजहर के दूरी-प्रविधि लगभग 16 कि.मी. की दूरी पर खड़कालाल में विश्वविद्यालय में स्थानांतरित हुई। बाद की समस्या संबंधी, जल प्रणाली की प्रभाव अनुभवों का प्रणालीबद्ध अध्ययन करने में निम्नांश गई भूमिका को देखते हुए। 1936 में भारत सरकार ने इसे अपने निजी विकास में लिया।

स्वतंत्रता प्रभाव के पश्चात् और देश के जल संस्थानों के योजनाबद्ध विकास के आरम्भ होने पर, जल और ऊर्जा संस्थानों का भी वित्त और जल-वाह परिवहन के क्षेत्र में परीक्षाओं की अनुसंधान तथा विकास की जरूरत पूरी करने के लिए केंद्रीय जल और विद्युत अनुसंधान शाला एक प्रमुख केंद्रीय एजेंसी के नाते उद्धीविराह हुई। अत: यह अनुसंधान शाला, केंद्रीय जल संस्थान क्षेत्र के वर्तमान कायांवल के रूप में, जल विज्ञान और अनुसंधान के क्षेत्र में विकास में एक प्रमुख संस्था बन गई है। निष्कर्ष निर्देशन तथा विचार, जलीय संस्थानों, बंदरगाह, तीर्थस्थल व अन्य क्षेत्रों के जलीय अंगिकायों, पर्यावरणीय अध्ययन, भूविज्ञान और विशेषज्ञताओं के क्षेत्र में भूमिका तथा विशेषज्ञता प्राप्त अध्ययनों द्वारा केंद्रीय जल और विद्युत अनुसंधान शाला विशेषज्ञों से प्रदा दिया करती है। केंद्रीय जल और विद्युत अनुसंधान शाला का एक अध्ययन के रूप में जल संस्थान, जलीय और बंदरगाह अभिव्यक्ति की संभावित उड़ान तथा जलीय अभियान से संबंधित विभिन्न समस्याओं का तत्कालीन व संदर्भित समाधान निर्माण में काम है। पूर्व गतिविधियों के रूप में यह अनुसंधान शाला जल और विद्युत प्रणाली से संबंधित मान्यता (भारत), अत: विभिन्न तथा अनुसंधान संस्थानों के साथ भी संबंधित करती है। भारत सरकार द्वारा मिलनेवाली विशेष अनुदान के साथ, अनुसंधान शाला के अन्य संस्थाओं और विशेषज्ञों को अध्ययन करने हेतु जलीय अनुसंधान के क्षेत्र में तेजी से हो रही तकनीक के साथ विवेक से विकास में मिलाकर चलने की प्रक्रिया शुरू होने की है। सन 1971 से, ESCAP की शाखा केंद्रीय शाला के रूप में मान्यता अद्ययाली केनजिसा ने ग्रामीण और अन्य देशों और पक्षकारों के अनेक परीक्षाओं को अपनी संबंधित दिनों की है।

फिल्मशाही इस संस्थान के कार्यक्षेत्र में सिंचाृय, विद्युत और जल-वाह परिवहन से संबंधी विभिन्न परीक्षाओं का व्यापक अनुसंधान तथा विकास संयमित के लिए वैकल्पिक अनुसंधान, अपनी गतिविधियों के अधिकृत में तकनीकी का परिमाण और सारांश देना, जलीय अनुसंधान भारतीय में विशेषज्ञता और अनुसंधान के क्षेत्र में प्रकाश करना, विभिन्न संस्थाओं के साथ अनुसंधान गतिविधियों में सहभागिता और अनुसंधान अधिकारियों को प्रशिक्षण दिलाने जैसे महापूर्ण कार्य शामिल है।

90 वर्ष की सेवा पूरी करने पर, केंद्रीय जल और विद्युत अनुसंधान शाला "अनुसंधान के माध्यम से सेवा" यह आपना आदर्श रैली दर्शाते हुए राष्ट्र के प्रति अपना सेवा प्रदान करने का प्राण करती है।
ABOUT CENTRAL WATER AND POWER RESEARCH STATION

In the beginning of the 20th century, the need for small scale laboratory investigations to study the twin problems of irrigation and drainage was recognised by the Government. The Central Water and Power Research Station (CWPRS), Pune, as it is known today, was established in 1916 by the then Bombay Presidency as a "Special Irrigation Cell" with a limited mandate to modify irrigation practice to meet agricultural requirements. Recognising its role in the systematic study of various phases of water flow, including floods, the institution was taken over by the Government of India in 1936. Due to considerable increase in its activities with development of water resources projects, the Research Station was shifted to Khadakwalsa, about 16 km southwest of Pune, with a larger campus in 1925.

With the dawn of independence and launching of planned development of the nation's water resources, CWPRS became the principal central agency to cater to the R&D needs of projects in the fields of water and energy resources development and water-borne transport. Today, CWPRS, a part of the Union Ministry of Water Resources, is one of the foremost organisations in the world in the field of hydraulics and allied research. CWPRS provides specialised services through physical and mathematical model studies in river training and flood control, hydraulic structures, harbours, coastal protection, foundation engineering, construction materials, pumps and turbines, ship hydraulics, hydraulic design of bridges, environmental studies, earth sciences, and cooling water intakes. The studies conducted by CWPRS are able to provide hydraulically sound and economically viable solutions to various problems associated with projects on water resources, energy and water-borne transport including coastal and harbour engineering. CWPRS also collaborates with other organisations like WAPCOS and educational and research institutions to complement its activities. Thanks to the Government of India's financial support, CWPRS has been able to keep pace with the rapid advancements in hydraulic research by way of updating its facilities and expertise. As the Regional Laboratory of ESCAP since 1971, CWPRS has offered its services to a number of projects in the neighbourhood as well as countries in Middle East and Africa.

The current mandate of the institution encompasses undertaking specific research studies supported by necessary basic research to comprehensively offer R&D support to a variety of projects dealing with irrigation, power and water-borne transport; offering consultancy and advisory services to the government within the sphere of its activities; disseminating expertise and research findings amongst hydraulic research fraternity; collaborating research activities with various institutions and carrying out training of research manpower.

Having completed ninety years of service, CWPRS reaffirms its motto "Service Through Research" and looks forward to be of continued service to the Nation.
HYDROLOGY AND WATER RESOURCES ANALYSIS

Hydrology and Water Resources Analysis Laboratory undertakes studies relating to hydrological modelling, water yield assessment, flood forecasting, design flood estimation and water quality monitoring and analysis.

AREAS OF SPECIALIZATION AND MAJOR STUDIES UNDERTAKEN

**Hydrometeorological Studies**
- Hydrological Modelling: Narmada, Godavari, Tapi River Basins
- Flood Forecasting/Warning System: Tapi, Godavari and Mahanadi River Basins; Kahalgaon Super Thermal Power Project and Kol Dam

**Water Yield Studies**: Amba at Pali, Tapi at Ghala, Narmada at Mortakka, Wellington Cantonment Area, INS Mandovi, Tirupati-Tirumala Devasthanam Area, Upper Mahanadi Basin, Godavari and its Tributaries, Krishna at Dhom, Venna at Kanher

**Gauge-Discharge Relationships**: Brahmaputra, Kosi, Damodar, Godavari, Indravati, Iraunala, Kalinadi, Narmada and Yamuna Rivers

**Dam Break Analysis**: Supa-Bommanahalli-Kodasalli-Kadra (Kalinadi), Lakya (Lakya-Hole), Ukai Dam (Tapi), Mandira (Sankh) and Barvi

**Probable Maximum Flood Estimation**: Sardar Sarovar, Indira Sagar, Omkareshwar, Maheshwar, Bargi, Ukai, Tapovan-Vishnugad and Loharinag-Pala Projects

**Extreme Value Analysis of Rainfall**: Mithi River Basin (Mumbai); Kudankulam (Tamil Nadu) and Barh (Bihar) Regions; Ungauged Basins

**Development of Digital Elevation/Terrain Model**: Koa, Dhauliganga, Bhagirathi and Kateri Catchments

**Rainfall Runoff Studies**

**Low Flow Assessment**: Godavari, Krishna-Venna, Mahanadi, Narmada and Tapi rivers

**Sedimentation Studies**: Chamera Stage-II (Ravi), Loharinag-Pala (Bhagirathi), Lata-Tapovan and Tapovan-Vishnugad (Alaknanda), Upper Indravati Project, Kudremukh Iron Ore Company, Utikal Alumina Bauxite and Neyveli Mines

**Resources Management and Decision Support System**: Mahanadi Project, Krishna-Keyna Irrigation Scheme, Chambal Ayacut Development Project
HYDROLOGY AND WATER RESOURCES ANALYSIS

* Safe Grade Elevation and Design of Storm Water Drains: Hazira, Simhadri, Kakinada, Dadri, Nagothane, Koderma, Barh, Darlipali, Lara and Nabinagar Thermal Power Projects
* Estimation of Irrigation Return Flow: Kukadi Project Left Bank Canal, Maharashtra

![Irrigation Return Flow Study](image)

* Sedimentation Survey: Yeshwant Sagar (MP), Indira Sagar (MP), Gangapur Dam (Maharashtra), Kateri Lake (Tamil Nadu), Supa (Karnataka)

![Reservoir Sedimentation Survey System](image)

* Backwater Effects: Sardar Sarovar, Jayakwadi, Srisailam, KL Rao Sagar (Pulichintala), Neella Reservoirs; Mutha and Arpa Rivers

### Water Quality Studies
* In situ analysis of Electrical Conductivity, pH-Value, Temperature, Turbidity, Dissolved Oxygen
* Analysis of Silt and Bed Material

* Computation of Water Quality Indices
* Laboratory Analysis of Physicochemical/Biological Parameters

![Field Data Collection](image)

![Phytoplankton Species](image)

* Projects studied include Sardar Sarovar, Panshet, Khadakwasa, Bommannahalli, Ujani, Tungabhadra and Dandeli: Reservoirs; Ennore and Mahim Creek; Trombay: Godavari, Kalinadi, Krishna and Tapi Rivers

### FACILITIES AND EQUIPMENT
* Application Softwares such as IDRISI, MIKE11, ILWIS, DWOVER, SPSS, DIDGER and other in-house developed softwares

![Atomic Absorption Spectrophotometer](image)

**AREAS OF SPECIALIZATION**

**River Training**
- River training works like spurs and groynes
- Flood embankments, guide/aflux bunds
- Bank protection works like revetments, pitching

**Barrages and Weirs**
- Layout, orientation and waterway, aflux
- Crest levels of spillway and undersluices
- Hydraulic design parameters: velocity, discharge intensity / distribution
- Schedule of gate operation
- Discharging capacity and coefficient of discharge
- Appurtenant works: guide / approach bunds, divide wall, abutments

**River Morphology**
- Long term changes of river planform and bed levels
- Analysis of river flood discharges and water levels for long period

**Bridges**
- Location, orientation, adequacy of waterway, aflux, safe deck levels
- Scour level and foundation level, protection measures
- Appurtenant Structures such as guide bunds, approach / aflux embankments
- Morphology to examine stability of river course

**Terminal Location for Inland Navigation**
- Identification of location by estimating depths during low flows
- Estimate silting and dredging requirement
- Morphological studies to assess river behaviour
Intake Structures for Water Supply Schemes
- Identification of suitable location from toposheets, satellite imageries and site inspection
- Minimum flows, minimum water levels
- Intake sill level and drawdown level
- Bank protection works on upstream and downstream

Stream Gauging and Sediment Sampling
- Calibration of gauging site of river/canal
- Rating of discharge measurement structures
- Measurement of sediment concentration and analysis for suspended sediment distribution
- Transmission losses in water conductor systems

Sediment Control and Exclusion Devices
- Sediment settling efficiency of desilting chamber/basin
- Sediment carrying capacity and efficacy of flushing tunnels
- Optimum design of desilting chamber in respect of size, shape, inlet and outlet transitions
- Layout of sediment exclusion devices like silt ejectors/excluders
- Optimizing waterway, sill level, size and shape of silt exclusion arrangement

Siltation in Reservoirs
- Estimation of sedimentation profiles and optimization of flushing discharge, duration and frequency
- Gate regulation for effective flushing
- Sedimentation assessment through remote sensing technique

MATHEMATICAL MODEL STUDIES
- Flood Routing Studies: Rivers Tapi, Krishna and Mula-Mutha
- Cubature Computations: Kosi
- Hydraulic Transients in Water Conducting System of Hydel Projects: Rana Pratap Sagar, Lower Sileru, Kalinadi
- System Analysis of Water Resources: Ganga basin
- Morphological Model Studies: Ganga, Yamuna, Barak
- River Regime Studies: Yamuna
- Stratified Flows: Hot water recirculation for Kaiga Nuclear Power Project
RESERVOIR AND APPURTEEN STRUCTURES

This laboratory undertakes studies for evolving efficient, economical and safe hydraulic designs of spillways, water conductor systems and other appurtenant structures such as spillway profiles, energy dissipators, protection works, high head gates, sluices and outlets, surge tanks, tunnels, penstocks and galleries. The studies are carried out with the help of hydraulic models, mathematical models and analysis of the data.

AREAS OF SPECIALIZATION

Spillways and Energy Dissipators
* Discharging capacity assessment
* Hydrodynamic pressures on spillway and energy dissipator
* Cavitation potential

* Approach flow conditions
* Efficacy of energy dissipator
* Aeration grooves on spillway surface

* Construction stage flow conditions
* Protection works near spillway
* Assessment of prototype performance

Power Intake and Tail Race Channel
* Layout, location and dimensions of intake and water conductor system
* Flow conditions in the vicinity of intake
* Submergence from considerations of vortex formation

* Observations of water profiles along spillway and energy dissipator
* Scour downstream of energy dissipator
* Plunge pool design

* Spillway Airgowne
* Construction Stage (Model)
* Construction Stage (Prove)
* Approach Flow Conditions
* Model Approach Flow
* Flow Conditions near Power Intake
RESERVOIR AND APPURTENANT STRUCTURES

- Layout and alignment of tail race channel
- Flow conditions and velocity distribution along tail race channel
- Draft tube submergence
- Flushing of sediments in the tail race channel
- River bank protection works
- Water conductor systems and transients analysis for water hammer effect

- Head loss at intake and tail race channel
- Pressure along the tunnels
- Air water column separation and assessment of necessity of airvent
- Energy dissipation at the downstream end
- Flow conditions and water levels in surge shafts

Vertical, Radial and Stoplog Gates
- Overall layout of the gates and location of airvents
- Optimization of hydrodynamic uplift and downpull forces
- Hydrodynamic pressures and air demand
COASTAL AND OFFSHORE ENGINEERING

The laboratory undertakes studies for ports and harbours development, coastal protection against erosion, design of coastal structures, coastal processes, tidal inlets, intake and outfall systems of thermal/nuclear power plants using physical as well as mathematical modelling techniques.

AREAS OF SPECIALIZATION

Development of Ports and Harbours
* Optimisation of harbour layout including location, length and alignment of breakwaters, jetties, berths, approach channels, turning circles, etc.
* Estimation of sitation in harbours and navigation channels
* Hydraulic design of port structures
* Harbour resonance and response of vessels
* Ship manoeuvring, motions and mooring forces
* Dredging, disposal and sand bypassing
* Stability of tidal inlets

Shoreline Changes, Coastal Erosion and Protection
* Littoral drift and shoreline changes
* Effect of harbour development on beach behaviour
* Design of shore protection works such as seawalls, groynes, revetments, offshore bunds, beach nourishment
* Innovative coastal protection methods
* Training to the state government engineers involved in coastal protection works

Design of Maritime Structures
* Design of breakwaters and coastal protection structures
* Design of intake and outfall structures
* Storm wave hindcasting for determining extreme wave conditions
* Storm surge analysis and determination of safe grade elevation

Cooling Water Systems for Power Plants
* Thermal dispersion for locating intake and outfall structures of thermal/nuclear power projects
* Flow patterns around the Intake structures
* Innovative techniques for enhanced heat dissipation and pre-cooling systems
COASTAL AND OFFSHORE ENGINEERING

**Water Quality and Environmental Aspects**
- Estimation of water quality parameters
- Density currents due to interaction between salt/sediment laden and fresh water
- Effect of reclamation on hydrodynamics and siltation
- Disposal and dispersion of dredged material, industrial and municipal effluents and oil spills

**Field Studies**
- Collection and analysis of field data for waves, water levels, currents, temperature, salinity, bathymetry, water quality, suspended and bed sediments

**Facilities and Equipments**

**Laboratories**
- Random sea wave flumes: 120mx4mx2m, 90mx2mxt1.5m
- Regular wave flumes
- Shallow basins with random wave generation
- Wave models for ports and fishing harbours with regular wave generators
- Tidal models for major/minor ports with automatic tide generators

**Software Packages**
- Offshore to nearshore wave transformation
- Wave penetration in harbours
- Ship manoeuvring, ship motions and mooring
- Tidal hydrodynamics and sedimentation in estuarine and coastal areas
- Water quality
- Litoral drift and shoreline evolution
- Remote sensing and GIS

**Salinity Distribution in Chilika Lake**

**Random Sea Wave Generation**

**Current Measurement**

**Dye Dispersion Studies**

**Mooring arrangement at Visakhapatnam**
COASTAL AND OFFSHORE ENGINEERING

Field Equipments
* Propeller Type Direct Reading, In-situ Self Recording and Electro-magnetic Current Meters, Acoustic Doppler Current Profiler
* Wave Rider Buoys, Pressure Type Wave Gauges
* Automatic In-situ Tide Gauges
* DGPS, Handheld GPS, Total Station, Distomats
* Salinity-Temperature-Depth Unit
* Grab Samplers, Horizontal Samplers

MAJOR STUDIES UNDERTAKEN

Ports and Harbours
* Major Ports: Kandla, Mumbai, Jawaharlal Nehru Port, Mormugao, New Mangalore, Cochin, Tuticorin, Chennai, Ennore, Visakhapatnam, Paradip, Haldia, Kolkata

* Medium / Minor Ports / Fishing Harbours: Porbandar, Mul-Dwarka, Mangrol, Veraval, Jarnagar, Pipavav, Hazira, Revandanda, Varsoli, Ramagiri, Karwar, Honnavar, Bhatkal, Beypore, Malhe, Munambam, Neendakara, Azhikkal, Pondicherry, Nizampatnam, Krishnapatnam, Kakinada, Port Blair, Ratnagyl Bay, Mur, Campbell Bay, Hut Bay, Kalpeni, Androth, Kavaratti

Storm Wave Hindcasting and Safe Grade Elevation
* Porbandar, Dahej, Tarapur, Mumbai, Goa, Cochin, Kakinada, Visakhapatnam, Paradip, Kalpakkam
Design of Maritime Structures
* Breakwaters at Porbandar, Veraval, Mul-Dwarka, Ratnagiri, Karwar, New Mangalore, Tuticorin, Chennai, Visakhapatnam, Paradip, Pondicherry, Kakinada
* Reclamation bunds at Pipavav, Chennai
* Guide bunds at Varsoli, Old Mangalore, Bepore, Munambam
* Protection to submarine pipelines at Worli-Bandra, Uran, Kakinada
* Rehabilitation of breakwaters at Veraval, Porbandar, Campbell Bay, Hut Bay

Intake/Outfall Structures for Power Plants
* Atomic Power Projects at Tarapur, Kudankulam, Kalpakkam
* Thermal Power Projects at Dahanu, Ennore, North Madras

Environmental Aspects
* Salinity intrusion at Chilika lake
* Fresh water lake at Port Blair
* Disposal of dredged material at Mumbai, Campbell Bay
* Oil spill at Sikka

Shoreline Changes, Coastal Erosion and Protection
* Shoreline evolution at Gopalpur, Cochin, Kudankulam, Kalpakkam, Mangalore, Paradip
* Seawalls at Mumbai, Paradip, Pondicherry, Maravanthe, Pavinkurve, Mahabalipuram, Chandipur, Tithal, Moti Danti, Umarsadi, Kosamba, Alibag, Theronda
* Bank protection works at Ankaleshwar
* Groynes at Cochin, Shankarpur
* Offshore bunds at Udwada, Dahanu
* Artificial beach nourishment at Raj Bhavan and INS HML in Mumbai
* Sand bypassing at Visakhapatnam

Foreign Assignments
* Port development at Singapore
* Thermal power projects at Tripoli (Libya), Pasir Gudang (Malaysia), Port Klang (Malaysia)
HYDRAULIC MACHINERY

Hydraulic Machinery Laboratory undertakes calibration of closed conduit flow meters, tests on pumps and hydro-turbines, verification of hydraulic performance of pump intakes, hydraulic designs of pumping systems.

AREAS OF SPECIALIZATION

Laboratory Studies

* Gravimetric and volumetric calibration of flowmeters
* Performance evaluation and tests for voltage fluctuation on borewell pumps
* Assessment of head loss across filters
* Evaluation of performance of valves
* Pumping system design: optimisation and water hammer analysis
* Pump sump model studies for flow condition improvement

Field Studies

* Verification of hydraulic performance for hydropower projects as per IEC 41 stipulations
* Hydraulic performance of pumps and turbines
* Flow measurement and water auditing

FACILITIES

Gravimetric Flow Measurement

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<td>Traceability</td>
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Volumetric Flow Measurement

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</table>
**Borewell Pump Tests**
- Maximum line size: 200 mm NB
- Standard: IS 9137, 11346 and 325
- Maximum flow rate: 100 lps
- Maximum head: 50 mwc
- Maximum input Power: 70 kW
- Test voltage range: 320-500 V
- Test uncertainty: ± 0.5 %

**EQUIPMENTS**
- Ultrasonic and Turbine type Master Flow Meters
- 100 Tonne Electronic Weigh Bridge
- High Resolution Timer
- 50 Bar Pressure Transducers
- Pre-calibrated Master Weights
- 80 Bar Dead Weight Tester

**SOME MAJOR STUDIES**
- **Flow meter Calibration**: MSEB, TCE, Manufacturers and Users
- **Head loss across Filters**: Otoklin, Gujarat Otoilt, Flash Point
- **Submersible Pump Tests**: Uttar Pradesh Irrigation Department, Rajasthan Public Health Engineering Department
- **Pumping System Design**: Damodar Valley Corporation, Sinna Madha, Ambora
- **Pump Intake Model Studies**: Bhopal City Water Supply, IGCAR, Unchahar, Ramgundam, Nathpa Jhakri, Takari, Mhaisal, Parli, Korba, Kota
- **Field Studies on Water Turbines**: Koyna Stage I,II and IV, Bhīra, Loktak, Salal

**Images**
- Filter Test
- Field Flow Measurement
- Electromagnetic Flow Meter
- Water Hammer Analysis
- Venturi Meter Calibration
HYDRAULIC INSTRUMENTATION CENTRE

Scientific analysis of natural processes, in nature or in the laboratory under simulated conditions, requires observation of various parameters. The Instrumentation and Control Engineering Laboratory is responsible for providing instruments for measurement of various hydraulic parameters, data acquisition, analysis and control systems.

CAPABILITIES

* Development of transducers, instrumentation, measurement and calibration systems, computer based simulation systems, multichannel data acquisition, analysis and control systems for hydraulic model studies

* Development of custom-built software packages for data analysis, flow visualization, graphics, Management Information System

* Provide consultancy services in the areas of hydrological networks, data communication networks, and dam instrumentation

* Field data collection of water level, velocity, wave height and period, temperature, salinity, depth of water and analysis thereof

* Computer controlled hydograph and H-Q characteristics simulation systems for river and canal models

* Sluice gate operation simulation and measurement system

* Multichannel dynamic pressure measurement and analysis system

* A precision workshop providing support in design and fabrication of sensors and control systems

LABORATORY INSTRUMENTS

**Velocity**: Propeller currentmeters 6 to 50 mm size, 5 to 100 cms/sec range, 1% accuracy

- [Image: Multichannel Current Meter]

**Flow direction**: Self aligning vane with digital encoder

**Water level**: Water surface follower, range upto 50 cm, accuracy 0.2 mm

**Water Temperature**: Multichannel, direct indicating logging system, 5° to 45° C, accuracy +/- 0.1° C

**Wave heights / Surge**: Multichannel units, 50 cm range, 1 mm resolution, 5 Hz frequency response

- [Image: Signal Conditioner]
- [Image: Velocity Interface]
**HYDRAULIC INSTRUMENTATION CENTRE**

**Ship motions**: Movements of Ship models in six degrees of freedom

**Pressure**: Piezo resistive / Piezo electric / capacitance transducers, range 0 to 10m of water column

**Salinity**: Conductivity probe, range 0.5 to 40 ppt

**Displacement**: Fibre optic probes for measurement of small displacements, LVDTs, range 0 to 25 mm.

**Force and bending moment**: Custom built shear beam type strain gauge force transducers, range upto 5000 N

**Bed profiles**: PC based relocatable bed profiler for depths upto 0.5 m, accuracy 1 mm

* Hydrographic survey system with GPS position fixing system and echosounder for marine/riverine surveys

* Water level recorder

* Reservoir wave height recording system

* Ship motion and mooring force measurement and analysis system

* Discharge measurement in closed conduits

* Test and calibration system for dam instrumentation

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**EQUIPMENT FOR FIELD MEASUREMENTS**:  
* Ocean wave and current recording systems
* Tide gauges
* Sediment samplers

* Salinity / temperature / depth measuring systems
The Foundation and Structures Laboratory undertakes studies relating to soil and rock mechanics for foundation investigations, estimation of engineering properties of construction materials and stability and stress analysis of major structures.

**AREAS OF SPECIALIZATION**

**Soil Mechanics**
- Geotechnical investigations for foundations and ground-structure interaction
- Evaluation of liquefaction potential of foundation strata and sea beds
- Slope stability analysis of embankments, mine slopes
- Evaluation of properties and assessment of suitability of geotextiles and geomembranes for application in hydraulic structures

**Rock Mechanics**
- Field studies for measurement of deformability, shear strength parameters, permeability, bearing capacity and in-situ stress of rock mass
- Laboratory studies for estimation of physical and engineering properties of rock

**Stress Analysis**
- Analysis of dam instrumentation data
- Estimation of effects of vibrations on structures
- Model / prototype hydrostatic testing of penstock bifurcation, gates etc.

- Static and dynamic stress analyses of earthen and gravity dams by Finite Element Modelling
- In-situ measurement of stress, deformation, strain, pore-pressure for monitoring long-term structural performance
- Stress analysis of dams, tunnels etc. by experimental techniques such as photo-elasticity and electrical resistance strain gauge

**Concrete Technology**
- Determination of strength, elastic, thermal and creep properties of mass and roller compacted concrete
- Suitability of epoxy compounds for rehabilitation of distressed hydraulic structures
- Laboratory studies for concrete and masonry materials

**Model Studies for Penstock Bifurcation**

**Temperature Distribution in Concrete Dam**
**Facilities and Equipment**

- Flat Jacks and Deformation Gauges
- Data Acquisition System and Strain Gauge Instrumentation
- Direct Shear Testing Machines, Dynamic Triaxial Soil Test Machine, UTM
- Resonant Testing Equipment for soil/rock cores
- Standard Penetration Test Apparatus
- Adiabatic Calorimeter, Tensile Strain Capacity, and Creep Test Setup
- Extensometers, Point Load Tester, Petrological Microscope
- Polariscope, Stress-Freezing Ovens, Hiltcher’s Lateral Extensometer, Loading Frames
- Finite Element Software Packages
- Precision Workshop for fabrication of models

**Some Major Studies**

**Foundations:** Idukki, Srisailam, Hidkal, Sardar Sarovar, Supa, Subansiri, Hirehalli, Rana Pratap Sagar, Dudhanga, Kadana, Tawa, Ghatghar, Bhakra, Upper Tunga

**Dams:** Koyana, Amarja, Supa, Kodasalli, Ukai, Srisailam, Thokrewadi, Indira Sagar, Jhuj, Hirakud, Idukki, Nagarjunasagar, Warna, Ujjani, Kolwewadi, Ghatghar, Bhandardara

**Underground Structures:** Sardar Sarovar, Bhira, Balimela, Beas-Sutlej, Koyna, Srisailam, Kalinadi, Dehar, Pench, Nagzari, Lower Periyar, Varaahi

**Water Conductor Systems:** Lower Periyar, Beas, Idukki, Kalinadi, Nagarjunasagar, Nathpa-Jhakri, Koyna, Ramganga, Upper Kolab, Mumbai Water Supply Tunnels, Sharavathy

**Penstocks:** Idukki, Vaharai, Kalinadi, Khopoli, Sharavathy, Loktak

**Atomic Power Projects:** Rajasthan, Kaiga, Kakrapar, Kalpakkam, Tarapur, Kayambalam, Kudankulam

**Others:** Bandra- Worli Outfalls, Gannavaram Aqueduct, Hooghly Estuary, Breakwaters at Mangalore, Munambam and Kakinada, Kutchh Branch Canal, Kudremukh, Simhadri
EARTH SCIENCES

The Earth Sciences Laboratory comprises Geophysics, Earthquake Engineering, Tracer Hydrology, Hydrogeology and Vibration Technology Divisions. The laboratory undertakes studies for foundation evaluation, source and path of seepage, seismic surveillance and seismic design parameters for major projects.

AREAS OF SPECIALIZATION

- Microearthquake and strong-motion studies for water resources projects
- Evaluation of site-specific design seismic parameters (accelerograms and response spectra)
- Delineation and evaluation of bedrock profile for massive water control structures
- Evaluation of dynamic Young's and shear moduli of subsurface strata
- Location of shear zones, faults and buried river courses
- Location of groundwater resources
- Delineation of sub-bottom stratigraphy and 3D mapping of sea/reservoir bed
- Detection of source and path of seepage through structures and their foundations
- Measurement of earth resistivity for power houses and other applications
- Detection of buried pipelines, tanks and contaminant plumes
- Determination of in situ engineering and hydrological parameters of subsurface strata
- Dynamic response analysis of structures by forced and ambient vibrations
- Seismic qualification tests on shake table
- Controlled blast studies for safety of nearby structures at construction sites
- Detection of cracks and evaluation of quality of concrete and masonry by non-destructive sonic and ultrasonic techniques
- Estimation of in-situ dynamic properties of foundation soil
FACILITIES AND EQUIPMENT

* Ground Penetrating Radar
* 24-Channel Land Seismic Reflection and Refraction Seismographs
* Borehole Acoustic Logging System
* Multi-Electrode Resistivity Imaging System
* High Resolution Chirp Sonar Reflection System
* Side Scan Sonar, Dual frequency Echo Sounder
* Ultrasonic Velocity Measuring System
* Magnetometer and Gravimeter
* Borehole Logging Instruments
* Surface Density and Moisture Gauges
* Fluoro Meter, Conductivity Meter, pH Meter
* Electrodynamic Vibration Test System
* Vibration Measuring and Data Acquisition Systems
* Engineering Seismographs
* Various types of Seismometers and Accelerograms
* Microearthquake and Strong-motion Recorders
* Block vibration Test Equipment

SOME MAJOR STUDIES

* Dams: Srisailam, Almatti, Harangi, Tala and Sankosh (Bhutan), Teesta, Narmadasagar, Pancheshwar, Rihand, Itzeho, Zambia, Tipaimukh, Subansiri, Jamirani, Idukki, Kadana, Nagarjung, Dhadganga, Panna, Koyna, Omkareshwar, Hichak, Sardar Sarovar, Kalinadi, Pench, Tapovan-Vishnugad, Lata-Tapovan, Loharinagpala

* Thermal Power Stations: Khaperkheda, Kayamkulam, Koradi, Anpara, Vindhyachal, Maithon, Mangalore, Chandrapur, Dahanu, Vijaywada

* Atomic Power Projects: Tarapur, Kudankulam, Kaiga, Kudakapar, Rajasthan

* Ports: Karwar, Jawaharlal Nehru, Tuticorin, Visakhapatnam, Kandla, Ennore

* Canals: Tungabhadra, Nandgaon, Indira Gandhi Nahar Pariyovana
IMPORTANT INFRASTRUCTURE FACILITIES

The research activities at CWPRS are supported by excellent infrastructure facilities like sufficient space for physical models, current meter rating trolley, coastal data bank, remote sensing centre, library, campuswide LAN with intranet and broadband internet facilities.

REMOTE SENSING CENTRE

Major facilities include Silicon Graphics Workstation under Unix environment, Digital Image Processing and GIS Software.

Important studies undertaken include reservoir sedimentation, river morphology, assessment of tidal storage, shoreline stability etc.

CURRENT METER RATING TROLLEY

- Rating tank 228m long, 3.66m wide and 2.13m deep
- Speed range 0.01m/s to 6.0 m/s
- AC servo motor drives for precise speed control
- PC based data acquisition and processing system
- Measurement accuracies conforming to International Standards

LIBRARY

- Subscription to over 100 scientific and technical journals/periodicals with on-line access to many important journals
- Over 50,000 books and reports representing a comprehensive collection in engineering and allied subjects
- About 18,000 bound volumes of technical journals/periodicals
- Selective dissemination of information services to groups of users within and outside CWPRS
- Retrospective and on-line searches on holdings of the library
TECHNICAL CO-OPERATION AMONG DEVELOPING COUNTRIES

- Afghanistan: Hydraulic model studies for Khanabad barrage and Salma H.E. Project
- Bangladesh: Training of personnel from River Research Institute, Dhaka
- Bhutan: Hydraulic model studies for Chukha and Tala Projects; Seismic surveillance studies for Tala, Wangchu, Punatsangchu and Sankosh Projects
- Egypt: Setting up of hydraulic laboratory; Training of personnel
- Ethiopia: Consultancy in water resources management, soil stability
- Kampuchia: Flood control measures on Tonlesap river
- Philippines: Training of personnel; Review of technical reports
- Indonesia: Development of inland fish culture in tidal zones
- Iran: Consultancy on upgradation of Water Resources Research Institute, Tehran; Supply of equipment
- Iraq: Setting up of Hydraulic Laboratory at Baghdad; Spillway model studies for Bekhme dam; Fabrication and installation of spillway models of Bakurman and Khalilkan dams; Supply of equipment
- Libya: Thermal recirculation studies for Tripoli (West) Power Station, including collection of field data
- Malaysia: Contractual testing of turbine model for Tenom Pangi Project; Thermal recirculation studies for Klang and Pasir Gudang Thermal Power Stations
- Myanmar: Rehabilitation of four ports; Hydraulic model studies in Sedawgyi dam spillway; Hydraulic model studies for rehabilitation of irrigation sluices
- Mozambique: Seepage analysis and rehabilitation studies for Massinger dam project
- Nepal: Model studies for sediment exclusion in the power channel, Trisuli, seismological studies for Saptkosi and Sunkosi Projects
- Singapore: Port Development, reclamation
- Sri Lanka: Setting up hydraulic laboratory
- Thailand: Contractual testing of turbine model for Pattani Hydro Power Project
- Togo/Benin: Coastal erosion and protection measures
- Vietnam: Consultancy in drafting Project Document; Development of Hydraulic Research; Training of personnel
- Zambia: Seismic surveillance studies for Iteshitezhi Reservoir Project
AREAS OF ACTIVITIES AT CENTRAL WATER AND POWER RESEARCH STATION

- जल विज्ञान तथा जल संसाधन विश्लेषण
  HYDROLOGY AND WATER RESOURCES ANALYSIS
- नदी इंजीनियरी
  RIVER ENGINEERING
- जलाशय तथा संबंधित संरचनाएँ
  RESERVOIR AND APPURTENANT STRUCTURES
- तटीय तथा तटदूर इंजीनियरी
  COASTAL AND OFFSHORE ENGINEERING
- पोत झर-गति विज्ञान
  SHIP HYDRODYNAMICS
- झर्ने मशीनें
  HYDRAULIC MACHINERY
- मापन साधन का अनुप्रयोग
  CALIBRATION OF MEASURING DEVICES
- भू-विज्ञान
  EARTH SCIENCES
- साधन विनियोग तथा नियंत्रण इंजीनियरी
  INSTRUMENTATION & CONTROL ENGINEERING
- भवन तथा संरचनाएँ
  FOUNDATIONS AND STRUCTURES
- पर्यावरण जल विज्ञान
  ENVIRONMENTAL HYDRAULICS
- जल सूचना विज्ञान
  HYDROINFORMATICS