

Technical Memorandum No. 93  
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उत्तराखण्ड शासन



अपार शक्ते: स्त्रोत: गंगेयम्



# ANNUAL REPORT 2022-23



**IRRIGATION RESEARCH INSTITUTE**

(An ISO 9001:2008 Certified Organisation)

**Roorkee - 247 667, Uttarakhand**



## COSULTANCY AREAS

IRI undertakes Research and Development activities related to Irrigation and Hydro-electro Projects in the following major areas:

### • Providing efficient and economical hydraulic design for various engineering works viz.

- Canal works
- Spilways
- Power house
- Intakes

- Diversion Works
- Surge Tanks
- Sediment Excluding
- Ejecting Devices

Sitting of Bridges  
&  
Barrages

- River Training
- Flood Protection
- Anti-erosio Measures

### • Geotechnical Investigation, Concrete Mix Design & Materials Testing for all Civil Engineering Structures.

### • Economical Design of Concrete Mixes using Flyash and Superplasticizers; Roller Compacted Concrete for Massive structures.

### • Ground Water Development

- Conjunctive use of Sub-surface & Surface Water
- Water Logging

- Suitability for Canal Linings
- Seepage from Canals & Tubewells
- Water Logging

- Stability due to Sub-surface flow
- Water Suitability

- Studies for Regeneration/ Seepage from Water Bodies

- Artificial Recharging

### • Sedimentation Studies

- Capacity and Life of Reservoirs

### • Mathematical Modeling

- Hydrological Events

- Sub-Surface flow
- Surface Flow

- Hydraulic Structures etc. (Surge Tank, Water hammer and Sedimentation Chamber)

### • Basic & Fundamental Research in the field of Water Resources and Hydropowers.





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अपार शक्तेः स्त्रोतः गंगेयम्

# ANNUAL REPORT 2022-23

## वार्षिक प्रतिवेदन 2022-23



### IRRIGATION RESEARCH INSTITUTE

### सिंचाई अनुसंधान संस्थान

(An ISO 9001:2008 Certified Organisation)

Roorkee - 247667, (Uttarakhand)



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## संदेश

मुझे यह जानकर अत्यन्त हर्ष हो रहा है कि **सिंचाई अनुसंधान संस्थान, रुड़की** द्वारा वर्ष 2022-23 में किये गये विभिन्न शोध और परीक्षण कार्यों पर आधारित **“वार्षिक विवरणिका”** का प्रकाशन किया जा रहा है। आज के समय में भू-जल दोहन के कारण नदियों के प्रवाह में कमी, भू-जल संसाधनों के स्तर में कमी एवं तटीय क्षेत्रों के जलमृत्तों में लवण जल का अवांछित प्रवेश हो रहा है। कुछ क्षेत्रों में नहरों से अत्यधिक सिंचाई के परिणामस्वरूप जल ग्रसनता एवं लवणता की समस्या पैदा हो चुकी है, इस कारण संस्थान के उत्कृष्ट शोध एवं परीक्षण कार्य न केवल वर्तमान समय के लिए महत्वपूर्ण है, बल्कि भविष्य योजनाओं के लिए भी अत्यन्त महत्वपूर्ण है। मुझे आशा है कि उक्त विवरणिका में प्रकाशित होने वाले नवाचार से सम्बन्धित शोध पत्र एवं लेख भावी योजनाओं के क्रियान्वयन का समावेश होने से यह पाठकों एवं शोधार्थियों के लिए अत्यन्त उपयोगी सिद्ध होगी।

मेरी ओर से **सिंचाई अनुसंधान संस्थान, रुड़की** को **वार्षिक विवरणिका वर्ष 2022-23** के सफल प्रकाशन के लिए हार्दिक बधाई एवं शुभकामनाएँ।

(पुष्कर सिंह धामी)







सतपाल महाराज  
मंत्री  
SATPAL MAHARAJ  
Minister



उत्तराखण्ड सरकार

लोक निर्माण विभाग, पर्यटन, सिंचाई, लघु सिंचाई  
ग्रामीण निर्माण, पंचायती राज, जलागम प्रबंधन, संस्कृति, धर्मस्व  
भारत-नेपाल उत्तराखण्ड नदी परियोजनायें  
उत्तराखण्ड सरकार

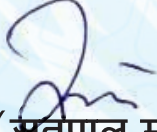
Public Work Department, Tourism, Irrigation, Minor Irrigation,  
Rural Works Department, Panchayati Raj, Watershed Mangement, Culture  
Flood Control, Indo-Nepal-Uttarakhand and River Projects  
Government of India



## संदेश

यह अत्यन्त प्रसन्नता की बात है कि सिंचाई अनुसंधान संस्थान, रुड़की द्वारा वर्ष 2022-23 में किये गये विभिन्न शोध एवं परीक्षण कार्यों की 93वीं वार्षिक विवरणिका का प्रकाशन किया जा रहा है हम सब विदित हैं कि उत्तराखण्ड राज्य में जल संसाधन, नदियों एवं अन्य जल स्रोतों का अपूर्व भण्डार है। राज्य के जल स्रोत सदा से ही जल विद्युत उत्पादन का प्रमुख स्रोत रहे हैं। आज के समय को देखते हुए ऊर्जा के इस अक्षय भण्डार के रक्षण एवं पोषण की जो उपयोगिता इस संस्थान ने समझी है, इसके लिये संस्थान बधाई का हकदार है। मुझे आशा है कि इस विवरणिका में वर्णित कार्य एवं पूर्व में इस संस्थान द्वारा किये गये शोध कार्य आगामी योजनाओं के क्रियान्वयन में मील के पथर सिद्ध होंगे।

मैं सिंचाई अनुसंधान संस्थान, रुड़की द्वारा प्रकाशित होने वाली "वार्षिक विवरणिका" के सफल प्रकाशन हेतु अपनी शुभकामनाएं ज्ञापित करते हुए संस्थान के अधिकारियों/कर्मचारियों के उज्ज्वल भविष्य की कामना करता हूँ।

  
(सतपाल महाराज)







J. L. Sharma  
Joint Secretary



Irrigation, Minor Irrigation  
Secondary Education,  
Govt. of Uttarakhand  
Dehradun

### Message

It is a matter of great pleasure that IRI, Roorkee is publishing its Annual Report which contains its R&D activities carried out during the year 2022-23.

IRI Roorkee is known for its significant contribution in the field of R&D activities related to Hydraulic Modeling studies, Capacity Survey & Sedimentation Studies, Material Testing, Ground Water, and Concrete Technology.

I am pleased to learn that IRI roorkee has been associated with prestigious projects like; Jamrani Drinking Water Multipurpose Project, Nainital (Uttarakhand), Reoli Dugli Hydro Electric Project (Himachal Pradesh), Koldam Hydro Electric Project (Himachal Pradesh), Maneri Bhali Stage-I HEP (Uttarakhand), Arun-3 Hydro- Electric Project (Nepal) and Bathymetric Reservoir Capacity Survey & Sedimentation Studies of Jagro, Dhekuwa & Sukhara Dam Reservoir in the Mirzapur District of Uttar Pradesh State.

Awarded by CBI&P Award-2022 reflects the excellent working style of this institute in field of R&D related to hydraulic studies.

Through this, I take an opportunity to compliment to all the Engineers, Research Officers & entire staff for their relentless efforts in carrying out research activities at IRI, Roorkee

I Wish all success for the publication of Annual Report 2022-23.

(J.L. Sharma)









अपार शक्तेः स्त्रोतः गङ्गेयम्



**Jaipal Singh**  
Engineer-in-Chief



उत्तराखण्ड राज्य



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I am pleased to know that the Irrigation Research Institute; Roorkee, which has a standing of about 70 years in the field of Hydraulic Modelling, Material Testing and has grown into a centre of excellence, is publishing its 93<sup>rd</sup> Annual Report for year 2022-23.

I believe that the research and development activities published in the annual report will enhance the image and standard of the institute. I also appreciate the efforts of officers and employees of the institute for their dedication and untiring effort in executing the works and bring out a comprehensive report.

This Institute received CBI&P Award-2018 & 2022 for Best R&D Contribution in Water resource sector by the Central Board of Irrigation and Power, Govt. of India which reflects the excellent working style of this institute in the field of R&D related to Hydrology.

I would also like to place on record my heartfelt appreciation to all the officers and staff of Irrigation Research Institute for their sincere efforts in preparing this report.

I hope this 93<sup>rd</sup> Annual Report of Irrigation Research Institute, Roorkee will serve as valuable source of information to all readers all over the country.

In the end I am thankful to all Officers, Research Personnel's and entire staff who have helped in achieving the goals and are ready to undertake upcoming challenges with hard work.

**Jaipal Singh**







अपार शक्तेः स्त्रोतः गंगेयम्



**Sh. Sudhir Kumar**  
Chief Engineer (Design) & Director



उत्तराखण्ड राज्य



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### **From Director's Desk**

It gives me immense pleasure to present the 93<sup>rd</sup> Annual Report of Irrigation Research Institute, Roorkee for the year 2022-23. This annual report provides a glimpse of R&D activities carried out by different research units of the institute. This institute is an excellent work station in field of hydraulic model studies, testing of civil engineering construction material & studies related to ground water, capacity survey & sedimentation of reservoirs etc.. The hydraulic model studies for various irrigation, hydro-projects & flood protection work related to Uttarakhand, other states of country & foreign countries are being conducted at institute's Hydraulic Research Station at Bahadradab.

- The institute has excellent facilities for carrying out hydraulic model studies at Hydraulic Research Station, Bahadradab. It is worth mentioning that model studies for major projects of international importance has been carried out at IRI, Roorkee only viz. Jamarani Drinking Water Multipurpose project, Nainital (Uttarakhand), Reoli Dugli Hydro Electric Project (Himachal Pradesh), Koldam Hydro Electric Project (Himachal Pradesh), Maneri Bhali stage-I HEP (Uttarakhand), Arun-3 Hydro-Electric Project (Nepal) and Bathymetric Reservoir Capacity Survey & Sedimentation studies of Jargo, Dhekuwa & Sukhara Dam Reservoir in the Mirzapur district of Uttar Pradesh State.
- Major completed and undergoing Projects/Activities of institute during year 2022-23 are :
  1. During this period 34 Research Reports and 668 Test Reports were issued.
  2. Irrigation Research Institute is working as Nodal Agency for implementation of National Hydrology Projects by Minister of Water Resources, River Development & Ganga Rejuvenation, Govt. of India, New Delhi.
  3. Studies of Flood Plain Zoning in a length of about 2200 km of all rivers in their critical zones were divided into four phases viz. Phase-I (50 km), Phase-II (532 km), Phase-III (401 km) and Phase-IV (850 km) in the state of Uttarakhand.
  4. State Specific Action Plan sponsored by Ministry of Water Resource, River Development and Ganga Rejuvenation, Govt. of India, New Delhi is undertaken and is under preparation.
  5. Vetting of Design Proposal carried out under River Morphology Project conceptualized in view of flood of 2013 is being done as a Nodal Agency.
  6. Officers of IRI, Roorkee played active role in State Committee on Dam Safety, Uttarakhand and State Dam Safety Organisation, Uttarakhand.

I appreciate the remarkable efforts by the institute towards R&D activities related to present day scenario of irrigation and hydro electric projects through applied and field oriented research. An institute's annual report is an excellent medium to disseminate its scientific creativity and its finding to the engineering fraternity.

I take this opportunity to express my gratitude to various sponsors all over the country for referring the institute. Also, I thank Irrigation Research Institute entire staff including Research Personnel, Engineers for their commendable contribution in achieving the desired goal and hope the Institute will continue to attain higher level of achievement

  
(Sudhir Kumar)







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## A IMPORTANT STUDIES AND HIGHLIGHTS OF LAST FOUR YEARS :

- A Memorandum of Understanding (MoU) for **“Testing of Construction Materials and Quality Control/Assurance/Inspection/Quality Audit/Technical Checking of Development/ Construction works being undertaken by various government departments of the Uttarakhand State”** between the Secretary, State Planning Department, Govt. of Uttarakhand and Chief Engineer (Design) & Director, Irrigation Research Institute, Roorkee, Irrigation Department Uttarakhand was signed on 14<sup>th</sup> September, 2018.
- A Memorandum of Understanding (MoU) for **“Quality and Quantity audit of Civil Works”** was signed between the Director (Planning), State Infrastructure and Industrial Development Corporation of Uttarakhand Ltd. (SIIDCUL) Dehradun and Chief Engineer (Design) & Director, Irrigation Research Institute, Roorkee, Irrigation Department Uttarakhand on 11<sup>th</sup> November, 2019.
- A Memorandum of Understanding (MoU) for **“Third Party Quality Control Assurance and Technical Checking Works** was signed between the Mela Officer, Kumbh Mela, Haridwar and Chief Engineer (Design) & Director, Irrigation Research Institute, Roorkee, Irrigation Department Uttarakhand on 14<sup>th</sup> January, 2020.
- **“CBIP Award 2018 for the Best R&D Contribution in Water Resources Sector”** was awarded to IRI, Roorkee by CBI&P, New Delhi.
- Citation Award for Excellent works of IRI, Roorkee in Mahakumbh Mela-2021, Haridwar.
- Third Party Quality Control Works of different construction works of:
  - Mussoorie Dehradun Development Authority (MDDA), Dehradun.
  - Namami Ganges Programme, Uttarkashi, Uttarakhand.
  - Public Works Department (PWD), Govt. of Uttarakhand.
  - Irrigation Department, Govt. of Uttarakhand.
  - State Industrial Development Corporation Uttarakhand Limited (SIDCUL), Uttarakhand.
  - Northern Railway, Saharanpur (U.P.).
  - KEC Waterleau, Roorkee.
  - Shree Pranami Sewa Kendra, Gurera (Haryana).
  - M/s A. P. Associates Govt. Contractor, Amba Enclave, Uttar Pradesh.
- IRI, Roorkee was nominated for the implementation of National Hydrology Project (NHP), a Central Govt. assisted prestigious Project of DoWR, RD and GR, Ministry of Jal Shakti, GoI. Major activities were carried out for various projects viz:
  - Construction & Establishment of State Water Informatics Centre (SWIC) Building at Roorkee
  - Supply, Testing & Commissioning of Acoustic Doppler Current Profiler (ADCP)
  - Supply, Installation, Testing & Commissioning of Real Time Data Acquisition System (RTDAS) for surface water & ground water
  - River cross-section, topographical survey & construction of bench mark pillar at 623 locations in the state.
  - Development of G-D Curve for identified location in Uttarakhand State
  - Development of A Comprehensive Plan for Conservation and Sustainable Management of Bhimtal and Naukuchiatal Lakes in Uttarakhand State
  - Sustainable Development & Management of Springshed in Uttarakhand State
  - Supply, Installation, Testing & Commissioning of SCADA system for Gaula Barrage, Haldwani and Kosi Barrage, Ramnagar (Uttarakhand)
  - Creation of state chapters for India WRIS etc.





- Establishment of 02 Nos. Water Quality Laboratories
  - ◆ One at Irrigation Research Institute, Roorkee &
  - ◆ Another at Jamrani Colony, Haldwani, etc.;
- National Water Mission (NWM), DoWR, RD and GR, MoJS, GoI envisages preparation of State Specific Action Plan (SSAP) for water sector of each State/UT aligning with the State Action Plans on Climate Change (SAPCC) already prepared by the States/UTs with support from the Ministry of Environment, Forests and Climate Change. Irrigation Design Organisation, Roorkee (IDO), a sister organisation of IRI, Roorkee was nominated for the preparation of SSAP in the State of Uttarakhand. Draft Status Report (DSR) of SSAP was prepared and the same was approved by both the Committees of NWM viz. Technical Committee and Steering Committee.
- Uttarakhand Flood Plain Zoning Act, 2012 was enacted in 2012 on the guidelines of National Disaster Management Authority (NDMA), GoI in the State in order to minimize the damages of property, lives, live stocks etc. by flood happened in the rivers flowing in the State.  
Irrigation Research Institute, Roorkee was nominated to start for scientific studies for flood plain zoning in the State of Uttarakhand. Initially, studies of flood plain zoning in a length of about 2200 km all rivers in their critical zones were divided into four phases viz. Phase-I (50 km), Phase-II (532 km), Phase-III (401 km) and Phase-IV (850 km). Studies of Phase-I and Phase-II were completed successfully. Studies of Phase-III & IV are in progress.
- Bathymetric Surveys and Sedimentation Studies of Ichhari Dam, Maneri Dam Reservoirs, Bhimtal Lake & Naukuchiyatal Lake.
- Establishment of 03 new laboratories namely Pipe Testing Lab., Timber Testing Lab., Paint testing Lab. in Irrigation Research Institute, Roorkee
- 35 Nos. Physical Hydraulic Model Studies of Hydro-Electric Projects (spillway capacity, reservoir sedimentation and flushing, breast wall, surge tank, tail race system, etc.), Irrigation Projects, River Training Works, Railway Bridges, Highway Bridge, etc.
- 02 Nos. EHDA Model Study for Uplift Pressure and Exit Gradient of Barrage.
- 16 Nos. Mix Design of different Grades and Types of Concrete and Shotcrete, Testing of samples of Concrete Cubes (4191 Nos.), Steel Bars (2166 Nos.), Coarse Aggregate (517 Nos.), Fine Aggregate (196 Nos.), Bricks (1196 Nos.), Tiles (388 Nos.), Cement (170 Nos. Physical Test & 54 Nos. Chemical Test), Fly ash (12 Nos. Physical Test & 13 Nos. Chemical Test), Grain Size Analysis & Gradation Curve of Soil/RBM (154 Nos.), Silt Factor of River Bed Materials (21 Nos.), Maximum Dry Density of Soil (04 Nos.), Alkali-Aggregate Reactivity Test (06 Nos.), Shear Parameter Cohesion and Angle of Internal Friction Test (26 Nos.), Cement Concrete/Mortar Proportioning (34 Nos.), etc. of various Departments/Organizations viz. Irrigation Department, Uttarakhand, PWD, Uttarakhand, Uttarakhand Payjal Sansadhan Vikas & Nirman Nigam, MDDA, WAPCOS Ltd., Uttarakhand Jal Vidyut Nigam (UJVNL) Ltd., UP Jal Nigam, RES, Uttarakhand, UP Project Corporation Ltd., M/s WASH Institute, Saharanpur, M/s Singh & Associates, Saharanpur (U.P.), M/s Ayush Adarsh Yuva Samiti, Haridwar (Uttarakhand), M/s GoGoal Hydro Pvt. Ltd., Haridwar, (Uttarakhand) etc.
- Field Tests Bridge Load Test (06 Nos.), Block Shear Test (26 Nos. Rock to Concrete 29 Nos. Rock to Rock), Soil Bearing Capacity Test (09 Nos.) etc.
- 06 Nos. of Pressure Release Valve Test of ID (Uttar Pradesh), ID (Tamilnadu), ID (Punjab);
- 652 Nos. Water samples of various Rivers/Lakes and Drinking water of all 13 districts of Uttarakhand State.
- Observations of Meteorological Data at Hydraulic Research Station, Bahadrabad (Uttarakhand) on daily basis.
- Issuing of Research Reports in respect of Physical Hydraulic Model Studies (54 Nos.), Mix Design of Concrete/Shotcrete (11 Nos.), Capacity Survey & Sedimentation Studies of Reservoirs (4 Nos.);
- Issuing of 1841 Nos. Test Reports in respect of diverse tests of Bitumen, Bridge Load, Block Shear, Plate Load, Cement, Concrete, Steel Bars, Fly Ash, Bricks, Aggregates, Water, Mortar, Concrete Cores, Soil Samples, RBM, Current Meter Calibration etc.

## B HIGHLIGHTS OF THE YEAR 2022-2023:

- Awarded “**CBIP Award 2022 for the Best R&D Contribution in Water Resources Sector**” to IRI, Roorkee by CBI&P, New Delhi.
- Bathymetric Reservoir Capacity Survey & Sedimentation Studies of Jargo Dam Reservoir, Dhekuwa Dam Reservoir and Sukhara Dam Reservoir in Mirzapur District of Uttar Pradesh.
- Basic Studies conducting for monitoring of spread areas of Glacial Lakes in pithoragarh district of Uttarakhand from June 2020 to October 2020 and June 2021 to October 2021 using Remote Sensing Techniques.
- Third Party Quality Control works of different construction works of
  - State Industrial Development Corporation Uttarakhand Limited (SIDCUL), Uttarakhand.
  - Uttarakhand Peyjal Sansadhan Vikas Evam Nirman Nigam, Dehradun
  - Irrigation Department, Govt. of Uttarakhand
  - Public Works Department, Govt. of Uttarakhand, etc.;
- 07 Nos. Physical Hydraulic Model Studies of Hydro-Electric Projects (Spillway Capacity, Reservoir Sedimentation and flushing, breast wall, surge tank, tail race system, etc.), Irrigation Projects, River Training Works, Railway Bridges, Highway Barrage;
- 01 Nos. EHDA Model Study for Uplift Pressure & Exit Gradient of Barrage.
- 06 Nos. Mix Design of different grades and types of Concrete & Shotcrete, Testing of samples of Concrete Cubes (623 Nos.), Steel Bars (563 Nos.), Coarse Aggregate (62 Nos.), Fine Aggregate (48 Nos.), Bricks (133 Nos.), Tiles (300 Nos.), Cement (23 Nos. Physical Test and 02 Nos. Chemical Test), Fly ash (01 Nos. Physical Test and 01 Nos. Chemical Test), Grain Size Analysis and Gradation Curve of Soil/RBM (20 Nos.), Silt Factor of River Bed Materials (26 Nos.), Alkali-Aggregate Reactivity Test (01 Nos.), Shear Parameter Cohesion and Angle of Internal Friction Test (01 Nos.), Cement Concrete/Mortar proportioning (04 Nos.), etc. of various departments/organizations viz. Irrigation Department Uttarakhand, PWD Uttarakhand, World Bank Project Unit, Uttarakhand Peyjal Nigam, Uttarakhand Payjal Sansadhan Vikas and Nirman Nigam, MDDA, Uttarakhand Jal Vidyut Nigam (UJVNL) Ltd., UP Jal Nigam, RCD Uttarakhand, Director (Training), Uttarakhand Training and Employment Directorate, Haldwani, UP Project Corporation Ltd., WAPCOS Ltd., M/s WASH Institute, Saharanpur (U.P.), Adarsh Yuva Samiti, (AYUS), Haridwar (Haridwar), M/s Singh and Associates, Saharanpur (U.P.), M/s Ayush Adarsh Yuva Samiti, Haridwar, M/s Bridge & Roof Company (India) Ltd., New Delhi, M/s Construction Unit-37, U.P. Projects Corporation Ltd., World Bank Office, Roorkee, etc.
- Field Tests Bridge Load Test (01 Nos.), Block Shear Test (02 Nos. Rock to Concrete, 04 Nos. Rock to Rock), Soil Bearing Capacity Test (01 Nos.), etc.
- 01 Nos. of Pressure Release Valve Test of Irrigation Deptt. Punjab;
- 328 Nos. water samples of various River/Lake/ and Drinking Water of all 13 districts of Uttarakhand State.
- Observations of Meteorological Data at Hydraulic Research Station, Bahadrabad (Haridwar) on daily basis.
- Issuing of Research Reports in respect of Physical Hydraulic Model Studies (08 Nos.), Mix Design of Concrete/Shotcrete (06 Nos.), Capacity Survey and Sedimentation Studies of Reservoirs (03 Nos.);
- Issuing of 668 Nos. Test Reports in respect of diverse tests of Bitumen, Bridge Load, Block Shear, Plate Load, Cement, Concrete, Steel Bars, Fly Ash, Bricks, Aggregates, Water, Mortar, Concrete Cores, Soil Samples, RBM & Current Meter Calibration etc.



- Implementation of National Hydrology Project (NHP), a Central Govt. assisted prestigious Project of DoWR, RD and GR, Ministry of Jal Shakti, GoI. Major activities were carried out:
  - Execution works continued for developing rating curves using Acoustic Doppler Current Profiler (ADCP),
  - Supply, Installation, Testing & Commissioning of Real Time Data Acquisition System (RTDAS) for surface and ground water
  - River cross-section, topographical survey and construction of bench mark pillar at 623 identified locations in the state
  - Installation, testing & commissioning of SCADA system for Gaula Barrage, Haldwani and Kosi Barrage, Ramnagar
  - Creation of state chapters for India WRIS, Establishment of State Water Informatics Centre (SWIC), etc.
  - Purpose Driven Studies for Development of A Comprehensive Plan for Conservation and Sustainable Management of Bhimtal and Naukuchiatal Lakes, Uttarakhand
  - Sustainable Development and Management of Springshed in Uttarakhand
  - Operation and Maintenance of 02 Nos. Water Quality Laboratories at Roorkee & Haldwani.
- Preparation of Interim report on water budgeting of the State of Uttarakhand under State Specific Action Plan (SSAP) of National Water Mission (NWM), DoWR, RD and GR, MoJS, GoI.
- Uttarakhand Flood Plain Zoning Act, 2012 was enacted in 2012 on the guidelines of National Disaster Management Authority (NDMA), GoI in the State in order to minimize the damages of property, lives, live stocks etc. by flood happened in the rivers flowing in the State. Initially, studies of flood plain zoning of Phase-III (401 km) completed and tendering process of Phase-IV (850 km) was completed.
- Officers of IRI, Roorkee namely Sh. Sudhir Kumar, Chief Engineer (Design) & Director and Sh. Shankar Kumar Saha, Superintending Engineer, Research Circle played active role in State Committee on Dam Safety, Uttarakhand and State Dam Safety Organisation, Uttarakhand respectively. Sh. Saha, SE prepared Annual Report 2022-23 of State Dam Safety Organisation, Uttarakhand in order to implement the Dam Safety Act, 2021 in Uttarakhand State.



उत्तराखण्ड शासन



अपार शक्तेः स्त्रोतः गंगेयम्

**IRRIGATION DEPARTMENT, GOVT. OF UTTARAKHAND**

**सिंचाई विभाग, उत्तराखण्ड सरकार**

**IRRIGATION RESEARCH INSTITUTE, ROORKEE**

**सिंचाई अनुसंधान संस्थान, रूड़की**



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**CHAPTER – I**

**IRRIGATION DEPARTMENT, UTTARAKHAND,  
IRRIGATION RESEARCH INSTITUTE, ROORKEE  
& THEIR MANDATES**







## IRRIGATION RESEARCH INSTITUTE, ROORKEE AND IRRIGATION DEPARTMENT, UTTARAKHAND

### **Irrigation Department, Uttarakhand at a Glance** (सिंचाई विभाग, उत्तराखण्ड: एक झलक) :

Irrigation Department, Uttarakhand is a department of Govt. of Uttarakhand State created with the prime goal for providing irrigation facility to farmers of the State of Uttarakhand, Compliance and Implementation of State Water Policy and related acts and creating new irrigation potential, harnessing water power, anti-erosion/flood protection works to protect agriculturable land and property. The main priorities of the department are:

- To provide Irrigation facility to unirrigated agriculture land at far places of the state by constructing Canals/Lift Canals/Tubewells;
- To provide Irrigation facility in the hilly areas by constructing Mini Tubewells;
- Application of Drip and Sprinkler Technique;
- Creation of Lakes/Ponds/Small Reservoirs by constructing Barrages/Dams at suitable places in the state for Water Conservation, Irrigation, Drinking Water and Encouraging Tourism;
- Extension/Renovation/Modernisation of Existing Dams and Reservoirs under AIBP;
- Constructing Check Dams in Gadheras for Irrigation and Ground Water Recharge;
- Constructing Anti-Erosion/Flood Protection Works to protect Agriculture Land and Property;
- Sustainable Development and Management of Springs and Springsheds in the State;
- Developing River Front Development Projects on various Rivers of the State to reclaim Land;
- Development of Pump Storage Schemes on various Lakes/Projects to generate Hydropower during peak hours;
- Construction of Song Dam/Jamrani Dam for Irrigation, Drinking Water and Hydropower;
- Construction of Arakot-Tiuni and Tiuni-Plasu Hydroelectric Projects;
- Construction Works of Various Departments of the State in Deposit mode;
- Implementation of National Hydrology Project (NHP) in the State;
- Implementation of State Specific Action Plan (SSAP) in the State;
- Implementation of Flood Plain Zoning in the State;
- Enforcement of allotted works/projects/responsibilities etc. to Irrigation Department by the State Government, etc.

### **1. Institue/Organization/Academy of the Irrigation Department, Uttarakhand**

(सिंचाई विभाग, उत्तराखण्ड के संस्थान / संगठन / अकादमी) :

#### **1.1 Irrigation Design Organisation (IDO), Roorkee (सिंचाई परिकल्प संगठन, रुड़की)**

Earlier in erstwhile UP period, Irrigation Department, Uttar Pradesh constructed a number of Irrigation, Hydroelectric, Multipurpose, etc. water resources projects after self-designing of each structure of the projects. In continuation to the construction of various projects in the territory of present Uttarakhand State, Irrigation Design





Organization (IDO), Roorkee was set up in 1977-78 for the design of the same and also in-house capacity building amongst departmental engineers in the field of Design of various Hydraulic Structures. After formation of Uttarakhand State in 2000, IDO, Roorkee become a unit of Uttarakhand Irrigation Department. Since then, it has been serving the State in the field of Design of Hydraulic Structures proposed by the department in the State.

### 1.2 State Engineers Academy (SEA), Roorkee (प्रान्तीय अभियन्ता प्रशिक्षण अकादमी, रुड़की)

Training is an important part of human resources development. Training is very vital for newly appointed and newly promoted engineers in order to know how about responsibilities towards their duties, work culture in the department with public and public representative(s), practical knowledge of departmental various schemes, latest technical knowledge, system simplification etc. To achieve above goals and for capacity building amongst Engineers of different engineering departments of the State, State Engineers Academy was initially established at Kalagarh which was shifted at Roorkee in the year 2014-15.



### 1.3 Irrigation Research Institute (IRI), Roorkee (सिंचाई अनुसंधान संस्थान, रुड़की)

Irrigation Research Institute, Roorkee (Formerly UPIRI) was initially established as a small Research Unit in the year 1928 at Lucknow, the Capital of North Central Province during British Era. The purpose of this unit was to carry out research and development works related to Irrigation Canal projects being executed by the Irrigation

Department, Uttar Pradesh. Mr. Gerald Lacey, the pro-pounder of very popular regime theory for the design of irrigation canals in alluvial soils, was the founder of the above unit. The success of this research unit boosted up the confidence of practicing engineers and hence the research activities were further expanded when the aforesaid unit was shifted to a small town at Bahadradab in 1946, which is located on the bank of Northern Ganga Canal near Haridwar on the national highway. Later on, it became to a full-fledged Research Institute in 1954 at Roorkee.



The institute gradually developed as a pioneer Research Station of the country, which is providing facilities essentially for hydraulic model studies, testing of almost all types of civil engineering materials and basic/applied research related to Hydroelectric Projects, Civil Engineering Structures, Flood Protection, and Canal Works etc. In addition, it also provides consultancy services on Planning, Design and Constructions of Canal and River Valley Projects to all the State Governments, Central Government Departments and private engineering organisations such as UP PWD, Public Health Engineering Deptt., Haryana, U.P. State Bridge Corporation Limited, National Hydro-electric Power Corporation (NHPC), Rail India Technical and Engineering Services (RITES), Tehri Hydro Development Corporation (THDC), Hindustan Construction Company (HCC) Ltd., Satluj Jal Vidut Nigam (SJVN) Ltd., GVK Ltd. Secundrabad, Lanco Infrastructure, Dans Energy Ltd., Teesta Jal Urja Ltd. GMR Consultancy by Angelique International Pvt. Ltd, Hydrel/ Irrigation Departments of Chhattisgarh, Odisha, Uttar Pradesh, Haryana,



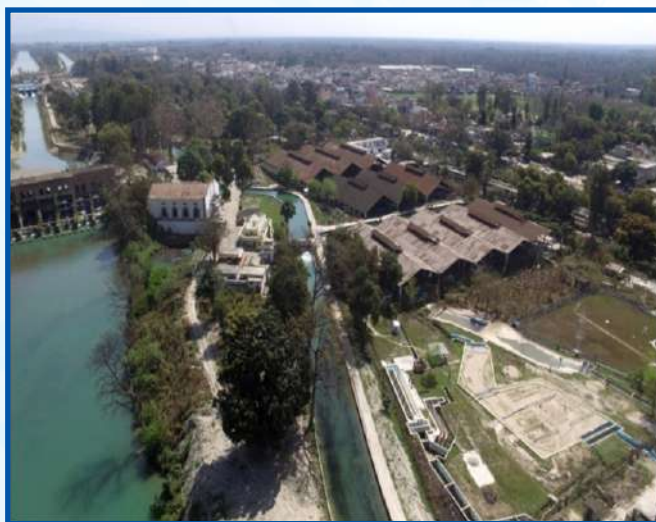
Himachal Pradesh, J&K, Gujrat, Sikkim etc. Also, this institute was awarded by ISO 9001:2008 certification in 2012.

### 1.3.1 Infrastructure Facilities:

Basically, two research stations one at Roorkee namely IRI, Roorkee and another at Bahadrabad namely Hydraulic Research Station, Bahadrabad, IRI, Roorkee.

#### A) At IRI, Roorkee

IRI, Roorkee at Roorkee is well facilitated with sufficient spaced 15 laboratories with requisite testing Equipments/Machine/ Apparatus along with 17 Rooms for offices, a Computer Centre, a Big Library with 30 persons reading capacity and more than 20000 Technical Books / Journals / Publications/BIS Codes/News Papers/ Magazines, 250 persons seated auditorium with balcony, 25 persons seated Committee Room for meeting, about 750 quarters for officers and staff.



#### B) At Hydraulic Research Station, Bahadrabad, IRI, Roorkee

At Hydraulic Research Station, Bahadrabad, IRI, Roorkee, following infrastructural facilities are available:

- Space – 18 Hectare,
- Water Drop Head up to 10 m
- Discharge 6-8 cumecs i.e. up to 280 cusecs for model studies

- Model Construction Facilities– at a time, 5-10 models or more at required model scale(s) as per space availability and requirement of study can be constructed in parallel
- Studies Facilities– at a time more than 8-10 models can be run simultaneously.

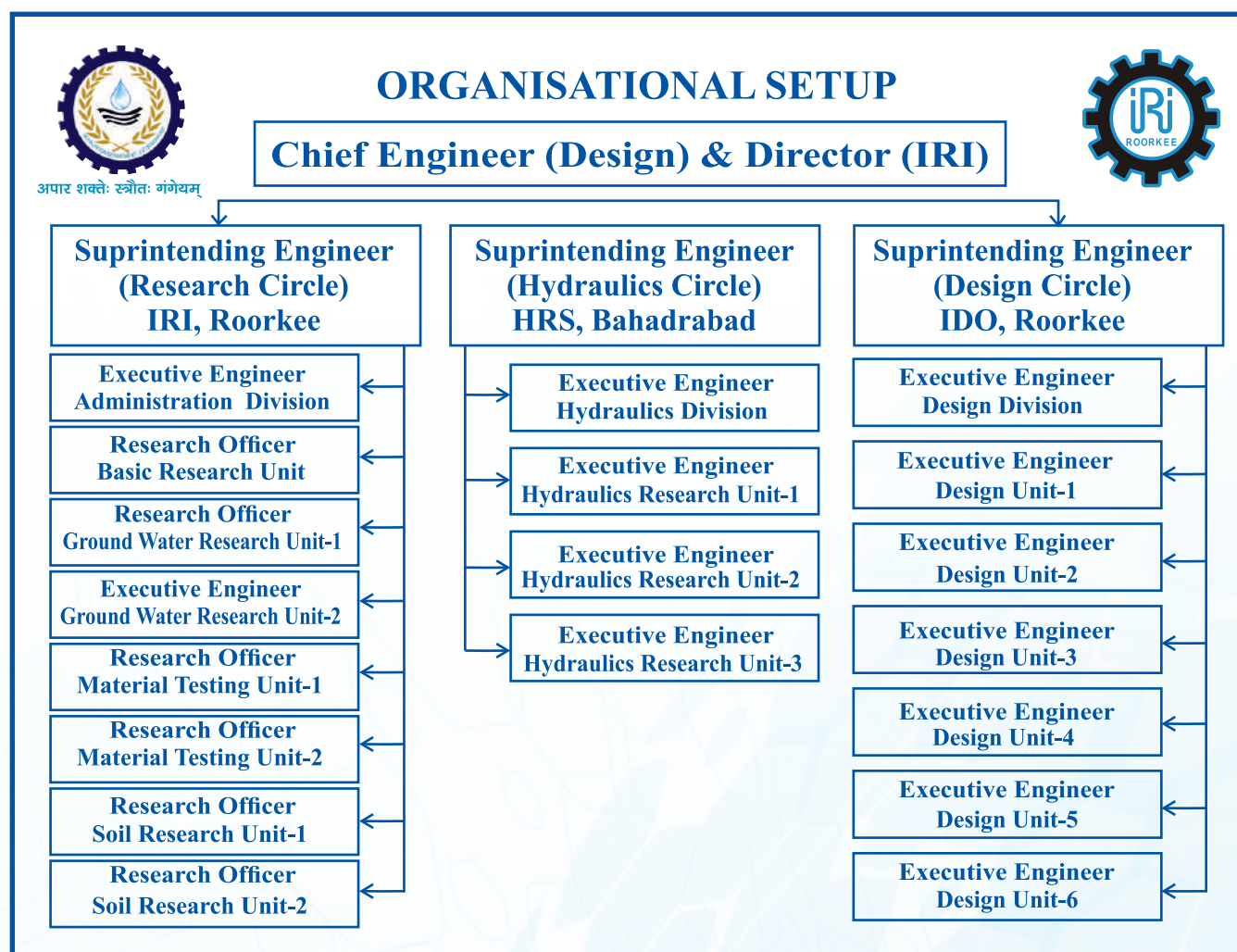
The station is well facilitated with sufficient spaced 06 trays with requisite Testing/Observational Equipments/Machine/Apparatus, facility for Current Meter Calibration, Hydro-Meteorological Observatory along with 01 Rooms for offices, a small Computer Centre, a Small Library with 20 persons reading capacity, 15 persons seated Inspection House hall for meeting, about 107 quarters for officers and staff.



#### C) Human Resources:

The IRI, Roorkee is headed by Chief Engineer Level-2 (Design) and Director, IRI, Roorkee under which three Circle offices headed by three Superintending Engineers are working. Amongst three Superintending Engineers, one SE heads Research Circle, Roorkee, seconds heads Hydraulic Circle, Bahadrabad and third one heads Design Circle, Roorkee under IDO, Roorkee. The organizational setup and human resources of IRI, Roorkee deployed for constructing and conducting the Model studies at Hydraulic Research Station, Bahadrabad, IRI, Roorkee, testing and studies at IRI, Roorkee and design of various hydraulic structures are given below as:





Sl. No.	Post	Research Circle, Roorkee	Hydraulics Circle, Bahadrabad
<b>Group "B"</b>			
1	Assistant Engineer (Civil)	10	10
2	Assistant Engineer (Mechanical)	01	0
3	Assistant Research Officer	15	03
	<b>Total Group "B"</b>	<b>26</b>	<b>13</b>
<b>Group "C"</b>			
1	Additional Assistant Engineer/ Junior Engineer (Civil)	09	09
2	Research Supervisor	30	18
3	Scientific Assistant	28	18
4	Model Assistant	28	18
	<b>Total Group "C"</b>	<b>95</b>	<b>63</b>

- Other Technical/Non-Technical Supporting Staff – 75+

## MANDATES OF IRI ROORKEE

The current mandate of the institute encompasses undertaking physical hydraulic model studies of various projects dealing with Irrigation and Power, Bridges, Flood Management, River Training works, etc., 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, testing of various construction materials viz. concrete and its ingredients, bricks, steel bars and plates, tiles, cements, admixtures, water, pipes, timber, paints, highway materials, etc. field and laboratory testing of engineering materials like soil, rock, RBM, etc., conducting ground water studies, pressure release valves tests, Non-destructive Test (NDT), canal lining studies, aquifer modelling, remote sensing studies, reservoir capacity survey, etc. having completed more than Ninety Years of service, IRI, Roorkee extends its service into various other research and testing fields and looks forward to continue its service to the Nation.

### SERVICES:

Irrigation Research Institute, Roorkee serves for various sectors like

- Water Resources Development & Management –Preparation of DPR of Irrigation, Drinking water, Artificial Groundwater Recharge, Landslide Mitigation Works, Drainage Plan etc. Projects, Implementations of National Hydrology Project, National Water Mission Projects, Flood Plain Zoning Works, Water Budgeting, etc.
- Model Studies for various Hydraulic Structures and River Engineering Works
- In-situ and Laboratory Testing of various construction and engineering materials
- Concrete Mix Design of various types and Grades of Cement Concrete
- Capacity Survey & Sedimentation Studies for Reservoirs
- Water Quality Testing
- Ground Water Studies
- Third Party Quality Controls – during construction and after construction works.









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**IRRIGATION DEPARTMENT, GOVT. OF UTTARAKHAND**

**सिंचाई विभाग, उत्तराखण्ड सरकार**

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**CHAPTER – II**

**TEST FACILITIES AVAILABLE AT  
IRRIGATION RESEARCH INSTITUTE, ROORKEE**





## TEST FACILITIES AVAILABLE AT IRI, ROORKEE

### 1. Test Facilities at Hydraulic Research Station, Bahadrabad, IRI, Roorkee:

2D and 3D Physical Hydraulic Model studies of various hydraulic structures such as:

- Sedimentation/Desilting Chamber/Tank
- Spillway, under Sluice and Energy Dissipation Devices



- Hydraulic Design of Power Intake
- Determination of axes of Barrage, Bridge, etc.
- Spillway and Sediment Transport
- Water Quality Studies
- Estimation of High Flood Level
- Studies for Flood Protective Measures
- Studies for Canal, Canal Head and Cross Regulators, Cross Drainage Works (Aquaduct, Super Passage, Siphon Aqueduct, Level Crossing), etc.



- Sediment Excluder and Sediment Ejector
- Surge Tank and Penstocks
- Diversion Tunnel
- Formation of Vortex in front of Power Intake/Diversion Tunnel/HRT, etc.
- Studies for afflux due to construction of Dam/Barrage/Bridges, etc.
- Studies for guide and afflux bunds due to construction of Dam/Barrage/Bridges, etc.
- Pump Storage Plants

### 1.1 Facilities of Observations/Studies carried out in the Model available at HRS, Bahadrabad:

Generally, the following observations are taken on the model after reproducing the Dam/Barrage/Weir and related structures:

- Discharges passing through the bays/under sluice of spillway/glacis
- Water levels at different locations and discharge for finding out depth of flow, water surface slope and afflux, etc
- Velocities at different sections and in bays for determining discharge distribution and concentration of flow including at exit of stilling basin
- Velocities along structures for assessing the stability
- Angle of approaching flow to assess the obliquity
- Surface and bed lines of flow for estimating curvature of flow





- Erosion (Scour Pattern) on the upstream and downstream of the hydraulic structures
- Locating areas where sediment deposition or scour may take place
- Differential head at the piers and divide wall
- Bed configuration during and after running the hydrograph
- Afflux in the river due to structures



- Possibility of formation of vortices in front of Power intake, intakes of HRT, diversion tunnel, etc.
- Coefficient of discharge for sluice bays, weir bays and head regulator under free flow/critical flow and sub-merged flow conditions
- Energy dissipation in hydraulic jump under different inflow and tail water conditions and also for different operating condition of gates
- Performance and hydraulic behaviour of river training works
- Performance of the basin/plunge pool under oblique approach flow, if any
- Flushing of sediments deposited vis-a-vis gate operation
- Negative head/pressure on spillway napped/



weir glacis and at the toe of spillway near energy dissipation arrangement, along pier and abutment, breast wall, HRT/diversion tunnel, etc. wherever required

- Selection of proper energy dissipation arrangement
- Profile of under sluice and bays of different hydraulic structures.
- Silt flushing ability of power intake, sedimentation tank, sediment excluder/ejector
- Determination of dam/barrage/weir vis-à-vis power intake axes
- Determination of different flow parameters such as cavitation index, Froude number, hydraulic gradient/total energy line, flow behaviour in surge tank and at bifurcation of tunnel, upper/lower surge levels in tandem operation, etc.



## 1.2 Other facilities

- Calibration of Current Meter



- Observations of meteorological parameters (Rainfall, Min. and Max. Temperature, Relative Humidity, Evaporation, soil Temperature, etc.),





## 2. Testing/Study Facilities at IRI, Roorkee :

A number of laboratories viz. Capacity Survey Lab., Cement Concrete Lab., RCC Lab., Highway Lab., Pipe Testing Lab, Chemical Lab., Water Quality Lab., Remote Sensing Lab., EHDA Lab., PRV/ Tubewell Lab., Canal Lining Lab., Soil Lab., Rock Mechanics Lab., Aquifer Modelling Lab., Paint Testing Lab., etc. were set up at IRI, Roorkee with all requisite Testing Instruments/Apparatus/ Machines. For capacity building and basic study a Computer Centre was also established. A big library with facility of more than 20,000 Technical Books/ Publication/Journals/Standards/Literature books was set up to enhance the technical knowledge amongst research personnels. A model room was also setup to exhibit various studies carried out by IRI, Roorkee in the past. Details of testing/study facilities are described below as under:

### 2.1 Capacity Survey and Sedimentation Studies of Reservoirs:

IRI, Roorkee is fully equipped with instruments/ machine for bathymetric survey of Reservoirs/Lakes. Studies regarding the status of siltation in reservoir, reduction status of live, dead and gross storages of reservoir, sedimentation rate of the reservoir, life of reservoir, etc. of various resrviors/lakes were carried out.



### 2.2 Cement and Concrete:

All facilities relatelatl to following tests of concrete and its ingredients are availbale at laboratories of IRI, Roorkee:

- Physical Tests and Chemical Analyses facilities of all types of cements including heat of hydration test, fine and Coarse aggregates {sieve analysis, silt content (material finer than 75 micron), flakiness index, elongation index, specific gravity, water absorption, abrasion value, crushing value, impact value and soundness, alkali-aggregate reactivity test, etc.}, water for concrete, admixtures (mineral and chemical) etc.
- Non-Destructive Test and Abrasion Test of cement concrete.

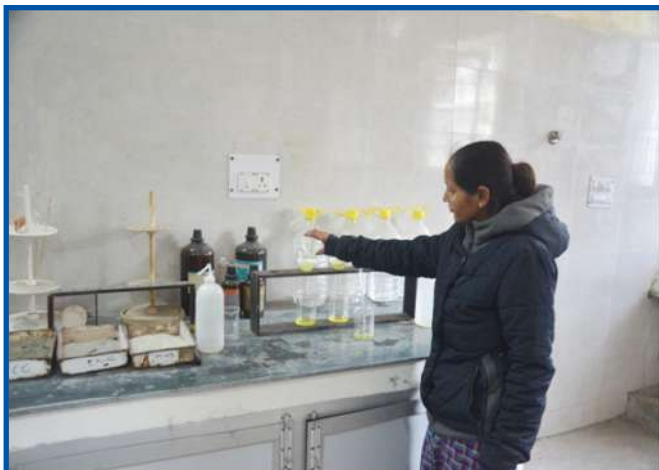


- Mix Design of various types and grades of concrete viz. normal concrete, mass concrete, high performance concrete(HPC), fibre-reinforced concrete (FRC), Roller Compacted Concrete (RCC), Self-compacting concrete (SCC), shotcrete, etc.





- Testing of green concrete viz. slump test, compaction factor test, VeeBee consistometer test, Air content test, consistency, bleeding, flow test, etc.
- Testing of hardened concrete i.e. compressive strength, transverse strength, unit weight, direct tensile test, flexural strength test, abrasion test, split test, etc.



- Chemical analysis for Mix proportioning of cement mortar/concrete
- Calibration of proving rings and Compression Testing Machine
- Physical Tests of Steel Bars and Plates and Welded Joints
- Physical Tests of Bricks, Tiles, etc.

### 2.3 Rock:

Following tests facilities of Rocks are available at laboratories of IRI, Roorkee:

- Bearing Capacity of Rock foundation by Plate Load Test.
- Block Shear Test for Rock to Rock and Concrete to Rock.
- Pullout Test (Anchor Bar & Rock Bolts).
- Uni-axial Jacking Test (Modulus of Deformation).
- Load Test for Bridges & Aqueduct.
- Modulus of Elasticity and Poisson's Ratio of Rocks
- Unconfined Compressive Strength on Rock core specimens.
- Shear Parameters—'c' and ' $\phi$ ' by Tri-axial Shear Test.
- Point Load Strength Index of Rocks.

- Water Absorption, Specific Gravity and other properties of Rocks.
- Weathering/Durability/Porosity/Soundness/Permeability Test of Natural Building Stone.



### 2.4 Soil and River Borne/Bed Materials (RBM):

Following tests facilities of Soil and RBM are available at laboratories of IRI, Roorkee:

- Bearing Capacity of foundation soil by Plate Load Test, Direct Cone Penetration Test and Standard Penetration Test.
- Permeability test determining Seepage Losses in soil.
- Laboratory Tests for Soil Classification, Shear Parameter, Compaction, Consolidation, etc.
- Determination of suspended sediment concentration in P.P.M.
- Grain Size Distribution of silt samples by using Puri's Siltometer.
- Determination of silt factor of Soil/RBM



## 2.5 Timber and Plywood :

Following tests facilities of Timber and Plywood are available at laboratories of IRI, Roorkee:

Testing of Timber	Testing of Plywood and Particle Board
<ul style="list-style-type: none"> <li>Physical Properties               <ul style="list-style-type: none"> <li>Moisture content</li> <li>Specific gravity</li> </ul> </li> <li>Shrinkage               <ul style="list-style-type: none"> <li>Volumetric,</li> <li>Tangential</li> <li>Radial</li> </ul> </li> <li>Mechanical Properties               <ul style="list-style-type: none"> <li>Static banding</li> <li>Impact banding</li> </ul> </li> <li>Compressive Strength               <ul style="list-style-type: none"> <li>Parallel to grain</li> <li>Perpendicular to grain</li> </ul> </li> <li>Tensile strength               <ul style="list-style-type: none"> <li>Parallel to grain</li> <li>Perpendicular to grain</li> </ul> </li> <li>Cleavage test               <ul style="list-style-type: none"> <li>Nail and screw pulling test-withdrawal test</li> </ul> </li> <li>Torsion test</li> </ul>	<ul style="list-style-type: none"> <li>Physical Properties               <ul style="list-style-type: none"> <li>Moisture content</li> <li>Specific gravity</li> <li>Density</li> <li>Water Resistance Test</li> <li>Boiling Water Proof Test</li> <li>Boiling Water Resistance Test</li> <li>Moisture Resistance Test</li> <li>Swelling test</li> </ul> </li> <li>Mechanical Properties               <ul style="list-style-type: none"> <li>Glue Adhesion/ Glue Shear Strength</li> <li>Mycological Test</li> <li>Modulus of Rupture                   <ul style="list-style-type: none"> <li>Parallel to grain</li> <li>Perpendicular to grain</li> </ul> </li> <li>Modulus of Elasticity                   <ul style="list-style-type: none"> <li>Parallel to grain</li> <li>Perpendicular to grain</li> </ul> </li> </ul> </li> </ul>

## 2.6 Highway Materials:

Following tests facilities of highway materials are available at laboratories of IRI, Roorkee:

- Thickness Design and Testing of Rigid and Flexible Pavements



- CBR test
- Job mix for Bituminous Pavement
- Testing of all ingredients of Rigid and Flexible Pavements
- Core Cutting and Testing of Bituminous and Concrete Pavements

## 2.7 Water Quality:

Following tests facilities of water/effluents/sewage water samples are available at laboratories of IRI, Roorkee :

- Testing of Drinking/ River/ Lake/ Sewage Water/ Effluents
- Physical and Chemical Parameter
- Biological Parameter
- Heavy Metals and Pesticide Residue





## 2.8 Various types of Pipes:

Following tests facilities of various types of Pipes viz. G.I./M.S/D.I. Pipes and PVC and concrete hume pipes are available at laboratories of IRI, Roorkee:

- G.I./M.S/D.I. Pipes and PVC Pipes up to Dia 6 mm to 450 mm
- **Testing of Physical Parameters** -Dia, Outer Dia, Wall Thickness, Length, Mass, length-mass ratio, etc.
- Hydrostatic Leakage/Pressure Test
- **Testing of Concrete Hume Pipe up to 1200 mm dia.**
- Inner Dia, Outer Dia, Wall Thickness, Length, length-mass ratio, etc.
- Hydrostatic Leakage/Pressure Test



- Permeability Test
- Crushing Value Test

## 2.9 Paints:

- Testing facilities available for all Physical Properties of Enamel, Emulsion and other paints.

## 2.10 Canal Lining Studies:

- Efficacy and Suitability of different types of canal lining materials
- Studies of Leakage through different types of canal lining
- Studies of Leakage in canals due to damaging of canal lining

- Testing of Pressure Release Valves used in canal lining – Susceptibility Test, Discharge Capacity Test, Back-Leakage Test



## 2.11 Ground Water Studies:

- Aquifer Modelling
- Determination of Uplift Pressure and Exit Gradient beneath the barrage using Electrical Hydro-Dynamic Analogue (EHDA) Techniques.
- Phreatic Line Studies
- Seepage Study



## 2.12 Studies related to Water Resources Development and Management:

- Preparation of DPR of Irrigation, Drinking Water, Artificial Ground Water Recharge, Slope Treatment & Landslide Mitigation Works, Comprehensive Drainage Plan etc. Projects,
- Implementations of National Hydrology Project, NWM Projects, etc.
- Flood Plain Zoning Studies
- Water Accounting and Budgeting of Dam/ Barrage etc.





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**CHAPTER – III**

**TESTING OF CONSTRUCTION MATERIALS  
DURING THE YEAR 2022-23**





## TESTING OF CONSTRUCTION MATERIALS

### Concrete Mix Design

- Mix Designs of various grades and types of concrete were carried out as per procedure laid down in IS 10262:2019 and IS 456:2000 after required testings of all ingredients as per their relevant standards.
- In all the Mix Designs, criteria for minimum cement content and maximum water-cement ratio in order to compliance the requirements of compressive strength and durability factor were also taken into account.
- Details of various mix design of different grades and types of concrete along with the name of project and client are given below as:

- ❖ Mix Designs of cement-concrete  $A_{20}M_{35}S_{150\pm5}$ ,  $A_{20}M_{35}S_{75\pm5}$  and  $A_{20}M_{40}S_{75\pm5}$  for the construction of New Bajrang Setu near Laxman Jhula, Rishikesh, Uttarakhand.

**Client-** Project Planning and Monitoring, Quiet Office 7 (FF and SF), Sector 35-A, Chandigarh.

- ❖ Mix Design of cement-concrete  $A_{20}M_{25}S_{75\pm5}$  for the construction of ITI Building at Talheri Bujurg and Beenpur, Gangoh, Distt. Saharanpur (UP).

**Client-** U.P. Projects Corporation Ltd., above Punjab and Sindh Bank, Gurudwara Road, Saharanpur (U.P.).

- ❖ Mix Design of cement-concrete  $A_{20}M_{25}S_{75\pm5}$  for the construction of Entrance Gate, Smart Gym and Multipurpose Hall at Dr. Ambedkar Stadium, Saharanpur (UP).

**Client-** U.P. Projects Corporation Ltd., above Punjab and Sindh Bank, Gurudwara Road, Saharanpur (U.P.).

- ❖ Mix Design of cement-concrete  $A_{20}M_{25}S_{100\pm5}$  for construction of Sainik Dham Building at Purkul in Dehradun District.

**Client-** Project Manager, Construction Unit, Uttarakhand Peyjal Sanshadhan Vikas and Nirman Nigam, Bansipur (Harbatpur), Vikasnagar, Dehradun.

- ❖ Mix Design of cement-concrete  $A_{40}M_{20}$  and  $A_{40}M_{25}S_{75\pm5}$  for construction of Retaining Wall along right bank of Kali River from Ghatgad Nala to Taxi Stand in Dharchula Block, Pithoragarh.

**Client-** Project Manager, Executive Engineer, Irrigation Division, Dharchula, Pithoragarh.

- ❖ Mix Design of cement-concrete  $A_{20}M_{25}$  and  $A_{20}M_{30}S_{75\pm5}$  for construction works for Jagjeetpur Peyjal Yojna, Haridwar.

**Client-** Executive Engineer, World Bank Project Unit, Uttarakhand Peyjal Nigam, Devpura, Haridwar (Uttarakhand).

## ELECTRICAL HYDRO DYNAMIC ANALOGY (EHDA) STUDIES

- ❖ **3-D EHDA Model Study for Determination of Uplift Pressure and Exit Gradient Below the Foundation of Ayodhya Barrage, Executive Engineer, Investigation and Planning Division, Gonda, Uttar Pradesh.**

Chief Engineer (Investigation and Planning), Irrigation and Water Resource Department, Saryu Bhawan, Hanuman Garhi, Sahadat Ganj, Ayodhya, Uttar Pradesh requested to carry out the Sub-surface study of the proposed Ayodhya Barrage across the

river Saryu to find out Uplift pressure and exit gradient below the foundation of this proposed barrage by Electrical Hydro Dynamic Analogy Modelling Technique.

Ayodhya Barrage is proposed to be constructed across the river Saryu at approx. 1.0 km U/S of old Sarju Bridge (Ayodhya–Gonda Highway), near Gola Ghat, in District Ayodhya (U.P.). The Irrigation and Water Resources Department, Uttar Pradesh (IWRD UP), has been proposed to construct a







Multipurpose Barrage across Saryu (Ghaghara) River in Ayodhya to ensure continuous availability of flow of water on Ghats, irrigation, drinking water supply, tourism, pisciculture and other benefits.

3-D EHDA model technique has been adopted for the determination of uplift pressures below the foundation and exit gradient at d/s face of d/s sheet pile when strata is homogeneous and isotropic up to infinite depth. The hydraulic conditions in the prototype are reproduced in the model with the help

of Ohm's law for electrical flow, which is analogous to Darcy's law for flow of water through porous media. The instruments used are amplifier, audio oscillator, signal tracer and potentiometer. Wheatstone bridge principle is applied to detect the residual electric potential (corresponding to hydraulic head) at any point. The electrolyte (tap water) is then filled in the experimental tray to represent the foundation strata. The copper plates are fixed at the locations of the upstream and downstream pervious river bed and are connected to 100 % terminal of the potentiometer to represent the maximum pond level in upstream side and to 0% terminal of potentiometer to represent dry bed in the downstream side. All the three instruments are used in the experiment to energize with the help of AC  $230 \pm 10$  volts. To study the uplift and exit gradient beneath the proposed Ayodhya Barrage, a 3-D foundation model, showing foundation profile of structure were made up of seasoned teak wood to a geometric similar model scale of 1:400 and study was carried out as explained earlier.

## DETERMINATION OF WATER QUALITY

- ❖ Collection of water samples of drinking water of more than 15 locations of all 13 districts of the State of Uttarakhand on quarterly basis and determination of their qualities.
- ❖ Collection of water samples from Bhimtal and Naukuchiatal lakes for Purpose Driven Study (PDS) under National Hydrology Project and determination of their qualities.
- ❖ Collection Kosi river water samples from proposed Khairna Barrage and determination of their qualities.
- ❖ Determination of PPM of silt in Khoh River at Matiyali, Dwarikhal, Irrigation Division Dugadda, Pauri Garhwal.
- ❖ Determination of water quality of Tumaria dam in U.S.Nagar district.





## CAPACITY SURVEY & SEDIMENTATION STUDIES

### ❖ Reservoir Capacity Survey and Sedimentation Studies of Jargo Dam Reservoir, Chunar, Mirzapur (U.P).

Jargo Dam is an earthen Dam constructed across the Jargo River situated in Tehsil Chunar of Uttar Pradesh which was completed in 1959. Jargo dam is located between 25002'59" to 25000'59" latitude and 85055'43" to 82058'42" longitude with a catchment area of 396.80sq.km. The design storage capacity of the reservoir was estimated as 150.85 M.C.M with provisions of live storage as 141.780 MCM and Dead storage as 9.070 MCM. This is the first bathymetric survey of the reservoir done by I.R.I., Roorkee after its filling in the year 1959. After bathymetric and geodetic survey of the reservoir



area in March to May 2022, it is found that reservoir storage capacity has been reduced and reduction in capacity also observed in live and dead storage.

### ❖ Reservoir Capacity Survey and Sedimentation Studies of Survey of Dhekuwa Dam Reservoir, Chunar, Mirzapur (U.P).

Dhekuwa Dam is an earthen Dam constructed across the Pahiti Dhari river situated in Tehsil Chunar of Uttar Pradesh which was completed in 1980. Dhekuwa dam is located between 24059'58" to 24044'08" latitude and 82045'28" to 82044'41" longitude with a catchment area of 43.52sq.km. The design storage capacity of the reservoir was estimated as 9.900 M.C.M with provisions of live storage as 8.640 MCM and Dead storage as 1.260 MCM. This institute conducted first bathymetric survey of reservoir after its filling in the year 1980. After bathymetric and geodetic survey of the reservoir area in November 2022, it is found that reservoir storage



capacity has been reduced and reduction in capacity also observed in live and dead storage.

### ❖ Reservoir Capacity Survey and Sedimentation Studies of Sukhara Dam Reservoir, Mirzapur (U.P).

Sukhara Dam is an earthen Dam constructed across the Sukharanala and Adwa canal, situated in Halia Block, District Mirzapur of Uttar Pradesh, which was completed in 1909. Sukahra dam is located between 24047'81" to 24047'49" latitude and 82016'91" to 82016'27" longitude with a catchment area of 16.70 sq.km. The design storage capacity of the reservoir was estimated as 7.362 M.C.M with provisions of live storage as 7.262 MCM and Dead storage as 0.100 MCM. This institute conducted first bathymetric survey of reservoir after its filling



in the year 1909. After bathymetric and geodetic survey of the reservoir area in December 2022, it is found that reservoir storage capacity has been reduced and reduction in capacity also observed in live and dead storage.



## REMOTE SENSING

### ❖ Basic Studies to Monitoring of Glacial Lakes.

IRI, Roorkee has started the studies of variations in spread areas of glacial lakes fall under the territory of the State of Uttarakhand under NHP through its Remote Sensing Laboratory. A glacial lake is a body of water with origins from glacier activity. In the Himalayan Mountain region, a large number of glacial lakes have developed in the recent past due to glacier recession under the influence of climate change. They are formed when a glacier erodes the land, and then melts, filling the depression created by the glacier. As per NRSC Inventory of the year 2016, there are 43 glacial lakes, 192 nos. glacial lakes and 83 Nos. glacial lakes are identified in Pithoragarh, Chamoli and Uttarkashi districts of the State respectively.

An outburst flood is the sudden surge of melt water when a glacial lake's moraine- or ice-dam fails. Flash flood caused by the outburst of glacial lakes called as Glacier Lake Outburst Flood (GLOF). To minimize the risk of glacial lake outburst flood and to reduce the vulnerability of nearby communities, it is important to carry out the systematic inventory of these lakes, their growth analysis and simulation of lake breach with better accuracy to understand the flash flood extent more precisely.

Satellite Remote Sensing techniques are utilized using Environment for Visualizing Images (ENVI 5.6) and ARC GIS 10.8.1 software for Layer stacking, mosaic, subset, Normalized Difference Water Index (NDWI) generation, digitization of Lakes, their analysis, Digital Elevation Model (DEM) preparation, various map Generation and monitor the glacier lakes in Pithoragarh District of Uttarakhand State and Thermal Infrared (TIRS) Collection 2 Level-2 Science Products 30-meter multispectral images were downloaded from Earth Explorer of United States Geological Survey (USGS) for preparing the inventory of glacial lakes. The index map showing the study area i.e. glacial lakes falling in Pithoragarh district of the State is exhibited in Figure1.

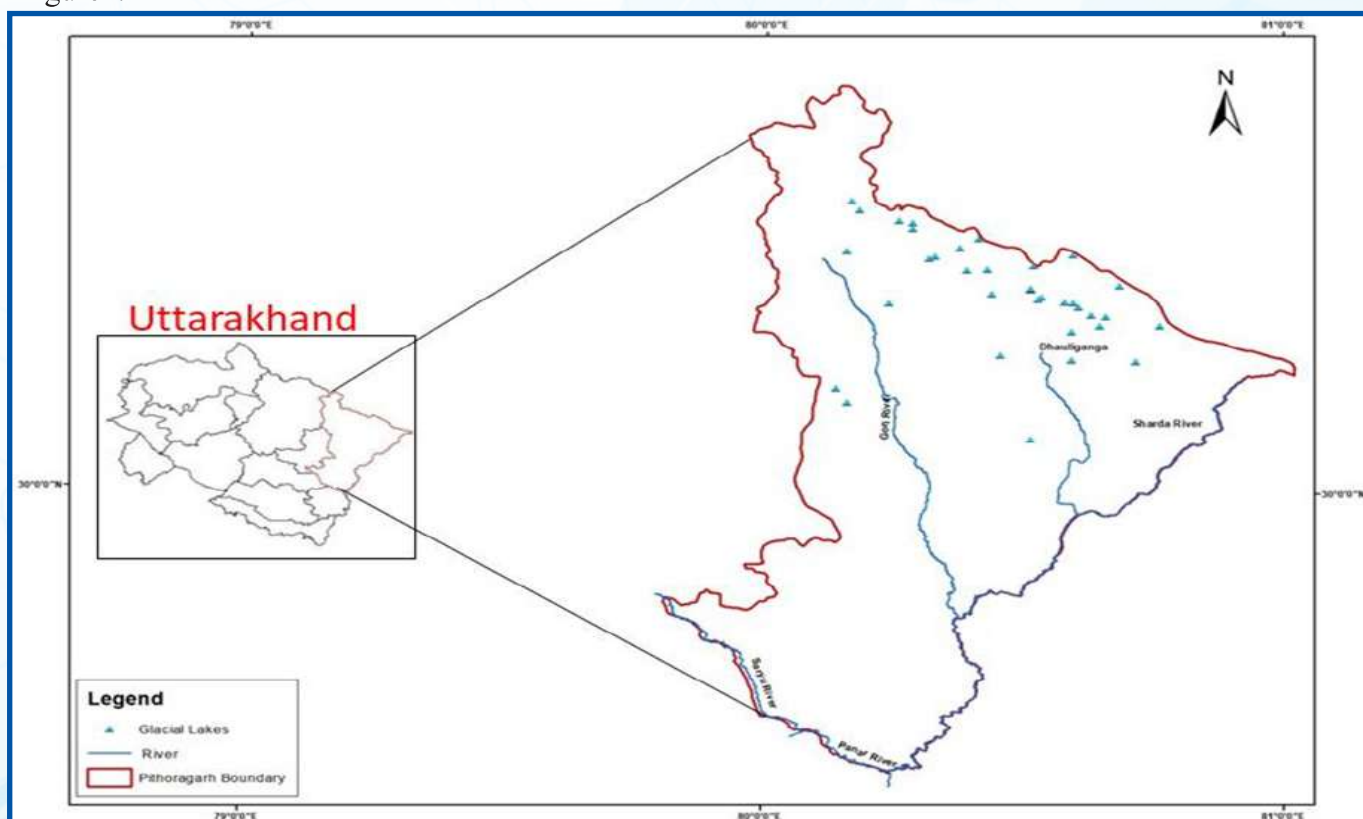


Figure1. Index Map of study area



### 1. A Basic Study to Monitoring of Glacial Lakes in Pithoragarh District for the Year 2020 (June to October)

On the basis of aforesaid methodology, spread area of all visible free from clouds glacial lakes of June, 2020 to October, 2020 were studied. Variation in the spread area of various glacial lakes are given in Table-

Percentage Variation in Spread Area/ Spread Area (in Hectare)	No. of Glacial Lakes			
	< 5%	5%-20%	20%-40%	>40%
< 1 Hectare	1	0	0	2
1-5 Hectare	1	1	1	7
5-10 Hectare	0	0	0	3
> 10 Hectare	1	1	2	1

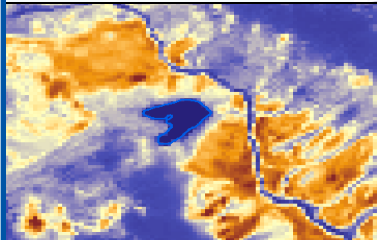
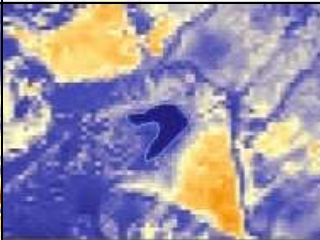
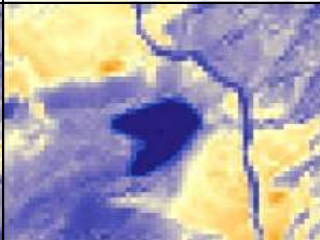
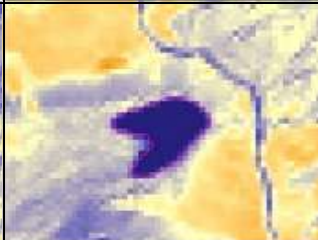
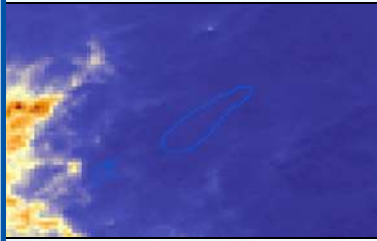
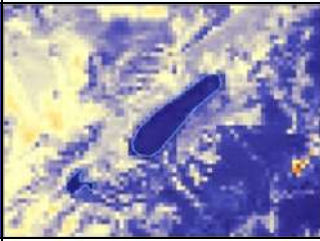
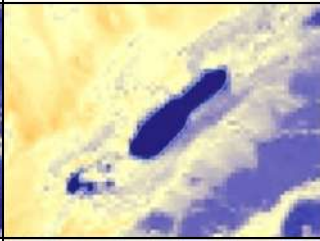
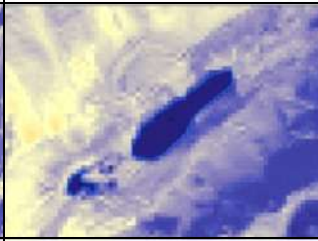

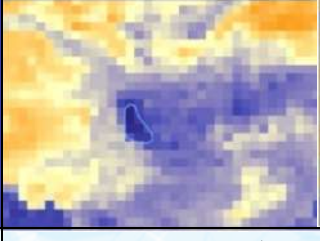
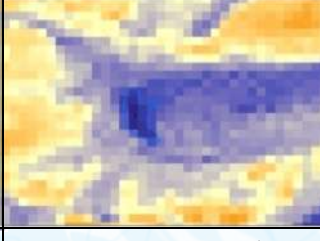
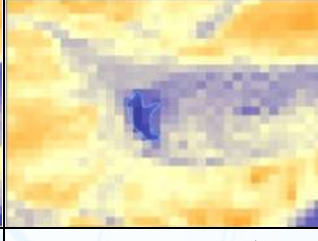
June 2016	June (2020)	September (2020)	October (2020)
			
Area = 10.0039 ha	Area = 7.59645 ha	Area = 13.5206 ha	Area = 12.6045 ha
			
Area = 11.2116 ha	Area = 12.54 ha	Area = 14.4063 ha	Area = 14.7297 ha
			
Area = 1.12954 ha	Area = 0.796543 ha	Area = 1.26033 ha	Area = 0.753177 ha

Figure - 2 Glacier Lake mapping (June to October, 2020)

## 2. A Basic Study to Monitoring of Glacial Lakes in Pithoragarh District for the Year 2021 (June to October).

On similar way, spread area of all visible free from clouds glacial lakes of June, 2021 to October, 2021 were studied. Variation in the spread area of various glacial lakes are given in Table-

Percentage Variation in Spread Area/ Spread Area (in Hectare)	No. of Glacial Lakes			
	< 5%	5%-20%	20%-40%	>40%
< 1 Hectare	5	2	3	4
1-5 Hectare	4	1	3	7
5-10 Hectare	1	0	0	2
> 10 Hectare	1	0	1	2

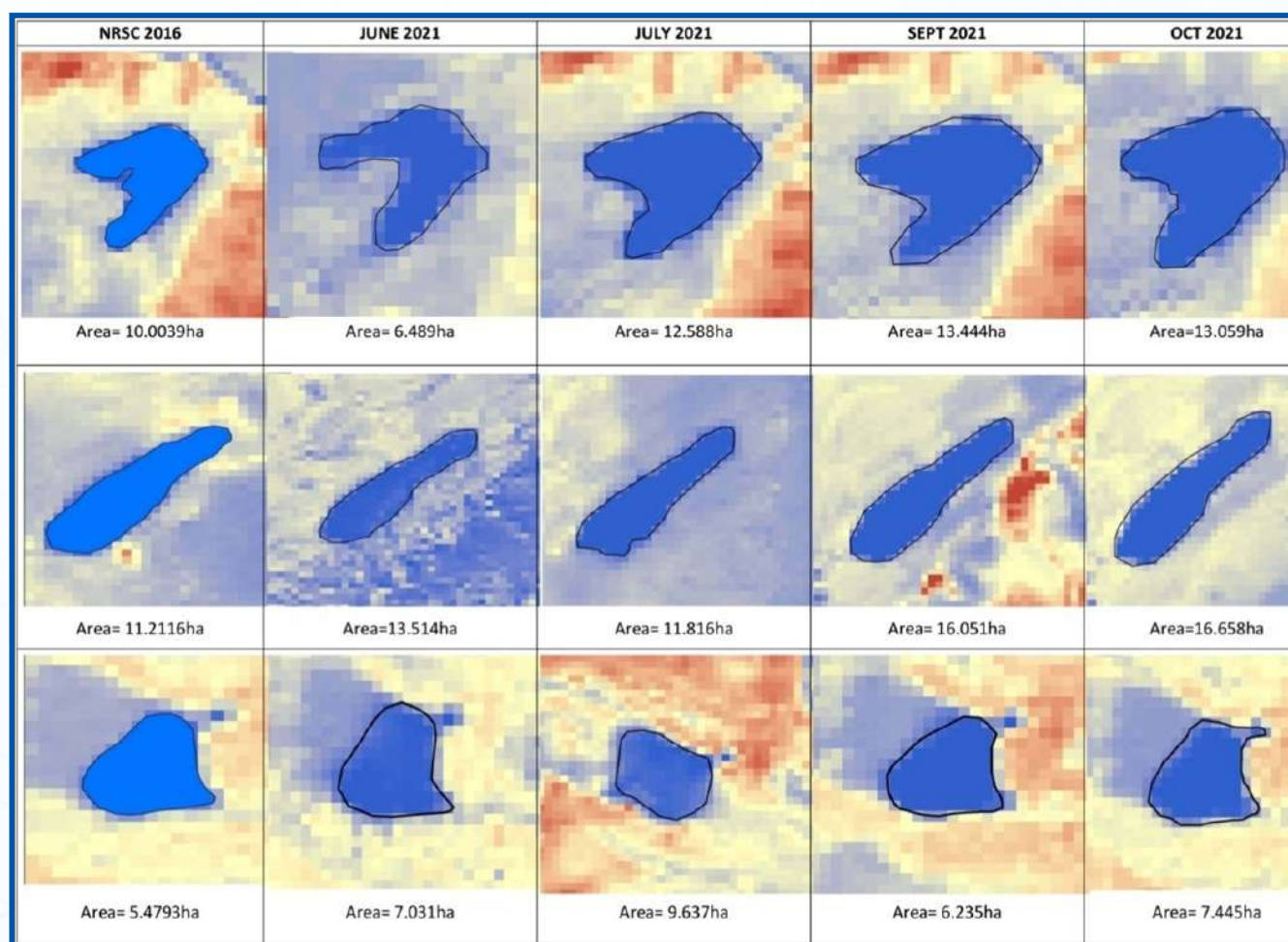


Figure - 3 Glacier Lake mapping (June to October, 2021)





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**IRRIGATION DEPARTMENT, GOVT. OF UTTARAKHAND**

**सिंचाई विभाग, उत्तराखण्ड सरकार**

**IRRIGATION RESEARCH INSTITUTE, ROORKEE**

**सिंचाई अनुसंधान संस्थान, रूड़की**



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**CHAPTER – IV**

**FIELD/IN-SITU TESTS CONDUCTED  
DURING THE YEAR 2022-23**







### 1. In-Situ Testing of Highway Materials:

Various in-situ tests of highway materials constructed/ under construction of State Infrastructure and Industrial Development Corporation of Uttarakhand Limited (SIIDCUL), Irrigation Department, Uttarakhand, PWD, Uttarakhand, etc. were carried out by IRI, Roorkee. Some of above are described below as under:

#### SIIDCUL, Dehradun

- Infrastructure Work at IIE, Sitarganj (Phase-II, Package-II) in District Udham Singh Nagar.



- Maintenance of Road from Bijti to Manjhola at Sitarganj in District Udham Singh Nagar



- Construction of Storm Water Drain at Escort Farm in Kashipur in District Udham Singh Nagar.



- Maintenance of Civil Works and Strengthening of Road in Pantnagar in District Udham Singh Nagar.



- Construction of road from NH Bypass to Bijti and Barieni at Sitarganj in District Udham Singh Nagar.



- Estimate for Add Works at City Park Rudrapur in District Udham Singh Nagar.
- Balance Work of Construction of Motor Road from Srirampur to Arjunpur via Dabar Factory in Block Gadarpur District Udham Singh Nagar.



- Construction of Motor Road from Rambag to Madanapur via. Chandan Nagar at Block Gadarpur in District Udham Singh Nagar.





- Construction of Motor Road from Chandipur to Jadeshpur via Sanjay Nagar at Block Gadarpur in District Udham Singh Nagar.
- Construction of Motor Road in Industrial Area Jainagar no-1 to no-5 at Block Rudrapur, District Udham Singh Nagar.
- Construction of Motor Road from Srirampur to Arjunpur via. Dabar Factory at Block Gadarpur, District Udham Singh Nagar.
- Construction of Motor Road from Kulaha-Tilpuri to Forest Barrier at Block Gadarpur, in District Udham Singh Nagar.



- Construction of Motor Road from Kulaha-Tilpuri Motor Road to Metha Belt at Block Gadarpur in District Udham Singh Nagar.

#### **PWD Thatyur, Tehri Garhwal:**

Renovation works of Nakot-Negyana Motor Road were done by Temporary Division, Public Work Department Thatyur, Tehri Garhwal. The samples of cores from bituminous pavement after construction were taken by IRI team and were tested at Highway Lab., IRI, Roorkee for its thickness density, binder content etc.



#### **Irrigation Division, Dehradun:**

Field testing of all construction materials viz. cement, aggregates, concrete, hume pipe etc. during the construction of construction works for the shifting and undergrounding of Bullawala canal from km 3.870 to km 9.940 (Rajaji National Park Chowki-2 to Village Jhabrawala) and construction of road in the same reach in Doiwala Block, district Dehradun, being executed by Irrigation Division, Dehradun were carried out by IRI, Roorkee. In order to test the quality of work, testing of said work is given to Irrigation Research Institute, Roorkee by Executive Engineer, Irrigation Division, Dehradun.







## 2. In-situ Testing of Flood Protection Works:

Field as well as laboratory testings of construction materials by IRI Roorkee which is used in the construction work of Flood Protection works on the right bank of Song River in Village Gauhrimafi, Raiwala (Rishikesh) is being executed by Irrigation Division, Dehradun.

## 3. Non-Destructive Tests (NDT):

- 130 Nos. Non Destructive Test, Director (Training), Training and Employment Directorate, Haldwani, Uttarakhand.
- 40 Nos. Non Destructive Test, Executive Engineer, P.I.U (Amrit) Uttarakhand Peyjal Nigam, Roorkee.
- 20 Nos. Non Destructive Test, Executive Engineer, World Bank Project Unit, Uttarakhand Peyjal Nigam, Haridwar.

## 4. Block Shear Tests:

4.1 Dr. Shayama Prashad Mukharjee Jalashay Pariyojna Drinking Water Project has been envisaged the construction of a dam of about 73.5m height near village Thangaon of Sahaspur Block, District Dehradun (Uttarakhand). This project is mainly proposed for domestic water uses. 02 nos. Rock to Concrete Block Shear Test were conducted at site on the Left Bank Drift and Right Bank Drift of stream as proposed by the Project Authority.

- i. Rock to Rock Block Shear Test at proposed Dr.Shayama Prasad Mukherjee Jalashaya

Pariyojna, Block Sahaspur, Dehradun for Executive Engineer, Irrigation Division, Vikasnagar (Dehradun).

- ii. Rock to Concrete Block Shear Test and Plate Load Test at proposed Dr. Shayama Prasad Mukherjee Jalashaya Pariyojna, Block Sahaspur, Dehradun for Executive Engineer, Irrigation Division, Vikasnagar (Dehradun).



4.2 Talghati Drinking Water and Water Body Creation Project, Pauri Garhwal (Uttarakhand) has been envisaged the construction of a dam across river Vindhvasini near village Kandar in Yamkeshwar Block under Pauri Garhwal, Uttarakhand. This project is intended to meet the projected drinking water demand up to the year 2080 for the 29 villages of Yamkeshwar Block of Pauri Garhwal. 01 no. Rock to Rock Block Shear Test was conducted at site on the Right Bank of stream as proposed by the Project Authority. 01 no. Rock to Rock Block Shear





Test was carried by IRI, Roorkee at proposed Talghati Drinking Water and Water Body Creation Project, Pauri Garhwal sponsored by Sigma Floodkon JV, Ranchi (Jharkhand).

#### **5. Collection and Testing of Soil/RBM Samples**

04 nos. disturbed soil sample were collected by IRI, Roorkee from Talghati Drinking Water and Water Body Creation Project, Pauri Garhwal (Uttarakhand).



#### **6. Discharge Measurement**

Discharge Measurement of dry weather flow in Bindal River at Dehradun was observed with the help of Acoustic Doppler Current Profiler



(ADCP) was carried out by Irrigation Research Institute, Roorkee as sponsored by M/s EMS Limited, Ghaziabad (U.P.)

#### **7. Collection of Water samples and their Field as well as laboratory Testing**

173 and 145 nos. samples of drinking and waste water were collected by Roorkee & Haldwani Water Quality Labs. and requisite field tests were performed just after their collection at site.



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**CHAPTER – V**

**HYDRAULICS MODEL STUDIES CONDUCTED  
DURING THE YEAR 2022-23**







## HYDRAULICS MODEL STUDIES CONDUCTED DURING THE YEAR 2022-23

### 1. Hydraulics Model Studies for Jamrani Drinking Water Multipurpose project (14 MW), Nainital (Uttarakhand).

Jamrani Drinking Water Multipurpose project (14 MW) has been proposed to be constructed 150.6 m high dam across the river Gaula, a tributary of river Ramganga to augment a gross storage of 208.60 MCM. The main benefits of the project are to supply drinking water to Haldwani City, irrigation to Uttarakhand and adjoining areas of State of Uttar Pradesh and incidental power generation of 14 MW including other indirect benefits like tourism, groundwater recharge, social development, etc. Project Authority referred to conduct Hydraulics Model Studies the said project for discharging capacity of sluice spillway with fully and partial operation of gate, water surface profile, pressure profile, velocity profile for entire range of discharge and performance of energy dissipation arrangement.



A geometrically similar comprehensive model to the scale of 1:55 representing about 1000m upstream and 500m downstream river reach from dam axis of the river was constructed in the model to conduct the aforesaid Hydraulics model studies. Proving of river model was completed and further studies will be carried out in next year.

### 2. Hydraulics Model Studies for Model Study for Reoli Dugli H.E Project (456 MW) 3D (Comprehensive) SJVNL (Himachal Pradesh).

Reoli Dugli Hydro Electric project (456 MW) has been envisaged across the river Chenab in the territory of State of Himachal Pradesh to generate

hydro power energy with installed capacity of 456 MW. Project Authority referred to conduct Hydraulics Model Studies the said project for discharging capacity of sluice spillway with fully and partial operation of gate, water surface profile, pressure profile, silt sedimentation, velocity profile for entire range of discharge and Hydraulics behavior in the stilling basin. A geometrically similar 3D model to a scale of 1:60 representing



about 700m upstream to 1000m downstream was built to conduct the aforesaid Hydraulics model studies. In this year construction of river portion was completed and further studies will be carried out in the next year.

### 3. Hydraulics Model Study for Reoli Dugli H.E Project 2-D Sectional Flume Model, SJVNL (Himachal Pradesh).

Reoli Dugli Hydro Electric project (456 MW) has been envisaged across the river Chenab in the territory of State of Himachal Pradesh to generate hydro power energy with installed capacity of 456 MW. Project Authority referred to conduct Hydraulics Model Studies the said project for discharging capacity of sluice spillway with fully and partial operation of gate, water surface profile, pressure profile, silt sedimentation, velocity profile for entire range of discharge and Hydraulics behavior in the stilling basin. A geometrically similar 2D model (Flume Model) to a scale of 1:30 representing about 700m upstream to 1000m downstream was built to conduct the discharging





capacity of sluice spillway with fully and partial operation of gate, water surface profile, pressure profile, velocity profile for entire range of discharge, Hydraulics behavior in the stilling basin and its optimization. In this year construction of the model was completed and further studies will be carried out in the next year.

#### **4. Hydraulics Model Studies of Plunge Pool at Koldam HEPP, NTPC Ltd. (Himachal Pradesh).**

Koldam HEPP has been envisaged a 146m high dam across the river Satluj in the State of Himachal Pradesh, to generate hydro power with an installed capacity of 576 MW. The Sponsor M/s NTPC Ltd. referred the Hydraulics Model Studies for the optimization of the Plunge Pool of the said dam also for suggestions towards minimizing the damage under various operation conditions in the downstream hill slopes. The studies were conducted on geometrically similar scale of 1:55. The



protection proposal provided by sponsor to reduce the damage tested in model with certain limitations.

#### **5. Hydraulic Model Studies for Maneri Bhali stage-I HEP (90 MW), Uttarakhnad**

Maneri Bhali Hydro-Electric Project Stage-I, Uttarkashi has been envisaged a diurnal pondage Run-of-the-river scheme across the river Bhagirathi. Under this project, a 39 m high and 127m long concrete gravity dam was constructed to generate hydropower with an installed capacity of 90 MW and was commissioned in 1984. Earlier dented roller bucket was proposed and constructed for spillway energy dissipation. But, during flood all dents got damaged due to boulders rolling with the flow. The sponsor M/s UJVNL Ltd. referred the Hydraulics model studies of the said dam for selecting and optimizing a suitable energy dissipation arrangement with requisite modification/ alteration. In order to conduct the aforesaid studies, a



geometrical similar 3D comprehensive model to a model scale of 1:45 representing 800 m in the upstream and 1200m in the downstream was constructed. Various options and alterations were studied and final recommendations will be issued in the next year after conducting the studies on some more alterations.

#### **6. Hydraulics Model Study for Constnution and Restoretion of Balawali to Khanpur Bund on right bank of river Ganga, Haridwar, Uttarakhand.**

The river Ganga enters in Bhawr region in Rishikesh-Haridwar. There after it enters in tarai/plain regions where it changes its water course due to deposition of silt in the left side of the river



and erodes the right bank bunds from Balawali to Khanpur of Haridwar district of the State of Uttarakhand. The sponsor i.e. the Department



referred the studies for physical Hydraulics model studies of Construction and Restoration of Balawali to Khanpur Bund on right bank of river Ganga District-Haridwar Uttarakhand with the followings scope of works:

- (a) To ascertain whether the proposed length of spur is appropriate or not.
- (b) To finalize the length of the spur.
- (c) Water surface profiles for entire range of discharges.



- (d) Flow condition for entire range of discharges.
- (e) Observation of velocities at key points and measurement of scour developed in the model.

The study was conducted on a distorted model built to a scale of horizontal i.e. length and breadth ( $L_r$ )-1:175 and vertical i.e. depth ( $D_r$ )- 1:25 representing a reach of 8.0 km in the model. All the aforesaid model studies were conducted and optimization was made by providing 20 numbers attracting/deflecting spurs with variable lengths up to 100 m.

## 7. Hydraulics Model Studies for Water Hammer Pressures and Surge Shaft Orifice of Arun-3 Hydro-Electric Project (900MW), Distt.- Sankhuwashabha (Nepal).

Arun-3 Hydro Electric Project has been proposed across the river arun with an installed capacity of 900 MW (4 x 225 MW) in the Sankhuwashabha district of Nepal. In this project,



9.5m dia horse shoe shaped head race tunnel with a restricted orifice surge shaft of diameter of 24.0m has been proposed. The sponsor referred the said model study to determine an average value of the discharge coefficient of the surge shaft orifices with





two gate grooves and surge studies under various transient conditions. The said model studies were conducted on a distorted physical model of Length scale ratio ( $L_r$ )-1: 100, HRT Dia scale ratio ( $D_r$ )-1: 31.089, Surge scale ratio ( $Z_r$ )-1: 100, Conduit Velocity scale ratio ( $V_r$ )-1: 10, Time scale ratio ( $T_r$ )-1: 10 and Discharge scale ratio ( $Q_r$ )-1: 9665.5 based on the principle of dynamic similitude. The studies were performed and the average discharge coefficient values under inflow and outflow conditions were communicated to the sponsor for his comments.

#### **8. Maintenance of various Models:**

On the repetitive requests of M/s THDC Ltd., three models earlier studied at HRS, Bahadrapad viz. Tehri PSP Inlet Outlet model, Tehri PSP U/s Bifurcation model and Tehri PSP D/s Bifurcation model were kept intact and also were maintained by the Institute during the year.

#### **9. Proposal of New Model Studies Received:**

The institute received many requisitions for conducting the model studies of various projects viz. Lakhwar Multipurpose Project, Uttarakhand, Nafra HEP (120 MW), Arunachal Pradesh, Tato-II HEP (700 MW), Arunachal Pradesh, Bariyarpur, MP etc. construction and running of the models will be started after receiving the detailed design and drawings and other related information/documents.



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**IRRIGATION DEPARTMENT, GOVT. OF UTTARAKHAND**

**सिंचाई विभाग, उत्तराखण्ड सरकार**

**IRRIGATION RESEARCH INSTITUTE, ROORKEE**

**सिंचाई अनुसंधान संस्थान, रूड़की**



**ANNUAL REPORT 2022-23**

**वार्षिक प्रतिवेदन 2022-23**

**CHAPTER – VI**

**OTHER ACTIVITIES**







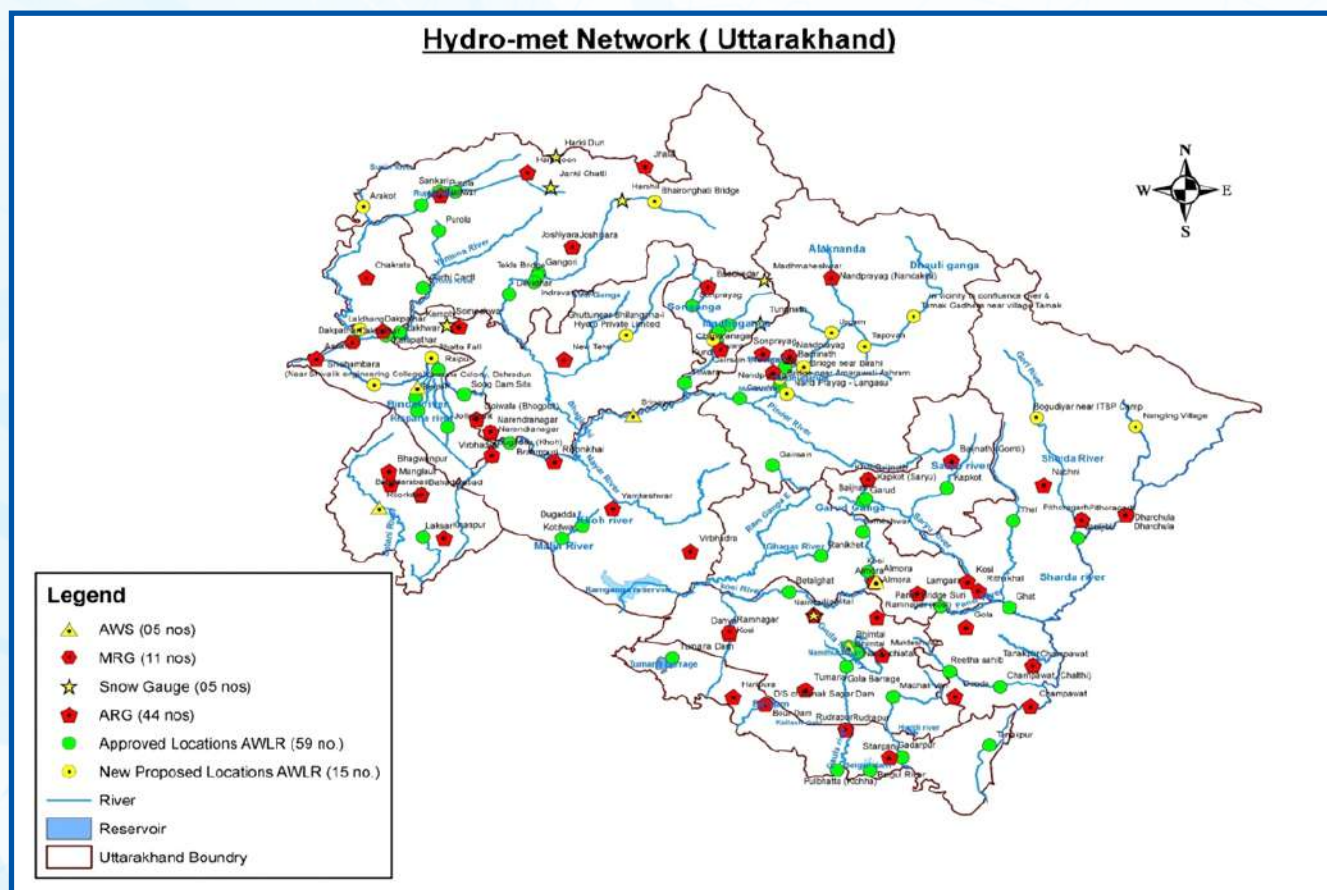
## OTHER ACTIVITIES

### National Hydrology Project (NHP)

NHP is a fully Central Govt. assisted project funded by the World Bank for a period of 8 years (2017-25). The main mandate of NHP is to strengthen the capacity of Water Resources Management in India, to develop Reliable water resources information, improve water monitoring systems of state for Flood Routing, Efficient Water Use, Irrigation benchmarking etc., to develop single window for better sharing of Real-Time Hydro-Meteorological data amongst States, to execute dynamic water resource assessment, water accounting and basin-wise modelling will improve targeting of investment and 'right-sizing' of the project.

To implement the NHP in Uttarakhand an MoA was signed between Principal Secretary (Irrigation), GoUK and Joint Secretary, DoWR, RD and GR, Ministry of Jal Shakti, GoI on 15.11.2016. Principal Secretary (Irrigation), GoUK constituted an SPMU under his Coordinatorship on 03.06.2016. Under NHP, following activities were executed in the State during the year.

- i) Real Time Data Acquisition System (RTDAS) for surface water was developed to get real time hydro-met data viz. water level, rainfall, snow fall, other meteorological data under which Automatic Water Level Recorder (AWLR) - 59 Nos., Automatic Rain Gauge (ARG) - 44 Nos., Automatic Weather Station (AWS) - 04 Nos., Snow Gauge (liquid and solid) - 05 Nos. and Ordinary Rain gauge (ORG) - 11 Nos. were proposed.



Real Time data of the installed instruments can be seen on <http://ukswic.in/>.





AWLR Dunda (Devidhar), Uttarkashi



AWLR Indravati Gad, Uttarkashi



AWLR Purola, Uttarkashi



AWLR Mori, Uttarkashi

Installations of progress of RTDAS is given below as:

SURFACE WATER				
Type of Station	Installed	Installation under Progress	Commissioned	Commissioning under Progress
<b>Automatic</b> Water Level Recorder (AWLR)	<b>48</b>	<b>11</b>	<b>48</b>	<b>-</b>
<b>Automatic</b> Rain Gauge (ARG)	<b>38</b>	<b>06</b>	<b>34</b>	<b>05</b>
<b>Snow</b> Gauge	<b>-</b>	<b>05</b>	<b>-</b>	<b>-</b>
<b>Automatic</b> Weather Station (AWS)	<b>04</b>	<b>-</b>	<b>04</b>	<b>-</b>
<b>Total</b>	<b>90</b>	<b>22</b>	<b>86</b>	<b>05</b>

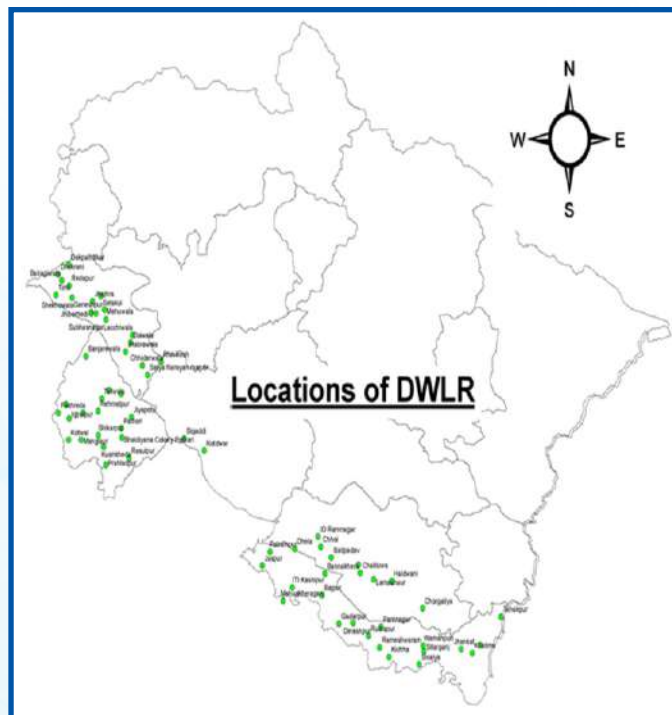
ii) Conducting of 500 Nos. River Cross-sections, Topographical survey and Construction of 500 Nos. bench mark pillar and 123 Nos. River Cross-sections additional for Flood Forecasting (FF) and Early Warning System (EWS) in the State.

iii) Developing rating curves at two locations viz. Gauchar and Katapatthar with the help of Acoustic Doppler Current Profilers (ADCP).

iv) Starting the work of SCADA (Supervisory Control and Data Acquisition) system for Gaula Barrage and Ramnagar Barrage.



- v) Ground Water Monitoring at 66 Locations in Plain Areas of Uttarakhand-** To Receive Real Time Ground water Level through Telemetry and to take sample for monitoring of ground water quality, piezometers were installed at 66 locations made and 34 nos. Digital Water Level Recorder (DWLR) were installed for monitoring of ground water level in this year.



- viii)** For providing drinking water to Nainital and Ranikhet towns and adjoining areas, detailed project report (DPR) of Khairna Drinking water Project (41 MLD), Nainital, Uttarakhand was prepared. For providing drinking water to Talghati Areas (12 villages) of Yamkeshwar Block, Pauri Garhwal, work of preparation of detailed project report (DPR) was started.



- vi)** Water Quality Monitoring of Rivers /Lakes, Drinking Water in Uttarakhand. Drinking water samples from at least 15 different locations of each districts of the State and river water from some selected places of various rivers and lakes were collected and got tested in two Water Quality Laboratories at Roorkee and Haldwani on quarterly basis. The test parameters are determination of Physio-chemical parameter, Detection of E-coli, Detection of Heavy Metals and Detection of Pesticides Residues.

- vii)** Purpose Driven Studies (PDS) to estimate the lives and to prepare comprehensive plan for Sustainable Development and Management of Bhimtal and Naukuchiatal Lakes of both lakes were completed.

- ix)** Identification and implementation for rejuvenation of Springs/Springshed and for the preparation of Digital Maps, Water Quality, comprehensive plan for sustainable development of Springs/springshed of Dehradun Districts, related works were initiated and about 112 springs were identified and their water qualities were tested.

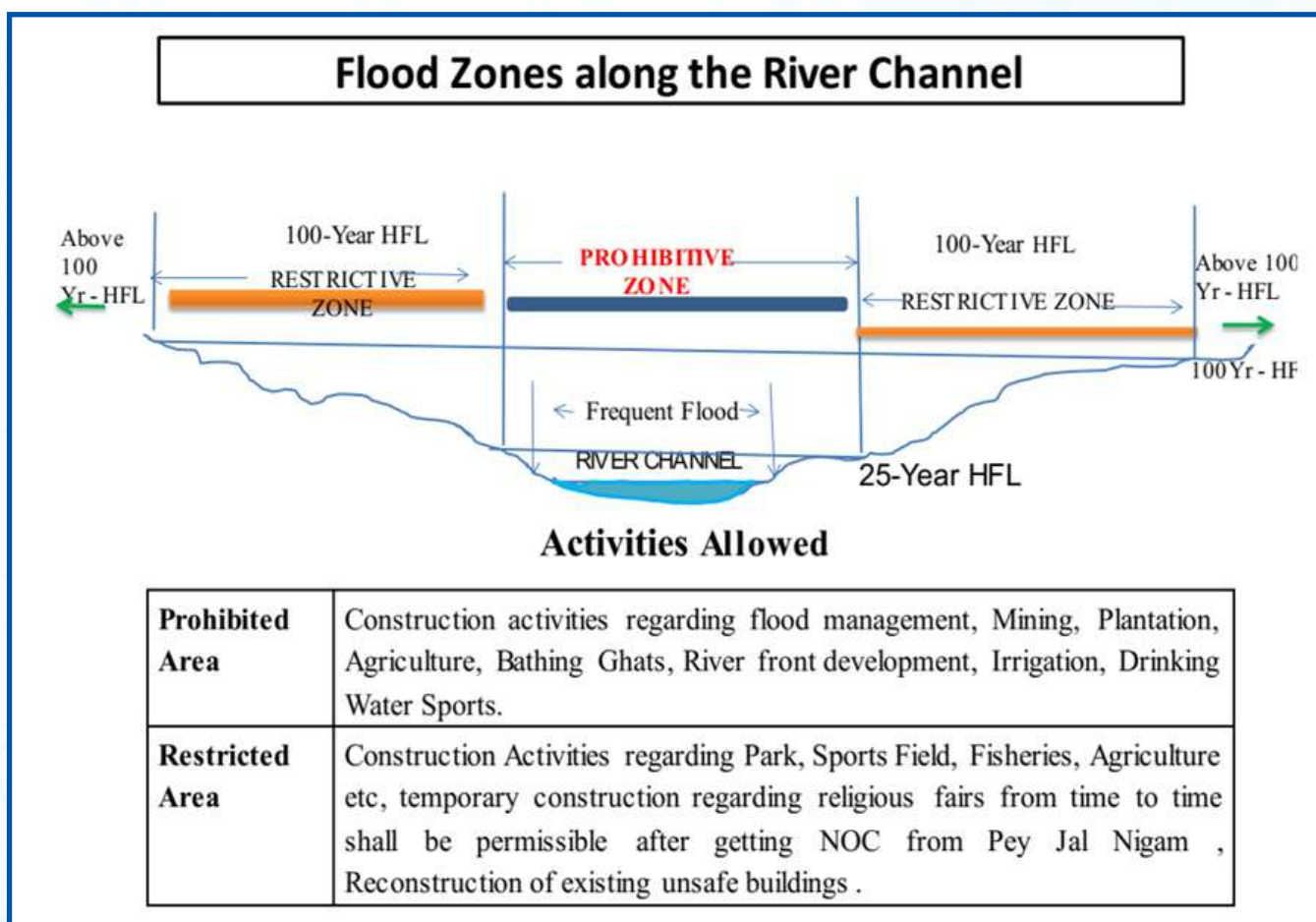
- x)** Establishment of State WRIS and its integration with India WRIS- In order to create a layer of Canal network and Tubewell, tracking and Digitization works of canal network and tubewell network were started and tracking of canals about 345 km was completed.



## Flood Plain Zoning

Flood plain zoning is a concept central to flood plain management. This concept recognizes the basic fact that the flood plain of a river is essentially its domain and any intrusion into or development of a activity the river must recognize the river's 'right of way'. Flood-plain zoning measures aim at demarcating zones or areas as likely to be affected by floods of different magnitudes or frequencies and probability levels, and specify the types of permissible developments in these zones, so that whenever floods actually occur, the damage can be minimized, if not avoided.

In pursuance of the provisions of clause (3) of Article 348 of the constitution of India, the Uttarakhand Government passed the Uttarakhand Flood Plain Zoning Act 2012. The aftermath of 2013 Kedarnath flood, the Honorable Supreme Court and the Honorable National Green Tribunal (N.G.T.) has taken a serious note of that and in the lights on the directions passed by Honorable Supreme Court and subsequently by the Honourable N.G.T., it becomes imperative to decide the limit of boundary for rivers/streams in Uttarakhand. For regulating and use in different flood zones, the National Disaster Management Authority (N.D.M.A.) has classified following priorities in respect of construction of buildings and other utility services.



### NDMA Guidelines of Different Zones and Priorities

S.No.	Priority	Reach
1	Prohibitive Zone (Priority1)	<ul style="list-style-type: none"> <li>• Parks and playgrounds Infra-structure such as playgrounds and parks can be located in areas vulnerable <b>to frequent floods.</b></li> <li>• Since every city needs some open areas and gardens, by restricting building activity in a vulnerable area, it will be possible to develop parks and play grounds which would provide a proper environment for the growth of the city.</li> </ul>
2	Restrictive Zone (Priority 2)	<ul style="list-style-type: none"> <li>• Public institutions, Government offices, universities, public libraries and residential areas. Buildings should be above a level corresponding to <b>a 25-year flood or a 10 year rain fall with stipulation</b> tha tall buildings in vulnerable zones should be constructed on columns or stilts.</li> </ul>
3	Above Warning Zone (Priority3)	<ul style="list-style-type: none"> <li>• Defence installations</li> <li>• Industries</li> <li>• Public utilities likes hospitals, electricity installations, watersupply, telephone exchange, aerodromes, railways stations, commercial centres,etc.</li> <li>• Buildings should be located in such a fashion that they are above the levels corresponding <b>to a 100 year flood frequency or the maximum observed flood levels.</b></li> <li>• Similarly they should also be above the levels corresponding to a 50-year rainfall and the likely submergence due to drainage congestion.</li> </ul>





IRI, Roorkee was nominated to start for scientific studies for Flood Plain Zoning in the State of Uttarakhand. Initially, studies of flood plain zoning in a length of about 2200 km all rivers in their critical zones were divided into four phases viz. Phase-I (50 km), Phase-II (532 km), Phase-III (401 km) and Phase-IV (850 km). Studies of Phase-I and Phase-II were completed successfully in the previous years. In this year, studies of Phase-III were started and are in progress. Details of different phases are given below:

**Phase-I**

Sl. No.	Reach Name	River	Length	Status
1.	Chandi Bridge, Haridwar to Kalsia Village in Lakasar Haridwar District	Ganga	50 Km	The final notification of this reach has been issued by Irrigation Department vide G.O. No. 828/II(2)-2018/06(65)/2018, dated 11.05.2018.
2.	Gangori Village to BadhethiChungi in Uttarkashi District	Bhagirathi	10 Km	The final notification of this reach has been issued by Irrigation Department vide G.O. No. 829/II(2)-2018/06(66)/2018, dated 11.05.2018.

**Phase-II**

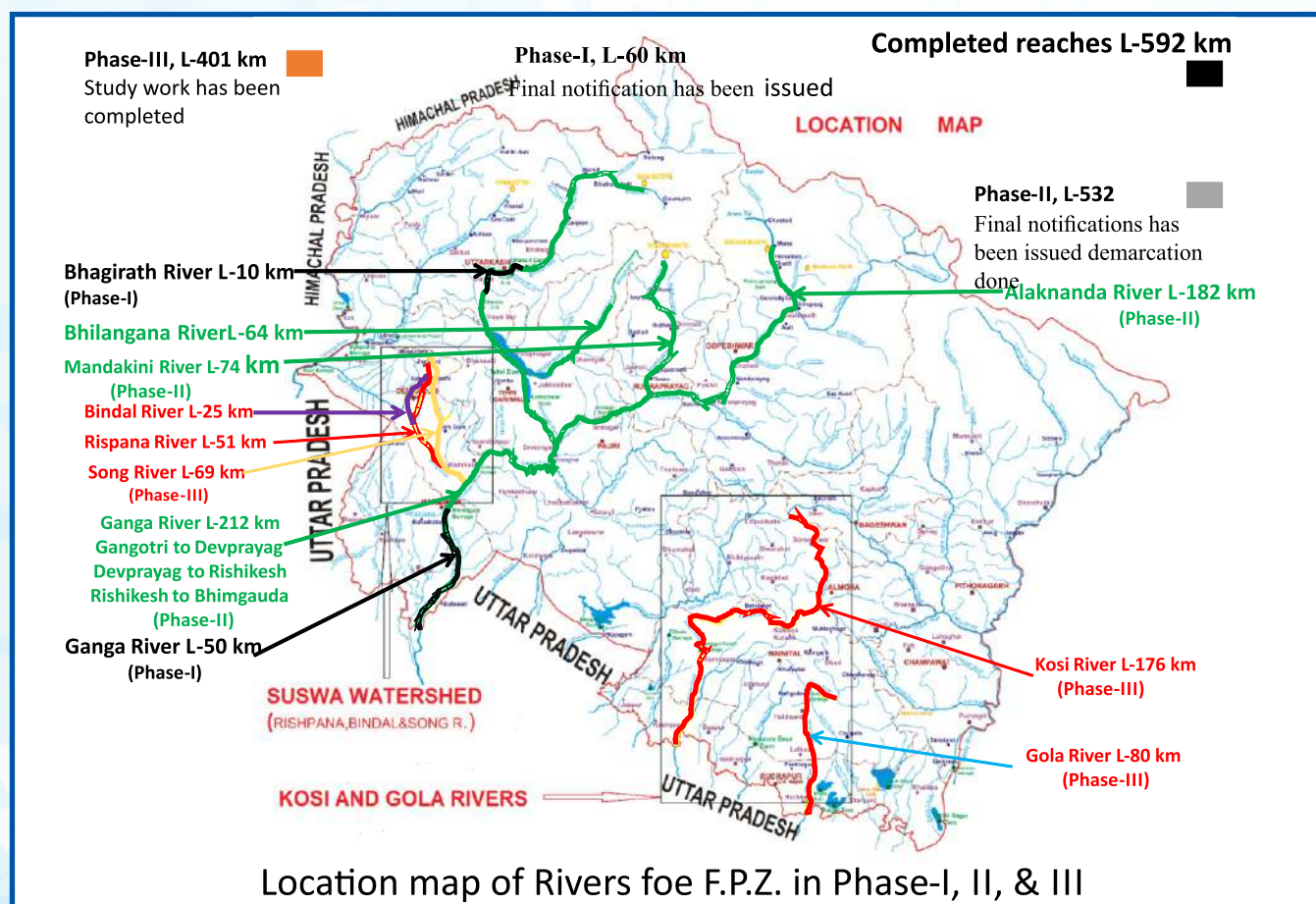
S. No.	Reach name	Length of reach (Km.)	Status
1	From Gangotri to Devprayag, excluding the reach from Gangori to Badethi Chungi	125	Study work completed and initial notification is progress.
2	From Devprayag to Rishikesh	68	
3	From Rishikesh to Bhimgauda Barrage	19	
4	Bhilangana river	64	
5	Badrinath to Devprayag, Alaknanda River	182	
6	Kedarnath to Rudraprayag Mandakini River	74	
<b>Total Length (in Km)</b>		<b>532</b>	

**Phase-III**

Sr. No.	Name of the River	Length
1	Rispana	51.00
2	Bindal	25.00
3	Song	69.00
4	Kosi	176.00
5	Gola	80.00
<b>Total Length (in Km)</b>		<b>401.00</b>

**Phase-IV**

Sl. No.	Name of the River	Length (Km.)
1	Asan and tributaries (Nimi,Nun,swarna Rivers and Sitla Rao)	106
2	Jhakhan/Ranipokhri	28
3	Chandrabhaga	8
4	Yamuna	145
<b>Total</b>		<b>287</b>
1	Pindar River	106
2	Dhauliganga River	87
3	Nandakini River	36
<b>Total</b>		<b>229</b>
1	Solani	70
2	Malini	3.4
3	Ratmau	42
4	Nandhaur	38
5	Ladhiya	64
6	Ram Ganga River	114
<b>Total</b>		<b>331.4</b>
<b>Grand Total (in Km)</b>		<b>847.4</b>





## State Specific Action Plan

### Uttarakhand State Specific Action Plan (SSAP) for Water Sector

The main goals of SSAP are the Development of water database which can be accessible to all and to study the impacts on climate change on water resource, Promotion of general public and state level action for water conservation, water resource enhancement and preservation, Special attention to vulnerable areas including over exploited areas, Increasing water use efficiency by 20%, Promotion of basin level integrated water resources management etc. with main objective of To formulate annual State / UT Water Budgets, To formulate a comprehensive and integrated water plan for WATER SECURITY, SAFETY AND SUSTAINABILITY TILL 2050 with equity through convergence, synergy and role/accountability of all stakeholders - Government and Non- Government agencies including civil society.

Water Budget for the State of Uttarakhand was estimated for the year 2019-20. A total of water was estimated as 89.5 BCM out of which 15.6 BCM was the snow melt contribution. Groundwater was estimated as 2.9 BCM while live storages in Dams/Barrages and Ponds/Tanks were estimated as 5 BCM and 1 BCM respectively. Total Outflow from Uttarakhand State to other States (Uttar Pradesh and Haryana) was estimated as 39.9 BCM.

Accordingly, Draft Status Report (DSR) was prepared and the same was approved by both the Committees of NWM viz. Technical Committee and Steering Committee.

### Third Party Quality Control Works

Various in-situ tests of Constructed/Under Construction works have been conducted during the year for following clients:

- State Industrial Development Corporation Uttarakhand Limited (SIDCUL), Uttarakhand.
- Uttarakhand Peyjal Sansadhan Vikas Evam Nirman Nigam, Dehradun, Uttarakhand.
- Irrigation Department, Uttarakhand.
- Public Works Department, Uttarakhand.
- Training and Employment Directorate, Uttarakhand.
- Uttarakhand Peyjal Nigam.

### Hydro-Meteorological Observatory at Hydraulic Research Station, Bahadradab

#### ❖ **Compilation and Analysis of observations recorded at Meteorological observatory:**

Various elements of meteorological observations such as Temperature, relative Humidity, Rainfall, Wind Velocity, Vapour Pressure, Sediment Concentration, Evaporation rate and Soil Temperature were observed at Meteorological Observatory, Hydraulic Research Unit-2, Hydraulic Research Station, Bahadradab (Haridwar) for the year 2022. Maximum and minimum temperature recorded in a year was 43.0°C on 10-06-2022 and 0.6°C on 28-12-2022. Out of total 938.0mm rainfall of the year 2022, about 77.4% of total yearly rainfall was received from June to September only. The wettest month of the year was September 2022, in which 303.6mm rainfall was recorded. Total numbers of rainy days were 60. Maximum average wind velocity observed was 6.0km/hr. on 29-08-2022 and Maximum vapour pressure of 30.9 mm was observed on 28-06-2022. Maximum rate of evaporation i.e., 15.50 mm/day was observed on 31-05-2022. The total evaporation of 1011.4mm was recorded during year 2022. Maximum sediment concentration in the feeder channel of HRS was observed as 3000.0ppm on 13-08-2022.



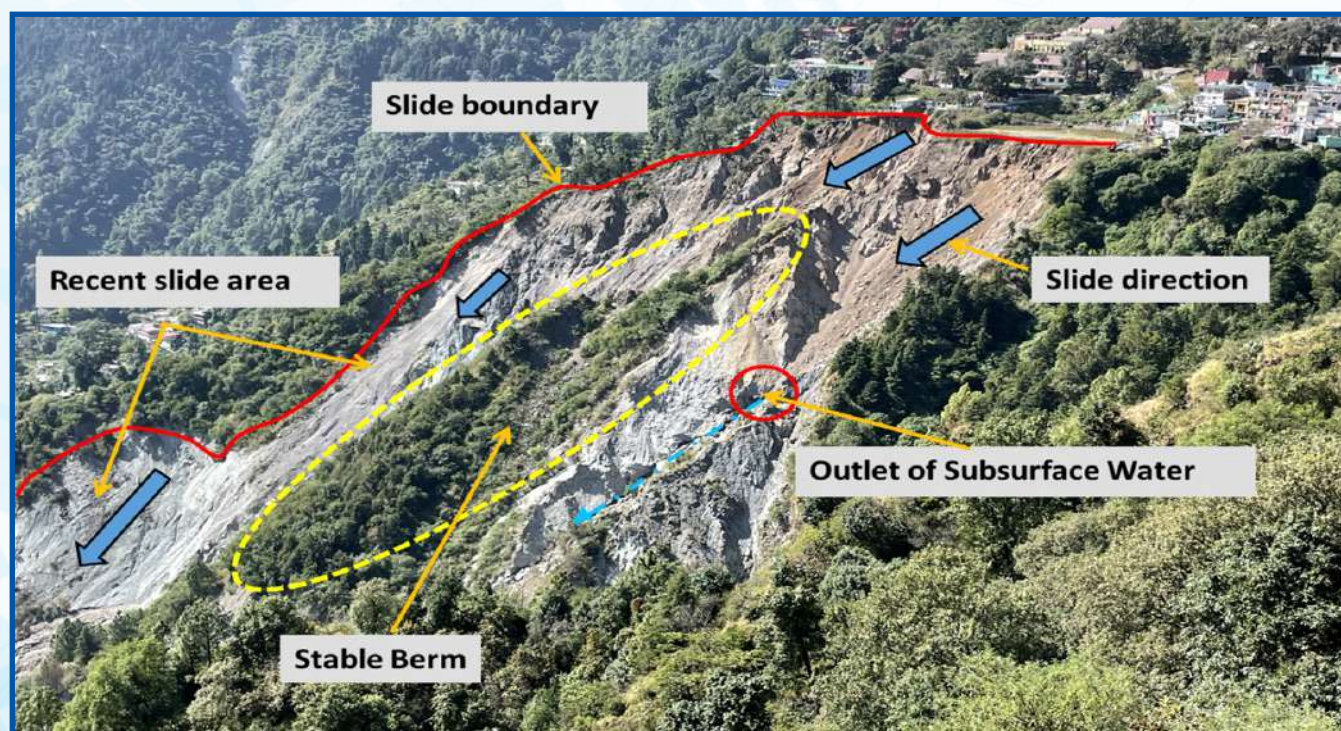


## Preparation of Detailed Project Report (DPR) of Fragile Slope Treatment and Sustainable Mitigation Works of Baliyanala, Nainital (Uttarakhand)

In the past, the Baliyanala area has witnessed mass movements in 1866, 1867, 1880, 1893, 1898, 1924, 1989 and 1998 while recently in 2008, 2014, 2015, 2018 and 2020. These inflicted heavy loss of life, infrastructure,



property and geo-environment. Baliyanala is the outlet of the Nainital or Naini Lake at Tallital. Baliyanala Land slide area is at around 700m away from Naini Lake. The elevation of the Landslide ranges from 1866m





(scarp of the slide) to 1600m (toe of the slide) – about 266m high. The right bank of this stream has two populated localities of economic importance. One is Government Inter College (GIC) and the other Saraswati Vihar, both affected by landslides. DPR for Fragile Slope Treatment and Sustainable Mitigation Works of Baliyanala, Nainital was prepared by IRI, Roorkee and was approved at all stages.

### Implementation of Dam Safety Act, 2021:

Irrigation Research Institute, Roorkee had played important roles towards implementation of Dam Safety Act, 2021 in Uttarakhand State in coordinating SDSO and SCDS meetings, issuing various directions to dam owners and minutes of meetings etc. Sh. Saha, SE, IRI, Roorkee prepared the Annual Report 2022-23 of SDSO, Uttarakhand. CE (Design & Direct) and SE, Research Circle, IRI, Roorkee are the members of SCDS and SDSO respectively.



उत्तराखण्ड शासन



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**CHAPTER – VII**

**ACHIEVEMENTS**







## ACHIEVEMENTS

### CBI&P Award 2022

Irrigation Research Institute, Roorkee was nominated as the Best R&D Institute in Water Resources Sector by Central Board of Irrigation & Power (CBI&P), New Delhi and received this Award on March 03, 2023.



### Preparation of DPRs of :

- Gairsain Drinking Water Project, Distt. Chamoli, Uttarakhand.
- Khairna Drinking Water Project, Distt. Nainital, Uttarakhand.
- Fragile Slope Treatment and Sustainable Mitigation Works of Baliyanala, Nainital, Uttarakhand.







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**CHAPTER – VIII**

**FINANCIAL MATTERS**







## FINANCIAL MATTER

S.No.	Name of Circle/Division/ Other	Total Fund Received	Total Expenditure	Balance
1	ADM. Div. IRI, Rke	1,10,22,928.00	97,49,135.00	12,73,793.00
2	Hydraulic Div. HRS, Bahadrabad	3,8102,088.00	1,88,65,132.00	1,92,36,956.00
3	NHP	11,34,06,080.00	8,88,82,568.00	2,45,23,512.00
4	SSAP	Nil	Nil	Nil
5	Flood Plain Zoning	2,91,76,000.00	92,47,913.00	1,99,28,087.00







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**CHAPTER – IX**

**HUMAN RESOURCES**







## HUMAN RESOURCES

The Quality of work in any Institute depends on the quantity & quality of available man power. This Institute had a total sanctioned strength of 43 officers.

Name	Designation	E-mail	Work Experience
 <b>Dinesh Chandra</b>	Chief Engineer Level-1 (Design) & Director IRI, Roorkee (01 Apr. 2022 to 09 Nov. 2022)	cedesign-irri-uk@gov.in ce@iriroorkee.res.in	Construction and Maintenance of Building Works , Maintenance of Hydro power project (Dam & Intake), Designing & Construction of Flood Protection Work, Hydraulic Model Studies and Various Project of Irrigation Department.
 <b>P.S. Panwar</b>	Chief Engineer Level-2 (Design) & Director IRI, Roorkee (10 Nov. 2022 to 31 Mar. 2023)	cedesign-irri-uk@gov.in ce@iriroorkee.res.in	Construction irrigation canals, Flood protection work, Building & Road works in Hilly areas..
 <b>Shankar Kumar Saha</b>	Superintending Engineer Research Circle IRI, Roorkee	sereserch-irri-uk@gov.in sksahaukid1999@gmail.com	10 years experience - Investigation & Planning, Construction, Quality Control, Material Procurements, Regulation and O&M works of Water Resources Projects; 5.5 years experience - Hydraulic Design/Research and Hydraulic Model Studies of various WR Projects 3 Years Experience- Inter-State water related matters, preparation of Water Accounting Manual; conceptual layout & design of office building of UYRB 3.5 years experience -Testing of construction materials & water quality, Third Party quality Control, studies related to groundwater etc.
 <b>Manoj Kr. Singh</b>	Superintending Engineer Design Circle IDO, Roorkee	serke-irri-uk@gov.in	Flood protection work & Hydraulic model studies, building & road works, Construction of irrigation canals.
 <b>R.C. Gupta</b>	Superintending Engineer Hydraulics Circle, HRS Bahadrabad	sehyd24@gmail.com	Construction of Barrages & Intake of HEP Project & rehabilitation work. Construction & Maintenance works of Stage Hilly Roads. Hydraulic Model Studies for Dam, Intake, Spillway ,Bridges & other different Hydraulic Structure, flood plain zoning work for different flood frequency of Ganga Basin



	Research officer Material Testing Unit-I	romt1@irirorkee.res.in	Research/Testing of Cement, Cement Concrete and Soil Testing & Ingredients of Cement & Concrete Mix Design
	Research officer Soil Research Unit-I	ros1@irirorkee.res.in	Remote Sensing & Chemical tests in Soil Research
	Research officer Soil Research Unit-II	ros2@irirorkee.res.in	Model Studies of Hydraulic Structure, Sedimentation Survey of Reservoirs, Chemical Analysis of Cement Mortar/Concrete and Water & Alkali aggregate Reactivity Test of Aggregate Soil Samples & Water Quality Testing
	Executive Engineer Ground Water Research Unit-II	rogw2-irri-uk@gov.in	Construction of irrigation canals in hill areas, Flood Protection & Civil Work.
	Executive Engineer, Administration Division,	eeadminrke@irirorkee.res.in	Regulation, operation & maintainance of hydro power project (Dam & Intake). Construction & maintance of hill canal and flood protection work, Tehri Dam rehabilitation pertain work, building & road works.
	Executive Engineer Hydraulics Division	roh3.iri@gmail.com	Construction of Building & irrigation canals, Flood protection work & Hydraulic model studies.
	Executive Engineer Hydraulics Research Unit-I	rk.irgn@gmail.com	Flood protection work & Hydraulic model studies, Building & Road works, Construction of irrigation canals.

	Executive Engineer Hydraulics Research Unit-II	roh2.iri@gmail.com	Construction irrigation canals in hill areas, Flood protection work & Hydraulic model studies.
	Research officer Ground Water Research Unit-I	rajmohan2261@yahoo.in	Regarding to 2D, 3D Physical Modeling of Hydraulic structure to determine the Uplift Pressure & Exit Gradient Beneath the Hydraulic Structures on Alluvium & Permeable Soil.
	Research officer Basic Research Unit	robasic-irri-uk@gov.in sushil.iri@gmail.com	Hydraulic Model Studies, Capacity Survey of Reservoirs, Testing of rock material, Highway material and Maintenance of computer centre & website of IRI Roorkee.
	Executive Engineer SPMU, NHP	uk4883820@gmail.com	Construction irrigation canals in hill areas, Flood protection work & Hydraulic model studies.
	Research officer Material Testing Unit-II	romt2@iriroorkee.res.in	Remote Sensing & Capacity Survey of Reservoir, Rock Mechanics & Pipe Testing
	Assistant Engineer Soil Research Unit-II	abhi.88.iitr@gmail.com	Planning & Construction of flood protection works, canals & regulation and maintenance of canals.
	Assistant Engineer Basic Research Unit	ajakumar1963@gmail.com	Hydraulic Model Studies & Capacity Survey of Reservoir






 <b>Amarjeet Sah</b>	Assistant Engineer Hydraulics Research Unit-I	Amarjeet.sah@gmail.com	Conducting various hydraulic model studies, canals & regulation and maintenance of canals.
 <b>Anil Kr. Tyagi</b>	Assistant Engineer Hydraulics Research Unit-II	a.k.tyagi.rke@gmail.com	Construction irrigation canals in hill areas, Flood protection work & Hydraulic model studies.
 <b>Anoop Singh</b>	Assistant Research officer Soil Research Unit-II (22 Sep. 2022 to 31 Mar. 2023)	anoop.singh532@gmail.com	Studying the soil testing books related to Soil classification, compaction test, permeability test etc.
 <b>Arun Kr. Singh</b>	Assistant Engineer Hydraulics Research Unit-III	arunkhundiyan@gmail.com	Hydraulic Model Studies, Construction irrigation canals in hill areas, Flood protection work
 <b>Bhanwar Singh</b>	Assistant Research officer Soil Research Unit-II (21 Sep. 2022 to 31 Mar. 2023)	aro1adrke-irri@uk.gov.in	3D-EHDA (Electro Hydro Dynamic Analogy) Sub- Surface model study of Hydraulic structures and Testing of Pressure Release Valve (PRV).
 <b>D.C. Ramola</b>	Assistant Research officer Material Testing Unit-II (21 Sep. 2022 to 31 Mar. 2023)	ramolad89@gmail.com	Ground Water Artificial Recharge Study, Quality Control Works for Highway & Pipe Testing works
 <b>Jagpal</b>	Assistant Research officer Soil Research Unit-I	jagpaliri123@gmail.com	Soil testing and Hydrographic Survey.

 <b>Khadak Singh</b>	Assistant Engineer Administration Division,	k.s.chauhan078@gmail.com	Maintenance of civil works
 <b>Mahipal Singh</b>	Assistant Research officer Hydraulics Research Unit-III	mpsingh.iri@gmail.com	Model Studies, Chemical Analysis of Cement, Cement Mortar/Cement Concrete, Water Samples, Alkali Aggregate Reactivity Test of Aggregate Samples and Grain size distribution of silt.
 <b>Manish Shankar Sant</b>	Assistant Engineer Basic Research Unit	manishshankarsant@gmail.com	Involved in implementation of NHP funded by World Bank and assisted by Ministry of Water Resources, River Development & Ganga Rejuvenation, Govt. of India, New Delhi. Successfully completed the quality control assurance works of Arddh Kumbh Mela 2016.
 <b>Md. Hamid Hassan</b>	Assistant Engineer Basic Research Unit	hamid14uk@gmail.com	Construction and Maintenance of Building Works (RAMSA), Designing & Construction of Flood Protection Work, Hydraulic Model Studies and Mix Design work of Conventional & Roller Compacted Concrete
 <b>Naveen Kr. Agarwal</b>	Assistant Research Officer Hydraulics Research Unit-I	naveenka.bcs@gmail.com	Conducting various hydraulic model studies
 <b>Neha</b>	Assistant Engineer Basic Research Unit-III	nehakanojia24@gmail.com	3D EHDA Model Studies Siphon Aqueduct on Rapti Main Canal, Involving in World Bank aided project for Uttarakhand state & River Migration Study, Digitization with the help of Remote Sensing Techniques
 <b>Pushendra Kumar</b>	Assistant Engineer Hydraulics Division	pushpender886@gmail.com	Construction work and prepared project and compile estimate like Irrigation canal, Flood protection work



 <b>Ram Ashish</b>	Assistant Research officer Soil Research Unit-II	ram_ash_ish@yahoo.com	Statistical Lab & hydraulic model studies
 <b>Raghuveer Singh</b>	Assistant Research officer Material Testing Unit-I	rvsingh.in@gmail.com	Concrete mix design and Construction Material Testing
 <b>Salma Jahan</b>	Assistant Engineer Hydraulics Research Unit-III	salmajahan786r@gmail.com	Hydraulic model studies of different hydraulic structure
 <b>Sharad Kumar</b>	Assistant Engineer Design Unit-III,	sharadgupta.iitr@gmail.com	State Specific Action Plan & Design Work
 <b>Siddharth Pushkar</b>	Assistant Engineer Soil Research Unit-I	simplysid37@gmail.com	Hydraulic Model Studies for hydraulic structure, Flood protection work, Sub soil investigation & Soil testing various parameters.
 <b>Subodh Singh</b>	Assistant Engineer-II Hydraulics Division	ae2hbd-irri@uk.gov.in	Construction work and prepared project and compile estimate like Irrigation canal, Field Outlets, Flood protection work
 <b>Sumit Malwal</b>	Assistant Engineer Hydraulics Research Unit-II	sumit11malwal1@gmail.com	Hydraulic model studies of different hydraulic structure

 <b>Surendra Kumar</b>	Assistant Research Officer Hydraulics Research Unit-II	sk2027.iri@gmail.com	Hydraulic model studies of different hydraulic structure
 <b>Vijay Kashyap</b>	Assistant Research Officer Ground water Unit	vijayukid@gmail.com	Hydraulic model studies & Capacity Survey of Reservoir
 <b>Vivek Kumar</b>	Assistant Engineer Administration Division	ae55.adm@gmail.com	Maintenance of civil works & Construction of building

## APPENDIX-I

### List of Research Reports

#### Description of Research Reports during the year:

S.No.	Title of Study	Name of the Sponsor
<b>HYDRAULICS UNIT</b>		
1.	Maintenance work of Tehri PSP Inlet Outlet model	THDC India Ltd. Rishikesh (Uttarakhand)
2.	Maintenance work of Tehri PSP U/s Bifurcation model	THDC India Ltd. Rishikesh (Uttarakhand)
3.	Maintenance work of Tehri PSP D/S Bifurcation model	THDC India Ltd. Rishikesh (Uttarakhand)
4.	3D Physical Model Study of Power Intake of Lakhwar Multipurpose Project (300MW), Uttarakhand	DGM, UJVN Ltd., Rishikesh (Uttarakhand)
5.	3D Physical Model Study of Water conductor System of Lakhwar Multipurpose Project (300MW), Uttarakhand.	DGM, UJVN Ltd., Rishikesh (Uttarakhand)
6.	Nafra HEP (120 MW), Arunachal Pradesh	Executive Director, Neepco Ltd., Guwahati
7.	Tato-II HEP (700 MW), Arunachal Pradesh	Executive Director, Neepco Ltd., Guwahati
8.	Jamrani Drinking Water Multipurpose project (14 MW)	The Project Manager, Uttarakhand Project Development & Construction Corporation Ltd., Nainital (Uttarakhand)
9.	Model Study for Reoli Dugli H.E Project (456MW) (3D Comprehensive) Himachal Pradesh	SJVN Ltd. (Himachal Pradesh)
10.	Model Study for Reoli Dugli H.E Project-2 D Sectional Flume Model	SJVN Ltd. (Himachal Pradesh)
11.	Hydraulic Model Studies of Plunge Pool at Koldam HEPP (Himachal Pradesh)	NTPC Ltd. (Himachal Pradesh)
12.	Hydraulic Model Studies for optimization of stilling basin for 90MW Maneri Bhali stage-I HEP (Uttarakhand)	Uttarakhand Jal Vidyut Nigam Ltd. (Uttarakhand)
13.	Compilation and Analysis of observations recorded at Meteorological Observatory, Bahadrabad (Uttarakhand)	Hydraulic Research Station, Bahadrabad
14.	Hydraulic Model Study for Construction and Restoration of Balawali to Khanpur Bund on right bank of river Ganga District- Haridwar Uttarakhand	Govt. of Uttarakhand
15.	Hydraulic Model Studies for Water Hammer Pressures and Surge Shaft Orifice of Arun-3 Hydro-Electric Project (900MW), Distt.-Sankhuwashabha (Nepal).	S.J.V.N Ltd., Shimla (H.P.)
16.	Design of Concrete Mixes for Construction of New Bajrang Setu near Laxman Jhula, Rishikesh (Uttarakhand)	Sr. Manager Project Planning and Monitoring, Quiet Office 7, Sector 35-A, Chandigarh



17.	Design of Concrete Mix for Construction of ITI Building at Talheri Bujurg and Beenpur, Gangoh in Distt. Saharanpur (U.P.).	Project Manager, Construction Unit-26, U.P. Projects Corporation Ltd., Saharanpur (U.P)
18.	Design of Concrete Mix for Construction of Entrance Gate, Smart Gym and Multipurpose Hall at Dr. Ambedkar Stadium, Saharanpur under Smart City Scheme.	Project Manager, Construction Unit-26, U.P. Projects Corporation Ltd., Saharanpur (U.P)
19.	Design of Concrete Mix for Construction of Sainik Dham Building at Purkul in Dehradun District (Uttarakhand).	Project Manager, Construction Unit, Uttarakhand Peyjal Sanshadhan Vikas and Nirman Nigam, (Harbatpur), Dehradundun (Uttarakhand)
20.	Design of Concrete Mixes for Construction of Retaining Wall along right bank of Kali River from Ghatgad Nala to Taxi Stand in Dharchula Block, Pithoragarh (Uttarakhand).	Executive Engineer, Irrigation Division, Dharchula (Uttarakhand)
21.	Design of Concrete Mixes for Construction works for Jagjeetpur Peyjal Yojna, Haridwar (Uttarakhand).	Executive Engineer, World Bank Project Unit, Uttarakhand Peyjal Nigam, Haridwar (Uttarakhand)

#### GROUND WATER

22.	Testing of physical and mechanical properties of timber wood specimens	Superintending Engineer, Research Circle, IRI, Roorkee (Uttarakhand)
23.	Determination of water quality of drinking water sources in different districts of Kumaun region.	National Hydrology Project (NHP), IRI, Roorkee (Uttarakhand)
24.	Determination of water quality of Bhimtal and Naukuchiatal under Purpose Driven Study (PDS)	National Hydrology Project (NHP), IRI, Roorkee (Uttarakhand)
25.	Determination of water quality of Kosi river at Khairna Barrage site in Nainital district (Uttarakhand).	National Hydrology Project (NHP), IRI, Roorkee (Uttarakhand)
26.	Determination of PPM of silt in Khoh river at Matiyali, Dwarikhal, Pauri Garhwal (Uttarakhand).	Irrigation Division Dugadda (Uttarakhand)
27.	Determination of water quality of Tumaria dam in U.S.Nagar district (Uttarakhand).	ITC Rudrapur, U.S. Nagar (Uttarakhand)
28.	3-D EHDA Model Study for Determination of Uplift Pressure and Exit Gradient Below the Foundation of Ayodhya Barrage (U.P.).	Executive Engineer, Investigation & Planning Division, Gonda, (U.P)

#### BASIC UNIT

29.	Capacity Survey of Jargo Dam	Executive Engineer, Irrigation Division, Chunar, Mirzapur (U.P.)
30.	Capacity Survey of Dhekuwa Dam	Executive Engineer, Irrigation Division, Chunar, Mirzapur (U.P.)
31.	Capacity Survey of Sukhara Dam	Executive Engineer, Sirsi Dam division, Mirzapur (U.P.)
32.	Monitoring of Glacial Lakes in Pithoragarh District for the Year 2020, (June to October)	Basic Study (Uttarakhand)
33.	Monitoring of Glacial Lakes in Pithoragarh District for the Year 2021, (June to October)	Basic Study (Uttarakhand)



## APPENDIX-II

### List of Test Reports

These following tests regarding various studies conducted during the year:

Sl.No.	Title of Test	No. of Test	Name of the Client
<b>CEMENT AND FLY ASH</b>			
1.	Physical Properties of Cement	23	U.P. Projects Corporation Ltd., Dehradun(Uttarakhand) Uttarakhand Peyjal Nigam, Haridwar (Uttarakhand) U.P. Projects Corporation Ltd., Saharanpur (U.P) Singh & Associates, Saharanpur Planning & Monitoring, Sector 35-A, Chandigarh U.P. Jal Nigam (Urban) Meerut (U.P) Rural Construction Department, (Uttarakhand) Uttarakhand Peyjal Sansadhan Vikas & Nirman Nigam Dehradun (Uttarakhand) Irrigation Department Uttarakhand (Dehradun) WAPCOS Limited, Dehradun (Uttarakhand)
2.	Tensile strength test of Steel Bar/Steel Plates	563	WASH Institute, Saharanpur (U.P) Singh & Associates, Saharanpur (U.P) U.P. Projects Corporation Ltd., Dehradun (Uttarakhand) U.P. Jal Nigam, 2-Shankarnagar Saharanpur (U.P) U.P. Projects Corporation Ltd., Saharanpur (U.P) Rural Construction Department, (Uttarakhand) Peyjal Sansadhan Vikas & Nirman Nigam, (Uttarakhand) WAPCOS Limited, Dehradun (Uttarakhand) Adarsh Yuva Sa miti, (AYUS),Haridwar (Uttarakhand)
3.	Testing of C.C. Cubes	336	WASH Institute, Saharanpur (U.P) Singh & Associates, Brother's Colony, Saharanpur (U.P) World Bank Project Unit, Uttarakhand Peyjal Nigam, (Uttarakhand) U.P. Projects Corporation Ltd., Dehradun (Uttarakhand) Rural Construction Department, (Uttarakhand) U.P. Projects Corporation Ltd., Saharanpur (U.P) WATSAN, Swami Rama Himalayan University, Dehradun (Uttarakhand) Uttarakhand Peyjal Sansadhan Vikas & Nirman Nigam, (Uttarakhand) Muzaffarnagar Congress Committee, Purkaji, Muzaffarnagar (U.P) Wapcos Limited, Haridwar (Uttarakhand) Bridge & Roof Company (India) Ltd., Connaught Place, New Delhi-110001 Public Works Department, Uttarakhand
4.	Testing of C.C. Paver Blocks	554	Uttarakhand Peyjal Nigam, Devpura, (Uttarakhand) M/S S K Enterprises, Haridwar (Uttarakhand) Public Works Department,Uttarakhand M/S Kumar Enterprises, Saharanpur (U.P) U.P. Projects Corporation Ltd., Roorkee (Uttarakhand) M/S Sobti Associates, Najibabad, (U.P)-246763
5.	Testing of Bricks/Tiles	440	Singh & Associates, Brother's Colony, Saharanpur (U.P) WASH Institute, Saharanpur (U.P)



			U.P. Projects Corporation Ltd., Saharanpur (U.P)
			U.P. Jal Nigam (Urban), Meerut (U.P)
			Rural Construction Department, (Uttarakhand)
			Uttarakhand Peyjal Sansadhan Vikas & Nirman Nigam, Dehradun (Uttarakhand)
			U.P. Projects Corporation Ltd., Roorkee (Uttarakhand)
			Uttarakhand Peyjal Sansadhan Vikas & Nirman Nigam (Uttarakhand)
			Chairman, Adarsh Yuva Samiti, (AYUS), Hardwar (Uttarakhand)
			Training and Employment Directorate, Uttarakhand, Haldwani (Uttarakhand)
6.	Testing of Coarse Aggregate	62	WASH Institute, Saharanpur (U.P)
			Singh & Associates, Saharanpur (U.P)
			U.P. Projects Corporation Ltd., Dehradun (Uttarakhand)
			U.P. Projects Corporation Ltd., Saharanpur (U.P)
			U.P. Jal Nigam (Urban), Meerut (U.P)
			Rural Construction Department, (U.P)
			Uttarakhand Peyjal Sansadhan Vikas & Nirman Nigam, (Uttarakhand)
			Wapcos Limited, Haridwar Uttarakhand)
			Chairman, Adarsh Yuva Samiti, (AYUS), Hardwar (Uttarakhand)
7.	Testing of Fine Aggregate	48	WASH Institute, Saharanpur (U.P)
			Singh and Associates, Saharanpur (U.P)
			U.P. Projects Corporation Ltd., Dehradun
			U.P. Projects Corporation Ltd., Saharanpur (U.P)
			U.P. Jal Nigam (Urban), Meerut (U.P)
			Rural Construction Department, (Uttarakhand)
			Uttarakhand Peyjal Sansadhan Vikas & Nirman Nigam, (Uttarakhand)
			Wapcos Limited, Haridwar (Uttarakhand)
			Chairman, Adarsh Yuva Samiti, (AYUS), Haridwar (Uttarakhand)
8.	Cement Mortar	09	Training and Employment Directorate, Uttarakhand, Haldwani (Uttarakhand)
			SIIDCUL, Dehradun (Uttarakhand)
9.	Preliminary test result of conventional concrete mix design study at 28 days	72	Jamrani Dam construction division -2, (Uttarakhand)
10	Physical and Chemical tests of coarse aggregate, fine aggregate, cement fly ash and chemical admixture	74	Jamrani Dam construction division -2, (Uttarakhand)
11	Test result of Roller compacted concrete mix design study	693	Jamrani Dam construction division -2, (Uttarakhand)
<b>ROCK MECHANICS</b>			
12.	Report on Testing of MS (ERW) Pipe	01	Garhwal Borewell Roorkee (Uttarakhand)
13.	In-situ Rock to Rock Block Shear Test at proposed Dr. Shayama Prasad Mukherjee Jalashaya Pariyojna, Block Sahaspur, Dehradun (Uttarakhand)	02	Irrigation Department, Uttarakhand (Dehradun)



14.	Determination of Unconfined Compressive Strength, Water Absorption and Apparent Porosity of Rock Samples	06	Administration Division, Irrigation Research Institute, Roorkee, (Uttarakhand)
15.	In-situ Rock to Concrete Block Shear Test and Plate Load Test at proposed Dr. Shayama Prasad Mukherjee Jalashaya Pariyojna, Block Sahaspur, Dehradun (Uttarakhand)	02	Irrigation Department, Uttarakhand (Dehradun)
16.	In-situ Rock to Rock Block Shear Test at proposed Talghati Drinking Water and Water Body Creation Project, Pauri Garhwal (Uttarakhand)	02	Sigma Floodkon JV, Ranchi (Jharkhand)
17.	Report on Testing of RCC, NP3 (Dia. 1000mm) from Research Officer, Basic Research Unit, IRI Roorkee.	02	Basic Research Unit, Irrigation Research Institute, Roorkee, (Uttarakhand)
<b>SOIL ANALYSIS</b>			
18.	Soil Classification and Silt factor	11	Irrigation Department, Uttarakhand (Dehradun) SIGMA FLOODKON JV, Ranchi (Jharkhand)
19.	Grain size analysis	20	Basic Research Unit, Irrigation Research Institute, Roorkee, (Uttarakhand)
20.	Soil Classification	02	Irrigation Department, Uttarakhand (Dehradun)
21.	Silt factor	10	Irrigation Department, Uttarakhand (Dehradun)
<b>CHEMICAL ANALYSIS</b>			
22.	Chemical analysis of 01 no cement sample and 01 no Fly ash sample	02	Material Testing Unit-1 Irrigation Research Institute, Roorkee (Uttarakhand)
23.	Chemical analyses of cement mortar samples	01	Basic Research Unit Irrigation Research Institute, Roorkee (Uttarakhand)
24.	Chemical analyses of 04 no cement mortar samples 01 no cement concrete sample	05	Material Testing Unit-1 Irrigation Research Institute, Roorkee (Uttarakhand)
25.	Chloride content and ash content of admixture sample	01	Material Testing Unit-1 Irrigation Research Institute, Roorkee (Uttarakhand)
26.	Chemical analyses of cement mortar and cement concrete samples	03	Material Testing Unit-1 Irrigation Research Institute, Roorkee (Uttarakhand)
27.	Chemical analyses of cement Plaster samples	03	Basic Research Unit Irrigation Research Institute, Roorkee (Uttarakhand)
28.	Alkali aggregate reactivity test of aggregate samples.	02	Material Testing Unit-1 Irrigation Research Institute, Roorkee (Uttarakhand)
29.	Chemical analysis of cement sample	01	Material Testing Unit-1 Irrigation Research Institute, Roorkee (Uttarakhand)
30.	Determination of organic and inorganic solids of water samples	09	Soil Research Unit-II Irrigation Research Institute, Roorkee (Uttarakhand)
<b>HIGHWAY/CONSTRUCTION WORK</b>			
31.	Gradation Coarse Aggregate	24	Irrigation Department, Uttarakhand (Dehradun)
32.	Gradation and FM of Fine Aggregates	7	Irrigation Department, Uttarakhand (Dehradun)
33.	Combined Flakiness and Elongation Indices	23	Irrigation Department, Uttarakhand (Dehradun)
34.	Impact Value	23	Irrigation Department, Uttarakhand (Dehradun)
35.	Water Absorption and Specific Gravity	23	Irrigation Department, Uttarakhand (Dehradun)
36.	Density test of BM Core	132	SIIDCUL Dehradun (Uttarakhand)
37.	Binder Content of BM Core	132	SIIDCUL Dehradun (Uttarakhand)
38.	Binder Content of DBM Core	84	SIIDCUL Dehradun (Uttarakhand)

41.	Density test of DBM Core	84	SIIDCUL Dehradun (Uttarakhand)
42.	Binder Content of BC Core	256	SIIDCUL Dehradun (Uttarakhand)
43.	Density of BC Core	256	SIIDCUL Dehradun (Uttarakhand)
44.	Binder Content of SDBC Core	118	SIIDCUL Dehradun (Uttarakhand)
45.	Density of SDBC Core	118	SIIDCUL Dehradun (Uttarakhand)
46.	Binder Content of PC Core	21	Public Works Department (Uttarakhand)
47.	Density of PC Core	21	PWD Thatyur Tehri Garhwal (Uttarakhand)
48.	Slump Test	95	Irrigation Department, Uttarakhand (Dehradun)
49.	Compressive strength of CC Cubes	287	Irrigation Department, Uttarakhand (Dehradun)
		6	Uttarakhand Peyjal Sansadhan Vikas Evam Nirman Nigam, Dehradun (Uttarakhand)
		54	SIIDCUL Dehradun (Uttarakhand)
51.	compressive Strength of Brick	18	SIIDCUL Dehradun (Uttarakhand)
52.	Water Absorption of Brick	15	SIIDCUL Dehradun (Uttarakhand)
53.	Moisture Content and Density of GSB	15	Irrigation Department, Uttarakhand (Dehradun)

#### WATER QUALITY

54.	Determination of water quality of water supply and sewage distribution network at Banjarawala, Dehradun (Uttarakhand).	02	Vishnuprakash R Punglia LTD, Dehradun (Uttarakhand)
56.	Determination of water quality of ground water (Piezometer) of Kuankhera, Prahladpur and Shikarpur in Distt- Haridwar (Uttarakhand).	03	National Hydrology Project, Roorkee (Uttarakhand)
57.	Determination of water quality of ground water (Piezometer) of Badhiyana colony pathari, Distt - Haridwar (Uttarakhand).	03	National Hydrology Project, Roorkee (Uttarakhand)
58.	Determination of water quality of ground water (Piezometer) of Kotwal Iqbalpur and Manglore in Distt. Haridwar (Uttarakhand).	03	National Hydrology Project, Roorkee (Uttarakhand)
59.	Determination of water quality of ground water (Piezometer) of Rahmatpur Teliwala and Aurangabad in Distt. Haridwar (Uttarakhand).	03	National Hydrology Project, Roorkee (Uttarakhand)
60.	Determination of water quality of ground water (Piezometer) of Ibrahimpur and Roshanabad and Banjarawala in Distt. Haridwar (Uttarakhand).	03	National Hydrology Project, Roorkee (Uttarakhand)
61.	Determination of water quality of ground water (Piezometer) of Lachhiwala, jhabrawala, Doiwala, Chhiderwala, Dehradun (Uttarakhand).	04	National Hydrology Project, Roorkee (Uttarakhand)
62.	Determination of water quality of ground water (Piezometer) of Subhashnagar, Mehuwala and Selaqui, Dehradun (Uttarakhand).	03	National Hydrology Project, Roorkee (Uttarakhand)
63.	Determination of water quality of Drinking water of IRI colony, Roorkee, (Uttarakhand).	21	National Hydrology Project, Roorkee (Uttarakhand)
64.	Determination of water quality of Salempur, Gharondar, Bahadradab (Uttarakhand).	01	Anil Saini Salempur, Gharondar, Bahadradab (Uttarakhand)
65.	Determination of water quality of Drinking water of Distt. Chamoli (Uttarakhand)	15	National Hydrology Project, Roorkee (Uttarakhand)
66.	Determination of water quality of Drinking water of Distt. Uttarkashi (Uttarakhand)	10	National Hydrology Project, Roorkee (Uttarakhand)



67.	Determination of water quality of Drinking water of Distt. Tehri Garhwal (Uttarakhand).	12	National Hydrology Project, Roorkee (Uttarakhand)
68.	Determination of water quality of Drinking water of Distt. Pauri Garhwal (Uttarakhand).	20	National Hydrology Project, Roorkee (Uttarakhand)
69.	Determination of water quality of Drinking water of Distt. Rudraprayag (Uttarakhand).	11	National Hydrology Project, Roorkee (Uttarakhand)
70.	Determination of water quality of Drinking water of Distt. Haridwar (Uttarakhand).	18	National Hydrology Project, Roorkee (Uttarakhand)
71.	Determination of water quality of Drinking water of Distt. Dehradun (Uttarakhand).	26	National Hydrology Project, Roorkee (Uttarakhand)
72.	Determination of water quality of various river of Garhwal region (Uttarakhand).	16	National Hydrology Project, Roorkee (Uttarakhand)
73.	Determination of water quality of construction water	9	Material Testing Unit-1, Irrigation Research Institute. Roorkee (Uttarakhand)
74.	Determination of PPM of silt in Khoh river at Matiyali, Dwarikhal, Pauri Garhwal	5	Irrigation Department, Uttarakhand (Dehradun)
75.	Determination of water quality of drinking water in U.S.Nagar (Uttarakhand).	15	National Hydrology Project, Roorkee (Uttarakhand)
76.	Determination of water quality of Kosi river at Khairna barrage site in Nainital (Uttarakhand).	5	National Hydrology Project, Roorkee (Uttarakhand)
77.	Determination of water quality of drinking water in Champawat (Uttarakhand).	15	National Hydrology Project, Roorkee (Uttarakhand)
78.	Determination of water quality of drinking water in Pithoragarh (Uttarakhand).	15	National Hydrology Project, Roorkee (Uttarakhand)
79.	Determination of water quality of drinking water in Nainital (Uttarakhand).	30	National Hydrology Project, Roorkee (Uttarakhand)
80.	Determination of water quality of drinking water in Almora (Uttarakhand).	30	National Hydrology Project, Roorkee (Uttarakhand)
81.	Determination of water quality of drinking water in Bageshwar (Uttarakhand).	30	National Hydrology Project, Roorkee (Uttarakhand)
<b>GROUND WATER</b>			
82.	Testing of Hydraulic Performance of Pressure Release Valve (PRV).	01	Rajasthan Feeder Division, Ferojpur, Punjab.
<b>HYDRULIC RESEARCH STATION, BAHADRABAD</b>			
83.	Current Meter Calibration	435	The Western Precession Emporium, Roorkee (Uttarakhand)
			Gauri Engineering Works, Roorkee (Uttarakhand)
			Steel Fabricators, Roorkee (Uttarakhand)
			India Instruments, Ghaziabad (U.P)
			Anusandhan and Niyojan (Jal Sansthan) Khand, (U.P)
			R.K. Engineering Corporation, Roorkee (Uttarakhand)
			Virtual Hydromate, Roorkee (Uttarakhand)





**APPENDIX-III****MoUs****Different Memorandum of Understanding (MoUs) were done during the Year:****❖ PLANNING COMMISSION UTTARAKHAND**

- Memorandum of Understanding (MoU) was signed between Planning Commission, Planning Department, Govt. of Uttarakhand and Irrigation Research Institute, Roorkee for the Quality and Quantity Audit of various kinds of works.

**❖ SIIDCUL**

- Memorandum of Understanding (MoU) was signed between State Infrastructure and Industrial Development Corporation of Uttarakhand Ltd. (SIIDCUL), Dehradun and Irrigation Research Institute, Roorkee for the Quality and Quantity Audit of civil works.

**❖ MAHAKUMBH MELA-2021**

- Memorandum of Understanding (MoU) was signed between Mela Officer, Kumbh Mela, Haridwar and Irrigation Research Institute, Roorkee for the Third Party Quality Control Assurance and Technical Checking Works.

## APPENDIX-IV

### Awards

The Institute received the first CBI&P Trophy in 1986 for Outstanding Contribution in the field of Research & Development. The institute also received CBI&P - IRPO-HI-TECH-87 award for the exhibition set up at Pragati Maidan New Delhi. The Research Personnel of the Institute have received the following prestigious awards:

- CBIP- Pt. Jawahar Lal Birth Centenary Research Award
- CBIP- Young Engineers Award
- CBIP-Cash Your Idea Award
- HYDROSEM Award of the Institution of Engineers (India), U. P. State Centre
- Gold Medals, Cash Awards and Certificate of Merits for Best Research Papers.
- CBI&P Award 2019.



### CBI & P Award 2022



CBI&P Award 2022 for Best R&D Institute in Water Resources Sector Presented by Hon'ble Minister Sh. Raj Kumar Singh, State (IC) for Power and New Renewable Energy, Govt. of India.

### Ardh Kumbh Mela-2016 Award

Irrigation Research Institute, Roorkee was nominated as a 'Third Party Agency' for "Quality Control and Assurance Works" by Govt. of Uttarakhand vide his letter No.: 117/A.K.M./Technical Cell/III Party dated 06.06.2015. After successful completion of various works related to Ardh Kumbh Mela-2016 and Mahakumbh Mela-2021 IRI Roorkee has been awarded with the **"Citation Certificate"** for its timely and quality work by the Hon'ble Chief Minister of Uttarakhand.





## APPENDIX-V

### Publication

The following are the types of publications, which were issued during the Year.

- (i) **Technical Papers and Research Reports** - during the year 2022-23, a Total number of **33 Research Reports** were issued by the Institute on the basis of studies carried out by different research units. Abstract of various Research Reports regarding to different studies during the year is given in Appendix-I.
- (ii) **Test Reports** - Test reports are issued on the basis of field or laboratory tests carried out by the respective units. During the year 2022-23, a Total number of **668 Test Reports** pertaining to various Projects/ Agencies were issued.



## APPENDIX-VI

### List of Visitors regarding Various Studies

Details of various Visitors during the year:

Sl. No.	Name /Designation	Address	Purpose of Visit	Date	Comments
1.	Mr. S.K.Singh, DGM (Civil Maintanance-Bhagirathi Valley), Maneri Mr. M.S. Nath. EE(Civil), Maneri Dam MB-1 HEP Mr. Mohit Uniyal, AE (Civil), Maneri Dam, MB-1 HEP, Mr. Vipin Thapliyal, AE (Civil) Joshiyara Barrage, MB-II HEP, Dr. M.R. Bhajantari Consultant, Maneri Dam MB-I HEP	UJVNLtd.	Model Inspection	March 2022	Sponsor was fully satisfied by the performance of the model
2.	03 Faculty Members and 60 diploma Students	Government Polytechnic, Mandi Adampur, Hisar	Educational Visit	15 June 2022	Excellent Facilities for the Research & Testing Works
3.	Trainee Judges	Uttarakhand Judicial and Legal Academy	General Visit	13 Sep. 2022	Impressed by the Research & Testing Works.
4.	Mr. G. Srinivasulu, Deputy Director (NWA Faculty), 15 Nos. of Central Water Engineering Service (Group A) Probationary Officers & Mr. Vysakh, AD-II, NWA, Accompanying Official	Government of India, Central Water Commission, National Water Academy	Project Visit for Educational Purpose	29 Oct. 2022	Well established premises for the R&D.
5.	Dr.Quentin Shaw, Dam and Hydraulic Specialist/ Chair, POE Mr. Felix Seebacher, Hydrologist, POE Project Implementation Unit (PIU), Jamrani Mr. Prashant Vishnoi, General Manager Mr. Bharat B. Pandey, Deputy General Manager Mrs. Pratibha S. Sant, Project Manager Mr. Siddarth Pushkar, Assistant Project Manager Ehyte Team, Consultant Mr. Anil k. Goyal , Managing Director ,Ehyte Mr. H.K. Sahu, Dam Design Expert, Ehyte	The Project Manager, Uttarakhand Project Development & Corporation Ltd., Damuadhunga, Kathgodam (Nainital).	Model Inspection	2022	Sponsor was fully satisfied by the performance of the model

## APPENDIX-VII

### Participation in High Level Meetings/Seminars/Symposium/Workshops/Training

S. No.	Name of Meeting/ Seminar/Symposium/ Workshop/Training	Place	Date	Name of Personnel & Designation
1.	Fragile Slope Treatment and Sustainable Mitigation Works of Baliyanala, Nainital	Irrigation Research Institute, Roorkee	05 Apr. 2022	Mr. Shankar Kumar Saha, SE Mr. D. P. Joshi, EE Mr. Umesh Kumar, EE Mr. R.R. Mohan, RO Mr. Md. Hamid Hasan, AE Mr. Vivek Kumar, AE Mr. Khadak Singh, AE Mrs. Neha, AE Mr. Sidharth Pushkar, AE Mr. Damodar Singh, AE Mr. Manish Shankar Sant, AE Mr. Vijay Kashyap, ARO
2.	Exploring ARCGIS Pro and Analysis Techniques	NHP, Roorkee Uttarakhand	17 Oct. 2022 to 18 Oct. 2022	Mr. Chhattar Singh, RO Mrs. Neha, AE Mrs. Ankita Joshi, SA Mr. Lalit Kumar, SA Mr. Avneet Kumar Bharti, SA Mrs. Sonia Sharma, MA Mr. Tushar Belwal, MA
3.	Demonstration/Training of Differential Global Positioning System (D.G.P.S) (Under NHP project)	NHP, Roorkee Uttarakhand	19 Oct. 2022 to 21 Oct. 2022 & 26 Oct. 2022	Mr. Ajay Kumar, ARO Mr. Sunil Kumar, RS Mr. Nitin Kumar, RS Mr. Dilwar Singh, SA Mr. Raja, SA
4.	Advanced Tools and Techniques for Managed Aquifer Recharge	NIH Roorkee	21 Nov. 2022 to 25 Nov. 2022	Mr. R.R. Mohan, RO
5.	Integrated Water Resources Modelling in changing Climate in the Indian Himalaya	NIH, Roorkee	21 Nov. 2022 to 24 Nov. 2022	Mrs. Neha, AE
6.	Landslide mechanism Analysis and design of Mitigation measures instrumentation and Mitigation for Baniyanala Landslide	Irrigation Research Institute, Roorkee	23 Nov. 2022	Mr. Shankar Kumar Saha, SE Mr. Rajeev Goswami, EE Mr. D. P. Joshi, EE Mr. Amarjeet Sah, AE
7.	Geo technical Instrumentation and Numerical Modelling	Delhi	08 Dec. 2022 to 09 Dec. 2022	Mr. Chatter Singh, R O
8.	Tier-II training program on Sustainable Development and Management of Ground Water Resources	Ministry of Jal Shakti, Regional Director, Central Ground Water Board, Uttaranchal Region Balliwala, Dehradun	12 Dec. 2022 to 14 Dec. 2022	Mr. Ram Ashish, ARO Mr. Vijay Kashyap, ARO Mr. Tushar Belwal, MA



S. No.	Name of Meeting/ Seminar/Symposium/ Workshop/Training	Place	Date	Name of Personnel & Designation
9.	Scientific Data Collection and Processing Techniques for Sprigshed Management and Rejuvenation	State Water Informatics Centre (SWIC), Roorkee	19 Dec. 2022 to 22 Dec.2022	Mr. Shankar Kumar Saha, SE Mr. Sushil Kumar, RO Mr. D. P. Joshi, EE Mr. Abhishek Rajput, AE Mr. Sumit Malwal, AE Mr. Amarjeet Sah, AE Mr. Md. Hamid Hasan, AE Miss. Pallavi Malkani, AE Mrs. Neha, AE Mr. Pankaj Kumar, RS Mr. Kailash Dhyani, RS Mr. Vikas Kumar, RS Mrs. Ankita Joshi, RS Miss. Sheetal Sharma, RS Mr. Prem Sagar Uniyal, SA Mr. Avneet Kumar Bharti, SA Mr. Md. Zulfikar, MA Mr. Tushar Belwal, MA
10.	Measurement Uncertainty & Decision rule ISO 17025-2017	IRI Roorkee	23 Dec. 2022 to 24 Dec. 2022	Mr. Manish Shankar Sant, AE Mr. Abhishek Rajput, AE Miss. Pallavi Malkani, AE Mr. Jagpal, ARO Mr. Raghuveer Singh, ARO Mr. Janeshwar Prasad, ARO Mr. Vinod Kumar, RS Mr. Kailash Dhyani, RS Mr. Pankaj Kumar, RS Mrs. Chitra Upadhyay, RS Mr. Vipin Prajapati, RS Mr. Gireesh Chandra, RS Mr. Sunil Kumar, RS Mr. Vipin Prajapati, RS Mrs. Rakhi Upadhyay, RS Mr. Sunil Kumar Sati, SA Mr. Varun Kumar, SA Mr. Rahul Kumar, SA Mr. Samshad, MA Mr. Sachin Kumar, MA Mr. Parul, MA Mr. Vaseem Ahmad, MA
11.	Hands on advanced instrumentations in water quality analysis	NIH Roorkee	16 Jan. 2023 to 20 Jan. 2023	Mr. R.R. Mohan, RO Miss Pallavi Malkani, AE Mrs. Chitra Upadhyay, RS Mr. Manoj Kumar Verma, RS Mr. Naresh Kumar Pant, SA
12.	ICP-OES and GC-MS Training Course and Hands on Advance Instrumentation in water Quality Analysis under National hydrology Project	NIH, Roorkee	16 Jan. 2023 to 20 Jan. 2023	Mr. Dheer Singh, RO Mr. D. P. Joshi, EE Mr. Abhishek Rajput, AE Mr. Ram Ashish, ARO Mr. Bhanwar Singh, ARO Mr. Vipin Prajapati, RS Mr. Tushar Belwal, MA



S. No.	Name of Meeting/ Seminar/Symposium/ Workshop/Training	Place	Date	Name of Personnel & Designation
13.	Rock Engineering	C.S.M.R.S. New Delhi	19 Jan. 2023 to 20 Jan. 2023	Mr. Vinod Kumar, RO Mr. Janeshwar Prasad, ARO
14.	Environment Data Processing	NIH, Roorkee	30 Jan. 2023 to 03 Feb. 2023	Mr. Vipin Prajapati, RS Mr. Tushar Belwal, MA
15.	5 Day training course on "Water Quality Monitoring & Management"	NIH, Roorkee	13 Feb. 2023 to 17 Feb. 2023	Mr. Arun Kumar singh, AE Ms. Pallavi Malkani, AE Mr. Pankaj Kumar, RS Mr. Dheeraj Kumar, RS
16.	Water and Waste Water Treatment	NIH, Roorkee	20 Mar. 2023 to 24 Mar. 2023	Sh. Manoj Kumar Verma, R.S. Sh. Varun Kumar Singh, R.S. Km. Bhavana Bahuguna, S.A. Mr. Samshad, MA
17.	Computer for Basic Analysis & Decision Making	Computer Centre, IRI Roorkee	24 May 2022 to 27 May 2022  13 Jun. 2022 to 16 Jun. 2022  18 Jun. 2022 to 21 Jun. 2022  22 Jun. 2022 to 24 Jun. 2022  04 Jul. 2022 to 07 Jul. 2022	Mr. Bijendra Pal, RO Mr. R.R. Mohan, RO Mr. Vinod Kumar, RO Mr. Chhatter Singh, RO Mr. Arun Kr. Singh, AE Mr. Pramindra Meena, AE Mr. Raghuveer Singh, ARO Mr. Vijay Kr. Kashyap, ARO Mr. Mahipal Singh, ARO Mr. Jagpal, ARO Mr. Naveen Kr. Agarwal, ARO Mr. Aakil, AAE Mr. Amit Kumar, AAE Mr. Kant Kumar, RS Mr. Ajay Kumar, RS Mr. Mohd. Raqib, RS Mr. Amit Kumar, RS Mr. Bhanwar Singh, RS Mrs. Priya Semwal, RS Mrs. Seema, RS Mr. Varun Kr. Singh, RS Mr. Vinod Kumar, RS Mr. Vikas Kumar, RS Mrs. Rakhi Upadhyay, SA Mrs. Meeta Rawat, SA Mrs. Meena, SA Mr. Raja, SA Ms. Neelam, SA Mr. Varun Kumar, SA Mr. Shashikant Giri, SA Mr. Govind Ram, SA Mr. Saurabh Kumar, SA Mr. Anzar Alam, SA Mr. Madan Ram, SA Mrs. Renu Saini, SA Mrs. Ranjee Devi, SA Mr. Prem Sagar Uniyal, SA Ms. Sheetal Sharma, SA Mr. Virendra Kumar, SA Ms. Ekta, MA Mr. Ashish Rawat, MA Mr. Sachin Kumar, MA Mr. Parul, MA Mr. Pooran Singh, MA Mr. Samshad, MA



## APPENDIX-VIII

### Vocational Training

Engineering students of following institutes took part as “Group Trainees” during the year.

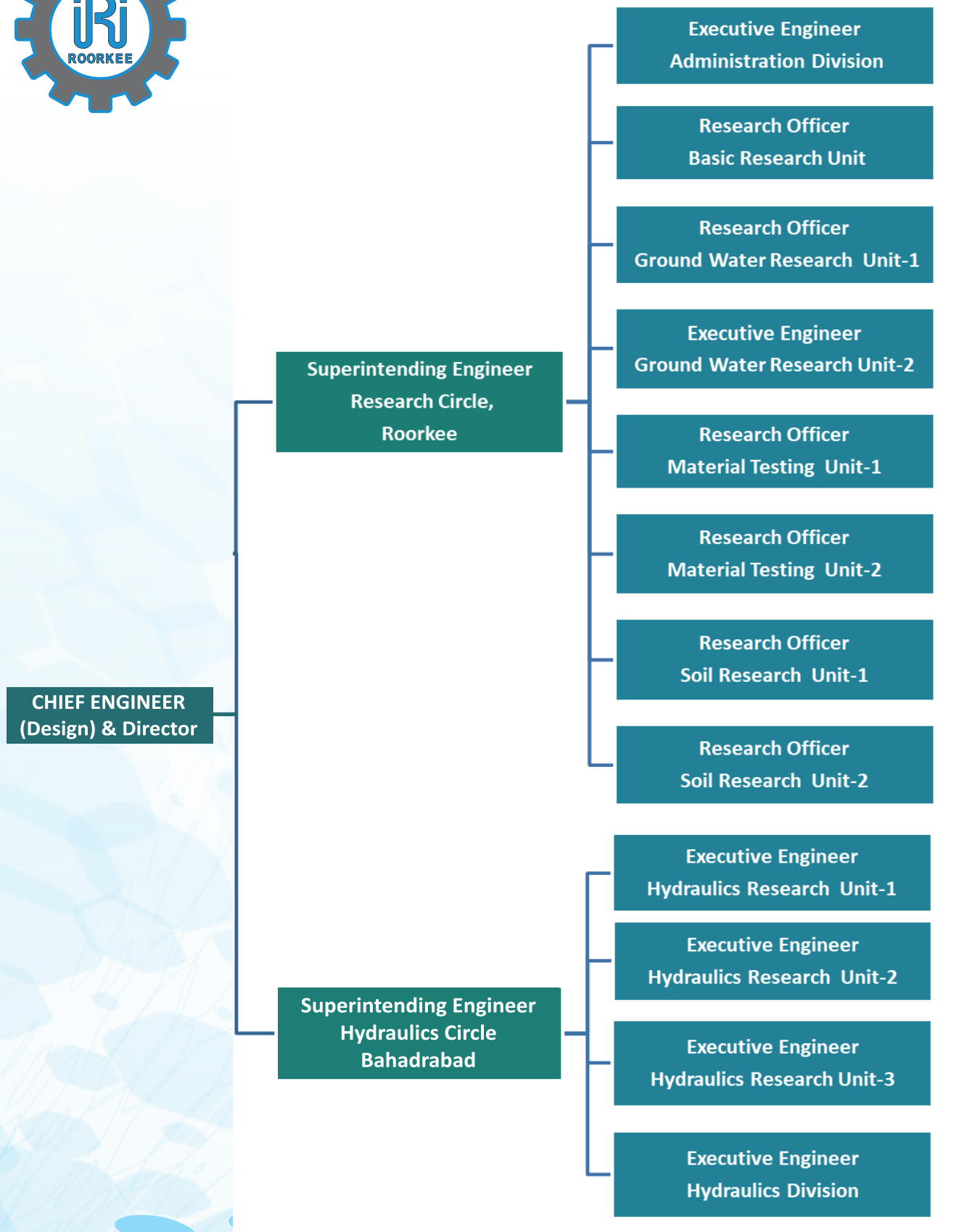
Sl. No.	Name of Institution	Period (In Weeks)
1	G. B. Pant Institute of Engineering and Technology, Pauri Garhwal (Uttarakhand)	04
2	B.T. Kumaon Institute of Technology, Dwarahat (Nainital)	04
3	National Institute of Technology, Srinagar (Jammu and Kashmir)	06
4	G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand)	04
5	Women Institute of Technology, Dehradun (Uttarakhand)	04
6	Indraprastha Institute of Management and Technology (U.P)	04
7	THDC Institute of Hydropower Engineering and Technology, Tehri, Uttarakhand	04
8	K.L. Polytechnic, Roorkee, (Uttarakhand)	04
9	Government Polytechnic Srinagar, (Uttarakhand)	04
10	Government Polytechnic, Kashipur (Uttarakhand)	04
11	Government Polytechnic, Bazpur (Uttarakhand)	04
12	Government Polytechnic, Gaja, Tehri-Garhwal (Uttarakhand)	04
13	Government Polytechnic, Pratapnagar, Tehri-Garhwal (Uttarakhand)	04
14	K.L. Polytechnic, Roorkee, (Uttarakhand)	04
15	College of Advanced Technology, Roorkee, (Uttarakhand)	04
16	Phonics Group of Institution, Roorkee, (Uttarakhand)	04





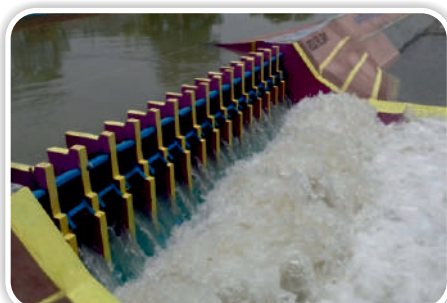
# ORGANIZATIONAL STRUCTURES

Irrigation Research Institute, Roorkee









**Aerial view of Hydraulic Research Station, Bahadrabad**



**For details, contact**

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