National Hydrology Project

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NATIONAL HYDROLOGY PROJECT

HP-I (1995-2003)

HP-II (2006-2014)

HP-III (2014 – ongoing)

- 9 States
- 6 Central Agencies

- 13 States
- 8 Central Agencies

Across All Indian States and UTs

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HP-I (1995-2003)

Establishment of Hydrological Information System (HIS)

WB IDA credit of SDR 75.1 million (US $ 101 million)

- 9 States
- 6 Central Agencies

Total Revised cost : Rs.616.22 crore

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HP-II (2006-2014)

✓ To extend and promote the sustained and effective use of HIS by all implementing agencies

✓ To extend HIS to the four new state agencies

✓ Strengthening the capabilities for efficient water resource planning and management; DSS, HDA., PDS etc.

- **13 States**
- **8 Central Agencies**

Estimated Cost : Rs. 631.83 Crore (US $ 135.01 million) - World Bank funding US $ 104.98 million in the form of IBRD loan

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NATIONAL HYDROLOGY PROJECT
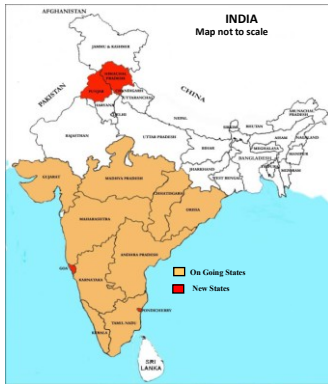
HP-II (2006-2014)

INDIA
Map not to scale

On Going States
New States

- **13 States**
- **8 Central Agencies**

Achievements :

➢ Moved From Manual Data Collection to Real Time Data Acquisition System

➢ From Desktop Data Management to Web-based Data Management

➢ Collating Data into Analyzed Information for Decision Making through Decision Support System (DSS) Planning, Hydrological Design Aids (HDA), Purpose Driven Studies (PDS) etc. Up gradation to real time flood forecasting and reservoir operation systems through development of Real Time DSS (RTDSS), Real-Time Stream Flow (RTSF) & Reservoir Operation System (ROS).

➢ National web based applications, like e-GEMS (Ground Water Estimation & Management System), e-SWIS (Surface Water Information System), e-WQIS (Water Quality Information System) etc.
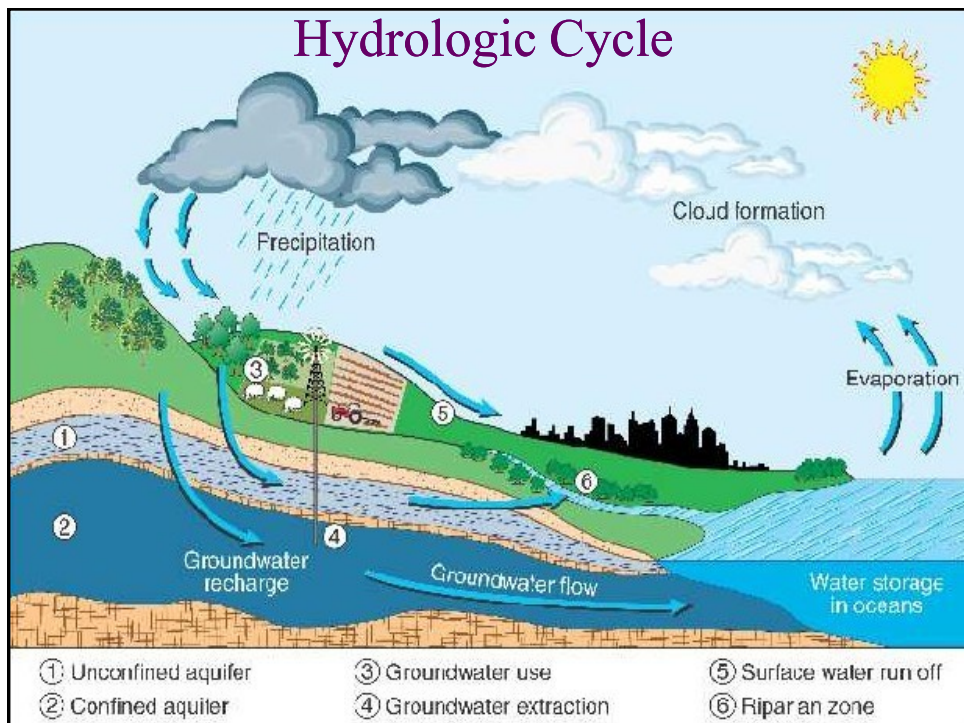
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NATIONAL HYDROLOGY PROJECT

HP-III (2015 – 2023)

Across All Indian States and UTs

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Hydrologic Cycle

Precipitation

Cloud formation

Evaporation

③ Groundwater use

⑤ Surface water run off

Groundwater recharge

Groundwater flow

Water storage in oceans

① Unconfined aquifer
② Confined aquifer
③ Groundwater use
④ Groundwater extraction
⑤ Surface water run off
⑥ Riparian zone

What is HIS?

- **Hydrological**
    - **Hydrology** is the science of water in the Hydrological cycle and is concerned with its states, storages and fluxes in location, time and phase. **Hydrometry** is the sister science, concerned with the measurement of these states, storages and fluxes

- **Information**
    - Information is **data** which has been manipulated and processed to give them meaning and purpose (**reliability, availability** and **presentation)**

- **System**
    - It is a logical and structured system to collect, convert, process, check, store and disseminate in a form suitable to users.

NEED OF HIS

- **Water Is A Vital Natural Resource**
- **Occurrence Of Water Not Uniform In Space And Time Domain**
- **Planning, Design & Operation Of Water Resource Systems Requires**
  - **Knowledge of Occurrence & Behavior of Movement of Water**
  - **Not Only Quantity but Quality Is Also Equally Important**
- **Fast Growing Population And Rapid Urbanisation**
  - **Ever Increasing Demand for Water Related Information**

HYDROLOGICAL INFORMATION SYSTEM (HIS)

- One of the pre-requisite for WRD&M
  - Reliable, comprehensive and timely hydrological data
    - + info. on economical, social and environmental dimensions
- Realizes part of our National Water Policy (MoWR 1987)
  - a well-developed Water Information System (WIS) and
  - free exchange of data among various agencies
    - " … as the prime requisites for water resources planning"

DATA NEEDS AND DATA USERS...(I)

- **Potential Hydrological Data Users**
  - **Government Organisations:**
    - State Surface Water Departments
    - Central Water Commission
    - State Ground Water Departments
    - Central Ground Water Board
    - India Meteorological Department
    - State Pollution Control Boards
    - Water Supply And Sewage Boards
    - Geology And Mines Departments
    - Urban Water Supply And Drainage Boards
    - Public Health Departments
    - Hydropower Corporations
    - Thermal Power Corporations
    - Industries And Commerce Departments

DATA NEEDS AND DATA USERS...(II)

- Agricultural Departments
- Fisheries Departments
- Forestry Departments
- Development Authorities
- Road Departments
- Railways Departments
- Drought Monitoring Cells
- Tourist Boards
- Universities & Research Institutes
- Remote Sensing Agencies
- Ministry Of Transport (For Navigation)
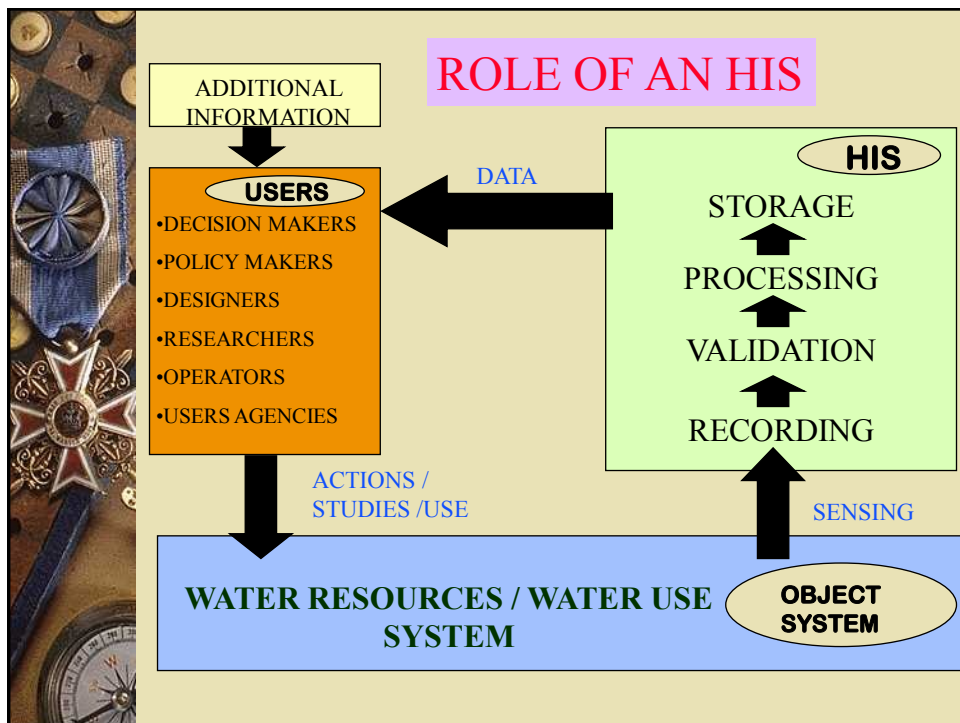- Ministry Of Environment And Forest
- Ministry of Defence

DATA NEEDS AND DATA USERS...(III)

- **Non-governmental Organisations:**
  - Chambers Of Commerce
  - Water Users Associations
  - Farmers Development Agencies
  - Environmental Protection Organisations
  - Tourist Organisations
- **Private Sector:**
  - Industries: E.G. Paper Mills, Fibre Industries, Cotton Mills, Etc.
  - Engineering Consultants
  - Contractors

Most Commonly Required Data

- Water level in a river
- Discharge/Flow
- Rainfall
- Climate(Sunshine, Humidity, Temp. Wind, Evaporation etc.)
- Water Quality
- Sedimentation

ROLE OF AN HIS

HIS

DATA

USERS
- DECISION MAKERS
- POLICY MAKERS
- DESIGNERS
- RESEARCHERS
- OPERATORS
- USERS AGENCIES

ADDITIONAL INFORMATION

STORAGE

PROCESSING

VALIDATION

RECORDING

ACTIONS / STUDIES /USE

SENSING

WATER RESOURCES / WATER USE SYSTEM

OBJECT SYSTEM

G&D data on web

- http://water.bom.gov.au/waterstorage/awris/
- http://www.timeanddate.com/
- National Water Portal for Canada
  http://www.wateroffice.ec.gc.ca/
- National Water Portal for the USA
  http://water.usgs.gov/nwis
- State Water Portal of California
  http://cdec.water.ca.gov/
- Water Portal for Regional Water Authority
  http://hydromet.lcra.org/
- India
- www.india-**wris**.nrsc.gov.in/

HIS design

- Number of stations
- Type of instrumentation
- Type of telemetry
- Data collection
- Data processing
- Data dissemination
- Decision support

Network Design

A complete network design addresses the following questions that pertain to the collection of hydrological data
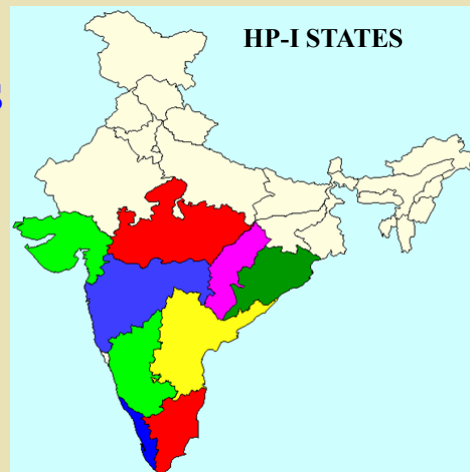
- What hydrological variables need to be observed?
- Where do hydrological observations need to be observed?
- What is the duration of the observation program?
- How accurate should the observations be?

Technology Related Components
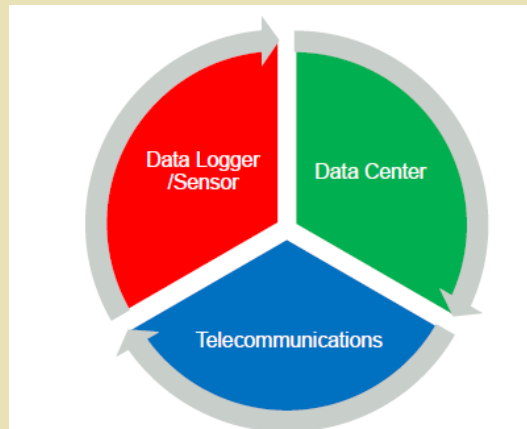
Hydrology Project-I&II

HP-I STATES

- Strengthening HIS in 9+4 states with the assistance from the WB

- PHASE-I : PROJECT DURATION 6 YEARS (1996 - 2002)
- PHASE-II : PROJECT DURATION 6 YEARS (2006 - 2012)

the first concerted effort at this scale for improving HIS in the country

PARTICIPATING AGENCIES-I&II

CENTRAL

- CENTRAL WATER COMMISSION
- CENTRAL GROUNDWATER BOARD
- INDIA METEOROLOGICAL DEPTT.
- CENTRAL WATER & POWER RESEARCH STATION
- NATIONAL INSTITUTE OF HYDROLOGY
- BHAKRA-BEAS MGMT. BOARD
- CENTRAL POLLUTION CONTROL BRD

STATES

- ANDHRA PRADESH
- CHHATTISGARH
- GUJARAT
- KARNATAKA
- KERALA
- MADHYA PRADESH
- MAHARASTRA
- ORISSA
- TAMIL NADU
- PUDUCHERRY
- GOA
- PUNJAB
- HIMACHAL PRADESH

INFRASTRUCTURAL PROFILE

6500	digital water level recorders
7900	dedicated piezometers
920	river gauging stations
1800	rainfall stations
150	full climatic stations
80	water quality laboratories
1600	offices and site buildings
580	vehicles
1500	computer systems with dedicated software
390	data entry and processing centres
31	data storage centres
27000	staff training units organised

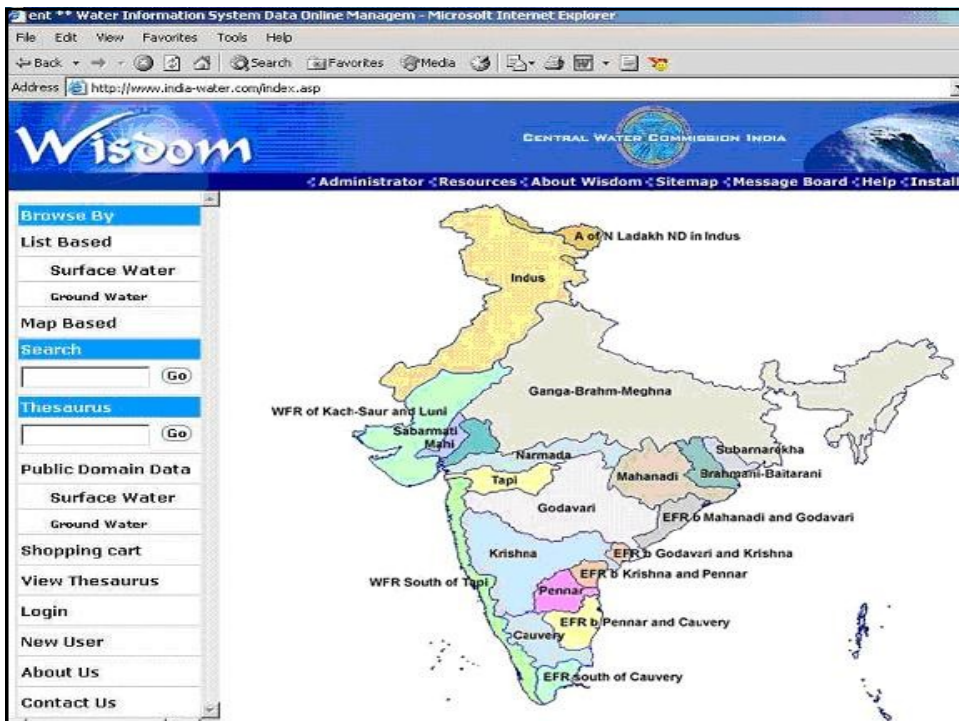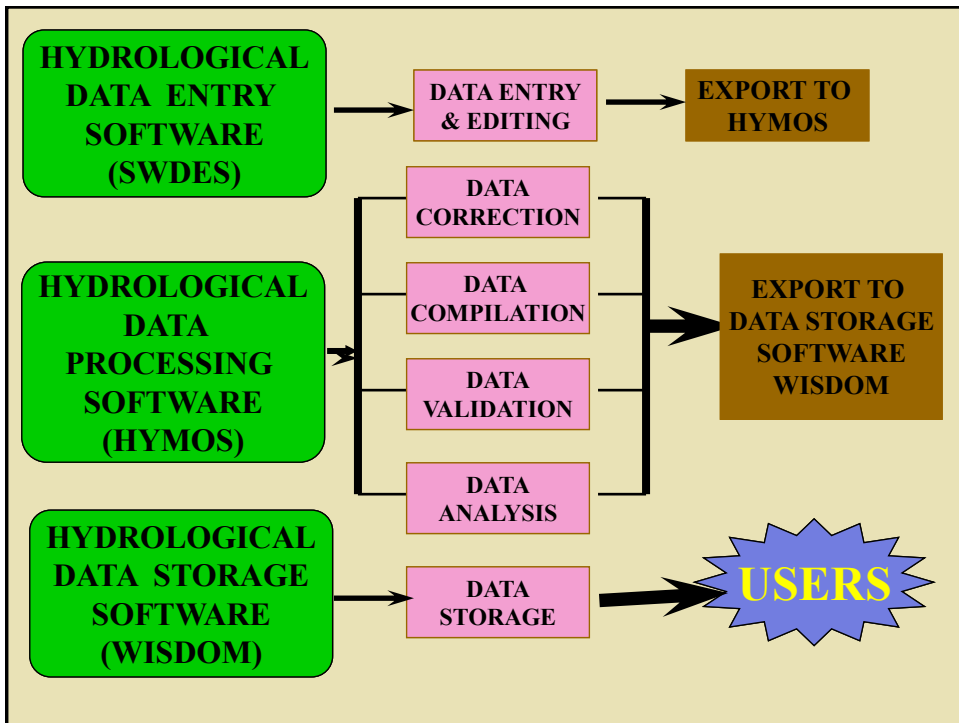# HIS Components

- **AN HIS COMPRISES**
  - INFRASTRUCTURE OF PHYSICAL & HUMAN RESOURCES TO
    - COLLECT, PROCESS, STORE & DISSEMINATE (GEO-) HYDROLOGICAL, HYDRO-METEOROLOGICAL DATA
- **PHYSICAL INFRASTRUCTURE INCLUDES**
  - OBSERVATION NETWORKS
  - LABORATORIES
  - HARDWARE
  - SOFTWARE
  - DATA COMMUNICATION SYSTEM
  - DATA CENTRES HAVING DATA PROCESSING & DATABASE TOOLS
- **HUMAN RESOURCES - WELL TRAINED STAFF**

SOFTWARES FOR HIS

- **SWDES : Surface Water Data Entry System**

- **HYMOS : Hydrological data processing System**

- **WISDOM : Hydrological Data Storage System**

INDIA-WRIS

India Water Resources Management Programme – Hydrology Project (Phase – III)

Major River Basins of India

RELIABLE, TIMELY, QUALITY, CONSISTENT, PUBLIC DATA

HYDROLOGY PROJECT – Journey Ahead

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Across All Indian States and UTs

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Concepts of Hydrology Project –Phase III

- ➢ **Standardizing Water Resources Monitoring and Information System for the country with uniform procedures and database.**

- ➢ **Enhancing collaboration between Centre & States.**

- ➢ **Improving access to information in the public-domain.**

- ➢ **Introducing country wide generic solutions for flood forecasting and water resources management.**

- ➢ **Developing site specific solutions for water resources planning and management including used of remote sensing based techniques.**

GIS and other data sets Data Rescue

Data Management & Modeling (for weather, hydrological, inundation & other forecasts – short-term and seasonal)

"Top-Down" Data Acquisition System

Satellite Earth Observation

Earth observation data access via suitable mechanisms (e.g. Internet, GeoNetCast)

Interaction with other Knowledge Base and Analytical Systems

Data Repositories to store and serve both raw feed and processed data (on Cloud Platform)

Dissemination Platforms

Crowd-sourced / Community Surveillance Data

Telemetry

Manual Monitoring Automated Monitoring Radars
"Bottom-up" Data Acquisition System

Web Portals (e.g. integrated hydromet. visualization platforms)

Stakeholder Alerts

Operational Control Rooms

Project Design

Project Objective:

Improve the data, information and knowledge systems to strengthen water resources planning, operation and management across India.

Project Components:

A. Improving Water Resources Monitoring system (WRMS)
B. Improving Water Resources Information Systems (WRIS)
C. Water Resources Management Applications (WRMA)
D. Strengthening Institutions and Capacity Building

Budget Outlay: 3000 Crores INR
Timeline: 8 years

Moving towards a programmatic approach

Project Design

Implementation arrangements

Budget Outlay: 3000 Crores INR
  (2000 Crore World Bank, 1000 GoI)
- *As per EFC : WB 1820, Center 1226, States 594.5, Total 3640*

Duration: 8 years

Implementing agencies include:

- 29 States

- Central agencies: CWC, CGWB, NIH, IMD, CPCB, SoI, NRSC, CWPRS, and BBMB

Project Timeline

S. No.	Activity	Due by
1	Itemized Cost estimate by IAs	October 15, 2014
2	First draft of PIP	November 15, 2014
3	Finalization of PIP by MoWR	Dec 15, 2014
4	Submission for EFC clearance	Jan 2015
5	EFC Clearance	March 2015
6	Project Appraisal	May 2015
7	Negotiation	July 2015
8	Submission to World Bank Board for clearance	August 2015
9	Effectiveness	September, 2015

Project Design – Output components

A. **Improving Water Resources Monitoring system (WRMS):** India's Water Resources Monitoring System (WRMS) has been upgraded, established and/or expanded nation-wide, and transparent and easy access for all data users is provided

B. **Improving Water Resources Information Systems (WRIS):** A centralized Water Resources Information System is established and public domain information services are provided

Project Design – Output components

A. **Water Resources Management Applications (WRMA):** All concerned agencies have applied tools for water resources planning and management activities, Flood Forecasting and Drought Management Systems have reduced annual flooding and drought losses, and studies have contributed to knowledge advances in India's water sector

B. **Strengthening Institutions and Capacity Building:** Integrated water resources knowledge centers are established and Implementing Agencies are strengthened

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Component A : Improving Water Resources Monitoring System

A1. Water Resources Monitoring Systems

- **Improve and expand water resources monitoring (*including real-time*) systems including:**
  - Weather
  - Rivers
  - Groundwater
  - Reservoirs/tanks/lakes
  - Water uses/ demands
  - Sediment
  - Coastal monitoring
- **Set monitoring standards: water quantity/quality, AQC methods**
- **Develop data sharing and data validation protocols across state agencies**
- **Pilot community based monitoring and water management;**
- **Introduce community based mobile monitoring system for small streams, groundwater, water bodies, flooding and drought.**
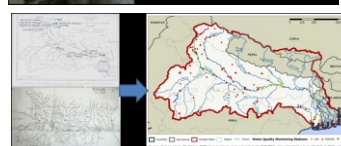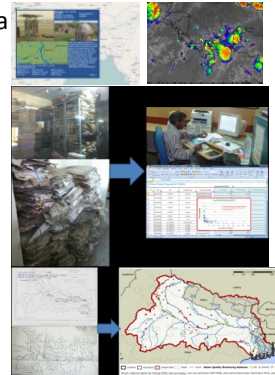
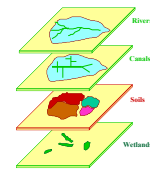## Component A: Improving Water Resources Monitoring System

A2. Database Population and Maintenance

- Digitization, categorization and integration of paper data and documents (e.g. documents, books, maps)
- Develop spatial river basin information
- Upgrade centralized and web-based data entry, storage management and dissemination systems: E-SWIS, E-GEMS and E-WQIS

A3. Targeted Surveys in Selected Areas

- Reservoir sedimentation surveys
- Bathymetric river surveys in critical areas
- Water quality/waste loads assessment
- **Groundwater exploration and aquifer mapping for selected areas (complementary or in parallel to NAQUIM efforts)**

Component B : Improving Water Resources Information Systems

B1: Centralized Spatial Dataset

- **Development of Digital Elevation Model (DEM) for the entire country for improved flood mapping and other planning purposes.**

- **High resolution surveys such as LIDAR for flood prone areas for flood risk mapping.**

- **Temporal Earth Observation/Remote Sensed products for the entire country.**

- **Temporal land use/land cover for entire country.**

- **Weather forecast.**

- **Climate change projections.**

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Component B : Improving Water Resources Information Systems

B2. Water Resources Information System

- **Strengthening India's National WRIS web-based portal for water resources information**

- **Introduce State Chapters to India WRIS**

B3. Public-Domain Services

- **Provide public-domain information services** (incl. online open data and map services, digital online libraries)

- **Provide information products** (e.g. online yearbooks, online interactive atlases, customizable interactive visualization dashboards, benchmarking products)

Component C : Water Resources Management Tools and Applications

C1. Water Resources Management Tools

- **Planning and Decision Support Systems** for river basin planning, introduction of community based groundwater management, climate risk assessment, water quality management, watershed planning, scenario analysis for investment planning

- **Flow/Flood Forecasting Systems** for short-term and seasonal forecasts for floods, flows, inundation, drought

- **Operational Management Systems** for reservoirs, irrigation systems operations, flood preparedness, spill management, and other water infrastructure

- **Design Tools:** improve design tools such as Hydrologic Design Aids (HDA) to improve design practices of water resource infrastructure – web-based
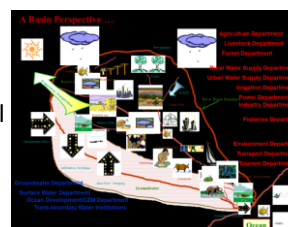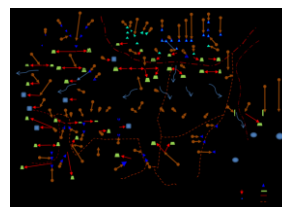
Component C : Water Resources Management Tools and Applications

C2. Water Knowledge Products

- **River Basin Management Plans** (with stakeholder involvement).

- **Customizable knowledge portals and mobile Apps; Bulletins** (e.g. flood forecasting).

- **Special Issue Based Reports** (e.g. on climate change and basin performance).

- **Flagship Knowledge Products** (e.g. State of India's Water Resources).

Component D: Improving Institutions and Capacity Building

D1. Integrated Water Resources Knowledge Centers

- **Establishment of the National Water Informatics Center** (integrated Center of Excellence for water resources knowledge and analysis, including use of modern modeling tools etc.)
- **State/basin Level** (similar downscaled centers at basin, regional or state levels based on requirements)
- **Institutional Modernization Support**
- **Office Furnishing** including laboratory and information management tools

D2. Water Resources Capacity-Building

- **Policy Support**
- **Strengthened Partnerships** with other knowledge providers, open data initiatives, academia, CSOs, internships/visiting experts, international exchange program

Component D: Improving Institutions and Capacity Building

D3. Training & Outreach
- **Annual Water Resources Knowledge Forum** (showcasing the best of what India has to offer and facilitate knowledge exchange).
- **Training** (including curriculum development, technical courses, refresher courses).
- **Multi-media: distance learning** (e.g. using videoconferencing)**, e-learning** (e.g. self-paced courses, webinars)**, vendor fairs, regular video & audio podcasts, documentaries.**
- **Competitions** (e.g. Online Tools, Appathons, Hackathons)

D4. Project Management and Technical Assistance
- **Establishment of a permanent WRIS Coordination Secretariat in MoWR**
- **Support to Project Management Units at IA level**
- **Project Implementation Facilitation** (e.g. technical assistance and support for procurement, financial management, safeguards, training and sustainability) at central and state levels
- **Project Monitoring (M&E, FMR, progress reporting)**

Expected Benefits

- **Standardized country-wide water resources database and India is brought under one water resources information framework.**

- **Enhanced collaboration between Centre and States.**

- **Improved access to information in the public-domain**

- **Centers of excellence providing modern water resources knowledge services and partnerships.**

- **Availability of country wide generic solutions for flood forecasting and water resources management.**

- **Focus on use of water resources information for addressing critical water challenges in the country**

- **Improved learning and knowledge exchange**

Thank you