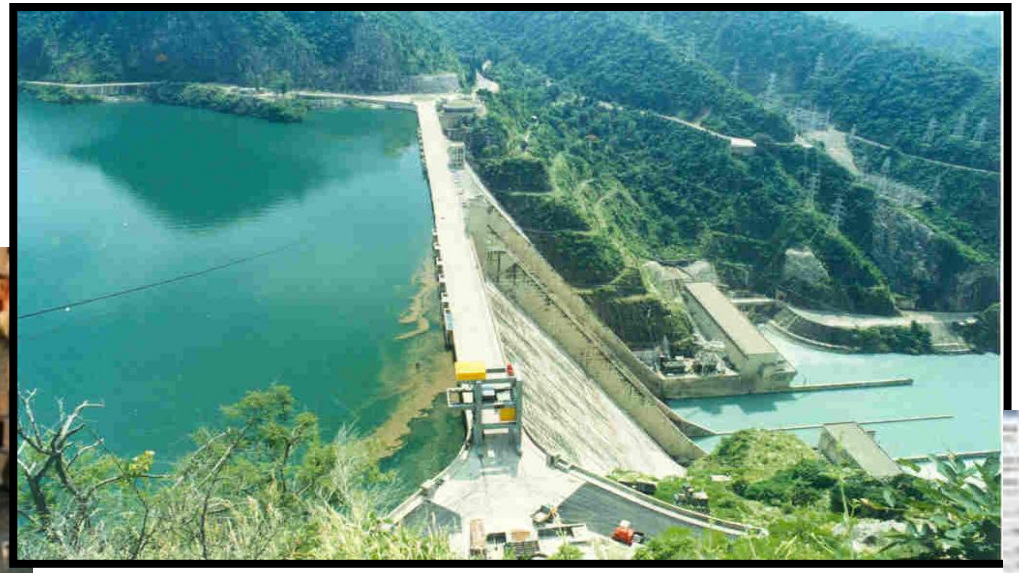
HYDROLOGY PROJECT
CRUCIAL FOR INDIA

India Water Week 2015

Hydrology Project:
Integrated Water Resources Management



Dr. Anju Gaur
Senior Water Resources Specialist
The World Bank
agaur@worldbank.org

RELIABLE, TIMELY, QUALITY, CONSISTENT, PUBLIC DATA

HYDROLOGY PROJECT – Journey Ahead

WORLD BANK GROUP

HP-I (1995-2003)
SDR 70.79 M

- 9 States
- 6 Central Agencies

HP-II (2006-2014)
USD 105 M

- 13 States
- 8 Central Agencies

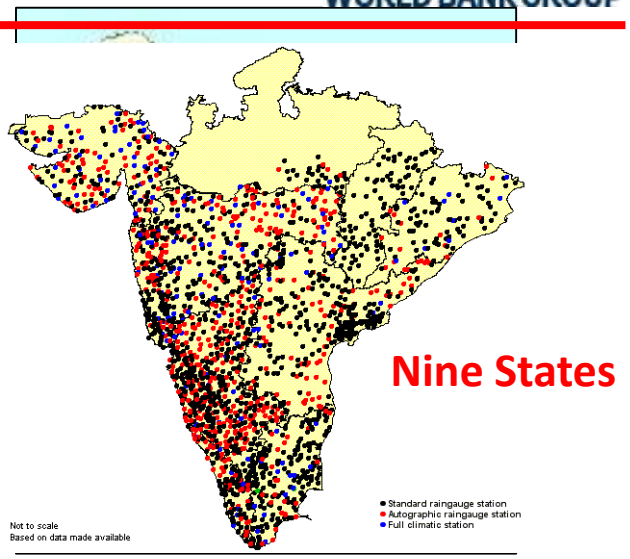
National HP-III
(under preparation)

Across All Indian States and UTs

World Bank aided HYDROLOGY PROJECT

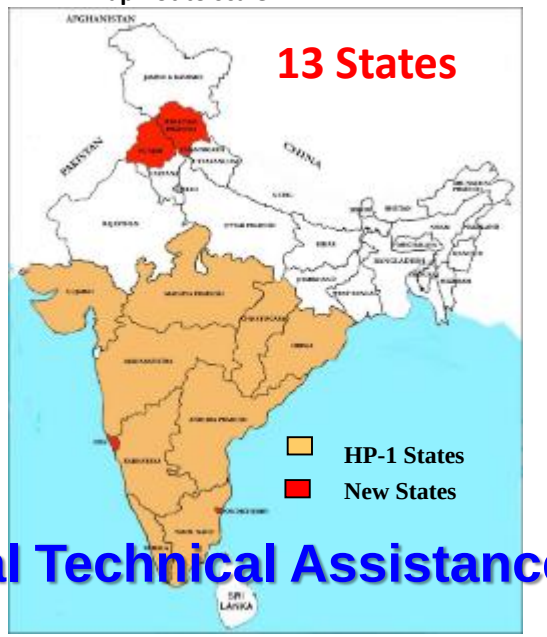
WORLD BANK GROUP

- **(1995-2003) SDR 70.79 M** Hydrology Project-I (HP-I) was taken up to develop **Hydrological Information System (HIS)** for collecting hydrological, meteorological and water quality data.



- **(2006-2014) USD 104.98 M** HP-II was taken up to extend and promote the use of **HIS** by all potential users concerned with the Water Resources Planning and Management, both in public and private, thereby contributing to improve productivity and cost effectiveness of water related investments.

Map not to scale



Both the projects were supported by International Technical Assistance

HP3: Project Design (Tentative)

Project Objective:

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

Project Components:

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

Budget Outlay: **INR 3000 Crores (USD 500 million)**

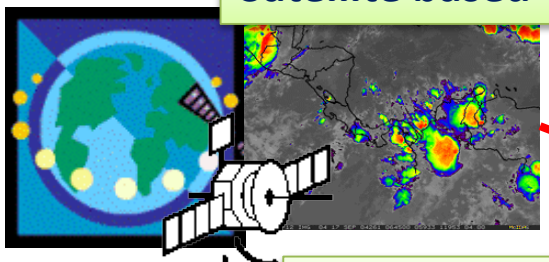
Timeline: Expected to launch by Oct 2015

Moving towards a programmatic approach

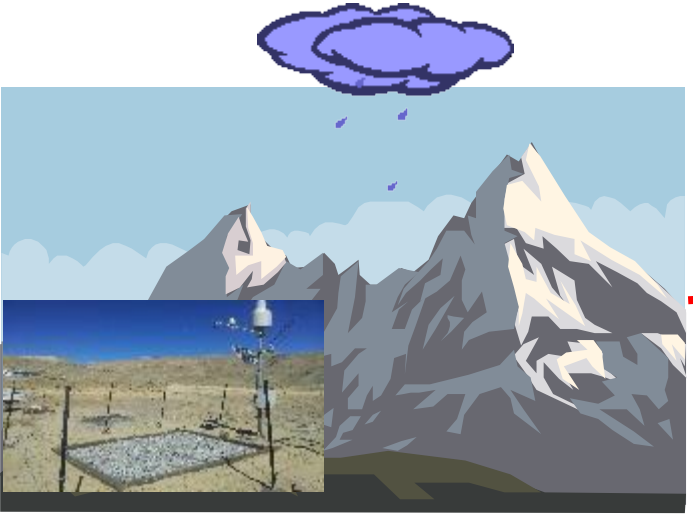
REAL TIME HYDRO-MET SYSTEM

Data Generation
Bottom-up+Top-down

Satellite based Climate



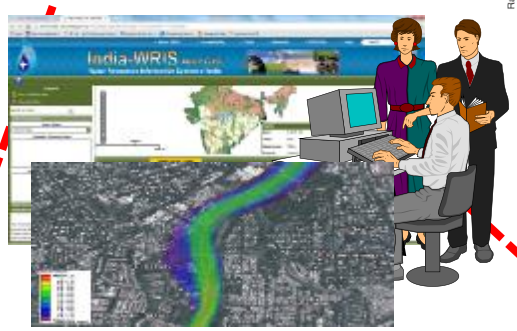
Data Transmission
(e.g. Satellite-InSAT, V-SAT, Cellphone)

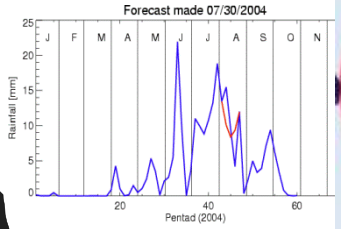


Precipitation (rain & snow)

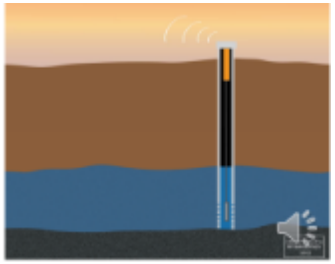
Reservoir Levels

Water Quality





River and Canal Stage/ Discharge/Sediment

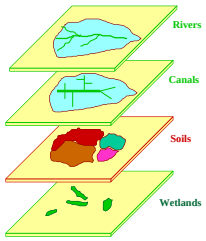


Groundwater

Internet/ Intranet

Data Visualization & Use

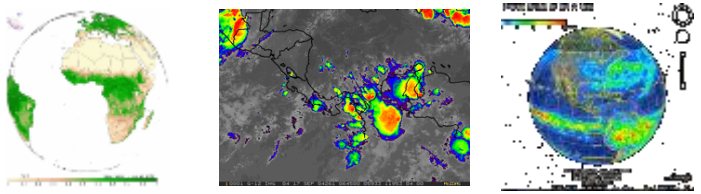
HP3 Vision: Water Information and application system



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)

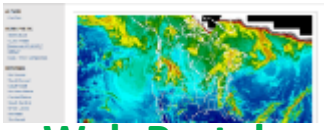
Dissemination Platforms

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

Concepts of Hydrology Project –Phase III

- Standardizing Water Resources Monitoring and Information System for the country with uniform procedures and database.
- Enhancing data exchange 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, operation and management including used of remote sensing based techniques.

HP2: Real time /Automated Hydro MET

WORLD BANK GROUP

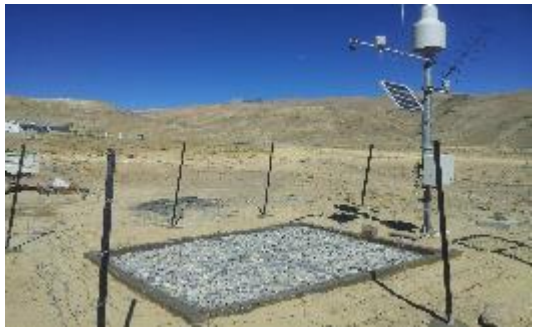
Automatic Weather Stations

Water Level Recorder

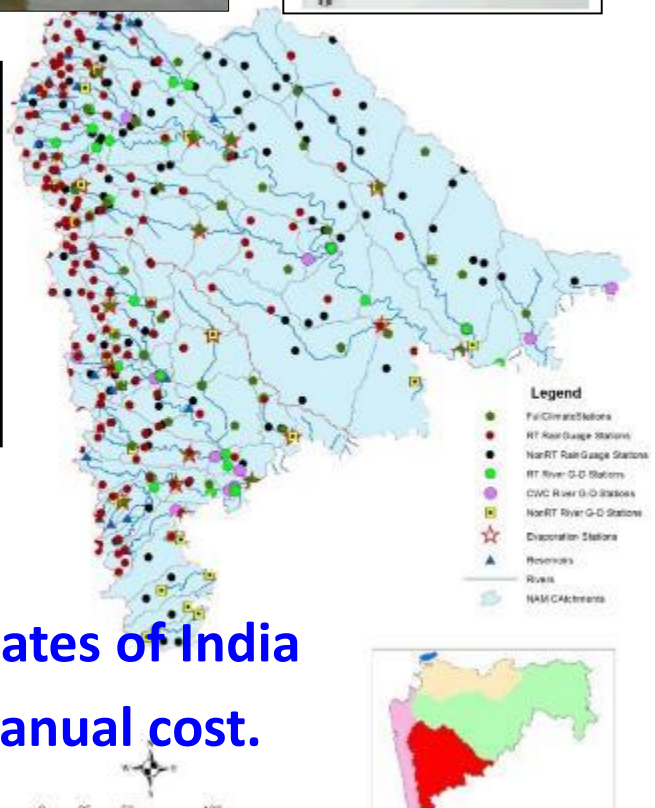
Water Quality Station

Digital GW Recorder

Snow Pillows



River Flow



Output:

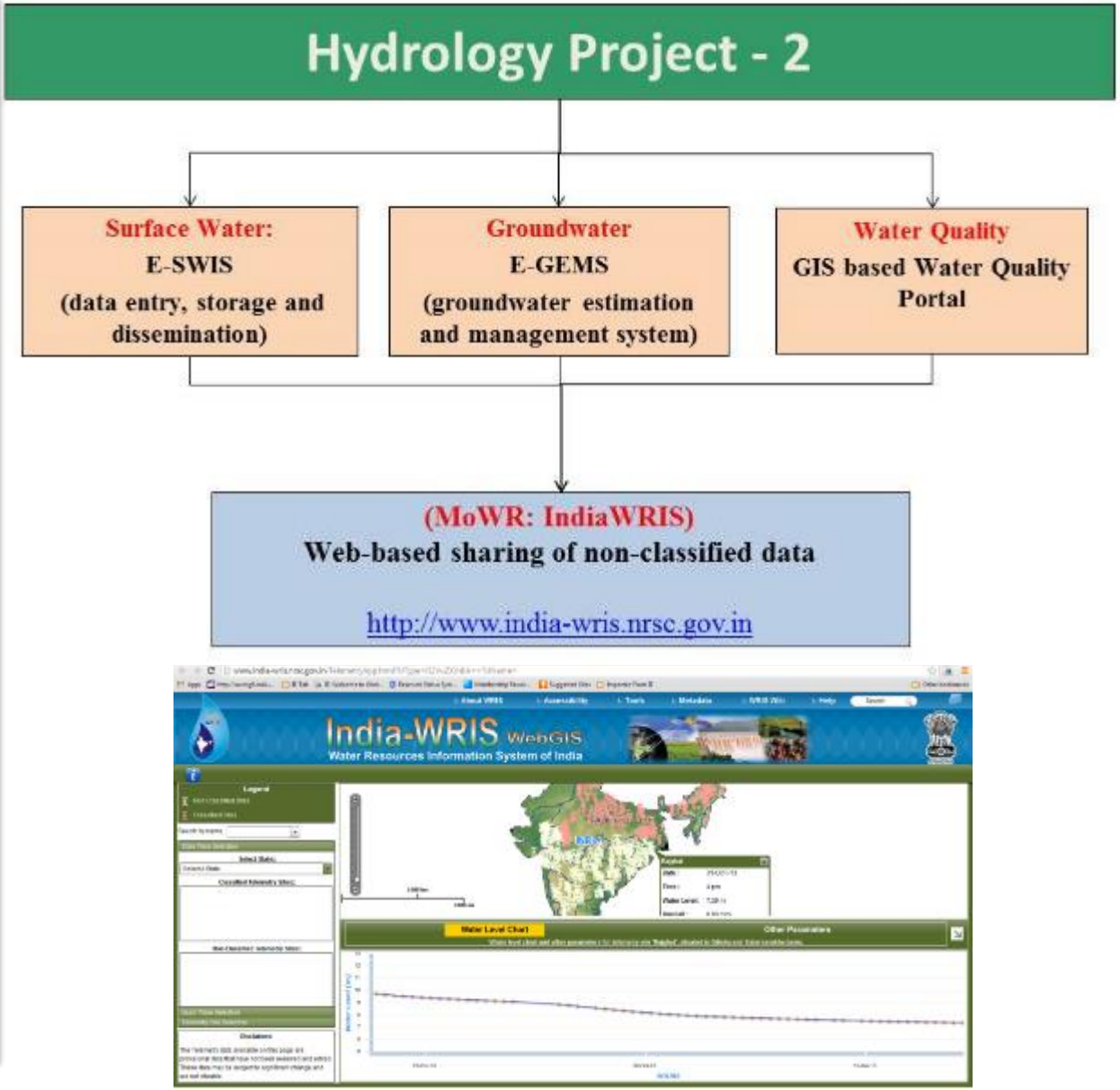
- Reliable and timely data in several states of India
- Saving in operating cost by 50% of manual cost.

Web-Based Water Resources Information System

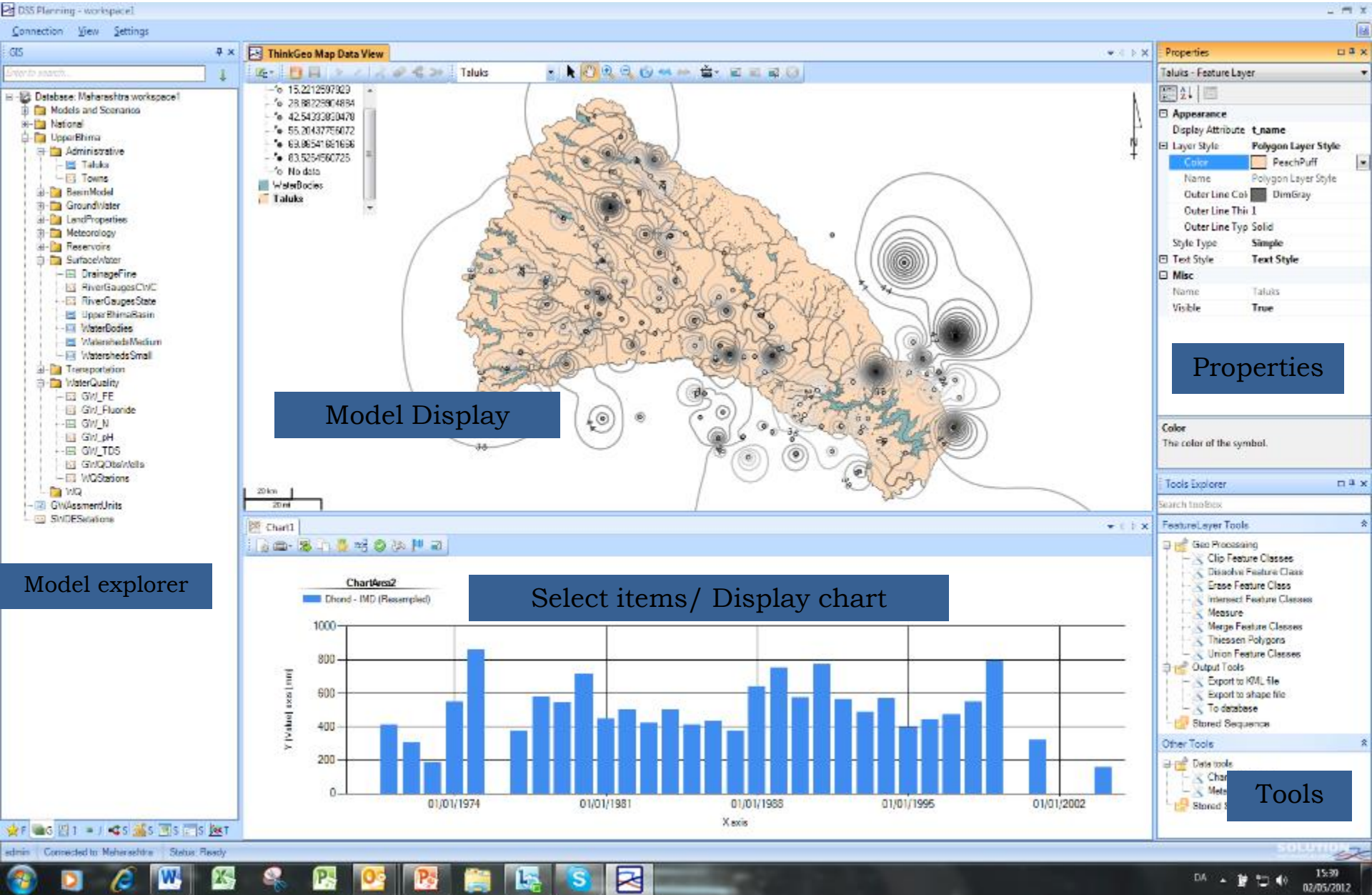
WORLD BANK GROUP

Advantages:

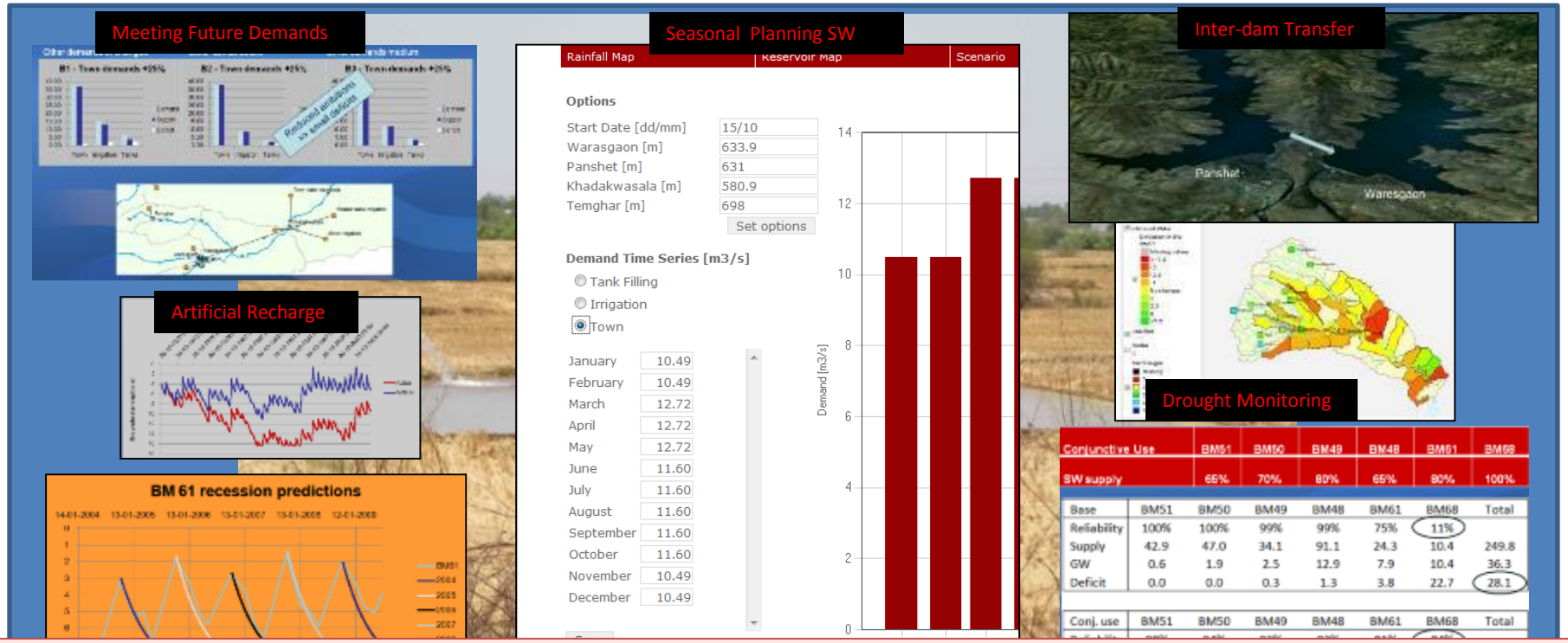
- *Standardized database with reliable, transparent and timely access to data.*
- *Expedite Plan Preparation for water investments using state owned data.*
- *Enhance exchange among state and central agencies at real time to make decisions at river basin level in particular for flood management and reservoir operation.*
- *Maharashtra, Karnataka, Tamil Nadu, Puducherry are sharing data in public*



DSS for River Basin Planning and Management



DSS for River Basin Planning and Management



Cost effective designs and investments were supported during HP2

"We must start using the DSS for conflict resolution among states sharing the same river basin resources"

- Senior Government Engineer, WRD, Maharashtra

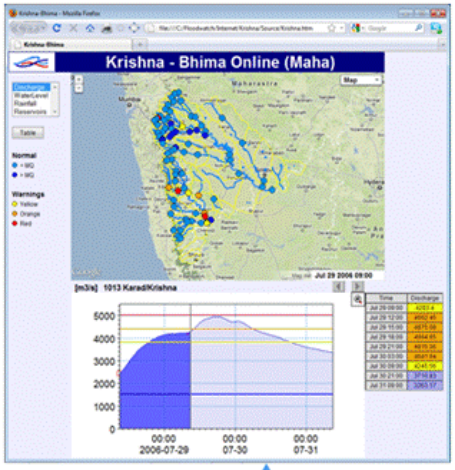
The states can now optimize their management of surface and groundwater, prioritize problems, test efficiency of possible solutions, and increase the awareness and participation of stakeholders in meeting the challenges of securing water for future generations.

Flood Management

WORLD BANK GROUP

Developed Stream Flow Forecasting and Reservoir Operation Systems for Flood Management in 2 River Basin Systems

Real Time Flood Forecasting System



DATA BASE Historical Data Real Time

RTDAS

Met Forecasts

Calibrated Models (RR-HD)

Forecasting, Operation System

COMMUNICATION Warning Dissemination

WEB

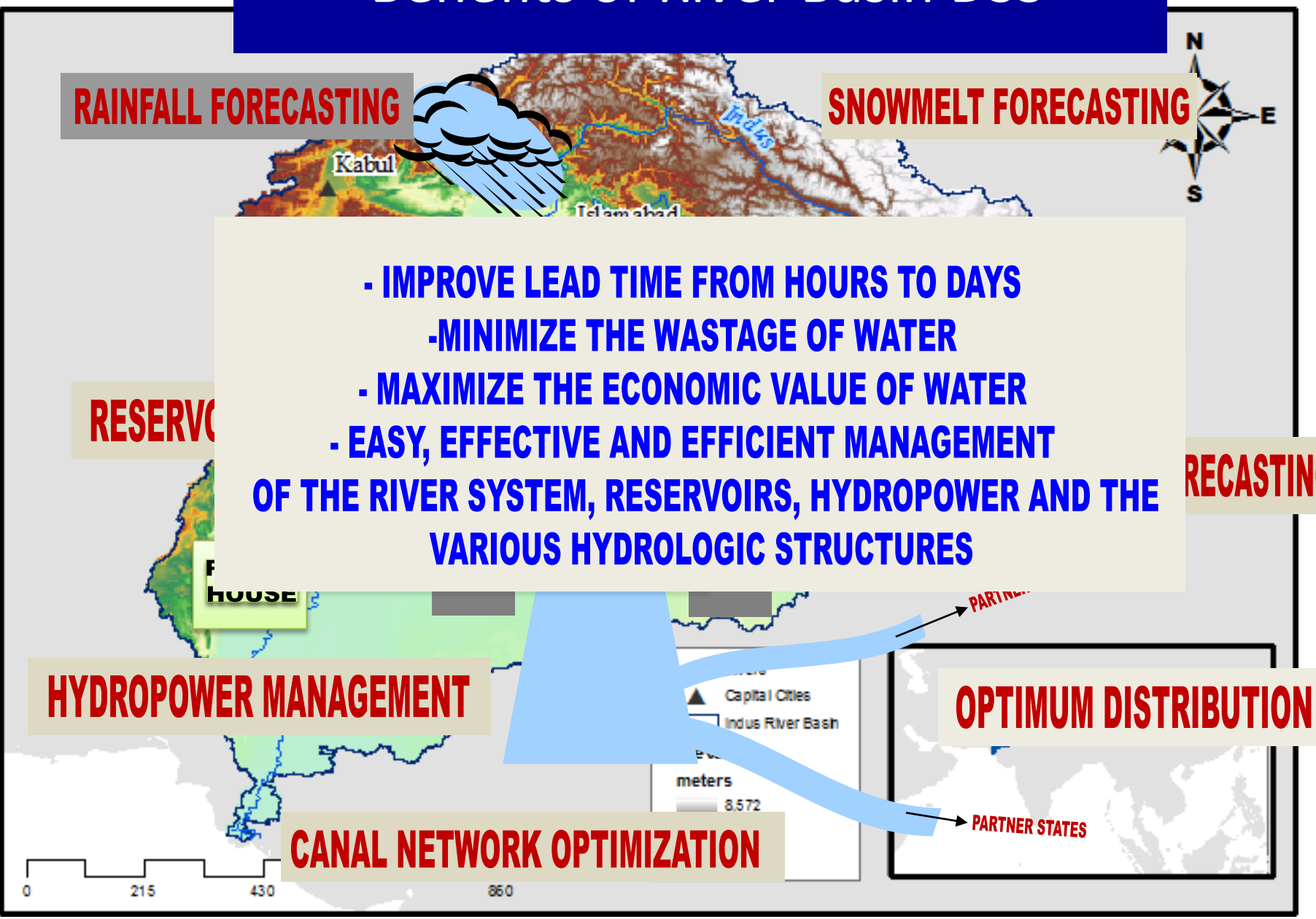
PC

WEB

Mobile

As per 12th Fiver year plan, annual flood damage to private infrastructure and property to be US$1 Billion (INR 6000 crore) and 3.2 Million people

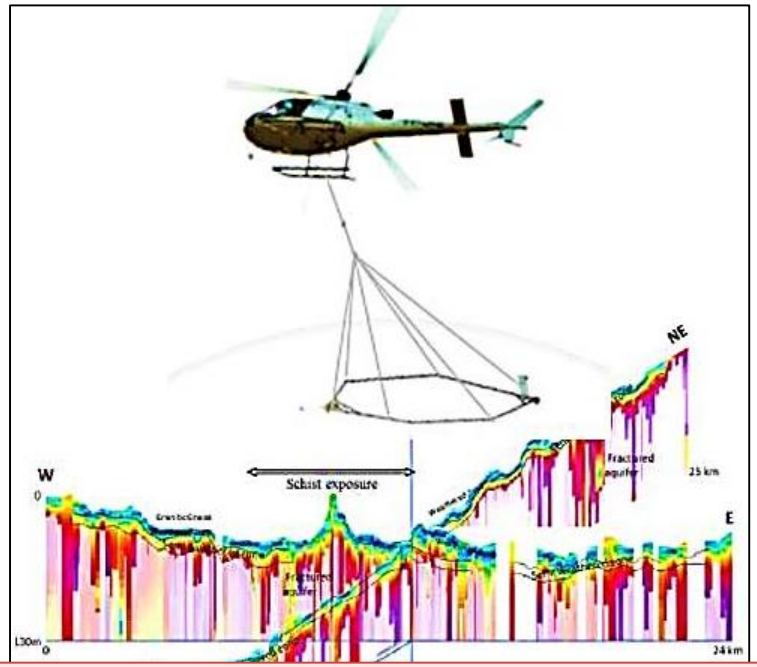
Benefits of River Basin DSS

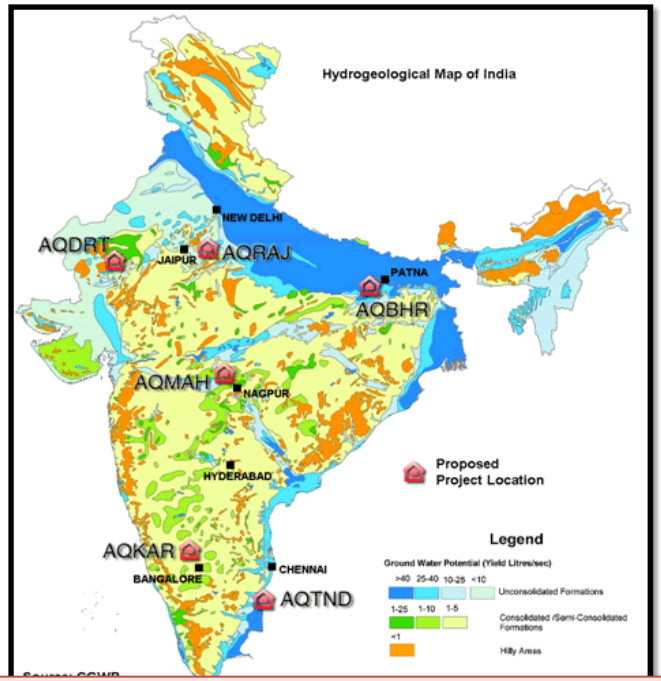


Groundwater management

3. Groundwater Management (Aquifer Mapping)

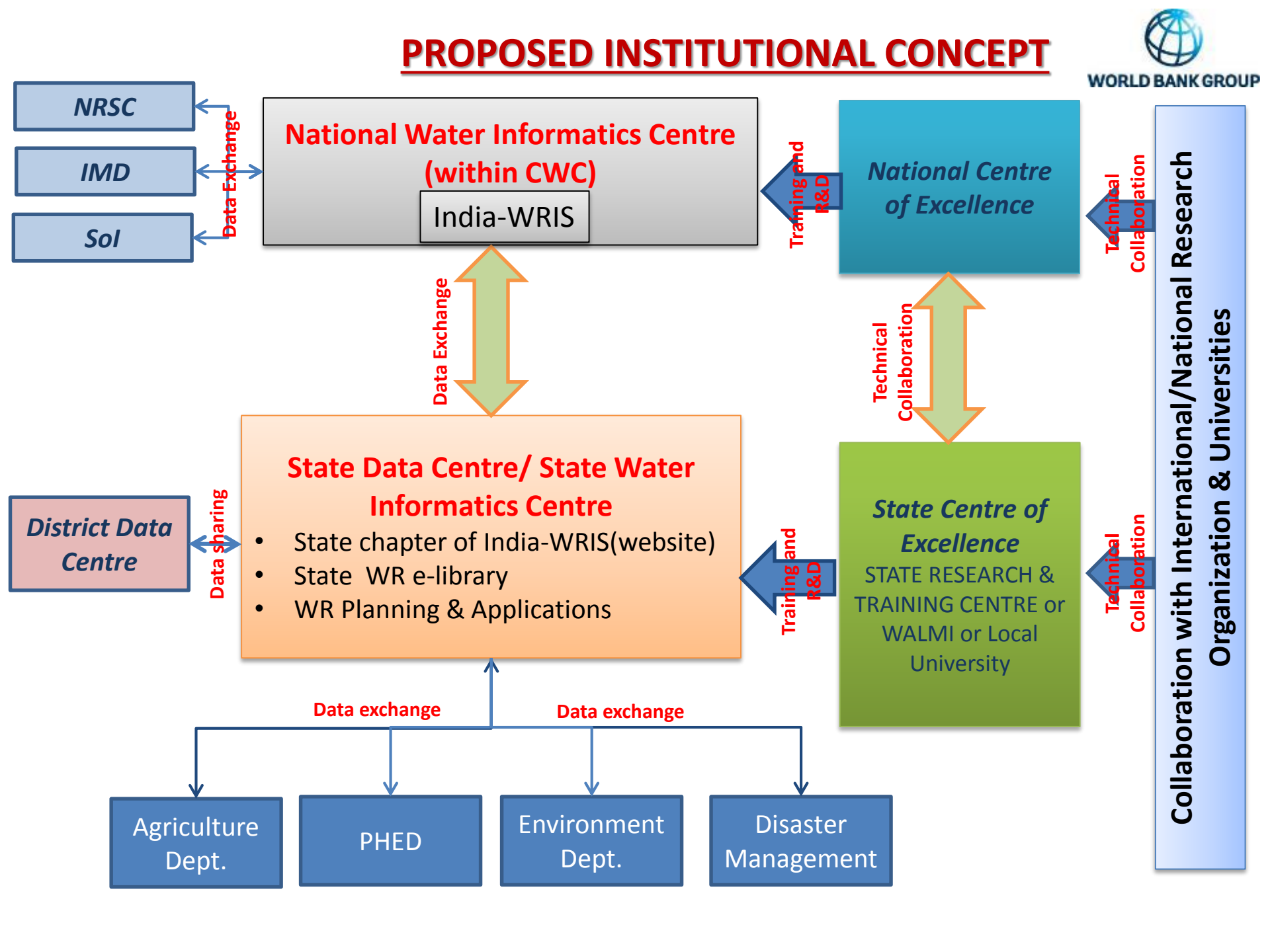
- Pilot for National Aquifer Mapping program.
- Time and cost effective Advance Geophysical techniques including Heliborne TEM





Included collaborations with NGRI India; Aarhus University. Denmark and technical guidance of USGS

PROPOSED INSTITUTIONAL CONCEPT

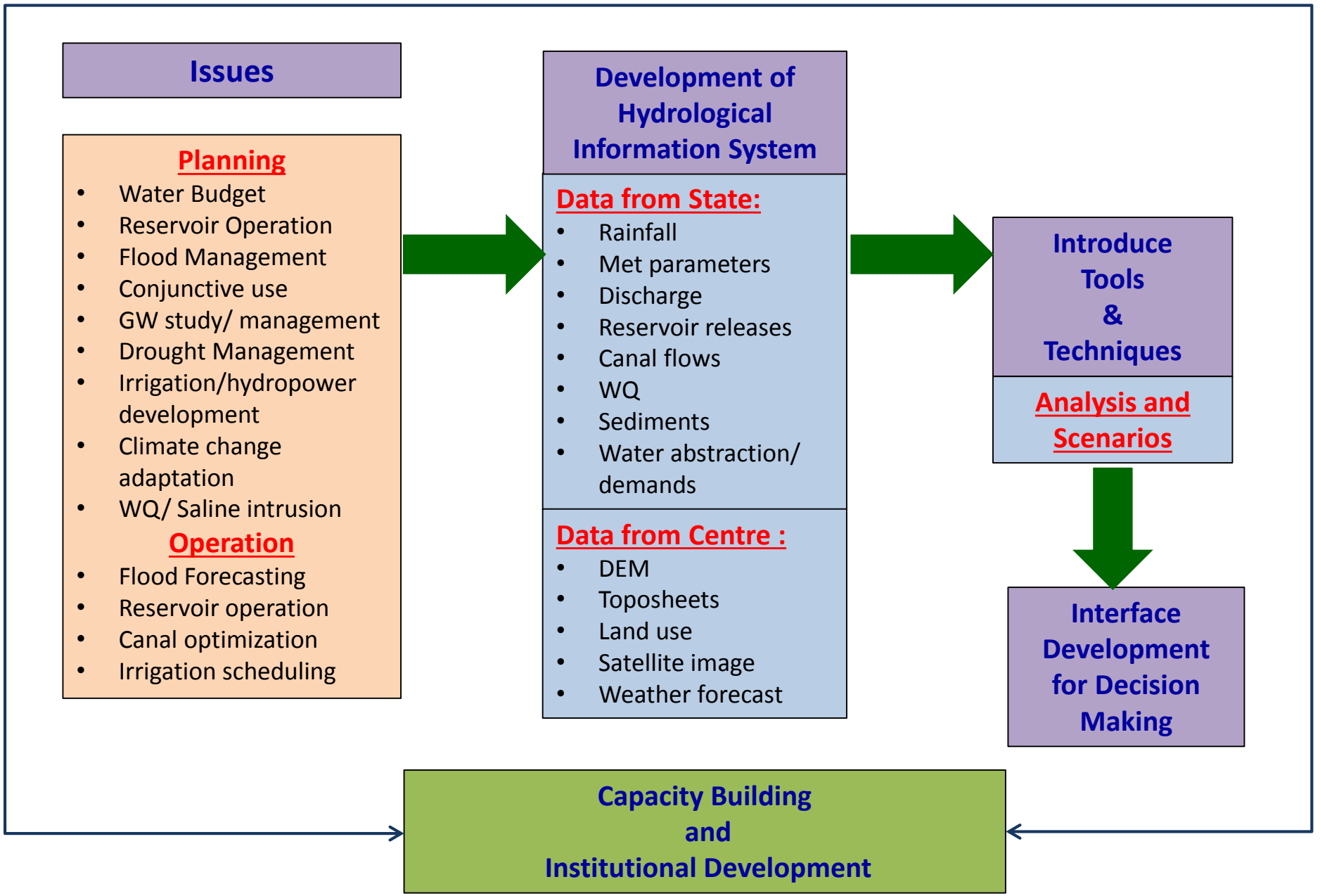


'If You Can't Measure It, You Can't Manage It‘

Thank you

agaur@worldbank.org

Approach


Issues
Planning
Water Budget
Reservoir Operation
Flood Management
Conjunctive use
GW study/ management
Drought Management
Irrigation/hydropower development
Climate change adaptation
WQ/ Saline intrusion
Operation
Flood Forecasting
Reservoir operation
Canal optimization
Irrigation scheduling
Development of Hydrological Information System
Data from State:
Rainfall
Met parameters
Discharge
Reservoir releases
Canal flows
WQ
Sediments
Water abstraction/ demands
Data from Centre :
DEM
Toposheets
Land use
Satellite image
Weather forecast
Introduce Tools & Techniques
Analysis and Scenarios
Interface Development for Decision Making
Capacity Building and Institutional Development

Component A : Improving In Situ Monitoring System

- **Automated /real time Water monitoring systems across India including climate, rivers, groundwater and usage and water quality.**
- **Community based monitoring**
- **Focused survey for flood management, reservoir sedimentation and aquifer mapping.**

Component B : Improving Water Resources Information Systems

B1. Spatio-temporal Centralized database management for data entry, storage and processing.

B2. Water Resources Information System

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

- **Introduce State Chapters to India WRIS**

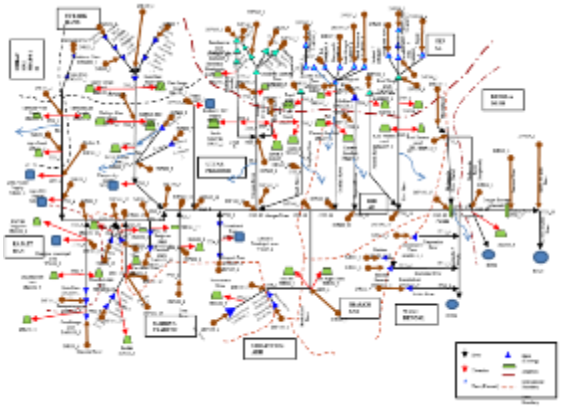
B3. Public-Domain Services

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

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



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)**