National Workshop on Integrated Water Resources Management
Summary Report

National Workshop on Integrated Water Resources Management

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Central Water Commission, Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India
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This summarizes the proceedings and outcomes of a national workshop on Integrated Water Resources Management (IWRM) held on 2-3 February, 2015 in New Delhi, India. The workshop was organized jointly by the Central Water Commission (of the Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India), the World Bank Group and the Asian Development Bank. The workshop participants (around 100 people) included relevant central and state government officials, national and international experts, and representatives from the two multilateral development banks.

The overall purpose of the workshop was to contribute to the evolving practice of IWRM in India. The specific objectives were to: (i) share international experiences of IWRM; (ii) discuss and provide directions for finalizing National IWRM Guidelines; and (iii) consider potential new IWRM initiatives and investments for India.

IWRM is a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. River basins provide a logical unit for IWRM implementation.

To address the first objective, international experts provided case studies from around the world, including from Australia, China, Indonesia, across Asia, the United Kingdom and USA. IWRM progress and initiatives across India were presented and discussed including (i) progress on legislative reform (the draft River Basin management Act), (ii) the experiences of Indian river basin organizations and regulatory authorities, (iii) an overview of work on water data and modelling, and (iv) overviews of the projects supported by multi-lateral development banks. All presentations from the workshop are available at www.indiawrm.org.

Break-out groups discussed: (i) institutions and legal frameworks, (ii) inter-sectoral water allocation, and (iii) potential new projects and investments. The first group concluded that while the draft National IWRM Guidelines provide a useful overview of IWRM principles and objectives, further work is required prior to finalization, and an independent peer review is recommended. Importantly, the group concluded that for IWRM Guidelines to be effective, the proposed River Basin Management Act needs to be passed into law (following some revisions). Revisions to the proposed Act were suggested for (i) establishing formal water access rights, (ii) clarifying and separating advisory functions from decision functions in IWRM institutions, and (iii) a more workable dispute resolution mechanism.

The group on inter-sectoral water allocation discussed several important issues and recommended: improved water resource assessments, exploration of water rights and trading, clarification of water use priorities under variable supply, improved demand-side management, defining environmental water allocations for all basins, and improved demand projections.

The group on projects and investments identified priority work to be undertaken in data collection, data systems and modelling; establishment of new institutions and building the technical and policy capacity of government officers through training programs; work on environmental flows to improve the sustainability of water resources; investment in infrastructure and technology including for irrigation efficiency and control, flood forecasting and early warnings, and water storages and their operation.

Emergent themes from all the groups was the need for broad stakeholder consultation to inform a participatory approach to IWRM, the importance of legislative reform to enable the establishment of effective river basin organizations, and the criticality of formalizing water access rights and establishing mechanisms for these access rights to move to higher value uses as the demand pattern changes and supply options become fewer. The Ministry for Water Resources, River Development and Ganga Rejuvenation, noted that with a water crisis emerging across India, the time for action is now, and we must act fast.
India’s rapidly urbanizing and industrializing economy is bringing major new water demands while options for supply augmentation are few. Recent projections indicate that India’s water demand may be twice the available supply by 2030 without major reform and investment, although the scale and character of this challenge vary greatly between river basins. In response to ineffective surface water management there has been rapid and uncontrolled development of groundwater resources across India and many groundwater systems are now depleted and polluted. In the face of this growing crisis, the twelfth five-year plan of the Government of India calls for a “paradigm shift” in water resource management and outlines several necessary elements of a reform process including strengthening river basin management.

Water security is critical for driving economic growth and social development, and for ensuring political stability. In the face of population growth and climate change, achieving water security will be a growing challenge that will require strong political commitment to difficult reforms. However, without this commitment, declining water security will ultimately constrain economic growth, slow poverty alleviation and leave many exposed to the threats of floods, droughts and water-borne disease.

IWRM provides a framework for planning, development and management of water resources. IWRM seeks to enable the efficient, equitable and sustainable management of the water resources of a river basin in order to ensure “water security”. River basins thus provide an appropriate geographic basis for IWRM implementation. Water security can be defined as “the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (UN-Water Task Force on Water Security, 2013).

Achieving water security requires an end to fragmented responsibilities for water and the adoption of an integrated river basin approach to water resources management across all sectors. This approach is outlined in India’s 2012 National Water Policy that has embraced IWRM as a framework for guiding and informing water resources planning, development and management decision making in India.

IWRM requires four key elements to be successful: (i) an enabling environment of suitable policies, strategies and legislation for sustainable water resources development and management, (ii) institutional arrangements with the capacity to enable these policies, strategies and legislation to be operationalized, (iii) management instruments required for these institutions to be effective and (iv) data and tools to provide the knowledge and information for evidence-based management. These elements provide a framework for assessing the current status of IWRM.

Enabling Environment

The River Boards Act (1956) allows for the establishment of river boards by the Government of
India in consultation with relevant state governments, for the purpose of enabling integrated water resources development and flood management. The Inter-state River Water Disputes Act (1956) was passed to resolve the water disputes that would arise in the use, control and distribution of inter-state rivers. Although several river boards have been established using this legislation, these have largely focused on the delivery of specific development projects or a single water management problem, such as flooding. No river basin organizations exist in India with the mandate and resources for comprehensive planning and management of water resources at the basin-scale.

The Government of India has drafted a River Basin Management Act (intended to replace the River Boards Act) that would require states to adopt cooperative, integrated and basin-scale approach to water resources planning and management through establishment of appropriately empowered River Basin Authorities for regulation and development of inter-state river basins. The proposed new legislation will require the support from state governments and thus progress will require strong relationships between the Centre and the states based on a shared understanding of the need for major reform to address India’s growing water challenges.

Institutions and Governance

To strengthen adoption of a river basin management approach it is important to build a cooperative approach that builds shared understanding of each river basin based on a culture of open sharing of data and information and demonstration of the benefits of the approach to water users. Key benefits should include clarity for water users on supply reliability (in the face of multi-sector demands on the resource and supply variability) and opportunities for better risk management at both basin and local scale. Greater regulation and enforcement is often required once the “rules of the game” are clearly established and once the system-wide benefits are well understood. Regulation and enforcement help ensure equity and prevent inequitable individual gain at the expense of other users or at the expense of the environment. Currently, there are a number of special purpose institutions for various river basins in India, but few have a comprehensive IWRM mandate. In many cases these bodies have been established under one-off pieces of legislation. Moving to a more nationally consistent approach, that enables relatively quick establishment of multiple river basin organisations with appropriate powers and responsibilities for inter-sectoral water allocation and environmental water management is urgently required.

Data and Tools

A critical component of river basin management is having adequate data and information to represent, understand and simulate river basin dynamics. This should begin with hydrology and water resources but typically grow to encompass the environmental, economic and social outcomes from water resources management. This ensures river basin management is built on a foundation of facts and evidence and not myths and opinions. To ensure fairness, it is important to strive for open access to the data and information that guides river basin management. This allows for informed dialogue amongst stakeholders and encourages broad engagement in participatory management. River basin models help to assess the outcomes of different interventions (infrastructure or policies) and the impacts of externalities (e.g. climate change). This capability helps manage issues of equity (between states, sectors and users), sustainability (environment vs consumptive use) and efficiency (maximizing net economic benefits) and is important for demonstrating what issues require a basin-scale approach (and thus inter-state cooperation) for effective management.

Recently Central government has recognized the critically of high quality and consistent water data and the opportunities to build water information products and services based on these data. The National Water Policy (2012) calls the establishment of a National Water Informatics Centre to collect, collate and process hydrologic data regularly from all over the country, conduct the preliminary processing,
and maintain in open and transparent manner on a GIS platform and indicates that all hydrological data should be in the public domain (other than data classified on national security grounds). The National Water Policy calls for water related data to be integrated using well-defined procedures and formats to support informed decision making in water management. In response to these policy directions, Ministry of Water Resources, River Development and Ganga Rejuvenation, the Central Water Commission, and the Indian Space Research Organization have been jointly executing the India Water Resources Information System (India-WRIS) project.

The World Bank-supported Hydrology Project Phase 2 has included the development of decision support systems for water resources planning to facilitate greater value and information to be derived from the available hydrologic data. These DSS provide (i) databases and associated tools to display, manage, and analyse GIS and time series data, (ii) modelling tools to analyse water management options and extract key results for decision makers, and (iii) web tools to easily upload data and information on water resources and management plans for external stakeholders.
The Central Water Commission has drafted national IWRM guidelines, and as a means to further debate and refine these, and to more broadly raise awareness about IWRM, including with respect to IWRM success stories from around the world, the Commission requested assistance from the World Bank and the Asian Development Bank to organise a two-day national workshop on IWRM. In addition to these objectives, the Department of Economic Affairs (Ministry of Finance), wished to explore lending opportunities for new IWRM projects in the context of recent and ongoing initiatives. Overall, there is agreement across relevant government ministries that a more systematic approach to the planning, development and management of water resources in India is critical for economic growth and environmental sustainability.

The workshop was organized around a series of presentations and group discussions that brought together water planners and managers from across India together with international experts in basin-scale IWRM implementation. The workshop agenda is attached as Annex A. Attendance at the workshop was by invitation. Participants included senior officials of relevant central and state government agencies with responsibility for water and/or environmental management in different parts of India, international experts on IWRM, as well as academicians, NGOs and consultants with relevant experience. A list of participants is attached as Annex B.
Three key presentations at the workshop framed the opportunities and contextual requirements. Professor YK Alagh (Former Member, Planning Commission) described the opportunities for IWRM implementation in India, AB Pandya (Chairman, Central Water Commission) provided an overview of the important of IWRM for India while highlights key constraints to implementation, and M Gopala Krishna (Former Secretary General, International Commission on Irrigation and Drainage) presented proposed institutional and legislative reforms intended to overcome these implementation constraints.

Opportunities for IWRM Implementation

In a keynote address, Professor YK Alagh stressed that to achieve efficient water management one must work at a local watershed level as well as at the basin scale. This ensures system scale outcomes as a result of local action. Different solutions are required for different agro-climatic regimes, but in all cases we must integrate the water management system with agricultural systems using best practices from across the country and similar agro-climate zones abroad.

IWRM implementation will require improved technology and management systems. In India, the Central Water Commission, the Ministry of Water Resources, River Development & Ganga Rejuvenation, and National Institution for Transforming India (NITI) Aayog have important roles to play for IWRM success. India can learn from the work of basin organizations like the Mekong River Commission, hence the importance of this workshop for sharing international experiences. A key part of this for India will be establishing faster and more effective dispute resolution processes for inter-state water issues.

The Importance IWRM and Key Implementation Constraints

Mr Pandya presented an overview of the IWRM context in India. The National Water Policy emphasizes the need for a comprehensive legislation for optimum development of inter-state rivers and river valleys to facilitate inter-state coordination. This aim of this legislation is to ensure scientific planning of land and water resources taking basin as a unit with unified perspectives of water in all its forms (including precipitation, soil moisture, groundwater and surface water) and ensure holistic and balanced development of both the catchment and the command areas. Such legislation should enable establishment of basin authorities comprising riparian states, with appropriate powers to plan, manage and regulate utilization of water resource in the basins.

IWRM is an evolutionary process and the most important aspects are:

- A basin management plan and vision
- Participation and coordination mechanisms, fostering information sharing and exchange
- Capacity development
- Well defined flexible and enforceable legal framework and regulation
- Water allocation plans
- Adequate investment, financial stability and sustainable cost-recovery
- Good knowledge of natural resources present in the basin
- Comprehensive monitoring and evaluation
- Political will and commitment

It is crucial to develop guidelines for assessing water availability and requirements, water rights and priorities for the success of IWRM. There is a need to evolve a national framework law as an umbrella statement of general principles governing the exercise of legislative and/or executive powers.
by the centre, the states and the local governing bodies. A comprehensive legislation is necessary for optimum development of inter-state rivers and river valleys to facilitate inter-state coordination ensuring scientific planning of land and water taking basin as unit. There should be sectoral provisions for drinking water, irrigation, flood control and management, hydropower, industrial use, ecology and other uses, and groundwater management (multi-disciplinary and participatory approach, scope for aquifer identification and mapping, and artificial recharge etc).

Potential conflicting interests in inter-state river basins can be overcome through mutual trust and understanding between states, appropriate legal and institutional frameworks, joint approaches to planning and management, and sharing of the ecological and socio-economic benefits, and related costs. The solution for international water conflicts calls for cooperation amongst the co-basin countries. There is a need for a joint water resources development program at the basin-scale, owned and managed by the riparian countries themselves, in close cooperation with the technical institutions, investment institutions and civil society.

Proposed Institutional and Legislative Reforms

M Gopalakrishna gave an overview of the proposed institutional and legislative reforms – in particular the draft River Basin Management Act. With increasing population, the need is emerging for better water governance. In order to have better management of water resources for domestic, agricultural, industrial and environmental needs, and to overcome the current problems in water sharing due to increasing water stress, a committee was recently constituted to consider relevant aspects by revisiting the River Boards Act 1956 and suggest appropriate revisions. The existing water legislation is inadequate in meeting the aspirations of the states and a new legislation that enable the states which share river basins, should be passed by the Government of India.

It would be expedient in the public interest that the Central Government take under its control the regulation and development of inter-state rivers and river valleys to the extent required, to enable optimal water management. M Gopalakrishna stressed the importance of sharing international best practices on river basin management approach and having a River Basin Management Act to address the issues better in the Indian context so as to create an enabling environment for IWRM.

The proposed River Basin Management Act supports the establishment of River Basin Authority for the regulation and development of inter-state rivers and river basins. M Gopalakrishna explained in detail the composition and various provisions under the proposed RBM Act and the need for this act and the elements of river basin master plans which will evolve after the launch of the act.
International experiences from Australia and Asia (including China, Indonesia and the Philippines) were shared by expert practitioners. Key messages that emerged from these presentations included firstly, that environmental improvements in rivers cannot be achieved without sound scientific knowledge, robust stakeholder consultation and engagement, and an agreed and officially endorsed river basin plan. Secondly, it was stressed that good hydrological data is crucial as (i) one cannot manage what one cannot measure, (ii) it is critical to move beyond perceptions to facts, (iii) it is important to agree on the level of evidence that provides “sufficient certainty” rather than pursuing perfect knowledge; and (iv) it is important to be clear on what it is that one is seeking to manage and change, with a focus on only 3-4 critical priorities.

The presentations from the international experts are all available at www.indiawrm.org. Because of travel complications, Larry Simpson (past-General Manager, North Colorado Water Conservancy District) was unable to participate in the workshop; however, his presentation on the Colorado experience is nonetheless available on the above website.

**Murray-Darling Basin, Australia**

Don Blackmore (Former CEO, Murray-Darling Basin Commission) provided a historical perspective on water related challenges in the Murray-Darling Basin, Australia. He noted three major water challenges facing Australia: diminishing water security, over-allocation of resources, and environmental degradation. He explained the evolution of the water management process in the Murray-Darling Basin. The Murray-Darling Basin is a useful example, as the issues and challenges in this basin are comparable to many developed river systems across the world.

In the Murray-Darling Basin the key water challenges can be summarized as: over-allocation of water and ensuring environmental flows, problems of river and land salinization, and ensuring financial sustainability of irrigation districts. The Murray-Darling Basin Plan specifies ‘Sustainable Diversion Limits’ for twenty river valleys across the basin. The plan covers management of surface water and groundwater, considering the impacts of climate change. The plan has provisions for the protection of environmental ‘assets’ such as floodplain forests and wetlands, management of environmental flows, water quality and salinity. Political and social aspects dimensions are incorporated in the plan.

**Integrating Water Quality Management into a Basin Approach in Europe**

Fritz Holzwarth (Former President of the International Commission for the Protection of the Rhine, Former President of the International Commission for the Protection of the Danube River) explained how for good management of a river system, it is important to understand the issues which are related to quantity, quality, hydro-morphology, groundwater, biodiversity, infrastructure and transport. There should be clarity about the intensity of the issues, the baseline, emission limit values/water quality standards and the realistic time frame required for managing these issues. It is crucial to set the priorities for taking measures and making investments.

IWRM needs a jointly agreed river basin management plan with clarity on responsibilities for implementation and coordination. IWRM needs stakeholder involvement, and a strong governance structure with proper institutional arrangements. Availability of data and knowledge is indispensable. The keys to IWRM success in Europe have been a river basin approach, clear decisions by the
governments at all levels involving the sector ministries, appropriate institutional arrangements, involvement of all stakeholders, clear and transparent communication and information strategy. Clarity of priorities, timelines and the ‘starting point’, were all critical.

**IWRM Implementation in the Brantas River Basin, Indonesia**

Tjoek Subijanto (Former President Director, Jasa Tirta I Public Corporation, Indonesia) described the adaptive-collaborative process that is the essence of IWRM and it is the key factor for effective IWRM implementation. Effective implementation of IWRM will promote transparent and efficient water resources management, facilitate effective conflict resolution, encourage effective demand management and instil in the stakeholders a sense of ownership. This will also help in maintaining the sustainability of water resources for mankind and the ecosystems in the future. He emphasized the fact that strong leadership is fundamental to build willingness and ownership. Incentives play an important role in transforming capacity into performance.

Mr Subijanto outlined the reasons for the success of the capacity development program of the RBO in the Brantas River Basin, East Java, Indonesia. These were an effective CD program consistently supported by solid team work, dedicated staff, “Brantas Spirit” (the “3-Cs” spirit: creative, cooperative and confident spirit) to achieve common goals, and a culture of continuous performance improvement. He then described the evolution of the river basin management system in the Brantas River Basin. The river basin organization was developed in two phases, viz. development phase and management phase. Lessons learned from the Brantas River Basin experience include:

- IWRM is a collaborative and adaptive process involving stakeholders
- A water resources management council or multiple coordination bodies should be established as a forum for coordination, consultation, integration and synchronization
- River basin organizations play a strategic role in IWRM implementation. To be effective, these institutions need to build technical competencies and managerial capacity
- Capacity is the ability to perform functions effectively, efficiently and sustainably. Capacity development is essential for an organization to effectively perform its role and functions.

**Institutional Experiences in River Basin Organizations Across Asia**

Keizrul bin Abdullah (Chairman, NARBO – Network of Asian River Basin Organizations) provided an overview of the institutional Experiences in river basin organizations across Asia. The goal of NARBO is to help achieve IWRM in river basins throughout Asia. He outlined three basic IWRM principles: economic efficiency, equity and environmental sustainability. The following are the most critical factors for IWRM success at the river basin level:

- Political will and commitment
- Participation and coordination mechanisms
- Capacity development
- Comprehensive monitoring and evaluation
- Basin management plan and clear vision
- Well defined, flexible, and enforceable legal framework
- Adequate investment and financial stability
- Water allocation plan

Mr Abdullah shared institutional experiences of river basin organizations in Asia. For the Japan Water Agency he noted three pillars: financial (government grants and subsidies), human resources (capacity building), and technological (construction, operation and management of water resources facilities) that support the credibility of JWA as a river basin organization.

For the Jasa Tirta I Public Corporation, the factors leading to the success were a modern approach to water resources development, institutional development, incorporation of corporatization
principles in water resources management, stakeholder satisfaction, and commitments to contribute to increasing the triple bottom line (economic, environmental and social) benefits at the basin level. For Jasa Tirta II Public Corporation, success lies in three aspects: governance (effective regulations in delivering its tasks), capacity building and technology (appropriate technology and management system, work safety & health, good corporate governance) and sound financial management (funding has been from government, water tariffs, private/public investments and foreign assistance).

In China, uncontrolled and rapid industrial and urban development have been rapidly depleting the water resource. Once degradation has occurred, it is difficult and expensive to reverse (especially pollution). This calls for pre-emptive action. River basin units are recognized as the necessary unit for planning the sharing of water, the management of drought and pollution management.

There are two main models being used in China: (i) a top-down consultative model followed by the national level River Basin Commissions, and (ii) a newer cooperative, participative approach followed by the lower level river basin organizations. Both seem to work reasonably well. River Basin Organizations are more effective in China than in many other countries because they have clear decision making powers and responsibilities. The nested approach (National-Province-County-WUA) to water resource management is effective and it ensures that the basin level planning connects to water users. The other important aspect is that the management of surface water and groundwater resources are entrusted in one agency enabling strong and integrated management. Chinese agencies have a very strong focus on action and the end results. They have managed to keep the approaches fairly simple and practical.

Environmental Flows in IWRM

Professor Mike Acreman (Natural Capital Science Area Lead, Centre for Ecology and Hydrology, National Environmental Research Council, UK) described the importance of environmental flows as a component of IWEM. The goal of IWRM is economically efficient water use, equitable access of water by all stakeholders, and environmental sustainability with set water quality and flow standards. There is no single definition of
environmental flows. There are over 250 methods for estimating e-flow and e-flow is dependent on the type of river envisaged. The water requirement in a river may be determined by the objective desired, for example, conservation objective (e.g. maintain nature character in Ramsar site) or ecosystem service objective (e.g. maintain depth for river during specific water related religious festival in India). For determining the flow requirements, it is important to involve the stakeholders in the process; and awareness raising and involvement of the local community are crucial in the process.

Adaptive management is essential to estimate environmental flows because environmental flow assessments are uncertain and the response of environmental flow management is unpredictable. Therefore there is a need to monitor the situation and adjust the flow requirements because circumstances may change in the basin/sub-basin. In the conclusion, he stated that healthy rivers are essential for human health and quality of life, and healthy rivers need environmental flows. India needs to develop skills in assessing and maintaining environmental flows.
IWRM Institutions in India

A number of state or basin level institutions have been established in India to undertake or support IWRM or aspects of IWRM. Brief presentations on these institutions were valuable to guide workshop discussions on the appropriate arrangements for IWRM implementation in different settings.

Maharashtra Water Resources Regulatory Authority

Dr Suresh Kulkarni (Maharashtra Water Resources Regulatory Authority) outlined water resources availability in, and allocation and demand scenarios for Maharashtra. The objectives of setting up of Maharashtra Water Resources Regulatory Authority are to regulate water resources within the state and facilitate and ensure judicious, equitable and sustainable management, allocation and utilization of water resources, in addition to fixing the rates for use of water for agriculture, industrial, drinking and other purposes and acting as the State Groundwater Authority. The key functions of the agency are:

- To determine criteria for bulk water tariff for various categories of users
- To determine the criteria for the distribution of entitlements by RBAs within each category of user after sectoral allocation is made by the government
- To determine the priority of equitable distribution of water available at water resource project, sub-basin and river basin levels during periods of scarcity
- To clear water resource projects as per the Governor’s directive for removal of regional imbalance in irrigation development
- To act as the appellate authority for dispute resolution relating to entitlement between Water User Entities (WUE) and RBA

The agency is successful in solving several water related issues in the state. There are still some challenges for the agency in the road ahead which include conversion of existing irrigation development corporations to river basin agencies, coping with increasing non-irrigation demands, establishing groundwater regulations, adoption of drip/sprinkler system for perennial crops in command area, controlling pollution of water-bodies, implementation of environmental flows in rivers.

Damodar Valley Corporation

Dipankar Chaudhary (Damodar Valley Corporation) described the activities of the Damodar Valley Corporation, the challenges faced by the agency and strategies to tackle these challenges. The Corporation was formed in the year 1948 by the act of constituent assembly of government of India. The functions of the corporation include promotion and operation of schemes for:

- Irrigation, water supply and drainage
- Generation, transmission and distribution of electric energy—both hydro-electrical and thermal
- Flood control in Damodar River and its tributaries and the channels excavated by the Corporation in connection with the scheme and for the improvement of flow conditions in Hooghly river

The Corporation also works in the promotion and control of navigation in Damodar River and its
tributaries, and for the promotion of public health and agricultural, and for industrial, economic development in the Damodar valley and its area of operation. The major issues faced by the Corporation include land acquisition, rehabilitation and resettlement, flood operation, environmental impact, capital sharing, erosion and sedimentation, sharing of water, and lack of pro-active participation of stakeholders. Mr Chaudhary outlined the strategies to combat these issues.

**Narmada Control Authority**

Mukesh Chauhan described the Narmada Control Authority and explained how the Authority encourages IWRM at the basin level. The Authority scientifically assessed and accounted utilizable flows in Narmada and it has defined guidelines for distribution of water by the riparian states to utilize their share of water. The Authority has a mechanism to redress institutional differences and encourages inter-basin transfer to mitigate drought problems, and has established advanced real-time data acquisition system for the basin.

**Tungabhadra Board**

Mr D Ranga Reddy (Tungabhadra Board) outlined the functions of Tungabhadra Board, in particular with respect to the regulation of supplies of water to the states of Andhra Pradesh and Karnataka. The Board is responsible for maintenance of the dam and reservoir under the project, common to both the states (right half of the dam and 33 spillway gates), regulation and monitoring of power from the three powerhouses on the right side, and maintenance of the common portion of the two interstate canals – Right Bank High Level Canal and Right Bank Low Level Canal including common distributaries. He also described some of the water issues in the basin like siltation, weed growth, unauthorized withdrawals, increasing demand for water for Industries, wastage of water in paddy cultivation, effects of newly constructed projects on upstream, and presented an overview of how the Board is tackling these issues.

**Data and Tools for IWRM in India**

**Water Data**

Yogesh Paithankar (Director, Central Water Commission) described the efforts of the Government of India in developing a water database across central and state agencies and gave a historical perspective of India-WRIS (Water Resources Information System). India-WRIS is a web-enabled water resources information system developed jointly by the Central Water Commission and the National Remote Sensing Centre of the Indian Space Research Organization. The goal of India-WRIS is to provide a ‘single window’ solution to water resources and related data across India in a standardized GIS format and in a national framework that supports water resource assessment and monitoring, and water resources planning and development. India-WRIS is intended to provide a foundation for advanced water modelling by government and non-government organizations.

India-WRIS should evolve to become a spatial Decision Support System for IWRM implementation. This involves three stages:

- Designing a common framework of water resources data along with ancillary data to be used by all stakeholders for water related issues
- Undertaking studies on watershed, river basin or state level using detailed data, customized application studies and applying models for problem solutions
- Automation of data collection and data management, as well as real or near real-time analysis and forecasting

The first stage is largely complete. The second and third stages will be the responsibility of the proposed National Water Informatics Centre, guided by consultation with key stakeholders.
Environmental and Socio-Economic Data

Professor Vinod Tare (IIT Kanpur) stressed the importance of data to support environmental flow determinations and river health assessments. Data collection is expensive and takes time, and while effort should be invested in data collection, this should not delay action. For example, water quality improvement can be progressed through improved management of wastewater and non-point source pollution, prior to comprehensive data collection and analysis. Scenario assessments of river condition can guide development of river monitoring protocols by appropriate government agencies. Additionally, the community should be empowered to also gather data.

Decision Support Systems

Dr RP Pandey (Scientist F, National Institute of Hydrology) described the decision support system (DSS-P) developed to support water resources planning. A DSS is a computer based system that integrates tools and databases to assist decision makers in assessing options and making informed decisions. DSS-P is designed to support: (i) surface water planning, (ii) integrated reservoir operation, (iii) conjunctive surface and ground water planning, (iv) drought monitoring, assessment and management, and (v) management of surface and ground water quality.

DSS-P dividing a river basin into a number of sub-basins based on the location of hydraulic structures and the hydrological network. A hydrological model (NAM) is calibrated for each sub-basin to estimate the hydrological components (evaporation, rainfall recharge, overland flow, interflow and base flow). An allocation model (MIKE Basin) is used to allocate the available surface water and groundwater. DSS-P integrates surface water and groundwater modelling, and can be used to process and analyze spatial data GIS and time series data, and to publish information and model applications for long-term/short-term scenario planning.

Hydrologic Modelling

Professor Ashvin Gosain (IIT Delhi) described the existence of parallel programs for watershed management, rainwater harvesting, urban and industrial development etc., with no consideration of environmental demands and no mechanism for trade-offs between competing demands. This approach can compromise the sustainability of water resources, which requires maintaining the hydrological and environmental health of the river basin.

Basin-level IWRM is the scientific approach to address these issues, as a river basin is a natural system where water balance can be described and the impacts of man-made interventions interferences can be quantified. It is crucial to develop IWRM plans considering resource availability (temporal and spatial), present and future demands, efficiencies of projects, environmental status, developmental pathways (with and without climate change aspect), and information formulation and sharing. All these aspects require scientific knowledge, and the associated actions require the use of specific models.

Dr. Gosain presented an overview of the modelling activities undertaken by IIT Delhi, specifically India’s National Communications (NATCOM) to the UN Framework Convention on Climate Change, and the Ganga River Basin Management Plan. The outputs from these studies include water balance assessments at different spatial and temporal scales, and assessments of the changes in magnitude and frequency of floods, the severity of droughts, changes in flow patterns, and changes in groundwater recharge.

World Bank Support for IWRM in India

Bill Young (Lead Water Resources Specialist, World Bank) outlined the key water resource related issues in India and the challenges for implementation of IWRM projects. He described the increasing trend in relative water scarcity with high climate and spatial
variability in India. Water is critical for livelihoods (water supply, sanitation, food security) but water use efficiency and productivity are generally very low with high water demands across all sectors. There is a need to solve sanitation related issues which cause major health concerns. Indian rivers are polluted and over-abstraction in common during lean season. There is a need for irrigation development and management to meet growing food demands.

Groundwater sources are increasingly polluted and are being depleted due to over-exploitation. Water storage capacity in India is at very low levels by world standards. Frequent floods impose high economic and social costs, exacerbated by the impact of climate change. Trans-boundary water management is a key challenge for India.

There is a safety concern from the construction of huge dams. Cooperative and river basin planning and management approaches are crucial to address growing water related challenges in India. If the water resource management challenges are not met, water will increasingly be a limiting factor to growth and poverty reduction.

Dr Young highlighted the challenges faced by India in the implementation of IWRM. He emphasized the need for an integrated management framework that facilitates cross-sectoral planning, development and management across competing uses. The existing legal and regulatory frameworks need to be updated. New water institutions need to be established and the existing ones need to be strengthened. He also commented that the multi-lateral and multi-state basin management mechanisms require addressing major regional and trans-boundary water management challenges. Single and multipurpose water development priorities need to be planned and developed in an integrated, equitable and sustainable manner. The major IWRM-related projects supported by the World Bank in India were presented with a focus on the lessons learned.

The World Bank supports various aspects of IWRM including infrastructure investments and reforms. The Bank is supporting some major national initiatives as well as various state level initiatives that could be extended to other priority states; state-level support is focused in low-income states.

Priorities for IWRM success in India were indicated to include:

- Develop the information base to support evidence-based planning and management
- Bring about legislative reforms to empower river basin organizations and establish an appropriate water entitlement system
- Incentivize water use efficiency in all sectors
- Shift focus from flood prevention to improved flood forecasting and warnings, and floodplain zoning
- Consider regional scale climate change risks to water resources and build system resilience
- Bring about institutional reforms that facilitate water user and other stakeholder engagement and stimulate private sector investment

Asian Development Bank Support for IWRM in India

Arnaud Cauchois (Senior Water Resources Specialist, Asian Development Bank) outlined the core concept of IWRM and the Asian Development Bank’s support to IWRM in Odisha and Kamataka. Mr Cauchois described the IWRM as a process rather than a plan. A process that need to bring stakeholders together to increase water security in river basins through win win solutions that are locally appropriate and that generate a triple bottom line of economic, social and environmental benefits. Mr Cauchois further described the process by presenting the IWRM spiral model that was developed by NARBO and UNESCO IHE with ADB supports. In India, ADB is supporting the Odisha Integrated Irrigated Agriculture and Water Management Investment Program in the Baitarani River Basin. It is supporting programs on sustainable and increased irrigated productivity and institutional strengthening including IWRM for the entire Odisha with piloting in Baitarani river basin. Mr Cauchois presented the challenges in implementing IWRM in
the Baitarani basin and summarized critical lessons including (i) requirement to build the capacity of a dedicated team and not to rely only on one champion to drive the process, (ii) secure public participation and ownership through the preparation and implementation of communication and participation plans and (iii) prepare IWRM road map to guide the IWRM process but use them as guiding framework only, allowing changes to adapt to the evolution of the local context.

Clive Lyle (Consultant, Asian Development Bank) described ADB’s support to the Integrated and Sustainable Water Resources Management Investment Program in Karnataka, India. Water scarcity and quality in Upper Tungabhadra Basin are affecting economic development and the environment adversely. Water related issues are getting worse with the accelerating industrialization in the region. There is a need to adopt a river basin approach for water resources management to avoid hydrologically ‘closed’ river basins. The need of the hour is to accelerate transition from irrigation management to water resources management in this basin. The positive aspect related to the program is that Government of Karnataka demonstrates strong commitment to IWRM concepts and approach, and improving water management for food security and sustained economic growth.

The IWRM roadmap includes four themes, namely institutions and policies for IWRM, Integrated River Basin Management, inter-sector water sharing, and IWRM based irrigation management, with supporting themes - data, Information, and knowledge management and stakeholder involvement. This is a state-wide program with Upper Tungabhadra (K-8) sub-basin as the pilot basin for demonstrating IWRM, with potential replication to other basins. The expected outputs of this project are: (i) IWRM and river basin management knowledge and capacity building, (ii) modernization of the irrigation system infrastructure and management, and (iii) development of a dedicated system for implementation and management involving various committees such as an inter-agency IWRM steering committees, program coordination committees, executing agencies with expert team (national and international) for IWRM implementation.
Informed by the presentations on the current situation and initiatives in India and on international experience, workshop participants worked in break-out groups to discuss and arrive at recommendations on three key aspects of IWRM implementation: (i) institutions and legal framework, (ii) inter-sectoral water allocation, and (iii) potential new projects and investments. The recommendations are summarized below.

**Institutions and Legal Framework**

The break-out group on institutions and legal framework discussed the draft National IWRM Guidelines and the draft River Basin Management Act. A summary of the key points discussed and the recommendations from this group on these aspects are listed in the sections below.

**Draft National IWRM Guidelines**

- The draft guidelines provide a useful overview of IWRM principles and the importance of an IWRM approach for India. However, much of the material in the guidelines is very generic, not procedural and unlikely to be directly useful in practice. Additionally, the draft guidelines are biased towards an investment project perspective and shy away from the critical issue of institutional reforms to enable a best practice river basin approach to be adopted.
- Without new legislation in place, establishing appropriate institutional arrangements will be difficult and thus the guidelines are unlikely to be effective in addressing the fundamental problems of resource allocation in the face of competing demands. Critical to this will be to formalize access rights/entitlements (on a percentage share basis) so these can be re-allocated when necessary. This should be recognized under the “Important Conditions” section of the Guidelines.
- It is not fully clear for the guidelines are intended for. State governments are a key audience, but much of the document is more relevant for central government, while parts appear more for local authorities and other stakeholders/actors.
The document would be much strengthened by clarifying the audience and the different roles and responsibilities of different agencies and organizations for aspects of IWRM.

The guidelines describe some very important specific institutional reforms, but as this is a non-binding document there is nothing to ensure these reforms occur. The guidelines indicate that decisions of water regulatory authorities should be subject to judicial review. However, faster and more evidence based review/audit/dispute resolution mechanisms are required than those provided by the judiciary.

India should consider a more specific roadmap for water reform that would become a formal, binding agreement between state and central governments with a clear implementation timetable. This could be national or could be approached basin by basin. Potential components of such a roadmap include:

- The required legislative reforms at central and state levels and the required institutional reforms indicating appropriate roles and responsibilities

  - a nationally consistent water access entitlement framework, wherein entitlements are perpetual or open-ended shares of the consumptive pool of a specified water resource, as determined by the relevant river basin or water resources plan
  - a nationally consistent framework for preparing statutory river basin or water resources plans
  - a nationally consistent approach for including agreed environmental and other public benefit outcomes into river basin or water resources plans
  - a best practice framework for water pricing and institutions for regulation of pricing
  - a national framework, process and supporting systems for robust measurement, monitoring and reporting of the status of water resources and their use for various purposes including public benefit outcomes
  - a prioritized national program of water R&D to inform the ongoing reform process

**Draft River Basin Management Act**

- **Water access rights:** to ‘stabilize’ the water allocation and management system, the current informal access rights should be formalized. Movement of access rights deemed necessary to achieve a more sustainable balance could be achieved via compensation by central government or transfer of access rights through market mechanisms. The legislation should establish a water rights system; more work is required on this aspect.

- **Roles and responsibilities:** there is an important advisory function for diverse stakeholders, but this should be separated from the formal policy making function. The size and membership of the governing/decision making body should be limited; the currently proposed model would be unwieldy in practice. A separate advisory body with representatives of relevant interest groups should be constituted for each basin. As it is critical to engage with and get input from stakeholders at multiple levels in a well-structured manner, a three-tier system (NGOs/local stakeholders, administrative/bureaucratic level and political level) may be considered.

- **Dispute resolution:** tusing as a fall back, the dispute resolution mechanism in the Inter State River Water Disputes Act is undesirable as this is too slow and risks being ill-informed on complex technical matters. An alternative is required, possibly a referral process to an independent expert third party.

**Inter-Sectoral Water Allocation**

The break-out group arrived at the following ten action points to improve inter-sectoral water allocation:

- Identify and quantify the different sources water (surface water, groundwater, rainwater, recycled water) and different water uses through a comprehensive water accounting framework. Improved tools are needed for water resource
assessments and water resource scenario analyses.

- Examine the legal basis for the ownership of water or water access rights, and consider mechanisms for trade in water access rights.
- Examine the practicality on how to allocate water using market mechanisms. “Water-trading” may be a useful mechanism for re-allocation of water.
- Assess current and potential future variability in water availability, and assess options for better management of variability through the construction of more storage.
- Include water quality assessments in supply-demand analyses, given the different water quality requirements for different water uses.
- Establish an appropriate priority order for different water uses to guide water allocation, keeping in mind relevant aspects of the water-land-energy-food nexus, and considering how relative priorities should change according to within and between year changes in water availability.
- Assess likely future water demands by sector. Greater attention on demand management is required, including via establishing incentives for improving water use efficiency.
- Estimate environmental water requirement for each river basin. This is a key responsibility of IWRM institutions to ensure the sustainability of the resource base.
- Examine how to best maximize demand and supply of water. Technical tools and processes may play an important role here.
- Estimate water allocation for various sectors. Currently water is allocated to each state according to Interstate Agreements, Interstate Water Dispute Tribunal awards or via informal cooperative agreement between co-basin state governments. Each state then decides how to allocate water across various sectors. This should transition to basin-wide process of allocating to various sectors through an empowered river basin organization.

Potential Projects and Investments

The break-out group discussed the types of IWRM projects and investments that should be developed, both for funding by from government budgets and through multi-lateral development bank financing. The key types of IWRM projects and investments identified were:

Data, Modelling and Analysis

- Further investments are required in water data collection (including of water use), establishment and management of open data systems, and modelling and analysis for water resources assessment, planning and management.
- Hydro-economic analysis should be undertaken to guide all project preparation to ensure the best economic use is made of the scarce water resource within the constraints of environmental sustainability and social equity.
• Performance evaluations should be undertaken of existing projects to guide the design of all new projects.

Institutions And Capacity
• Investment is required to establish appropriate new institutions such as river basin organizations or regulatory authorities. There is no “one size fits all” but there are key functions to be fulfilled at basin level including water resource assessments and accounting, inter-sectoral water allocation planning and management, operational management of reservoir systems, and coordinated flood forecasting and response.
• Enhanced professional capacity building will be critical for IWRM implementation, especially for officers of river basin organizations and water regulatory authorities. Capacity building is required both to enhance the basic skills of professionals in both government and non-government organizations.

Environmental Sustainability
• Assessments of ecological water requirements should be undertaken for all river basins and these should be included in the sectoral allocation of water.
• Improved sediment management both in catchments and in rivers is required, both for river health and for protection of water infrastructure.

Infrastructure and Technology
• Additional work on irrigation system modernization is required, including more widespread use of instrumentation for monitoring and control.
• An assessment should be made of the opportunities for economically viable new water storages.
• Greater investment should be made into flood forecasting and early warning systems using new instrumentation (including rainfall radars), improvements in modelling including use of newly available remotely sensed data products, and enhanced communications systems and processes for efficient and effective dissemination of early warnings.

Management Approaches
• All infrastructure projects should have a greater emphasis on operations and maintenance, to progress beyond the common cycle of build-neglect-restore.
• Greater attention should be given to demand-side management to improve water use efficiency; this will require innovation in incentives and stronger regulation.
• There should be a shift away from a subsidy-driven approach to a market-driven approach. This will assist in increasing water use efficiency as well as improving water resource system resilience.
In the closing session of the workshop the co-conveners sought to draw together key themes and key messages that emerged from the presentations and discussions, in ways consistent with the more specific recommendations captured above.

**World Bank (Bill Young).** Key issues to progress IWRM include: (i) a greater focus on demand-side management rather than supply augmentation is required, (ii) environment water needs should be assessed and considered in the balancing of multiple water demands in all river basins, (iii) legislative reform should be accelerated to enable establishment of stronger institutional mechanisms for IWRM, and (iv) water is everyone’s business, so all stakeholders should be engaged in a participatory approach to IWRM. The draft National IWRM guidelines while will require further refinement to be useful to states for IWRM implementation, and in the absence of the recommended legislative reform, IWRM implementation in line with the guidelines is unlikely to progress well.

**Asian Development Bank (Arnaud Cauchois).** Three key opportunities to progress IWRM: (i) capacity building and training and necessary reform to allow retaining highly specialized trained staff in the job positions or institutions for which they have been trained, (ii) increased public awareness on the water governance problems to foster a constituency for change and politicians interest with IWRM/RBWRM reforms, and (iii) greater attention to irrigation demand management to facilitate trade-offs between agriculture and other sectors.

**Ministry of Water Resources, River Development and Ganga Rejuvenation (Dr Amita Prasad and Mr Sunil Kohli).** The time for action is now and we must “act fast”. Water stakeholders are multifaceted, and water is not a monolithic sector. There is need for a focused inter-sectoral, multi-disciplinary and consultative approach for the success of IWRM. Strengthening the institutional arrangements and proper inter-sectoral water allocation are critical for the success of IWRM. “Development” is strongly associated with IWRM and this should engage all stakeholders. Relevant Ministries should act to accelerate progress. Clear plans and associated actions are required to ensure adequate water is available to all sectors.

Different agencies give different values for the number of river basins in India. Consensus is needed based on agreed delineation of river basins. States should work harder to resolve inter-state water disputes because engineering solutions are insufficient. Future IWRM projects should include data management and information generation, in addition to human resources management. Producing quality data and verification of existing data will be crucial.
National Workshop on Integrated Water Resources Management
Shangri-La Hotel, New Delhi, 2–3 February, 2015

**DAY 1: February 2, 2015**

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<td>09:00 – 09:30</td>
<td>Arrival and Registration</td>
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<tr>
<td>09:30 – 09:35</td>
<td>Welcome and Introduction – Dr. Bill Young World Bank</td>
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<td>09:35 – 09:45</td>
<td>Opening Remarks &amp; Workshop Objectives – Shri A B Pandya, Chairman, CWC</td>
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<td>09:45 – 09:50</td>
<td>Opening Remarks – Shri Sunil Kumar Kohli, Joint Secretary &amp; Financial Advisor, MoWR, RD &amp; GR</td>
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<td>09:50 – 10:00</td>
<td>Opening Remarks – Shri Bhaskar Das Gupta, Department of Economic Affairs, Ministry of Finance</td>
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<td>10:00 – 10:30</td>
<td>Opportunities for Integrated Water Resources Management in India – Professor Y.K. Alagh (Former-Member, Planning Commission)</td>
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<td>10:30 – 11:00</td>
<td>Group Photo Session &amp; Tea Break</td>
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**Session 2: IWRM – International and Regional Experiences**

**Chair: William Young, World Bank**

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<thead>
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<th>Time</th>
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<tr>
<td>11:00 – 11:30</td>
<td>Murray Darling Basin Experience – Don Blackmore, Australia</td>
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<td>11:30 – 12:00</td>
<td>Integrating water quality management into river basin management – Fritz Holzwarth, Germany</td>
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<td>12:00 – 12:30</td>
<td>IWRM Implementation and Capacity Development of River Basin Organization: The Case of Brantas River Basin, Indonesia – Tjoek W Subijanto, Indonesia</td>
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<td>12:30 – 13:00</td>
<td>Institutional Experiences in RBOs Across Asia – Dr Keizrul bin Abdullah, Chairman NARBO</td>
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<td>13:00 – 14:00</td>
<td>Lunch Break</td>
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**Session 3: IWRM – Initiatives in India**

**Chair: Shri A B Pandya, Chairman, CWC**

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<th>Time</th>
<th>Topic</th>
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<tr>
<td>14:00 – 14:20</td>
<td>World Bank IWRM Initiatives in India – Dr William Young, World Bank</td>
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<td>14:20 – 14:40</td>
<td>ADB IWRM Projects (South &amp; South East Asia) – Arnaud Cauchois and Clive Lyle, Asian Development Bank</td>
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<td>Time</td>
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<td>14:40 – 15:00</td>
<td>National IWRM Guidelines Shri A B Pandya, Chairman, CWC</td>
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<td>15:00 – 15:30</td>
<td>Questions and Facilitated Discussion</td>
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<td>15:30 – 16:00</td>
<td>Tea Break</td>
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**Session 4 Enabling Environment for IWRM**

**Chair:** Shri MA Chitale, Former Secretary, MoWR; **Co-Chair:** Shri AD Mohile, Former Chairman, CWC

**Rapporteurs:** Shri Rishi Srivastava, CWC & Shri Kiran Pramanik, CWC

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<th>Time</th>
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<tr>
<td>16:00 – 16:15</td>
<td>Proposed Institutional and Legislative Reforms with special emphasis on proposed River Basin Management Act Shri M Gopalakrishnan</td>
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<tr>
<td>16:45 – 17:45</td>
<td>Panel Discussion: Enabling Environment for IWRM • Tjoek W Subijanto, Indonesia • Shri Alok Sikka, Deputy Director General, National Rainfed Area Authority</td>
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18:00 – 20:00 Cocktails and Dinner

**DAY 2: February 3, 2015**

**Session 5 Data, Information And Modelling**

**Chair:** Shri AB Pandya, Chairman, CWC; **Co-Chair:** Don Blackmore

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<tr>
<td>09:00 – 09:30</td>
<td>Present/future state of Water Data in India Shri Yogesh Paithankar, Director, CWC</td>
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<tr>
<td>09:45 – 10:00</td>
<td>Environmental and Socio-economic Data for Water Resources Management Prof Tare, IIT Kanpur</td>
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<td>10:00 – 10:15</td>
<td>Decision Support Systems for IWRM Dr R P Pandey, NIH, Roorkee</td>
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<td>10:15 – 10:30</td>
<td>Hydrological Modelling in India Prof A K Gosain, IIT Delhi</td>
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<td>10:30 – 11:00</td>
<td>Environmental Flows in an IWRM Context Dr Mike Acreman, CEH, UK</td>
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<td>11:00-11:30</td>
<td>Tea Break</td>
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**Session 6 Institutions And Projects**

**Chair: Mr. Fritz Holzwarth, Germany**

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<th>Time</th>
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<tr>
<td>11:30 – 11:50</td>
<td>Maharashtra Water Resources Regulatory Authority, Dr Suresh Kulkarni</td>
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<td>11:50 – 12:10</td>
<td>Damodar Valley Corporation (DVC), Shri Dipankar Chaudhary</td>
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<td>12:10 – 12:30</td>
<td>Narmada Control Authority, Shri Mukesh Chauhan</td>
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<td>12:30 – 12:50</td>
<td>Tungabhadra Board, Dr S K Srivastava</td>
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<td>12:50 – 13:20</td>
<td>Discussion and conclusion by Chair</td>
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<td>13:20 – 14:20</td>
<td>Lunch Break</td>
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<td>Session 7</td>
<td>Panel-Led Discussions In Break-Out Groups</td>
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| 14:20 – 16:00 | **Group 1: Institutions and Legal Framework**  
Chair: Shri MA Chitale, Former Secretary, MoWR; Co-Chair:  
Rapporteurs: Shri Rishi Srivastava, CWC & Shri Sanjiv Kumar, CWC  
- Tjoek W Subijanto, Indonesia  
- Fritz Holzwarth, Germany |
| 16:00 – 16:30 | **Group 2: Inter-Sectoral Water Allocation**  
Chair: Shri A D Mohile, Former Chairman, CWC  
Rapporteurs: Shri B.C. Vishwakarma, CWC & Shri S.K. Suman, CWC  
- Shri Alok Sikka, Deputy Director General, National Rainfed Area Authority  
- Dr Sanjay Bajpai, Department of Science and Technology  
- Dr Keizrul bin Abdullah, NARBO  
- Dr Mike Acreman, United Kingdom |
| 16:30 – 16:45 | Presentation by Group 1 – Institutions and Legal Framework |
| 16:45 – 17:00 | Presentation by Group 2 – Inter-sectoral Water Allocation |
| 17:00 – 17:15 | Presentation by Group 3 – Future Projects and Initiatives |
| 17:15 – 17:45 | Discussion and Remarks  
- Dr Amita Prasad, Joint Secretary, MoWR, RD & GR  
- Shri Sunil Kumar Kohli, Joint Secretary & Financial Advisor, MoWR, RD & GR  
- Dr Bill Young, World Bank  
- Arnaud Cauchois, Asian Development Bank  
- Shri A B Pandya, Chairman, CWC |
| 17:45 – 18:00 | Vote of Thanks – Shri. R.K. Jain, Chief Engineer, CWC |
| | **Session 9**  
**Way Forward**  
16:30 – 16:45 Presentation by Group 1 – Institutions and Legal Framework  
16:45 – 17:00 Presentation by Group 2 – Inter-sectoral Water Allocation  
17:00 – 17:15 Presentation by Group 3 – Future Projects and Initiatives  
17:15 – 17:45 Discussion and Remarks  
- Dr Amita Prasad, Joint Secretary, MoWR, RD & GR  
- Shri Sunil Kumar Kohli, Joint Secretary & Financial Advisor, MoWR, RD & GR  
- Dr Bill Young, World Bank  
- Arnaud Cauchois, Asian Development Bank  
- Shri A B Pandya, Chairman, CWC  
17:45 – 18:00 Vote of Thanks – Shri. R.K. Jain, Chief Engineer, CWC |
Annex B: Workshop Participants

Government of India [62]


Betwa River Board [1]: MC Tyagi
Central Groundwater Board [3]: YB Kaushik, Sanjay Maunblu, Upendra Srivastav
Central Water & Power Research Station [2]: Selva Balan, C Ramesh
Narmada Control Authority [1]: Mukesh Chauhan
National Institute of Hydrology [1]: RP Pandey
National Water Academy [1]: Sunil Kumar
Sardar Sarovar Construction Advisory Committee [1]: Sushil Kumar
Tungabhadra Board [2]: D Ranga Reddy, SK Srivastava
Upper Yamuna River Board [1]: HK Sahu

Ministry of Finance, Department of Economic Affairs [1]: Bhaskar Dasgupta
Ministry of Agriculture [4]: Dharmendra Gupta, RAS Patel, Yogesh A Raundal, BVN Rao
Ministry of Development of the North Eastern Region [2]: Trilochan Barua, Mercy Epao
Ministry of Science and Technology [2]: Sanjay Bajpai, Neeuma Alun
Ministry of Power, Damodar Valley Corporation [2]: Dipankar Choudhary, SB Pandey
Ministry of Rural Development [1]: Mukesh
Ministry of Shipping, Inland Waterways Authority of India [1]: Surendra Singh

State Governments [13]

Assam Department of Water Resources [1]: Ananta Kumar Barwah
Bihar Department of Water Resources [1]: Uday Kumar
Goa Department of Water Resources [3]: Agmlo Dias, Jagadish S Hosamani, Maruti Rane
Haryana Department of Irrigation & Water Resources [2]: Rajeev Bansal, Visender Singh Rawat
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Maharashtra Department of Water Resources [1]: Malini Shankar
New Delhi Department of Irrigation and Flood Control [2]: VK Jain, Mukesh Kumar
Punjab, Bhakra Beas Management Board [3]: Anil Dhawan, Anil Vyas, GS Wasson

Academic/Research Institutions & International Organizations [8]
Central University, Gujarat [1]: YK Alagh
Commonwealth Scientific and Industrial Research Organisation (Australia) [1]: Amit Parashar
IEC College of Engineering and Technology [1]: Rablee Gupta
Indian Institute of Technology, Delhi [1]: Professor A Gosain
Indian Institute of Technology, Kanpur [1]: Professor Vinod Tare
Indian Institute of Technology, Roorkee [1]: NK Goel
International Commission on Irrigation & Drainage [2]: M Gopala Krishna, Vijay Labhsetwar

Multilateral Development Banks [11]
Asian Development Bank [3]: Arnaud Cauchois, C Lyle, HK Verma
World Bank Group [8]: Anju Gaur, Rafik Hirji, Annelieke Laninga, Shankar Narayan, Satya Priya, C Rajagopal A Sen, Singh, William Young

INTERNATIONAL EXPERTS [5]
Keizrul Bin Abdullah, Chairman, NARBO – Network of Asian River Basin Organizations
Mike Acreman, Science Area Lead (Natural Capital), Centre for Ecology and Hydrology, UNITED KINGDOM
Don Blackmore, Former CEO, Murray-Darling Basin Commission, AUSTRALIA
Fritz Holzwarth, Former President of the International Commission for the Protection of the Rhine, Former President of the International Commission for the Protection of the Danube River
Tjoek Walujo Subijanto, Former President Director, JASA TIRTA I Public Corporation, INDONESIA
Group Photograph of all participants