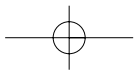
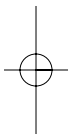
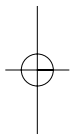
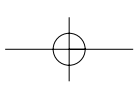
CHARTING A NEW COURSE

A Strategy for Sustainable Management of
India's Water Resources in the 21st Century









CHARTING A NEW COURSE

A Strategy for Sustainable Management of India's Water Resources in the 21st Century

G N Kathpalia
Rakesh Kapoor

Alternative **Futures**

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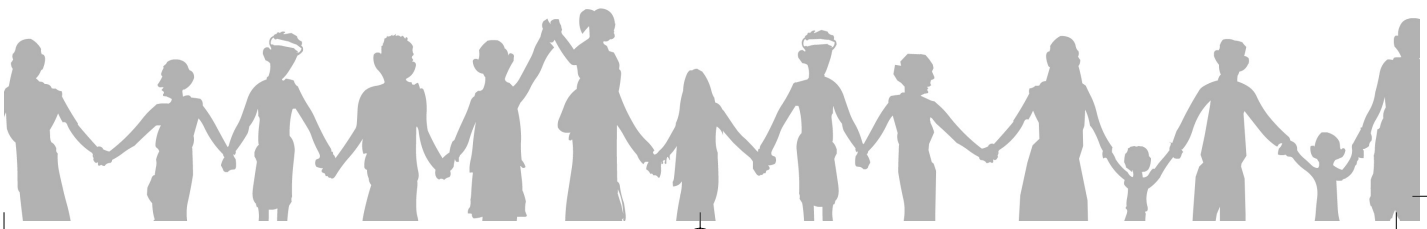

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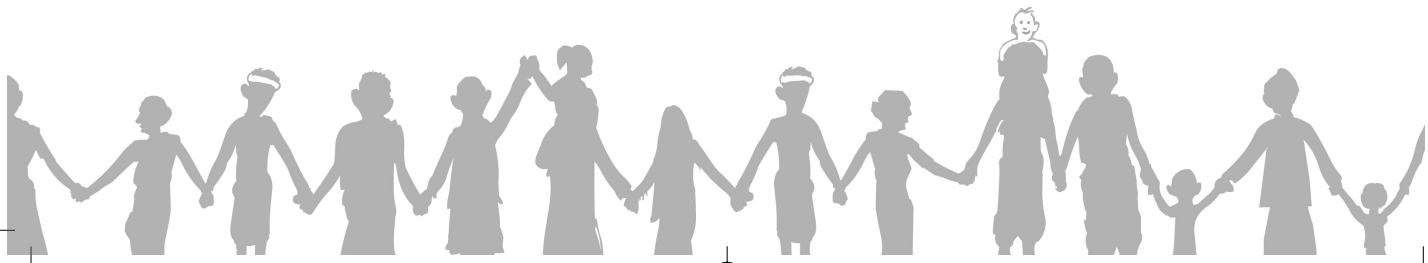

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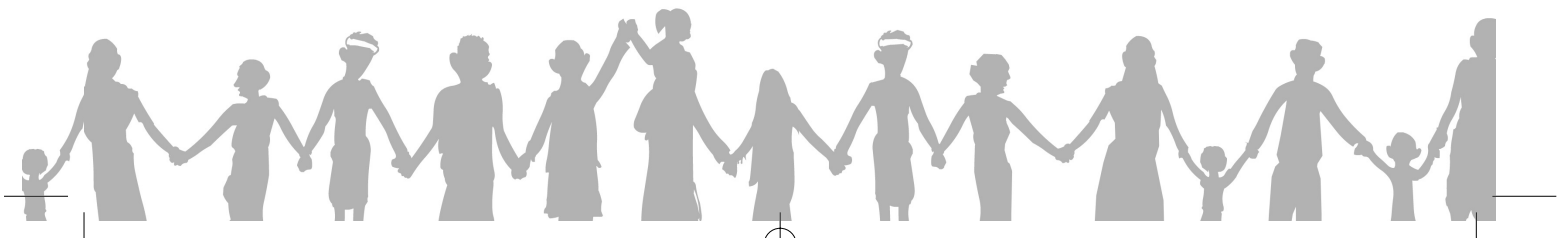


Alternative **Futures**

Alternative Futures is a development research and communication group working on creative and meaningful alternatives, policy, social and technological innovations for development. Alternative Futures is inspired by the vision of a society based on the principles of ecological sustainability, social justice, spirituality and cultural pluralism. AF looks at change in a holistic manner, even while working on various specialized issues. It seeks to support and strengthen innovative efforts for sustainable development and social and personal transformation. AF believes that there is a need to expand the community of willing change-makers in order to move towards an alternative future that is more humane, just and sustainable. AF seeks to encourage social and policy innovations, civil society initiatives and democratic, transparent and accountable governance. Activities undertaken by the group include policy and field research, documentation of initiatives and innovations for development/social transformation, monitoring and evaluation studies and support to innovative voluntary efforts and capacity-building initiatives.

A Note for Readers

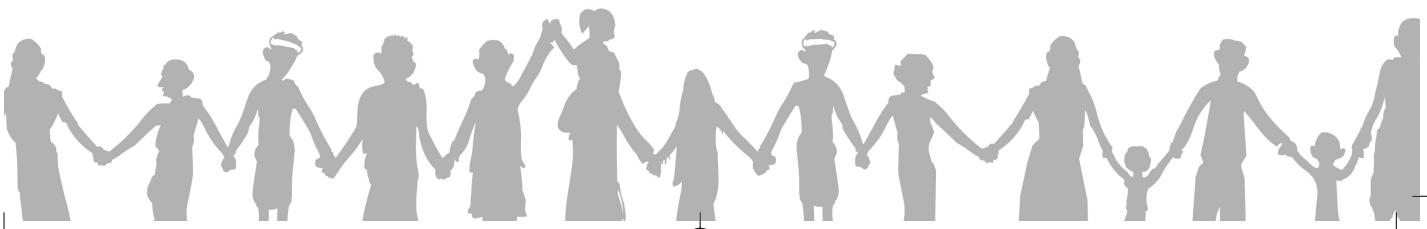
While the crisis of water and the coming conflicts over it are a common concern today, and there is much discussion on the management of water resources in India, there is little in terms of clear suggestions for strategic changes required for the future. Our purpose is to put forward some key policy and managerial changes required for a more efficient, optimum as well as environmentally sound and sustainable management of water resources in India.

The discussion and debate in India on water resources is unfortunately characterised by extreme positions taken by the so-called activist, 'pro-environment' groups on the one hand and the 'pro-development' engineers, government officials and others on the other. We have attempted to go beyond these extreme positions to put forward a balanced perspective including specific and pragmatic strategy and policy measures for the future. We hope that the balanced position taken here and the practical measures suggested for the future will help in building a consensus on the management of our water resources for the future.

We hope that the alternative integrated water resources management (IWRM) strategy put forward by us will generate debate and discussion among policy makers, engineers, administrators, other professionals, NGOs and communities involved in the management of water resources. In particular, we hope that the strategy and action plan put forward by us will be of some use in the formulation of the operational Action Plans by the States to move towards a sustainable system of management of water resources in the 21st century.

We welcome comments from all concerned to make this strategy and action plan even more responsive to the demands of optimum utilisation and sustainable management of water resources for a prosperous and ecologically sustainable India in the 21st century.

G.N. Kathpalia
Rakesh Kapoor



Preface

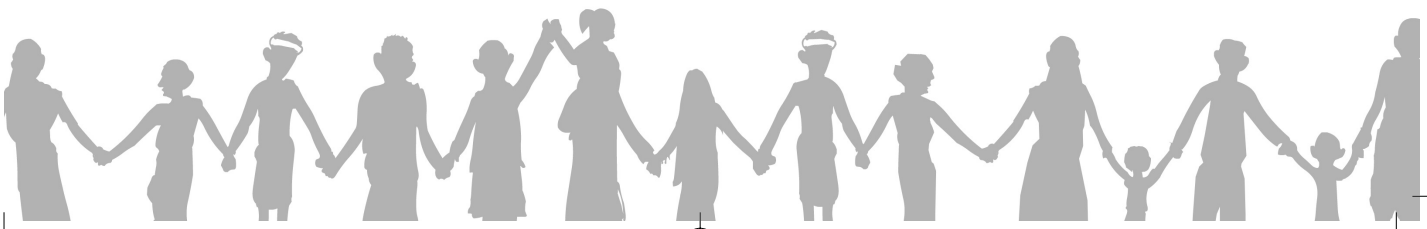
One of the biggest challenges for India in the 21st century is going to be environmental governance—the sustainable management and optimum utilisation of its land, water and forests for the long term economic welfare and social justice for the billion plus population. We are blessed with adequate water resources and despite the huge population we are not as yet a "water-scarce" or a "water-stressed" country. (Water stress is defined as a condition of water availability of less than 1700 cum per capita per annum, while water scarcity is defined as a condition of water availability of less than 1000 cum per capita per annum.) But with a burgeoning population, greater economic activities and more consumptive lifestyles, we may become water-stressed (with water availability of less than 1700 cum per capita per annum) within a decade or so.

The water policy followed by the Indian government since independence has not adopted an integrated and comprehensive approach to dealing with the management of our water resources. Instead, the water policy and management systems have adopted piecemeal solutions from time to time depending upon needs recognised in the short run, and with many different departments involved in the management of different aspects of water resources, each going its own way. The river-linking plan has to be seen in the same light. Therefore, there is a need, first of all, to evolve an integrated and comprehensive water policy and management strategy, that takes all kinds of resources into account, attempts to work out realistically all kinds of demands in the future, and then suggests a way to plan for matching availability with realistic demand in a comprehensive way.

This is what we attempt to do in this paper. The voluminous discussions on the management of water resources in India as well as the talk about integrated water resources management (IWRM) are lacking in terms of clear suggestions for strategic changes required for the future. *Our purpose is to present clearly and briefly the key policy and administrative changes required for a more efficient, optimum as well as environmentally sound and sustainable management of water resources in India.*

Our approach implies the following major paradigm shifts:

- From *irrigation focussed* water resources management to focus on *integrated* water resources management (IWRM) for multiple uses.



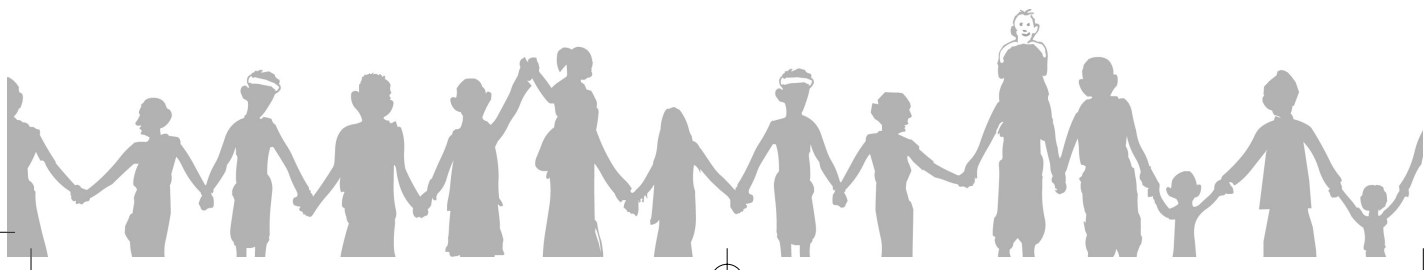
- From ad hoc utilisation of water resources to the optimum utilisation of water resources based on planning at the level of the river basin and based on accurate and transparently available information about the quantity and quality of water available.
- From centralised, government control to community-centred control and management of water resources, albeit with an appropriate regulatory framework and monitoring of the water usage.
- From a supply-focussed system involving the free and wasteful use of water to a demand-focussed system involving much more disciplined and efficient use of water, including recycling of water.
- From water as an abundant, carelessly used resource to water as a precious and scarce natural resource.
- From water as only a free public good to water also as an economic resource, valuable for economic and livelihood purposes too. So the differential pricing of water services has to balance between two objectives: the free availability of drinking water to all, especially in drought prone areas, and the generation of enough resources, to invest in the structures and their maintenance and operations for efficient water resources management.

In order to achieve the goals of sustainable management and optimum utilisation of our water resources in the 21st century, we have suggested some fundamental changes in the institutional structures at the macro and the micro levels.

At the *macro level* we have suggested the adoption of the river basin approach to the integrated planning and management of water resources, and a restructuring of the concerned government departments to enable them to manage water resources in an integrated manner. This approach involves the regulation of water resources and monitoring of the water use at multiple levels.

At the *micro level* we suggest the setting up of community organisations throughout the country—Watershed Management Associations (WMAs) in rainfed areas, Water Users Associations (WUAs) in irrigated areas, Joint Forest Management (JFM) committees in forest areas and Resident Welfare Associations (RWAs) in urban areas. These community organisations will be given the required authority and responsibility and will be the organisational mechanism through which people can be involved in the management of water resources. We have suggested a set of guidelines for the setting up and sustaining of these CBOs.

Whatever be the merit of these proposals, however, a mindset and attitudinal change on the part of policy-makers and government functionaries towards managing water sustainably and towards involving user communities in the tasks of water management is essential before these proposals can be implemented.



Summary
Key Elements of the IWRM Strategy and Recommendations for Action

STRUCTURAL-ORGANISATIONAL AND MANAGERIAL CHANGES

- Adopt the river basin approach to the integrated planning and management of water resources in order to enable the optimal utilisation of all the water available within a river basin in an integrated manner. The river basin approach implies regulation in terms of the allocation of water to different areas and the pricing of water for different uses. For this purpose, to begin with *public regulatory bodies at multiple levels* (the river basin; part river basin falling within a State; the watershed level; the sub-watershed level and the gram sabha at the lowest level) should be set up.

- Ultimately, set up *River Basin Organisations (RBOs) for each river basin* to carry out these regulatory functions. The RBOs will consist of (i) a representative river Basin Assembly representing all areas and sectoral interests falling within the area of the river basin, and (ii) a technical board advising the RBA on technical matters. *These should be set up first (in the next 5 years) for small river basins or part river basins (of larger rivers) starting with Area Water Partnerships (AWPs) at the sub-watershed level (10,000 ha) falling within States and subsequently (after 5 years) for the larger inter-State river basins. For inter-State rivers the RBOs can be set up jointly by the concerned States by agreement among themselves* (see **Chart 3** on RBOs). The RBOs will regulate: (i) the allocation of water to different areas within the river basin, at multiple levels, and (ii) the pricing of water for different uses. For these purposes authority will be delegated to the RBOs by the States. The RBOs will also play an advisory role with regard to some other aspects, such as advising farmers on crops to be grown in a particular area. [See sections 2.1 and 2.3 for details]

- Restructure the administrative set up for the planning and management of water resources *at the centre and in the States*, by bringing together the various disciplines dealing with water

resources management within an integrated structure. (The execution of various components of IWRM projects will be done by existing departments/agencies while the planning, coordination and monitoring will be done by the nodal agency.)

- Revamp the national water information system by building on sub-watershed level databases, covering both quantity and quality, through sharing of information from existing sources and data collection from 30,000 sites in next 5 years, increased from only 2000 at present.

CBOS FOR MANAGEMENT FUNCTIONS AT THE LOCAL LEVEL BY THE PEOPLE

- Set up community based organisations (CBOs) throughout the country for water management functions at the local or micro level to be carried out by the people. These CBOs will include:
  - Watershed Management Associations (WMAs) in rainfed areas
  - Water Users Associations (WUAs) in irrigated areas
  - Joint Forest Management (JFM) committees in forest areas, and
  - Resident Welfare Associations (RWAs) in urban areas

  A total of approximately *7 lakh CBOs need to be set up to cover the whole population* [See **Table 3**]. The CBOs should have a legal status and should be recognised fully by the concerned administrative authorities.

- *Give the community the first right to use rainfall directly, store and recharge groundwater wherever possible, within the allocation of water made to them by the regulatory body or the RBO.*

- Give a greater role to local bodies such as municipalities and gram panchayats in the operation, maintenance and the management of water infrastructure/facilities. Eventually give the authority to local bodies and to CBOs to manage these facilities. [See section 4.3]

DEMAND MANAGEMENT

- Emphasise demand management through recycling, reuse and better irrigation efficiency [Section 3.4].

- Make rain-water harvesting compulsory in public buildings and also in private buildings larger than a certain size. Also, disallow filling up of urban ponds and water bodies into land for urban use in order to enable the recharge of groundwater [Sections 3.2 and 3.5].

- Optimise Irrigation intensity so as to extend the benefits of irrigation to as large a number of farm families as possible, keeping in view the need to maximise production and providing minimum sustainable income above the poverty level. Strongly discourage water intensive crops such as sugarcane and paddy in water-scarce areas.

- Policies such as subsidies, minimum support price, sale of certain grains through the Public Distribution System (PDS) influence the cropping pattern and thus the use of water in different areas. *Therefore, offer economic and other incentives and disincentives through central and State government policies to encourage other low water-intensive crops (such as coarse grains, oilseeds and pulses), which will lead to the reduced demand for water.*

WATER QUALITY AND ENVIRONMENTAL ASPECTS

- Ensure a minimum good quality water flow (to be decided by the RBO) at all times as required for the life of the river and for sustaining livelihoods.

- Adopt the "polluter pays principle" to prevent pollution of water bodies and thus to ensure water quality. Take the help of CBOs also in the monitoring of pollution and polluters.

- Prevent the detrimental environmental consequences of over-exploitation of groundwater by legislation and its enforcement by local bodies, RWAs and gram sabhas, who will have to play a vital role in this.

- Avoid over exploitation of ground water near the coast to prevent ingress of seawater into sweet water aquifers.

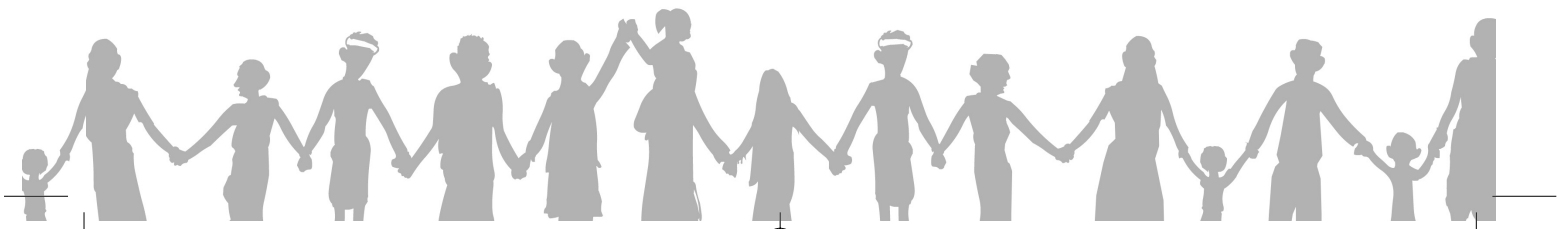
SOCIAL ASPECTS AND BENEFITS TO LOCAL PEOPLE

- Formulate a national policy on resettlement and rehabilitation of project affected people.

- *Ensure that all water and power development projects provide benefits of the project to the local people first. For example, water supply and electric connections should be provided on priority to all local people who are affected, especially those upstream.*

WATER PRICING AND OPERATIONAL ASPECTS

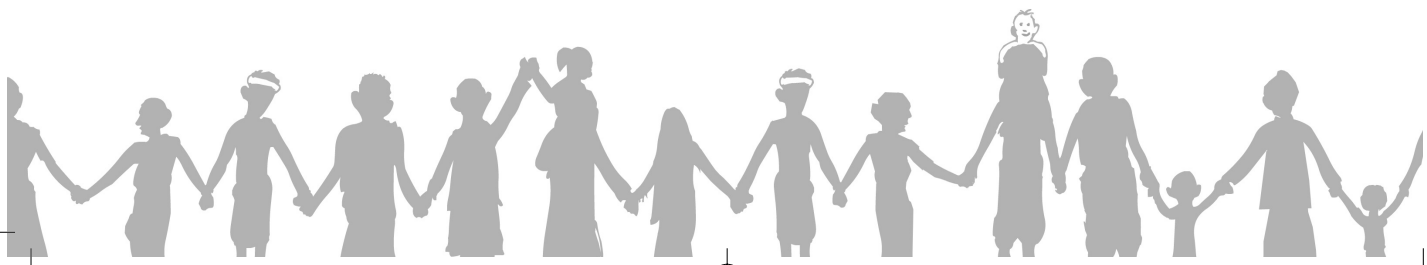
- *In government water development projects other than drinking water projects recover the full cost of operation and maintenance along with 50 per cent cost of the capital.* The water charges should be increased gradually, along with improvements in service and supply, to reach that level within the next 10 years.



- Prioritise ongoing water development projects basin-wise and State-wise. Due to the extreme paucity of funds, prioritise projects in such a way that those on-going projects where over 20 per cent of the project cost has already been incurred are completed first.
- *Set up a national body of experts under the Planning Commission to midwife the process of setting up the first few RBOs* (out of a total of about 20 to be set up) and to lay down the rules and regulations for their functioning.

DEALING WITH FLOODS AND DROUGHT-PROOFING

- Adopt flood mitigation policies and efforts based on the realisation that floods and their negative consequences can only be managed, they cannot be 'controlled'. Floods also have certain benefits which should not be overlooked.
- Adopt drought-proofing policies and measures to minimise and mitigate the negative consequences of droughts, in the long run. For this purpose, emphasise watershed development projects and rainwater harvesting; agro-climatic regional planning; besides integrated river basin planning.



1
Introduction

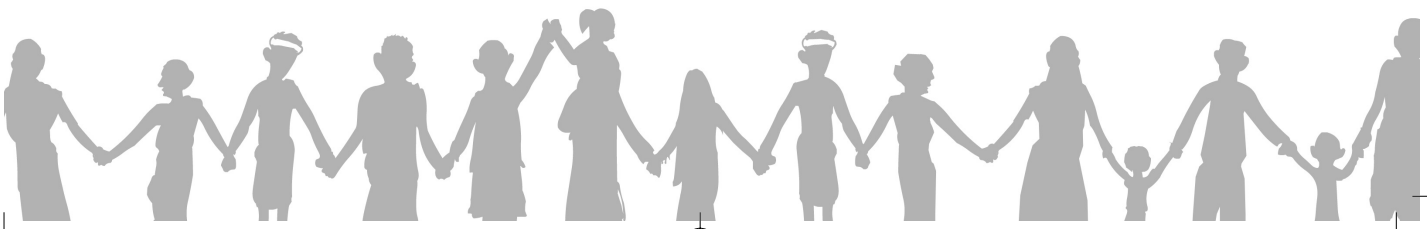
India has been blessed with abundant water resources, which have been more than adequate in the past for our large population. It is estimated that out of the total precipitation of around 4000 billion cubic metres in the country, the surface water availability is about 1870 billion cubic metres. Out of this, only 690 bcm or about 37 per cent can be put to consumptive beneficial use because of topographical, ecological and other constrains. In addition, there is a ground water potential of about 430 bcm (see **Box 1**). The per capita availability of water is given at **Box 2**.

Our national water policy and management systems have responded from time to time to different objectives such as increasing food production to prevent famine and generating power. These systems were able to take care of our various needs as the population was lesser, the extent of urbanisation was low and the per capita water availability was abundant (see **Box 2**) However, the situation has now changed substantially, with water availability of 1820 cum per capita per annum, and we are nearing a water stressed condition (where water availability is less than 1700 cu m per capita per annum). Besides this, the demands from

BOX 1
Water Resources Available in India (In Billion Cubic Meters)

Total Precipitation	4000
Total Water Availability	1869
Total Utilisable Water	1122
Surface Water—690	
Ground Water—432	
Present Utilisation	629
(83% Utilised for Irrigation)	

Source: Planning Commission



BOX 2
India: Annual Per Capita Availability of Water

5177 cubic metres in 1951

1820 cubic metres in 2001

Reduction mainly due to population growth and more irrigated areas

Note

< 1700 cubic metre is considered "Water Stress" condition

< 1000 cubic metre is considered "Water Scarce" condition

... India is on the verge of "Water Stress" condition

Source: Planning Commission

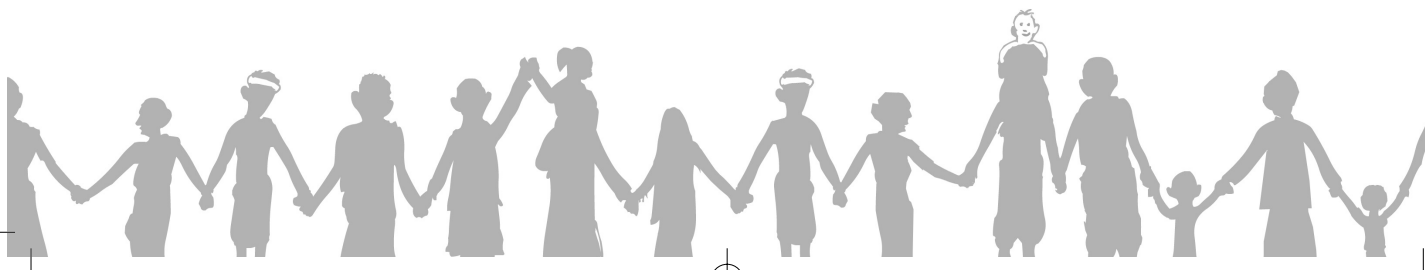
various competing uses have increased due to factors like greater food production, greater industrial activity and urbanisation, etc. This new situation demands a response from natural resource planners and policy makers that is radically different from what we have been used to. The new response to face up to the challenges requires a change in perspective as well as in the organisational structures through which water resources have been managed uptil now.

In the last century, the key concerns of water resources management in India have been the following:

- Need to optimise use of available water resources (groundwater development, watersheds, etc.)
- Increased food production to prevent shortage and proper distribution with increased purchasing power
- Drought proofing and development of agriculture, especially in rainfed/fragile ecosystem areas (watersheds)
- Need to utilise irrigation water efficiently
- The generation of hydro electricity
- Need to involve farmers and other users
- Floods moderation
- Prevention of pollution of water

Table 1 outlines the evolving concerns of the water policy and management system in the 20th century. It also suggests the key concerns that should guide the water policy in the 21st century.

A WRM strategy for the future has to recognise and adequately address *the challenges we face and are going to face in the 21st century.*

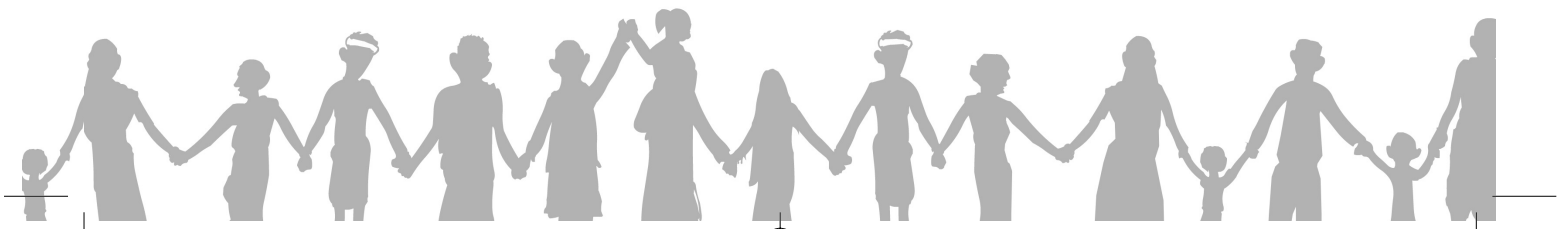


These challenges include:

- Dealing with drought and water scarcity: the reduced per capita availability of water in the coming years may go down to as low as 1000 cubic metres per capita per annum by 2050, putting us in the category of water scarce nations!
- Increasing water use efficiency in irrigation and the use of water in rainfed agriculture to ensure food security for all.
- Regulating the use of water in agriculture and for drinking and other purposes in a rational and just manner.
- Preventing the overuse of groundwater and ensuring groundwater recharge in areas with low groundwater levels.
- Preventing losses in water supply in urban areas.
- Ensuring the health of rivers and water bodies by ensuring that only treated water is discharged into rivers, ensuring minimum flow of water in rivers all through the year and protecting water bodies from pollution and overuse.
- Dealing with water-logging and salinity in irrigated areas.
- Moderating and managing the impact of floods, and learning to live with them.
- Avoiding and resolving amicably inter-State and international river water disputes.
- Putting into effect a pricing regime for water services that can maintain the character of water as a public good, and yet can raise enough resources to enable operation and maintenance (O&M) activities.
- Completing ongoing incomplete projects and creating of new storage, power generation and irrigation capacities.

1.1 Integrated Planning and IWRM

As outlined in the table above, our national water policy and management systems have evolved in an ad hoc manner to take care of urgent demands perceived from time to time. These systems and policies were able to serve the purpose when the population was much lower than today and the competing demand among different areas and sectors for the use of water was not intense. In the last two decades, with increasing pressure on water resources, the necessity of integrated water resources management has been recognised internationally. The Global Water Partnership, for instance, has recognised IWRM as an important objective. In India too, policymakers have been talking since the 1990s about IWRM but have not been able to translate the concept into practice. This is so both because the existing administrative systems and organisational structures act as a hindrance to adopting IWRM principles and practices, and because there has not been a clear strategy to proceed with and implement IWRM. The strategy we have put forward suggests



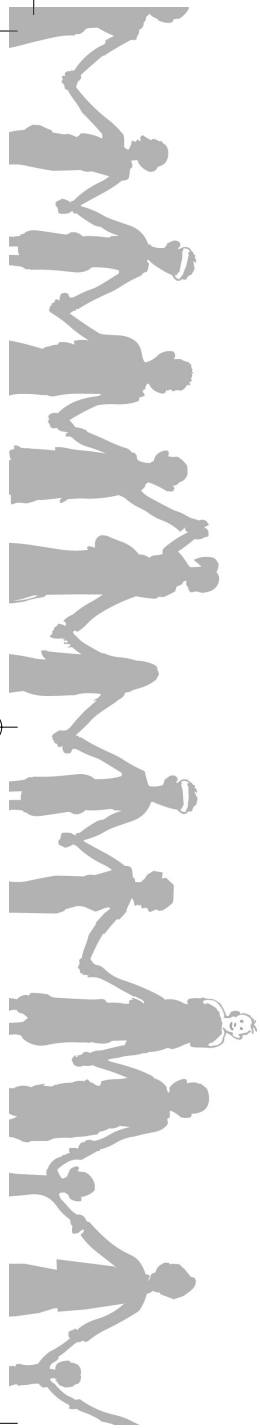


TABLE 1
Water Resources Management in India: Evolution of Administrative Systems and Future Directions

Sl. No.	Period	Primary Objectives of Water Policy/Management Systems	Main Organisation/ Agencies Involved	Relationship between Different Stakeholders	Human Resource Development Aspects
01.	1900–1950	• Famine prevention and increased food production· • Hydro power on canals in UP, from dams in the south	• State irrigation departments in northern States, PWDs in the south	Government officials remained in close touch with farmers and took care of people's requirement ("paternalistic" relationship between government officials and people)	On the job training of junior officers through attachment with senior officers
02.	1951–1970	• Increased food production in a hurry (drought during '67–68)· • Use of State tubewells in a big way· • Hydro power	• Central design organisation for big dams· • Separate design organisations in major States· • Construction and management of dams/irrigation by State government agencies	Continued but lesser contact with farmers and reduced attention to management aspects	Staff training institutes set up
03.	1971–1990	• Increased food production· • Private tubewells encouraged· • Domestic water supply and sanitation • Control of water pollution	• Command Area Development (CAD) programme from 1975 onwards involving various State government agencies/departments at the district level· • CGWB, SGWBs, CPCB, SPCBs, NWDA etc.	Breakdown of relationship between government officials and farmers. Farmers started bypassing officials and seeking decisions/favours from politicians	Water and Land Management Institutes (WALMIs) set up in most States for training of irrigation and agriculture officials (1985 onwards)

(*contd.*)

04.	1991–2005	• Agricultural production · • Domestic water supply and sanitation (both urban and rural)· • Pollution control and attention to environmental aspects· • Water harvesting and watershed management	• Besides continuing role of government departments, increasing role of farmers/ users sought in the management/distribution of water • Involvement of communities and NGOs in watershed development • Lesser emphasis on construction of dams/ new irrigation projects • CGWA etc.	Attempt to involve farmers/users in water management but legal provisions for the same made only in a few States. Involvement of multiple government agencies in various watershed development schemes. NGO-initiated programmes in some areas	Continuing training of government officials through WALMIs but little attention to non-engineering aspects (environmental aspects, community mobilisation, etc.)
05.	2006 and beyond	• Integrated management of water resources for efficient and equitable use - attention to river basins (beginning with those within States)· • Attention to increasing and competing demands for water resources from different sectors· • Demand management and water conservation • Food security and generation of livelihood for increased population expected in the 21st century	• Reliance upon existing central and State government agencies continues, but setting up of Community Organisations required to institutionalise involvement of users • Need to restructure institutions/integrated agencies for water resources management, especially in the States • Need to evolve river basin organisations	• Need to evolve mechanisms to co-ordinate between different stakeholders and to institutionalise involvement of users in water resources management, starting with AWPs • Nodal agencies need to be identified for each major task	Need to shift from attention only to engineering aspects to genuinely multi-disciplinary approach (especially focus on environmental and sociological aspects)

specific proposals through which the concept of IWRM can be implemented in order to move towards a sustainable management of our water resources in the 21st century.

The IWRM perspective is to look at all water resources in an integrated manner. *This means that the utilisation of water within a river basin should be planned in an integrated manner taking into account the following types of integration:*

- Between rainfall, surface water and ground water
- Between different sectoral uses and environmental requirements
- Between structures i.e. water harvesting structures for use of water and recharge of ground water to the high dams on the main rivers
- Between water to be supplied from the bigger structures to the smaller structures when required during drought/lean period
- Between institutions at the community level, NGOs and the government
- Between different types of land use (agriculture, forestry, wetlands, non-agricultural uses, flood buffer zone) keeping in mind the requirement of water for different uses

Besides this, other important measures that have also to be considered in carrying out the integrated planning of water resources include the following:

- Demand management and recycling of water
- Desalination of brackish / sea-water
- Inter-basin transfer, in a few cases where after adopting the IWRM approach the availability of surplus water in a basin is clearly established

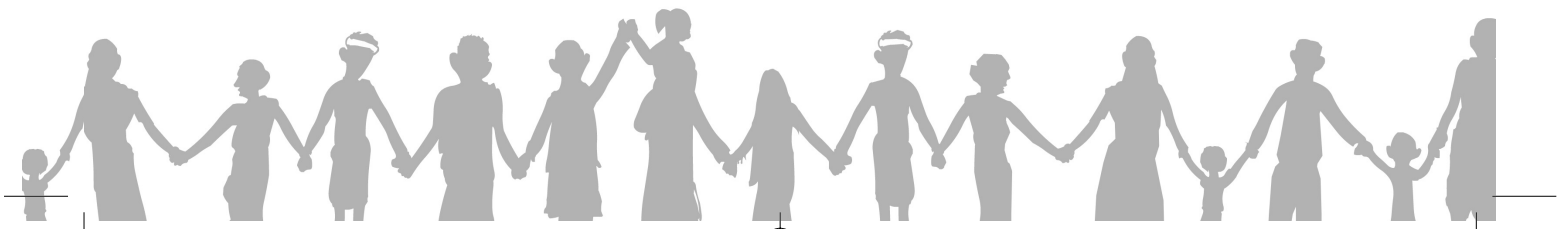
The integrated water resources planning and management that is required in the new situation today cannot come about only through the policies, administrative and management systems and organisational structures that have been put in place during the last century. We discuss next, in greater detail the institutional and organisational changes required at the macro and micro levels in order to effectively carry out the tasks of integrated water resources planning and management.

1.2 Key Elements of an IWRM Strategy for the 21st Century

An IWRM strategy for the future, which will be able to deal with the challenges for the 21st century listed above, should include the following key elements:

- An integrated and comprehensive planning of all water resources in a river basin, taking into account all sources of water and all the different uses of water.

- Institutional changes and organisational restructuring needed at the *Macro level* in order to carry out the integrated planning and management of water resources:
  - River basin organisations (RBOs) to implement the integrated river basin approach for the management of water resources
  - Restructuring of the administrative set up for the planning and management of water resources in the States, by bringing together the various disciplines dealing with water resources management within an integrated structure. (The execution of various components of IWRM projects will be done by existing departments/agencies and monitoring will be done by the nodal agency.)
- Public Regulatory System operating at multiple levels to regulate the allocation of water to different areas and regulate the pricing of water for different uses. Ultimately, these functions will be carried out by the RBOs, but till such time that the RBOs are created autonomous regulatory bodies will have to be set up at various levels. Subsequently they can be merged with the RBOs.
- Institutional changes at the *Micro level*: the setting up and training of community organisations in all areas to involve people in the management of water resources at the local level.
- Demand management through recycling and reuse and better irrigation efficiency.



2

Institutional and Organisational Changes required for IWRM

As part of the strategy proposed herewith, we suggest suitable changes at the *macro level* in the governmental organisational structures and the adoption of the *river basin approach* to the integrated planning and management of water resources. This includes the operation of a Public Regulatory System operating at multiple levels to regulate the allocation and the pricing of water for different uses. Ultimately, these functions will be carried out by the River Basin Organisations (RBOs), but till such time that the RBOs are created autonomous regulatory bodies will have to be set up at various levels. At the *micro level* we suggest the setting up of community based organisations (CBOs) throughout the country—Watershed Management Associations (WMAs) in rainfed areas, Water Users Associations (WUAs) in irrigated areas, Joint Forest Management (JFM) committees in forest areas and Resident Welfare Associations (RWAs) in urban areas—to take care of water management functions at the micro or local level.

2.1 Macro Level: River Basin Organisations and Integrated Water Resources Departments

A river basin is the catchment area of a river from the source to the sea including the catchment area of tributaries. It is the geographical area where rainfall is captured, used and drains into one single river. Therefore smaller river basins of tributaries together constitute the major river basin which is known by the name of the main river. There are a total of 14 major river basins in India (See **Table 2**). The water available in a river basin includes rainfall, groundwater and surface water, which is stored in various structures (dams, ponds, canals, etc.), natural wetlands, etc. of all sizes. If all the water available in a river basin is considered in an integrated manner, say like the financial budget of a State government, it can be planned, developed, operated and managed in the most efficient way, including the recycling and multiple reuse of part of this water for various purposes.

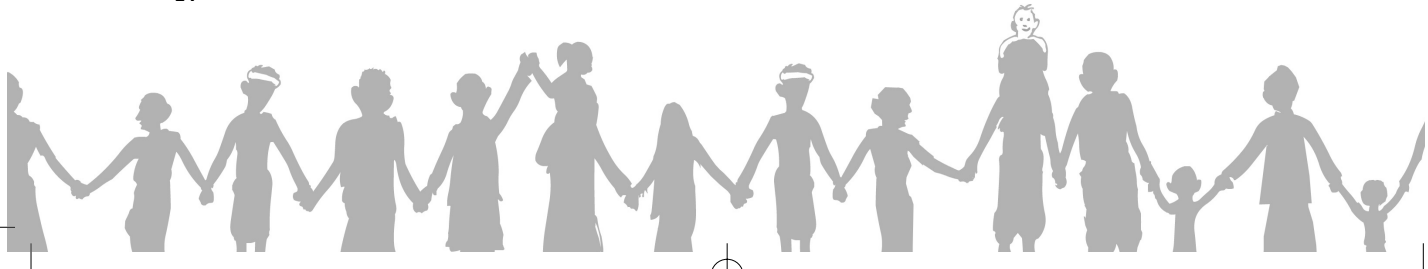
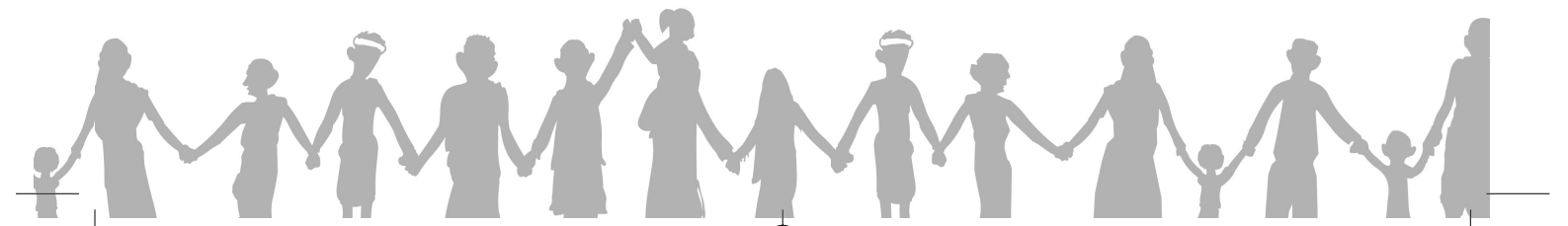


TABLE 2
Major River Basins of the Country

Sl. No.	River Basin	Catchment area, sq km	States in which catchment area falls	Cultivable area, (000 ha)
01.	Ganga	8,61,404 (10,50,000)	UP, HP, Punjab, Haryana, MP, Rajasthan, Bihar, West Bengal and Delhi	60,161
02.	Indus	3,21,290 (4,68,068)	J & K, HP, Punjab, Haryana and Rajasthan	9,638
03.	Godavari	312,812	AP, Karnataka, MP, Maharashtra and Orissa	18,931
04.	Krishna	258,948	AP, Karnataka and Maharashtra	20,299
05.	Brahmaputra	358,008 (5,80,000)	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and West Bengal	6,145
06.	Mahanadi	141,589	Bihar, MP, Maharashtra and Orissa	7,994
07.	Narmada	98,796	Gujarat, MP and Maharshtra	5,901
08.	Cauvery	87,900	Karnataka, Kerala and Tamil Nadu	5,523
09.	Tapi	65,145	Gujarat, MP and Maharashtra	4,292
10.	Penar	55,213	AP and Karnataka	3,539
11.	Mahi	34,842	Gujarat, MP and Rajasthan	2,210
12.	Sabarmati	21,674	Gujarat and Rajasthan	1,548
13.	Subarnarekha	19,296	Bihar, W. Bengal and Orissa	1,194
14.	Brahmani	39,033	Bihar, MP and Orissa	2,360
	Total	**2,575,949**		**149,735**

Source: R C Nayak, in NWDA, 2005.
Note: The figures within brackets indicate the total catchment area of the river basin including catchment of neighbouring countries.

But the current manner in which different departments dealing with water resources are organised does not make such integrated planning and use possible. In the current set up each department—irrigation, rural water supply, urban and industrial water, groundwater etc.—functions independently, taking only its own jurisdiction into consideration. *The integrated planning and management can be done only if a restructuring and reorganisation of the various departments dealing with water resources is carried out, at the centre and in the States so as to bring different sources of water and the different functions together within an integrated set up.* However,



there will have to be *a nodal agency* at the centre and in States to coordinate information on the availability and quality of water, to plan overall water use and development and to lay down policies for the centre/State levels. The nodal agency at the centre will be the Ministry of Water Resources while at the State level the nodal agency will be the water resources department.

Chart 1 shows the reorganisation required for the ministry of water resources at the centre. In the States, there can be a water resources department with wings for each river basin in the State, as shown in the attached **Chart 2.** To begin with, the RBOs should be set up within the States only. A beginning in this direction has already been made by setting up of a few Area Water Partnerships (AWPs) at a few places at the sub-watershed level by some NGOs. The concept of Area water partnerships to be set up by communities and NGOs has also been advocated by the Global Water Partnership (GWP) to develop systems for integrated water resources management.

For an inter-State river these river basin organisations (RBOs) can be set up jointly by the concerned States by agreement among themselves (see **Chart 3** on RBOs). *These would act on the authority delegated by the States*. An RBO will have two components: a representative *River Basin Assembly (RBA)* and a technical wing consisting of professionals. The RBA will consist of representatives from each State and watershed starting from the lowest watershed with a federated system, while the technical wing will consist of a multidisciplinary team of professionals taken from various departments of each State and fresh recruits in disciplines where such experts are not available from departments. The RBA representatives should represent all interests like:

- Watershed Associations
- Water Users Associations in irrigated areas
- Associations of forest users and pastoral people
- Resident Welfare Association representatives as users of domestic water
- Large industries
- Small and tiny industries
- Other users and livelihood activities such as fisher-folk, washer-men, potters etc.

Where *inter-State disputes* are not resolved by themselves or by the RBO, these could be *referred by States to an arbitrator or a team of arbitrators* to give the verdict, which should be accepted by all under a legal provision. This system will lead to quicker decision-making and help to reduce the politicisation of the issue and avoid protracted judicial processes.

2.2 Public Regulatory System Operating at Multiple Levels

By *regulation* we mean (i) allocation of water for different areas, (ii) the pricing of water for different uses within a State, and (iii) laying down of rules and guidelines for water development projects. Also, monitoring of the actual allocation done.

BOX 3
Public Regulatory System at Multiple Levels

Lowest level: Gram Sabha or Village Water Committee under panchayat (1000 ha)
Sub-watershed level (10,000 ha)
Watershed level (50,000-1 lakh ha) (corresponds to district level)
Sub-river basin or tributary level
Full river basin level (RBO)

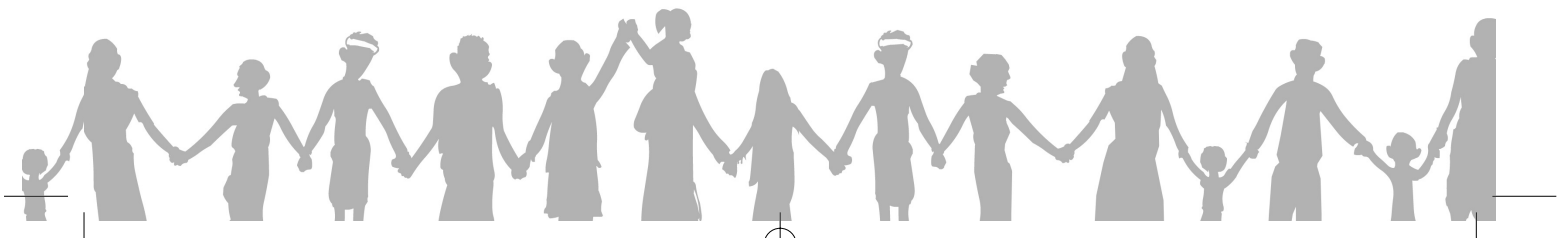
The functions of the Public Regulatory System will include the following:

- Framing rules for allocation of water at different levels upto the sub-watershed level (10,000 ha) and for pricing of water for different uses. Also, making the rules for development of new water projects at various levels.
- Regulation of groundwater level, upper and lower limits, on advice of hydrological experts.
- Regulation of downstream releases.
- At the sub-watershed level, the regulatory body will advise about the allocation of water for different uses, such as for agriculture, forestry and industrial units to be set up.
- At the sub-watershed level the regulatory body will also advise farmers on cropping patterns.
- Pricing of water for different uses (in different areas).
- Monitoring of the allocation done and of the rules for development of water projects.
- Framing guidelines for giving *limited areas* on lease to private parties for water development, management etc.

As mentioned above, ultimately, these functions will be carried out by the River Basin Organisations (RBOs), but till such time that the RBOs are created autonomous regulatory bodies will have to be set up at various levels, as shown below in **Box 3**.

2.3 Micro Level: Water Resources Management at the Local Level by People through Community Based Organisations (CBOs)

The management of water resources for diverse uses at the micro or local level should be done by adopting a partnership approach, involving the user communities, through community based organisations, in the various aspects of planning, design, development and management of water



resources. The following four types of CBOs can be involved (where pre-existing) or set up for this purpose: Water Users Associations (WUAs) in irrigated areas; Watershed Management Associations (WMAs) in rainfed areas; Joint Forest Management (JFM) Committees in forest areas and; Resident Welfare Associations (RWAs) or Neighbourhood User Groups (NUGs) in urban areas. In addition, in some areas, there should be community based flood and drought management committees to plan for and deal with these and other disaster situations.

At the planning stage, decisions should be taken after according opportunity to the respective Gram Sabhas to voice their concerns and if their submissions are rejected, the reasons should be duly recorded and publicised. Necessary legal and institutional changes should be made at various levels to ensure the implementation of the above objectives. WUAs and the local bodies such as municipalities and gram panchayats should particularly be involved in the operation, maintenance and the management of water infrastructures/facilities at appropriate levels progressively with a view to eventually transfer the management of such facilities to the user groups/local bodies.

The number and different types of community based organisations required in the country is given at **Table 3** and **Figure 1**. A list of operational aspects relating to establishing and sustaining community organisations is given at **Box 4** below.

TABLE 3
Number of Community Based Organisations (CBOs) for Management of Water Resources at the Local Level*

Sl. No.	Type of Land Area/Population	Land Area (mha) and Corresponding Number of CBOs Required (lakhs)		
		1995–96	2020	2050
1.	Net Irrigated Area	54	65	85
2.	Number of WUAs required @ one WUA/500 ha	1.08	1.30	1.70
3.	Area that needs watershed management	141	1.25	100
4.	Number of WMAs required @ one WMA/500 ha	2.82	2.50	2.00
5.	Forest Area	69	66	65
6.	Number of JFM committees required @ one JFM committee/500 ha	1.38	1.32	1.30
7.	Urban population	350 million	500 million	700 million
8.	Number of RWAs/NUGs required @ one RWA/500 households	1.40	2.00	2.80
9.	Total number of community organisations required	6.68	7.12	7.80

Note: * For the land use area taken in this table please refer to Table 4.

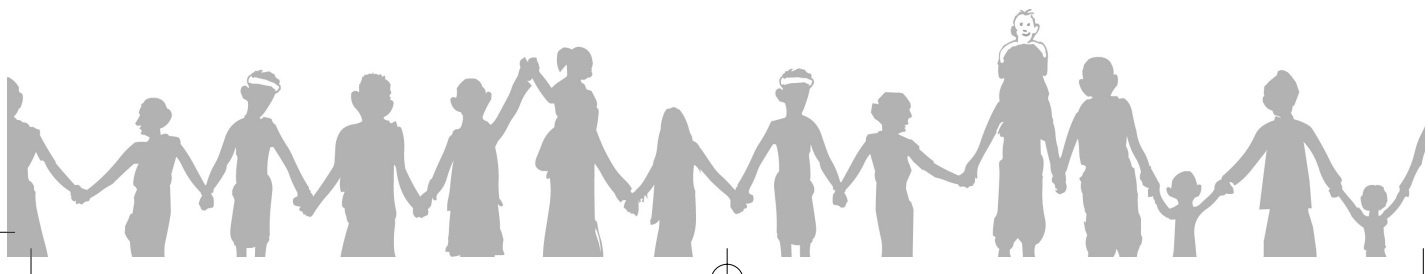
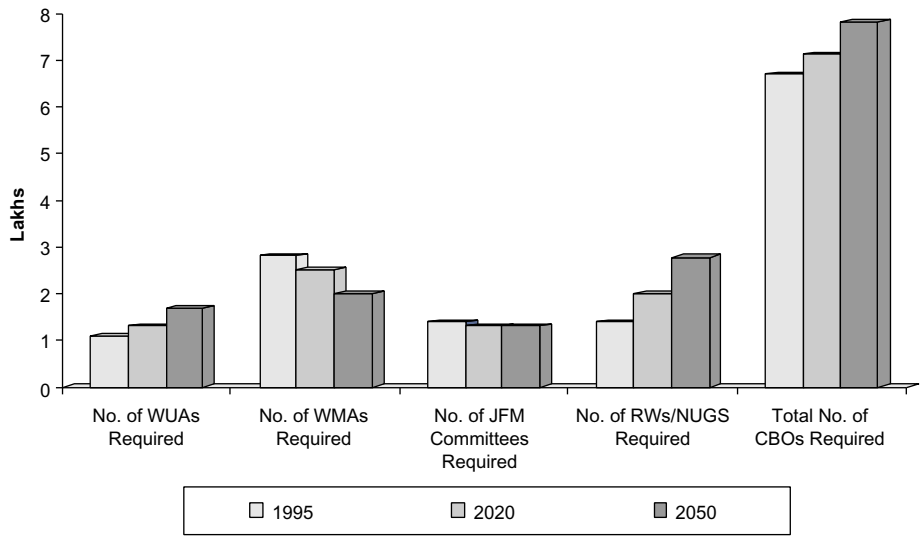
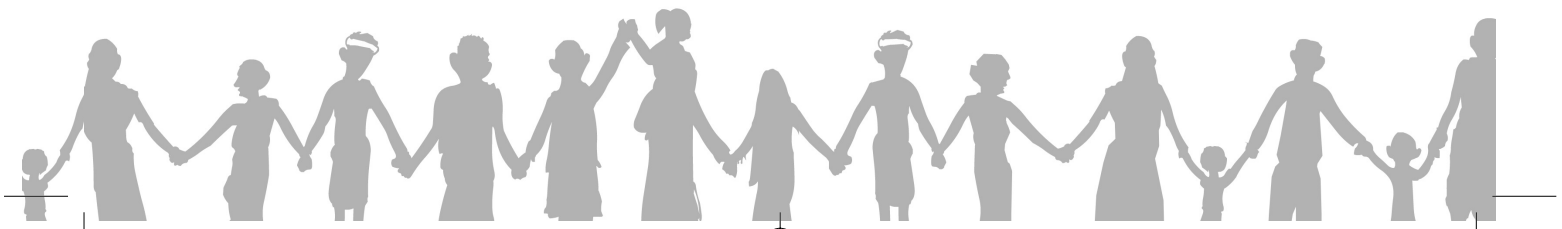


FIGURE 1
No. of Community Based Organisations (CBOs) for Management of Water Resources at the Local Level



It is evident from this table that *nearly 6.7 lakh community level organisations are required at present and about 7.8 lakh such organisations will be required half a century later in the country as a whole to ensure participation of all local level communities in the management of land and water resources.*

Formation of water users associations and other community based organisations should be mandatory as this will facilitate accountability and maintenance of the distribution system, discipline and recovery of charges, besides being more effective in actually distributing the water.



BOX 4
Guidelines for Establishing and Sustaining Community Based Organisations (CBOs)

- The CBOs should have a legal status and should be recognised fully by the concerned administrative authorities.
- Government officials/NGOs may help to set up Community Based Organisations but should not themselves be members of the CBO. They may advise the CBO from the outside and may even be present in their meetings, but should not have voting/decision-making rights or force their opinion on them.
- NGOs with the requisite competence should be asked to come forward, motivate and train the potential leaders and competent individuals from the community or smaller NGOs. To facilitate and support the work of the NGOs, the concerned nodal departments/ministries (Ministry of Rural Areas for WMAs, Irrigation department for WUAs, Forest department for JFM committees, Ministry of Urban Areas for RWAs/NUGs) should play a suitable role.
- Since each area has its own local problems and priorities, there should be no restriction through a centralised scheme for the type of project to be prepared. Only broad guidelines should be indicated by the government within which the community based organisation can prepare the project.
- Potential leaders (5-6 candidates) in each unit should be identified and trained further for leadership roles, care being taken not to include contractors.
- Technical NGOs and government departments should help the CBOs in preparing required projects aimed at the integrated management of land, water and biomass and the provision of livelihood for all, for funding by various agencies.
- Contribution by the CBO towards the creation of physical assets, in the form of labour, material or cash, should be at least 10-20% in the initial stages and should gradually, over the years, be increased to 50%.
- After project approval and funding, the work should be implemented only by the CBO. For this purpose a committee should be formed to supervise the project implementation.
- Operation, maintenance and management should be done by the CBO concerned, for which the cost should be recovered from the beneficiaries or members.
- Monitoring of works should also be done by fund providers and also by government to safeguard natural resources and ensure proper use of funds. Post-project monitoring should also be done to ensure that the project benefits reach all members of the community and are not cornered by the powerful local elite or upper classes or castes.

3

Components of an Integrated Water Resources Management Strategy

While the most important changes to be carried out for the paradigm shift to integrated water resources management have been discussed above, there are a number of other aspects of and requirements for the integrated planning and management of water resources, which are discussed below:

1. An improved system of assessment and information collection on water resources
2. The broad guidelines and principles for the allocation of water for different uses
3. Planning new water development projects and public-private partnerships
4. Demand management, conservation and efficiency of utilisation
5. Groundwater management
6. Watershed areas management and drought-proofing
7. Maintaining river life and water quality

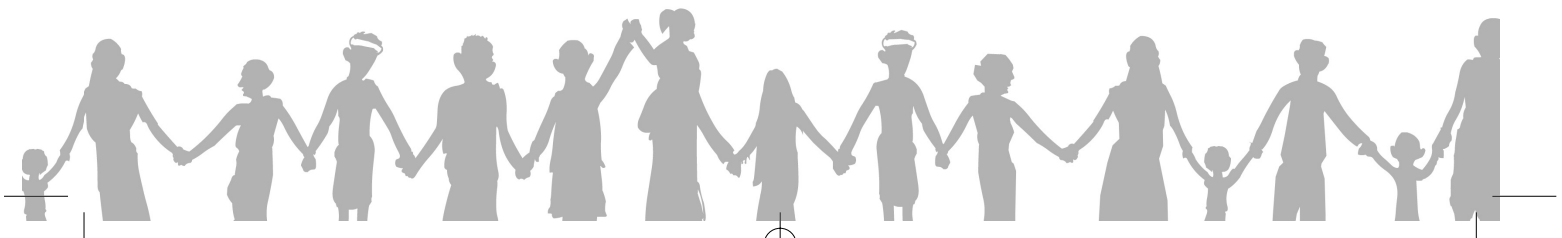
The following issues are also linked to the integrated management of water resources and are discussed below:

8. Resettlement and Rehabilitation Management
9. Inter-linking of Rivers
10. Flood Management

3.1 Information System and Water Resources Assessment

An improved system of water resources assessment and information collection will involve:

- *A national information system built on micro watershed level databases, covering both quantity and quality, through sharing of information from existing sources*

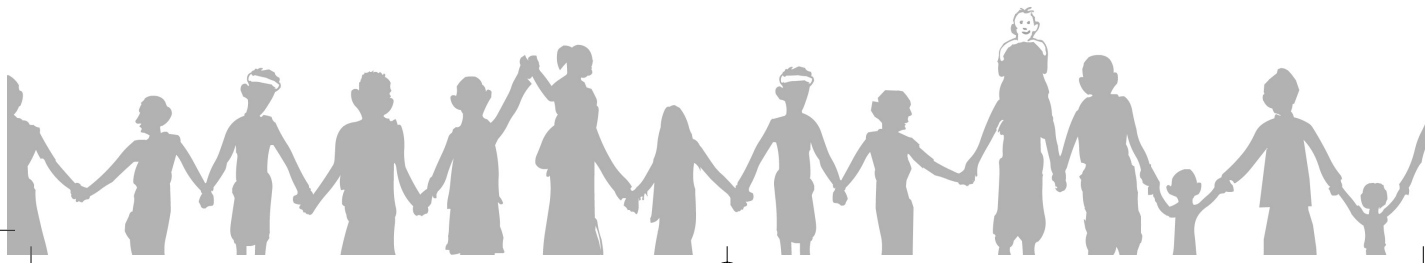


- Availability of the information in the public domain through a website. This requires a change in the Official Secrets Act and would also be in keeping with the spirit of the the Right to Information Act
- Adoption of uniform standards for coding, classification, processing and data collection
- Data collection from 30,000 sites in next 5 years, from 2000 at present
- Information and advise on groundwater levels in each watershed should be publicly available

A national information system that builds itself on micro-watershed level databases and integrates with the State and national levels is required. This database should contain information on rainfall, ground water, surface water availability and also water use for different purposes along with its quality. It should be available in a user-friendly format and should be available for public access through the Internet. The practice uptil now has been that the official information on peninsular rivers has been more readily available while the government has not been forthcoming about the information on the Himalayan rivers as sharing the water of these rivers with neighbouring countries has been a contentious issue with them. This, however, is a very undesirable state of affairs. The available information on the Himalayan rivers too should be publicly available and agreements over water sharing with neighbouring counties should be worked out on mutually agreed principles.

Uniform standards for coding, classification, processing and methods/procedures for data should be adopted. Advances in information technology must be introduced to create a modern information system promoting free exchange of data among the various agencies like the Ministries of Water Resources (MoWR), Agriculture, Environment and Forests, Urban Development and Rural Development in GoI and similar departments at the State level. MoWR may be the nodal agency for this purpose. Similarly access to this information at district, panchayat and community levels is also important. Special efforts should be made to develop and continuously upgrade the capability to collect, process, use and disseminate reliable data in the desired time frame. At present, comprehensive data is being collected from about 2000 sites. This needs to be increased to about 30,000 in the next 5 years to coincide with the number of watersheds (average size of 10,000 ha). Some of the work has already been done in the seven southern States under the World Bank supported Hydrology project. This has to be extended to the other States and built upon.

Apart from data regarding water availability and its use, the system should also include comprehensive and reliable projections of future demand, availability and its quality. The depth to which groundwater extraction is advisable/allowed along with quality in each watershed area should be publicly available. Both surface water and ground water should be regularly monitored for quality. A phased programme should be undertaken for improvements in water quality. The data generated by this exercise should be available in the public domain through the Internet. Also, there should be a reassessment every ten years on a scientific basis of all forms of water, taking into consideration the quality of the water available for various uses.



3.2 Water Allocation for Various Uses

Sectoral Allocation: The water allocation amongst the basin States should be guided by a national perspective with due regard to water resources availability and requirement within each State and the river basin. This task will be carried out by RBOs or the regulatory bodies set up specially for this purpose if the RBOs are not in place yet. Broad guidelines for the allocation of water amongst the basin States need to be formulated[1].

In planning operation systems, *water allocation priorities* should broadly be as below, but governed on the basis of local conditions and requirements:

- Drinking and domestic use (for humans as well as animals)
- Sustaining environment, maintaining river systems and aquatic life, which is also essential for livelihoods such as fisheries, washermen, etc.
- Irrigation and food production
- Hydro-power
- Thermal power and industries
- Recreation and religious uses
- Navigation
- Transfer to other basins (if surplus available)

The first three uses have the highest priority but within these, the allocation of water should be decided by the people at the watershed level. For allocation to other uses where bulk supplies are required and where supply to the first three categories is affected, people's agreement would be necessary.

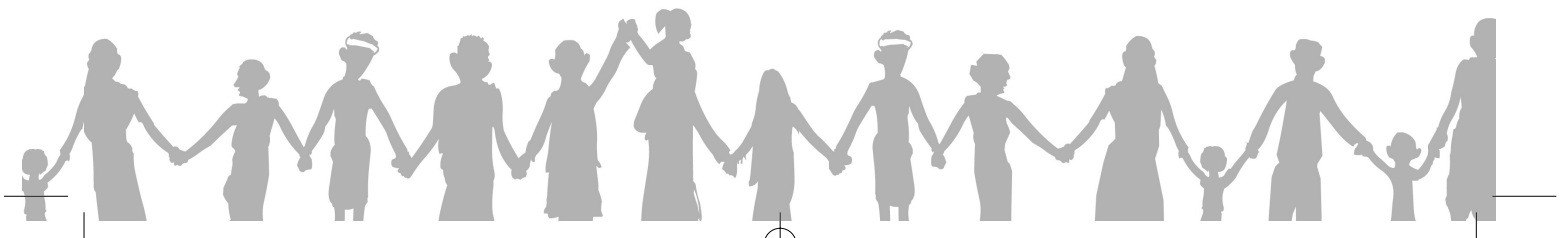
Domestic Use

Drinking water needs of human beings and animals should be the first charge on any available water. The standard with regard to water allocated per capita for domestic use should be 30 to 60 litres per day, excluding the water to be used for sanitation purposes. It may vary according to rainfall zones i.e. less in Rajasthan and more in Assam, but should be the same for rural and urban areas.

Irrigation and food production

The production of food grains has increased from around 50 million tonnes in the fifties to about 200 million tonnes by the year 2000 but according to government projections this will have to be

1. The allocation of water for each hydrological zone should be based on the principle of providing at least 1000 cubic metres per capita per annum (for all uses). The surplus water over and above this amount can be allocated for various bulk uses by mutual agreement between different hydrological zones.



raised to around 450 million tonnes[2] by the year 2050. Out of a total culturable area of 195 mha in the country the net area under cultivation has remained stagnant at 142 mha[3] (irrigated area 54 mha and the remaining 88 mha being rainfed area) for the past two decades (see **Table 4** and **Figures 2, 3, 4 and 5**). The remaining 53 mha of culturable land (which is not presently cultivated) needs urgent attention for watershed development and for the production of fuel, fodder, timber and food. Overall, a total rainfed area of 141 mha at present (88 mha cultivated and the remaining 53 mha not cultivated) needs more attention for watershed development. This is expected to come down to 100 mha in 2050, as per the projections made in **Table 4.**

Irrigation planning either in an individual project or in a basin, as a whole should take into account the irrigability of land, cost effective irrigation options possible from all available sources (including traditional ones). Wherever water is scarce, if economically advantageous, deficit irrigation[4] may be practiced. The irrigation intensity should be such as to extend the benefits of irrigation to as large a number of farm families as possible, keeping in view the need to maximise

TABLE 4
Land Area of India by Usage (mha): Current and Projections for 2020 and 2050

Usage	Area Reported (1995-96)	Projections for 2020	Projections for 2050
Culturable area	195*	190	185
Net** irrigated area	(54)	(65)	(85)
Non-irrigated/rainfed area	(130)	(110)	(80)
Rainfed area covered by trees#	(11)	(15)	(20)
Forest area	69	66	65
Non-agricultural use (urban, roads, etc.)	22	30	36
Barren	19	19	19
Total area reported	**305**	**305**	**305**

Note: ** Out of this, area actually under cultivation is 142 mha and this is expected to go down to 140 mha in the future.*
** Net area refers to the actual area covered on the ground and should not be confused with the claimed irrigation potential.
# This includes orchards and areas with low tree density, that are not classified forests and which yield fruits or NTFP, primarily for local use.
Source: CWC for current land area; projections by authors

2. This projected requirement for 2050, however, is an overestimate in our view. A more realistic figure will be much lower than 450 million tonnes.
3. This may go down to 140 mha in the future.
4. Deficit irrigation is when about 10-20 per cent less water is given than required by the crop with negligible reduction in produce; this is practiced due to shortage of water or for irrigating more area, thus increasing total production.

FIGURE 2
Land Area of India by Usage (mha): Current and Projections for 2020 and 2050

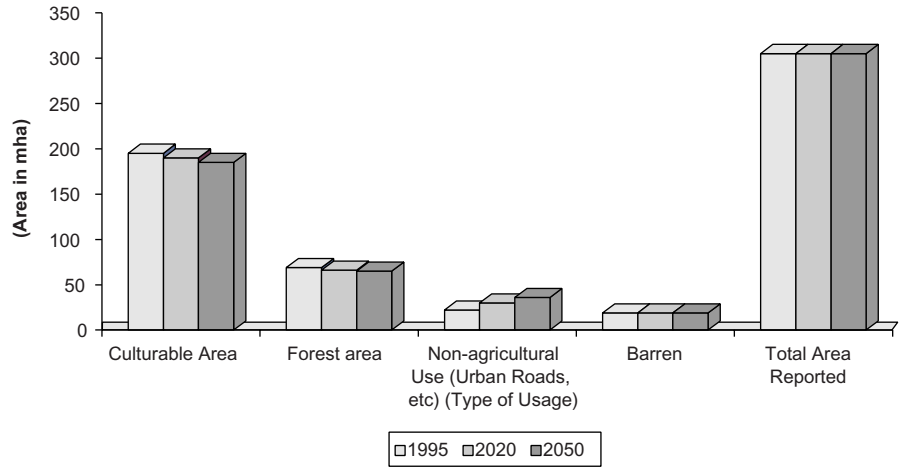
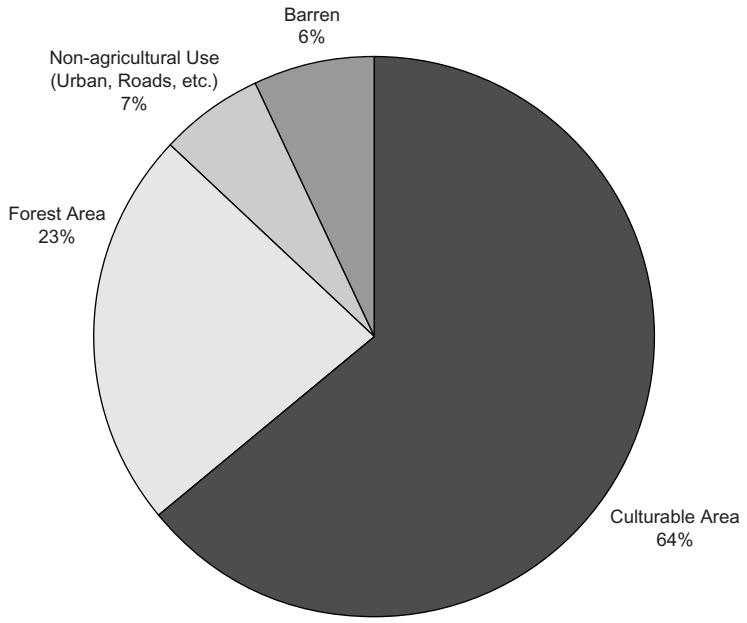


FIGURE 3
Land Area of India by Usage (mha)**: 1995** (Total area reported: 305 mha)



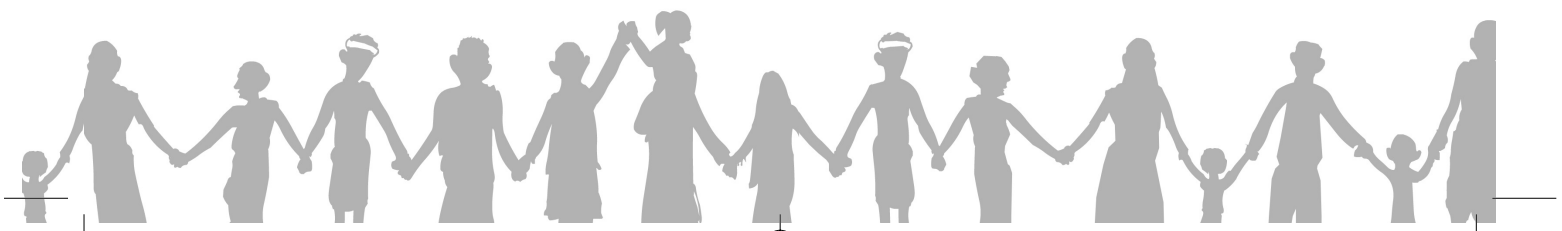


FIGURE 4
Total Culturable Area in India: 1995 (195 mha)

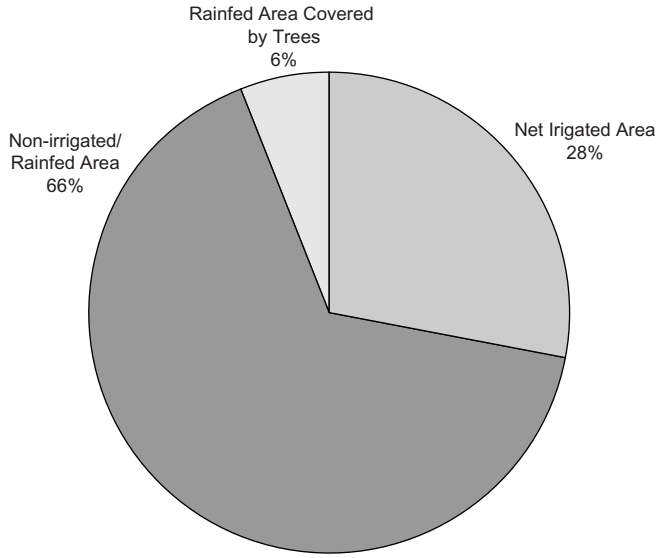
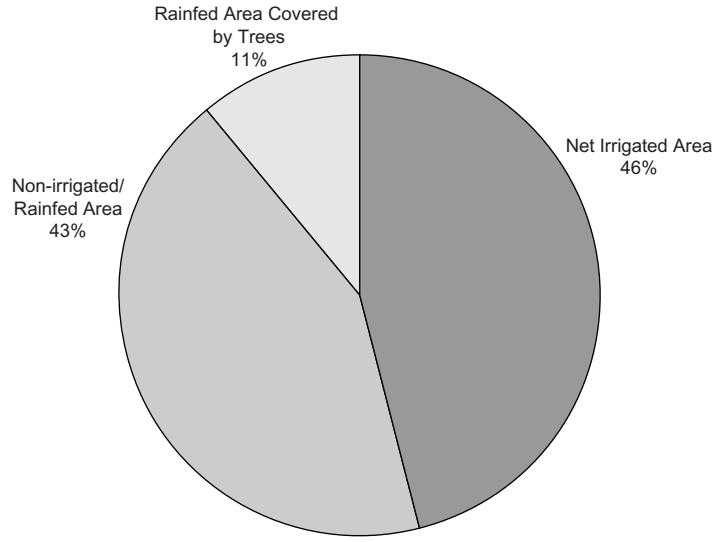
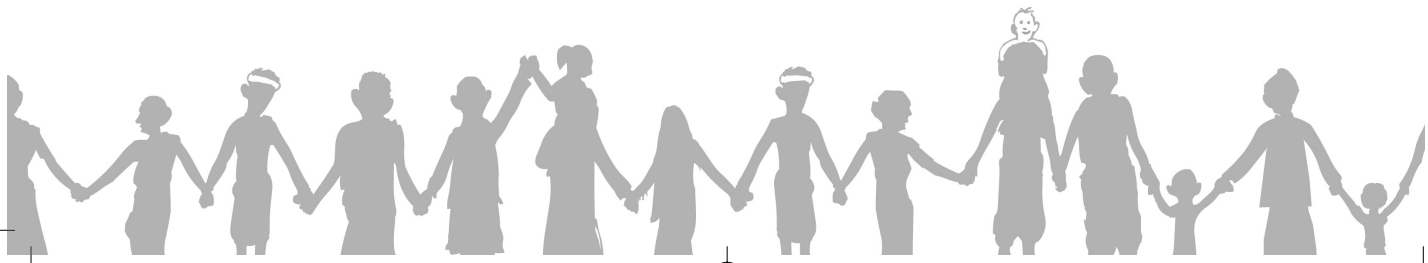


FIGURE 5
Total Culturable Area in India: Projection for 2050 (185 mha)





production and providing minimum sustainable income above the poverty level. Water intensive crops such as sugar cane and paddy should be strongly discouraged in the areas of water scarcity. Irrigation efficiency in irrigation projects should be improved from the present average of 40 per cent to the maximum achievable, which is approximately 60 per cent and above. This will also require a reliable supply of power to rural areas as the irregular and intermittent supply of power to farms leads to farmers leaving the pump sets on and thus to great wastage of water and energy.

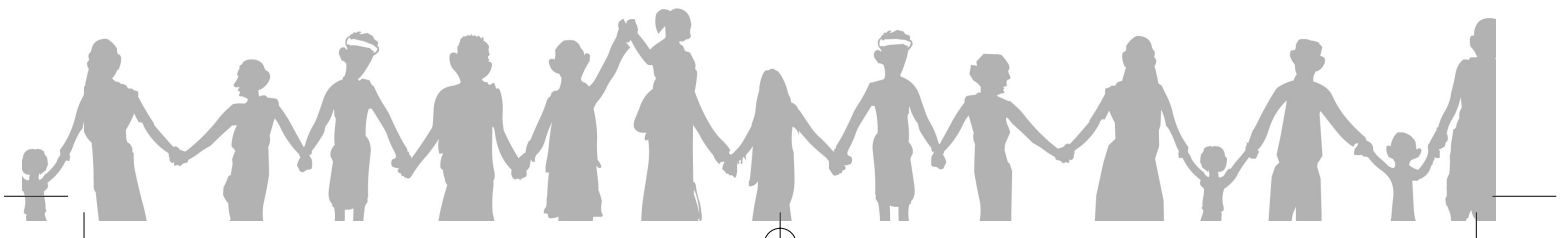
Water allocation in an irrigation system should be done with *due regard to equity and social justice.* Disparities in the availability of water between head-reach and tail-end farms and between large and small farms should be obviated by adoption of a rotational water distribution system and supply of water on a volumetric basis to WUAs subject to certain ceilings. WUAs should have an important role to play in managing distribution, maintenance and recovery of service charges.

Canal irrigated areas have created some water-logged areas which need to be drained out to make the land fit for agriculture and other purposes. To avoid water-logging and salinity, firstly, the attempt should be to avoid the supply of excess water and then wherever possible, bio-drainage[5] and vertical drainage[6] should be preferred rather than surface drainage. Domestic sewage and industrial effluents should be discharged into surface water only after treatment, so that the water can potentially be reused for some purpose. A combination of drainage arrangements should be adopted to use the least amount of land and which can also be properly maintained at least cost on a regular basis.

Prioritisation of minor/major/medium projects: The prioritisation of projects basin-wise and State-wise is needed. Due to the extreme paucity of funds, projects should be prioritised in such a way that those on-going projects where over 20 per cent of the project cost has already been incurred should be completed first. In basins where most water resources available have already been developed, the emphasis should be on the modernising and up-gradation of existing systems in an integrated manner. However, in basins where much development work remains, the emphasis should be on complete investigation and planning in an integrated manner. Economic criteria should not be ignored in sanctioning projects except in some special cases where development has been poor because of paucity of water potential and there is no other alternate means of economic development.

Redefinition of major, medium and minor projects: So far the utilisation of potential created on an irrigation project is one of the main criteria for its performance. The potential given in the project report is based on a certain assumed cropping pattern. But in actual practice the cropping patterns keep on changing on the basis of demand and market price from year to

5. Bio-drainage refers to the plantation of trees in water-logged areas as a means of soaking and using up the excess water.
6. In certain reaches where water is good quality or tolerably saline, especially in the upper reaches of the canal system, it is taken out through tubewells (by the government) and put back into the canal system for supplying the lower reaches.



year. The actual potential is also different at the time of completion of the project due to land availability and the soil condition at site being different from those given in the project report. *Often there is an over-estimate of potential*, so as to indicate a better B/C ratio and Rate of Return. In some cases in actual practice the use of water also shifts from agriculture to industrial or other uses. Unfortunately, however, the known reduction in the actual potential of irrigation is not reflected accurately in the figures, which gives a wrong picture of the gap between potential and utilisation. Besides, there is also the need to reduce the gap by more efficient use of and better distribution of water in the field. In agriculture the efficient use of water should also be judged through the economic value of the product per unit of water used.

The present system of categorisation is based on irrigated area, and the irrigation potential is based on an assumed cropping pattern, which keeps on changing over time. The focus, however, should be on overall water use. In certain projects, it may be power generation, drinking water or flood control, which may be the major component, rather than irrigation. Thus, instead of being based on the area irrigated or height of the dam, *projects should now be categorised on the basis of live storage capacity.* Projects above 100 MCM would be categorised as major, between 10 and 100 MCM would be medium; and those below 10 MCM would be minor. Projects smaller than 1 MCM would be categorised as micro. For run of the river schemes, the volume of water diverted in a year would determine the categorisation of the project as major, medium, minor or micro.

Industry and Thermal Power

Most of the thermal power houses and industries with heavy use of water should be located on the coast, so that abundant sea water can be used for their purpose instead of using scarce fresh water. They should be encouraged to use sea water/desalinated water, adopt processes with minimum use of water, recycle and reuse and discharge only treated and cooled water into the sea to maintain its ecology.

Navigation

In order to save energy and reduce our dependence on petroleum products, the major portion of which are imported, navigational transport in rivers is essential. This will require that minimum flow and depth in specific reaches of the river is assured.

3.3 Planning New Water Development Projects and Public-Private Partnerships

All individual development projects and proposals should be formulated and considered within the framework of an overall plan for a basin or a sub-basin so that the best possible combination of options can be made and sustained. There should be an integrated and multi-disciplinary approach to the planning and implementation of projects. This should inter alia include catchment area treatment and management, environmental and ecological aspects, the rehabilitation of affected people and command area development. *Co-ordinated development of surface*

water and ground water and their conjunctive use should be envisaged right from the project planning stage and should form an essential part of the project. Over exploitation of ground water should be avoided near the coast to prevent ingress of seawater into sweet water aquifers.

Economic development activities including agricultural, industrial and urban areas should be planned with due regard to the constraints imposed by the water availability. There should be water zoning of the country and the economic activities should be guided and regulated in accordance with such zoning.

Since all water resources have a common property character, private participation in planning, development and management of water resource projects must be subjected to careful social scrutiny based on well-developed mechanisms of accountability and regulation. Where local communities or public utilities are neither able to invest nor able to efficiently manage water delivery systems, corporate sector participation can be invited. All agreements must be cleared by the local community, whose water resources are being tapped on the principle of prior informed consent based on recognition of water rights of local communities. Private sector participation may help in introducing innovative ideas, generating financial resources and introducing modern management practices in improving service efficiency and accountability to users. However communities need to be involved in decisions related to technology choice, and prices of services. For urban projects various combinations of private sector participation, in building, owning, operating, leasing and transferring of water resources facilities, may be considered. However at no point should water be reduced to a commodity, with access determined by purchasing power and not as a common resource to be equally shared.

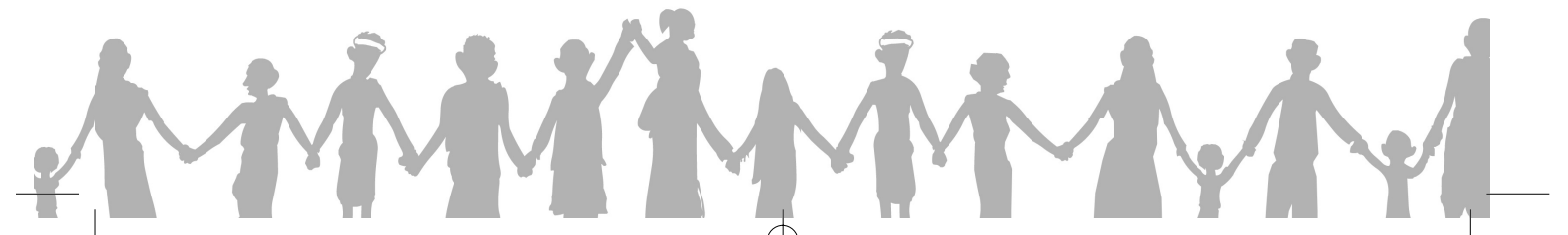
3.4 Demand Management, Conservation and Efficiency of Utilisation

The efficiency of utilisation in all the diverse uses of water should be improved and conservation consciousness should be promoted through measures such as those suggested below.

Domestic Sector

- Introduction of domestic water saving devices
- Compulsory rain-water harvesting in new buildings of a certain size
- Water meters on all consumers/ groups of consumers
- Progressive water tariff structure
- Auditing of water balance on each distribution system
- Sewage and other domestic use to be piped out separately[7]

7. Domestic wastewater, sewage and rainwater should be piped out separately. Domestic wastewater should be treated in local level water treatment plants and the treated water should then be reused for sanitation and gardening purposes.



- Primary treatment of domestic water used in each locality for reuse in gardens, parks, etc.

Industrial Sector

- Progressive water tariff
- Water recycling facilities
- Treated urban sewage water for cooling and other processes
- Compulsory rain-water harvesting in public buildings

Agriculture Sector

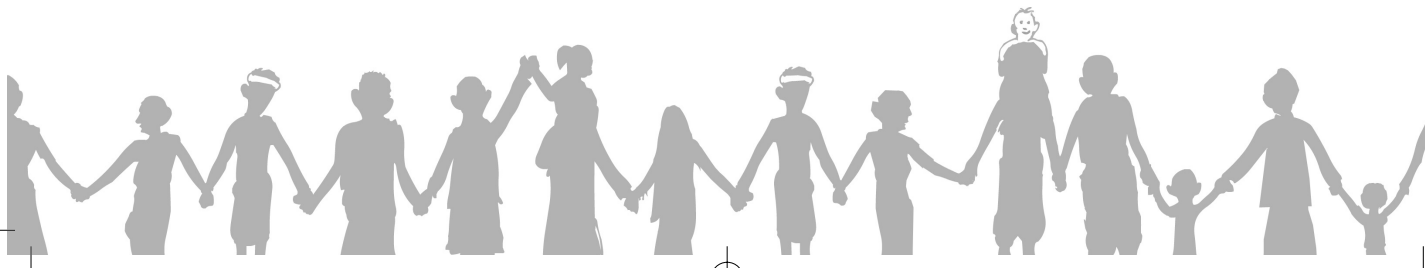
- Water rates on volumetric basis to WUAs should be pegged at an appropriate level to yield enough revenue for maintenance costs
- Treated sewage water for non-edible crops
- Saline water for tolerant crops
- Improvement in irrigation practices and reduction of water losses
- Pressure irrigation systems to be introduced
- *Suitably modify PDS and minimum purchase price policies to discourage the focus only on wheat and rice.*
- *Encourage mass marketing of less-water-consuming crops and discourage heavy water-consuming crops like sugarcane and paddy*
- *Multi-cropping and diversified and multiuse of water and land*
- Encourage coarse grains and oilseeds in low rainfall areas to decrease water consumption

River management for each basin

- Afforestation and soil conservation
- Livestock management
- Treatment before disposal of sewage
- Prevention of pollution from agriculture use through use of bio-fertilisers and bio-pesticides

3.5 Groundwater Management

There are two crucial aspects of groundwater management where strategic changes are needed if groundwater is to be managed in a sustainable way for the future. *One, the control over groundwater* has to lie with the local communities and local level governance structures need



to be kept in mind. *Two, information on groundwater* has to be made available to the public by the government in order to enable local communities and other people to manage groundwater in a rational and sustainable manner.

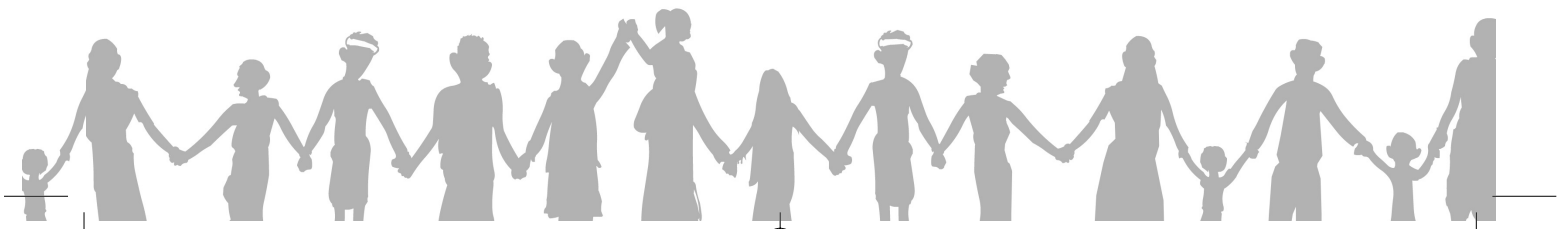
The first right to groundwater should be to the concerned community and not to an individual on land-ownership basis. In areas with scarcity of water, the respective community organisations should have the right to inspect and monitor the use of groundwater by private landowners to ensure that groundwater beyond permissible limits is not being withdrawn. The community should have the first right to use rainfall directly, store and recharge groundwater wherever possible. *The rights over water should not be restricted to only those who own land. Water should be allocated on per head basis and not on the basis of land area and heavy water consuming crops should not be allowed by consensus/agreement.* Some existing models are notable in this regard. For instance, Ralegaon Sidhi and the Pani Panchayat model developed by Gram Gaurav Pratishthan. In Bangladesh, the Grameen Bank gives credit for development of shallow tubewells for groundwater development to landless people, and the groundwater is then sold to landowners.

Diversion of groundwater to urban areas or for industrial use without consent of the gram sabha/village community should also not be permitted. The government should transfer the authority for regulating groundwater use to the lowest level, the Gram Sabha, as discussed above in section 2.2. In this case *the government should have the responsibility of laying down the rules and regulations and then monitoring the implementation.* In case of default the Gram Sabha should be penalised and would in turn be authorised to collect it from individuals or groups as necessary.

In canal-irrigated areas, groundwater planning should be integrated with the water supplied through the canal system so as to avoid water-logging and also utilise public or private funds of the community and local management talent.

Development of groundwater resources should be so regulated as not to exceed the recharging possibilities, as also to ensure social equity. *The detrimental environmental consequences of over-exploitation of groundwater need to be effectively prevented by existing legislation and its enforcement by local government bodies, RWAs and gram sabhas, who will have to play a vital role in this.* To give teeth to their actions the Central and State governments should enact suitable legislation and notify the permissible water depths to which ground water depletion will be permitted for each region/block/gram sabha/watershed after identifying the special problems of each area.

Groundwater recharge projects should be developed and implemented with community participation for augmenting the available supplies. Also, filling up of urban ponds and water bodies for urban use should be disallowed in order to enable the recharge of groundwater. Development of ground water must take India's great hydro geological diversity into account. Great caution needs to be exercised especially in hard rock regions that constitute a major



part of India's land area. There should be a reassessment of groundwater quantity and quality every 5 years.

In order to discourage excessive use of ground water, the electricity and diesel should be supplied at the market rate and should not be subsidised. However, it should be ensured that the electricity is supplied for 12-16 hours per day without interruption. This would also encourage use of other means of energy. In case subsidies are to be given to the marginal and poor farmers, these should be designed and targeted in such a way that the subsidies reach only the targeted beneficiaries and not the better-of farmers.

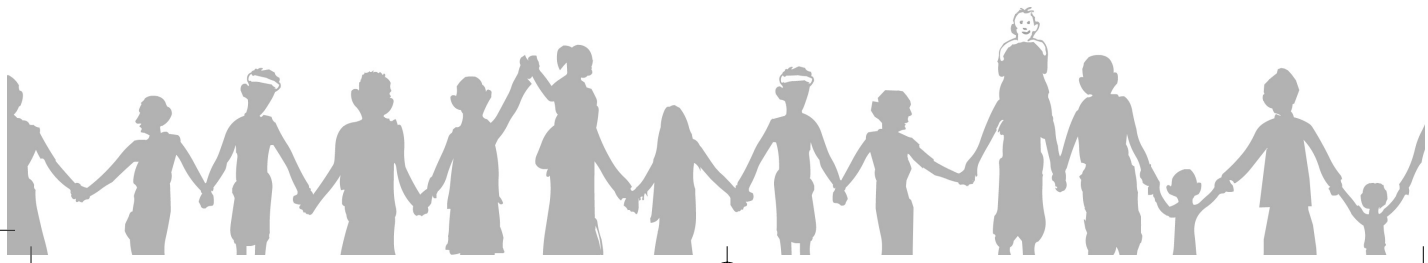
Over-exploitation of groundwater should be avoided near the coast to prevent ingress of sea water and also from excessive saline layers of aquifers. To stop further ingress and to reverse salinity, small reservoirs can be built on water channels near the coast to recharge groundwater, as has been done in Gujarat.

3.6 Watershed Areas Management and Drought-Proofing

People-centered and managed *watershed development* in India's rainfed areas has to be accorded the highest priority in order to contribute to the vital national goals of drought proofing, employment generation and food security. Out of a total land area of 141 mha that needs watershed management only about 40-50 mha has received attention yet and that too primarily from the government with little involvement of the people. Thus, the current watershed management effort is neither adequate nor likely to be sustained by the people in the long run. A net area of 54 mha is irrigated at present. This can go up to a maximum of 85 mha in the next four to five decades. *It is obvious that during this period much greater attention—from the lowest to the highest level—has to be given to watershed management and development.*

Watershed management and minor irrigation projects would be *most suitable for drought prone, tribal and hill areas*, which should be encouraged to be developed by the local communities, with technical and financial help from the government and NGOs. The management of these projects should be with the local communities, through Watershed Management Associations/WUAs.

Drought-Proofing: Due to the uneven distribution of rainfall in India in time as well as space, a substantial part of India (121 mha out of a total reported area of 305 mha) is drought prone. The drought prone area covers 222 districts comprising 1207 blocks and is spread over 17 States, with a total number of 471 districts. 75 mha of the drought prone area is covered by the Drought Prone Areas Programme (DPAP) and 46 mha is covered by the Desert Development Programme (DDP). The thrust of activities under these programmes is soil conservation, land shaping and development, water resources conservation and development, afforestation, etc. While immediate relief and employment generation programmes are necessary in the short run to take care of the crisis situation caused by drought, in the long run the



emphasis should be on drought-proofing by adopting suitable policies and measures to prevent and mitigate the severe negative consequences of drought. For this purpose, the emphasis should be on the following policies and measures:

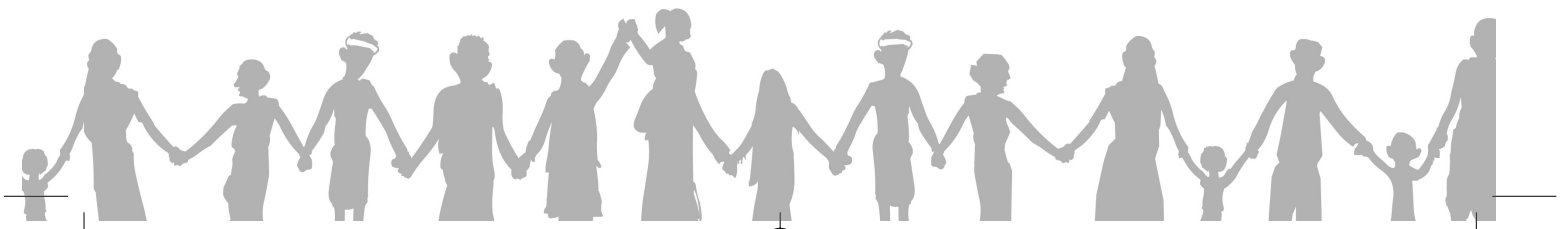
- Watershed development and rainwater harvesting projects—for soil and water conservation and preventing water run off. These projects can be implemented under the Employment Guarantee Scheme or otherwise.
- Agro-climatic regional planning and the growing of most suitable and less water intensive crops and other vegetation so that the available resources are utilised optimally in a scientific manner.
- Integrated planning and utilisation of water resources in the river basin, as has been discussed above.

3.7 Maintaining River Life and Water Quality

Besides taking care of urban and rural needs, *maintaining the life of river systems and other water bodies* should be an important objective of planning. This includes maintaining minimum water flows, prevention of pollution from industry and agriculture and control of riverbed sand extraction to ensure the maintenance of aquatic life and other ecological factors. As a result, water, a limited resource, will be under greater demand pressure in future. This underscores the need for utmost efficiency in water utilisation and public awareness of the importance of its conservation.

A *minimum good quality water flow* should be ensured at all times as required for the life of the river and for sustaining livelihoods. This should include the allocation of water for various purposes including conserving the environment, preventing groundwater salinity and sea water intrusion, supporting livelihood based on aquatic life and other uses of water, recreation, and cultural activities like bathing and festivities. The requirement of water for these various purposes should be calculated scientifically. To begin with one estimate suggested a 20% of mean annual flow equally distributed over the year or at least 50 per cent of the lean period flow before the structure was built (average of 1-2 months) over and above the committed use should be allowed to go downstream of all existing and new structures. Implementation of this would be possible only with the help of all communities involved with proper monitoring and also by allocating this quantity on a priority from new reservoirs.

Water quality has to be a very important aspect of IWRM strategy. The best way to ensure water quality is the prevention of pollution of water bodies and introduction of the "polluter pays principle". In addition, improvements in existing strategies and the innovation of new techniques resting on a strong science and technology base will be needed to eliminate the pollution of surface and ground water resources, *to improve water quality and to step up the*



recycling and re-use of water. Realising the importance and the pressure of demand on fresh water, it has to be treated as an essential part of the environment for sustaining all life forms.

In project planning, implementation and operation, *the preservation of the quality of the environment and the ecological balance* should be a primary consideration. The adverse impact, if any, on the environment should be minimised and should be off-set by adequate compensatory measures. Effluents should be treated to acceptable levels and standards before discharging them in natural streams and other water bodies. Details of all effluents generated by each industry or urban area should be available to the public. The standards of treatment and the achievement levels by each effluent discharger should also be available to the public. The responsibility of making this available to the public will be with the pollution control board and with the local government bodies.

The study of the impact of a project during construction and later, on human lives, settlements, occupations, socio-economic environment and other aspects should be an essential component of project planning. All projects that seek to conserve/impound water or generate power should make *the Environmental Impact Assessment (EIA), the Social Impact Assessment (SIA) and Cost Benefit Analysis open for public scrutiny* and should examine alternate options before coming to a conclusion about the most appropriate strategy. Environmental Management Plan (EMP) and compensatory actions should also be considered and should be open to public discussion to ensure public participation in implementation and subsequent maintenance.

Necessary legislation should be made for the preservation of the existing water bodies by preventing encroachment and deterioration of water quality. An annual list of defaulters in this regard with the extent of area under encroachment will be prepared and published by the pollution control board so that social and legal pressure can be brought to bear on the defaulters.

Traditional and natural wetlands and water bodies like tanks, *jheels, chors* and village ponds, etc. have been badly neglected in the last few decades. These structures should be restored, maintained and used properly and these water bodies should not be allowed to be encroached upon for any other land use.

3.8 Resettlement and Rehabilitation

Although optimal management of water is best achieved through a sound micro watershed development programme, *sometimes it would be necessary to construct large storages*. The consequent resettlement and rehabilitation of people should be governed by a national policy. Under this policy the project-affected persons (PAPs) should be entitled to rehabilitation that precedes the project completion and compensation where payable should be both for appropriation of property as well as for livelihood.

Land for land in respect of agriculturists should be the preferred option in those regions and States where land for resettlement is or can be made available. In some cases, *where*

allotting land for land is not possible due to small holdings throughout the command, following alternative measures should be taken:

- *Annuity for a certain number of years*, where the amount of annuity and the number of years for which it is to be paid may be worked out on the basis of factors like skill level, value of loss of livelihood, and number of remaining years of active working life.
- *A suitable job in the development project itself*, where the skill and job profile match or person's skill can be upgraded by suitable training and only where the job is expected to be of a permanent nature, and is not merely created for the purpose of rehabilitation.

The compensation awarded to PAPs should match market rates, even if this means that the cost of Resettlement and Rehabilitation (R&R) as percentage of the total project cost goes up.

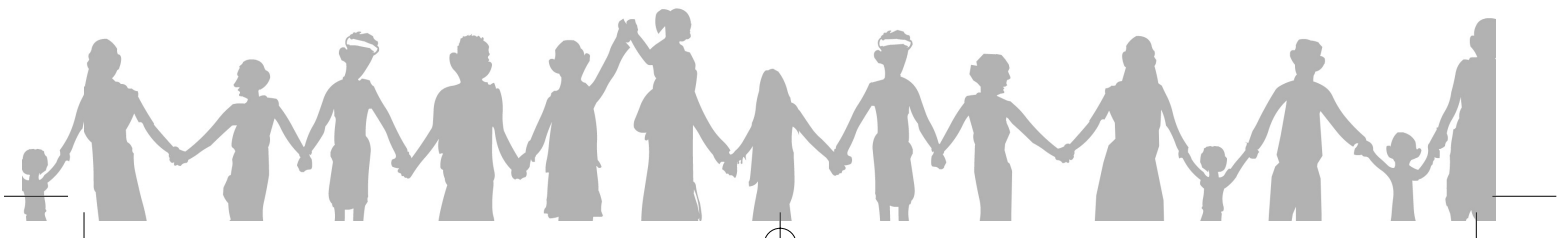
The definition of PAPs should be such as to cover all the people who are actually affected by the project[8]. The definition should include, besides the persons displaced due to the dam reservoir, borrow area or mine etc., the persons displaced due to the project colony, the canal system or any other 'development' during the project construction. Tribals or others, who may not have legal titles to the land, but who are nevertheless land-owners in terms of customary laws, should also be considered as PAPs. Persons, such as downstream fisher-folk, washermen, etc. whose livelihood is affected due to a project, should be compensated suitably.

All water and power development projects should *ensure that benefits of the project go to the local people first*. For example, water supply and electric connections should be provided on priority to all local people who are affected.

A separate R&R cell or wing should be created within the project management structure to be staffed with social scientists (sociologists, anthropologists, economists) and extension/community workers besides engineers. This cell should focus on bringing about attitudinal change among the project managers and government officials towards the problems of the PAPs. The central or State governments or corporations which are repeatedly involved in R&R activities should set up a cadre of persons (from both engineering and social science backgrounds) trained in R&R activities.

The concerned government should appoint *an independent agency (outside the project implementation) to monitor the R&R activities* at regular intervals for the whole duration of the development project. Representatives of local people/reputed NGOs should be associated/

8. According to the NWDT Award, for instance, an oustee meant "any person who, since at least one year prior to the date of publication of notification u/s 4 of the Land Acquisition Act, has been ordinarily residing or cultivating land or carrying on any trade, occupation or calling or working for gain in the area likely to be submerged permanently or temporarily."



co-opted as a part of this agency to inspire confidence among the affected people. They should visit the sites/villages for redressing the grievances rather than wait for complaints.

3.9 Inter-linking of Rivers

Inter linking of rivers has been in vogue for a long time to achieve specific objectives. These have been mainly generation of power (as in the case of Beas–Sutlej link) and supplying water through the existing canal system for irrigation of more area. The present proposal apparently aims to achieve drought proofing and flood moderation. Besides supplying water for irrigation, generating power, enhancing storage capacity with surplus water from the donor basin specially during the monsoon period. With regard to the flood moderation it can be independently achieved to some extent by providing big storages and flood plain absorption provided it permits suitable economic activities. While framing a project within the proposed programme the following points should be kept in view before taking any decision.

a) Before any basin is declared as surplus, an integrated river basin plan should be prepared, which is not being done at the present moment. In fact each State should do this at the earliest for the portion of the basin in their State before integrating it with the other States in the same basin.

b) *The hydrology of supplier and recipient basin should be studied over a period of 100 years* to see how often the surplus of donor basin matches with the storage in the recipient basin. The matching year should be more than 60 years and preferably about 80 years.

c) A plan of operation from the supplier to the recipient basin should be prepared for all the 100 hydrological years so as to judge how successful the operation would be to satisfy the public for this minimum requirement both in the rural and urban areas.

d) The surplus water during flood season may be available for not more than 30 days after considering the water requirements for all the flood benefits in the donor basins. The storage and the link canal capacity in the recipient basin would have to be designed accordingly. The storage should also take care of two drought years one after the other which happens quite often in the drought areas.

e) *The next objective for transfer of water should be income generation and providing livelihood for people below the poverty line and low income group.* Other possibilities for achieving this should be considered before opting for the transfer of water. In such a case the priority should be to give water to the areas which have no irrigation and are prone to drought. Since the transferred water would be costly the tendency would be to avoid the above category of people or give water at a highly subsidised rate. The tendency would be to give water to existing irrigated areas for a second or third high

value crop so that they could bear the high cost of the water. Thus, the small farmers in the drought areas in whose name the project/programme is being planned would be left high and dry.

f) All storages in the supplier basins would have to take care of the environmental, sanitation, pollution, ground water recharge and rural/urban water supply requirements for which no water is allocated at present and also the requirements for various uses during the non-monsoon period. It is well known that the glaciers in the Himalayan regions which took care of the flows in the river during the spring and early summer season are now receding and drying up due to climate change. Thus, any new storages would have to take care of these flows also. These projects should be taken up on their own rather than included in the linkage programme.

g) In order to keep the cost of transfer of water to the minimum as far as possible lifting of water should be avoided.

h) Since the government alone would not be able to provide all the funds it would be necessary to get loans from financial institution and thus the recovery plan from the beneficiaries has to be prepared on a realistic basis.

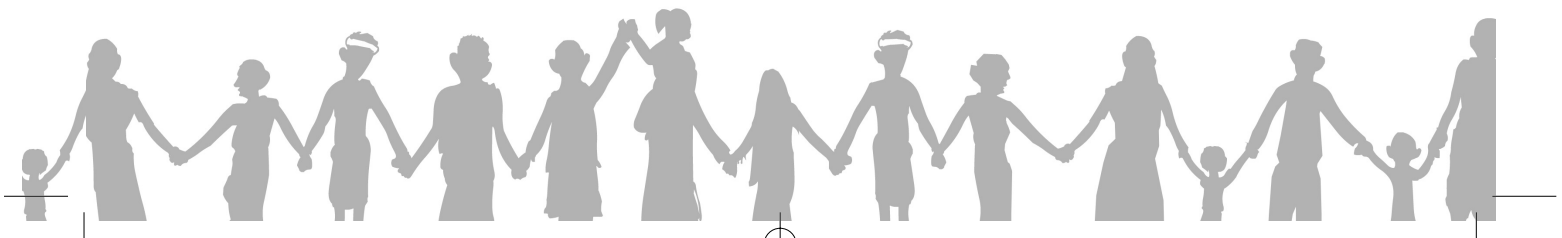
i) For such a programme it would be necessary to take the public at large into confidence and not only the politicians and bureaucrats by explaining the realistic benefits to the recipient. This would also achieve people's participation in all respects from planning, construction, operation and proper use of water.

j) If water for irrigation and other major uses is given from the link canals then the question of riparian rights may arise. Since the water would flow for a few days during the monsoon season this may create problems.

It is understood that feasibility reports for 20 links have been prepared so far out of the 30 links proposed. It would be desirable to take up one of the feasible links for a detailed project report including an operation plan, which would go a long way in convincing the public. Ken-Betwa link for which socio-economic studies have also been done in 1992 is a suitable link to be taken up for this purpose. Preparation of Detailed Project Reports (DPR) and the recent agreement between U.P. and M.P. in this regard therefore is a welcome development.

3.10 Flood Management

The flood prone area in the country is 40 mha. Insurance against floods and droughts requires local action as well as national coordination. It is essential to realise that *floods and their negative consequences can only be managed, they cannot be 'controlled'*. The seasonal floods in most parts of India are largely a consequence of the concentration of heavy rainfall within a period



of few days/weeks during the monsoon months and low flows for most part of the year. The flood management strategy should recognise this fact and should begin with the premise that people are prepared to live with the floods in ways that are least disruptive and harmful for them.

A number of systematic measures, which include the adoption of suitable policies, operational and managerial steps, disaster preparedness, flood forecasting, ecological measures and international river water sharing agreements should be taken urgently to deal with floods in such a way that their intensity is moderated and the negative consequences on flood-prone populations are minimised. The planning for flood management should be done in a holistic manner including formation of CBOs so that the needs during the non-flood season are also taken care of.

Measures for Flood Management

i) A *master plan for flood management for each flood-prone basin should be prepared.* An integrated river basin water WRM strategy for States sharing a river basin should be evolved. Such groups of States should co-operate, make use of computerised information systems and undertake joint measures for information sharing, flood forecasting, management, and operation of reservoirs, etc.

ii) In those instances where flood control is one of the key purposes of multi-purpose dams, it should be ensured that the dam intercepts significantly at least 33 percent of the catchment/drainage above the affected area. Flood management should be one of the important purposes wherever dams and reservoirs are built for multipurpose benefits. *In highly flood prone areas, flood management should be given overriding consideration* in reservoir regulation policy even at the cost of sacrificing some irrigation or power benefits.

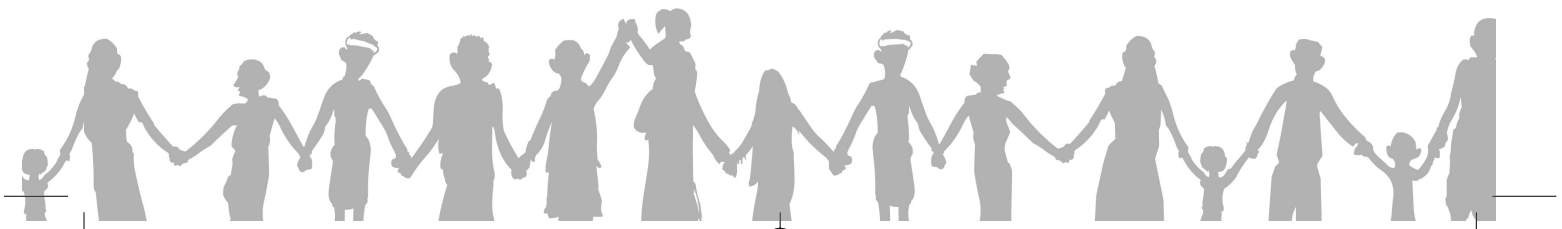
iii) While physical flood protection works like embankments and dykes may be necessary in some areas, increased emphasis should be laid on non-physical measures such as *flood forecasting and warning, flood-plain zoning* and flood proofing, for the minimization of losses, so as to reduce the recurring expenditure on flood relief. *An extensive network for flood forecasting should be established for timely warning to settlements* and economic activity areas in the flood plain zones in order to keep people in a State of preparedness and to minimise the loss of life and property on account of floods. The working of the existing flood forecasting and warning network in flood prone regions should be reviewed and strengthened using the latest technology and to render real time information/warning coupled with a decisive support system, comprising simulation models, policies of operation of structures based on historical data, to develop the likely scenario in the flood plains.

iv) Land-use regulation should be integrated with *flood plain zoning* to avoid inappropriate land-use in flood-plains and other flood-prone areas and consequent higher damages and relief costs in the long run. Flood prone areas should be demarcated at different probability levels and appropriate development measures and economic activities should be devised for flood prone and non-flood prone areas (as recommended by the Rashtriya Barh Aayog).

v) Unauthorised and unabated encroachment in the flood plains and riverbeds as also cultivation of riverbeds/drainage courses during the flood period should be prevented. The land, however, may be leased for agricultural purposes during the non-flood months.

vi) Watershed management through extensive soil conservation measures, such as check dams, contour trenches etc., preservation of forests, increasing the forest cover, etc. should be promoted to reduce the intensity of floods. The *traditional flood management systems* of the area should be revitalised, maintained and suitably upgraded. The traditional method of building houses on stilts, for instance, should be revived and encouraged. Thus the government policy should build on people's resolve to live with floods and should aim at dealing with floods so as to minimise losses and hardship while obtaining certain benefits.

vii) Construction of *embankments* should be considered only after careful detailed studies and investigations as a part of a package. Regular and adequate maintenance of embankments should be ensured with the involvement of people. Where embankments have been made, arrangements for adequate drainage of the area behind them should be made through appropriately located sluices. Development works such as roads, railways and housing construction should take into account natural waterways and adequate natural drainage should be provided without creating an aflux upstream. Sluices located in upstreem portion of the embankment could also be used for filling the wetlands and silting the land behind the embankment to absorb some flood water, fertilise the soil and recharge the groundwater. The sluices located downstream could drain out the surplus water when levels in the river permit.



4

Action Programme and Important Implementation Aspects

The implementation of the IWRM strategy suggested above requires administrative, organisational, legal and project implementation action. Since it requires de-centralisation of authority to States, districts, blocks and gram sabha organisations and the people themselves, besides co-operation among the various departments and ministries concerned, it should be discussed widely among water sector professionals, NGOs, community organisations and all concerned officials within the government, in the next one to two years, especially with a view to finalise the action programme.

4.1 New Organisational Structures

A National body of experts should be set up by the central government, preferably in the Planning Commission to midwife the process of setting up the first few RBOs (out of a total of about 20 to be set up) and to lay down the rules and regulations for their functioning. This body may be initially constituted for a period of 2-3 years during which the first five RBOs may be set up, and may suggest ways in which all the possible RBOs may be set up and made operational within a decade. The first five RBOs may be set up within States and may include at least two river basins in the North and two in the South. Area water partnerships that have been set up at some places at the sub-watershed level by NGOs and communities can be considered as a starting point for setting up RBOs. Subsequently, RBOs may be set up for inter-State rivers and for one river basin that goes beyond National boundaries.

Once the WRM strategy measures and the action programme outlined here are agreed upon, it would be necessary to switch over to the new administrative organisations. This would have to be a gradual process so that at least by the end of 5 years all intra-State and inter-State RBOs would have been set up. A Water Resources Department should be set up in each State in two years along with a few intra-State RBOs. At the State level the nodal ministries/departments

should be identified for water resources (MoWR), watershed development and rural domestic water supply (MoRD), irrigation (Irrigation department) domestic water supply in urban areas (Public Health Department), and pollution control (State Pollution Control Board). Similar action should be taken at the central level.

4.2 Information Collection

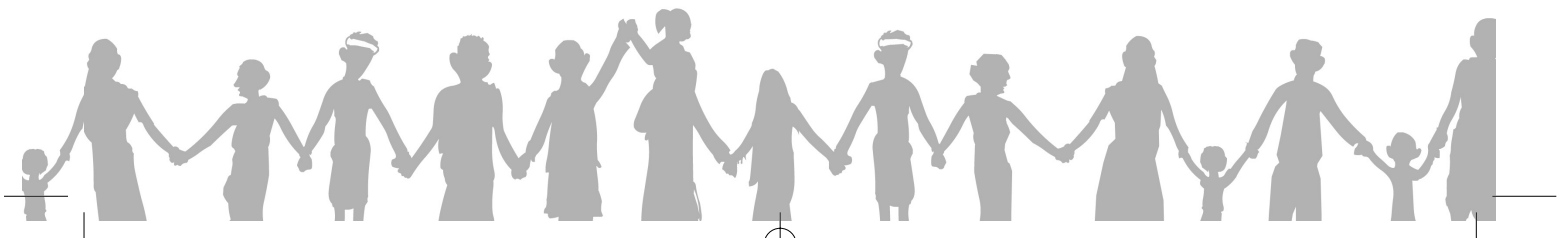
The first task should be to set up an information organisation with the co-operation of all the departments who are already collecting information. This information collection, starting at the lowest level, should be computerised and made available to the public on the Internet, with the MoWR being the nodal agency for this purpose. *This should begin at the lowest level and for this purpose the number of full-fledged information centres should be increased from about 2,000 to 30,000 in the next 5 years.* Various departments at present collect limited data at many more places but not at agreed locations, which need to be consolidated. This organisation would also have to revise and update the assessment of water resources in various forms, which should be completed in first 5 years and then revised every 5 years.

4.3 Legal Changes

On a number of policy issues relating to the management of water resources, which have been suggested herein, necessary legislation should be passed by the Parliament and by State governments to enable the changes to be implemented in practice. However, a number of actions could be taken administratively by the centre and State governments, without even requiring legislative changes. Appropriate and enabling legislation will have to be passed particularly with respect to the following policy and operational aspects:

a) Setting up of river boards, both within States and inter-State, to plan in an integrated way for the development of water resources within a river basin. The necessary legislation should provide for the two-tier constitution of river boards, consisting of the river basin assembly and a supporting technical body. River basin organisations within States can be set up by government orders under existing legislation itself.

b) Enabling full and effective participation of the farmers and rural and urban communities in the task of managing water resources. The existing legislative framework, which provides overriding control over water resources to the State, should be modified to provide usufruct rights to local communities and a pivotal role in the management of water resources at the local level. The exact modalities of how such water users associations, watershed associations and resident welfare associations in urban areas will interact with panchayats and urban local self government bodies will have to be worked out. In the southern and western States of India the panchayat system is working reasonably well, so a separate committee under the gram panchayat consisting of



the actual users/beneficiaries of water could be formed to deal with watershed management and irrigation management at the minor levels. In the northern and eastern States it may be necessary to set up separate WMAs and WUAs who could cooperate with panchayats but not under them, as the latter are not functioning properly.

c) Regulation of groundwater so as to prevent and stop the overuse and depletion of groundwater in many areas. The existing law provides for control and ownership of groundwater by the landowner. This should be modified by transferring at least the management of groundwater to the gram sabha and the RWA. The overuse of groundwater should be stopped and regulated by the respective gram sabhas / RWAs, with higher levels of government providing the necessary information, framing rules for regulation and monitoring the situation.

d) Provision of accurate and up to date information on water resources in the public domain in a user-friendly form. This is essential for the rational and integrated planning of water resources in the country, for involving local communities in the task of management of water resources and for smooth resolution of water related conflicts between different parties. The Official Secrets Act and the attitudes and practices relating to its interpretation should be modified in order that information on water resources in the country is freely available.

These legal changes should be carried out within the next five years so as to remove the hurdles for implementing the new water WRM strategy, with the involvement of NGOs and people's organisations.

4.4 Irrigation Projects

Far too many projects are under construction at the present moment and it would be necessary to provide funds on priority for those on which more than 20 per cent of expenditure or physical progress has been made for completion in the next 5-10 years with practically no new projects to be taken up during these years. Some of the existing projects would need to be modernised, which should be the next priority and completed within the next 15 years. The third priority should be to complete all hydro and irrigation project within each basin by the year 2025. An agreement with Nepal for the purposes of hydropower generation and flood moderation should be pursued vigorously for all common river basins.

4.5 Domestic Water Supply

A target of providing water to everybody within next 5 years, particularly in all the rural areas and especially where the quality of water is not up to the mark, should be fixed. However, after this, certain areas would still come up where the quality has deteriorated and as such would have to be given a new source of supply or better treatment of the water available. This, of

course, would have to be a continuous process and should be monitored all the time. For sanitation in urban areas the target should be to provide it to all in the next 15 years. Wherever possible, two separate pipeline networks, one for sewage and one for kitchen and bath water should be provided so as to reduce treatment costs and to be able to recycle the water. Rooftop rainwater should also be stored separately for use or for groundwater recharge.

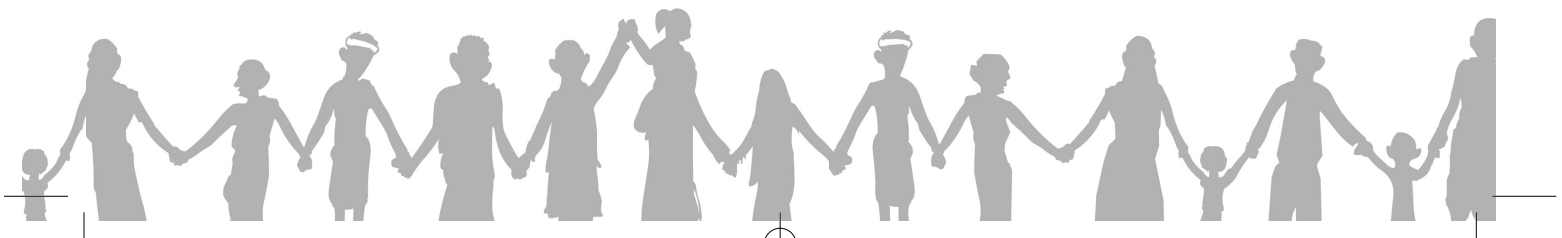
4.6 Implementation of Watershed and Drought-Proofing Projects

As indicated earlier, this sector requires more urgent and intensive attention, both for integrated development of land and water and for improvement in the economic condition of the population. Watershed management is required in the culturable land of about 141 mha that is rainfed at present. This has to be managed by people with the help of NGOs and the government for integrated development of land, water and biomass. Some of these areas have already been covered by watershed management or by joint forest management but these would have to be reviewed in order to achieve the above objectives. The rural development ministry at the centre and in the States should be the nodal agency for this purpose.

A total land area of 141 mha is to be covered under this programme (see *Table 4* above). There is no precise record/information with regard to the land area taken up and completed under various watershed management schemes taken up by various agencies. However, it is estimated that about 40-50 mha has been tackled by government agencies and NGOs through outside financial help thus the balance 80-90 mha has still to be managed by various agencies. The Planning Commission has drawn up a programme of covering 63 mha in the next 25 years. There is no adequate arrangement for the maintenance and management of the watershed work already done by the government agencies, as the people were not fully involved in carrying out this work. Such works may have to be repaired or re-done through community level organisations. *Table 3* (above) gives an idea of the large number of WMAs that are needed for people-centred watershed development and management activities in the country.

At present various departments and ministries like rural development, forest and agriculture etc. are looking after this programme through special programmes imposed from the centre, which are not always suitable for local conditions. A nodal agency like the Rural Development ministry needs to co-ordinate and monitor the work and funds released with the freedom to choose the technology as per local conditions with full involvement of the gram sabha from the planning stage itself so that maintenance and operation can be done by them with authority and responsibility.

There are several land-based programmes being serviced by different ministries of the government of India. The important land-based programmes are: Drought Prone Area Programme (DPAP) and Desert Development Programme (DDP), National Watershed Development Project for Rainfed Areas (NWDPRA), Integrated Watershed Development Programme (IWDP), soil conservation in the catchments of river valley projects and flood



prone rivers. However, despite efforts in the past, progress has not met expectations. The MoA has restructured NWDPRA providing for decentralisation for procedures, flexibility in choice of technology and provision for active involvement of the watershed community in the planning, implementation and evaluation of the programme so that it becomes sustainable. The States of Karnataka, Maharashtra, Orissa and Rajasthan have already established a separate nodal department for implementing all the GOI and the State government watershed and soil conservation programmes.

At present not many NGOs are involved in watershed management. They should be persuaded, motivated and trained to take up this work, so that the total work can be completed in a shorter period. Adequate legal and administrative action would have to be taken to encourage Gram sabhas and NGOs to get involved in this work. Technical help can be provided by the government and also by technically competent NGOs at a reasonable cost.

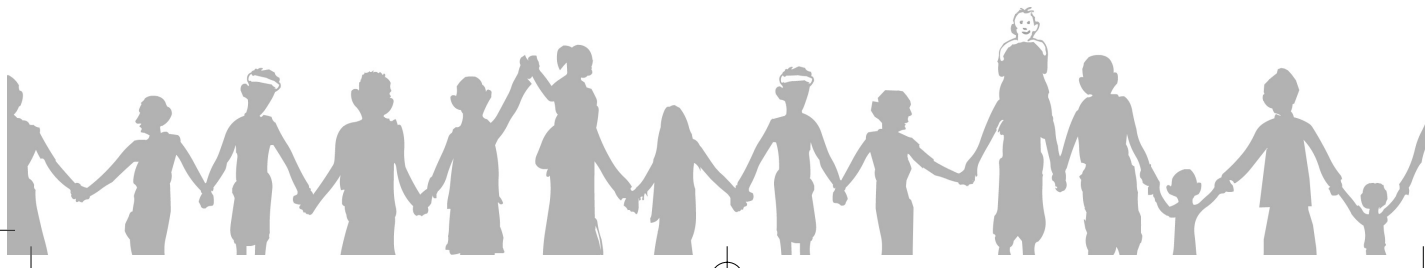
4.7 Preventing and Controlling Water Pollution

Special attention has to be paid to the water from agricultural lands, which are difficult to treat as there is no single point of pollution and as such prevention is the best answer. *For this purpose bio-fertilisers, bio-pesticides and organic farming should be encouraged*, in order to reduce the use of chemicals, which could be done gradually but substantially over the next two decades. Treatment of water from industries and sewage should be implemented within the next 10 years. All this water could also be reused and recycled for various purposes.

4.8 Financing Projects and Water Service Charges

Government financing of water projects is getting reduced due to other priorities and this situation is likely to continue for a long time. It has increasingly become evident that government alone cannot provide the funds needed for the financing of water projects. Water charges need to be increased gradually to cover at least O&M expenditure both in irrigation and domestic water supply and subsidies should be eliminated over a period of 10 years. Transfer of management and authority to local organisations would be necessary to achieve this objective. Local communities on the one hand and the corporate sector on the other have an important role to play in the better development and utilisation of water resources. The government should facilitate this by putting in place a suitable legal and administrative environment.

At present government investment is in major, medium and minor irrigation projects, besides domestic water supply, while watershed development has been done both by the government and the private sector. The capital cost is not recovered and even the operational and maintenance cost is only partially recovered for government projects. Private investment is mainly in groundwater development for irrigation and industrial purposes and the investors also fully bear the cost of operation and maintenance. *However electricity to agriculture sector is highly subsidised, leading to inefficient and poor service and overuse and wastage of groundwater.*



This situation will have to be rectified and the subsidies reduced and, ultimately, removed to if there is to be viable investment of the private sector in groundwater development.

As a matter of principle in government projects the full cost of operation and maintenance along with the 50 per cent cost of the capital should be recovered, except for projects for domestic water supply. The water charges should be increased gradually to reach that level within the next 10 years. In the case of private sector investment, suitable means like commercial use of land or other means can be found to compensate for less recovery in the early stages of operation of the projects. In areas where sanitation services have been provided by the government the water user charges should be substantially enhanced (to double the existing charges or so) in order to recover the capital cost and to generate the funds for maintenance, extension, decentralisation and modernisation of the sewage disposal and treatment system.

The energy pricing should be done at market rates for electricity and diesel (used for groundwater exploitation) and the surface water rates should be comparable so that it induces conservation of water and creates a sense of value of water. Recently under the Uttar Pradesh Water Sector Restructuring Project the World Bank and the Government of Uttar Pradesh have entered into an agreement to set up an autonomous regulatory body to fix service charges for all types of uses of water. This kind of regulatory body to fix tariffs for the different uses of water should be set up in all States.

The water may be sold on volume basis to WUAs, RWAs and other groups so that recovery points and administrative cost can be reduced. This will reduce chances of theft and better distribution by local groups and agencies. This would also require transfer of authority and responsibility to them and in some existing projects even transfer of funds.

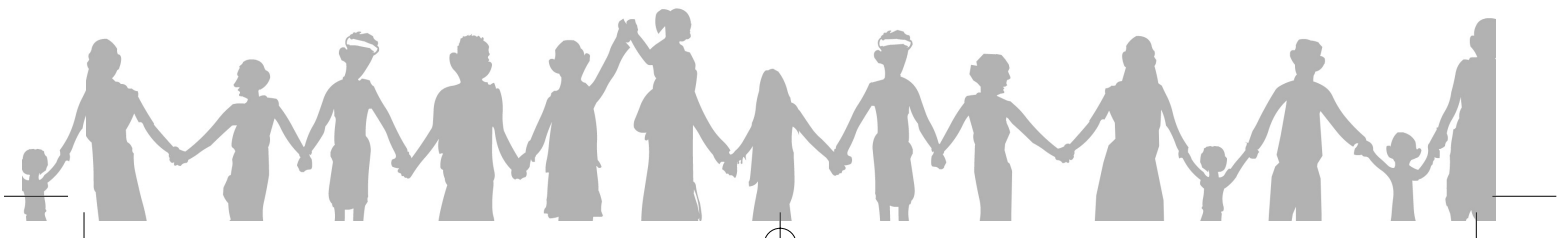
Adequate emphasis needs to be given to the physical and financial sustainability of existing facilities. There is, therefore, a need to ensure that the water charges for various uses should be fixed in such a way that they cover at least the operation and maintenance charges of providing the service and a part of the capital cost. The water charges could be increased gradually. These rates should be linked directly to the quality of service provided. The subsidy on water rates to the disadvantaged and poorer sections of the society should be well targeted and transparent.

Subsidy could be given to small and marginal farmers at lower rates, but specially targeted because at present, the major benefit of subsidies goes to middle and bigger farmers.

4.9 Project Implementation

The environmental and rehabilitation aspects have not been up to the mark, particularly in terms of implementation in the existing projects and those under construction. All these projects should be reviewed and action taken for completion in the next 5 to 10 years.

There should be a system to monitor the performance of the project and socio-economic impact of the project. Such a monitoring process should take the community into confidence



by involving them at every stage. All data gathered for this should be made available in the public domain. A close monitoring of the projects to identify bottlenecks and to adopt timely measures to obviate time and cost overruns should form part of project planning and execution.

4.10 Private Sector Participation

In the first four decades after Independence, due to the absence of expertise and the required skills not being available in the private sector, the expertise and skill for investigation, planning, feasibility reports, detailed designs, and even departmental construction were developed in the government sector. Since a number of projects were taken up in various States, most of the major States had developed this expertise along with research and model testing. Now the tempo of work has slowed down and the required expertise has also developed with the private sector, which can move from project to project in different States, or even take up projects outside India. The private sector can operate with less manpower and better utilisation of expertise. Such tasks can now be given out on contract to private sector firms (through competitive bidding) who are in a better position to keep themselves up-to-date with the latest technology and with least cost.

4.11 Maintenance and Modernisation: Performance Improvement

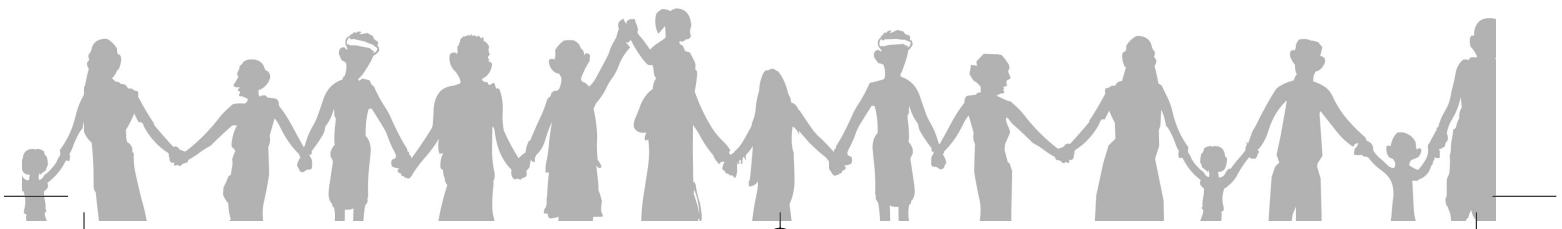
There is an urgent need for a paradigm shift in the management of water resources sector. From the present emphasis on the creation and expansion of water resources infrastructure for diverse uses, there is now a need to give greater emphasis to performance improvement of the existing water resource facilities. Therefore, allocation of funds under the water resources sector should be re-prioritised to ensure that the needs for development as well as operation and maintenance of the facilities are met along with the funds allocated to other activities under the sector. Structures and systems created through massive investments should be maintained in good health. Appropriate annual provisions should be made for this purpose in the budget. There should be a regular monitoring of the structures and systems and necessary rehabilitation and modernisation programmes should be undertaken.

4.12 Safety

There should be proper organisational arrangements at the national and State levels for ensuring the safety of storage dams and other water related structures consisting of specialists in investigation, design, construction, hydrology, geology, etc. Dam safety legislation should be enacted to ensure proper inspection, maintenance and surveillance of the existing dams and also to ensure proper planning, investigation, design, construction and safety of new dams. The guidelines on the subject should be kept under constant review and periodically updated and reformulated. There should be a system of continuous surveillance and regular visits by experts.

4.13 Training

Since the over all thrust of the new national water WRM strategy is towards people's participation at all stages, the highest priority should be accorded to the training of those who are to manage the water resources at all levels. The training must sensitise all partners to the demands of a people's planning approach to water resource development. Training should also ensure the technical empowerment of all local institutions and communities who are to plan for, develop and manage water resources. These include panchayats, gram sabhas, NGOs, watershed associations, WUAs, RWAs, etc. It should cover training in information systems, sectoral planning, project planning and formulation, project management, operation of projects and their physical structures and systems and the management of the water distribution systems. The training should have a strong component on attitudinal and behavioural change.



Bibliography

Agarwal, A. and Narain, S (Eds), 1997, *Dying Wisdom: Rise, Fall and Potential of India's Traditional Water Harvesting Systems* (State of India's Environment 4: A Citizens' Report). Centre for Science and Environment, New Delhi.

Central Water Commission, Government of India, 2000, *Water and Related Statistics,* Information Systems Organisation, Water Planning and Projects Wing, New Delhi.

Chopra, Kanchan, 2003, 'Sustainable Use of Water in India: the Next Two Decades', 14th Kanwar Sain Memorial Lecture, Water Resources Day and World Water Day.

Deptt. of Agriculture and Cooperation, 2000, *Common Approach for Watershed Development*', Ministry of Agriculture and Cooperation, GOI, New Delhi.

India Water Partnership and Institute for Human Development, 2000, *India Water Vision 2025: Report of the Vision Development Consultation,* New Delhi.

India Water Resources Society, 1999, *Water: Vision 2050*, Theme Paper, Water Resources Day.

India Water Resources Society, 2001, *Management of Floods and Droughts*, Theme Paper, Water Resources Day.

Iyer, R. Ramaswamy, 1998, 'Water Resource Planning: Changing Perspective', *Economic and Political Weekly,* December 12, pp. 3198-3205.

Iyer, Ramaswamy R., 2003, *Water: Perspectives, Issues, Concerns*, Sage, New Delhi.

Kapoor, A. S., 1998, Bio-drainage to Overcome Water-logging and Salinity Problems in Irrigated Land in Dry Arid Regions, CBIP, New Delhi.

Kathpalia, G. N. and Kapoor, Rakesh, 2002, 'Water Resources Management in India: Evolution of Policies, Practices and Directions for the Future', Paper presented at the conference on Policy Futures for Water Resources Management in India, organised by IWMI-India, Hyderabad.

Kumar, Anand, et al, 1999, *The Troubled Waters: A Report on the 1998 Floods in Eastern Uttar Pradesh,* Poorvanchal Gramin Vikas Sansthan, Uttar Pradesh.

Ministry of Rural Development, 1996, 'Draft National Policy for Rehabilitation of Persons: Displaced as a Consequences of Acquisition of Land', *Economic and Political Weekly,* June 15, pp. 1541-1545.

Mishra, Anupam, 1993, *Aaj Bhi Khare Hain Talab*. Gandhi Peace Foundation, New Delhi, new edition, 2004.

Mishra, Dinesh Kumar, 2000, *Boya Ped Babul Kaa: Barh Niyantran Kaa Rahasya*, Prithvi Prakashan, New Delhi

National Commission for Integrated Water Resource Development, 1999, *Integrated Water Resource Development: A Plan for Action,* Volume 1, Ministry of Water Resources, GOI, New Delhi.

Nayak, R. C., 2005, 'Interlinking of Rivers in India,' in *Report of the Eleventh National Water Convention*, 11 May 2005, Organised by the National Water Development Agency, New Delhi.

Prasad, Kamta, 2005, *Manual on Community Approach to Flood Management in India,* The Associated Programme on Flood Management, World Meteorological Organisation and Global Water Partnership, New Delhi.

Prasad, Kamta, 2005, *Indian Approach to Dams and Development,* Institute for Resource Management and Economic Development with IWP, New Delhi.

Rao, C.H. Hanumantha, 2000, 'Watershed Management in India: Recent Experience and Emerging Issues', *Economic and Political Weekly,* November 4, pp. 3943-3947.

Shah, Mihir et al. 1998, *India's Drylands: Tribal Societies and Development through Environmental Regeneration,* Oxford University Press, New Delhi.

Singh, Chatrapati (ed.), 1992, *Water Law in India*, Indian Law Institute, New Delhi.

Thatte, C. D., Keynote address, Workshop on Flood and Drought Management, 16-17 September 2004, Organised by Central Board of Irrigation and Power and New Delhi Centre of World Water Council, New Delhi.

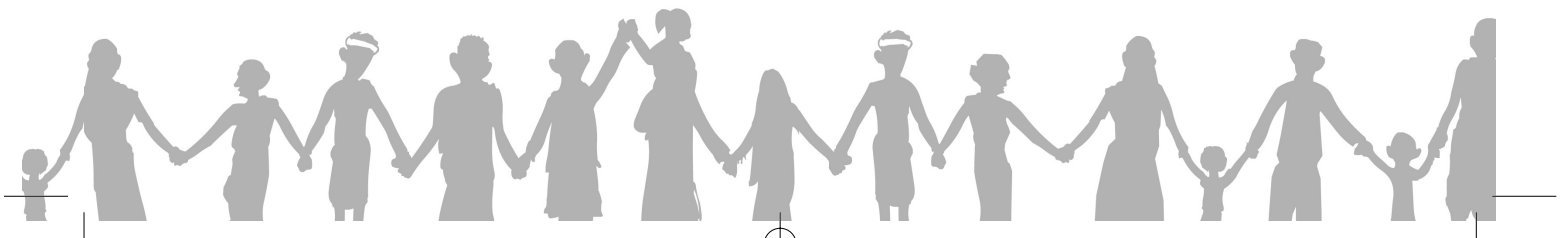
Vaidyanathan, A., 1991, 'Integrated Watershed Development: Some Major Issues', Founders Day Lecture, Society for the Promotion of Wastelands Development, New Delhi.

Vaidyanathan, A., 1999, *Water Resource Management: Institutions and Irrigation Development in India,* Oxford University Press, New Delhi.

World Bank, 1999, *Initiating and Sustaining Water Sector Reforms: A Synthesis,* South Asia Rural Development Series, Allied Publishers, New Delhi.

World Bank, 1999, *Inter-sectoral Water Allocation, Planning and Management,* South Asia Rural Development Series, Allied Publishers, New Delhi.

World Commission on Dams, 2000, *Dams and Development: A New Framework for Decision-Making, The Report of the World Commission on Dams*, Earthscan, London.



ANNEXURE 1
Action Plan Schedule for Implementation of Suggested Measures

Policy Implementation Aspect	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020-26
1 Public discussion on IWRM Strategy and Action Plan		1 to 2													
2 Setting up WRD/Ministry in each State Regulatory System			2 to 3												
3 Finalise State water policies & set up RBOs within States			2 to 3												
4 Setting up inter-State RBOs				2 to 4											
5 Administrative and legal changes required				2 to 4											
6 Information and Assessment Organisation				2 to 4											
7 Groundwater regulation				2 to 4											
8 Review and implementation of R&R in existing projects					2 to 5										
9 Review and implementation of EIAs in existing projects									2 to 8						
10 Domestic water supply provided to all					1 to 5										
11 Sanitation provided to all															1 to 15
12 Watershed management in 130 mha (net)										1 to 10					
13 Completion of priority projects under construction including CAD										1 to 10					
14 New irrigation area projects (21 mha) completed															10 to 20 years and beyond
15 Modernisation and rehabilitation of old projects															1 to 25
16 Pollution control and prevention in exsisting projects										1 to 10					
17 Increase water charges gradually to cover O&M costs										1 to 10					
18 Agreement with Nepal on Power, Floods, Envt., R&R															
19 Completion of Nepal projects															5 to 25

CHART 1

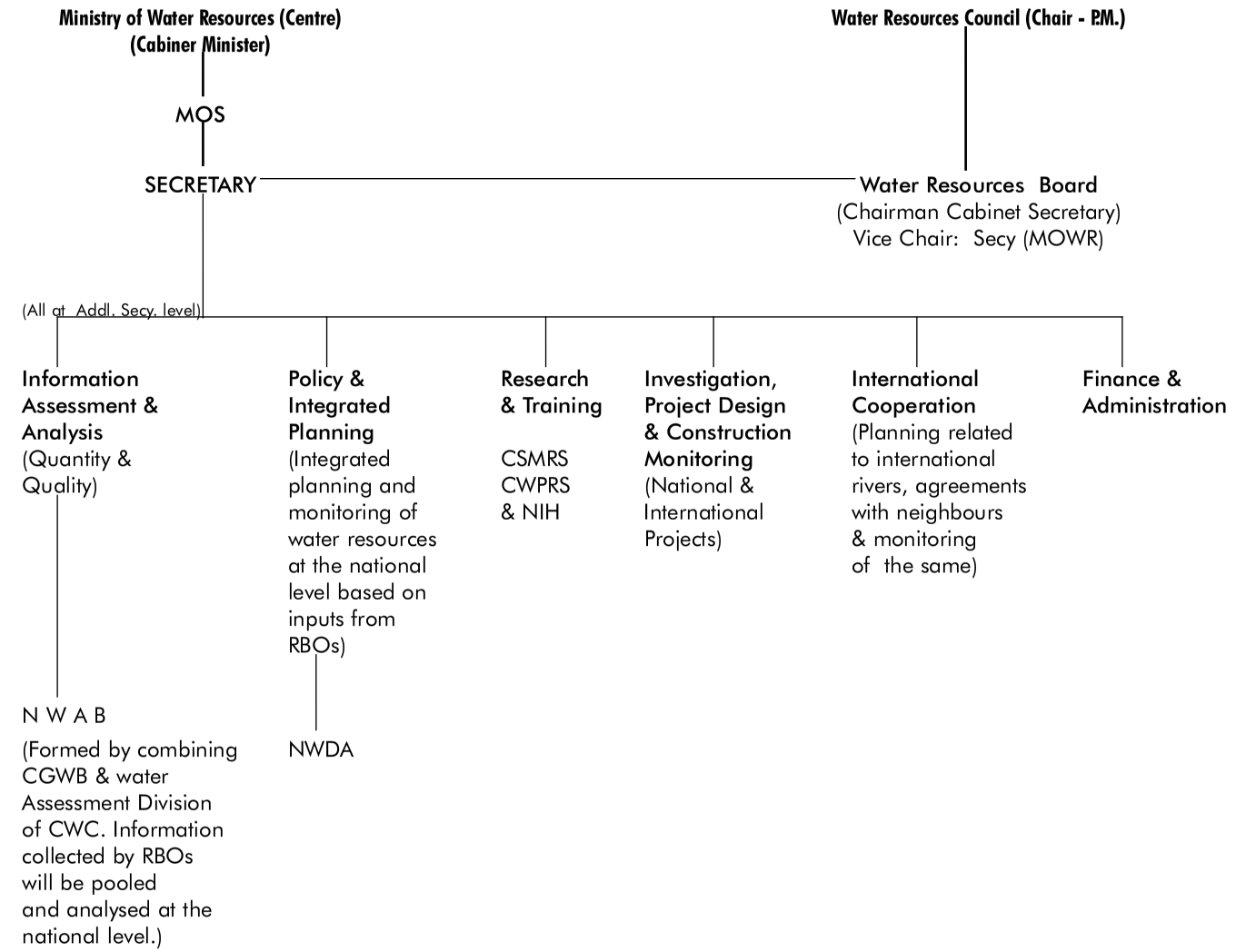
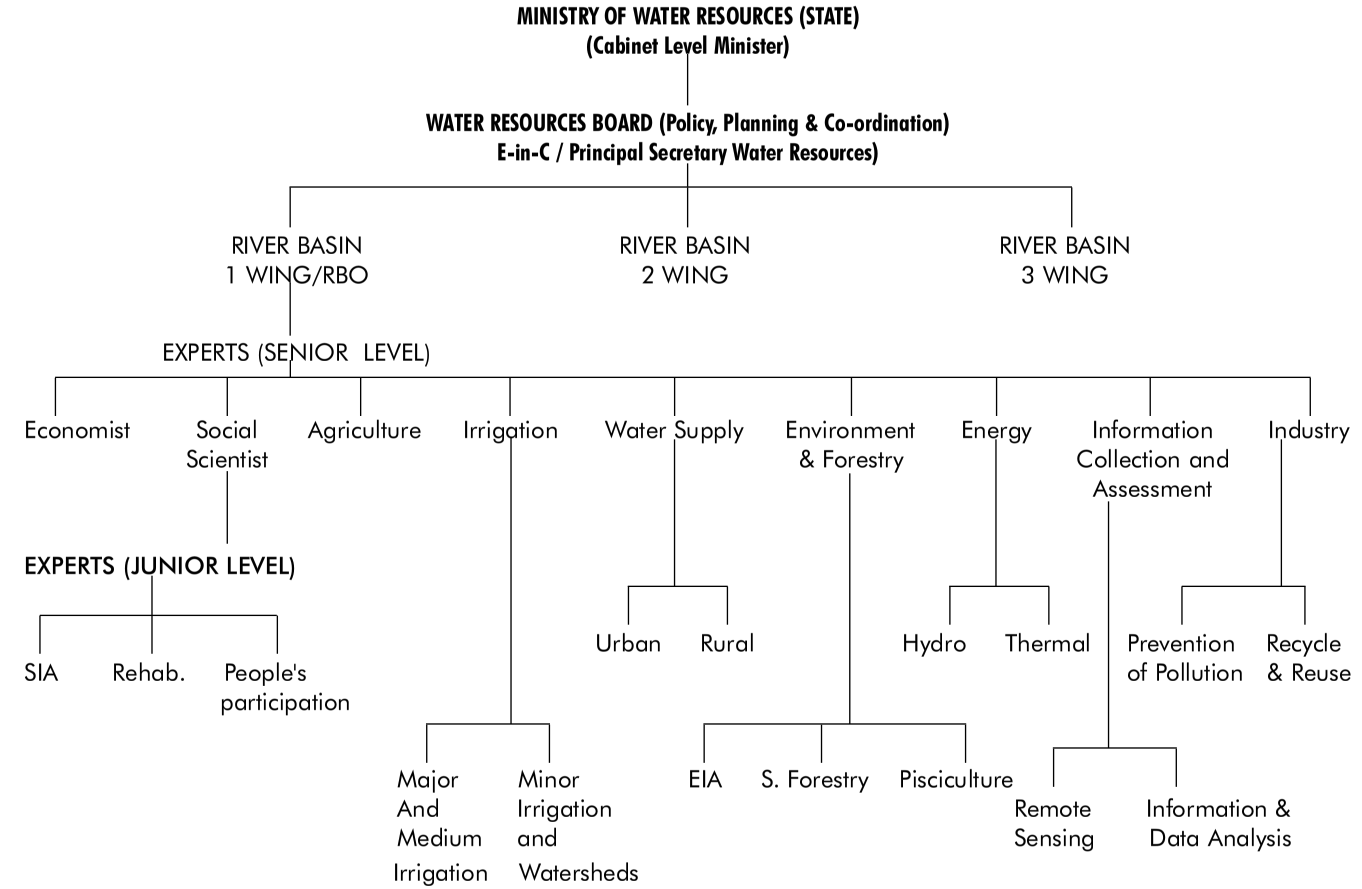
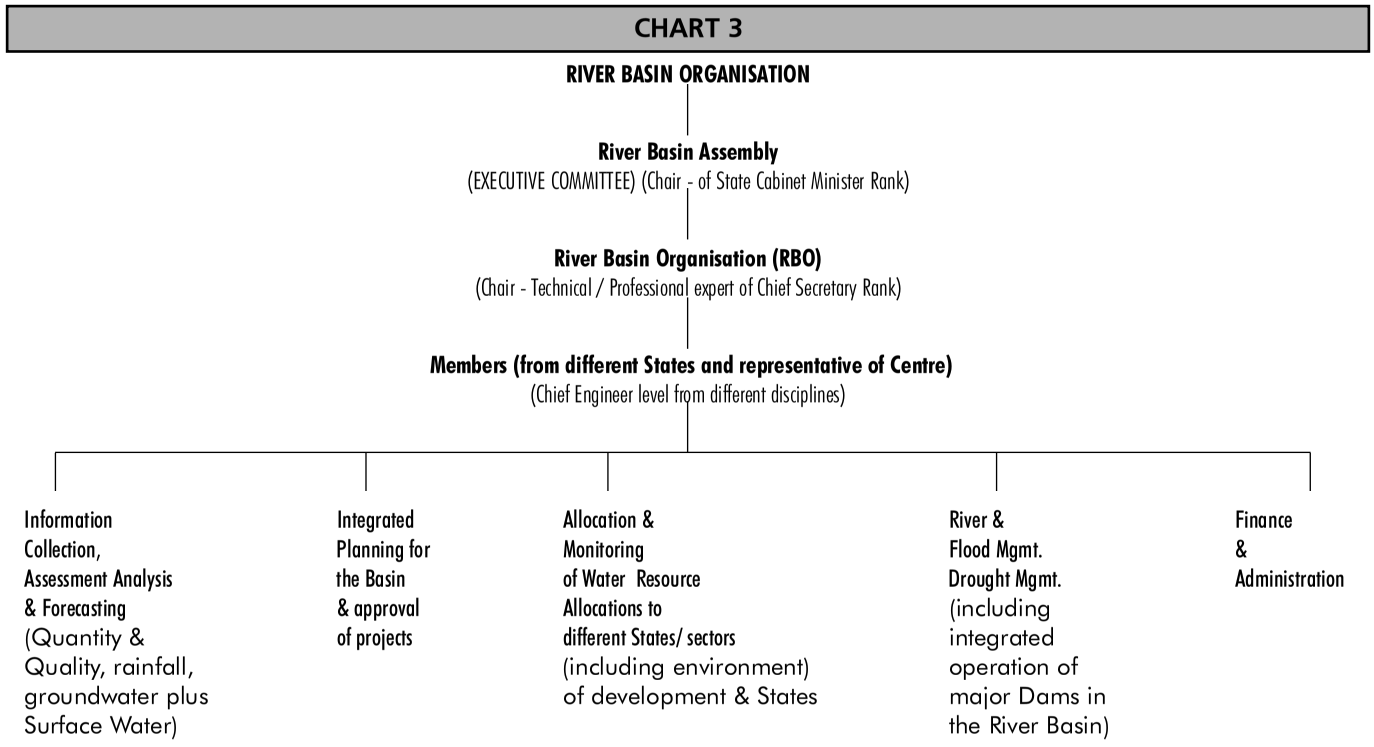


CHART 2



Note: * The State will have a River Basin Wing for each of the major river basins of which the State forms a part. In case of a river basin that lies wholly within the State, there will be a R.B.O. Each River Basin Wing will have under it a range of engineers and experts from different disciplines, to deal with the different aspects of water resources management in the basin in an integrated manner.

CHART 3



About the Book

The debate in India on water resources is unfortunately characterised by extreme positions taken by the so-called 'pro-environment' groups and NGOs on the one hand and the 'pro-development' engineers, contractors and government officials on the other. This pamphlet goes beyond these extreme positions and puts forward a strategy for integrated water resources management (IWRM) with suggestions for the key organisational and managerial changes required at the macro and micro levels in order to implement the IWRM approach.

This pamphlet is intended to generate debate and discussion among policy makers, engineers, administrators, NGOs and communities involved in the management of water resources, and ultimately to help us move towards consensus on this vital issue. It will also prove useful to the State governments and water resource managers to formulate operational Action Plans and sustainable systems of management of water resources in the 21st century.

About the Authors

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